

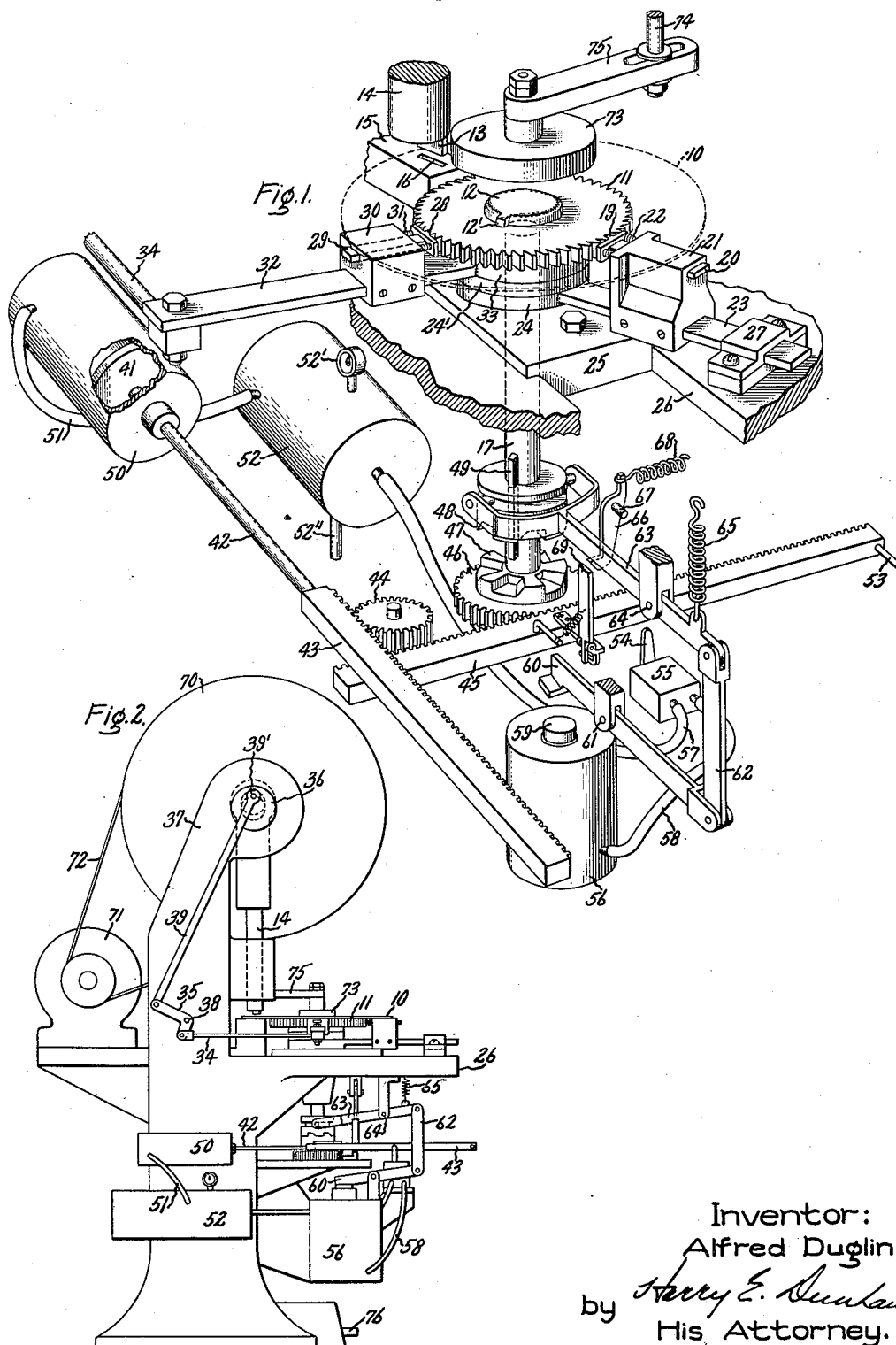
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INDEXING DEVICE

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INDEXING DEVICE

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My invention relates to punch presses and more particularly to an improved indexing device for use with such presses.

One object of my invention is to provide an indexing device operable at high speeds and simultaneously with a high degree of accuracy.

For a better understanding of my invention, together with other and further objects thereof, reference is had to the following description taken in connection with the accompanying drawing, and its scope will be pointed out in the appended claims.

In the accompanying drawing Fig. 1 is a perspective diagrammatic view of my improved indexing device and Fig. 2 is a side elevation of a punch press equipped with my improved indexing device.

Referring to the drawing in detail, a round metal disk or lamination 10 is supported upon a ratchet wheel 11. It is centered upon the wheel by an arbor 12 which arbor is attached to the surface of the ratchet wheel and is provided with a suitable key 12'. The lamination 10 is to be operated upon by a perforating punch 13 mounted in a ram 14 of the punch press. The punch 13 cooperates with a die 15, having therein a slot 16 into which the metal removed from the lamination is discharged by the punch 13.

The lamination 10 is to be moved about its axis in a step-by-step movement so as to enable the punch 13 to produce successive holes or slots in the perimeter of the lamination. These holes or slots are to be accurately spaced from each other. The step-by-step movement is obtained by intermittently advancing the ratchet wheel 11 which is mounted upon a vertically supported shaft 17. The lamination is moved with the ratchet wheel by the key 12' which registers with a key slot in the lamination and prevents a relative movement between the ratchet wheel and the lamination.

The ratchet wheel is positioned about its axis by two pawls. The first of these is a pawl 19 which is provided to engage the ratchet wheel and to hold it against a counterclockwise movement about its axis. This pawl 19 is attached to a tongue 20 which is slidable in a holder 21 and is pressed into notches of the ratchet wheel by springs 22. The holder 21 is adjustably mounted upon a guide arm 23 so that its distance from the axis of the ratchet wheel may be readily adjusted. The arm 23 projects radially from the axis of the ratchet wheel and is supported at its axis end by a disk 24 which is concentric with the ratchet wheel. The disk 24

is anchored by the shaft 17, which projects through it, and rests upon an adjustable section 25 of the bed plate 26 of the punch press. The arm 23 is supported at its outer end by a suitable clamp 27, this clamp 27 being mounted upon the bed plate 26 of the punch press.

A second and reciprocating pawl 28 is provided to impart a clockwise movement to the ratchet wheel. This pawl is similar to the pawl 19, being attached to a tongue 29 which is slidable in a holder 30 against the pressure of springs 31. The holder itself is adjustably mounted upon an arm 32. The inner end of this arm 32 is attached to a rotatable disk 33 which is concentric with the disk 24 and is spaced therefrom by an intermediate disk 24'. The outer end of the arm 32 is attached to a rod 34 which is reciprocated by a bell crank 35 operated from the crank shaft 36 of the punch press. This is shown more clearly in Fig. 2.

The bell crank 35 is pivoted on the frame 37 of the punch press by a pivot pin 38. It is moved by a connecting rod 39 connected between the end of the crank shaft 36 and one end of the bell crank 35. This connecting rod is connected to the end of the crank shaft by a pin 39' which is spaced from the axis of the crank shaft and is in such angular relation to the ram 14, which is also operated by the crank shaft 36, that the rod 34 moves the arm 32 and the pawl 28 counterclockwise about the axis of the ratchet wheel during the descent of the ram 14. During this ram motion the ratchet wheel is held against counterclockwise rotation by the pawl 19. During the succeeding ascent of the ram 14, the rod 34 moves the arm 32 and the pawl 28 clockwise, thereby moving the ratchet wheel and the lamination, supported upon the wheel and arbor, a predetermined angular distance about its axis.

In operation, especially high speed operation, the above described movement of the ratchet wheel tends to become inaccurate for the reason that there is no specific force holding the tooth of the ratchet wheel against the face of the pawl 19. The friction of the pawl 28 sliding over the ratchet teeth is the only force available at this period of the operation to hold the ratchet wheel against the face of the pawl 19. That force is, however, not constant and is not sufficiently great to prevent a slight rebound movement of the ratchet wheel when it is pressed up against the face of pawl 19 at the beginning of the return stroke of the arm 32. In other words, the friction between the pawl 28 and the

tooth of the ratchet wheel 17 is a maximum at the beginning of the return movement of the pawl. That friction effects a movement of the ratchet tooth against the face of pawl 19 with such force that upon the immediately following reduction of the friction between the pawl 28 and the ratchet wheel, that is, when the pawl 28 moves into a succeeding notch, the ratchet wheel may actually rebound and thereby introduce an inaccuracy in the spacing of a succeeding slot in the lamination.

In order to eliminate this inaccuracy and thereby enable this fixture to operate at a high speed, I have provided, in accordance with my invention, means for applying a continuous force tending to hold the ratchet wheel against the pawl 19 with sufficient force to hold it stationary at the instant at which the die engages the lamination. This means, however, does not prevent the advancement of the ratchet wheel 11 by the pawl 28 in a clockwise direction at the proper instance during an operating cycle. This improved means includes a pressure operated piston 41, the force of which is applied to shaft 17, the ratchet wheel 11 and the arbor 12 through a mechanical connection including a piston shaft 42, gear rack 43, pinion 44, gear rack 45, gear 46, clutch 47, 48 and key 49. The clutch member 48, being keyed to shaft 12 by the key 49, transmits, to the ratchet wheel 11, the force of the piston 41 when it engages the other clutch member 47. This latter clutch member 47, when not engaging the clutch member 48, is free to rotate about the shaft 17 and is integral with the gear 46 which drives the rack 45. The rack 45 engages and drives the pinion 44 which in turn drives the rack 43 on the piston shaft 42.

The piston 41 moves in a cylinder 50 which receives a compressible fluid such as air, for example, through a conduit 51 from a suitable reservoir 52, this reservoir being provided with a pressure gauge 52' and a suitable inlet conduit 52". During operation the pawl 28 moves the ratchet wheel 11 in a clockwise direction thereby moving the piston 41, through the clutch and gear arrangement just described, against the pressure of the fluid in the cylinder 50. This fluid is partly compressed and is partly returned to the reservoir 52 during this part of the operating cycle. The pressure in this reservoir may be adjusted to suit each mechanism. A fluid pressure of 15 pounds to the square inch, for example, has been found satisfactory for the mechanism illustrated.

The stroke of this piston is preferably arranged to be of sufficient length to equal the perimeter of the clutch gear 46. At the end of each revolution of this gear a pin 53 on the end of the rack 45 moves a valve arm 54 of a valve 55. This valve, upon operation of its arm 54, permits fluid to enter a tripping cylinder 56, the fluid for operating this cylinder being received from a suitable source of supply which may be the reservoir 52, through a conduit 57 connected to the valve 55, and a conduit 58 extending from the valve 55 to the cylinder 56. This fluid raises a piston 59, in the cylinder 56, which engages a lever 60 causing it to move in a clockwise direction about its stationary pivot 61 and effecting an opening of the clutch 47, 48 through a link 62 and lever 63.

In Fig. 1 the clutch is illustrated as being in the open position with the piston nearing its starting position at which the clutch is reclosed, and in Fig. 2 this clutch is illustrated as being in the closed position. When the valve 55 is actuated as described, the clutch lever 63 is moved

clockwise about its stationary pivot 64 against the pull of a spring 65 to lift the clutch member 48 out of engagement with the clutch member 47. The clutch lever 63 is moved upwardly to a position at which the lever is engaged by a latch 66. This latch is pivoted upon a pin 67 and is moved to engage the arm by a spring 68 when the arm reaches its upper position.

The opening of the clutch 47, 48 enables the fluid pressure in the cylinder 50 to move the piston 41 forward since the clutch member 47 rotates freely about the shaft 17. This movement of the piston moves the rack 45 to the right through the force transmitted by the pinion 44. This movement of the rack 45 continues until a tripping member 69 on the rack 45 engages the latch 66, moves it out of engagement with the arm 63 thereby permitting the arm 63 to drop and the clutch member 48 to move into engagement with the clutch member 47 by the action of the spring 65, the valve arm 54 at this stage of the operating cycle having returned to its original position to shut off the air to the cylinder 56 and permitting the piston 59 to return to its lower position. At the following operating cycle the gear rack 45 is again driven to the right, the tripping member 69 being pivoted so as to enable it to pass under the clutch arm 63 during this return movement of the gear rack.

Fig. 2 illustrates a common form of punch press comprising a frame 37, a crank shaft 36, a fly-wheel 70 operated by a motor 71 through a belt 72, and an operating ram 14. A suitable disk 73 is provided to hold the lamination 10 upon the arbor 11. This disk is merely supported upon a suitable shaft 74 and upon an arm 75 which may be rotated about the shaft 74 to move the disk 73 into position above the lamination 10 or to move it away to provide clearance for removing the lamination and placing a new one upon the arbor. A suitable foot treadle 76 is provided to start and to stop the operation of the punch press. This may be any suitable device of which many are on the market. It is not a part of my invention.

In operation, of the above mechanism, a lamination 10 is placed upon the arbor 12 so that its key slot engages the key 12' on the arbor. The disk 73 is moved over the lamination and is lowered in any suitable manner, not shown, so as to weight the lamination down and hold it against the surface of the ratchet wheel 11. The gear rack 45 at this time is at the extreme right position with the clutch 47, 48 in closed position. The operator actuates the foot treadle 76 and starts the punch press. The pawl 28 then moves the ratchet wheel as described and the piston 41 is moved against fluid pressure thereby exerting a constant torque opposing the movement of the ratchet wheel and holding the ratchet wheel stationary against the pawl 19 during the return movements of the pawl 28. The punch 14 perforates the perimeter of the lamination. This operation continues until the ratchet wheel has made one complete revolution at which time the punch press is stopped either automatically or by the treadle 76. The rack 45 at that instant is at its extreme left position in which it actuates the valve 55 and the clutch 47, 48 is opened. The clutch member 47 being free to rotate about the shaft 17, it enables the piston 41 to return to its initial position because of the fluid pressure in the cylinder 50. When it reaches this initial position, the trip member 69 trips the latch 66 thereby effecting a closure of the clutch 47, 48 thereby placing the fixture in condition for

operation for another revolution. After the first lamination 10 is removed and another placed in its position, the fixture and machine are again ready to be started by the treadle 76.

The indexing device described has made possible the increase in speed of operation, over other devices used for this same purpose, which increase in one case was an increase from several hundred strokes per minute to over a thousand strokes per minute without loss of accuracy and an actual improvement in accuracy, even at this increased speed. The cost of producing laminations has thereby been proportionally reduced.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In an indexing device, the combination of a rotatable arbor, means to drive said arbor intermittently in one direction, means preventing its rotation in another direction, and fluid pressure responsive means mechanically connected to said arbor to apply a substantially continuous force tending to rotate said arbor in the direction opposed to said driving means.

2. In an indexing fixture for a punch press, the combination of a rotatable arbor, a ratchet wheel attached thereto, a stationary pawl engaging said ratchet wheel and preventing its rotation in one direction, a reciprocating pawl engaging said ratchet wheel to move said ratchet wheel in an opposite direction, and fluid pressure responsive means mechanically connected to said arbor arranged to apply a substantially continuous force tending to rotate said arbor in said first direction.

3. In an indexing device, the combination of a rotatable arbor, means to drive said arbor intermittently in one direction, means preventing its rotation in another direction, a cylinder, fluid pressure operated piston in said cylinder, means for connecting said piston to said arbor to apply a substantially continuous force tending to rotate said arbor in the direction opposed to said first means, said piston being moved against fluid pressure in said cylinder during the movement of said arbor, means for breaking said connection between said piston and said arbor at the end of a complete revolution of said arbor thereby enabling said piston to return to its starting position, and means to reestablish said connection between said piston and said arbor when said piston reaches its starting position.

4. In an indexing device, the combination of a rotatable arbor, means preventing its rotation in one direction, means to move said arbor in an opposite direction, a cylinder, a fluid pressure operated piston within said cylinder, means for mechanically connecting said piston to said arbor to apply a substantially continuous force to said arbor tending to rotate it in the direction opposed to its movement, a clutch device in said connecting means between said piston and said arbor, means to open said clutch device at the end of one complete revolution of said arbor thereby to release said piston to return to its initial position, and means to reclose said clutch when said piston reaches its initial position.

5. In an indexing device, the combination of a ratchet wheel mounted upon a shaft, a sta-

tionary pawl engaging said ratchet wheel and preventing its rotation in one direction, a second pawl engaging said ratchet wheel, means to reciprocate said second pawl intermittently to move said ratchet wheel in an opposite direction, a cylinder, a piston in said cylinder, a mechanical connection between said ratchet wheel shaft and said piston, fluid under pressure in said cylinder tending to rotate said ratchet wheel shaft in a direction opposed to its movement, means operable to disconnect said piston from said ratchet wheel shaft, and means to operate said disconnecting means at the end of one complete revolution of said ratchet wheel thereby to enable said piston to return to a starting position and to operate said disconnecting means to reconnect said piston to said ratchet shaft when said piston returns to its starting position whereby said piston opposes the movement of said ratchet wheel during the next revolution.

6. In an indexing device, the combination of a rotatable arbor, a ratchet wheel mounted upon a shaft and supporting said arbor, a stationary pawl engaging said ratchet wheel and preventing its rotation in one direction, a second pawl engaging said ratchet wheel, means to reciprocate said second pawl intermittently to move said ratchet wheel in an opposite direction, a cylinder, a piston therein, a fluid in said cylinder arranged to operate said piston, a mechanical connection between said piston and the shaft of said ratchet wheel whereby said piston opposes the movement of said ratchet wheel by a force proportional to the fluid pressure acting upon said piston, a clutch in the mechanical connection between said piston and said ratchet wheel shaft, and means for operating said clutch to open position at the end of each revolution of said ratchet wheel shaft thereby to permit said piston to return to its initial position by action of the fluid and for reclosing said clutch when said piston returns to its initial position thereby to oppose the movement of said ratchet wheel shaft during the succeeding revolution.

7. In an indexing device, the combination of a rotatable arbor, a ratchet wheel supporting said arbor and mounted for rotation about the axis of said arbor, a stationary pawl engaging said ratchet wheel and preventing its rotation in one direction, a second pawl engaging said ratchet wheel, means to operate said second pawl to move said ratchet wheel intermittently in an opposite direction, a cylinder, a fluid pressure operated piston in said cylinder, a gear and rack connection between said piston and said ratchet wheel whereby said piston is moved when said ratchet wheel is moved, a compressible fluid in said cylinder urging said piston to oppose the motion imparted to it from said ratchet wheel, a clutch in said gear and rack connection, and means to operate said clutch to open position at the end of a revolution to release said piston and permit the compressible fluid to move said piston forward to its initial position and to reclose said clutch when said piston is moved to its initial position thereby to oppose the movement of said ratchet wheel during the succeeding revolution.

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