

(No Model.)

4 Sheets—Sheet 1.

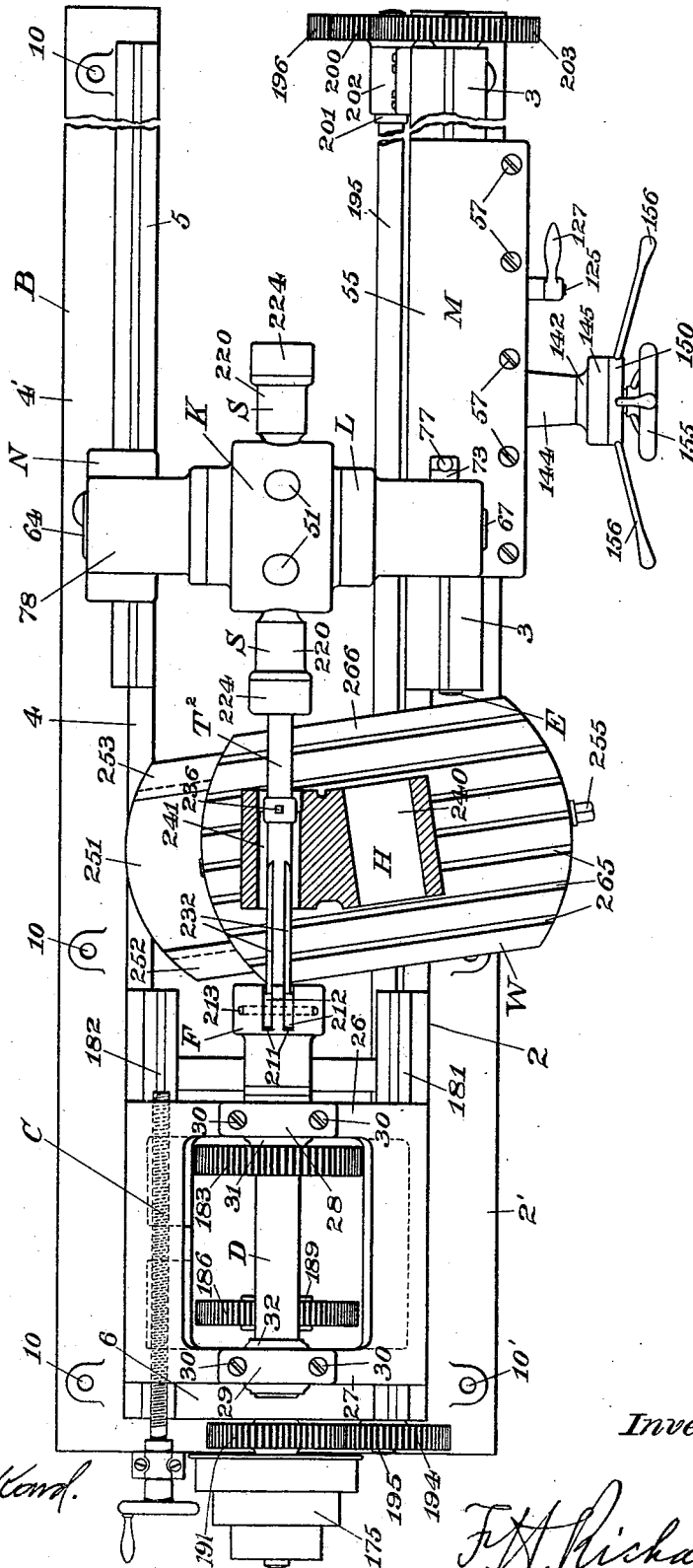
F. H. RICHARDS.

TURRET MACHINE FOR BORING CYLINDERS.

No. 513,827.

Patented Jan. 30, 1894.

Fig. 1



Witnesses:

*Henry L. Reedland.*  
*H. Hallner.*

Inventor:

*F. H. Richards*

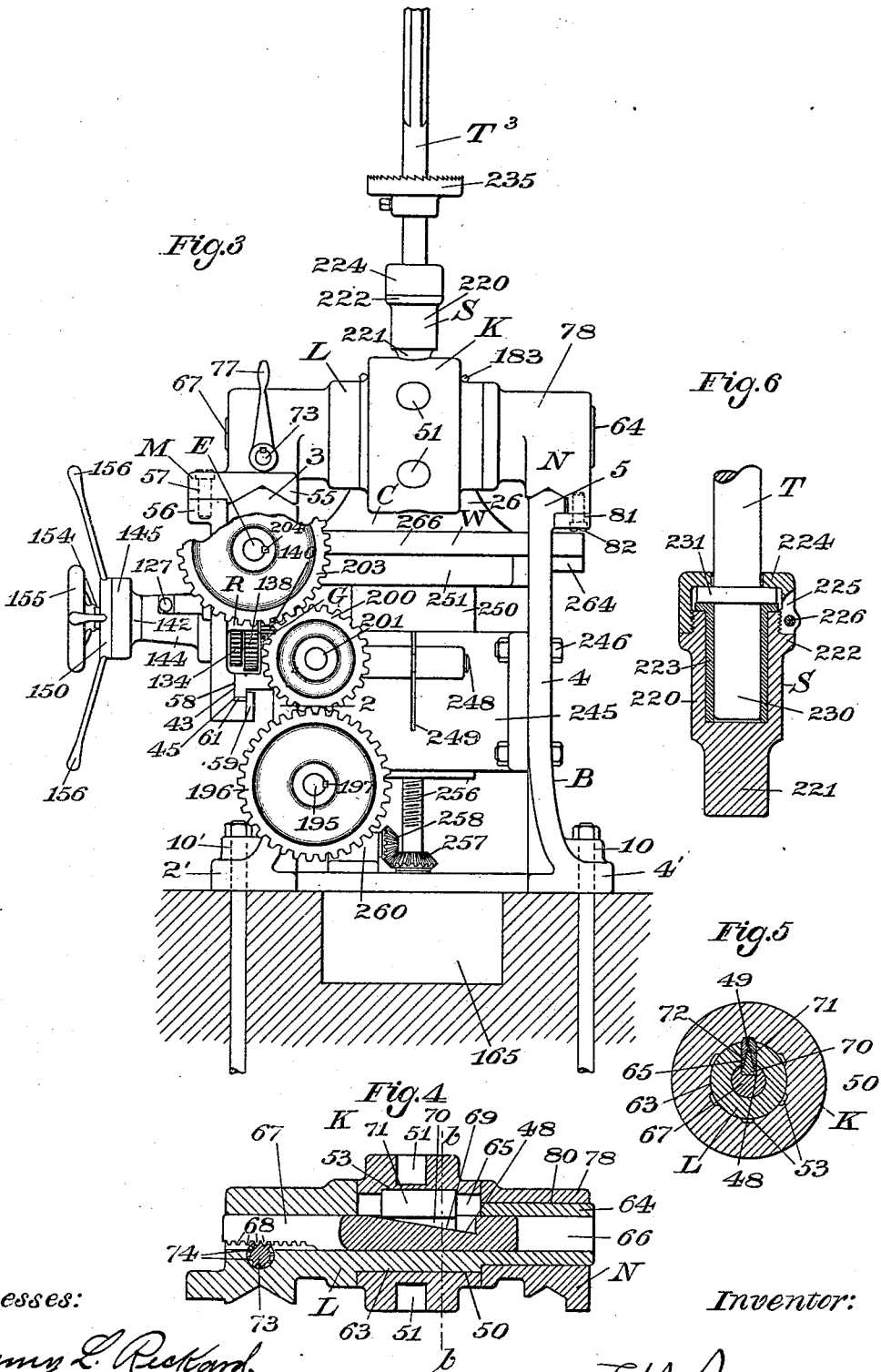


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A. Mallner.

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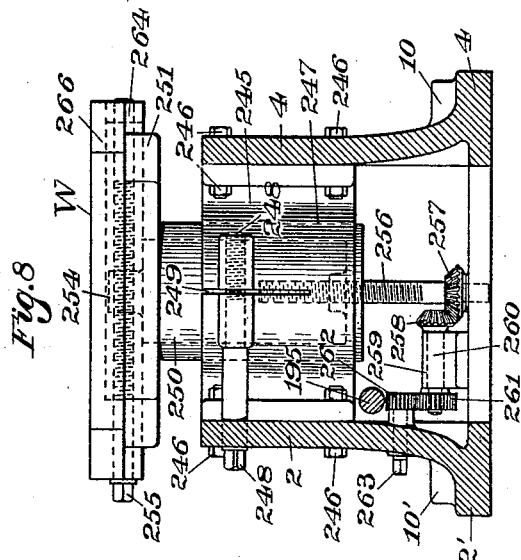
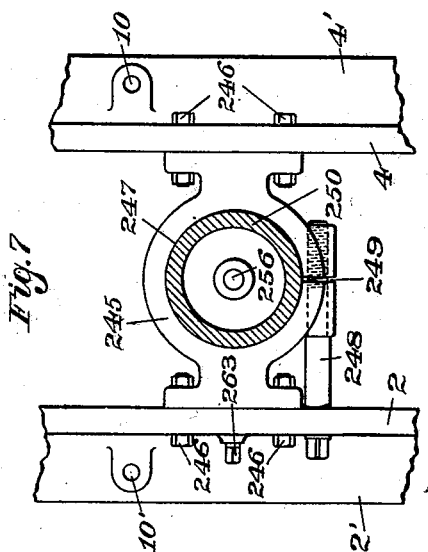
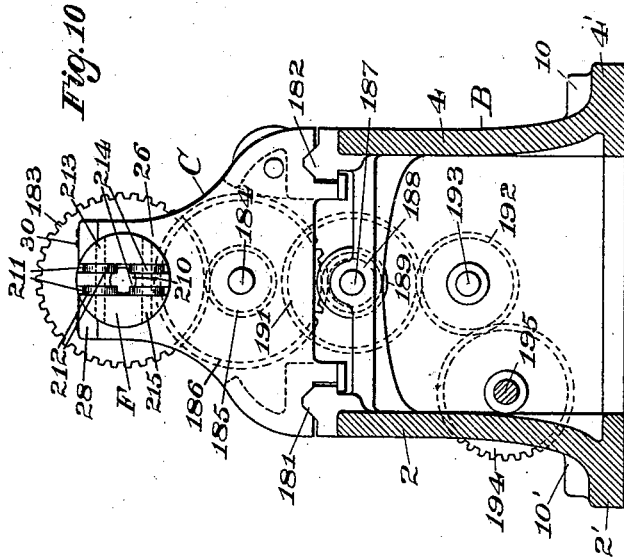
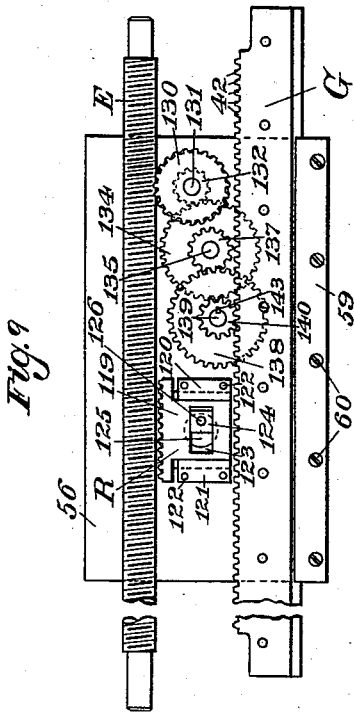
4 Sheets—Sheet 4.

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Witnesses:

Henry L. Rickard.  
H. Mallner.

Inventor:

F. H. Richards

# UNITED STATES PATENT OFFICE.

FRANCIS H. RICHARDS, OF HARTFORD, CONNECTICUT, ASSIGNOR TO WALTER WOOD, OF PHILADELPHIA, PENNSYLVANIA.

## TURRET-MACHINE FOR BORING CYLINDERS.

SPECIFICATION forming part of Letters Patent No. 513,827, dated January 30, 1894.

Application filed November 3, 1893. Serial No. 489,934. (No model.)

*To all whom it may concern:*

Be it known that I, FRANCIS H. RICHARDS, a citizen of the United States, residing at Hartford, in the county of Hartford and State of Connecticut, have invented certain new and useful Improvements in Turret-Machines for Boring Cylinders, of which the following is a specification.

This invention relates to that class of turret-machines which are more especially intended for boring cylinders and like work; the object being to furnish a turret-machine adapted for using a series of boring-bars in succession.

The invention consists in the organized machine, and in the features and combinations embodied therein, which are hereinafter more fully set forth.

In the drawings accompanying and forming a part of this specification, Figure 1 is a plan view of a turret-machine embodying my present improvements. Fig. 2 is a front elevation of the turret-machine showing the work-holding table in a different position from that shown in Fig. 1, or at right angles to the length of the frame of the machine. Fig. 3 is an end elevation of the machine or lathe as seen from the right-hand in Figs. 1 and 2; in this view some parts are broken away the better to show certain features of the construction. Fig. 4 is a sectional view of the turret and its supports. Fig. 5 is a sectional view, in line *b-b*, Fig. 4, and is illustrative of the turret-locking and clamping mechanism. Fig. 6 is a sectional view of the tool-holding chuck. Fig. 7 is a plan view of a portion of the bed of the lathe and the work-table support. Fig. 8 is a vertical transverse section, in the line *d-d*, Fig. 2, showing the work-table and the means for actuating the same at the left-hand of said line. Fig. 9 is a rearward view of the carriage-plate, showing the feed-gearing in place thereon. Fig. 10 is a vertical section of the lathe in line *e-e*, Fig. 2, showing the parts at the left-hand of said line.

Similar characters designate like parts in all the figures.

The particular kind of turret-machine to which my present improvements are applied is described and claimed in Letters Patent of

the United States No. 497,212, granted to me May 9, 1893.

The framework of my improved turret-lathe or machine consists, in the preferred form thereof shown in the drawings, of the front-wall 2 and the back-wall, 4, these walls being connected together at the left-hand, or head-end of the machine, and usually and preferably (unless the framework should be made of excessive length) left open at the right-hand end thereof, as indicated in Figs. 1 and 3. At the base of the frame, each side-wall thereof is flanged, as at 2' and 4', respectively, and these flanges are provided with suitable holding-down bolts, at a series of points, 10' and 10, respectively. At one end of the framework (at the left-hand as herein shown) this is provided with some suitable head, as C, whose uprights, 26 and 27, carry the front and back bearings, 31 and 32, respectively, of the spindle D; said bearings being held in place by caps, 28 and 29, and cap-screws, 30.

The spindle D is or may be provided with a suitable chuck, as F, for receiving the grooved outer end of the tool-carrying bars, and serving as a means for rotating said bars from the spindle D in a manner hereinafter more fully set forth.

The upper edge of each of the frame-walls 2 and 4 is provided with a carriage-way, these being designated by 3 and 5, respectively. On the forward carriage-way 3, the principal carriage, designated in a general way by M, is fitted to slide, while the back carriage-way 5, has fitted thereto the separate auxiliary carriage, N. These two carriages are operatively connected through the turret-bearing, L, upon which the turret, K, is journaled.

The main carriage M is herein shown constructed of two principal parts, the carriage-frame, 55, and the carriage-plate, 56, these two parts being rigidly connected together by a series of suitable screws, as 57, Figs. 1 and 3. (In engine-lathes, the part corresponding to the plate 56 is usually designated as the carriage "apron.") Said parts 55 and 56 may, however, be formed integral, being herein made separate only for the purpose of facilitating the construction and the assembling of

the machine, following in this respect the usual practice referred to in the case of engine-lathes. The lower edge of the carriage-plate 56 is fitted upon the lower carriage-way, 5 45, which way is shown as formed integral with a rack, G, (this having the rack-teeth 42) that is shown fixed to the front of the frame-wall 2 by means of a series of screws, 46. For holding the carriage-plate closely to the said 10 lower way, and for adjusting any wear or play thereof, said plate is furnished with the strap, 59, held in place by screws, 60, (see Fig. 9) and with the gib, 61, adjusted by gib-screws, (not shown) in a well known manner.

15 As a means for sliding the carriage M on its ways by hand, the carriage-plate carries means for supporting the pilot-wheel-shaft, 139, Fig. 2, to the rearward end of which is fixed (by means of key, 143) the pinion, 140, whose 20 teeth mesh with the aforesaid rack-teeth 42. The forward end of said shaft 139 has fixed thereto (by means of a key or otherwise) the pilot-wheel-hub, 150, furnished with the usual set of pilot-wheel-arms, 156. The feed-gear- 25 ing here described is organized as shown in the several figures of drawings, so that the upper pilot-wheel handle moves in the direction of the carriage-movement, this organization being most convenient for the operator.

30 For the purpose of feeding the carriage M on its ways by power, a feed-screw, E, is provided, this screw being driven from the spindle D, and operatively connected with the aforesaid pilot-wheel-shaft 139 through inter- 35 mediate gearing and a feed-clutch. The feed-screw E is located immediately under the front way 3, and should be supported by suitable bearings, as, for instance, the bearings 15 and 16, Fig. 2, which may be fixed to the framework 40 by suitable screws, as 18. The feed-screw may be actuated from a driving-shaft; and for this purpose I have shown a set of gears organized and arranged as follows:—A gear, 191, is carried fixed to the driving shaft, 187, 45 which is journaled in suitable bearings in the framework, said shaft being rotated by means of a belt applied to a driving-pulley, 175, that is keyed or otherwise fixed to said shaft. Said gear, 191, meshes with an intermediate 50 gear, 192, carried on a stud, 193, fixed in the framework; the intermediate gear 192 meshes with a larger gear, 194, which is fixed to the left-hand end of a shaft, 195, that is journaled in suitable bearings in the framework, near 55 the rearward side of the front wall 2 thereof. Another and similar gear, 196, is shown fixed to the right-hand end of the shaft 195, by means of a key, 197, Fig. 3, which gear meshes with an intermediate gear, 200, that is carried by a stud, 201, journaled in a bearing, 60 202, therefor, fixed to the inner side of the front wall 2 of the bed. The intermediate gear 200 meshes with a gear, 203, which is fixed by means of a key, 204, to the right- 65 hand end of the feed-screw E; this completes the set of gears referred to, provided for

rotating the feed-screw from the driving-shaft.

The feed-screw E may be operatively connected with the shaft 139 through the gear- 70 ing shown in Figs. 3 and 9. This gearing consists of the worm-wheel, 130, Fig. 9, which meshes at the upper side thereof with the threads of the screw E, and is carried by a stud, 131, fixed in the carriage-plate 56. Said 75 worm-wheel 130 carries fixed thereon the pinion, 132, which meshes with an intermediate wheel, 134, Fig. 2, carried on a stud, 135, (also fixed in the carriage-plate 56,) which wheel carries another pinion, 137, that meshes with 80 another gear, 138. The gear 138 is preferably fixed by a key or otherwise to the inner end of a sleeve, of which the outer end, 145, only, is shown; said sleeve forms the immediate 85 bearing of the shaft 139, and is itself journaled in a bearing, 144, which is fixed to the aforesaid carriage-plate 56 by means of a series of screws. The enlarged end 145 of the above mentioned sleeve is bored to receive the pilot-wheel-hub 150; between said hub 90 and sleeve there is arranged a friction-clutch device (not shown) by means of which the gear 138 and the pinion 140, engaging the rack, may be coupled together for simultane- 95 ous rotation, the hand-wheel, 155, serving as a means for rendering operative or inoperative said clutch-device. I have not fully shown the clutch-device in the drawings of this application, not deeming it necessary; but I 100 have fully shown and described, and also claimed a clutch of preferred form in my prior application, Serial No. 434,859, filed May 31, 1892, to which reference may be had for a further understanding of said device.

As a means for connecting the carriage M 105 with the feed-screw for screw-cutting purposes, said carriage is furnished with the half-nut, R, Fig. 4, which is formed on the upper end of a slide, 119, that is fitted to move vertically between the guides 120 and 121, that 110 are fixed to the back side of the plate 56 by means of screws, 122, as will be understood from Fig. 9. For operating the feed-nut R, the slide thereof has formed therein a mortise, 123, in which is fitted a crank-block, 124, 115 that is carried by a crank-pin, 126, formed on a shaft, 125, journaled in said plate 56 and furnished with the handle, 127, whereby to operate the same for throwing the nut into engagement or out of engagement with said 120 feed-screw E, in a well-known manner.

The connection, as hereinbefore mentioned, between the two carriages M and N, is made by means of the turret-bearing L. This bearing is shown (see Figs. 1, 2, 3, 4 and 5) formed 125 integral with the carriage-frame 55 or carriage M, and the rearward end, 64, Fig. 3, of said bearing L is shown journaled in a bearing, 78, formed on the carriage N, which bearing extends forward against the rearward 130 side of the turret K, as will be understood by comparison of Figs. 1, 3 and 4. The carriage

N is fitted to slide on the carriage-way 5 of the frame-wall 4 being gibbed thereto by a strap, 81, that is fixed to the carriage by suitable screws, as 82. See Fig. 3.

5 The turret K, for the purpose of locking the same in its successive positions, has formed on the inner side thereof a series of notches, 53, (see Fig. 5;) and the turret-bearing L, in that part thereof which lies within the turret, has formed therein a slot, 65, into which is fitted a lock-bolt, consisting in the present instance, of these parts, as follows: The turret-engaging portion of the lock-bolt is formed of two parts, 71 and 72, which together at the 15 outer edges thereof fit in and fill the bevel-sided grooves, or notches, 53; said parts 71 and 72 being preferably, operatively connected by a tongue-and-groove at 49, as illustrated in Fig. 5. Between the tapered lower 20 edges of the lock-bolt plates 71 and 72 is fitted the wedge, 70, whose upper side is tapered, as shown in Fig. 5, to spread the lock-bolt plates, and whose lower side, as shown in Fig. 4, is tapered longitudinally as a means 25 for actuating the same. Said wedge 70 fits into the correspondingly inclined groove, or channel, 48, formed in the sliding shaft 67. This shaft slides within the bore, 66, of the turret-bearing L, being actuated longitudinally by means of a pinion, 73, whose teeth mesh with the teeth, 68, of said shaft 67. The 30 pinion 73 is actuated by means of a lever, 77, Figs. 1, 2 and 3. A pin or screw, 76, fixed in the carriage-frame 55, has a point entering the groove 75 (Fig. 2) of the pinion-shaft 73, for the purpose of normally preventing the displacement of said shaft; this simple retaining device, being of itself well known, will be understood without a more 40 particular description thereof. The turret-bearing L being slotted at 65 as described, and the turret-locking device being constituted of the two plates 71 and 72 and the wedge 70, these parts constitute a turret-locking-and-clamping apparatus operating to simultaneously clamp the turret when the same is locked in position, by expanding the turret bearing within the bore of the turret. 50 The wedge 70 being forced outward by the incline of the shaft or wedge 67, spreads the two plates 71 and 72 apart and against the sides of the slot 65 to expand said turret-bearing firmly within the turret; at the same time, as hereinbefore stated, the wedge forces said 55 plates outward into one of the turret-notches 53, thereby firmly locking the turret against rotation. This turret-locking-and-clamping apparatus is shown and described in my aforesaid Letters Patent No. 497,212.

60 A series of tools or tool-carrying bars, designated respectively by T, T', T<sup>2</sup>, T<sup>3</sup>, is shown carried by the turret K, being supported by the shanks thereof in suitable chucks, as S, carried in the turret-holes 51. 65 In Figs. 1 and 3, some of these tool-bars are omitted for the purpose of simplifying the figures of the drawings. In Fig. 2, the tool-

bar T is shown carrying a tool, 233, for boring out the hole, 240, of the piece of work, as H, and the tool-bar T' is shown furnished 70 with a mill, or facing-tool, 235, for finishing the face of the piece H about the bore 240; likewise the bars T<sup>2</sup> and T<sup>3</sup> are furnished with a boring-tool, 236, and mill, 238, respectively, for boring out the hole, 241, and facing about 75 said hole.

For the purpose of illustrating the practicability of boring and finishing holes of varying angles in work of irregular shape, I have shown in Figs. 1 and 2 a piece of work hav- 80 ing two holes, 240, 241, formed therein in different planes. In Fig. 1, the work-holding table, upon which the work is secured, is shown as set at an inclination to the axis of the tool-driving spindles D, to bring the hole 85 241 in axial alignment with the tool which is shown in operative position, while in Fig. 2 said table is set substantially at right angles to the axis of the spindle which brings the other hole 240 in operative axial alignment 90 with the tool operating upon it.

The tool-bars T are carried in suitable chucks as S, in which they are securely held against longitudinal movement but are free to be rotated therein. In Fig. 6 one of said 95 tool-holding chucks is shown in section with a tool-bar held in place therein. Said chuck consists of the stem or shank, 221, fitting the sockets 51 of the turret, the body 220, bored to receive a bushing, 223, in which the shank, 100 230, of the bar T is freely fitted, and a cap, 224, engaging a flange or collar, 231, on the tool-bar, thus securing said bar against longitudinal movement in the chuck. The cap 105 224 is preferably screwed onto the forward end of the chuck-body, bringing up against the flange, 222, thereof so as not to cause binding of the bar-flange 231 between the bushing 223 and the cap. Said cap is preferably split on one side as at 225, and fur- 110 nished with a binding-screw as 226, for properly securing the same.

The tool-bars T, carrying the tools, are rotated from the driving-shaft 187, by the following means: The shaft 187 is a splined 115 shaft, the spline, 190, shown in dotted lines in Fig. 2, running nearly the full length thereof; a flanged pinion or gear, 189, is keyed to the shaft 187 by means of said spline, being fitted to slide longitudinally on the shaft. 120 An intermediate shaft, 184, is journaled in bearings formed in the head C, and has fixed thereto by means of a key, or otherwise, a gear 186 meshing with the pinion 189; a pinion, 185, also fixed to the shaft 184 meshes 125 with the spindle-gear 183, for driving the spindle. This construction is preferable as it permits of the head C being adjustable longitudinally of the bed, the gear 189 sliding on the driving shaft when the head is moved. 130 The head C rests on the ways 181 and 182 that are formed on the bed B, and may be secured thereon by means of straps and screws in a well known manner.

A suitable chuck as F, is carried by the hollow spindle D and is bored at 210, to receive the forward ends of the tool-bars; said chuck is furnished with a pair of rollers, 212, 5 journaled on a shaft, 213, and with a second and similar pair of rollers, 214, journaled in a like manner on a shaft, 215, said pairs of rollers lying in the grooves, 211, that are formed in the chuck-body. The said chuck-rolls engage the corresponding grooves, 232, 10 formed in the tool-bars and act as keys for rotating a particular tool-bar (when in engagement therewith) on the rotation of the spindle D.

15 Referring to Figs. 1, 2, 3, 7 and 8, I have shown a convenient form of work-holding table, designated in a general way by W. Said table is furnished with means for vertically and laterally adjusting the same, it being 20 also rotatable. Such a work-table is deemed preferable as it permits of the boring of a number of holes in the same piece of work without changing the location of the work on the table after it has been once secured thereon; and said holes may be in the same plane 25 or in different planes, and at different angles.

For supporting the table W in the machine, I have provided a suitable bracket, 245, (shown best in Figs. 7 and 8) secured to the 30 bed of the machine by bolts as 246, which pass through the walls 2 and 4 of said bed. Said bracket is bored at 247, to receive the column, 250, of the table and is split on one side at 249 for a portion of its length, and provided 35 with a binding-screw as 248, for the purpose of securely clamping the table at a required height. The enlarged upper end or plate, 251, of the column has formed thereon the guides, 252 and 253, between which is fitted 40 the tongue, 264, of the table, 266; said table is provided with a screw, 255, engaging the nut, 254, Fig. 8, of the column as a means for moving the table laterally of the column. I have also shown a device for raising and lowering 45 the work-table W, consisting of an elevating-screw, 256, journaled at its lower end in the bed B and engaging the column 250; said screw has fixed thereto a bevel gear, 257, engaging a similar gear, 258, which is carried 50 on a stud, 259, that is journaled in a bearing, 260, fixed to the bed. To the opposite end of the stud 259 there is fixed a gear, 261, which meshes with a similar gear, 262, that is formed on or fixed to the stud, 263, journaled in the 55 front wall 2 of the bed B; by means of a wrench or crank applied to the squared head of stud or shaft 263, the screw 256 may be turned to raise or lower the table W. A series of T-slots, 265, may be formed in the table 60 to facilitate the holding of the work to the table.

By comparison of Figs. 1 and 3, it will be seen that the carriage-frame 55 projects little, if any, beyond the plane of the inside of the 65 front way 3, thus leaving substantially the entire space between the two carriage-ways 3 and 5 for the sweep of the tool-arms carried

by the turret. This will be obvious from inspection of Figs. 1 and 7, in both of which the guide-blocks O and P are shown projecting 70 inwardly from their respective ways for a distance equal to, or greater than, the width of their respective guide-grooves 102 and 110. By means of this organization of the mechanism, the entire space between said carriage-ways is made available for the passage of the 75 cutting appliances carried by the turret.

In Fig. 3, a pit, 165, is shown underneath the machine and between the frame-walls 2 and 4 thereof. This illustrates one of the 80 principal objects of the machine, which is to furnish a mechanism adapted for the use of long boring-bars, as for instance, the boring-bar T<sup>3</sup>, which bar may, as shown in the drawings, project from the turret a much greater 85 distance than the length of the lathe carriage, the necessary room for swinging the same (when the bar is longer than the height of the machine) being obtained by means of a pit, as herein described. 90

By means of the organized machine herein described, the long tool-holding bars required for finishing certain parts of steam-engines for boring cylinders and like work, may be carried by a turret, and at the same time the 95 operator may stand close to the machine, where he can properly manage the same and observe the progress of the work as this proceeds.

In Figs. 1, 2 and 10, I have shown one form of mechanism for adjusting the spindle-supporting head longitudinally of the frame of the machine. It will be understood, however, that I do not desire to limit myself to this exact construction of adjusting mechanism, as 100 any device for accomplishing this end might be used without departing from my invention.

Having thus described my invention, I claim—

1. In a turret-machine, in combination, a 111 revolvable turret adapted for sliding movement, a tool-driving spindle, a tool-bar or tool adapted for engagement with said spindle and in rotative engagement with the turret, means for rotating the spindle and tool-bar or tool, 112 and means for sliding the turret, substantially as described.

2. In a turret-machine of the class specified, in combination, a turret revolubly supported by and intermediate to two sliding carriages, 12 a sliding head, a spindle journaled therein, mechanism for rotating said spindle, and a tool or tool-bar carried by said spindle and engaging with and rotating in the turret, substantially as and for the purpose set forth. 12

3. In a turret-machine, the combination with the frame thereof, of a turret revolubly supported for sliding movement longitudinally of the frame toward and from the tool-driving spindle, a chuck or tool-holder removably fixed in said turret, a tool-bar or tool 13 revolubly supported at one end in said chuck, a tool-driving spindle adapted for engaging the opposite projecting end of, and for rotat-

ing said tool-bar or tool, means for rotating said spindle, and means for moving the turret toward and from said spindle, substantially as described.

5 4. In a turret-machine of the class specified, the combination with a revoluble turret supported for sliding movement, of a tool-driving spindle revolubly supported in a head adjustably mounted upon the frame of the machine,  
10 a tool-bar or tool engaging the turret and spindle so as to rotate in the turret and slide in and be driven by the spindle, and mechanism for rotating said spindle and tool, or tool-bar, substantially as and for the purpose described.

15 5. In a turret-machine of the class specified, in combination, a revoluble and sliding turret, a longitudinally adjustable tool-driving spindle, a tool or tool-bar supported, in an operative position, at both ends, one end in rotative engagement with the turret and the  
20 opposite end in non-rotative engagement with the spindle, and means for moving the turret toward and from the spindle, and means for rotating the spindle and the tool or tool-bar, substantially as and for the purpose described.

25 6. In a turret-machine of the class specified, the combination with the frame, a revoluble turret mounted upon a carriage having a sliding movement longitudinally of the frame, a  
30 series of radially-disposed tool-bars or tools all of which are in engagement at one end with, and adapted for rotation in, said turret and are adapted for being brought successively into axial alignment with the tool-driving  
35 spindle, and a tool-driving spindle constructed for engaging the opposite projecting end of each tool-bar successively, and for rotating said tool-bars successively as they are brought into position, substantially as described and for the purpose set forth.

40 7. In a turret-machine of the class specified, in combination, a sliding carriage, a revoluble turret supported thereon, a spindle constructed for engaging one end of a tool-bar and for  
45 driving the same, a series of radially disposed tool-bars or tools supported at one end for rotation in the turret and adapted to be brought successively with their opposite projecting ends into sliding engagement with the  
50 spindle whereby they may be successively rotated, means for rotating said spindle, and means for moving the carriage toward and from said spindle, substantially as described.

55 8. In a turret-machine, the combination with a revoluble and sliding turret, of a longitudinally grooved or ribbed tool-bar revolubly supported at one end upon the turret and adapted for carrying a cutting-tool intermediate to its ends, a tool-driving spindle and  
60 key-devices carried thereby adapted for engagement with the ribs or grooves in the tool-bar for the purpose of driving the said tool-bar, and means for rotating said spindle, substantially as and for the purpose described.

65 9. The combination in a turret-machine with a revoluble turret adapted for sliding movement, of a tool-bar longitudinally

70 grooved or ribbed at one end and revolubly supported at its opposite end by the turret, a cutting-tool carried by said bar intermediate to its ends, a hollow spindle carrying rollers adapted for engagement with the grooved or  
75 ribbed end of the tool-bar, for the purpose of driving said tool-bar and at the same time allowing anti-frictional longitudinal movement thereof, and means for rotating said spindle, substantially as described.

10. In a turret machine of the class specified, the combination of a revoluble turret adapted for sliding movement toward and  
80 from the tool-driving spindle, a series of tool-bars equi-distantly disposed and revolubly supported at one end thereof upon the periphery of the turret and having their opposite ends grooved or ribbed longitudinally, a hollow  
85 spindle provided with roller bearings adapted for engagement with the grooved end of the tool-bars as they are successively brought into axial alignment therewith, means for rotating said spindle and tool-bar, and means  
90 for bringing each of the series of tool-bars, successively, into alignment and engagement with the spindle, and means for locking the turret against rotary movement when each of its tool bars are brought into operative  
95 position in engagement with the spindle, substantially as described.

11. In a turret-machine of the class specified, in combination, a revoluble turret adapted for sliding movement, a tool-driving spindle, a tool-bar or tool adapted for engagement  
100 with said spindle and in rotative engagement with the turret, means for rotating said spindle and tool-bar or tool, and a work-holding table intermediate to said spindle and turret, substantially as and for the purpose described.

12. In a turret-machine of the class specified, in combination, a revoluble turret, a tool-driving spindle, a tool engaged at one end  
110 and driven by said spindle and revolubly supported at its opposite end by the turret, means for rotating said spindle, and a vertically and laterally adjustable work-holding table intermediate to said spindle and turret, substantially as and for the purpose described.

13. In a turret-machine of the class specified, in combination, a revoluble turret adapted for sliding movement toward and from the  
120 tool-driving spindle, a tool-driving spindle, a tool-bar or tool adapted to be brought into engagement with said spindle at one end, and in rotative engagement at its opposite end with the turret, means for rotating said  
125 spindle and tool-bar or tool, a work-holding table located intermediate to said spindle and turret and adapted for vertical, lateral and rotary adjustment, and means for adjusting said table and locking the same in  
130 adjusted position, substantially as and for the purpose described.

14. In a turret-machine of the class specified, the combination with the frame thereof,

of two remotely disposed parallel sliding carriages, a vertically revoluble turret supported by and intermediate to said carriages, a tool-driving spindle revolubly supported upon a head adapted for sliding adjustment upon the frame of the machine, means for moving the turret-supporting carriages toward and from the spindle, tool-bars or tools revolubly supported at one end by the turret and adapted for being brought into sliding engagement at the opposite end with the spindle, means for locking said turret against movement when the tool or tool-bar is in engagement with said spindle, and an adjustable work-holding table located below and intermediate to said spindle and turret, means for driving said spindle and tool or tool-bar, and means for adjusting the said table and locking the same in adjusted position, substantially as described.

15. In a turret-machine of the class specified, the combination with the frame of a spindle-supporting head longitudinally adjustable upon said frame, means for adjusting said head and securing the same in adjusted position, a tool-driving spindle, and means for rotating said spindle, a revoluble turret capable of a sliding movement toward and from the spindle, actuating mechanism therefor, a tool or tool-bar driven by the spindle and revolubly supported by the turret, and a work-holding table intermediate to said spindle and turret, substantially as described and for the purpose set forth.

16. In a turret-machine of the class specified, a revoluble turret and a tool-driving spindle both of which are adjustable toward and from each other, and both of which have adjusting mechanism and means for securing them in adjusted position, in combination with a tool or tool-bar revolubly supported at one end by the turret and supported at its opposite end by the spindle so as to revolve with said spindle, and means for rotating said spindle, substantially as and for the purpose set forth.

17. In a turret-machine of the class specified, in combination, a revoluble turret and a tool-driving spindle adjustable toward and from each other, and both of which are provided with adjusting mechanism, a tool or tool-bar supported at one end by the tool-driving spindle, and at the other end by the turret, a locking device connected with the turret for locking the same when the tool is in operative position, an adjustable work-holding table intermediate to said turret and spindle, means for rotating the spindle, and means for adjusting the work-holding table, substantially as described.

18. In a turret-machine of the class specified, in combination, a tool-driving spindle, a revoluble turret supported for movement toward and from the spindle and having tool-

receiving sockets therein, a tool-holder or chuck consisting of a body bored to receive a bushing and having a shaft fitted in the turret-socket, a bushing fitted in the bore of said chuck-body, a cap fitted to the outer end of said chuck-body, a tool-bar revolubly supported at one end in the bushing and having a collar or flange interposed between the outer end of the bushing and cap of the chuck and carried at its opposite end in sliding engagement with the spindle, and means for rotating said spindle, substantially as described.

19. The combination in a turret-machine, of a tool-driving spindle revolubly supported in a sliding head, a turret having sockets therein, a centrally-bored chuck or tool-holder fitted to the socket of the turret and having its outer ends screw-threaded, a screw-threaded cap fitting the outer end of said tool-holder, and a tool-bar or tool engaging the tool-holder at one end and the spindle at the opposite end so as to revolve in the tool-holder and slide in and be driven by the spindle, and means for driving said spindle, substantially as described.

20. In a turret-machine, the combination with the bed, of a revoluble spindle, means for rotating said spindle, a revoluble turret supported for sliding movement toward and from the spindle, and a tool engaging the turret and spindle so as to revolve in the former and slide in, and be driven by the latter, substantially as described.

21. In a turret-machine of the class specified, the combination with the bed of the machine, of a driving spindle and a turret mounted for movement toward and from each other, a tool-bar engaging the turret and spindle so as to revolve in the turret, and slide in, and be driven by the spindle, a cutting-tool mounted upon said tool-bar intermediate to its ends and adapted for rotation therewith, and means for rotating the spindle, substantially as described.

22. In a turret-machine of the class specified, the combination with the bed of the machine, of a revoluble spindle and a revoluble turret supported thereon for movement longitudinally thereof, a tool-bar supported at one end in the turret and at its opposite end in the spindle so as to revolve in the turret and to slide in and be driven by the spindle, a tool carried by said bar intermediate to the ends thereof, an adjustable work-holding table supported intermediate to the spindle and turret, means for driving the spindle, and means for moving the spindle and turret one toward the other, substantially as described.

FRANCIS H. RICHARDS.

Witnesses:

JOHN L. EDWARDS, Jr.,

FRED. J. DOLE.