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(54) **BENDING PRESS**

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**EP-B1- 0 476 092 WO-A1-98/46378
GB-A- 784 981 US-B2- 6 732 559**

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Description

TECHNICAL FIELD OF THE INVENTION

[0001] The invention concerns a press-bending machine, according to the preamble of claim 1

PRIOR ART

[0002] In order to bend metal sheets usually PR press-bending machines are used of the type described in US 6 732 559 or WO 98/46378, see fig 1. These PR machines comprise a fixed lower table or cross-piece 12 with a bending matrix 22, and an upper cross-piece 10, that is mobile with respect to the lower cross-piece 12 and that is equipped with a punch 20 corresponding to the matrix 22. A frame 18 is used for supporting the upper cross-piece 10, whereas thanks to power actuator means, the cross-pieces 10, 12 come closer to one another so as to obtain the bending action.

[0003] The frame 18 is always a solid and very heavy C-shaped structure (see for example figure 2 of US 6 732 559) since it must support the thrust reaction on the piece to be bent as well as the weight of the upper cross-piece. It comes from the above one piece heavy and bulky, both in height and in depth, thus limiting the mobility of the workers around the machine and the maximum stoke of the upper cross-piece. Moreover, a similar frame is very expensive and an enormous amount of metal is needed to build it.

[0004] Document GB 784,981 discloses a press-bending machine according to the preamble of claim 1, comprising a fixed lower cross-piece with a holder for a matrix bending, an upper cross-piece, supported by a frame movable with respect to the lower cross-piece and provided with one or more punches corresponding to the matrix, and power actuator means for pushing the cross-pieces toward each other, the upper cross-piece being integral with the frame, and both being movable and displaceable by the power actuator means towards the lower cross-piece during pressing phase. This document describes a solution for feeding pieces in the machine which foresees the rotation of the whole upper cross-piece around the axis of one of the cylindrical guide members.

[0005] Document EP 0476092 B1 discloses a sheet bending machine in which the upper cross-piece is mounted on lateral supports and guided on the frame in an up and down movement so as to be pivotable about an horizontal axis, and in which the lower bending punches are articulately coupled to each other.

[0006] The purpose of the invention is to propose an alternative press-bending machine that does not have these drawbacks.

SUMMARY OF THE INVENTION

[0007] Such a purpose is obtained with a press-bend-

ing machine according to claim 1.

[0008] By making the upper cross-piece integral with the frame makes it possible to eliminate the known heavy C-shaped structure of the prior art. This is due to the fact that the frame no longer has to support the strain of the pressing force.

[0009] The power actuator means, which in the prior art were mounted on the C-shaped frame and made the structure complicated because they required reinforced undercuts or seats, can comprise a linear actuator that exerts a thrust between two points of application so as to make them move apart during the pressing phase. In order to efficiently push the cross-pieces against one another, the first of said points is (advantageously) made to push on the lower cross-piece and the second point is made to push on the frame and is located closer than the first one to a plane on which the lower cross-piece rests. This provides the press-bending machine with a compact structure and exploits the power of the power actuator means to the maximum.

[0010] If the frame only extends substantially at the sides of the lower cross-piece thus eliminating all the weight and bulk concentrated in the "C-shaped part" of known frames, the structure of the press-bending machine is greatly simplified. This design choice is optional, but preferred.

[0011] It is preferable for the frame to have a vertical stroke such as to be able to move down below the plane on which the lower cross-piece rests. This makes it possible for the frame to move down, for example, below the height of the flooring on which the lower cross-piece rests, avoiding having to use big industrial buildings for machines with high power and long strokes.

[0012] According to the invention the frame comprises two elongated bodies which are vertically mobile having the upper end fixedly connected to the upper cross-piece so as to pull it downwards and the lower end configured so as to receive the driving of the power actuator means. Such means are fixed to the short side of the lower cross-piece and are positioned at the side of each elongated body or on the same axis thereof. The compactness of the structure and at the same time the ease with which it can be ensured for it to resist deformations when undergoing stress, should be noted. Whereas before the known "C-shaped structure" had to support a spreading movement of the "C shape", now the frame must only withstand a stretching force.

[0013] The elongated vertical bodies have each two arms that are substantially parallel, spaced apart and joined at their ends with two joint-segments. Preferably, the elongated vertical bodies have a symmetrical shape with respect to the longitudinal axis.

[0014] These arms have the upper joining portion that is fixedly connected to the upper cross-piece so as to pull it downwards and the lower joining portion configured so as to receive the driving of the power actuator means, which are fixed to the lower cross-piece and positioned in the empty space available between the two arms. The

arms thus move outside of the actuator means. It should be noted how there is a more compact structure associated with a greater hardness to traction stress.

[0015] For example, the two elongated bodies can be substantially U-shaped or have the shape of an elongated closed loop, and such as to leave a span between the arms through which a piece to be bent can be fed to the press-bending machine along a direction that is substantially parallel to the plane containing the cross-pieces. In such a way it is possible to avoid the other drawback of the prior art of not being able to manipulate the piece being processed from the short side of the lower cross-piece (i.e. from the sides of the machine, since generally cross-pieces have an almost rectangular shape and carry out bending along one edge of a long side).

[0016] Since it is necessary for guide structures to be foreseen, they are advantageously arranged on the lower cross-piece in such a way that the two elongated bodies run along it in a guided manner. In the prior art the guide elements were arranged on the edges of the C-shaped frame, which also has the drawback that in order to obtain for example one metre of useful stroke of the upper cross-piece, it is necessary to have a 1m long cylinder, from which a 1m long piston, and 1m long guide elements come out. This is due to the fact that in the conventional "C-shaped" structure the guide elements can only be installed in axis with the pistons. In the structure of the invention, on the other hand, the guide elements (or guiding means) are positioned so that, in order to obtain a 1m useful stroke of the upper cross-piece, there are only 2m of longitudinal bulk, i.e. a 1m long cylinder plus a 1m long piston.

[0017] Moreover, for physical reasons, i.e. the behaviour during bending and twisting of the structure, the conventional "C-shape" would give a worse stability with respect to the "loop" or "U-shaped" structure of the invention, which on the other hand ensures a greater bending quality.

[0018] Preferably said guide structures comprise T-shaped guide elements, arranged on two sides of the lower cross-piece, in each of which the two arms of the elongated bodies are slidingly inserted. The lower cross-piece thus ensures the rigidity of the guiding structure. On the surface of the guide structures in sliding contact with the elongated bodies, sliding skids can be arranged. The advantages (see previous considerations) especially concern the containment of the vertical dimensions.

[0019] The press-bending machine can be equipped with a platform arranged on the side of the lower cross-piece on which a manipulator robot for loading/unloading/moving the pieces to be bent, can move. The hourly production speed and its flexibility of use are thus improved.

[0020] Due to the configuration of the press-bending machine according to the invention, the platform can also surround at least three sides of the lower cross-piece, so that the robot can move around the press-bending machine from one long side to the other of the lower cross-

piece.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021] Further preferred characteristics and advantages of the invention shall in any case become clearer from the description given as an example of a press-bending machine, together with the attached drawings, in which:

figure 1 shows a known press-bending machine;
figure 2 shows a front view of a press-bending according to an embodiment of the invention;
figure 3 shows a side view of the press-bending machine of figure 2;
figure 4 shows a top view of the press-bending machine of figure 2;
figure 5 shows a perspective view of the press-bending machine of figure 2.

[0022] In figure 2 and in the following figures, a press-bending machine 30 can be seen having a fixed lower table or cross-piece with a bar 38 to receive a holder for a matrix bending and an upper cross-piece 32 equipped with mounts 36 for a punch corresponding to the matrix.

[0023] The upper cross-piece 32 is mobile with respect to the lower cross-piece 34, so that the punch enters into the matrix bending a metal sheet arranged between them.

[0024] A frame, that supports the upper cross-piece 32 and that is integral with it, is made up of two elongated bodies 40 movable vertically each having two arms 42, 44 that are substantially parallel, spaced apart and joined at the ends by two joint-segments 46, 48, upper and lower respectively. The bodies 40 extend in their entirety in a compact manner at the sides of the lower cross-piece 32. The press-bending machine 30 substantially has a symmetrical structure.

[0025] The arms 42, 44 have the upper end fixedly connected to the upper cross-piece 32 so as to pull it downwards and the lower end configured so as to receive the driving of the power actuator means 50. Overall, the two elongated bodies 40 substantially have the shape of an elongated closed loop, so as to leave, between the arms 42, 44, a span LL (see figure 3), through which it is possible to see the press-bending machine 30 and through which it is possible to feed the latter with a piece to be bent along a direction that is parallel to the greater dimension of the cross-pieces 32, 34.

[0026] The means 50 are like a hydraulic cylinder 52, fixed to the lower cross-piece 34, from which a piston 54 can come out to a certain extent. The means 50 are located in the empty space between the two arms 42, 44. The piston 54 abuts against the lower portion 48 and receives the thrust, which is then transferred to the upper cross-piece 32.

[0027] In such a way the actuator means 50 act as a linear actuator that exerts a thrust between two points of

application: one point pushes against the upper cross-piece 34 and the other point pushes against the frame, where the latter is located lower than the former.

[0028] At the sides of the lower cross-piece 32 there are two T-shaped guide elements 60, in each of which the arms 42, 44 of the elongated bodies 40 are slidably inserted. The guide elements 60 are formed by a horizontal bar that projects with a base 64 on the short side of the lower cross-piece 34 for as far as the thickness of the arms 42, 44. Therefore, the bar 62 prevents the arms 42, 44 from separating from the lower cross-piece 34. Another bar 66 acts as a lower support for the arms 42, 44 on the side opposite to that in which the bar 62 acts.

[0029] On the surface of the bars 62, 64 in sliding contact with the elongated bodies 40 there are some sliding skids 70, so as to promote a friction-free movement.

[0030] On the side of the lower cross-piece 34, there is a platform 80, on which a robot (not shown) can move, whereas at the feet of the lower cross-piece 34 there is an electric motor 90 for pumping oil into the means 50.

[0031] It should be understood that during the pressing phase, when the actuator means 50 are activated, the piston 54 comes out from the cylinder 52 and the cross-pieces 32, 34 come closer to each other pressing on the piece.

[0032] Due to the structure of the frame, it can have a vertical stroke such as to go down below the plane on which the lower cross-piece 34 rests, i.e. below the level of the platform 80.

Claims

1. Press-bending machine comprising

- a fixed lower cross-piece (34) provided with a holder for a matrix bending;
- an upper cross-piece (32), movable with respect to the lower cross-piece and provided with means (36) for bringing one or more punches corresponding to the matrix;
- a frame (40) for supporting the upper cross-piece;
- a power actuator means (50) for pushing the cross-pieces toward each other;

the upper cross-piece being integral with the frame, and both being movable and displaceable by the power actuator means towards the lower cross-piece during pressing phase; said frame (40) being made up of two elongated bodies movable vertically, extending in their entirety in a compact manner at the sides of the lower cross piece (34),

characterized by the fact that each of said two elongated bodies has two arms (42,44) that are substantially parallel, spaced apart and joined at the ends by two joint segments (46,48) upper and lower respectively, said arms (42,44) having the upper end

fixedly connected to the upper cross piece (32) so as to pull it downwards and the lower end configured so as to receive the driving of the power actuator means (50).

2. Press-bending machine according to claim 1, wherein the power actuator means comprise a linear actuator (50) adapted to exert a thrust between two application points in order to make them depart during a pressing phase, the first of said points being pushing onto the lower cross-piece and the second point being pushing onto the frame and placed closer than the first one with respect to a plane on which the lower cross-piece rests.
3. Press-bending machine according to claim 1 or 2, wherein the frame extends substantially only along the sides of the lower cross-piece.
4. Press-bending machine according to any one of the preceding claims, wherein the frame has such a vertical stroke to be able to descend below a plane on which the lower cross-piece rests.
5. Press-bending machine according to claim 1, wherein the two elongated bodies (40) have substantially U-shape or elongated closed-loop shape, and such to leave between the arms (46,48) a span through which a piece to be bent can be fed to the press-bending machine along a direction substantially parallel to the plane containing the cross-pieces.
6. Press-bending machine according to claim 1, wherein the lower cross-piece comprises guiding structures (60) in which the two elongated bodies slide guided.
7. Press-bending machine according to claim 6, wherein said guiding structures comprise T-guides (60), placed on two sides of the lower cross-piece, in each of which are slidably inserted the two arms of an elongated body.
8. Press-bending machine according to claim 6 or 7, wherein on the surface of the guiding structures in sliding contact with the elongated bodies there are present sliding skids (70).
9. Press-bending machine according to any one of the preceding claims, comprising a platform (80) placed sideways to the lower cross-piece on which is movable a manipulator robot for loading/unloading/handling of the pieces to be bent, where the platform encloses at least three of the lower cross-piece, so that the robot can move around the press-bending machine from a long side to the other long side of the lower cross-piece.

Patentansprüche

1. Biegepresse, umfassend

- einen unbeweglichen Unterbalken (34), der mit einem Halter für eine Biegematrize versehen ist;
- einen Oberbalken (32), der gegenüber dem Unterbalken beweglich und mit Mitteln (36) versehen ist, um einen oder mehrere Stempel in Entsprechung mit der Matrize zu bringen;
- einen Rahmen (40) zum Tragen des Oberbalkens;
- ein Antriebsbetätigungsmittel (50) zum Gegen-
einanderdrücken der Balken;

wobei der Oberbalken einstückig mit dem Rahmen ausgeführt ist und die beiden bewegt und während der Pressstufe durch das Antriebsbetätigungsmittel zum Unterbalken verschoben werden können; wobei der Rahmen (40) aus zwei senkrecht beweglichen länglichen Körpern besteht, die sich gänzlich in kompakter Weise auf den Seiten des Unterbalkens (34) erstrecken,

dadurch gekennzeichnet, dass jeder der zwei länglichen Körper zwei Schenkel (42, 44) aufweist, die im Wesentlichen parallel, beabstandet und an den Enden durch zwei Verbindungsabschnitte (46, 48), einen oberen beziehungsweise einen unteren, verbunden sind, wobei bei diesen Schenkeln (42, 44) das obere Ende starr mit dem Oberbalken (32) verbunden ist, um ihn nach unten zu ziehen, und das untere Ende gestaltet ist, um den Antrieb des Antriebsbetätigungsmittels (50) aufzunehmen.

2. Biegepresse nach Anspruch 1, wobei das Antriebsbetätigungsmittel einen Linearbetätiger (50) umfasst, der geeignet ist, eine Schubkraft zwischen zwei Angriffspunkten auszuüben, um sie während einer Pressstufe voneinander zu entfernen, wobei der erste dieser Punkte auf den Unterbalken drückt und der zweite Punkt auf den Rahmen drückt und sich näher als der erste bei einer Ebene befindet, auf welcher der Unterbalken liegt.
3. Biegepresse nach Anspruch 1 oder 2, wobei sich der Rahmen im Wesentlichen nur längs der Seiten des Unterbalkens erstreckt.
4. Biegepresse nach einem der vorhergehenden Ansprüche, wobei der Rahmen einen solchen senkrechten Hub aufweist, dass er unter eine Ebene absinken kann, auf welcher der Unterbalken liegt.
5. Biegepresse nach Anspruch 1, wobei die zwei länglichen Körper (40) im Wesentlichen U-Form oder die Form einer länglichen Öse derart aufweisen, dass zwischen den Schenkeln (46, 48) eine lichte Weite ist, durch die der Biegepresse ein zu biegendes

Werkstück längs einer Richtung zugeführt werden kann, die im Wesentlichen parallel zu der die Balken enthaltenden Ebene ist.

6. Biegepresse nach Anspruch 1, wobei der Unterbalken Führungskonstruktionen (60) umfasst, in denen die zwei länglichen Körper geführt gleiten.
7. Biegepresse nach Anspruch 6, wobei die Führungskonstruktionen auf zwei Seiten des Unterbalkens angeordnete T-Schiene (60) umfassen, in jeder von denen die zwei Schenkel eines länglichen Körpers gleitend eingesetzt sind.
8. Biegepresse nach Anspruch 6 oder 7, wobei sich auf der in Gleitkontakt mit den länglichen Körpern befindlichen Oberfläche der Führungskonstruktionen Gleitschuhe (70) befinden.
9. Biegepresse nach einem der vorhergehenden Ansprüche, die eine seitlich vom Unterbalken angeordnete Plattform (80) umfasst, auf der ein Handhabungsroboter zum Laden/Entladen/Handhaben der zu biegenden Werkstücke bewegt werden kann, wobei die Plattform mindestens drei Seiten des Unterbalkens umschließt, so dass sich der Roboter von einer Längsseite zur anderen Längsseite des Unterbalkens um die Biegepresse bewegen kann.

Revendications

1. Presse plieuse comprenant

- une traverse inférieure fixe (34) munie d'un support pour une matrice de pliage ;
- une traverse supérieure (32), mobile par rapport à la traverse inférieure et munie de moyens (36) pour amener un ou plusieurs poinçons correspondants à la matrice;
- un châssis (40) pour supporter la traverse supérieure ;
- des moyens d'actionnement motorisés (50) pour pousser les traverses l'une vers l'autre ;

la traverse supérieure étant d'une seule pièce avec le châssis, et les deux étant mobiles et déplaçables par les moyens d'actionnement motorisés vers la traverse inférieure durant la phase de pressage ; ledit châssis (40) étant composé de deux corps allongés mobiles verticalement, s'étendant dans leur totalité d'une manière compacte au niveau des côtés de la traverse inférieure (34),

caractérisée en ce que chacun desdits deux corps allongés a deux bras (42,44) qui sont sensiblement parallèles, écartés et unis aux extrémités par deux segments d'articulation (46,48) respectivement supérieur et inférieur, lesdits bras (42,44) ayant l'ex-

trémité supérieure reliée de manière fixe à la traverse supérieure (32) de manière à la tirer vers le bas et l'extrémité inférieure configurée de manière à recevoir l'entraînement des moyens d'actionnement motorisés (50).

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ces à plier, dans laquelle la plate-forme enferme au moins trois de la traverse inférieure, de manière que le robot puisse se déplacer autour de la presse plieuse d'un côté long à l'autre côté long de la traverse inférieure.

2. Presse plieuse selon la revendication 1, dans laquelle les moyens d'actionnement motorisés comprennent un actionneur linéaire (50) adapté pour exercer une poussée entre deux points d'application de manière à les faire s'écarter durant une phase de pressage, le premier desdits points poussant sur la traverse inférieure et le deuxième point poussant sur le châssis et étant placé plus près que le premier par rapport à un plan sur lequel repose la traverse inférieure. 10 15
3. Presse plieuse selon la revendication 1 ou 2, dans laquelle le châssis s'étend sensiblement seulement le long des côtés de la traverse inférieure. 20
4. Presse plieuse selon l'une quelconque des revendications précédentes, dans laquelle le châssis a une course verticale telle qu'il soit en mesure de descendre au-dessous d'un plan sur lequel repose la traverse inférieure. 25
5. Presse plieuse selon la revendication 1, dans laquelle les deux corps allongés (40) ont sensiblement un profil en U ou un profil en boucle fermée allongée, et de manière à laisser entre les bras (46,48) un intervalle à travers lequel une pièce à plier peut être amenée à la presse plieuse suivant une direction sensiblement parallèle au plan contenant les traverses. 30 35
6. Presse plieuse selon la revendication 1, dans laquelle la traverse inférieure comprend des structures de guidage (60) dans lesquelles les deux corps allongés coulissent de manière guidée. 40
7. Presse plieuse selon la revendication 6, dans laquelle lesdites structures de guidage comprennent de guides en T (60), placés sur deux côtés de la traverse inférieure, dans chacun desquels sont insérés de manière coulissante les deux bras d'un corps allongé. 45
8. Presse plieuse selon la revendication 6 ou 7, dans laquelle des patins de glissement (70) sont présents sur la surface des structures de guidage en contact glissant avec les corps allongés. 50
9. Presse plieuse selon l'une quelconque des revendications précédentes, comprenant une plate-forme (80) placée latéralement à la traverse inférieure sur laquelle est mobile un robot manipulateur pour le chargement/déchargement/manipulation des piè- 55

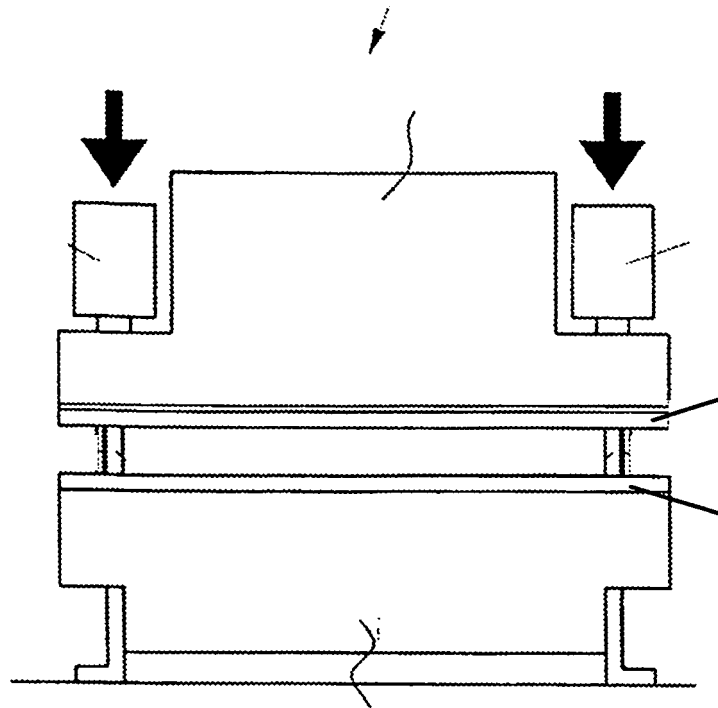


FIG. 1

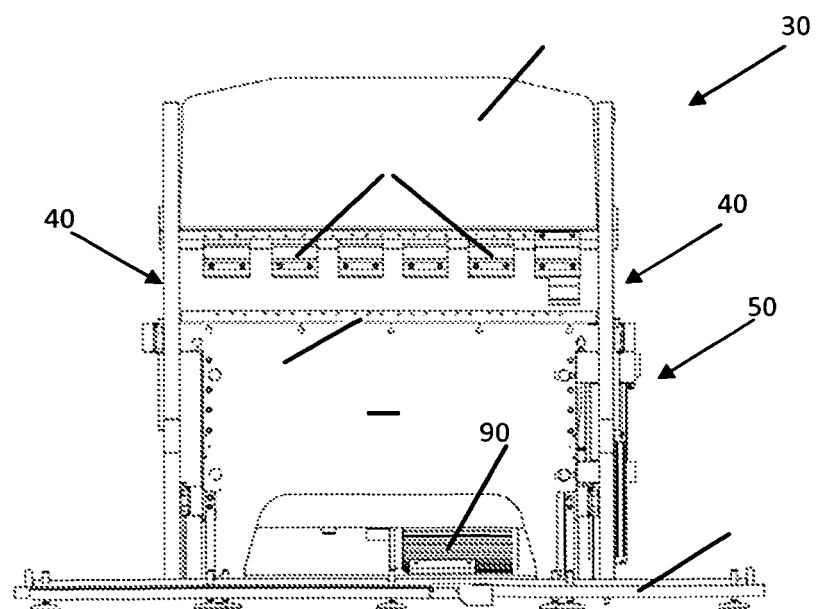


FIG. 2

FIG. 3

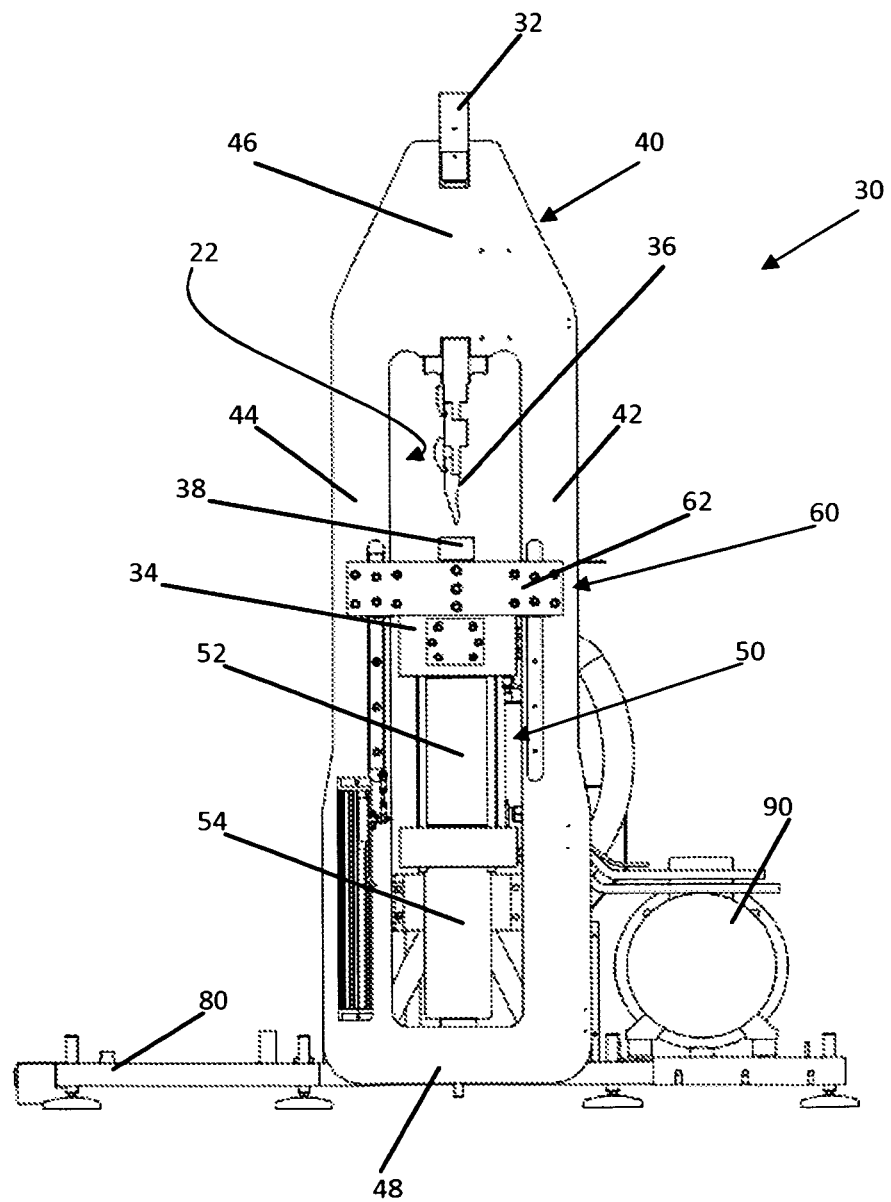
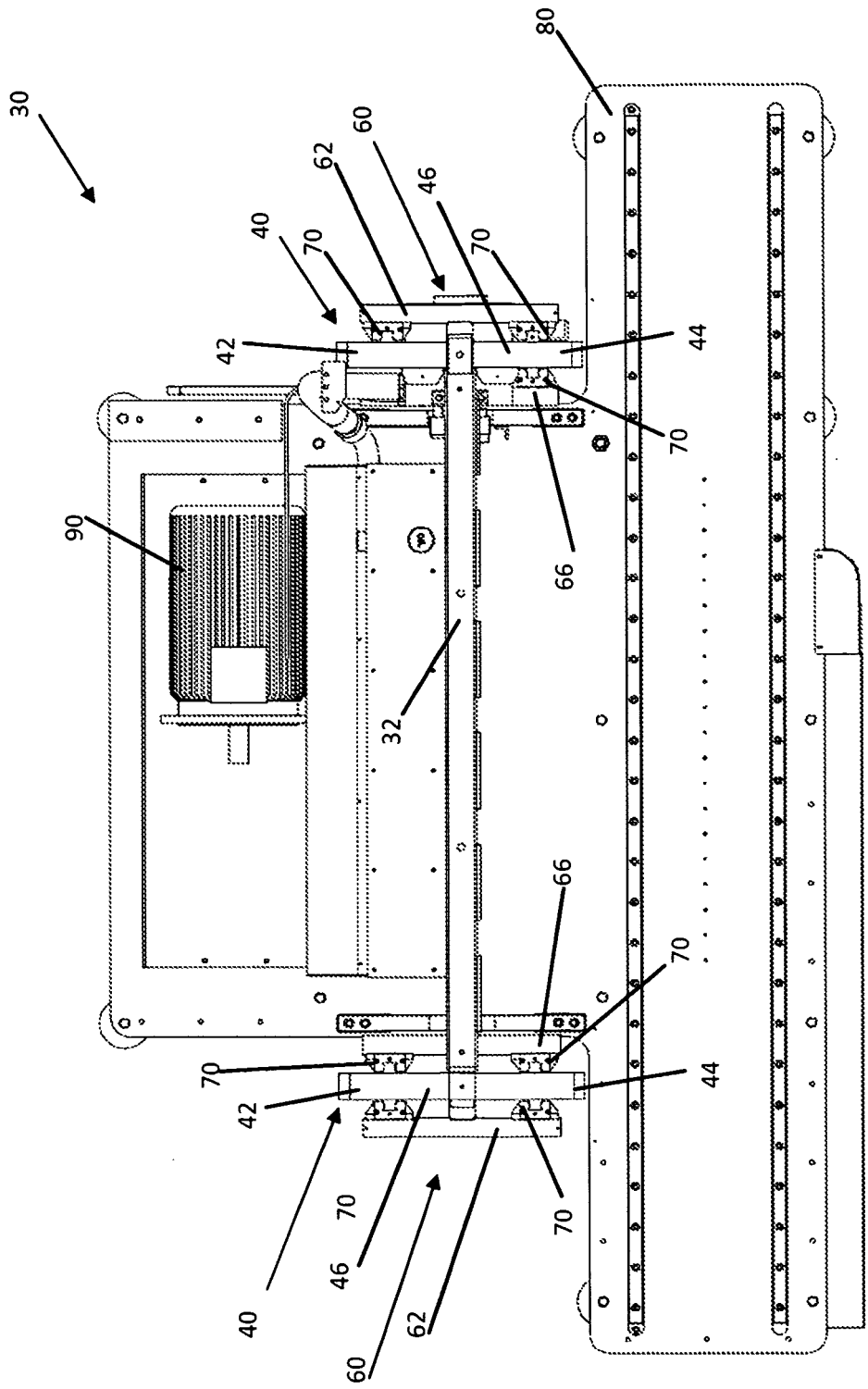


FIG. 4



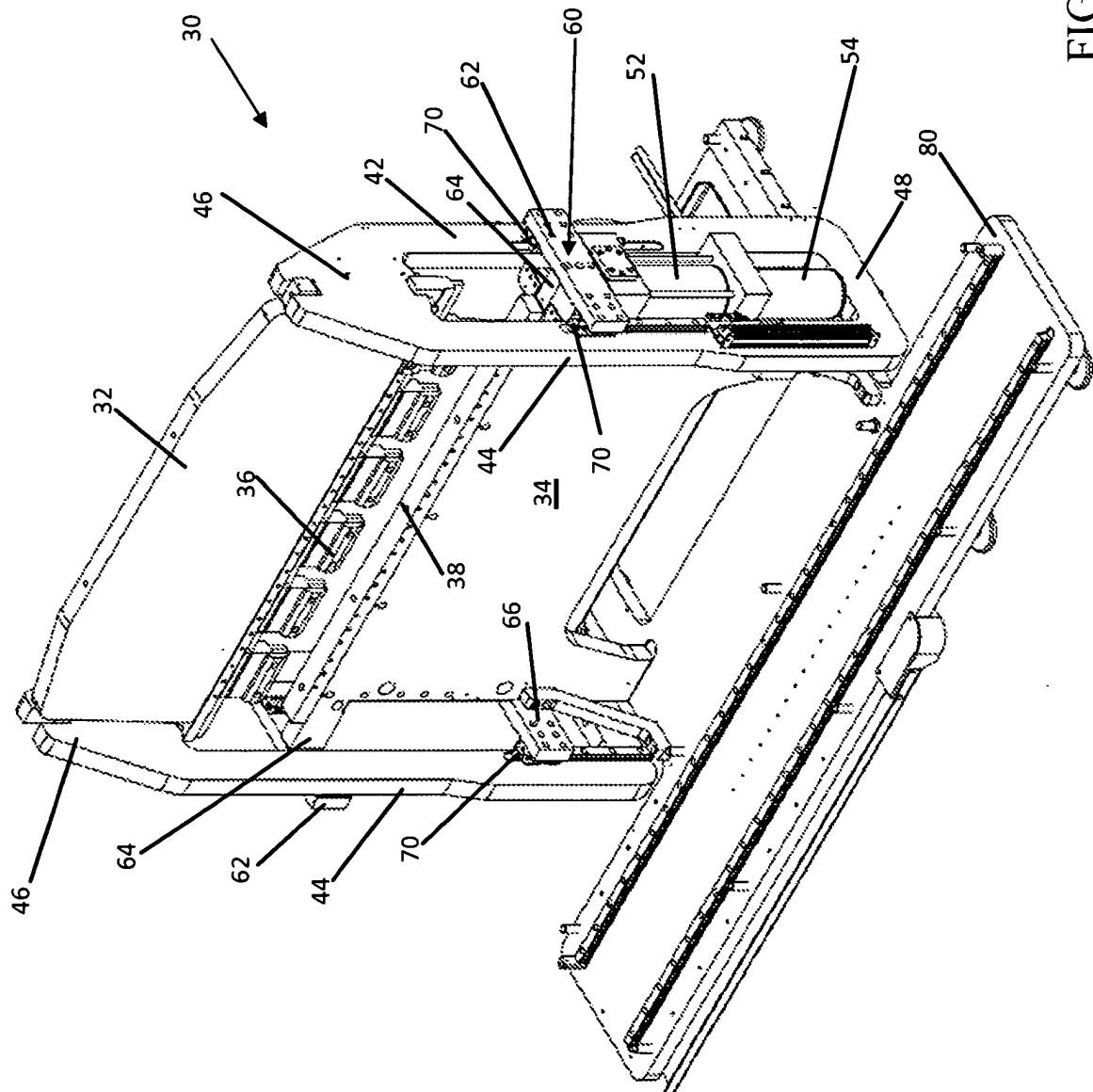


FIG. 5

REFERENCES CITED IN THE DESCRIPTION

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