United States Patent [19]

Kawagoshi et al.

[11] **3,772,986**

[45] **Nov. 20, 1973**

[54] **MECHANICAL DOUBLE ACTION PRESS USING A LINK MECHANISM**

[75] Inventors: **Tameo Kawagoshi; Kiyoji Aoshima,** both of Komatsu, Japan

[73] Assignee: **Kabushiki Kaisha Komatsu Seisakusho,** Tokyo-to, Japan

[22] Filed: **Dec. 29, 1971**

[21] Appl. No.: **213,431**

[30] **Foreign Application Priority Data**

Dec. 31, 1970 Japan 45/123573

[52] **U.S. Cl.** **100/282**

[51] **Int. Cl.** **B30b 1/06**

[58] **Field of Search** 100/282, 280, 281, 100/283, 284, 285, 237

[56] **References Cited**

UNITED STATES PATENTS

2,644,417	7/1953	Georgeff	100/282 X
3,052,200	9/1962	Dehn et al.	100/282 X
3,315,596	4/1967	Peters	100/282
3,695,090	10/1972	Kita	100/237 X

Primary Examiner—Harvey C. Hornsby
Assistant Examiner—Arthur O. Henderson
Attorney—Toren and McGeady

[57] **ABSTRACT**

A mechanical double action press using a link mechanism is utilizing four point link mechanism which is the simplest in construction, comprising main shafts extending from front to rear of a crown and having the length substantially equal to that in front to rear of it, one of said main shafts whereon inner slide driving gears being fitted, and another said main shaft whereon outer slide driving gears being fitted. In condition of operating, the speed in an idle stroke is higher than that in drawing work stroke, thereby it is possible to reduce the time required for one cycle.

1 Claim, 6 Drawing Figures

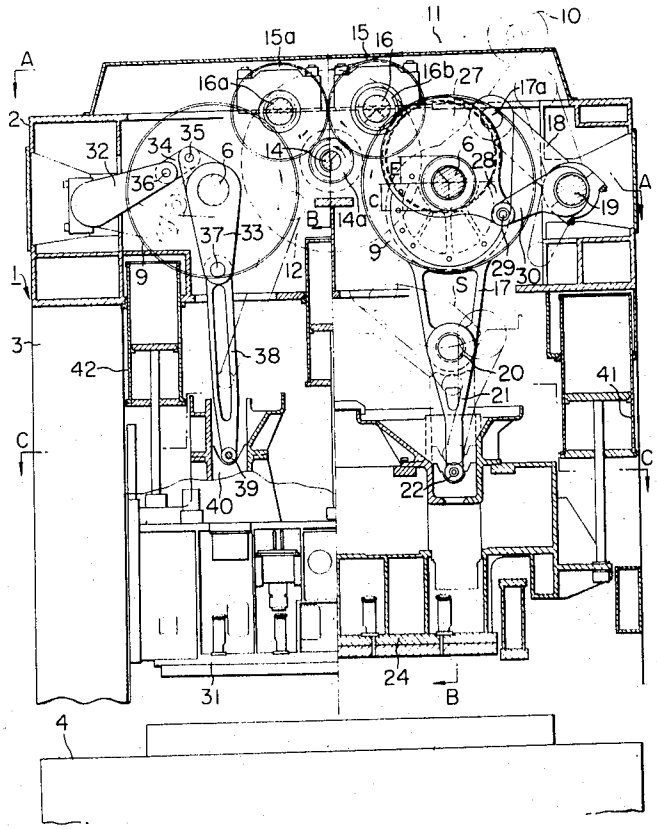
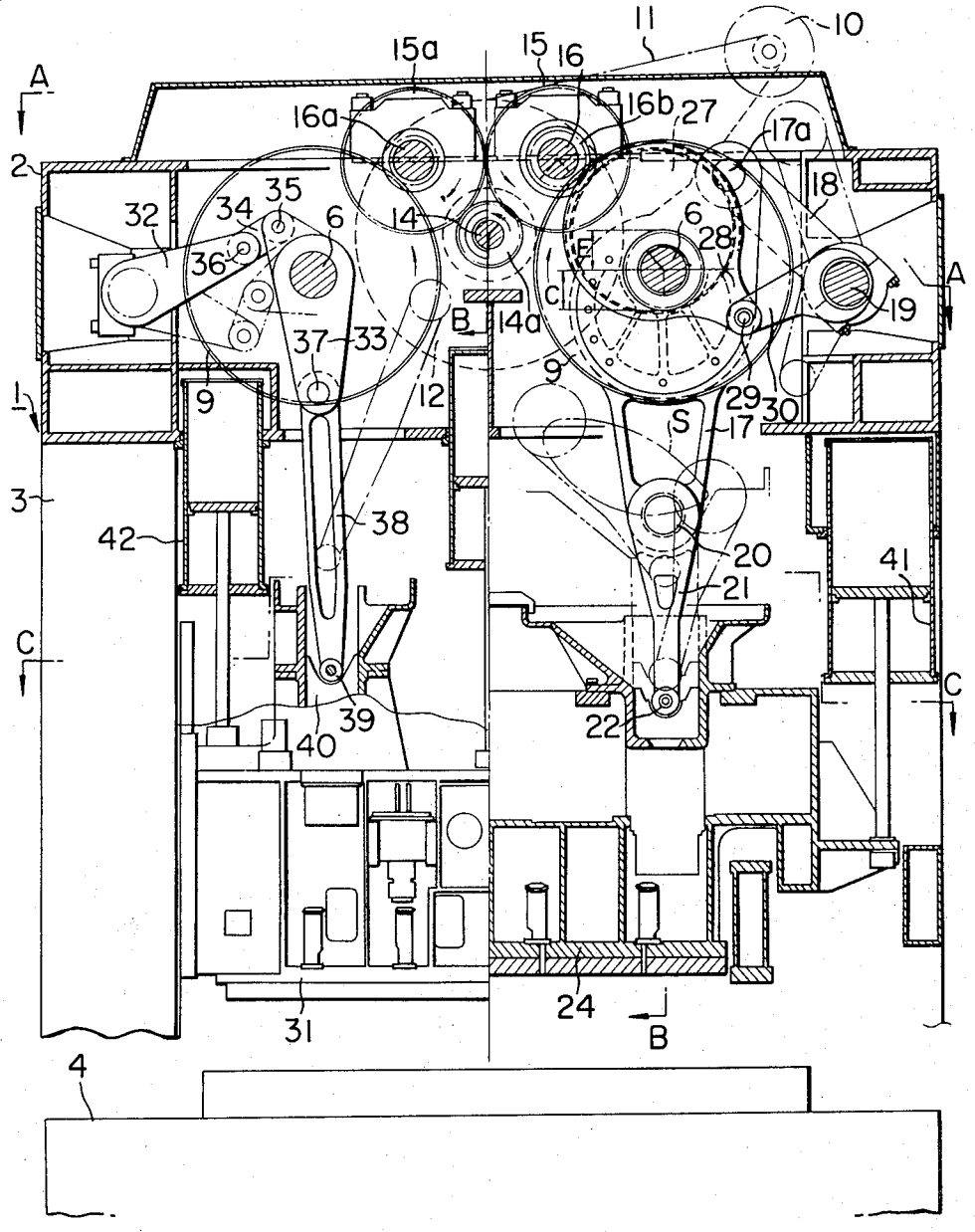
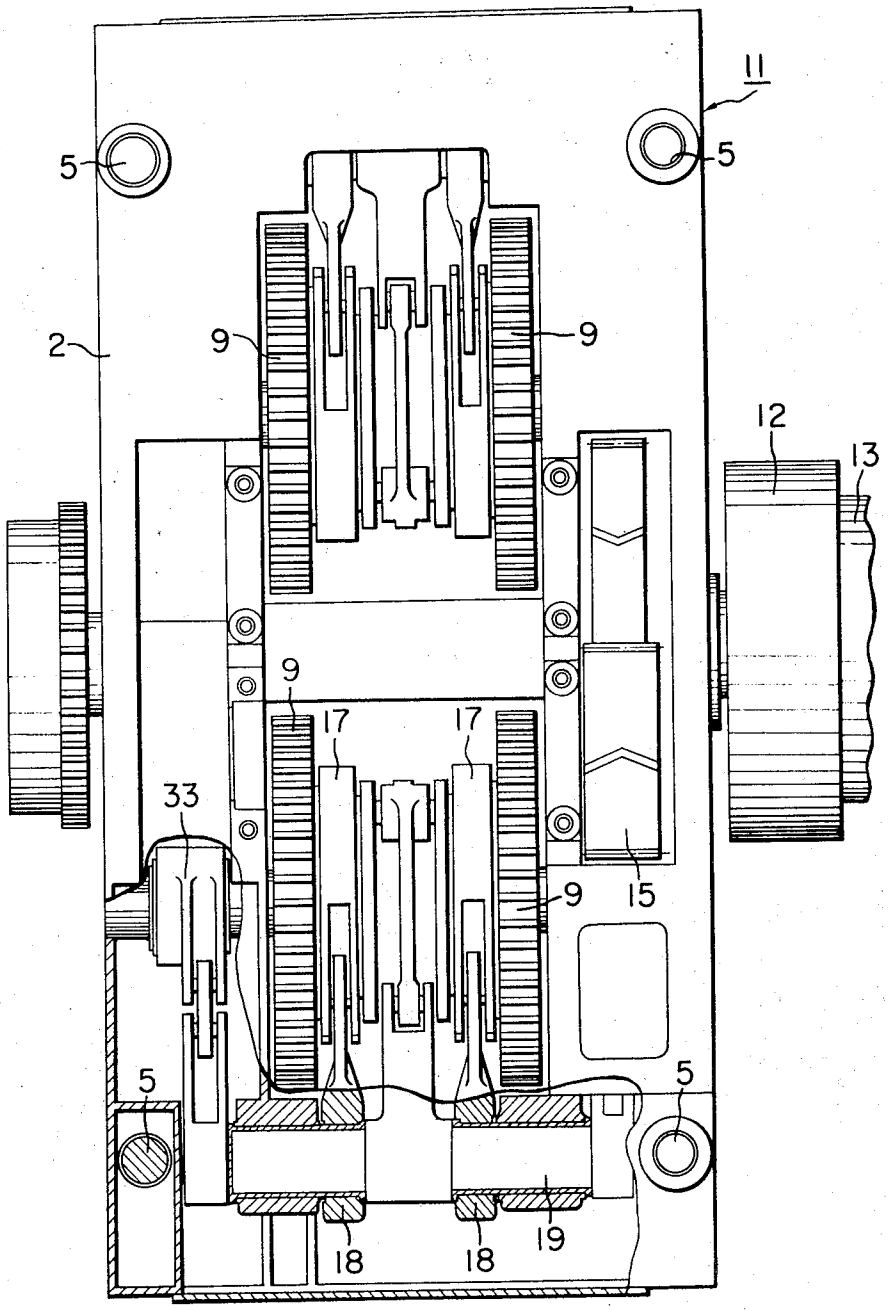


FIG. 1



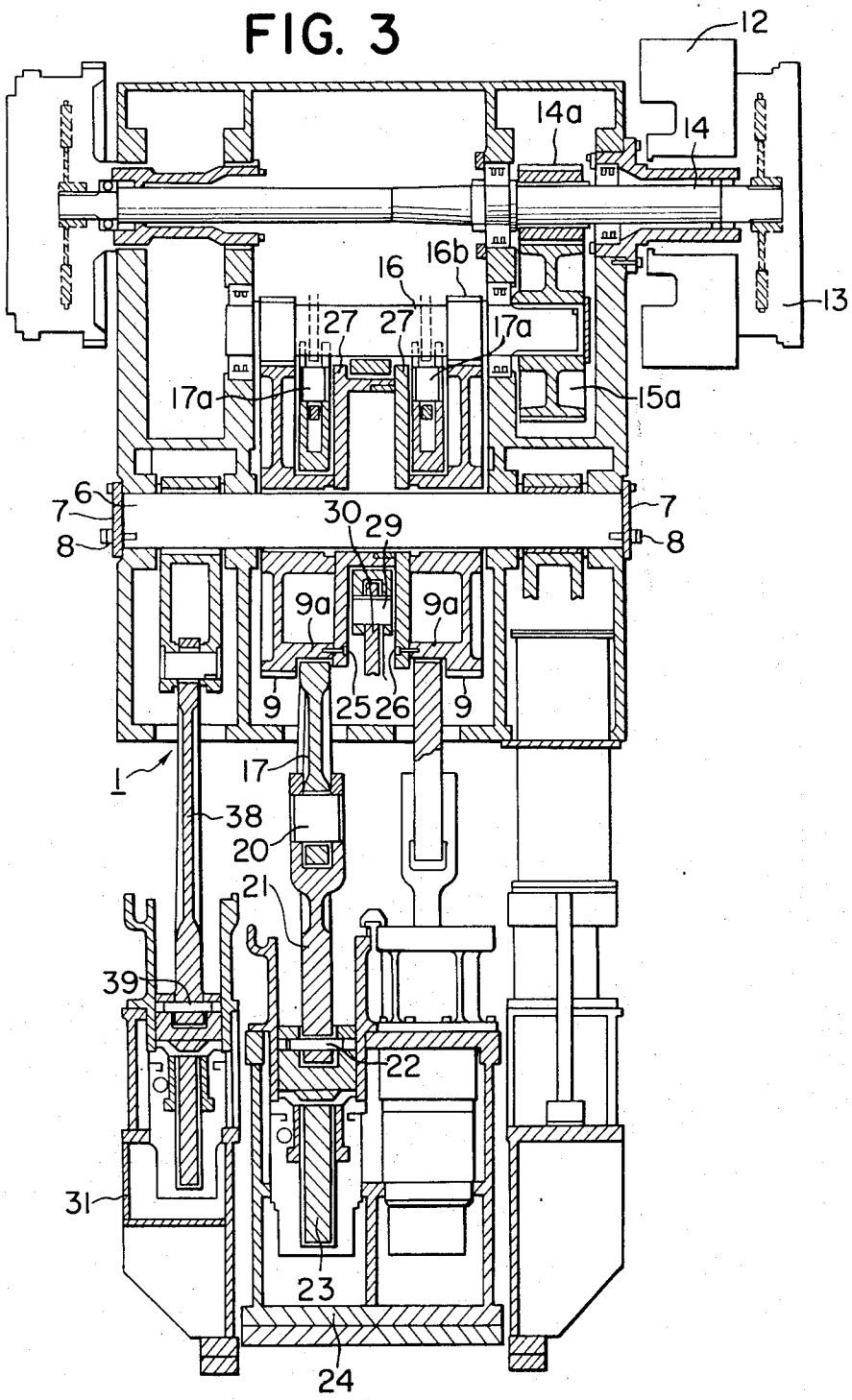
INVENTORS
TAMEO KAWAGOSHI
KIYOSI NOSHIMA
BY Toren and McCready
ATTORNEYS

FIG. 2



INVENTORS
TAMEO KAWAGUCHI
KIYOJI AOSHIMA
BY Toren and McReady
ATTORNEYS

FIG. 3



INVENTORS
TAMEO KAWAGOSHI
KIYOJI AOSHIMA
BY Toren and McKeady
ATTORNEYS

FIG. 4

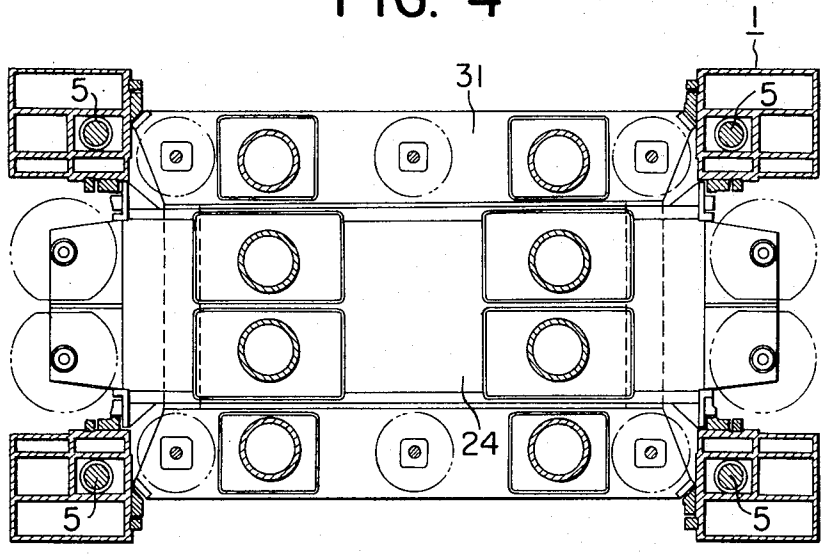
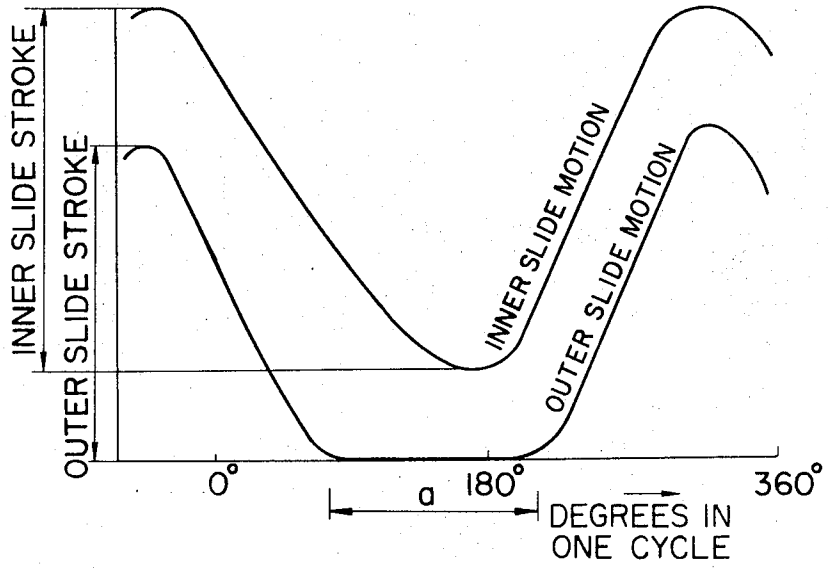
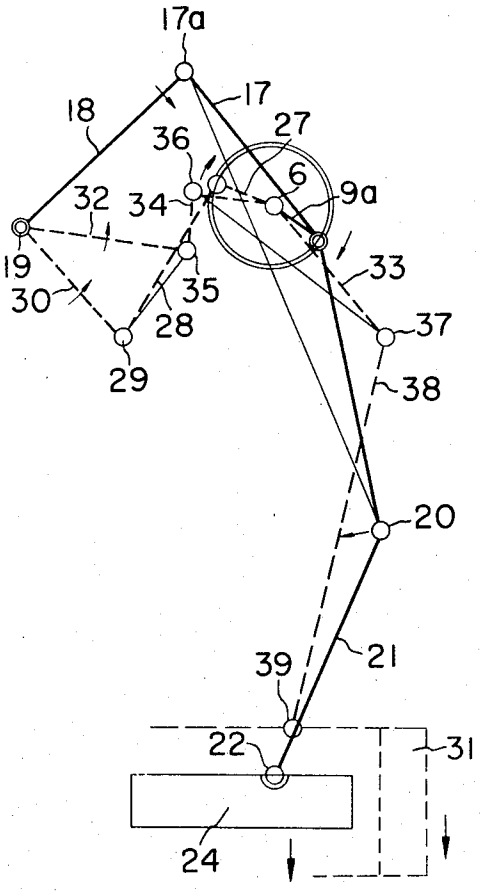


FIG. 6



INVENTOR.
TAMEO KAWAGOSHI
KIYOJI AOSHIMA
BY Toren and McCready
ATTORNEYS

FIG. 5



INVENTORS
TAMEO KAWAGOSHI
KIYOJI AOSHIMA
BY Toren and McKeady
ATTORNEYS

MECHANICAL DOUBLE ACTION PRESS USING A LINK MECHANISM

BACKGROUND OF THE INVENTION

In mechanical double action presses used heretofore, the inner slide is made to operate with a simple crank mechanism, so that the maximum drawing speed in the drawing works is limited to a certain value according to the nature of the material. Generally, in press working, the drawing speed becomes equal to the pressing speed of the slide, so that the material may be broken when the slide speed exceeds the limit speed of the metal material.

Accordingly, in the case of a conventional press machine heretofore used, when the number of strokes is increased simply to improve the productivity, the critical drawing speed of the inner slide is exceeded, which results in the above-said drawbacks. Thus, it was impossible to increase production by increasing the number of strokes of the press.

In order to eliminate the above-described drawbacks, a number of moving mechanisms have been developed for reducing the time required for one cycle by increasing the idle strokes other than the period for drawing work, that is, the approaching stroke up to the contact with the metal material and return stroke after working, more than the speed at the drawing work.

As for the mechanism for practising and motion, a press having four links has been suggested. With this mechanism, however, although the link mechanism itself is most simple, it is almost impossible, from its constructional point of view, to apply it to a double action press machine. Thus, when it is intended to carry out said motion in conventional double action presses, it was necessary to use an extremely complicated link mechanism, which was by no means adoptable for a practical use.

The applicant developed in the past a mechanical double action press using a link mechanism as one utilizing above-said four-link on the double action press (Patent application Ser. No. 28258/1966), but in this case, the main shaft must inevitably be divided in two because of the constructional restriction due to the front-to-back direction of the crown proper from the particular construction of the double action press, which leads to poor accuracy and complicated construction, leaving numerous problems in practice.

With the above points in view, the present invention has succeeded in using four linking mechanism which is the simplest in construction, and yet made it possible to pass the main shaft longitudinally through the press, thus a mechanical double action press which can solve former problems concurrently.

SUMMARY OF THE INVENTION

The present invention relates to a mechanical double action press using a link mechanism.

The object of the present invention is to provide a mechanical double action press using a link mechanism, in which the speed in an idle stroke is higher than the speed in drawing work stroke, and then the time required for one cycle can be reduced.

Another object of the present invention is to provide a mechanical double action press using a link mechanism utilizing a four point link mechanism for operating an inner slide and an outer slide.

Still another object of the present invention is to provide a mechanical double action press using a link mechanism, in which it is possible, in a press cycle, to allot a longer stroking time required for drawing work than time required for lifting stroke of the inner slide, so that the drawing speed of the inner slide decreases considerably, whereby it becomes possible to increase the number of strokes in unit hour of the press even when the drawing speed is limited below the critical speed, accordingly the efficiency of the pressing work can be improved remarkably.

Further object of the present invention is to provide a mechanical double action press using a link mechanism, in which an eccentric wheel and a connecting rod are used as the driving source of the outer slide, it becomes possible to pass the main shaft through the crown body, so that the rigidity of the main shaft is much more increased, and moreover, the bending of the main shaft itself due to the load transmitted thereto through the drawing gear is lessened, whereby the accuracy of the inner slide at the pressing can be improved by far, and also it is possible, in its construction, to constitute the main shaft without dividing it into two parts, front and rear, so that a more simple construction is obtained. Thus, a press having an extremely high efficiency and high accuracy as compared with conventional double action presses can be obtained.

BRIEF DESCRIPTION OF DRAWINGS

FIG. 1 is a partly broken front elevation of a mechanical double action press using a link mechanism according to the present invention showing each half of respective driving mechanisms of the inner slide and the outer slide,

FIG. 2 is a partly broken sectional view through a line A—A in FIG. 1 with the cover removed,

FIG. 3 is a sectional view through a line B—B in FIG. 1,

FIG. 4 is a sectional view through a line C—C in FIG. 1,

FIG. 5 is a schematic representation of the linking relation of the device shown in FIG. 1, and

FIG. 6 is a stroke diagram of the inner slide and the outer slide in the device of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

The present invention relates to a mechanical double action press using a link mechanism.

An example of the present invention will now be described referring to the drawings.

The press body **1** is constituted by combining an upper crown body **2**, and upright **3**, and a bed body **4** by tie rods **5,5**, and in said crown body **2**, each one of the right and left main shafts **6,6** pass through from the front to the rear surface, both ends of these main shafts **6,6** are fixed on the crown body **2** by plates **7,7** as shown in FIG. **3** so that the shafts **6,6** will not be transferred axially, and they are fixed by bolts **8,8**, so that they are unable to be rotated.

Driving gears **9, 9** are mounted on each of the main shafts **6, 6**. A drive gear **15** is rotated through a belt **11**, a flywheel **12**, a clutch **13**, a drive shaft **14** and a pinion **14a** by a motor **10**. The drive gear **15** rotates an intermediate gear **15*a***. As viewed in FIG. **1**, the drive gear **15** is splined with a right pinion shaft **16** and the intermediate gear is splined with a left pinion shaft **16*a***, so that as the drive gear **15** and intermediate gear **15*a***

rotate, driving pinions 16*b*, 16*b* on these shafts rotate and, in turn, rotate the driving gears 9, 9.

A driving link 17 is inserted into an eccentric circular plate portion 9*a* which has an eccentric center with an interval (*e*) from the center of the driving gears 9, 9 and is formed together, and the driving link 17 is connected to one end of a rocker arm 18 through a pin 17*a* provided on the upper end of the driving link 17. The other end of this rocker arm 18 is connected to a rocker shaft 19, and is swingable with the rocker shaft 19 as the fulcrum.

On the lower end of said driving link 17 there is pivoted the upper end of the link lever 21 through a pin 20, the lower end of this link lever 21 is connected to a screw 23 through a pin 22. The screw 23 is fixed through thread on an inner slide 24, which is adapted to move the inner slide 24 up and down through the link lever 21 in response to the vertical motion of said driving lever 17. The relative position of the inner slide 24 relative to the crown body 2 is made adjustable by means of the thread provided on this screw 23.

A pin 29 is provided displaced at a desired angle relative to said eccentric circular plate portion 9*a* provided at the driving gear 9 mounted on said main shaft 6. With this pin 29, the end portion of a connecting rod 28 and the tip end of the rocker arm 30 for the inner slide are connected to the eccentric wheel 27 fixed on the driving gear 9 by means of a knock pin 25 and a bolt 26 and is eccentric with an interval (*e*) from the center of the driving gear 9. The base end of the rocker arm 30 is fitted onto said rocker shaft 19.

On the other hand, a rocker arm 32 at the side of the outer slide 31 is made integral with said rocker arm 30 and the rocker shaft 19, so that it is rotated for the same angle as this rocker arm 30.

The tip end of said rocker arm 32 is connected to the upper end of a driving link 33 inserted in said main shaft 6 through a connecting lever 34 and pins 35, 36 at the both ends. The lower end of the driving link 33 is connected to the upper end of a connecting link 38 through a pin 37, the lower end of this link 38 is connected to a screw 40 through a pin 39, and the screw 40 is threaded and fixed on the outer slide 31. It is to be noted, as in the case of said inner slide 24, the relative position of the outer slide 31 to the crown body 2 is made adjustable by means of a thread provided on the screw 40.

In the drawing, the numerals 41, 42 designate balancers provided to make smooth the raising and lowering of the inner slide 24 and the outer slide 31.

The operation of the device having the above-described constitution according to the present invention will be explained in the following.

The driving force of the motor 10 causes to rotate the flywheel 12, a clutch 13, a drive shaft 14, and a pinion 14*a*, a drive gear 15, and intermediate gears 15*a* are rotated. Accordingly, as the drive gears 15 are splined with the right pinion shaft 16, and intermediate gears 15*a* are splined with the left pinion shaft 16*a*, respectively, so when the drive gear 15 and intermediate gears 15*a* rotate, pinions 16*b*, 16*b* rotate, too. Driving gears 9, 9 engaged with pinions 16*b*, 16*b* are rotated in directions shown by arrows.

With the rotation of the driving gear 9 on the side of the inner slide 24, the drawing link 17 is restricted by the rocker arm 18 through the pin 17*a*, and the pin 20 at the lower end of the driving link 17 traces a locus defined as cycle S shown by a chain line shown in FIG. 1. The inner slide 24 moving reciprocatingly up and down by the link 21 goes down slowly in the drawing region, and after a slight pressing down at the lower dead point, moves to return quickly. On the other hand, with the rotation of the drive gear 9, the eccentric rings 27, 27 mounted on said driving gear 9 swing the rocker arm 30. The rocker arm 30 swings the rocker arm 32 for the same rotational angle through the rocker shaft 19, the rocker arm 32 rotates the upper end of the driving link 33 through the link 34, pins 36, 35. At the same time, the lower end of the link 33 gives vertical reciprocating motion to the outer slide 31 through the link 38, and when the outer slide 31 reaches to the lower dead point, the angle formed by the link 34 and the rocker arm 32 approaches about 180°, so that even when the eccentric ring 27 rotates, the outer slide 31 remains standstill, and during this time inner slide 24 continues drawing operation.

Considering the above-described motion in detail, the outer slide 31 moves very slightly while it is positioned at the lower dead point, but since this movement is confined within a swinging range which is quite small made by the link 34 with the pin 37 as the center which moves with an extremely small movement, the movement of the pin 37 itself becomes very small. Accordingly, the movement of the pin 37 is so small that it is almost absorbed by elastic elongation of each part of link mechanism as seen from the movement of the outer slide 31, thus it will not really give movement for the slide 31.

FIG. 5 shows that the linking relation which drives the inner slide (indicated by a solid line) and the linking relation which drives the outer slide are (indicated by a dotted line) correlative.

Thus, as for the operating curve, it passes a slow descending curve in descending region *a* of the inner slide 24 as shown in FIG. 6, and at the time of restoring to rise, it depicts a sudden sharp curve when it ascends to an upper dead point. The outer slide 31 operates depicting symmetrical curve both in the drawing region *a* and the returning period.

The desired standstill period at the lower dead point of the outer slide 31 can be obtained by adjusting the length of a link 34.

What is claimed is:

1. A mechanical double action press using a link mechanism, comprising a press body, said press body including a bed body, an upright extending upwardly from said bed body and a crown body spaced above said bed body and mounted on said upright, said crown body having a front side and an oppositely disposed rear side, an inner slide and an outer slide mounted in said press body for movement in the upward and downward directions, a pair of main shafts disposed in spaced relation in said press body and each said main shaft extending completely through said crown from its front side to its rear side as a single member, plates attached to the ends of said main shafts and said plates rigidly fixed to said crown body so that said shafts are not axially transferable and cannot rotate, one of said main shafts is associated with said inner slide and the other said main shaft is associated with said outer slide, a plurality of driving gears rotatably mounted on each of said main shafts, an eccentric circular plate portion located on said driving gears mounted on said main shaft associated with said inner slide, an inner slide

driving link fitted to each of said eccentric circular plate portions, a link lever pin connected to said inner slide driving link and to said inner slide, an eccentric wheel secured to each of said driving gears on said main shaft associated with said inner slide, inner slide, a connecting rod mounted on each of said eccentric wheels, a rocker shaft spaced laterally from said main shaft associated with said inner slide, an inner slide rocker arm pin connected to said connecting rod at one end and mounted on said rocker shaft at its other end, outer slide rocker arms associated with said rocker shaft and displaceable through the same rotational angle as said inner slide rocker arm through said rocker shaft, a vertically arranged outer slide driving link having an upper end and a lower end and mounted on said shaft associated with said outer slide, an upper connecting link pin connected to said outer slide rocker arm and to the upper end of said upper slide driving link, and a lower connecting link pin connected both to the lower end of said driving link and to said outer slide.

* * * * *