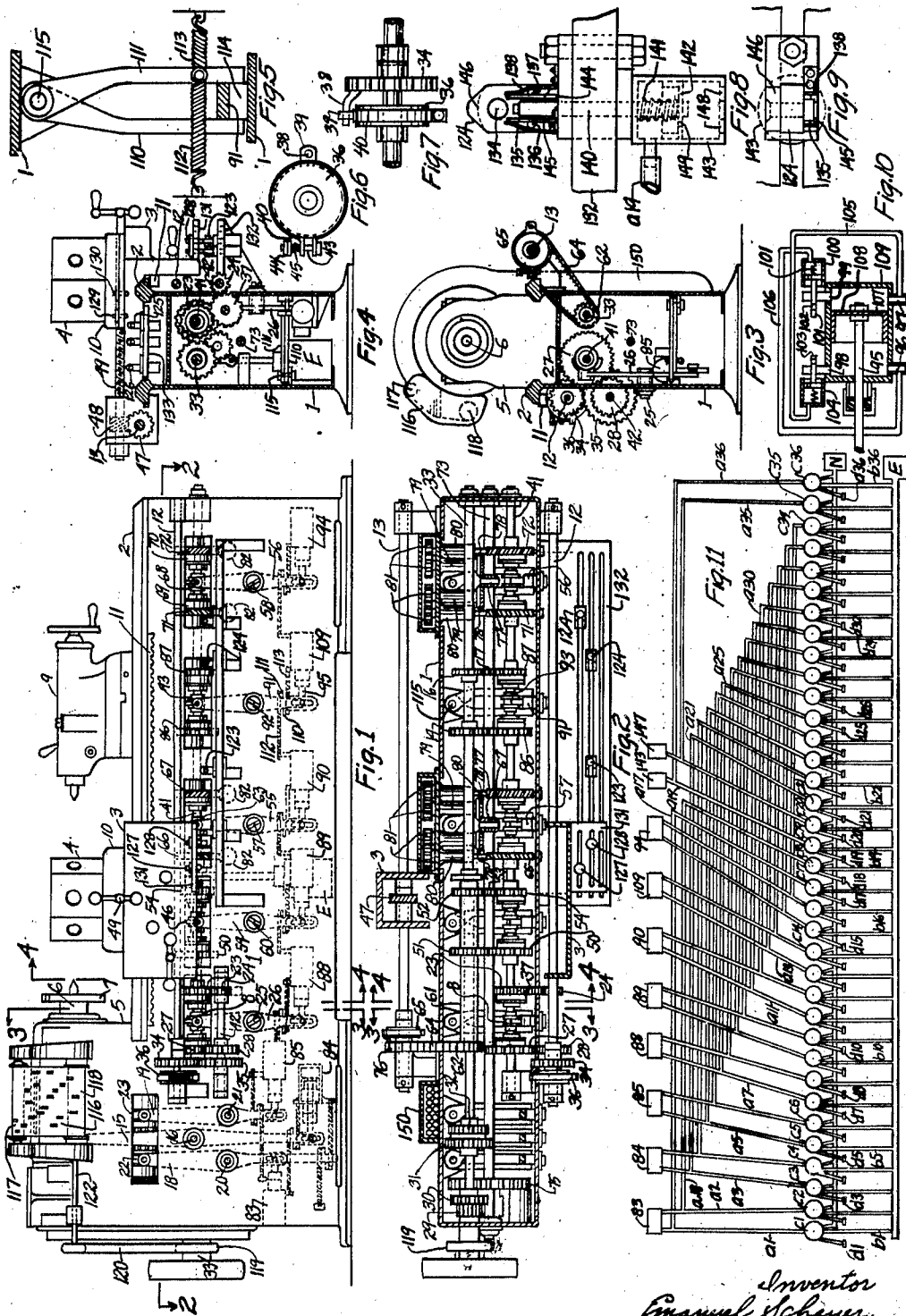


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AUTOMATIC LATHE.
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AUTOMATIC LATHE.

1,381,752.

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To all whom it may concern:

Be it known that I, EMANUEL SCHEYER, a citizen of the United States, residing at New York, county of Queens, State of New York, have invented certain new and useful Improvements in Automatic Lathes, of which the following is a specification.

This invention relates to an automatic lathe capable of doing work beyond the range of the ordinary automatic turret lathe, cam controlled. Cam controlled machines are not capable of performing an operation of long duration through an extended distance and of a complicated motion. The cams become too cumbersome and it is often impossible to give them the form necessary for the desired motion.

In such machines although the machine itself may run for hours, it is really repeating the operation over again every few seconds. It is impracticable to make large pieces or pieces of a complicated shape, although large numbers should be wanted, which it is found at present more economical to make on a hand operated turret lathe or an ordinary engine lathe.

Instead of using cams, I employ a perforated paper record for controlling the operation of my lathe. Unlike the cam, the length of an operation is no limitation with a paper record, as paper can be obtained in strips of great length, nor does the complexity of the motion present any difficulty, the only effect being a greater variation in the way the perforations follow each other on the record.

The cross slide is controlled in its motion from a slotted feed shaft in back of and running parallel to the bed of the lathe and the carriage is driven by a feed shaft in its usual location in front of the bed. Clutches are used to cause the engagement and disengagement of the aforementioned shafts with a power shaft, the gearing between them and the power shaft being such that reversals of direction can be obtained by the engagement of some of the clutches. In order to be able to handle pieces mounted on the centers or on arbors a turret tool holder with suitable indexing mechanism is mounted on the cross slide. As is well known to the art, this indexing mechanism operates upon the tool holder being moved into a certain predetermined position. Others of the clutches bring into play different sets of gearing whereby the traverse and feed of the carriages can be

varied in speed. Still others of the clutches control the different spindle speeds. All of the clutches are shifted by levers, one end of the lever being forked over the sliding part of the clutch and the other end fastened to the piston rod of a pneumatic cylinder. As air is admitted on one side or other of the piston in the cylinder, the clutch is thrown into engagement in turn to its mating parts. When the air pressure is equalized on both sides of the piston, the lever is brought by springs to its central position disengaging the clutch. The action of the cylinders is controlled by the perforations of the record, which choose which cylinders are to operate as well as the length of time the pistons are held in any desired position. The action of the perforated record is similar to that used in automatic pianos, except that in this invention the perforations control the motion of levers instead of operating the keys.

Owing to the fact that, when the clutches controlling the motion of the carriage and cross slide are thrown in by the perforations of the record, the carriage and cross slide may overrun or fall short of the required motion, a plurality of stops are provided to arrest the motion at the correct places. In setting up the machine the stops are located at the proper places, as many stops being used as is necessary to provide for the desired motions. The record has certain of its perforations to control the action of these stops, a stop being able to arrest the carriage or cross slide only when there is a perforation of the record corresponding to it in operation at any time. The perforations for the stops are so placed on the record that a stop is thrown in before the perforations calling for the engagement of the corresponding clutch are out of action, thus causing the carriage or cross slide to be urged against a stop for a considerable interval of time, the feed shafts being provided with a slippage device which permits part of the driving mechanism to be rotated by the clutches while the other part is stationary. The slippage device is adjusted to have sufficient grip to hold for the cutting action of the tools, but will give when the carriage is arrested by a stop.

Instead of using the turret on the cross slide, the more usual construction of the automatic turret lathe can be followed by mounting the turret directly on the bed in

place of the tail stock and having the usual carriage and cross slide. Feed shafts with their corresponding clutches and control mechanism would be provided for the carriage, cross slide and longitudinal motion of the turret. By properly mounting the turret for a cross feed motion in addition to its longitudinal motion and providing an additional feed shaft a greater variety of operations could be performed. There would be four feed shafts in this lathe, controlled in their rotation by the perforations of the record.

In the accompanying drawings, which are largely diagrammatic, I have illustrated one practical form in which the invention may be embodied; but it will be understood that the same may be varied considerably in respect to details within the scope of the appended claims; and referring thereto:—

Figure 1 is a front elevation of the machine. Fig. 2 is a plan taken at the general level indicated at 2—2, Fig. 1. Fig. 3 is a cross-section taken approximately at the plane 3—3 as shown on Figs. 1 and 2. Fig. 4 is also a cross section and is taken approximately at the plane 4—4, Figs. 1 and 2. Fig. 5 is an enlarged detail of the spring mechanism for holding the clutch levers in their neutral position. Figs. 6 and 7 are views of the slippage mechanism used on the feed shafts. Fig. 8 is an enlarged elevation of the stop and its actuating cylinder. Fig. 9 is a plan view of the stop. Fig. 10 is an enlarged detail with its air connections of the cylinders actuating the clutch levers. Fig. 11 is a diagram of the air connections of the machine.

Referring to Figs. 1 to 4 inclusive, 1 designates as an entirety the substantially rectangular frame or housing of the machine surmounting which and extending the major part of its length are parallel V-shaped ways 2 that support the lathe carriage 3 which is adapted to slide along the V-ways 2. Mounted and adapted to slide on the carriage 3 is the cross slide 10 upon which is rotatably mounted the turret tool holder 4. The indexing of the turret is accomplished by indexing mechanism (not shown) many types of which are known to those skilled in the art. This mechanism operates when the turret is moved past a predetermined position.

The carriage 3 is driven by the feed shaft 12 which operates the usual carriage gearing (not shown). This gearing coöperates with rack 11 and is thereby enabled to move carriage 3 back and forth as desired. Through spiral gears 47 and 48 (Fig. 4) the shaft 13 operates the cross-slide 10 by means of cross feed screw 49.

The train of connections between shaft 12 and the source of power will now be described. Shaft 73 (Figs. 2, 3 and 4) is

driven by gear 75 which is belted to the spindle drive mechanism (not shown) exactly as is done in United States Patent Number 1,081,396, December 16, 1913, to W. L. Miller, as shown in Figs. 1 and 12 of said patent and described on page 3 lines 125 to 129 inclusive, of same. Fixed to shaft 73 are two bevel gears 77 (my Fig. 2) each one driving two other level gears 78. This and what follows is shown more particularly in Figs. 5 and 13 of Miller's patent, the numbers used in my application being the same as used in Miller's for corresponding parts. The gears 78 are fixed to shaft 79 which through change gears 81 rotate spiral gears 82, (my and Miller's Fig. 1). The spiral gears 82 mesh with spiral gears, 66, 67, 71 and 72, loose on shaft 41. The clutch shifting levers 55 and 56 operate double-faced clutch followers 63 and 68 respectively which in turn operate expansion ring clutches fixed to spiral gears 66, 67, 71 and 72. Two of these clutches are shown at 69 and 70 (Fig. 1), the clutches for gears 66 and 67 being similar. These spiral gears are made fast to shaft 41 in accordance with which expansion ring clutch is operated. The object of this arrangement is to provide a means whereby shaft 41 and as will be shown, feed shafts 12 and 13 can be given several different speeds of rotation whereby different feeds can be given to the carriage 3 and the cross slide 10.

For the quick traverse motions of the carriage 3 and cross slide 10, the main pulley shaft 33 has keyed to it, the gears 14 and 16. Gear 14 meshes with gear 86 normally loose on shaft 41. Gear 16 drives idler gear 17 which in turn drives gear 87 also normally loose on shaft 41. The clutch follower 93, which can be shifted by lever 91 pivoted at 92, operates expansion ring clutches fixed to gears 86 and 87 fastening one or the other to shaft 41. When gear 86 is made fast, shaft 41 is rotated in one direction, and when gear 87 is made fast, in the opposite direction.

Fixed to feed shaft 12 is the slippage device or friction coupling 36. Immediately next to it but loose on shaft 12 is gear 34. Pin 38 (Figs. 6 and 7) projects from gear 34 through a hole in lug 39 forming a part of the band 40 encircling the coupling 36. The right amount of friction grip is obtained by means of spring 45 bolt 43 and lock nuts 44.

Gear 34 and hence shaft 12 is driven from shaft 41 through gear 35 fixed to short shaft 42. The clutch follower 8 on shaft 41 is shifted by lever 26 pivoted at 25 and is adapted to fasten, depending upon its position in a similar manner to that described for gears 86 and 87, the gears 27 and 23 to shaft 41. Gears 27 and 23 are normally loose on shaft 41. Gear 27 meshes with gear

28 to drive short shaft 42 in one direction and gear 23 through idler gear 37 and gear 24 drives it in the opposite direction.

The mechanism for driving shaft 13 and hence the cross feed screw 49 and cross slide 10 will now be described. The clutch follower 46 on shaft 41 is adapted to be shifted by lever 59 pivoted at 60. Gears 50 and 54 normally loose on shaft 41 are adapted to be made fast to shaft 41 by means of expansion ring clutches attached to them, depending upon the position of the clutch follower 46. Shaft 33 carries loose, near its left hand end a sleeve 61 having fixed to it gears 51 and 52. When gear 50 is fastened to shaft 41 it drives the sleeve 61 in one direction by means of gear 51 and when gear 54 is made fast to shaft 41 it drives sleeve 61 in the opposite direction, through idler gear 53 and gear 52. At the left hand end of sleeve 61 is sprocket 62 fixed to it. Shaft 13 carries a sprocket 76 loose on it at its left end. By means of link belt 64, sprocket 62 drives sprocket 76. Next to sprocket 76 is the slippage device 65, which is driven from sprocket 76 by means of a pin and friction band similar to that already described in connection with slippage device 36 shown in Figs. 6 and 7. Slippage device 65 is fixed to shaft 13 and drives it in accordance with the position of the clutch follower 46.

The various levers 18, 15, 19, 26, 59, 55, 91 and 56 are actuated by the piston rods of the pneumatic cylinders 83, 84, 85, 88, 89, 90, 109 and 94 respectively, a typical one of which 109 is shown in enlarged detail in Fig. 10. The piston 108 which slides within the cylinder 109 carries the piston rod 95. The other end of piston rod 95 engages with the lower end of lever 91. As the piston 108 is forced to one end or the other of the cylinder 109 the lever 91 is caused to shift its clutch follower 93 into its opposite operating positions. When air is exhausted through the tube 96, the pressure to the left of the piston 108 is reduced while at the same time air is exhausted through the branch tube 106 and to the right of the piston in the small cylinder 100, causing the piston to be drawn in against the pressure of spring 101. Piston rod 101 has an opening 102 in it, which when drawn into line with tube 99 admits air at atmospheric pressure to the right of piston 108 causing it to move to the left. When air is exhausted through tube 97 the pressure is reduced to the right of cylinder 108 while at the same time it is reduced through branch tube 105 to the left of the piston of small cylinder 104, drawing in its rod 103 until the opening in the rod registers with the tube 98 admitting air at atmospheric pressure to the left of piston 108 and forcing it to the right. When air is exhausted neither from tube 96 nor 97 it is caused to become equalized on

both sides of the piston through leak hole 107 in the piston. The use of leak holes in pneumatics is well known to the art of automatic player pianos. When no air is withdrawn from either side of the piston 108, the lever 91 is soon drawn into its central position by means of levers 110, and 111, and springs 112 and 113. (Figs. 1 and 5.) The levers 110 and 111 are pivoted at 115 to a lug from the housing 1. Spring 112 normally holds lever 111 against lug 114 projecting from the housing 1 and spring 113 normally holds lever 110 against lug 114, thus maintaining lever 91 in its central position when not acted upon by piston 108. A similar arrangement is used to keep the levers 18, 15, 19, 26, 59, 55 and 56 in their central positions when not acted upon by their corresponding pistons.

The perforations of the record 116 determine which ports of the various lever actuating cylinders 83, 84, 85, etc., should exhaust air at any given time and thus effect the operation of the machine as will now be described. The perforations of the record 116 as it unwinds from spool 117 onto spool 118 pass over tracker ducts indicated by d^1 , d^2 , d^3 — d^{36} in Fig. 11. The use and action of a perforated record and tracker ducts is well known to the automatic player piano art and is also fully described in my United States Patent Number 1,172,059, February 15, 1916 (see Figs. 6, 7, 10 11 and 12 of said patent). Pulley 119 on shaft 33 by means of belt 120 drives pulley 121 fixed to shaft 122 which is geared by reducing gearing (not shown) to the shaft rotating spool 118. Likewise shaft 122 drives an exhaust pump indicated at N in Fig. 11 in a similar manner to that shown in Figs. 6 and 7 of my above mentioned patent, where the record mechanism is sufficiently explained to make it unnecessary to do so here.

Referring to Figs. 1, 4 and 11 of the present application, the exhaust pump E driven from shaft 33 is connected by tubes b^1 , b^2 — b^{36} to cylinders c^1 , c^2 — c^{36} . Cylinders c^1 , c^2 — c^{36} are so constructed (see Fig. 12 and lines 62 to 99, page 3 of my Patent 1,172,059) that when a perforation of the record comes over a tracker duct, say d^1 , the exhaust E through pipes b^1 and a^1 is connected to the left of the piston in cylinder 83, thereby shifting the bottom of lever 18 to the left. In a similar manner the other tracker ducts control the connection of the exhaust E to the other lever shifting cylinders. In Fig. 11 of the present application it will be noticed that tube a^1 has a branch a^{17} leading to cylinder c^{17} and duct d^{17} , tube a^2 , a branch a^{18} to cylinder c^{18} and duct d^{18} , tube a^3 , a branch a^{21} to cylinder c^{21} and duct d^{21} , etc. The object of this is to prevent the necessity of a continuous slot in the record in the case where it is desired to keep one of the clutch levers

18, 15, 19, etc., in the same position for a considerable length of time. With the construction just described the perforations alternate say for duct d^1 and duct d^{17} keeping the left hand end of cylinder 83 continuously connected to the exhaust E.

Owing to the fact that carriage 3 and cross slide 10 may overrun or underrun their desired motions when the clutch followers 8 or 46 are in, stops such as are shown at 123 and 124 (Figs. 2 and 4) and 125 and 126 (Fig. 4) are provided. Carriage 3 has projecting from it the slotted plate 131 in which can be bolted in various positions the dogs 127 and 128. More dogs and stops can be used, depending on the number of operations desired. In a similar manner cross slide 10 carries dogs 129 and 130 or more if required.

The stops 123, and 124 can be adjustably placed in the slots of plate 132 projecting from housing 1. In a similar manner the stops 125 and 126 are held in plate 133 projecting from carriage 3 (Fig. 4).

The dogs 127 and 128 are adapted to engage the top of stops 123 and 124 and thereby arrest the motion of the carriage. Only those stops are able to arrest the motion of the carriage which are actuated by a perforation of the record at any given time. Referring now to Figs. 8 and 9, 124 is the stop having its upper end beveled and rounded off. Stop 124 has its lower end bifurcated and it swings about a pivot 134 supported in upright 146. The piston rod 140 is adapted to enter the bifurcated lower end of the stop 124 and thereby prevent it from turning about pivot 134. When a perforation of the record comes over tracker duct d^{19} it actuates the piston of cylinder c^{19} so that the exhaust E is connected through tubes b^{19} and a^{19} to cylinder 143 above the piston 142 (Fig. 8). This causes the piston 142 to rise against the pressure of spring 141, normally keeping the piston 142 at the bottom of cylinder 143. When piston 142 rises it forces the piston rod 140 into the bifurcated end of stop 124, and now when the dog 127 comes against stop 124 the motion of carriage 3 is arrested. The record is so perforated, that the perforation for actuating piston 143 is over tracker duct d^{19} for a considerable interval of time before the perforations of the record throwing in the clutch follower 8 have ceased to pass over tracker ducts d^7 and d^{25} . For arresting the motion of the carriage when traveling in the opposite direction the perforation for actuating piston 143 is in before the perforations for tracker ducts d^8 and d^{26} have ceased to pass over them. This allows the slippage device 36 to rotate shaft 12 until carriage 3 is jammed hard against stop 124 when the parts of the device slip over each other maintaining the carriage against the stop as long

as the perforations for the clutch follower 8 pass over their tracker ducts.

In Fig. 11 only two stop actuating cylinders 143 and 147 are shown, not to complicate the drawing, the other stops are controlled in a like manner. It can be seen in Fig. 11 that there are two tracker ducts for each cylinder, e. g., d^{19} and d^{36} for cylinder 143.

When carriage 3 passes over a stop, say 124, at any time which is not supposed to arrest its motion because there are no perforations calling for its actuation, the piston rod 140 (Figs. 8 and 9) is kept down by its spring 141 from the slot in the lower end of stop 124. Now as a dog 127 comes in contact with the beveled upper end of stop 124, the stop is rotated about pivot 134, until dog 127 passes clear of it. Springs 135 and 138 normally maintain stop 124 in its vertical position, in a similar manner to the way lever 91 (Fig. 5) is maintained in its central or neutral position. The springs 135 and 138 normally press against uprights 144 and 145 at the same time engaging the pins 136 and 137 projecting from the stop 124. When air is no longer exhausted from tube a^{19} , by means of leak hole 149 in piston 142 the pressure is equalized above and below piston 142. The space below piston 142 is maintained at atmospheric pressure by means of the large ports 148. The stops and dogs for cross slide 10 arrest its motion and are controlled in a similar manner to that just described for carriage 3.

Tubes, flexible where necessary, connect the cylinders c^1 , c^2 — c^{36} near the record with the lever actuating cylinder 83, 84, 85, etc., and the stop actuating cylinders 143, 147 etc. Some of these tubes are shown in the casing 150 (Fig. 2) passing down the back of the lathe, but not elsewhere to avoid confusion.

Instead of using an exhaust pump "E" by a slight rearrangement of the valves a compression pump could be used as explained in my Patent Number 1,172,059.

There are several different types of record that can be used instead of the perforated paper record. For example an embossed record could be used to make and break electric circuits (see Fig. 29 of my U. S. Patent Number 1,172,058, February 15, 1916) and the making and breaking of these circuits could control solenoid actuated valves (see Fig. 26 of my other Patent Number 1,172,059) instead of the pneumatically controlled valves c^1 , c^2 , etc. of the present application. Also a perforated record, say of brass, could be used to operate mechanism as shown in Fig. 28 of my Patent Number 1,172,059 and described on page 11 lines 21 to 38 inclusive, as well as the method shown in Figs. 25 and 27 of same and described on pages 10 and 11 with the exception that

the selector mechanism described there is omitted and the valves r^1 , r^2 , etc. instead of the cylinders c^1 , c^2 of the present application connect the exhaust E to the lever throwing and stop actuating cylinders of the lathe.

The method of operation is as follows:—Having determined the operations, speeds and feeds necessary for turning out a given piece, the record is laid out in the drafting room, and the lathe is set up by fixing the tools in the turret and setting the stops and dogs in their proper positions. Now as the record feeds, the various perforations control the positions of the clutch followers which produce the desired motions of the lathe carriage and cross slide as well as their speeds of feeding and traversing and the desired successive spindle speeds.

The word "marked" as used in the appended claims is intended to include the idea of being perforated.

Having thus fully described my invention, I claim as new and wish to secure by Letters Patent:—

1. In a machine of the character described, the combination with a machine bed and a tool-carrier mounted thereon, of mechanism for causing the motion of the tool-carrier in reversible directions, a plurality of stops, a record provided with suitable means automatically to effect the desired control of said mechanism and the desired operation of said stops, said stops being suitably constructed to arrest the motion of the tool-carrier when called for and as selected by the record.

2. In a machine of the character described, the combination with a machine bed and a tool-carrier mounted thereon, of a plurality of clutches for controlling the motion of the tool-carrier, a plurality of stops, a record provided with suitable means automatically to effect the desired successive engagements and disengagements of said clutches and the desired operation of said stops, said stops being suitably constructed to arrest the motion of the tool-carrier when called for and as selected by the record.

3. In a machine of the character described, the combination with a machine bed and a tool-carrier mounted thereon, of mechanism for causing the motion of the tool-carrier, mechanism for varying the spindle speed, a plurality of stops, a record provided with suitable means automatically to effect the desired motion of the tool-carrier, the desired spindle speeds and the desired operation of said stops, said stops being suitably constructed to arrest the motion of the tool-carrier when called for and as selected by the record.

4. In a machine of the character described, the combination with a machine bed and a tool-carrier mounted thereon, of a mechanism for causing the motion of the tool-carrier, mechanism for varying the spindle

speeds and a record suitably perforated to cooperate with the mechanism for causing the motion of the tool-carrier and said spindle speed mechanism automatically to control the motions of the tool-carrier and the spindle speeds.

5. In a machine of the character described, the combination with a machine bed and a lathe carriage having mounted thereon a cross slide, of mechanism for causing the motion of the carriage in a longitudinal direction, mechanism for causing the cross-feed motion of the cross slide, a plurality of stops, some of the said stops for arresting the longitudinal motion of the carriage and others for arresting the cross-feed, a record provided with suitable means automatically to effect the desired motions of both the carriage and cross slide and the desired operation of said stops, said stops being suitably constructed to arrest the motions of the carriage and cross slide when called for and as selected by the record.

6. In a machine of the character described, the combination with a machine bed and a tool-carrier mounted thereon, of mechanism for causing the motion of the tool-carrier, a record suitably perforated to cooperate with mechanism intervening between said record and said motion causing mechanism whereby the perforations of the record are adapted to control the motions of the tool-carrier, said intervening mechanism, said record having some of its perforations causing motion in one direction, and others in the opposite direction, each direction of motion having corresponding to it at least two sets of perforations in different lateral locations on the record.

7. In a machine of the character described, the combination with a machine bed of a turret tool-carrier, mechanism for causing motion of the tool-carrier, a record suitably perforated automatically to effect the desired motion of said tool-carrier.

8. In a machine of the character described, the combination with a machine bed and a tool-carrier mounted thereon, of mechanism for causing the motion of the tool-carrier, a plurality of stops, a perforated record, a plurality of tracker ducts, fluid pressure actuated means, adapted to be controlled by the relative motion of the record and tracker ducts and the perforations of the record, suitably constructed to control said motion causing mechanism and the operation of said stops.

9. In a machine of the character described, the combination with a machine bed and a tool-carrier mounted thereon of mechanism for causing the motion of the tool-carrier, a plurality of stops, a record provided with suitable means automatically to effect the desired motion of the tool-carrier and the desired operation of said stops, said record

having some of said means so located as to actuate the stops to arrest the motion of the tool-carrier at the same time others of said means call for motion of said carrier against said stops.

10. In a machine of the character described, the combination of a tool-carrier, a plurality of stops, a record provided with suitable means automatically to effect the desired motion of the tool-carrier and the desired operation of the stops, mechanism for causing the motion of the tool-carrier being suitably constructed to allow slippage between some of its parts, the grip between said parts being sufficient to hold for cutting but to give when said carrier is arrested by a stop.

11. In a machine of the character described, the combination with a machine bed and a tool-carrier mounted thereon, of a variable speed mechanism for causing the motion of the tool-carrier, a plurality of stops, a record suitably perforated automatically to effect the desired successive speeds and directions of motion of said tool-carrier and the desired operation of said stops, said stops being suitably constructed to arrest the motion of the tool-carrier when called for and as selected by the perforations of the record.

12. In a machine of the character described, the combination with a machine bed and a tool-carrier mounted thereon of variable speed mechanism for causing the motion of the tool-carrier, mechanism for varying the spindle speed, a plurality of stops, a record provided with suitable means automatically to effect the desired successive speeds and directions of motion of the tool-carrier, the desired successive spindle speeds and the desired operation of said stops, said stops being suitably constructed to arrest the motion of the tool-carrier when called for and as selected by the record.

13. In a machine of the character described, the combination with a machine bed and a tool-carrier mounted thereon, of mechanism for causing the motion of the tool-carrier, mechanism for varying the spindle speed, a plurality of stops, a record suitably perforated automatically to effect the desired motion of the tool-carrier, the desired spindle speeds, and the desired operation of said stops, said stops being suitably constructed to arrest the motion of the tool-carrier when called for and as selected by the perforations of the record.

14. In a machine of the character described, the combination with a machine bed and a tool-carrier mounted thereon, of a plurality of clutches for controlling the motion of the tool-carrier, a plurality of stops, a record suitably perforated automatically to effect the desired successive engagements and disengagements of said clutches and the

desired operation of said stops, said stops being suitably constructed to arrest the motion of the tool-carrier when called for and as selected by the record.

15. In a machine of the character described, the combination with a machine bed and a tool-carrier mounted thereon of variable speed mechanism for causing the motion of the tool-carrier, mechanism for varying the spindle speed, a record suitably perforated automatically to effect the desired successive speeds and directions of motion of the tool-carrier, and the desired successive spindle speeds.

16. In a mechanism of the character described, the combination of a body suitably mounted to have motion, supporting means upon which said body is movable, mechanism for causing said motion in reversible directions, engaging means traveling with said body, stationary means with which said traveling means engage, a record provided with suitable means, automatically to control the directions of motion of said body and to control the selective engagement of said engaging means with said stationary means whereby the extents of said motion are controlled and means for automatically feeding said record.

17. In a mechanism of the character described, the combination of a body suitably mounted to have motion, supporting means upon which said body is movable, mechanism for causing said motion in reversible directions, selective means suitably set for stopping the motion of the body at predetermined positions, a record suitably prepared, automatically to control the directions of motion of said body and to control the action of said means for stopping the body and means suitably constructed for automatically feeding said record with a continuous motion.

18. In a mechanism of the character described, the combination of a body suitably mounted to enable it to have simultaneous motion along at least two components, supporting means upon which said body is movable, for each component, mechanism for causing motion of the body in reversible directions along each component supporting means, adjustably locatable selective means for stopping the motion of the body at predetermined positions, a set for each component supporting means, a record provided with suitable means automatically to control the directions of motion of said body along said component supporting means and to control the action of said selective means.

19. In a machine of the character described, the combination with a machine bed of a turret tool-carrier, mechanism for causing motion of said tool-carrier, selective means for stopping the motion of said tool-carrier at predetermined positions, a record

suitably prepared automatically to control the directions of motion of said tool-carrier and to control the action of said selective means.

5 20. In a machine of the character described, the combination with a machine bed and a tool-carrier mounted thereon, of mechanism for causing the motion of the tool-carrier, selective means suitably set for stopping the motion of said tool-carrier at predetermined positions, a record suitably perforated automatically to control the directions of motion of said tool-carrier and to control the action of said selective means.

15 21. In a mechanism of the character described, the combination of a body suitably mounted to have motion, supporting means upon which said body is movable, mechanism for causing said motion, selective means for stopping the motion of the body at predetermined positions, a record provided with suitable means to effect the desired motion of said body and the desired operation of said selective means, said record having marks so located as to effect the stopping of said body at the same time other marks call for motion of said body, said motion causing mechanism being suitably constructed to give under the resulting strain.

25 22. In a mechanism of the character described, the combination of a body suitably mounted to have motion, supporting means upon which said body is movable, mechanism for causing said motion, adjustably locatable engaging means traveling with said body, stationary means with which said traveling means engage, a record provided with suitable means automatically to control the directions of motion of said body and to control the selective engagement of said engaging means with said stationary means.

30 23. In a mechanism of the character described, the combination of a body suitably mounted to have motion, supporting means upon which said body is movable, mechanism for causing said motion, engaging

means traveling with said body, adjustably locatable stationary means with which said traveling means engage, a record provided with suitable means automatically to control the directions of motion of said body and to control the selective engagement of said engaging means with said stationary means.

35 24. In a mechanism of the character described, the combination of a body suitably mounted to have motion, supporting means upon which said body is movable, mechanism for causing said motion, pneumatically operated selective means suitably set for stopping the motion of the body at predetermined positions, a record suitably perforated, automatically to control the directions of motion of said body and to control the action of said selective means.

40 25. In a mechanism of the character described, the combination of a body suitably mounted to have motion, supporting means upon which said body is movable, a source of fluid pressure, fluid pressure operated mechanism for causing said motion, selective means suitably set for stopping the motion of the body at predetermined positions, a record suitably perforated, automatically to control the fluid pressure of said motion causing mechanism and to control the action of said selective means.

45 26. In a mechanism of the character described, the combination of a body suitably mounted to have motion, supporting means upon which said body is movable, a source of fluid pressure, a plurality of clutches for controlling the motion of said body, a plurality of fluid pressure actuated means for operating said clutches, selective means suitably set for stopping the motion of the body at predetermined positions, a record suitably perforated, automatically to control the pressure in said clutch operating means and to control the action of said selective means.

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