Oct. 3, 1939.

R. W. DINZL

2,174,569

TURNTABLE MECHANISM FOR PRESSES

Filed Feb. 15, 1938

2 Sheets-Sheet 1

Fig. 1.

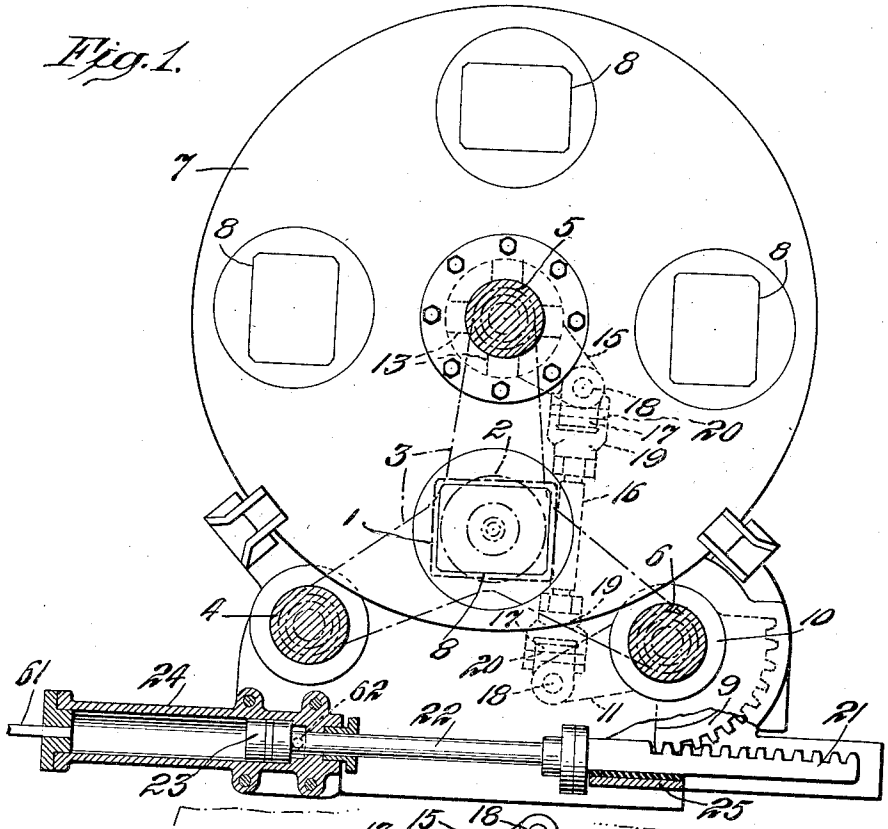
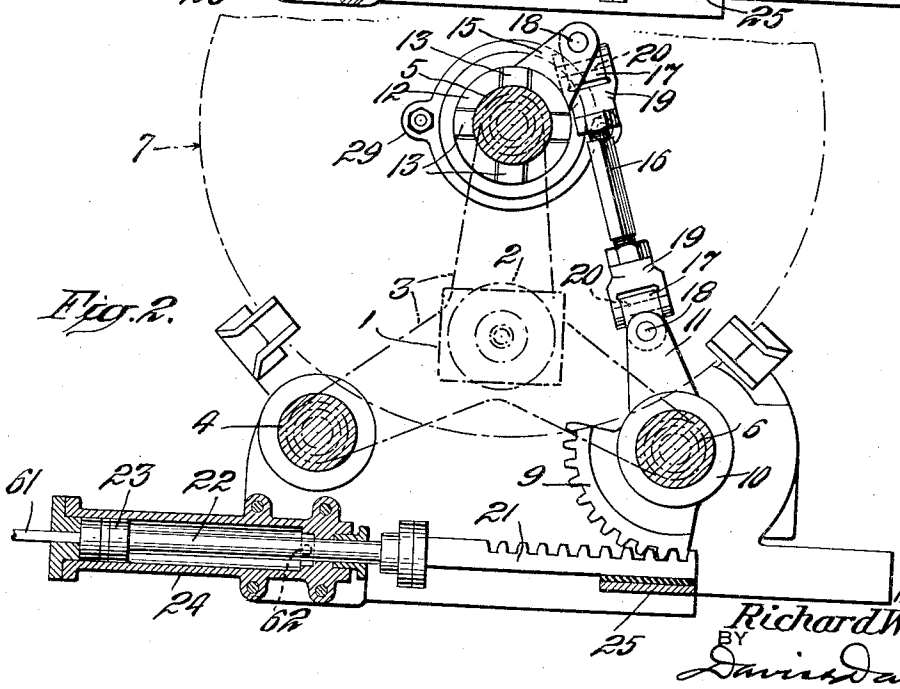


Fig. 2.



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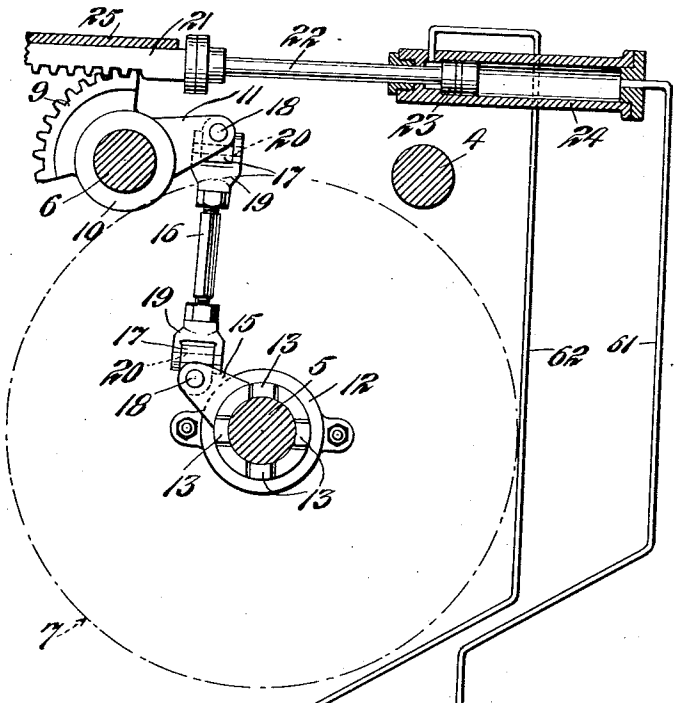

Fig. 3.

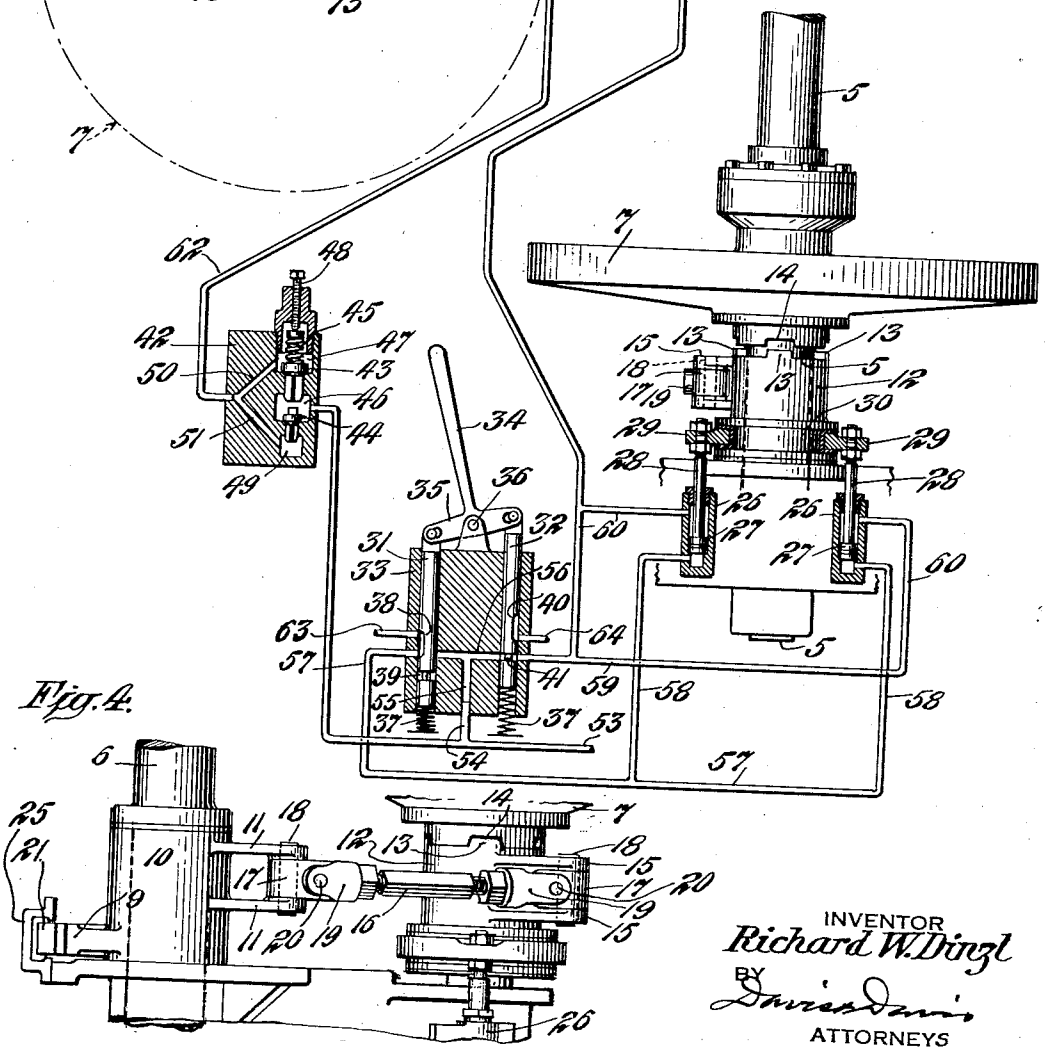

Fig. 4.

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TURNTABLE MECHANISM FOR PRESSES

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Application February 15, 1938, Serial No. 190,595

10 Claims. (Cl. 74—126)

This invention relates more particularly to improvements in mechanisms for intermittently rotating a turntable employed in a multi-stage molding press apparatus. In such an apparatus the turntable bears, in positions spaced around its axis, a series of molds or dies. These are charged at one position around the turntable, brought successively into register with the press located at another position and, at the conclusion of the pressing operation, moved away from the press, by rotating the turntable step-by-step.

The turntables employed for said purpose are usually quite massive. They require much power to rotate them and they acquire considerable momentum. An important object of the present invention is to provide improved mechanism for rotating such a turntable step-by-step and for so controlling the rotation as to stop the turntable without shock at the conclusion of a step.

Another important object of the invention is to provide, in combination with such a mechanism, improved means for clutching it to the turntable and releasing it therefrom.

Other objects of the invention will appear hereinafter.

In the drawings,

Fig. 1 is a plan view, partly in section, showing the turntable rotating mechanism associated with a press apparatus of the aforesaid type and with the parts of the mechanism in position to commence the rotation of the turntable;

Fig. 2 is a view similar to Fig. 1, with the parts of the mechanism in the positions which they occupy at the conclusion of a rotative movement of the turntable;

Fig. 3 is a diagrammatic view of said mechanism, an associated clutch mechanism and a hydraulic system for operating both of said mechanisms in a required sequence; and

Fig. 4 is a side view of the toggle linkage and clutch for rotating the turntable.

In Figs. 1 and 2 a press is indicated in plan by dot-and-dash lines. In the present instance the press includes an upper press head 1 reciprocable by a fluid pressure operated ram working in a cylinder 2. The cylinder is borne by a frame 3 mounted upon three fixed columns 4, 5, and 6. As the press structure forms no part of the present invention detail illustration of it is omitted. A turntable 7 is rotatably mounted upon the column 5. The columns 4 and 6 are outside of the periphery of the turntable. At points spaced around its axis the turntable has seats 8 for molds or dies, not shown. In the present instance there are four of the seats evenly spaced so that each quarter turn of the turntable will bring one of the molds or dies into a position beneath the press head 1.

The mechanism for rotating the turntable includes a gear segment 9 formed on a hub 10 which is rotatably mounted upon the column 6. A radial arm 11 is also formed on or rigidly borne by said hub at a level above that of the gear segment. Beneath the turntable a clutch member 12 is mounted upon the column 5 for rotation and vertical reciprocation thereon. Teeth 13 at the upper side of the clutch member are engageable in recesses 14 in the hub of the turntable. A radial arm 15 is formed on the clutch member, and a rigid thrust link 16 has one end pivotally connected to the arm 15 and its opposite end pivotally connected to the arm 11 so that rocking of the latter arm will oscillate the arm 15 and the clutch member. The pivotal connection between the link 15 and said arms are of the universal type in order to permit vertical shifting of the clutch member. Each pivotal connection comprises a block 17 pivotally connected to the respective arm by a vertical pin 18, and a fork 19 borne by the thrust link and straddling the block 17 and pivotally connected to the block by a pin 20. The arms are forked at their outer ends and straddle the blocks 17.

The gear segment 9 and the arm 11 are rocked by reciprocation of a rack 21 meshing with the segment. Said rack has a stem 22 coupled to it and bearing a piston 23 fitted to reciprocate in a hydraulic pressure cylinder 24. The cylinder is mounted in a fixed position on the base of the apparatus, and guide means 25 support the rack in engagement with the gear segment.

The arm 11 and the thrust link 16 constitute toggle linkage. At the beginning of a rotative step of the turntable the toggle linkage is broken, as shown in Figs. 1 and 3. At the end of the step the linkage is straightened, as shown in Fig. 2, with the pivot axis of arm 11 and the pivotal connections 18 of the thrust link on dead center. By operation of the linkage toward dead center the movement of the turntable is gradually retarded until it becomes zero when the linkage is straightened. The linkage thus stops the rotation of the massive turntable without shock. The parts of the mechanism are so proportioned and arranged that movement of the piston 23 a full stroke, from its position in Fig. 1 to its position in Fig. 2, will operate the toggle linkage to swing the clutch arm 15 a quarter turn, or ninety degrees. When the clutch is applied, as will be

described hereinafter, the turntable will be rotated ninety degrees.

Hydraulic-pressure-operated means are provided for shifting the clutch member 12 into and out of engagement with the hub of the turntable. Said means includes a pair of fixed vertically arranged cylinders 26 at opposite sides of the axis of the turntable. Pistons 27 working in said cylinders have stems 28 extending upwardly from the cylinders and secured to a clutch shipper 29. The latter engages in a circumferential groove 30 in the clutch member.

There is a hydraulic pressure control system provided to govern the reciprocation of the rack 21 and the operation of the clutch 12. This system includes a valve device comprising, in the present instance, a pair of valve plungers 31 and 32 reciprocable in parallel cylinder bores in a casing 33. These valves are shiftable in unison by a manually operable lever 34 formed at its lower end with a walking beam 35. At a point intermediate the ends of said beam the lever is pivotally mounted, as at 36, upon the valve casing. The opposite ends of the beam have pin-and-slot operative connections with the valves. Springs 37 act when the lever is released to position the beam horizontally and dispose the valves in neutral position. Valve 31 has a side cavity 38 and a circumferential groove 39 spaced along the valve. Similarly, valve 32 has a side cavity 40 and a circumferential groove 41. These cavities and grooves are registerable with piping and with passages in the valve casing, as will be described hereinafter. The structure of the valve device may be varied, the illustration of it being more or less diagrammatic.

The control system also has a check valve unit including a valve casing 42 containing two upwardly opening check valves 43 and 44. Check valve 43 is urged to closed position by a spring 45 and controls communication between a central chamber 46 and an upper chamber 47. The pressure of the spring upon the valve is regulated by an adjusting screw 48. Check valve 44 controls communication between chamber 46 and a lower chamber 49. Converging passages 50 and 51 lead from the chambers 47 and 49 respectively and open into each other.

A supply pipe 53 leads from a source of hydraulic pressure, not shown, to the central chamber 46 of the check valve unit. Said pipe has a branch 54 leading to a vertical passage 55 connecting with a cross passage 56 in the casing of the control valve device. The cross passage connects the bores containing the valve plungers. A pipe 57 leads from the bore containing valve 31 and has branches 58 leading to the lower ends of cylinders 26 of the clutch-operating mechanism. A pipe 59 leads from the bore containing valve 32 and has branch piping 60 leading to the upper ends of cylinders 26 and a branch pipe 61 leading to the end of cylinder 24 remote from the rack 21. A pipe 62 leads from the check valve unit, at the meeting point of passages 50 and 51, to the end of cylinder 24 nearest the rack 21. Discharge pipes 63 and 64 lead from the bores containing control valves 31 and 32 respectively.

When the operating lever 34 of the control valve device is free the walking beam 35 is horizontal and the valves 31 and 32 are in neutral position, to block flow through the control valve device. Assuming then that the piston 23 of the turntable rotating mechanism is at the inner end of cylinder 24, the toggle linkage is broken and the clutch 12 is released, movement of the lever 34 to the right, with reference to Fig. 3, will cause application of the clutch and operation of the toggle linkage to rotate the turntable. Said movement of the lever raises the valve 31 and depresses the valve 32. Cavity 40 of valve 32 then connects pipe 59 to the discharge pipe 64. Since pipe 59 is connected to pipe 61 leading from the outer end of cylinder 24 there is discharge of pressure from said end of the cylinder. Pipe 59 is also connected to the piping 60 leading from the upper ends of cylinders 26 so that there is discharge of pressure from said ends. At the same time, groove 39 of valve 31 connects passage 56 with pipe 57. Hydraulic pressure is then delivered from supply pipe 53 through branch pipe 54, passage 55, cross passage 56, groove 39, pipe 57 and piping 58 to the lower ends of cylinders 26. This pressure moves the pistons 27 upwardly to apply the clutch 12 to the hub of the turntable. Within the end of cylinder 24 nearest the rack 21 there is constant pressure tending to move the piston 23 to the opposite end of the cylinder. This pressure is delivered from supply pipe 53 past check valve 43 through passage 50 and through pipe 62. Owing however to the resistance of the spring load on check valve 43 and the inertia of the turntable rotating mechanism, movement of piston 23 will be delayed until the clutch 12 has been applied. Movement of the piston then will operate the toggle linkage to rotate the turntable with a movement which is gradually retarded to zero when the toggle linkage is straightened. The turntable is thereby stopped by the linkage without shock.

In order to break the toggle linkage and prepare for rotation of the turntable another step, the control lever 34 is shifted to the left, with reference to Fig. 3. Valve 31 is thereby raised and valve 32 depressed. Valve cavity 38 is thereby registered with discharge pipe 63 so that pressure in the lower ends of cylinders 26 can discharge through piping 58, pipe 57 and cavity 38 to pipe 63. At the same time, groove 41 of valve 32 connects cross passage 56 to pipe 59. Pressure can then flow from supply pipe 53, through pipe 54, passage 55, cross passage 56, groove 41 and piping 59 and 60 to move the pistons 27 downwardly for release of the clutch. This pressure also flows from pipe 59 through pipe 61 to the outer end of cylinder 24. Movement of the piston 23 to break the toggle linkage is, however, delayed by the inertia of the mechanism operated by the piston and also by the aforesaid constant pressure upon the opposite side of the piston. Therefore the clutch, which is more easily operated, is released by the fluid pressure before the piston 23 commences to move. Owing to the fact that the admitted fluid pressure operates upon a larger area of piston 23 than the opposed constant pressure the latter is overcome to shift the piston for breaking the toggle linkage.

When the toggle linkage is operated for rotation of the turntable it retains full control of the movement of the turntable through the medium of the clutch means. The clutch teeth 13 and the recesses 14 in the hub of the turntable to receive the teeth are formed to positively lock the clutch member to the turntable and prevent relative rotative movement in either direction. That prevents the turntable from overrunning the clutch member as the latter is rotated by the toggle linkage. Thereby the toggle linkage posi-

tively controls the movement of the turntable from the beginning to the end of each step.

What I claim is:

1. Mechanism for rotating a turntable step-by-step comprising toggle linkage, a clutch operable to operatively connect the toggle linkage to the turntable and release it therefrom, power means to operate the toggle linkage, the toggle linkage being constructed and arranged to rotate the turntable a step when the clutch is applied and the linkage is operated toward dead center, and control means for said power means and clutch operable to cause application of the clutch and application of power to the toggle linkage for operation of the latter toward dead center, said control means being operable also to cause release of the clutch and operation of the toggle linkage away from dead center.

2. Mechanism for rotating a turntable step-by-step, comprising toggle linkage, means to operatively connect said toggle linkage to the turntable and release it therefrom, and means for operating the toggle linkage, the toggle linkage and said means for operatively connecting it to the turntable being constructed and arranged for cooperation to rotate the turntable a step and with a gradually retarded movement by operation of the linkage toward dead center and to stop said rotation of the turntable by straightening of the linkage on dead center.

3. Mechanism for rotating a turntable step-by-step, comprising toggle linkage, means to operatively connect said linkage to the turntable, and power means to operate the toggle linkage, the toggle linkage and said means for operatively connecting it to the turntable being constructed and arranged for cooperation to rotate the turntable a step by operation of the linkage toward dead center by said power means and gradually retard the movement of the turntable.

4. Mechanism for rotating a turntable step-by-step, comprising toggle linkage, a clutch operable to operatively connect said linkage to the turntable and release it therefrom, power means to operate the toggle linkage into and out of dead center, said linkage and clutch being constructed and arranged for cooperation to rotate the turntable a step by operation of the toggle to dead center when the clutch is applied and gradually retard the movement of the turntable and stop it by straightening of the toggle, and control means for the clutch and for said power means and including a member manually operable in one direction to cause application of the clutch and shift of the toggle linkage to dead center by the power means, and operable in another direction to cause release of the clutch and operation of the toggle linkage away from dead center.

5. Mechanism for rotating a turntable, according to claim 4, characterized in that the said power means for operating the toggle linkage is fluid pressure operated, fluid pressure operated means are provided to cause application and release of the clutch, and the said control means comprises valve means to control fluid pressure for the said operations of the clutch and the toggle linkage.

6. Mechanism for rotating a turntable, according to claim 2, characterized in that one end of the toggle linkage is pivotally mounted with its axis fixed and has a toothed segment, the opposite end of the linkage is mounted for oscillation about another fixed axis, for rotating the turntable by rotation of said segment in one direction, there is a reciprocable rack meshing with said segment for rocking the latter and operating the toggle linkage, and fluid pressure operated means are provided for reciprocating said rack.

7. Mechanism for rotating a turntable, according to claim 3, characterized in that one end of the toggle linkage is pivotally mounted with its axis fixed, the said power means is fluid pressure operated and is operatively connected to said end of the toggle linkage, the opposite end of the toggle linkage is mounted for oscillation about another fixed axis, there is a clutch operable by said oscillatable end of the linkage and shiftable for operative connection with the turntable and for release therefrom and having fluid pressure operated means for shifting it, and control valve mechanism is provided for said fluid pressure power means and said fluid pressure clutch shifting means and includes an operating member shiftable in one direction to cause application of the clutch and operation of the power means for rotating the turntable and shiftable in another direction to cause release of the clutch and shift of the toggle linkage away from dead center.

8. In combination, mechanism operable for rotating a turntable a step and operable for retraction in preparation for another step, a clutch operable to operatively connect said mechanism to the turntable and release it therefrom, power means to operate said mechanism, and control means for the clutch and for said power means and including a member manually operable in one direction to cause application of the clutch and shift of said mechanism by the power means to rotate the turntable a step, and operable in another direction to cause release of the clutch and retraction of said mechanism.

9. Mechanism for rotating a turntable step-by-step comprising toggle linkage, means operable to operatively connect said linkage to the turntable and release it therefrom, and power means to operate the toggle linkage, said toggle linkage, power means and the means for operatively connecting the toggle linkage to the turntable being constructed and arranged for cooperation to rotate the turntable a step by operative connection of the linkage to the turntable and operation of the linkage toward dead center by said power means and gradually retard the movement of the turntable and retain control of the movement to the end of the step to prevent overrunning of the turntable.

10. Mechanism for rotating a turntable step-by-step, according to claim 9, characterized in that there is a common control means for said power means and for said means for operatively connecting the toggle linkage to the turntable, and said control means is constructed and arranged to have one operation to first cause operative connection of the toggle linkage to the turntable and then cause operation of the linkage to rotate the turntable, and another operation to first cause release of the toggle linkage from operative connection with the turntable and then cause operation of the linkage away from dead center.

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