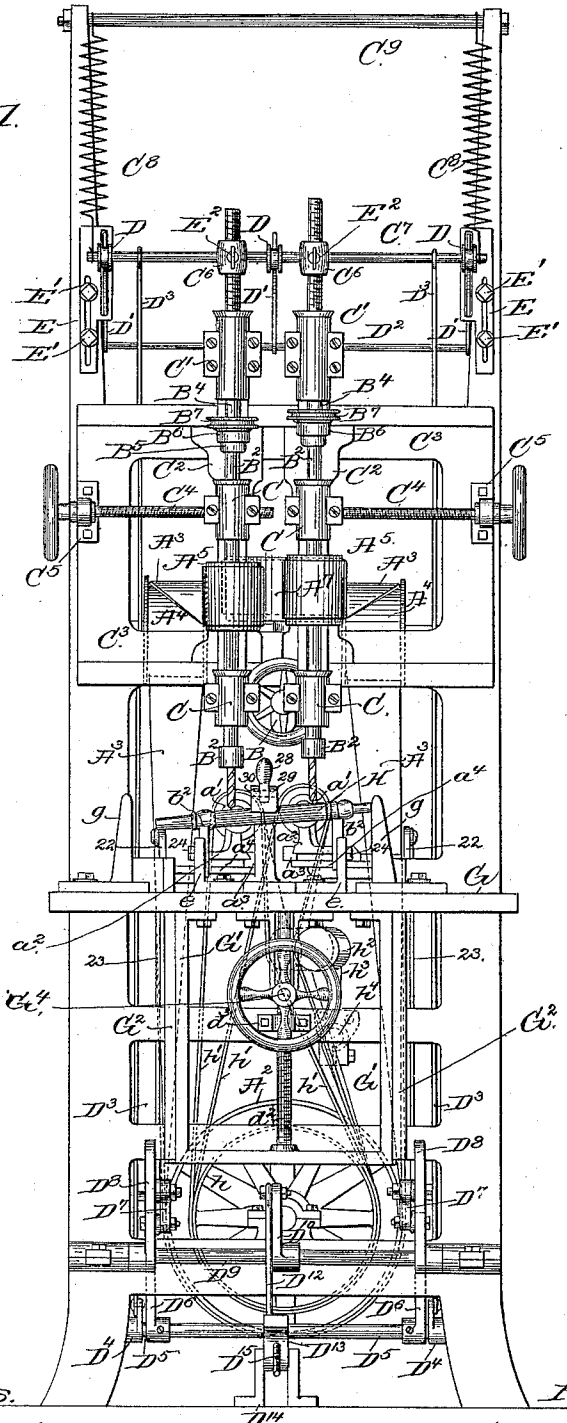
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L. G. McKNIGHT & H. C. KNOWLTON.

BORING MACHINE.

No. 328,966. Patented Oct. 27, 1885.

Fig. 1.



Witnesses.
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Levi G. McKnight and
Henry C. Knowlton.
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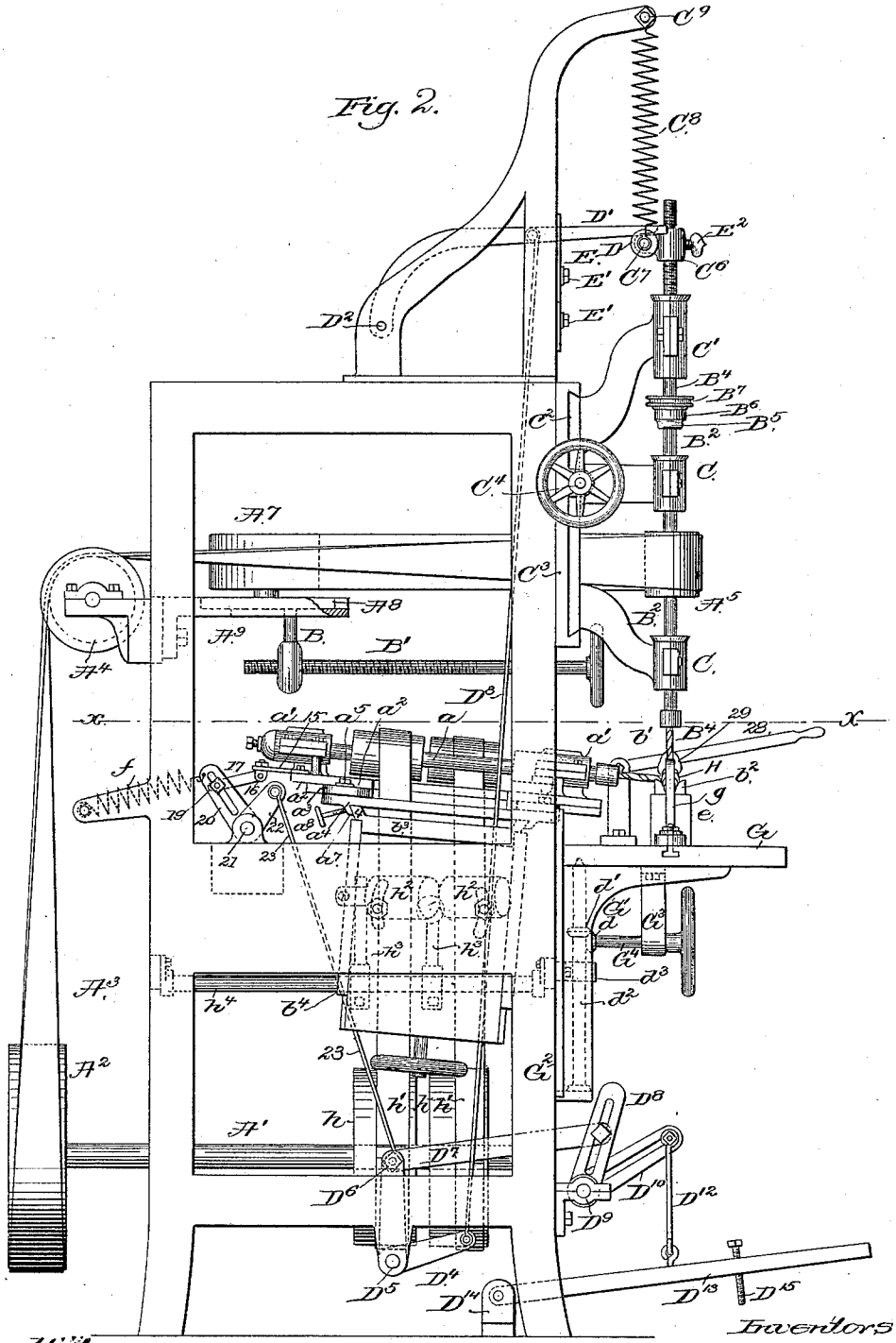
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Fig. 2.



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Fig. 3.

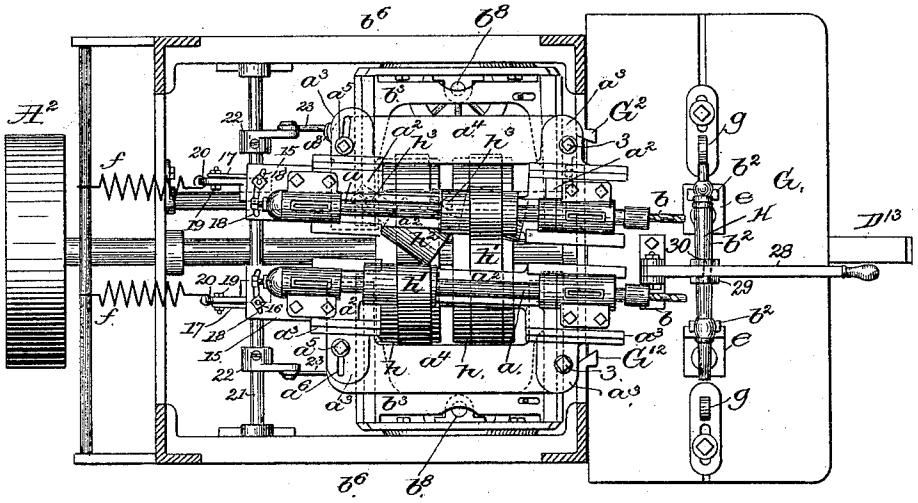


Fig. 4.

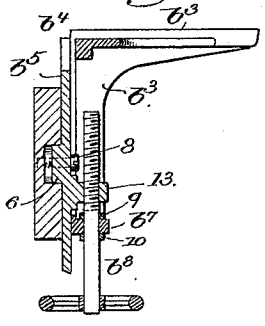
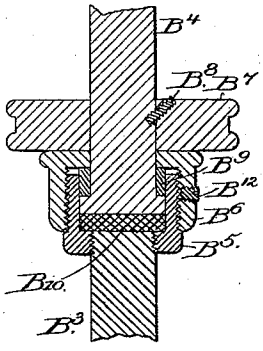


Fig. 5.



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(No Model.) 4 Sheets—Sheet 4.

L. G. McKNIGHT & H. C. KNOWLTON.

BORING MACHINE.

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Fig. 6.

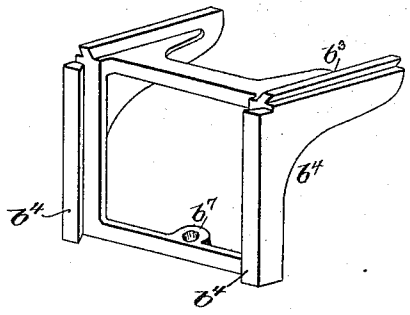


Fig. 7.

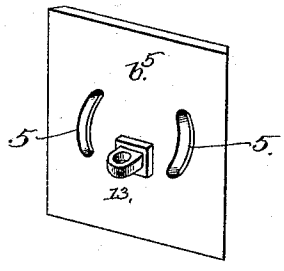
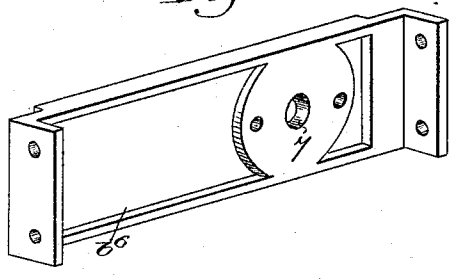


Fig. 8.



Witnesses.
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UNITED STATES PATENT OFFICE.

LEVI G. McKNIGHT AND HENRY C. KNOWLTON, OF GARDNER, MASS.

BORING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 328,966, dated October 27, 1885.

Application filed March 2, 1885. Serial No. 157,479. (No model.)

To all whom it may concern:

Be it known that we, LEVI G. MCKNIGHT and HENRY C. KNOWLTON, both of Gardner, county of Worcester, and State of Massachusetts, have invented an Improvement in Wood-Boring Machines, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

This invention has for its object to improve the construction of a boring-machine to adapt the same for chair-leg and other work.

Our improved machine contains two sets of two or more spindles and bits, each of which may be adjusted independently of the other to place it at any desired angle with relation to the article to be bored, so that the holes to be made may occupy positions more or less angular with relation to each other, and to the center line of the leg or other article.

The table having the support for the work is made adjustable independently of the frame-work carrying the spindles and bits, to thereby adapt the machine to a greater variety or range of work.

Each horizontal spindle has combined with it mechanism whereby it may be raised or lowered independently, and may be tipped independently in a vertical and in a horizontal plane, as may be desired.

Each spindle with its attached bit may be adjusted longitudinally independently of the other.

The special features of our invention will be hereinafter set forth in the claims at the end of this specification.

Figure 1 is a front elevation of a boring-machine embodying our improvements; Fig. 2, a left-hand side elevation thereof; Fig. 3, a section in the line *x x*, Fig. 2. Fig. 4 is a vertical sectional detail of the lifting-frame for the horizontal spindles; Fig. 5, a detail showing the construction of the devices for connecting the live and dead spindles and for causing the two spindles to move vertically in unison, thus avoiding lost motion or backlash; Fig. 6, a detail of the vertically-movable slide to be described; Fig. 7, a detail of the swivel-plate to support the vertically-movable slide; and Fig. 8, a detail of the middle girt, to be referred to.

The frame-work A, of suitable shape to support the working parts, has proper bearings for the main rotating shaft A′, it in practice having applied to its end, at the rear side of the machine, a fast and a loose pulley, (not shown,) the former receiving upon it a suitable belt by which to rotate the shaft A′. The shaft has a pulley, A^2, which receives and drives a belt, A^3, extended about idle-pulleys A^4, and thence about the pulleys A^5 of the two vertical spindles to be described, the said belt after passing about the pulleys on the said spindles being passed partially about an adjustable tightening-pulley, A^7, mounted on a stud erected in a slide, A^8, fitted in a guide-way cut in a plate or bracket, A^9, bolted or secured to the frame-work. The slide A^8, having at its lower side a threaded part, B, extended down through a slot in the plate A^9, is entered by a screw-rod, B′, having a hand-wheel by which to turn the said rod and keep the belt A^3 taut.

The vertical spindles B^2 are just alike, so we shall designate each by like letters, and specifically describe but one of them. The vertical spindles B^2, denominated by us as "live-spindles," are loosely connected with what we shall denominate "dead-spindles" B^4 by means, as herein shown, of a two-part union, B^5 B^6. (Shown best in Fig. 5.) The upper end of the spindle B^2 is screw-threaded to engage the externally-threaded part B^5 of the union, the latter receiving upon it the internally-threaded part B^6 of the union, the latter being placed upon the dead-spindle from its upper end, and before the said dead-spindle is secured to its hand-wheel B^7 by the screw B^8.

The lower end of the dead spindle has a flange, and above and below it in the union we have placed suitable packing, B^9 B^{10}, and to always insure the exact movement of the dead and live spindles longitudinally in unison we have provided the two-part union with a set-screw, B^{12}, which retains the live and dead spindles closely in operative connection, arresting any loose or lost motion or end-play, the one independently of the other. The live and dead spindles B^2 B^4, connected loosely in line with each other, as described, are supported, respectively, in the boxes C and C′,

supported by suitable arms extended from the carriage C^2, the base of which is fitted to slide horizontally in the guide-plate C^3, the latter being bolted on the frame-work.

It will be noticed that the live-spindle has two bearing-boxes and the dead-spindle one, and in Fig. 1 it will be seen that each carriage C^2 has connected with it an adjusting device, (shown as a screw-rod, C^4,) supported outside the said carriage by a threaded nut, C^5, having feet, which are suitably attached to the guide C^3 by bolts or otherwise, the said adjusting device enabling the operator to place the vertical spindles at the proper distance apart horizontally.

The dead-spindles B^4, screw-threaded above the boxes C', enter threaded nuts C^6, which at their rear sides have lugs, provided each with a hole to receive the rod C^7, on which latter the said nuts are free to slide longitudinally.

The ends of the rod C^7 are entered into loops or eyes at the lower ends of springs C^8 supported by the cross-rod C^9, or in other suitable manner. The rod C^7 is provided preferably with anti-friction rolls D D, loose thereon, which are acted upon by arms D' of a rock-shaft, D^2, suitably supported in the frame-work, the said arms being connected by rods or links D^3 with an arm, D^4, of a rock-shaft, D^5, the said rock-shaft having other arms, D^6, which, by links D^7, are adjustably connected with arms D^8 of a second rock-shaft, D^9, provided with a slotted arm, D^{10}, with which in turn is adjustably connected a link, D^{12}, attached to a foot or other lever, D^{13}, having its fulcrum on a stand, D^{14}, or otherwise, and having an adjustable stop, D^{15}, by which to regulate the descent of the lever D^{13}.

The operator, by the foot upon the treadle, may, through the devices described, turn the arms D' and effect the gradual descent of the vertical spindles and their attached bits to bore the article placed under them, and which it is desired to bore at two or more places simultaneously. The arms D' D', nearest the ends of the rod C^7, are extended through slotted guide-plates E, adjustably attached to the frame-work A by bolts E', the slots in the said guide-plates being of such length as to act preferably as stops for the arms D' in their most elevated and depressed positions, thus enabling the extent of the reciprocations of the vertical spindles to be regulated by the said guide-plate, and, if desired, the screw D^{15} may be dispensed with.

The dead-spindle is provided with a hand-wheel, B^7, by which it may be turned after loosening the set-screw E^2, the hand-wheel permitting the vertical spindles to be adjusted vertically with relation to each other and to the surface or outline of the article to be bored.

The horizontal spindles *a*, two or more, are each supported in bearings *a'*, erected on a carriage, a^2, which is fitted to slide longitudinally in an adjustable guideway, a^3, herein shown as having ears, one of which is pivoted by a bolt, 3, on the cross-slide a^4, the ear at the other end of the said guideway being slotted at a^6 to receive a bolt, a^5, the said slot and bolt permitting the guideway and the carriage within it to be turned or adjusted in a substantially horizontal plane to place the spindle at a greater or less angle with relation to the axis or center line of the article to be bored—as, for instance, if a chair-leg is to be bored it is well known that the adjacent holes therein have to be bored at different angles. The adjustment of the guideway containing the carriage which supports the horizontal spindles provided with bits *b* about a fixed center, as stated, enables the said spindles and bits to be placed at different angles with relation to the longitudinal center of the article H to be bored, and by supporting the said article (herein shown as a chair-leg) on vertically-adjustable rests b^2 the said article may be presented with its surface at an angle to the vertical plane in which the vertical spindles reciprocate when the bits carried by them enter the said article, such angular presentation of the article to the vertical spindles and their bits enabling us to dispense with pivoting the carriages C^2, yet permitting both the bits carried by the vertical spindles as well as those carried by the horizontal spindles to bore the article, each bit at a different angle from the other, if desired.

The cross-slide a^4, at its under side, has attached bevel-flanges a^7, one of which is shown by full and the other by dotted lines, Fig. 2, the said flanges embracing a dovetailed guide, 4, projecting upward from the upper side of a vertically-movable slide, b^3, having side lips, b^4, which embrace the edges of a swivel-plate, b^5, provided with two slots, 5 5, and at one side with a hub or projection, 6, (see Fig. 4,) to enter a hole, 7, in the side girt, b^6, of the frame.

The projection 6 constitutes a central pivot for the swivel-plate b^5, and bolts 8 in the slots 5 enable the said plate to be placed in any desired position of inclination to thus provide for the movement of the slide b^3 thereon at any desired angle, thus inclining the spindles *a* more or less from true horizontal position.

The slide b^3 has a lug, b^7, which receives the adjusting screw b^8 loosely, the said screw being held therein by the collars 9 10, the latter constituting a part of the screw, while the other is screwed thereon. The adjusting-screw b^8, having a suitable hand-wheel, enters a threaded lug, 13, on the swivel-plate b^5, so that as the said screw is turned the slide-plate b^4 and the devices supported by it, including the carriage a^2 and the spindles *a*, are correspondingly raised and lowered.

Instead of pivoting the guide-plate a^3, as shown clearly in Fig. 3, and as described, it is obvious that it may be pivoted centrally, as described of the swivel-plate b^5, and be slotted each side the said pivot.

Each spindle *a* may be adjusted independ-

ently of the other, both vertically and horizontally or laterally, and the bits may therefore be placed opposite the article b^2 to be bored, no matter what may be its inclination from a horizontal plane.

Each carriage a^2, having the bearings for the spindles a, has at its end a plate, 15, either bolted to it, as shown, or forming a part of it, the said plate being slotted at 18 to receive the shank of an ear, 16, which serves to receive a pivot-pin, by which to connect to the said ear the link 17, the latter having its outer end adjustably attached by bolt 19 to the slotted arm 20 of the rock-shaft 21, having a second arm, 22, which, by link or rod 23, is attached to the arm D^6 of the rock-shaft D^5, before described as under the control of the foot or other lever D^{13}.

The connection of the carriages a^2 with the arm D^6, as described, enables the horizontal spindles a and their attached bits to be fed or pushed forward to enter the article b^2 simultaneously with and at the same speed as that of the vertical spindles.

The extent to which the bits b shall enter the material and the difference in the depth of the holes therein made by the said bits may be varied at will by adjusting the bolt 19 in the slot of the arm 20.

The cross-slide a^4 is held in position on the slide b^3 by the set-screw a^8.

The table G has, as herein shown, a centrally-placed leg, G′, which is secured in a gibbed guideway, G^2, attached to the frame-work.

The table G has at its lower side a lug, G^3, which receives a hand-shaft, G^4, having at its inner end a bevel-gear, d, which engages a bevel-gear, d', fast on a screw, d^2, placed in a threaded ear, d^3, attached rigidly to the frame-work, the said screw at its upper end resting in a cup at the under side of the table G, and at its lower end loosely in a cross-bar of the leg G′, rotation of the said screw in the said leg enabling the table to be adjusted vertically. This provision for adjusting the table vertically is old.

The brackets e e, attached to the upper side of the table G by bolts extended into the latter, receive and have co-operating with them the bearings b^2 for the article H to be bored. The bearings b^2 are each attached vertically and adjustably in or on the brackets e e by bolts 24 to thus hold or support the said article with one end elevated higher than its other end, or with its longitudinal center more or less out of horizontal position, the adjustment of the brackets e e on the table G horizontally enabling the said bearings to be more or less close together, according to the requirements of the article to be bored. The bearings b^2 are shown as forked to receive a chair leg, and the said leg is held in the said bearings by a hand-lever, 28, and an attached clutch, 29, the latter being pivoted on the lever at 30.

The springs f f, attached to the frame-work and to the levers 20, serve to draw the carriages a^2 back after the bits b have completed boring holes in the article H.

The table G has at its upper side an adjustable gage, g, against which to place one end of the article H to be bored.

The main shaft A′ has fast on it two pulleys, h h, about which are placed belts h' h', extended each over a pulley on one of the spindles a, each belt being acted upon by an idler, h^2, mounted loosely on a stud of an arm, h^3, (shown in dotted lines, Fig. 2,) adjustably attached to a shaft, h^4.

We claim—

1. In a wood-boring machine, the two or more spindles, B^2, a carriage to support each spindle, a dead-spindle loosely connected with the said spindles B^2, and supports for the said dead-spindle, combined with means, substantially as described, to adjust the said dead-spindle vertically, substantially as described.

2. Two or more live-spindles, B^2, their attached bits, a carriage to support each spindle, a dead-spindle loosely connected with each live-spindle, and a bearing for the dead-spindle, combined with adjusting devices, substantially as described, to adjust independently in horizontal direction the carriages containing the live-spindles, substantially as described.

3. Two or more live-spindles, independent carriages to support them, and loosely-connected threaded dead-spindles and independent carriages for each dead-spindle, combined with a threaded nut, into and from which the said dead-spindles may be turned to place the lower ends of their connected live-spindles in different horizontal planes, substantially as described.

4. In a wood-boring machine, the live-spindle, the carriage and bearings thereon to support it, the longitudinally-adjustable dead-spindle and the carriage and bearings thereon to support it in line with the live-spindle, combined with the two-part union B^5 B^6, to connect the live with the dead spindle, and with the set-screw to maintain the two parts of the union in adjusted position, substantially as described.

5. The live-spindles, their carriages, the loosely-connected dead-spindles, bearings to support them, the nuts C^6 to support the dead-spindles, and the spring-supported rod to sustain the said nuts, combined with the arms to depress the said rod and the frame to support the said parts, to operate substantially as described.

6. The live-spindles, their carriages, the loosely-connected dead-spindles, bearings to support them, the nuts C^6 to support the dead-spindles, the spring-supported rod to sustain the said nuts, the arms to depress the said rod, and the treadle or lever D^{13}, combined with connecting means, substantially as described, between the said treadle and the said arms, to operate as set forth.

7. In a wood-boring machine, the swivel-

plate b^5, the adjustable guide b^3 thereon, its attached cross-slide a^4, and the carriage a^2 and its spindle a, combined with the interposed adjustable guideway in which the said carriage is free to slide, the parts being constructed and arranged to operate substantially as described.

8. In a wood-boring machine, the spindle a, its carriage a^2, fitted to slide in a guideway, a^3, pivoted at one end and slotted at the other, so as to be adjustable in an arc of a circle, combined with a rock-shaft, 21, and means to move it, and a link, 17, connected to a slotted arm of said rock-shaft and to a curved slot in the said carriage, substantially as and for the purpose described.

9. In a wood-boring machine, two spindles, a a, the independent carriages a^2, in which they are mounted to rotate, the two independently-adjustable guideways in which the said carriages are free to slide, and the two cross-slides and vertically-adjustable guide-plates b^3, on which they are secured, combined with means, substantially as described, to adjust the said guide-plates vertically, each independently of the other, as and for the purposes set forth.

10. The independently-adjustable table G and its attached brackets and bearings to support the article to be bored, and the two or more live-spindles, their loosely-connected vertically-adjustable dead-spindles, and the independent carriages and bearings for the said live-spindles, and adjusting devices, substantially as described, to adjust the said carriages independently in horizontal direction, combined with two or more horizontal spindles, a a, their independent carriages, and with means, substantially as described, to adjust the said carriages both vertically and horizontally, substantially as described.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

LEVI G. McKNIGHT.
HENRY C. KNOWLTON.

Witnesses:
G. W. GREGORY,
B. J. NOYES.