

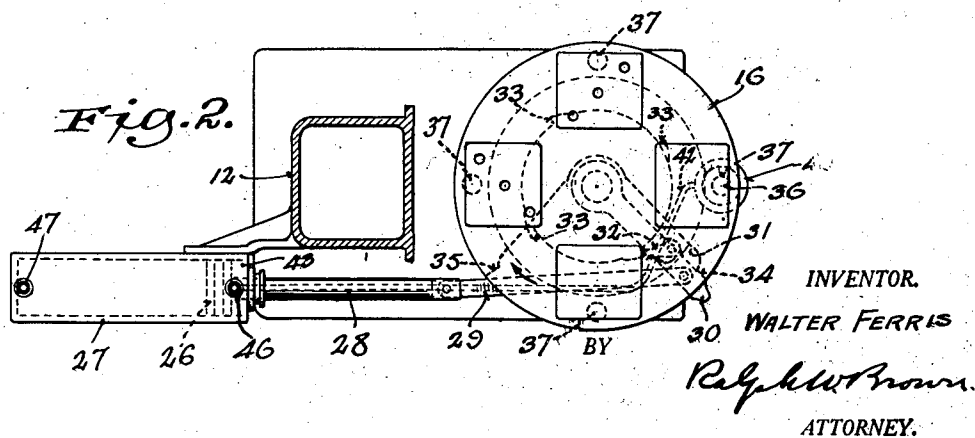
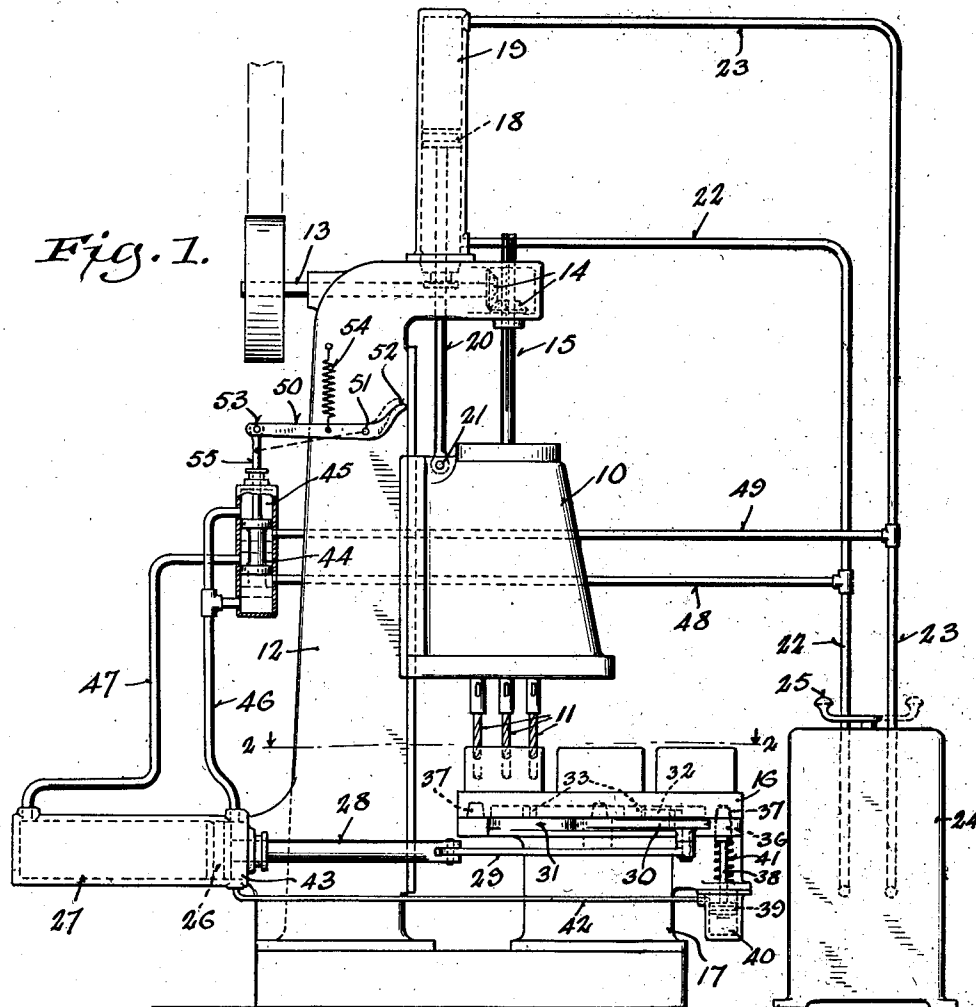
March 23, 1926.

1,578,232

W. FERRIS

HYDRAULIC INDEXING MECHANISM

Filed June 11, 1923



UNITED STATES PATENT OFFICE.

WALTER FERRIS, OF MILWAUKEE, WISCONSIN, ASSIGNOR TO THE OILGEAR COMPANY, OF MILWAUKEE, WISCONSIN, A CORPORATION OF WISCONSIN.

HYDRAULIC INDEXING MECHANISM.

Application filed June 11, 1923. Serial No. 644,713.

To all whom it may concern:

Be it known that I, WALTER FERRIS, a citizen of the United States, residing at Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented a certain new and useful Improvement in Hydraulic Indexing Mechanism, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

This invention relates to indexing mechanism for fluid actuated machines, such, for instance, as hydraulic presses, drills and other reciprocating machine tools.

One object of the present invention is the provision of an indexing mechanism designed to operate in properly timed relation with respect to the working strokes of the machine and to be driven from the same pressure source as that provided for driving the machine.

Other objects will appear from the following description of an illustrative embodiment of the invention.

In the drawings:

Figure 1 is a view in side elevation of a drill press equipped with an indexing mechanism constructed in accordance with the present invention.

Figure 2 is a horizontal sectional view of the machine taken substantially on the line 2-2 of Figure 1.

For purposes of illustration and explanation, the invention will be described as embodied in a drill press for effecting a step by step rotation of the work table thereof, although it is equally applicable to machines of other types and may be employed to advantage in connection with work feed mechanisms of other forms or for effecting a step by step rotation of a tool carrying turret or the like.

The machine shown is a vertical, multiple spindle drill press of a well known type. It comprises the usual head 10, carrying the several tools 11, and mounted for vertical reciprocation upon the standard 12. The tools are driven in the usual manner from a pulley shaft 13, through the bevel gears 14 and vertical shaft 15, having splined connections with one of the gears 14 and journaled in the head 10. The machine shown is also equipped with the usual

work table 16 rotatably mounted upon an appropriate base 17 so as to permit a step by step advance of the work carried thereby into operating position beneath the tools. The parts thus far referred to are old and well known in the art and need not be further described.

Reciprocation of the head 10 toward and from the work is effected in this instance by a piston 18 working in a cylinder 19 fixed to the top of the standard 12. The piston is provided with the usual piston rod 20 connected as at 21 with the head 10. The opposite ends of the cylinder are respectively connected through pipes 22 and 23 with an appropriate source of hydraulic pressure in the form of a pump 24. The pump is of well known type. That shown is a constant speed, reversible, variable delivery pump, such as described in my co-pending application Serial No. 460,184, filed April 11, 1921. It will suffice here to say that the direction and rate of flow of fluid from the pump shown is controlled by a hand lever 25. This lever is movable through an arc of approximately one hundred and eighty degrees from the full line to the dotted line position shown. When in the full line position, fluid is delivered under pressure and at a maximum rate through the pipe 22 to the lower end of the cylinder 19. This causes an upward travel of the piston 18 and head 10 at a maximum rate, the fluid from the upper end of the cylinder returning to the pump through pipe 23. When the handle is shifted into the dotted line position, a maximum flow of fluid in the other direction occurs and the piston and head 10 travel downwardly at maximum rate. At the intermediate or ninety degree position of the lever, pump displacement is zero and the piston and head remain stationary. To effect a slow travel of the head in either direction the handle is adjusted to a position a little on one side or the other of the neutral position.

As above pointed out, the present invention provides for the indexing of the work table 16 in properly timed relation with respect to the movements of the tool carrying head 10. Although this may be accomplished in various ways, the mechanism about to be described is well adapted for this purpose. This mechanism includes a

piston 26 working in a horizontal cylinder 27 secured to the standard 12 adjacent the work table. This piston is provided with a piston rod 28 connected through a link 29 with an arm 30. Arm 30 is mounted to swing about the axis of rotation of the table and within a cut away portion 31 formed in the top of the supporting base 17 immediately beneath the table. A spring pressed pawl 32 carried by the arm cooperates with ratchet teeth 33 formed in the bottom face of the table. Stop lugs 34 and 35 formed on the base 17 limit the swinging movement of the arm. The arrangement is such that when the arm swings under the action of the piston 26, from the limiting position shown, the table rotates therewith through an arc substantially equal to the distance between successive teeth 33, and when the arm is returned by the piston to the position shown the pawl 32 engages behind the next tooth 33 on the table.

In order to accurately position the table after each partial rotation thereof, an indexing pin 36 of usual form is provided for engagement successively with tapered sockets 37 formed in the table. The indexing pin is mounted for vertical reciprocation in the base 17 and is provided with a stem 38 connected with a piston 39 working in a cylinder 40 secured to the base. The pin is pressed upwardly and yieldably retained in socket engaging position by a coiled spring 41 surrounding the stem 38, and is withdrawn from that position by the action of the piston 39 under pressure derived through a small capacity tube 42 connected with the upper end of the cylinder 40. Tube 42 is connected with one end 43 of the cylinder 27.

The piston 26 is actuated by fluid pressure derived from the pump 24 and automatically controlled by the head 10. In this instance a four way piston valve is employed. This valve includes a double headed piston 44 working in a cylinder bore 45. The two ends of the cylinder bore 45 are both connected with one end 43 of the cylinder 27 through a pipe 46. The other end of a cylinder 27 is connected through a pipe 47 with an intermediate portion of the bore 45. Pipes 48 and 49 effect communication between the pipes 22 and 23, respectively, and the cylinder bore at points on either side of the pipe connection 47. The arrangement is such that when the piston valve is in the full line position shown communication is established between pipes 22 and 46 through the lower end of the cylinder bore and between pipes 23 and 47 through the intermediate portion of the cylinder bore. And when the piston valve is lowered to the dotted line position shown pipe 23 communicates with pipe 46 through the upper end of

the cylinder bore and pipe 22 communicates with pipe 47.

The position of the piston valve is controlled by a lever 50 pivotally mounted as at 51 upon the standard 12 with one end 52 thereof normally projecting into the path of movement of the head 10. The other end 53 of the lever is connected with the stem 55 of the piston valve. A spring 54 yieldably retains the lever in the full line position while the head 10 is in the lower portion of its path of travel. In its upward movement, however, the head engages the end 52 of the lever and rocks it into the dotted line position shown, in which position it is retained until the head has again moved downwardly out of contact therewith.

In the illustrated position of the machine, fluid under pressure is passing through pipe 22 from the pump to the lower end of the cylinder 19, thereby forcing the piston 18 and consequently the head 10 upwardly away from the work. At this instant, pressure has been established in the end 43 of cylinder 27 from the pipe 22 through the pipes 38 and 46. Due to the small capacity of the tube 42, however sufficient fluid has not been supplied to the cylinder 40 to withdraw the indexing pin 36 from locking engagement with the work table 16. As the head starts its upward travel the table is thus held by the pin against rotation until sufficient time has elapsed for the tools to clear the work. The instant the pin is withdrawn, however, the piston 26 starts moving to the left, under the existing pressure in the end 43 of its cylinder, and the arm 30 is swung into its limiting position against the stop 35. This, of course, causes a similar clockwise rotation of the table, due to the engagement of the pawl 32 with one of the teeth 33 thereof.

Thereafter, the head 10 in its upward travel engages the end 52 of lever 50 and rocks this lever so as to shift the valve 44 into the dotted line position shown. This movement of the valve opens communication between pipes 46 and pipe 24, in which low pressure exists, thus relieving the pressure in the end 43 of cylinder 27 and in the tube 42 and cylinder 40 so that the indexing pin is free to be pressed by the spring 42 into locking engagement with the adjacent socket 37 in the table. The table and work is thus centered preparatory to the next downward stroke of the tool carrying head. This movement of the valve also establishes pressure in the left end of cylinder 27 from pipe 22 through pipes 48 and 47. Under this pressure, the piston 26 moves toward the right and returns the arm 30 to the full line position against the stop 34 with the pawl 32 in engagement with the next succeeding tooth 33.

When the table indexing operation is com-

pleted, the operator swings the handle 25 into neutral position, thereby reducing the delivery of the pump to zero and arresting the movement of the head 10. To begin a 5 working stroke the handle is shifted into the dotted line position thereby causing a flow of fluid through pipe 23 from the pump to the upper end of cylinder 19, fluid returning to the pump from the lower end of the 10 cylinder 19 through pipe 22. The head 10 in its downward movement again passes out of engagement with the end 52 of lever 50 thus permitting this lever and valve 44 to return to the full line position shown. During 15 this downward movement of the head the table is retained in fixed position by the indexing pin and the arm 30 is held against movement in either direction by the stop 34 and the engagement of pawl 32 with the adjacent tooth 33.

Various changes may be made in the embodiment of the invention hereinabove described, without departing from or sacrificing any of the advantages of the invention 25 as defined in the appended claims.

I claim:

1. In a machine of the character described having a tool carrier and work support the combination of hydraulically actuated feed 30 mechanism for effecting relative reciprocation between said carrier and support, a variable displacement pump for driving said mechanism and for controlling the speed of operation thereof, indexing mechanism, and 35 fluid connections between said pump and said indexing mechanism for effecting an intermittent operation thereof in timed relation with respect to the operation of said feed mechanism.

2. In a machine of the character described having a tool carrier and work support, the combination of a variable displacement pump mechanism actuated and controlled by 40 fluid delivered by said pump for effecting relative reciprocation between said carrier and support, indexing mechanism actuated by fluid delivered by said pump, and means responsive to movement of said first named 45 mechanism for controlling the operation of said indexing mechanism.

3. In a machine of the character described having a tool carrier and work support, the combination of a variable delivery pump, hydraulic means actuated and controlled by 50 said pump for reciprocating said carrier toward and from the work, hydraulically actuated indexing mechanism, and fluid

connections between said pump and mechanism, including a valve controlled by movement of said carrier.

4. In a machine of the character described having a tool carrier and rotatable work support the combination of a variable delivery pump, hydraulic means actuated and controlled by said pump for reciprocating 60 said carrier toward and from the work, hydraulic means actuated by said pump for effecting an intermittent rotation of said work support, and means including a valve between said pump and said last named 65 hydraulic means for controlling the operation thereof.

5. In a machine tool the combination of fluid actuated feed mechanism for effecting relative reciprocation between the tool and 70 work, fluid actuated indexing mechanism, a variable delivery pump, fluid connections between said pump and each of said mechanisms for operating said mechanisms, and a valve controlled by said feed mechanism for 75 controlling the operation of said indexing mechanism.

6. In a machine of the character described the combination of a rotatable support, a latch for locking said support against rotation, a fluid pressure source, means actuated 80 from said source for rotating said support, means actuated from said source for releasing said latch, and means including a restricted fluid passage for retarding the 85 action of said latch releasing means.

7. In a machine of the character described the combination of a rotatable support, a latch for locking said support against rotation, fluid actuated means for rotating said 90 support, fluid actuated means for releasing said latch, and fluid connections between said means including a restricted passage for retarding the action of said latch releasing means. 95

8. In a machine tool the combination of a variable delivery pump, hydraulic mechanism actuated by said pump for moving the tool toward and from the work, indexing 100 mechanism, hydraulic mechanism actuated by said pump for automatically operating said indexing mechanism during movement of the tool from the work, and means for 105 delaying the action of said last named hydraulic mechanism until the tool has cleared 110 the work.

In witness whereof, I hereunto subscribe my name this 4th day of June, 1923.

WALTER FERRIS.