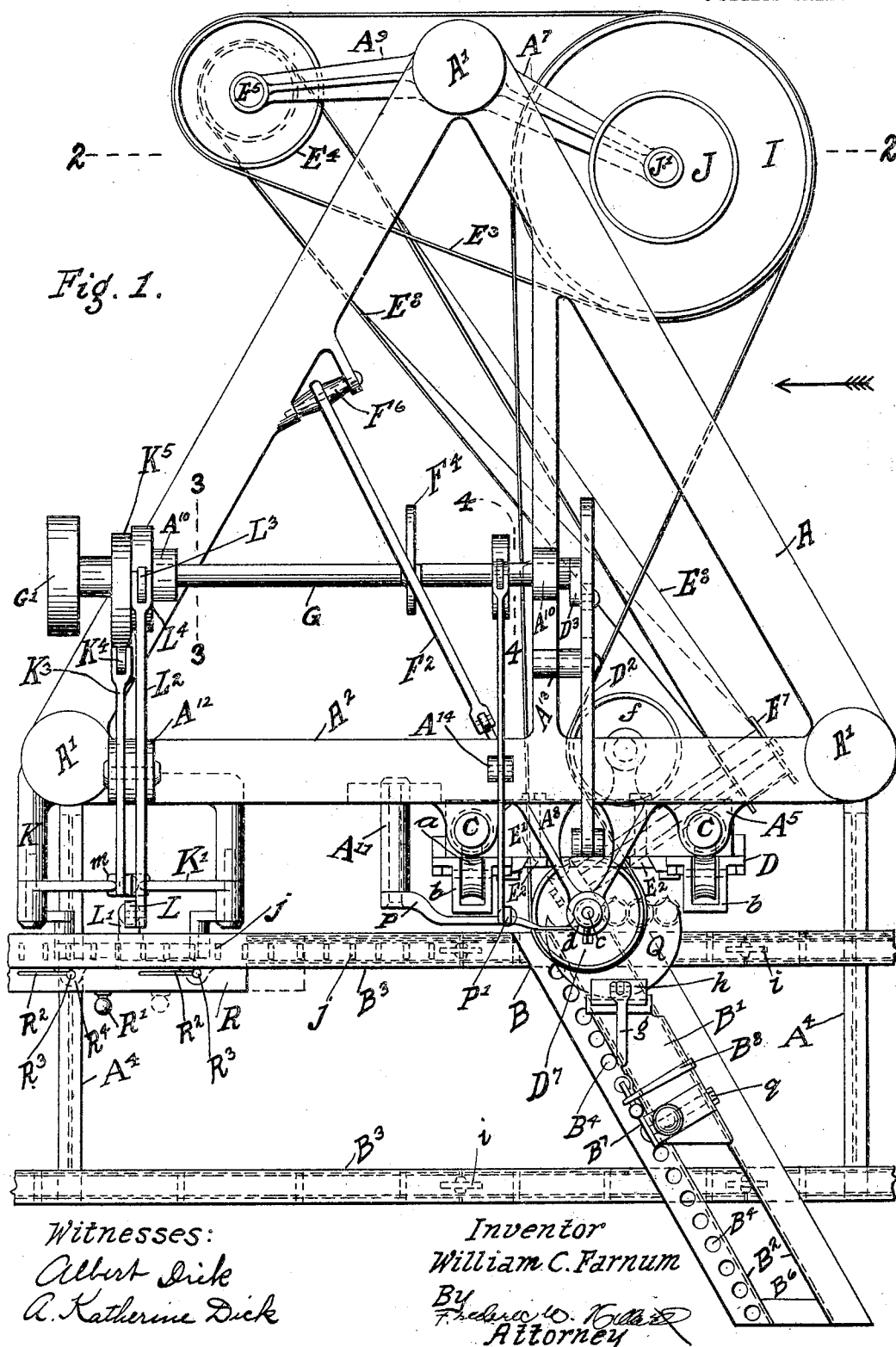


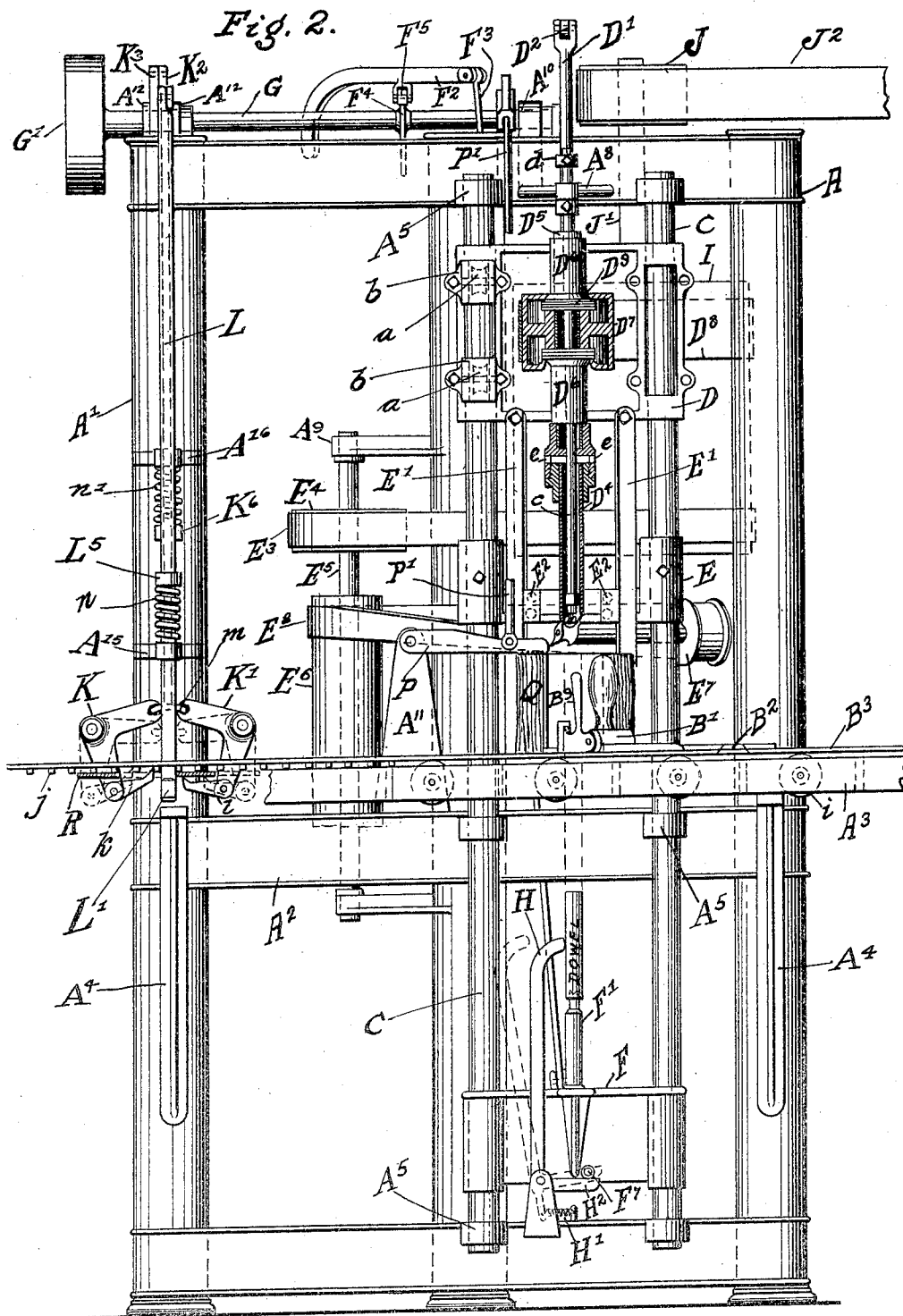
W. C. FARNUM.
DOWEL MAKING MACHINE.
APPLICATION FILED SEPT. 7, 1904.

5 SHEETS—SHEET 1.



W. C. FARNUM.
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5 SHEETS—SHEET 2.



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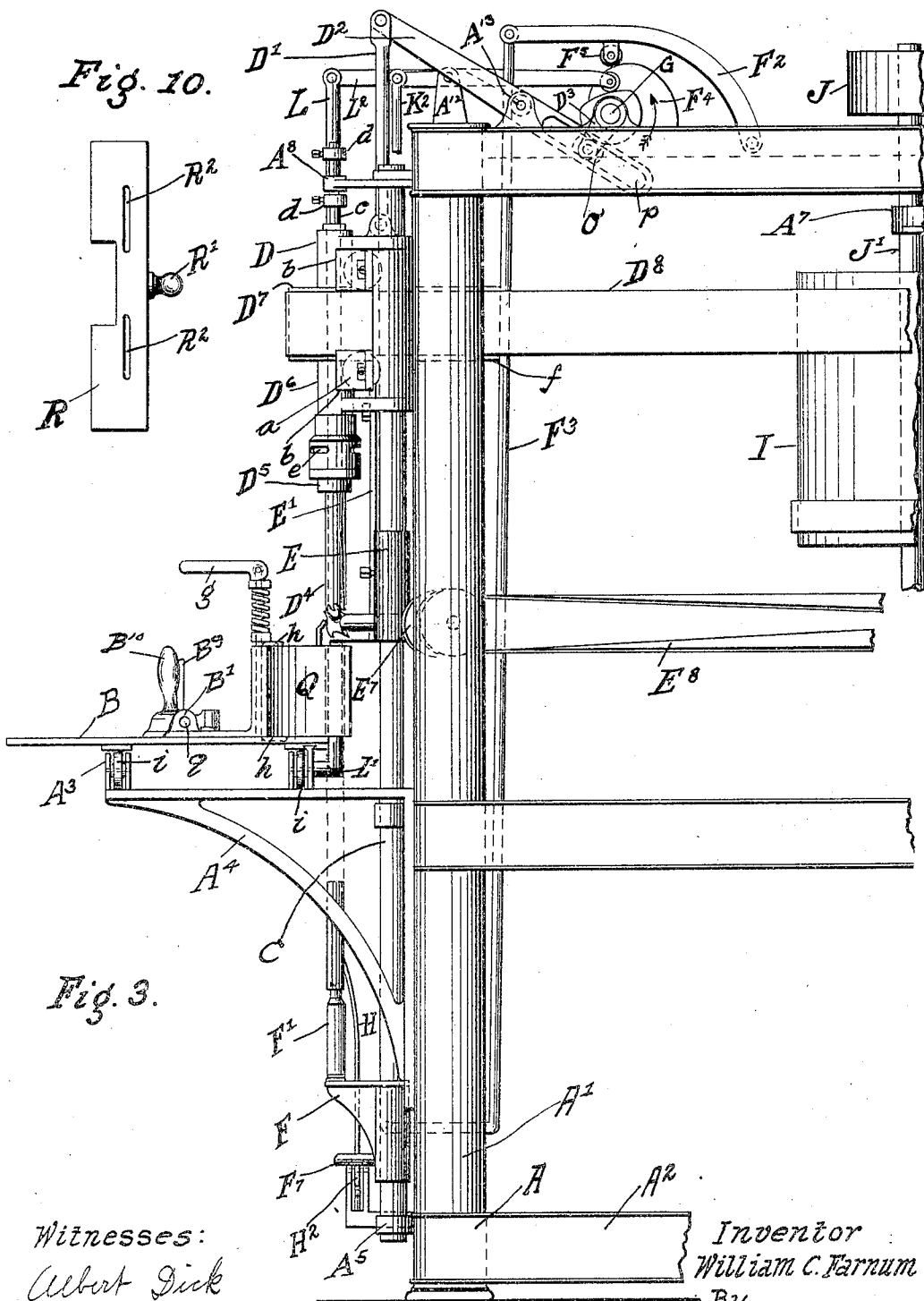
No. 802,184.

PATENTED OCT. 17, 1905.

W. C. FARNUM.
DOWEL MAKING MACHINE.

APPLICATION FILED SEPT. 7, 1904.

5 SHEETS-SHEET 3.



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5 SHEETS—SHEET 4.

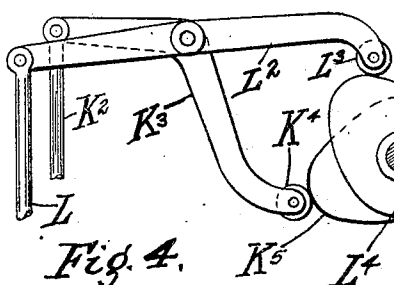


Fig. 4.

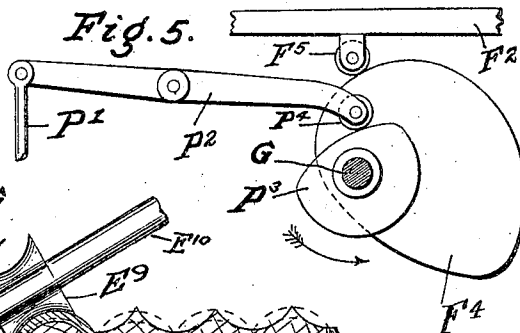


Fig. 5.

Fig. 6.

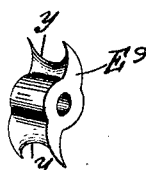
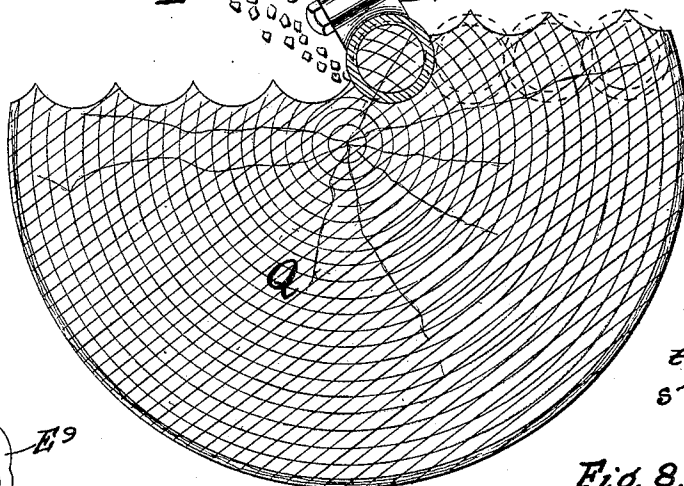


Fig. 7.

Fig. 8.

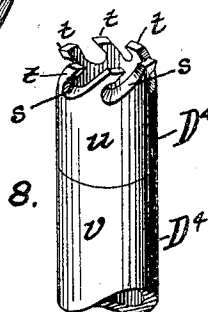
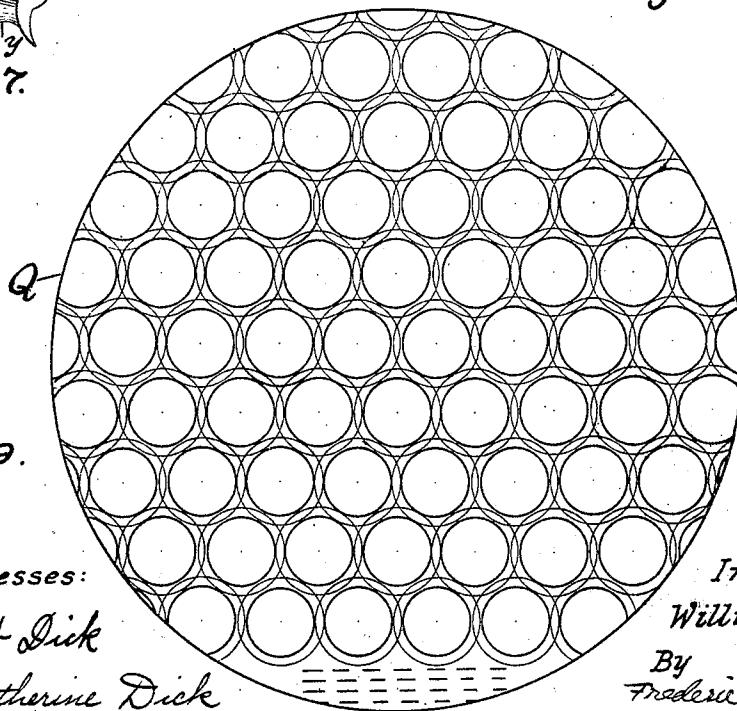


Fig. 9.



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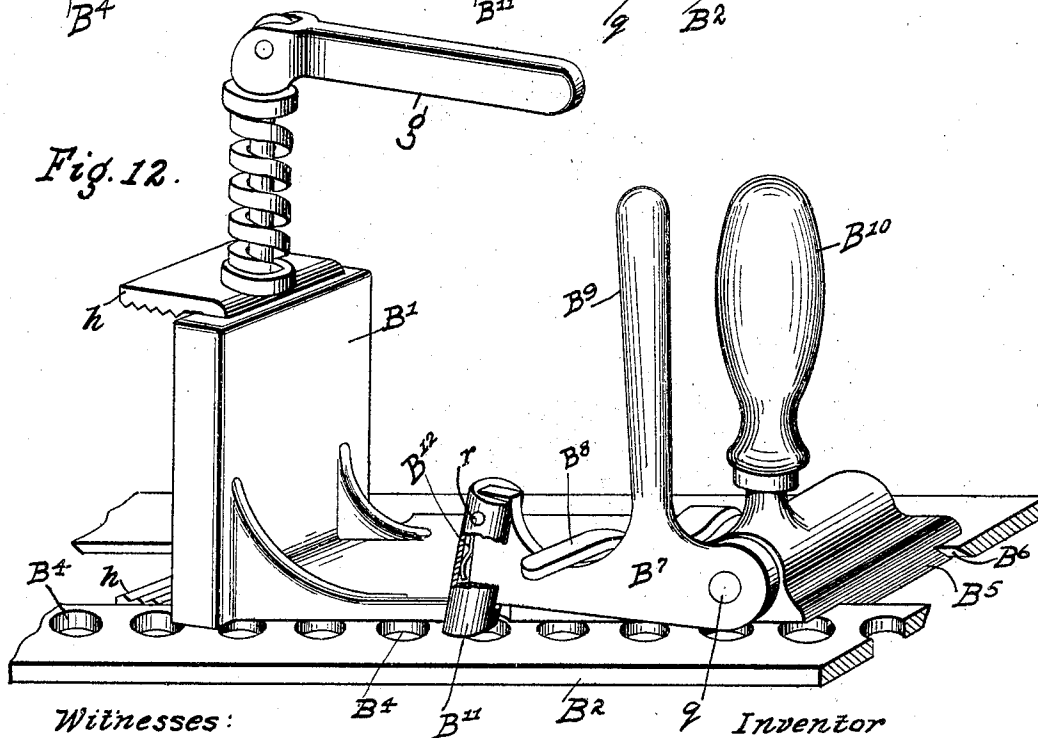
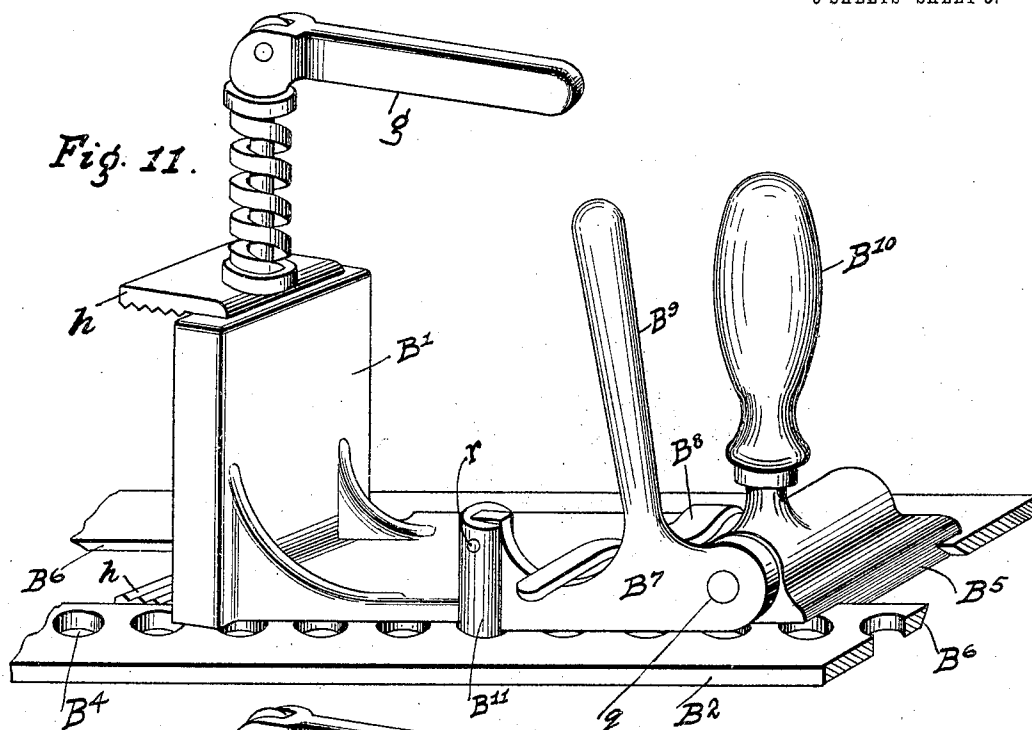
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5 SHEETS—SHEET 5.



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UNITED STATES PATENT OFFICE.

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DOWEL-MAKING MACHINE.

No. 802,184.

Specification of Letters Patent.

Patented Oct. 17, 1905.

Application filed September 7, 1904. Serial No. 223,622.

To all whom it may concern:

Be it known that I, WILLIAM C. FARNUM, a resident of Arlington, in the county of Bennington and State of Vermont, have invented certain new and useful Improvements in Dowel-Making Machines, of which the following is a specification.

My invention is an improvement in the manufacture of dowels.

By my hereinafter-described method of manufacture the logs are first cut up into bolts of the lengths of the finished dowels, the bolts being then mounted on my hereinafter-described dowel-making machine and the dowels sawed out round and to finish size by means of a tubular saw, the dowels being preferably cut out of the bolt from positions corresponding to those of the cells in a honeycomb—i. e., in rows which cut each other at an angle of sixty degrees, as do the rows of cells in the honeycomb. By my method a large saving (about one-third) is made over the old process both in lumber used and also in the labor required.

In the accompanying drawings, forming a part of this specification, Figure 1 is a plan view of the complete machine, excepting certain portions thereof which are not shown. Fig. 2 is a front view of the complete machine, excepting certain portions thereof which are not shown or shown in section only. Fig. 3 is a side view, broken away at the rear on the line 2 2, Fig. 1. Fig. 4 is a cross-section of the cam-shaft and its parts at 3 3, Fig. 1, looking in the direction of the arrow. Fig. 5 is a cross-section of the cam-shaft and parts at 4 4, Fig. 1, looking in the same direction. Fig. 6 is a plan view showing operation of tubular saw and shaper-head cutting cylinders out of block of wood, or, in other words, as hereinafter defined, cutting dowels out of bolts. Fig. 7 is a perspective view of the shaper-head. Fig. 8 is a perspective view of the tubular saw and a section of its spindle. Fig. 9 is a diagrammatic view showing honeycomb arrangement of the dowels in the bolt of wood, or, in other words, of the cylinders in the wooden block. Fig. 10 is a plan view of the carriage-feed reverse plate or slide. Fig. 11 is an enlarged detail perspective view of the bolt-holder or clamp for holding the wooden block in its locked or working position. Fig. 12 is a similar view showing the holding-dog disengaged from the rack, so as

to free the bolt-holder for movement by hand on the carriage.

Ordinarily where wooden dowels are to be made by my method the logs are first mounted on a saw-carriage and sawed into sections of the length of the finished dowels. Such sections of the log or the blocks from which the dowels are to be cut I term "bolts." The bolts are therefore generally cylindrical in form or, more strictly speaking, have plane and parallel upper and lower surfaces, (made by the saw-cuts,) being cross-sections of the log and usually comprising an entire cross-section, excepting in case of very large logs, which are generally split, so that the bolts will not be too large for the bolt-holder. The bolts are placed one at a time in the dowel-making machine and the dowels sawed out of the bolts by means of a tubular saw, as I will describe. The dowels are a finished commercial product, but are usually intended to be used as blanks from which to make bobbins, spools, clothes-pins, handles, and other manufactured articles of a similar character.

The machine consists, essentially, of the frame A, having three upright posts A', the frame being triangular in shape with the posts at the corners. The posts are connected by three sets of cross-beams A² at base, working-level, and top, respectively. The bolt-carriage B is provided with a transversely-extending frame B', having tracks supported on and adapted for transverse movement back and forth over antifriction-bearing rollers which are journaled in track-frame A³. The track-frame A³ is fastened to supporting-brackets A⁴, which are fastened to the two posts A' at the front of the frame. Upon the front cross-beams A² are fixed or mounted saw-carriage shaft-brackets A⁵, in which are fastened the two vertical rails C, upon which is slidably mounted saw-carriage D. The saw-carriage is connected, by means of connecting-links D', to feed-lever D², which latter is reciprocated by crank D³. A shaper-head carriage E is slidably mounted on rails C and is connected by links E' to the saw-carriage and is adjustable vertically relatively to the saw-carriage to compensate for the use of tubular saws of different lengths, as for the cutting of dowels of correspondingly-varying lengths. The links E' are fixedly bolted at their upper ends to the saw-carriage and extend downwardly therefrom and are provided with beveled edges

adapted to be clamped by bolts E^2 , having oppositely-beveled edges under their heads, the bolts E^2 being mounted on the shaper-head carriage. By this means the links E' can be clamped to the shaper-head carriage to secure that carriage at any desired distance below the saw-carriage corresponding to the length of saw used. Where dowels of different diameter are to be made, the shaper-head, if used, may be moved horizontally with relation to the saw-carriage, preferably by means of a lateral adjustment of the shaft on which the shaper-head is mounted. When dowels of small diameter are to be made, the shaper-head is not necessary and may be removed from the machine, although the shaper-head is of course adapted to use with work of small diameter as well as large and may be used with the tubular saw in making dowels of all sizes.

In the operation of the machine the saw-carriage and shaper-head carriage reciprocate together vertically, the shaper-head carriage feeding in advance of the saw-carriage, both carriages feeding downwardly in the dowel-cutting movement.

A spur-carriage F is slidably mounted at the lower ends of vertical rails C and in the operative movement of the parts feeds upward vertically, its movement being the reverse of that of the saw and shaper-head carriages. The carriage F is provided with an upwardly-projecting spur F' , which in the operative movement is adapted to be driven into the lower end of each dowel while the saw is cutting it out of the bolt of wood just prior to its complete severance therefrom. The carriage F is connected to the reciprocating feed-lever F^2 by means of connecting-rod F^3 , which latter has a short horizontal arm at its lower end extending rearwardly from the carriage for clearance purposes, and thence extends in a substantially vertical direction and at its upper end is linked to the feed-lever. The feed-lever F^2 is pivotally mounted at its rear end in frame A and projects forwardly over cam F^4 , secured on cam-shaft G . An anti-friction-roller F^5 is mounted in a downwardly-extending fork of lever F^2 and rides on the cam F^4 . The spur-carriage is thus lifted vertically in the feeding movement by cam F^4 and on the return movement drops down to its normal position again by gravity.

Referring to Fig. 1, it will be observed that the lever F^2 crosses cam-shaft G at an angle, so that the revolution of the shaft G tends to shift the lever sideways off to the left from cam F^4 . The lever F^2 should preferably be provided with a long pivot-shaft and hub F^6 , as shown in the drawing.

As shown, the saw and shaper-head carriages feed vertically downwardly and are lifted back to their normal positions on the return movement.

H is an L-shaped tripping lever or kicker

designed to hit the dowels a blow as they are drawn down by the spur after being sawed out, thereby throwing them into a receptacle or in a heap to one side of the machine. The kicker is journaled at its lower end to a bracket A^6 . When the spur-carriage rises to force its spur into the dowel, the kicker-pin F^7 on the carriage releases spring H' , which spring then sets the kicking-lever H in position (shown in dotted lines in Fig. 2) to one side of the path of the spur. When the carriage F drops back to its lowest position again with the dowel, as shown in full lines in Fig. 2, the spur F' strikes the horizontal arm H^2 at the foot of the kicking-lever, and thus throws the dowel from the spur to one side of the machine.

The drum I , which drives the saw, is driven by pulley J , both being fixed on vertical shaft J' , supported and journaled in bearings at the outer ends of arms A^7 . The pulley J is driven by a belt J^2 , which may be connected with a counter-shaft and pulley supplying power. The function of the drum I is to revolve the tubular saw and the mechanism for revolving the shaper-head. Tubular saw D^4 is driven on the hollow spindle D^5 , which journals in brackets or bearings D^6 , and to this spindle is fastened a driving-pulley D^7 , which is driven by driving-belt D^8 from drum I . The pulley D^7 is drawn in section in Fig. 2 to show several loose washers D^9 , which serve to relieve friction between the pulley D^7 and bearings D^6 .

Saw-carriage D is supported from four rollers a , journaled in boxes b , (two of which are removed in Fig. 2.) These rollers serve to relieve the friction caused by tension of belt D^8 . Adjustably mounted in bracket A^8 and running through the hollow spindle D^5 is a swab-rod c for the purpose of cleaning the inside of the saw and to throw out dowels from the saw, the swabber being a piston-like rod which projects from the end of the hollow spindle opposite to that on which the saw is mounted and has a relatively endwise reciprocating movement through the saw-spindle and is adjustable to any length of saw by raising or lowering the two collars d on the swab-rod, the one above and the other below bracket A^8 , in which the saw journals and may revolve with the saw. The collars d when adjusted are fixed on the swab-rod by set-screws. Near the lower end of the swab-rod there is an enlarged collar which fits comparatively snugly in the hollow spindle D^5 . (See Fig. 2.) The function of this collar is to prevent dust and small refuse matter from getting by the collar up into the inside of the spindle, while below the collar there is a smaller end on the swab-rod, which is adapted to pass freely between the swaged teeth t of the tubular saw without direct contact therewith, such smaller end of the rod serving to discharge the dowels and large refuse matter from the mouth of the

saw. In the hub of spindle D^5 radial openings or slots e are arranged, through which sawdust may be thrown by centrifugal force while the saw is cutting.

5 By reference to Figs. 2 and 3 of the drawings, it will be seen that the hub of the spindle D^5 , in which are the radial slots e , is of considerably larger diameter than that of the body of the spindle and that of the saw at the lower end of the spindle. Hence centrifugal force acts more strongly at the slots e when the spindle D^5 is running than it does within the mouth (of smaller diameter) of the tubular saw or within the body of the spindle. 10 The slots e in the periphery of the hub thus serve to cause a strong suction upwardly through the saw and spindle, causing a current of air flowing upwardly to draw along with it any sawdust or other refuse matter 20 within the saw to the slots e , where they are forcibly thrown outward through the slots by the action of centrifugal force.

.At the rear of the carriage in line with the pulley D^7 there is an idle pulley f , serving to carry belt D^8 in the desired path to take up slack and to give it greater bearing-surface on pulley D^7 . The belt E^3 on drum I drives intermediate pulley E^4 , which is fixed on vertical shaft E^5 , the latter being supported and journaled in arms or bearings A^9 . To this shaft is also fixed a drum E^6 , which drives the shaper-head pulley E^7 by belt E^8 . Drums I and E^6 are arranged for travel thereon longitudinally of the belts, for as the saw-carriage and shaper-head carriage feed downwardly the belts must also travel downwardly over their drum and return upwardly with their carriages upon the upward or return movement of the carriages. 35

40 Referring to Figs. 1, 2, and 3, I have shown a bolt of wood Q , (or the block of wood from which the cylinders are to be cut,) mounted on the bolt-carriage and partially cut into dowels, (or wooden cylinders,) the saw having cut one dowel from the tier shown in dotted lines in Fig. 1. In Figs. 1 and 6 the dotted lines represent the exact places from which the saw will cut consecutively the dowels in the tier. The bolt is clamped in the bolt-holder B' , Figs. 1 and 3, by pressing eccentric-lever g downward, thus firmly holding it between the clamps h . The lever g is removed in Fig. 2 for clearness of illustration of the shaper-head and other parts. The bolt-carriage B feeds laterally back and forth on the antifriction-rollers i , which are mounted on track-frame A^3 , Fig. 3. Notches or teeth j are formed on the lower side of carriage-frame B^3 and are spaced apart equidistant from one another at distances corresponding to those of the dowels in the bolt, so that when a dowel is cut the carriage will be moved one notch or tooth farther and the bolt thus brought into position for the next cut. 50

65 The carriage B is moved laterally by means

of the teeth j and the pusher-dogs k l , working thereon. Bell-cranks K and K' carry, respectively, the dogs k l , and these bell-cranks are reciprocated by a vertical reciprocating rod K^2 , having a foot m , which has a tongue- 70 and-groove connection with the free ends of the horizontal arms of bell-cranks K K' , thus operating to feed dogs k and l when rod K^2 is reciprocated vertically. The rod K^2 is connected to a reciprocating lever K^3 , having a 75 cam-roller K^4 , which rides on cam K^5 and is fulcrumed in bracket A^{12} . The reciprocating rod L , having at its lower end a shoe L' , is for locking or holding the bolt-carriage in place while the dowels are being cut. The 80 rod L is connected at its upper end to reciprocating lever L^2 , having cam-roller L^3 , which rides on cam L^4 , and the rod is fulcrumed in bracket A^{13} .

A spiral spring n tends to push the rod L 85 upward, and thereby wedging the shoe L' between two of the notches j locks the carriage B rigidly in place while the saw is cutting. As shown in Fig. 2, there is a fixed bracket A^{15} on frame A beneath spring n , and 90 there is a collar L^5 on rod L above the spring n , the said collar and bracket serving to hold spring n under tension, the function of the spring being to lift the rod L and hold it under constant tension, so as to constantly force 95 the lever L^2 against cam L^4 .

Directly back of and in line with the rod L in Fig. 2 and indicated by dotted lines therein is the rod K^2 , which is provided with a spiral spring n' and with a fixed bracket A^{16} 100 on frame A and with a collar K^6 , the bracket and collar serving to hold the spring n' under tension, as do the corresponding bracket and collar the spring n on rod L ; but the positions of the bracket and collar are reversed 105 on rod K^2 , and spring n' therefore tends to push the rod downward and draw back the bell-cranks K K' and dogs k l into the dotted-line position of Fig. 2. The rod K^2 is lifted by cam K^5 against the tension of spring n' to move the dogs k l into the full-line position of Fig. 2 to feed the carriage. The function of spring n' is to press rod K^2 down and lever K^3 against cam K^5 . 110

In Fig. 4 I have shown a section of the cam-shaft G and cams L^4 K^5 and levers L^2 and K^3 115 to more clearly illustrate the arrangement and operation of these levers and cams controlling the bell-cranks K K' and locking-rod shoe L' . As the rod K^2 is forced downward by spring n' the bell-cranks K K' and pusher-dogs k l are brought into the positions shown in dotted lines—i. e., they are drawn back into the next tooth j , as shown in Fig. 2—and then upon the revolution of cam-shaft G as cam-lever 120 K^3 rides on cam K^5 to the position shown in Fig. 4 it forces rod K^2 upward and positions bell-cranks K K' and pusher-dogs k l in the full-line position, Fig. 2, and during this movement the carriage B is fed or pushed the 125 130

distance of one tooth either to the right or to the left, depending on which way the feed-reversing plate R is set.

The dogs *k* and *l* are held up normally by springs (not shown) tending constantly to lift each dog into teeth *j*. For the purpose of preventing one dog from working in the rack-teeth while the other dog is free to enter the teeth and push the carriage in the desired direction and for alternately causing the rack and its carriage B to be fed first in one direction and then in the other by the dogs, I have provided a feed-reversing plate or slide R, which alternately renders one of the pusher-dogs *k* and *l* idle while the other one functionates. A detail view of the plate is shown in Fig. 10, and its mode of operation is illustrated in Figs. 1 and 2. When in the position shown in full lines in Figs. 1 and 2, the plate R renders pusher-dog *l* idle by covering the notches or teeth *j* directly over it, thus preventing dog *l* from entering the rack-teeth while at the same time leaving dog *k* to enter the rack-teeth and feed the carriage B one tooth or notch at every revolution of cam-shaft G. The plate R has a central opening or cut-away portion to permit the functioning of locking-shoe L', both when the plate is set so that dog *k* functionizes and when the dog *l* functionizes—that is, the shoe is never interfered with by plate R in either of the two positions to which it can be slid for rendering the two dogs alternately idle.

When the slide R is in the position shown in dotted lines in Figs. 1 and 2, it renders pusher-dog *k* idle, by covering the rack-teeth or notches directly over it, and the pusher-dog *l* will then perform the function of feeding the carriage B a notch or tooth to the left at each revolution of the cam-shaft G. Thus the direction of feeding movement of carriage B is alternately reversed by pushing by hand the sliding plate R to its right-hand position or to its left-hand position by means of knob R'.

When it is desired to prevent all feed of the bolt-carriage while cam-shaft G is running, as when removing a sawed-up bolt and inserting a new one, the plate R may be centrally set or positioned so as to bring the obstructing ends of the plate between both dogs *k* and *l* and the rack-teeth *j* to make both dogs idle, and thus prevent the feed of the bolt-carriage. I provide for this by making the cut-away central part of plate R, Fig. 10, of such a width that when the plate is moved to a position half-way between its two extreme or feeding positions its two ends will lie, respectively, between the two dogs *k* and *l* and the teeth *j*, so that both dogs will then be put out of action. In order to readily move and hold plate R in the central position, I arrange to snap it into a notch in the central position, as well as in each end position, and to hold it snapped in each of its three positions either by spring tension or by friction. I do not deem it necessary to illustrate any device for

doing this, as such devices are exceedingly simple and well known. As seen in Fig. 1, the plate R slides laterally in slots R² and is held by pins R³ on ears R⁴, which are integral with tracks A³. In Fig. 2 the plate or slide R is shown partially in section.

While bell-cranks K and K' and pusher-dogs *k* and *l* are drawing back to the next tooth, as shown in dotted lines in Fig. 2, the cam L⁴ forces rod L downward and the locking-shoe L' out from between the notches or teeth *j*, thereby releasing the carriage B for free and unobstructed movement. When the carriage is fed a tooth-space and the saw-carriage D is about to descend, as shown in Fig. 2, the locking-shoe is on the point of entering between the teeth *j*, as seen by the position of the cam and lever in Fig. 4. Cam-shaft G journals in bearings A¹⁰ and has at its outer left-hand end a driving-pulley G'. This pulley may be connected with a counter-shaft running at a suitable speed in relation to the speed of tubular saw and shaper-head.

P is the bolt-locking clamp, its purpose being to hold the bolt rigidly in place while each dowel is being sawed out. This clamp is composed of a lever P, having teeth at its free end to grip into the wooden bolt, and is fulcrumed at the opposite end in a bracket A¹¹ on frame A and is reciprocated by rod P' and reciprocating lever P². The lever P² is centrally pivoted (see Fig. 5) and is connected at one end to rod P' and on the opposite end is provided with cam-roller P⁴, which rides on cam P³. The lever P² is fulcrumed in bracket A¹⁴ on the frame A. The rod P' is broken away in Figs. 2 and 3 to more clearly show the mechanism of the saw-carriage and is also, like rods L and K², supplied with a spiral spring to hold lever P² to its cam, (the spring not being shown in the drawings.)

The function of the bolt-locking clamp P is quite similar to that of the locking-shoe L', and it performs its work in about the same way and time, excepting that the clamp P is for holding the bolt rigidly while the dowel is being sawed out, whereas the shoe L' holds the carriage rigidly at that time. As seen in Fig. 5, the roller P⁴ is traveling up the inclined face of cam P³, thus forcing downward rod P' and driving-bolt-locking clamp P downward to force the teeth on the free end of the lever P into the bolt to grip the bolt while the shaper-head and tubular saw are cutting the dowel out of the bolt, and prior to such cutting movement the roller P⁴ will have traveled up to the top of the inclined face on the outer periphery of the circular portion of the cam, where it will remain and hold clamp P, gripping the bolt-holder until the dowel has been entirely sawed out of the bolt, after which it will travel down the inclined face at the other end of said outer periphery on the cam, thus releasing the bolt from the clamp P for its step-by-step feeding

movement to position the bolt for the cutting of the next succeeding dowel, one dowel being cut out of the bolt at each revolution of cam P³. The drawings, Figs. 1, 2, and 3, show the saw-carriage in position to descend and, while the saw and shaper-head are revolving at high speed, cut a dowel out of the wooden bolt Q, while the other coacting mechanisms are properly positioned in relation thereto, as above described.

It is essential that the saw-carriage D and the shaper-head carriage E descend relatively slowly while the saw is cutting the dowel out of the bolt, and when the cut has been made it is desirable in order to economize time that the two carriages be again lifted at a high rate of speed. In order to thus differentiate the speeds of descent and ascent of the saw and shaper-head carriages, I provide reciprocating lever D², fulcrumed at A¹³ and connected to saw-carriage D by connecting-rod or link D'. The lever D² is in form similar to the working beam of a steam-engine. A crank D³ on cam-shaft G carries a sleeve and slide o, which travels in a slot p in the rear end of lever D². (Shown in dotted lines in Fig. 3.)

When the cam-shaft revolves in the direction of the arrow in Fig. 3, the sliding box o, fulcrumed on crank D³, moves away from the fulcrum-point A¹³ of lever D², and while the cam-shaft and its crank-arm D³ are revolving through about three-quarters of their circuit the saw-carriage D and shaper-head carriage E will descend slowly for the cutting movement; but while the cam-shaft G and crank-arm D³ are completing the last quarter of their circuit the sliding box o will be at the end of its path nearest to the axis A¹³ and will cause lever D² to lift the saw-carriage and shaper-head carriage rapidly. The effect of this mechanism is to feed the two carriages downwardly for the cutting movement through about three-fourths of the time and to lift them back to their raised positions in about one-fourth of the whole time consumed in one complete cycle of movement.

The bolt-holder B' feeds forward or toward the saw-carriage on the bolt-carriage B on dovetailed tracks B² on the carriage. The tracks B² are placed or set at an angle of sixty degrees to the tracks A³, on which in the frame B³ of the carriage B travels, so that when a tier of dowels has been cut off from the bolt the bolt-holder can be moved on the bolt-carriage at an angle of sixty degrees relatively to the direction of the feeding movement of the bolt-carriage itself, so as to position the bolt on the carriage for the cutting of the next succeeding tier of dowels, the combined feeding movements of the bolt-carriage and bolt-holder thereon being such that the dowels are cut out of the bolt from positions corresponding to those of the cells in a honeycomb.

A set of holes B⁴ is arranged in a straight line parallel with the said tracks B² at the said

angle of sixty degrees to the line of the track-teeth j; and the holes B⁴ are spaced apart at equal distances from each other and at distances equal to those between the rack-teeth j, constituting, in effect, a second row of teeth, or a second rack. The bolt-holder is provided with a dovetailed slide B⁵, fitted to slide in the open dovetailed way B⁶ between the tracks B² at the said angle of sixty degrees. The forward feed of the bolt-holder toward the saw and shaper-head is effected as follows:

A spacing-lever B⁷ is pivotally mounted on the bolt-holder B' on the left-hand end of pivot-shaft q, Figs. 1, 2, and 3, the said shaft q being journaled in the bolt-holder below the handle B¹⁰, which is fixedly mounted at the rear of the bolt-holder frame, or at the end farthest from the saw and shaper-head. The spacing-lever B⁷ is provided with an upwardly-extending handle B⁹ in front of its pivotal point on shaft q and to the rear of the free end, which carries the dog B¹¹, which engages the rack-holes B⁴. The free end of the spacing-lever B⁷ is normally held down under spring-pressure by the flat spring B⁸, which is fastened at its right-hand end upon the right-hand side of the bolt-holder and presses with its free end down on the free end of the spacing-lever.

Referring particularly to the enlarged perspective views, Figs. 11 and 12, it will be observed that the free end of the spacing-lever B⁷ extends upwardly and has pivotally connected to it the spacing-dog B¹¹ by means of the pivot-pin r. Fig. 11 shows the dog B¹¹ in engagement with one of the rack-holes B⁴. Fig. 12 illustrates how the operator grasps the two handles B⁹ and B¹⁰ to lift dog B¹¹ out of the holes B⁴ and the position which the dog assumes when so lifted, in which position it is ready to drop down when released by the operator and rest on track B², between the hole B⁴ from which it has been withdrawn and the next succeeding one, into which it will be moved upon the next forward feed of the bolt-holder by the downward pressure of spring B⁸ when the bolt-holder is pushed forward for the cutting of the next succeeding tier of dowels. In Fig. 12 a portion of the left-hand side of dog B¹¹ is cut away to show the spring pressing the dog forward, so that when released by the operator the dog will drop down on top of the track-frame B² instead of dropping back into the hole from which it has been withdrawn. I have used the term "forward" of the feeding movement of the bolt-holder on the carriage and of the dog on the bolt-holder as indicating the direction of their step-by-step movement toward the saw and shaper-head, and their forward movement, therefore, is their movement toward the rear of the machine.

As shown in the enlarged perspective view, Fig. 8, the edges of the throats s of the saw-

teeth t back of the cutting-faces are beveled or chamfered or flared outwardly. The purpose of this is to cause the sawdust to be thrown outwardly off from the edges of the throats of the teeth by centrifugal force when the saw is cutting instead of remaining in the throats of the teeth and clogging them, as it would tend to do if the edges were not so flared or chamfered.

As indicated in Fig. 8, the tubular saw is preferably made in two parts, comprising, respectively, the saw-head proper, u , and its spindle v , the two parts being preferably fastened together by a finely-threaded screw connection. The reason for making the saws in two parts is for convenience in hardening and tempering the saw-heads and so that when one head becomes worn or dulled from use it may be quickly and cheaply replaced by another one.

Fig. 7 shows in enlarged perspective view the shaper-head forming-cutter E^9 , having the two knife-edges y , and Fig. 6 is an enlarged plan view of the forming-cutter E^9 and of a section of the spindle E^{10} on which it is mounted on the shaper-head. In Fig. 6 the cutter E^9 is shown at work on the bolt of wood, cutting in advance of the saw and removing the surplus stock from and forming an arc of the periphery on the outer side of the dowel, (*i. e.*, that on the outer edge of the bolt,) the inner cut (*i. e.*, that on the side of the dowel within the bolt) which is being made by the tubular saw to cut the supplementary arc of the periphery and cut the dowel free of the bolt being indicated by the section of the saw which is seen surrounding the dowel that is being cut out. As seen in Fig. 6, the cutter E^9 cuts out and forms the periphery of nearly one-half of the dowel, thus providing ample room for the escape of sawdust out of the throats of the teeth on the tubular saw, as well as greatly lessening the amount of work to be done by the saw in cutting out the remainder of the periphery to finish the dowels and cut them free of the bolt. In Fig. 6 also the corresponding parts to be cut out by the saw in the succeeding dowels of the same tier are indicated in dotted lines. The dowels and the material cut out by the saw-cuts are graphically illustrated for the entire bolt in Fig. 9, together with the small portion at the lower edge of the bolt, which is required for gripping in the bolt-holder.

In the operation of the machine power is applied to the saw and shaper-head to keep them constantly running at a high rate of speed. The operator having set the plate R in its central position, so as to prevent feed of the bolt-carriage, draws the bolt-holder toward himself until it is sufficiently removed from the saw to permit him to insert the bolt in the holder without interference from the running saw. He then inserts and clamps the

bolt in its holder and, grasping the handles B^9 and B^{10} , releases dog B^{11} from the hole B^4 with which it was engaged and then pushes the bolt-holder forward toward the saw until its front edge (corresponding to the upper edge of the bolt in Fig. 9) is in line to be fed into the path of the saw and shaper-head upon the feeding movement of the bolt-carriage, which advances the bolt-carriage, together with the bolt-holder and bolt thereon, step by step crosswise the machine, thus positioning the bolt in the path of the tubular saw and shaper-head cutter for the cutting of the successive dowels in one row out of the bolt. The operator then releases dog B^{11} and pushes it into the nearest hole B^4 and then grasps the feed-reversing plate R by its knob R^4 and pushes it out of its central position into the end position for feeding the bolt-carriage in the direction requisite for cutting the first tier of dowels, (or for cutting out the upper edge of the bolt, as in Fig. 9.) The bolt-carriage is fed to the right by pusher-dog k and to the left by pusher-dog l , and assuming for the purpose of illustration that dog k first functionizes, as shown in Fig. 2, the bolt-carriage will first be positioned for the cutting of the first dowel therefrom by the feeding movement of the bolt-carriage one notch to the right by dog k . As soon as the bolt-carriage has been thus positioned the carriage is rigidly locked in its dowel-cutting position by the locking-shoe L' , while the bolt itself is also rigidly locked on the bolt-carriage in its dowel-cutting position by the bolt-locking clamp P . Then the shaper-head carriage descends and its forming-cutter E^9 cuts the stock away from the periphery on the outer side of the dowel, forming that side of the cylinder, while the tubular saw, simultaneously descending and following the cutter E^9 , saws out the inner side of the periphery, forming that side of the cylinder and cutting the dowel clear of the bolt. While these shaping and sawing operations are taking place on the dowel the spur-carriage F is ascending, and just prior to the cutting of the dowel entirely free from the bolt the spur-carriage will have attained such a height that the spur F' will be driven into the lower end of the dowel. Then the saw-carriage D and shaper-head carriage E upon the complete severance of the dowel from the bolt reverse their direction of movement and, ascending, draw the tubular saw and cutter E^9 up above and thus entirely out of the horizontal path of movement of the bolt-carriage and bolt, while the spur-carriage, simultaneously reversing its movement and descending, draws with it the spur F' and the dowel caught thereon to the position shown in Figs. 2 and 3—*i. e.*, into a position such that the dowel will have been drawn down entirely out of and well below the level of the bolt and bolt-carriage. Then the pusher-dog k , having meantime

been drawn back to the left to the next succeeding notch or tooth *j*, again feeds forward or to the right, thus feeding the bolt-carriage and bolt into position for the cutting of the next dowel, while the kicker *H* simultaneously kicks the dowel just cut from the bolt and drawn down off from the spur *F'* to one side of the spur-carriage and preferably into a receptacle prepared to receive it. When the first tier of dowels has been thus sawed out of the bolt, the operator, again grasping handles *B*⁹ and *B*¹⁰, pushes the bolt-holder forward one tooth or hole *B*⁴ and then reverses the bolt-carriage feed by shifting plate *R* to its other or reverse end position, and so on until the entire bolt is sawed up into dowels, when the operator again shifts plate *R* to its central position to shut off the bolt-carriage feed, grasps handles *B*⁹ and *B*¹⁰ and draws the bolt-holder along the tracks *B*² toward himself a sufficient distance away from the saw, so that he can conveniently remove the sawed-up bolt from the holder and insert a new one, the above-described cycle of operation being repeated each time a new bolt is inserted and sawed up.

One important advantage of my invention is the combination of the automatically-operated feeding means and the hand-operated feeding and reversing means, whereby one is enabled to control by hand the position of the bolt-holder on the bolt-carriage and to reverse the feeding movements of the bolt-carriage and bolt-holder by hand at any point in the line of their respective feeds, as well as to arrest the automatic feeding movement of the bolt-carriage at any point without stopping or in any way interfering with the automatic feeding movements in the machine, which meantime continue. Thus in Fig. 9 there is shown a bolt of a certain size and to be sawed up into dowels of a certain size. This bolt is to be mounted on the bolt-holder and fed by hand therewith on the bolt-carriage (while the tubular saw and the forming-cutter on the shaper-head are both revolving at high speed and being reciprocated up and down endwise on their carriages together with the spur on its spur-carriage and while the two pusher-dogs are also automatically reciprocating) into position such that the saw will cut the first of the row of three partial dowels at the upper edge of the bolt. Then the automatic feed for the bolt-carriage is thrown in by hand and that carriage fed crosswise the machine to cut out the two other partial dowels of the upper row. Then while all of the enumerated automatically-operated parts are still running the bolt-holder is again fed by hand into position on the bolt-carriage for the cutting of the next row of dowels, the direction of feeding movement of the bolt-carriage is reversed by hand, and that carriage automatically fed in the opposite direction crosswise the ma-

chine for the cutting of the second row of dowels, after which such automatically-operated movements are continued, and such hand-operated movements are repeated until the entire bolt has been sawed up. Such combination of automatically-operated feeding movements and hand-operated feeding and reversing movements are of great advantage as time and labor savers and enable one to economically and quickly handle and saw up bolts of widely-differing sizes, corresponding to the logs of widely-differing sizes and shapes as they are usually encountered in lumbering.

From the above description it will be seen that my invention contemplates, broadly, cutting the dowels out of the bolts in parallel rows with the dowels of each row cut from positions midway between those of the next adjacent rows. In order that the dowels of one row should be cut from positions which lie with mathematical precision exactly midway between those of the next adjacent row, it is necessary that the dowels of the one row should be so positioned in the bolt relatively to those of the other row that the triangle formed by drawing connecting-lines between the centers of any three dowels therein, each of which lies adjacent to the other two, should be an equilateral triangle, and in order to attain the greatest possible saving in lumber this mathematical precision should in practice be approximated as closely as possible; but it is obvious that the substantial benefits of my invention may be more or less perfectly attained without conforming to such mathematical precision. It may therefore be stated generally that my invention contemplates cutting the dowels in parallel rows out of the bolts with the dowels in each succeeding row cut from positions in the bolt midway between those of the last preceding row.

Where in the claims I specify a tubular saw, a bolt-holder, and a movement of one of said parts (shown herein as the bolt-holder) step by step bodily in one direction for the cutting of a row of dowels out of the bolt, a reverse movement thereof or one in the opposite direction, and a movement of one of said parts (also shown herein as the bolt-holder) step by step bodily at an angle of sixty degrees for the cutting of the several rows of dowels, I do not in this latter movement wish to be limited to the precise mathematical angle of sixty degrees, but merely mention the stated angle as being the strictly correct one, which should in practice be approximated to as nearly as possible, as above described.

It is obvious that the scope of my invention is a broad one and that numerous changes may be made without departing from the spirit of the invention, and I therefore do not intend to limit myself narrowly to the particular details shown.

Having thus described my invention, what

I claim, and desire to secure by Letters Patent, is—

1. In a dowel-making machine, the combination, with a tubular saw and means for operating the saw to cut dowels out of bolts, of a bolt-holder, means for moving the bolt-holder, step by step, in one direction, means for reversing its movement and moving it in the opposite direction, and means for moving it step by step in a direction at an angle of sixty degrees to its first-mentioned line of movement, whereby the bolt-holder will be positioned in such relation to the saw that the dowels will be cut out of the bolt from positions corresponding to those of the cells in a honeycomb, substantially as described.

2. In a dowel-making machine, the combination, with a tubular saw and means for operating the saw to cut dowels out of bolts, of a bolt-holder, means for automatically feeding the bolt-holder step by step in one direction, to successively position it for the cutting of the several dowels in one tier out of the bolt, means for returning it in the opposite direction and means for feeding the said holder in a direction at an angle of sixty degrees to that of its said automatic feed, to position it for the cutting of a second tier of dowels, substantially as described.

3. In a dowel-making machine, the combination, with a tubular saw and means for operating the saw to cut dowels out of bolts, of a bolt-holder, means for automatically feeding the bolt-holder step by step in one direction, to successively position it for the cutting of the several dowels in one tier out of the bolt, means for feeding the said holder in a direction at an angle of sixty degrees to that of its said automatic feed, to position it for the cutting of a second tier of dowels, and means for reversing said automatic feeding movement and automatically feeding the holder in the opposite direction to successively position it for the cutting of the several dowels in said second tier, substantially as described.

4. The combination, with a tubular saw and means for operating the same to cut dowels out of bolts, and a reciprocating carriage on which the bolt is mounted, of means for feeding the carriage and bolt step by step for the cutting of one tier of dowels out of the bolt, means for returning them in the opposite direction and a feeding device for moving the bolt step by step on the carriage at an angle of sixty degrees to the direction of the carriage feed to position the bolt thereon for the cutting of succeeding tiers, whereby the dowels will be cut out of the bolt from positions therein corresponding to those of the cells in a honeycomb, substantially as described.

5. In a dowel-making machine, the combination of a tubular saw and a bolt-holder, means for moving one of said parts step by step bodily in one direction relatively to the

other, means for reversing said movement and moving the part in the opposite direction, and means for moving one of said parts bodily step by step, relatively to the other, in a direction oblique to the first-mentioned line of movement, whereby the bolt-holder will be positioned in such relation to the saw that the dowels will be cut out of the bolt from positions therein corresponding to those of the cells in a honeycomb, substantially as described.

6. In a dowel-making machine, the combination of a tubular saw and a bolt-holder, means for moving the bolt-holder step by step bodily in one direction relatively to the saw, means for reversing the said movement and moving the bolt-holder in the opposite direction, and means for moving the bolt-holder bodily step by step relatively to the saw, in a direction oblique to the first-mentioned line of movement, whereby the bolt-holder will be positioned in such relation to the saw that the dowels will be cut out of the bolt from positions therein corresponding to those of the cells in a honeycomb, substantially as described.

7. In a dowel-making machine, the combination of two members, one of which comprises a bolt-holder, and the other a tubular saw mounted on a spindle and a shaper-head mounted on a spindle vertical to said saw-spindle, means for feeding one of said members relatively to the other member for the purpose of cutting dowels out of bolts, the arrangement and operation being such that the shaper-head cuts in advance of the saw and in part of the same path and thereby removes the surplus stock from one side of the dowel, whereby clearance room is provided for the escape of sawdust off from the saw-teeth at one side of the dowel, substantially as described.

8. In a dowel-making machine, the combination, with a tubular saw and a bolt-holder, of means for positioning the bolt-holder so that the dowels will be successively cut from the edge of the bolt with the teeth on one side of the saw running in the open while those on the opposite side of the saw are cutting in the body of the bolt, outwardly-flaring edges on the teeth back of the cutting-faces and a shaper-head running in advance of the saw and serving to clear away surplus stock on the said open side of the dowel, the shaper-head serving, in conjunction with said outwardly-flaring edges of the teeth for the escape of sawdust from the teeth, substantially as described.

9. In a dowel-making machine, the combination, with a tubular saw, of a bolt-carriage arranged and adapted to feed step by step in the machine, along tracks or ways, to successively position the bolt for the cutting of a row of dowels therefrom, a rack mounted on the carriage and extending in a line parallel with said tracks or ways, two dogs mounted

on the machine independently of the carriage, both automatically operated by the propelling power and both adapted to engage the rack, one of the dogs operating, when so engaged, to feed the carriage in one direction, and the other, when so engaged, to feed the carriage in the opposite direction, and means for alternately engaging each said dog with the rack, including means for simultaneously holding the other dog out of engagement, substantially as described.

10. In a dowel-making machine, the combination, with a tubular saw, of a bolt-carriage arranged and adapted to feed step by step in the machine, along tracks or ways, to successively position the bolt for the cutting of a row of dowels therefrom, a rack mounted on the carriage and extending in a line parallel with said tracks or ways, two dogs mounted on the machine independently of the carriage, both automatically operated by the propelling power and both adapted to engage the rack, one of the dogs operating, when so engaged, to feed the carriage in one direction, and the other, when so engaged, to feed the carriage in the opposite direction, and means for alternately engaging each said dog with the rack, including means for simultaneously holding the other dog out of engagement, said last-mentioned means being also adapted to hold both of the dogs out of the rack at the same time, thus permitting the dogs to be automatically operated, as stated, without feed of the carriage in either direction, substantially as described.

11. In a dowel-making machine, the combination of a tubular saw and a bolt-holder, automatically-operated means for moving one of said parts bodily step by step in one direction relatively to the other, hand-operated means for reversing said movement at any point in the line of travel of said part which is so advanced, automatically-operated means for thereafter moving the said part which is so advanced, step by step bodily in a direction the reverse of its first said line of travel, and means for moving one of said parts bodily step by step, relatively to the other, in a direction crosswise the first-mentioned line of movement, substantially as described.

12. In a dowel-making machine, the combination of a tubular saw and a bolt-holder, automatically-operated means for moving the bolt-holder bodily step by step in one direction relatively to the saw, hand-operated means for reversing said movement at any point in the line of travel of the bolt-holder, automatically-operated means for thereafter moving the bolt-holder step by step bodily in a direction the reverse of its first said line of travel, and means for moving the bolt-holder bodily step

by step, relatively to the saw, in a direction crosswise its first-mentioned line of movement, substantially as described.

13. In a dowel-making machine, the combination of a tubular saw and a bolt-holder, automatically-operated means for moving one of said parts bodily step by step in one direction relatively to the other, hand-operated means for reversing said movement at any point in the line of travel of said part which is so advanced, automatically-operated means for thereafter moving the said part which is so advanced, step by step bodily in a direction the reverse of its first said line of travel, and means for moving one of said parts bodily step by step, relatively to the other, in a direction oblique to the first-mentioned line of movement, and at an angle of substantially sixty degrees thereto, whereby the bolt-holder will be positioned in such relation to the saw that the dowels will be cut out of the bolt from positions therein corresponding to those of the cells in a honeycomb, and whereby the extent of the line of the first-mentioned feeding movement and of the movement reverse thereto may be determined at will by the operator and be made to correspond to the width of each bolt operated on as well as to the width of each row of dowels therein.

14. In a dowel-making machine, the combination of a tubular saw and a bolt-holder, automatically-operated means for moving the bolt-holder bodily step by step in one direction relatively to the saw, hand-operated means for reversing said movement at any point in the line of travel of the bolt-holder, automatically-operated means for thereafter moving the bolt-holder step by step bodily in a direction the reverse of its first said line of travel, and means for advancing the bolt-holder, relatively to the saw, bodily in a direction oblique to its first-mentioned line of movement, and at an angle of substantially sixty degrees thereto, whereby the bolt-holder will be positioned in such relation to the saw that the dowels will be cut out of the bolt from positions therein corresponding to those of the cells in a honeycomb, and whereby the extent of the line of the first-mentioned feeding movement of the bolt-holder and of the said reverse movement thereof may be determined by the operator and be made to correspond to the width of each bolt operated on as well as to the width of each row of dowels therein.

Signed by me at Arlington, Vermont, this 23d day of August, 1904.

WILLIAM C. FARNUM.

Witnesses:

J. J. SHAKSHOBER,
FREDERIC W. HILLARD,
ALBERT DICK.