F. H. RICHARDS.

CARVING MACHINE.

APPLICATION FILED MAR. 27, 1902. RENEWED MAR. 8, 1911.

1,005,310. Patented Oct. 10, 1911.

3 SHEETS—SHEET 1.

Fig. 2.

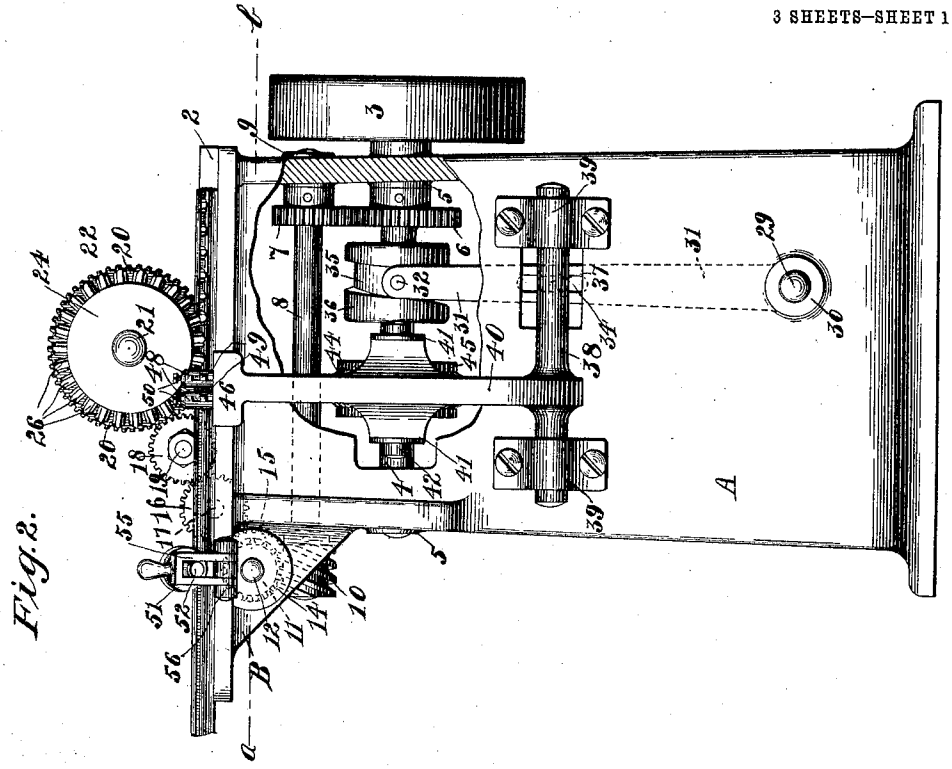
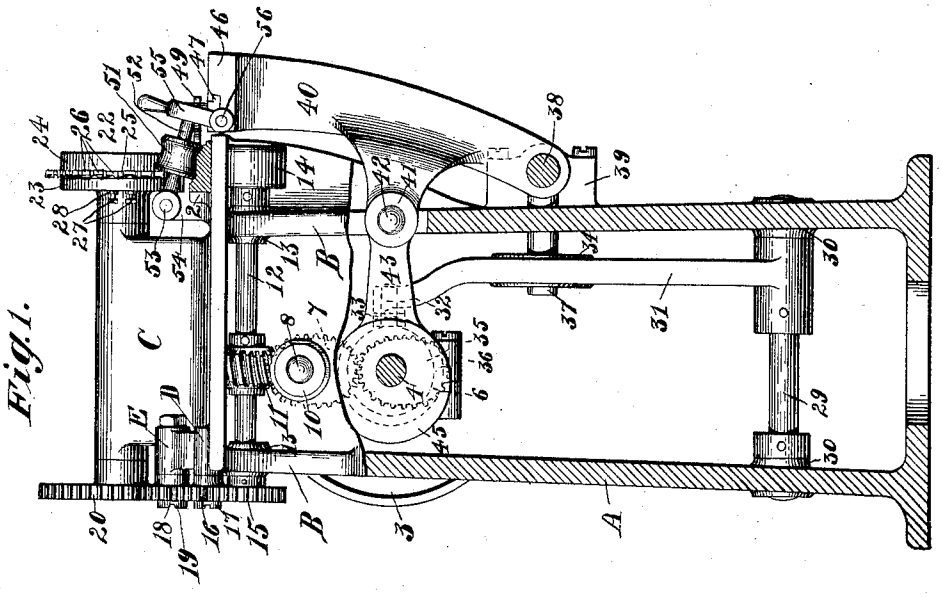


Fig. 1.



Witnesses:
F. G. Hachenberg.
R. W. Pittman

Inventor:
F. H. Richards.

COLUMBIA PLANOGRAPH CO., WASHINGTON, D. C.

F. H. RICHARDS.

CARVING MACHINE.

APPLICATION FILED MAR. 27, 1902. RENEWED MAR. 8, 1911.

1,005,310.

Patented Oct. 10, 1911.

3 SHEETS—SHEET 2.

Fig. 3.

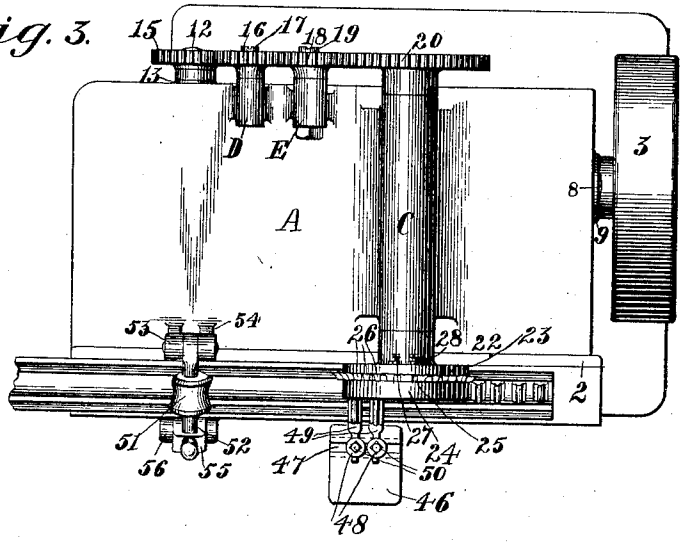
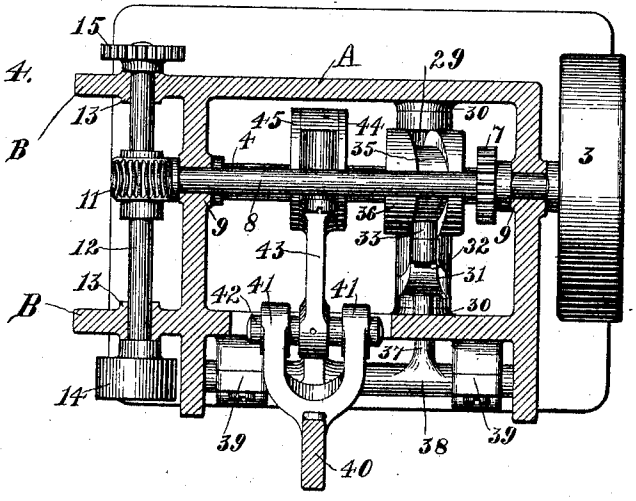


Fig. 4.



Witnesses:

F. G. Hachenberg.

R. M. Pittman

Inventor:

F. H. Richards.

F. H. RICHARDS.

CARVING MACHINE.

APPLICATION FILED MAR. 27, 1902. RENEWED MAR. 8, 1911.

1,005,310. Patented Oct. 10, 1911.

3 SHEETS—SHEET 3.

Fig. 5.

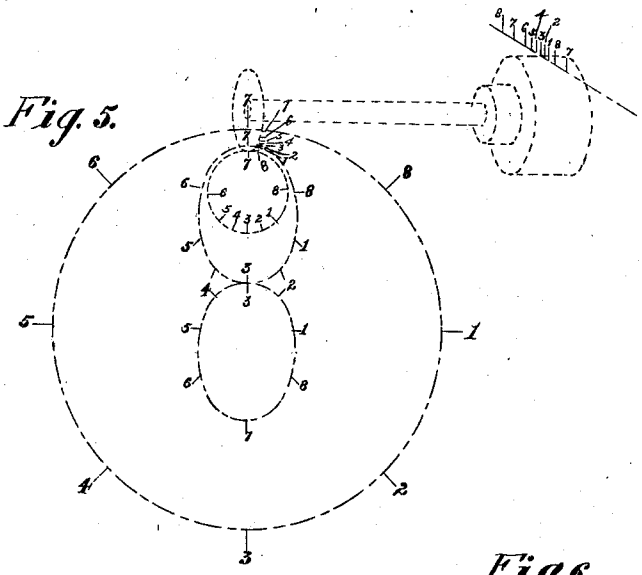


Fig. 6.

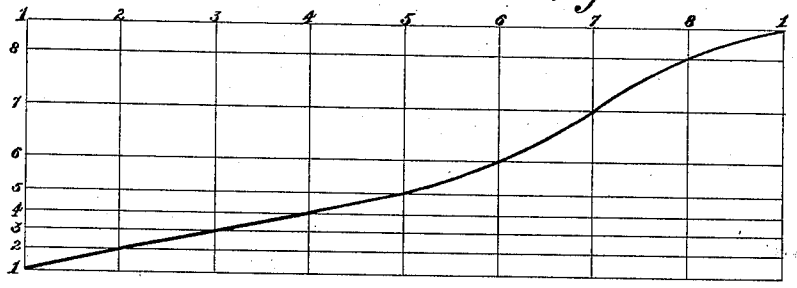


Fig. 7.

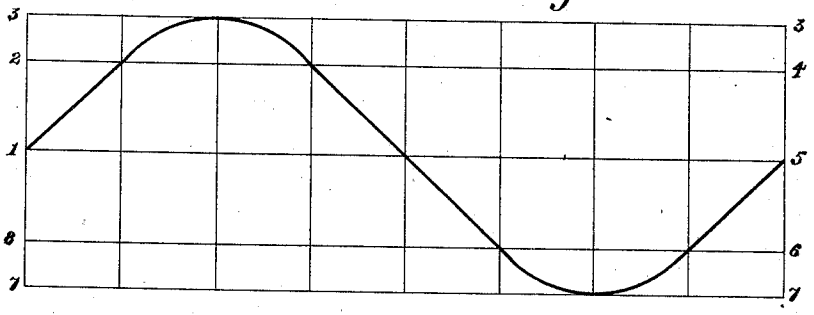
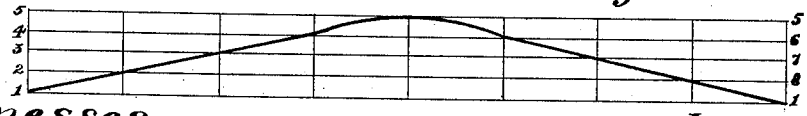


Fig. 8.



Witnesses:

F. G. Hachenberg.

R. M. Pittman

Inventor:

F. H. Richards.

UNITED STATES PATENT OFFICE.

FRANCIS H. RICHARDS, OF HARTFORD, CONNECTICUT.

CARVING-MACHINE.

1,005,310. Specification of Letters Patent. **Patented Oct. 10, 1911.**

Application filed March 27, 1902, Serial No. 100,210. Renewed March 8, 1911. Serial No. 613,167.

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 on wood, moldings or the like, where tools making meeting incisions coact to carve the desired design.

My invention consists in a continuously operating rotary cutter carrying mechanism operated in conjunction with a continuous stock feed mechanism, an oscillating cutter, and lateral tool feed mechanism for said oscillating cutter, all relatively combined in constant operative connection, organized and driven from a single source in the novel manner hereinafter set forth and further lies in the selected combination of mechanical elements and their relative positionment, interaction and connective distribution resulting in an harmonius nicely balanced and compact mechanical organization.

Some objects of my invention are to produce a well balanced machine for carving repeat ornaments on stock continuously fed to the same, to produce a machine of this character in which the several elements of its organization are intimately and constantly connected in a compact and practicable form and which is capable of operation at high speeds to render a greater output feasible than has heretofore been attained.

My invention embodied in a carving machine, is illustrated in the accompanying drawings, in which:

Figure 1, is a front elevation showing the front face of the frame broken away. Fig. 2, a side elevation showing the side face of the frame broken away; Fig. 3, a plan view; Fig. 4, a horizontal cross section on line *a—b* of Fig. 2; Fig. 5, a diagrammatical representation of the movements of the variable feed machanism; and Figs. 6, 7 and 8, respectively, time charts of the movements of the stock feed, the horizontal cutter and the lateral tool feed.

Referring to the drawings, the machine shown is assembled in and on a box like frame A. A stock guide 2 is provided upon the top of the frame A. A power pulley 3 is mounted on and drives a main power shaft 4 mounted parallelly to said stock guide 2 in bearings 5, 5, in the walls of the frame A. An elliptical gear 6 fast on shaft 4 meshes with and drives a like sized elliptical gear 7 fast on a shaft 8 parallelly mounted to said shaft 4 in bearings 9, 9, in the walls of the frame A. The elliptical gears 6 and 7 are mounted on their respective shafts within the frame A and serve to transmit a rotary motion of varying velocity to the shaft 8 from the uniformly rotating shaft 4.

The shaft 8 projects without the frame A and carries a fast worm 10 upon its projecting portion which worm meshes with and drives a worm wheel 11 fast on shaft 12. The shaft 12 is mounted in bearings 13, 13, in extensions B, B, of the frame A at right angles to the shafts 4 and 8. The shaft 12 carries a fast feed roll 14, the periphery of which projects through and a trifle above the floor of the stock guide 2. The shaft 12 also carries a fast gear 15 which meshes with and drives an idle gear 16 mounted on a stud 17 secured in the upstanding projection D of the frame A. The idle gear 16 meshes with and drives an idle gear 18 mounted on a stud 19 secured in the upstanding projection E of the frame A.

The idle gear 18 meshes with and drives a gear 20 fast on shaft 21 mounted in a bearing in the upstanding transverse projection C of the frame A. The shaft 21 on its opposite end carries a circular tool chuck 22 the peripheral face of which lies directly over the stock guide 2. The tool chuck 22 consists of two disks 23 and 24, the disk 23 is secured fast to the shaft 21 and the disk 24 which is provided with radial slots 25 in its upper face is securely bolted thereto, the slotted face abutting the disk 23. The radial slots, when the disks are brought into contact form peripheral recesses in the chuck 22. The slots 25 are shown as rectangular in cross section but they may be of any desired and practicable form. The disk 23 is provided with a plurality of set screws 27, registering with the slots 25 which are

adapted to secure tools 26 in said slots. Each set screw 27 is provided with a jam nut 28.

It will be noted that the variable velocity given shaft 8 by the elliptical gears 6 and 7 is transmitted to shaft 12 and hence to feed roll 14.

The gear train 15, 16, 18 and 20 transmits motion from shaft 12 to shaft 21 in the relation of one revolution of shaft 21 to two of shaft 12 and the periphery of the extreme cutting points of the tools 26 is double that of the feed roll 14 so that it will be seen that the peripheral velocity of the rotary cutting member will be exactly equal to that of the feed roll 14 and the varying phases of said peripheral velocity will occur synchronously in both said feed roll and rotary cutting member. Therefore it is evident that if stock be fed by feed roll 14 into the peripheral path of the rotary cutter, that member will traverse said stock in exact correspondence with the velocity thereof.

As the feed roll and rotary cutting member engage opposite sides of the stock they have been given opposite directions of rotation by the insertion of the two gears 16 and 18 between gears 15 and 20. It is obvious that an equivalent of this gearing would be to provide gears 15 and 20 of such diameter that they would intermesh, but for the sake of compactness the train of smaller gears has been illustrated.

The tools 26 may be set in the chuck 22 at equal intervals or at varying intervals, in the same plane or in different planes as the nature of the particular work is to be accomplished requires. Again the tools 26 may be of different configuration and be arranged about the chuck in repeating series. A rotary cutting member of this order is better adapted for making shallow cuts than for the longer or deeper ones in view of the variation of the angle of each tool in making its cut. However, the tools can be designed in such a manner that this objection is greatly obviated even in relatively deep work in some patterns, but as this member in this machine is only designed for very shallow cuts it is unnecessary to go further into detail in the matter of tool designing and pattern arrangement.

For patterns in which the ornamental cuts occur nearer or farther apart substitutable chucks are provided in which the slots 25 are suitably positioned for the particular pattern. Each tool 26 is adjustable and removable independently of the others by the set screws 27 and their jam nuts 28.

The rotary cutting member consisting of the chuck 22 and the tools 26 carried thereby makes a continuous series of cuts in the stock as it is continuously fed through by the feed roll 14.

A relatively long oscillatable arm 40 has a shaft portion 38 shown extending at right angles to its main body acting as the axis of oscillation and mounted in bearings 39 on the frame A. The bearings 39 are preferably positioned in a plane perpendicular to the floor of the stock guide at a point which corresponds approximately with the centers of the cuts to be made parallel to said floor. The arm 40 is oscillatable in a plane perpendicular to the stock guide 2. Upon the upper end of the arm 40 is formed a tool bed 46 lying pependicular to the plane of oscillation of the arm 40, and parallel with the chord of the arc to be made by the cutting edge of the tools 49 during their sojourn in the stock. A T-slot 47 is provided in the tool bed 46 parallel with the stock guide 2 in which a plurality of tool posts 48 are adjustable. The shanks of the tools 49 are adjustably held in the tool posts 48 and the tool posts held to the tool bed by set screws 50 in the usual manner. The same may be said of the tools 49 as was hereinbefore noted with reference to tools 26, that is, that they may be set at uniform or varying intervals, in the same or different planes, or may be all alike or of different configuration, conforming however for coöperation with those used in the rotary cutter.

In the machine illustrated herein only two tools 49 are shown set in like positions and of like configuration. The arm 40 is provided with a bifurcated extension carrying bearings 41 in which a wrist pin 42 rigidly mounted in and projecting at either side of the end of an eccentric rod 43 works. The eccentric rod 43 projects between the bearings 41 and said bearings 41 grasp the wrist pin 42 at either side thereof and are longitudinally reciprocable thereon, considerable lateral play being afforded between said bearings and the eccentric rod 43. The eccentric rod 43 in this case is made integral with an eccentric strap 44 which works on an eccentric 45 on the shaft 4.

The shaft portion 38 is longitudinally movable in the bearings 39 as well as oscillatory. It will therefore be seen that when the shaft 4 is revolved the arm 40 will be oscillated toward and from the said shaft and stock guide 2 by the action of eccentric 45 and its connections, and at the same time the arm 40 may be laterally moved in the direction of the stock guide without interfering with said oscillating connection in view of the lateral play of the bearings 41 on the wrist pin 42.

A rocker arm 31 secured fast at its lower end to a shaft 29 is mounted in bearings 30, 30, in the frame A. The arm 31 carries a stud 32 at its upper end on which is mounted roller 33 which works in a lateral cam groove 35 in a cam wheel 36 fast on shaft 4. When the shaft 4 rotates, the roller 33 traveling in cam groove 35 imparts an os-

cillating movement to arm 31. The arm 31 has a longitudinal slot 34 into which projects an arm 37 integral with the shaft portion 38 of arm 40. The oscillation of arm 31 imparts through arm 37 a reciprocating movement to the arm 40 parallelly of the stock guide 2.

The lateral cam groove 35 is designed to give through the oscillating arm 31 a reciprocating movement to the arm 40 carrying the tools 49, which in the direction of the feed of the stock exactly coincides with stock feed, that is, is given exactly corresponding velocities.

The eccentric moves the arm 40 to carry the tools 49 into and out of the stock, and in this particular machine the sojourn of the tools within the stock takes place during one half revolution of said eccentric and the tools are without the stock one half revolution. This is graphically illustrated by the curve shown in the time chart, Fig. 7. The ordinates in Figs. 6, 7 and 8, numbered from 1 to 8, represent eight equal time intervals in one complete revolution of the driving shaft and the points of intersection of the abscissas numbered from 1 to 8, therewith represent the relative positions at said ordinates assumed by the part the movement of which is graphically illustrated. The point attained by the several parts when the cutters 49 first engage the stock in making an incision is represented by the intersection of the ordinate 1 and the abscissa 1. It will therefore be seen, referring to Fig. 7, that the relative position of the profile of the stock to the tools 49 is along the abscissa in which the points 1 and 5 occur and the tools 49 are within the profile of the stock between the ordinates 1, 2, 3, 4, and 5 or during one-half revolution of the driving shaft and entirely without the profile of the stock between the ordinates 5, 6, 7, 8 and 1. This movement is brought about by the action of eccentric 45 and its connections.

The cam groove 35 is so fashioned in the wheel 36 and said wheel is so set upon the shaft 4 that it will impart through its connections a reciprocating motion to the arm 40 carrying tools 49 which movement takes place in the direction of the feed between the ordinates 1, 2, 3, 4, and 5 (see Fig. 8 which represents this tool feed movement) and in a return direction between the ordinates 5, 6, 7, 8, and 1. It will then be noted that the tool feed takes place in the direction of the stock feed during the same interval that the tools 49 are within the profile of the stock.

The time chart illustrated in Fig. 6 graphically depicts the feed of the stock brought about by the feed roll 14 actuated by the elliptical gears 6 and 7. The slow movement of the stock feed takes place between the ordinates 1, 2, 3, 4 and 5 and the acceleration occurs between the ordinates 5, 6, 7, 8 and 1. Therefore the lateral tool feed (see Fig. 8) takes place in the direction of the stock feed (Fig. 6) during the same interval that the stock feed is maintained at its lowest velocity and also while the tools 49 are within the profile of the stock.

Referring to Figs. 6 and 8 it is seen that between the ordinates 1, 2, 3, 4 and 5 (while the tools 49 are within the profile of the stock) the lateral tool feed exactly coincides with the stock feed, the stock feed the while being maintained at its lowest velocity. The rotary cutting member being geared directly to the feed roll mechanism the curve of its motion would be the same as that of the stock feed illustrated in Fig. 6 and would coincide therewith throughout the cycle. The return movement of the lateral tool feed takes place between the ordinates 5, 6, 7, 8 and 1 while the tools 49 are entirely without the profile of the stock and while the stock feed is maintained at its highest velocity. This relative disposition of the performance of the several working parts throughout the cycle of the machine produces a balanced condition which enables high speeds to be attained without detrimental effects.

It is obvious that the tools 49 might be arranged to remain in the stock a longer or shorter length of time than they are without said stock, and when such construction is deemed expedient the lateral tool feed should continue throughout the time the tools are in the stock and coincide with the stock feed throughout such time.

The arm 40 is of such length that the short movement imparted to the tools 49 though being an oscillating movement is practically a reciprocation and a reciprocating tool holder would be an equivalent element in this combination. The oscillator is, however, considered the preferred form for mechanical reasons and in view of the high speeds attained in the machine. The arm 40 is mounted relatively to the rotary cutting member so that the point in the travel of the last one of the tools 49 represented by the intersection of the ordinate 3 and the abscissa 3 in Fig. 7 will occur to one side of the rotary cutting member so that the edges of tools 26 and 49 will not interfere, and said tools 49 are mounted to exactly register with the cuts made by the tools 26 and cut out the chip forming an ornamental figure. In the present machine, the two tools 49 cut out two chips and the arm 40 is moved backward by the cam groove 35 and connections to register with the two succeeding cuts of the rotary member as the stock moves up when the arm 40 follows along beside the stock until the tools have cut out those two chips and have been with-

drawn from the stock and so on, the rotary cutting member making a continuous series of cuts the meanwhile.

A presser roll 51 is mounted on a stud 52 hinged to a projection 54 of the frame A by a pivot 53. The presser roll 51 is removable and substitutable by like presser rolls having faces conforming to differently configured stock. A keeper 55 is pivoted at 56 to a projection of the frame A and serves to hold the stud 52 and hold the presser roll 51 under spring pressure against the stock, preserving a close engagement between the stock and the feed roll 14. This keeper may be of any desired construction, that shown being similar to the one shown in my application No. 98,498, filed March 19, 1902.

It is obvious that various and sundry changes may be brought about in the details, arrangement or construction of my device by the utilization of equivalent elements or organization to adapt the same to any particular class of work without departing in any sense from the spirit of my invention.

The peculiar commercial utility and improved organization existing in this device lies not only in the theoretical operation of the combined elements but to no mean degree in the peculiar mechanical development which is capable of carrying out said operation in a practicable, efficient and commercial manner.

Having described my invention, I claim—

1. In a carving machine, the combination with a rotary chuck for carrying a series of cutters, of a reciprocatory member for carrying a cutter for making a cut transversely of and complemental to each of the cuts made by cutters carried by said rotary chuck and removing a chip.

2. In a carving machine, the combination with stock feeding mechanism, of a rotary peripheral incising member occupying a plane in the line of the said feed movement and rotatable in coincidence with the feeding movement, and a coöperative reciprocatory grooving member so mounted as to work substantially transversely of the said line of feed.

3. In a carving machine, the combination of a stock guide, means to impart a variable feed movement to the stock, a rotary cutter, means for imparting a variable rotation to said cutter to conform to the variation of the stock feed, a coöperative reciprocating cutter, and means for moving said reciprocating cutter with the stock while cutting and against the feed while the same is accelerated and while said cutter is idle.

4. In a carving machine the combination of a variable stock feed; a cutter mounted so that it will travel with the feed at its slower speed and return at the higher speed, means to reciprocate the cutter toward the stock at the slow speed and away from the same at the high speed; a rotary coöperative cutter adapted to incise the stock in a plane on the line of the feed; and means to variably rotate the said cutter to give a peripheral velocity equal to the feed movement.

5. In a carving machine, the combination of a stock-feed roll, a rotary cutter, intermediate means for rotating said roll and cutter at coincident varying peripheral velocities, a coöperative reciprocating cutter, and means to give the same its working stroke during the slower feed movement.

6. In a carving machine, the combination of a rotary cutter chuck having peripheral tool apertures, duplicate cutters mounted in said apertures, means for revolving said chuck, means for feeding the stock at a speed equal to the speed of rotation of the cutters, and a coöperative reciprocating cutter.

7. In a carving machine, the combination of a rotary cutter chuck consisting of a body member and a radially slotted disk securable to said body member, similar cutters mounted in said apertures, means for revolving said chuck, means for feeding the stock at a speed equal to the speed of rotation of the cutters, and duplicate coöperative cutters mounted to penetrate the stock in a different direction.

8. In a carving machine, the combination of a rotary cutter chuck consisting of a body member, a disk member securable to said body member, a series of radial slots in the abutting face of said disk member, and tool securing means in said body member registrable with said radial slots when said disk member is in place, similar cutters mounted in said apertures, means for revolving said chuck, means for feeding the stock at a speed equal to the speed of rotation of the cutters, and a coöperative cutter mounted to penetrate the stock from a different direction.

9. In a carving machine, the combination of a rotary cutter chuck consisting of a body member, a disk member securable to said body member, a series of radial slots in the abutting face of one or both of said members and tool securing means in one of said members registrable with said radial slots, similar cutters mounted in said apertures, means for revolving said chuck, means for feeding the stock at a speed equal to the speed of rotation of the cutters, and a set of coöperative duplicate cutters.

10. In a carving machine, the combination of a rotary cutter chuck consisting of a body member, a disk member securable to said body member, a series of radial slots in the abutting face of one or both of said members, and set screws in one of said members registrable with said radial slots to secure tools therein, duplicate cutters mounted in said apertures, means for revolving said chuck, means for feeding the stock at a speed equal to the speed of rotation of the cutters,

a coöperative cutter, and means for reciprocating the latter into and out of the stock.

11. In a carving machine, the combination of a rotary chuck, an endless series of peripheral cutters circumferentially secured to said chuck, similar cutters mounted in said apertures, means for revolving said chuck, means for feeding the stock at a speed equal to the speed of rotation of the cutters, a coöperative reciprocating cutter, and means for moving the latter to and fro along the stock.

12. In a carving machine, the combination with feeding means, of a cutter member rotatable in coincidence with the feeding movement, and a coöperative reciprocating cutting member.

13. In a carving machine, the combination of a rotatable cutting member, means for effecting a feeding movement in the direction of the cuts made by said cutting member, and a translationally movable cutting member movable into and from the stock.

14. In a carving machine, the combination of a rotatable cutting member, a cutting member mounted parallel to the axis of said rotatable member and translationally movable in a circuitous path with and against the feed of the stock and into and from the same, and means for feeding the stock in the direction of the line of cuts made by said rotatable cutting member.

15. In a carving machine, the combination of a rotatable cutting member and a cutting member translationally movable in a circuitous path tangential to the plane of rotation of said rotatable member.

16. In a carving machine, the combination of a rotatable cutting member and a cutting member translationally movable in a circuitous path lying in a curved plane, said path being tangential relative to the plane of rotation of said rotatable cutting member.

17. In a carving machine, the combination of a main driving shaft, a feed roll, a rotary cutter, and a continuously connected group of gears driven through elliptical gears from said main driving shaft, for rotating said feed roll and cutter coincidently at varying peripheral velocities, a reciprocating cutter, and means to move the same into the stock at the slow speed and from the same at the high speed.

18. In a carving machine, the combination of a main driving shaft, a cutter carrier oscillatable toward and from said main shaft and reciprocable parallelly of said main shaft, an eccentric member on said main shaft connected to said cutter carriage through a laterally movable pivotal connection to oscillate said cutter carriage, a lateral cam member on said main shaft, and an oscillatable arm engaging and oscillated by said cam member and engaging and reciprocating said cutter carriage.

19. In a carving machine, the combination of a driving shaft, a cutting member oscillatable toward and from said shaft by eccentric means thereon, and reciprocatable parallelly of said shaft by cam means on said shaft, a feed roll, a rotary cutting member, and a continuously connected group of gears driven through elliptical gears from said main shaft, for rotating said feed roll and rotary cutting member coincidentally at varying peripheral velocities.

20. In a carving machine, the combination with stock-feeding means of a rotatable tool holder coupled thereto; a set of tools mounted in said holder and revoluble thereon in the path of the stock at a speed to match the feeding movement of the stock; a coöperative cutting tool mounted to penetrate the stock in a different direction; and means positively connected to said stock-feeding means and tool-rotating means for reciprocating said coöperative cutting tool into and out of the stock.

21. In a carving machine, the combination with stock feeding mechanism, of coöperative cutting members mounted to penetrate the stock from different directions, means for effecting the movement of one of said members to and fro along the stock, in the line of movement of said feed and into and from the same transversely of said line of feed, and means for rotating the other of said cutting members within the contour of the stock in the direction of the said feeding movement and in coincidence therewith.

22. In a carving machine, the combination of coöperative cutting members mounted to penetrate the stock from different directions, mechanism for feeding the stock alternately fast and slow but continuously, means for reciprocating one of said cutting members longitudinally of the stock so that during the stock-penetrating operation it moves coincidently with the stock and at the slow feed thereof, and means for rotating the other cutting member in the path of the stock and in the direction of the feed of the stock and at coincident speed with the stock.

23. In a carving machine, the combination of a cutting member, means for effecting fast and slow but continuous feed movements of the stock, means for giving the cutting member a movement coincident with that of the stock during the cutting operation and for moving the cutting member back along the stock to normal position after each cutting operation, the cutting operation taking place during the slow feed, a coöperative cutting member comprising a circular series of cutters, and means for revolving said cutters in the path of the stock and in the direction of the feeding movement thereof and at coincident speed therewith.

24. In a carving machine, the combination of means for feeding the stock continuously, an arm, a carving tool thereon, means for vibrating said arm, means for causing said arm to travel coincidently with the stock during the cutting operation, a coöperative cutter mounted for rotation in the path of the stock, and means for rotating said cooperative cutter at a speed equal to the speed of the stock feed and in the same direction therewith.

25. A carving machine comprising means for feeding alternately fast and slow but continuously, an arm, a carving tool thereon, means for vibrating said arm, means for reciprocating said arm longitudinally of the stock, with the same during the slow feed and counter thereto during the fast feed, a coöperative circular set of carving tools, and means for rotating said set of tools in the path of the stock and in the same direction and at the same speed as the stock-feeding movement.

26. In a carving machine, the combination of a carving tool mounted for cutting a groove in the surface of the stock, means for reciprocating the tool into and out of and also along the stock, stock-feeding means, a circular set of cutting tools, and means for rotating said set in the path of the stock so that they may make incisions at the ends of the grooves cut by the first-mentioned tool.

27. In a carving machine, the combination of means for feeding the stock continuously, an arm, a cutting tool carried by said arm, means for reciprocating said arm so as to cause said tool to cut long grooves in the surface of the stock, means for reciprocating said arm along the stock, and means for making shallow incisions in the stock at the ends of said grooves to complete the cuts.

28. In a carving machine, the combination with a stock guide, of stock-feeding means, a set of cutting tools, means positively connected to said feeding means for revolving said cutting tools in a plane parallel with the line of said feed movement and at a speed equal to that of the stock-feeding movement, and a set of coöperating cutting tools mounted to travel with the stock during their cutting and to penetrate the stock in a direction transverse to said plane, means to cause such penetration during the feed, and means to cause such travel.

29. In a carving machine, the combination of coöperative cutting members mounted to penetrate the stock from different directions, and one thereof comprising duplicate cutting tools, mechanism for feeding the stock alternately fast and slow but continuously, means for reciprocating said duplicate cutting tools longitudinally of the stock so that during the stock-penetrating operation they move coincidently with the stock in its slow feed movement, and means for rotating the other cutting member in the path of the stock and in the direction of the feed of the stock and at coincident speed with the stock.

30. In a carving machine, the combination of duplicate cutting tools, means for effecting fast and slow but continuous feed movements of the stock, means for giving the cutting tools during the cutting operation a movement coincident with that of the stock and during the slow feed movement and greater than the distance separating said duplicate tools, and for moving the latter back along the stock to normal position after each cutting operation and during the fast feed movement, a coöperative circular series of duplicate cutters, and means for revolving said circular series of cutters in the path of the stock in the direction of its feeding movement and at coincident speed therewith.

31. A carving machine of the class described, comprising an arm, duplicate cutting tools thereon, mechanism for reciprocating said arm longitudinally of the stock a distance exceeding the distance between said cutting tools, variable-movement mechanism for feeding the stock slowly while said cutting tools are moving with it and rapidly during the return, and a rotatable cutter positively connected to said variable-movement mechanism and mounted to rotate in the path of the stock and coincidently with the stock feeding movement.

32. In a carving machine, the combination of duplicate carving tools for cutting grooves in the surface of the stock, means for reciprocating the tools into and out of and also along the stock, stock-feeding means, a circular set of cutting tools spaced to match the spacing of said duplicate tools, and means for rotating said circular set in the path of the stock so that they may make incisions at the ends of the grooves cut by the first mentioned tools.

33. In a carving machine, the combination of a rotatable cutting member, means for feeding the stock, a transverse cutting member, means for translationally moving said transverse cutting member in a circuitous path with and against the feed of the stock, and into and from the same, and comprising a reciprocable rock shaft mounted parallel with the feed, an arm carried thereby and supporting said transverse cutting member, means for rocking said arm, and means for reciprocating the same transversely of its rocking movement and during its travel with the feed and in coincidence therewith.

34. In a carving machine, the combination with means for feeding the stock, of means for carving the same in one plane, means for carving the same in another plane and

comprising a cutter head, an arm for carrying the same, a shaft fastened to said arm and supported with its axis parallel with the line of feed, means connected to said arm for drawing the same toward and from the stock, and means for reciprocating said shaft in a line parallel with the line of stock feed and during its coincidence of direction at coincident speed.

35. In a carving machine, the combination with a stock guide, means for feeding the stock along said guide, a cutter head, an arm carrying said head, a reciprocatory rock shaft fast with said arm, means for reciprocating said shaft, an eccentric, and an eccentric strap connecting said eccentric to said rock arm.

FRANCIS H. RICHARDS.

Witnesses:
FRED. J. DOLE,
JOHN O. SEIFERT.