

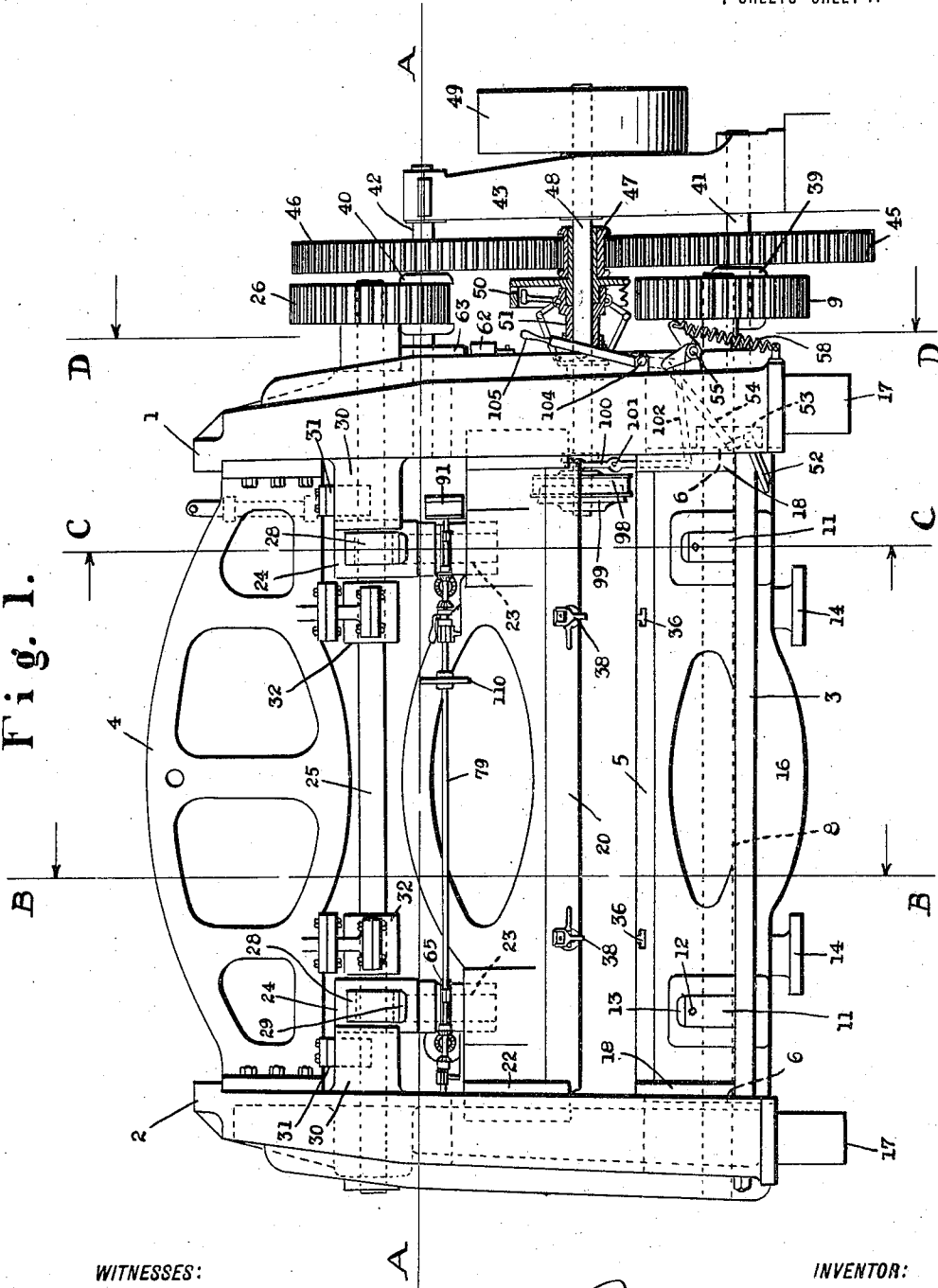
R. NAWRATH.
 PRESS.
 APPLICATION FILED OCT. 8, 1915.

Patented Apr. 8, 1919.

7 SHEETS—SHEET 1.

1,299,501.

Fig. 1.



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• 7 SHEETS—SHEET 2.

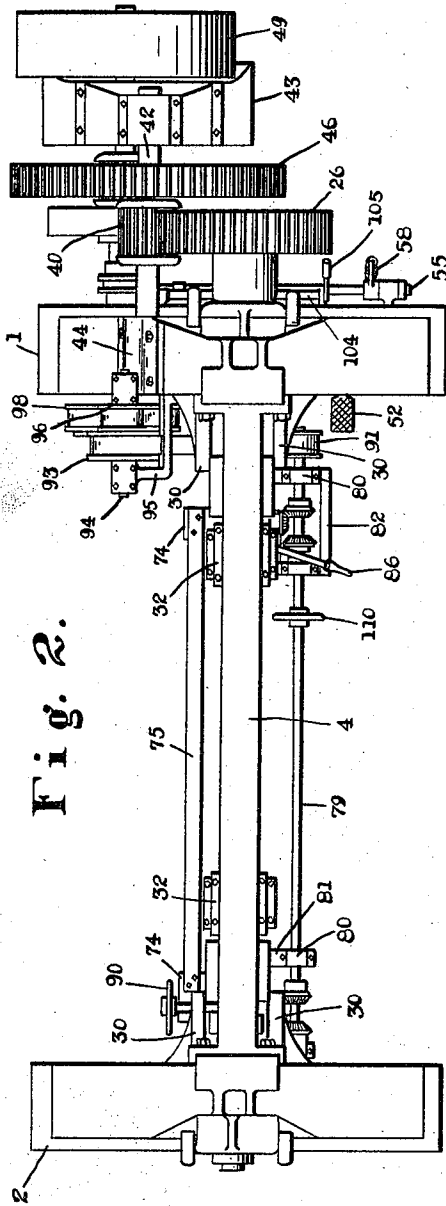


Fig. 2.

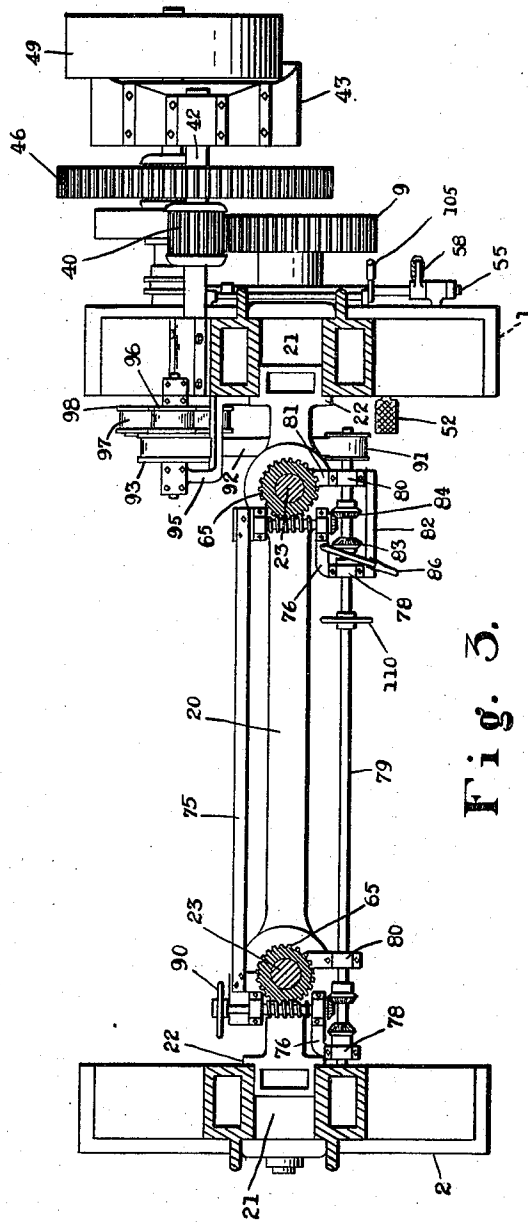


Fig. 3.

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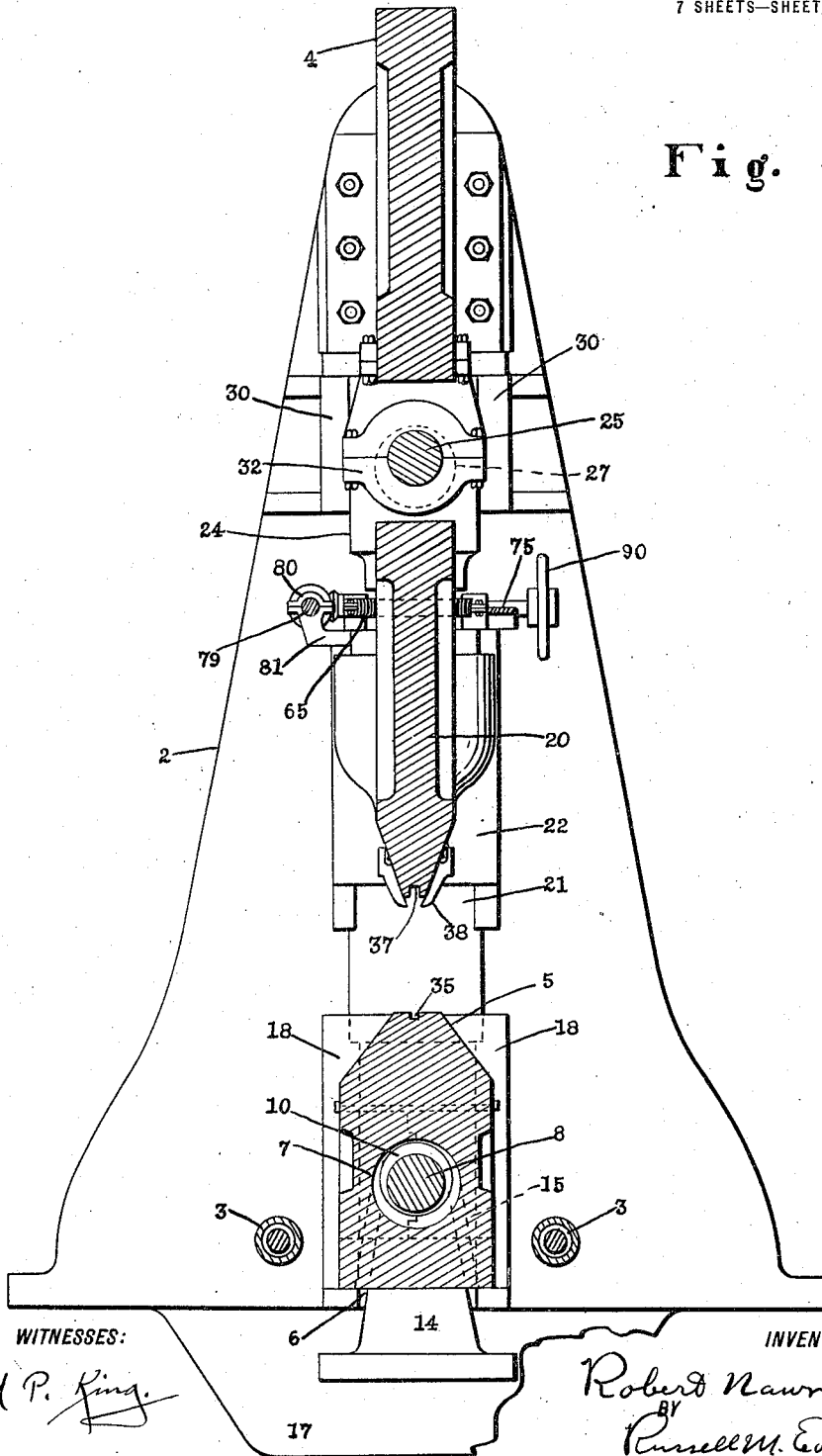
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7 SHEETS—SHEET 4.

Fig. 5.



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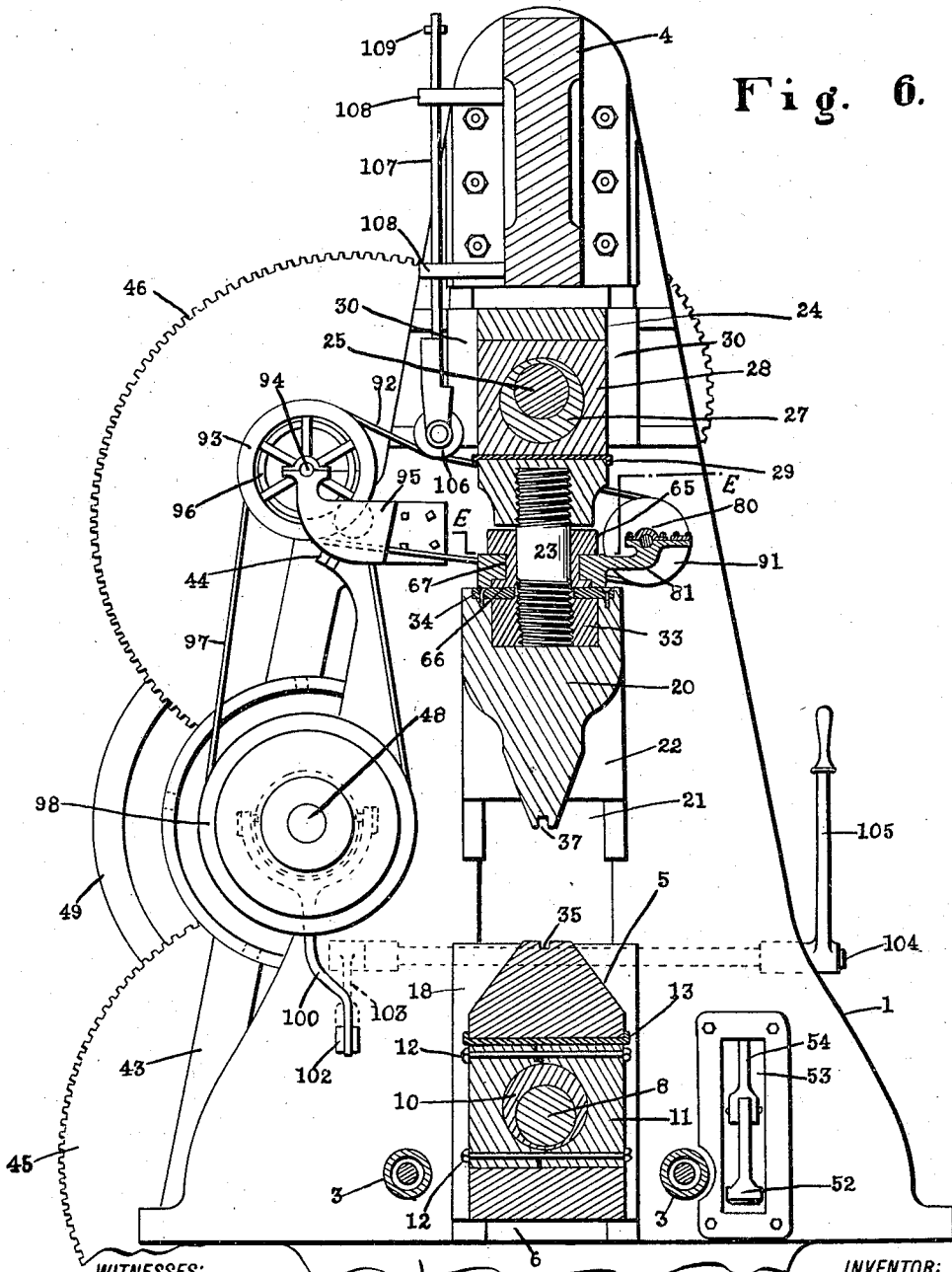
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Fig. 6.



WITNESSES:

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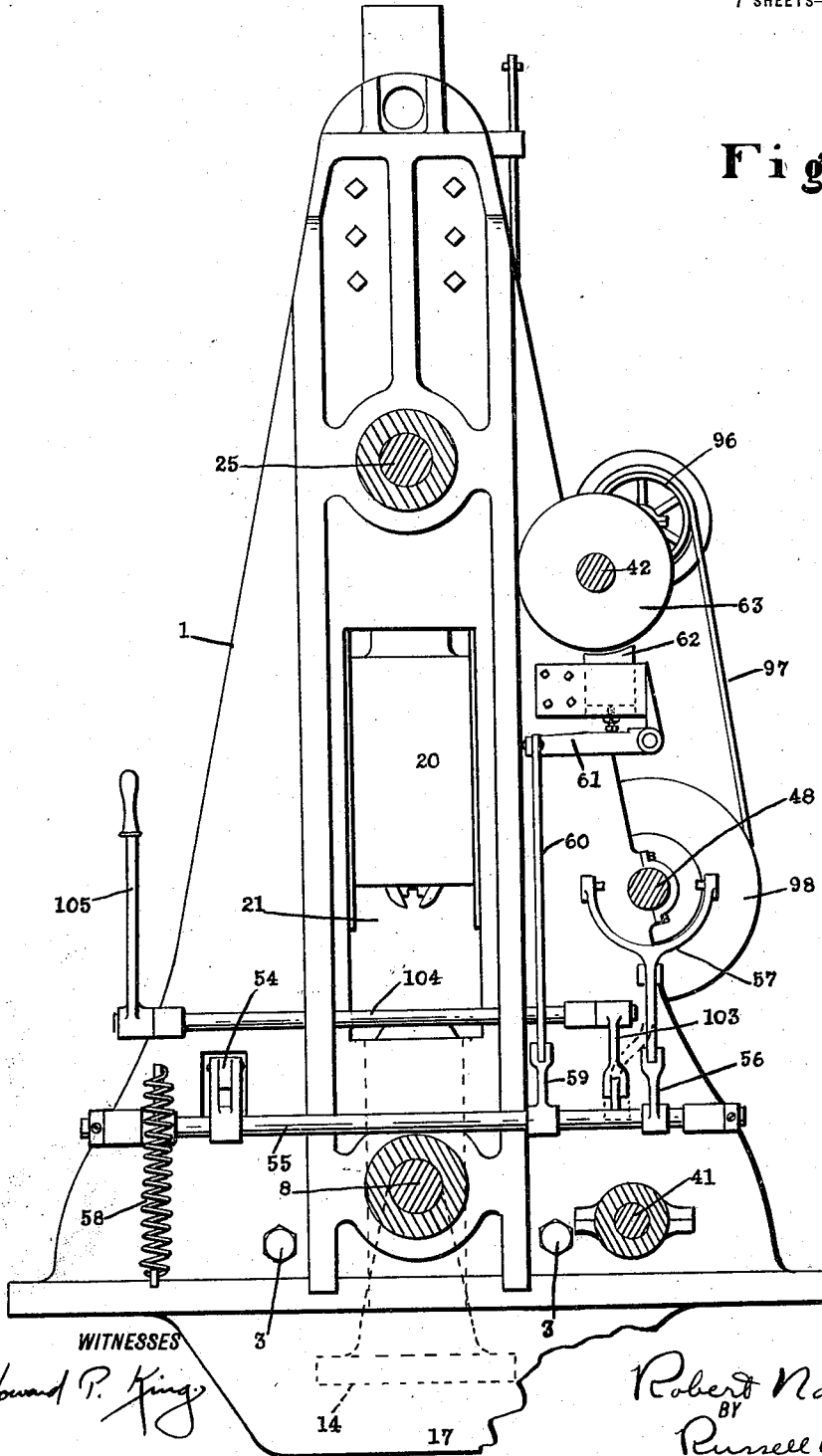
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Fig. 7.



1,299,501.

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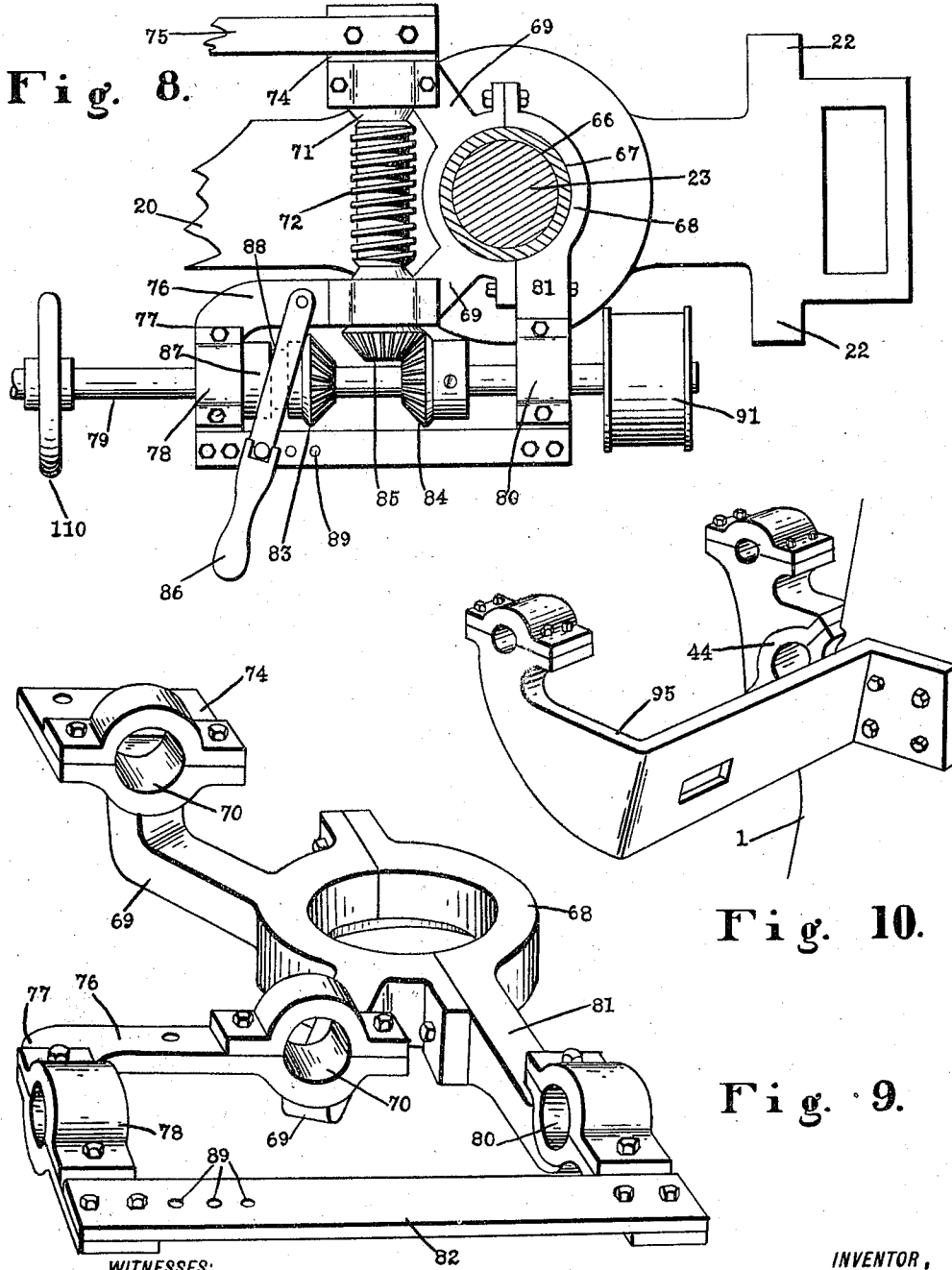


Fig. 8.

Fig. 10.

Fig. 9.

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UNITED STATES PATENT OFFICE.

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PRESS.

1,299,501.

Specification of Letters Patent.

Patented Apr. 8, 1919.

Application filed October 8, 1915. Serial No. 54,704.

To all whom it may concern:

Be it known that I, ROBERT NAWRATH, a subject of the Emperor of Germany, and a resident of Newark, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in Presses, of which the following is a specification.

This invention relates more particularly to presses for bending metal for structural purposes, such as sheet metal in the construction of doors and windows and their frames, cabinet work and the like, embossing metal ceilings and so forth, or bending heavier metal, such as channel irons, stair treads and the like, and for which presses there has arisen a large demand due to the recent extensive use of metal for the purposes above indicated.

The objects of the invention are to secure in a machine of given size and weight maximum force and efficiency in bending the metal; to secure a construction giving an increased bending power from a given driving power, and still providing an opening sufficient to get the work out of the machine; to accomplish this by imparting movement to both the upper and lower dies, each toward the other, so that the sheet metal is bent by the impact of said members when they meet; to provide suitable means for imparting to said upper and lower dies such movement toward each other; to provide improved means for adjusting the upper and lower dies into exact parallel relation; to insure movement of the hammers in a single plane without moving sidewise; to secure a strong and durable press of my improved construction, and to obtain other advantages and results as may be brought out in the following description.

Referring to the accompanying drawings, in which like numerals of reference indicate the same parts throughout the several views,

Figure 1 is an elevation of a press of my improved construction viewed from the front or side at which the operator stands, and showing certain parts of the driving means in central vertical sections;

Fig. 2 is a plan of the same;

Fig. 3 is a section on the horizontal plane indicated by the line A—A Fig. 1;

Fig. 4 is an end elevation of the press looking at the right hand end as shown in Fig. 1;

Figs. 5, 6 and 7 are vertical cross-sections taken upon lines B—B, C—C and D—D, respectively, of Fig. 1;

Fig. 8 is a detail plan of a portion of the adjusting means for the upper hammer partially in section upon line E—E, Fig. 6 and on larger scale;

Fig. 9 is a perspective view of one of the supporting collars for said adjusting mechanism, and

Fig. 10 is a perspective view of certain means for mounting a counter-shaft used in imparting motion to the adjusting means.

In the specific embodiment of the invention shown in said drawings 1, 2 indicate housings adapted to stand upright in substantially parallel relation at opposite ends of the machine, said housings being rigidly connected by tie rods 3, 3 at their lower ends and by a top leaf 4 at their upper ends. It will be understood that the upper and lower hammers carrying the dies between which the metal is shaped, according to my invention, extend horizontally between said housings and are adapted to be guided thereby in a vertical plane as they are moved up and down by suitable operating mechanism hereinafter described.

The lower hammer, designated by reference numeral 5, is arranged vertically edgewise between the housings 1, 2 in the middle vertical plane thereof and guided against lateral displacement by its ends fitting into shallow recesses or guideways 6, 6 in the housings. The said hammer is cored longitudinally, as at 7, (see Fig. 5) and through it extends a shaft 8 of smaller diameter which has bearings at its ends in the housings 1, 2 and projects beyond one of said housings as 1 to receive a driving gear wheel 9. At points of its length between the housings 1, 2, and which points I have shown as two in number although it might be otherwise, the shaft 8 is provided with eccentrics 10, 10 fast thereon, and each eccentric receives a block 11, Figs. 1 and 6, fitted into a transverse aperture of the hammer so as to slide in a direction from side to side of the hammer without any movement with respect to the hammer in its plane. These slide blocks are preferably made each in two halves as shown, adapted to be applied one from each side of the hammer, the sections

being then fastened together by any suitable means such as the bolts 12. Preferably liners 13 are inserted one at the top of each slide block to reduce the friction.

5 It will thus be seen that as the shaft 8 turns it will by its eccentrics 10, 10 impart motion to the slide blocks 11, 11, the vertical component of which motion is imparted to the hammer while the horizontal component simply slides the blocks transversely of the hammer. The hammer is thus given an up and down movement in the vertical plane in which it is held by its ends in the guide-ways 6, 6.

15 Preferably the shaft 8 is given additional support adjacent the slide blocks 11 by pedestals 14 each extending upward through a suitable recess 15 (see Fig. 5) in the lower part of the hammer and providing at its upper end a bearing beneath the shaft 8. These pedestals are suitably seated upon the foundation for the machine, which may be depressed between the housings 1, 2, and preferably the middle part of the hammer has at its bottom a swell 16, which is here shown in Fig. 1 as between the pedestals 14, 14, to prevent springing or yielding under the pressure. Furthermore, the housings 1, 2 are provided each at its bottom with a reinforcing extension 17 to project down into the foundation and strengthen the housing against the apertures and recesses vertically along its middle as described herein.

35 The lower hammer 5 is also preferably provided adjacent its ends which fit into the guideways 6, 6 in the housings, with lateral flanges 18 which lie against the inner faces of the housings 1, 2 and prevent any endwise movement of the hammer.

40 The upper hammer, designated by reference numeral 20 is also arranged vertically edgewise between the housings 1, 2 in the middle vertical plane thereof and guided against lateral displacement by its ends extending into apertures 21, 21 in the housings and which apertures provide guideways fitting said ends. The upper hammer also has adjacent its ends lateral flanges 22, 22 which lie against the inner faces of the housings 1, 2 to prevent any possible longitudinal movement of the hammer.

50 The upper hammer 20 is connected at its upper edge, as by adjusting screws 23, 23 to hangers 24, 24 through which extends a shaft 25 having bearings in the housings 1, 2 and outside of one of them as 1 receiving a gear wheel 26. I have shown the hammer 20 connected or supported at two points of its length, one near each end, but obviously it could be supported at more or less points located wherever desired. The shaft 25 is provided with eccentrics 27, 27 fast thereon and each eccentric receives a block 28, Figs. 1 and 6, fitted into a transverse aperture of
65 a hanger 24 so as to slide in a direction

from side to side of the machine without any movement with respect to the hanger in a vertical plane. Preferably liners 29 are inserted one beneath each slide block to reduce the friction.

70 It will thus be seen that as the shaft 25 turns, it will by its eccentrics 27, 27 impart motion to the slide blocks 28, 28, the vertical component of which motion is imparted to the upper hammer 20 while the horizontal component simply slides the blocks transversely of the machine or hangers 24. Preferably the said hangers 24 are prevented from any possible movement sidewise of the machine by projections 30 on the housings 1, 2, a pair of said projections extending from the inner side of each housing horizontally over the opposite sides of each hanger but not far enough to obstruct the lateral and horizontal movement of the slide blocks 28.

80 Preferably the bearings of the shaft 25 in the housings 1, 2 are supplemented by additional bearings 31 and 32, (Fig. 1) for said shaft extending downward from the top leaf 4 at the opposite ends of each hanger 24.

90 The adjusting screws 23 screw at their upper ends into the hangers 24, (see Fig. 6); and at their lower ends they screw into nuts 33 let into the top edge of the hammer 20 so as to be fast against turning with respect to said hammer and held in their seats by any suitable means such as the overlapping keeper plates 34. It will be understood that the adjusting screws 23 are right-handed at one end and left-handed at the other, so that as they are rotated the hammer is moved toward the hangers or away from them, and as hereinafter described suitable means are provided for turning either both screws at the same time or one screw independently of the other, so as to adjust the dies carried by the upper and lower hammers into desired relation with respect to parallelism.

100 Both hammers are provided at their adjacent edges with any suitable means for carrying dies adapted to perform the work required, such for example as the slots 35, 36 in the lower hammer and the slots 37 and clamps 38 on the upper hammer.

105 For moving the upper and lower hammers toward and away from each other the gear wheels 9 and 26 upon the shafts 8 and 25 are engaged by pinions 39 and 40 respectively mounted upon shafts 41, 42 which have their bearings in the housing 1 and a stanchion 43 parallel to said housing outside the same and suitably spaced therefrom. The shaft 42 has a bearing upon the rear edge of the housing with a cap 44 therefor while the shaft 41 extends only to the housing and has a bearing cast upon the outer side thereof. The said shafts 41 and 42 have upon
115 120 125 130

themselves outside the pinions 39 and 40 gears 45, 46 both of which mesh with a driving pinion 47 loose upon a driving shaft 48 which also has bearings in the housing 1 and stanchions 43 and extends through both of them so as to project therebeyond. Outside the stanchion 43 said driving shaft 48 carries a driving pulley 49.

It will be understood that a clutch is provided upon the driving shaft 48 one member 50 of which is fast to the pinion 47 and the other member 51 of which is fast to said shaft 48, said clutch members being normally held open or separated and means are provided for closing them when desired to start the press. The clutch may be of any suitable or ordinary construction, and any common and well-known means may be employed for operating it. For purposes of illustration I have shown a treadle 52 fulcrumed in a recess 53 of the housing 1 so as to be conveniently accessible to the operator's foot, said treadle being connected by a link 54 extending through the housing to a shaft 55 extending horizontally along the outside of the housing to rock the same. This shaft 55 has an arm 56, (Fig. 7) adapted to swing a fork 57 for operating the clutch sleeve, and also has an arm to receive a spring 58 for holding the clutch open or in idle position. Furthermore, said shaft 55 has an arm 59 which is connected as by a link 60 to a brake-operating lever 61 which applies a brake 62 to stop the machine as soon as the treadle is released and the clutch opened by the spring 58. The brake pulley 63 I have shown upon the pinion shaft 42, although it might be otherwise located if desired.

It will be understood that the upper and lower hammers are of substantially the same weight, so that they practically balance each other and thus they open and close readily, the power that is applied being used to bend the metal. For this reason very little brake pressure is necessary to stop them quickly when the clutch is released.

For turning the adjusting screws 23, 23 to adjust the dies with respect to their parallelism to each other, each screw has fast upon its middle unthreaded portion a worm wheel 65 with a hub 66 beneath the same having an annular groove 67 to receive a loose collar 68. (See Figs. 6, 8 and 9 especially). These collars 68, 68 have each two radially projecting and diverging arms 69, 69 extending horizontally toward the other collar, and said arms provide at their upper surfaces bearings 70, 70 for a shaft 71 carrying a worm 72 adapted to mesh with the worm wheel 65, it being understood that said worm and its shaft extend horizontally and transversely of the machine. The rear arms 69, 69 of the collars 68, 68 have rearward extensions 74, 74 back of the bearings

71, 71 which are connected by a bar 75 rigidly secured to them, as by the bolts shown, and which bar holds the collars against any rotation. The front arms 69, 69 of the collars 68, 68 are extended beyond the bearings 70, 70 toward each other, as at 76, 76, and then bent forwardly as at 77, 77 to carry bearings 78, 78 for a shaft 79 extending horizontally and longitudinally of the press at the front of it. This shaft 79 also has bearings 80, 80 in arms 81, 81 projecting forwardly from the collars 68, 68, and the outer ends of said arms 81 and extensions 77 may be connected by a bar 82 as shown at the right-hand end of the press.

The shaft 79 has upon itself pairs of bevel gears 83, 84, the gears of each pair adapted to lie on opposite sides of a bevel gear 85 on the end of the worm shaft 71, and to mesh alternately therewith as the shaft 79 is slid longitudinally. The said shaft 79 may be slid by any suitable means, but I have shown for the purpose a lever 86 pivoted upon the extension 76 of the arm 69 at the right-hand end of the machine which lever is connected to a collar 87 in an annular groove 88 of the hub of the bevel gear 83, so that by swinging the lever the shaft can be slid as desired. Furthermore, I have shown said lever 86 as lying across the bar 82, in which holes 89 are provided to receive a spring lock or detent of any ordinary and well-known kind upon the hand lever, although any other suitable means might be provided for locking the shaft in its various positions. It will be understood that means are provided for rotating said shaft 79 when desired and that according to whether the bevel gears 84, 84 are engaged with the bevel gears 85, 85 or the bevel gears 83, 83 are engaged with the bevel gears 85, 85, the adjusting screws 23, 23 will be turned in unison in one direction or the other to move the upper hammer toward or away from the lower hammer.

If it is desired to move only one end of the upper hammer with respect to the lower hammer, as to adjust the dies into a given angular relation or adjust them back again into exact parallelism, the shaft 79 is slid into its intermediate position so that neither the bevel gears 83 nor 84 engage the bevel gears 85, and then the worm 73 at one end of the machine is turned by hand. For this purpose, I have shown the shaft of the worm 72 at the left-hand end of the press extended rearwardly and supplied with a hand wheel 90, Figs. 2, 3 and 5.

For driving the shaft 79 it is provided at its end next the housing 1 with a pulley 91 from which a belt 92 extends to a pulley 93 upon a short countershaft 94 at the rear of the press and mounted in bearings one upon the cap 44 for the driving shaft 48 upon the rear edge of the housing 1 and the other in

a bracket 95 secured to the inner side of the housing, see Figs. 2, 6 and 10 more especially. Said shaft 94 also carries a pulley 96 from which a belt 97 extends to a cone clutch pulley 98 normally loose on the driving shaft 48. The pulley 98 is adapted to be slid into engagement with its cone 99, (see Fig. 1) fast on the driving shaft 48 by means of a forked lever 100 fulcrumed as at 101 and adapted to be operated by a link 102 connecting it to an arm 103 of a shaft 104 extending horizontally at the outer side of the housing 1 to the front of the press where it is provided with a hand lever 105 for rocking it. This hand lever 105 is so positioned that its weight holds it in place when the clutch is thrown out, although any other suitable means might be employed, and when the operator desires to rotate the shaft 79 to adjust the dies, he must positively hold the clutch thrown in with his hand upon said hand lever.

Preferably the belt 92 is provided with some form of belt tightener, because said belt must be slack in order to permit the up-and-down movement of the upper hammer in the operation of the press, and for purposes of illustration I have shown in Fig. 6 especially a pulley 106 resting upon the upper run of the belt and mounted in a stem 107 which extends slidably through suitable supports 108, 108 and is provided with a stop 109 to limit its downward movement in case the belt should break or be removed.

The adjusting shaft 79 is preferably provided with a hand wheel 110 which can be used for hand adjustment of the screws 23, 23 if desired, as well as for moving the bevel gears enough to make them mesh properly with the bevel gears on the worm shaft.

Obviously, as well as the gain in force secured by bending the metal by impact of the dies carried by the two hammers against the opposite sides of the metal simultaneously, it will be noted that neither die has to move as far, in order to secure a given space between them for the work, as if one of the dies were stationary and the other movable. This means that eccentrics of less throw can be employed, and consequently greater power obtained thereby.

It will be understood that various changes and modifications can be made in the building of my improved press, by those skilled in the art, without departing from the spirit and scope of the invention, and I do not intend to restrict myself except as required by the following claims when construed in the light of the prior art.

Having thus described the invention, what I claim is,—

1. In a press, the combination of opposite housings providing vertical guideways, a shaft journaled in said housings, an eccen-

tric fast on said shaft, a lower hammer loosely surrounding said shaft and adapted to slide in said guideways, said hammer being apertured transversely of the plane of sliding and recessed upwardly from its bottom to said shaft, a slide block upon said eccentric in said transverse aperture and fitting the same, and a pedestal extending upward through said recess in the hammer and providing a bearing for the shaft adjacent said eccentric.

2. In a press, the combination of opposite housings providing vertical guideways, a shaft journaled in said housings, a lower hammer loosely surrounding said shaft and adapted to slide in said guideways, said hammer being recessed upwardly from its bottom to said shaft, means connecting said hammer and shaft so that rotation of the shaft will impart an up and down movement to the hammer, and a pedestal extending upward through the recess in the hammer and providing a bearing for the said shaft.

3. In a press, the combination of opposite housings, a shaft journaled in said housings, a lower hammer loosely surrounding said shaft and adapted to slide up and down between said housings, said hammer being recessed upwardly from its bottom to said shaft, means connecting said hammer and shaft so that rotation of the shaft will impart an up and down movement to the hammer, and a pedestal extending upward through the recess in the hammer and providing a bearing for the said shaft.

4. In a press, the combination of opposite housings providing vertical guideways, a hammer adapted to slide in said guideways, a shaft journaled in said housings, an eccentric fast on said shaft, a hanger surrounding said eccentric and apertured transversely of the plane of sliding of the hammer, a slide block upon said eccentric in said aperture of the hanger and fitting the same, projections upon the adjacent housing extending over the sides of said hanger to hold the same in the plane of sliding of the hammer, said projections terminating short of the slide block, and an adjustable connection between said hanger and hammer.

5. In a press, the combination with a hammer, and adjusting screws with oppositely threaded ends for supporting the same, of worm wheels fast on said adjusting screws, collars in which said adjusting screws are rotatably loose and longitudinally fast, worm shafts carried by said collars, worms on said shafts meshing with said worm wheels, bevel gears on said worm shafts, a shaft also carried by said collars, pairs of bevel gears on said shaft one gear of each pair adapted to mesh with the worm shaft gear at one side of the same when the pair is slid in one direction and the other

gear of the pair adapted to mesh with the worm shaft gear at its other side when the pair is slid in the other direction, and means for sliding said shaft.

5 6. In a press, the combination with a hammer, and adjusting screws with oppositely threaded ends for supporting the same, of worm wheels fast on said adjusting screws, collars in which said adjusting
10 screws are rotatably loose and longitudinally fast, worm shafts carried by said collars, worms on said shafts meshing with said worm wheels, bevel gears on said worm shafts, pairs of bevel gears one gear of each pair adapted to mesh with a worm shaft
15 gear at one side of the same when the pair is slid in one direction and the other gear of the pair adapted to mesh with the worm shaft gear at its other side when the pair is
20 slid in the other direction, means for sliding said pairs of bevel gears simultaneously, and means for locking said pairs of gears with either corresponding gears of the pairs in mesh with the worm shaft gear or with
25 both of them out of mesh.

7. In a press, the combination with a hammer, and adjusting screws with oppositely threaded ends for supporting the same, of worm wheels fast on said adjusting
30 screws, collars in which said adjusting screws are rotatably loose and longitudinally fast, worm shafts carried by said collars, worms on said shafts meshing with said worm wheels, bevel gears on said worm
35 shafts, pairs of bevel gears one gear of each pair adapted to mesh with a worm shaft gear at one side of the same when the pair is slid in one direction and the other gear of the pair adapted to mesh with the worm
40 shaft gear at its other side when the pair is slid in the other direction, means for sliding said pairs of bevel gears simultaneously, and means for turning one of said worm shafts independent of the other.

45 8. In a press, the combination with a hammer, and adjusting screws with oppositely threaded ends for supporting the same, of worm wheels fast on said adjusting screws, collars in which said adjusting
50 screws are rotatably loose and longitudinally fast, worm shafts carried by said collars, worms on said shafts meshing with said worm wheels, bevel gears on said worm shafts, pairs of bevel gears one gear of each
55 pair adapted to mesh with a worm shaft gear at one side of the same when the pair is slid in one direction and the other gear of the pair adapted to mesh with the worm shaft gear at its other side when the pair is
60 slid in the other direction, means for sliding said pairs of bevel gears simultaneously, and means upon the opposite end of one of said worm shafts from its bevel gear for turning the same by hand.

65 9. In a press, housings providing guide-

ways, a hammer slidable in said guideways and having a socket at its edge, a shaft mounted in said housings, a screw connected to said shaft so as to receive reciprocating motion therefrom as the shaft rotates, a nut
70 in said socket at the edge of the hammer, said nut receiving said screw, and a plate detachably secured to the hammer and projecting over said nut to hold it in its socket.

10. In a sheet metal bending press, the
75 combination with opposite housings providing slideways, a die-holding hammer having an exposed working edge between said housings adapted to receive a die longitudinally of said edge and extending between said
80 housings, means engaging said hammer at a plurality of separated points intermediate its ends for reciprocating the same in its slideways, a second die-holding member opposed to said hammer with its ends slidably
85 free in the housings and presenting toward the hammer a working edge adapted to receive longitudinally of itself a die extending between the housings, and supporting means for said second die-holding member engag-
90 ing the same at a plurality of separated points intermediate its ends and opposite the said points of support of the hammer, both said die-holding member and hammer being unsupported except at said separated
95 points intermediate their ends.

11. In a sheet metal bending press, the combination with opposite housings providing
100 slideways, a die-holding hammer having an exposed working edge between said housings adapted to receive a die longitudinally of said edge and extending between said housings, means engaging said hammer at a plurality of separated points intermediate its ends for reciprocating the same in its
105 slideways, a second die-holder opposed to said hammer with its ends slidably free in the housings and presenting toward the hammer a working edge adapted to receive longitudinally of itself a die extending be-
110 tween the housings, a member extending between the ends of the housings at the opposite side of said die-holder from the hammer, and means for supporting said die-holder upon said member at a plurality of
115 separated points intermediate its ends and opposite the said points of support of the hammer, both said die-holder and hammer being unsupported except at said separated points intermediate their ends.
120

12. In a press, the combination with opposite housings providing slideways, a die-
125 holding hammer with its ends free in said slideways, a shaft substantially parallel to said hammer, and a plurality of similar shafts for transmitting motion from said shaft to reciprocate said hammer, said motion transmitting means being spaced from each other and from the ends of the hammer, one between the middle of the hammer and
130

each of its ends, of a second-die-holding member also having its ends free in said slideways and adapted to move toward and away from the first mentioned die-holding member, a second shaft substantially parallel to said second die-holding member, a plurality of means for transmitting motion from said shaft to said second die-holding member to reciprocate the same, said motion transmitting means being spaced from each other and from the ends of the hammer so as to properly distribute the strain, one between the middle of the hammer and each of its ends, and means for driving said shafts in unison.

13. In a sheet metal bending press, the combination with opposite housings providing slideways, a die-holding hammer having an exposed working edge between said housings adapted to receive a die longitudinally of said edge and extending between said housings, means engaging said hammer at a plurality of separated points intermediate its ends for reciprocating the same in its slideways, a second die-holding member opposed to said hammer with its ends slidably free in the housings and presenting toward the hammer a working edge adapted to receive longitudinally of itself a die extending between the housings, and supporting means for said second die-holding member engaging the same at a plurality of separated points intermediate its ends, both said die-holding member and hammer being unsupported except at said separated points intermediate their ends.

14. In a sheet metal bending press, the combination with opposite housings providing slideways, a die-holding hammer having an exposed working edge between said housings adapted to receive a die longitudinally of said edge and extending between said housings, means engaging said hammer at a plurality of separated points intermediate its ends for reciprocating the same in its slideways, a second die-holder opposed to said hammer with its ends slidably free in the housings and presenting toward the hammer a working edge adapted to receive longitudinally of itself a die extending between the housings, a member extending between the ends of the housings at the opposite side of said die-holder from the ham-

mer, and means for supporting said die-holder upon said member at a plurality of separated points intermediate its ends, both said die-holder and hammer being unsupported except at said separated points intermediate their ends.

15. In a sheet metal bending press, the combination with opposite housings providing slideways and adapted to be engaged and connected by a suitable foundation, a die-holding hammer having an exposed working edge between said housings adapted to receive a die longitudinally of said edge and extending between said housings, means engaging said hammer at a plurality of separated points intermediate the housings for reciprocating the same in its slideways, a second die-holding member opposed to said hammer with its ends slidably free in the housings and presenting toward the hammer a working edge adapted to receive longitudinally of itself a die extending between the housings, and means adapted to also engage the foundation for the press and support said second die-holding member at a plurality of separated points intermediate the housings.

16. In a press, the combination with spaced housings, a top leaf connecting said housings, a hammer extending between said housings next said top leaf, a die holder extending between said housings on the opposite side of said hammer from the top leaf, and means connecting the housings at the opposite side of the hammer and die holder from the top leaf and supporting said die holder at spaced points intermediate its ends, said die holder being otherwise free to move away from the hammer.

17. In a press, the combination with spaced housings providing slideways, a hammer extending between said housings with its ends in said slideways, a die holder opposed to said hammer and extending between said housings with its ends in the slideways thereof, and means at the side of said die holder away from the hammer for supporting the die holder at spaced points intermediate its ends, said die holder being otherwise free to move away from the hammer.

ROBERT NAWRATH.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."