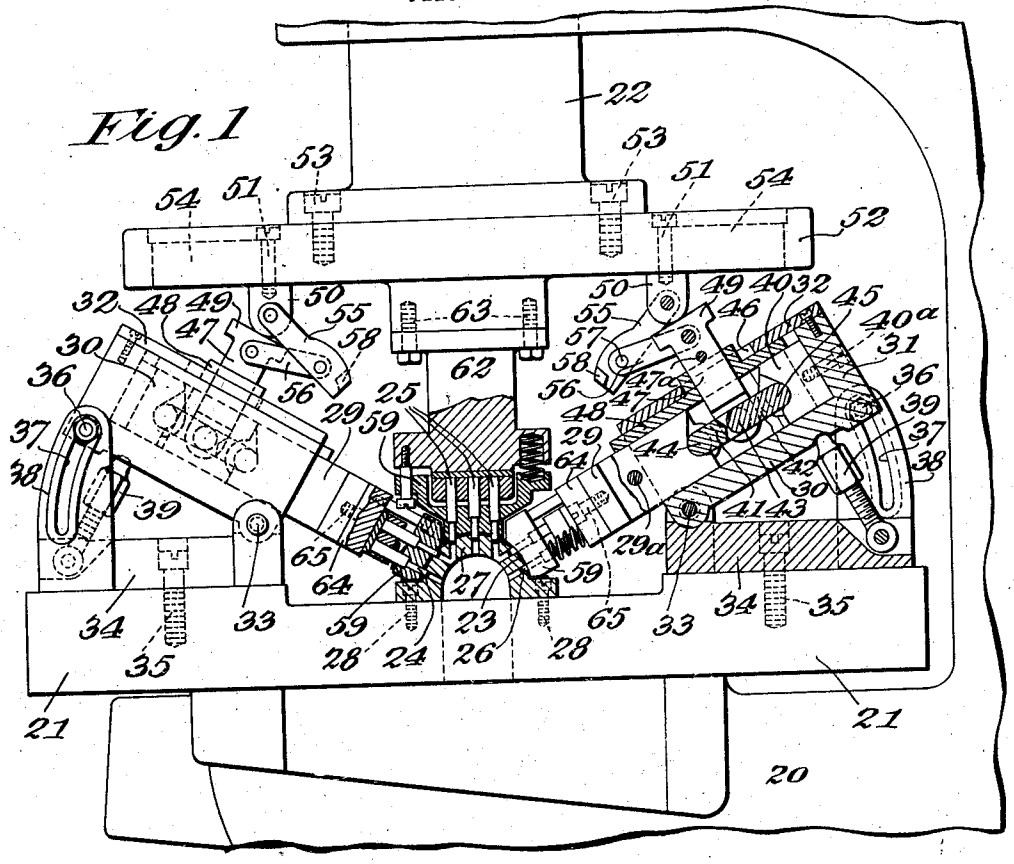
June 30, 1931. O. J. GROEHN 1,812,046

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Fig. 1



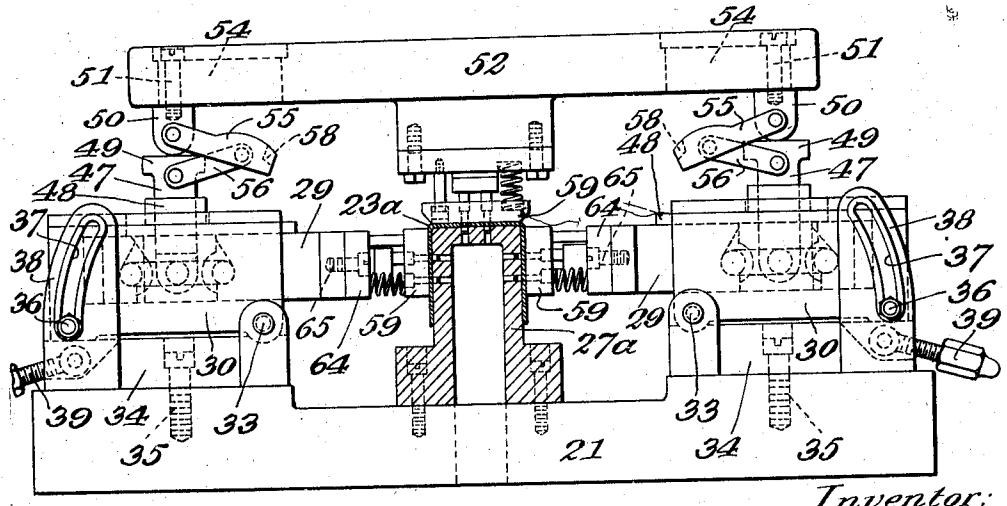


Fig. 2

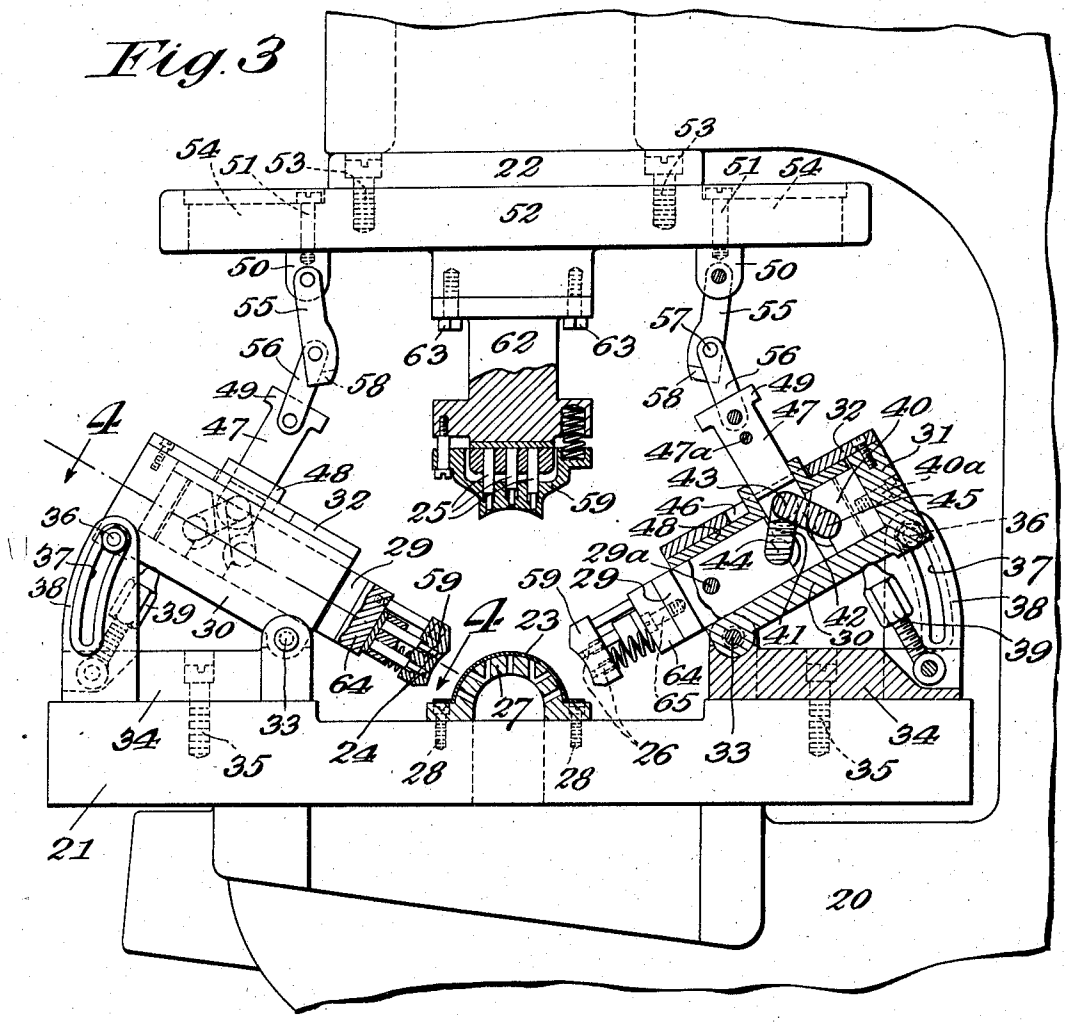
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Fig. 3



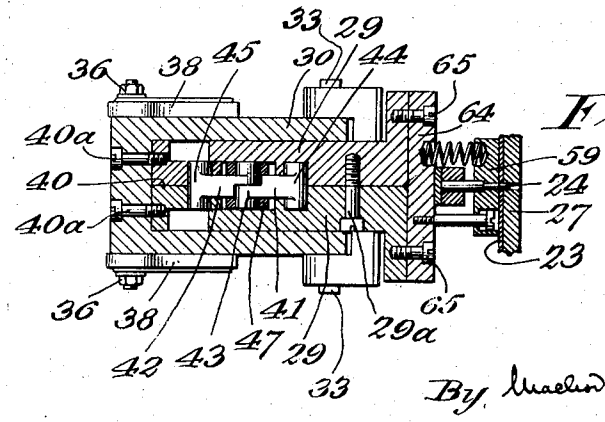


Fig. 4

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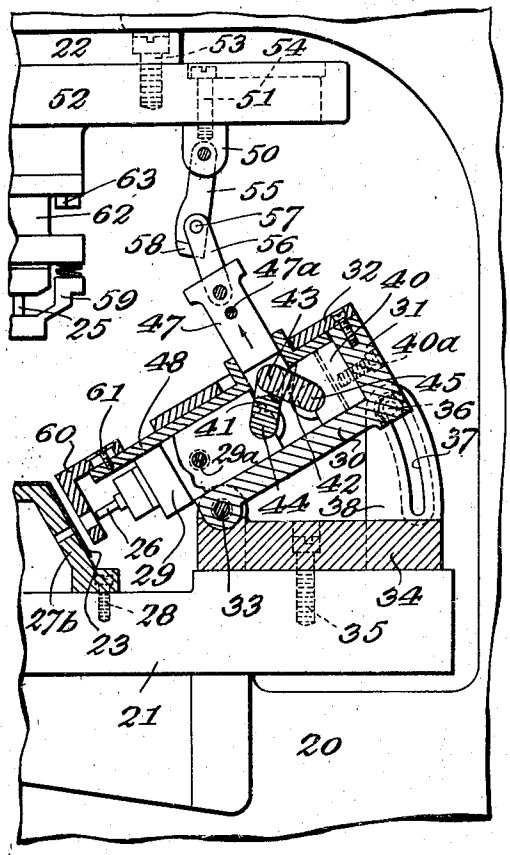


Fig. 5

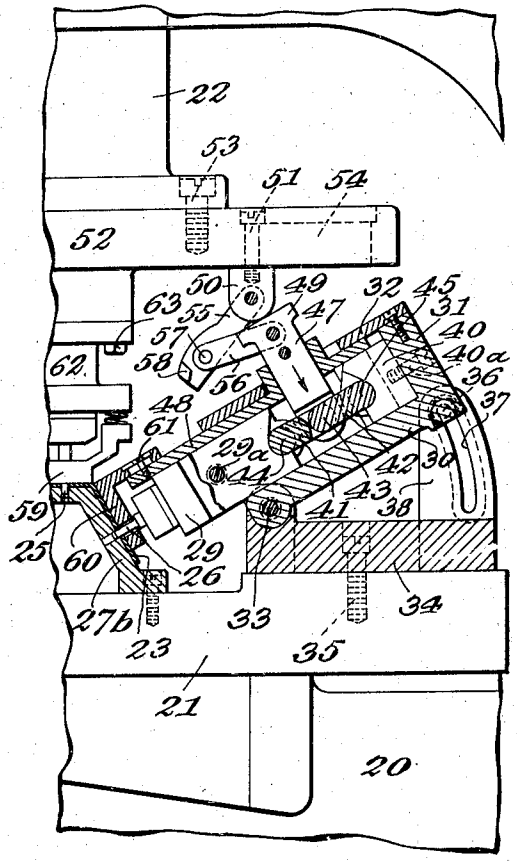


Fig. 6

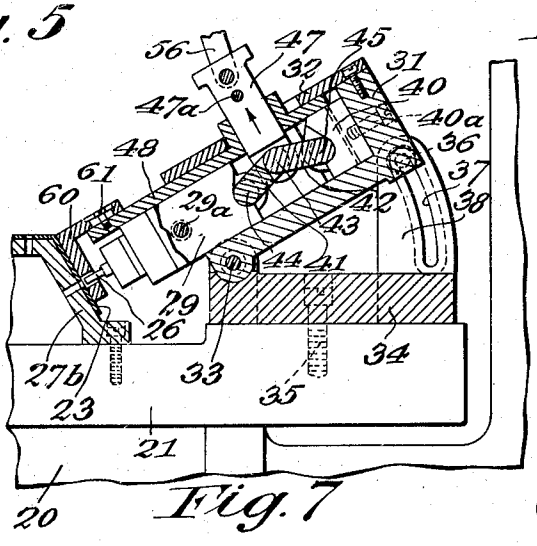


Fig. 7

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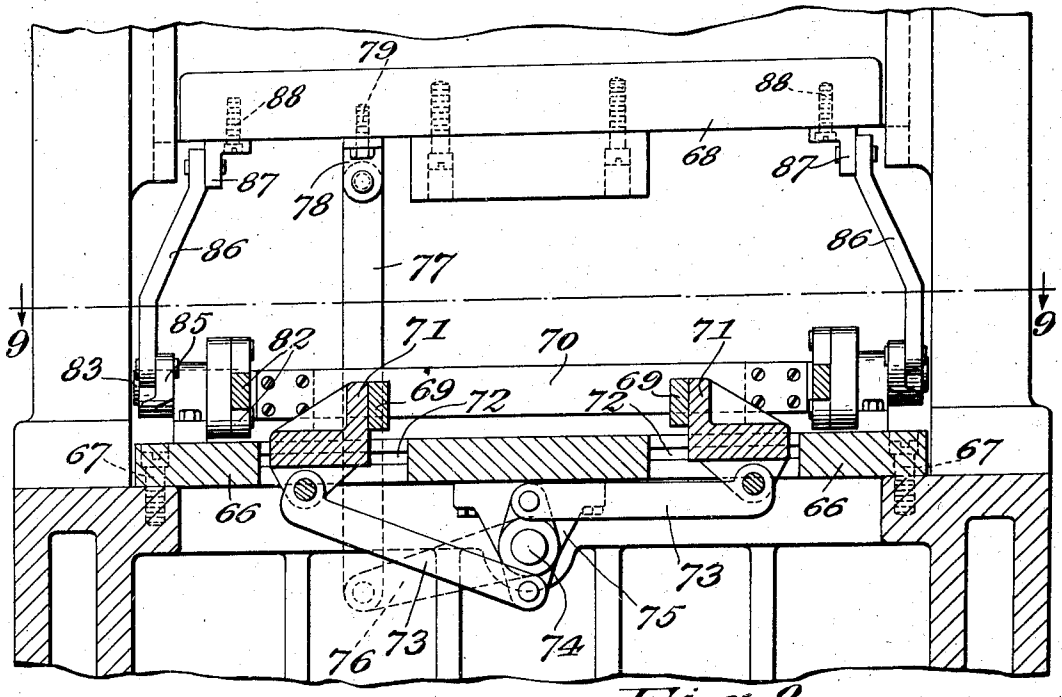


Fig. 8

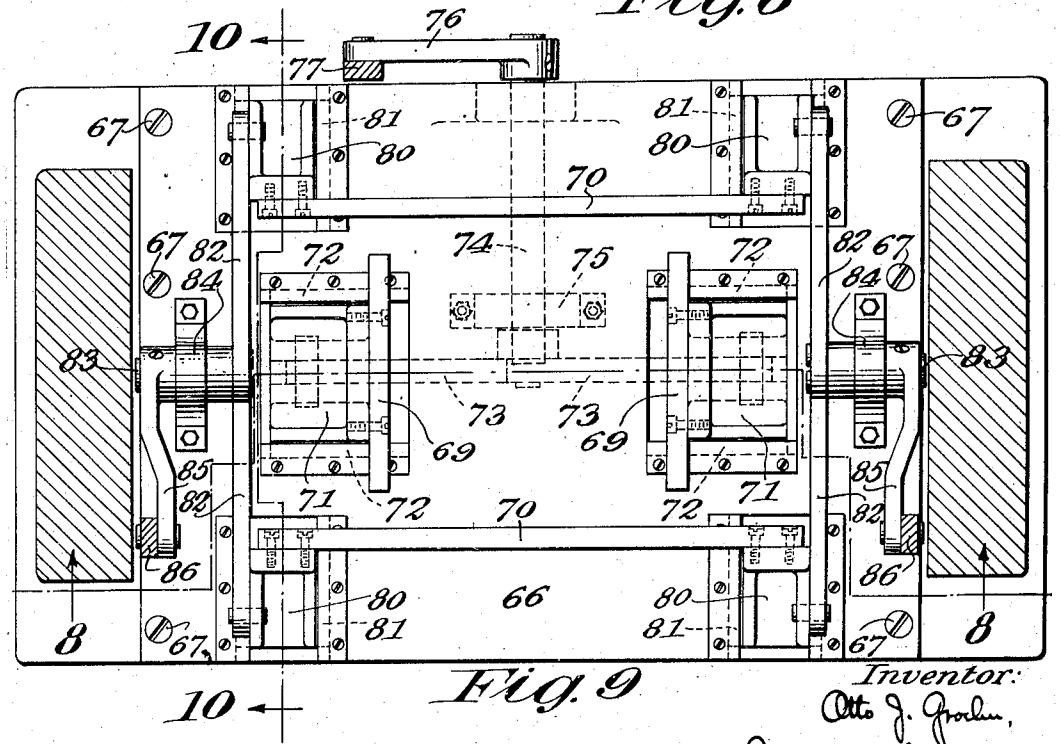


Fig. 9

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Fig. 10

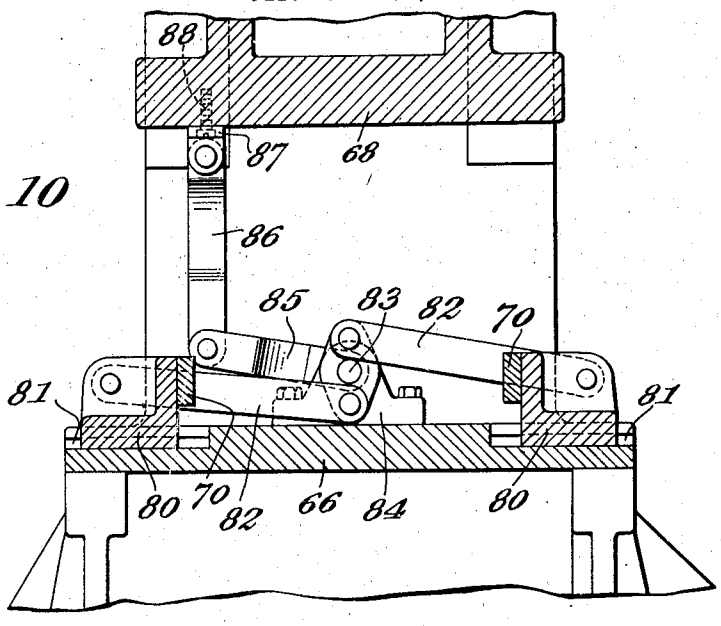
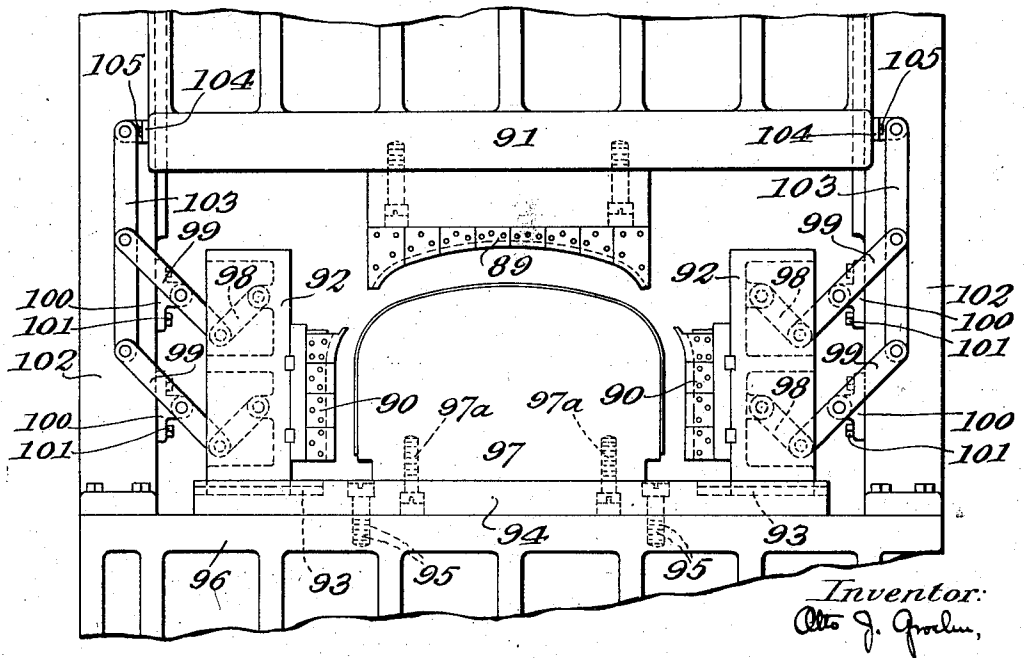


Fig. 11



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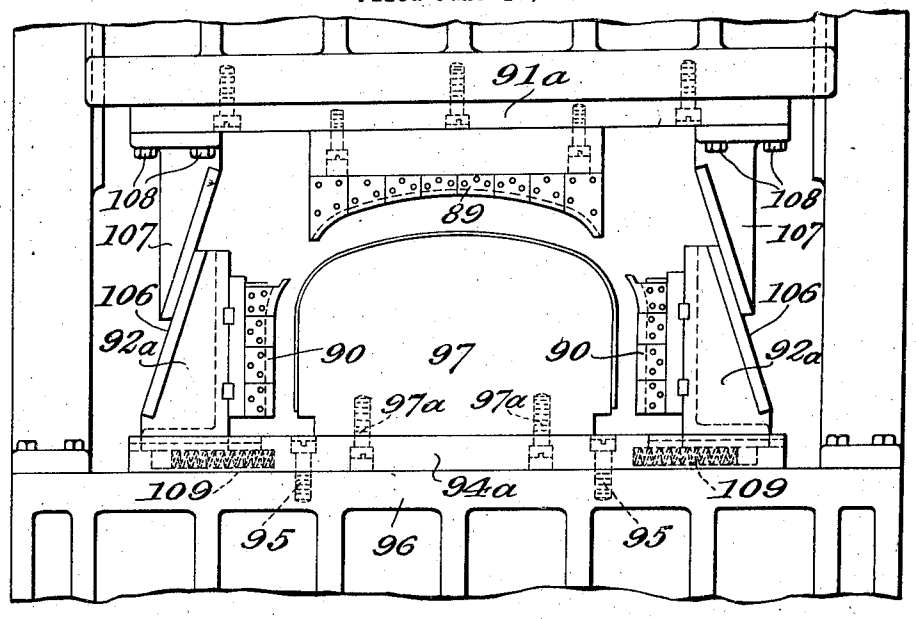


Fig. 12

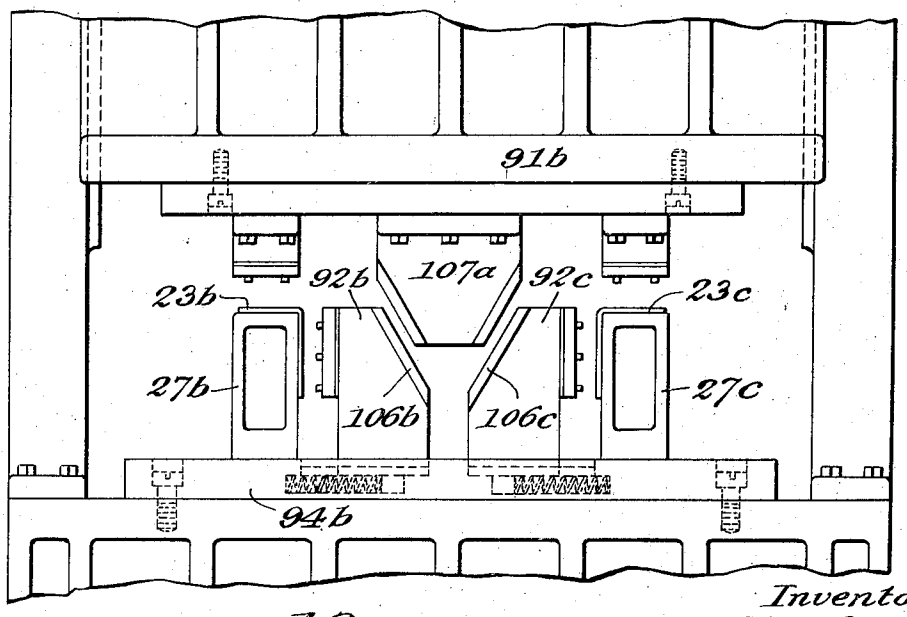


Fig. 13

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Patented June 30, 1931 1,812,046

UNITED STATES PATENT OFFICE

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DIE PRESS

Application filed June 17, 1929. Serial No. 371,650.

This invention relates to die press mechanism for forming articles or parts from sheet metal or the like and has for its general object to increase the possible range of operation of such mechanism whereby changes in the design of the work to be produced, or in the nature of the operations to be performed, can be provided for by relatively simple adjustments of the mechanism, or by the substitution of readily interchangeable standardized parts, and at a minimum of trouble, expense, and delay in the reconstruction of dies or the preparation of new dies. My invention makes it possible to use repeatedly and for jobs of differing character parts which in the past have been formed as parts of the dies and therefore have been discarded whenever a new set of dies has been required.

Many die working operations (including holding, drawing, bending, punching, trimming, et cetera) incidental to the formation of certain articles or parts of more or less irregular configuration or complicated design, such, for example, as certain parts of metal automobile bodies, involve the exertion of pressure, and consequent relative movement of cooperating die members, in more than one direction. It is usually necessary that these operations or pressures occur simultaneously or in a definitely timed sequence. Heretofore the wedge slides or equivalent devices for producing relative movements of die parts or members transverse or at an angle to the direction of movement of the press ram have been built into or as a part of the dies themselves, resulting in a complicated and expensive die structure. The mechanism forming a part of one set of dies cannot ordinarily be used with another set of different dimensions or requiring different movements. As a result, any changes in the design of the product which called for new dies necessitated discarding the entire mechanism with the old dies. Such mechanism has, in many instances, represented twenty per cent or more of the total cost of the dies, and its abandonment with the discarded dies has constituted a direct loss amounting, in some plants, to hundreds of thousands of dollars yearly, to say nothing of the indirect loss due to delays involved in the construction of new mechanisms as a part of the new dies.

The present invention has, therefore, for a more particular object to provide auxiliary mechanism separate from and independent of the dies which will convert the motion or pressure of the ram of the press into motion or pressure through the dies in another direction or directions. While, in accordance with the broader aspect of the invention, the means for producing these secondary movements or pressures from the primary movement or pressure of the ram may form an integral part of the press itself, it is preferably in the form of an interchangeable machine tool or adapter separate from both the press and the dies and applicable, within its limits, to any press or to any dies calling for movements of the character which the adapter is designed to produce. A given adapter may be so designed as to convert a part of the normal movement or pressure of the ram into secondary movement or pressure at any angle or multiplicity of angles thereto, and such adapter may thereafter be used with any set of dies, irrespective of their size or detail design, requiring movement or pressure of this character. Therefore, changes in the dies will not require discarding and reconstructing any associated mechanism so long as the directions of relative movements remain the same. Preferably also, and in accordance with another feature of the invention, the adapters are so constructed as to permit of the adjustment of the angle or angles of action and to increase or decrease the number of such angles, so that a single design or a relatively few interchangeable designs of adapter will readily adapt any press to use with any dies, within, of course, certain limits as to size, power, et cetera.

In accordance with still another feature of the invention the moving parts of the adapter or other mechanism for producing the secondary movements are positively actuated in both directions, so that, where punches or similar elements are operated by such mechanism, there may be provided a positively actuated stripper to prevent any

sticking of the work to the punches or equivalent parts which might interfere with the return movement of any parts operating in lines transverse or at an angle to the lines of action of the punches and consequent injury to the work.

The precise nature of the invention will best be understood from the following description of certain forms or embodiments thereof illustrated in the accompanying drawings. It will be recognized, however, that the particular constructions and applications of the invention described and shown have been chosen for purposes of exemplification merely, and that the invention, as defined by the claims hereunto appended, may be otherwise embodied without departure from the spirit and scope thereof.

In said drawings:

Fig. 1 is a side elevation, partly in section, of a portion of a press having the invention applied thereto, the parts being shown in the positions assumed thereby at the completion of the operative stroke of the ram.

Fig. 2 is a similar view illustrating the adjustment of the adapter to cooperate with slightly different dies for operating upon work of a different shape.

Fig. 3 is a view similar to Fig. 1 showing the positions of the parts upon the completion of the retraction of the ram.

Fig. 4 is a detail section taken substantially on the line 4—4, Fig. 3.

Figs. 5, 6 and 7 are vertical sectional views of one of the auxiliary pressure mechanisms, showing the parts in several different positions corresponding to different positions of the ram and also showing a slightly modified construction.

Fig. 8 is a front elevation, partly in section on the line 8—8, Fig. 9, of a press having applied thereto another form of the invention.

Fig. 9 is a plan view, partly in section on the line 9—9, Fig. 8, of the adapter mechanism shown in the latter figure.

Fig. 10 is a vertical section taken substantially on the line 10—10, of Fig. 9.

Fig. 11 is a front elevation of a portion of a press having applied thereto another embodiment of the invention.

Figs. 12 and 13 are views similar to Fig. 11 illustrating further modifications.

Referring to Figs. 1 and 3, there is shown therein a conventional form of die press comprising a suitable frame 20 supporting a bed 21 and in which is guided for reciprocation toward and from the bed a ram generally indicated at 22. The dies employed in the press will, of course, be chosen in accordance with the work to be turned out or the operations to be performed, but as shown in Figs. 1 and 3 the parts are arranged to perform punching operations upon a piece of substantially semi-cylindrical work 23, and to this end the dies comprise a plurality of punches or gangs of punches 24, 25 and 26, operated as hereinafter described from the ram 22, and a cooperating punch die 27 shaped to conform to the work 23 and detachably mounted, as by bolts 28, on the bed 21. In the particular set-up shown the punches 25 are carried and directly operated by the primary ram 22, being movable thereby in the direction of movement of said ram, while the punches 24 and 26, which require movements transverse or at an angle to the direction of movement of the primary ram 22, are operated by secondary rams or auxiliary pressure devices 29 operatively connected with the primary ram 22 and adapted to convert a part of the pressure of said ram into pressures in the required directions. As shown in Figs. 1 and 3 two secondary rams 29 are employed, said rams and the means for operating, guiding and operating them being substantially identical.

Each ram or pressure element 29 comprises a slide mounted for longitudinal movement in the predetermined direction in a guide 30 comprising a channel having a closed outer end 31 and a detachable cover plate 32. The guide 30 is pivotally mounted at 33 to a base plate 34 detachably secured, as by bolts 35, to the bed 21. The pivotal mounting of the guide 30 permits its outer end to be raised or lowered, thereby varying the direction or angle of action of the ram 29 with respect to the direction of movement of the ram 22, and consequently accommodating the mechanism to a wide variety of work. For example, in Figs. 1 and 3 each guide is shown with its outer end in an elevated position to provide for movement of each ram 29 in an inclined path in accordance with the requirements of the work for which the mechanism is shown in these figures as being set up, whereas in Fig. 2 the guides are shown as adjusted into a substantially horizontal position to adapt the mechanism to cooperate with a punch die 27*a* of the form shown to punch the web and flanges of a channel member 23*a*. Any suitable means may be provided for securing the guides in adjusted position. As shown in Figs. 1 to 3 each guide is provided with a pair of clamping screws 36 which cooperate with arcuate slots 37 in brackets 38 rising from the base plate 34. If desired, an adjustable swinging strut 39, hinged to the base plate 34, may, in addition, be employed to brace the guide 30 against the action of the pressure applying mechanism.

The ram 29 is connected by a toggle with a fixed thrust block 40 secured, as by bolts 40*a*, to the inner face of the closed end 31. The toggle comprises a pair of links 41 and 42 pivotally connected with one another at 43 to form a knuckle, the link 41 being pivotally connected at 44 to the ram 29 and the link 42

being pivotally connected at 45 to the thrust block 40. Pivotally connected to the knuckle joint 43, and extending through an opening 46 in the cover 32, is a plunger 47 guided, for movement in a direction substantially perpendicular to the direction of movement of the ram 29, in a slide 48, said slide being in turn guided in the guide 30 for movement parallel to said ram. Preferably, and as shown in Fig. 4, the toggle links have formed thereon trunnion members interengaged with the cooperating parts to provide the pivotal connections, the ram 29, thrust block 40, and plunger 47 being each formed in two parts to facilitate the assembly, and the parts of said ram and plunger being secured together by bolts 29*a* and 47*a*. The plunger 47 is formed with an enlarged head 49 which, when the primary ram 22 descends, is engaged by an abutment 50 on the latter to depress the plunger 47 and straighten the toggle. The abutment 50 is adjustably mounted on the ram 22 in order to compensate for angular adjustment of the guide 30 and to insure engagement thereof with the head 49 in all positions of angular adjustment of said guide. As shown, each abutment 50 is secured by bolts 51 to a plate 52 which in turn is detachably secured by bolts 53 to the primary ram 22. The bolts 51 pass through in slots 54 in the plate 52, whereby the abutments may be adjusted inwardly and outwardly in accordance with the adjustment of the guides 30, as will be apparent by comparison of Figs. 1 and 2. Each plunger 47 is also connected with the ram 22 by lost motion linkage providing for the positive actuation of said plungers upwardly as well as downwardly and the consequent positive operation of the rams 29 in both directions. As shown, said linkage comprises a pair of links 55 and 56 pivoted together at 57, the link 55 being pivotally connected to the abutment 50, and the link 56 being pivotally connected to the plunger 47. One of said links is provided with a stop 58 adapted to engage the other to limit their straightening movement and exert a positive upward pull upon the plunger 47 when the ram 22 rises, as shown in Fig. 3, said links however collapsing to permit the abutment 50 to engage said plunger when the ram decends, as shown in Fig. 1.

The operation of the mechanism thus far decribed is illustrated in Figs. 5 to 7. Fig. 6 shows the positions of the parts at the completion of the operative stroke of the primary ram, Fig. 7 the positions just after the beginning of the upward or return stroke of said ram, and Fig. 5 the positions at the completion of said return stroke. It will be observed that the perpendicularity of the plunger 47 to the path of movement of the secondary ram 29 is maintained by its guide in the slide 48, said slide moving parallel to said ram during the straightening and breaking of the toggle, but differentially with respect to said ram due to the fact that the longitudinal component of the movement of the knuckle pivot 43 of the toggle is only one-half that of the pivot 44 connecting the link 41 with the ram. While, therefore, and as shown in Figs. 1 to 4, the usual yieldingly mounted strippers 59 may be provided for the punches 24 and 26 as well as for the punches 25, preferably, and as shown in Figs. 5 to 7, the slides 48 may be utilized to operate positively actuated strippers 60. Said strippers 60 are preferably adjustably secured to the slides 48, as by screws 61, and, due to the movement of said slides, are operated thereby positively and differentially with respect to the movement of the punches in both directions. Thus, at the completion of the operative strokes of the several rams, the strippers 60 will operate firmly and positively to clamp the work against the punch die 27*b*, as shown in Fig. 6, and, when the parts are retracted, said strippers, moving through a less distance, and consequently at less speed, than the punches will act positively to strip the work from the latter, said punches being withdrawn through the strippers and the latter being withdrawn to a less distance to release the clamped work.

The movable die elements, herein the punches 24 and 26, are detachably mounted on the secondary rams 29, and the punches 25 likewise detachably mounted on the primary ram 22 so as to be insertable into and removable from the press independently of the other mechanism. As shown, the punches 25 are carried by a head 62 detachably secured, as by bolts 63, to the plate 52, while the punches 24 and 26 are similarly carried by plates 64 detachably secured, as by screws 65, to the secondary rams 29. It will therefore be seen that all of the die elements, including the punch die 27 or 27*a*, can be readily removed from the press without removing the adapter or secondary pressure mechanism and replaced by other cooperating die elements adapted for similar or other operations (such as holding, drawing, bending, trimming, or otherwise) requiring the same or similar relative movements, which movements may, however, be varied by adjustment of the mechanism as above explained. When therefore it is necessary to make changes in the dies, necessitated either by changes in the nature of the operations to be performed or by changes in the design of the work, it is necessary only to replace the die elements themselves without replacing any auxiliary mechanism for giving said elements the required relative movements. It will also be seen that the adapted mechanism described can be readily removed from the press by removing the bolts 35 and 53 and as readily applied to any other press

corresponding sufficiently closely thereto in size and general design. Such an adapter may therefore be utilized, within reasonable limits, to adapt substantially any press to use with any dies requiring substantially any combination of compound movements in different directions.

In the form of the invention shown in Figs. 8 to 10, the adapter mechanism is carried by a plate 66 detachably secured, as by bolts 67, to the bed, or to the press frame in lieu of the usual bed, and operatively connected to the primary ram 68. The mechanism comprises two pairs of cooperating secondary rams or pressure members 69 and 70, the pressure members of each pair being movable toward and from one another in a path substantially perpendicular to the path of movement of the members of the other pair and to the path of movement of the primary ram. The pressure members 69 comprise bars or plates carried by slides 71 guided in ways 72 in the plate 66 and connected by links 73 to oppositely extending arms on a rock shaft 74 journalled in brackets 75 secured to the underside of said plate 66. The rock shaft 74 is provided, beyond one edge of the plate 66, with a third arm 76 connected by a link 77 with a bracket 78 detachably secured, as by screws 79, to a primary ram 68. The pressure members 70 likewise comprise bars or plates each of which is carried by a pair of slides 80 guided in ways 81 in the plate 66. Corresponding slides 80 of the several pairs are connected by links 82 with oppositely extending arms on rock shafts 83 journalled in brackets 84 secured to the top of the plate 66. Each rock shaft 83 is provided with a third arm 85 connected by a link 86 with a bracket 87 detachably secured, as by a bolt 88, with the primary ram 68.

From the foregoing description, it will be seen that, when the primary ram 68 descends, the several pairs of secondary rams will be moved toward one another to exert pressure upon interposed work in two directions transverse to one another and to the direction of movement of the primary ram, and that when said primary ram rises, said secondary rams will be moved away from one another to release the pressure, said secondary rams being positively actuated in both directions.

In the form of the invention shown in Fig. 11, die members 89 and 90 are carried respectively by the primary ram 91 and by secondary rams 92 guided for movement toward and from one another, in a direction transverse to the direction of movement of the primary ram 91, in ways 93 in a plate 94 detachably secured, as by bolts 95, to the bed 96. The die members 89 and 90 cooperate with a die member 97 detachably secured, as by bolts 97*a*, to the plate 94. Each of the secondary rams 92 is operated by a pair of toggles comprising links 98 and levers 99, the latter being pivoted intermediate their ends to brackets 100. The brackets 100 are detachably secured, as by bolts 101, to the press frame uprights 102 in which the primary ram is guided. The levers 99 of each pair are connected by a link 103 with a bracket 104 detachably secured, as by a bolt 105, to the primary ram 91. In this form of the invention, it will be seen that, as in the forms previously described, a portion of the downward pressure of the primary ram 91 will be converted into pressures through the secondary rams 92 and die members 90 in a direction transverse to the direction of movement of said primary ram.

The form of the invention shown in Fig. 12 is similar to that shown in Fig. 11, the secondary rams 92*a* being, however, provided with inclined surfaces 106 which cooperate with wedges 107 depending from and detachably secured to the primary ram 91*a*, as by bolts 108. In this construction the secondary rams 92*a* are positively actuated toward one another by the wedges 107 when the primary ram descends, but are moved away from one another by springs 109 housed in suitable recesses in the supporting plate 94*a*.

In Fig. 13 is shown a modification of the mechanism last described adapted to operate simultaneously upon two pieces of work 23*b* and 23*c* supported by die members 27*b* and 27*c* mounted on the supporting plate 94*b*. In this form of the invention the secondary rams 92*b* and 92*c* are, upon the descent of the primary ram 91*b*, moved away from one another and toward the die members 27*b* and 27*c*, respectively, by a double wedge member 107*a* detachably secured to the primary ram and cooperating with wedge surfaces 106*b* and 106*c* on said secondary rams respectively. The operation of this form of the invention will be obvious from the preceding description.

Having thus described my invention, I claim:

1. The combination with a press having a reciprocating ram, of dies having relatively movable coperating members, and mechanism associated with said press for converting at least a portion of the pressure of said ram into pressure through said dies in a direction transverse to the direction of movement of said ram, said mechanism having provision for varying the angle of said transverse pressure.

2. The combination with a press having cooperating press elements comprising a bed and a reciprocating ram, of dies detachably mounted in said press and having relatively movable cooperating members, and an adapter detachably mounted on one of said press elements and detachably connected with the other and with certain of said die members for converting at least a portion of the pressure of said ram into pressure through said dies in

a direction transverse to the direction of movement of said ram, said adapter having provision for varying the angle of said transverse pressure.

3. The combination with a press having a reciprocating ram, of dies having cooperating members including complementary punch elements relatively movable in a direction transverse to the direction of movement of said ram, a stripper cooperating with said punch elements, and mechanism associated with said press for converting a portion of the movement of said ram into relative movement of said punch elements in said transverse direction, said mechanism including means for operating said stripper positively and differentially with respect to the movement of said punch elements.

4. In a press, in combination, a bed, a primary ram reciprocable toward and from said bed, a secondary ram, a guide in which said secondary ram is mounted for movement in a direction transverse to the direction of movement of said primary ram, said guide being angularly adjustable to vary the direction of movement of said secondary ram, a toggle for operating said secondary ram, and means for actuating said toggle from said primary ram.

5. In a press, in combination, a bed, a primary ram reciprocable toward and from said bed, a secondary ram guided for movement in a direction transverse to the direction of movement of said primary ram, a toggle for operating said secondary ram, a plunger pivotally connected with the knuckle of said toggle, means for operating said plunger from said primary ram, and a slide guided for movement parallel to said secondary ram and in which said plunger is guided for movement transverse thereto.

6. In a press, in combination, a bed, a primary ram reciprocable toward and from said bed, a secondary ram guided for movement in a direction transverse to the direction of movement of said primary ram, a toggle for operating said secondary ram, a plunger pivotally connected with the knuckle of said toggle, means for operating said plunger from said primary ram, a punch element carried by said secondary ram, and a stripper rigidly carried by said slide and cooperating with said punch element, a slide guided for movement parallel to secondary ram and in which said plunger is guided for movement transverse thereto.

7. In a press, in combination, a bed, a primary ram reciprocable toward and from said bed, a secondary ram guided for movement in a direction transverse to the direction of movement of said primary ram, a toggle for operating said secondary ram, a plunger connected with the knuckle of said toggle, and an abutment carried by said primary ram and adapted to engage and operate said plunger when said primary ram moves toward said bed.

8. In a press, in combination, a bed, a primary ram reciprocable toward and from said bed, a secondary ram guided for movement in a direction transverse to the direction of movement of said primary ram, a toggle for operating said secondary ram, a plunger connected with the knuckle of said toggle, an abutment carried by said primary ram and adapted to engage and operate said plunger when said primary ram moves toward said bed, and linkage connecting said abutment and plunger.

9. In a press, in combination, a bed, a primary ram reciprocable toward and from said bed, a secondary ram, a guide in which said secondary ram is mounted for movement in a direction transverse to the direction of movement of said primary ram, said guide being angularly adjustable to vary the direction of movement of said secondary ram, a toggle for operating said secondary ram, a plunger connected with the knuckle of said toggle, and an abutment adjustably mounted on said primary ram and adapted to engage and operate said plunger when said primary ram moves toward said bed.

10. An adapter of the character described for sheet metal presses comprising a slide movable at an angle to the movement of the moving member of the press with which it is to be used, actuating mechanism for said slide capable of moving the slide by movement at an angle to the slide, and means whereby the angle of the path of movement of the slide relative to the path of movement of a moving member of the press may be adjusted.

In testimony whereof I affix my signature.

OTTO J. GROEHN.