April 8, 1930. J. E. DOBSON 1,753,695

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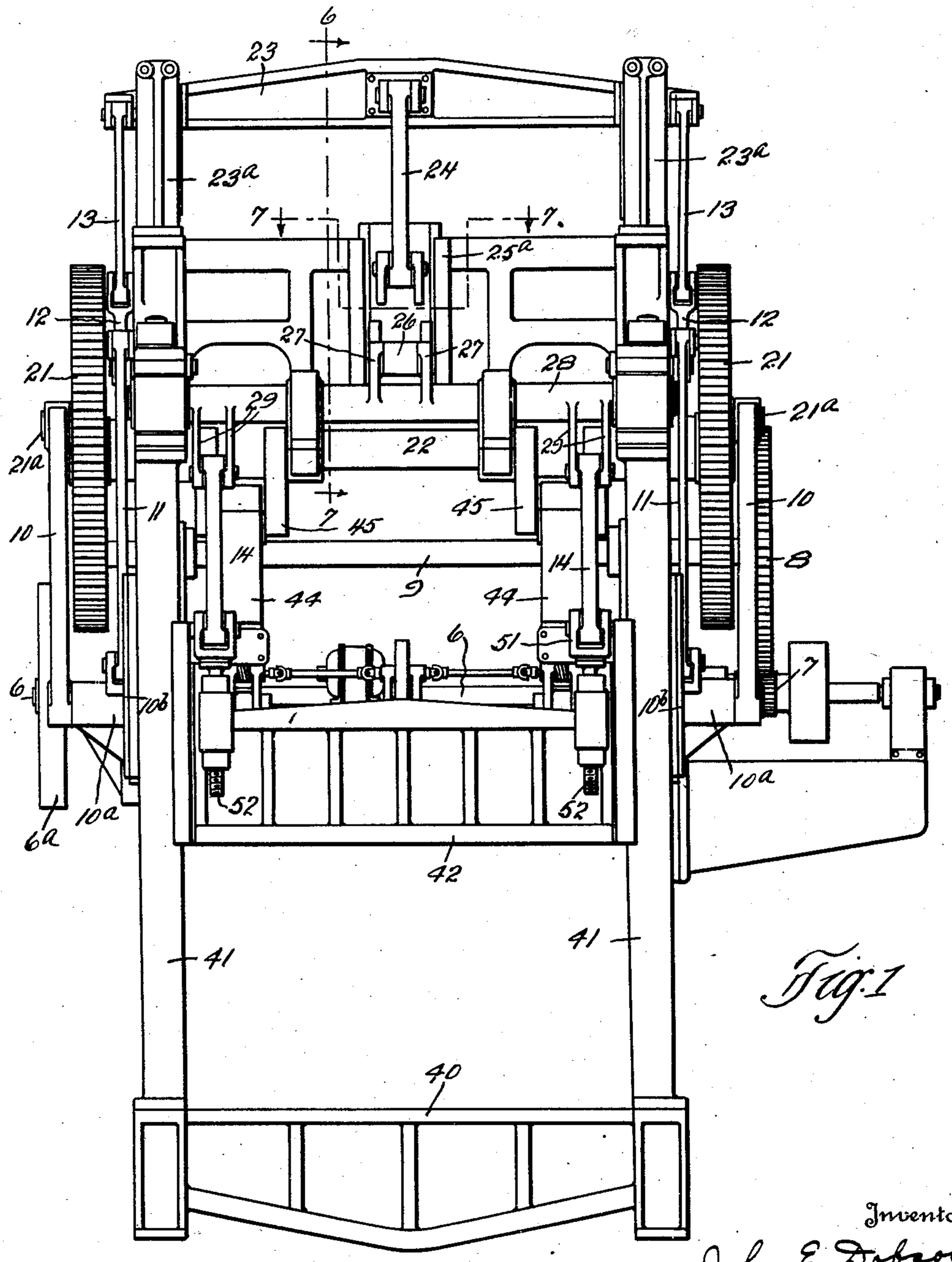


Fig. 1

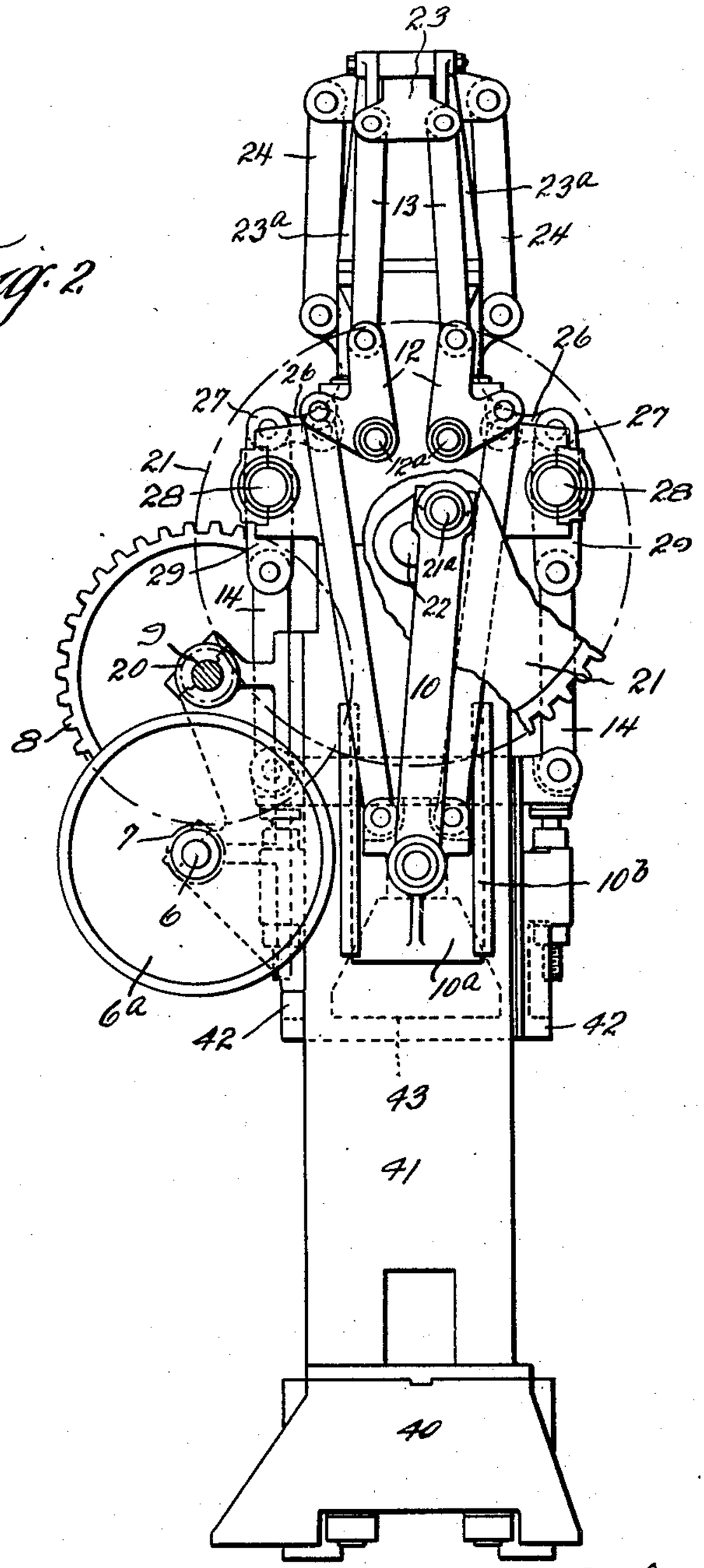
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Fig. 2.



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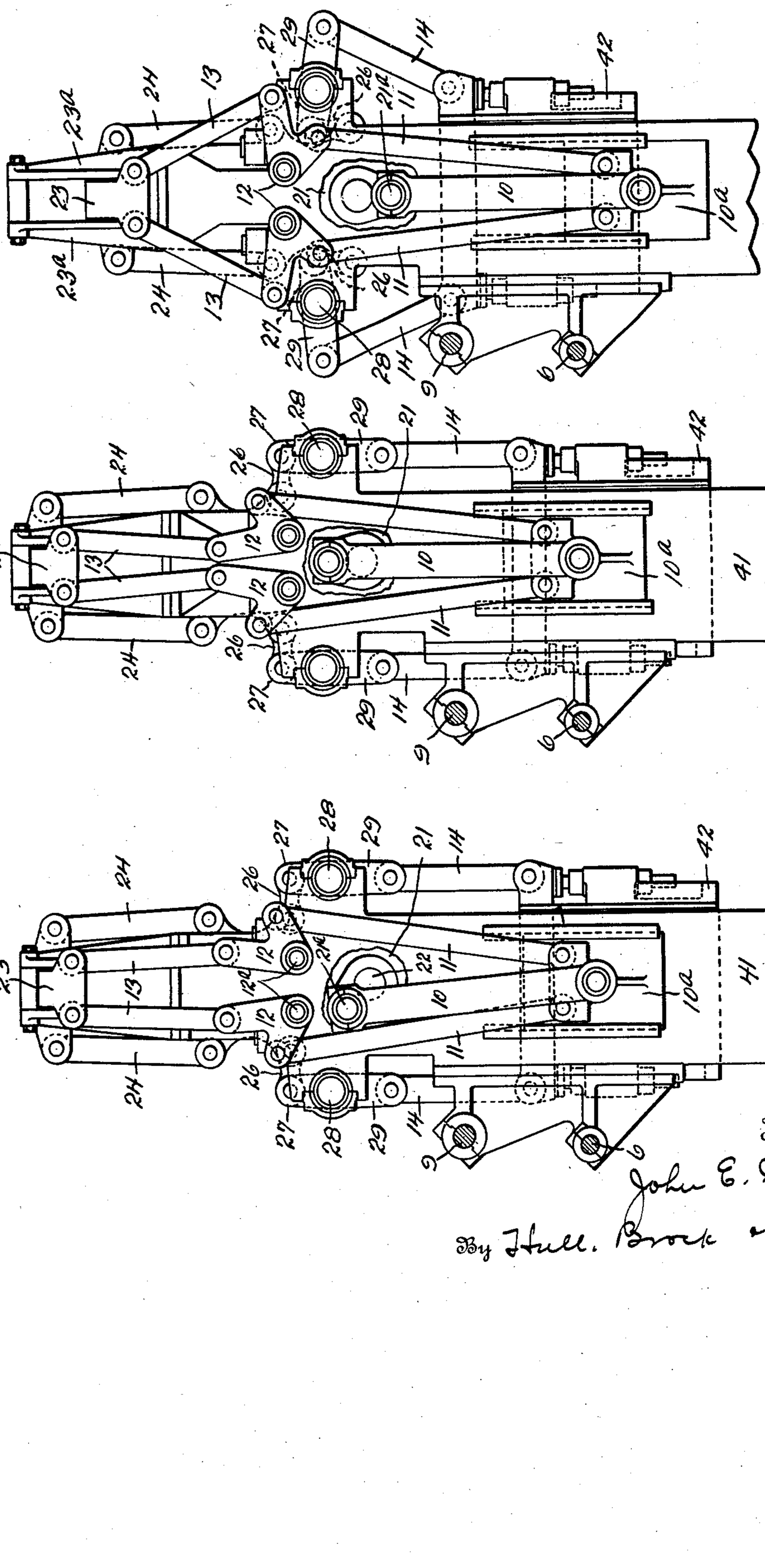


Fig. 5

Fig. 4

Fig. 3

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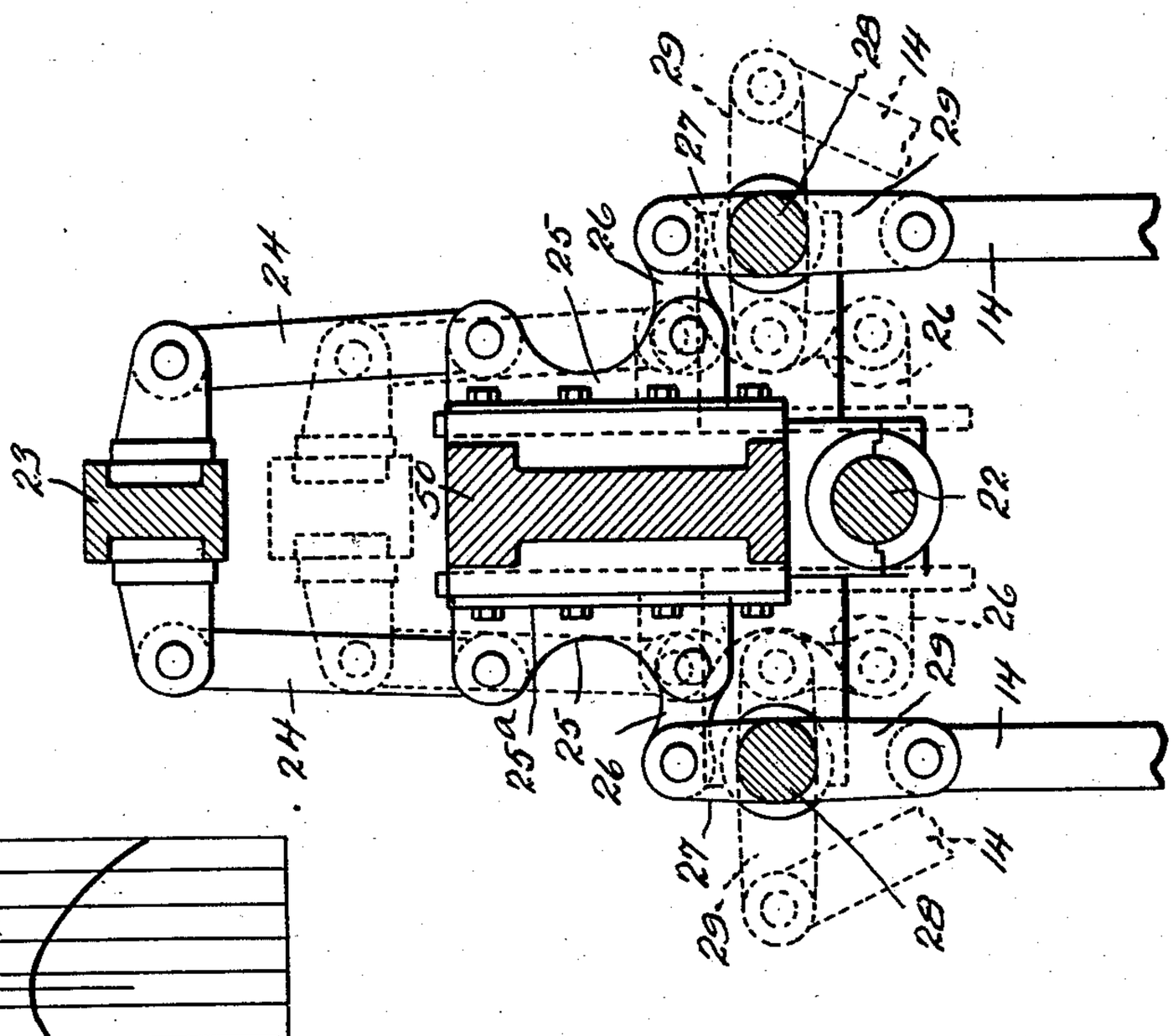


Fig. 6

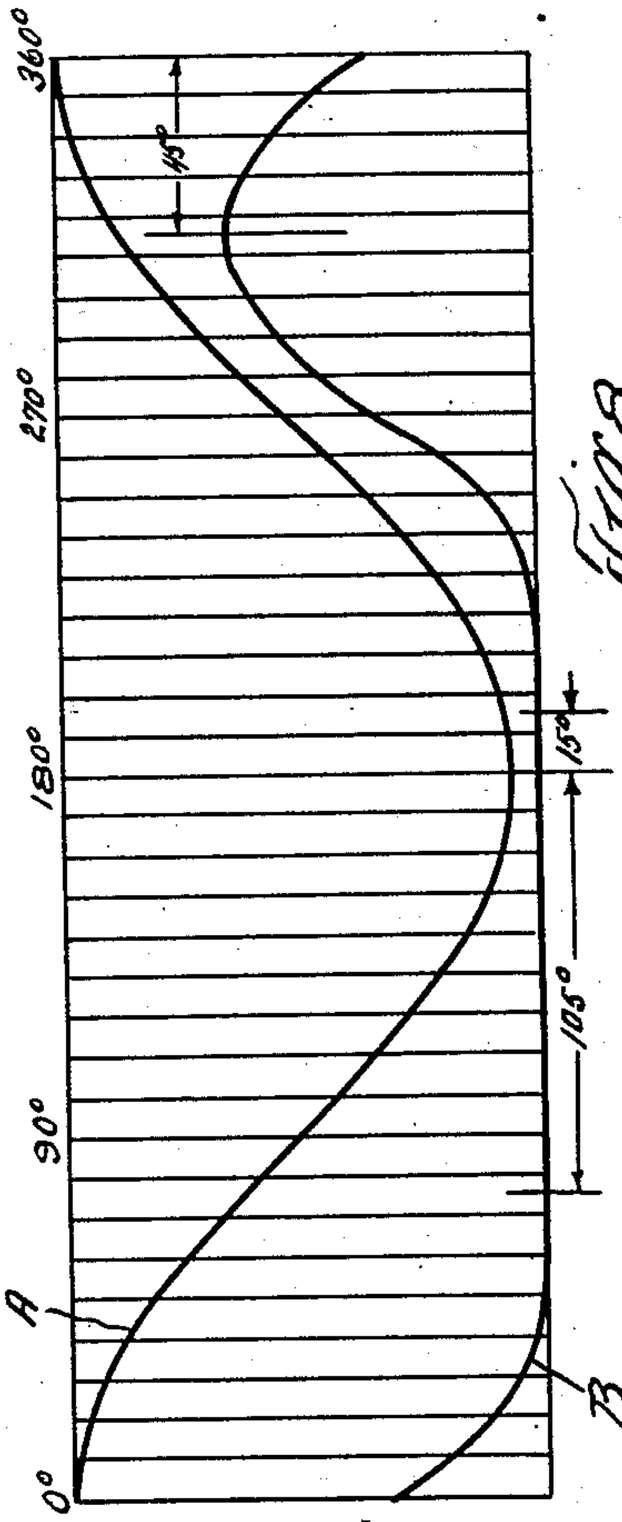


Fig. 8

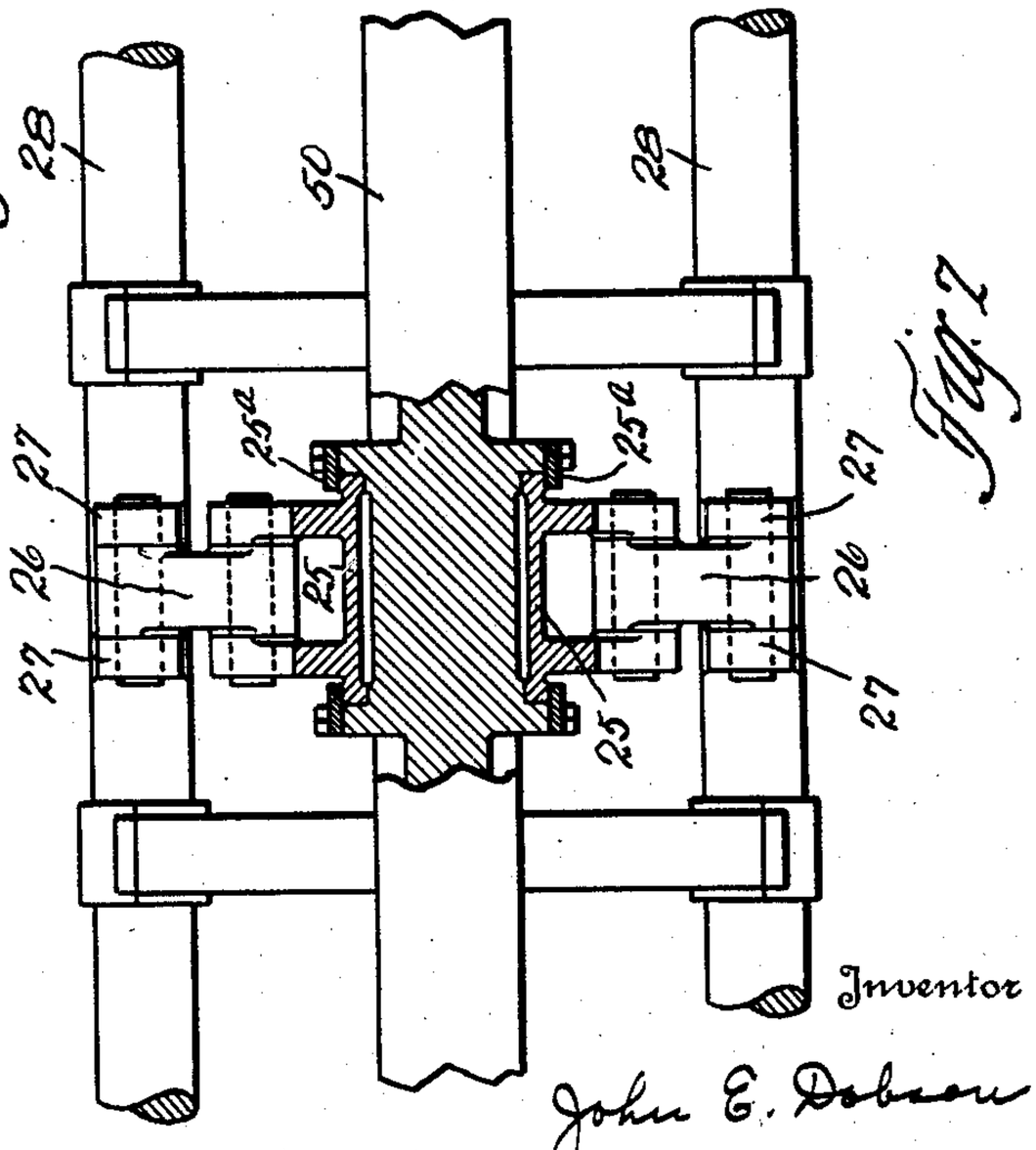


Fig. 7

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UNITED STATES PATENT OFFICE

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DRAWING PRESS

Application filed July 25, 1927. Serial No. 208,182.

This invention relates to power presses for drawing, shaping or cutting metal, and particularly to presses of the type wherein sheet metal to be drawn or shaped is held at the edges by a blank holder while subjected to the action of a die or plunger which works through the blank holder. While the invention is particularly suitable for presses of this type, it is capable of use in connection with other types of presses and machines.

The object of the invention is to provide a press of this kind in which the blank is firmly clamped by the blank holder long before the forming die or plunger has reached the limit of its stroke and is held clamped until after the forming die has reached the limit of its stroke thus holding the blank during the entire period of the operation of the drawing die or plunger no matter how protracted said operation may be.

A further object of the invention is to provide improved means for causing such protracted dwell in the movement of the blank holder without the use of cams or cam shafts which have proved unsatisfactory for this purpose, especially in heavy press operations.

A further object of the invention is to provide an improved toggle mechanism between the main crank shaft of the machine and the blank holder, whereby the latter will be reciprocated at proper times and the dwell before referred to will be advantageously produced at the bottom of the down stroke of the holder.

A still further object of the invention is to enable the shaft by which the drawing die or plunger is reciprocated to operate the blank holder in such a manner as to produce the dwell in such member while in work-engaging position, meanwhile operating such member by means of a connection which moves continuously with the shaft.

A further object of the invention is to improve generally and strengthen the construction of the operating mechanism of presses of this type.

A machine constructed according to the invention is shown in the accompanying drawings, in which Fig. 1 is a front elevation of the machine; Fig. 2 is a side elevation; Figs. 3, 4 and 5 are details in side elevation showing toggle mechanism in successively different positions during the stroke; Fig. 6 is a vertical section on the line 6—6 of Fig. 1; Fig. 7 is a horizontal section on the line 7—7 of Fig. 1; Fig. 8 is a graph illustrating the relative strokes of the plunger or forming die and the blank holder during one revolution of the crank shaft.

Referring first to Fig. 8, the line A illustrates the movement of the forming die or inner plunger during one revolution, or 360°, of the crank shaft. The line B illustrates the movement of the blank holder during the same cycle, and it will be noticed that the latter line has a straight portion representing a dwell at the bottom of the stroke, beginning at about 75° in the revolution and continuing to about 195° in the revolution and completely lapping at both ends the period of the power or drawing stroke of the forming plunger, whereby the blank is clamped by the blank holder before the drawing die comes into action and continues to be clamped until after said die is withdrawn from engagement with the work on the up stroke, and then the blank holder rises quickly to the limit of the up stroke, at about 315°, and then quickly descends in advance of the down stroke of the drawing die. The mechanism to produce this operation so illustrated by the graph will now be described.

The frame of the machine includes a bed 40 and side frames 41, which latter form guides for the hollow blank holder 42 through which works a drawing or forming die in a manner well known in the art and indicated in dotted lines at 43, and shown, for example, in the patent of Klocke #1,132,008. This drawing die or plunger is operated by connecting rods 44 from cranks 45 on the main crank shaft 22. No extended description thereof is considered necessary, since the present invention relates to the mechanism for operating the blank holder 42.

A power shaft 6 extends across the machine and may be driven by any suitable means, a pulley 6ª being shown. This shaft carries a pinion 7 meshing with a gear 8 on a countershaft 9, which also extends across the ma-

chine, and has pinions 20 which engage gears 21 at the ends of the crank shaft 22 and so rotate that shaft.

Each gear 21 is provided on its outer side with a crank pin 21ª which is connected by a rod 10 to a slide 10ª mounted in güides 10ᵇ on the outer sides of the frames 41. Each slide 10ª is connected by a pair of pivoted links 11 to one arm of a pair of bell cranks 12 pivoted at 12ª to the side frames, and the other upwardly extending arms of the bell cranks are connected by a pair of pivoted links 13 to the end of a cross head or beam 23, which slides up and down in guides 23ª at the top of the side frames. It will be noted that these parts are duplicated at opposite sides of the machine.

The cross beam 23 is connected at its middle by a pair of pivoted links 24 to a corresponding pair of slides 25 which move up and down in guides 25ª on a main cross frame 50 connecting the side frames 41 at the top thereof. Each slide 25 is connected by a pivotal link 26 to crank arms 27 projecting at one side of the rock shaft 28 which has near each end the crank arms 29, opposite in throw to the arms 27, and connected by pivoted links 14 to the knuckles 51 connected by adjustable screw rods 52 to the blank holders 42. These parts are duplicated at front and back, so that there are four rods connected to the blank holder at substantially the four corners thereof.

The operation of the blank holder may now be understood:

As crank shaft 22 and its gears 21 rotate (in clockwise direction as shown, although it may in either) the cranks 21ª as shown in Fig. 3 are lifting the slides 10ª and the links 11 are lifting the lower arms of the bell cranks 12 to throw the upper arms of the bell cranks across the center lines of the toggles formed by said arms and the links 13. This action carries the cross beam 23 to its highest point and causes the links 24 to pull up the slides 25 which rocks the shafts 28 by the link connections 26 and the arms 27, swinging down the arms 29 which by the links 14 forces the blank holder down and holds the same in its clamping position as shown in Figs. 3 and 4. This is the position of the dwell illustrated by the lower portion of the line B in Fig. 8, the cranks 21ª turning meanwhile through the upper dead center position. The rise which would otherwise be incident to the throw of the cranks 21ª is absorbed or substantially negatived by the numerous toggle joints between said cranks and the blank holder, since each joint introduces a lower angle or arc of rise and therefore the blank holder remains practically stationary at the lower limit of its stroke during 120° or more of the revolution of the crank shaft, overlapping the down stroke of the drawing plunger and holding the blank firmly during all of the drawing period.

On the up stroke of the drawing plunger, as illustrated in Fig. 5, the slides 10ª travel downwardly and the bell cranks 12 are rocked to reverse position, thereby pulling down the beam 23 with a quick motion, carrying down the slides 25 and rocking the shafts 28 to quickly lift the blank holder 42 after the cranks 21ª pass the lower dead center to repeat the operation.

It will be noted that during the period the blank holder is depressed to clamping position the toggles formed by the upper arms of the bell cranks 12 and the links 13, and by the arms 29 and the links 14, are as illustrated at the points of least throw, as well as the crank connections of the links 26 and the arms 27. These connections cause, as stated, a flattening of the graphic curve which would otherwise be produced by the cranks 21ª; and it may be remarked that these cranks during this period are also passing the upper dead center or point of least throw. All this insures a dwell or continued clamping action by the blank holder during a large portion of a complete cycle, and the clamping stroke of the holder precedes the drawing stroke of the plunger and follows the up or withdrawing stroke of the plunger.

The invention is not limited to the particular machine shown, but may be embodied in a machine horizontally or otherwise arranged, or modified in various other parts within the scope of the invention.

Having thus described my invention, what I claim is:—

1. In a machine of the character described, the combination of a crank shaft, a reciprocating blank holder, a plunger working through the blank holder and operatively connected to the shaft, a sliding cross beam, and operating connections between the shaft and the holder to reciprocate the latter, said connections including toggle means arranged to cause a dwell of the blank holder during the entire period of operation of the plunger on the blank, said toggle means including bell cranks the respective arms of which are operatively connected to the cross beam and to the crank shaft.

2. In a machine of the character described, the combination of side frames and a crank shaft mounted therebetween, a reciprocating blank holder, a plunger working through the blank holder and operatively connected to the shaft, a cross beam, slides mounted on the side frames, operative connections between the crank shaft and the slides, operative connections between the slides and the cross beam, and operative connections between the cross beam and the blank holder.

3. In a machine of the character described, the combination of a crank shaft, a reciprocating blank holder, a plunger working

through the blank holder and operatively connected to the shaft, and operating connections between the shaft and the holder to reciprocate the latter, said connections including toggle means to cause a dwell of the blank holder during the entire period of operation of the plunger on the blank, said toggle means including bell cranks the respective arms of which are operatively connected to the cross beam and the crank shaft, said bell cranks being pivoted on the frame of the machine.

4. In a power press, the combination of side frames, a crank shaft between the same, a blank holder slidable on the side frames, a cross beam slidable on the side frames and operatively connected to the blank holder between said frames, and toggle connections between the crank shaft and the cross beam, said toggle connections being located outside the side frames and including bell cranks pivoted on the side frames.

5. In a power press, the combination of side frames, a crank shaft between the same, a blank holder slidable on the side frames, a cross beam slidable on the side frames and operatively connected to the blank holder between said frames and toggle connections between the crank shaft and the cross beam, said toggle connections being located outside the side frames and including slides mounted on the side frames connected to the crank shaft and the toggle.

6. In a power press, the combination with side frames, a crank shaft supported by and between the same, and a blank holder slidable on the frames, of operating connections to the blank holder from the crank shaft, said connections being constructed and arranged to cause a dwell in the movement of the blank holder during its clamping period, said connections including a slide connected to the crank shaft, a bell crank connected to the slide, a cross beam slidable on the frames and connected to the bell crank, another slide connected to the cross beam, and connections between the last mentioned slide and the blank holder.

7. In a power press, the combination of side frames, a blank holder slidable on the frames, a crank shaft supported by and between the frames, slides mounted on the side frames, crank connections between the shaft and said slides, bell cranks pivoted on the frames, a sliding beam extending across the frames, toggle connections between the bell cranks and the ends of said beam, and operating connections between the middle of said beam and the blank holder.

8. In a power press, the combination of side frames, a blank holder slidable on the frames, a crank shaft supported by and between the frames, slides mounted on the side frames, crank connections between the shaft and said slides, bell cranks pivoted on the frames, a sliding beam extending across the frames, toggle connections between the bell cranks and the ends of said beam, and operating connections between the middle of said beam and the blank holder, said operating connections including slides located between the side frames, and rock shafts extending across between the side frames and operatively connected to the last mentioned slides and the blank holder respectively.

9. In a machine of the character described, the combination of side frames and a crank shaft supported by and between the same, a reciprocating blank holder, a plunger working through the blank holder and operatively connected to the shaft, a reciprocating cross beam, slides mounted on the side frames, bell cranks pivoted to the side frames, operative connections between the crank shaft and the slides, links connecting the slides and one arm of the bell cranks, links connecting the other arms of the bell cranks and the cross beam, a slide connected to the middle of the cross beam, a pair of rock shafts one on each side of the last mentioned slide, toggle connections between the said last mentioned slide and the rock shafts, and toggle connections between the rock shafts and the blank holder.

10. In a press of the character described, the combination of an operating shaft and a plunger operatively connected thereto, a blank holder, a cross beam, a crank pin on each end of the operating shaft, operative connections between the crank pins and the ends of the beam for reciprocating the latter, a slide connected to the center of said beam, and operative connections between the slide and the blank holder.

11. In a press of the character described, the combination of an operating shaft and a plunger operatively connected thereto, a blank holder, a cross beam, a crank pin on each end of the operating shaft, operative connections between the crank pins and the ends of the beam for reciprocating the latter, a slide connected to the center of said beam, and operative connections between the slide and the blank holder, said last mentioned connections including a rock shaft having oppositely projecting arms, links connecting one arm to the slide, and links connecting the other arm to the blank holder.

12. In a press of the character described, the combination of an operating shaft and a plunger operatively connected thereto, a blank holder, a cross beam, a crank pin on each end of the operating shaft, and operating connections between the crank pins and the ends of the cross beam for reciprocating the latter, a slide connected to the center of said beam, a pair of laterally spaced rock shafts, toggle connections between the slide and the rock shafts, and toggle connections between the rock shafts and the blank holder.

13. In a press of the type described, the combination of an operating shaft, a plunger

operated thereby, a cross beam, driving connections between the ends of said shaft and the ends of the cross beam for reciprocating the latter, a slide carried by the central portion of said beam, a pair of rock shafts, one on each side of said slide, toggle mechanism connecting opposite sides of said slide with each of said pair of shafts for rocking the latter, a blank holder, and toggle connections between each of said shafts and said blank holder.

14. In a press of the character described, the combination of an operating shaft and a plunger operatively connected thereto, a reciprocating blank holder, gears on the ends of said shaft, crank pins on the gears, a sliding cross beam, links connecting the crank pins and the ends of the cross beam for reciprocating said beam, a slide connected to the center of said cross beam, a pair of rock shafts, one on each side of the slide, an upwardly projecting crank at the center and downwardly projecting cranks at each end of each of the said rock shafts, links connecting the upwardly projecting cranks to opposite sides of the slide, and links connecting the downwardly projecting cranks to the blank holder.

In testimony whereof, I hereunto affix my signature.

JOHN E. DOBSON.