Nov. 22, 1932. A. A. BYERLEIN 1,888,450

DRAWING PRESS

Filed Nov. 2, 1931 3 Sheets-Sheet 1

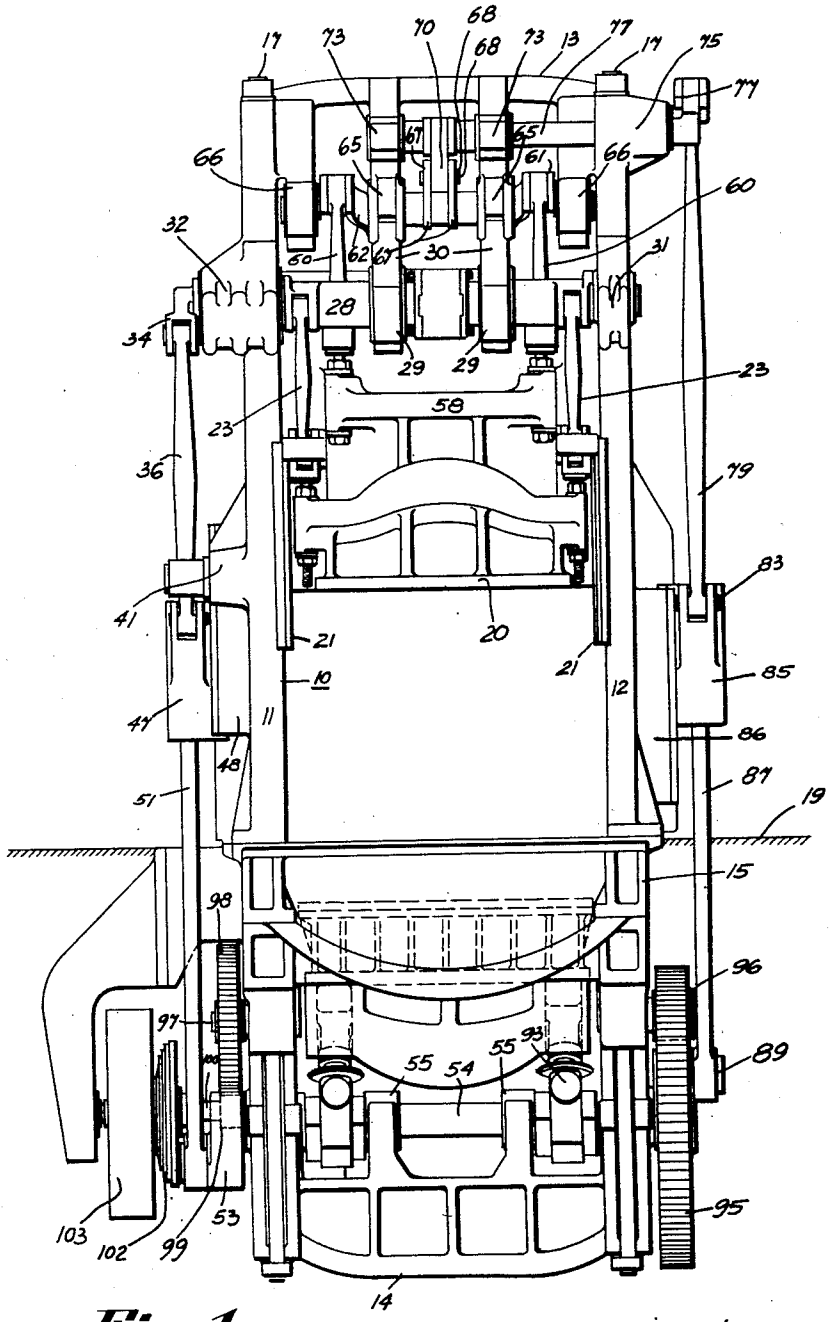


Fig. 1

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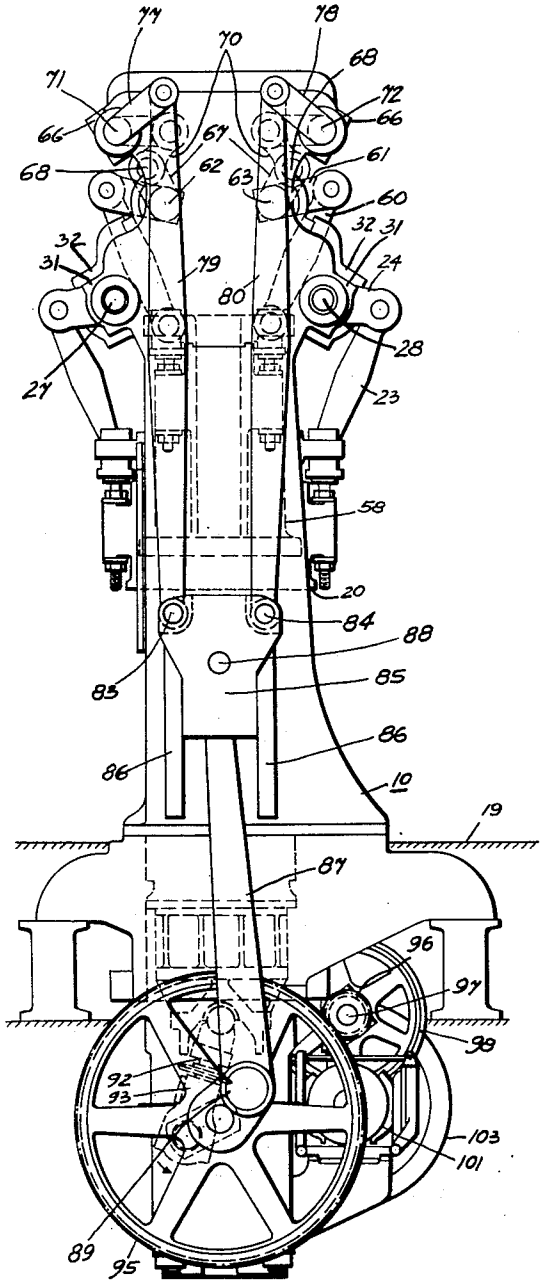


Fig. 2

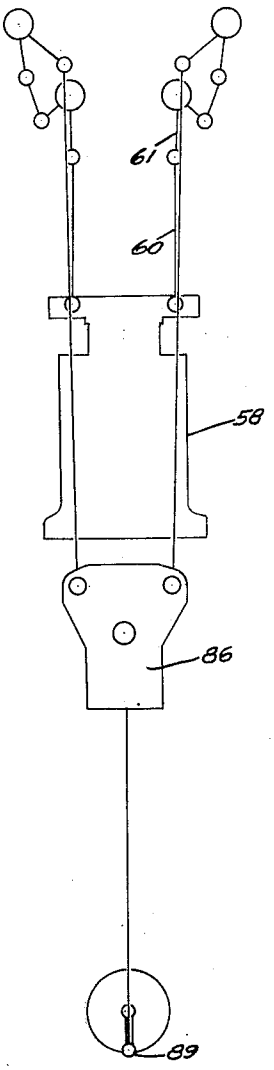


Fig. 3

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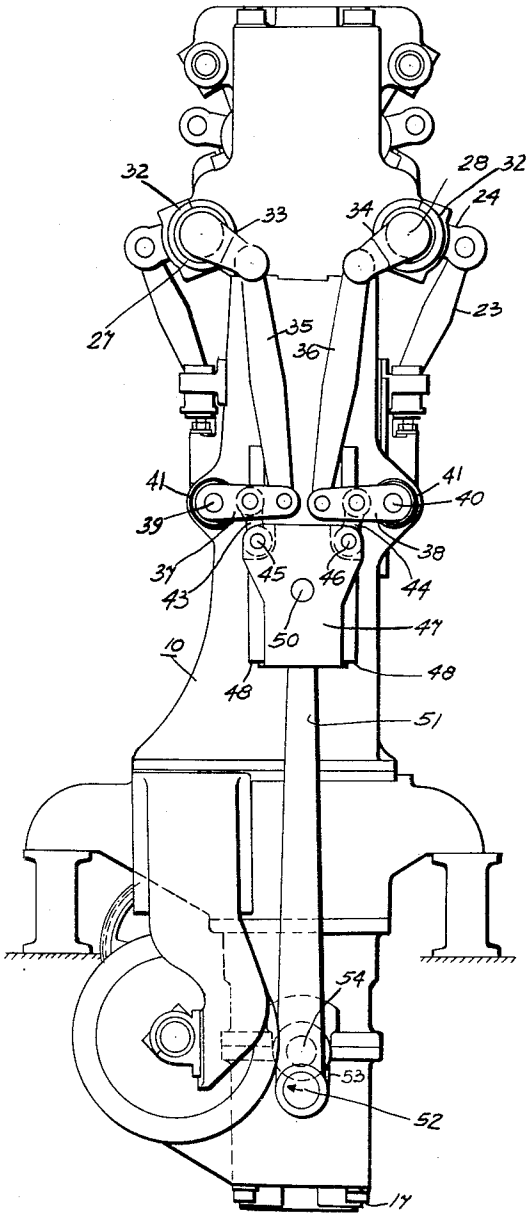


Fig. 4

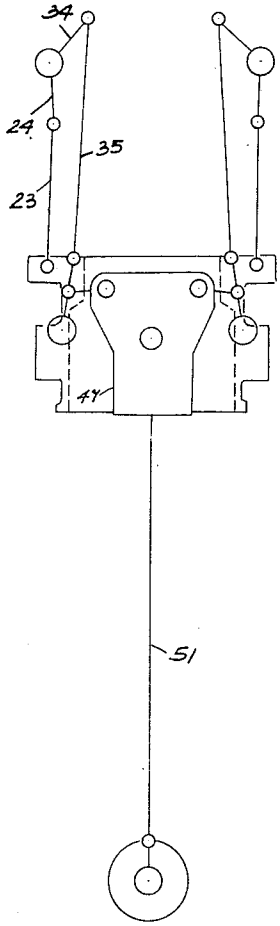


Fig. 5

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Patented Nov. 22, 1932 1,888,450

UNITED STATES PATENT OFFICE

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DRAWING PRESS

Application filed November 2, 1931. Serial No. 572,556.

This invention relates to metal drawing presses.

One object of the invention is the provision of a metal drawing press having a plurality of toggle operated die slides having dwells in their movements, means being provided on opposite sides of the press frame for operating the different toggle systems in proper timed relationship.

Another object of the invention is the provision of a drawing press having a blank holder and an inner slide movable therein, the lower part of the press incorporating a drive shaft connected to the blank holder and the inner slide so as to operate them both with dwells in their movements without requiring flywheels or gearing in the upper portions of the machine.

Further objects and advantages of the invention will be apparent from the following description, the appended claims and the accompanying drawings, in which—

Fig. 1 is a front elevation of a drawing press embodying the present invention;

Fig. 2 is a side elevation of the press showing it as viewed from the right;

Fig. 3 is a diagrammatic showing of the toggle and linkage system for the inner die slide showing the relationship of the parts when the slide is in its lowermost position;

Fig. 4 is a side elevation of the press as viewed from the left in Fig. 1; and

Fig. 5 is a diagrammatic showing of the position of the operating parts of the blank holder when in its lowermost position.

Referring more particularly to the drawings by reference numerals, 10 designates the frame of a press of the type used in drawing or shaping sheet metal and the like. The frame 10 comprises the opposite side portions 11 and 12, top arch 13, bottom arch 14 and the bed press 15. The top and bottom arches are preferably connected to a series of stacked frame sections that build up the frame portions 11 and 12, vertical through bolts 17 serving to rigidly interconnect all of these parts. As shown, the press is of very considerable size and is adapted to operate on large sheets of metal. The bed and the lower portion of the press frame are conveniently positioned below the ground level which is indicated at 19 so that the work position will be quite accessible.

The press is provided with an outer top die carrying slide 20 guided at opposite ends in guides 21 provided on the frame portions 11 and 12. This slide 20 is adapted to carry the blank holding die, not shown, which operates downwardly toward the work position to hold the blank during the time the forming die or dies are effective in forming or stamping the metal. The slide 20 is operated by a toggle system comprising the four toggle links 23 connected to the four corners of the slide, the upper ends of which are pivotally associated with toggle links 24, which are shown as short arms rigidly provided on the two rock shafts 27 and 28. The rock shafts 27 and 28 are simultaneously moved in opposite directions so as to straighten the several toggles and thus move the die slide or blank holder 20 downwardly toward the bed of the press.

The rock shafts 27 and 28 are rotatably mounted in bearings 29 provided in the frame walls 30 that depend from the top arch 13, and supported at one end thereof in bearings 31 in the frame portion 12. Bearings 32, preferably of large size, are provided in the frame portion 11 for the support of the other ends of the shafts. The left-hand ends of these two rock shafts are provided rigidly with arms 33 and 34 that are pivotally connected to links 35 and 36 respectively, extending down along the side of the press frame. The lower ends of these downwardly extending links are pivotally connected to levers 37 and 38 respectively, supported for pivotal movement about fixed axes 39 and 40, the supporting shafts of these levers being suitably mounted on bosses 41 on the press frame. Pivotally connected to the two levers 37 and 38 are short links 43 and 44 that are also pivotally supported at 45 and 46 respectively on a slide block 47 which is guided for vertical reciprocatory movement in guides 48 provided on the frame portion 11. The slide block 47 is pivotally connected at 50 to a long link 51 that projects downwardly along the side of the press and is pivotally con-

nected at 52 to an arm 53. This arm 53 is a crank provided on the end of a crank shaft 54, which is rotatably supported in bearings 55 and in additional end bearings provided in the opposite sides of the press frame. It will be readily understood that as the crank shaft 54 revolves, the link 51 is reciprocated so as to move the slide 47 and thus cause the levers 37 and 38 to be moved into alignment with the links 35 and 36, respectively, such movement causing the straightening of the toggle systems which interconnect the rock shafts to the blank holder. As shown in Fig. 5, when the lever 37 stands in alignment with the link 35, the link 43 extends approximately transversely with respect to the line of movement of the reciprocable slide 47. By reason of relationship of the parts at the dead center positions of the crank pin 52, the lever and toggle link system between the slide block and the rock shafts, and the toggle system connecting the rock shafts to the blank holder, a very substantial dwell of the blank holder takes place. In other words the blank holder can remain stationary at its lowermost position properly holding the work with a desired force during a very substantial angular movement of the crank shaft 54.

The blank holder 20 slidably guides an inner slide 58, which is also movable downwardly toward the work position in proper timed relationship with respect to the blank holder 20. The inner slide 58 is also operable with a considerable dwell in its movements and may serve to hold a forming die, or it may serve as a blank holder, or operate first to form the metal and then to hold the metal during a following operation by another slide.

The inner slide 58 is operated by the four toggle links 60 connected to the four corners of the slide as shown in Figs. 1 and 2. The upper ends of the toggle links 60 are pivotally connected to the toggle arms 61 provided on the two parallel spaced rock shafts 62 and 63. The shafts 62 and 63 are rotatably supported in suitable bearings 65 provided in the walls 30 and in additional bearings 66 provided in opposite sides of the press frame. The middle portion of each of the rock shafts 62 and 63 is rigidly provided with an arm 67, these arms being pivotally connected at 68 to arms 70 on the two operating rock shafts 71 and 72. The operating shafts 71 and 72 are journalled in suitable bearings 73 provided in frame walls 30 and project toward one side of the press as shown in Fig. 1, where they are additionally supported in bearings 75. On the projecting ends of the shafts 71 and 72 are arms 77 and 78. Long links 79 and 80 respectively are connected pivotally to the ends of these arms 77 and 78 and extend down along the right-hand side of the press as shown in Fig. 1, to points of connection at 83 and 84 symmetrically arranged on the slide block 85. The slide block 85 is vertically guided for reciprocatory movement in a suitable guide 86 on the frame section 12. A long link 87 is pivotally connected at 88 so as to cause the vertical reciprocation of the slide block. The lower end of the link 87 is operated by a crank pin 89 on the right-hand end of the crank shaft 54. Thus it will be seen that as the crank shaft 54 rotates the link 87 will be moved vertically, rocking the shafts 71 and 72 which causes the rock shafts 62 and 63 to straighten the toggles connecting to the inner slide 58.

As shown in Fig. 3 when the crank shaft 54 is in such position that the crank pin 89 is at its lowermost point, the slide block 86 will be in its lowermost position and the toggle systems will all be straight so as to hold the die slide 58 in its lowermost position, the several dead center positions of the crank shaft and toggle levers providing for a substantial dwell in the slide. This dwell, however, is preferably considerably less than the dwell of the outer or blank-holding slide 20. The arrangement is preferably such that the die of the blank holder 20 comes down and engages the work before the die carried by the inner slide 58 becomes effective on the work, the die of the inner slide 58 operating on the work and then holding against the work during some subsequent forming action. The outer or blank holding member 20, serves merely to hold the work with the required force and may be satisfactorily operated through the driving connection at one end only of the two rock shafts 27 and 28 by means of the slide system provided on one side of the press frame. The inner slide 58 which is effective in forming the metal as well as in holding the metal, frequently operates with great force and consequently the drive system provided on the right-hand side of the press frame supplies power to the two operating rock shafts 71 and 72 that are connected to the center points of the two toggle operating rock shafts 62 and 63, so as to supply power equally and symmetrically to the four toggle connections of the slide 58, resulting in a balanced flow of power and freedom from vibration while at the same time permitting the use of a very simple system of slides and links, entirely devoid of operating gearing in the upper or exposed portions of the press. This results in a press which is comparatively cheap in cost, and in which the drive shaft and crank shaft are provided in the lower portion of the press so that they may therefore be positioned below the floor line below the bed where they are well out of the way and close to the foundations.

In the press bed portion of the frame is slidably mounted a plunger 92 that may operate through suitable pins in a bolster plate to move a lower die in an upward direction, or toward the blank holder 20. The details

of construction of the plunger may correspond if desired to the construction shown in my prior Patent No. 1,768,503. Suitable connecting rods 93 of adjustable length may interconnect the lower side of the plunger 92 to the two cranks of the crank shaft.

At one end of the crank shaft 54 is the large gear 95 driven by the small gear 96 on a drive shaft 97. The crank pin 89 to which the lower end of the long link 87 is connected is provided on the outside of the gear 95. On the other end of the drive shaft 97 is a large gear 98 meshing with a driving pinion 99 on a driving shaft 100. The shaft 100, which may be provided with a suitable brake mechanism such as the drum 101, is driven through a suitable clutch 102 from a drive wheel 103 that can be rotated by a suitable drive motor, not shown. With the clutch 102 engaged, the driving shaft 100 causes the rotation of the crank shaft 54 through the drive shaft 97, the crank shaft 54 directly controlling the operation of the plunger 92, and causing the simultaneous movements of the slide blocks provided on the opposite sides of the press frame so that the blank holder 20 and the inner slide 58 are moved in proper timed relation. The plunger 92 can thus bring the die it controls into engagement with the work after the inner top slide 58 has engaged the work and during the time it is dwelling.

While the form of apparatus herein described constitutes a preferred embodiment of the invention, it is to be understood that the invention is not limited to this precise form of apparatus, and that changes may be made therein without departing from the scope of the invention which is defined in the appended claims.

What is claimed is:

1. In a drawing press, a frame, a die supporting member in said frame, a die slide operable in said frame, toggle links connected to said slide for operating it with a dwell in its movements, a second die slide, toggle links connected to said second die slide for operating it with a dwell in its movements, a drive shaft in said frame, means operated from one end of said drive shaft for moving said first named toggle links, and means operated from the other end of said drive shaft for operating said second named toggle links.

2. In a drawing press, a frame, a die slide operable in said frame, toggle links connected to said slide for operating it with a dwell in its movements, a second die slide, toggle links connected to said second die slide for operating it with a dwell in its movements, a die supporting member in said frame adapted for cooperation with said die slides, a drive shaft rotatably mounted adjacent the lower end of said frame, means operated from one end of said drive shaft for moving said first named toggle links, and means operated from the other end of said drive shaft for operating said second named toggle links.

3. In a drawing press, a frame, a die slide operable in said frame, toggle links connected to said slide for operating it with a dwell in its movements, a second die slide, toggle links connected to said second die slide for operating it with a dwell in its movements, a shaping plunger and means for operating said plunger, a drive shaft provided in said frame, a slide block mounted on one side of said press frame for operating said first named toggle links from said drive shaft, and a slide block provided on the other side of said press frame for operating said second named toggle links from said drive shaft.

4. In a drawing press, a frame, a die slide operable in said frame, toggle links connected to said slide for operating it with a dwell in its movements, a second die slide, toggle links connected to said second die slide for operating it with a dwell in its movements, a drive shaft provided in a lower portion of said frame, a slide block mounted on one side of said press frame for operating said first named toggle links from said drive shaft, and a slide block provided on the other side of said press frame for operating said second named toggle links from said drive shaft.

5. In a drawing press, a frame, a die slide movable in said frame, toggle links connected to said slide for operating it with a dwell in its movements, a second die slide, toggle links connected to said second die slide for operating it with a dwell in its movements, a die supporting member in said frame adapted for cooperation with said die slides, a pair of rock shafts for the toggle links of each slide, a slide block provided on the side of the frame and operably connected to the end portions of one pair of rock shafts, drive means provided on the other side of the press frame, and means connecting said drive means to the centers of the other pair of rock shafts.

6. In a drawing press, a frame, a die supporting member in said frame, a die slide movable in said frame, toggle links connected to said die slide for operating it with a dwell in its movements, rock shafts for operating said toggle links, a slide block provided on one side of the press frame for operating the ends of said rock shafts, a second die slide slidably mounted within the outer die slide, toggle links connected to said inner slide for operating it with a dwell in its movements, a second pair of rock shafts for operating said last named toggle links, operating shafts connected to the centers of said second rock shafts, a slide block provided on the other side of said press frame for moving said operating shafts, and drive means for operating said slide blocks.

7. In a drawing press, a frame, a die slide movable in said frame, toggle links connected to said die slide for operating it with a

dwell in its movements, rock shafts for operating said toggle links, a slide block provided on one side of the press frame for operating the ends of said rock shafts, a second die slide slidably mounted within the outer die slide, toggle links connected to said inner slide for operating it with a dwell in its movements, a second pair of rock shafts for operating said last named toggle links, operating shafts connected to the centers of said second rock shafts, a slide block provided on the other side of said press frame for moving said operating shafts, a drive shaft provided in said frame, a crank shaft operated by said drive shaft, a plunger operated by said crank shaft, and means connected to end portions of said crank shaft for operating said slide blocks.

8. In a drawing press, a frame, a die slide movable in said frame, toggle links connected to said die slide for operating it with a dwell in its movements, rock shafts for operating said toggle links, a slide block provided on one side of the press frame for operating the ends of said rock shafts, a second die slide slidably mounted within the outer die slide, toggle links connected to said inner slide for operating it with a dwell in its movements, a second pair of rock shafts for operating said last named toggle links, operating shafts connected to the centers of said second rock shafts, a slide block provided on the other side of said press frame for moving said operating shafts, a drive shaft provided in said frame, a crank shaft operated by said drive shaft, a plunger provided above said drive shaft and crank shaft and operated by said crank shaft in an upward direction towards said die slides, and means connected to end portions of said crank shaft for operating said slide blocks.

9. In a toggle press, a frame, a die slide movable in said frame, toggle links connected to said slide for operating it with a dwell in its movements, a second die slide reciprocally guided in said first slide, toggle links connected to said second slide to operate it with a dwell in its movements, a plunger movable to operative position toward said die slides, a crank shaft mounted below said plunger for operating said plunger, a drive shaft for operating said crank shaft, means connected to one end of said crank shaft for operating the toggle links of one slide, and means connected to the other end of said crank shaft for operating the toggle links of the other slide.

10. In a drawing press, a frame, a die slide operable in said frame, toggle links connected to said slide for operating it with a dwell in its movements, a second die slide, toggle links connected to said second die slide for operating it with a dwell in its movements, a rotatable shaft journalled in a lower portion of the frame, a plunger operated by said rotatable shaft in a direction upwardly towards said die slides, a vertically movable slide block on one side of the frame for operating said first named toggle links, a vertically movable slide block on the other side of said frame for operating said second named rock shafts, and means connected to opposite ends of said rotatable shaft for operating said slide blocks.

In testimony whereof I hereto affix my signature.

ARTHUR A. BYERLEIN.