Oct. 6, 1936. W. KLOCKE 2,056,402

PRESS

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Fig. 1.

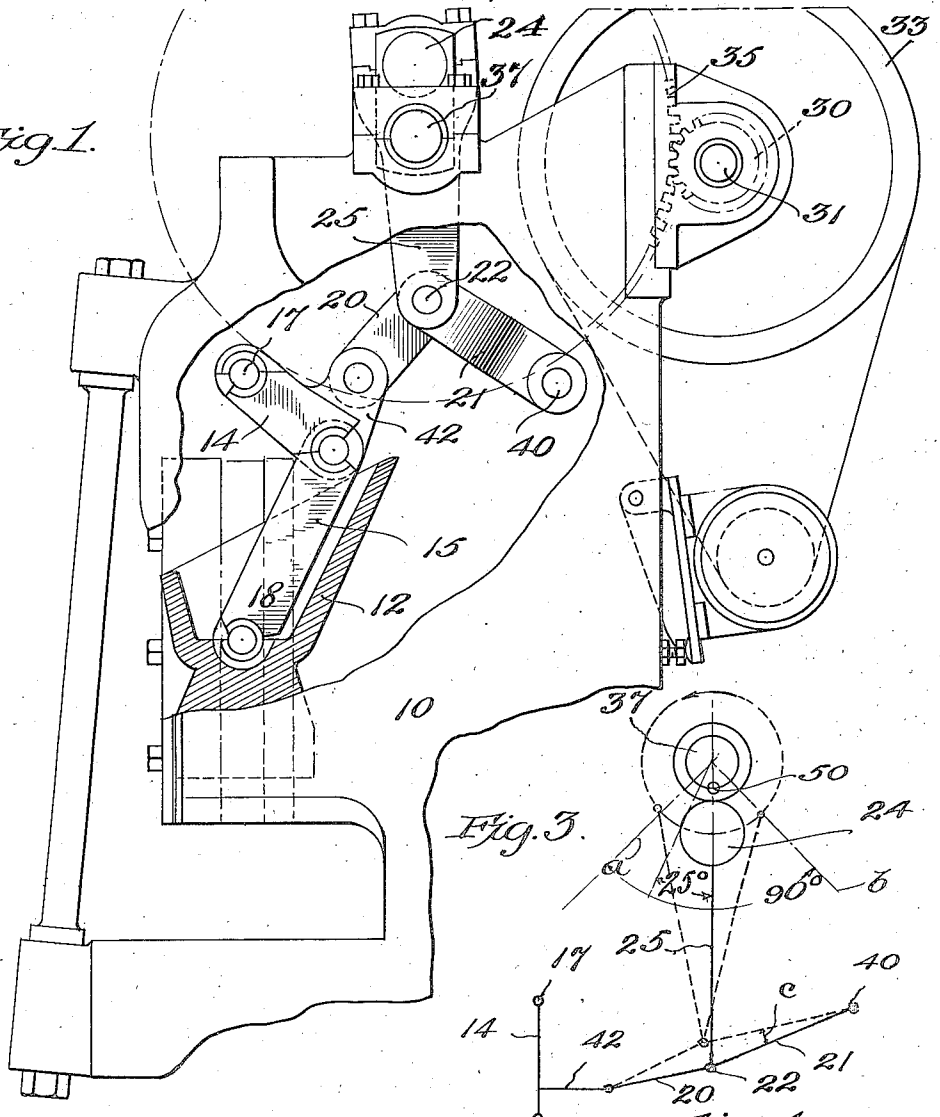


Fig. 2.

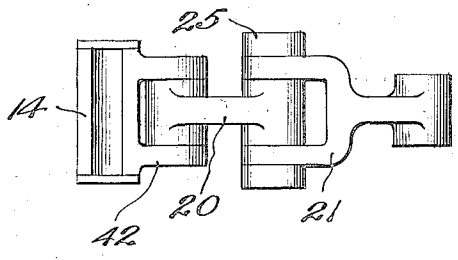
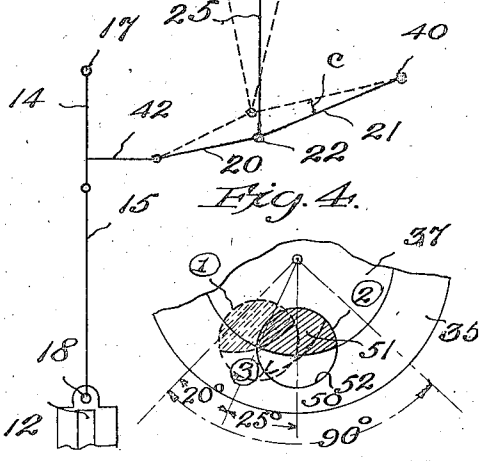


Fig. 3.

Fig. 4.



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Fig. 5

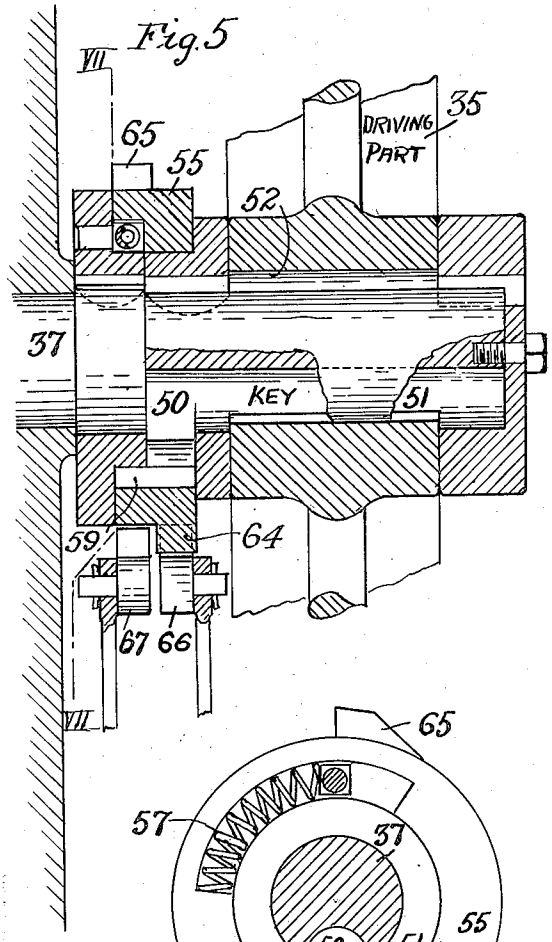


Fig. 6

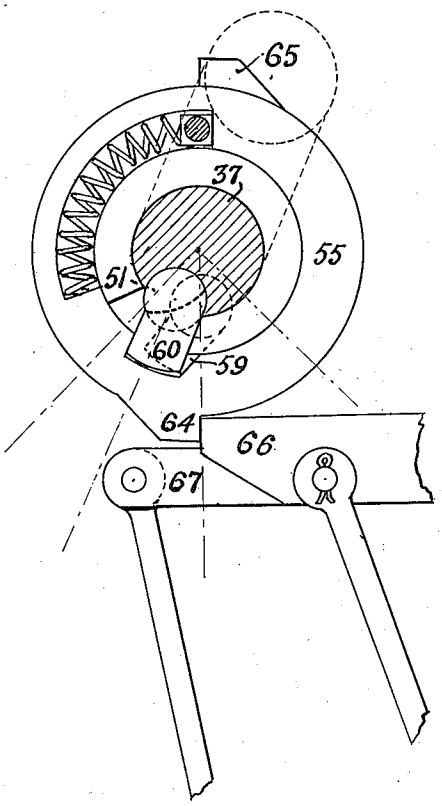
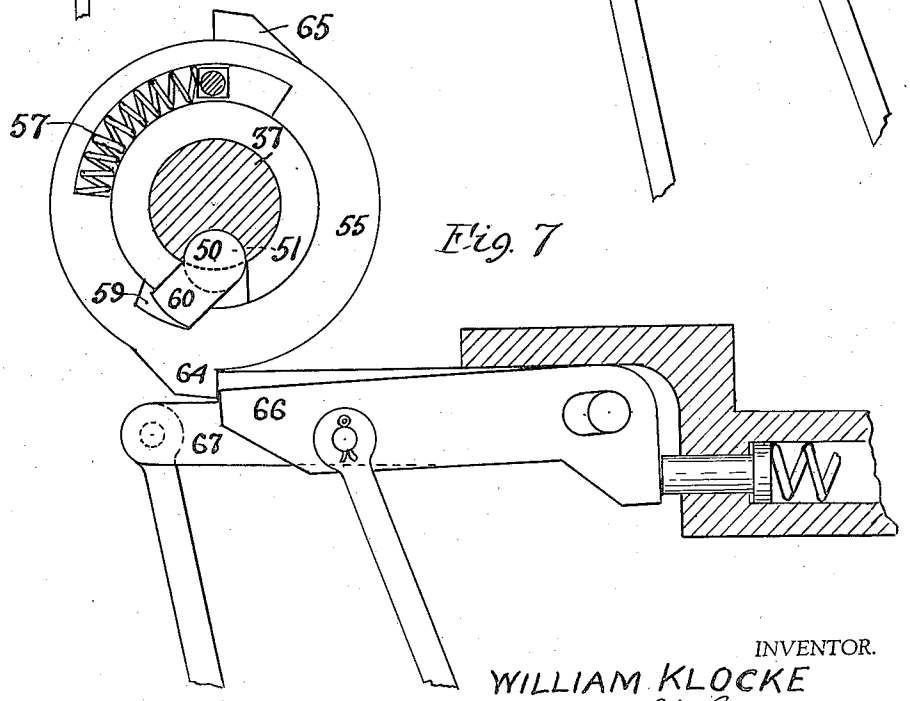


Fig. 7



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UNITED STATES PATENT OFFICE

2,056,402

PRESS

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Application October 25, 1935, Serial No. 46,699

9 Claims. (Cl. 74—38)

This invention relates to presses, and provides improvements therein.

The present invention achieves an advance in the accuracy with which metal parts may be formed by a press operation, the invention providing a press by which metal can be bent and drawn to an accuracy within a few ten-thousandths of an inch of a required dimension. The mechanism is such that the slide may have a substantial and normal stroke characteristic of presses for general purposes, and have a "dwell" of an absolute nature at the bottom-of-the-stroke position while the slide actuating parts are moving through a considerable part of their cycle of movement.

The invention further provides a press of the character described which is of simple construction, and in which driving forces are transmitted to the moving parts at good working angles, and with good mechanical advantage, and in which the working stresses are advantageously distributed in the frame of the press. It further provides a press in which the shocks and strains on the press-tools are greatly eased, while allowing of the application of great forces and pressures to the material operated on by the press.

The invention further provides a press having a clutch of the positive engagement type in which the clutch parts can be disengaged and re-engaged while the press-slide is in its bottom-of-the-stroke position and the frame under maximum stress, against a relatively very small resistance, and in which, furthermore, the driving mechanism may turn through a greater or less angular distance of considerable amount after engagement of the clutch parts, against said relatively small resistance so that the driving mechanism can gain or retain considerable momentum before meeting the relatively great resistance required to free the press-tools and lift the press-slide from its bottom-of-the-stroke position.

An embodiment of the invention is illustrated in the accompanying drawings, wherein:

Fig. 1 is a view thereof in side elevation, with parts broken away to better illustrate certain of the working parts.

Fig. 2 is a view, from the underside, of the levers and connections shown in side elevation in Fig. 1.

Fig. 3 is a diagrammatic view illustrating the slide actuating mechanism in the positions which the parts occupy in the bottom-of-the-stroke position of the slide.

Fig. 4 is a diagrammatic view illustrating the engaging and disengaging action of a clutch of the well known oscillating-key type.

Figs. 5, 6 and 7 illustrate a suitable clutch having the mode of operation illustrated and described with reference to Figs. 3 and 4; Fig. 5 being a longitudinal sectional view, and Figs. 6 and 7 being sections each on the line VII—VII Fig. 5, Fig. 6 showing the parts at the beginning of the clutch engagement, and Fig. 7 showing the parts at the start of the operation to engage the clutch.

Referring to said drawings, numeral **10** designates the press-frame, between the sides of which is a slide **12** arranged to be reciprocated in suitable gibs on the frame by the actuating mechanism about to be described.

The slide actuating mechanism comprises the knuckle-jointed levers **14, 15**, turning on the bearings **17, 18** on the frame and on the slide respectively, a pair of toggle levers **20, 21**, pivotally connected, as indicated by **22**, a crank (or an equivalent, such as an eccentric) **24**, and a connecting or pitmen-rod **25** connecting the crank **24** with the connected toggle levers **20, 21**.

The crank **24** is turned by any suitable means, as by a pinion **30** on the shaft **31** of a fly-wheel pulley **33**, meshing with a large gear wheel **35** on the shaft **37** of crank **24**.

The connected toggle-levers **20, 21** are connected at one end to a fixed bearing **40** on the press frame **10** and at the opposite end to the knuckle-jointed levers **14, 15**, and the arrangement and correlation is such that when the crank **24** is turning in its dead-center arc (about 90° of movement) the toggle-levers **20, 21** are approximately in line (the center **22** moving through a small arc of the order of 10° across the line of dead-center alinement of said levers **20, 21**) and the knuckle-jointed levers **14, 15** remain in virtually absolute alinement (the arc of movement being of the order of 2°, and the calculated movement of the slide **12** being in millionths of an inch). There is accordingly obtained a dwell of the slide **12** which is absolute for all practical purposes, for 90° of crank-movement. The length of the connecting rod **25** is somewhat greater than the distance between the center of crank **24** in its lower dead-center position and the center of the joint **22** in the alined position of levers **20, 21**, so as to cause the aforesaid movement of the connected toggle-levers **20, 21** in a small arc across the position of alinement of said levers.

The knuckle-jointed levers **14, 15** are arranged in line with the line of reciprocation of the slide

12, and the toggle-levers 20, 21 preferably extend across the frame of an angle approximating 180° to the line of reciprocation of the slide. By this arrangement the greatest stress is lengthwise of the press-frame in a direction where the frame can best sustain it. The force transmitted through the crank 24 is transmitted almost wholly as a turning force to the toggle levers 20, 21, virtually none of it acting directly as a thrust against a fixed bearing or bearings. Owing to the mechanical advantage with which the toggle-levers act on the knuckle-levers 14, 15, the force acting between the bearings 17 and 40 is only a small fraction of that acting between the bearings 17 and 18; the frame 10 does not have to sustain the action of exceptionally large forces cross-wise thereof, and the frame and transmitting mechanism can be made exceptionally light for the forces transmitted to the slide 12.

To obtain a relatively long stroke of the slide 12 without exceptionally lengthening the knuckle-jointed levers 14, 15 and the height of the press, the toggle-lever 20 is made shorter than the lever 21, and an elbow 42 is provided on the lever 14, and the toggle-lever 20 is pivotally connected thereto; also, to the same end the knuckle-jointed lever 14 is made shorter than the lever 15.

The crankshaft 37 is preferably located at the top of the press-frame, and is so arranged that the crank 24 and connecting-rod 25 are in their dead center position when the knuckle-jointed levers 14, 15 are in their position of alinement.

A clutch 50 of the oscillatory-key type is preferably provided between the driven crankshaft 37 and the driving gear-wheel 35. A known clutch of this type and its operating mechanism is illustrated in Figs. 5, 6 and 7. The clutch is constructed and arranged to disengage and engage the driving and driven parts at positions corresponding to the top and bottom positions of the crank 24 and slide 12. The key 51 is oscillated to engage and disengage in the notch or recess 52 by means of a collar 55 having a limited amount of angular movement (against the pressure of a spring 57) with reference to shaft 37 and associated parts in which the key 51 is mounted. The collar has a cam-notch 59 into which a tail 60 on key 51 projects, and by means of which the key 51 is oscillated to and from engaging position with notch 52. The collar 55 also has two angularly spaced abutments 64, 65 adapted and arranged to be engaged by one or more latches. As here shown, two latches 66, 67 are used, and the abutments 64, 65 are off-set laterally, so that latch 66 engages abutment 64, and 67 engages 65. To disengage the clutch latch 66 is released so as to lie in the path of abutment 64. When abutment 64 is struck, the collar 55 is held still while the crank-shaft 37 and the parts keyed thereon continue to rotate to a limited extent, during which time the key 51 is oscillated to disengage it from notch 52 in the driving part, and thereby bring the slide 12 to rest at the top of its stroke. The movement of slide 12 is started again by removing latch 66 from the path of abutment 64, whereupon collar 55 by the action of spring 57, cam-notch 59 and tail 60, oscillates key 51 to engage the notch 52 in the driving part. Latch 67 in the path of abutment 65 operates to disengage the clutch at the bottom-of-the-stroke position of the slide 12. The rotation of collar 55 is stopped while the shaft 37 carrying key 51 continues to move, as here shown, through an angle of 25°. During this angular movement of shaft 37 the key 51 is oscillated to a position to clear notch 52. The upward movement of slide 12 is started by removing latch 67 from the path of abutment 65, whereupon collar 55 operates to oscillate key 51 to engage it in notch 52 of the driving part. About 25° to 30° of movement of the crank-shaft 37 is allowed for movement of the oscillating key 51 from its fully engaged position with the notch 52 in the hub of the gear-wheel 35 to its fully disengaged position, which amount of angular movement is in accordance with usual practice, and the key 51 is so located on the shaft 37 that its aforesaid movement of 25° to 30° occurs within the 90° of angular movement of the crank-shaft 37 through which the crank 24 travels in its arc passing through its dead-center position and during which 90° of angular movement the knuckle-jointed levers 14, 15 are in virtual absolute alinement. During said 90° of angular movement of the crank 24, the force required to move the toggle-levers 20, 21 is very small as compared with the force required to move them just before and after the limits of said 90° arc of movement of the crank 24 are reached when the slide is being forced with a maximum effort to and from its bottom-of-the-stroke position. Consequently, with the clutch parts so arranged that the 25° or so of crank-shaft movement required for operating the clutch is included within the aforesaid 90° arc of movement of the crank 24, the parts of the clutch 50 can be disengaged and re-engaged against a relatively small resistance while maximum force is acting on the slide 12 and the frame 10 is stressed to its maximum. By suitably spacing the aforesaid 25° arc required for the clutch operation within the aforesaid 90° arc of movement of the crank 24, a suitable lag to the beginning of the clutch operation after the crank 24 reaches the beginning of its aforesaid 90° arc of movement may be obtained; and also a suitable engagement of the parts of the clutch 50 in advance of the crank 24 reaching the end of its aforesaid 90° arc of movement may be obtained so the driving mechanism (motor, fly-wheel 30, gear-wheel 35, and shaft 37) may drive the crank 24 through a greater or less angle against a relatively small resistance, and thereby gain, or retain, momentum, before the crank 24 meets the greatly increased resistance at the end of its aforesaid 90° arc of movement. As shown in Fig. 3, the clutch 50 is so positioned that its parts are disengaged and re-engaged at about the middle of said 90° arc of movement of crank 24, so that disengagement begins after the crank 24 has moved about 20° in its aforesaid 90° arc of movement, and engagement is completed about 45° before the crank 24 reaches the end of its aforesaid 90° arc of movement. It becomes practicable by my invention to disengage and re-engage a clutch of the positive engagement type with the slide in its bottom-of-the-stroke position and while held under the action thereon of an enormous force.

The clutch operating angle need not however be geometrically included within the 90° angle which passes through the dead-center position of the crank, but may be included as a matter of timing, so that the clutch operation takes place within the time that the crank 24 is within said 90° angle or arc of movement.

Operation

Starting with the clutch 50 engaged, and with

the slide 12 at the top of its stroke (position shown in Fig. 1) the crank 24 drives the slide 12 through the toggle-levers 20, 21 and the knuckle-jointed levers 14, 15 to its bottom-of-the-stroke position, shown diagrammatically in Fig. 3. The knuckle-jointed levers 14, 15, reach and maintain virtually absolute alinement, and the slide 12 dwells virtually absolutely, while the crank moves from *a* to *b* Fig. 3 through an angle of approximately 90° (the crank movement is in fact through a slightly greater angle) and the toggle levers move back and forth through a small angle *c* across the line of dead-center alinement of said levers 20, 21. The leverages of the toggle-levers 20, 21 and of the knuckle-jointed levers 14, 15 are great as these levers approach alinement, and the tool on the slide 12 is forced against the piece of metal in the tool on the bed of the press with an enormous force and by reaction the press frame is correspondingly stressed.

A piece of metal (a strip of steel to be formed into a flanged half-round liner for a bearing, for example) is forced into shape by the tools on the slide and bed during the approach of the slide to the bed, and the formed piece of metal is held between the immovable press-tools under enormous pressure for a time corresponding to the movement of the crank 24 from *a* to *b* through an angle of 90°, during which time the molecules of the metal have time to readjust themselves so that the formed piece of metal retains the shape to which it is forced by the press-tools to a very much greater degree than in presses where the "dwell" of the slide is not virtually absolute. In metal-pieces formed in ordinary presses, the molecular forces in the metal are such as to cause parts of the formed piece, when released by the press tools, to depart two or three thousandths of an inch from their position in the die. By my press the variation of the formed piece from the shape to which it is forced within the tools of the press, may be reduced to the order of tenths of thousandths of an inch.

By disengaging the clutch 50 while the crank 24 is in its 90° angle *a*—*b* of movement, (which may be readily and practicably done owing to the mechanical principles embodied in my invention) the time during which the slide 12 may be held immovable by the knuckle-jointed levers 14, 15 may be increased to any desired extent. By disengaging the clutch 50 for about 3 seconds, metal strips (cold steel for example) can be given a shape which varies only two or three ten-thousandths of an inch from its shape within the press-tools.

The knuckle-jointed levers 14, 15, when alined, transmit virtually all of the stress to the press-frame. The levers 14, 15 remain in their alined position through the angle *a*—*b* (approximately 90°) of movement of crank 24, and while so alined, only a relative small force is required to turn the crank, and to oscillate the toggle-levers 20, 21. The clutch 50 may be operated within the time in which the crank 24 is in said 90° arc of its movement against a minimum of resistance, and by timing the engagement of the clutch parts so that it occurs while the crank 24 is well within said 90° angle *a*—*b*, the driving parts (motor, flywheel 33, gear wheel 35 etc.) may gain or retain momentum before the crank 24 reaches the end (*b*) of the said 90° angle and the great resistance to moving the knuckle-jointed levers 14, 15 and lifting the slide 12 to separate the press-tools, is encountered. The strain on the clutch parts during engagement and disengagement is relatively small, the operation is easy, and excessive wear and frequent breakage eliminated.

The invention may receive other embodiments than that herein specifically illustrated and described.

What is claimed is:

1. A press comprising a reciprocatory slide, and means for actuating the same, comprising a pair of knuckle-jointed levers, a pair of jointed toggle levers connected to said knuckle-jointed levers, a crank, and a connection between said crank and toggle levers, said connection having a length somewhat greater than the distance between the center of the crank in its lower dead center position and the center of the joint of said toggle levers in the alined position of said toggle-levers, so that the toggle-levers move in a small arc across the line of dead-center alinement of said toggle-levers through a wide angle of movement of the crank, and while said knuckle-jointed levers are in virtually absolute alinement.

2. A press according to claim 1, wherein the toggle-lever proximate the connection to the knuckle-jointed levers is substantially shorter than the other toggle lever.

3. A press according to claim 1, wherein one of said knuckle-jointed levers has an elbow thereon, and wherein the toggle-lever proximate the connection to the knuckle-jointed levers is substantially shorter than the other toggle-lever and connected to said elbow.

4. A press according to claim 1, wherein said toggle levers are so arranged as to be in substantial alinement along a line approximating at 180° to the alined position of the knuckle-jointed levers, and wherein said crank and connecting rod are so arranged as to be alined, in a dead-center position parallel to the alined position of said knuckle-jointed levers.

5. A press according to claim 1, further comprising a clutch of the positive engagement type, and positioned with relation to said crank so that the angular movement required for disengagement and reengagement of its parts is included within the aforesaid wide angle of movement of said crank.

6. A press comprising a reciprocatory slide, and means for actuating the same, comprising a pair of knuckle-jointed levers, a pair of jointed toggle levers connected to said knuckle-jointed levers, a crank, and a connection between said crank and toggle levers, said connection having a length somewhat greater than the distance between the center of the crank in its lower dead center position and the center of the joint of said toggle levers in the alined position of said toggle levers, so that the toggle-levers move in a small arc across the line of dead-center alinement of said toggle-levers through an angle of movement of the crank of approximately 90°.

7. A press according to claim 6, further comprising a clutch of the positive engagement type the parts of which are movable to disengaging and re-engaging position in about 25° of angular movement of said crank, and positioned with relation to said crank so that the 25° of movement or thereabout required for its operation are included within the aforesaid 90° of movement of said crank.

8. A press comprising a reciprocatory slide, and means for actuating it comprising a crank, means for driving said crank, a clutch of the positive engagement type the parts of which are movable to disengaging and re-engaging position within a given angular movement of said

crank, and means driven by said crank for holding said slide in its bottom-of-the-stroke position through a greater angle of movement of said crank than the aforesaid angular movement for operating said clutch.

9. A press comprising a reciprocatory slide, and means for actuating it comprising a crank, means for driving said crank, a clutch of the positive engagement type the parts of which are movable to disengaging and re-engaging position within about 25° of angular movement of said crank, and means driven by said crank for holding said slide in its bottom-of-the-stroke position through approximately a 90° angle of movement of said crank, said 25° angle being included within said 90° angle.

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