Dec. 18, 1951 E. K. JOHANSEN 2,579,078

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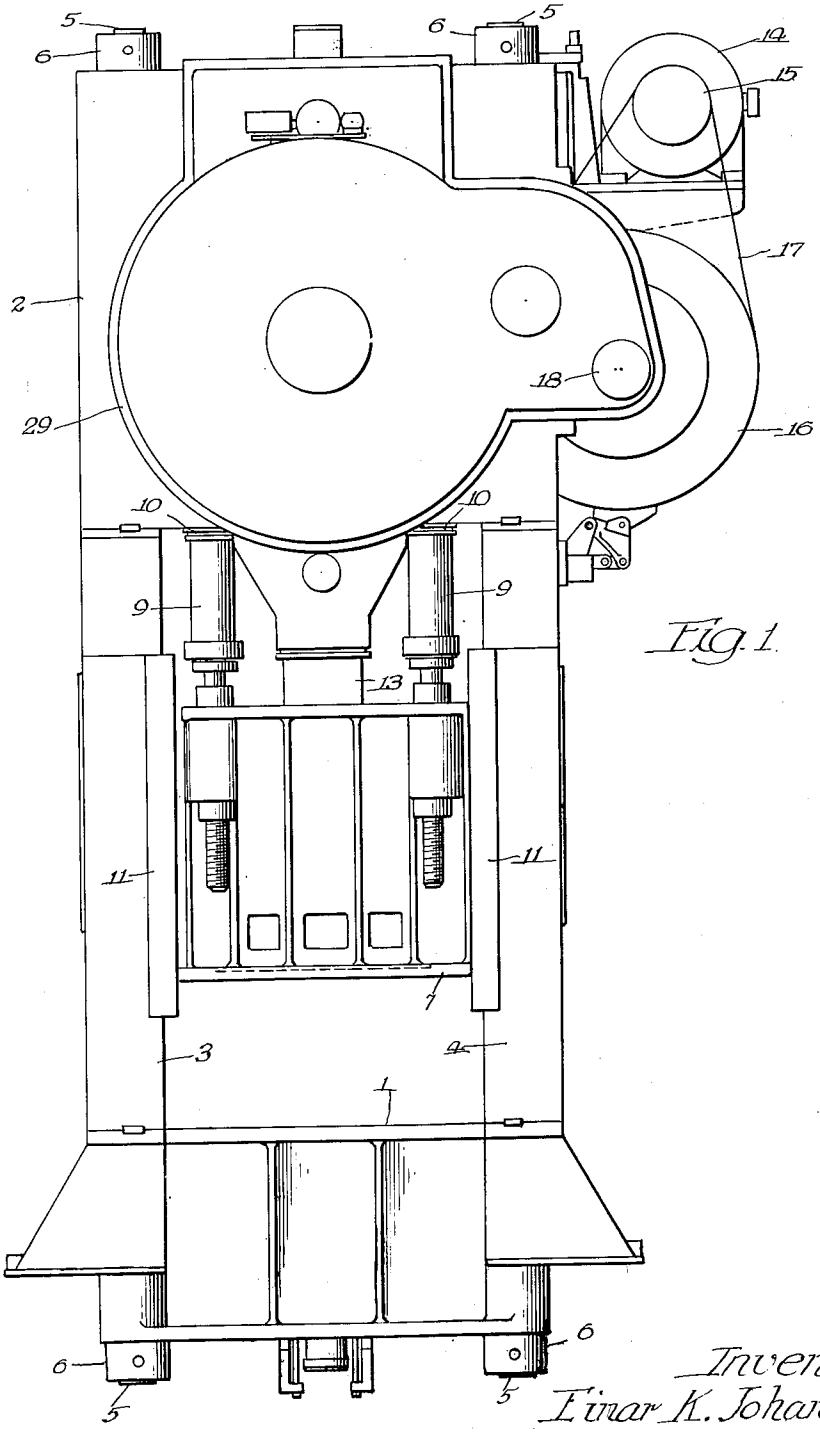


Fig. 1.

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Fig 2.

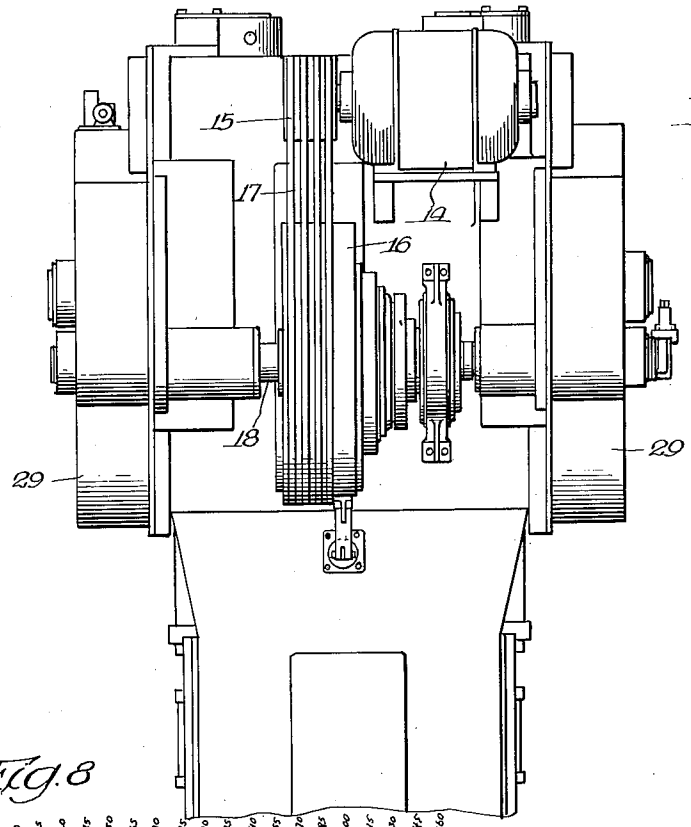
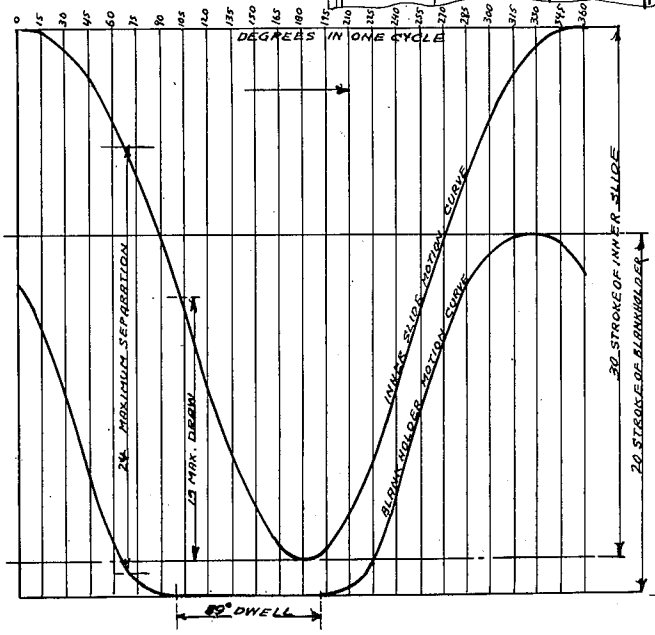


Fig. 8



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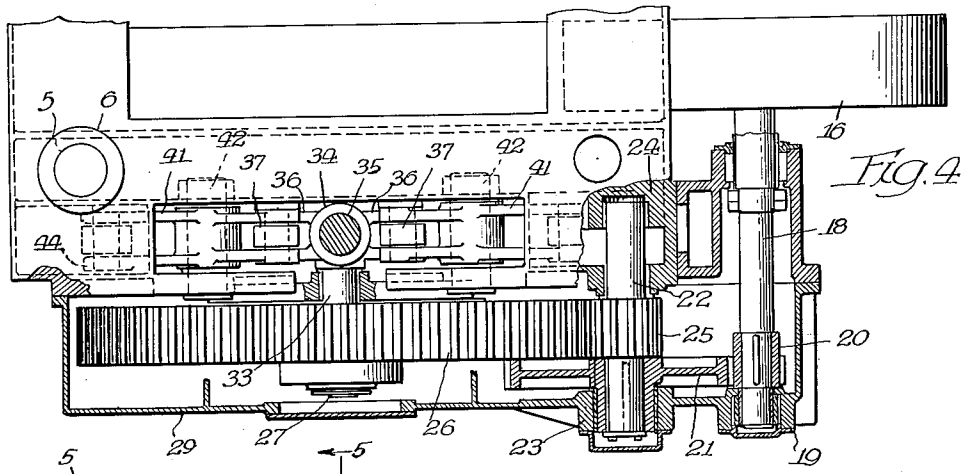


Fig. 4

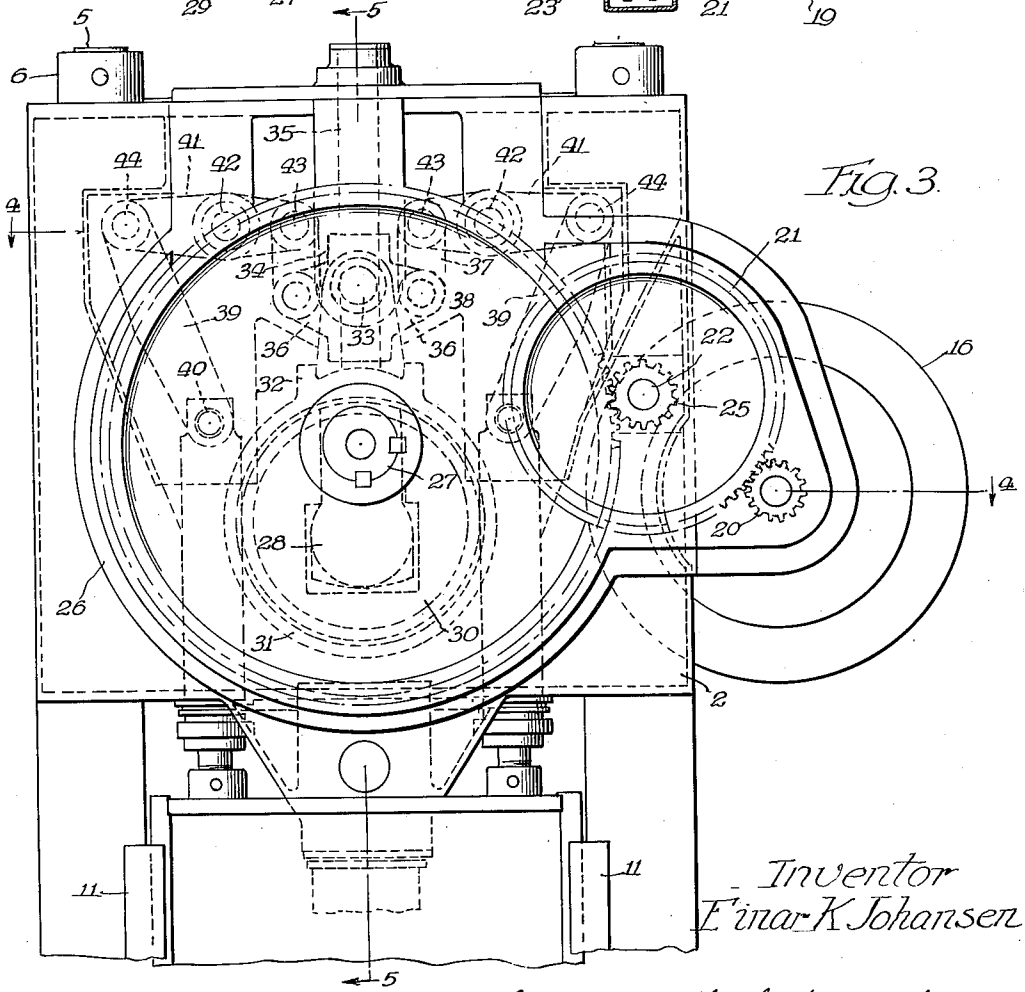


Fig. 3.

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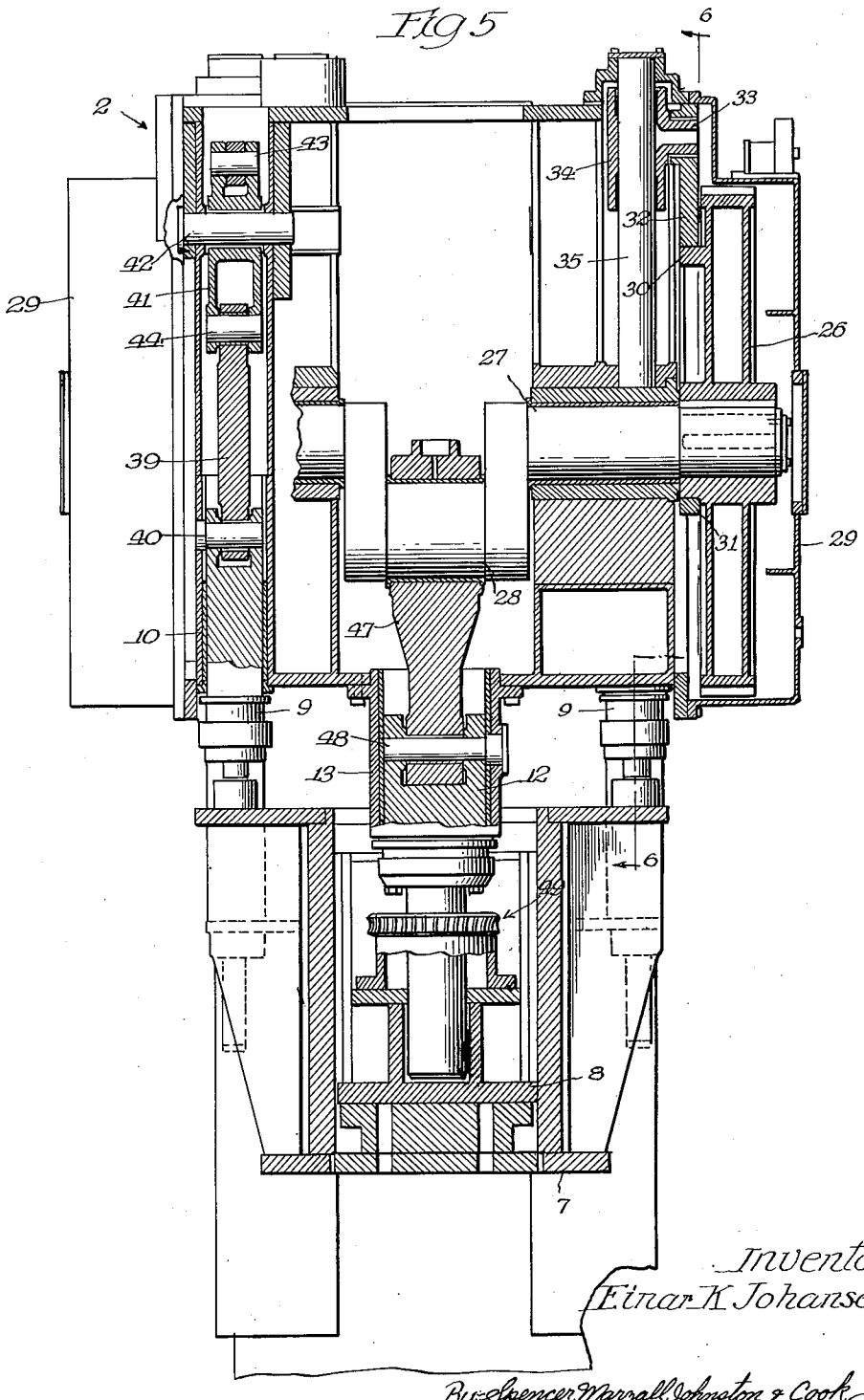
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Fig 5



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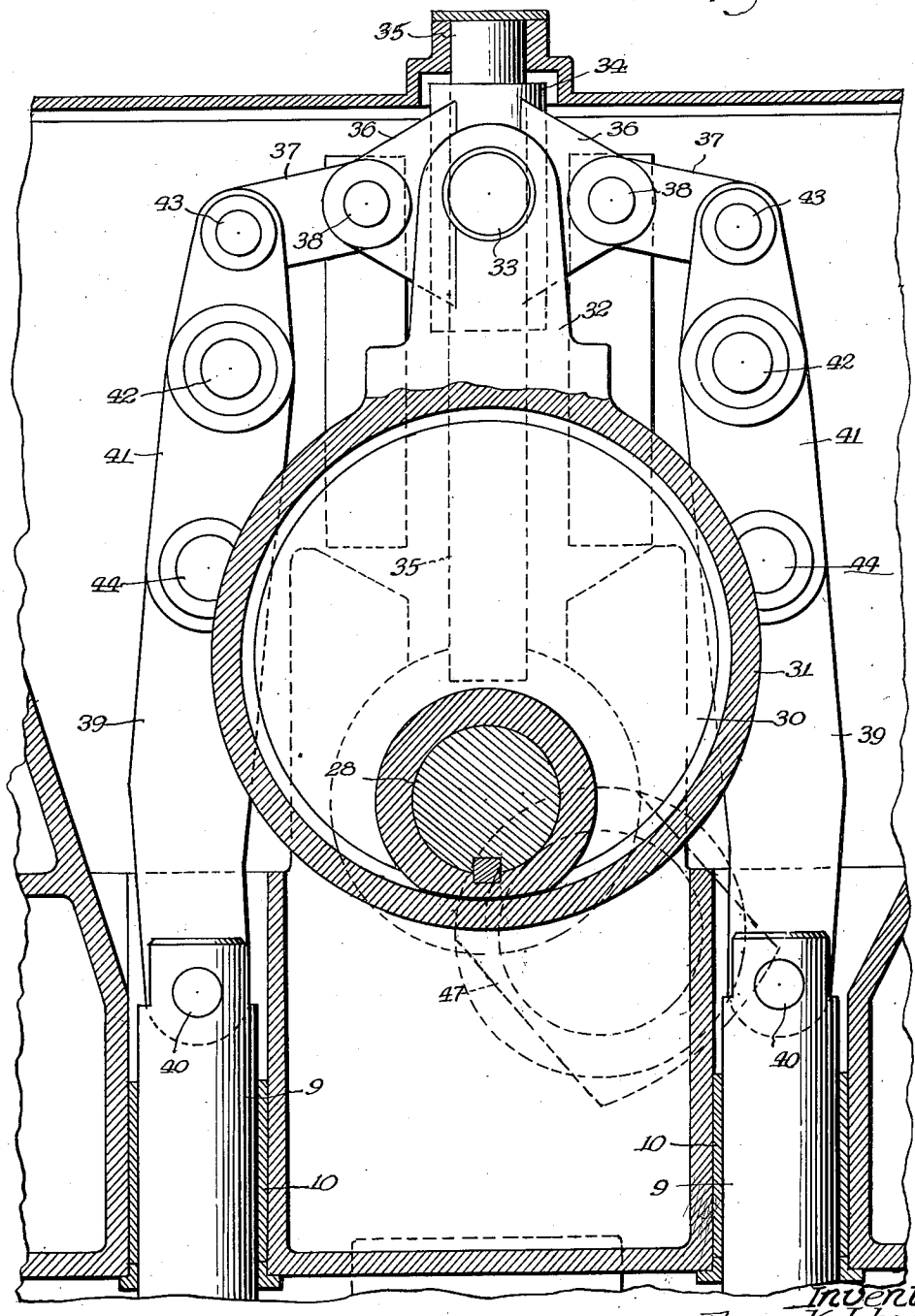
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Fig 6.



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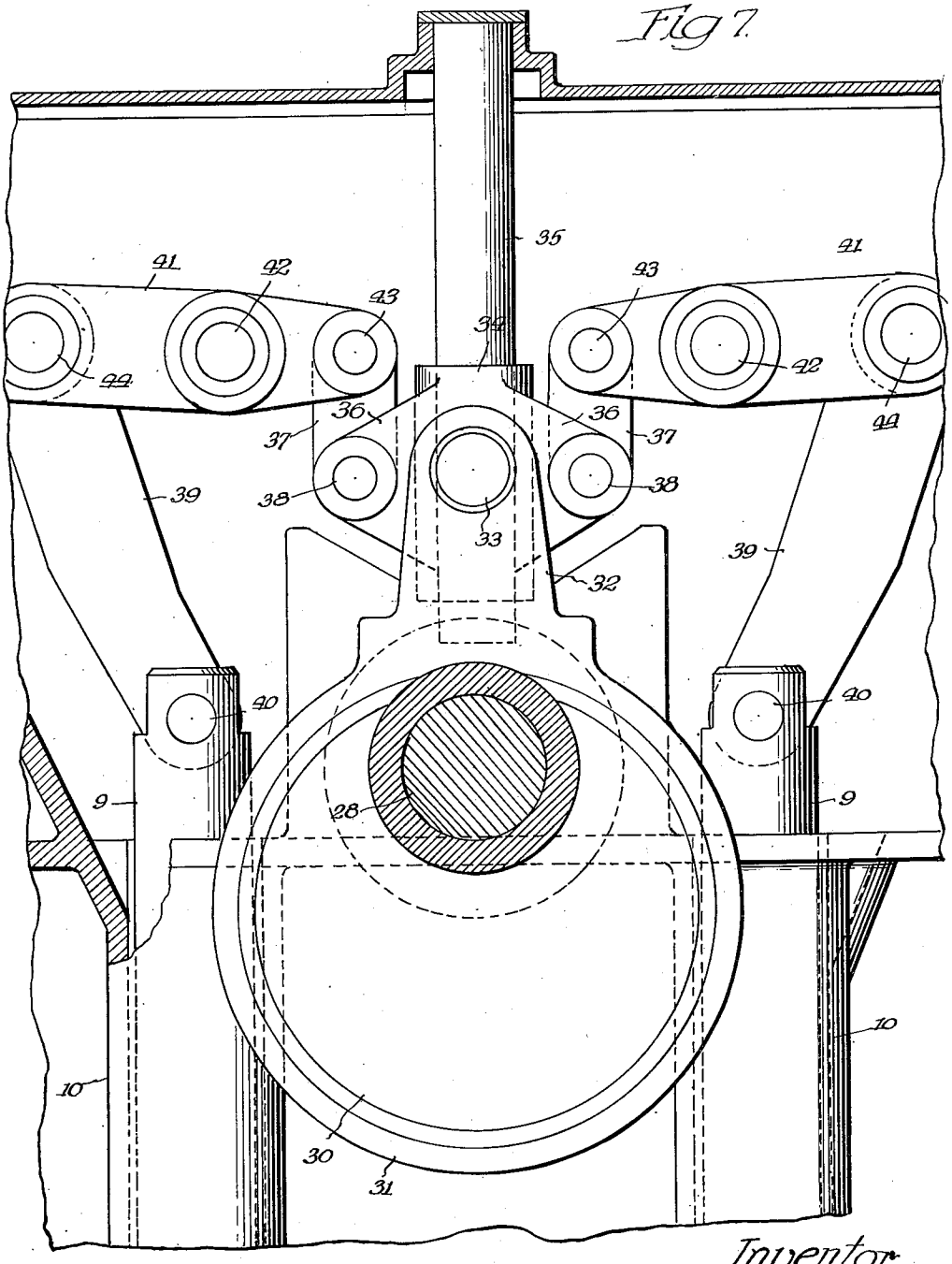
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Fig 7.



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Fig. 9.

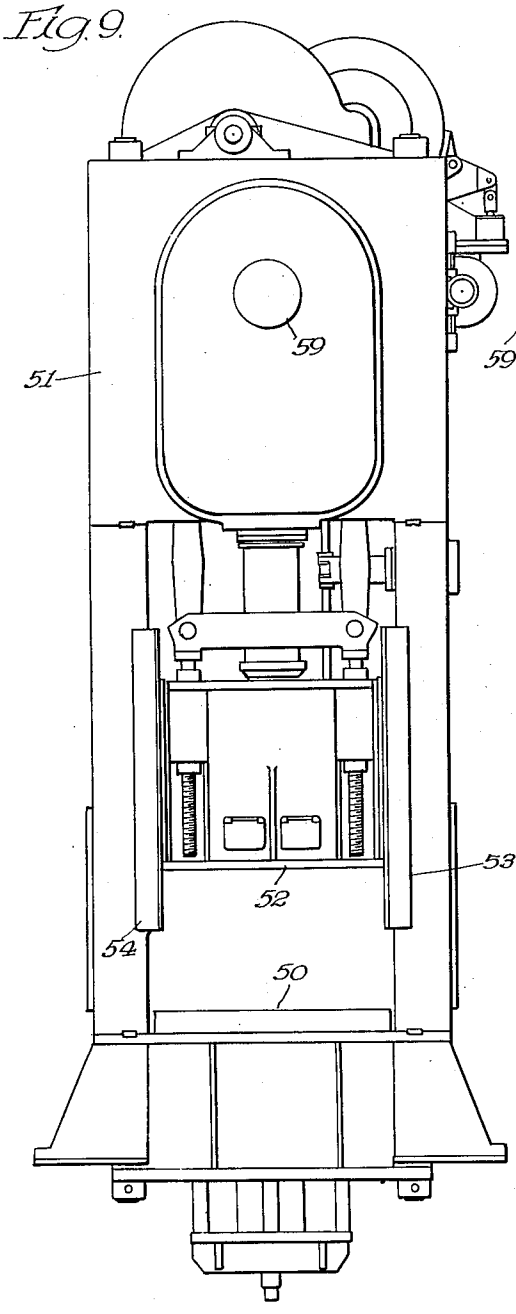
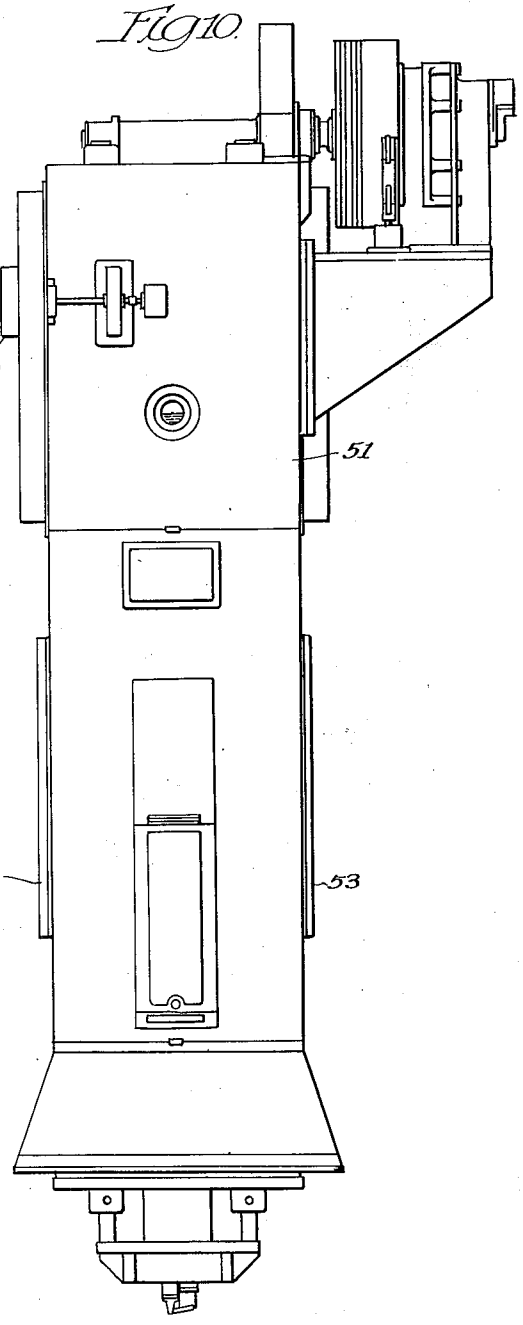


Fig. 10.



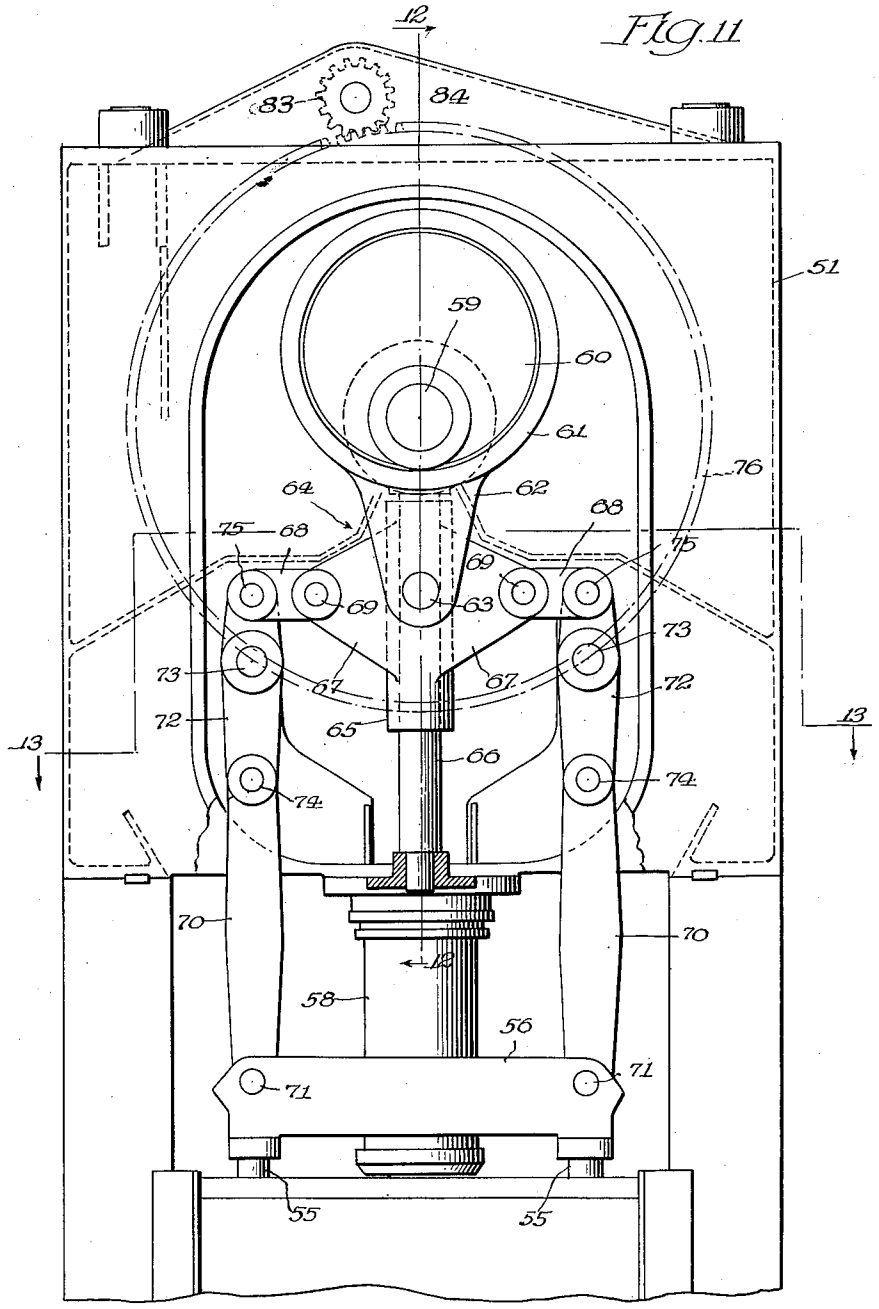
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FIG. 11



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Fig 12

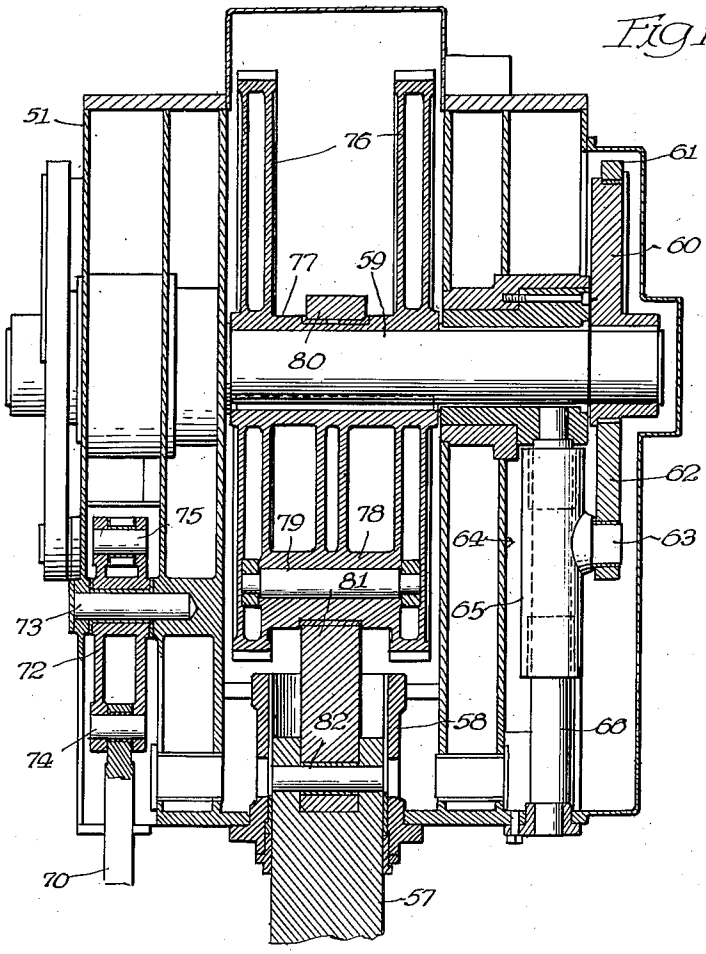
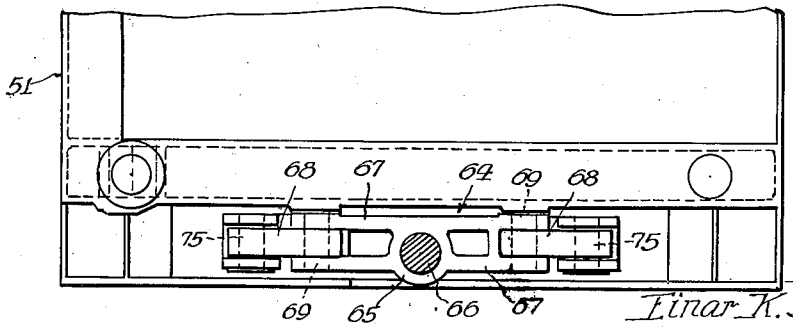


Fig 13



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UNITED STATES PATENT OFFICE

2,579,078

METAL DRAWING PRESS

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Application April 26, 1947, Serial No. 744,093

1 Claim. (Cl. 113—38)

1

This invention relates, in general, to improvements in metal-drawing presses of the type having an outer slide member operating as a work holder and an inner slide member performing an operation upon work.

One of the principal objects of this invention is to provide a simplified arrangement of operating mechanism for the slide members which mechanism will enable the press to be operated in a more efficient manner and to be manufactured more economically.

Another object of the invention is to provide a metal drawing press wherein a novel form of linkage mechanism is utilized for actuating one of the slide members.

A further object is to provide a press of this character wherein the operating means for both the inner and outer slide members are actuated by rotation of a single shaft extending between the sides of the machine.

Still another object is to provide a press wherein an inner slide member is actuated by means of a single and centrally located eccentric mechanism operating in timed relation with the operating mechanism for the outer slide member.

A still further object is to provide a metal drawing press wherein the inner and outer slide members are actuated by mechanism connected with a single shaft; and wherein a novel and simplified form of linkage mechanism is utilized to actuate one of the slide members so that a dwell of considerable duration is imparted to that slide member, while the other slide member is performing an operation upon work.

Other objects and advantages of the invention will become apparent upon reading the following description taken in conjunction with the accompanying drawings in which:

Fig. 1 is a front elevational view of a metal drawing press embodying the present invention;

Fig. 2 is a fragmentary side elevational view of the press illustrated in Fig. 1;

Fig. 3 is an enlarged fragmentary front elevational view showing the upper part of the press with the cover plate removed therefrom;

Fig. 4 is a fragmentary plan view partly in section and taken substantially along the plane of line 4—4 of Fig. 3;

Fig. 5 is a vertical sectional view taken substantially along the plane of line 5—5 of Fig. 3, and showing the inner and outer slide members in their lower position;

Fig. 6 is a still further enlarged detail vertical sectional view of the upper part of the machine taken substantially along the plane of line 6—6

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of Fig. 5, and showing the inner and outer slide actuating means in their lower positions;

Fig. 7 is a view similar to Fig. 6 but showing the inner and outer slide actuating means in their upper positions;

Fig. 8 is a cyclographic view of the movement of the two slides and showing the period of dwell obtained in one of the slides;

Fig. 9 is a front elevational view of a similar form of metal drawing press embodying a modified form of the present invention;

Fig. 10 is a side elevational view of the press shown in Fig. 9;

Fig. 11 is an enlarged vertical sectional view through the machine of Fig. 9 showing the actuating mechanism for the slide members in their lower positions;

Fig. 12 is a vertical sectional view taken substantially along the plane of line 12—12 of Fig. 11; and

Fig. 13 is a fragmentary horizontal sectional view taken substantially along the plane of line 13—13 of Fig. 11.

The press of the present invention as illustrated in Figs. 1 through 8 includes, generally, a bed 1, which is adapted to support work to be operated upon, and a crown 2 spaced upwardly therefrom and adapted to contain the operating mechanism of the press therein. Frame members 3 and 4 separate the crown and bed, the entire structure being secured together by elongated tie rods 5 having collars or nuts 6 at each end thereof. An outer slide member 7 operates as a work holder which is adapted to hold work on the bed 1 while an inner slide member 8, Fig. 5, operates to perform an operation thereon.

The operating mechanisms for the outer slide 7 and the inner slide 8 are arranged within the crown 2, the outer slide being connected with its actuating mechanism by means of upwardly extending adjustable connecting members 9 which move vertically through suitable guide sleeves 10 mounted in the sides of the press. These guide sleeves 10 serve as a means to relieve guideways 11, of the outer slide 7, against lateral stresses which would otherwise be exerted thereupon by the actuating mechanism.

The connection of the inner slide 8, with its actuating mechanism, includes an adjustable connecting member 12 which reciprocates vertically within a guide 13 centrally located within the press or machine.

The actuating mechanism for both slides has motion imparted thereto by means of a suitable motor 14 having a pulley 15 on the shaft thereof.

The pulley 15 is adapted to drive a larger pulley 16 by means of a belt 17 between the two pulleys 15 and 16. The larger pulley 16 is mounted on a shaft 18 journaled in bearings 19 at each side of the machine.

The shaft 18 carries a pinion 20 at each end thereof, and each pinion 20 meshes with a gear 21 located at each side of the machine on a shaft 22 journaled in bearings 23 and 24, Fig. 4. The operating mechanism at each side of the machine is identical and Fig. 4 illustrates in plan the linkage mechanism and operating means therefor at one side of the machine. A description of this mechanism will apply to both sides of the press.

A pinion 25 is secured to the shaft 22 and drives a large gear 26 mounted on the shaft 27 which extends between the sides of the machine, the shaft 27 being provided with a crank portion 28 intermediate its ends. A cover plate 29 is adapted to enclose the gears and pinions indicated by the numerals 20, 21, 25 and 26 so that the entire mechanism may be enclosed within the crown 2.

Reference will now be made more particularly to Figs. 3 to 7, inclusive, in describing the actuating mechanism for the inner and outer slides. Each gear 26 is provided on the inner face thereof with an eccentric portion 30 adapted to have a circular strap 31 therearound. The upper part of the strap 31 is provided with an extension 32 having an opening therein for the purpose of receiving an outwardly extending pin 33, preferably formed as an integral part of a crosshead which includes a tubular member 34 mounted for vertical reciprocation. The pin 33 is illustrated as being of a tubular construction, but this is merely for convenience to facilitate the manufacture thereof. This pin could as well be a solid member secured to the tubular portion 34 of the crosshead. The purpose of such pin 33 is to reciprocate the tubular portion 34 of the crosshead on the vertically extending slide rod 35 as the eccentric 30 is rotated by the gear 26 and the shaft 27. The stationary guide rods 35 depend from the crown 2 adjacent the ends of the shaft 27 and inwardly of the sides of the press. The reciprocation of the crosshead actuates a linkage mechanism for operation of the outer slide member which acts as the work holder.

The crosshead includes a pair of spaced ears 36 which extend outwardly in opposite directions from the tubular portion 34, this structure being illustrated more clearly in Figs. 4, 6 and 7. A link 37 is received between each set of ears 36, and this link is pivotally secured to the ears by means of a pivot pin 38. The remainder of the linkage mechanism comprises a lower link 39 pivotally secured to the upper end of each guide rod 9 of the outer slide by means of a pivot pin 40, and an intermediate link 41 adapted to rotate about a stationary pivot pin 42 suitably mounted on a stationary part of the machine. The upper end of each intermediate link 41 is pivotally secured to the upper link 37 by means of a pivot pin 43, and the lower end of the intermediate link 41 is pivotally secured to the upper end of the lower link 39 by means of a pivot pin 44.

The gear 26, and its eccentric portion 30, will carry with it the strap 31 which surrounds the eccentric 30 during rotation of the gear 26. The upper extension 32 on the strap 31, being pivotally connected at 33 to the crosshead, will thereupon impart a vertical reciprocating movement to the crosshead to thereby actuate the linkage mechanism. Thus, when the crosshead is in its uppermost position, as illustrated in Fig. 6, the links 37, 41 and 39 connected thereto will have been moved in such a way as to force the outer slide downwardly in contact with the work which has been placed on the bed, to thereby hold the work while an operation is being performed thereon by the inner slide.

As the gear 26 and its eccentric 30 rotate in a clockwise direction, as seen in Figs. 6 and 7, the crosshead, with its ears 36 and tubular portion 34, will be carried downwardly until it reaches the lowermost position thereof as shown in Fig. 7, whereupon the linkage mechanism, including the links 37, 41 and 39, will have been moved in such a way as to elevate the outer slide connected thereto. Each of the linkage mechanisms described lies in a plane perpendicular to the main drive shaft 27, as shown in Figs. 5 and 6.

In accordance with the operation of the machine, the outer slide or work holder 7 must precede the inner slide in its downward movement in order to hold the work while an operation is being performed thereon. The outer slide reaches the work first and remains in contact therewith until after the operation has been performed thereon by the inner slide, after which the inner slide will begin its upward movement just before the upward movement of the outer slide begins. This movement of the two slides is clearly illustrated by the cyclograph of Fig. 8, wherein the movement of the outer slide is indicated by the motion curve 45 and that of the inner slide is illustrated by the curve 46. The outer slide has a considerable period of dwell, which period may be of any suitable duration as long as the outer slide reaches the work first and remains in contact therewith until after the inner slide has reached its lowermost position and has begun its upward movement.

This latter described motion of the outer slide is accomplished through the medium of the linkage mechanism, and the dwell is obtained during the latter part of the upward movement and the first part of the downward movement of the crosshead 34. The lowermost position of the crosshead is shown in Fig. 7. During the upward movement of the crosshead, the two links 39 and 41 will gradually approach alignment with each other to move the outer slide downwardly. This position of alignment of the links 39 and 41 will be reached before the crosshead 34 arrives at its uppermost position and, in fact, the links 39 and 41 will be in alignment when the link 37 is in a position as illustrated in Fig. 6. This position of link 37 is such that the pivot pin 38 is the same distance below a true horizontal as it will be above a true horizontal in its final position. Further clarifying this statement, the link 37 will move through dead center equal distances from one side of dead center to the other without imparting any movement to the links 41 and 39 or the outer slide. Therefore, the crosshead 34 will carry the links 37 from their dotted line positions shown in Fig. 6 upwardly to the full line positions thereof, and again downwardly to the dotted line positions without imparting any movement to the outer slide 7. This will permit a dwell in the outer slide of sufficient duration to permit the inner slide to move downwardly, perform its operation on the work, and start its upward movement before the outer slide will release the work from the bed.

There are two of the vertical slide rods 35, one at each side of the machine, and four sets

of the links 37, 39 and 41, so that the linkage mechanisms at both sides of the machine will be actuated simultaneously to operate the outer slide.

The inner slide 8 is adapted to carry a die member which performs an operation upon work held on the bed by the outer slide 7. This inner slide 8 must have a reciprocating movement in a predetermined timed relation with respect to the outer slide. The novel arrangement and actuating means which has been devised for actuating the inner slide includes the central crank portion 28 of the crank shaft 27. A link or connecting rod 47 surrounds the crank portion 28 and extends downwardly within the guide 13 where it is pivotally secured to the guide 12 by means of a transversely extending pivot pin 48. This guide 12 is adjustably secured to the inner slide 8 by any suitable and well known means generally indicated at 49.

Rotation of the crank shaft 27, which is caused by the driven gear 26 mounted thereon, will operate the crank 28 and the link 47 connected thereto in such a way as to impart a vertical reciprocating movement to the inner slide 8 through the connecting means just described.

It must be necessary, however, to preserve a definite relationship between the position of the crank 28 and the crossheads 34 to insure the proper timed operation between the inner and outer slides. For this reason the crank 28 is located so that it will be at an angle with respect to the vertical when the crosshead 34 is in its uppermost position as shown in Fig. 6. In the particular embodiment of the invention as shown herein, the position of the crank 28 will be approximately 36° from the true vertical when the crosshead 34 is in its uppermost position and is about to begin its descent. As the shaft 27 continues to rotate in a clockwise direction, the crank 28 will continue to move downwardly until it reaches a position in alignment with the true vertical, at which time the inner slide will have reached its lowermost position and will have performed the operation on the work. Also, during this movement of the inner slide and the crank 28, the crosshead 34 will be moving downwardly, but will not reach the point where the linkage mechanism becomes operable until shortly after the crank 28 has started its upward movement on the opposite side of the vertical. This phase of the operation is evident from a study of Fig. 6. Thus, the novel linkage mechanism illustrated herein will operate in a simplified manner to actuate the outer slide and cause a dwell of considerable duration to hold the work while the inner slide performs an operation thereon.

The modified form of the invention illustrated in Figs. 9 through 13 embodies substantially the same principles above described but with slight differences. While the general appearance and specific mechanism involved in this modified form of press is slightly different from that shown in the preferred form, the basic construction is the same and includes a bed 50 and a crown 51, the crown 51 being spaced upwardly from the bed 50 within which crown the actuating mechanism is housed. The outer slide member 52 is adapted to be the work holder and reciprocates in similar guide ways 53 and 54. Adjustable connecting means 55 are located at the top of the outer slide and are connected together by means of the cross pieces 56.

Referring to Figs. 11 and 12, a centrally located connecting member 57 is secured in any suitable manner to the inner slide (not shown) and reciprocates within a tubular guide member 58. A main drive shaft 59 extends between the sides of the machine, the rotation of which shaft actuates the inner and outer slides in a manner similar to that described above with respect to the preferred form of the invention. The main difference involved is that the linkage mechanism in the first form was disposed above the main drive shaft 27, whereas the present modified form locates the linkage mechanism below the main drive shaft 59.

Eccentrics 60 are mounted on the shaft 59 adjacent each end thereof, and each eccentric is provided with a strap 61 having a downwardly extending portion 62 at the lower side thereof. The portion 62 of each strap 61 has an opening adapted to receive a pin 63 which may be made integral with, or otherwise suitably secured to, a crosshead generally indicated at 64. The crosshead 64 includes a tubular member 65 mounted for vertical reciprocation on a slide rod 66 and outwardly extending ears 67.

The linkage mechanism which actuates the outer slide includes upper links 68, two at each side of the machine, each of which is pivotally mounted to a set of ears 67 by means of a pivot pin 69. The lower links 70 are pivoted to the cross members 56 by means of pivot pins 71, and the intermediate links 72 are mounted for rotative movement on a stationary pin 73. The lower end of each intermediate link 72 is pivotally mounted to the upper end of a lower link 70 by the pivot pin 74, and the upper end of the intermediate link 72 is connected by means of a pivot pin 75 to the outer free end of the upper link 68.

Vertical reciprocation will be imparted to the crosshead 64 by means of the eccentrics 60 upon rotation of the shaft 59, which will thereupon cause a vertical reciprocation of the outer slide 52 through the linkage mechanism just described. Fig. 11 illustrates this latter form of the invention wherein the crosshead 64 is in its uppermost position with the outer slide in its lowermost or work holding position. As the shaft 59 rotates in a clockwise direction, the crosshead will be moved downwardly on the slide rod 66 to elevate the outer slide in the same manner as previously described with respect to the form of the invention illustrated in Figs. 1 through 8. The dwell imparted to the outer slide in its lower position will be of substantially the same duration as the dwell in the preferred form and the cyclograph illustrating the relative movements of the inner and outer slides will be substantially the same as that shown in Fig. 8.

The shaft 59, however, is not a crank shaft, but rather is a straight shaft extending between the sides of the machine, and has a pair of spaced gears 76 secured thereto between the ends thereof. The two gears 76 have a common hub or sleeve 77 keyed to the shaft 59, and an eccentric 78 is mounted on this hub or sleeve 77, the eccentric 78 being connected between the two gears 76 by means of the pin 79. A sleeve 80 surrounds the eccentric 78 and this sleeve 80 has a lower downwardly extending portion 81 connected by means of the pivot pin 82 with the connecting means 57 of the inner slide. Thus, rotation of the shaft 59 and gears 76 will impart a reciprocating movement to the inner slide through the medium of the sleeve 80 and its connecting extension 81.

The gears 76 are engaged by pinions 83 mounted on a shaft 84 at the top of the machine and within the crown. The shaft 84 may be rotated by any suitable power means such as an electric motor mounted on the top of the press. Thus, the gears 76 are positively driven through suitable drive means to rotate the shaft 59 and reciprocate the outer slide by means of the linkage mechanism, and the inner slide by means of the centrally disposed eccentric mechanism.

The operation of both forms of the press is substantially the same, the linkage mechanism in each case being similarly arranged to actuate the outer slide and cause a dwell of considerable duration to thereby hold the work in place while an operation is being performed thereon by the inner slide.

The advantages arising out of the simplified construction of the present invention as herein described are numerous, and the location of the entire linkage mechanism within the crown will enable such mechanism to operate in a bath of oil if so desired, to thereby continually lubricate all of the working parts and cause the press to operate quietly.

Changes may be made in the form, construction and arrangement of parts from those disclosed herein without in any way departing from the spirit of the invention or sacrificing any of the attendant advantages thereof, provided, however, that such changes fall within the scope of the claim appended hereto.

Having thus described my invention what I claim as new and desire to secure by Letters Patent of the United States is:

A metal drawing press with spaced sides and a crown and including inner and outer slide members, said outer slide member being constructed and provided with relatively adjustable connecting members extending upwardly from each end of the outer slide member, a guide sleeve for each of said connecting members mounted in the sides of the press, a rotatable main drive shaft mounted in the sides of the press and having outwardly extending ends, a stationary guide rod depending from the crown adjacent each end of said shaft and inwardly of said spaced sides, a crosshead slidably mounted on each of said guide rods, a plurality of linkage means for connecting the crossheads to the outer slide member, each linkage means lying in a plane perpendicular to the main drive shaft and connecting one of said crossheads with one of the relatively adjustable connecting members on said outer slide member, an eccentric mounted on each extending end of said drive shaft, a strap surrounding each eccentric and pivotally connected to the adjacent crosshead, whereby rotation of said shaft will reciprocate said crossheads through the medium of said eccentrics to actuate said linkage means and operate the outer slide member connected thereto, one of the links of each of said linkage means being mounted for free movement through a predetermined distance, permitting said outer slide member to dwell in actuated position during continued movement of said crossheads, said drive shaft being formed with a central crank portion, and a connecting rod pivotally secured to said crank portion and said inner slide member, to thereby actuate said inner slide member in a predetermined timed relation with the outer slide member.

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