March 6, 1951

F. K. MAUSSNEST

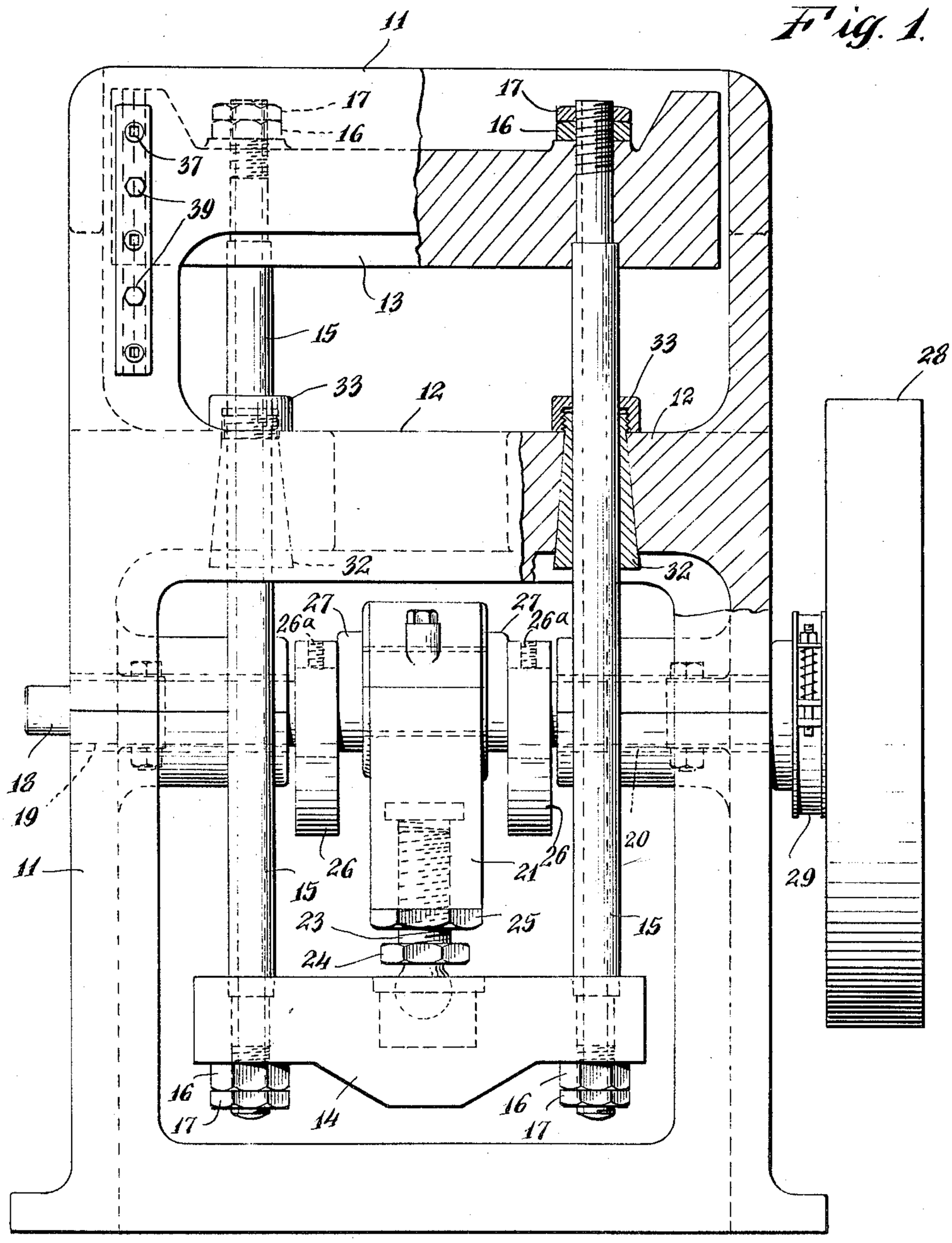
2,544,540

UNDERDRIVE PUNCH PRESS

Filed Feb. 17, 1948

3 Sheets-Sheet 1

Fig. 1.



INVENTOR.

Frederick K. Maussnest

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Fig. 3.

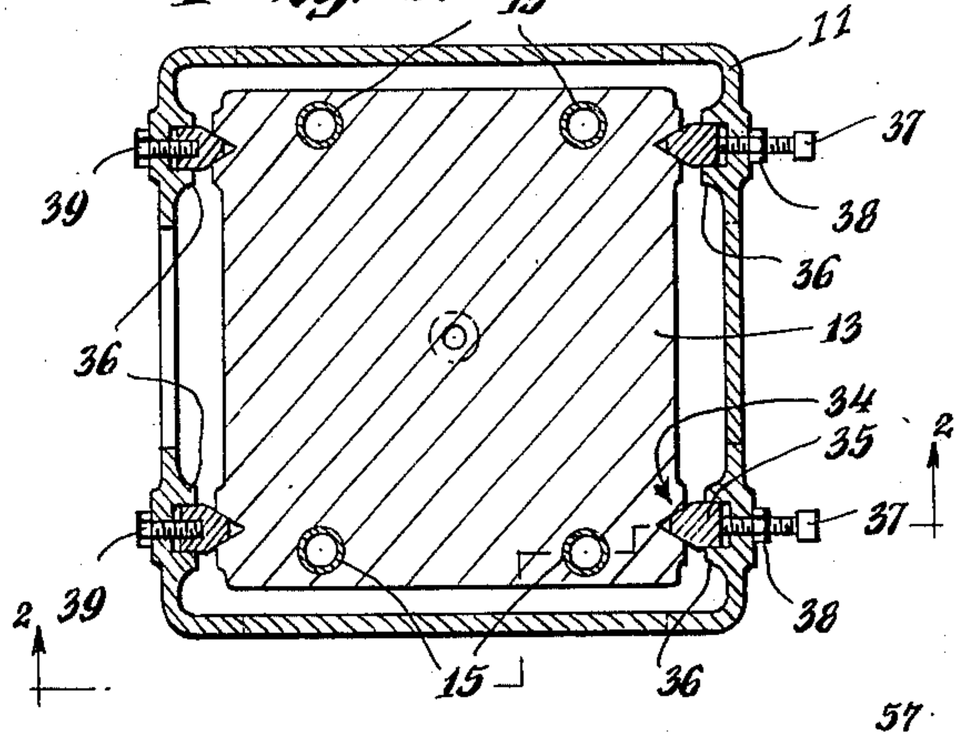


Fig. 7.

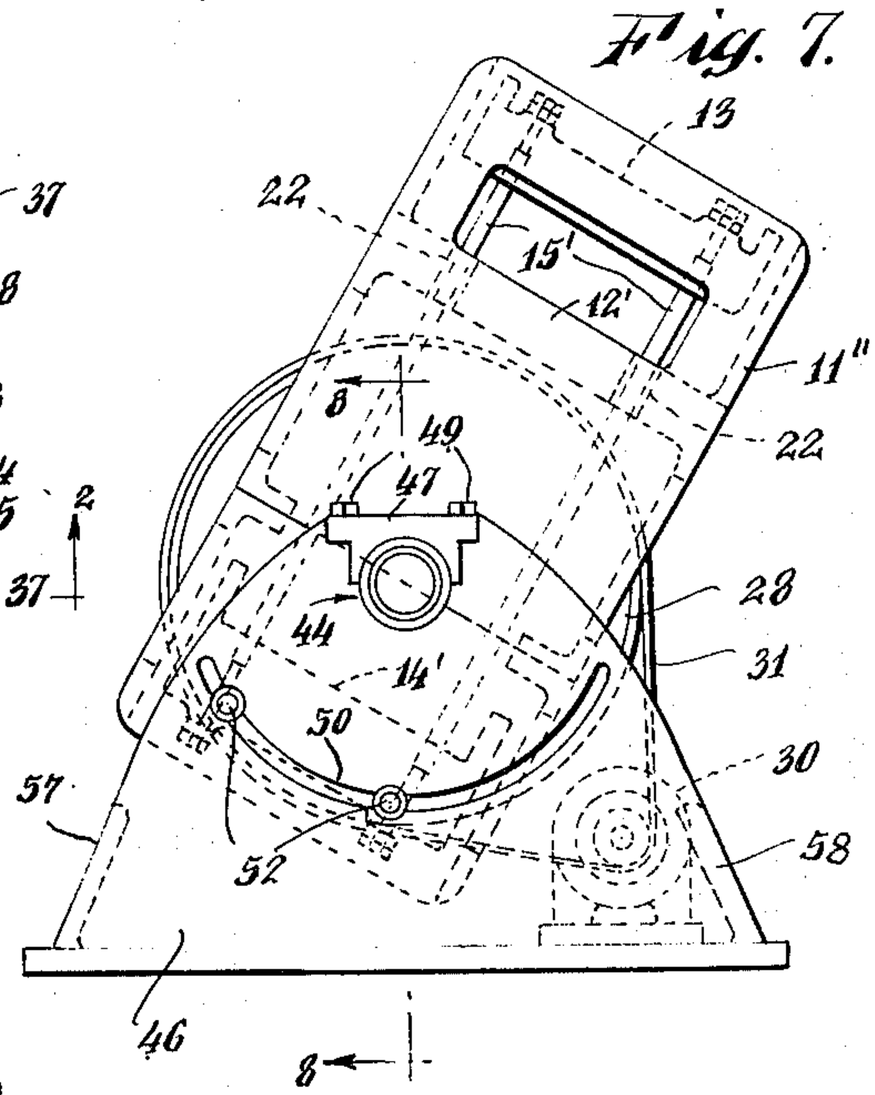


Fig. 2.

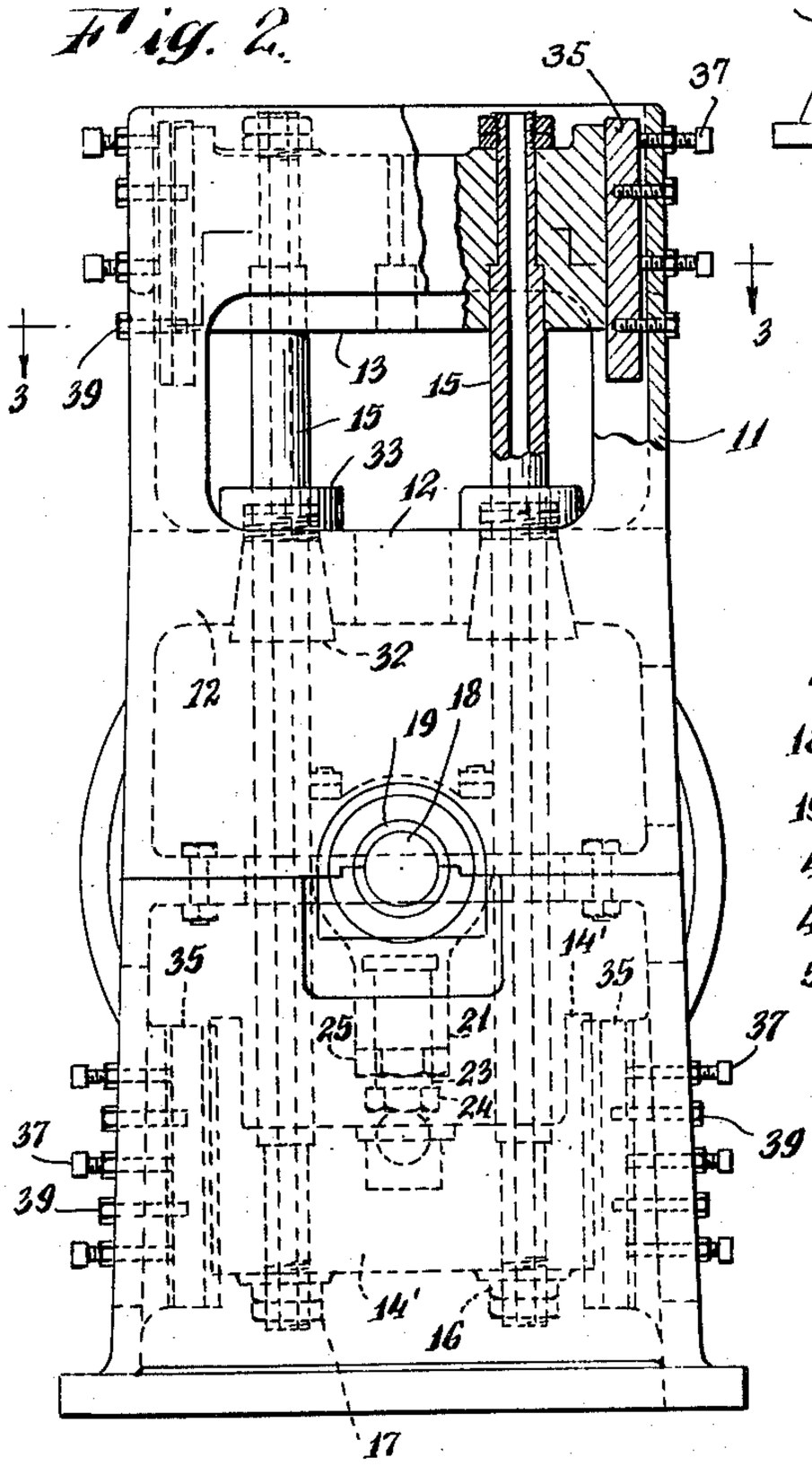
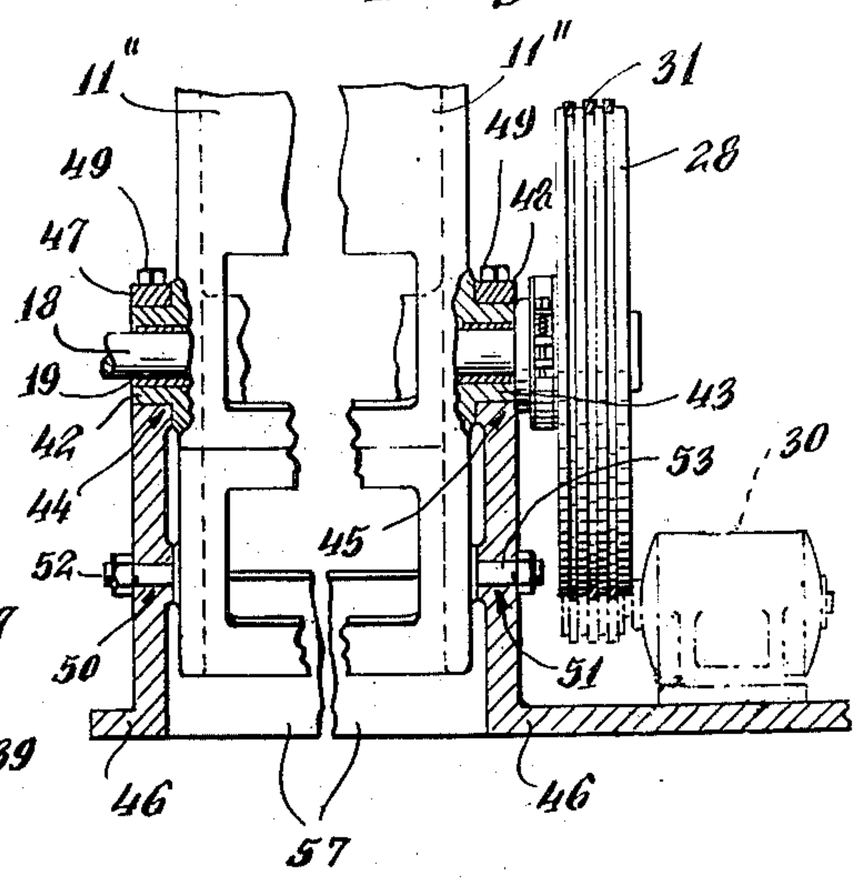


Fig. 8.



INVENTOR.

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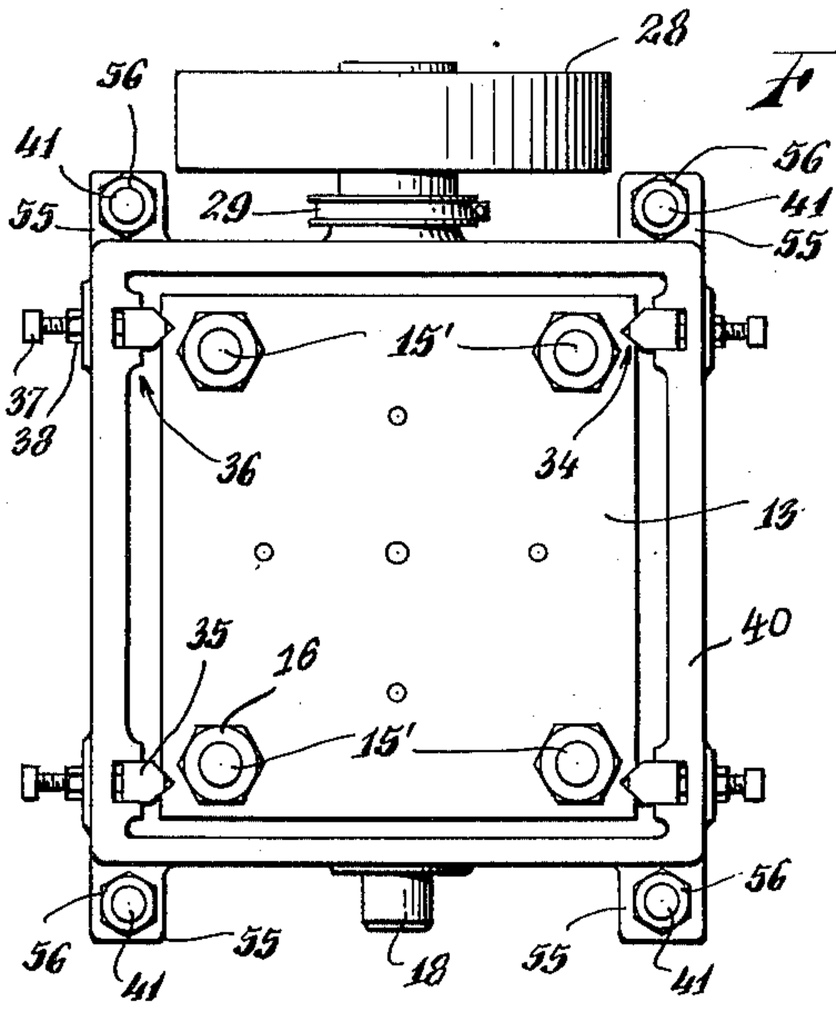

Fig. 5.

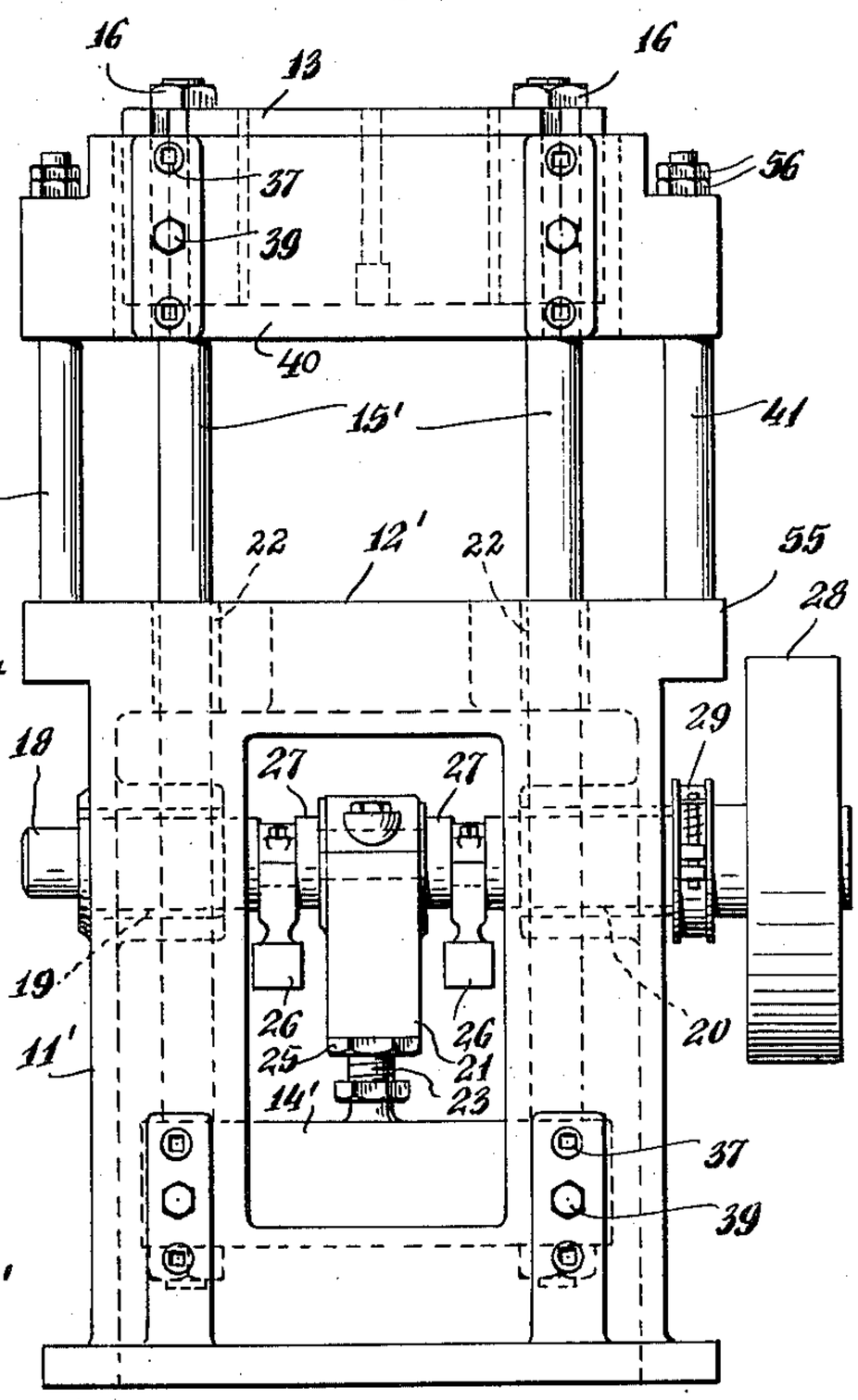

Fig. 4.

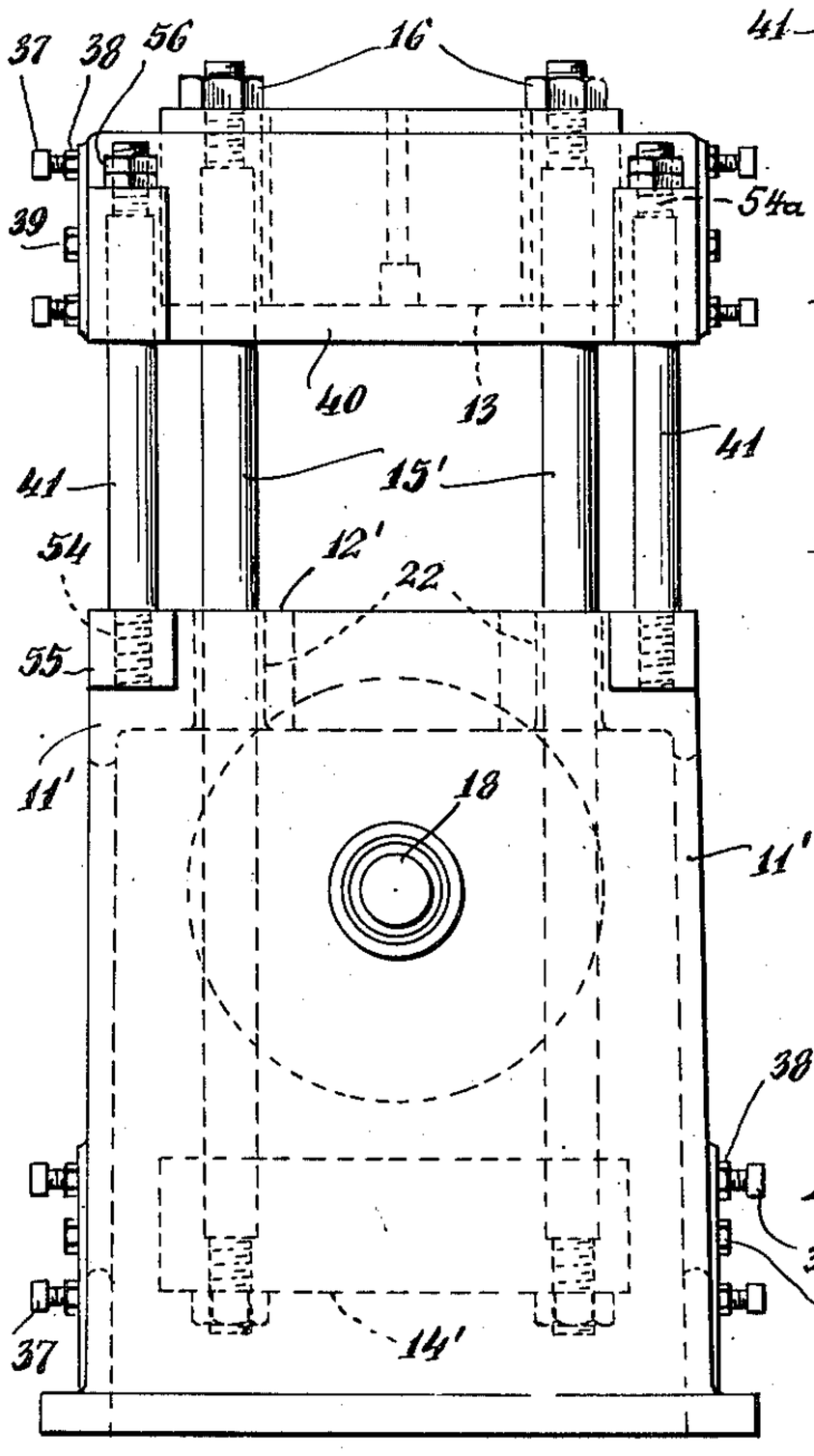

Fig. 6.

INVENTOR.

Frederick K. Maussnest

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UNDERDRIVE PUNCH PRESS

Frederick K. Maussnest, Queens Village, N. Y., assignor to Hedwig Maust, Queens Village, N. Y.

Application February 17, 1948, Serial No. 8,816

3 Claims. (Cl. 164—102)

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The present invention relates to the class of machines generally known as punch presses which are commonly used for blanking, stamping, embossing, drawing or forming metallic and non-metallic articles from strips or sheets by employing suitable tools, such as punches and dies. More particularly, this invention relates to such punch presses with "underdrive," where the drive-shaft and flywheel are located in the base of the machine and the upper cross-head, which carries the male die or punch, is pulled downward by a plurality of draw-rods. Four such draw-rods are usually employed. They are connected to a lower cross-head, reciprocated in vertical direction by the drive-shaft. Between the upper and lower cross-heads a table or die-support is provided for mounting the female part of the tool, simply called die.

The tools of punch presses represent very considerable investments. They must be manufactured to close tolerances and require periodic resharpening, when the cutting edges have been dulled. Die life and maintenance depend to a large extent on the precise alignment of punch and die during the working operation. Previously known designs have gone to great lengths to create precision alignment between the upper cross-head carrying the punch, and the table on which the die is mounted, by providing long guides for the lower cross-head as well as for the draw-rods.

The principal object of the invention is the provision of guiding means for the upper cross-head proper so that this cross-head will always be positively guided parallel to the table, and while auxiliary guides known heretofore may be employed for the lower cross-head and for the draw-rods in addition to the novel guiding means proposed, reliance must not be placed exclusively on such auxiliary and indirect guiding means for the upper cross-head, but the latter will be aligned at all times by my novel guiding means which directly support said upper cross-head, whereby the latter will even be maintained in parallel relation to the press bed when the upper cross-head is subjected to eccentric loads.

It is another object of the invention to provide adjusting means for the wearing surfaces of the guiding means to keep cross-head and bed permanently in precise alignment.

Another object of the invention is the elimination of guides for the draw-rods for certain classes of punch press work.

A still further object is the elimination of

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guides for the lower cross-head for other classes of punch press work.

Another object is the provision of inclining means for the frame of a punch press of the character described, having inclining means adapted to swing said frame around the drive-shaft as a pivot point.

A further object is to provide the novel punch press in combination with the inclining mechanism with a direct drive by mounting the motor or other driving means on a base or platform forming a part of, or being attached to, said inclining device, so that the complete press, including its drive, forms one unit, capable of being placed as such in any production line.

These and other objects of the invention will appear as the mechanism is described in detail.

In the accompanying drawings,

Fig. 1 is a front elevation, partly broken away, of a punch press embodying my invention;

Fig. 2 is a left hand side view of a similar press, partly broken away along line 2—2 of Fig. 3;

Fig. 3 depicts a cross-sectional view along line 3—3 of Fig. 2;

Fig. 4 is a front elevation of a press having a modified and separate guide frame for the upper cross-head, mounted on rods which are fastened to the press frame proper;

Fig. 5 is a plan view of the press shown in Fig. 4;

Fig. 6 shows a left hand side view of the same press;

Fig. 7 illustrates a press embodying the invention with the frame adapted to be inclined;

Fig. 8 shows the pedestal for inclining the press frame in section along line 8—8 of Fig. 7 together with a V-belt drive from the prime mover to the clutch-flywheel.

Referring to Fig. 1 of the drawings, the machine comprises a main frame 11 which may be placed directly on a floor. A heavy cross-rib 12 of frame 11 forms the press table, on which the die is supported. The punch is adapted to be carried by a generally square or rectangularly shaped upper cross-head 13, which is located above table or die-support 12 and operatively connected to a similarly shaped lower cross-head 14 by four cylindrical rods 15, which may be of tubular cross-section to decrease their mass. The opposite ends of the rods 15 may be tied to the upper and lower cross-heads 13 and 14 by means of nuts 16 and lock-nuts 17. A crankshaft 18 is located between lower cross-head 14 and press bed 12, mounted in bearings 19 and 20 of frame

11, respectively. The crankshaft or drive-shaft 18 carries a pitman 21 connected to lower cross-head 14 by a suitable connection, such as a ball-type screw connection 23. A nut 24, integral with the screw 23, may be employed for adjusting the lower cross-head 14 and consequently the upper cross-head 13 in vertical directions for setting the tools. A lock-nut 25 may be provided to prevent movement of the screw 23 by tightenning said lock-nut 25 against the pitman 21. This and similar pitman connections are common to machines of this type.

The crankshaft 18 may carry counterweights 26 adjacent to the cheeks 27 for counteracting the unbalanced inertia forces of the crank mechanism. These counterweights may be angularly displaced on shaft 18 and locked in their selected respective positions by any suitable means, set-screws 26*a* being shown as an example. By placing these adjustable counterweights 26 in different positions one with respect to the other, unbalance from zero to their combined maximum may be corrected in any required angular direction.

Crankshaft 18 also carries the clutch-flywheel 28 and a suitable brake 29 for bringing the press to a stop, and may be driven in any ordinary manner, such as by an electric motor 30 and V-belts 31 (Fig. 8). Clutch-flywheel 28 may be coupled with crankshaft 18 in any suitable manner and not specifically shown herein, because these clutching means will be readily understood by those skilled in the art and are not necessary for a clear understanding of the invention. The crank mechanism is adapted to reciprocate the upper and lower cross-heads, which, together with the rods 15, form the reciprocating cross-head structure.

Fig. 1 depicts this cross-head structure guided on the draw-rods 15 by means of split, tapered bushings 32 in bed 12, threaded at their upper ends and adjustable by means of coacting threaded nuts 33 which rest on top of bed 12. The lower cross-head 14 is not specifically guided. However, according to the present invention, the upper cross-head 13 is positively supported and in sliding engagement with the main frame 11 of the machine so that parallel alignment of cross-head 13 with bed 12 is maintained at all times. To make the description simple, all the presses shown in the several illustrations are depicted with similar V-type guides or gibs for the cross-heads. Therefore, while Fig. 3 illustrates a section through the upper cross-head of the press shown in Fig. 2, this Fig. 3 is also representative of a similarly located cross-section of the press depicted in Fig. 1. The upper cross-head or slide 13 may be provided with V-shaped grooves 34 adjacent to the corners thereof. Matching gibs 35 may be held against side-movement between suitable vertical shoulders 36 of frame 11. A plurality of set-screws 37, threaded in frame 11, abut the vertical gibs 35 for adjustment of the sliding clearance between the gibs 35 and cross-head 13. Lock-nuts 38 serve the purpose of maintaining set-screws 37 in their adjusted positions. Screws or bolts 39, threaded into tapped holes of gibs 35, are adapted to draw the gibs up against said set-screws 37 and to maintain the gibs in the desired vertical position.

It will be noted that the gibs 35 may extend above and below the slide 13, and the V-ways 34 may extend the full height of the upper cross-head or slide 13. The height of slide 13 and, consequently, the length of the guiding surfaces is limited only by practical considerations. The preferred method of guiding is to make the gibs 35 long enough so that the slide 13 will be guided along its entire height during every part of the working cycle. These long guiding means, being for all practical purposes part of the rigid main frame 11 of the machine, assure the precise alignment between slide 13 and table 12. The tapered bushings 32 will guide the draw-rods 15 and, therefore, the lower cross-head 14. In as much as the lower cross-head 14 has no primary effect on the alignment of the slide 13, this inexpensive design will be found desirable for many types of punch press work.

The frame 11 is provided with a number of strategically placed openings or windows as shown to allow access to the tools and to the operating mechanism. The reciprocating cross-head structures of the presses shown in the several illustrations are depicted in top dead-center position.

To make the description clear and simple, similar parts have received identical numerals in the several illustrations, but with a prime mark added, if necessary.

Fig. 2 shows a press similar to that of Fig. 1 with the difference, however, that the lower cross-head 14′ is guided on the main frame 11 in identically the same way as the upper cross-head 13, previously described in detail in connection with Fig. 1. Fig. 3 is therefore also representative of a corresponding section through lower cross-head 14′. No further description of Fig. 2 is believed necessary, but it will be understood that this design will be justified for extreme precision work and for high speed production in combination with automatic feeds, where even the slightest vibration of the lower cross-head structure might prove to be objectionable.

Referring now to Figs. 4, 5, and 6, it will be seen that the slide 13 is guided in the identical manner described before, but in a separate guide frame 40 which is rigidly connected to the main frame 11′ by means of four tie-rods 41, whose threaded lower ends 54 engage tapped holes in pads 55 of lower frame 11′ and whose threaded upper ends 54*a* are fastened to guide structure 40 by coactive threaded nuts 56. This modification increases the visibility into the tools, while the guide frame 40 still insures precise alignment. The separate guide frame 40 may be secured to main frame 11′ in a number of other ways, such as for instance, by placing tubular spacers around the tie-rods 41 and preloading the latter. The draw-rods 15′ have ample clearance in openings 22 of press bed 12′ and are not individually guided. They will therefore have little, if any influence on the alignment of either cross-head (13 or 14′). On account of their slenderness, the rods 15′ will transmit no appreciable bending load. They will therefore act as draw-bars under practically pure tensional load.

It is frequently desirable to place the punch press in an inclined position to let gravity help in removing the finished article. Figs. 7 and 8 show the arrangement of the underdrive punch press which permits the frame of the press to be inclined to the left or to the right of the vertical as desired. The outside of the crankshaft-bearing hubs terminate in circular projections 42 and 43 which rest in suitable half-bearings 44 and 45 of pedestal 46. Bearing caps 47 and 48, fastened to pedestal 46 by means of bolts 49, hold

the projections 42 and 43 of the main frame 11'' in sliding engagement. Circular slots 50 and 51 in the side frames of pedestal 46 have the longitudinal axis of the concentric part of the crankshaft 18 as center. Studs 52 and 53, threaded into main frame 11'', serve to securely clamp the main frame 11'' to pedestal 46 by means of threaded nuts, after frame 11'' has been rotated into the desired inclined position. By way of illustration, pedestal 46 has been shown as one integral piece, with cross-ribs 57 and 58 connecting the two side frames. This pedestal could, of course, also be assembled of two separate side frames with suitably arranged spacers therebetween.

The general arrangement of the inclinable press as shown in Figs. 7 and 8 is identical with Figs. 4, 5, and 6, in that both upper and lower cross-heads are guided, while the draw-rods 15' have ample clearance in openings 22 of the press bed 12'.

The clutch-flywheel will maintain its vertical position, when the main frame 11'' is being rotated into the desired angular position, because the axis of the crankshaft is being used as the pivot point or center of rotation for the main frame 11''. The prime mover, mechanical variable speed unit or electric motor, for actuating the clutch-flywheel 28 and drive-shaft 18 may therefore be mounted on an extension of the pedestal 46. Thus the press with its drive may be moved as a unit from one place to another which is particularly convenient when the same press must be used in several production lines.

From the foregoing description of the invention, it will be apparent that the objects heretofore enumerated and others have been accomplished, and that a novel "underdrive" punch press has been created, having direct and positive guiding means for the upper cross-head or slide. With the construction shown, any load, whether eccentrically placed or not, will be counteracted where the load occurs, namely, at the slide itself. Reliance need not be placed henceforth in the secondary guiding action of the lower cross-head or in the rigidity of the rods 15 alone, which, without the primary guiding of the slide itself, are frequently subjected to severe bending moments and consequent elastic deformations. With present invention, the life of the expensive tools and the intervals between resharpening of the tools are therefore substantially extended.

Four gibs have been shown for guiding the cross-heads (Figs. 3 and 5), but actual requirements may dictate the use of fewer or more gibs. While the gibbing arrangement shown is of the V-type, any other gibbing known in the art, such as square gibbing, flat V-gibbing, etc. may be employed for guiding the cross-heads. The novel guiding method for the upper cross-head described may be used in combination with any type press with underdrive.

Therefore, I do not wish to be limited to the particular constructions shown, which constructions may be varied within the scope of this invention, and it is my intention to cover hereby all adaptations, modifications, and variations

thereof which come under the practice of those skilled in the particular art to which the invention relates.

Having thus described my invention, what I claim is:

1. In a press with underdrive, a tiltable main frame, an upper cross-head, a lower cross-head, draw-rods for operatively connecting said upper cross-head to said lower cross-head, a drive-shaft supported by said main frame and located between said cross-heads for reciprocating the latter, a pedestal for tiltably supporting said main frame with the horizontal axis of said drive-shaft as the axis of tilt, and means for locking said main frame to said pedestal at the desired angle of tilt.

2. In a press with underdrive, a main frame, an upper cross-head, a lower cross-head, draw-rods for operatively connecting said upper cross-head to said lower cross-head, a drive-shaft located between said cross-heads and journaled in said main frame for reciprocating said cross-heads, guiding means for said upper cross-head constructed to slidingly support the latter, means for tilting said main frame comprising projections on said main frame concentric to said drive-shaft, a pedestal including supporting means for tiltably carrying said main frame on said projections to permit said main frame to be rotated on said pedestal with the horizontal axis of said drive-shaft as the axis of rotation, and means for locking said main frame to said pedestal in tilted position.

3. In a press with underdrive, a tiltable main frame, an upper cross-head, a lower cross-head, draw-rods for operatively connecting said upper cross-head to said lower cross-head to form a cross-head structure, a drive-shaft supported by said main frame and located between said cross-heads for reciprocating the latter, a pedestal for tiltably supporting said main frame with the horizontal axis of said drive-shaft as the axis of tilt, motor means fixed on said pedestal, belt means for operatively connecting said motor means and said drive-shaft so that the drive tension of said belt means will not be affected when changing the tilt of said main frame on said pedestal.

FREDERICK K. MAUSSNEST.

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