Feb. 6, 1934. K. M. BOBLETT ET AL 1,945,992

AUTOMATIC POWER PRESS

Filed Sept. 1, 1930 5 Sheets-Sheet 1

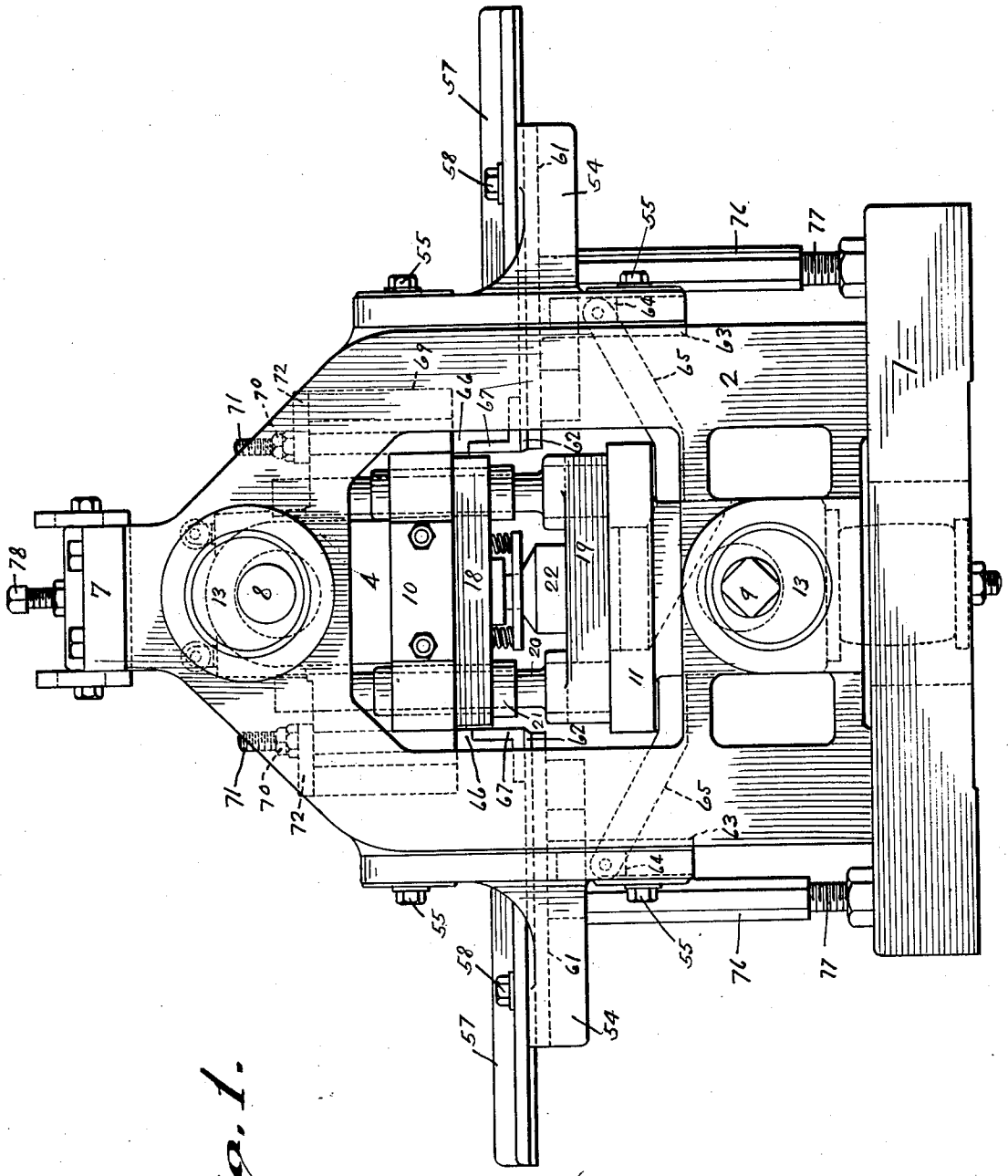

Fig. 1.

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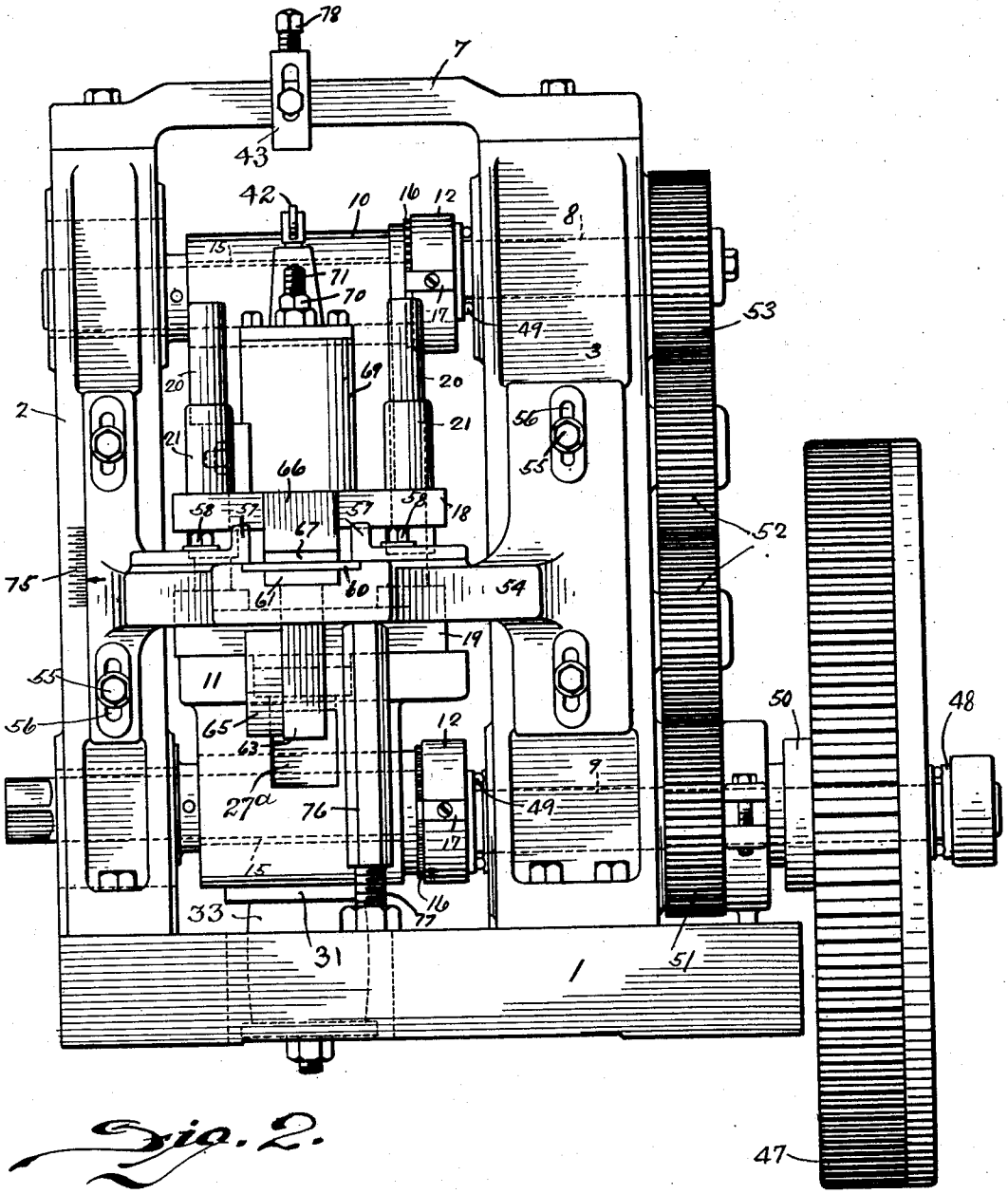

Fig. 2.

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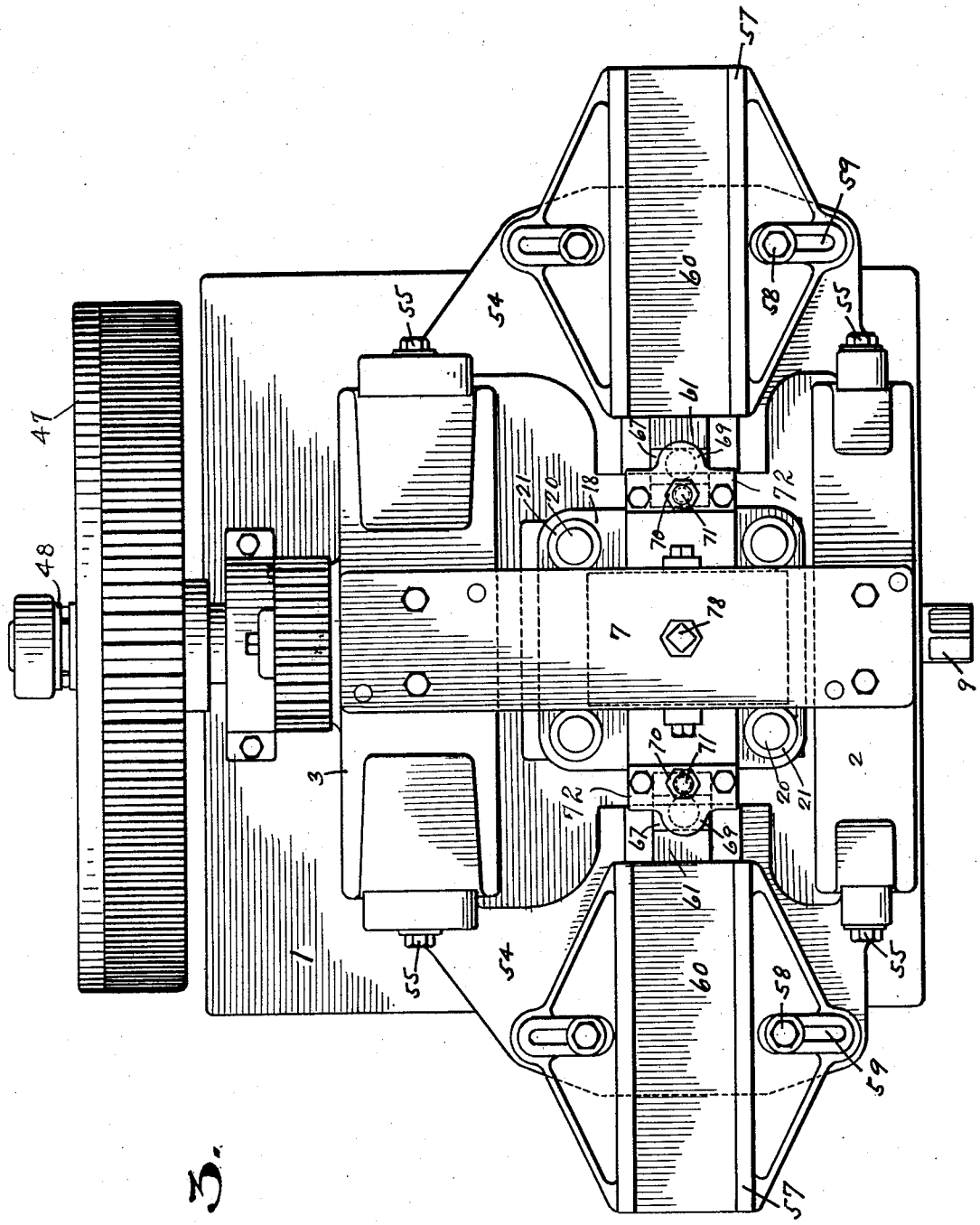

Fig. 3.

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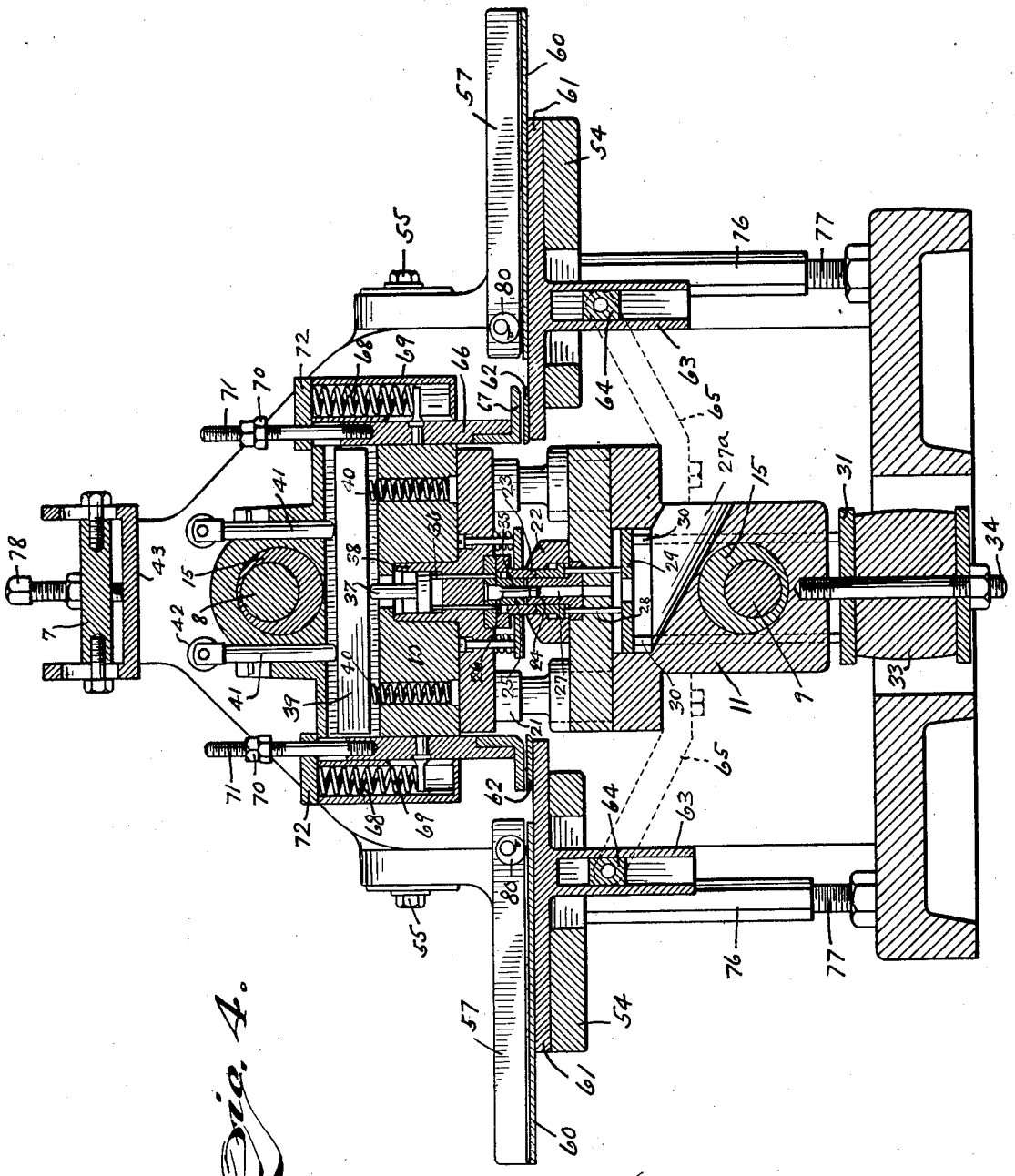

Fig. 4.

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Feb. 6, 1934. K. M. BOBLETT ET AL 1,945,992

AUTOMATIC POWER PRESS

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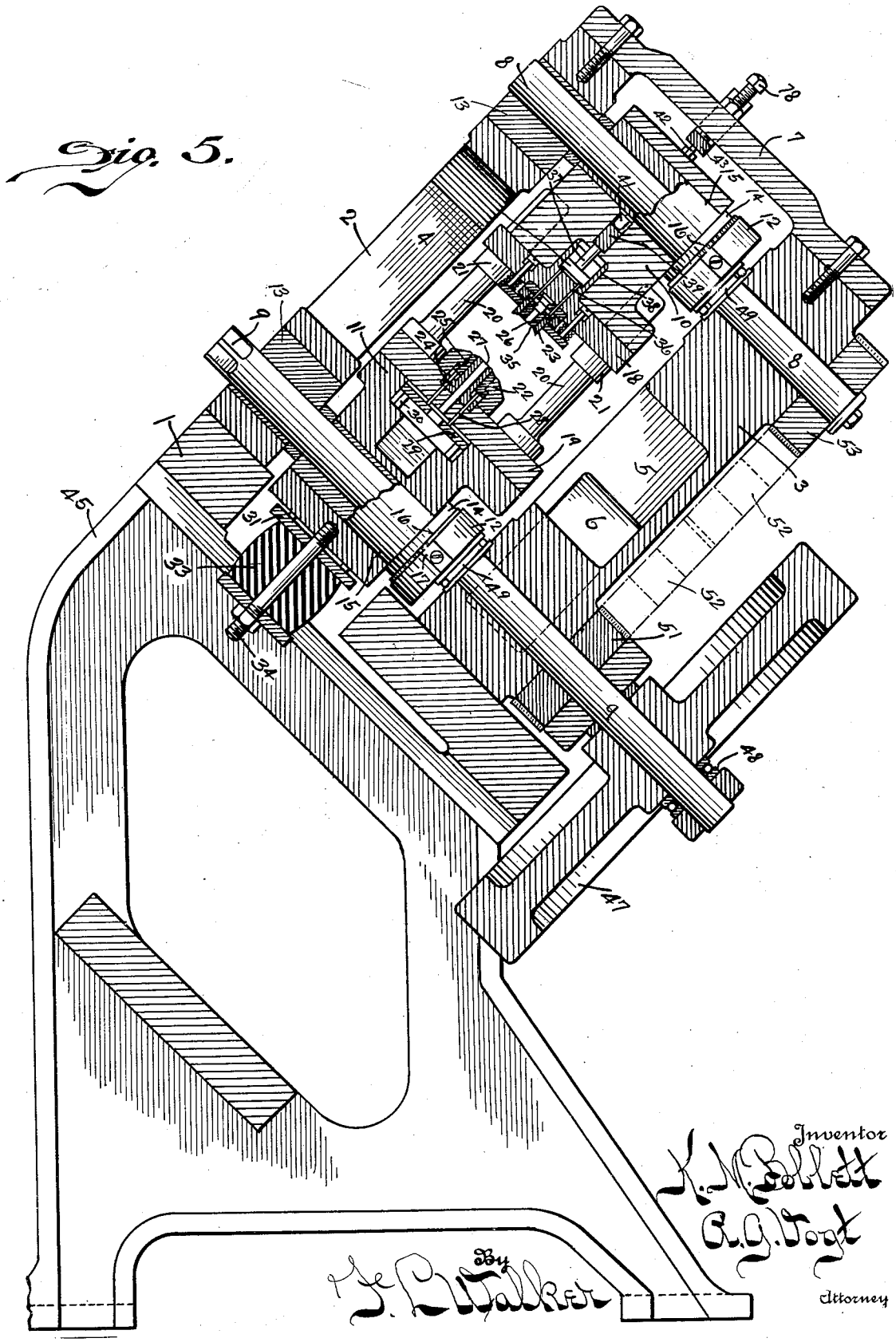
Fig. 5.



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Patented Feb. 6, 1934 1,945,992

UNITED STATES PATENT OFFICE

1,945,992

AUTOMATIC POWER PRESS

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Toledo, Ohio

Application September 1, 1930. Serial No. 479,112

13 Claims. (Cl. 164—21)

This invention relates to cutting and punching mechanism and more particularly to an automatic power press for performing such blanking, forming, and piercing operations as may be necessary for the production of articles from sheet material.

In the present press construction, the complementary die members are both given gyratory motion in substantially tangential paths of travel, whereby the male and female die elements possess lateral swinging motion simultaneously with their approach toward and recession from each other.

Stock feeding devices are connected to and move in unison with the die elements through the same gyratory motion, whereby the stock is advanced in synchronism with the press operation. Means is provided for varying the stroke of the die elements and also for varying the degree of advance movement of the stock at each operation independently of the variation of the die stroke. The machine is mounted in an inclined position which enables it to clear itself by discharging finished parts and waste beyond the zone of operation.

The object of the invention is to improve the construction as well as the means and mode of operation of power presses, whereby they will not only be cheapened in construction, but will be more efficient in operation, automatic in action, of compact construction, capable of operating at relatively high speeds, and unlikely to get out of repair.

A further object of the invention is to provide improved means for actuating the complementary die elements in unison whereby they are caused to simultaneously advance toward and recede from each other while following different circular paths of travel in which the elements interengage at a substantially tangential point while swinging laterally in unison with the advance movement of the stock operated upon.

A further object of the invention is to provide means for positively feeding the stock in synchronism with the die movement and to further provide means whereby the feeding movement of the stock is effected by the operative motion of the die.

A further object of the invention is to provide a construction wherein the stock feeding movement and the punching or forming die movement can be so closely related as to obviate the necessity of pilot or work-locating means.

A further object of the invention is to provide adjustment for the stock feeding means and also for the die element stroke whereby each may be easily and quickly changed independently of each other.

A further object of the invention is to provide a power press which will be substantially universal in its adaptability to the use of progressive, compound, and combination dies for blanking, piercing, forming, or drawing operations.

A further object of the invention is to provide for the ejection of finished parts or of waste from either above or below the zone of operation and provide the knock-out or ejector means in offset relation with the point of operation so that the ejected material will fall clear of the operating field.

A further object of the invention is to provide an actuating crank for a power press or the like, having an adjustable throw or stroke-varying means.

A further object of the invention is to provide improved stock feeding means including complementary gripper elements reciprocating in intercepting paths of travel.

With the above primary and other incidental objects in view, as will more fully appear in the specification, the invention consists of the features of construction, the parts and combinations thereof, and the mode of operation or their equivalents as hereinafter described and set forth in the claims.

Referring to the accompanying drawings wherein is shown the preferred, but obviously not necessarily the only form of embodiment of the invention, Fig. 1 is a front elevation of the assembled press mechanism forming the subject matter hereof.

Fig. 2 is a side elevation of the press mechanism viewed from the right of Fig. 1.

Fig. 3 is a top plan view thereof.

Fig. 4 is a vertical sectional view on line 4—4 of Fig. 3 showing the operating parts in their closed or operated position.

Fig. 5 is a vertical sectional view at right angles to that of Fig. 4 on line 5—5 of Fig. 1 showing the press mechanism mounted at an inclination upon a supporting pedestal with the operating parts in their wide open or retracted position.

Like parts are indicated by similar characters of reference throughout the several views.

Referring to the accompanying drawings, 1 is the bed or base plate above which are mounted in spaced relation upright front and rear frame members 2 and 3 between which are located the operating parts of the press. The forward frame member 2 is provided with an enlarged opening

4 affording easy access to the die elements and through which the die parts may be interchanged and the operations observed. The rear frame member 3 is formed hollow with an opening at the inner side leading to the cavity or recess 5 through which finished work or waste parts, as the case may be, may drop when ejected from the die, into the cavity or recess 5 of the rear frame member 3 from which leads a discharge chute 6. The frame members 2 and 3 are interconnected at their top by a bridging tie member 7.

Transversely disposed at the top and bottom of the frame and journalled in the front and rear members 2 and 3, are two actuating crank shafts 8 and 9 upon which are carried the relatively movable ram 10 and bolster 11, to which are attached the complementary die elements. The drive portions of the crank shafts 8 and 9 are journalled in the rear frame member 3 and carrying intermediate the frame members 2 and 3 an eccentrically disposed wrist pin or working portion interconnected with the main shaft portion 11 by the usual cheek 12. At their forward ends the cranks 8 and 9 carry eccentric cylindrical bearing heads 13 detachably connected with the wrist pins or working portions of the cranks and having revoluble bearings in the front frame member 2. These eccentric bearing heads 13 are disposed with their axes coincident with the axes of the main or driving portions of the crankshafts journalled in the rear frame member 3.

While the ram 10 and bolster 11 may be mounted directly upon the wrist pin or working portions of the cranks 8 and 9, in order to provide adjustability for varying the length of the stroke of the respective members, eccentric bearing sleeves 15 are located on the crank shafts 8 and 9. These eccentric bearing sleeves are formed with terminal notched flanges 16 positioned adjacent to the cheeks 12 of the crank shafts. Locking keys 17 secured to the cheek portion 13 of each shaft 8 and 9 are engageable with different notches of the flanges 16 of the eccentric sleeves to hold the sleeves in their positions of revoluble adjustment relative to the crank shaft. By rotating the eccentric bearing sleeves 15 upon the crank shafts 8 and 9, the throw of the shafts may be accentuated or diminished to varying degree, thus reducing or extending the length of the strokes of the ram 10 and bolster 11.

Secured to the adjacent faces of the ram 10 and bolster 11 are the punch holder 18 and the complementary die holder 19 which are maintained in registering alinement with each other by guide pins or studs 20 carried by one of these members having sliding bearings in bushing sleeves 21 carried by the other member. The sliding or telescopic movement of the guide pins or studs 20 which in this case are shown attached to the die holder 19, within the bushing or guide sleeve 21 carried by the punch holder 18 serve to telescopically connect the ram and bolster to maintain their parallel relation throughout their gyratory paths of travel.

The particular die structure forms no part of the present invention. For illustrative purposes there has been shown a simple form of blanking, drawing, and piercing die. Secured to the die holder 19 is the blanking and drawing die 22 with which coacts the cutting and forming punch 23 carried by the punch holder 18. Located concentrically within the blanking and drawing die 22 is the anvil 24 over which the piece is to be formed and around which within the blanking and drawing die 22 the cutting and forming punch projects as the ram and bolster approach each other in the operating portion of their cycle. The cutting and forming punch 23 operates within the blanking and drawing die 22 against the yielding resistance of the pressure ring or draw pad 25 which possesses a limited reciprocatory motion around the anvil 24 and within the blanking and drawing die 22. The present die is designed to form a circular disc of sheet metal blanked from the stock over the anvil 24 into a cup-shaped thimble which is then pierced by the piercing punch 26 carried by the punch holder 18 in concentric relation with the cutting and forming punch 23 and registering with a central bore 27 in the anvil 24. The yielding resistance of the pressure ring or draw pad 25 as the metal is being formed over the anvil 24 prevents the formation of wrinkles or "staring" of the formed piece. This pressure ring or draw pad is normally supported upon draw pins 28 resting upon a plate 29 which in turn is supported upon reciprocatory pins 30 extending through the bolster 11 and resting upon a bearing plate 31 supported by a resilient body 33 which may be of rubber or a compression spring which is suspended by the stud bolt 34 from the underside of the bolster 11 and therefore moves therewith. Thus at each operation the pressure ring or draw pad 25 is depressed against the yielding resistance of the cushion 33 which immediately returns the ring or pad 25 upon the separation of the parts and withdrawal of the punch 22. At the limit of the approach of the relatively movable parts, the punch 26 pierces the formed piece, the slug removed thereby falling through the bore or passage 27 into the outlet chute 27*a* formed in the bolster 11.

Surrounding the punch 26 and located within the blanking and drawing punch 23 is a reciprocatory knock-out sleeve 35 connected by push rods 36 with a plunger 37 having bearing in an upwardly projecting hub or boss 38 upon the punch holder 18 with the stem of the plunger 37 projecting therebeyond.

Located in a transverse opening or passage in the ram 10 is a laterally movable knock-out bar 39 normally supported in elevated position upon springs 40 seated within the ram 10. Projecting through the top of the ram 10 at opposite sides of the actuating crank shaft 8, are two plungers 41, the lower ends of which rest upon the spring supported knock-out bar 39. As the ram 10 approaches the limit of its retractive movement, the upper ends of the plungers 41 which are preferably though not necessarily provided with antifriction rollers 42, engage with an adjustable contact plate 43 secured to the transverse bridging tie bar 7 of the main frame. The continued motion of the ram 10 subsequent to such contact of the plungers 41 with the plate 43, serves to depress the knock-out bar 39 within the space 38 of the ram against the yielding resistance of the supporting springs 40 thereby exerting pressure downwardly upon the plunger 37 which is transmitted through the push rod 36 to the knock-out sleeve 35. This knock-out sleeve 35 in its descent about the punch 26 and within the blanking and drawing punch 23 ejects from therein the formed piece which is lifted from the anvil 24 by the retraction of the ram and punch members carried thereby.

The press mechanism is mounted upon a pedestal 45 in an inclined position as shown in Fig. 5 whereby the formed piece at the moment of ejection from the punch is positioned in laterally offset relation from the plane of the die and directly

over the opening in the rear frame member 3 leading to the interior recess or cavity 5 into which the ejected piece falls and from which it is discharged through the chute 6.

The relatively movable ram and bolster with their attached die parts are operated in synchronism by means of a driving motor mounted within the supporting pedestal 45 and having a driving pinion engaging with a large gear wheel 47 carried upon the crank shaft 9 of the bolster 11, which gear wheel 47 also performs the function of a fly wheel. Inasmuch as the machine is mounted in inclined position, a thrust bearing 48 is provided at the lower side of the fly wheel or driving member 47. For the same reason, thrust bearings 49 are provided for the crank shafts 8 and 9. Obviously in lieu of a driving motor, the press mechanism may be operated by a belt applied to a pulley upon the extension of the crank shaft 9 in lieu of the large gear wheel 47. This driving member, whether it be the gear wheel 47 or a belt pulley, is operatively connected with the crank shaft 9 by a suitable driving clutch 50 which may be of any suitable type and be operated either by foot or by hand and is preferably such that it may be locked for continuous operation. Carried upon the crank shaft 9 is a driving gear pinion 51 transmitting motion through intermediate idler pinions 52 to a corresponding gear pinion 53 upon the crank shaft 8 which operatively carries the ram 10. By means of this gear train 51, 52, and 53, the crank shafts and ram and bolster carried thereby are operated in unison and in exact synchronism. As before explained, the crank shafts 8 and 9 being relatively adjusted with their throw in opposition to each other, the parts carried thereby describe gyratory paths of travel in which they have simultaneous lateral swing motion in unison with their approach and recession. This lateral swinging motion is utilized in the present instance to effect the advance feeding movement of the stock of material operated upon.

Stock feeding mechanism

Adjustably secured to the opposite sides of the main frame are stock feeding tables or ledges 54 secured to the frame members 2 and 3 by clamp bolts 55 extending through slots 56 in vertically extending arms of the feed tables. Each of the feed tables 54 is provided with a pair of parallel relatively adjustable stock guides 57 held to the table 54 by clamp bolts 58 extending through elongated slots 59 in said guides 57. Intermediate and underlying these stock guides is a hardened bearing plate 60 over which the material is slidingly advanced. The stock may be fed in either direction depending upon the direction of rotation of the crank shafts 8 and 9 and consequently the direction of lateral swinging motion of the punch and die carrying parts. However, as shown in the drawings, the stock is fed from the right between the guides 57 and over the bearing plate 60 upon the feed table 54 and thence between the punch and die elements, the refuse stock continuing its course in a straight path through the machine is ejected over the feed table 54 and between the stock guides 57 at the left.

To effect this advance movement of the stock intermittently in properly timed relation with the movement of the press mechanism, there are provided in each of the feeding tables 54, reciprocatory feeding slides 61 carrying at their inner end gripper plates 62. The slides 61 are each provided with dependent legs 63 slotted to receive a sliding block 64 connected by arms 65 with the bolster 11. The blocks 64 are free for vertical sliding motion within the slotted legs 63 of the feeding slides 61 in unison with the vertical movement of the bolster 11 as it follows its gyratory path of movement. However, in this gyratory or circular movement of the bolster 11 due to the interconnection of the arms 64, the feeding slides 61 are reciprocated to and fro in unison with the movement of the bolster 11. Thus while the bolster 11 has a circular or gyratory motion combining both vertical and lateral movement, the feeding slides 61 respond to only the lateral movement and therefore reciprocate to and fro in properly timed relation, the vertical movement of the bolster being compensated for by the idle sliding movement of the slide block 63 within the slotted legs 62 of the stock feeding slides 61.

Mounted upon the opposite side of the bolster 11 are reciprocatory spring pressed plungers 66 carrying at their lower ends gripper feet 67 coacting with the gripper plates 62 of the feed ng slides 61. These plungers 66 are pressed downwardly by compression springs 68 located in spring housings 69 at opposite sides of the ram 10. The downward movement of the plungers 66 under influence of the spring 68 is limited by stop nuts 70 upon screw threaded stems 71 projecting from the upper ends of the reciprocatory plungers 66 and which engage with stop blocks 72 at the upper ends of the spring housings 69.

The feeding plungers 66 carried by the ram 10 project somewhat beyond the plane of the punch elements carried by the ram as the ram approaches the operating plane. The stock which is supplied to the machine in continuous strip form always rests upon the gripper plates 62 of the reciprocatory stock feeding slides 61. In the approach of the ram toward operating position, the gripper feet 67 of the plunger 66 engage the stock strip, clamping it between said gripper feet 67 and the gripper plates 62. As the ram, carrying the punch elements, continues to approach the simultaneouly approaching bolster carrying the die elements, the springs 68 are compressed, thus exerting ever increasing pressure upon the gripper members to hold the stock in relatively fixed relation with the die elements during the continued movement of the press parts. During the lateral swinging motion of the ram and bolster as the punch elements engage and release the stock intermediate the gripper members, the stock strip is advanced over the feeding tables 54 in unison with the lateral movement of the press parts. The springs 68 compensate for the relative movement of the ram and punch elements in relation with the gripper plungers 66 which are held by the springs in gripping engagement with the stock resting upon the gripper plates 62 of the feeding slides. When in the continued course of the gyratory motion of the ram the latter begins its ascending movement, the gripper plungers 66 are still held in stock-engaging position by the springs 68 until the stop blocks 72 at the upper ends of the spring housing 69 engage the stop nuts 70 upon the stem 71 of the plungers 66 thereby elevating the plungers from engagement with the stock. The bolster 11 carrying with it the stock-engaging plungers 66 passes over dead center position and descends at the opposite side of the axis of rotation of the crank shaft 8 and the plungers 66 are again depressed into engagement with the stock strip in advance of the engagement of the punch elements. Each succeeding point of engagement of the gripper plungers with the stock,

however, is in uniformly spaced relation with the previous point of engagement. Thus in the cycle of operation the gripper members repeatedly engage the stock strip, advancing it a distance determined by the degree of lateral swinging motion of the ram and bolster and then releasing the stock strip, returning with the continued motion of the ram to effect a new engagement therewith preparatory to the next punching and forming operation. At the same time the gyratory motion of the bolster 11 has been transmitted to the feeding slide 61, giving to these slides reciprocatory motion by which the gripper plates 62 are maintained at all times in registry with the gripper feet 67 of the plungers 66.

By adjusting the stop nuts 70 upon the plunger stems 71, the feeding plungers 66 may be retracted or extended relative to the ram 10 and thus be made to engage with the stock strip earlier or later in the cycle of operation. The earlier in the cycle of operation the disengagement is effected, the longer will be the feeding stroke of the stock, in proportion to the movement of the punch and die elements. The stroke of the ram and bolster are varied by the revoluble adjustment of the bearing sleeves 16 upon the crank shafts 8 and 9. This adjustment of the eccentric bearing sleeve changes the diameter of the circular or gyratory path of travel of the ram and bolster and consequently this will also effect a corresponding change in the advance feeding movement of the stock strip. However, by the adjustment of the stop nuts 70, the advance step of the stock may be very accurately regulated independently of the length of the ram and bolster stroke. It is quite obvious that the relative lengths of the strokes of the bolster and ram may be varied at will as may be also the relative lengths of the stock feeding strokes.

It is sometimes desirable to adjust the plane of operation to accommodate the press to different dies and different conditions of use. It is for this reason that the feeding tables 54 at opposite sides of the press are made adjustable relative to the main frame by releasing the clamp bolts 55. To enable the accurate adjustment of these feed tables, a series of graduations or index 75 is preferably provided upon the frame member 2 with which cooperates an indicator mark or gauge mark upon the feeding table. To facilitate the accurate adjustment of the feeding tables 54 when their securing bolts 55 have been loosened, a simple form of screw jack comprising a sleeve 76 of hexagonal stock screw threaded upon a screw stud 77 is provided beneath each of the feed tables 54. After loosening the clamp screws 55, the rotation of the sleeve 76 upon the screw stud 77 will serve to adjust the feed tables vertically with precision and hold them until they are again secured by the tightening of the clamp bolts 55. Likewise to enable accurate adjustment of the knock-out devices for the punches carried by the ram 10, the contact plate 43 with which the knock-out plungers 41 engage, is provided with a stop screw 78 screw threaded through the bridging tie members 7 of the main spring and by its adjustment limiting the relative adjustment of the contact plates 43 when its clamp bolts 79 have been loosened.

To prevent retraction of the stock strip due to inherent tension or curling, particularly when such stock material is supplied from a reel or closely wound roll, there are provided oscillatory gripper dogs 80 eccentrically pivoted to the inner faces of the stock guides 57 and urged into camming engagement with the stock passing therebeneath by springs 81. These eccentrically pivoted gripper dogs yield to permit the passage of the stock in the proper direction but exert a camming action binding upon the stock strip to resist its retractive movement due to inherent tension when the strip has been released by the stock feeding grippers 62—68.

Having thus described our invention, we claim:

1. In a power press, a main frame, a pair of reversely disposed crank shafts mounted therein and interconnected for unison rotation, a pair of cooperative die carrying members, one mounted on each crank shaft for unison actuation, an intermediate sliding connection between the die carrying elements whereby they are maintained in alinement during their relative travel movements, a stock gripper plunger yieldingly mounted upon one of the die carrying members and movable therewith, a complementary stock gripper member slidingly mounted upon the main frame and operatively connected with one of the die carrying members for unison movement therewith, said gripper members engaging the stock in the course of the cycle of operation in advance of the engagement therewith of the die members carried by said die carrying elements and serving to move the stock in unison with the movement of the die carrying members.

2. In a power press, a pair of complementary die carrying members, means for actuating said members toward and from each other and for giving to said members unison lateral shifting motion, and stock feeding members moving in unison with the die carrying members and engaging the stock in advance of its engagement by the die to positively advance the stock intermittently in unison with the lateral movement of said die carrying members, said members advancing the stock through a distance greater than the distance through which it is engaged by the dies.

3. In a power press, a pair of complementary die carrying members, means for actuating the members through gyratory paths of travel in which said members approach toward and recede from each other simultaneously with a lateral swinging motion, and stock gripping means carried by a die carrying member and operable to intermittently advance the stock in unison with the lateral swinging motion of the die carrying members while the die elements carried thereby are in engagement with the stock and retractive with the die carrying member independently of the stock, said gripping members causing the stock to move in unison with the dies prior to the engagement of the stock with the dies.

4. In a power press, a pair of complementary die carrying members, means for actuating said members simultaneously through different gyratory paths of travel in which they approach toward and recede from each other simultaneously with a unison lateral swinging motion, and guiding means for maintaining the die elements carried thereby in alinement throughout the cycle of operation, and stock feeding means operable by the movement of the die carrying member engageable with the stock in advance of its engagement by the die and operated to intermittently advance the stock while engaged by the die prior to and while the stock is engaged by the dies.

5. In a power press, a pair of complementary die carrying elements, means for actuating said

die carrying elements toward and from each other and for transmitting to said members a unison lateral motion while in intimate relation with a section of stock engaged therebetween and feeding means intermittently engaging the stock in advance of its engagement by the die carried by such element and moving in unison therewith during the period of die engagement whereby the stock is given advance movement prior to the engagement thereof by the dies.

6. In a power press, a pair of complementary die carrying members, actuating means transmitting to said members both movement toward and from each other and a lateral unison travel motion, and stock gripping members moving in unison with the die carrying members and engaging the stock operated upon in advance of the engagement of the die elements carried by said die carrying members to advance the stock in unison with the lateral motion of the said die carrying member said stock gripping member releasing the stock after the disengagement of the die therefrom.

7. In a power press, a die carrying member having both vertical and lateral motion, a complementary die carrying member with which the first member cooperates, a spring tensioned gripper plunger carried by said first mentioned die carrying element, a second gripper member into cooperating relation with which the plunger is advanced by the vertical movement of the die carrying member to grip therebetween a section of stock to be operated upon, said grippers moving to advance the engaged stock in unison with the lateral motion of the die carrying member, said gripping members advancing the stock a distance greater than the distance it is engaged by said die members.

8. In a power press, a die carrying member having both vertical and lateral motion, a complementary die carrying member with which the first member cooperates, a reciprocatory gripper member operatively connected with the die carrying member whereby the first mentioned die carrying member moves vertically independently of said gripper member and said gripper member moves horizontally in unison with the die carrying member, and a second gripper member cooperating with said first mentioned gripper member to advance the stock operated upon in unison with the lateral motion of the die carrying element.

9. In a power press, the combination with complementary die carrying elements of stock feeding means including a feeding table, a reciprocatory feeding element mounted thereon and having therein a guide portion extending perpendicularly to the plane of reciprocation, a rotary actuating member having free sliding connection with said guide portion whereby to and fro reciprocatory motion is transmitted from the rotary actuator to said feeding element, and a complementary feeding element movable toward and from the reciprocatory feeding element through a portion of its course and parallel therewith through the remainder of its course and a rotary actuator therefor with which the second feeding element is yieldingly mounted.

10. The comination with a power press, tools carried by the press for operating upon material fed thereto, of intermittently operated stock feeding means including a reciprocatory gripper member, and a complementary gripper member having a substantially gyratory path of travel intersecting that of the reciprocatory gripper member to grip therebetween the material to be advanced and traveling in unison with said reciprocatory member through a parallel path of travel during the material feeding movement, said gripper members engaging the material for a greater period of time than the engagement of the tools with the material.

11. The combination with a power press, tools carried thereby for operating upon the material fed thereto, of intermittently operated stock feeding mechanism including a reciprcatory gripper member and a complementary swinging gripper member following a circuitous path of travel in which it approaches toward and recedes from the reciprocatory gripper member during a portion of its path of travel and moves parallel to and in unison therewith during the remainder of its path of travel while the stock is engaged therebetween, the tools operating upon the material only during a portion of the time it is engaged by the gripper members.

12. In a power press, cooperative die carrying elements, and stock feeding means cooperating therewith, including a pair of complementary gripper members, means for reciprocating one of the gripper members in a substantially straight line and means for simultaneously moving the other gripper member through a substantially gyratory path of travel, a portion of which is parallel to that of the complementary gripper member with which it coacts during such parallel travel to advance the stock, said gripper members engaging the stock for a period greater than the period of engagement of the die members.

13. In a power press, a die carrying member, means for transmitting thereto a gyratory motion, a complementary die carrying member with which the first member cooperates, a stock gripper plunger yieldingly mounted on said die carrying member and moving in unison therewith, and a second stock gripper with which the plunger cooperates, extending into the path of travel thereof, said gripper members operating to advance the stock operated upon in a straight path of travel in unison with the lateral swinging motion of the die carrying member but for a greater period of time.

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