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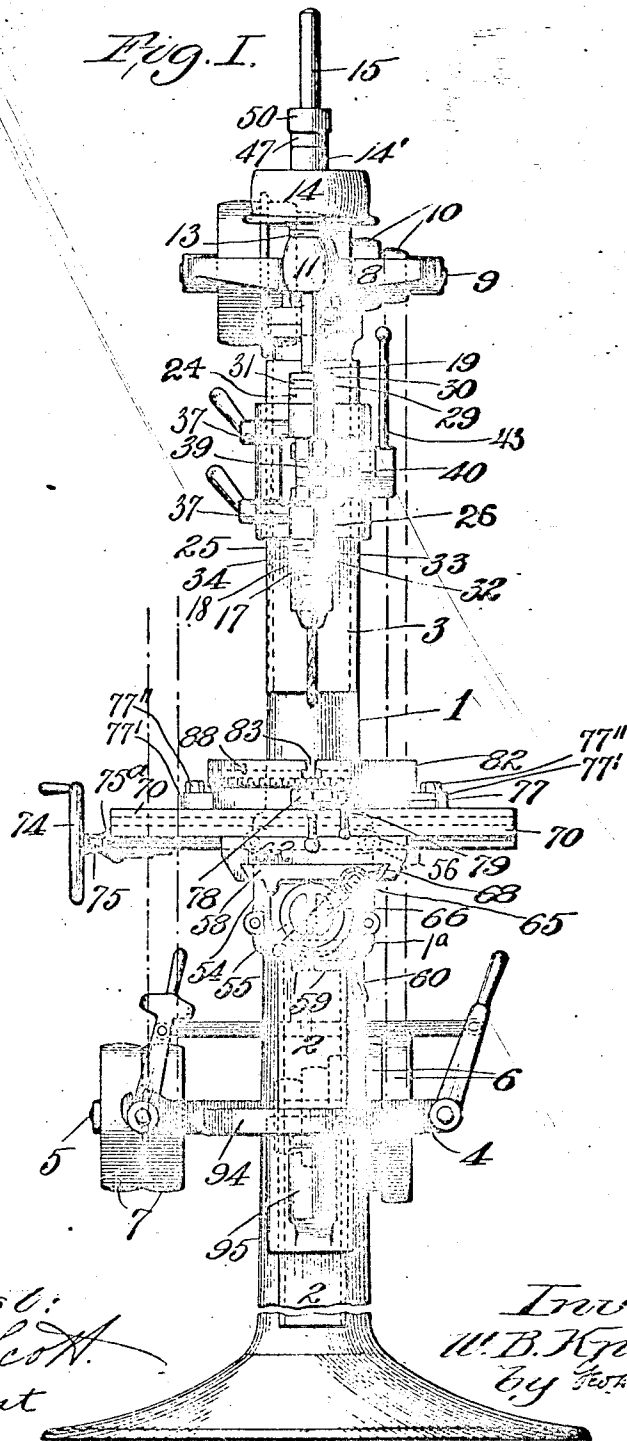
W. B. KNIGHT.

PATENTED AUG. 4, 1908.

WORK SUPPORT FOR MILLING AND DRILLING MACHINES.

APPLICATION FILED MAR. 1, 1907.

3 SHEETS—SHEET 1.



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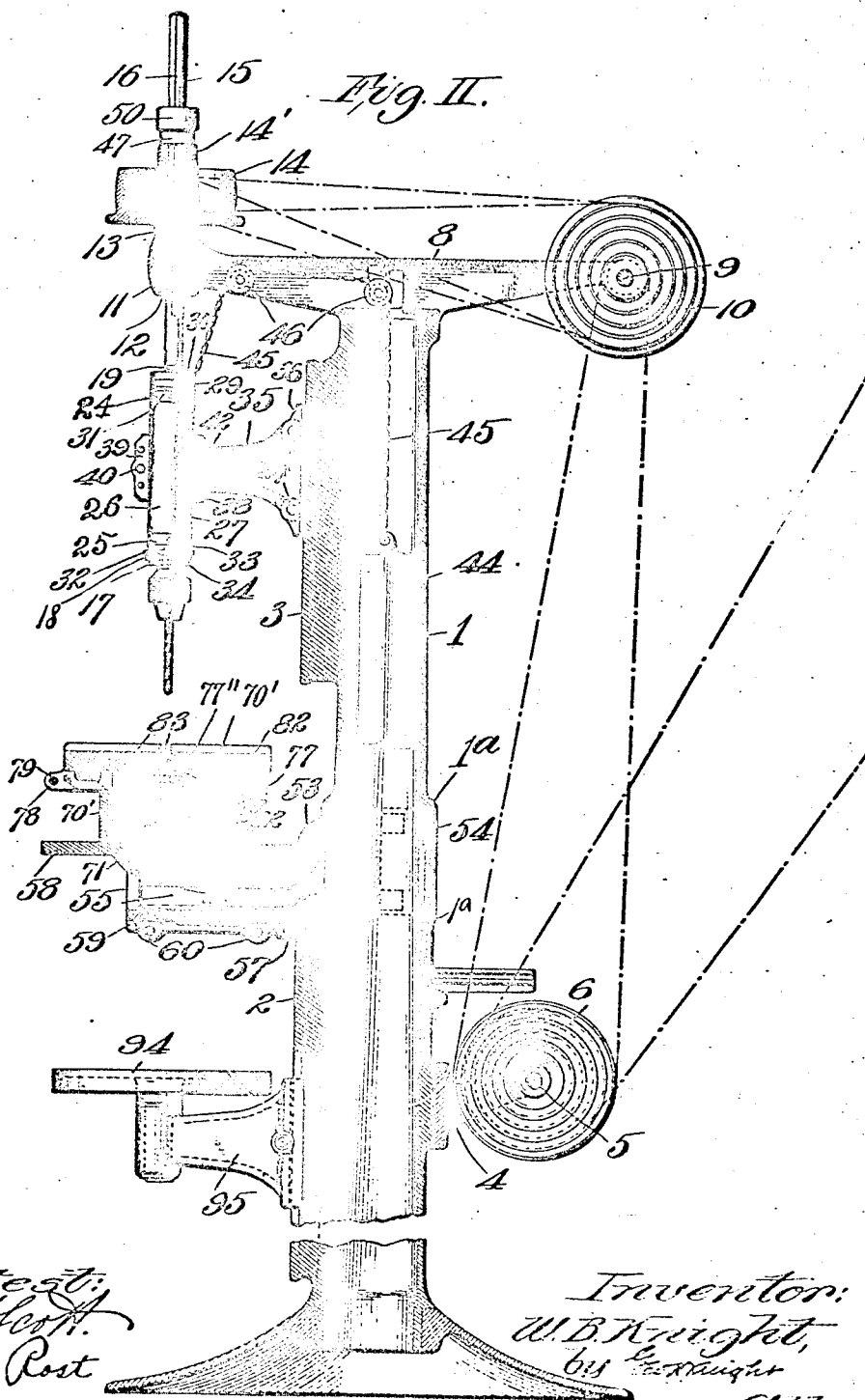
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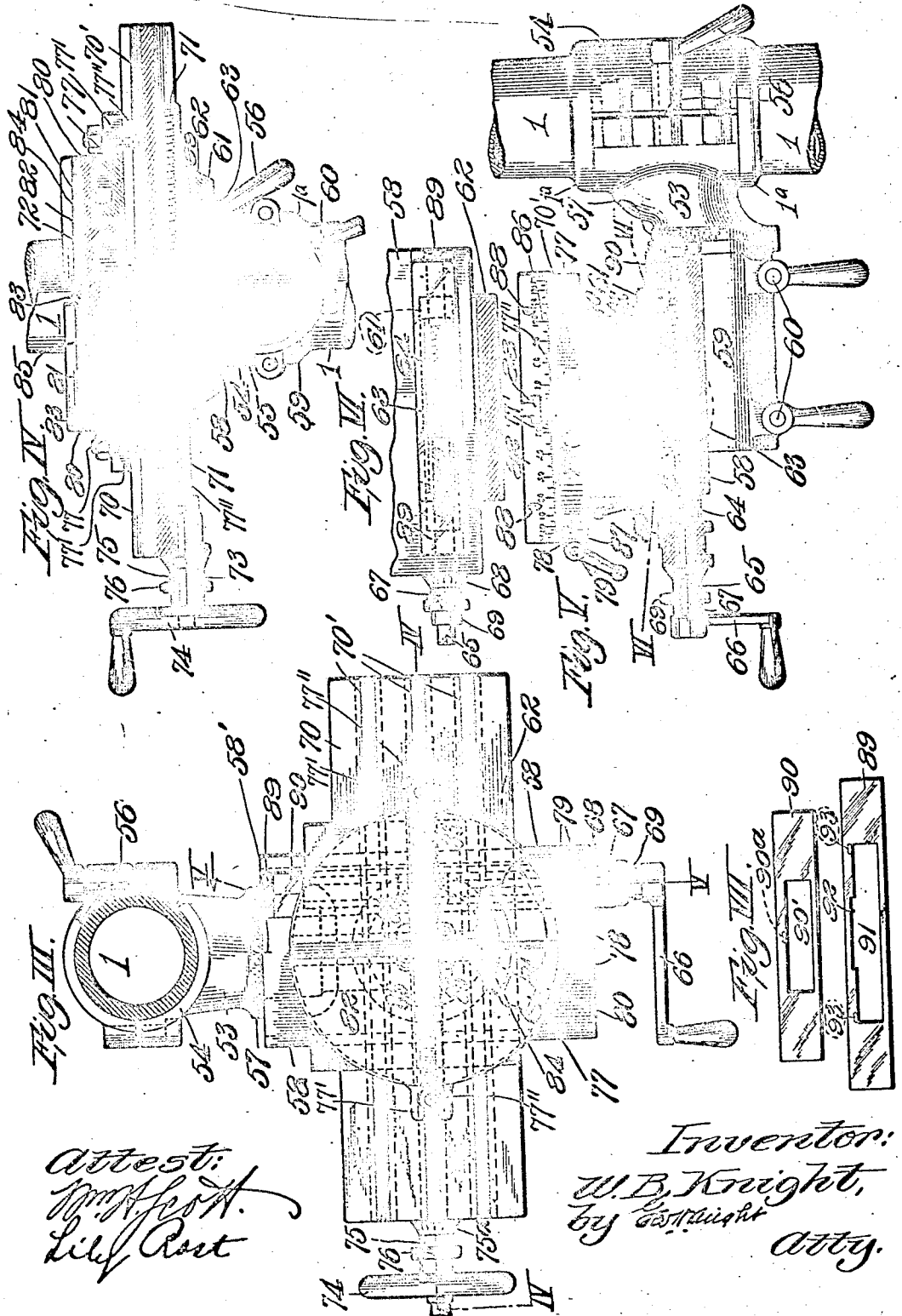
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3 SHEETS—SHEET 3.



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UNITED STATES PATENT OFFICE.

WILLIAM B. KNIGHT, OF ST. LOUIS, MISSOURI, ASSIGNOR TO W. B. KNIGHT MACHINERY COMPANY, OF ST. LOUIS, MISSOURI, A CORPORATION.

WORK-SUPPORT FOR MILLING AND DRILLING MACHINES.

No. 895,093.

Specification of Letters Patent.

Patented Aug. 4, 1908.

Application filed March 1, 1907. Serial No. 359,963.

To all whom it may concern:

Be it known that I, WILLIAM B. KNIGHT, a citizen of the United States of America, residing at the city of St. Louis, in the State of Missouri, have invented certain new and useful Improvements in Work-Supports for Milling and Drilling Machines, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification.

My invention relates to a machine for milling and drilling operations upon metal or other materials and it has for its object to provide a machine of this character in the use of which either of the operations specified may be carried on with accuracy and speed in milling in a large variety of configurations and drilling either single holes or holes arranged in a piece of material in regular or irregular positions relative to each other.

Figure I is a front elevation of my machine. Fig. II is a vertical section taken through the machine. Fig. III is an enlarged top or plan view of the work supporting and holding members of the machine with the column of the machine-shown in horizontal section. Fig. IV is a longitudinal vertical section taken on line IV-IV, Fig. III through the work supporting and holding members of the machine. Fig. V is a longitudinal vertical cross section taken through the work supporting and holding members on line V-V, Fig. III with the adjacent portions of the machine shown in side elevation. Fig. VI is a horizontal section taken on line VI-VI, Fig. V and illustrating in detail the shiftable guard plates located on the tilting table of the machine. Fig. VII is a top or plan view of the guard plates shown in Figs. V and VI.

1 designates the column of my machine which is hollow and is provided with a lower vertical guide 2 and an upper vertical guide 3, each preferably of V-shape.

4 is a bracket secured to the column and in which is journaled a lower counter shaft 5. This counter shaft has fixed to it a stepped or cone pulley 6 and has mounted thereon a pair of pulleys 7, one of which is tight on the shaft and the other of which is loose on the shaft.

8 designates a cross head surmounting the column of the machine. This cross head is

forked at its rear end and has mounted in the arms of its fork a counter shaft 9 to which is fixed a stepped or cone pulley 10 that is adapted to be driven by a belt leading from the stepped or cone pulley 6. At the forward end of the cross head 8 is a bearing box 11.

12 is a bearing sleeve that is vertically positioned in the bearing box of the cross head and is provided with an annular rim 13 that rests upon the top of said bearing box, the sleeve being extended above said rim to serve as a journal for a belt wheel 14 that is loosely fitted to said sleeve and receives a driving belt leading from the upper stepped or cone pulley 10.

15 designates a tool holding spindle that is vertically positioned in the bearing sleeve 12 and is provided with a longitudinal groove 16. The spindle is splined to the belt wheel 14 by virtue of the upper end of the hub 14' of said belt wheel being extended above the upper end of the bearing sleeve 12 and said hub being provided internally with a spline (not shown) that fits in the groove in the spindle. In the lower end of the spindle is a socket 17 for the reception of the shank of a tool, such as a milling tool or the shank of a chuck for holding a drill bit. Adjacent to the lower end of the spindle is an annular rim 18 that serves as a seat for a bearing member to be hereinafter mentioned, and on the spindle at the top of its conical portion is a screw thread 19.

26 is a shift sleeve located between the adjustment nuts 24 and 25 which bear against the ends of said sleeve. The shift sleeve 26 is provided with a rack 27 for service in a manner to be explained.

29 is a set nut fitted to the screw thread 19 of the tool holding spindle and 30 is a jam nut also fitted to said thread and bearing against said set nut. The nut 29 serves as a support for the spindle 15.

31 is a washer that is located above the upper end of the adjustment nut 24 and separates said nut from the set nut 29, thereby providing an end thrust bearing between these parts.

32 is an end thrust bearing ring mounted on the rim 18 of the tool holding spindle and 33 is an end thrust bearing ring surrounding the spindle above the ring 32 and resting against the lower adjustment nut 25. Between the end thrust bearing rings are anti-

friction balls 34 that receive the end thrust during the operation of the spindle.

35 designates a guide bracket for the tool holding spindle and the parts surrounding its lower portion. This guide bracket is slidably fitted to the upper guide 3 of the column of the machine, its rear end being split, as seen at 36, for the purpose of providing two clamping arms that engage the guide 3. These arms are designed to be clamped to said guide by binding screws 37 which are seated in the arms and serve to draw them toward each other. The guide bracket is provided at its forward end with a barrel 38 in which the shift sleeve 26 operates. This barrel is split at 39 to provide a pair of arms in which are mounted clamp screws 40 that serve to draw the arms toward each other for the purpose of clamping the shift sleeve 26 within the barrel when it is desired to hold the barrel and spindle from movement while the guide bracket 35 is being raised or lowered.

41 is a rock shaft mounted in the guide bracket 35 and provided with teeth 42 that mesh with the rack 27 of the shift sleeve 26. This rock shaft has attached to it an end lever 43 by which the shaft may be rotated for the purpose of shifting the sleeve 26 and raising and lowering the tool holding spindle that is surrounded by said sleeve. For the purpose of counter-balancing the weight of the tool holding spindle and the parts associated with said spindle, I employ a counterweight 44 that operates in the hollow column of the machine and is connected to the shift sleeve 26 by a chain 45. The chain 45 operates upon sheaves 46 that are supported by the cross head 8.

47 is a stop collar that is loosely fitted to the spindle.

50 is a binding nut surrounding the spindle.

53 is a supporting arm for the work holding members which is provided with a split collar 54 that is rotatably fitted to a vertical bearing located between lower and upper retaining flanges 1^a in the column of the machine. The arm 53 has a cylindrical downwardly offset horizontal stem 55 that is normally retained in a position directly beneath the tool holding spindle 15 through the medium of a clamp screw 56 that is mounted in the split collar of the supporting arm, see Figs. III and V. At the rear end of the stem of the supporting collar is a rim 57 bearing a graduation scale.

58 is a tiltable table that is supported by the supporting arm stem and is provided with a split sleeve 59 that surrounds the stem 55 and is adapted to be held in a set position thereon by clamp screws 60, see Figs. I, II, IV and V. Upon the upper surface of the table 58 is an index mark 58', see Fig. III, that is adapted to co-incide with the

scale on the rim of the supporting arm for the purpose of indicating the degree to which the table is tilted upon the stem that supports it, thus furnishing knowledge to the user of the machine and enabling the operator to determine when the table is in a level position and also to determine the angle of the upper face relative to a horizontal plane when the table is tilted upon its stem to any extent.

By the construction and arrangement just set forth, I provide for the support of a piece of work mounted above the tiltable table in such manner that the work may be operated upon by the tool when the table is either in a horizontal position or a tilted position while the operator is constantly in possession of knowledge as to the accuracy with which the work is being accomplished. In the tiltable table at one side and extending longitudinally thereof, is a groove 61, see Figs. IV and V.

62 is a longitudinally movable carrier plate that is dove-tailed to the tiltable table 58 and adapted to ride thereon in a direction toward and away from the column of the machine. This carrier plate has fixed to its under side a shift nut 63 that is adapted to move in the groove 61 of the tiltable table.

64 is a longitudinal feed screw journaled in the forward and rear ends of the tiltable table and the threaded central portion of which passes through the shift nut 63 for the purpose of imparting movement to the carrier plate when the feed screw is rotated. The forward end or shank 65 of the feed screw is adapted to receive a crank or handle 66 by which the screw is rotated.

67 is a set collar mounted upon the shank of the feed screw and provided with a graduation scale as seen at 68 Figs. I, III and VI. This set collar is adapted to be held in a fixed position upon the feed screw shank by means of a set screw 69 that passes therethrough and bears against said shank. The scale upon the set collar is adapted to register with an index mark upon the forward end of the tiltable table for the purpose of indicating the degree of rotation that may be imparted to the feed screw in shifting the carrier plate for the purpose of altering the position of the work supported above it relative to the tool that is carried by the tool holding spindle of the machine.

70 is a transverse platen that is slidably mounted upon the carrier plate 62 and dove-tailed thereto in order that it may be shifted cross-wise of said carrier plate and the tiltable table beneath it.

71 is a cross-feed screw loosely mounted in one end of the platen 70 and operating in a shift nut 72 that is held in a fixed position by the carrier plate 62 for the purpose of causing cross movement to be imparted to the platen when the feed screw is rotated. The shank 73 of the cross feed screw has fitted to

it a hand wheel or crank 74 by which the feed screw is operated.

75 is a set collar mounted upon the feed screw shank and held in a fixed position thereon by a set screw 76. This set collar bears a graduation scale as seen at 75^a, see Figs. I and III, the marks upon which are adapted to co-incide with an index mark upon the adjacent end of the platen for the purpose of furnishing information as to the degree of rotation imparted to the cross feed screw in moving the platen 70. In the platen 70 are inverted T-slots 70' for the reception of clamping bolts having the utility of holding work directly upon the platen or an additional work holder on which the work is mounted.

To provide for the holding of work in such manner that it may be rotated beneath the tool holding spindle of the machine, I utilize what I term a circular attachment. This attachment is constructed as follows: 77 is a vise ring adapted to be securely mounted upon the platen 70 and has recessed transverse lugs 77' and depending clamping bolts 77'' which occupy the central inverted T-slot 70'. This vise ring is of split form, as seen most clearly in Fig. III, it being provided at its ends with ears 78 that receive a draw screw 79. At the upper side of the vise ring is an outer rim 80 and an inner rim 81. 82 is a rotatable platen mounted upon the vise ring and provided at its upper side with inverted T-slots 83 for the reception of work holding clamp bolts. The rotatable platen rests at its outer edge upon the outer rim 80 of the vise ring and at the lower side of the platen is a circular boss 84 that occupies a position within the vise ring, see Figs. II and IV. This boss serves as a receiving member for the vise ring which exerts clamping action thereagainst when the draw screw in the ring is tightened, thereby holding the rotatable platen from movement. In order that the rotatable platen may be yieldingly held to the vise ring without interfering with its rotation relative to said ring when the ring is in loosened condition, I utilize a spring retaining plate 85 that is attached to the central portion of the rotatable platen and bears loosely against the lower side of the vise ring, as seen in Fig. IV. The rotatable platen is provided at its periphery with a graduation scale, as seen at 86, the marks of which are adapted to register with an index mark 87 upon the periphery of the vise ring, see Fig. V, to indicate the degree of rotation of the platen when it is moved for the purpose of causing the tool of the machine to operate at a different point upon the work from that at which it previously operated during the use of the machine. In the platen are holes 88 adapted to receive a lever for the purpose of rotating the platen.

For the purpose of excluding chips of

metal resulting from the operation of the machine from the groove in the tiltable table in which the shift screw 64 operates, I employ a pair of shiftable guard plates 89 and 90 that are loosely seated on the table at the location of said groove. The guard plate 89 is the lower one of these plates and it rests loosely and directly upon the tiltable table to slide thereon. In this plate is a slot 91 that extends longitudinally of the plate and is of less length than the groove in the table. At one side of said slot is a notch 92 and at the bottom of the plate and adjacent to the ends of the slot are stop lugs 93. In the guard plate 90 which is uppermost and slidably mounted on the plate 89 is a longitudinal slot 90' that is adapted to register with the notch 92 in the lower guard plate and at the bottom of the plate 90 at one side of the slot therein and centrally of the length of said slot is a shift lug 90^a that is adapted to play in the notch 92 of the lower plate. Upon the transverse movement of the carrier plate 62 in shifting the work holding members, the shift nut 63 in traveling in the groove in the tiltable table moves within the slots in both of the guard plates 89 and 90 and in so doing abuts against the upper guard plate at the forward end of the slot therein when the carrier plate is moved forwardly and against the upper guard plate at the rear end of the slot when the carrier plate is moved rearwardly. As a result, the upper guard plate is moved forwardly and backwardly and its shift lug 90^a abuts against the shoulder at the forward end of the notch 92 in the lower plate when the upper plate is carried forwardly and against the shoulder at the rear end of said notch when the upper plate is carried rearwardly with the consequence of causing the two guard plates to be constantly maintained over the groove in the table for chip excluding service without there being any interference with the travel of the shift screw 63. During the forward and backward movement of the lower guard plate, its movement is restricted in the desired degree by the stop lugs 93 which are adapted to strike against the forward and rear walls of the groove in the tiltable table.

94 designates a supplemental work supporting table that is supported beneath the work holder supporting arm 53 by a bracket 95 slidably fitted to the lower guide 2 on the column 1 and which may be brought into service when simple drilling operation is to be carried on. When this table is to be used the work holding members above it are moved from a position beneath the tool holding spindle by swinging the supporting arm 53 and the parts it supports relative to the column of the machine after which, when the table 94 is elevated and the tool holding spindle is lowered to bring these parts more closely assembled, the tool carried

by the spindle may readily be brought into operation upon the work that is seated upon said table.

I claim:

- 5 1. In a machine of the character described, a supporting member, a vise ring mounted on said supporting member, a rotatable platen supported by said vise ring, and an upwardly bulged spring plate secured to the
- 10 central portion of said rotatable platen and bearing against said vise ring.
2. In a machine of the character described, a table provided with a groove, a carrier plate mounted on the table and having a
- 15 shift nut arranged in said groove and a pair of slotted shiftable guard plates mounted on said table at the location of said groove and adapted to be moved in opposite directions by said nut.
- 20 3. In a machine of the character described, a table provided with a groove, a carrier plate mounted on said table and having a

shift nut arranged in said groove, and a slotted shiftable guard plate mounted on said table at the location of said groove and in which said nut operates; said guard plate being provided with a pair of stops for restricting the movement of the plate in both forward and backward directions.

4. In a machine of the character described, a table provided with a groove, a carrier plate mounted on said table and having a shift nut arranged to operate in the groove in said table, a lower slotted guard plate loosely mounted on said table above the groove therein, and an upper guard plate surmounting said lower plate; said lower plate being provided with a notch and said upper plate being provided with a shift lug adapted to operate in said notch.

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In presence of—

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