March 7, 1944. L. L. BABCOCK ET AL 2,343,441

BENDING BRAKE

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Fig. -1.

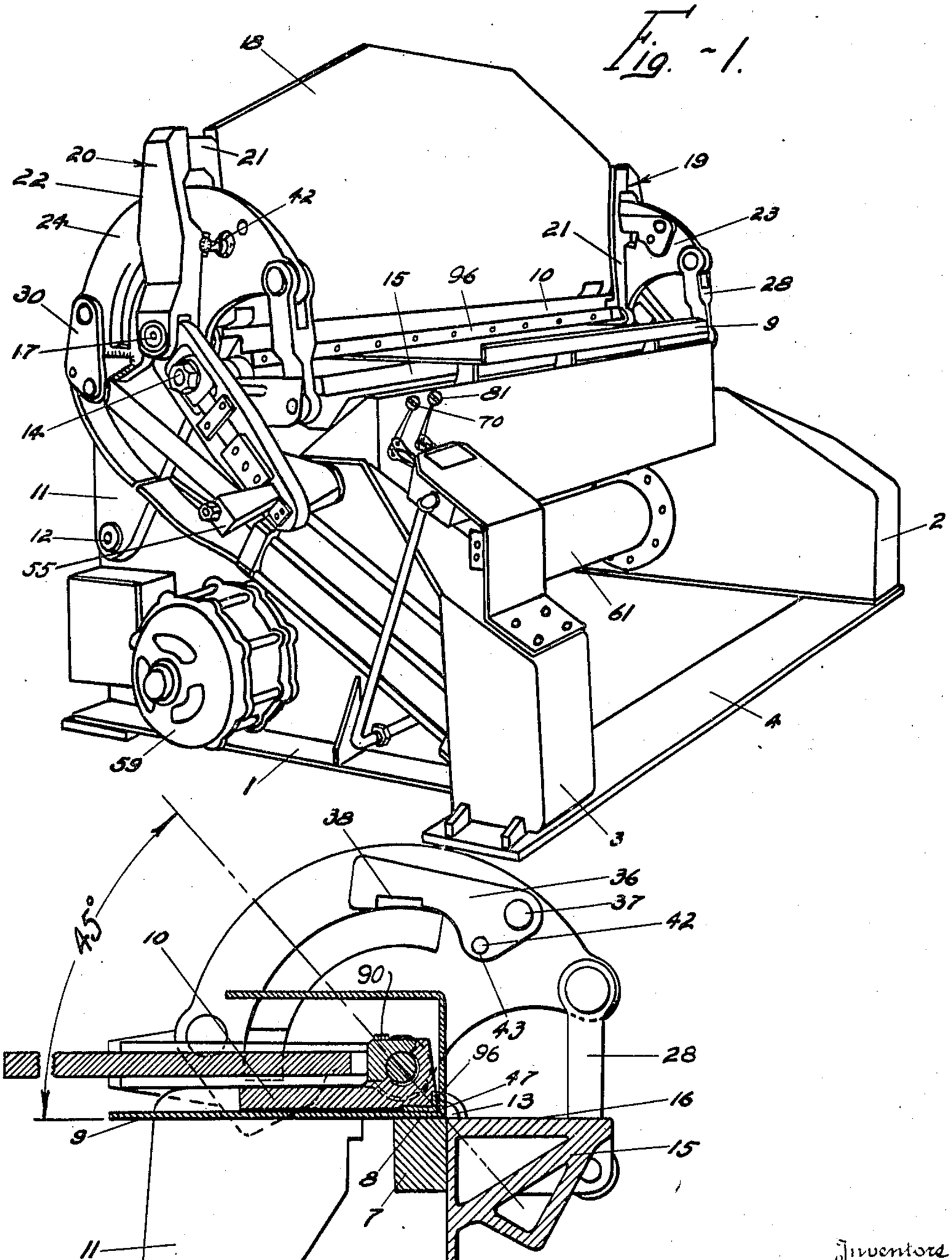

Fig. -3.

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Fig. -5

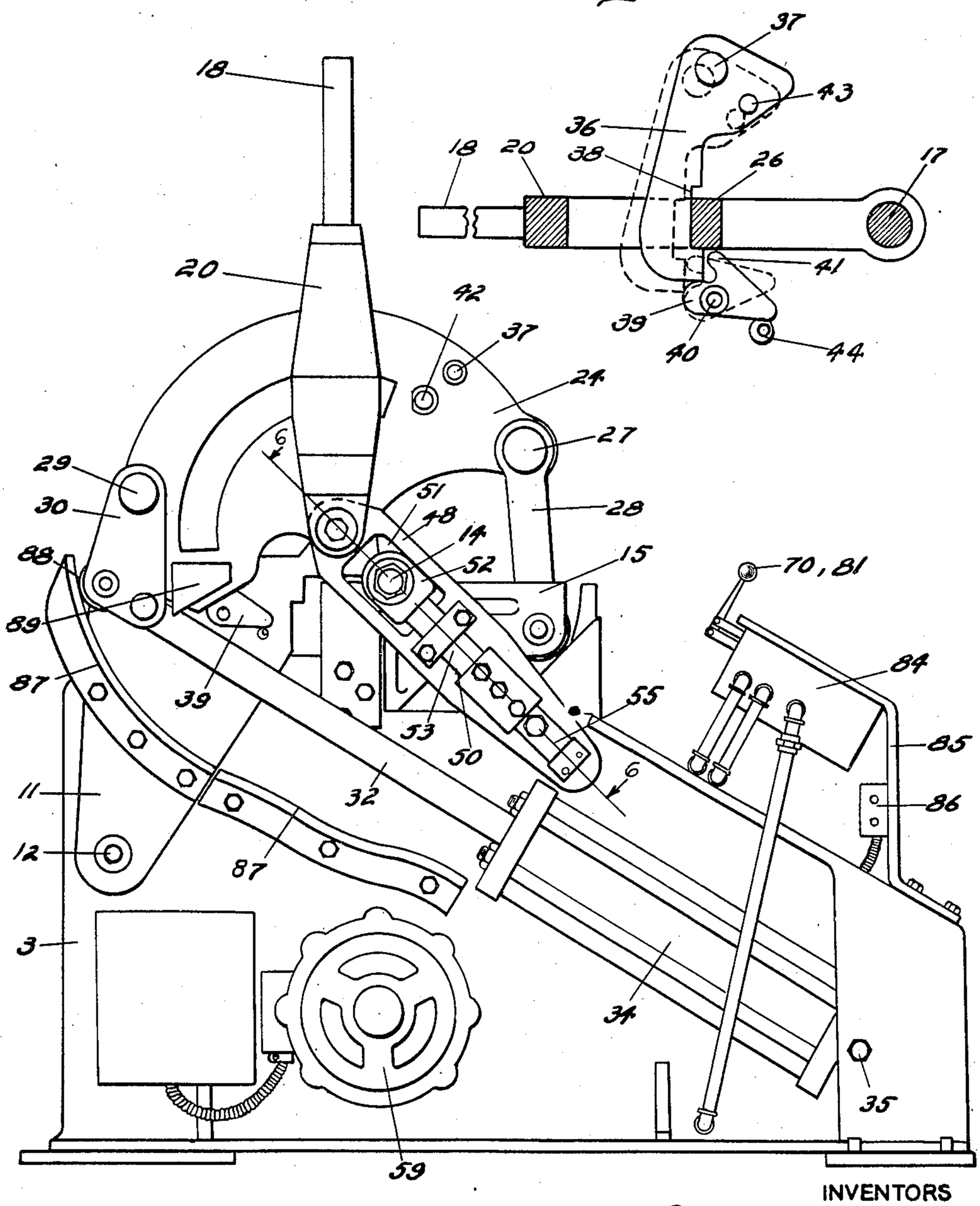

Fig. -2.

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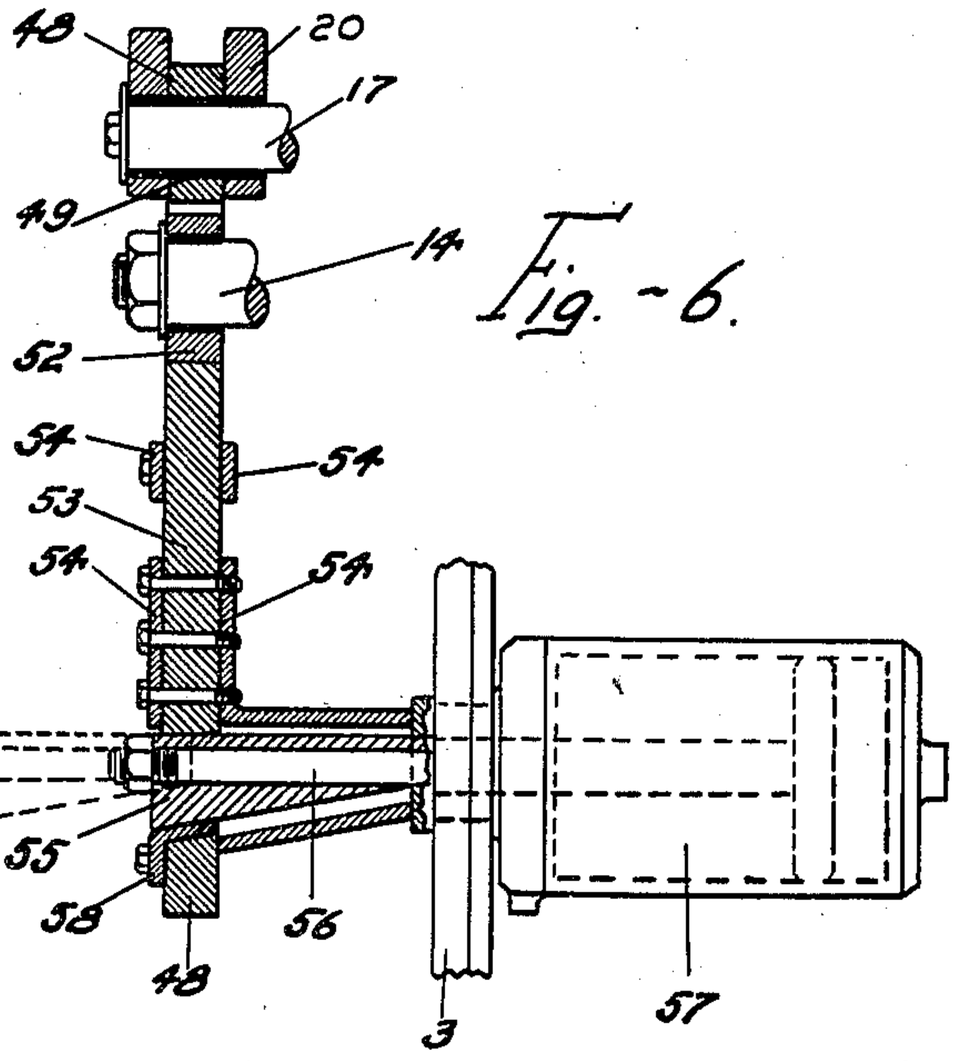

Fig. - 6.

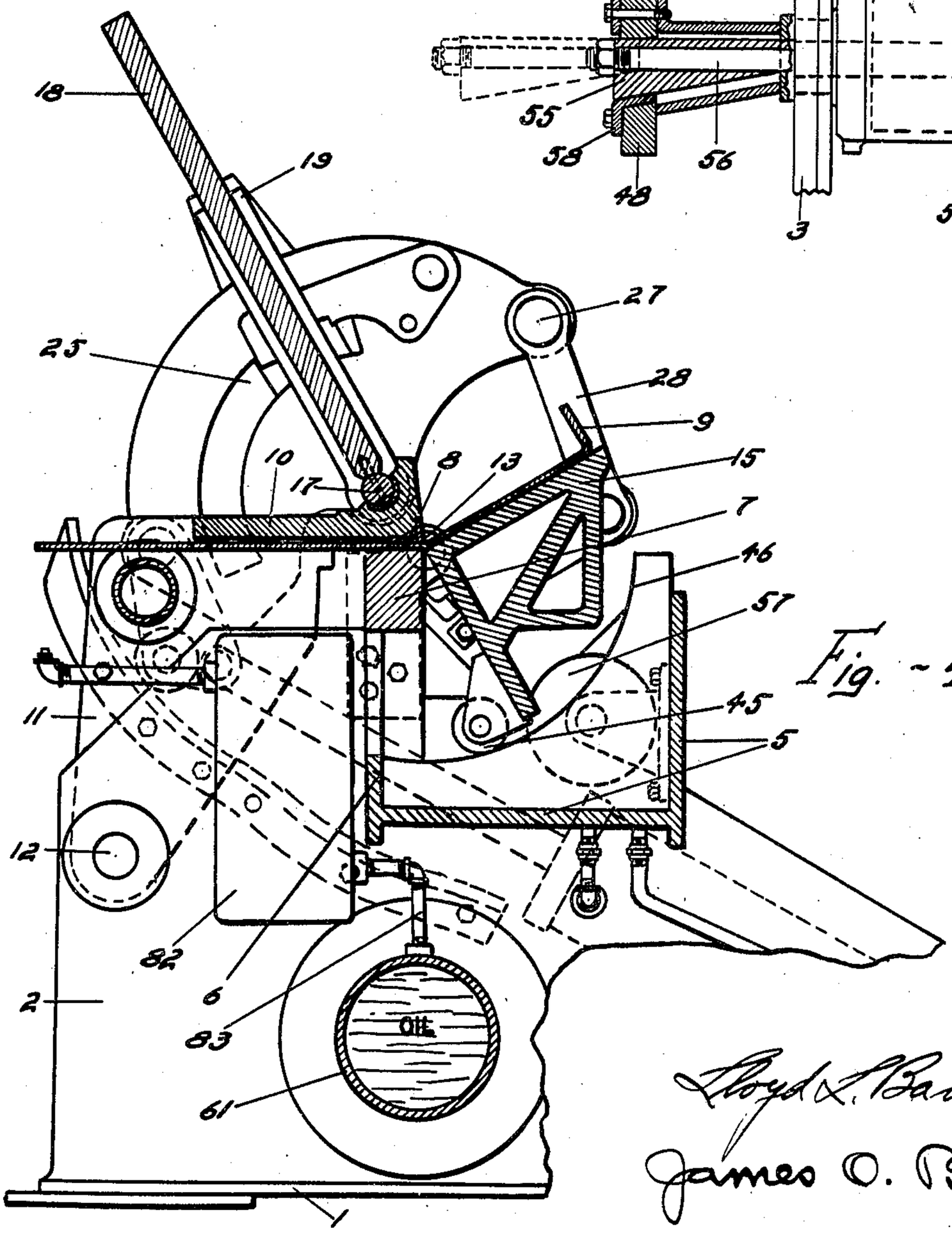

Fig. - 4.

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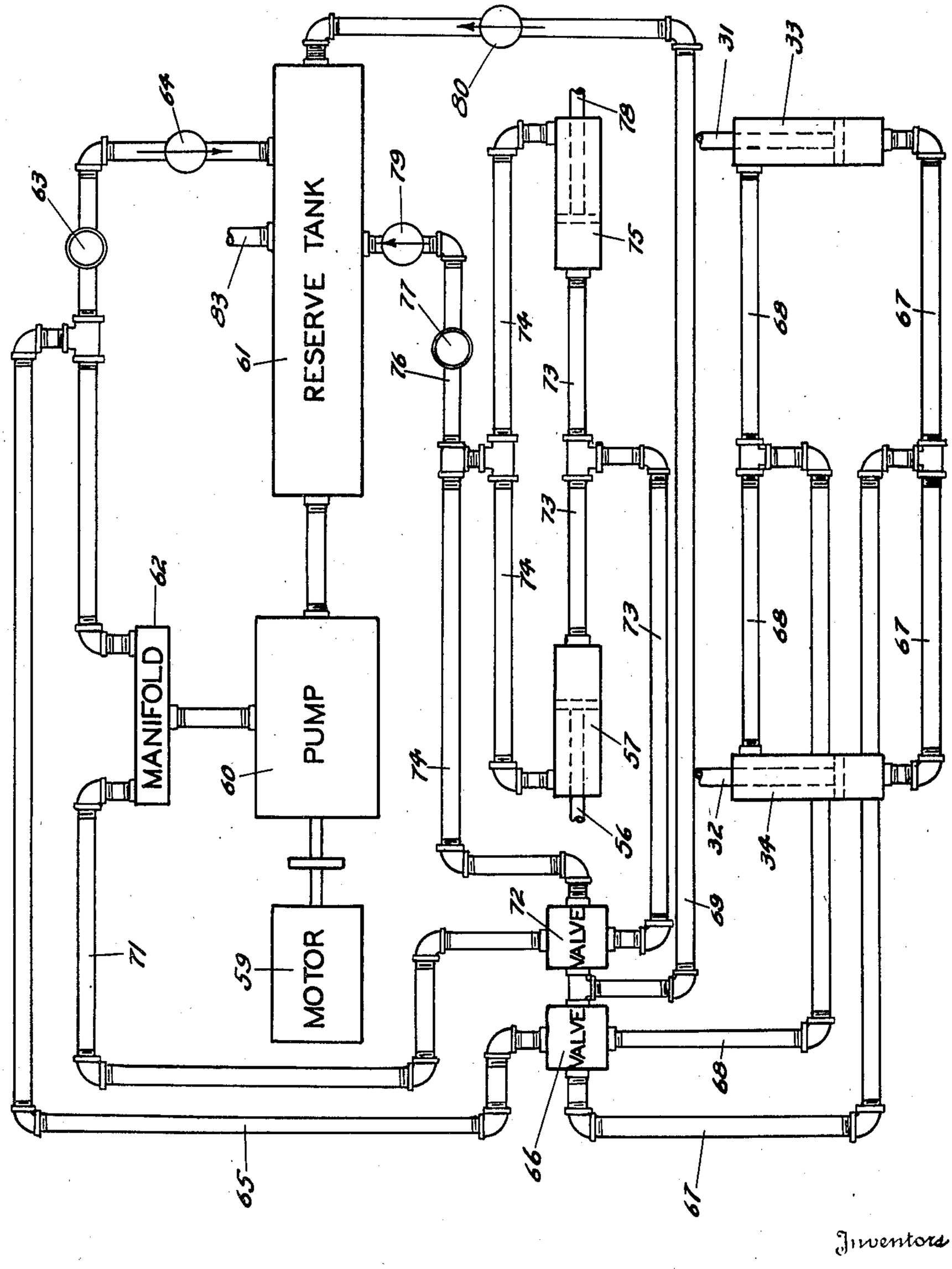

Fig. - 7

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UNITED STATES PATENT OFFICE

2,343,441

BENDING BRAKE

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Application October 21, 1941, Serial No. 415,916

25 Claims. (Cl. 153—16)

This invention relates to bending machines of the type commonly used for bending plate or sheet metal.

An object of this invention is to provide a self-contained bending machine operated by hydraulic power. Another object is to provide a bending machine of the type having upper and lower platens for clamping a work-piece and a pivotally mounted folding leaf, and provided with a pivotally mounted strongback adapted to prevent deflection of one of the platens under load. Another object is to provide a device of this type in which the strongback is adapted to rotate about its pivotal axis to remain substantially at right angles to the folding leaf. Another object is to provide a bending machine in which the strongback may be moved to an inoperative position to facilitate making a double bend, or box section. Another object is to provide a bending machine having upper and lower platens for clamping a work-piece, one of the platens being movable in an inclined direction with respect to the plane of the other platen in order to compensate for the thickness of the work-piece. Another object is to provide a bending machine having upper and lower platens and a folding leaf, in which the force applied to the folding leaf reacts to hold the platens in clamped position. A further object is to provide an improved apparatus for clamping the upper and lower platens together. Other objects and advantages will appear hereinafter.

In the drawings,

Fig. 1 is a perspective view showing a plate bending machine embodying our invention.

Fig. 2 is a side elevation thereof.

Fig. 3 is a sectional side elevation showing a portion of the device, and illustrating the strongback in its inoperative position.

Fig. 4 is a sectional side elevation similar to Fig. 3 but being more complete and showing a plate being bent.

Fig. 5 is a detail view partly in section showing a preferred form of apparatus for releasably actuating the strongback.

Fig. 6 is a partial sectional view taken substantially on the line 6—6 as shown on Fig. 2.

Fig. 7 is a schematic diagram showing the hydraulic system employed for actuating the folding leaf and the plate clamping mechanism.

Referring to the drawings, the base or frame 1 includes a pair of duplicate side members 2 and 3 integrally connected with transverse structural elements 4, 5, 6 and 7. The cross beam or lower platen 7 is provided with a flat upper surface or table 8 upon which the work piece 9 is adapted to rest. The upper platen or clamping member 10 extends transversely between the side members 2 and 3 and is provided with depending arms 11 which are pivotally supported on the side members by means of pins 12. This mounting permits the upper platen 10 to be moved about the axis of the pins 12 to accommodate plates 9 of different thicknesses. A pair of trunnions 13 and 14 are secured integrally to the frame 1 and are mounted with their axes co-axial and coincident with the upper outer edge of the table surface 8. Mounted for pivotal movement on these trunnions 13 and 14 is a heavily braced member referred to as the folding leaf 15. This folding leaf 15 is provided with a flat upper surface 16 adapted to engage the workpiece 9. Further to resist deflection of the folding leaf 15, a plurality of rollers 45 may be mounted thereon at spaced intervals and arranged to roll on trackways 46 supported on the frame elements 5 and 6.

A bar 17 mounted for turning movement with respect to the upper platen 10 and secured thereon by clips 90, extends transversely between the side frames 2 and 3, and secured to this bar 17 is the strongback 18 which, as illustrated, may consist principally of a single relatively thick steel plate. The purpose of this strongback 18 is to prevent deflection of the upper platen 10 while the folding leaf 15 is bending a workpiece 9. At each end the strongback 18 is provided with an end piece 19, 20 pivotally secured to the transverse bar 17. Each end piece 19, 20 is formed as a bifurcated member having an inside leg 21 and an outside leg 22 each provided with an aperture for reception of the bar 17.

Pivotally mounted on the bar 17 and positioned between the inside and outside legs 21, 22 of the end pieces 19, 20 respectively are a pair of quadrants 23 and 24. Each of the quadrants 23, 24 is provided with a cut-out or slot 25 which extends in an arc with the axis of the bar 17 as its axis. A cross rib 26 integrally connecting the legs 21 and 22 of the end piece 19, 20 is adapted to travel in the slot 25. Each of the quadrants is connected by means of a pin 27 to a tension link 28 which in turn is pivotally connected to the folding leaf 15. On the opposite side of the bar 17 from the pins 27, each quadrant 23, 24 is provided with a pin 29 for connection with a link 30. Also pivotally connected to the links 30 are the piston rods 31 and 32 extending from the main hydraulic cylinders 33 and 34. The cylinders 33, 34 are connected to their respective side frames 2, 3 by means of pins 35, to permit lim-

ited oscillatory movement of the cylinders occasioned by changes in the angular position of the piston rods 31, 32. It will be apparent from the drawings that when the piston rods 31, 32 are moved into their respective cylinders 33, 34 under hydraulic pressure that the quadrants 23, 24 are caused to rotate about the bar 17 to actuate the folding leaf 15.

A releasable latch mechanism is provided for connecting the strongback 18 to each of the quadrants 23 and 24, and includes latches 36 pivotally connected by pins 37 to each of the quadrants. A notch 38 in each latch 36 is adapted to engage the cross rib 26 associated with each of the end pieces 19 and 20, and when the notch 38 and cross rib 26 are thus engaged, the strongback 18 pivots as a unit with the quadrants. When the strongback is turned to a substantially horizontal position as shown in Fig. 5 the latches 36 each engage the nose of a cam 39 which is mounted on the frame 1 by means of a pivot pin 40. Continued rotation of the quadrants moves the latch 36 from the solid-line position to the position shown in dotted lines. During this movement a projection 41 on the cam 39 engages the side of the latch 36 and automatically disconnects the notch 38 from the cross rib 26. A plunger pin 42 mounted on the quadrant may then be manually engaged with the recess 43 provided in the latch 36, and thereby lock the latch in an inoperative position. Upon such disengagement of the latches 36, the quadrants and folding leaf 15 may be operated independently of the strongback. The cam 39 is of such shape that the notch 38 automatically re-engages the cross rib 26 upon return movement of the quadrants unless the plunger pin 42 is utilized to prevent this re-engagement. An eccentric 44 may be provided for adjusting the position of the cam 39.

The upper platen or clamping member 10 is preferably provided with a laterally extending removable angle piece 96 which forms the bending edge 47 around which the work-piece is bent. While it is necessary for the upper platen 10 to be capable of movement or adjustment in order to accommodate work pieces of different thicknesses, it will be apparent upon analysis that simple vertical adjustment of the upper platen 10 would not allow for the thickness of the work-piece at the location of the bend. For 90° bends (and this is the most common) it follows that the bending edge 47 should not be positioned directly above the pivotal axis of the folding leaf 15 but should lie in a plane containing this axis and inclined at 45° from the plane 8 of the lower platen or table 7. In this way the inside edge and the outside edge of the bend are formed in their proper angular relationship. Accordingly the upper platen 10 is mounted so that the bending edge 47 moves in an arc around the pivots 12, which arc approximates (within the limits of movement) a 45° plane containing the pivotal axis of the folding leaf 15.

When the hydraulic cylinders 33, 34 actuate their respective piston rods 31, 32 to pull downwardly upon the quadrants 23, 24, an upward force is transmitted to the folding leaf 15 through the links 28. Consequently the forces imposed on opposite sides of the quadrants produce a reaction force of the quadrants downwardly on the bar 17. This downward reaction force is thus applied to the upper platen 10 and hence assists in clamping the work-piece in place. It is thus apparent that actuation of the folding leaf 15 by means of the hydraulic cylinders 33, 34 automatically induces a reaction force to clamp the work piece between the upper and lower platens.

It has been found necessary in some cases to supplement this automatic clamping action by an additional positive acting means which is independent of the forces transmitted to the folding leaf 15. As shown, this supplementary clamping device includes a tension link 48 provided with an aperture 49 at one end for reception of the transverse bar 17 (see Fig. 6). Duplicate links and clamping devices are provided on both sides of the machine, and hence disclosure and description of one side only is deemed sufficient. The tension link 48 has a slot 50 therethrough extending for the major portion of its length, and enlarged at the end adjacent the aperture 49. Mounted within the enlarged opening 51 and having clearance therewith is an abutment lug 52 pivotally mounted on the stationary trunnion 14. A compression element 53 is slidably mounted within the slot 50 and is adapted to bear against the abutment lug 52 at one end. Keeper plates 54 are provided for maintaining the compression element in place within the slot 50. At its opposite end the compression element contacts one side of a transversely movable wedge 55.

The wedge 55 is secured on a piston rod 56 adapted to be actuated by hydraulic cylinder 57. When the wedge 55 is pulled in toward the position shown in full lines Fig. 6 the lower side of the wedge rides against a bushing 58 carried at the end of the slot 50 in the tension link 48. This action places the link 48 in tension and the element 55 in compression, thereby moving the trunnion 14 and bar 17 toward each other. Since the stationary trunnion 14 is anchored on the frame 1 the result is to force the bar 17 and upper platen 10 down upon the work-piece 9. This clamping force is released by moving the wedge 55 to the position shown in dotted lines in Fig. 6, thereby permitting the link 48 to move upward relative to the stationary trunnion 14 and hence release the work-piece.

The hydraulic system for actuating the main cylinders and the wedge cylinders includes an electric motor 59 driving a hydraulic pump 60. A reserve tank 61 is built into the frame structure 1 between the side members 2 and 3, and the pump 60 is adapted to deliver oil from this tank 61 to the distributing manifold 62. An adjustable pressure regulating valve 63 is provided for automatically limiting the maximum pressure which the pump 60 may work against. When the pressure in the manifold exceeds the predetermined value, the valve 63 opens and discharges back to the reserve tank 61 by way of the check valve 64. Piping 65 connects the manifold 62 with the main valve 66. From the main valve 66 are parallel lines 67, 68 leading to opposed ends of the main hydraulic cylinders 33 and 34, as well as a return line 69 leading back to the reserve tank. The main valve 66 has three positions, as follows: (*a*) for connecting the pressure line 65 with the line 67, and simultaneously connecting the line 68 with the return line 69; (*b*) for connecting the pressure line 65 with the line 68, and simultaneously connecting the line 67 with the return line 69; and (*c*) a neutral position in which the pressure line 65 is connected to neither line 67 nor line 68. A conveniently

located control lever 70 is provided for moving the main valve 66 to any of these positions.

Piping 71 connects the manifold 62 with the auxiliary valve 72, and also connecting to this valve 72 are parallel lines 73, 74 leading to opposed ends of the wedge-operating cylinders 57 and 75, as well as a return line 76 leading back to the reserve tank 61. A second pressure regulating valve 77 is provided to limit the maximum pressure which can be applied to actuate the piston rods 56 and 78. Check valves 79 and 80 may be provided in the return lines 76 and 69, if desired. A valve control lever 81 is used in a manner similar to that described for the main valve 66, in order to control movement of the piston rods 56 and 78. Thus the valve control lever 81 can be utilized to (*a*) connect pressure line 71 with line 73 and simultaneously connect line 74 with the return line 69, or (*b*) to connect pressure line 71 with line 74 and simultaneously connect line 73 with the return line 69, or (*c*) to close off communication with the pressure line 71.

An auxiliary oil chamber 82 may be provided if desired and connected to the reserve tank 61 by means of piping 83 (see Fig. 4). This chamber 82 is only partially filled with oil in order to provide for fluctuation in oil level. The oil level in the chamber 82 varies in height because the volume of oil contained in the hydraulic cylinders 33, 34, 57 and 75 depends upon the relative positions of their respective piston rods, since the piston rods reduce the available oil volume on one side of each piston.

The valves 66 and 72 are preferably mounted within a housing 84 carried by a bracket 85 on the side frame 3. The valve control levers 70 and 81 project upwardly for convenient operation. The control switch 86 for the electric motor 59 is also advantageously mounted on the bracket 85.

When it is desired to insert a work-piece 9 between the upper platen 10 and the lower platen 7 the piston rods 31 and 32 are moved outwardly to their full extent. Guide tracks 87 are provided on the depending arms 11 and side frames 2 and 3 to cooperate with rollers 88 mounted on the link 30. The quadrants 23 and 24 are thus rotated to return the folding leaf 15 to its initial position, and when the folding leaf reaches this position continued movement of the piston rods 31 and 32 lifts the quadrants 23, 24 and hence the bar 17 and upper platen 10 through clips 90. Upward movement of the platen 10 is limited by the abutment lugs 52 meeting the lower end of the openings 51 in the links 48.

The operation of the bending machine is as follows. The electric motor is started by manually actuating the switch 86, and the pump 60 thereafter maintains a constant supply of fluid under pressure in the manifold 62. The main control lever 70 is moved forward to cause delivery of pressure fluid to the back ends of the main hydraulic cylinders 33, 34 via piping 67 and hence the piston rods 31, 32 move out to their fully extended position. This raises the upper platen 10 away from the surface 8 of the lower platen 7, as explained above. A metal sheet 9 may then be inserted between the platens 7 and 10. The main control lever 70 is then moved rearward to cause delivery of pressure fluid to the front ends of the main hydraulic cylinders 33, 34 via piping 68 and hence the piston rods 31, 32 are retracted until the upper platen 10 rests on the sheet or plate 9. The lever 70 is then returned to neutral position.

The auxiliary control lever 81 is then moved forward to deliver pressure fluid to the front ends of the wedge-operating cylinders 57 and 75 via piping 74 and thereby cause the piston rods 56 and 78 to move the wedges 55 back into the slots 50 in the links 48. This action pulls the bar 17 toward the trunnions 13, 14 and hence clamps the work-piece or plate 9 between the upper platen 10 and the lower platen 7. The wedges 55 do not reach the fully retracted position shown in full lines Fig. 6, but owing to the thickness of the plate 9 stop at some intermediate point between the dotted line extended position and the full line retracted position. When the upper platen 10 and the lower platen 7 have the work-piece 9 clamped therebetween in solid metal-to-metal relation, the wedges 55 stop their inward movement and the excess pressure fluid delivered to the cylinders 57 and 75 by the pump 60 is by-passed back to the reserve tank 61 by means of the pressure regulating valve 77. The auxiliary control lever 81 is then returned to its neutral position, thereby maintaining tension on the links 48 and holding the work-piece securely clamped between the upper and lower platens.

To commence bending the plate 9, the main control lever 70 is moved forward. This causes the main hydraulic cylinders 33, 34 to pull downwardly on piston rods 31, 32 and move the links 30 into contact with abutments 89 secured on the quadrants 23, 24. The tension exerted on the quadrants by way of the abutments 89 and pins 29 acts to pivot the quadrants about the bar 17 and thus turn the folding leaf 15 about the stationary trunnions 13, 14. With the control lever 70 holding the main valve 66 fully open, the rate of turning of the folding leaf 15 is determined by the rate of discharge from the hydraulic pump 60 into the main cylinders 33, 34. The bending of the plate 9 may be stopped at any desired angular position or may be continued to form a right angle bend. It should be noted that the strongback 18 remains substantially at right angles to the folding leaf surface 16, and hence is maintained in the optimum position for preventing deflection of the upper platen 10. When the bend has been completed the control lever 70 is moved rearward and the hydraulic cylinders 33, 34 then return the quadrants, strongback and folding leaf to their initial positions. The auxiliary control lever is then moved rearward to move the wedges 55 outward to their inoperative position, thereby releasing the clamping forces so that the plate 9 may be removed.

If it should be desired to make more than one bend in a plate 9, the strongback 18 may be released from the quadrants 23, 24 after the second bend to permit returning the folding leaf 15 to its initial position while maintaining the strongback horizontal (see Fig. 3). If the strongback could not be released from the quadrants it would be impossible to remove the U shaped plate from the machine, because the strongback would remain at right angles to the folding leaf as the latter turned back to its initial position. It is to be understood that both bends are made with the strongback 18 functioning to prevent deflection of the upper platen 10, and that it is released from the quadrants 23, 24 only at the completion of the second bend. When it is desired to reestablish the latch connection between the quadrants and the strongback, the folding leaf 15 is

raised to its vertical position. The manually operated plunger pins 42 are then pulled out of engagement with the recesses 43 in the latches 36. The folding leaf is again lowered and the latches 36 swing by gravity to engage the recesses 38 with the cross ribs 26 of the strongback end members 19 and 20.

While we have shown only the preferred form of our invention, it should be understood that various changes or modifications may be made within the scope of the appended claims without departing from the spirit of the invention.

We claim:

1. In a plate bending machine, the combination of upper and lower platens adapted to clamp a plate therebetween, a folding leaf pivotally mounted with respect to the lower platen and adapted to bend the plate, a stiffener member pivotally mounted on the upper platen, and means operatively connecting the stiffener member and the folding leaf adapted to maintain the stiffener member substantially at right angles to the work engaging face of the folding leaf for any operative position thereof.

2. In a plate bending machine, the combination of a frame having a stationary table thereon, a movable clamping member adapted to cooperate with the table to clamp a plate to be bent, a folding leaf pivotally mounted on the frame, a strongback pivotally mounted on the movable clamping member and adapted to prevent deflection thereof under load, and means adapted to maintain the strongback at substantially right angles to the work engaging face of the folding leaf during rotation of the folding leaf about its pivotal axis.

3. In a bending machine, the combination of a stationary member and a movable member adapted to clamp a work-piece therebetween, a folding leaf adapted to bend the work-piece, a strongback pivotally mounted relative to one of said members and adapted to prevent deflection thereof under load, means forming an operative connection between the strongback and the folding leaf to effect dependent rotation thereof, said means acting to cause pivotal movement of the stiffener member in conformance with movement of the folding leaf, said operative connection being releasable to permit independent movement of the folding leaf.

4. In a plate bending machine, the combination of a frame having a stationary table thereon, a movable clamping member adapted to cooperate with the table to clamp a plate to be bent, a folding leaf pivotally mounted of the frame and adapted to bend the plate, a strongback pivotally mounted on the clamping member and adapted to prevent deflection thereof under load, means forming an operative connection between the strongback and the folding leaf to cause pivotal movement of the strongback in conformance with the movement of the folding leaf, said connection being releasable to permit the strongback to remain in an inoperative position during operative movement of the folding leaf.

5. In a plate bending machine, the combination of a stationary table, a movable clamping member adapted to cooperate with the table to clamp a plate to be bent, a folding leaf, a power source, a force transmitting element operatively connected at spaced points to said folding leaf and said power source respectively, pivotal means operatively connecting the force transmitting element to said clamping member at a location intermediate the aforesaid spaced points, the power source being adapted to turn the force transmitting element about its pivotal axis to actuate the folding leaf for bending the plate.

6. In a plate bending machine, the combination of a stationary table, a movable clamping member adapted to cooperate with the table to clamp a plate to be bent, a folding leaf pivotally mounted independently of the clamping member, a force transmitting element pivotally mounted on the clamping member, a link directly connecting the force transmitting element and the folding leaf, and means adapted to turn the force transmitting element about its pivotal axis to actuate the folding leaf for bending the plate.

7. In a plate bending machine, the combination of a frame having a stationary table thereon, a movable clamping member adapted to cooperate with the table to clamp a plate to be bent, a folding leaf pivotally mounted on the frame, means for actuating the folding leaf to bend the plate, said means including a quadrant pivotally mounted on the clamping member, means at one side of the quadrant axis operatively connecting the quadrant to the folding leaf, and means at the other side of the quadrant axis operatively connecting the quadrant to a power source, the arrangement and position of the last two said means being such that when the power source is operated to turn the quadrant about its axis to actuate the folding leaf that a reaction force is produced on the clamping member to maintain the plate in clamped position.

8. In a bending machine, the combination of a frame having a stationary table thereon, a movable member adapted to cooperate with the table to secure a work-piece to be bent, a folding leaf pivotally mounted on the frame and adapted to bend the work-piece, a laterally extending trunnion on the movable member, a tension link pivotally connected at one end to said trunnion and extending at the other end to a position remote from the trunnion and from the pivotal axis of the folding leaf, means to apply a tension force to the other end of said link in order to clamp the movable member with respect to said frame, said means including a wedge operable in a direction transverse to the link, and means selectively operable to actuate the wedge.

9. In a bending machine, the combination of a frame having a stationary table thereon, a movable clamping member adapted to cooperate with the table to secure a work piece to be bent, a strongback mounted on the clamping member, a tension link pivotally associated at one end with the strongback and extending at the other end to a position remote therefrom, means to apply a tension force to the other end of said link in order to clamp the movable member with respect to said frame, said means including a wedge operating transversely through an aperture formed in the link.

10. In a bending machine, the combination of a frame having a stationary table thereon, a movable clamping member adapted to cooperate with the table to secure a work piece to be bent, a strongback supported on the clamping member and adapted to prevent deflection thereof, means forming a pivotal connection between the strongback and the clamping member, a tension link provided with a longitudinally extending aperture, said tension link being pivotally mounted at one end with respect to said means and extending at the other end to a

position remote therefrom, and additional means acting in said aperture near the remote end of said link adapted to apply a tension force to said link to clamp the movable member with respect to said frame.

11. In a bending machine, the combination of a frame having a stationary table thereon, a movable member adapted to cooperate with the table to secure a work piece to be bent, a folding leaf pivotally mounted on the frame and adapted to bend the work-piece, a strongback pivotally supported on the movable member and adapted to prevent deflection thereof under forces applied by the folding leaf, a tension link pivotally associated at one end with said movable member and strongback and extending at the other end to a position remote therefrom, and means near the remote end of said link and acting transversely of the link to apply a tension force thereto in order to clamp the movable member with respect to said frame.

12. The construction claimed in claim 11 in which the link extends away from the strongback and movable member in a direction approximately 45° from the plane of the table.

13. In a bending machine, the combination of a frame having a stationary table thereon, a movable member adapted to cooperate with the table to secure a work piece to be bent, a folding leaf pivotally mounted on the frame and adapted to bend the work-piece, a bar pivotally mounted on the movable member and extending parallel with the pivotal axis of the folding leaf, a strongback comprising a heavy plate member secured along one edge to said bar and adapted to prevent deflection of the movable member, a tension link pivotally connected at one end to said bar and means mounted on the frame adapted to apply a tension force to the other end of said bar whereby the movable member may be clamped with respect to said table.

14. In a bending machine, the combination of a frame having a stationary table thereon, a movable clamping member adapted to cooperate with the table to secure a work piece to be bent, a folding leaf adapted to bend the work piece, pivotal means for supporting the folding leaf including a trunnion fixed integrally upon the frame, a strongback adapted to prevent deflection of the movable member, a bar secured to the strongback along one edge thereof and pivotally supported on the movable member, a bar extending parallel to the pivotal axis of the folding leaf, a tension link pivotally secured at one end to said bar and extending at the other end to a position remote therefrom, the link having a central aperture into which the trunnion extends, means to apply a tension force to said link in order to clamp the movable member with respect to said frame, said means including a wedge operatively interposed in the aperature between said trunnion and the remote end of said link, and selective means for moving said wedge in a direction transverse to said link.

15. In a bending machine, the combination of a frame having a stationary table thereon, a movable member adapted to cooperate with the table to secure a work piece to be bent, a folding leaf pivotally mounted on the frame and adapted to bend the work piece, a bar pivotally mounted on the movable member and extending transversely of the work piece, a strongback comprising a heavy plate member secured along one edge to said bar and adapted to prevent deflection of the movable member, a force transmitting member pivotally mounted upon said bar, a link connecting the force transmitting member and the folding leaf, and power means adapted to turn the force transmitting member about its pivot in order to actuate the folding leaf.

16. In a bending machine, the combination of a frame having a stationary table thereon, a movable member adapted to cooperate with the table to secure a work piece to be bent, a folding leaf pivotally mounted on the frame and adapted to bend the work piece, a strongback adapted to prevent deflection of the movable member, a bar secured to the strongback along one edge thereof and pivotally supported on the movable member, the bar extending parallel to the pivotal axis of the folding leaf, the strongback having an opening extending therethrough, a quadrant member pivotally mounted upon said bar and arranged to oscillate through said opening, link means connecting the quadrant member and the folding leaf, and power means for operating the quadrant member.

17. The construction as claimed in claim 16 in which a releasable mechanical connection is provided between the quadrant member and the strongback.

18. In a bending machine, the combination of a movable clamping member, a strongback pivotally mounted on the clamping member and adapted to reinforce it against deflection, a folding leaf, means for operating the folding leaf including a quadrant member pivotally mounted on the movable clamping member, the pivotal axes of the quadrant member and the strongback being coincident, means including a releasable latch normally connecting the strongback to the quadrant member, power means for turning the quadrant member and the strongback about their common pivotal axis, and means automatically operable to disconnect the latch upon the strongback turning through a predetermined angular distance.

19. The combination set forth in claim 18 in which a manually operable element is provided for maintaining the latch in disconnected position.

20. In a plate bending machine, the combination of a frame having a stationary table thereon a movable clamping member adapted to cooperate with the table to clamp a plate to be bent, a folding leaf pivotally mounted on the frame and having a work-engaging surface adapted to bend the plate, a force transmitting element pivotally mounted on the clamping member, power means to rotate said folding leaf about its axis to bend the plate, and means operatively connected between the folding leaf and said element to maintain the principal plane of said element substantially normal to the working surface of the leaf throughout the operating range of said leaf.

21. In a bending machine, the combination of a frame having a stationary table thereon, a movable member adapted to cooperate with the table to secure a work-piece to be bent, a folding leaf pivotally mounted on the frame and adapted to bend the work-piece, means to clamp the movable member with respect to the frame, said means including an open link element surrounding a stationary element on said frame, wedge means operatively interposed between said link and stationary elements, and hydraulic means selectively operable to actuate said wedge means.

22. In a plate bending machine, the combi-

nation of a frame having a stationary table thereon, a movable clamping member adapted to cooperate with the table to clamp a plate to be bent, a folding leaf pivotally mounted on the frame and having a work-engaging surface adapted to bend the plate, a force transmitting element pivotally mounted on the clamping member, power means to rotate said folding leaf about its axis to bend the plate, means operatively connected between the folding leaf and said element to maintain the principal plane of said element substantially normal to the working surface of the leaf throughout the operating range of said leaf, and means to disconnect said element from operative connection with said leaf.

23. In a plate bending machine, the combination of upper and lower platens adapted to clamp a plate therebetween, said platens being relatively stationary in the clamping position, a folding leaf adapted to bend the plate, a stiffener member pivotally mounted on one of said platens and adapted to prevent deflection thereof under load, and means operatively connecting the stiffener member and the folding leaf for dependent rotation and maintaining a substantially constant angular relation between said stiffener member and the work engaging face of said folding leaf during its pivotal movement.

24. In a bending machine, the combination of a stationary member and a movable member adapted to clamp a work-piece therebetween, said members being relatively stationary in the clamping position, means to apply a bending force to the work-piece, a strongback pivotally mounted relative to one of said members and adapted to reinforce and prevent deflection thereof under load, and means adapted to maintain the strongback substantially parallel to the direction of the bending force, said means being operative to turn the strongback on its mounting relative to the one said member in a manner to constantly reinforce the one said member during bending of the work-piece and maintain a constant angular relation between said strongback and the work engaging face of said force applying means.

25. In a bending machine, the combination of a stationary member and a movable member adapted to clamp a work-piece therebetween, said members being relatively stationary in the clamping position, a folding leaf pivotally mounted relative to the stationary member and adapted to bend the work-piece, a strongback adapted to prevent deflection of the movable member while the folding leaf bends the work-piece, means for maintaining a predetermined angular relation between said folding leaf and said strongback throughout the bending operation, and means to establish an operative connection between the folding leaf and the strongback and adapted to move the strongback to an inoperative position.

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