W. ARTER.

GRINDING AND SIMILAR MACHINE.

APPLICATION FILED JUNE 14, 1917.

1,324,992.

Patented Dec. 16, 1919.

2 SHEETS—SHEET 1.

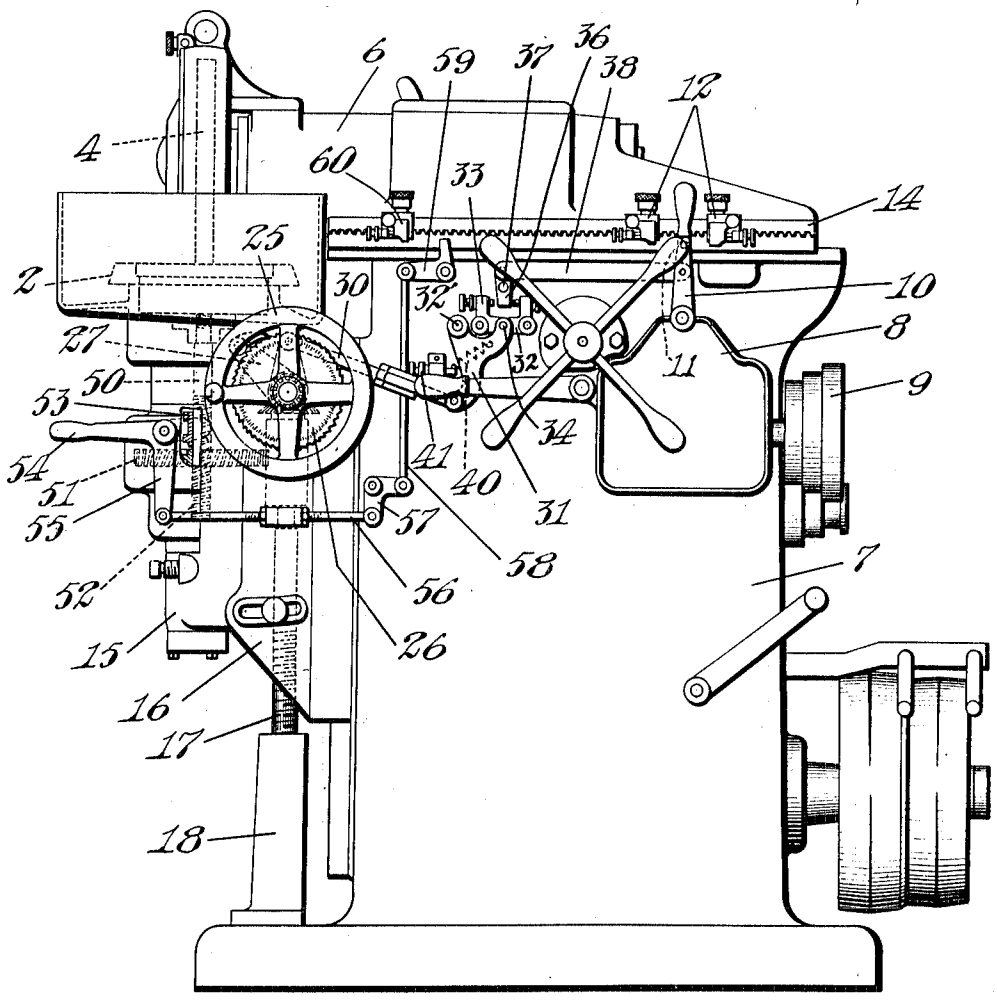


Fig.1.

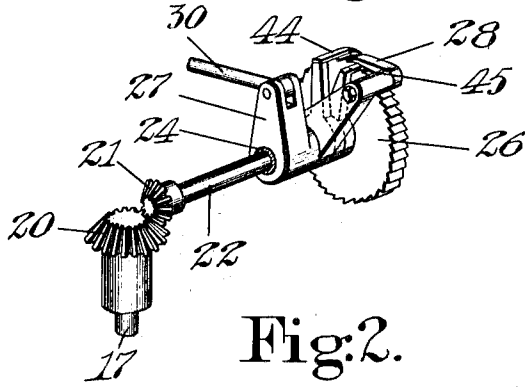


Fig.2.

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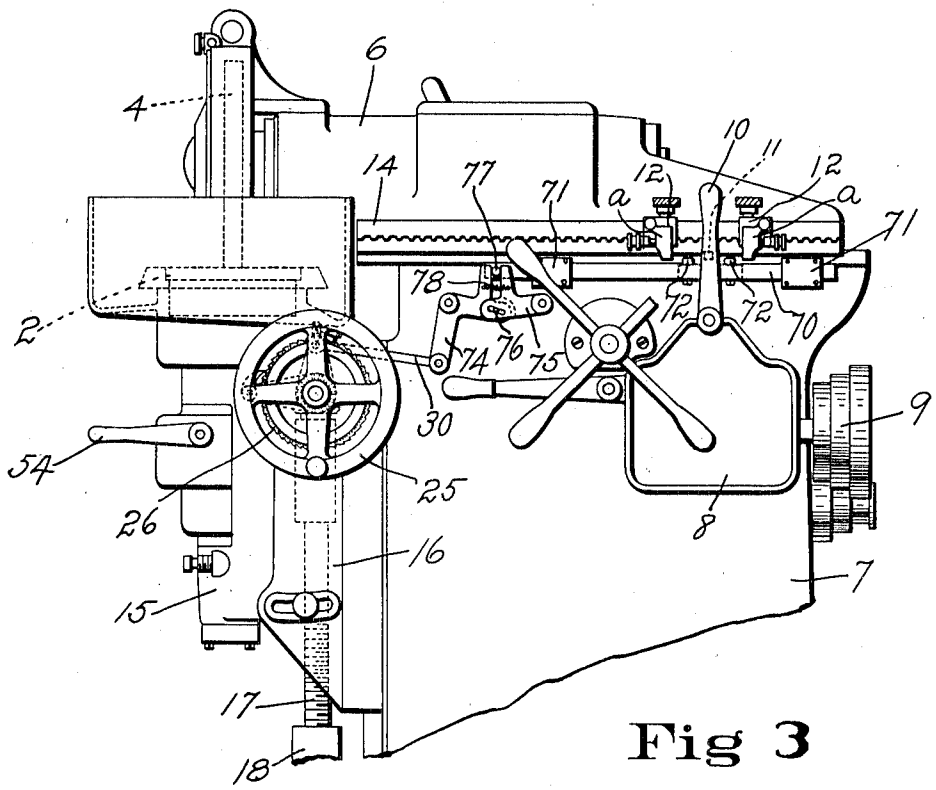


Fig 3

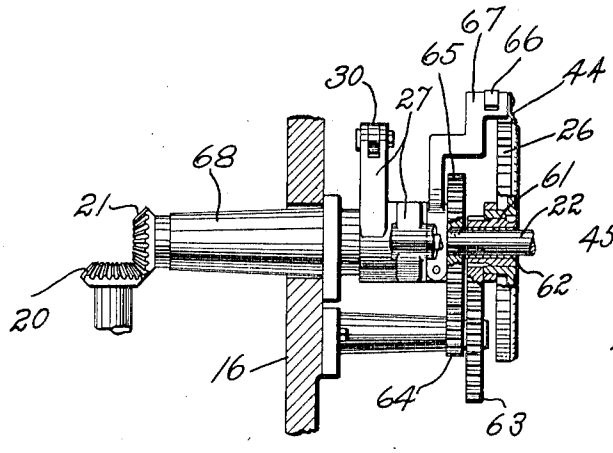


Fig 5

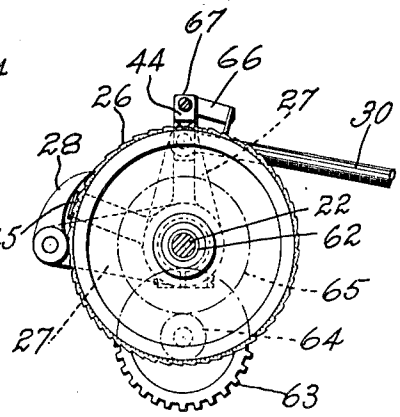


Fig 4

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UNITED STATES PATENT OFFICE.

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GRINDING AND SIMILAR MACHINE.

1,324,992. Specification of Letters Patent. Patented Dec. 16, 1919.

Application filed June 14, 1917. Serial No. 174,795.

To all whom it may concern:

Be it known that I, WILLIAM ARTER, a subject of the King of Great Britain, residing at 540 Salisbury street, Worcester, in the county of Worcester and State of Massachusetts, have invented certain Improvements in Grinding and Similar Machines, of which the following description, in connection with the accompanying drawings, is a specification, like reference characters on the drawings indicating like parts in the several figures.

This invention relates to grinding machines and similar machine tools, and has for its chief object to devise means for relieving the operator of certain duties now required of him, to increase the production of machines of this type and to render them more automatic in their action. These, and other objects of the invention, and the means by which it is proposed to accomplish them, will appear more fully in the following description of the embodiment of the invention now preferred by me, reference being made to the accompanying drawings, in which

Figure 1 is a view in side elevation of a grinding machine constructed in accordance with this invention;

Fig. 2 is a perspective view showing a detail of construction of the chuck elevating mechanism of the machine shown in Fig. 1;

Fig. 3 is a view similar to Fig. 1 of a modified construction;

Fig. 4 is a front elevation showing, on a somewhat larger scale than Fig. 3, certain details of construction of the chuck elevating mechanism of this machine; and

Fig. 5 is a left side elevation of the parts shown in Fig. 4, certain of the parts being shown in cross section for the purpose of illustrating more clearly the details of construction.

The machine shown in Figs. 1 and 2 comprises a work supporting chuck 2, and a grinding wheel 4, which is mounted on a horizontal shaft supported in bearings carried by a table or carrier 6 that reciprocates on suitable ways formed on a machine frame or bed 7. This reciprocating movement carries the wheel 4 or other tool back and forth across the work supporting chuck 2 and the wheel of course is rotated rapidly while this movement is taking place. The carrier 6 is given its reciprocating movement by means that include a reversing mechanism, which is inclosed in a casing 8, and to which power is applied by a belt running on any one of a series of pulleys 9. This reversing mechanism may be of any suitable type, but preferably is either of the construction shown in a co-pending application Serial No. 96,101 filed by me May 8, 1916, or like that shown in Patent No. 1,184,905, granted May 30, 1916, both said application and patent being assigned to the assignee of the present invention. This reversing mechanism includes a reversing lever 10 and a pair of dogs 12, the construction of which is clearly shown and described in the White application, above designated, and which are adjustable into any position on a rack 14 that is bolted to the side of the carrier 6. These dogs through engagement with a pin 11 projecting from the lever 10, operate the lever which, in turn, operates through the reversing mechanism to reciprocate the carrier 6 on its ways. This general organization is similar to that which has long been employed in machines of this type and will be readily understood by those skilled in this art.

The chuck 2 is supported by a bracket 15, which is mounted on a slide 16 that may be raised or lowered to adjust the chuck properly with reference to the grinding wheel 4. This slide moves on vertical ways formed on the front of the frame 7, and for the purpose of raising or lowering it, it carries a vertical shaft 17, the lower end of which is threaded into a post 18 that rests on the base of the machine. This screw threaded shaft 17 is freely rotatable in the slide 16, but cannot move vertically with reference to the slide. Consequently, when this shaft is rotated it will be threaded into or out of the post 18, depending on its direction of rotation, and will move the slide 16 up or down. For the purpose of rotating the shaft 17 in this manner, a beveled gear 20 is mounted fast on the upper end of the shaft and meshes with a beveled pinion 21 secured fast on a horizontal shaft 22 that rotates in a bearing bushing or bracket 24, which is carried by the slide 16. A hand wheel 25 mounted fast on the end of the shaft 22 provides a convenient means for

turning this shaft and thus rotating the screw threaded shaft 17.

The present invention provides automatic means for operating this screw elevating or feeding mechanism for the chuck. This automatic means comprises a toothed ratchet wheel 26 mounted fast on the shaft 22 just behind the hand wheel 25, and a bell crank lever 27 mounted to oscillate on the bushing 24 and carrying a gravity pawl 28 that engages the teeth of the ratchet wheel 26. An adjustable link 30 connects one arm of the bell crank lever 27 with an arm of a similar lever 31 which is fulcrumed at 32'. Two smaller bell crank levers 32 and 33 are fulcrumed adjacent to the member 31 and have arms that extend horizontally toward each other, as clearly shown in Fig. 1. The ends of these arms overlap each other and each has a horizontal slot formed in it through which extends a pin 34 that is secured fast in one arm of the bell crank lever 31. These three levers 31, 32 and 33 are so located, as will be clear from an inspection of Fig. 1, that when the vertical arms of the levers 32 and 33 are swung away from each other, they will lift the pin 34 and consequently will swing the bell crank lever 31 in a counter-clockwise direction. This movement will be transmitted through the link 30 to the bell crank lever 27, and will swing the pawl 28 forward, thus causing it to turn the ratchet wheel 26 in a clockwise direction, as this wheel appears in Fig. 1. This movement of the bell crank levers 32 and 33 is produced by a short lever 36 fulcrumed at 37 and connected by a link 38 with the lever 10 of the reversing mechanism. Each of the levers 32 and 33 carries in its vertical arm an adjustable screw which points toward the lower end of the lever 36, and is engaged by this part of the lever when it is swung about its fulcrum 37.

As the carrier 6 travels back and forth to give the wheel 4 its operative stroke, the dogs 12 act at the ends of the stroke of the carrier to swing the lever 10 first to the right and then to the left, thus reversing the movement of the carrier at a point in each stroke determined by the location of the dogs. This movement of the lever 10 is transmitted through the link 38 to the lever 36 and causes this lever to swing one or the other of the levers 32 or 33, depending on the direction in which it is moved by the link 38, and this movement of either of the bell crank levers 32 and 33 acts in the manner just described to transmit a feeding movement to the ratchet wheel 26 and consequently to effect an elevating movement of the chuck 2. A spring 40 connected at one end to the swinging lever 31 and at its opposite end to the machine frame, tends to hold this lever against an adjustable stop screw 41, and this spring returns the lever 31 to its original position after each actuation or movement produced by the lever 36. By adjusting the stop screw 41 the extent of this return movement may be adjusted, and consequently the throw, or extent of the feeding movement of the pawl 28, can be adjusted. This adjustment can also be effected by varying the distance that the stop screws carried by the levers 32 and 33 project toward the lever 36. In this connection it will, of course, be understood that the throw of the lever 36 is substantially constant.

The front face of the ratchet wheel 26 is graduated, as shown in Fig. 1, and a pointer 44 (see Fig. 2) mounted fast on the stationary bushing 24 coöperates with these graduations to indicate the extent of the feeding or elevating movement of the chuck.

It is sometimes convenient to be able to set the chuck elevating mechanism to feed automatically a certain distance, say, for instance, fifteen thousandths of an inch and then stop automatically. For this purpose a throw-out finger 45 (see Fig. 2) is mounted frictionally on the shaft 22 just behind the ratchet wheel 26 so that this finger will rotate with the shaft 22, but can be rotated relatively to the shaft by hand for the purpose of setting it. If this finger is set back to the left (as seen in Fig. 1) a certain distance, say fifteen thousandths of an inch, as shown by the graduations on the ratchet wheel 26, and the feeding mechanism is then started, it will automatically elevate the chuck 2, step by step, the desired distance; at which time the finger 45 will be brought under the pawl 28 and lift it off the wheel 26 and keep it from engaging the teeth of the ratchet wheel while it is at the backward part of its stroke. Any further feeding movement of the wheel thus is prevented. The pawl, of course, will continue to oscillate, but will merely ride back and forth on the finger 45 and out of contact with the teeth of the wheel 26.

It will be evident that by arranging this mechanism so that it is operated by the reversing mechanism, any necessity for an independent set of reversing dogs is avoided, and also that the feeding movement of the chuck is effected substantially at the end of the stroke of the grinding wheel 4. Usually the movement of the carrier is so adjusted that the wheel will clear the work at each end of its stroke and it is, of course, desirable to effect the feeding movement of the chuck at this time. The feeding mechanism above described obviously meets this requirement. It will readily be appreciated also that the same feeding movement is effected on either stroke, although if it is desired to have the chuck elevated at the end of one stroke and not at the end of the other, it is merely necessary to back out the set

screw in the lever 32 or 33 which it is desired to render inoperative. Furthermore, since the carrier 6 is power driven, and since the chuck elevating mechanism is operated by a movement of the carrier, these movements are effected positively and the mechanism thus is absolutely reliable in its operation.

The chuck used in machines of this type usually is mounted to rotate. For this purpose the chuck 2 is supported on the upper end of a shaft 50, which rotates freely in suitable bearings carried by the bracket 15. The shaft 50 carries a beveled gear 51, which is driven by another beveled gear 52 to which power is applied in any convenient manner. The gear 51 normally rotates freely on the shaft 50, but is thrown into or out of driving engagement with the shaft by means of a clutch sleeve 53, which is keyed to the shaft so that it can slide up or down, toward or from the gear 51, to render the gear inoperative or operative to drive the shaft 50. This movement is imparted to the sleeve 53 by a hand lever 54 which carries a pair of studs or rolls that run in the groove of the sleeve 53. This mechanism is substantially like that shown in my application above referred to for throwing the power on or off the carrier 6.

The present invention provides an automatic means for operating the clutch that controls the driving mechanism for the chuck shaft. For this purpose the lever 54 has a depending arm 55 formed on it. This arm is connected by an adjustable link 56 with a bell crank lever 57, which is connected by another link 58 with a bell crank lever 59 having an arm lying in the path of movement of a dog 60. This dog is like the dogs 12, and is adjustably mounted on the rack 14 in the same way that the dogs 12 are mounted. Accordingly, when this dog strikes the bell crank lever 59, as the carrier 6 moves toward the right, it will operate through the connections just described to swing the lever 54 about its fulcrum in a counter-clockwise direction, and thus move the clutch sleeve 53 into its raised or inoperative position. This, of course, stops the rotation of the chuck; but in order to start the chuck again it is merely necessary for the workman to lift the lever 54 and throw in the clutch.

This mechanism is very convenient in grinding some kinds of parts in which it is desired to have the wheel 4 make only a single reciprocation or a single stroke across the work. The workman stands in front of the chuck 2 and as the wheel 4 moves back to the right, Fig. 1, out of engagement with the work, the dog 60 stops the rotation of the chuck automatically as the grinding wheel 4 nears the rearward limit of its stroke. The workman then removes from the chuck the piece of work last ground and replaces it by another piece. This operation takes but an instant. The workman then lifts the lever 54, thus throwing the clutch 53 in again, and starts the chuck to rotating before the wheel 4 comes into contact with the work. The automatic movement of the clutch is effected in timed relationship to the reciprocating movement of the tool 4; and the workman thus is relieved of the duty of stopping the chuck at a time when his entire attention is needed in handling the work. It is obvious, of course, that this clutch might be thrown in again by a spring or by a dog as the table advances, but for most conditions this additional control of the chuck is not necessary.

A modified form of automatic chuck elevating mechanism is shown in Figs. 3, 4, and 5, and inasmuch as many of the parts of this mechanism are substantially the same as those shown in Figs. 1 and 2 the same reference numerals are applied to them in these figures that are used to designate them in the views above described. In this arrangement a back gearing is interposed between the shaft 22 and the ratchet wheel 26. As clearly shown in Fig. 5 the ratchet wheel 26 is keyed on the hub of a pinion 61 that rotates freely on a bushing 62 which is supported on the shaft 22. This pinion 61 meshes with a gear 63 that is mounted to rotate freely on a stub shaft supported by the machine frame. A second pinion 64 rotates with the gear 63 and meshes with a gear 65 that is keyed to the shaft 22. In other words, this mechanism constitutes a reduction gearing through which the movements of the ratchet wheel 26 are transmitted to the shaft 22.

The thrown-out finger 45 is mounted on the hub of the ratchet wheel 26, as in the construction previously described. This modified construction also includes a gravity pawl 66 pivoted to the upper end of a stationary arm 67 that is supported on the bearing 68 for the shaft 22. This pawl prevents any back lash of the ratchet wheel. The pointer 44 also is secured to the upper end of the stationary arm 67.

The operating mechanism for the ratchet wheel 26 comprises a horizontal bar 70 mounted to slide through suitable bearing pieces 71 that are bolted to the frame 7. This bar is slotted to receive two adjustable stops or dogs 72. Each of these stops consists of a bolt head, toothed on its under side to engage corresponding teeth formed on the upper edge of the bar 70, and provided with a nut by means of which the bolt teeth are held securely in mesh with the bar teeth. This bar slides just back of the handle 10 and the stops 72 project high enough to engage the pin 11 on the handle 10 and to be engaged by the adjustable members *a* of the dogs 12. Consequently, when these

members *a* are set down low enough to engage the stops 72, one of the dogs 12 will push its corresponding stop 72 in the direction in which the table 6 is moving, and the stop so moved will engage the pin 11 and move the handle 10 thus throwing the reversing mechanism into operation and producing a reversal of the movement of the table 6.

The movement of the bar 70 produced in this manner is transmitted to the ratchet wheel 26 through mechanism that includes two bell crank levers 74 and 75, connected by a pin 76 carried by one lever and working in a slot formed in the other lever, these levers being provided with upstanding arms arranged to engage opposite sides of a pin 77 fixed in the bar 70. A spring 78 holds the upright arms of the levers 74 and 75 in engagement with the pin 77.

It will now be evident that if the movement of the bar 70 produced in the manner above described is toward the left, Fig. 3, this movement will be transmitted through the pin 77, lever 74 and link 30 to the bell crank lever 27, thus oscillating this lever and operating through the pawl 28 to move the ratchet wheel 26 forward and thus to elevate the chuck. If the movement of the bar 70 is in the reverse direction, that is, toward the right, then this movement will be transmitted through the pin 77, bell crank lever 75 and pin 76 to the other bell crank lever 74 and thence, as before, to the pawl 28 and the ratchet wheel 26. The extent of these movements obviously will depend on the adjustment of the stops 72 on the bar 70.

This mechanism has some advantages over that shown in Figs. 1 and 2 since the presence of the back gearing reduces the strain on the parts through which the motion of the table 6 is transmitted to the ratchet wheel 26 and it also provides for a finer adjustment of the chuck elevating movement. There is also less danger of back lash in this construction than in that previously described. It is obvious that whenever it is desired to discontinue the use of the automatic chuck elevating mechanism it is merely necessary for the workman to adjust the parts *a* of the dogs 12 into a position high enough to cause them to clear the tops of the stops 72. If it is desired to have the chuck elevating movement occur at the end of one stroke only of the table 6, then the proper dog 12 is adjusted to render it incapable of engaging its corresponding stop 72. Preferably the dogs used are constructed as shown and described in the patent above designated so that this adjusting movement may be conveniently made.

While convenient embodiments of the invention have been herein shown and described it is obvious that the invention is not limited to the specific embodiments disclosed but that many changes in details of construction and in arrangement of the parts may be made within the skill of the mechanic and the discretion of the designer while still retaining the essential characteristics of the invention.

What is claimed as new is:

1. In a machine of the character described, the combination with a work support, a tool and a carrier for one of said devices mounted to reciprocate to transfer the point of operation of the tool over the work, of mechanism arranged to be operated by the carrier to effect a relative feeding movement of said tool and work support, said mechanism comprising a ratchet, a pawl and lever connections through which the motion of the carrier in either direction may be transmitted to the pawl to operate said ratchet.

2. In a machine of the character described, the combination with a work support, a tool and a carrier for one of said devices mounted to reciprocate to transfer the point of operation of the tool over the work, of mechanism arranged to be operated by the carrier to effect a relative feeding movement of said tool and work support, said mechanism comprising a pawl and ratchet and adjustable means for automatically throwing the pawl out of operative relationship to the ratchet when a feeding movement of substantially predetermined extent has been effected.

3. In a machine of the character described, the combination with a work support, a tool and a carrier for said tool mounted to reciprocate in substantially a horizontal plane to carry the tool back and forth across said support, of adjustable reversing dogs on said carrier, and elevating mechanism for said support constructed and arranged to be operated by said dogs.

4. In a machine of the character described, the combination with a work support mounted to be raised, and lowered, a tool, and a carrier for said tool mounted to reciprocate in substantially a horizontal plane to carry the tool back and forth across said support, of a screw elevating mechanism for said support, pawl and ratchet means for operating said mechanism, adjustable dogs on said carrier, and means operated by said dogs for operating said pawl and ratchet mechanism.

5. In a machine of the character described, the combination with a work support mounted to be raised and lowered, a tool, and a carrier for said tool mounted to reciprocate in substantially a horizontal plane to carry the tool back and forth across said support, of a screw elevating mechanism for said support, pawl and ratchet means for operating said mecha-

nism, a swinging member connected with said pawl and ratchet mechanism to operate it, a pair of levers connected with said member, a pair of dogs adjustably mounted on said carrier, and a device arranged to be operated by said dogs and operative to rock said levers.

6. In a machine of the character described, the combination with a work support and a tool mounted for reciprocating movement across said support, of means operative automatically to give said support an elevating movement substantially at the end of each stroke of said tool, and adjustable means for automatically rendering said automatic elevating means inoperative when it has given said support a predetermined elevating movement.

7. In a machine of the character described, the combination with a work supporting chuck, a tool, and a carrier for said tool mounted for reciprocating movement to carry the tool back and forth across said chuck, of means for rotating said chuck, and connections whereby said means is controlled by said carrier.

8. In a machine of the character described, the combination with a work supporting chuck, a tool, and a carrier for said tool mounted for reciprocating movement to carry the tool back and forth across said chuck, of means for rotating said chuck, said means including a clutch, and controlling mechanism for said clutch arranged to be operated by said carrier.

9. In a machine of the character described, the combination with a work supporting chuck, a tool, and a carrier for said tool mounted for reciprocating movement to carry the tool back and forth across said chuck, of means for rotating said chuck, said means including a clutch, a dog adjustably mounted on said carrier, and mechanism arranged to be operated by said dog to throw out said clutch.

10. In a machine of the character described, the combination with a work supporting chuck, a tool, and a carrier for said tool mounted for reciprocating movement to carry the tool back and forth across said chuck, of means for rotating said chuck, and mechanism for controlling said means automatically in timed relationship to the movement of said carrier.

11. In a machine of the character described, the combination with a work support mounted to be raised and lowered, a tool, and a carrier for said tool mounted for movement to carry the tool over the face of said support, of an elevating mechanism for said support, a reduction gearing arranged to operate said mechanism, and a step by step actuating mechanism for said gearing arranged to receive its motion from the movement of said carrier.

12. In a machine of the character described, the combination with a work support mounted to be raised and lowered, a tool, and a carrier for said tool mounted for movement to carry the tool over the face of said support, of an elevating mechanism for said support, and a step by step operating mechanism therefor constructed and arranged to transmit motion from said carrier to said elevating mechanism including a pair of connected bell crank levers through which the motion of the carrier is transmitted.

13. In a machine of the character described, the combination with a work support, a tool, and a carrier for one of said devices mounted to reciprocate to transfer the point of operation of the tool over the work, of mechanism arranged to be operated by the carrier when it arrives substantially at the end of its stroke to effect a relative feeding movement of said tool and work support.

14. In a machine of the character described, the combination of a work support mounted to be raised and lowered, a tool, a carrier for said tool mounted for reciprocating movement relatively to said work support to transfer the point of operation of the tool over the work, a screw elevating mechanism for said support, pawl and ratchet means for operating said mechanism, a pair of bell crank levers connected together to cause the movement of one lever about its fulcrum to move the other lever in the opposite direction, means operating in unison with said carrier for moving said levers, and connections through which the movement of said levers operates said pawl and ratchet mechanism.

In testimony whereof I have signed my name to this specification.

WILLIAM ARTER.