This invention relates to new and useful improvements in woodworking machinery and has particular relation to automatic woodturning machines.

The objects and advantages of the invention will become apparent from a consideration of the following detailed description taken in connection with the accompanying drawings wherein a satisfactory embodiment of the invention is shown. However, it is to be understood that the invention is not limited to the details disclosed but includes all such variations and modifications as fall within the spirit of the invention and the scope of the appended claims.

10 In the drawings—

Fig. 1 is a side elevational view of my improved machine;

Fig. 2 is a top plan view of the machine;

Fig. 3 is an end elevational view taken as looking from the right in Fig. 1, certain parts being omitted;

Fig. 4 is a detail sectional view taken as along the plane of the line 4—4 of Fig. 1;

Fig. 5 is an enlarged longitudinal sectional view of the work holding chuck and the spindle mounting the same;

Fig. 6 is a further enlarged detail sectional view of a portion of the chuck opening and closing means; and

Fig. 7 is a detail view showing one of a pair of dogs employed for connecting the chuck and the means for opening and closing the same.

Referring in detail to the drawings the machine comprising my invention is shown as comprising a base generally designated 16 and adapted to be disposed on a bench or the like not shown. Base 16 includes a bed portion 41, front and rear side wall portions 12 and 13 respectively located toward one end of the base and end walls 14 and 15. The entire base is preferably cast in one piece as shown. On one end of the bed 11 is a housing-like means 18 which at its upper side supports an electric motor 17 used for the driving of the machine's spindle and cam shaft as will appear.

On the bed of the machine is a forward bearing 18 for the spindle and also a rearward bearing 19 for the spindle. These bearing members may be secured to the machine bed in any suitable manner. The machine's spindle is generally designated 20 and is rotatably mounted by the mentioned bearings and includes an outer spindle or sleeve 21 mounted in the bearings and in fact extending through each of them. At its rear end the sleeve is simply mounted in the bear-

ing 19 which includes anti-friction means 22 and dust excluding means 23.

The forward bearing 18 also includes dust excluding means 24 and anti-friction means 25 the inner raceway 26 of the latter being clamped in place on the sleeve 21 as by means of a nut 27. Threaded to the forward end of the sleeve 21 is a cone or nosepiece 28 having an inclined inner surface portion 29 to cooperate with the inclined outer surfaces of the fingers of a collet chuck 30 in the usual manner whereby to cause the chuck to close and grip a piece of work when the chuck is drawn inwardly of the said cone. Threaded or otherwise connected with the inner end of the chuck 30 is an inner spindle 31 hollow as in the case of the sleeve or outer spindle 21 and having the opening therethrough in alignment with the opening through the chuck whereby work may be fed through the spindle and chuck from the inner or rear end of the spindle.

Secured to the sleeve 21 are pulleys 32 over which are trained belts 33 driven by large pulleys 34 on the shaft 35 of the electric motor 17. As the sleeve 21 is driven or rotated the chuck 30 and the inner spindle 31 are also driven or rotated. Means (later to be described) serve to shift the chuck 30 to and from gripping relation to the work in timed relation to the operation of means which acts on the work and which latter means is now to be described.

A small pulley 36 on the motor shaft 35 has a belt 37 trained thereover and such belt from the motor serves to drive a pulley 38 secured on a counter-shaft 39 mounted in a bearing member 40 located at the rear side of the machine. Belt 31 also passes over a guide pulley 41 mounted on the frame part 16. Secured to the rear end portion of the shaft 39 is a gear 42 meshing with a gear 43 having fixed thereto a gear 44. Gears 43 and 44 are mounted on a short shaft (not shown) carried by an arm 45 adapted for pivotal movement about the shaft 39, the said arm being carried by or including a short sleeve-like portion 46 about said shaft.

Small gear 44 meshes with and transmits power to a larger gear 47 fixed with respect to a pinion not shown, and which pinion meshes with and drives a gear 48 fixed to a cam shaft 49 having bearings in the end walls 14 and 15 and an intermediate transverse wall 50 of the base 16. By means of a hand lever 51 the arm 45 may be rocked about the shaft 39 to bring the small gear 44 into or to shift it out of mesh with the gear 47 whereby to have the cam shaft 49 driven by the
motor 11 or to have such shaft stationary as may be desired.

The material to be acted upon by the machine may be fed by automatic means or by hand as desired. Such material is fed through the rear end of the sleeve 31 and through the inner hollow spindle 31 and into and through the chuck. The material projecting beyond the forward end of the chuck is acted upon by suitable tools depending on the shape, size, and the like of the material. The drawing is stopped when the stop finger 62 limits the distance the work may be projected beyond the forward end of the chuck.

Finger 62 passes through a guide block 53 adjustable along a supporting bar 54 arranged to extend longitudinally of the machine base and secured at its respective ends as at 55 to the bearing 18 and at 56 to the upper end portion of a supporting rod 57 suitably secured on the bed of the machine. At its upper end finger 52 is secured to an actuating bar 58, such bar having a slot 39 therein through which passes a pin 61 searing the fly wheel to the index which may be adjusted longitudinally of the bar to determine the length of the work that may be projected beyond the forward end of the chuck. Obviously the guide block 53 is adjustable to the desirous extent. As shown, the link 62, the actuating bar 58 is pivotally mounted on the upper end portion of the rod 57 at 61.

An operating rod 62 passing vertically through the bed 11 and a guide means 53 thereon, has its upper end pivotally connected with the actuating bar 58 at 64. The lower end 65 of the bed 11 a coil spring 65 surrounds the rod 62 and bears on the bottom surface of the bed and a stop 66 fixed to the rod. The tendency of this spring is to move the rod 62 downwardly and to keep the lower end of the rod against the surface of a cam 67 fixed to the cam shaft 49. Consequently the lower end of the rod 62 may be equipped with a roller to ride against the cam 67.

A bracket 69 on the bed 11 supports a shaft 69 pivotally mounted a tool carrier 70 supporting a tool 71 adapted to act on work projecting from the forward end of the chuck 30 at predetermined times as will be described. Carrier 70 includes an extension 72 equipped at its lower end with a roller 73 riding against a cam 74 which is also fixed to the cam shaft 49. A coil spring 75 fixed at one end to the base wall 13 at its other end to a piece 76 on the extension 72 serves to maintain the extension in position with the roller 73 against the cam 74 and thus the spring serves to move the tool 71 to a retracted position away from the work as the high portion of the cam moves from under the roller.

At the rear side of the base 10 is located a bracket 77 supporting a short shaft 78 pivotally mounting an arm 79 carrying a platform 80. On the platform 80 is mounted an electric motor 81 which through pulleys 82 and 83 and a belt 84 drives a disc saw 85. The lower end of the arm 79 carries a roller 86 kept against a cam 87 (also on the cam shaft 49) by means of a coil spring 88 secured to the platform 80 and to the bench 88 at 90.

The relation of the parts thus far described is such that a piece of work—usually a rod—is pushed through the chuck the stop finger 52 is in a down position located in the path of movement of such work. Thus the work will be permitted to project only a predetermined distance from the forward end of the chuck. Now the work having been positioned the timed relation of the parts is such that the chuck is closed to grip the work and the cam 67 acts on the rod 62 (against the tendency of the spring 86) to raise the rod 62 and thus the bar 56 and thereby elevate the finger 62 to an out of the way position.

Now cam 74 comes into play and acting on extension 72 rocks the tool carrier 70 on pivots 83 to bring the tool 71 against the work being held by the chuck. As the work of the tool is completed the drawing is stopped and the spring 75 acts to retract the tool carrier and thus the tool. At this time the cam 67 acts on the roller 86 and rocks the platform 80 (through the arm 19) to bring the saw 85 into action to cut off the shaped piece from the rod being fed through the machine. Obviously as the high portion of cam 67 recedes the spring 88 will act to bring the platform back to normal position with the saw spaced from the work.

The means for shifting the chuck between gripping and released positions is hydraulically actuated whereby to have the work grasped with the same predetermined pressure regardless of minor variations in the diameters and shapes of the rods fed the machine for treatment thereby. Disposed on the bed 11 intermediate the bearings 8 and 9 is a block 91 having an opening 92 therefor. Ring-like members 97 bolted against the outer side thereof a pair of spaced raised annular portions 95 and 96 comprising the piston portion against which the fluid under pressure is directed to cause movement of the piston longitudinally of the sleeve 21.

Rings-like members 97 bolted against opposite ends of the block 91 serve to close the openings 92 about the skirt portion of the piston 93 whereby to have the block form a cylinder about the piston. Bolts 98 serve to secure the rings-like members in place and at the inner sides of such members are sealed at pressure by a metal ring 99 having openings 100 therein and expansible leather or the like rings 101 located in back of the rings 99 and adapted to be expanded by the fluid under pressure passing through the openings 100 in said rings 98.

Liquid under pressure is supplied to operate the piston 93 first in one direction and then in the opposite direction. As here shown the liquid is maintained in a suitable reservoir 102 preferably located below the bench or other support on which the machine may be located. A pump 103 driven by an electric motor 104 takes the liquid from the reservoir through a pipe 105 and delivers it under pressure into a tube 106 connected at its upper end with the intake port of a distributing valve 107.

A by-pass valve or pressure regulating valve means 108 provides for the by-passing back to the reservoir through the pipe 109 any excess liquid delivered by the pump and the device may be equipped with a pressure indicator 110 as desired. Distributing valve 107 alternately and in proper timed order delivers the liquid under pressure to the tubes 111 and 112 and such valve also has connected thereto a return pipe 113 for the return to the reservoir of the liquid drained from one side of the piston as the liquid under pressure is being supplied to the other side thereof. Valve 107 is controlled by a cam 114 located
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on the cam shaft 49 above mentioned. Such cam acts against a roller 115 carried by the end of the stem 118 of the valve and shifts the valve in certain timed relation with the action of the cams 61, 64 and 67 whereby to have the piston 93 of the inner spindle 31 positioned in the chuck 30 to gripped and released positions in timed relation to movements of the stop finger 52, the tool 71 and the saw 85 all as will appear. Tubes 111 and 112 are connected to deliver liquid under pressure to the opposite sides of the piston 93. To this end elbow fittings 117 and 118 connect the respective tubes (see Figs. 5 and 6) 111 and 112 whereby to have the former deliver to the outer side of piston part 95 while the latter delivers to the outer side of the piston part 96. Thus when the valve 101 delivers liquid under pressure to the tube 112 the piston will be moved toward the rear of the machine or toward the left as viewed in Figs. 1, 2, 5 and 6 and when the tube 111 has liquid under pressure delivered thereto the piston will be moved toward the forward end of the machine or toward the right in such figures.

The forward end of the skirt portion or sleeve-like portion 94 of the piston has threaded or otherwise securely thereon an annular extension 119 of enlarged diameter. Such extension overlies the portion of the cylinder 80 toward the inner spindle 3 by the screws 22 and 23 and is secured to the opposite sides of the sleeve 21. Secured to opposite portions of the inner spindle 31 and projecting through such slots are dogs 121 secured as by screws 122 and slightly recessed into the spindle 31 as at 123 (see Fig. 7). An annular ring 124 is disposed over the dogs 121 and secured to them as by pins 125. Disposed on the ring 124 is the inner raceway 128 of a ball bearing means a nut 127 being threaded onto the outer end of the ring and securing the said raceway in place. The outer raceway 128 of said ball bearing means is secured to the extension 119 by a nut 129 threaded into the extension as shown.

Since the dogs 121 project into the slots 120 and are secured to the inner spindle 31 by the screws 122 it will be clear that as the sleeve 21 is rotated by the belts 33 and 34 the dogs 121 by the outer spindle or sleeve 21, the inner spindle 31 and the chuck 30 will be rotated together. However, with the ball bearing 130 located between the raceways 126 and 128 it will be apparent that such rotary motion is not transmitted to the extension 119 and thus is not transmitted to the piston 93. Due to the construction described it will be understood that any movement of the piston longitudinally of the sleeve 21 will result in similar movement of the inner spindle 31 and of the chuck 30. The end thrust is delivered through the ball bearings.

Thus viewing Fig. 5 on liquid under pressure delivered to the cylinder by the tube 112 the piston will move the inner spindle 31 to draw the chuck into the cone 26 whereby the chuck will be caused to grip any work projecting therethrough. Next the liquid under pressure is delivered through tube 111 and the piston, inner spindle and chuck are moved in the opposite direction to the tool 71 and then cut off by the saw 85 after which the chuck releases the work for further movement forward to position its forward end portion for action by the tools.

A bracket 131 on the bed 11 frictionally engages against the under side of the extension 119 whereby to at least partly prevent any forward motion between the piston and the spindle 31 and also whereby through such frictional engagement prevent creeping of the extension with the inner rotatable parts of the connection. On the forward end of the cam shaft 49 is a hand wheel 132 by means of which the sleeve 49 may be turned manually when setting the cams for the control of new tools. Should the machine stop with the chuck gripping the work then the wheel 132 should be manually turned a slight distance to have the chuck release the work. In Fig. 5 it is noted that the liquid under pressure is introduced into the cylinder at the upper side thereof whereby the liquid does not completely drain from the cylinder when the machine is stopped and therefore the operating pressure may be more readily obtained.

After the machine has been in use the owner thereof may change chucks and in doing so may insert into the machine a chuck which is too long or too short or of the wrong diameter. Under such circumstances with an established throw for the piston the chuck is preferably chosen to make a suitable engagement when the piston operates in one direction or it may not close properly when the piston is operated in the opposite direction. To compensate for this I provide an adjustment including a nut-like means 133 threaded on the rear or inner end of the shaft portion or sleeve-like portion 94 of the piston. On tightening or loosening of this nut a greater or lesser throw is allowed the piston whereby to prevent too much or too little opening of the chuck which is not an exact duplicate of the chuck accompanying the machine when it leaves the factory.

Having thus set forth the nature of my invention, what I claim is:

1. In combination, an elongated hollow rotary spindle, a chuck at the forward end of said spindle, means mounting said spindle and chuck for rotary movement, said chuck operatively disposed axially of the spindle in one direction to grip the work and in the opposite direction to release the work, a tubular piston about said spindle in spaced relation to said chuck, said piston movable longitudinally of the spindle, said spindle rotatable in said piston, a stationary cylinder about said piston, driving means on the spindle between the piston and chuck and through which the spindle and chuck may be rotated, means for supplying fluid under pressure alternately to opposite sides of the piston to shift it longitudinally of the spindle, means connecting the piston with the chuck for alternately opening and closing the latter as the piston is moved by said fluid under pressure, and said connecting means including a rotatable part on the spindle and a non-rotatable part on the piston whereby the spindle is rotated independent of the piston and the latter is not rotated in the cylinder.

2. In combination, an elongated hollow rotary outer spindle, a chuck at the forward end of said outer spindle, means mounting said outer spindle and chuck for rotary movement, chuck operatively disposed axially of the spindle in one direction to cause the chuck to grip the work and in the opposite direction to cause the chuck to release the work,
a cylinder and piston construction, driving means on said outer spindle between said piston and cylinder construction and said chuck and through which the outer spindle and chuck may be rotated, means for supplying fluid under pressure alternately to opposite sides of said piston to shift it in said cylinder, means connecting the piston with the inner spindle for alternately moving the same longitudinally in opposite directions to close and open the chuck as said piston is moved by the fluid under pressure, said connecting means including a rigid rotatable part on the inner spindle and passing through the outer spindle whereby the former is rotated with the latter, and a non-rotatable part connected with the piston and said rotatable part whereby the outer and inner spindles and the chuck are rotated independent of the piston and the latter is not rotated in the cylinder.

3. In combination, a chuck, a hollow rotatable sleeve having the chuck in one end thereof and adapted to have work fed therethrough and through the chuck, said chuck moveable longitudinally of said sleeve between gripped and released positions, a hollow spindle within the sleeve and connected with said chuck, a tubular piston about said sleeve, means for supplying fluid under pressure alternately to opposite sides of said piston to move it back and forth on the sleeve, a connection between the piston and spindle whereby as the piston is moved back and forth the chuck is moved to gripped and released positions, said connection including dogs located in slots in said sleeve, means connecting said dogs to said spindle, an extension on said piston and overlying said dogs, and a ball bearing means connecting said extension and dogs and located to accept thrust caused by movement of the piston without imparting turning movement of the spindle to the piston.

4. In combination, a base, a hollow rotary spindle, a chuck at the forward end of said spindle, means rotatably mounting said spindle and chuck on the base, said chuck moveable longitudinally of the spindle in one direction to grip the work and in the opposite direction to release the work, a tubular piston about a portion of said spindle and moveable longitudinally thereon, means for supplying fluid under pressure alternately to opposite sides of said piston to shift it longitudinally of said spindle, means connecting the piston with the chuck for alternately opening and closing the latter as the piston is moved by said fluid under pressure, said means including a non-rotatable part on the piston and a rotatable part on the chuck whereby rotation of the latter is not imparted to the former, means for rotating the chuck, and screw threaded means connected with said piston and operable to adjust the same and thereby the chuck longitudinally of the spindle to adjust the end location of the chuck to prevent too much and too little opening thereof when shifted by said piston.

5. In combination, a base, a chuck, a hollow rotatable spindle having the chuck in the forward end thereof and adapted to have work fed therethrough and through the chuck, means rotatably mounting the spindle and chuck on the base, said chuck moveable longitudinally of the spindle in one direction to grip the work and in the opposite direction to release the work, a tubular piston about a rearward portion of said spindle and moveable longitudinally thereof, means for supplying fluid under pressure alternately to opposite sides of said piston to shift it longitudinally of the spindle, means for rotating the chuck and spindle, means connecting the chuck and piston whereby as the latter is alternately moved to gripped and released positions, said last means including a rotatable means intermediate the chuck and piston and connected with the chuck, a non-rotatable means between the chuck and piston and radially about said rotatable means and connected with the piston, bearing means between and connecting said rotatable and non-rotatable means whereby the chuck rotates independent of the piston, and a supporting means on said base forwardly of the spindle mounting means and frictionally engaging the underside of said non-rotatable means to assist in supporting and holding the same against rotation but yet permit of movement thereof with the piston.

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