(No Model.) 4 Sheets—Sheet 1.

D. H. CHURCH.

STAFF TURNING LATHE.

No. 532,532. Patented Jan. 15, 1895.

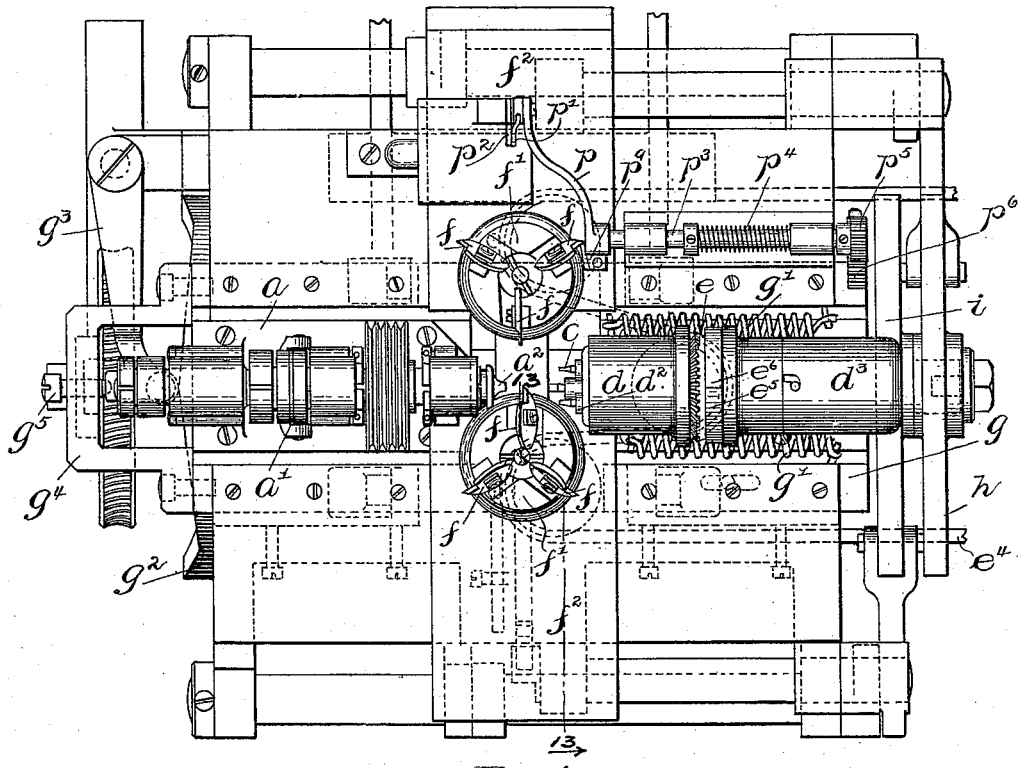

Fig. 1.

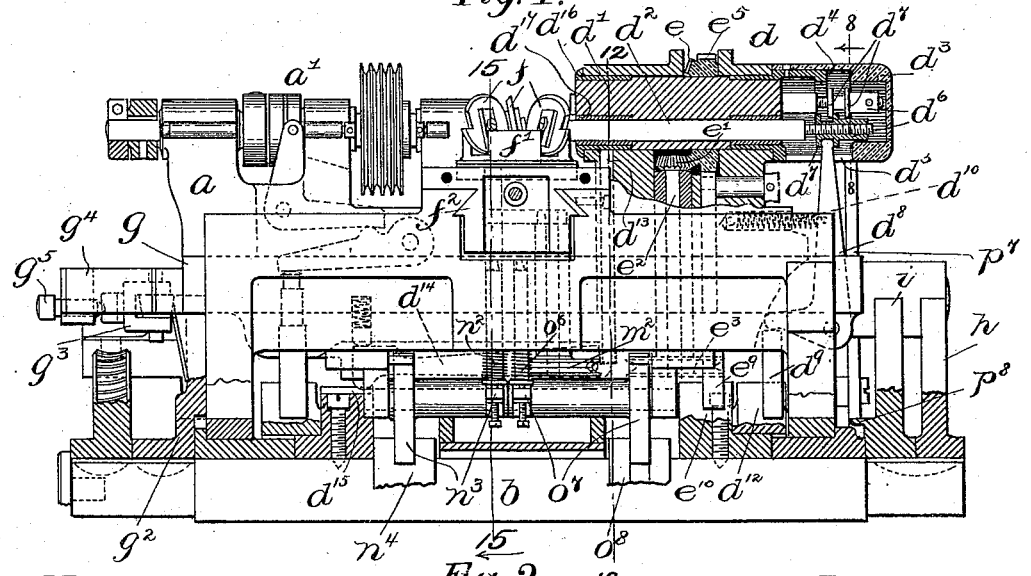

Fig. 2.

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Inventor:
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Attys.

(No Model.) 4 Sheets—Sheet 2.

D. H. CHURCH.

STAFF TURNING LATHE.

No. 532,532. Patented Jan. 15, 1895.

Fig. 3.

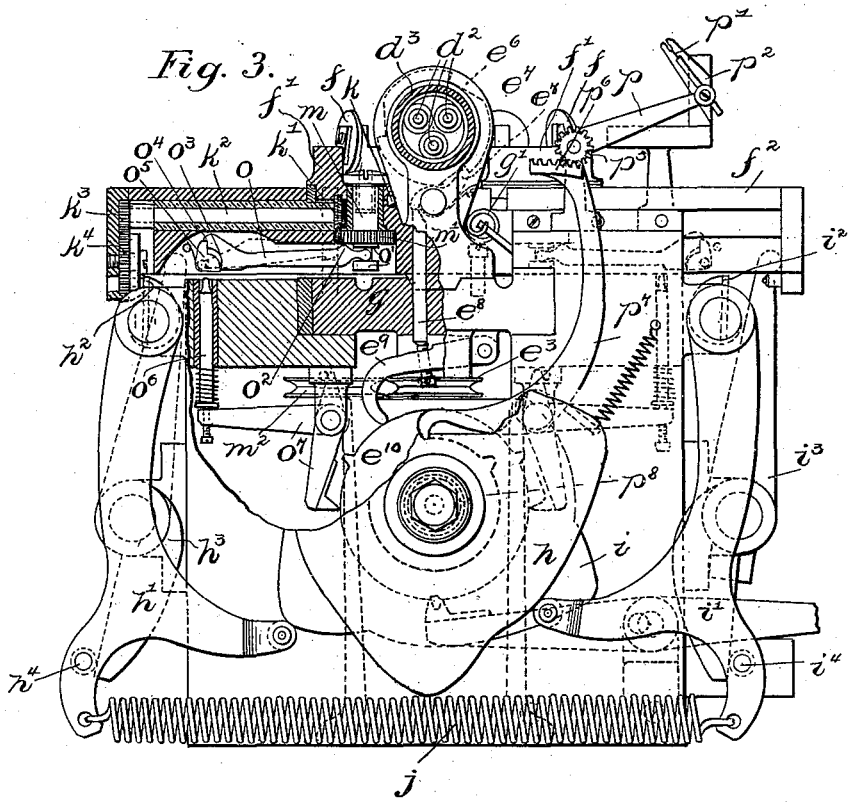


Fig. 4.

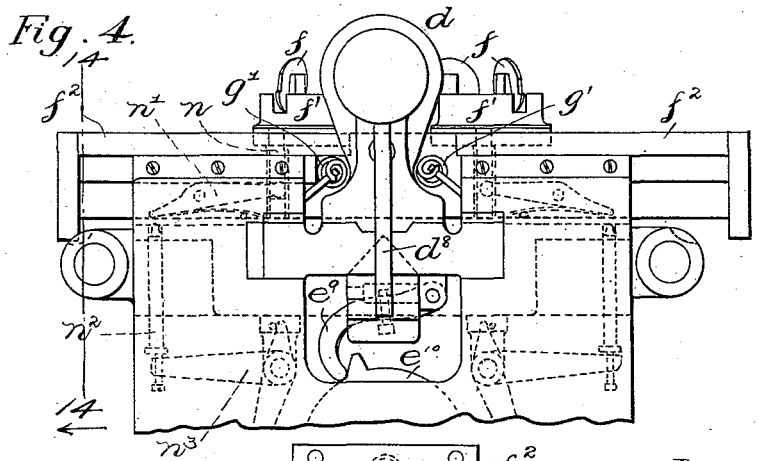
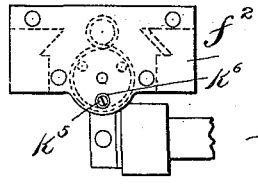


Fig. 5.



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(No Model.) 4 Sheets—Sheet 3.

D. H. CHURCH.

STAFF TURNING LATHE.

No. 532,532. Patented Jan. 15, 1895.

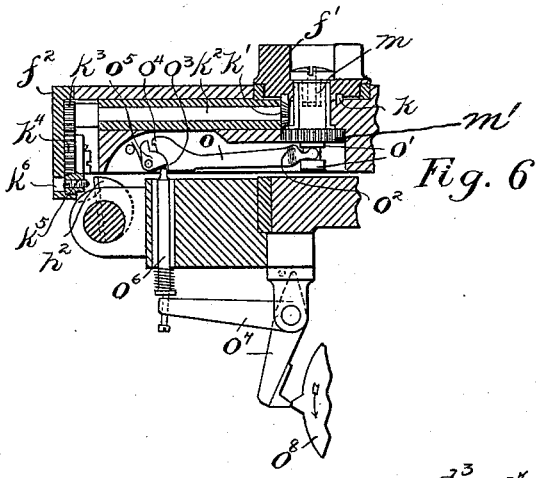

Fig. 6.

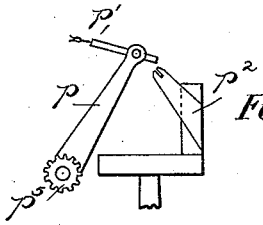

Fig. 7.

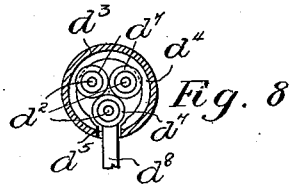

Fig. 8

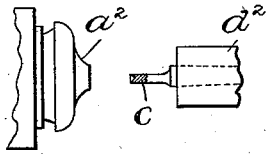

Fig. 9.

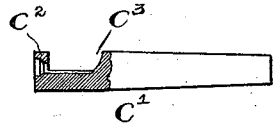

Fig. 10.

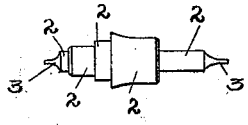

Fig. 11.

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(No Model.)

4 Sheets—Sheet 4.

D. H. CHURCH.

STAFF TURNING LATHE.

No. 532,532. Patented Jan. 15, 1895.

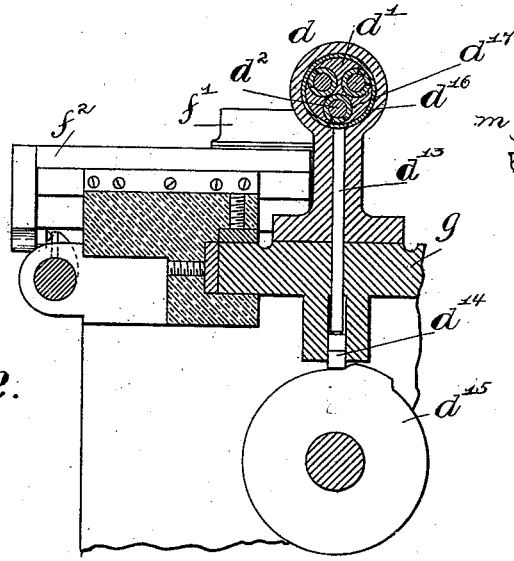

Fig. 12.

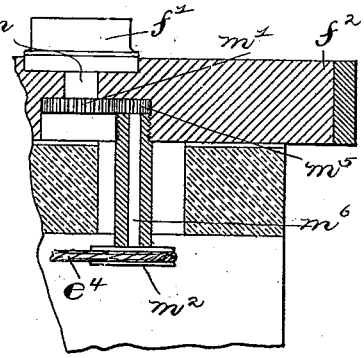

Fig. 13.

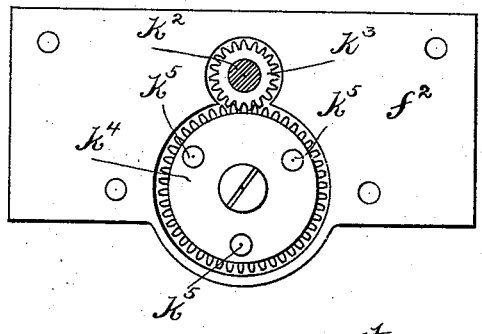

Fig. 14.

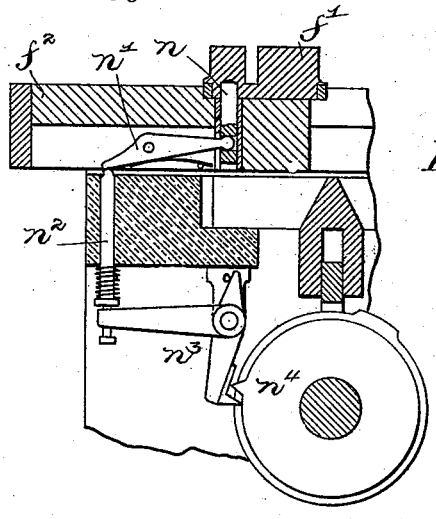

Fig. 15.

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C. Parker Davis.

Inventor:
D. H. Church
by Wright Brown Quinby & Atty.

UNITED STATES PATENT OFFICE.

DUANE H. CHURCH, OF NEWTON, MASSACHUSETTS.

STAFF-TURNING LATHE.

SPECIFICATION forming part of Letters Patent No. 532,532, dated January 15, 1895.

Application filed November 11, 1893. Serial No. 490,614. (No model.)

To all whom it may concern:

Be it known that I, DUANE H. CHURCH, of Newton, in the county of Middlesex and State of Massachusetts, have invented certain new and useful Improvements in Staff-Turning Lathes, of which the following is a specification.

The object of the present invention is to provide a machine which will turn down work to varying diameters in the production of staffs for use in watch-making, and convert the blank into a completed staff.

By this invention, a plurality of tools are brought to act successively on the work in varying degrees; and the proper control of the tools to bring them to operative position at the right times and for the right lengths of time, and other provisions necessary to the accomplishment of the design of this invention, involve numerous constructions, arrangements and combinations of parts, which will be particularly described hereinafter and the essentials recited in the claims.

The accompanying drawings illustrate an embodiment of the invention.

Figure 1 shows a top plan view of the machine. Fig. 2 shows a part front elevation and part section of the machine. Fig. 3 shows a part end elevation of the machine, as viewed from the right of Fig. 1. Fig. 4 shows an elevation of a portion of the same end of the machine, with a broken-line representation of certain parts. Fig. 5 shows a detail end view of the tool-slide. Fig. 6 shows the parts which appear in the sectional illustration at the left of Fig. 3, in a different adjustment from that shown in said Fig. 3. Fig. 7 shows a detail of means for discharging the work from the machine. Fig. 8 shows a detail sectional view, taken on line 8—8 of Fig. 2. Figs. 9 and 10 show details of the different styles of dead centers which are carried in the tail-stock. Fig. 11 shows a completed staff, which is the product of the machine. Fig. 12 shows a section on line 12—12 of Fig. 2, looking toward the left. Fig. 13 shows a section on line 13—13 of Fig. 1, looking toward the right. Fig. 14 shows a section on line 14—14 of Fig. 4, looking toward the left. Fig. 15 shows a section on line 15—15 of Fig. 2, looking toward the left.

The same letters and numerals of reference indicate the same parts in all the figures.

In order that it may first be clearly understood what work the machine is designed to do, attention is called to Fig. 11, which shows on a greatly enlarged scale a staff, as it issues from the machine. It will be observed that this staff is of varying diameter throughout its length, and that the different portions 2, having different diameters, vary in their extent, and that the staff terminates at each end in tapering points 3. The blank when it enters the machine is in the form of a straight, round rod or bar, and the machine turns it down to the form shown in Fig. 11.

Of the machine, the work-supporting means will first be described.

The letter a designates the head-stock, which supports a rotary spindle, adapted to be connected with and disconnected from the driving power by a clutch a', which is operated by levers, co-acting with a cam on the main-shaft b. A detailed description of this construction is not here entered into, as the same construction will be found in other machines of like character. The rotary spindle carries a chuck a^2, which supports one end of the work.

The character of the work makes necessary the employment of a plurality of centers for supporting the opposite end of the work; for, while in the beginning a simple center, as c (Fig. 9), with socket in the end to receive the work, is all that is required, further on in the operation of the machine the work is reduced to such an extent as to make necessary a rest to support it, and then a center of the form shown in Fig. 10 is employed. This center c' is formed with an annular projection c^2, through which the work may extend, and is cut away, as at c^3, behind said projection, to admit the tool. This style of center is employed when turning down tapered points 3.

The tail-stock d supports a rotatable barrel d', which is formed with bores to receive spindles d^2 supporting the centers, there being three of these spindles shown in the present instance. The spindles are arranged in a circle, concentric with the barrel, and each is capable of occupying a position in an axial line of the chuck-spindle.

Means are provided for advancing and retracting each center-spindle when in the latter position, to engage the center with the work, and to withdraw it therefrom, and the means here shown are as follows: A cylindrical casing d^3, affixed to the tail-stock, is formed on the interior with an annular groove d^4, and is slotted, as at d^5 on the under side, the slot obliterating the groove at this point. Each spindle d^2 projects into the casing d^3, and carries a sleeve d^6, having flanges d^7, designed to enter the groove d^4 and by engagement with the walls thereof prevent longitudinal movement of the spindle. When the spindle-collar is thus engaged with the said groove, the spindle is retracted; but when, under rotation of the barrel d', the spindle is brought into axial line with the chuck-spindle, the collar is disengaged from the groove by entering the slot d^5, and the spindle may then be advanced for engagement with the work, and is advanced by a bell-crank lever d^8, one of whose arms engages between the flanges d^7, while the other is acted upon by a pivoted arm d^9. The lever d^8 is impelled in a direction to advance the center-spindle by a spring d^{10}, and in the opposite direction by a cam d^{12} on the main-shaft, acting through the arm d^9. When the center-spindle arrives at a position in axial line with the chuck-spindle, the spring d^{10} advances the center to position for engagement with the work, and at the proper time the cam d^{12} retracts the center, and the lever d^8 stands in readiness to enter into engagement with the next succeeding center-spindle.

The center-spindle is locked in its projected position by means of a tappet-rod d^{13}, acting through the tongue of a split bushing d^{16} (see Fig. 12) surrounding the barrel d' against the tongue of a split bushing d^{17} which surrounds the spindle and crowding said tongue against the spindle; a spring-pressed lever d^{14} actuating said rod; and a cam d^{15} on the main-shaft, and co-acting with said lever. By acting against the bushing d^{16} the tappet-rod causes the latter to bind the barrel d' and prevent any play thereof.

The means for intermittently rotating the barrel, and stopping it at the required points to properly position the centers, are as follows: A bevel-gear e is affixed on the barrel, and is engaged by a bevel-pinion e' on the upper end of a shaft e^2, which carries a pulley e^3 on its lower end, said pulley being engaged by a driving-belt e^4, which is adapted to rotate it and consequently the barrel in the absence of sufficient resistance to prevent, but in the presence of such resistance the belt slips on the pulley. The bevel-gear e is formed with a raised rim e^5, having notches e^6, corresponding in number and location with the centers, and adapted to be engaged by a spring-pressed pawl e^7, which by such engagement prevents rotation of the barrel and causes the belt e^4 to slip on the pulley e^3. Said pawl is disengaged from the notch at the proper time by a tappet-rod e^8, which is actuated by a hinged arm e^9 in co-action with a cam e^{10}, whereby the pawl is released momentarily and returns for engagement with the next notch brought around by the revolution of the gear under influence of the belt e^4, which takes effect immediately upon the disengagement of the pawl.

The tools f are secured to rotatable posts f', which are mounted on a slide f^2 on opposite sides of a longitudinal central line of the lathe, and said slide is designed to move transversely in ways on the bed of the machine. A longitudinally-movable slide g carries the head and tail-stock, and said longitudinally-movable slide is actuated in one direction by springs g' connecting it with a stationary part of the lathe, and is actuated in the opposite direction and governed as to extent of travel by a cam g^2, acting upon a roll which is carried by a pivotal arm g^3, the latter projecting into a bracket g^4, fastened to the slide g, and bearing against a screw g^5 in said bracket. The acting surface of the cam has a form which produces the requisite varying degrees of travel of the slide.

The desired reciprocations of the transverse slide f^2, to bring tools on opposite sides alternately into action, are effected through the following means: Cams h and i are affixed to the main-shaft b, and their acting surfaces are formed in exact correspondence with the work, the said two cams being reversely set, so that when a high portion of one is in action the corresponding low portion of the other is in operative position. The said two cams h and i co-act respectively with levers h' and i', which are both actuated toward the cams by one spring j connecting their lower ends. These levers are pivoted in proximity to the transverse tool-slide, and have short arms h^2 i^2 above the pivots, and adapted to bear against parts carried by the slide. The arms h^2 i^2 are of slight extent as compared with the arms $h'i'$, so that motion transmitted to the latter by the cams h and i produces comparatively slight movement of the upper arms. Other levers h^3 i^3 are pivoted to stationary supports, and their upper arms extend behind portions of the tool-slide; while their lower arms, which are shorter than the upper arms, extend behind pins h^4 i^4 on the levers h' i', and are adapted to be actuated thereby.

The object of the above-described arrangement of levers is to provide for a rapid movement of the slide during a portion of its travel, viz., that portion which carries one tool away from the work and advances the opposite tool to the work; and a much slower movement during the remainder of the travel of the slide, which feeds the acting tool into the work.

The operation of these devices is as follows, reference being had to Fig. 3, where the parts appear as when the slide has been moved

through the rapid portion of its travel in one direction, and the tool at the left-hand side is feeding into the work: The lever i' has been carried to a low part of the cam h by the spring j, and in its movement has actuated the lower arm of the lever i^3, and this movement has been multiplied in the longer upper arm, and the rapid travel of the tool-slide thereby effected. At this point, the opposite end of the carriage comes to bear against the short upper arm h^2 of the lever h', and the further travel of the tool-slide is controlled by said short arm and is correspondingly slow. Variations in tools are compensated for by providing means whereby the point at which their feeding movement begins may be adjusted, and this is effected in combination with the rotary tool-posts, as follows, the arrangement at each side being the same, and hence that at one side only being described: The tool-post has bevel-gear teeth k on its under side, and a bevel pinion k' meshes with said teeth, and is affixed on one end of a spindle k^2, supported in a bearing on the tool-slide and carrying on its opposite end a spur-gear k^3, which meshes with a gear k^4, supported on a stud fastened in the pendent portion of the slide. Said gear k^4 carries adjustable bearing-screws k^5 for contact with the short arm h^2 of the lever h', and there is one of these screws for each tool, and they are designed to assume operative position, as do the tools, through the gearing described, so that, when the turning of the tool-post brings a certain tool into operative position, the particular bearing-screw which is adjusted for this tool is brought to position for co-action with the lever h'. Access to the bearing-screws, for adjusting the same, may be had through an opening k^6 in the pendent portion of the slide. (See Fig. 6.)

The means for rotating the tool-post, and for locking and binding it at the different positions which determine the operative adjustment of the tools, will next be described. The post is connected by a screw with a stud m, extending down through a bearing in the slide, and carrying a gear m' on its lower end, which gear is in mesh with a pinion m^5 on the upper end of a spindle m^6, to whose lower end is affixed a pulley m^2. (See Fig. 13.) The belt e^4 engages said pulley m^2, and is designed to slip thereon when the tool-post is locked.

The tool-post is locked in its different positions by a pin n, which is projected into sockets in the under side of the post by a spring-pressed lever n' (see Fig. 15), and withdrawn therefrom at the proper time by a spring-held tappet-rod n^2, which is actuated by a lever n^3, in co-action with a cam n^4. The means for binding the post to prevent any play or "shake" of the same comprise a lever o, fulcrumed at one end between collars o' on the lower end of the stud m, and having a projection o^2 designed to bear against the gear m', said lever at its opposite end being formed with a quadrant-shaped socket o^3, and a lug o^4; a detent o^5, having a quadrant-shaped portion for engagement with the socket o^3, and an arm adapted to engage under the lug o^4, said detent being pivoted and spring-actuated in a direction to move its arm under the lug o^4; a spring-held tappet-rod o^6; a lever o^7; and a cam o^8. When the detent o^5 is engaged under the lug o^4, the lever o is binding the tool-post tightly by the engagement of its end with the stud m and its projection o^2 with the gear m', and when the parts are in this adjustment, which is illustrated in Fig. 3, no play or "shake" of the tool-post can take place. At the time when the tool-post is to be turned to bring a different tool into operative position, the cam o^8 actuates the lever o^7, and thereby the tappet-rod o^6 is pushed up against the under side of the detent o^5 and trips the arm of the latter from under the lug o^4, whereupon the lever o drops to the position shown in Fig. 6, and the tool-post is released from its binding effect. After the tool-post has turned and when it is locked in its new position, another portion of the cam o^8 acts on the lever o^7, thereby again pushing up the tappet-rod o^6, the latter in the meantime having assumed its normal position, and the tool-slide having moved so as to bring the lever o over the said tappet-rod. The tappet-rod now acts against the under side of the lever, and pushes the latter up to its binding position, whereupon the detent o^5 springs under the lug o^4, and holds said lever in such position. It will be observed that, when the lever o drops, its quadrant-shaped socket o^3 rests upon the quadrant-shaped portion of the detent, and freedom of movement of the detent is at the same time permitted.

The work, when completed, is discharged from the machine by means of the following devices: A swinging arm p is designed to go down between the head and tail-stock of the lathe and take the work therefrom, and to this end is equipped at its outer end with spring-nippers p', which take the piece, and from which it is discharged by a jack p^2 standing alongside the path of the nippers and notched in its end, so that on the return swing of the arm p the piece is received in the notch of the jack, and the further movement of the nippers disengages them from the piece and it thereupon drops from the jack. The arm p is affixed on a shaft p^3, which is supported in stationary bearings, and is capable of sliding longitudinally therein to a limited extent. A spring p^4 impels said shaft to the forward limit of its longitudinal movement. A spur-gear p^5, affixed on the rear end of the shaft p^3, meshes with a segment p^6 on the upper end of a lever p^7, which is actuated by a cam p^8 on the main-shaft. Said lever is vibrated by the cam at the proper time to swing the arm p

to position for taking the work and then to swing said arm back to position for discharging the work. On the backward swing of the arm, it is desirable to impart a lateral movement thereto, in order to completely free it from the work, and to this end a cam-piece p^9 is arranged in the path of the arm, so that upon the latter encountering said cam-piece it will be moved laterally, the longitudinal play of the shaft p^2 permitting such movement.

The general operation of the machine, briefly stated, is as follows: The blank enters the machine in the form of a continuous rod or round bar, and passes through the spindle of the head-stock, which spindle is hollow. The proper dead-center in the rotary barrel of the tail-stock being positioned to receive the work, the latter is engaged therewith, and the machine set in operation. The reciprocation of the transverse slide and the turning of the rotatable tool-blocks bring the tools to act consecutively on the work in the desired order to perform each its special part in the formation of the staff, while the motion of the longitudinal slide carries the work through varying distances so that each tool acts through the proper portion of the length of the work. The dead-centers in the barrel of the tail-stock are changed at proper times, according to the condition of the work. When a staff is completed, it is taken away, and discharged in the manner described.

The details of the operation will be understood from the preceding description.

The invention is not limited to the means shown and described.

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

1. In a lathe, the combination with a rotary work-holding chuck, of a plurality of work-supporting centers in a movable holder whose movement brings said centers severally into axial line with the work while held in the chuck, and means for intermittently moving the holder to bring the centers to such position.

2. In a lathe, a plurality of centers in a movable holder and having a path of movement which brings them singly into axial line with the work, means for intermittently moving the holder to bring the centers to such position, in combination with a tool-carrier, a plurality of tools thereon, and means for moving the said tool-carrier to different positions which bring the tools to act severally on the work.

3. In a lathe, the combination with a rotary work-holding chuck, of a plurality of work-supporting centers in a movable holder whose movement brings said centers severally into axial line with the work while held in the chuck, means for intermittently moving the holder to bring the centers to such position, and means for advancing and retracting the centers when in said position.

4. In a lathe, the combination with a rotary work-holding chuck, of a plurality of work-supporting centers in a movable holder whose movement brings said centers severally into axial line with the work while held in the chuck, means for intermittently moving the holder to bring the centers to such position, means for advancing and retracting the centers when in said position, and means for locking the centers when advanced and the holder in its different positions.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 3d day of November, A. D. 1893.

DUANE H. CHURCH.

Witnesses:
A. D. HARRISON,
F. PARKER DAVIS.