No. 666,217. Patented Jan. 15, 1901.

E. F. ABBEY.

AUTOMATIC MULTIPLE BORING MACHINE.

(Application filed Jan. 29, 1900.)

(No Model.) 3 Sheets—Sheet 1.

Fig. 1.

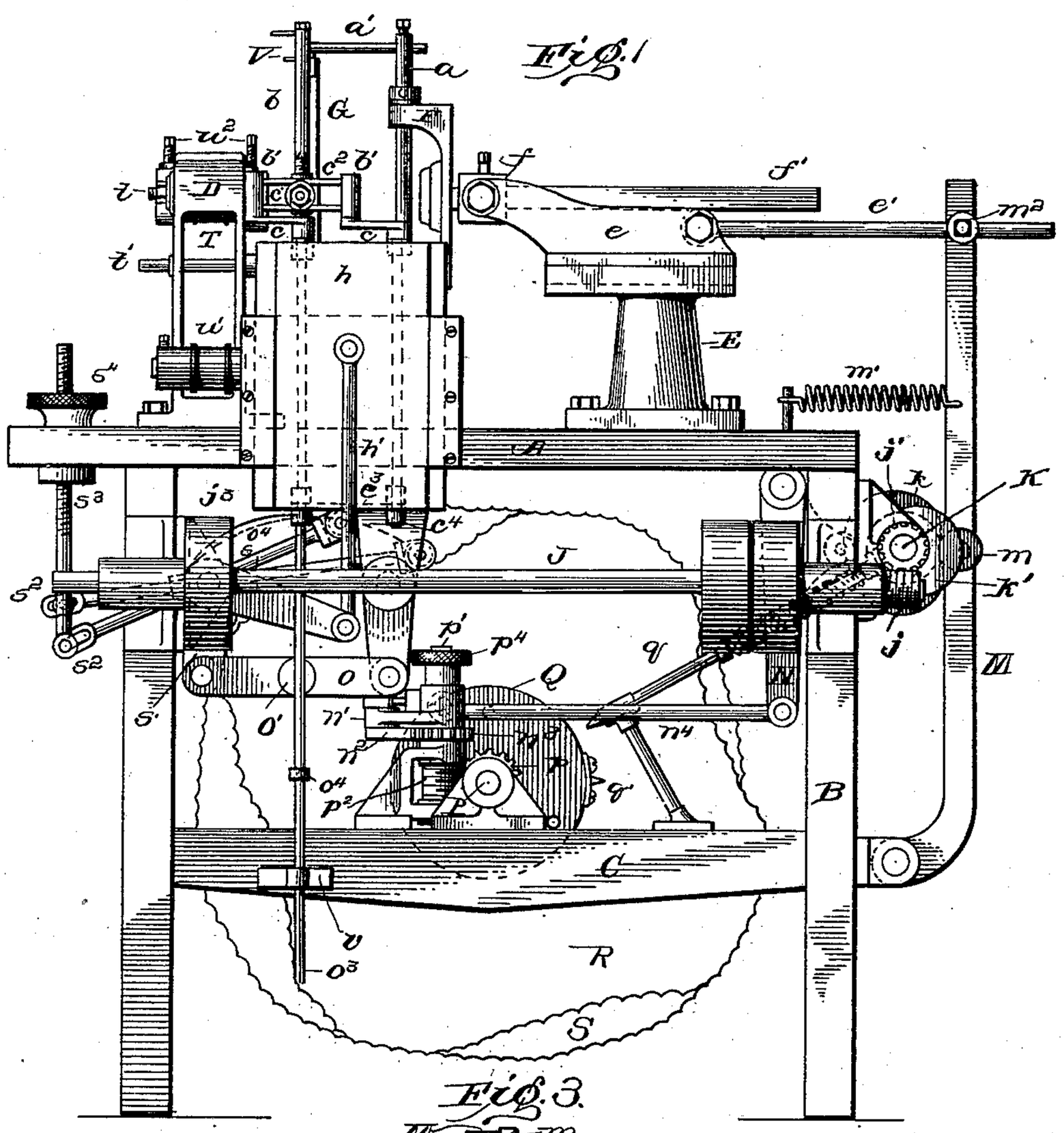
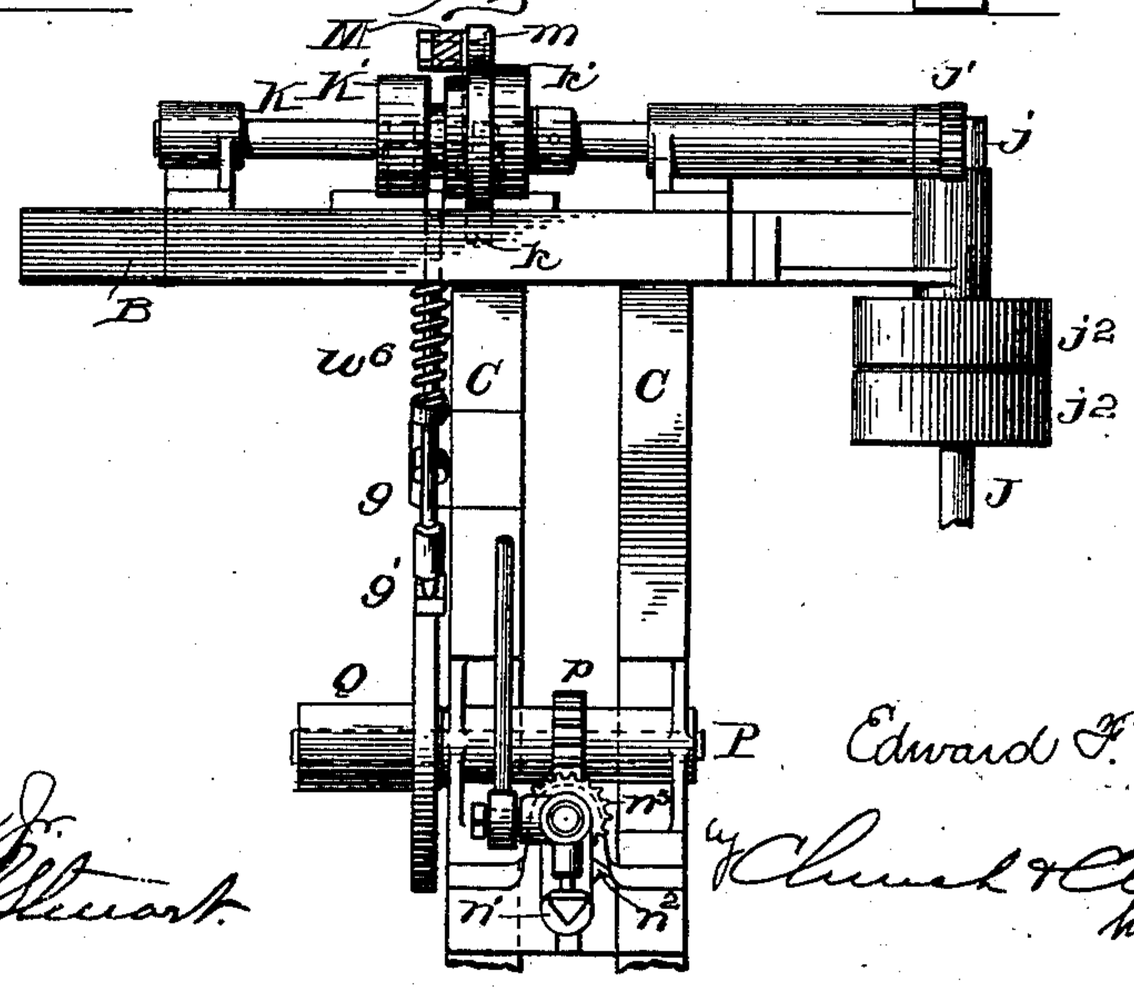


Fig. 3.



Witnesses
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(No Model.) 3 Sheets—Sheet 2.

Fig. 2.

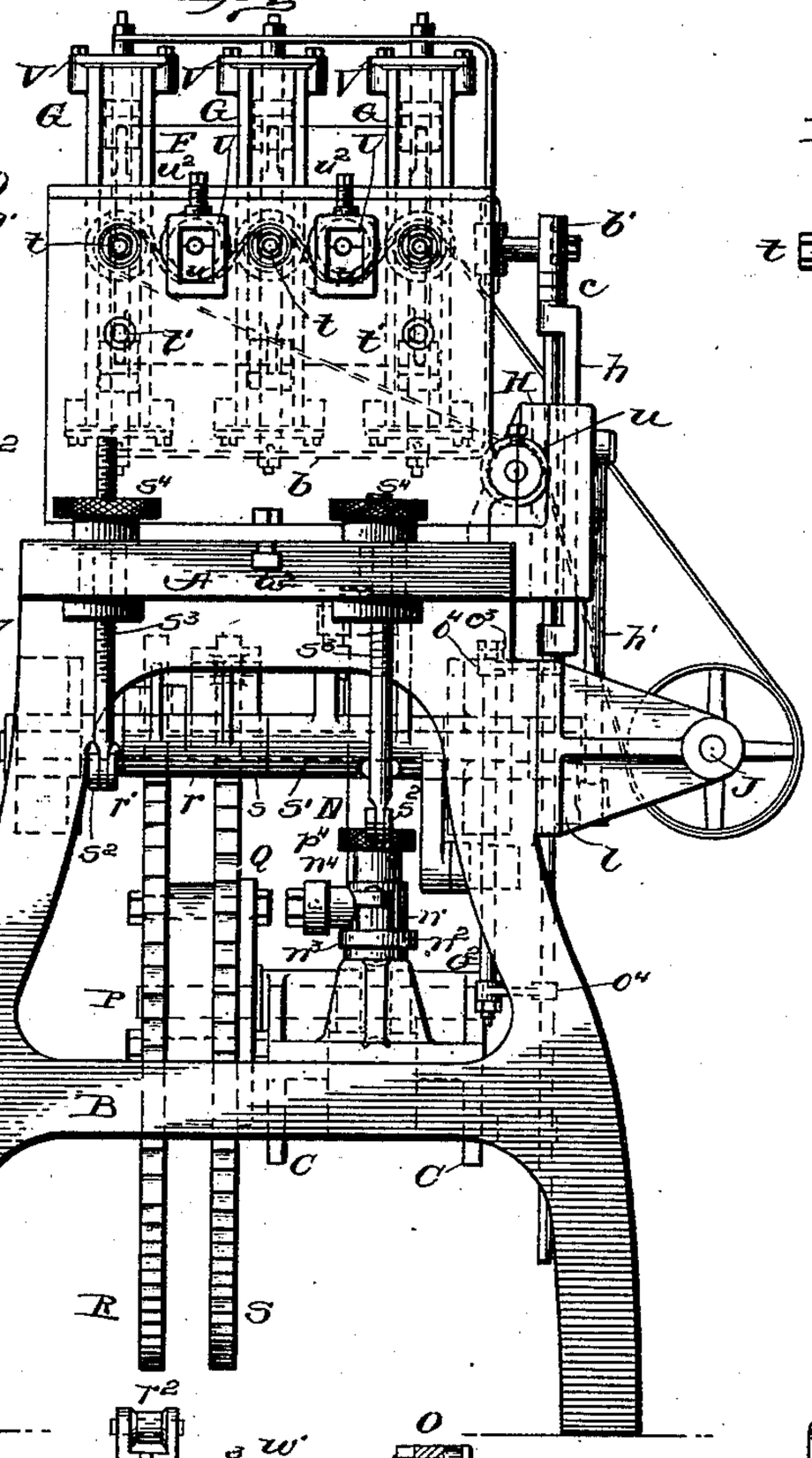


Fig. 11

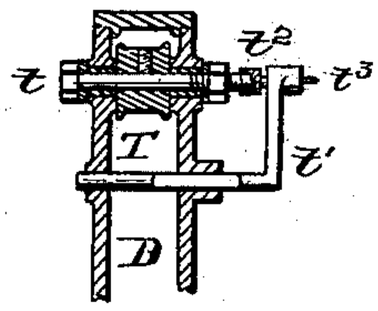


Fig. 10.

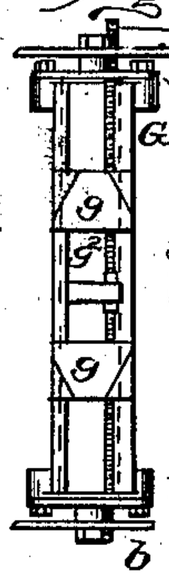
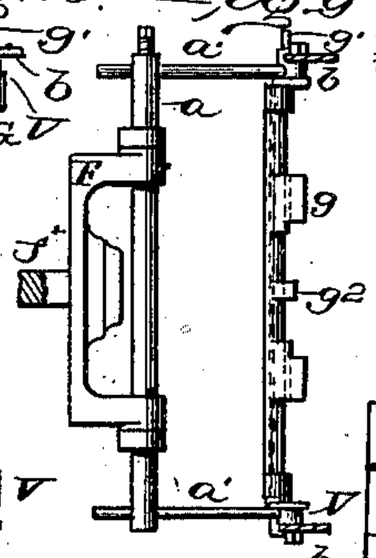


Fig. 9



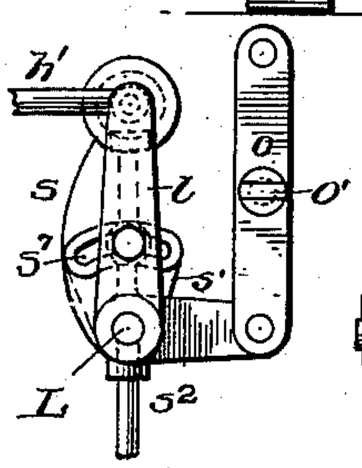


Fig. 6.

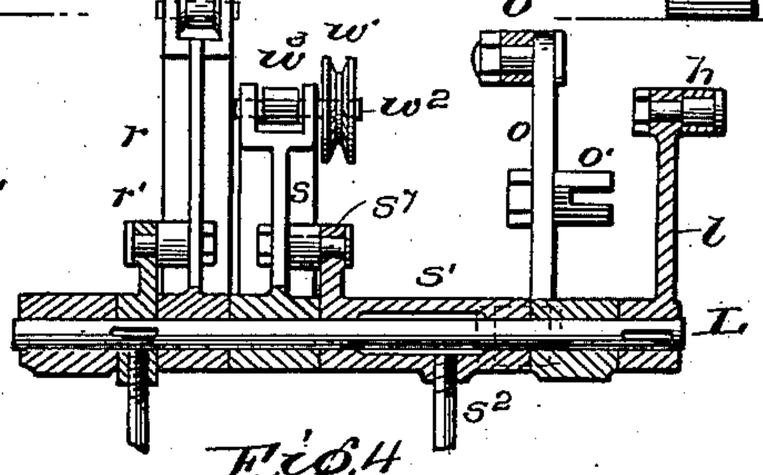


Fig. 4.

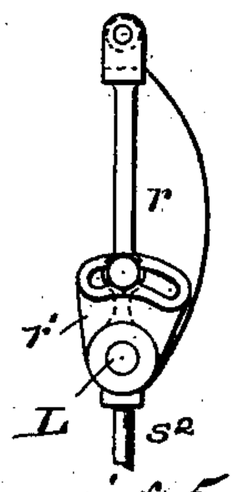


Fig. 5.

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(Application filed Jan. 29, 1900.)

(No Model.) 3 Sheets—Sheet 3.

Fig. 7.

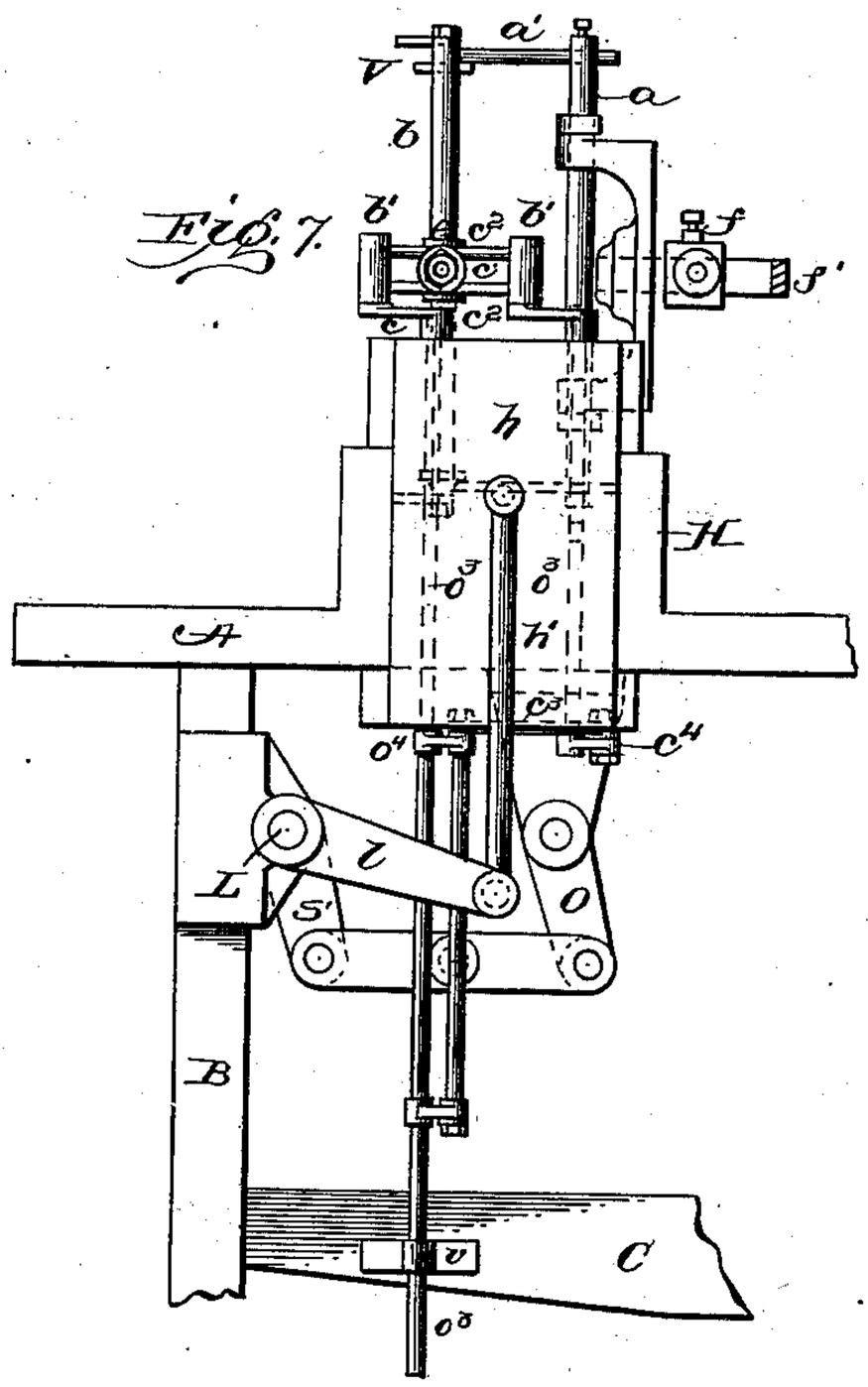


Fig. 8.

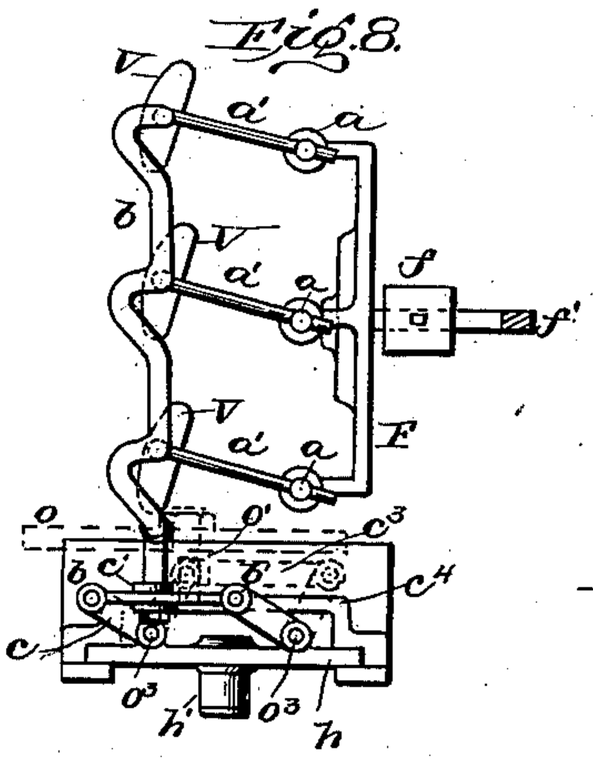


Fig. 12.

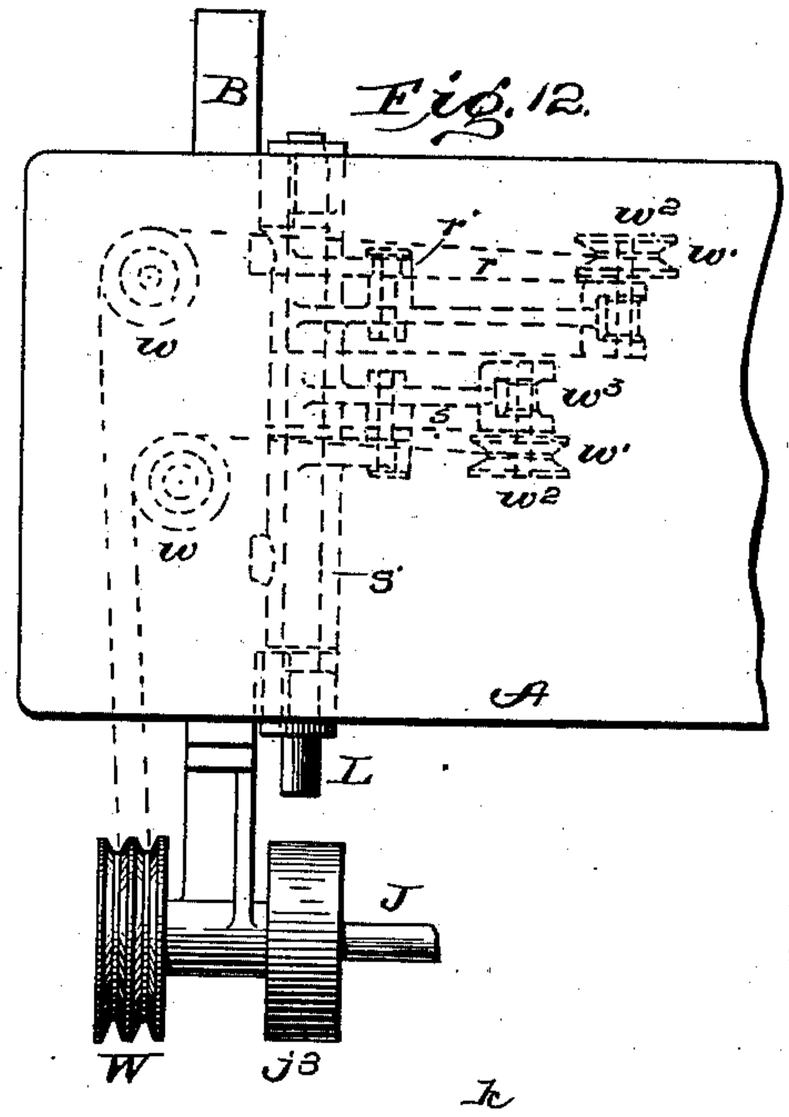


Fig. 13.

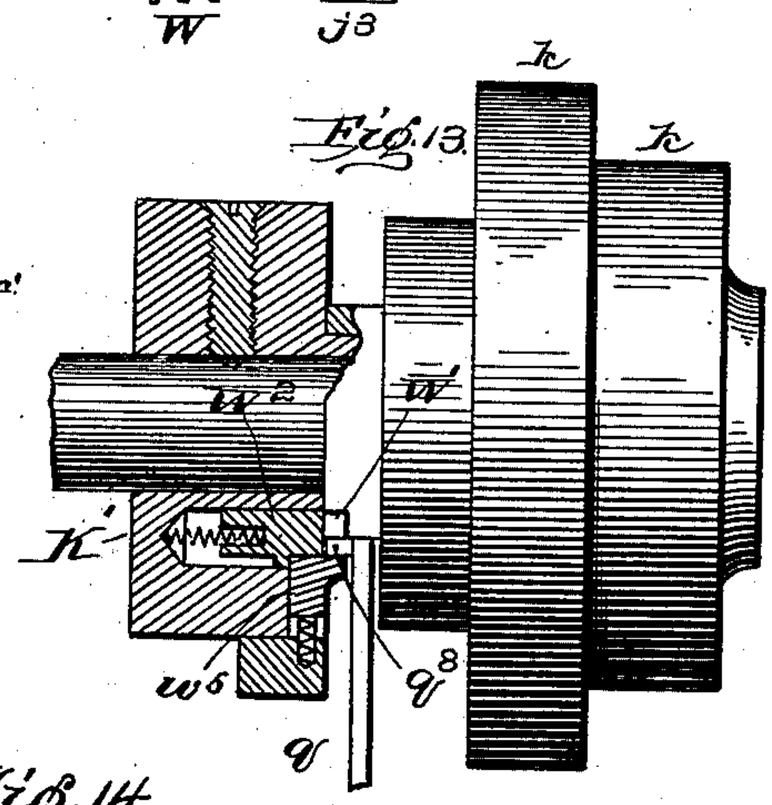
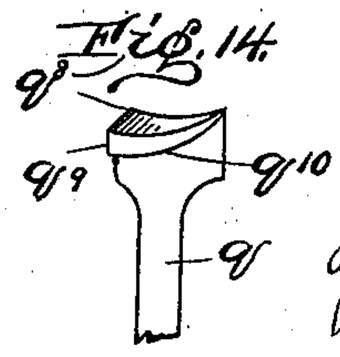


Fig. 14.



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UNITED STATES PATENT OFFICE.

EDWARD F. ABBEY, OF TOLEDO, OHIO, ASSIGNOR OF ONE-HALF TO CYRUS A. BYERS, OF SAME PLACE.

AUTOMATIC MULTIPLE BORING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 666,217, dated January 15, 1901.

Application filed January 29, 1900. Serial No. 3,219. (No model.)

To all whom it may concern:

Be it known that I, EDWARD F. ABBEY, a citizen of the United States, residing at Toledo, in the county of Lucas and State of Ohio, have invented certain new and useful Improvements in Automatic Multiple Boring-Machines; and I do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming a part of this invention, and to the letters of reference marked thereon.

The present invention relates to improvements in machinery for boring a multiplicity of holes in blocks of wood or other material, and more particularly to machines designed for boring brush-blocks to provide sockets for the bristles, although certain features of the invention are applicable to other machinery of a like character, and hence I do not wish to be limited to the specific adaptation mentioned.

The invention consists, primarily, in a machine wherein with a single drill for each block the holes may be formed successively and in the proper relative position and at the proper angles for the reception of the bristles without requiring the attendant to position the blocks or the drill by means of a templet, as has heretofore been done.

Further, the invention consists in a machine embodying a universally-movable work-holder, with a pattern for automatically controlling the positions of the work-holder, in combination with a coöperating mechanism for operating upon the work carried by the holder.

Further, the invention consists in certain novel details of construction and combinations and arrangements of parts, all as will be now described, and pointed out particularly in the appended claims.

Referring to the accompanying drawings, Figure 1 is a side elevation of a machine embodying the present improvements; and Fig. 2 is a front elevation of the same, the driving-belts in both of these figures being omitted in order to show underlying parts. Fig. 3 is a top plan view of a portion of the operating mechanism with the table, work-holders, and pattern-disks removed. Fig. 4 is a horizontal section through the rocker-shaft, showing the several controlling-arms carried thereby. Figs. 5 and 6 are side elevations of the rocker-arms for elevating and oscillating the work-holders and showing the means for adjusting the inclination of said arms with respect to the rocker-shaft. Fig. 7 is a detail side elevation of the elevating and oscillating mechanism for the work-holder. Fig. 8 is a top plan view of the mechanism shown in Fig. 7 with the rocker-shaft omitted. Figs. 9 and 10 are side and front elevations, respectively, of the work-holder, Fig. 9 showing the head for the work-holders. Fig. 11 is a detail section of the drill-head, showing the chuck, drill, and stop for controlling the depth of the hole formed by the drill. Fig. 12 is a top plan view illustrating the arrangement of the mechanism when employed for forming or cutting pattern-disks. Fig. 13 is a detail of the clutch in the stop mechanism. Fig. 14 is a detail view of the end of the clutch-operating rod.

Like letters of reference in the several figures indicate the same parts.

In the machine illustrated in the accompanying drawings the entire working mechanism is shown as mounted upon or within a main frame consisting, essentially, of a table A, mounted on legs B B, secured together by cross-pieces C. The work-holders and drills are mounted above the table A, while the major portion of the operating and controlling mechanism is located below the level of the table and is supported upon the legs B and cross-pieces C.

The drill-head D is rigidly mounted on the table at the left-hand side of Fig. 1 and is adapted to have journaled within it as many spindles *t* as there are work-holders in the particular machine, and it will be understood that the number of such spindles may be indefinitely increased, depending entirely upon the size of the machine and the available power. Each spindle is driven by a pulley T, keyed thereon and in turn receiving its motion from a belt to be hereinafter referred to.

Running longitudinally of the table is a suitable dovetail recess a^2, Fig. 2, in which is located a bolt for adjustably securing the base E of the feed-slide *e* to the top of the ta-

ble. The feed-slide *e* is mounted in suitable ways in said base, so as to be movable toward and from the drill-spindles, and is adapted to carry the work-holders in accordance with such movement. The work-holders are carried by a head F, mounted on the forward end of a bar *f'*, adjustably mounted in a trunnion-bearing block *f*, journaled in the feed-slide *e*, the work-holders and their direct supporting mechanism consisting, essentially, of vertical shafts *a*, journaled in the head F and carrying at top and bottom forwardly-projecting and adjustable rods *a'*, provided at their forward ends with block-holders G G, having vertically-adjustable jaws *g*, adapted to be moved toward and from each other by a spindle *g'*, Figs. 9 and 10, having right and left hand threads cut thereon and also provided near the center with an adjustable jaw or guide g^2 for irregular work. As thus mounted it will be noted that the work-holders may be swung horizontally with the shafts *a* as centers, and the length of the arc described by such work-holders will be governed by the length of the rods *a'*, which being adjustable in the shafts *a* enables the work to be swung in accordance with its surface contour, and it will be further observed that the head F being journaled on the trunnion *f* permits the work-holders to be swung in a vertical plane in accordance with its surface contour, the arc of swing in a vertical plane being controlled by the adjustment of the shaft *f'* in said trunnion-block *f*. The mechanism for directly controlling these movements of the work-holder, as well as for controlling the movement of the work-holder toward and from the drill, is primarily operated from a drive-shaft J, having fast and loose belt-pulleys j^2 j^2 thereon. Said shaft J is provided at one end with a worm *j*, which transmits motion to a transverse horizontal cam-shaft K through the medium of a worm-wheel *j'*, Fig. 3, and the latter is adapted to support the controlling-cam for the several mechanisms. Shaft K has at an intermediate point in its length a hub K', keyed thereon, and upon this hub are journaled cams *k k'*, the cam *k* controlling the movement of the feed-slide and work-holders toward and from the drills through the medium of an operating-lever M, roller *m*, bearing on the cam, and connecting-rod *e'*, adjustably connecting the said lever M and feed-slide, while the cam *k'* is adapted to coöperate with a roller *n*, (dotted lines, Fig. 1,) mounted at an intermediate point on the lever N, journaled beneath the table A at one end and at its opposite end connected by a connecting-rod n^4 with a bell-crank lever *n'*, Fig. 3, journaled on a vertical post *p'*. The bell-crank lever *n'* is provided with double-acting pawls n^2, adapted to engage a ratchet-wheel n^3, mounted on the post *p'*, and the latter, when rotated by the operation of the cam *k'*, being adapted to transmit such motion through the medium of a worm p^2 and worm-wheel *p* to a pattern-shaft P.

The lever M before referred to is adjustably connected with the rods *e'* by a set-nut m^2, and it is held against the cam and the slide advanced by a spring *m'*.

The cams *k k'* are timed to move the shafts P only when the lever M and feed-slide are moved rearwardly, and hence inasmuch as the adjustments of the work-holders are controlled through the pattern-disks carried by the shaft P it is obvious that the drills operate upon the work only when the cam *k'* is inoperative and while the work is held in its adjusted position.

The pattern-disks are preferably secured to a pattern-carrying disk Q on the shaft P and are indicated by the letters R and S in the accompanying drawings. One of said pattern-disks is adapted to control the vertical adjustment of the work-holders and the other the horizontal adjustment of the same through the medium of crank-arms *s* and *r*, carried by the rocker-shaft L and having antifriction-rollers r^2 and w^3, adapted to run on the peripheries of the pattern-disks and to be moved in accordance with the predetermined irregular outlines of the latter. Both of said movements are preferably imparted to the work-holders through the medium of a frame *b*, to which each of the work-holders is pivotally connected by a plate V, having a central trunnion, as shown clearly in Figs. 2 and 8, and which frame *b* is provided with a transversely-projecting arm carrying an antifriction-roller *c'*, to which the moving power is applied. For producing the horizontal movement the said antifriction-roller *c'* (which, it will be noted, is a grooved roller) is embraced by horizontal rods c^2, connected together rigidly by sleeves *b'*, mounted on the ends of parallel cranks *c*, forming the upper end of vertical shafts o^3 o^3, journaled in a slide *h*, carried in vertical slideways H on the main frame A. When either one of said vertical shafts o^3 is oscillated, it will swing the cranks *c*, and thus impart to the frame *b* and work-holders a horizontal movement on the shafts *a* as centers, the necessary transverse freedom being permitted by the arrangement of the antifriction-rollers *c'* between the parallel rods c^2. One of the shafts o^3 extends down below the slide *h* and is preferably sustained at its lower end in a bearing *v*. At an intermediate point it is provided with a relatively-long wing, preferably formed by a shaft o^2, connected with the shaft o^3 by arms o^4. This wing or shaft o^2 is embraced by a fork *o'*, Figs. 7 and 4, mounted on a link *o*, carried at one end by a link O, pivotally connected with the main frame, and at the opposite end by a sleeve and crank-arm *s'*, connected rigidly but adjustably with the crank-arm *s*, journaled on the rocker-shaft. (See Figs. 4 and 6.) These two arms *s* and *s'*, while connected, are loose on the rocker-shaft, so as to oscillate independently thereof, and provision is made for enabling the arm *s* to be adjusted for pattern-disks of various sizes by connecting its outer end with the part *s'*

through the medium of an arc-shaped slot and set-bolt s^7, Fig. 6.

The vertical shafts o^3 being mounted in bearings in the slide h it is only necessary to move said slide vertically in order to impart to the work-holders a vertical oscillation on the trunnion f, and this vertical movement of the slide h is secured by connecting with said slide through the medium of a link h' a crank-arm l on the end of the rocker-shaft L and connecting the arm r with the opposite end of said shaft by a key or otherwise. The arm r, it will be remembered, is controlled in its movements by one of the pattern-disks, and thus as said disk is rotated the arm will be moved up or allowed to drop in accordance with the irregularities of said disk, and thus the work-holders will be moved correspondingly.

To insure the unitary oscillation of the shafts o^3 o^3, they are also preferably connected by arms c^4, which project at an angle from the arms of cranks c and an intermediate link c^3, as shown clearly in Figs. 1 and 8.

In the practical operation of the machine it is desirable that pattern-disks should be provided which will be of such diameter as to control the formation of all of the holes in one piece of work, and when all the holes have been formed a stop mechanism should be brought into action which will arrest the further operation of the machine until the movement is again inaugurated by the attendant. This end I accomplish in the present instance by interposing between the cams k k' and the hub K a suitable clutch or pin connection W^2, which may be thrown out of action, so as to release the cams from the operation of the shaft, by means of a controlling-rod—such, for instance, as the rod q—and this rod q I control by means of a stop projection q' on the pattern-carrying disk Q. The stop projection q', coming in contact with the lower end of the rod q, will advance the same until it is in position to release the cams, as aforesaid, by running under the pin W^2 and lifting it out of the recess W', where it is held by the catch w^5 until the rod q is drawn out by its spring w^6 to release the pin. The end of rod Q is provided with a projection q^8, having two inclined faces q^9 q^{10}. The face q^9 passes under the end of pin W^2 to raise it and stop the cams k k', while the face q^{10}, when the rod is moved out by its spring, passes under the latch w^5, moving it out to release the pin W^2. By mounting the stop projection q' adjustably on the disk Q it is obvious that the adjustment may be made so as to arrest the operation of the machine at any desired point in the rotation of the pattern-disk, and consequently the work may be finished when any predetermined hole has been completed. To again inaugurate the movement of the machine, it is only necessary that the disk Q should be advanced by the attendant far enough to release the throw-out rod q from the action of the projection q', and in the present machine this may be conveniently accomplished by means of a hand-wheel p^4, mounted on the shaft p', and which the attendant may grasp and rotate slightly to advance the pattern-shaft and patterns.

The drill-spindles before referred to may be conveniently rotated by means of a belt running over a pulley j^3 on the shaft J and guided by an idler u'. To tighten said belt and insure a better grip on the pulleys of the drill-spindles, I prefer to mount intermediate each of said drill-spindles a tightener-pulley U, beneath which the belt will pass in running from one drill-spindle to the next and which tightener-pulleys may be adjusted by set-screws u^2, as shown clearly in Fig. 2. Each drill-spindle carries a chuck t^2 for holding the drills t^3, and to adjust the depth of the hole or cut of the drill I prefer to mount a gage t' adjustably in the head D, which gage surrounds the drill at its outer end, and thus the drill may be set or the gage set to give the required depth to the opening, inasmuch as the spring m' will only advance the work until it comes into contact with the gage or gages.

Inasmuch as the formation of the pattern-disks to give the desired angle and position to each of the holes being drilled might be difficult I propose in the present machine to form such pattern-disks directly in the machine itself, giving to such disks a contour formation which will be in accordance with a templet or sample work-block previously worked out by hand or otherwise produced. In order to accomplish this, suitable blank pattern-disks are substituted for the pattern-disks R and S, and the cutters W^3 are substituted for the antifriction-rollers r^2 in the ends of the arms r s. These cutters are adapted to be driven by belts passing around pulleys w' on the cutter-spindle w^2, and thence around idlers w to pulleys W on the shaft J, all as shown clearly in Fig. 12. With such an arrangement if the previously-formed templet or work-block be clamped in one of the work-holders and a blank stub or drill mounted in the corresponding drill-spindle the operator can by positioning the work-holders cause the cutters to dress down the peripheries of the pattern-disks to conform to the outlines necessary to control the reproduction of other work-blocks in exact conformity to the templet or sample block. To enable the operator to control the positioning of the work-holders, I preferably connect arms s^2 with the arms r s and extend screw shafts or links s^3 upwardly from the outer ends of the arms s^2 through the work-table A and apply hand wheels or nuts s^4 to such links, whereby the operator can by rotating said hand wheels or nuts force the work-holder into the proper position and simultaneously cut the peripheries of the pattern-disks, as before explained. When the machine is running automatically for the reproduction of work-blocks, the links s^2 and hand-wheels

s^4 are disconnected from the arms s^2 and perform no function whatever. The operation of cutting the pattern-disks is substantially the reverse of the drilling operation and provides a simple and effective means for producing pattern-disks having an exact contour outline for the reproduction of pattern-blocks of any desired character.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent of the United States, is—

1. In a machine of the character specified, the combination with the main frame, and tool for coöperating with the work, of a reciprocatory feed-slide mounted on the main frame, a work-holder head journaled in said feed-slide so as to oscillate in a single plane, a work-holder shaft journaled in said head to oscillate in a plane at right angles to the plane of oscillation of said head, work-holders mounted on forwardly-projecting rods carried by said shaft, pattern-disks and mechanism interposed between said pattern-disks and work-holders independent of the work-holder-carrying mechanism for positioning the same in accordance with the predetermined contour outlines of the pattern-disks; substantially as described.

2. In an apparatus such as specified, the combination with the main frame, and the feed-slide mounted in ways to reciprocate in right lines, of a work-holder head pivotally mounted in said slide to oscillate in a single plane, a work-holder shaft journaled in said head to oscillate in a plane at right angles to the plane of oscillation of the head, adjustable forwardly-extending rods on said shaft, work-holders carried by said rods, a frame connected with the work-holder and controlling the rod and work-holder and having a lateral projection thereon, pattern-disks, and controlling mechanism interposed between the pattern-disks and projection on said frame, whereby the work-holders may be moved in any direction in accordance with the predetermined contour formation of the pattern-disks; substantially as described.

3. In a machine for boring brush-blocks, the combination with a boring-spindle mounted in fixed bearings and a universally-movable work-holder mounted in a support adapted to advance toward and recede from the drill, of a controlling mechanism for said work-holder embodying pattern-disks, a slide controlled by one of said disks, and controlling the movement of the work-holder in one direction and crank-shafts journaled in said slide and controlled by the other disk and in turn controlling the movement of the work-holder in the other direction; substantially as described.

4. In a machine for boring brush-blocks, the combination with a drill-spindle and drill, and a universally-movable work-holder having a controlling-frame, of a vertically-movable slide, crank-shafts journaled in said slide and connected with said controlling-frame and two pattern-disks one controlling the adjustment of the slide and the other the adjustment of the crank-shafts in their bearings in said slide; substantially as described.

5. A machine of the character specified embodying the following elements, to wit; a universally-movable work-holder, a tool for cooperating with the work carried by said holder, a vertically-movable slide controlling the vertical movement of said work-holder, vertical crank-shafts journaled in said slide and controlling the transverse movements of said work-holder, two pattern-disks and bell-crank levers interposed between one of said disks and the slide and bell-crank levers interposed between the other of said disks and the crank-shafts journaled in the slide; substantially as described.

6. In an apparatus of the character specified, the combination of the following elements, to wit; a universally-movable work-holder, mounted in a slide for advancing the same, a tool mounted in a fixed support for coöperating with the work mounted in said work-holder, pattern-disks, a mechanism controlled by said pattern-disks for moving the work-holder horizontally and vertically in accordance with the predetermined contour outlines of the disks, a cam-shaft, cams rotated by said shaft and connections operated by said cams for operating the slide upon which the work-holder is mounted and for advancing the pattern-disks when the work-holder is retracted; substantially as described.

7. In an apparatus of the character specified, the combination of the following elements, to wit; a universally-movable work-holder mounted in a slide for advancing the same, a tool mounted in a fixed support and coöperating with the work mounted in said work-holder, pattern-disks, a mechanism controlled by said pattern-disks for moving the work-holder horizontally and vertically in accordance with the predetermined contour outlines of the disk, a cam-shaft, cams mounted on said shaft, connections operated by said cam for moving the slide upon which the work-holder is mounted and for advancing the pattern-disks when the work-holder is retracted and a stop mechanism for releasing the cams from their shaft controlled by the movement of the pattern-disks; substantially as described.

8. In an apparatus of the character specified, the combination of the following elements, to wit; a universally-movable work-holder mounted in a slide for advancing the same, a tool for coöperating with the work in the holder, a vertically-movable slide, crank-shafts journaled in said slide and coöperating with the work-holder for moving the same horizontally when the crank-shafts are rotated and vertically when the slide is moved, pattern-disks, connections between one of said pattern-disks and the slide, connections between the other of said pattern-disks and the crank-shaft journaled in the slide, a cam-

shaft, cams mounted on said shaft and connections operated by said cams for alternately operating the pattern-disks and the slide upon which the work-holder is mounted; substantially as described.

9. In an apparatus of the character specified the combination of the following elements, to wit; a tool, a universally-movable work-holder, connections for moving said work-holder horizontally and vertically, pattern-disks controlling such connections, a cam-shaft, a pawl-and-ratchet connection between the cam-shaft and pattern-disks whereby said pattern-disks are moved intermittently, a slide supporting the work-holder and an operating-lever operated by one of the cams on the cam-shaft and controlling the movements of said slide; substantially as described.

10. In a machine for boring brush-blocks the combination with a series of drill-spindles and driving mechanism therefor, of a corresponding series of block-holders mounted on universally-movable supports, a frame pivotally connected with all of said block-holders, a vertically-movable slide, crank-shafts journaled in said slide to swing horizontally, a horizontal guide connecting the cranks of said shafts, a projection on the said frame coöperating with said guide, pattern-disks and independent operating mechanism interposed between one of the disks and the slide and between the other one of said disks and the crank-shafts journaled in the slide; substantially as described.

11. In a machine for boring brush-blocks, the combination with a series of drill-spindles and driving mechanism therefor, of a corresponding series of block-holders mounted on universally-movable supports, a frame pivotally connected with all of said block-holders, and having a transverse projection, a vertically-movable slide, parallel crank-shafts journaled in said slide, a horizontally-slotted guide in which the said transverse projection works connecting the cranks of the said shafts, a vertically-extending wing on one of said shafts, a rocker-shaft, independently-movable arms on the rocker-shaft coöperating with the slide and wing respectively, pattern-disks, arms coöperating with the pattern-disks and controlling the first-mentioned arms, a driving-shaft and intermittingly-operating connections between said driving-shaft and pattern-disks; substantially as described.

12. In a machine of the character specified, the combination with the table, the slide-base adjustably mounted thereon, the slide mounted in ways in said base, the trunnion-block mounted in said slide, the work-holder head adjustably mounted in said trunnion-block, the shafts journaled in the head, the forwardly-projecting rods adjustably mounted on the shafts, the work-holders mounted rigidly on said arms and the frame pivotally connecting the work-holders and having a lateral projection, of a vertically-movable slide, vertical shafts journaled in the slide, cranks on said shafts, a slotted guide connecting the cranks and coöperating with the lateral projection on the said frame, pattern-disks controlling respectively the vertical adjustment of the slide and the movement of the shafts in their bearings in the slide and a driving mechanism operating intermittingly and alternately on the pattern-disks and feed-slide whereby the position of the work-holder is shifted only when the feed-slide is retracted; substantially as described.

13. In an apparatus of the character specified, the combination with the universally-movable work-holder, pattern-disks and mechanism controlled thereby for moving the work-holder, of a spring for advancing the holder, a drill-spindle and drill and a gage cooperating with the face of the work for limiting the advance of the work-holder and the depth the drill shall enter, whereby holes of the same depth may be formed in work of irregular contour; substantially as described.

14. In a machine of the character specified, the combination with a universally-movable work-holder, mechanism for moving said work-holder embodying pattern-disks and a pattern-disk shaft, of a drive-shaft, a pawl-and-ratchet gear interposed between the drive and pattern-disk shaft and a hand-wheel for advancing the pattern-disk shaft independently of the drive-shaft; substantially as described.

15. In a machine of the character specified the combination with a universally-movable work-holder, mechanism for moving said work-holder embodying pattern-disks and a pattern-disk shaft, a drive-shaft, cams thereon, a stop mechanism for releasing the cams from the shaft embodying a projection moving in unison with the pattern-disk shaft, a pawl and ratchet controlled by the cams for advancing the pattern-disk shaft and a hand-wheel for advancing the pattern-disk shaft independently of its drive-shaft to release the stop mechanism and inaugurate the automatic movements; substantially as described.

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