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INDEX MECHANISM

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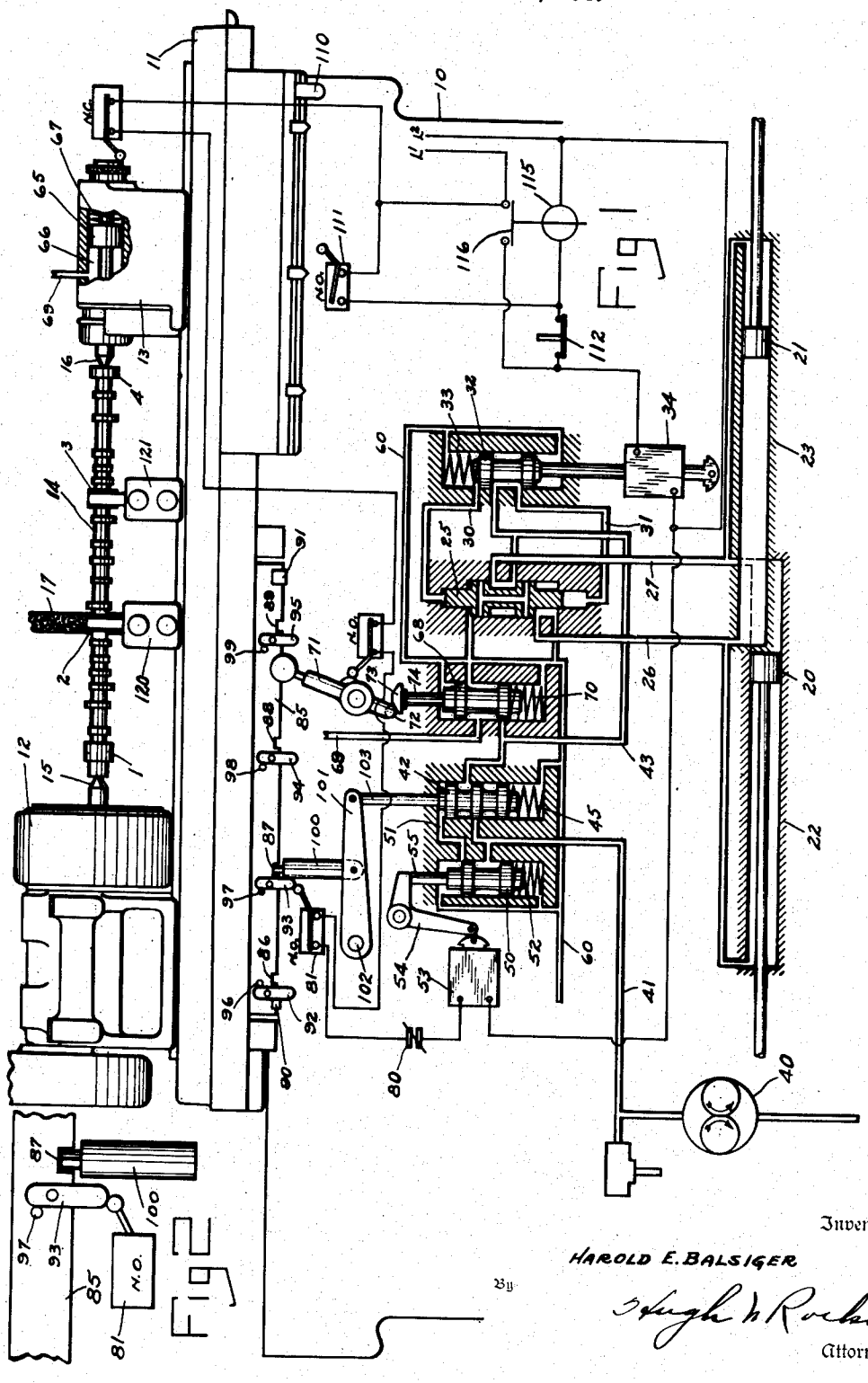


Fig 1

Fig 2

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INDEX MECHANISM

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This invention relates to machine tools, particularly grinding machines of the type used to grind selected portions of a work piece. Such a machine is disclosed in Ott et al., Patent Number 2,105,841, granted January 18, 1938.

An object of the invention is to provide means for grinding selected portions of a work piece automatically.

A further object is to provide means for grinding said portions automatically in any desired order.

Figure 1 is a diagrammatic layout of the parts essential to the operation of the invention.

Figure 2 is a closeup elevation showing the arrangement of the pivoted dog, plunger and switch.

In previous machines of the type disclosed, such as that shown in the above mentioned Patent 2,105,841, an end bearing was usually ground first and the others followed in regular order. Recently it has been found desirable in some cases to vary the order of grinding depending upon the conditions peculiar to each case. For example, in grinding the piece shown, rests are used only on the center portions. If the number one portion had been ground first, it would be tapered, out of round, and full of chatter due to distortion of the shaft for lack of support. By starting the grinding operation on the number two portion, the shaft may be supported right from the start and the above mentioned troubles avoided. The number three portion is then ground while being supported by the second rest. With the two center portions ground to size and supported by rests, the grinding on the remaining portions may be done without danger of distortion.

In order to accomplish this a conventional indexing device is used consisting of a notched bar and plunger. Applicant has considered a number of ways by which the order of grinding can be controlled. The method shown herein has been selected for disclosure because of its simplicity. It consists in mounting pivoted dogs adjacent each notch or in some predetermined relation thereto. A switch to be actuated by said dogs is mounted on the bed of the machine and connected to permit or prevent the engagement of the plunger with the notches in the spacing bar. The dogs are pivoted to rotate in one direction only being locked against rotation in the opposite direction. The direction in which a dog may rotate depends upon whether or not the portion of the work corresponding to said dog is to be ground during the progress of the work carriage in that direction.

The reverse of this arrangement would be just as satisfactory, that is, where a rigid dog is mounted on the spacing bar and engages a series of switches each actuated by a device similar to a pivoted dog.

This invention is not limited to the structure disclosed. The arrangement shown in the drawing and described in the specification has been selected for disclosure principally because of its simplicity. Therefore, the scope of the invention is limited only by the appended claims.

In the drawing, numeral 10 indicates the bed of a grinding machine, 11 a work carriage slidably mounted thereon, 12 a headstock and 13 a footstock on said carriage, and 14 a work piece rotatably supported on head and footstock centers 15 and 16 respectively, and having spaced portions 1, 2, 3, and 4 to be ground. A grinding wheel 17 is mounted and actuated in a manner similar to that disclosed in the above mentioned patent.

A hydraulic motor consisting of pistons 20 and 21 slidably mounted in cylinders 22 and 23 respectively, provides longitudinal reciprocating motion for said carriage. Fluid under pressure is supplied to said motor from a pressure operated reversing valve 25 thru passages 26 and 27. Said reversing valve is actuated by fluid directed to opposite ends thereof thru passages 30 and 31 by valve 32. Said valve is actuated in one direction by a spring 33 and in the opposite direction by a solenoid 34.

Fluid under pressure is supplied to valve 32 from a pump 40 thru passage 41, valve 42, and passage 43. Valve 42 is actuated by pressure in one direction and by a spring 45 in the opposite direction. Fluid under pressure for operating said valve 42 is supplied to one end thereof from a valve 50 thru passage 51. Said valve is actuated in one direction by a spring 52 and in the opposite direction by a solenoid 53 acting thru a bell crank 54 in contact with the stem 55 of said valve. An exhaust passage 60 is connected to all of the above described valves for carrying off exhaust fluid and drainage therefrom. The means for moving footstock center 16 toward and from operative position consists of a piston 65 slidably mounted in a cylinder 66 formed in the footstock 13. Said piston may be actuated in one direction by fluid under pressure and in the opposite direction by a spring 67. Fluid under pressure for operating said footstock is controlled by a valve 68 which receives said fluid from passage 43 and directs same thru passage 69 to footstock cylinder 66. Valve 68 is actuated in one direction by a spring 70 and in the other direction by a lever

71 having a roller 72 in the lower portion thereof for engaging a cam surface 73 on the stem 74 of valve 68.

The circuit for controlling solenoid 53 includes a normally closed sizing device or timer relay 80 and a normally open limit switch 81.

The means for stopping the carriage 11 with the portion of the work to be ground in grinding position consists of a spacing bar 85 having a series of notches 86, 87, 88, and 89 formed therein. At each end of said bar is a stop 90 and 91 for positively limiting the movement of the carriage. Adjacent each notch is a pivoted dog 92, 93, 94, and 95. Pins 96, 97, 98, and 99 are inserted in bar 85 beside each dog so as to prevent rotation of said dog in one direction. Dog 92 is held against rotation in a clockwise direction. Dogs 93, 94, and 95 are held against rotation in a counterclockwise direction. Obviously said dogs may be arranged in any sequence for clockwise or counterclockwise rotation depending on the order in which the several portions of the work are to be ground. A plunger 100 is pivotally attached to an intermediate portion of an arm 101. One end of said arm is pivotally attached to the bed 10 at 102, the other end is attached in a similar manner to the stem 103 of valve 42.

Operation

The grinding operation is started with the grinding wheel 17 near the headstock end of the carriage 11. Plunger 100 is in withdrawn position adjacent end stop 90. Valve 42 is in the downward position so that fluid under pressure from supply passage 41 and pump 40 is directed thru passage 43 to footstock valve 68, pilot valve 32, and reversing valve 25. In the vertical or inoperative position of lever 71, valve 68 is depressed and connects passage 69 with the supply passage 43. Fluid under pressure is thus conducted to cylinder 66 where it shifts piston 65 against spring 67 to hold footstock center 16 in retracted position. After the operator inserts a work piece in the macihne, he shifts lever 71 to the right releasing valve 68 and connecting passage 69 with exhaust passage 60. Spring 67 then moves center 16 into engagement with the work piece 14. Valves 32 and 25 are at this time in position to cause fluid under pressure to be directed thru passage 27 to move the carriage from left to right, that is, the opposite of the position of said valves in Figure 1. Valve 32 is held in this position by solenoid 34. In order to start the traverse movement, the operator depresses push button stop switch 112 thus deenergizing solenoid 34 and permitting spring 33 to shift valve 32 to the position shown in Figure 1. In this position of valve 32, fluid under pressure from passage 43 is directed thru valve 25 to passage 27 to shift pistons 20 and 21 with carriage 11 from left to right. Normally, plunger 100 would drop into notch 86 to stop the carriage in position to grind portion 1. However, in order to release said plunger the circuit to solenoid 53 must be closed as shown in Figure 1. Switch 81 in said circuit is normally open, but may be closed by one of the pivoted dogs 92, 93, 94, or 95. Dog 92 is pivoted so that it is free to rotate when engaged by the roller of switch 81 during movement of the carriage to the left. Therefore, solenoid 53 remains deenergized, valve 50 is held by spring 52 in position to direct fluid under pressure from passage 41 thru passage 51 to hold plunger valve 42 and plunger 100 in the downward position. Thus, the grinding operation on portion 1 is omitted at this time. The carriage movement continues until dog 93 engages switch 81. Said dog is locked against rotation during movement to the left, and, therefore, switch 81 is closed, solenoid 53 is energized, and valve 50 depressed to connect passage 51 to the exhaust passage 60. Spring 45 then urges valve 42 and plunger 100 upwardly, said plunger engages notch 87 and stops carriage 11 in position to grind portion 2.

The grinding operation on this type of machine may be controlled by a sizing device as disclosed in Patent No. 2,105,841 referred to above, or by a timing mechanism as shown in Serial No. 220,777, filed July 22, 1938, which became Patent No. 2,243,410, May 27, 1941. In either case the control device would function thru a relay contact 80, in this case normally closed, so that when the relay is energized by the size control device the circuit to solenoid 53 is broken and said solenoid deenergized, valve 42 depressed, and plunger 100 withdrawn. Valve 42 then directs fluid under pressure from passage 41 thru passage 43 to the traverse control valves 25 and 32 to move carriage 11 to the next position.

Dogs 94 and 95 are arranged to stop the carriage for portions 3 and 4. After portion 4 has been ground the movement of the carriage to the left is continued. This movement may be terminated either by an end stop 91 engaging plunger 100, in which case the carriage remains stationary until started manually in the opposite direction, or a dog 110 may engage a switch 111 to complete a circuit from line L1 thru said switch and a stop switch 112 to energize solenoid 34. At the same time relay 115 is energized to complete a circuit thru contact 116 bypassing both switches to energize solenoid 34. After release of said switches said relay is held thru said contact 116. Said solenoid then shifts valve 32 against spring 33 to direct fluid under pressure from passage 43 thru passage 30 to shift valve 25 to the downward position. Valve 25 then directs said fluid from passage 43 thru passage 26 to the left end of cylinders 22 and 23 to move pistons 20 and 21 and carriage 11 from left to right. During movement from left to right, dogs 93, 94, and 95 will not close switch 81. Therefore, the carriage will not stop at the positions corresponding to these dogs. Dog 92 is arranged to close said switch during movement from left to right and the carriage is thus stopped in position to permit the grinding of portion 1. When this portion has been ground to size, solenoid 53 is deenergized thru size control contact 80 and the carriage moved to the right until end stop 90 engages plunger 100 and stops the carriage for unloading and loading. Lever 71 is shifted to the vertical position depressing valve 68 and directing fluid under pressure thru passage 69 to footstock cylinder 66 to retract center 16 from the work.

The sequence of operation disclosed, i. e., grinding the intermediate portions of the work piece first and thereafter grinding the end portions, has been found very effective for attaining accuracey in one or both of the end portions. By grinding the intermediate portion or portions first, steady rests 120 and 121 may be applied to them to support the work piece during grinding of the end portions.

What is claimed is:

1. In a metal working machine, a tool, a work support, mechanism for effecting a relative longitudinal movement between said tool and said work support, means for initiating said longitudinal movement intermittently for positioning said tool and successive portions of a work piece, an indexing mechanism for controlling said posi-

tioning means, and means for omitting predetermined portions during the operation of said indexing mechanism including stopping devices which are operable only during said longitudinal movement in one direction.

2. In a metal working machine, a tool, a work support, mechanism for effecting a relative longitudinal movement between said tool and said work support, means for initiating said longitudinal movement intermittently for positioning said tool and successive portions of a work piece, an indexing mechanism for controlling said positioning means, means for omitting predetermined portions during the operation of said indexing mechanism, and for thereafter relatively positioning said tool at said omitted portions.

3. In a metal working machine, a tool, a work support, mechanism for effecting a relative longitudinal movement between said tool and said work support, means for initiating said longitudinal movement intermittently for positioning said tool and successive portions of a work piece including a size control mechanism, an indexing mechanism actuated by said size control mechanism for controlling said positioning means, and means for selecting predetermined portions for machining during the operation of said indexing mechanism including stopping devices which are operable only during said longitudinal movement in one direction.

4. In a metal working machine, a tool, a work support, mechanism for effecting a relative longitudinal movement between said tool and said work support, means for initiating said longitudinal movement intermittently for positioning said tool and successive portions of a work piece including a spacing bar having spaced notches corresponding to the said portions of the work piece, a plunger for engaging said notches, and means for preventing engagement of said plunger with certain of said notches.

5. In a metal working machine, a tool, a work support, mechanism for effecting a relative longitudinal movement between said tool and said work support, means for initiating said longitudinal movement intermittently for positioning said tool and successive portions of a work piece including a spacing bar having spaced notches corresponding to the said portions of the work piece, a plunger for engaging said notches, and means for causing said plunger to engage said notches in any predetermined sequence.

6. In a metal working machine, a tool, a work support, mechanism for effecting a relative longitudinal movement between said tool and said work support, means for initiating said longitudinal movement intermittently for positioning said tool and successive portions of a work piece including a spacing bar having spaced notches corresponding to the said portions of the work piece, a plunger for engaging said notches including a pivoted dog adjacent each of said notches, and a switch actuated by each of said dogs during movement of the carriage depending upon the direction of said movement for controlling withdrawal of said plunger.

7. In a metal working machine, a tool, a work support, mechanism for effecting a relative longitudinal movement between said tool and said work support, means for initiating said longitudinal movement intermittently for positioning said tool and successive portions of a work piece including a spacing bar having spaced notches corresponding to the said portions of the work piece, a plunger for engaging said notches including a pivoted dog adjacent each of said notches, and a switch actuated by some of said dogs during movement of said carriage in one direction and by other of said dogs during movement of said carriage in the other direction for controlling withdrawal of said plunger.

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