

Feb. 25, 1936.

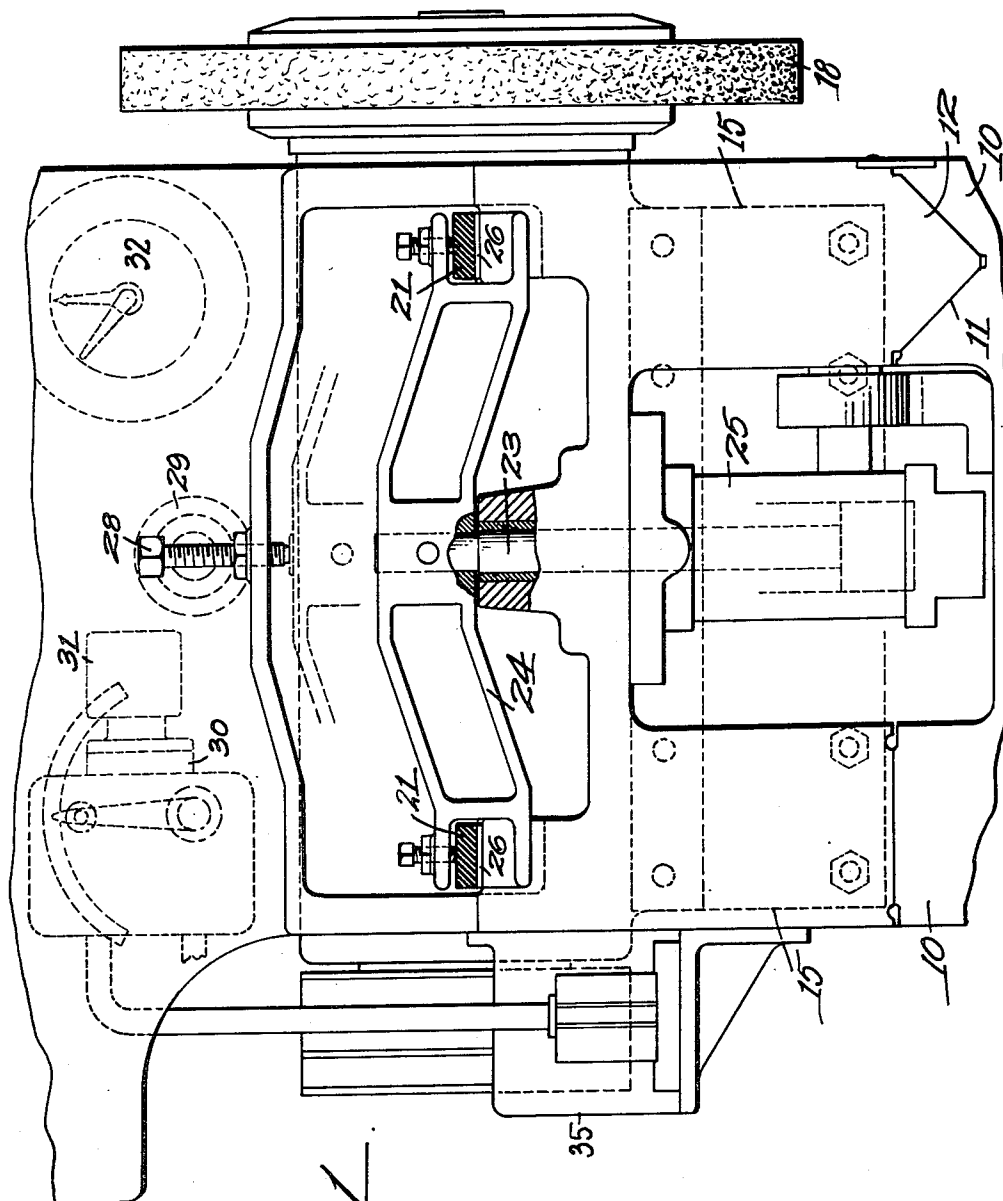
G. S. GOULD

2,032,011

SELF CONTAINED GRINDING WHEEL HEAD

Filed May 7, 1935

4 Sheets-Sheet 1



Feb. 25, 1936.

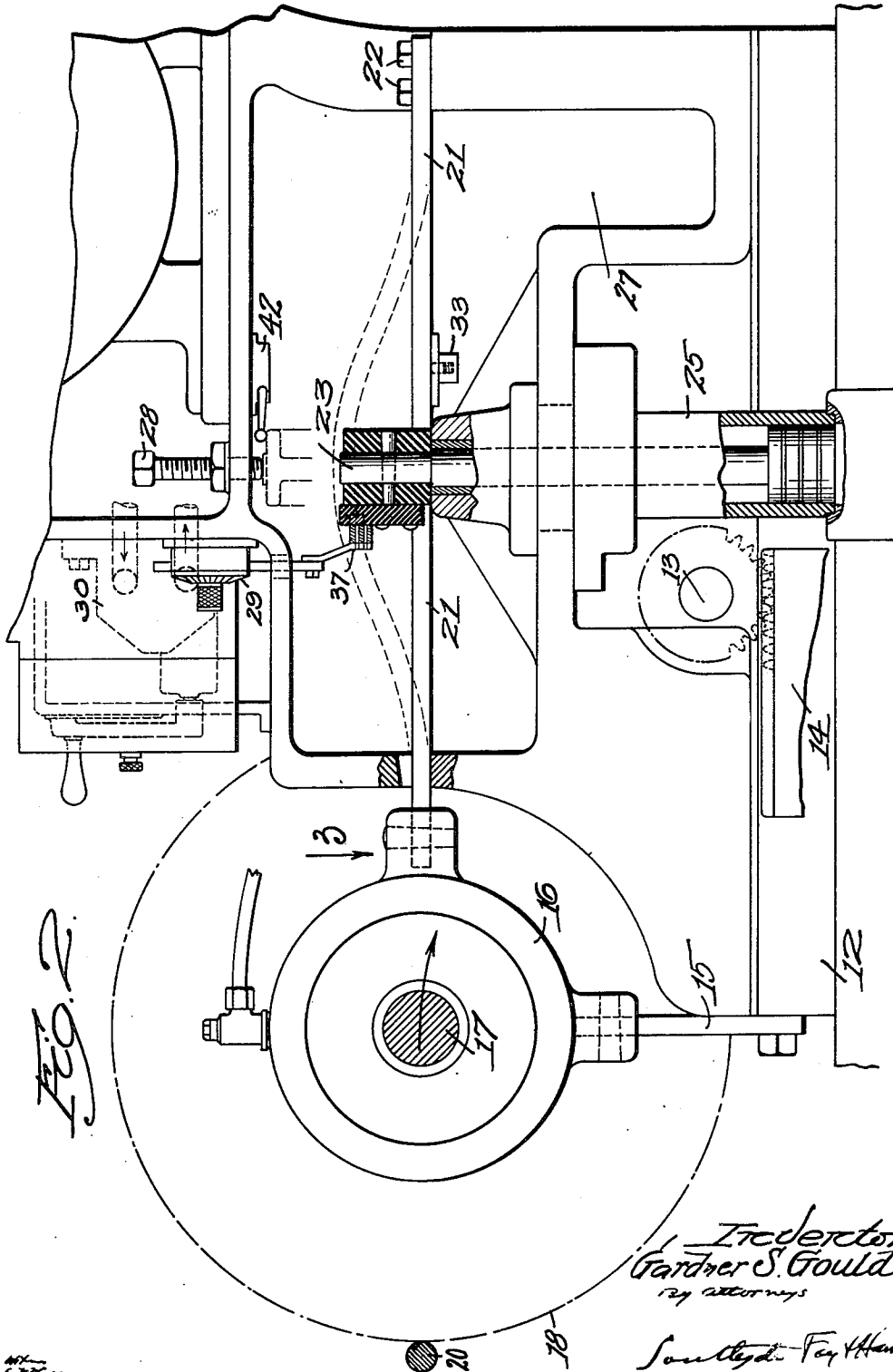
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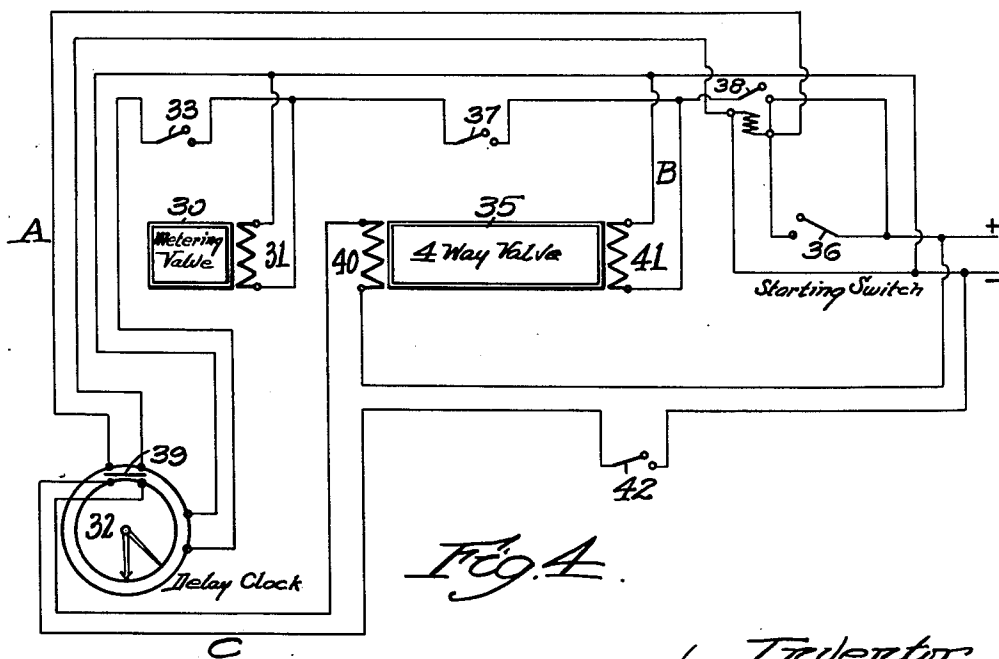
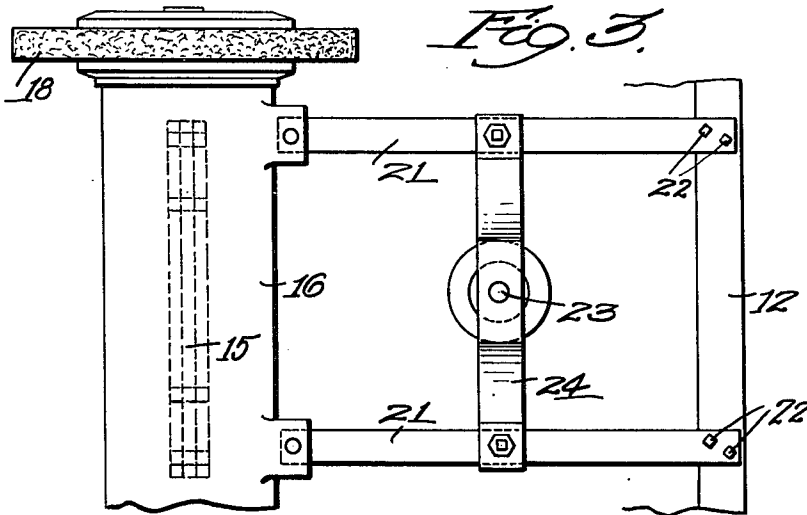
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4 Sheets-Sheet 3



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4 Sheets-Sheet 4

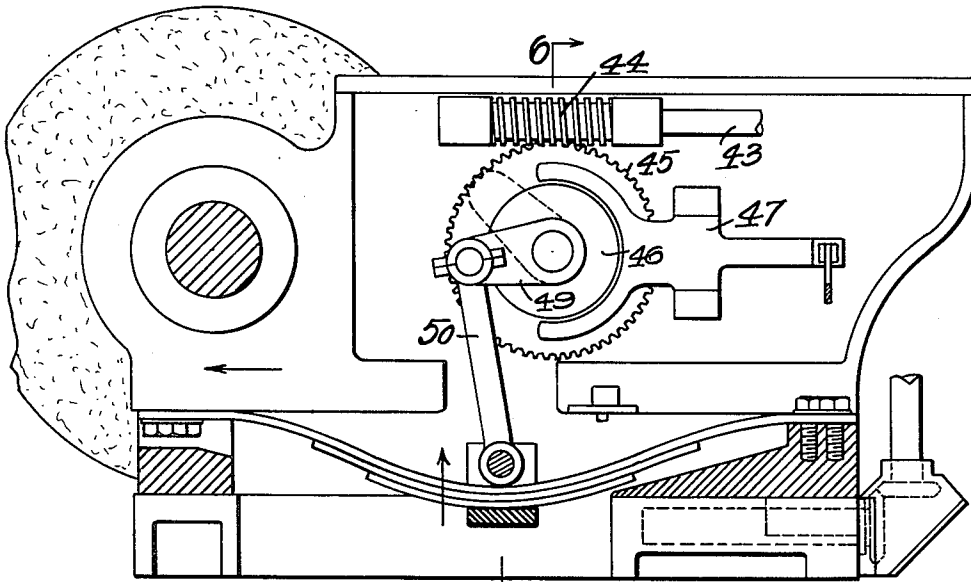


Fig. 5.

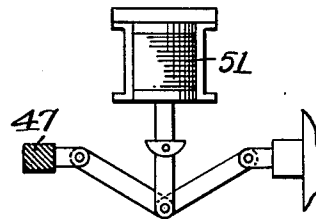


Fig. 7.

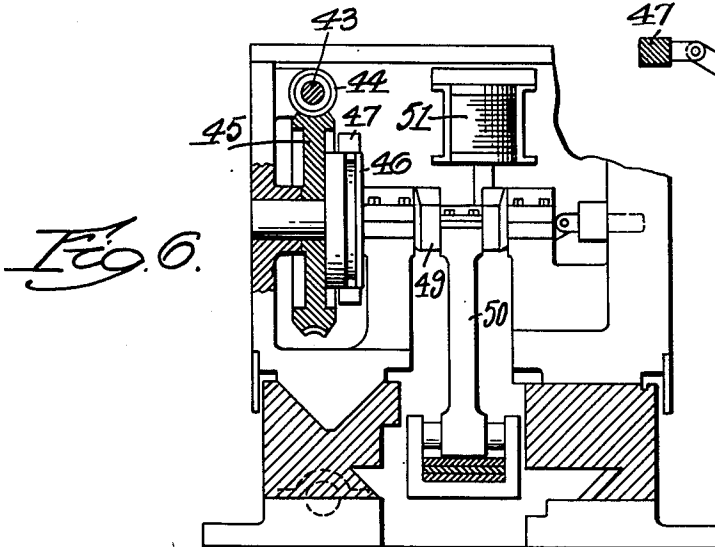


Fig. 6.

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2,032,011

SELF CONTAINED GRINDING WHEEL HEAD

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Application May 7, 1935, Serial No. 20,150

11 Claims. (Cl. 51-166)

The principal objects of this invention are to provide a head and slide for a grinding wheel or other tool, with wheel advance, wheel feed and grinding dwell, built in one unit so that there is no mechanical connection with the base of the machine except the means for holding the unit on the base and so that in some cases it can be sold as a replacement head; to provide a construction in which special grinders may be built up with a standard head, for the reason that the head may be positioned anywhere on the base and the unit can be arranged either right or left hand and two heads may be mounted on the same machine for certain jobs; to provide a most accurate feed for the duplication of size in grinding or other metal working operations; to provide a construction in which there is no back lash whatever from feed screws, levers, etc. which has been a fault to which all grinding machines heretofore have been subject; to provide a construction in which the time is set on a dial for the dwell and the elapsed time will be accurately duplicated for each grinding operation so that each grinding cycle will be an exact duplicate of the one before and give the same work size; to build the head in such a simple way that all the machining operations are very simple as is also the assembly of the tool, in so far as alignment and accessibility are concerned, while the cost, as compared with other makes of wheel heads, is reduced, and to provide a head in which the only variables are in the oil film in the wheel spindle and the wear of the wheel. The variation in the oil film cannot be obviated and the spindle wear is corrected when necessary with the diamond, which is set at the work size so the wheel head can be moved up on its slide in order to size the wheel.

Other objects and advantages of the invention will appear hereinafter.

Reference is to be had to the accompanying drawings, in which

Fig. 1 is a rear elevation of a wheel head constructed in accordance with this invention and shown partly in section on a central plane;

Fig. 2 is a side view of the same also shown partly in section on a central plane;

Fig. 3 is a fragmentary plan;

Fig. 4 is a wiring diagram;

Fig. 5 is a view similar to Fig. 2 showing a modification;

Fig. 6 is an end view of the same, and

Fig. 7 is a side view of the clutch operating solenoid.

A machine is shown in Figs. 1 to 4 in such a

form that the working cycle is controlled both electrically and hydraulically so that the working feed can be set to a predetermined rate and easily adjusted. The dwell time is controlled by an accurate elapsed time switch. Certain features of the invention can be arranged without the hydraulic and electrical arrangements shown and the head can be adapted for full automatic grinders on a magazine feed on certain operations.

This head is essentially built for a small parts grinder in which an 18" diameter wheel is a comparatively large one. When the machine is sold as a replacement head it is also to be employed in a field using small diameter wheels. This would be so especially in cases where the machines are tooled up for special operations but would not warrant the expense of an entirely new machine. In such a case this would make the machine a semi-automatic installation instead of a conventional one.

This head, whether sold with the rest of the grinding or metal working machine or as a replacement part, is mounted on a base 10 which has ways 11 for guiding a wheel slide 12. This wheel slide, as a whole, is adapted to be operated through a shaft 13 having a hand wheel, not shown. This shaft has a pinion meshing with a rack 14 on the wheel slide. Also fixed on the wheel slide is a steel strip 15, shown vertical in this case, which carries the wheel housing 16. Within this wheel housing is the shaft 17 having the usual bearings and any desired kind of lubrication and carrying a grinding wheel 18 or other metal working tool. The grinding wheel operates on the work 20 which is supported in any ordinary way and rotated constantly on the same axis during the grinding operation.

The housing 16 is fixed to two long spring steel strips 21 which are fixed at their opposite ends to the wheel slide by means of bolts 22. This wheel slide carries beds 26 in which these spring strips lie flat when the wheel is in the position for finishing the work. By suitable means these steel strips are moved upwardly in the middle, or downwardly, if desired, to reduce their effective length and pull the wheel housing back from the work for the starting of the operation of grinding.

A vertical shaft 23 carries a straddle arm 24, which is raised and lowered by the piston of a hydraulic cylinder 25. The movement of the piston upward moves the steel spring strips simultaneously and equally. A movement of 2" of the piston upward raises the centers of the steel springs 2" and moves the wheel housing horizon-

tally approximately a half inch. This is a wide allowance because most grinding operations require only an $\frac{1}{8}$ " movement of the grinding wheel. The ratio between the piston travel and the grinding wheel movement can be figured only by a complicated equation but it is sufficient that the ratio is higher in the grinding feed area than in the quick return sector. This combination is just right for ease of control where the feed must be precise.

An oil pump, not shown, is mounted directly on a spindle drive motor shaft. There is an oil reservoir 27 in the wheel slide. A stop screw 28 is mounted on the wheel slide above the straddle arm and set for the amount of return of the wheel head required.

A graduated dial 29 controls a circuit for a metering valve 30 and is calibrated for the amount of feed required. This calibration is graduated from .0 to .050" preferably. Thus, if there is .010" stock on the diameter of the work to be ground, this dial is set to No. 10 on the scale of the dial. In feeding the wheel, when it comes to within .005", for example, of the finished diameter on its rapid advance to the work, a solenoid 31 provided in a convenient place cuts in the metering valve 30 through a switch 37 and the feed is changed to a slow grinding feed.

An elapsed time switch 32 is set by moving the pointer for the dwell time. If five seconds is thought to be sufficient for that a contact switch 33 cuts in when the springs have reached their bedded position so as to connect up the elapsed time switch. At the end of five seconds the switch in the clock opens the circuit controlling the advance movement of the oil by means of a relay, not shown, and closes the opposite solenoid of a four-way valve 35. Now the fluid in the cylinder is reversed on the other side of the piston and the grinding wheel returns to starting position.

The operator depresses the starting switch 36 and the momentary contact through the relay, not shown, closes a switch 38. The circuit A is already closed by a switch 39 mechanically in the time delay clock 32. This circuit keeps the relay energized after the switch 36 is opened and holds a circuit B closed. When oil has moved the piston down so that the switch 37 closes, (start of grinding feed) it energizes a solenoid 31 to meter oil through the valve 30. When the steel strips have bedded, the switch 33 closes to start the time delay clock. Oil pressure holds the mechanism in bedded position. When the delay clock has ticked-off its predetermined time a switch, built in the clock, opens the circuit A and closes the circuit C. A switch 42 is closed by the mechanical movement of steel strips and is already closed. The C circuit energizes a solenoid 40 and, a circuit being open, deenergizes a solenoid 41 and the oil is reversed. When the springs have reached their starting position, a switch 42 is opened and the cycle is ready to start at the operator's convenience. Of course, before this the operator has the work properly loaded in the work head and the pressing of the switch 36 energizes the solenoid to throw the four-way valve so that the piston starts down rapidly and the wheel approaches the work rapidly. When the wheel has returned to its starting position a limit switch 42 opens the circuit for the control of the upward oil movement and all circuits remain open.

In the form shown in Figs. 5, 6 and 7 a shaft 43 gets its rotation from a convenient power source, such as a spindle drive motor, to drive a worm 44 and a worm gear 45 at proper speed. A

conventional friction slip clutch 46 is operated by a fork 47 and the clutch 46 is keyed to a crankshaft 49. By means of a connecting rod 50 the springs are pulled upward until they strike bedded position, when they can go no further and the friction clutch slips through. Otherwise the form of the invention operates in the same way as that shown in the first four figures.

In this case the operator depresses a conveniently located push button, not shown, to energize a solenoid 51 having its circuit through a relay to the release fork 47 so that the clutch drives the crank 49 to the position shown in dotted lines in Fig. 5. Then a switch 52 closes a circuit to start the time delay clock to hold the springs in the bedded position a predetermined time. After this elapsed time the solenoid circuit is opened to release the clutch 46 and the head is returned to starting position by the tension in the springs.

Having thus described my invention and the advantages thereof I do not wish to be limited to the details herein disclosed, otherwise than as set forth in the claims, but what I claim is:

1. The combination with a movable support for a metal working tool, of a flexible spring connected at one end therewith, and fixed at the other end, and means for moving the center of the spring transversely to change the effective length of the spring and move said support.

2. The combination of a pair of beds, a pair of springs adapted to be seated in flat condition in said beds, said springs being fixed at one end, means for moving the centers of said springs out of their beds, and a metal working tool connected with the free ends of the springs to be moved thereby.

3. The combination with a movable support for a metal working tool, of a flexible spring connected at one end therewith and fixed at the other end, means for moving the center of the spring transversely to change the effective length of the spring and move said support, and means for automatically causing a dwell in the feed for the metal working operation.

4. The combination with a base, of a slide movably mounted thereon, a housing flexibly carried by the slide, a tool carried by the housing, means supported entirely by the slide for moving the housing and tool to feed the tool toward the work, and means for controlling the feed of the tool to provide a rapid feed, a feed for grinding, and a rapid return, all mounted on the slide.

5. The combination with a base, of a slide movably mounted thereon, a housing flexibly carried by the slide, a grinding wheel carried by the housing, means supported entirely by the slide for moving the housing and grinding wheel to feed the wheel toward the work, means for controlling the feed of the wheel to provide a rapid feed, a feed for grinding, a rapid return feed, and hold-on screws for holding the slide in adjusted position constituting the sole mechanical connection between the base and the other elements specified.

6. The combination with a base, of a wheel slide movable thereon, a housing, flexible means for supporting the housing from the wheel slide to permit the housing to move back and forth, a grinding wheel carried by the housing, flexible means mounted entirely on the slide for moving the grinding wheel, and means mounted on the slide for flexing the flexible means to control the motion of the grinding wheel.

7. In a grinding wheel head, the combination of a wheel slide, means for moving the slide, a spring support mounted on the slide, a wheel housing carried by said support, a shaft and grinding wheel carried by the housing and movable therewith, a spring connected with the housing and at the other end secured to the wheel slide, and means carried by the wheel slide for flexing said spring to change its length and thereby move the housing and grinding wheel.

8. In a tool feeding device, the combination of a slide carrying a pair of parallel beds, a pair of springs in said beds, one end of each spring being fixed to the slide and the other free therefrom, a tool holder fixed to the free ends of said springs, and means for moving the centers of both of said springs out of their beds to shorten their effective length and move the tool holder back from the work.

9. In a tool feeding device, the combination of a slide carrying a pair of parallel beds, a pair of springs in said beds, one end of each spring being fixed to the slide and the other free therefrom, a tool holder fixed to the free ends of said springs, means for moving the centers of both of said springs out of their beds to shorten their effective length and move the tool holder back from the work, and means for controlling the motion

of the tool holder back and forth and the dwell thereof, all mounted on said slide.

10. In a tool feeding device, the combination of a slide carrying a pair of parallel beds, a pair of springs in said beds, one end of each spring being fixed to the slide and the other free therefrom, a tool holder fixed to the free ends of said springs, means for moving the centers of both of said springs out of their beds to shorten their effective length and move the tool holder back from the work, means for controlling the motion of the tool holder back and forth and the dwell thereof, all mounted on said slide, and means mounted on the slide for setting the feed at a predetermined rate and for adjusting said rate.

11. In a tool feeding device, the combination of a slide carrying a pair of parallel beds, a pair of springs in said beds, one end of each spring being fixed to the slide and the other free therefrom, a tool holder fixed to the free ends of said springs, means for moving the centers of both of said springs out of their beds to shorten their effective length and move the tool holder back from the work, means for controlling the motion of the tool holder back and forth and the dwell thereof, all mounted on said slide, and an elapsed time switch on said slide for controlling the dwell of the tool holder.

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