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(54) **Workpiece-supporting device for bending machines.**

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Description

The present invention relates to a device to support a workpiece which being bent by a press brake.

A press brake to bend heavy workpieces such as steel sheets is usually equipped with a device to support the workpiece which is raised as the processing progresses. The device functions to prevent the workpiece from bending at a shoulder of a die of the press brake because of the dead load as well as force of inertia, as well as to remove the workpiece from the press brake after the processing is completed.

The device comprises typically a fundamental frame placed before a bed of the press brake. The frame is equipped with an arm pivotaly fixed to the frame near the bed so that its rear half, or the farther one from the bed, is directed to the die on the bed. The rear half of the arm supports a table by way of a guidance means, which allows the table to approach or go away from the die. The table is so positioned before the processing starts that its top is on the same level with that of the die. A raising means is provided to raise the table by means of the arm in synchronization with the processing of the workpiece by the press brake. The device is also equipped with a position control means which maintains the distance between the table and die throughout the processing.

The guidance means usually comprises a pair of guide rails extending toward the die along the table top which supports the workpiece and two pairs of members to be guided by the rails, arranged at an appropriate interval between each pair. The members are actually sliders or rollers which slide or roll on the rails. The rails and members are arranged alternatively either on the bottom of the table or on the rear half of the arm. Because the guide rails extend straight, the arm and table are raised at the same angle.

Generally speaking, when workpieces are bent by bending machines, as the punch advances downward after it gets in touch with the workpiece, the workpiece is bent while supported at ridges where the top of the die meets surfaces forming a processing groove. Portions of the workpiece between and outside the ridges would be lowered and raised at the same speed if the workpiece were a perfectly rigid body. Actually, however, the workpiece is a sheet or plate of steel or iron and not a rigid body. Therefore, while portions outside and near the ridges are raised at an approximately same speed as the portion between the ridges is lowered, portions far from the ridges rise at a lower speed and accordingly behind the portions near the ridges because of the dead load as well as force of inertia. As a result, elastic deformation is caused and the workpiece curves convexly, swelling upwards, near the die. It is known that the elastic deformation is apparent particularly at the beginning of the processing where the processing is most rapidly. The deformation usually disappears as the processing by the punch progresses and becomes more and more slow.

The table top cannot follow up well the workpiece, particularly at the beginning of the processing, because the rise of the table is controlled in synchronization with descent of the punch or of the portion of the workpiece between the ridges. As a result, plastic deformation may be caused, at the ridges of the die for instance, or the workpiece curved apart the table may vibrate which causes the point of the workpiece where the punch should be applied to displace.

US-A-3,715,907 discloses apparatus according to the pre-characterising part of claim 1 for supporting sheet materials in bending presses. It has a support member which is mounted on a first link and a second link. Gearing exists between the first and second links so that the sheet materials is always in contiguous contact with the support member during the bending operation.

SUMMARY OF THE INVENTION

It is a general object of the present invention to provide a device to support the workpiece which is capable of closely following up the workpiece which is raised while curving convexly.

According to the present invention, a workpiece supporting device for a bending machine comprises a fundamental frame 2 disposed forwardly of a press brake 2 of the bending machine, a table 3 disposed above the fundamental frame 2; said table 3 being provided with an upper flat surface and positioned at a level substantially equal to the upper surface of a die 5 fixed on the press brake 1, an arm 14 pivotable about the front lower portion of the fundamental frame 2 as a pivotal center; said arm 14 having guidance means 15 for supporting the table 3 so that the table top is aligned with the die 5, the guidance means 15 support the table 3 at a portion of the arm 14 remote from the pivot to move forward and rearward against the die 5; said guidance means 15 including a pair of guide rails 16 provided with either the table 3 or the arm 14 to extend along the upper surface of the table 3 towards the die 5, two pairs of guide roller means 17 provided with either the table 3 or the arm 14 leaving a space in a direction of extension of the guide rails 16, so as to be guided by said guidance means 15, position control means 13 for controlling a distance between the table 3 and the die 5, to be constant at the time of swing of the arm 14 and the table 3, swing drive means for upwardly swinging

the table 3 via the arm 14 in cooperation with the operation of a ram 8 of the bending machine, said device is characterized in that:

each said guide rails 16 includes a curved guide portion 18 which, when the arm 14 is displaced during a bending operation, displaces at least one pair of said guide roller means 17 in a direction perpendicular to the upper surface of the table 3 so that in use, during initial bending the arm 14 is displaced and an inclined angle α of the table 3 becomes smaller than a swing angle β of the arm 14 and towards completion of bending the angles α and β approach equality.

An embodiment of the present invention is now described by way of an example and with reference to the accompanying drawings, wherein:

Figure 1 is a side elevational view in a cross section of an embodiment of the workpiece supporting device for a press brake according to the present invention;

Figure 2 is a diagram illustrating action of the arm and table of the supporting device;

Figure 3 is a schematic side view of the supporting device when the workpiece is mounted on the table;

Figure 4 is a schematic side view of the supporting device when the workpiece is positioned between the punch and die of the press brake;

Figure 5 is a schematic side view of the supporting device when the workpiece is positioned on the die;

Figure 6 is a schematic side view of the supporting device after processing of the workpiece is completed;

Figure 7 is a schematic side view of the supporting device when the workpiece are lifted apart the die;

Figure 8 is a schematic side view of the supporting device after the workpiece is withdrawn out of the press brake;

Figure 9 is a schematic side view of the supporting device when the workpiece is returned to the original position after the processing; and

Figure 10 is a timing chart illustrating time relation between actions of parts of the supporting device.

The workpiece-supporting device embodying the present invention comprises a fundamental frame 2 placed in front of a press brake 1. A table 3 having a plane top is supported by the frame 2. The Frame 2 and table 3 can be shifted toward or away from the press brake by means of a shifting means 7.

The frame 2 and table 3 are positioned in the rear, or farthest from the press brake, as illustrated in Figures 3 and 9, to mount a workpiece W such as a steel plate onto the table at a predetermined position from a conveyor not illustrated in the drawings or return the workpiece from the table to the conveyor. On the other hand, they are positioned in the front or nearest the press brake as illustrated in Figures 4-7 while the workpiece is processed. When the frame 2 and table 3 are in the front, the point of the workpiece to which the punch of the press brake is to be applied is located vertically above the center line of a groove 11 which is cut on the top of a die 5.

The shifting means 7 comprises an air cylinder 24 and a guidance means 25 as illustrated in Figure 1. The air cylinder 24 is fixed at one end in a pit 23 and connected at the other to a lifting means 6, which carries the frame 2 and table 3. The forward and backward movement of the lifting means carrying the frame and table is guided by the guidance means 25, which further comprises a pair of parallel guide rails 26 and two pairs of guide rollers 27. The guide rails 26, which is made of channel steel, extend in the pit 23 toward the press brake. The pairs of the guide rollers 27, arranged at an appropriate distance between each other, roll on the rails 26.

The other structure of the shifting means 7 than described above is also applicable as far as the frame 2 and table 3 can be carried to and fro between the front and rear positions.

The lifting means 6 comprises a table lifter which further comprises pairs of bars each consisting of two bars crossing each other as illustrated in Figure 1. The structure enables the frame and table to be lifted and lowered very accurately. The lifting means 6 is so constructed that it can lift and lower the table 3 at least between a standard position HO and a high position Hh as illustrated in Figure 1. The table 3 is positioned at the standard position HO while the workpiece is processed, where the bottom of the workpiece W mounted on the table is in touch with the top of the die 5. After the processing finishes, the table is lifted to the high position Hh to lift the workpiece W off the processing groove 11. The other structure than described above is also applicable as long as it can lift and lower the table 3 at least between the standard and high positions HO and Hh.

Preferably, the lifting means 6 is so constructed that it can lower the table 3 to a low position Hl as illustrated in Figure 1. When the workpiece W has been bent so deep, for example, that it will touch a punch 9 of the press brake if withdrawn horizontally, the table 3 is lowered from the high position Hh to the low position Hl while being withdrawn to the rear. The workpiece is thus able to pass obliquely between the punch 9 and die 5. Figures 7 and 8 illustrate such oblique lowering of the workpiece.

After the table 3 is positioned in the front and the punch 9 gets in contact with the workpiece W,

the table 3 at the standard position HO is is raised by a raising means 10 to support the portion of the workpiece which is raised on a ridge 12 of the die 5 as the punch 9 descends and the processing progresses. In the present embodiment, the table 3 is raised from a horizontal position A to an inclined position B as indicated in Figures 1 and 2 in synchronization with the processing. The workpiece is raised at about 45 ° at the inclined position B. The punch 9 is lifted off the workpiece after the processing finishes. The table 3 is then shifted to the rear by the shifting means 7 and returned to the horizontal position by the raising means 10. The distance between the table 3 and ridge 12 is maintained by a position control means 13 throughout the raising and lowering of the table.

The raising means 10 comprises an air cylinder 28 to raise the table 3 by way of the arm 14 and a supporting spring 29 to support the weight of the arm, table and workpiece at early stages of the processing. The supporting spring 29 is provided to nullify the load onto the air cylinder 28 at the beginning of the processing as well as to absorb any shock which occurs when the table returns to the horizontal position after the processing is completed. Additionally, a cushion is separated inside the cylinder 28, though not illustrated in the drawings, wherein pressure increases as the cylinder extends. The extension of the cylinder 28 is thus stopped very smoothly when the table reaches the inclined position.

Any other structure is applicable to the raising means 10 as long as the arm 14 is able to be raised and lowered around a fulcrum shaft 35 to raise and lower the table 3 between the inclined and horizontal positions.

The arm 14 is so incorporated in the system that its rear half, or the farther one from the die 5, is always directed toward the die throughout the processing. The table 3 supported by the rear half is able to move to and fro along the rear half while being guided by a guidance means.

The position control means 13 comprises a pair of parallel position control boards 31, a pair of position control pins 32 and, preferably, a supporting means 33. The parallel boards 31 are fixed under the table 3 with an appropriate distance between each other. They have congruent position control grooves 30 opened therein respectively. Each of the grooves 30 is an arc of which center is the ridge 12. The position control pins 32 are fixed on the sides of the fundamental frame 2 to be inserted movably in the grooves 30. The distance between the table 3 and ridge 12 is maintained irrespective of the angle α, by which the table is raised, by the position control means 13 which pushes the table away from the ridge as the table is raised. Any other structure of the position control means 13 is applicable as long as it can maintain the distance between the table and ridge throughout the operation.

The supporting means 33 is preferably included in the position control means 13, which comprises a link lever 34 and coil spring 36. The top end of the link lever 34 is connected to the front of the table 3, slidably in the vertical direction to the table top, while the middle of the lever is connected to the arm 14 with a pivot as illustrated in Figure 1. The coil spring 36 on the other hand connects between the bottom end of the link lever 34 and the fulcrum shaft 35.

The higher the table 3 is raised, the larger weight of the table 3 falls on the position control pins 32. The supporting means 33 is provided to share the weight so that the pins 32 and boards 31 can be of a smaller size. The supporting means is, however, not indispensable to the present invention. Even when it is added to the system, the structure is not restricted to the above-described one.

The guidance means 15 comprises a pair of guide rails 16 and two pairs of guide rollers 17. The guide rails 16 are fixed under the table 3. The guide rollers 17 are attached to both the sides of the rear half of the arm 14 with an appropriate distance between the pairs so that they can roll on the rails 16. The table 3 is pushed away from the ridge 12 by the position control means 13 as the arm 14 is raised while being guided by the guidance means 15.

A raising control means 18 is provided on the rails 16, nearer to the bed than the guide rollers 17 at the beginning of the processing, which curves convexly, swelling downwards. After the table 3 starts being raised and the front pair of the rollers 17 reach the raising control, the front end of the table is pushed up by degrees by the rollers proceeding along the raising control. After the rollers pass the summit of the raising control, the displacement of the table front is removed as the raising continues. As a result, the rising angle α of the table 3 is made smaller than the rising angle β of the arm 14 through a predetermined range of the angle β.

A number of fixing devices 19 are provided on the table top at appropriate intervals to fix the workpiece W on the table 3 while the workpiece is taken away from the press brake. Though, strictly speaking, the follow-up surface 20 which is in contact with the workpiece is determined by the tops of the fixing means 19, the follow-up surface 20 is illustrated in Figure 2 as coinciding with the table top for the sake of simplicity of the drawing.

Any kinds of fixing devices, such as electric magnets or vacuum absorbtion devices, will do as the devices 19 as far as they can firmly fix the

workpiece W on the table 3. The vacuum absorbtion devices are preferred in the present embodiment because they can fix the workpiece irrespective of its intensity of magnetism. The fixing devices 19 functions while, after the processing has been completed, the punch is lifted off the workpiece, the workpiece is lifted off the die and withdrawn out of the press brake, and the table returns to the rear horizontal position.

Additionally, the table 3 is divided into a middle table 21 and a pair of side tables 22 at both sides of the middle table. The middle and side tables are linked by means of a pivot and the bottoms of the middle and side tables are connected by a pair of second air cylinders. The side tables 22 can be raised to a standing position C as illustrarted in Figure 1 by extending the air cylinders after the table 3 reaches the inclined position B. The fixing devices 19 are provided on the side tables 22 so that the workpiece can be fixed between the inclined and standing positions B and C. When the front end of the bent workpiece W is positioned higher than the tip of the punch 9 after both the punch and workpiece have been lifted off the die 5, the side tables are raised further to the position C together with the bent workpiece so that the workpiece can be withdrawn out of the press brake horizontally without touching the tip.

The side tables 22 are equiped, though not illustrated in the drawings, on their tops with ball or roller bearings to facilitate the mounting of the workpiece onto the table 3 as well as removing thereof from the table.

The weight of the table and workpiece falls more and more on a front portion of the fundamental frame 2 as the table and workpiece are raised. A supporting spring 37 is therefore provided connecting the frame 2 with the base of the lifting means 6 to prevent the rear portion of the frame 2 from being raised.

Plate bending work is achieved as follows by the press brake equipped with the follow-up supporting device of the present invention, under the control of a program incorporated in the sytem, or following instructions provided by the operator to the system:

At setting step, the fundamental frame 2 is positioned in the rear while the table 3 is laid horizontally at the high position Hh so that a workpiece W is mounted thereon a a predetermined position with a conveyor not illustrated. The frame 2 is then shifted to the front position as illustrated in Figure 4 by extending the air cylinder 4 of the driving means 7, where the point of the workpiece to which the punch should be applied is positioned vertically above the center line of the groove 11. The table 3 is then descended to the standard position HO and the setting of the workpiece W in the press brake 1 is completed.

At processing step, the ram 8 starts descending and the table 3 starts being raised when the punch 9 gets in touch with the workpiece W.

The load against the punch 9, which is comparatively small at the early stages of the processing, increases as the processing progresses because of work hardening. As a result, the descending speed of the punch 9, as well as the rising speed of the workpiece W outside the ridge 12, becomes smaller and smaller. Diminution of the descending speed is represented for instance by a sine curve.

In the preferred embodiment, since the total weight of the arm, table and workpiece is wholly supported by the supporting spring 29 at the beginning of the processing, the air cylinder 28 starts extension with no considerable mechanical resistance when pressure air starts being supplied to the air cylinder. As the air cylinder 28 extends, the supporting spring 29 also extends and the weight of the arm, table and workpiece gradually becomes shared by the air cylinder 28. Additionally, pressure increases in the cushion cylinder of the cylinder 28 by degrees as the cylinder extends. The extension speed of the air cylinder 28 is thus the largest at the beginning of the extension and diminishes as the extension progresses.

Both the descent of the punch and extension of the air cylinder are at the highest speed at the beginning of the processing and diminish thereafter, which means the table 3 can fellow up well the workpiece W. Plastic deformation at the ridge, as well as oscillation on the table, of the workpiece W, which may be caused by the prior art because of the separate rising of the table and workpiece, can thereby be prevented.

Because of the air pressure in the cushion cylinder which increases as the air cylinder 28 extends, the extension of the air cylinder can be stopped very smoothly when the table is fully raised. Since the table 3 stops extension without no considerable schock, any displacement of the workpiece at the stop can be avoided.

As described above, at the early stages where the rising speed of the workpiece is comparatively high, elastic deformation of the workpiece is caused near the die, which makes the workpiece curve upwards convexly. The rising angle of a portion remote from the die, in other words, is smaller than that of a portion near the die. In the present invention, the front pairs of the guide rollers 17 advancing along the raising control means 18 pushes upwards the front end of the table at the early stages and thereby makes the rising angle α of the table smaller than the rising angle β of the arm, as pointed to by an arrow B′ in Figure 2. After the rollers pass the summit of the raising control, the

displacement of the table front is removed by degrees as the raising continues. The angles α and β agree again when the front rollers 17 pass over the raising control. As a result, the separate rising of the workpiece and table is prevented even at the early stages of the processing. Plastic deformation of the workpiece at the ridge 12, as well as oscillation and displacement thereof on the table, can be prevented.

The table 3 is in the inclined position as illustrated in Figure 6 when the punch 9 has pressed down the workpiece W to the bottom of the groove 11 and the processing has finished. Next, at withdrawal step, the ram 8 and punch 9 are lifted after the workpiece is fixed on the table by the fixing means 19. The table 3 is then lifted to the high position Hh with the lifting means 6 to separate the bent workpiece from the die 5 as illustrated in Figure 7. The workpiece is then withdrawn from the press brake 1 by contracting the air cylinder 24 of the driving means 7 and returning the frame 2 and table 3 to the rear, before or after the table is again laid horizontally. When the front end of the bent workpiece may get in touch with the lifted punch if shifted horizontally, for instance when the workpiece has been bent so deep or protrudes so far from the press brake, the workpiece can pass obliquely between the punch 9 and die 5 by achieving the horizontal shift of the table to the rear simultaneously with lowering of the same to the low position Hl. In this case the table 3 is laid horizontally only after the withdrawl to the rear has been completed. The table 3 can be returned to the horizontal state also smoothly because the supporting spring 29 absorbs the shock, which prevents the workpiece from rebounding and displacing on the table.

Thereafter, the table 3 is again lifted to the standard position HO with the lifting means 6 and the bent workpiece is transferred onto a conveyor, which carries the workpiece away, and one cycle of the processing is completed.

The way of the processing is not restricted to the one described above. For example, when the workpiece is bent not so deep or does not protrude so far, the table 3 may not be lifted to the high position Hh but returned from the inclined position B to the horizontal position A simultaneously with lifting of the punch 9 before shifted to the rear. The order of withdrawl to the rear, lowering to the horizontal state and lifting to the high position is exchangeable with each other or can be performed simultaneously. The table positions where the workpiece is mounted onto and removed from the table can be determined freely and can be different from each other.

While the embodiments of the present invention, as herein disclosed, constitute a preferred form, it is to be understood that other forms might be adopted.

Claims

1. A workpiece supporting device for a bending machine comprises a fundamental frame (2) disposed forwardly of a press brake (2), a table (3) disposed above the fundamental frame (2); said table (3) being provided with an upper flat surface and positioned at a level substantially equal to the upper surface of a die (5) fixed on the press brake (1), an arm (14) pivotable about the front lower portion of the fundamental frame (2) as a pivotal center; said arm (14) having guidance means (15) for supporting the table (3) so that the table top is aligned with the die (5), the guidance means (15) support the table (3) at a portion of the arm (14) remote from the pivot to move forward and rearward against the die (5); said guidance means (15) including a pair of guide rails (16) provided with either the table (3) or the arm (14) to extend along the upper surface of the table (3) towards the die (5), two pairs of guide roller means (17) provided with either the table (3) or the arm (14) leaving a space in a direction of extension of the guide rails (16), so as to be guided by said guidance means (15), position control means (13) for controlling a distance between the table (3) and the die (5), to be constant at the time of swing of the arm (14) and the table (3), swing drive means for upwardly swinging the table (3) via the arm (14) in cooperation with the operation of a ram (8) of the bending machine, said device is characterized in that:

each said guide rails (16) includes a curved guide portion (18) which, when the arm (14) is displaced during a bending operation, displaces at least one pair of said guide roller means (17) in a direction perpendicular to the upper surface of the table (3) such that in use, during initial bending the arm (14) is displaced and an inclined angle α of the table (3) becomes smaller than a swing angle β of the arm 14 and towards completion of bending the angles α and β approach equality.

2. A device as recited in claim 1 further comprising a lifting means (6) which is able to shift the fundamental frame (2) together with the table (3) in the vertical direction between a position higher than the die (5) at which the workpiece is mounted on the table (3) and another position which is lower than the die (5).

3. A device as recited in claim 1 or 2 of which the table (3) comprises:

a middle table;

a pair of side tables located on both sides of the middle table respectively;

a pivot extending through the ends nearer to the die of the middle and side tables;

a second raising means connecting the bottoms of the middle and side tables which further raises the side tables together with the workpieces after the bending work is completed.

Patentansprüche

1. Werkstückstützvorrichtung für eine Biegemaschine, welche ein Grundgestell (2) aufweist, das an einer Abkantpresse (1) in Richtung nach vorne angeordnet ist, ferner einen Tisch (3), welcher oberhalb des Grundgestells (2) angeordnet ist, wobei der Tisch (3) mit einer oberen, ebenen Fläche versehen ist und in einer Höhe im wesentlichen gleich wie die obere Fläche eines Gegenstempels (5) positioniert ist, welcher an der Abkantpresse (1) fest vorgesehen ist, einen Arm (14), welcher um das vordere, untere Teil des Grundgestells (2) als ein Drehmittelpunkt drehbeweglich ist, wobei der Arm (14) Führungseinrichtungen (15) zum Tragen des Tisches (3) derart hat, daß die Tischoberseite mit dem Gegenstempel (5) fluchtet, die Führungseinrichtungen (15) den Tisch (3) an einer Stelle des Arms (14) entfernt von der Drehachse abstützen, um diesen in Richtung nach vorne und hinten gegen den Gegenstempel (5) zu bewegen, die Führungseinrichtungen (15) ein Paar von Führungsschienen (16) umfassen, welche entweder am Tisch (3) oder am Arm (14) vorgesehen sind und entlang der oberen Fläche des Tisches (3) in Richtung zu dem Gegenstempel (5) verlaufen, sowie zwei Paare von Führungsrolleneinrichtungen (17), welche entweder am Tisch (3) oder am Arm (14) unter Freilassung eines Zwischenraums in Erstreckungsrichtung der Führungsschienen (16) derart vorgesehen sind, daß eine Führung mittels den Führungseinrichtungen (15) vorhanden ist, eine Positionssteuereinrichtung (13) zum Steuern eines Abstandes zwischen dem Tisch (3) und dem Gegenstempel (5) in einer solchen Weise, daß dieser zum Zeitpunkt der Drehbewegung des Arms (14) des Tisches (3) konstant ist, und eine Drehantriebseinrichtung zum nach oben Drehen des Tisches (3) über den Arm (14) im Zusammenwirken mit dem Arbeiten eines Kolbens (8) der Biegemaschine aufweist, wobei die Vorrichtung sich durch folgendes auszeichnet:

jede Führungsschiene (16) umfaßt einen gekrümmten Führungsteil (18), welcher dann, wenn der Arm (14) während eines Biegevorganges verschoben wird, wenigstens ein Paar der Führungsrolleneinrichtungen (17) in einer Richtung senkrecht zu der oberen Fläche des Tisches (3) derart verschiebt, daß im Gebrauchszustand während des Beginns des Biegevorganges der Arm (14) verschoben wird und ein Neigungswinkel α des Tisches (3) kleiner als ein Drehwinkel β des Arms (14) wird, und daß in Richtung der Beendigung des Biegevorganges die Winkel α und β annähernd gleich werden.

2. Vorrichtung nach Anspruch 1, welche ferner eine Hubeinrichtung (6) aufweist, welche die Fähigkeit hat, das Grundgestell (2) zusammen mit dem Tisch (3) in einer vertikalen Richtung zwischen einer Position, die höher als jene des Gegenstempels (5) ist, an der das Werkstück an dem Tisch (3) angebracht ist, und einer weiteren Position verschiebbar zu machen, welche niedriger als der Gegenstempel (5) ist.

3. Vorrichtung nach Anspruch 1 oder 2, bei der der Tisch (3) folgendes aufweist:

einen Mitteltisch;

ein Paar von Seitentischen, welche auf beiden Seiten des Mitteltisches jeweils liegen;

eine Drehachse, welche durch die Enden des Mitteltisches und der Seitentische geht, die näher zu dem Gegenstempel liegen;

eine zweite Hubeinrichtung, welche die Bodenteile des Mitteltisches und der Seitentische verbindet, und die die Seitentische zusammen mit dem Werkstück nach der Beendigung der Biegebearbeitung weiter anhebt.

Revendications

1. Dispositif pour supporter une pièce pour une machine à plier comportant un châssis de base (2) disposé à l'avant d'un frein de presse (1), une table (3) disposée au-dessus du châssis (2), ladite table (3) comportant une surface plane supérieure et étant positionnée à un niveau qui est sensiblement le même que celui de la surface supérieure d'une matrice (5) fixée sur le frein de presse (1), un bras (14) susceptible de pivoter par rapport à la partie inférieure avant du châssis de base (2) et qui constitue son centre de pivotement; ledit bras (14) comportant des moyens de guidage (15) pour supporter la table (3) de telle sorte que le sommet de la table soit aligné avec la matrice (5), le moyen de guidage (15) supporte la table

(3) en une partie du bras (14) qui se trouve éloignée par rapport au pivot pour se déplacer vers l'avant et vers l'arrière contre la matrice (5); ledit moyen de guidage (15) comportant une paire de rails de guidage (16) prévus soit sur la table (3) soit sur le bras (14) pour s'étendre le long de la surface supérieure de la table (3) vers la matrice, deux paires de moyens de guidage formant galets (17) prévus avec la table (3) ou avec le bras (14) en laissant un espace dans la direction d'extension des rails de guidage (16) de façon à être guidés par ledit moyen de guidage (15), un moyen de contrôle de position (13) pour contrôler que la distance entre la table (3) et la matrice (5) reste contante au moment du basculement du bras (14) et de la table (3), un moyen d'entraînement de basculement pour faire basculer vers le haut la table (3) par l'intermédiaire du bras (14) en coopération avec le fonctionnement d'un poussoir (8) de la machine à plier, ce dispositif étant caractérisé en ce que : chacun desdits rails de guidage (16) comporte une partie de guidage incurvée (18) qui, lorsque le bras (14) est déplacé au cours de l'opération de pliage, déplace au moins une paire desdits moyens formant galets de guidage (17) dans une direction perpendiculaire à la surface supérieure de la table (3) de telle sorte que, en cours d'utilisation, au début du pliage, le bras (14) se déplace et l'angle d'inclinaison α de la table (3) devient plus petit que l'angle de basculement β du bras (14) et, vers la fin du pliage, les angles α et β deviennent approximativement égaux.

2. Dispositif tel que décrit à la revendication 1, comportant en outre un moyen de levage (6) qui est susceptible de déplacer le châssis de base (2) avec la table (3) dans le sens vertical entre une position plus haute que celle de la matrice (5), dans laquelle la pièce est montée sur la table (3) et une autre position qui est plus basse que la matrice (5).

3. Dispositif tel que défini dans la revendication 1 ou 2, dans lequel la table (3) comporte :

une table de milieu ;

une paire de tables latérales disposées respectivement sur les deux côtés de la table de milieu ;

un pivot s'étendant à travers les extrémités des tables de milieu et latérales qui sont les plus proches de la matrice ;

un second moyen de soulèvement connectant les parties inférieures des tables de milieu et latérales, qui continue à soulever les tables latérales en même temps que la pièce à travailler une fois l'opération de pliage terminée.

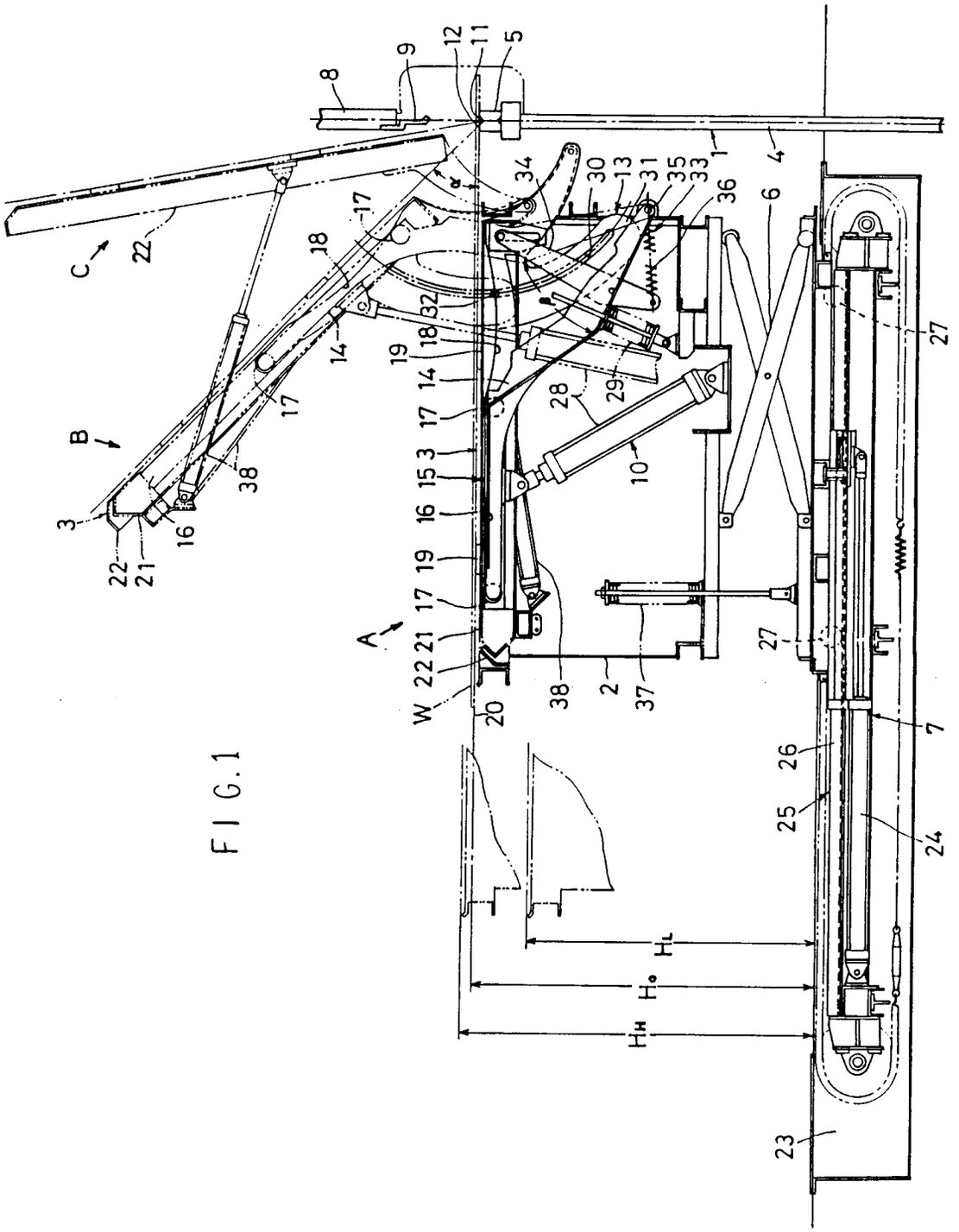


FIG.1

FIG.2

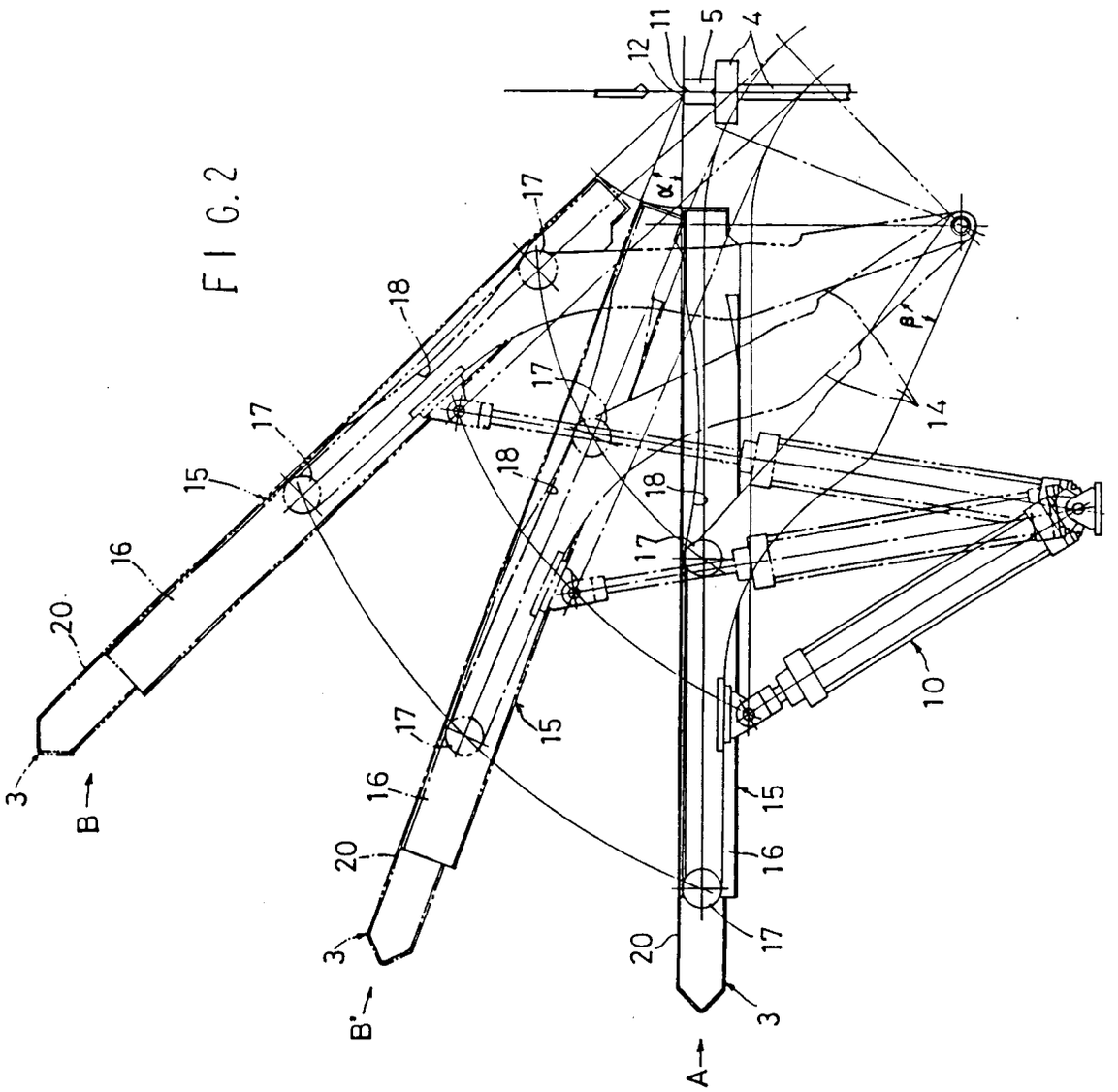


FIG.3

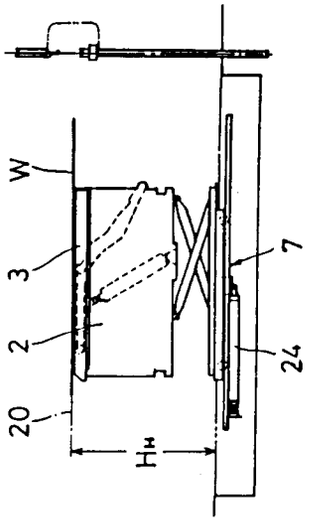


FIG.4

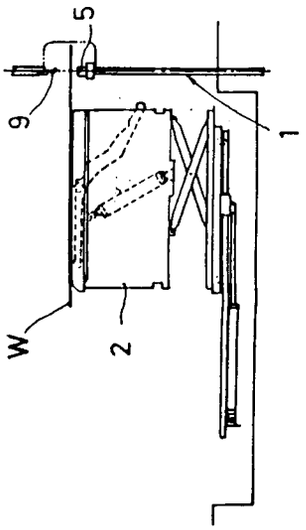


FIG.5

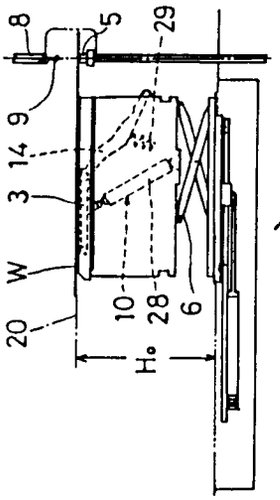


FIG.6

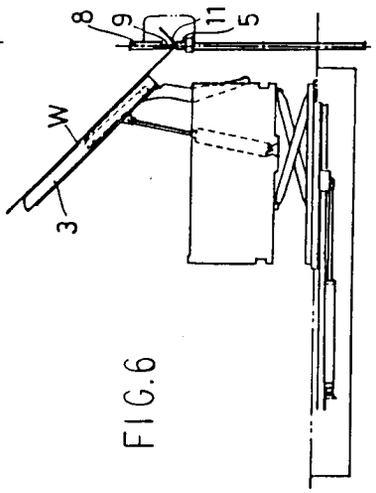


FIG.7

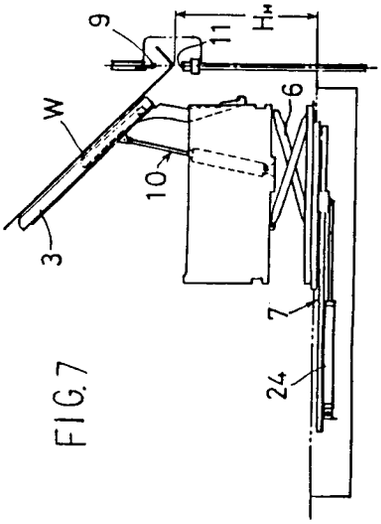


FIG.8

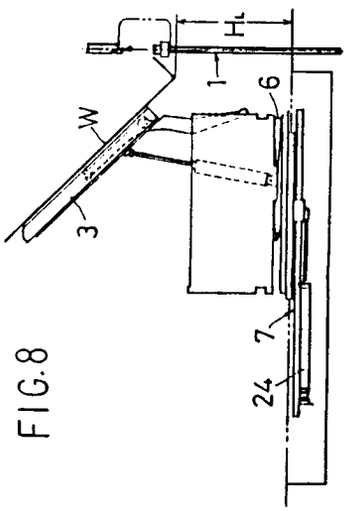


FIG.9

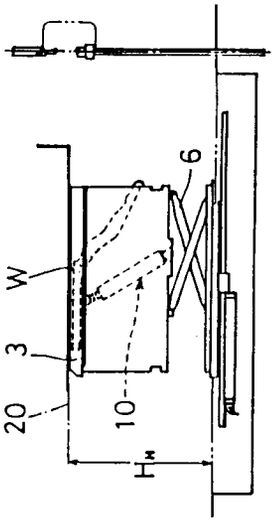
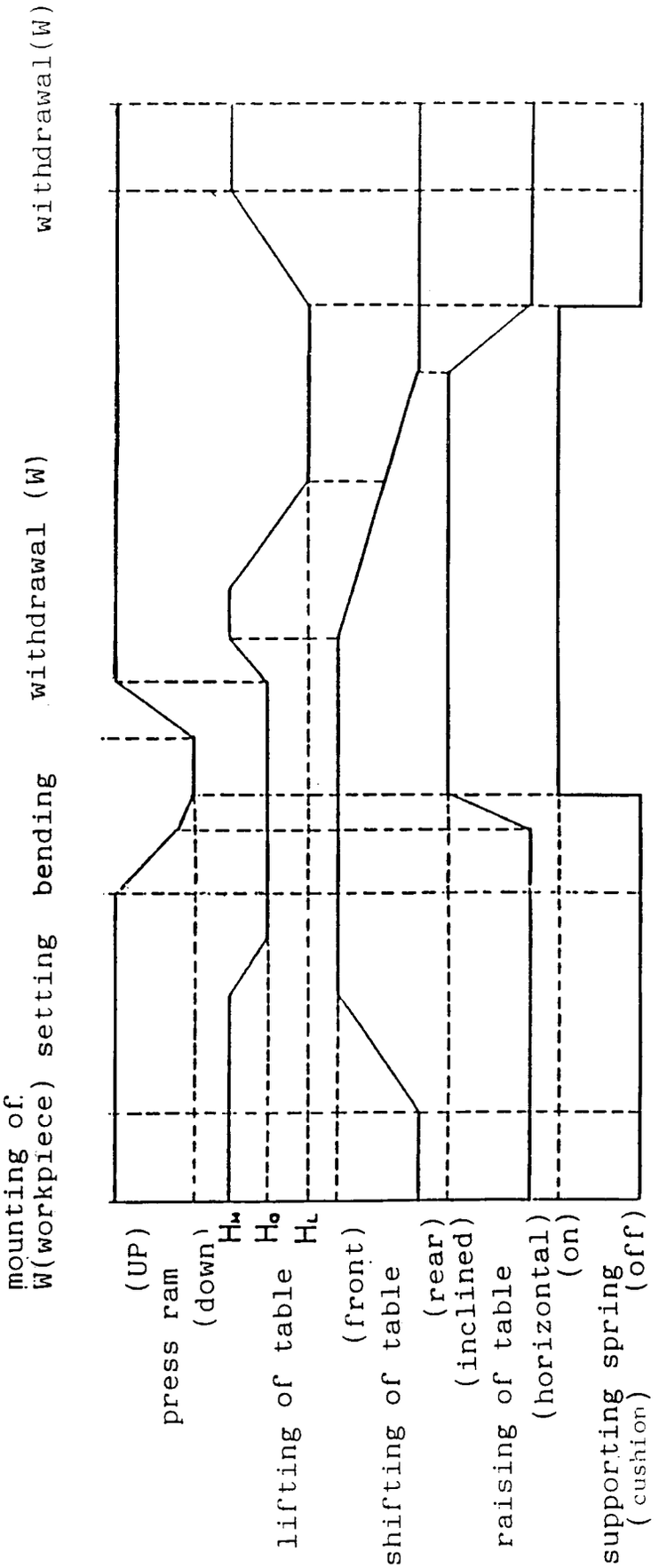


FIG. 10


mounting of W(workpiece)
setting
bending
withdrawal (W)
withdrawal(W)
(UP)
press ram
(down)
H_U
H_O
H_L
lifting of table
(front)
shifting of table
(rear)
(inclined)
raising of table
(horizontal)
(on)
supporting spring
(cushion)
(off)