(No Model.) 4 Sheets—Sheet 1.

H. YOUNG.

MACHINE FOR CUTTING STONE.

No. 397,410. Patented Feb. 5, 1889.

Fig. 1.

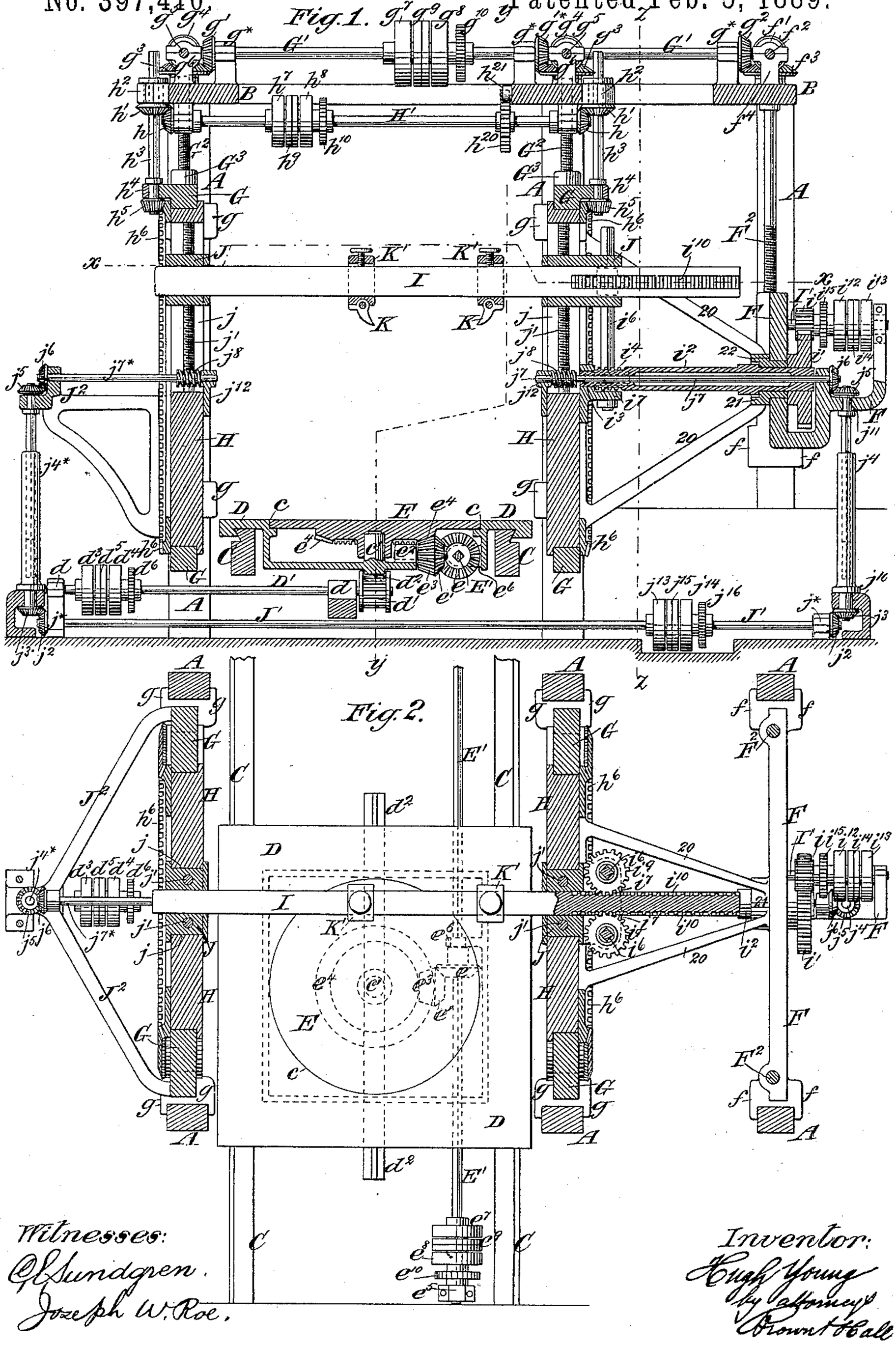

Fig. 2.

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MACHINE FOR CUTTING STONE.

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Fig. 3.

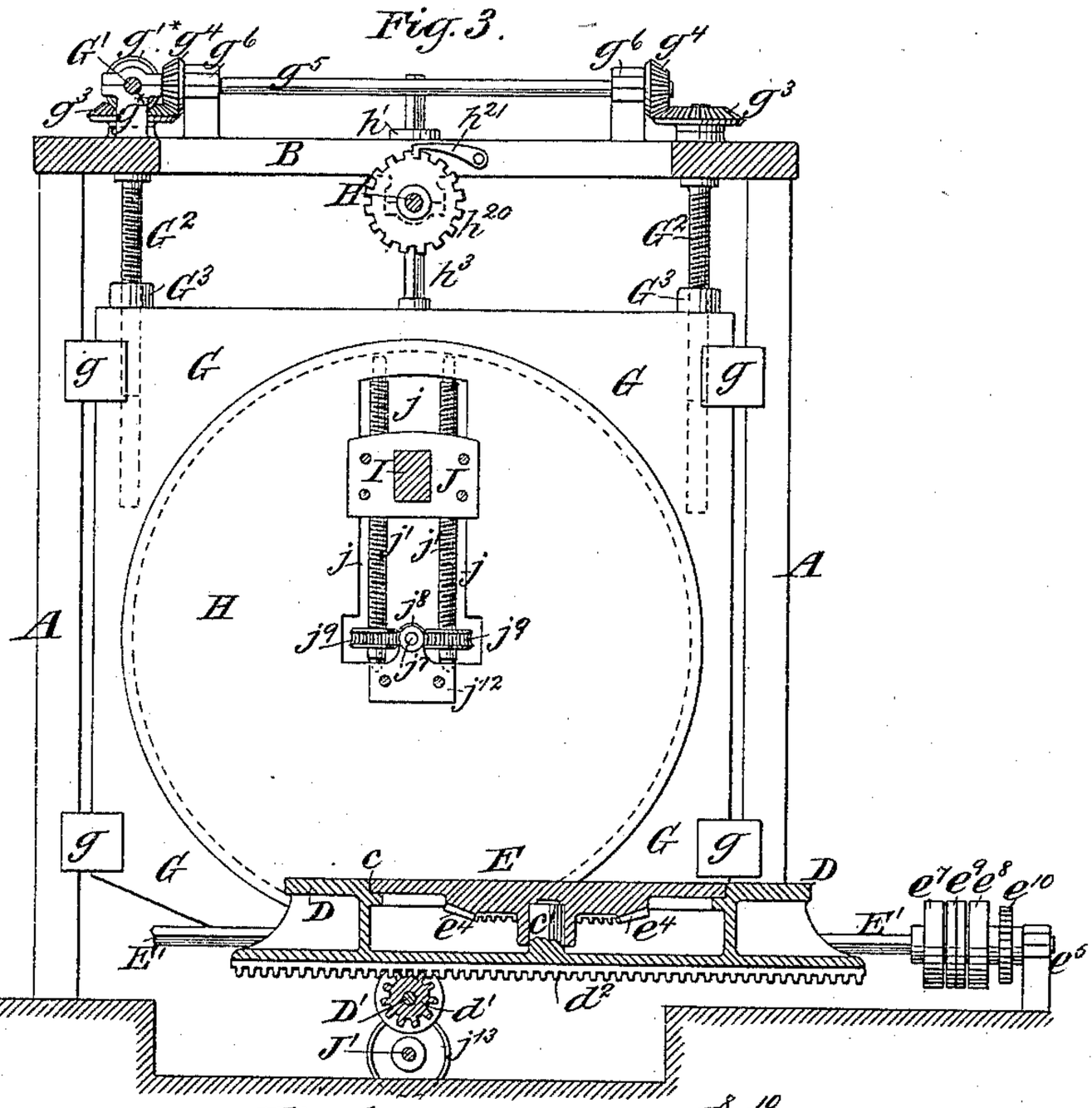
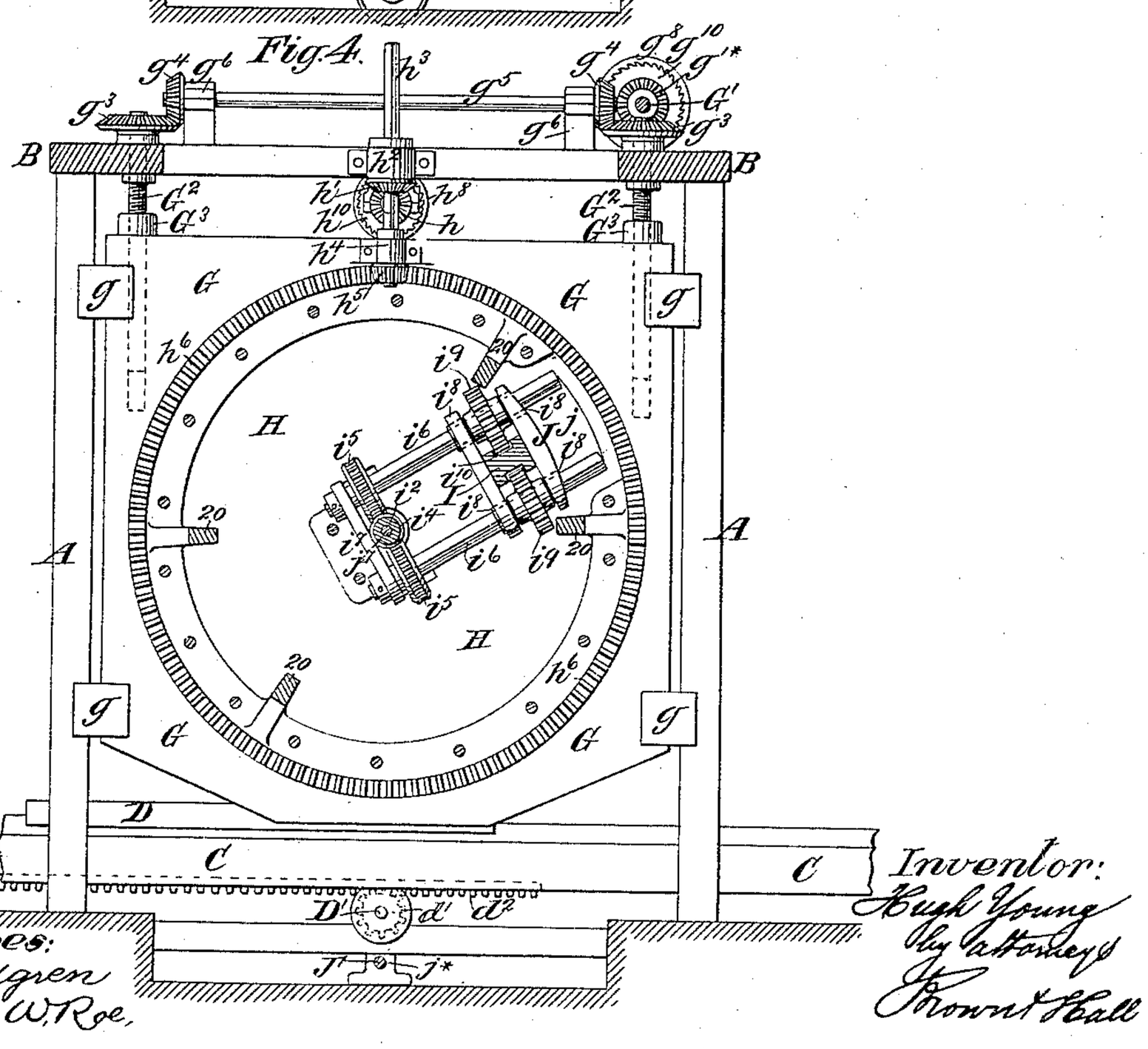


Fig. 4.



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MACHINE FOR CUTTING STONE.

No. 397,410. Patented Feb. 5, 1889.

Fig. 5.

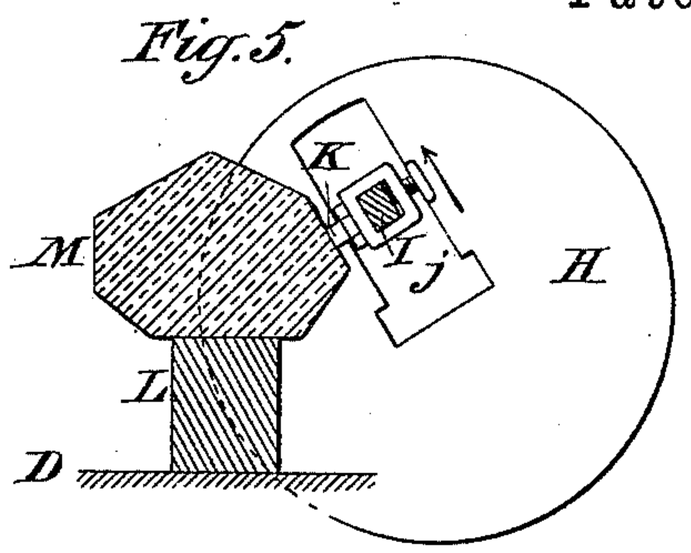


Fig. 6.

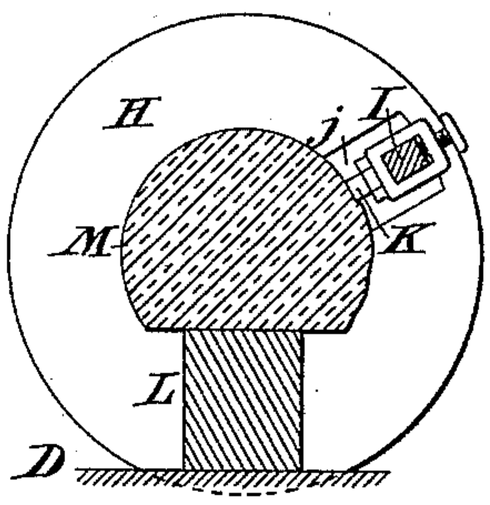


Fig. 7.

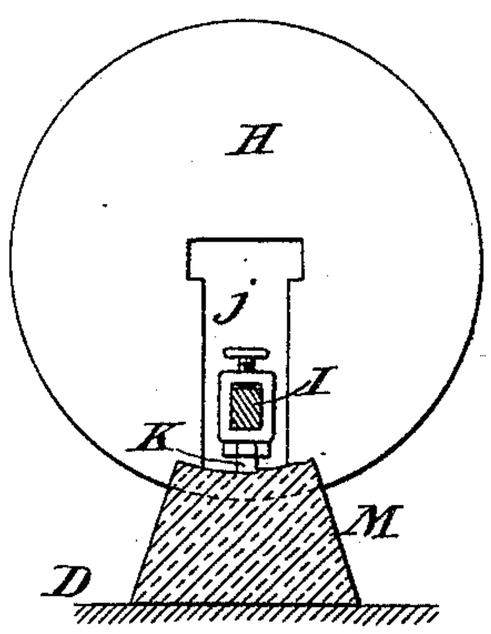


Fig. 8

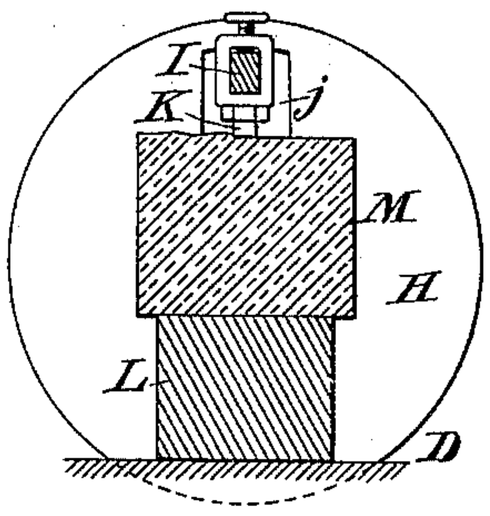


Fig. 9.

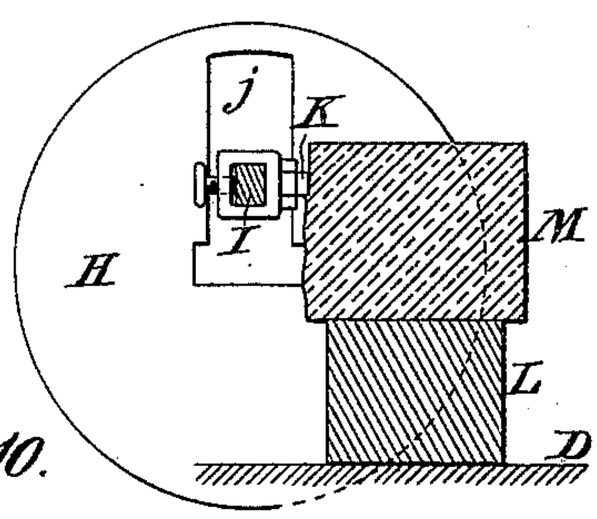
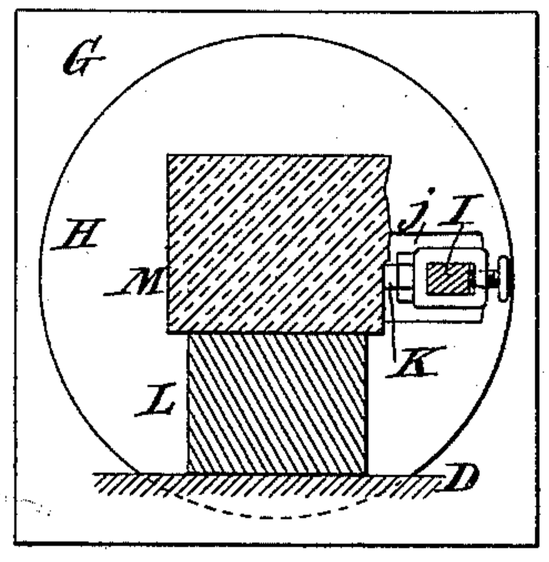


Fig. 10.



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MACHINE FOR CUTTING STONE.

No. 397,410. Patented Feb. 5, 1889.

Fig. 11.

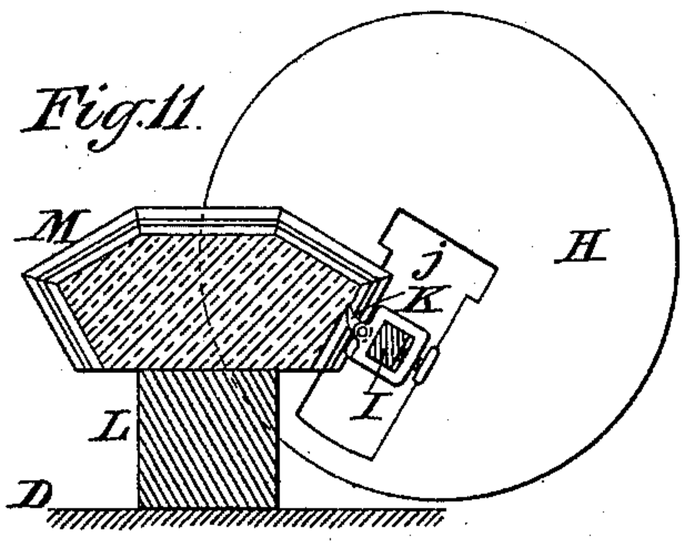


Fig. 12.

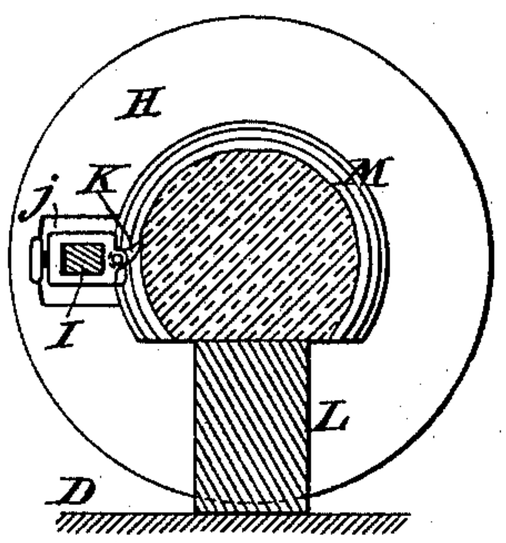


Fig. 13.

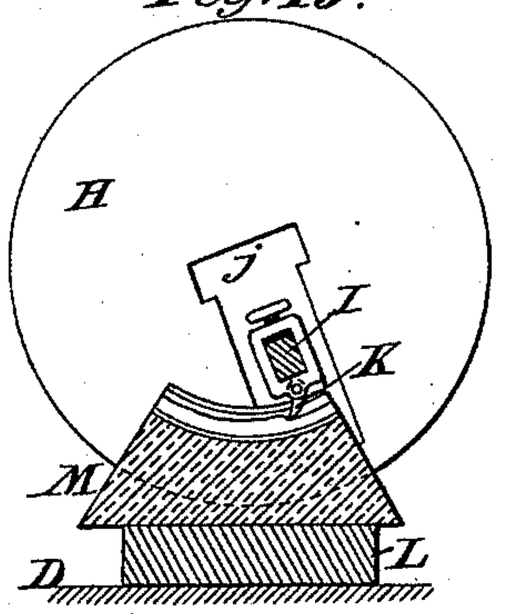


Fig. 14.

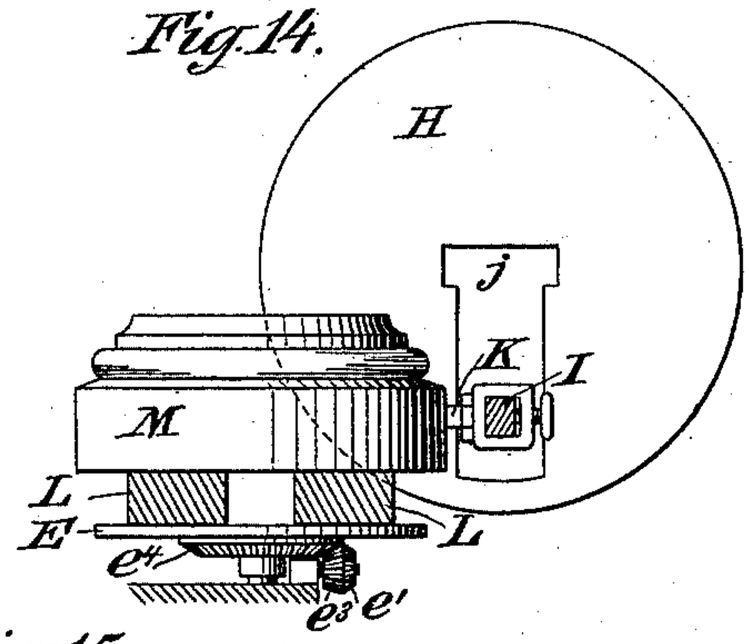
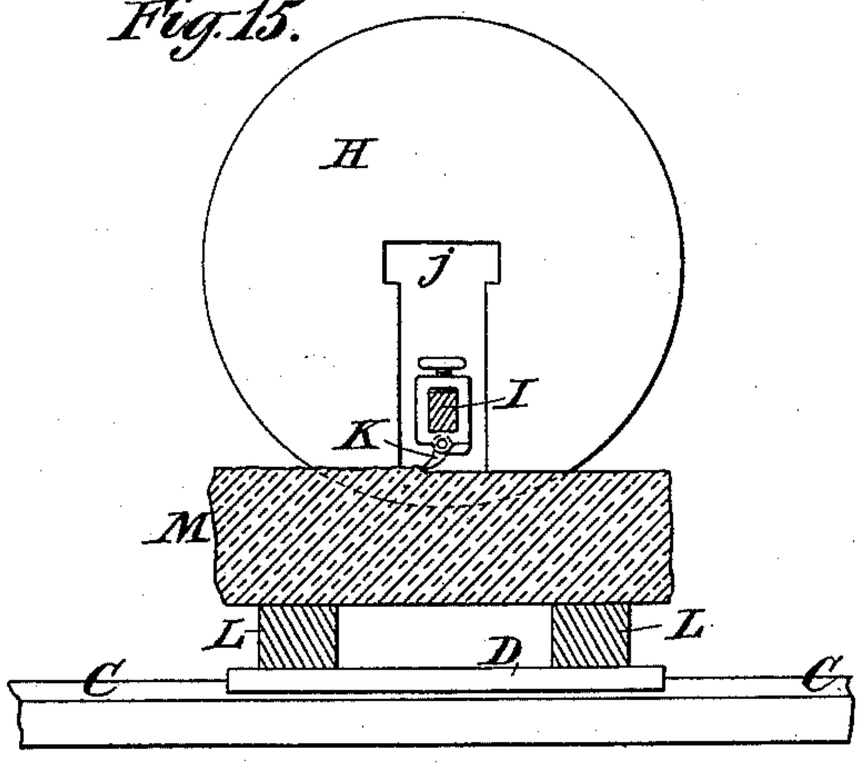


Fig. 15.



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Joseph W. Roe.

Inventor:
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UNITED STATES PATENT OFFICE.

HUGH YOUNG, OF NEW YORK, N. Y.

MACHINE FOR CUTTING STONE.

SPECIFICATION forming part of Letters Patent No. 397,410, dated February 5, 1889.

Application filed July 5, 1888. Serial No. 279,030. (No model.)

To all whom it may concern:

Be it known that I, HUGH YOUNG, of the city and county of New York, in the State of New York, have invented a new and useful Improvement in Machines for Cutting Stone and other Substances, of which the following is a specification.

The object of my invention is to provide in one machine for the cutting of stone or other substances into different forms having flat, polygonal, or curved surfaces; and a machine embodying my invention is composed of certain distinct and specific parts movable in certain distinct and specific lines by mechanism adapted to the production of said movements of said parts, each of said distinct and specific parts and the mechanism for producing its distinct and specific movements constituting a distinct member of said machine, all of said distinct members and the movements thereof being so arranged in relation to each other that any one of said members may, according to its fitness for the work required, be used as the primary or operative member of the machine for the time being, during which primacy of said member all the other members of the machine, whether stationary or in continuous or intermittent motion, become auxiliary for support, adjustment, or feed, the aim of this interchangeability of relation between the several members and movements thereof being to obtain a maximum of geometric range and combinations from a minimum of parts and movements.

I will proceed to describe a machine embodying my invention, and will afterward point out by claims the novelty of the invention.

In the machine selected to illustrate my invention there are six distinct members, each of which has its own distinctive line of movement. Member No. 1 has for its distinctive part a horizontal bed or table, and includes the mechanism for moving said bed or table horizontally in the line of its own length. Member No. 2 has for its distinctive part a rotary table, preferably mounted on the horizontal table, and includes the mechanism for imparting to it its rotary motion. Member No. 3 has for its distinctive part a cutter-bar, and includes the mechanism for imparting to it movement in the line of its own length. Member No. 4 has for its distinctive part vertical frames or gates, and includes the mechanism for imparting to them vertical motion. Member No. 5 has for its distinctive part a rotary cutter-bar carrier mounted and rotating on the vertically-moving gates, and includes the mechanism for imparting a rotary movement to said cutter-bar carrier; and member No. 6 has for its distinctive part boxes radially mounted on the cutter-bar carrier, in which the cutter-bar slides in the line of its own length and includes the mechanism for imparting a radial movement to said boxes in their relation to the axis of the cutter-bar carrier.

In the accompanying drawings, Figure 1 represents a central vertical section of the machine. Fig. 2 represents a horizontal section in the line *x x*, Fig. 1. Fig. 3 is a transverse vertical section in the line *y y*, Fig. 1, looking from the left. Fig. 4 is a vertical section in the line *z z*, Fig. 1, looking from the right. Figs. 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, and 15 are diagrams illustrating the operations performed by the machine.

Similar letters of reference designate corresponding parts in all the figures.

A B C designate the stationary framing of the machine, represented as consisting of upright posts A, an entablature, B, mounted thereon, and horizontal ways C C.

D designates a horizontal bed fitted to slide on the ways C, and having fitted to a circular recess, *c*, and pivot *c'* a circular rotary table, E.

Between the posts A, on opposite sides of the ways C and bed D, are two upright sliding frames or gates, G, the faces of which are parallel with the ways C C, the said gates being fitted to the posts with gibs *g*. Within each of these upright sliding gates G is one of two rotary disks, H, which combine to form what I will hereinafter term the "cutter-bar carrier." Said cutter-bar carrier carries the cutter-bar I by means of two sliding boxes, J, which are fitted to slide radially in the disks H in parallel-sided openings *j*, provided in the said disks, the said boxes being movable toward and from the center of the disks.

The sliding bed D, the rotary table E, the cutter-bar I, the vertically-sliding gates G, the rotary cutter-bar carrier H H, and the radially-moving boxes J J are severally provided with separate driving-shafts for producing their respective movements.

D′, Fig. 1, designates the driving-shaft for the reciprocating bed D, working in bearings at d, and furnished with a toothed pinion, d', gearing with a straight rack, d^2, on the bottom of the bed D. The said shaft D′ is represented as furnished with tight and loose pulleys d^3 d^4 d^5 for open and crossed belts to provide for turning the shaft in both directions and producing the horizontal movement of the bed D on the slides C in either direction. The said shaft D′ is also represented as furnished with a ratchet-wheel, d^6, through which motion may be communicated to it by a pawl deriving motion in any suitable manner.

E′ designates the driving-shaft for producing the rotary motion of the table E within the bed D, the said shaft working in a fixed bearing, e^5, as shown in Fig. 2, and being provided with a bevel-gear, e, gearing with a bevel-gear, e', which turns loosely on a fixed stud secured, as shown at e^2 in Fig. 1, in the sliding bed D. The said bevel-gear e' has secured to it another bevel-gear, e^3, which gears with a bevel-gear, e^4, which is secured to or integral with the bottom of the table E. The bevel-gear e, being required to move with the table E in the movement of the latter with the bed, is arranged to slide upon the shaft E′, but compelled to rotate with it by being fitted to said shaft with a square or spline, and it has a bearing, e^6, of its own, in which it rotates, provided for it on the frame D. Said shaft E′ is represented as also furnished with tight and loose pulleys e^7, e^8, and e^9 for open and crossed belts for driving it in either direction, and also represented as furnished with a ratchet-wheel, e^{10}, through which it may be turned by a pawl actuated in any suitable manner.

G′ designates the driving-shaft by which the upward-and-downward vertical movement of the upright sliding gates G is produced, working in bearings g^* on the entablature B of the framing. This shaft is furnished with three bevel-gears, g', g'^*, and g^2, forming part of a train of bevel-gearing for turning the upright screws G^2, by which the upward-and-downward movement of the gates G is produced. These screws—two for each gate G—are free to turn but confined longitudinally in bearings in the entablature B and screw into nuts G^3, fixedly secured upon the said gates G. Each of the said screws is furnished with a bevel-gear, g^3, these being all of equal size, the gears g' and g'^*, which are of equal size, gearing directly with those g^3 on two of the screws G^2—namely, one screw of each gate. The gears g^3 of the two screws of each gate are geared together by bevel-gears g^4, of equal size, on shafts g^5—one for each gate—arranged at right angles to the shaft G′ in bearings g^6 on the entablature B.

By the system of gearing above described the rotary motion of the shaft G′ produces precisely corresponding movements of the gates G, whose positions therefore always correspond. The shaft G′ is represented as furnished with tight and loose pulleys g^7, g^8, and g^9 to receive open and crossed belts for driving it in different directions. The said shaft is also represented as furnished with a ratchet-wheel, g^{10}, through which it may be turned by a suitably-actuated pawl.

H′ designates the driving-shaft for producing the rotary movement of the cutter-bar carrier H H within the gates G. This shaft is furnished at its ends with two bevel-gears, h, of equal size, gearing with two bevel-gears, h', the hubs of which are journaled into bearings h^2. These bevel-gears h' have fitted to them with squares or splines upright shafts h^3, which are journaled into bearings at h^4 on the upper parts of the sliding gates G, and they are furnished at their lower ends with bevel-gears h^5, of equal size, gearing with large bevel-gears h^6, which are bolted to the outer faces of the cutter-bar carrier disks H H. The shafts h^3, receiving rotary motion through the bevel-gears h h', are free to slide lengthwise through the gears h', while they move up and down with the gates and the contained cutter-bar-carrier disks, so that no matter what the position of the gates may be the rotary cutter-bar carrier is always in gear with its driving-shaft.

The shaft H′ is represented as furnished with tight and loose pulleys h^7, h^8, and h^9 for the reception of open and crossed belts for driving the shaft in either direction. It is also represented as furnished with a ratchet-wheel, h^{10}, through which it may receive motion from a suitably-actuated pawl.

In order to provide for locking the cutter-bar carrier H H in any position to which it may be turned, and so enable it to resist the pressure which in some sorts of work may be brought on the cutter-bar in a direction circumferential with or tangential to the said carrier, I have provided on the shaft H′ a locking-wheel, h^{20}, to be engaged by a hooked dog, h^{21}, hung on the entablature B, as shown in Figs. 1 and 3.

I′ is the horizontal driving-shaft for producing the longitudinal reciprocating movement of the cutter-bar I within and through the boxes J J, hereinafter described. This shaft is fitted to bearings in a vertically-sliding cross-head, F, which is fitted with gibs f to two of the upright posts A of the main framing of the machine. Within this cross-head, near the ends thereof, are provided nuts or female screw-threads, through which screw two upright screws, F^2, the threads of which correspond with the threads of the screws G^2, hereinabove described, for the purpose of producing the upward-and-downward movement of the sliding gates G. These screws

F^2 are supported in bearings in the entablature B in such manner as to allow them to turn freely but confine them lengthwise, and they are provided at their upper ends with bevel-gears f^3, which are of the same size as the bevel-gears g^3 on the screws G^2. The bevel-gear f^3 on one of these screws gears, as shown in Fig. 1, with the bevel-gear g^2 on the right-hand end of the shaft G′, before described, and the two bevel-gears f^3 on the two screws are geared together by two bevel-gears, f', on a horizontal shaft, f^2, working in bearings f^4 on the entablature The bevel-gears g', g'^*, and g^2 being all of the same size, and the bevel-gears g^4 and f' being of the same size, and the bevel-gears g^3 and f^3 being of the same size, the screws F^2 have always precisely the same movements as the screws G^2, so that the movement of the cross-head F always corresponds exactly with that of the two sliding gates G, and, in fact, the two sliding gates G and the cross-head F may be considered as practically parts of one vertically-sliding reciprocating carriage, within which the cutter-bar carrier rotates in planes parallel with the reciprocating movements of the said carriage, the said reciprocating and rotating movements being in planes perpendicular to the planes of the movements of the bed D and table E. One of the disks H of the rotary cutter-bar carrier—namely, the one shown at the right of Figs. 1 and 2—has connected with it by diagonal braces 20 a hollow journal, 21, which is concentric with the said disk, and which turns in a bearing at 22 in the cross-head F. These diagonal braces and this journal assist in establishing a firmer base to that one of the disks H of the cutter-bar carrier to which is attached the mechanism for producing the motion of the cutter-bar in the line of its own length.

The driving-shaft I′, for producing the reciprocating longitudinal movement of the cutter-bar, is fitted to bearings in the cross-head F, and is furnished with a small spur-gear, i, which gears with a larger spur-gear, i', on a horizontal shaft, i^2, which works in a bearing within the center of the hollow journal 21, as shown in Fig. 1, and in a journal-box, i^3, provided on the adjacent disk H of the rotary cutter-bar carrier. On this shaft i^2 is provided an endless screw, i^4, which gears with two worm-gears, i^5, upon two parallel shafts, i^6, which are journaled in bearings i^7, firmly secured to the adjacent disk H. On these shafts i^6 are provided sleeve spur-pinions i^9, journaled upon the sliding bar J, and which gear with toothed racks i^{10}, recessed in opposite sides of the cutter-bar I.

By means of the shaft I′, spur-gears i i', shaft i^2, endless screw i^4, worm-gears i^5, shafts i^6, pinions i^9, and racks i^{10} a longitudinal movement is given to the cutter-bar in either direction according to the direction of the revolution of the driving-shaft I′. In order that this movement of the cutter-bar may be produced at whatever distance the said bar may be from the center of its rotary carrier, the pinions i^9 are so fitted within the boxes J that they will move toward and from the center with the said boxes, and they are fitted to their shafts i^6 with splines or squares, so that they may slide longitudinally on the said shafts, while compelled to turn therewith.

The shaft I′ is furnished with fast and loose pulleys i^{12}, i^{13}, and i^{14} for the reception of open and crossed belts for driving it in either direction. The said shaft is also represented as furnished with a ratchet-wheel, i^{15}, through which it may receive motion from a suitably-actuated pawl.

J′ is a horizontal driving-shaft for producing the movement of the boxes J and the cutter-bar I, fitted thereinto, toward and from the center of the cutter-bar carrier. The said shaft J′ works, as shown in Fig. 1, in stationary bearings j^*, and is furnished at its ends with two bevel-gears, j^2, which gear with bevel-gears j^3 on the lower ends of two upright shafts, j^4 j^{4*}, on the upper ends of which are bevel-gears j^5, which gear with bevel-gears j^6 on two horizontal shafts, j^7 j^{7*}, on which are endless screws j^8, which gear with worm-wheels j^9, provided on the screws j', hereinbefore described, which work in nuts in the boxes J. The upright shaft j^4 at the right-hand end of the machine (see Fig. 1) has its lower journal fitted to a fixed bearing, j^{10}, and its upper journal fitted to a bearing at j^{11} in the cross-head F. The corresponding shaft, j^7, at the right-hand end of the machine (see Fig. 1) passes through the shaft i^2, which is bored to receive it. The said shaft j^7 is journaled near its outer end in a bearing in the cross-head F, and is journaled at its inner end in a bearing, j^{12}, secured concentrically to the adjacent rotary disk H of the cutter-bar carrier. The upright shaft j^{4*} and the horizontal shaft j^{7*} at the left-hand end of the machine (see Fig. 1) are journaled in bearings in a bracket, J^2, which is secured to the adjacent sliding gate G, and the horizontal shaft j^{7*} is journaled in a bearing, j^{12}, secured concentrically to the adjacent rotary disk H of the cutter-bar carrier.

By the system of gearing hereinabove described between the shaft J′ and the endless screws j^8 the rotary motion of the said shaft is caused to produce the rotary motion of the said screws, and thereby to move the boxes J and the cutter-bar I toward or from the center of the cutter-bar carrier H H, according to the direction in which rotary motion is given to said shaft. In order that this rotary motion may be produced without regard to the height of the vertically-sliding carriage G H F, the shafts j^4 j^{4*} are made telescopic, so that they may be elongated and shortened as the said sliding carriage ascends and descends, the upper and lower telescopic members being fitted together with splines or squares. The shaft J′ is represented as furnished with pulleys j^{13}, j^{14}, and j^{15} to receive open and crossed belts for driving the said shaft in

either direction. The said shaft is also represented as furnished with a ratchet-wheel, j^{16}, to be operated by a suitably-actuated pawl.

It will be observed that each of the driving-shafts D′, E′, G′, H′, I′, and J′ for producing the movements of the different members of the machine is furnished with pulleys for the reception of open and crossed belts for the purpose of producing the rotation of the said shafts in one direction or the other, and so producing the movement of the members of the machine, which they actuate, in one direction or the other. It will be also observed that each of the said shafts is furnished with a ratchet-wheel, the latter wheel being for the purpose of providing for giving to the said shaft a slow rotary motion. Each of the movements produced by the several shafts D′ E′ G′ H′ I′ J′ is capable of producing either the operative movement of the work or of the cutter necessary for cutting, or the movement thereof necessary for feeding and adjusting the work to the cutter or the cutter to the work. The cutter-bar I, which is not in itself a tool, is furnished with cutters K, which may be of any suitable kind, the said cutters being held in adjustable stocks K′, of any suitable construction. The said stocks should be so applied to the cutter-bar I that they may be adjustable lengthwise thereof, and that the points or cutting-edges of the cutters may be presented upward, downward, laterally, or transversely in any direction suitable to the work relatively to the said bar. The section of said bar and the interior of the stock are represented as of rectangular section, but may be round or of any other section or shape desired. It may be here mentioned that the cutter-bar does not itself rotate, but revolves laterally around the axis of the rotary carrier in which it is mounted.

Having described the construction of the machine in detail, I will describe a few of its operations in different kinds of work performed by it. The stone to be operated upon is always supported by the bed D, either directly or through the intervention of the rotary table E, suitable blocks, L, of wood or other material being placed between the stone and the table or bed, if necessary, as shown in Figs. 5 to 15 of the drawings.

In all the examples of the operation of the machine shown in Figs. 5 to 10, inclusive, the cutter-bar is operatively movable in the direction of its own length, and the work is done by the movement of the said bar and its cutter or cutters in that direction.

In the example illustrated in Fig. 5, which represents the cutting of an irregular polygonal prism by the longitudinal movement of the cutter-bar and cutter with the cutter set in a direction lateral to the said bar, the bed D and the block of stone, M, supported thereon, are stationary, and the feeding is performed by the movement of the cutter-bar and cutter in a radial direction within the cutter-bar carrier, as indicated by an arrow in the figure, the relative position of the tool to the work having been previously established by the horizontal motion of the bed, the vertical motion of the gates, and the rotary motion of the cutter-bar carrier.

In the example illustrated in Fig. 6, which represents the cutting of a partly-circular column by the longitudinal movement of the cutter-bar and cutter, the bed D and the work M thereon are stationary, and the cutter, which is set on the inner side of the cutter-bar I, is fed to its work by the lateral revolving movement of the said cutter-bar and cutter, produced by the rotating movement of the cutter-bar carrier H H on its axis, the proper radial position of the cutter-bar having been first established and the stone M having been also arranged concentric to the axis of the cutter-bar carrier by the horizontally-moving table and vertically-moving frame.

In the example represented in Fig. 7, which represents the cutting of the inner arc of a voussoir, the cutter is set on the outer side of the cutter-bar, the bed D and the stone M are stationary, and the cutter-bar, besides having a longitudinal operative movement by which the cutting is produced, has a lateral revolving feeding movement given to it by the circular motion of the cutter-bar carrier H H, the relative position of the tool to the work having been previously established by the radial movement of the bar, the vertical movement of the gates, and the horizontal movement of the table.

In the example illustrated in Fig. 8, which represents a simple horizontal planing operation by the lengthwise operative movement of the bar, the cutter is set on the inner side of the bar and the block of stone, M, is fed to the cutter by the movement of the bed D on the ways C, the cutter-bar carrier H being stationary, the relative position of the tool to the work having been previously established by the vertical movement of the gates, the rotary movement of the cutter-bar carrier, and the radial movement of the bar.

In the example shown in Fig. 9, which illustrates the planing of a vertical flat surface, the planing is also done by the longitudinal operative movement of the cutter-bar. The bed D and the stone M are stationary, and so is the cutter-bar carrier H, and the feeding is produced by the downward vertically-radial movement of the cutter-bar in the carrier H, the relative position of the tool to the work having been previously established by the horizontal movement of the table, the vertical movement of the gates, and the rotary movement of the cutter-bar carrier.

In the example shown in Fig. 10, which also illustrates the planing of a vertical flat surface by the same operative movement of the cutter-bar and cutter, the bed D and the stone M are stationary, the cutter is set on the inner side of the cutter-bar I, the cutter-bar carrier H is stationary within the upright sliding gates G, and the feeding of the cutter to the

work is produced by the movement of the gates G, the relative position of the tool to the work having been previously established by the horizontal movement of the table, the rotary motion of the cutter-bar carrier, and the radial motion of the bar.

In the examples shown in Figs. 11, 12, 13, 14, and 15 the longitudinal movement of the cutter-bar is not the operative or primary movement by which the cutting is effected, but becomes subordinate for the purposes of adjustment or feed. In Fig. 11, which illustrates the transverse cutting of one of the sides of an irregular prism, the bed D and the stone M are stationary, the cutter is set on one side of the bar, the operative movement for cutting is the upward radial movement of the cutter-bar I, and the feeding of the cutter to the work is produced by the longitudinal movement of the cutter-bar, while the carrier H is stationary, the relative position of the tool to the work having been previously established by the horizontal movement of the bar, the vertical movement of the gates, and the rotary movement of the cutter-bar carrier.

In the example shown in Fig. 12, which illustrates the transverse cutting of a partly-circular body, the cutter is set on the inner side of the cutter-bar, the operative movement for cutting is the laterally-revolving movement of the cutter-bar produced by the rotary movement of the cutter-bar carrier H, and the feeding of the cutter to the work is produced by the longitudinal movement of the cutter-bar, the bed D and the stone M being stationary, the relative position of the tool to the work having been previously established by the horizontal movement of the table, the vertical movement of the gate, and the radial movement of the cutter-bar.

In the example shown in Fig. 13, which illustrates the cutting of the inner arc of a molded voussoir, the cutter is set on the outer side of the bar, the operative movement for cutting is the laterally-revolving movement of the cutter-bar produced by the rotary movement of the carrier H, and the feeding of the cutter to the stone is produced by the longitudinal movement of the bar, the bed D and the stone M being in this case stationary, the relative position of the tool to the work having been previously established by the same means as in No. 12.

In the example shown in Fig. 14, which represents the cutting of the plinth of a circular column, the operative movement for cutting is the rotary movement of the table E, and the cutter, which is set laterally to the bar, is fed to the stone by the radial movement of the bar within the carrier H, the bed and the carrier being stationary, the relative position of the tool to the work having been previously established by the lengthwise movement of the bar, the horizontal movement of the table, the rotating movement of the cutter-bar carrier, and the vertical movement of the gates.

In the example shown in Fig. 15, which illustrates the horizontal planing of the upper side of a slab, the operative movement for cutting is the horizontal movement of the bed D on the ways C, and the feeding of the cutter to the work is produced by the longitudinal movement of the cutter-bar, while the carrier H is stationary, and in this case the cutter is set on the outer side of the bar, the relative position of the tool to the work having been previously established by the vertical movements of the gates, the rotary movement of the cutter-bar carrier, and the radial movement of the cutter-bar. The adjustment of the depth of cut may be produced by moving the stone toward the cutter or the cutter toward the stone, the movement being effected by slowly turning such one of the several driving-shafts as will produce the movement desired.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The combination, in a machine for cutting stone or other substance, of a rotary cutter-bar support, a cutter-bar revolving laterally around the axis of said support and operatively movable upon said support in a path parallel to said axis, and a tool adjustable upon said bar, substantially as described.

2. The combination, in a machine for cutting stone or other substance, of a rotary cutter-bar support, a cutter-bar revolving laterally around the axis of said support, said bar being operatively movable upon said support in the line of its own length and operatively and laterally movable nearer to and farther from the said axis, and a tool adjustable upon said bar, said tool being set radially to the axis of said support, substantially as herein described.

3. The combination, in a machine for cutting stone or other substance, of a rotary cutter-bar support, a cutter-bar operatively revolving laterally around the axis of said support, said bar being also operatively movable upon said support in the line of its own length and operatively and laterally movable nearer to or farther from the said axis, and a tool adjustable upon said bar, said tool being set at an angle to a radial line drawn to the axis of said support, substantially as herein described.

4. The combination, in a machine for cutting stone or other substance, of a rotary cutter-bar support, a cutter-bar revolving laterally around the axis of said support, said bar being operatively movable upon said support in the line of its own length and operatively and laterally movable nearer to or farther from the said axis, and a tool adjustable upon said bar, said tool being set at an angle to the length line of said bar, substantially as herein described.

5. The combination, in a machine for cutting stone or other substance, of a rotary cutter-bar support, a cutter-bar revolving laterally around the axis of said support, said bar

being operatively movable upon said support in the line of its own length and operatively and laterally movable nearer to or farther from the said axis, and a tool adjustable upon said bar, said tool being set inward toward the axis of said rotary support, substantially as herein described.

6. The combination, in a machine for cutting stone or other substance, of a rotary cutter-bar carrier and a cutter-bar movable within said carrier in the direction of its own length in lines parallel to the axis of rotation of said carrier, and a cutter adjustable on the said cutter-bar, substantially as described.

7. The combination, in a machine for cutting stone or other substance, of a rotary cutter-bar carrier, a frame in which the said carrier is contained and within which it rotates, and a cutter-bar movable within said carrier in the direction of its own length in lines parallel to the axis of rotation of said carrier, and a tool adjustable on the said cutter-bar, substantially as described.

8. The combination, in a machine for cutting stone or other substance, of a horizontally-movable bed or table, mechanism for moving the same in the line of its own length, a cutter-bar having a lateral revolving movement and a movement toward and from the axis of said revolving mechanism for producing the rotary movement of the cutter-bar, and mechanism for producing the movement of the cutter-bar toward and from the axis of rotation, the three said mechanisms being so organized that any two may be subordinated, while the other maintains a primacy, substantially as described.

9. The combination, in a machine for cutting stone or other substance, of a horizontally-movable bed or table, mechanism for moving the same horizontally in the line of its own length, a cutter-bar having a lateral revolving movement, and also having a lateral vertical movement, mechanism for producing the lateral revolving movement, and mechanism for producing the lateral vertical movement, all the three said mechanisms being so organized that any two may be subordinated, while the other maintains a primacy, substantially as described.

10. The combination, in a machine for cutting stone or other substance, of a horizontally-movable bed or table, mechanism for moving the same horizontally in the line of its own length, a cutter-bar having a lateral revolving movement and a horizontal movement in the line of its own length and parallel with the axis of its revolution, mechanism for producing the rotary movement of the cutter-bar, and mechanism for moving the cutter-bar in the line of its own length, all the three said mechanisms being so organized that any two may be subordinated, while the other maintains a primacy, substantially as described.

11. The combination, in a machine for cutting stone or other substance, of a horizontally-movable bed or table, mechanism for moving the same horizontally in the line of its own length, a rotary bed or table, mechanism for rotating the rotary table, a cutter-bar, and mechanism for laterally revolving said cutter-bar, all the three said mechanisms being so organized that any two may be subordinated, while the other maintains a primacy, substantially as described.

12. The combination, in a machine for cutting stone or other substance, of a horizontally-movable bed or table, mechanism for moving the same horizontally in the line of its own length, a cutter-bar having a vertical movement, a lateral revolving movement, and a movement toward and from the center of its revolution in any direction, mechanism for producing the said vertical movement of the cutter-bar, mechanism for producing the said revolving movement of the cutter-bar, and mechanism for producing the movement of the cutter-bar toward and from the center of its revolution, all the said mechanisms being so organized that any three may be subordinated, while the other maintains a primacy, substantially as described.

13. The combination, in a machine for cutting stone or other substance, of a horizontally-movable bed or table, mechanism for moving the same horizontally in the line of its own length, a cutter-bar having a lateral revolving movement, a horizontal movement in the line of its own length, and a movement toward and from the center of its revolution, mechanism for producing the said revolving movement of the cutter-bar, mechanism for producing the movement in the direction of the length of the cutter-bar, and mechanism for producing the movement of the cutter-bar toward and from the center of its revolution, all the said mechanisms being so organized that any three may be subordinated, while the other maintains a primacy, substantially as described.

14. The combination, in a machine for cutting stone or other substance, of a horizontally-movable bed or table, mechanism for moving the same horizontally in the line of its own length, a rotary table, mechanism for rotating the table, a cutter-bar having a lateral revolving movement and a movement toward and from the center of its revolution, mechanism for producing said revolving movement of the cutter-bar, and mechanism for producing the movement of the cutter-bar toward and from the center of its revolution, all the said mechanisms being so organized that any three may be subordinated, while the other maintains a primacy, substantially as described.

15. The combination, in a machine for cutting stone or other substance, of a horizontally-movable bed or table, mechanism for moving the same horizontally in the line of its own length, a cutter-bar having a lateral vertical movement and a movement horizontally in the line of its own length, mechanism for

producing the lateral vertical movement of the cutter-bar, and mechanism for producing the movement of the cutter-bar in the line of its own length, all the said three mechanisms being so organized that any two may be subordinated, while the other maintains a primacy, substantially as described.

16. The combination, in a machine for cutting stone or other substance, of a horizontally-movable bed or table, mechanism for moving the same horizontally in the line of its own length, a rotary table, mechanism for imparting a rotary movement to this table, a cutter-bar laterally movable in a vertical direction, and mechanism for producing said movement of the cutter-bar, all the said three mechanisms being so organized that any two may be subordinated, while the other maintains a primacy, substantially as described.

17. The combination, in a machine for cutting stone or other substance, of a cutter-bar having a lateral revolving movement, a movement toward and from the center of its revolution, and a vertical movement, mechanism for producing the revolving movement, mechanism for producing the movement toward and from the center of revolution, and mechanism for producing the vertical movement, all the said three mechanisms being so organized that any two may be subordinated, while the other maintains a primacy, substantially as described.

18. The combination, in a machine for cutting stone or other substance, of a cutter-bar having a lateral revolving movement, a movement toward and from the center of its revolution, and a movement in the direction of its own length and parallel with the axis of its revolution, mechanism for producing the rotary movement, mechanism for producing the movement toward and from the center of its revolution, and mechanism for producing a movement of the cutter-bar in the line of its own length, all the said three mechanisms being so organized that any two may be subordinated, while the other maintains a primacy, substantially as described.

19. The combination, in a machine for cutting stone or other substance, of a cutter-bar having a lateral revolving movement and a movement toward and from the center of its revolution, mechanism for producing the said revolving movement, mechanism for producing the movement toward and from the center of its revolution, a rotary table, and mechanism for producing the movement of this table, all the said three mechanisms being so organized that any two may be subordinated, while the other maintains a primacy, substantially as described.

20. The combination, in a machine for cutting stone or other substance, of a cutter-bar having a lateral revolving movement, a lateral vertical movement, and a movement horizontally in the line of its own length parallel with the axis of its revolution, mechanism for producing the lateral revolving movement, mechanism for producing the lateral vertical movement, and mechanism for producing said horizontal movement of the cutter-bar in the line of its own length parallel with the axis of its revolution, all the said three mechanisms being so organized that any two may be subordinated, while the other maintains a primacy, substantially as described.

21. The combination, in a machine for cutting stone or other substance, of a cutter-bar having a lateral revolving movement and a lateral vertical movement, mechanism for producing the lateral revolving movement, mechanism for producing the lateral vertical movement, a rotary table, and mechanism for rotating the table, all the said three mechanisms being so organized that any two may be subordinated, while the other maintains a primacy, substantially as described.

22. The combination, in a machine for cutting stone or other substance, of a cutter-bar having a lateral revolving movement and a horizontal movement in the line of its own length parallel with the axis of its revolution, mechanism for producing the lateral revolving movement, mechanism for producing said horizontal movement, a rotary table, and mechanism for rotating the table, all the said three mechanisms being so organized that any two may be subordinated, while the other maintains a primacy, substantially as described.

23. The combination, in a machine for cutting stone or other substance, of a cutter-bar having a lateral vertical movement and a movement horizontally in the line of its own length, mechanism for producing the lateral vertical movement, mechanism for producing the horizontal movement, a rotary table, and mechanism for rotating the table, all the said three mechanisms being so organized that any two may be subordinated, while the other maintains a primacy, substantially as described.

24. The combination, in a machine for cutting stone or other substance, of a bed or table for supporting the work, a rotary cutter-bar carrier, a frame in which the said carrier is contained and within which it rotates, and the cutter-bar movable within said carrier in the direction of its own length and parallel with the axis of rotation of the said carrier, and a cutter adjustable on said bar, substantially as described.

25. The combination, in a machine for cutting stone or other substance, of a bed or table for supporting the work, a rotary cutter-bar carrier, a frame in which the said carrier is contained and within which it rotates, and a cutter-bar laterally movable within the said carrier toward and from the center thereof, and a cutter adjustable on said bar, substantially as described.

26. The combination, in a machine for cutting stone or other substance, of a bed or table for supporting the work, a rotary cutter-bar carrier, a frame in which the said carrier is

contained and within which it rotates, and a cutter-bar movable within said carrier in the direction of its own length and laterally in a direction radial to the axis of said carrier, and a cutter adjustable on said bar, substantially as and for the purpose herein described.

27. The combination, in a machine for cutting stone or other substance, of a bed or table for supporting the work, a reciprocating carriage, a rotary cutter-bar carrier fitted to rotate within the said reciprocating carriage, and a laterally-revolving cutter-bar fitted to move operatively in the direction of its own length within said rotary carrier in lines parallel to the axis of said carrier, substantially as described.

28. The combination, in a machine for cutting stone or other substance, of a bed or table for the work, a reciprocating carriage, a rotary cutter-bar carrier fitted to rotate within the said carriage, and a laterally-revolving cutter-bar fitted to move operatively within the said rotary carrier in a direction radial to the axis thereof, and a tool adjustable on said bar, substantially as herein set forth.

29. The combination, in a machine for cutting stone or other substance, of a bed or table for supporting the work, a reciprocating carriage, a rotary cutter-bar carrier fitted to rotate within the said carriage, and a laterally-revolving cutter-bar fitted to said rotary carrier to move operatively therein in the direction of its own length in lines parallel to the axis of said carrier and laterally in a direction radial to said axis, and a tool adjustable on said cutter-bar, substantially as herein set forth.

30. The combination, in a machine for cutting stone or other substance, of a reciprocating table or bed for carrying the work, a carriage movable in a direction perpendicular to the reciprocating movement of the said bed, and a laterally-revolving cutter-bar operatively movable in the direction of its own length and parallel with the axis of its revolution within said carriage and in a direction toward and from the reciprocating table or bed, and a tool adjustable on said bar, substantially as described.

31. The combination, in a machine for cutting stone or other substance, of a rotary table for carrying the work, a carriage movable in a direction perpendicular to the plane of rotation of said table, and a laterally-revolving cutter-bar operatively movable in the direction of its own length parallel with the axis of its revolution within said carriage, and a tool adjustable on said bar, substantially as described.

32. The combination, in a machine for cutting stone or other substance, of a reciprocating bed for carrying the work, a carriage movable in a direction perpendicular to the reciprocating movement of the said bed, a rotary cutter-bar carrier fitted to rotate within said carriage, and a laterally-revolving cutter-bar operatively movable in the direction of its own length within said rotary cutter-bar carrier, substantially as herein set forth.

33. The combination, in a machine for cutting stone or other substance, of a reciprocating bed for carrying the work, a carriage movable in a direction perpendicular to the movement of the said bed, a rotary cutter-bar carrier fitted to rotate within said carriage, and a laterally-revolving cutter-bar operatively movable within said rotary cutter-bar carrier toward and from the center thereof, substantially as described.

34. The combination, in a machine for cutting stone or other substance, of a reciprocating bed for carrying the work, a carriage movable in a direction perpendicular to the reciprocating movement of the said bed, a rotary cutter-bar carrier fitted to rotate within said carriage, and a cutter-bar operatively movable within said rotary carriage both in the direction of its own length and in a direction radial to the axis of said rotary carrier, substantially as described.

35. The combination, in a machine for cutting stone or other substance, of a horizontally-moving supporting-bed, a table fitted to the said bed to rotate therein, a carriage movable vertically toward and from said bed, and a laterally-revolving cutter-bar operatively movable within said carriage in the direction of its own length, substantially as described.

36. The combination, with the reciprocating bed D and the rotary table E contained therein, of the driving-shaft E′, the bevel-gear *e*, fitted to slide on but to turn with the said shaft and fitted to turn in a bearing, e^6, on the said bed, the bevel-gears *e′*, carried by said bed and gearing with that, *e*, on the shaft, the bevel-gear, e^3, secured to *e′*, and the bevel-gear e^4 on the bed, gearing with e^3, all substantially as herein described, for driving the table E in all positions of the bed D, as herein set forth.

37. The combination, with the reciprocating carriage G G F and the rotary cutter-bar carrier H H, fitted to rotate in said carriage, of the driving-shaft H′, furnished with bevel-gears *h*, the bevel-gears *h′*, having fixed bearings and gearing with *h*, the shafts h^3, fitted to and longitudinally confined in bearings on said reciprocating carriage and sliding through but turning said bevel-gears *h′*, and the bevel-gears h^6 on the rotary cutter-bar carrier, gearing with said bevel-gears h^5, all substantially as herein described, for driving the rotary cutter-bar carrier in all positions of the vertically-moving carriage, as herein set forth.

38. The combination, with the reciprocating carriage G G F, the rotary cutter-bar carrier H H contained therein, the sliding cutter-bar boxes J, movable within the cutter-bar carrier to and from the center thereof, and the cutter-bar I, having a longitudinal movement within said boxes, of the driving-shaft I′, arranged in bearings movable with the said carriage, of the shaft i^2, working in bearings

carried by the cutter-bar carrier H H, geared with said driving-shaft I′, and furnished with an endless screw, i^4, and the shafts i^6, working in bearings on the cutter-bar carrier H H and furnished with worm-gears i^5, gearing with the endless screw i^4, and with spur-gears i^9, gearing with a rack, i^{10}, on the cutter-bar, the said gears i^9 being movable with the cutter-bar boxes and capable of sliding on the shafts i^6, all substantially as herein described, for driving the cutter-bar in all its positions relatively to the cutter-bar carrier H and in positions of the said carrier and carriage, as herein set forth.

39. The combination, with the reciprocating carriage G G F, the rotary cutter-bar carrier H H contained therein, the sliding cutter-bar boxes movable within the said carrier H H toward and from the center thereof, and the screws j', fitted to said carrier H and boxes J, of the driving-shaft J′, working in fixed bearings, telescopic shafts j^4 j^{4*}, geared with the said driving-shaft by bevel-gears j^2 j^3, and having each a fixed bearing near one end and a bearing near the other end and carried by the reciprocating carriage, and the shafts j^7 j^{7*}, geared with said shafts j^4 j^{4*} by bevel-gears j^5 j^6, and being furnished with endless screws j^8, gearing with worm-gears j^9 on the said screws j', all substantially as herein described, for producing the said movement of the boxes J in all positions of the reciprocating carriage and rotary cutter-bar carrier, as herein set forth.

40. The combination, with the rotary cutter-bar carrier H H and the sliding cutter-bar boxes J and reciprocating cutter-bar working therein, of the shaft j^7 and its gearing for producing the movements of the said boxes, and the shaft i^2 and its gearing for producing the longitudinal movement of the cutter-bar, both having bearings in and concentric with the said carrier, and the said shaft j^7 passing centrally through the shaft i^2, substantially as herein described.

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