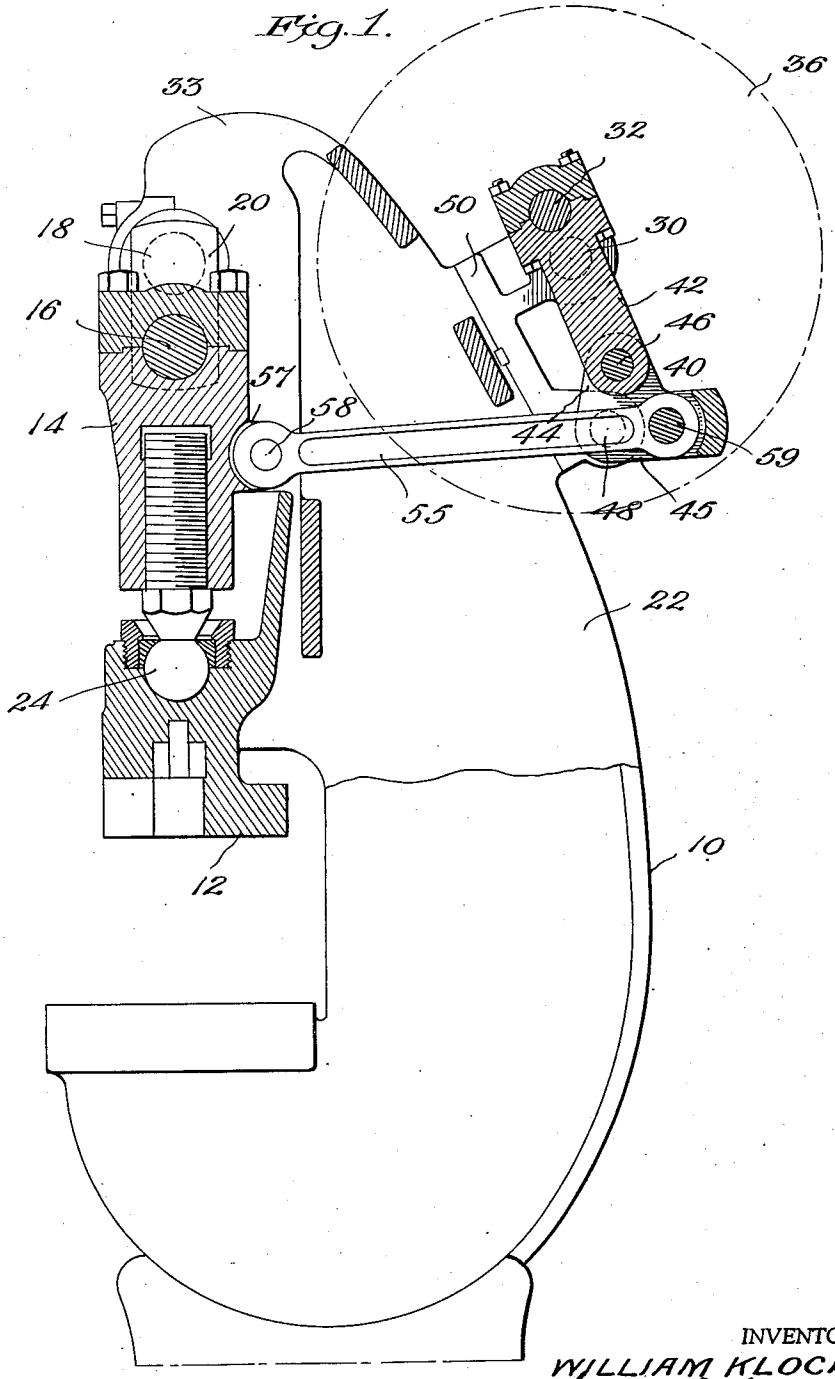
June 13, 1939. W. KLOCKE 2,161,869

PRESS

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Fig. 1.



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Fig. 2.

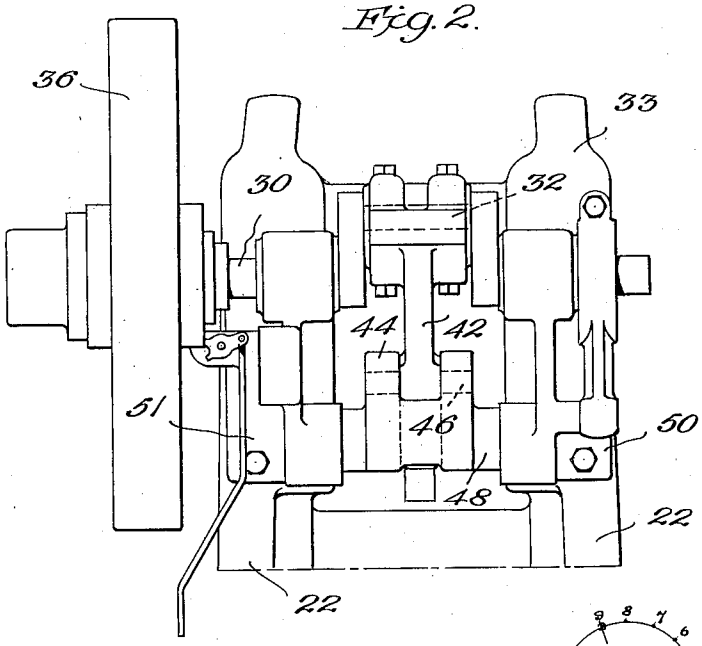


Fig. 3.

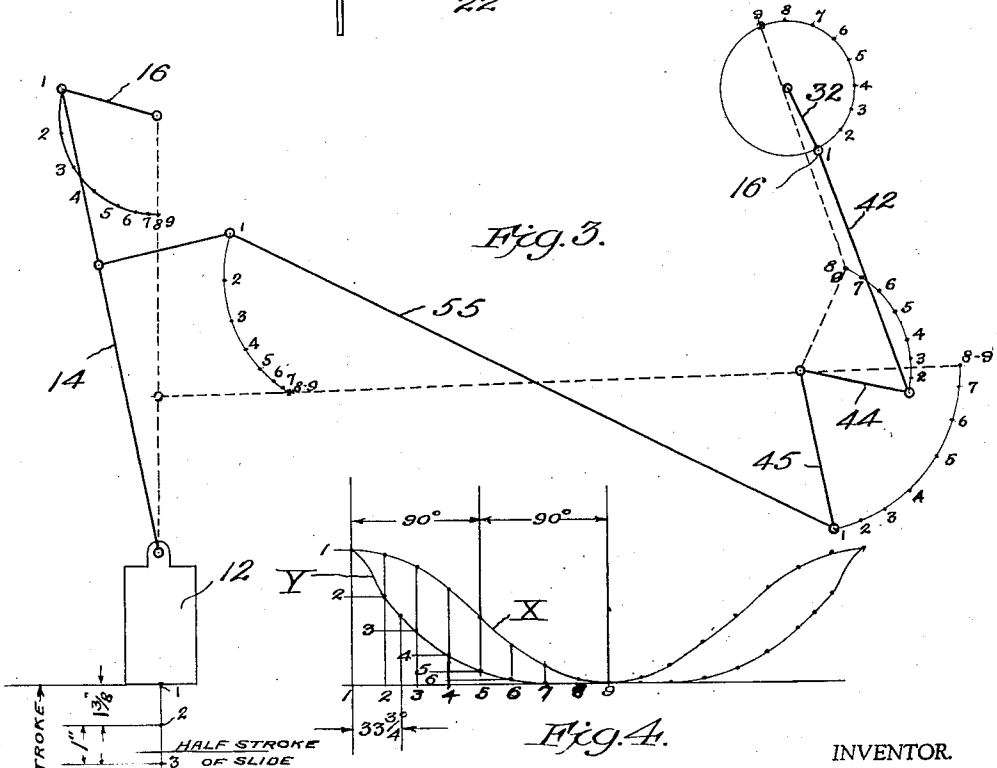


Fig. 4.

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Fig. 5.

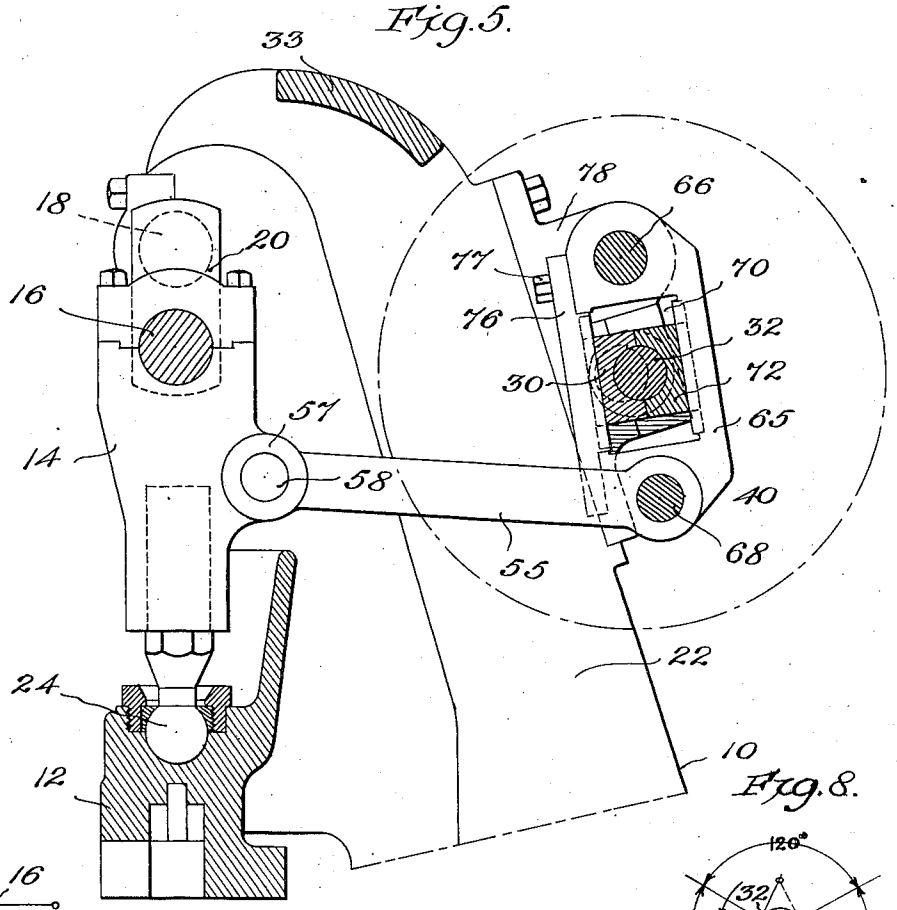


Fig. 8.

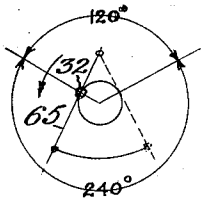


Fig. 6

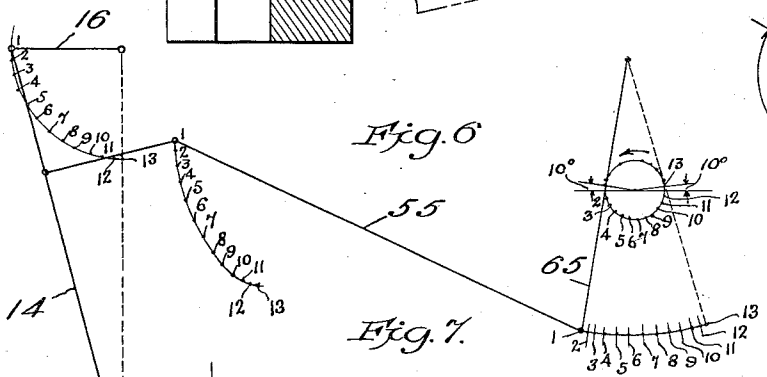
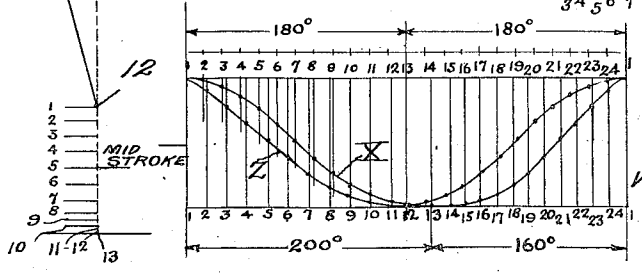


Fig. 7.



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UNITED STATES PATENT OFFICE

2,161,869

PRESS

William Klocke, Woodhaven, N. Y.

Application December 9, 1937, Serial No. 178,848

10 Claims. (Cl. 74—38)

This invention relates to power presses of the crankshaft type, and provides improvements therein.

Power presses of the crankshaft type are used for the greater part of the forming-operations on metal, and there are hundreds of thousands of them in use.

The speed of operation of power presses of the crankshaft type has been increased through the years to reduce capital investment and reduce manufacturing costs, but this has been offset in part by increased die-upkeep costs.

Moreover the limit of speed of operation has been reached in the use of such presses for drawing operations. The likelihood of shells being torn, I have observed, is greater at the higher speeds of operation. Only a very limited number of torn shells can be tolerated in production operation.

By the present invention I provide a power press which can be operated with present day high speeds with much lessened die upkeep costs; it also permits of increased speed of operation without greater die upkeep costs than is encountered with the previously known power presses.

By the present invention I also provide a power press which can be used for drawing shells without tearing, at greater speeds of operation than has been done with the previously known power presses.

Moreover, by the present invention, I effect a large saving in power for operating the press.

By the present invention I am also able to utilize in large part the structure of previously known power presses, enabling them to be converted, thereby enabling the great mass of owners of power presses to obtain the advantages of higher speed and improved performance hereinbefore referred to by having the presses converted, thereby saving the press-using public a great aggregate expenditure for new presses.

The invention has other advantages hereinafter set forth in the description which follows:

Two embodiments of the invention are illustrated in the accompanying drawings.

The drawings show the embodiment of the invention in a widely used type of power press, and show how such a press can be converted so as to obtain the advantages of the present invention. The press used for conversion was a No. 21-B "Bliss" Inclinable power press.

In said drawings,

Fig. 1 illustrates, partly in side elevation and partly in vertical section, one embodiment of my invention;

Fig. 2 is a rear elevation of parts shown in Fig. 1;

Fig. 3 is a diagrammatic view illustrating the movement of the parts shown in Figs. 1 and 2;

Fig. 4 is a graph illustrating the slide movement, compared with the slide movement of the ordinary and generally used power crank-press;

Fig. 5 is a vertical sectional view (similar to the upper part of Fig. 1) illustrating a second embodiment of the invention.

Fig. 6 is a diagrammatic view illustrating the movement of the parts shown in Fig. 5.

Fig. 7 is a graph illustrating the movement of the slide, Fig. 5, compared with the slide movement of the ordinary power crank-press; and

Fig. 8 illustrates diagrammatically a modified arrangement of the lever 65 and operating crank 32, Fig. 5.

Referring to said drawings, numeral 10 designates a press frame, and 12 designates a slide mounted so as to be reciprocated therein. The forming tool (not shown), is carried on the bottom of the slide in use.

The frame and slide illustrated are that of a power press (No. 21-B "Bliss" Inclinable power press) of which large numbers are in use, and it is one of the important advantages of the present invention that it may be applied, by making a few substitutions and additions to such power presses, and many others, of which there are large numbers in use.

The slide 12 is connected to the frame by a connecting rod 14 and an oscillatory crank 16 on a crank shaft 18. The connecting rod 14 and the crank 16 and shaft 18 may be identically the same as parts in machines already in use. The crank shaft 18 may fit in the bearings of presses already in use. However, the fly-wheel which is mounted on the shaft 18 in the ordinary crank press is removed, and the projecting end of the shaft 18 may be cut off. The connecting rod 14 fits closely adjacent the cheeks 20 of the crank, and the cheeks 20 fit closely against the bearings in the side pieces 22 of the frame, a press according to the present invention being equally as rigid as the usual crank press of the type hereinbefore referred to. The pivotal connection 24 may have any suitable or well known form, that shown being a ball and socket joint.

The mechanism for reciprocating the slide 12 comprises a crank 32 (which may be formed on a shaft 30) constructed and arranged to be revolvable in one direction through successive cycles and a link 55 driven from said unidirectional revolvable crank and connected to the slide

connecting rod 14. By this construction and arrangement the line of thrust of the link 55, in a position of said crank 16 which is 90° from its position of alinement with connecting rod 14, passes substantially off from, or at one side of the center of crank 16, so that the thrust of said link 55 in said 90° position of crank 16 exerts a substantial turning moment to the latter (crank 16). Thereby a straight resistance or pull on the bearings of crankshaft 18 almost in line with the thrust of link 55 is avoided and it is possible and practicable to impart an amount of angular movement to crank 16 even greater than 90° (see Fig. 3). The construction and arrangement is also such that unidirectional revolution of crank 32 imparts to slide 12 a fast movement at the beginning and end of the cycle of crank 32, and a slow movement in the mid-portion of the cycle of crank 32 (as the slide 12 approaches its bottom-of-the-stroke position) as compared with the movement of a slide with a direct connection to a revolving crank, which latter movement has the graphic representation of a sinusoid. The fast and slow movements just described may be accentuated by means of a rocking or oscillating part between the link 55 and the unidirectional revolvable crank 32, hereinafter more fully described.

The crank shaft 30 is rotated in any suitable manner, as by a fly-wheel pulley 36, which may be mounted on one end of the shaft 30.

A rocking part 40 may be, as shown in the drawings, interposed between the unidirectional revolvable crank 32 and the link 55.

In the embodiment illustrated in Figs. 1 to 3 inclusive, the rocking part 40 has two angularly spaced arms 44, 45, and the connection or rod 42 is connected to an arm 44 as by means of a pin 46. The rocking part 40 turns on stub-shafts 48. Advantageously the rotary crank shaft 30 and the stub-shafts 48 are mounted in brackets 50, 51 which are fastened to the back of the side frames 33 of the press. The mounting of the brackets in this way can be readily effected on the frames of presses which have been in use, by simply mounting them on the flats on the back of the side frames. The adaptation can be done in a similar way on many other makes of presses. As shown in both of the illustrated embodiments, the link 55 may be attached to the connecting rod 14 by means of ears 57, formed on or attached to the latter disaxially of the pivotal connection between connecting rod 14 and crank 16, and a pin 58 passing through the ears and the adjacent end of the link 55. At its opposite end, in the embodiment illustrated in Figs. 1 to 3, the link 55 is attached to the angularly spaced arm 45 as by means of a pin 59 which passes through the end of the link and through the arm. By arranging the connection of the link 55 to the connecting rod 14 as described, a relatively high lift can be imparted to the slide 14, without the link 55 encountering the shaft 18, and without imparting a thrust to the connectng rod 14 at too acute an angle to the crank 16, at its extreme position of lift, to cause binding or excessive strain on the bearings of the oscillatory shaft 18. In fact the angles between the links, connecting rods and rocking parts, throughout the cycle of operation are such that easy turning movements are obtained, and extraordinary strains on the bearings avoided.

Referring to Fig. 5, the rocking part 40 is embodied as a lever 65 pivoted on a pin 66, and also pivotally connected to the link 55 by a pin 68. The lever 65 is rocked or rotated by means of the rotary crank 32 on the crank shaft 30, by means of any suitable connection. In the embodiment shown, the lever is provided with a slot 70, and the connection between the rotary crank 32 and the lever 65 comprises a block 72 (preferably formed in two sections) which has a circular bearing on the crank 32 and a flat bearing on the inside parts of the lever 65 facing the slot 70. One side of the lever 65, as the side 76 may be formed as a separate part, united to the other part by fastening screws 77, which construction facilitates the assembling of the lever 65, block 72 and crank 32. The crank shaft 30, and the pin 66 may be mounted in brackets 78 formed or fastened on each of the side frames, advantageously near the crown or head 33 of the frame similarly to Figs. 1 and 2. As shown, the axis of pin 66 on which lever 65 turns is at approximately the same level as the axis of the oscillatory crank 16. The axis on which the lever 65 turns is advantageously at or above the aforesaid level, by which arrangement the fly-wheel and parts connected to the link 55 are high on the press frame, with the advantage of being located in a position where injury to persons around the press is least likely to be caused.

Operation

The slide 12 has imparted thereto a movement (considering the press cycle as beginning at the top of the stroke of the slide 12) which moves more rapidly during the first-half to two-thirds of the downward stroke than the slide of the ordinary crank press, and then moves more slowly than the latter during the remainder of the down stroke. The first part of the rising stroke of the slide is slow and the latter part fast, as compared with the movement of the slide of an ordinary crank press. Thereby, when the forming tool carried by the slide 12 is performing its forming work on the stock or material to be formed, and in most instances as it is immediately approaching and is about to make contact with the stock or material, it is moving more slowly than a tool on the slide of an ordinary crank press. Operating in this manner, the strain and effect on the forming tools of the press is greatly lessened, and the durability and serviceability of said tools greatly increased. Moreover when forming tools are used which draw a sheet of metal, the internal adjustments of the metal in the sheet being formed into a shell are more readily made, and the liability of the shell to tear greatly lessened.

There is also a large saving in the power required to operate the presses by reason of the construction and arrangement of the slide operating mechanism according to this invention. During the relatively fast part of the movement of the slide in the upper half of the cycle the power required is only that required to move the slide. During the relatively slow part of the movement of the slide in the lower half of the cycle, when the tools meet the resistance of the metal or stock to be formed, the power is applied with much greater mechanical advantage than in the ordinary crank press, and consequently the same force can be applied with less power at the motor or belt which drives the primary shaft. The link mechanism, according to my invention has the advantage of a toggle action movement. For example, the 21-B "Bliss" press hereinbefore referred to requires a five horsepower motor for

driving, whereas a corresponding press according to my invention, requires only two horsepower.

In the graph, Fig. 4 the sinusoidal curve X shows in a graphic way the movement of the slide of an ordinary crank press, and Y is a curve plotted similarly to the curve X, which shows the movement of the slide 12 in the embodiment Figs. 1 to 4. A similarly plotted curve for the embodiment shown in Fig. 5 differs somewhat in detail, but has the same characteristics as the curve Y with respect to the curve X.

In the diagram Fig. 3, the slide 12 is shown at about the limit of its rising movement or upstroke, and the positions of the parts are plotted for 22½° arcs or angles of movement of the revolvable crank 16. On the graph Fig. 4 the ordinates are correspondingly plotted, i. e., for 22.5° arcs or angles of movement of the crank 16. It is interesting to observe on Fig. 4 that the slide 12 moves from the top of the stroke to mid-stroke in 33¾° of rotation of the crank 16, as compared with a movement of the crank of an ordinary crank press of 90° before the slide reaches the same position, i. e., mid-stroke. After reaching mid-stroke the slide 12 has 146¼°, as compared with 90° of an ordinary crank press, for the tools on the slide 12 to make initial contact with the stock or material and apply the forming pressure thereto. The formation is stretched over a long period, a longer period than in an ordinary crank press, the complete cycle of operation however being completed in the same time.

In the diagram Fig. 6, the parts are shown in the positions which they occupy at the limit of the rising movement or upstroke of the slide, and the positions of the parts are plotted for twelve divisions (numbered 1 to 13 inclusive) of the crank-actuated lever 65. On the graph Fig. 7, the ordinates are correspondingly plotted. It will be observed, Fig. 6, that the slide 12 moves from the top of the stroke to mid-stroke at a much quicker rate than the slide of an ordinary crank press, and thereafter moves to the bottom of its stroke at a much slower rate than the slide of an ordinary crank press. It requires something over 90° for the slide of an ordinary crank press to reach mid-stroke. On a corresponding basis the slide 12 reaches mid-stroke in about 65°. In an ordinary crank press the slide reaches its bottom-of-the-stroke position (after reaching mid-stroke) in another 90°. From mid-stroke to its bottom-of-the-stroke position, the slide 12 takes 135°. As will be seen from the graph Fig. 7, the slide 12 moves through 200° on its downstroke, and through 160° on its up-stroke, as compared with 180° movement of the slide of an ordinary crank-press on its down-stroke and 180° movement on its up-stroke.

Moreover the proportion between the degrees of revolvable crank movement through which the slide moves on its up-stroke and on its downstroke may be readily varied to obtain a longer time in degrees on the down-stroke and a shorter time in degrees on the up-stroke than is diagrammatically shown in Figs. 6 and 7. Referring to Fig. 8, the arc through which the lever 65 is swung by the crank 32 may be increased so that the degrees of crank movement taken by the slide 12 on its downward stroke may be extended to 240°, the return movement of the slide being accomplished in 120° of crank movement.

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

What is claimed is:

1. A power press of the crank-shaft type, comprising a frame, a reciprocatory tool-carrying slide, a shaft in said frame having a crank thereon, a connecting rod having a pivotal connection to said crank and to said slide, and means for reciprocating said slide comprising a unidirectional revolvable crank and a link driven from said unidirectional revolvable crank and connected to said slide connecting rod at a point spaced from the pivotal connection between said connecting rod and said first-named crank, the construction and arrangement being such that the line of thrust of said link, in a position of said first-named crank which is 90° from its position of alinement, passes substantially off from the center of said first-named crank, so that the thrust of said link in said 90° position of said first-named crank exerts a substantial turning moment to the latter, and also such that the unidirectional revolution of said second named crank imparts to said slide a fast movement at the beginning and end of the crank-cycle and a slow movement in the mid-portion of the cycle (as the slide approaches its bottom-of-the-stroke position), as compared with the movement of a slide with a direct connection to a revolving crank, having the graphic representation of a sinusoid.

2. A power press of the crank-shaft type, comprising a frame, a reciprocatory tool-carrying slide, a shaft in said frame having a crank thereon, a connecting rod having a pivotal connection to said crank and to said slide, and means for reciprocating said slide comprising a unidirectional revolvable crank, a rocking part, a connection between said rocking part and said revolvable crank, and a link connected to said rocking part and to said slide connecting rod at a point spaced from the pivotal connection between said connecting rod and said first-named crank, the construction and arrangement being such that the line of thrust of said link, in a position of said first-named crank which is 90° from its position of alinement, passes substantially off from the center of said first-named crank, so that the thrust of said link in said 90° position of said first-named crank exerts a substantial turning moment to the latter, and also such that the unidirectional revolution of said second named crank imparts to said slide a fast movement at the beginning and end of the crank-cycle and a slow movement in the mid-portion of the cycle (as the slide approaches its bottom-of-the-stroke position), as compared with the movement of a slide with a direct connection to a revolving crank, having the graphic representation of a sinusoid.

3. A power press of the crank-shaft type, comprising a frame, a reciprocatory tool-carrying slide, a shaft in said frame having a crank thereon, a connecting rod having a pivotal connection to said crank and to said slide, and means for reciprocating said slide comprising a unidirectional revolvable crank, a pivoted lever, a connection between said pivoted lever and said revolvable crank, and a link connected to said pivoted lever and to said slide connecting rod at a point spaced from the pivotal connection between said connecting rod and said first-named crank, the construction and arrangement being such that the line of thrust of said link, in a position of said first-named crank which is 90° from its position of alinement, passes substantially off from the center of said first-named crank, so that the thrust of said link in said 90° position of said first-named crank exerts a sub-

stantial turning moment to the latter, and also such that the unidirectional revolution of said second named crank imparts to said slide a fast movement at the beginning and end of the crank-cycle and a slow movement in the mid-portion of the cycle (as the slide approaches its bottom-of-the-stroke position), as compared with the movement of a slide with a direct connection to a revolving crank, having the graphic representation of a sinusoid.

4. A power press of the crank-shaft type, comprising a frame, a reciprocatory tool-carrying slide, a shaft in said frame having a crank thereon, a connecting rod having a pivotal connection to said crank and to said slide, and means for reciprocating said slide comprising a unidirectional revolvable crank, a rocking part having angularly spaced arms, a connection between an arm on said rocking part and said revolvable crank, and a link connected to another arm of said rocking part and to said slide connecting rod at a point spaced from the pivotal connection between said connecting rod and said first-named crank, the construction and arrangement being such that the line of thrust of said link, in a position of said first-named crank which is 90° from its position of alinement, passes substantially off from the center of said first-named crank, so that the thrust of said link in said 90° position of said first-named crank exerts a substantial turning moment to the latter, and also such that the unidirectional revolution of said second named crank imparts to said slide a fast movement at the beginning and end of the crank-cycle and a slow movement in the mid-portion of the cycle (as the slide approaches its bottom-of-the-stroke position), as compared with the movement of a slide with a direct connection to a revolving crank, having the graphic representation of a sinusoid.

5. A power press of the crank-shaft type, according to claim 2, wherein said revolvable crank, rocking part and the first-named crank are mounted on said frame near the head or crown thereof.

6. A power press of the crank-shaft type according to claim 2, further comprising a bracket attached to the frame of the conventional crank press in which said revolvable crank and said rotary part are mounted.

7. A power press of the crank-shaft type, according to claim 3, wherein said lever has a slot therein and said revolvable crank is embraced within said slot.

8. A power press of the crank-shaft type, according to claim 3, wherein the axis on which said lever turns is approximately at or above the level of the axis on which said first-named crank turns.

9. A power press of the crank-shaft type, according to claim 4, wherein the axis around which said rotary crank revolves is at approximately the same level as the axis on which said first-named crank turns.

10. A power press of the crank-shaft type according to claim 4, wherein the axis on which said rocking part turns is approximately at or about the level of the point of connection of said link to said slide connecting rod.

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