No. 830,529. PATENTED SEPT. 11, 1906.

F. H. RICHARDS.

CARVING MACHINE.

APPLICATION FILED MAR. 4, 1902.

3 SHEETS—SHEET 1.

Fig. 2.

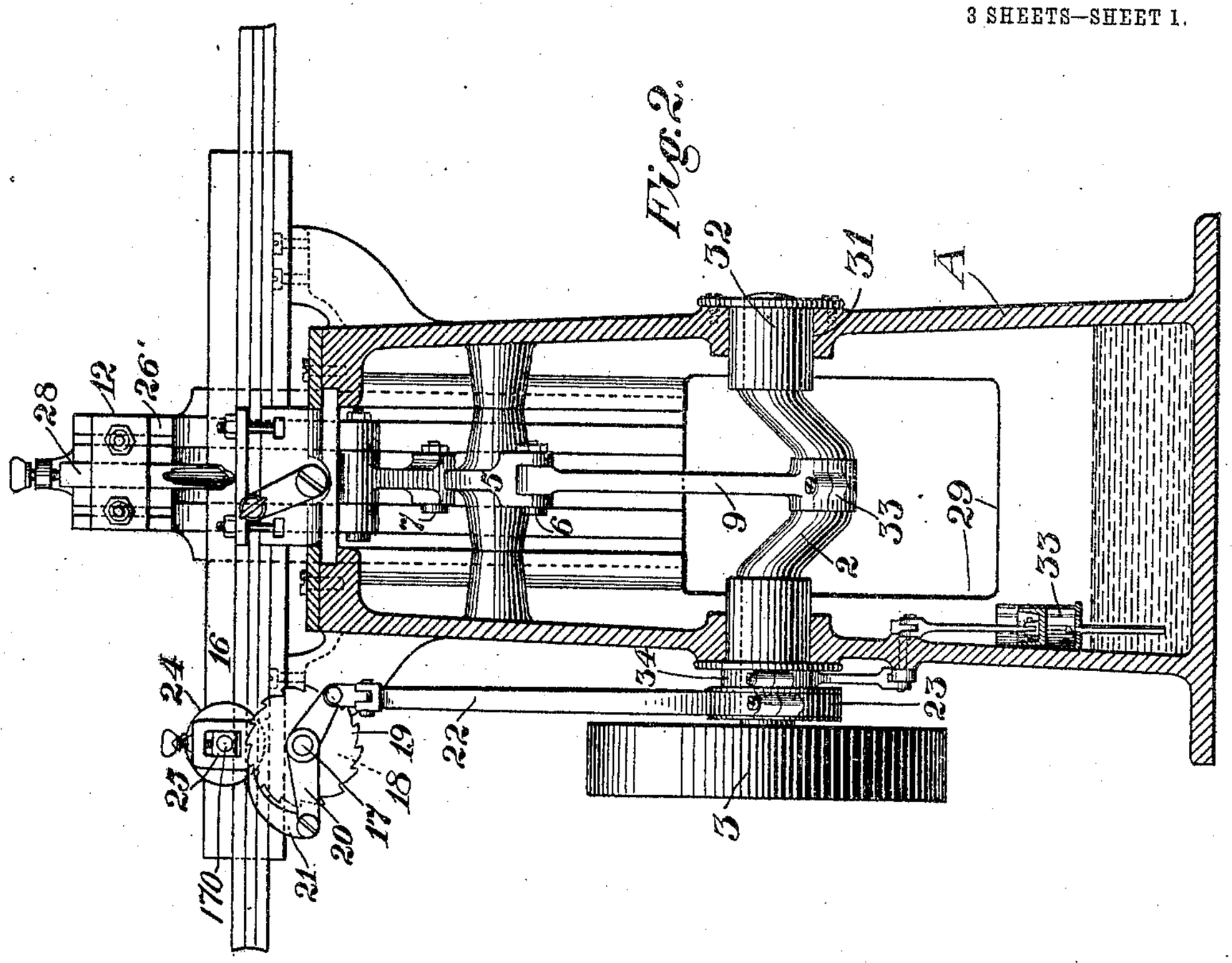
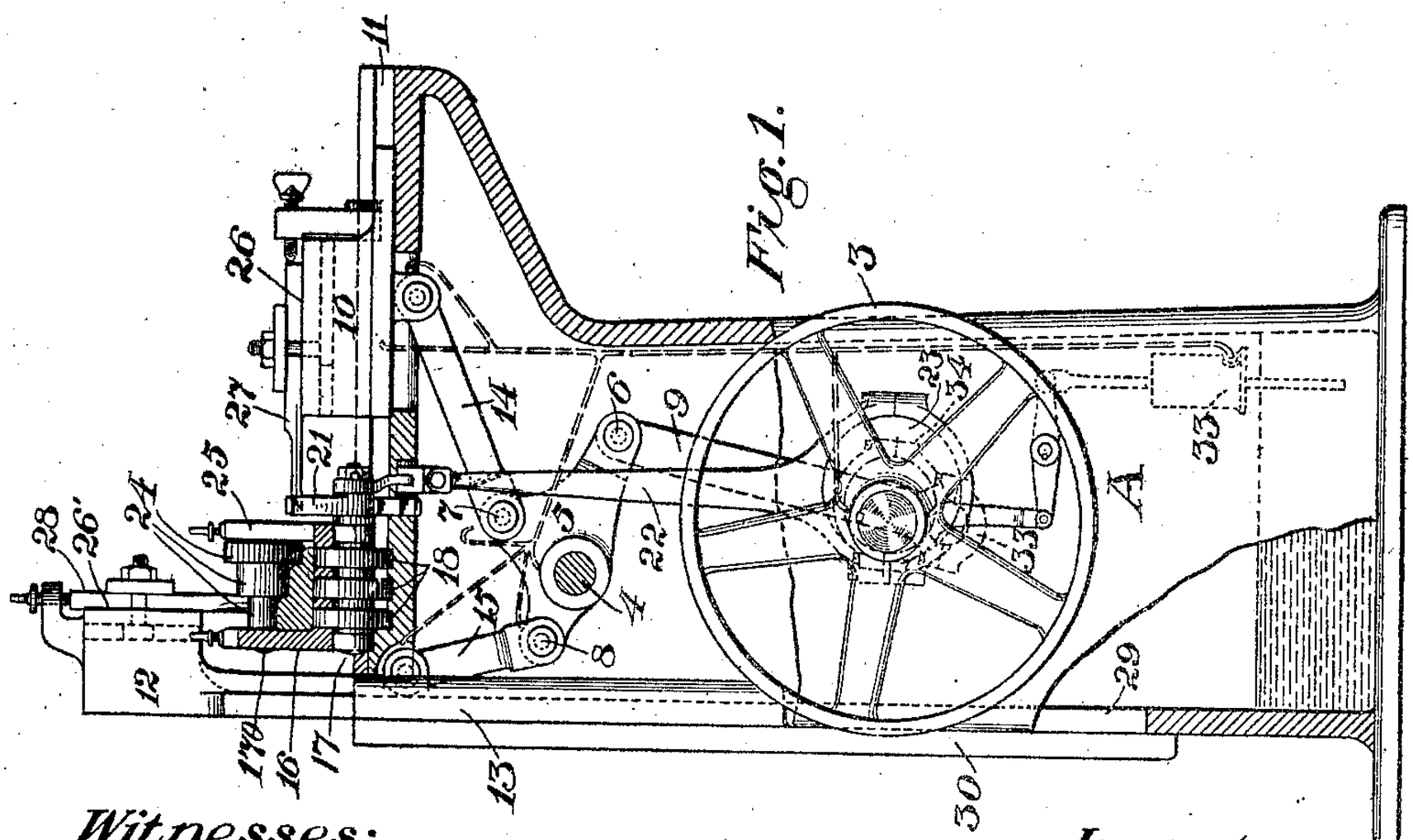


Fig. 1.



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3 SHEETS—SHEET 2.

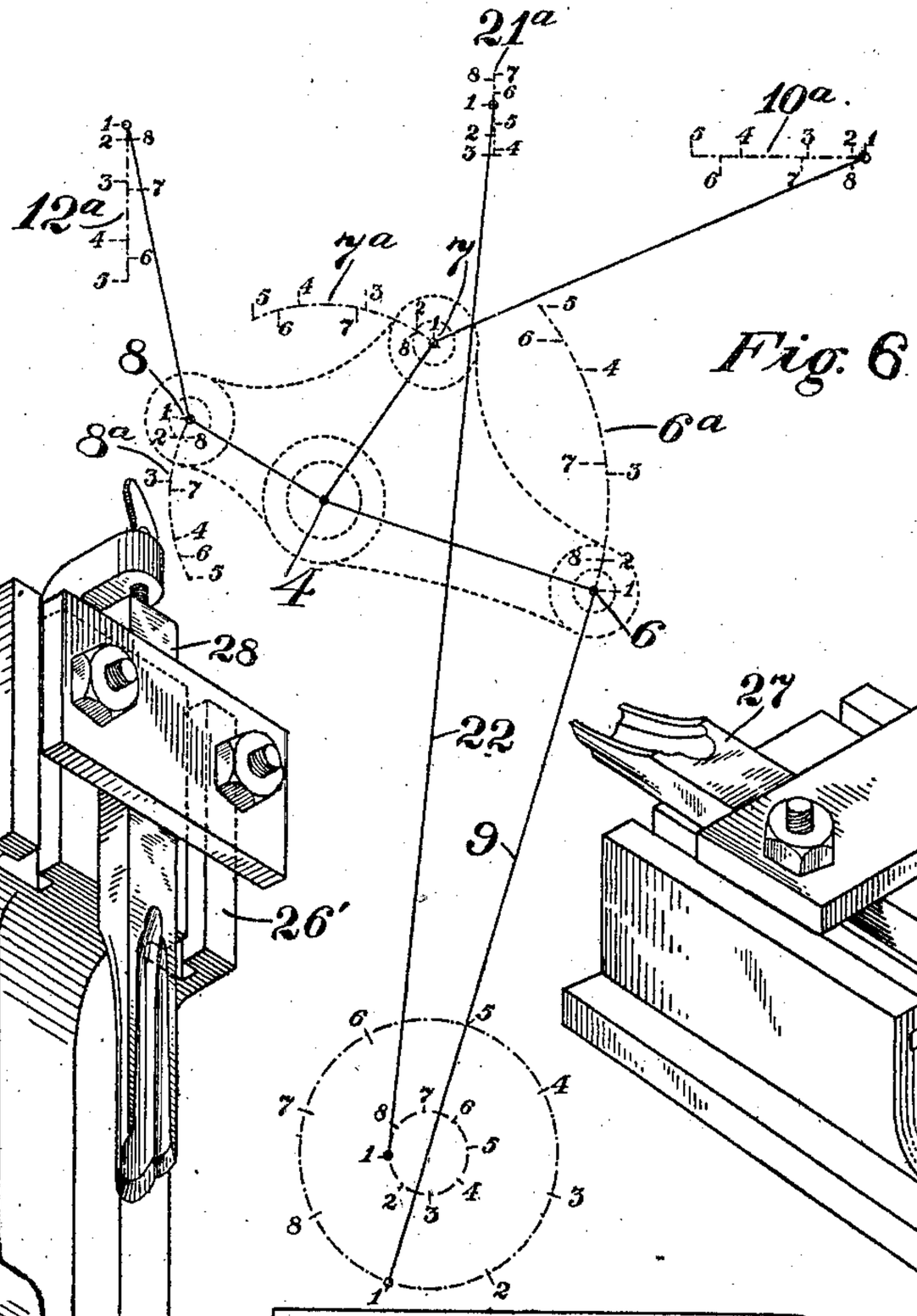

Fig. 6

Fig. 5.

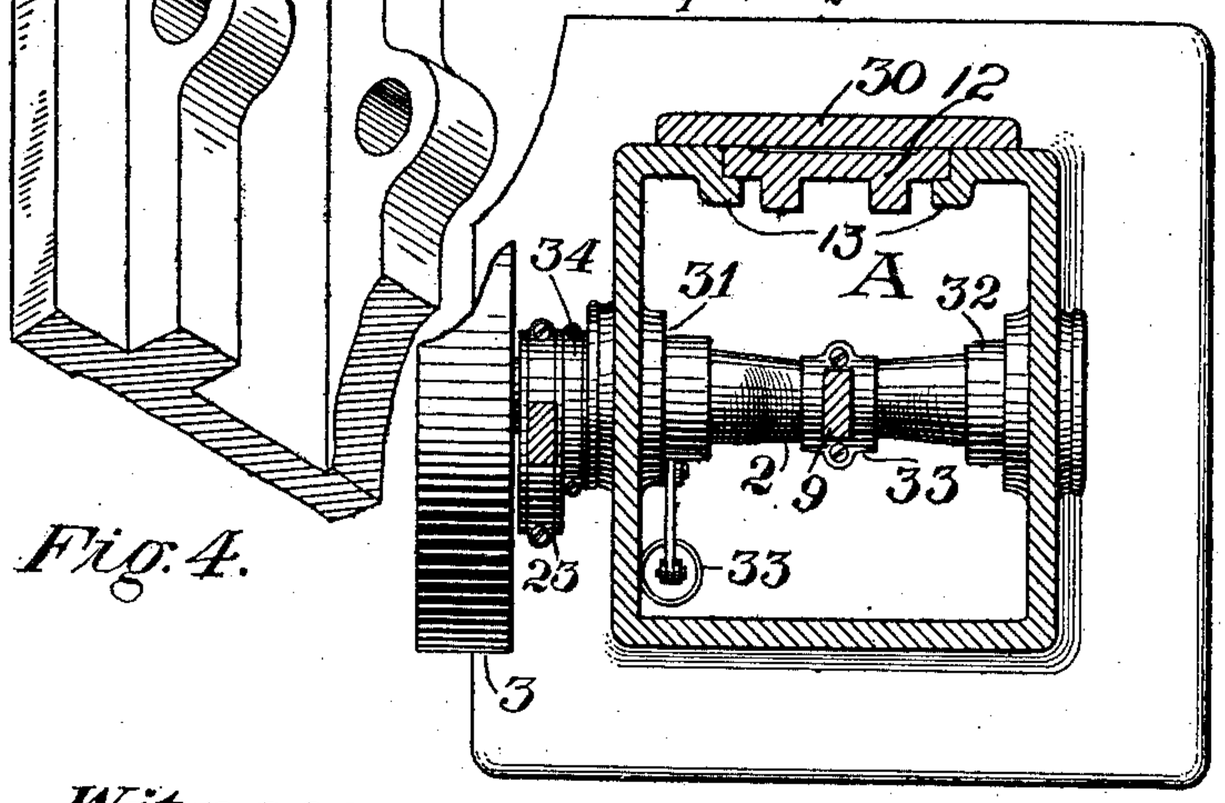

Fig. 4.

Fig. 3

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3 SHEETS—SHEET 3.

Fig. 7.

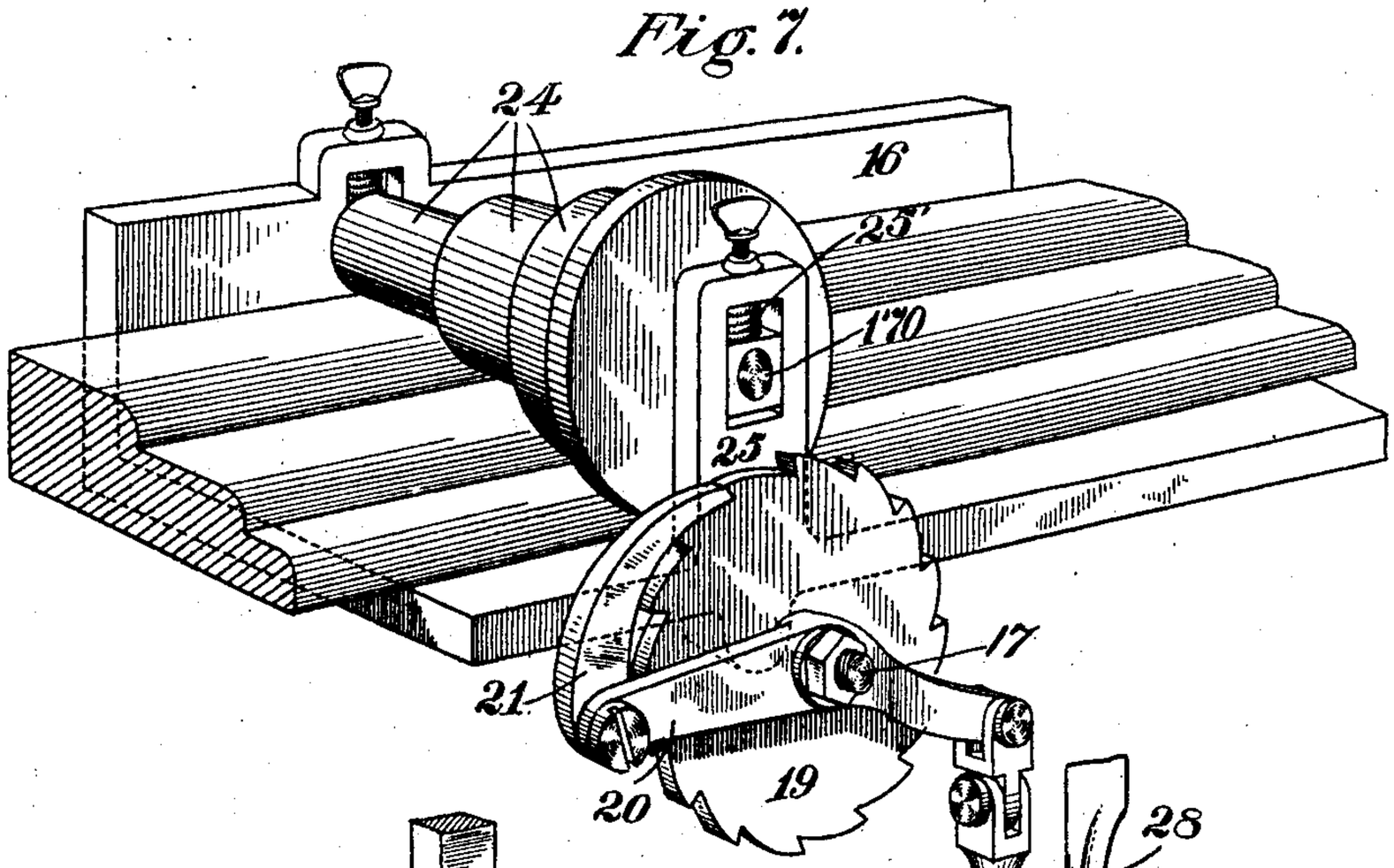


Fig. 9.

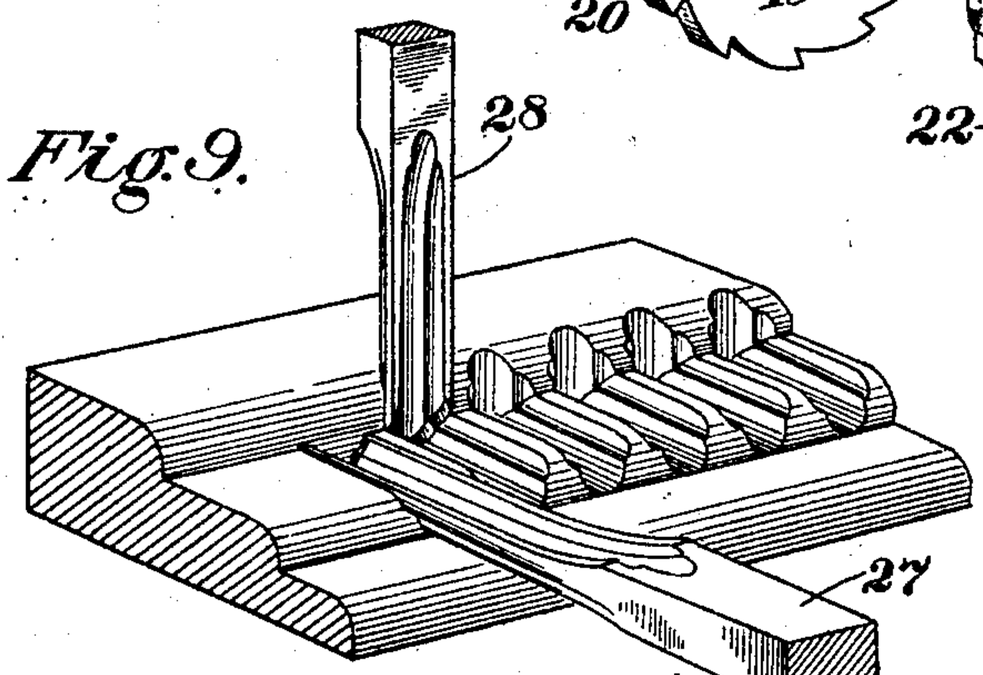
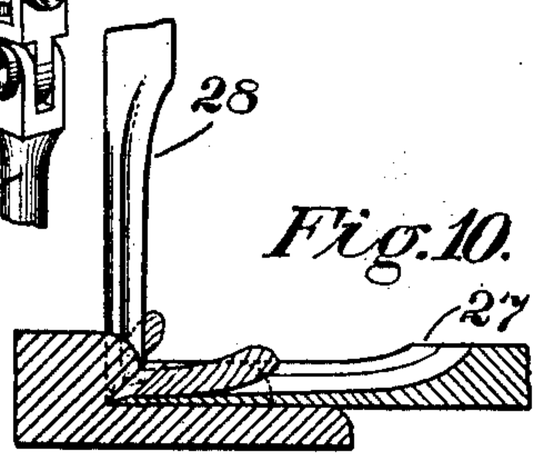


Fig. 10.



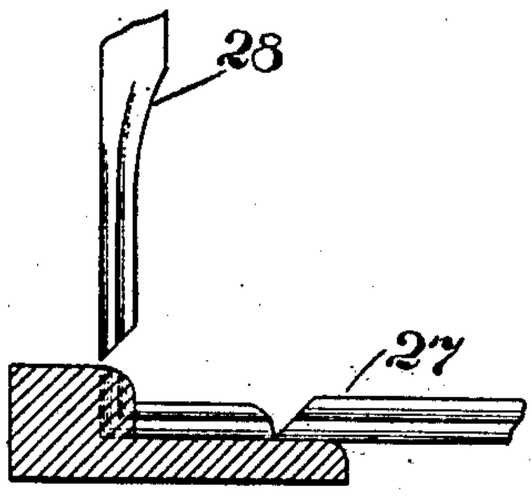


Fig. 11

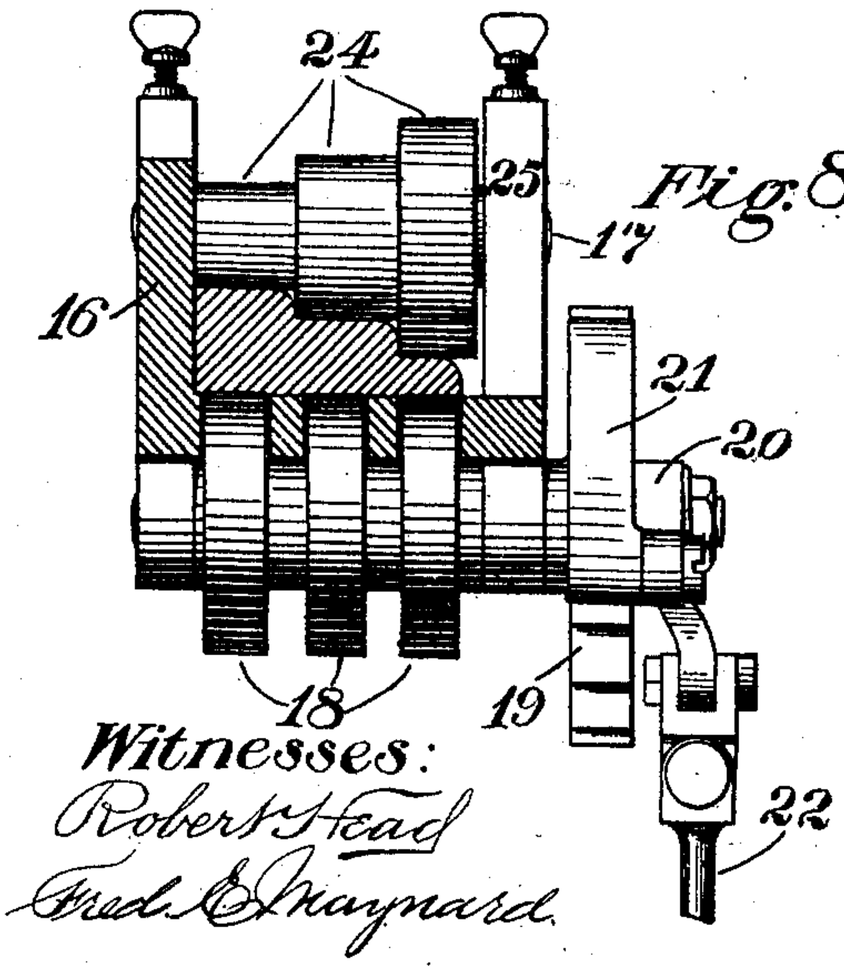


Fig. 8.

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UNITED STATES PATENT OFFICE.

FRANCIS H. RICHARDS, OF HARTFORD, CONNECTICUT.

CARVING-MACHINE.

No. 830,529. Specification of Letters Patent. Patented Sept. 11, 1906.

Application filed March 4, 1902. Serial No. 96,701.

To all whom it may concern:

Be it known that I, FRANCIS H. RICHARDS, a citizen of the United States, residing at Hartford, in the county of Hartford and State of Connecticut, have invented certain new and useful Improvements in Carving-Machines, of which the following is a specification.

This invention relates to machines for carving repeat ornaments or a repeating series of ornamental characters, wood-moldings, or the like, where two or more reciprocating tools or sets of tools, one or more for incising the contour of the ornament or a part thereof and another or others for making one or more angular cuts meeting said incision or incisions, coact to carve the desired design.

It is well known that the speed of the cutter operating in wood or the like has a material relation to the character and appearance of the finished product, and it is therefore desirable, if not imperative, to attain a relative uniformity of movement in the cutter throughout that portion of its stroke in which the work is done. If this result is obtained by a particular actuating mechanism, the speed of said actuating mechanism may be adjusted to produce the most effective results, which will then be relatively uniform throughout the work. It is also desirable in conceiving a mechanically-perfect mechanism to distribute the power exerted in operating the machine throughout the cycle of movement, thereby producing a balanced movement which allows the machine to be operated at high speeds without excessive wear or vibration. Again, in a great measure the utility and commercial efficiency of a machine lies in the simple and compact structure employed, and particularly in the choice of mechanical elements combined to produce the desired results. All these points I have aimed to embody in the structure here presented.

A form of my invention embodied in a molding-carving machine is illustrated in the accompanying drawings, in which—

Figure 1 is a side elevation, partly in section; Fig. 2, a central vertical section; Fig. 3, a horizontal plan section; Fig. 4, a detail in perspective of the vertical tool-carriage; Fig. 5, a detail of the horizontal tool-carriage; Fig. 6, a diagrammatic plan of the relatively movable parts; Fig. 7, a detail perspective of the stock-feed mechanism; Fig. 8, an end view of the stock-feed mechanism; Fig. 9, a detail showing the positions the cutting members may assume relative to the stock; Fig. 10, a detail showing positions the cutting members may assume at their extreme cutting position, and Fig. 11 a detail showing the cutting members withdrawn from the stock.

Referring to the drawings, the machine is shown assembled in and on a box-like housing or frame A. A crank-shaft 2 is shown journaled in the housing or frame A with its crank portion within said housing. The crank-shaft 2 is made in one piece, and the housing A is made in a single casting and provided with journal-apertures 31 of sufficient size to allow of the insertion through the same of the crank-shaft 2. Journals 32 for the crank-shaft 2 in the form of bushings and corresponding to the apertures 31 are put in place from outside the housing A after the insertion of the crank-shaft 2 and secured to said housing in some suitable manner. The connecting-rod 9 is provided at its lower extremity with a split journal 33 to engage the crank-shaft 2. The crank-shaft 2 projects without the housing A and is provided on its projecting portion with a power-pulley 3. Journaled upon a shaft 4 parallel to and above the crank-shaft 2 is an actuator 5. The actuator 5 in the present illustration is a multi-armed bell-crank lever and is shown provided with three arms, respectively carrying crank-pins 6, 7, and 8. The connecting-rod 9 connects the crank-shaft 2 with the crank-pin 6, imparting a rocking movement to the actuator 5 upon the revolution of the crank-shaft 2.

Referring to Fig. 6, the larger circle at the extreme lower portion of the figure represents the path of movement of the crank of crank-shaft 2. For convenience the said circle has been divided into eight equal parts, representing eight equal points in the movement of the said crank. The path described by the crank-pin 6 is shown by the arc 6^a, and the relative points from 1 to 8 in the rotation of the crank-shaft 2 are designated thereon, showing the rates of travel of the crank-pin 6 relatively to the rotation of the crank-shaft 2. The crank-shaft 2 is designed to be driven at a uniform speed, and it will be seen by reference to the arc 6^a that the velocity of the actuator 5 at the crank-pin 6 is not a uniform one, but that the travel of the rocker from point 1 to point 3 is quite slow. Its travel between the points 3 and 4

and 4 and 5 is approximately uniform, while in the return stroke between points 5 and 7 the maximum velocity is obtained, and the return to point 1 from 7 is again quite slow. The paths of travel of the crank-pins 7 and 8 are indicated by the arcs 7^a and 8^a, respectively. The velocities of the crank-pins 7 and 8, carried upon the actutaor 5 at any point in their movement, bear a constant ratio to that of the crank-pin 6 at the corresponding point of its movement.

A tool-carriage 10 is reciprocally mounted in horizontal guides 11 in the upper surface of the frame A. A second tool-carriage 12 is reciprocally mounted in vertical guides 13 in the rear wall of the frame A. The tool-carriage 10 is pivotally connected by a connecting-rod 14 to the crank-pin 7 on the actuator 5. The tool-carriage 12 is pivotally connected by a connecting-rod 15 with the crank-pin 8 on the actuator 5. It will be seen that the tool-carriages 10 and 12 will be given a simultaneous reciprocating movement by the rocking movement of the bell-crank rocker.

It will appear hereinafter that the stroke of the horizontal tool-carriage 10 in this particular machine is required to be of greater length than that of the vertical tool-carriage 12. This movement is accomplished by making the arm of the actuator 5, carrying crank-pin 7, longer than that carrying crank-pin 8, causing crank-pin 7 to describe an arc of greater length than that described by crank-pin 8, consequently giving tool-carriage 10 a longer stroke than that of tool-carriage 12.

Referring again to Fig. 6, the path of travel of tool-carriage 10 is shown by line 10^a and that of tool-carriage 12 by line 12^a. The velocities of the tool-carriages 10 and 12 are indicated upon lines 10^a and 12^a in a like manner as the velocities of crank-pins 7 and 8 on arcs 7^a and 8^a. The direction of travel of the tool-carriage 10 in its cutting stroke (referring to line 10^a, Fig. 6) is toward the left, and the actual cutting stroke occurs between the points 3 and 5, where the speed is relatively uniform. The retrograde movement between points 5 and 7 withdraws the cutting member from the stock, and the speed of the tool-carriage between these points is appreciably accelerated. The direction of travel of the tool-carriage 12 in its cutting stroke (referring to line 12^a) is downward, and, as in the case of the tool-carriage 10, the actual cutting-stroke occurs between the points 3 and 5, where the speed of the tool-carriage is relatively uniform, and the retrograde movement of the tool-carriage withdrawing the cutting member from the stock occurs between points 5 and 7, where the speed is appreciably accelerated. A horizontal stock-guide 16 is mounted upon the top of the frame A directly under and in line with the path of the vertical reciprocating tool-carriage 12. Guides 11 for the tool-carriage 10 are disposed transversely to the stock-guide 16. At one side of the paths of the cutting members and journaled on and supported by the stock-guide 16 is a shaft 17, carrying fast feed-rolls 18, the peripheries of which feed-rolls extend through the stock-guide and slightly above the bed thereof. Fast on a projecting portion of the shaft 17 is a ratchet-wheel 19. Loosely mounted on the shaft 17 adjacent the ratchet-wheel 19 is a lever 20 of the first class, carrying at the extremity of one of its arms a pawl 21, engaging the ratchet-wheel 19. At the extremity of the other arm of the lever 20 a connecting-rod 22 is universally pivoted and connects the lever 20 with an eccentric 23 upon the projecting portion of the crank-shaft 2. The action of the eccentric 23 upon the revolution of the crank-shaft 2 imparts, through the connecting-rod 22, the lever 20, the pawl 21, and the ratchet-wheel 19, an intermittent rotative movement to the shaft 17 and feed-rolls 18. The eccentric 23 is so set upon the crank-shaft 2 with relation to the crank thereof that the movement imparted to the feed-rolls 18 occurs during the interval of time when the cutting members upon the tool-carriages 10 and 12 are without and free of the stock. The relation of these movements is shown in Fig. 6, the smaller circle at the lowermost portion of the figure representing the path of movement of the eccentric 23. This circle is divided into eight parts and positioned with reference to the larger circle to show the movement of the eccentric 23 relatively to that of the crank-shaft 2. The movement of the connected end of the pawl 20 is indicated by the line 21^a, upon which the velocities of the said lever are indicated in a like manner to those on lines 10^a and 12^a. It will be seen that the upward movement of the connected end of the lever 20 occurs between the points 3 and 7. The pawl during this movement is being retracted and imparts no motion to the feed-rolls 18. It will be remembered that between the points 3 and 7 the cutting members are in the stock. It will also be remembered that between the points 7 and 3 the cutting members are entirely without the stock, and it will be seen that it is during this period between points 7 and 3 that the connected end of lever 20 is being drawn downwardly by the rod 22, and the pawl 21, carried by lever 20, imparts its motion through the ratchet-wheel 19 to the feed-rolls 18. In the particular machine shown the feed is that obtained by the movement of the ratchet-wheel 19 one tooth, and the diameter of the feed-rolls is particularly proportioned to feed the stock the required distance. The range of feed may be varied in some suitable manner, and this may be done by varying the diameter of the feed-

rolls or increasing the eccentricity of the eccentric 23 and changing the number of teeth upon the ratchet-wheel 19 or increasing the travel of the pawl 21 or any combination of these changes.

A pressure-roll 24 or, as in this case, a plurality of pressure-rolls approximately conforming to the face of the stock are carried by shaft 170, mounted directly above the feed-rolls 18 in adjustable journals 25 and preferably provided with downwardly-pressing springs 25′ to retain the stock in close contact with the feed-rolls 18. The feed-rolls 18 may be corrugated, milled, or otherwise roughened to insure a better grip upon the stock.

The two carriages 10 and 12 are provided with tool-beds 26 26′ of considerable width to allow of an extended lateral adjustment of the tools thereon and are provided with longitudinal T-slots for the engagement of the tool clamp or clamps. A pivoted arm is mounted upon the rearward end of the tool-carriage, carrying an adjusting thumb-bolt capable of lateral movement across the entire width of the tool-bed to engage the rearward end of a tool gripped at any point thereon to allow of a fine longitudinal adjustment of the tool and in a measure take up the thrust upon the tool.

The tools 27 and 28 are clamped upon the beds of the carriages 10 and 12 to present longitudinal alinement with the directions of reciprocation of the carriages, but are not intended to move in the same plane, but in parallel planes of a distance apart equal to the distance of that between the centers of the adjacent repeat ornaments or characters. One of said tools is designed to make the vertical incision of one ornament simultaneously as the other tool makes the horizontal incision of the next following ornament, or vice versa. By this arrangement the meeting of the cutting edges of the tools is avoided while the tools are operated simultaneously. This arrangement substitutes a single cutting movement for the following cutting movements to alternate with the feed, as has heretofore been the practice, reducing the number and time of the several movements making up the cycle of the machine and making a higher speed practicable.

It was hereinbefore explained that the tool-carriage 10 is given a greater play than carriage 12, and this movement imparted to the tools is clearly shown in Figs. 10 and 11. Fig. 10 represents the tools simultaneously reaching the limit of their cuts, and Fig. 11 represents the tools simultaneously leaving the stock, tool 28 having traversed a much greater distance than tool 27 in the same time.

It will be seen particularly in Fig. 3 that the tool-carriage guideways 13 are formed in the frame A at either side of an opening 29 and that the carriage 12 is retained in the guides 13 by a closure 30 for said opening, acting as gibs for the slide and permitting access to the interior of the supporting-frame for purposes of cleaning and repairing. It will also be noted that the connection between the slide 12 and its operating device is had through such opening and that the slide acts as a closure for such opening in conjunction with the lid 30 and that the slide 10 is also connected with the mechanism which is inside of the box-like support through an opening in the walls thereof, such slide also acting as a closure for its opening whereby the mechanism is securely housed within the frame or support, the slides acting as closures therefor, thus preventing dust from gaining access to the operating mechanism.

The box-like frame A at its bottom is designed to serve the purpose of a storage-reservoir for oil, and a pump 33 in said housing A and operated by an eccentric 34 on the crank-shaft 2 is provided to pump oil from the reservoir through a system of tubes (shown in dash-lines in Fig. 1) to the several working parts, and thereby provide a continuous system of lubrication when the machine is in operation.

A brief desciption of the cycle of operation of the machine herein illustrated is as follows: The machine is designed to receive power from the power-pulley 3 at an approximately uniform speed. The stock is fed to the tools by the movement of the feed-rolls actuated by the pawl-and-ratchet mechanism, in turn actuated by the eccentric 23. During the cessation of the feed the tools simultaneously enter at different points the stock to be ornamented and are withdrawn, after which the feed moves the stock lengthwise a distance equal to that between the centers of the tools at their extreme limit of cut. The tools again enter the stock, the rearward tool cutting out the chip incised by the forward tool in its previous movement simultaneously as the forward tool incises one cut of the following ornament. The power exerted in forcing the tools into the stock is greater than that exerted in withdrawing them, and by the mechanism already described it will be seen that the velocity of the withdrawal of the tools is increased over that of the movement of forcing the tools into the stock, thereby in a greater or less measure equalizing the power exerted in these two movements and rendering the balance of the machine more perfect. It is desired to call attention at this point to the approximate balance obtained in this device. It was above said that that portion of the stroke of the cutters when they are being forced into the stock occurs between the points 3 and 5. (See Fig. 6.) It will be further noted that the greatest resistance is presented to the cutters throughout this stroke and that the maximum power

used in the cycle is exerted throughout. That portion of the retrograde movement of the tool-carriage occupied by the withdrawal of the tool from the stock is from 5 to 7, and the acceleration given the carriage between these points approximately balances the movement by utilizing more power. On account of the low velocity of the carriage without the stock—that is, from points 7 to 3—very little power is exerted thereon, and the surplus is used at this time in actuating the stock-feed, thereby approximating the maximum power used. Therefore the maximum power used is approximately the same throughout the cycle of the machine, producing a balanced condition which allows of the attainment of high speed without detrimental vibratory effects.

It is obvious that various changes may be made in the structure and general arrangement of the machine to suit various classes of work without departing from the spirit of my invention.

The tools 27 and 28 of course take the particular form desired for any particular character of work for which they are required and are varied in form and material to suit the character of the material operated upon. In like manner the presser-rolls and stock-guide are to be made in various forms to lend themselves readily to the configuration of the stock to be used. The relative movements of the cutters should also be taken into consideration in constructing a machine for any particular class of work and may be varied to conform with the requirements of the machine.

Having described the several parts and operation of my device, what I claim is—

1. In a carving-machine, the combination of a plurality of cutters patterned and arranged to incise the contradistinctive incisions of separate repeats of a pattern, means to support the several cutters so that the distance between their centers will be equal to the distance between the centers of the repeats, means to operate said cutters in unison, a stock-feed, and means to operate said stock-feed to feed the stock a distance corresponding with the distance between the centers of said repeats alternately with the cutting movements of said cutters.

2. In a carving-machine, the combination of a support, a stock-guide on said support, a plurality of guideways on said support adjacent said stock-guide, said guideways directed transversely of said stock-guide and one another and approaching said stock-guide at separate points thereon, a plurality of cutting members mounted to reciprocate in said guideways, a multi-armed bell-crank-lever mounted in said support, links connecting sundry arms of said bell-crank lever with said cutting members, a driving-shaft mounted in said support, a crank on said driving-shaft, and a connecting-rod connecting said crank with an arm of said bell-crank lever to simultaneously reciprocate said cutting members toward and from said stock-guide to simultaneously incise contradistinctive portions of the contours of separate repeats of a repeating design on stock lying in said stock-guide.

3. In a carving-machine, the combination of a support, a stock-guide on said support, a plurality of guideways on said support adjacent said stock-guide, said guideways directed transversely of said stock-guide and one another and approaching said stock-guide at separate points thereon, a plurality of cutting members mounted to reciprocate in said guideways, a feed roll or rolls suitably mounted in proximity to said stock-guide, intermittent actuating mechanism connected with said feed roll or rolls for intermittently rotating said roll or rolls, a multi-armed bell-crank lever mounted on said support, links connecting sundry arms of said bell-crank lever with said cutting members, a driving-shaft mounted in said support, a crank on said driving-shaft, a connecting-rod connecting said crank with an arm of said bell-crank lever, a second crank on said driving-shaft, a connecting-rod connecting said second crank with said intermittent actuating mechanism, all organized to effect the simultaneous incision of contradistinctive portions of the contours of separate repeats of a repeating design on stock lying in said stock-guide during a portion of the cycle of the machine, and a feed of said stock by said intermittently-actuated feed-rolls during substantially the remainder of the cycle of the machine.

4. In a carving-machine, the combination of a support, a stock-guide on the top of said support, a guideway on the top of said support having an aperture therein leading to the interior of said support, said guideway approaching and directed transversely of said stock-guide, and a second guideway on said support leading from the interior of said support through the top thereof approaching said stock-guide at a point thereon separate from that approached by said first guideway, said second guideway directed transversely of said stock and said first guideway.

5. In a carving-machine, the combination of a support, a stock-guide on the top of said support, a guideway on the top of said support having an aperture therethrough leading to the interior of said support, said guideway approaching and directed transversely of said stock-guide, an aperture in one wall of said support, guideways in the wall of said support adjacent said aperture and extending through the top of said support to approach said stock-guide in a direction transverse of said stock-guide at a point separate from that approached by said first guideway, a closure for said aperture and serving as gibs

to hold a slide on said guideways, tool-slides on said respective guideways; and means within the support to actuate the same through said apertures.

6. In a carving-machine, the combination with a reciprocating cutter, of an oscillating actuator; a connecting-rod connecting said reciprocating cutter with said oscillating actuator; a driving crank member so positioned relatively of said oscillating actuator and connected therewith as to impart to said cutting member through the medium of said oscillating actuator a substantially uniform cutting movement, a relatively accelerated retrograde movement and a relatively slow movement between the retrograde and the next cutting movement; a feeding device; and means to control the same and actuated by the crank member to feed the work at the between movement of the cutter.

7. In a carving-machine, the combination with a cutter of speed-varying driving mechanism for imparting to said cutter a reciprocative movement of relatively higher velocity within than without the profile of the stock operated upon.

8. In a carving-machine, the combination with a carving-tool of a rotatable crank-shaft, a crank thereon, an oscillatable actuator, connecting-rod connecting said tool with said actuator and a connecting-rod connecting said crank with said actuator in such relation that the radius of said actuator passing through the point of connection between said actuator and the rod connecting the actuator to the crank at its position of nearest approach to said crank-shaft will be substantially perpendicular to the concurrent position of said connecting-rod.

9. In a carving-machine, a support, an oil-reservoir therein, cutting members operating upon the surface of said support, a power-driven member journaled in said support, operative connection between said member and cutting members and entirely inclosed within said support, and an oil-distributing mechanism contained within said support and operable to lubricate the mechanisms.

10. In a carving-machine, the combination of a rotatable crank-shaft, a crank thereon, a reciprocatable cutting member and operatively-connected means intermediate said crank and member consisting of an oscillatable actuator, a connecting-rod connecting said crank with said actuator in such relation that the radius of said actuator passing through the point of connection between said actuator and rod at its position of nearest approach to said crank-shaft will be substantially perpendicular to the concurrent position of said connecting-rod, and an operative link connection between said actuator and said cutting member.

11. In a carving-machine, a box-like support, an ingress and egress aperture in the wall of said support, guides in the wall of said support adjacent said aperture, a carriage reciprocable within said guides and a closure for said aperture and guides upon the inner face of said closure for retaining said carriage.

12. In a carving-machine, a box-like support, a stock-guide upon one face of said support, a cutter-carriage slidably mounted upon the same face and another cutter-carriage slidably mounted upon and projecting beyond another face of said support, and mechanism within the support to actuate the carriages and entirely housed by the support and carriages.

13. In a carving-machine, a box-like support, a cutter-carriage slidably mounted upon one face of said support, another cutter-carriage slidably mounted upon another face of said support, apertures in the support adjacent to the respective carriages and closed thereby, and mechanism within said support and connected to the carriages through said apertures to actuate the same.

14. In a carving-machine, the combination of a plurality of simultaneously-actuable tool-carriages operative in convergent planes at separate points on the line of intersection of said planes, a connecting-bar, an oscillatable actuator operatively connected thereby with said tool-carriages, a power-driven crank-shaft, a crank thereon, and a connecting-rod connecting said crank with said actuator in such relation that the radius of said actuator passing through the point of connection between said actuator and rod at its position of nearest approach to said crank-shaft will be substantially perpendicular to the concurrent position of said connecting-rod.

15. In a carving-machine, the combination with a reciprocating cutter-slide, of an oscillating actuator, a connecting-rod connecting said reciprocating slide with said actuator, a driving-crank member so positioned relatively of said actuator and connected therewith as to impart to said slide through the medium of said actuator a substantially uniform forward movement, a relatively accelerated retrograde movement and relatively slow movement between the retrograde movement and the next forward movement, a feeding device and means for controlling the same and actuated by the crank member for feeding the work at the between movement of the cutter.

16. In a carving-machine, the combination of a support, a stock-guide on said support, a plurality of transversely-disposed guideways on said support, cutting members reciprocatory in said guideways, a multi-armed lever mounted in said support, links connecting the arms thereof with said cutting members, a driving-shaft mounted in said support and provided with a crank, and a connecting-rod connecting said crank with an arm of said lever for rocking the same and

simultaneously reciprocating said cutting members toward and from said stock-guide.

17. In a carving-machine, the combination of a support, a stock-guide on said support, a pair of transversely-disposed guideways on said support, a cutting member reciprocatory on each of said guideways, a lever having a pair of arms of different length and mounted in said support, links connecting the said arms thereof with the respective cutting members, a driving-shaft mounted in said support and provided with a crank, and a connecting-rod connecting said crank with said lever for rocking the same and simultaneously reciprocating said cutting member, but each with a different length of stroke, toward and from said stock-guide.

18. In a carving-machine, the combination of a plurality of guideways on said support disposed transversely to said stock-guide, slides reciprocatory in said guideways, feeding means mounted in proximity to said stock-guide, intermittent actuating mechanism connected with said feeding means intermittently actuating the same, a multi-armed lever mounted on said support, links connecting said slides with arms of said lever, a driving-shaft mounted in said support and provided with a crank, a connecting-rod connecting said crank with an arm of said lever, a second crank on said driving-shaft, means controlled by said second crank for intermittently actuating the feeding means all organized to effect the simultaneous movement of said slides toward said stock-guide during a portion of the cycle of the machine, and the actuation of the feeding-rolls during another portion of the cycle of the machine.

19. In a carving-machine, the combination of a plurality of guideways on said support disposed transversely to said stock-guide, slides reciprocatory in said guideways, feeding means mounted in proximity to said stock-guide, intermittent actuating mechanism connected with said feeding means for intermittently actuating the same, a lever having arms of different length and mounted on said support, links connecting said slides with arms of said levers, a driving-shaft mounted in said support and provided with a crank, a connecting-rod connecting said crank with an arm of said lever, a second crank on said driving-shaft, means controlled by said second crank for intermittently actuating the feeding means, all organized to effect the simultaneous movement of said slides, but with dissimilar length of excursion, toward said stock-guide during a portion of the cycle of the machine, and the actuation of the feeding-rolls during another portion of the cycle of the machine.

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