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(54) **Improvements introduced in modular tabletop systems for connecting metal pieces by flanging**

Modulares Tischsystem zum Verbinden von Metallplatten durch Bördeln

Système de table modulaire pour la connexion de pièces métalliques par sertissage

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**US-A- 5 454 261**

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## Description

### OBJECT OF THE INVENTION

**[0001]** The present invention refers to a modular tabletop system for connecting metal pieces by flanging according to the preamble of claim 1 (see e.g. US-A-3130770). This connecting of metal pieces by flanging is a folding operation of the contour flange of an exterior sheet or panel, upon another sheet, or interior panel, by plastic mechanical deformation and so that the contour of both sheets are connected totally or partially.

**[0002]** Among the advantages of the invention, the following ones can be pointed out:

- Increase the cleanliness and maintenance of the system, since the previous hydraulic operating systems, that use oil as a fluid, are no longer necessary
- Reduction of the noise level
- Easier and better control of the parameters of the machine
- Economic saving

**[0003]** Another object of the present invention is to provide a new arrangement of the flanging means (pre-flanging and final flanging blades) upon the sliding part of the flanging unit.

### BACKGROUND OF THE INVENTION

**[0004]** The flanging systems used presently, are based on two different concepts: a press flanging system and a movable tabletop flanging system.

**[0005]** The press flanging system, in the mechanical press as well as in the hydraulic press, is carried out by means of a die, which is provided with some pawls that, duly operated, achieve the folding of the flange. This flanging system requires the installation of a press on civil work, aside from the maintenance of the equipment being very complex. Besides, this system is costly and it proves to be costly to control the thickness of the package formed after flanging, it only being possible to attack the surrounding flange from a single direction.

**[0006]** The other flanging system, in other words, the movable tabletop system, is based on the flanging units being placed in a working position and awaiting arrival of the pieces to be flanged, placed upon the cradle, and that reach their working position by means of a vertical operating system. This flanging system also offers certain inconveniences such as the place where the pieces are loaded and unloaded being quite high up, which permits the possibilities of certain loading and unloading systems. The cost of hydraulic operations is usually very high and requires a very high energy consumption, the weight of the machine also being very heavy. Likewise, the forces that are carried out in the flanging operation cause the flanging units to tend to come out of their operating position. Maintenance of the hydraulic cylinder

that moves the cradle is complicated by the difficult access thereto from the outside. This system is also only capable of attacking the flange in one direction.

**[0007]** Subsequently, the same applicant firm of the present invention developed a modular tabletop system for connecting metal pieces by flanging, object of Spanish patent application P-9601677 (Publication No. ES-A-2154529), where the sheet or external panel rests and is supported on a cradle whose support surface reproduces the shape of the external panel. Once the interior sheet or panel is located upon the exterior panel, the flanging operation is proceeded with by means of the combination of said flanging unit and that takes place in two successive steps. A first folding of the flange, called pre-flanging, is carried out in the first step, and then the flange of the exterior panel is closed upon the interior panel, in an operation called final flanging.

**[0008]** ES-A-2154529 discloses a preferably mechanowelded structure upon which is located a table constituted by a plate with fastening means of other additional elements such as suitable centering devices to ensure placement of the cradle in coordinates, the fastening means of the cradle itself, as well as supports of the flanging units, of the treading element and of the de-centering supports to correctly place said treader.

**[0009]** The table is provided with two mechanical stops for the flanging operation: one for the pre-flanging step and the other one for the final flanging step. These mechanical stops operate as ends of stroke of the slides of the flanging units, thus ensuring that the stroke always ends at the same point and position to achieve the required quality and so that the thickness of the package comprised of the exterior panel, the interior panel and the flange of the exterior panel that turns over the interior one, is constantly repeated.

**[0010]** The flanging units disclosed in ES-A-2154529, are interchangeable modular movable elements, whose operating means is constituted by hydraulic cylinders, one to produce tipping movement so that the approach and subsequent withdrawal of the flanging unit to the operating area, and a second hydraulic cylinder suitable to carry out the movements performing the two successive pre-flanging and final flanging operations take place. The fixed part includes some guides with graphite inserts, upon which will slide the strips integral to the movable part, thus allowing relative linear movement thereof.

**[0011]** Each flanging unit is comprised of one part connected to the table, or tippable part, constituted by a tipping shaft support assembly, with anchoring means for the blade holder slide, transmitting the movement from the first cylinder by means of rods. There is another movable part that slides with regard to the previous one, whose movement is carried out with the second hydraulic cylinder that is responsible for carrying out the flanging operations.

**[0012]** Continuing on with the characteristics described in ES-A-2154529, the mechanical stops provid-

ed for the different flanging units that are placed in the chosen points of the contour of the table, in order to correctly carry out the pre-flanging and final flanging operations, are preferably comprised of a steel rivet-dolly. The sliding means to operate the blades are preferably made out of symmetric tempered and ground steel strips that have means for anchoring to the sliding part of the flanging unit.

**[0013]** The flanging means located in the sliding part of the machine are preferably constituted by a blade holder with housing and fastening means of the pre-flanging blades and final flanging blades, the blades having a shape in accordance with the profile and contour of the final piece. These blades are complemented, for the contour corner areas of the piece, with detachable elements suitable for connection to the contiguous blades.

**[0014]** The existence of a mechanical stop of each flanging group on the table for pre-flanging and final flanging operations, preferably constituted by a steel rivet-dolly, allows the rotating of the flanging unit to rest, thus increasing the life of said shaft, as well as the reliability of the machine.

**[0015]** It has been observed that the structure and operation of the flanging units may be improved, with electric operation to achieve the movements of the sliding part of the machine, as well as the angular approach and withdrawal movement towards the working area being done with a pneumatic cylinder. Improvement of the blade support structure and the shape itself and arrangement of the blades in order to allow a reduction of the distance between the pre-flanging and final flanging working areas, which reduces the cycling time of the system, has also been provided for. According to the present invention, elimination of one of the blade holders, and manufacturing in a single piece the pre-flanging blade and another auxiliary flanging support blade, that was considered in the structure of the cited patent application ES-A-2154529 are achieved. This involves an economic advantage.

### **DESCRIPTION OF THE INVENTION**

**[0016]** In broad outline, the invention as defined in claim 1 provides improvements introduced in modular systems for connecting metal pieces by flanging, that solve the problems of conventional machines and improve the operation thereof. Further improvements are provided by the features defined in the dependent claims.

**[0017]** An improvement consisting of the electric operation included in each one of the flanging units that comprise a complete modular flanging system, is based on the following:

By means of a conventional reduction motor, the up-and-down-motion of the sliding part of the flanging unit is activated, by conversion of the rotating move-

ment of its shaft, in linear movement of a ball nut that is connected integrally to the sliding part of the flanging unit and pierced by a spindle. By means of a simple toothed belt pulley transmission of the rotation of the reduction motor to the spindle is achieved. Depending on the direction of rotation of the reduction motor, the ball nut will be obliged to carry out an up or down movement and therefore, the rising or lowering of the blades anchored to the sliding part of the flanging unit will take place, as we have indicated above.

**[0018]** In order to prevent the complete mechanical system from suffering, when the flanging unit exerts the pre-flanging or final flanging force (force exerted against the respective pre-flanging and final flanging stops), an elastic package that, being compressed, absorbs said force, since the reduction motor shaft continues to rotate, is placed on the spindle itself. In this way, the sudden impact against the mechanical stops is eliminated, absorbing the impact against the same. The elastic package accumulates energy while it is compressed and this permits, once the electric drive motor has stopped, the same final force being still exerted on the piece which is being worked. The reduction motor stops operating when its winding reaches a certain current level, calculated in terms of the flanging force that is to be exerted.

**[0019]** On the other hand, the tipping movement of the flanging unit is achieved by operation of a pneumatic cylinder that moves a rod system connected to the flanging unit, with the advantages that this involves, that have been referred to at the beginning of this specification.

**[0020]** Regarding another one of the improvements object of the present invention, in connection with the arrangement of the flanging means, in other words of the pre-flanging and final flanging blades, is based on the following:

The blades are fastened to a single blade holder, the final flanging blade being located in the top part of the blade holder, while the pre-flanging blade is located in the bottom part of the blade holder. Besides, in the arrangement disclosed in ES-A-2154529, the blades were arranged in a position reversed to the referred one, in other words, with the pre-flanging blade in the top part, and it was also necessary to have a auxiliary final flanging blade that was located in a position before the final flanging blade and in the same blade holder as this blade.

**[0021]** In accordance with the invention, the auxiliary blade is a portion of the final flanging blade itself. This reversal of arrangement of the blades that comprise each flanging unit, allows a reduction of the distance between the working areas of the blades, which reduces the cycling time of the system. Likewise, upon eliminat-

ing one of the blade holders and upon manufacturing in a single piece the pre-flanging blade and the auxiliary flanging support blade, the economic advantage is obvious.

**[0022]** In order to provide a better understanding of the characteristics of the invention and forming an integral part of this specification, some sheets of drawings, in whose figures the following has been represented in an illustrative and non-restrictive manner, are attached hereto.

### **BRIEF DESCRIPTION OF THE DRAWINGS**

#### **[0023]**

Figure 1 is a side raised view of a machine integrated into the modular tabletop system for connecting metal pieces by flanging, including the improvements object of the invention.

Figure 2 is a plan view of a blade holders to which the two pre-flanging and final flanging blades are mounted.

Figure 3 is a section taken on cut line A-A of figure 2. Figure 4 schematically shows the folding operation of the flange of the contour of one exterior sheet upon the edge of the interior sheet, in two operating steps corresponding to pre-flanging and final flanging, respectively.

### **DESCRIPTION OF THE PREFERRED EMBODIMENT**

**[0024]** Making reference to the numbering used in the figures, we can see how the improvements introduced in the modular tabletop system for connecting metal pieces by flanging, which the invention proposes, primarily consists of including the reduction motor (1) to achieve the rising and lowering movements of the movable or sliding part of the flanging unit (2), referred to as number (25) and that supports the pre-flanging (15) and final flanging (14) blades. The movement of the reduction motor (1) is transmitted to the spindle (7) by means of transmission by a toothed belt (8), in this embodiment shown in the figures. This belt (8) runs between the pulleys (5) and (6) pierced in the ends of the drive shaft (3) and of the spindle (7).

**[0025]** The rotation of the shaft (7) in one direction or the other depending on the direction of rotation of the motor, causes the rising or lowering of the ball nut (4) that is threaded to the spindle (7). This ball nut (4) is solidly connected to the sliding part (25) of the flanging unit (2).

**[0026]** In the position shown in figure 1, the flanging unit (2) is already in a vertical position with the sliding part (25) raised so that the blades (14) and (15) sequentially attack the plates arranged in the support cradle (16) of the metal pieces to be connected. Prior to occupying this vertical position, the approximation of the assembly takes place, by means of the action of the pneu-

matic cylinder (11) to which the rod system generally referred to as number (12) is connected and linked to the end of an arm (24) of the fixed part of the flanging unit (2), rotating around the shaft (17) fixed to the support frame (18). When the pneumatic cylinder (11) operates the assembly tips around the tipping shaft (19). The rotation of the motor causes the initial flanging operation upon the sliding part (25) of the flanging unit (2) lowering and the fixed part supporting the sliding guides remaining immobilized, which the arm (24) forms part of. Afterwards, in a combined action of angular and linear movements caused by the pneumatic cylinder (11) and the reduction motor (1), respectively, the final flanging and angular return of the assembly are proceeded with in order to release the worked pieces.

**[0027]** Reference (10) designates the elastic package that absorbs the force to which the complete mechanical system would be subjected, when the pre-flanging or final flanging force is exerted, since the reduction motor keeps on rotating, although the subsequent movement is checked by the existence of the mechanical stops (9). Thus, the sudden impact against these mechanical stops (9) is eliminated. As one can see in figure 1, the elastic package (10) is mounted on the spindle itself (7).

**[0028]** The improvements of the flanging means (pre-flanging (15) and final flanging (14) blades) can be seen more clearly in figures 2 and 3, being fastened to a single blade holder (13) previously anchored to the sliding part (25) of the flanging unit (2) of the machine.

**[0029]** The final flanging blade (14) occupies a position above the pre-flanging blade (15), both being in a juxtaposed position. The bottom or pre-flanging blade, has its own function as of the trapezoidal projection, which is seen in its section (figure 3) and the top part until it contacts with the final flanging blade (14). The portion under said trapezoidal projection carries out the function of the auxiliary support blade that was used as an independent part in the prior art and specifically considered in the above cited patent of invention, with the advantages that have also been referred to.

**[0030]** Now making special reference to figure 4, we can see the sequence of movements for the folding of the flange (20) of the exterior sheet or panel (21), in order to close over the interior sheet or panel (22), once the sealing adhesive (23) is deposited.

**[0031]** In the top part of this figure 4, in the position shown in a), the first step of folding of the flange (20) is shown, in other words, the pre-flanging position in which the corresponding blades fold the flange from its original position shown with dash lines, until the intermediate position corresponding to the solid line of this position a).

**[0032]** In the second flanging or final flanging step corresponding to position b) of figure 4, the flange (20) is folded by its corresponding blades from the intermediate position of the previous step, up to the final position in which it remains totally glued to the edge of the interior sheet (22).

## Claims

1. Modular tabletop system for connecting metal pieces by flanging by means of an operation comprising a first folding step of folding a flange (20) formed at the end of an exterior panel (21), over the edge of an interior panel (22) in a pre-flanging step, and a subsequent second step of folding said flange (20) upon the interior panel (22) in a final flanging operation, said flange (20) and edge of said interior panel (22) being positioned in a working area, the system comprising a flanging unit (2) that is approached to and withdrawn from the working area by pneumatic operation of a pneumatic cylinder (11) that moves a rod system (12) linked to said flanging unit (2), the flanging unit (2) comprising flanging means (13,14,15), **characterized in that** the pre-flanging and final flanging movements are carried out by electric drive, the electric drive being comprised of an electric reduction motor (1) that causes depending on the direction of its rotation, the up-and-down movement of a sliding part (25) of the flanging unit (2) carrying the flanging means (13,14,15), a ball nut (4) being integrally connected to the flanging unit (2), and a spindle (7) penetrating through the ball nut (4), the spindle receiving rotational movement of the reduction motor (1).
2. Modular tabletop system according to claim 1, **characterized in that**, mounted on the spindle (7), there is an elastic package (10) that absorbs the force exerted by the flanging unit (2) against stops (9) provided as the end of stroke of the pre-flanging and final flanging operations.
3. Modular tabletop system according to any of the preceding claims, **characterized in that** the electric reduction motor (1) comprises a winding that stops operating upon reaching a certain level of electric current calculated in terms of the flanging force to be exerted, such that pressure is maintained by the elastic package (10).
4. Modular tabletop system according to claim 1, **characterized in that** the flanging means (13,14,15) are arranged on the sliding part (25) of the flanging unit (2) and comprise a pre-flanging blade (15), a final-flanging blade (14), both fastened to a single blade holder (13), the final flanging blade (14) being located in a top position and the pre-flanging blade (15) in a bottom position contiguous to the previous final-flanging blade (15), whereby the pre-flanging blade (15) comprises a top portion functioning as an auxiliary support blade for the final flanging operation.

## Patentansprüche

1. Modulares Tischsystem zum Verbinden von Metallteilen durch Flanschen mittels eines Vorgangs, der einen ersten Abkantschritt des Abkantens eines Flansches (20), der am Ende einer äußeren Platte (21) ausgebildet ist, über den Rand einer inneren Platte (22) in einem Vor-Flanschschritt und einen folgenden zweiten Schritt des Abkantens des Flansches (20) auf die innere Platte (22) in einem Abschluss-Flanschvorgang (22) umfasst, wobei der Flansch (20) und die Kante der inneren Platte (22) in einem Arbeitsbereich angeordnet sind, wobei das System eine Flanscheinheit (2) umfasst, die durch pneumatische Betätigung eines pneumatischen Zylinders (11), der ein Stangensystem (12) bewegt, das mit der Flanscheinheit (2) verbunden ist, auf den Arbeitsbereich zu bewegt und aus ihm herausgezogen wird, wobei die Flanscheinheit (2) Flanscheinrichtungen (13, 14, 15) umfasst, **dadurch gekennzeichnet, dass** die Vor-Flansch- und die Abschluss-Flanschbewegung durch elektrischen Antrieb ausgeführt werden, wobei der elektrische Antrieb aus einem elektrischen Untersetzungsmotor (1), der je nach der Richtung seiner Drehung die Auf-und-Ab-Bewegung eines Gleitteils (25) der Flanscheinheit (2), das die Flanscheinrichtungen (13, 14, 15) trägt, bewirkt, einer Kugelmutter (4), die integral mit der Flanscheinheit (2) verbunden ist, und einer Spindel (7) besteht, die durch die Kugelmutter (4) hindurchtritt, wobei die Spindel Drehbewegung des Untersetzungsmotors (1) empfängt.
2. Modulares Tischsystem nach Anspruch 1, **dadurch gekennzeichnet, dass** an der Spindel (7) ein elastischer Körper (10) angebracht ist, der die Kraft dämpft, die von der Flanscheinheit (2) auf Anschläge (9) ausgeübt wird, die als das Ende des Hubs des Vor-Flansch- und des Abschluss-Flanschvorganges vorhanden sind.
3. Modulares Tischsystem nach einem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** der elektrische Untersetzungsmotor (1) eine Wicklung enthält, die aufhört zu arbeiten, wenn ein bestimmter Pegel des elektrischen Stroms, berechnet hinsichtlich der auszuübenden Flanschkraft, erreicht ist, so dass Druck durch den elastischen Körper (10) aufrechterhalten wird.
4. Modulares Tischsystem nach Anspruch 1, **dadurch gekennzeichnet, dass** die Flanscheinrichtungen (13, 14, 15) an dem Gleitteil (25) der Flanscheinheit (2) angeordnet sind und eine Vor-Flansch Klinge (15) sowie eine Abschluss-Flansch Klinge (14) umfassen, die beide an einem einzelnen Klingenhalter (13) befestigt sind, wobei sich die Abschluss-

Flanschklunge (14) an einer oberen Position befindet und die Vor-Flanschklunge (15) an einer unteren Position an die vorhergehende Abschluss-Flanschklunge (15) angrenzend, so dass die Vor-Flanschklunge (15) einen oberen Abschnitt umfasst, der als eine zusätzliche Stützklunge für den Abschluss-Flanschvorgang dient.

## Revendications

1. Système de table modulaire pour relier des pièces métalliques par bordage, au moyen d'une opération comprenant une première étape de pliage consistant à plier un rebord (20) formé à l'extrémité d'un panneau extérieur (21), sur le bord d'un panneau intérieur (22) au cours d'un étape de pré-bordage, et une deuxième étape successive consistant à plier ledit rebord (20) sur le panneau intérieur (22) au cours d'une opération de bordage final, ledit rebord (20) et ledit bord (22) dudit panneau intérieur étant positionnés dans une zone de travail, le système comprenant une unité de bordage (2) qui est rapprochée et/ou retirée de la zone de travail par un actionnement pneumatique d'un cylindre pneumatique (11) qui déplace un système à tige (12) relié à ladite unité de bordage (2), l'unité de bordage (2) comprenant des moyens de bordage (13, 14, 15), **caractérisé en ce que** les mouvements de pré-bordage et de bordage final sont exécutés par un dispositif d'entraînement électrique, le dispositif d'entraînement électrique comprenant un moto-réducteur électrique (1) qui génère le mouvement vers le haut et vers le bas d'une partie coulissante (25) de l'unité de bordage (2) supportant les moyens de bordage (13, 14, 15), en fonction du sens de sa rotation, un écrou à billes (4) étant relié de façon intégrale à l'unité de bordage (2), et un arbre (7) pénétrant au travers de l'écrou à billes (4), l'arbre recevant le mouvement rotatif du moto-réducteur (1).
2. Système de table modulaire suivant la revendication 1, **caractérisé en ce qu'il** est prévu, monté sur l'arbre (7), un ensemble (10) qui absorbe la force exercée par l'unité de bordage (2) contre des butées (9) définissant la butée de fin de course pour les opérations de pré-bordage et de bordage final.
3. Système de table modulaire suivant l'une quelconque des revendications précédentes, **caractérisé en ce que** le moto-réducteur électrique (1) comprend un enroulement qui interrompt le fonctionnement lorsqu'est atteint un certain niveau de courant électrique calculé en terme de force de bordage à exercer, de sorte que la pression est maintenue par l'ensemble élastique (10).
4. Système de table modulaire suivant la revendica-

tion 1, **caractérisé en ce que** les moyens de bordage (13, 14, 15) sont disposés sur la partie coulissante (25) d'une unité de bordage (2) et comprennent une lame (15) de pré-bordage, une lame (14) de bordage final, les deux lames étant fixées à un support unique (13) de lames, la lame (14) de bordage final étant située dans une position haute et la lame (15) de pré-bordage dans une position basse contiguë à la lame précédente de bordage final, de sorte que la lame (15) de pré-bordage comprend une partie supérieure fonctionnant comme une lame de support auxiliaire pour l'opération de bordage final.

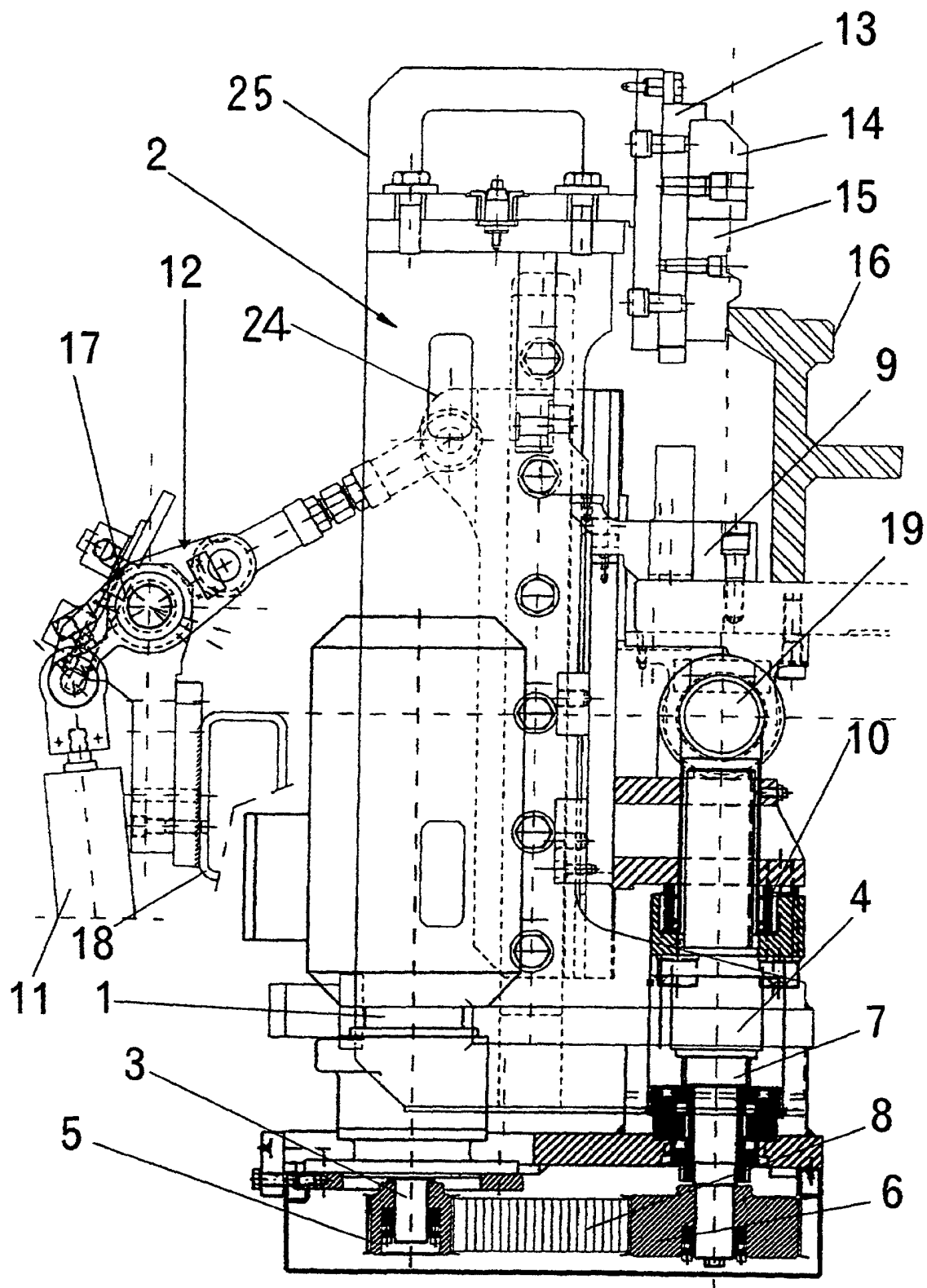
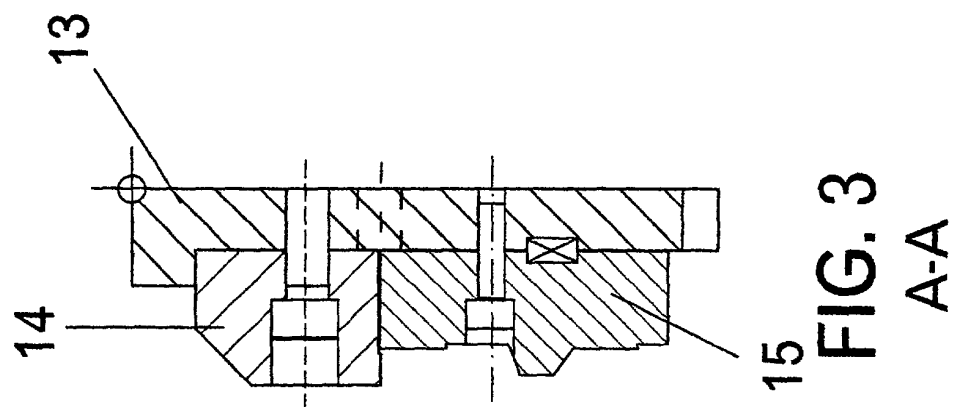
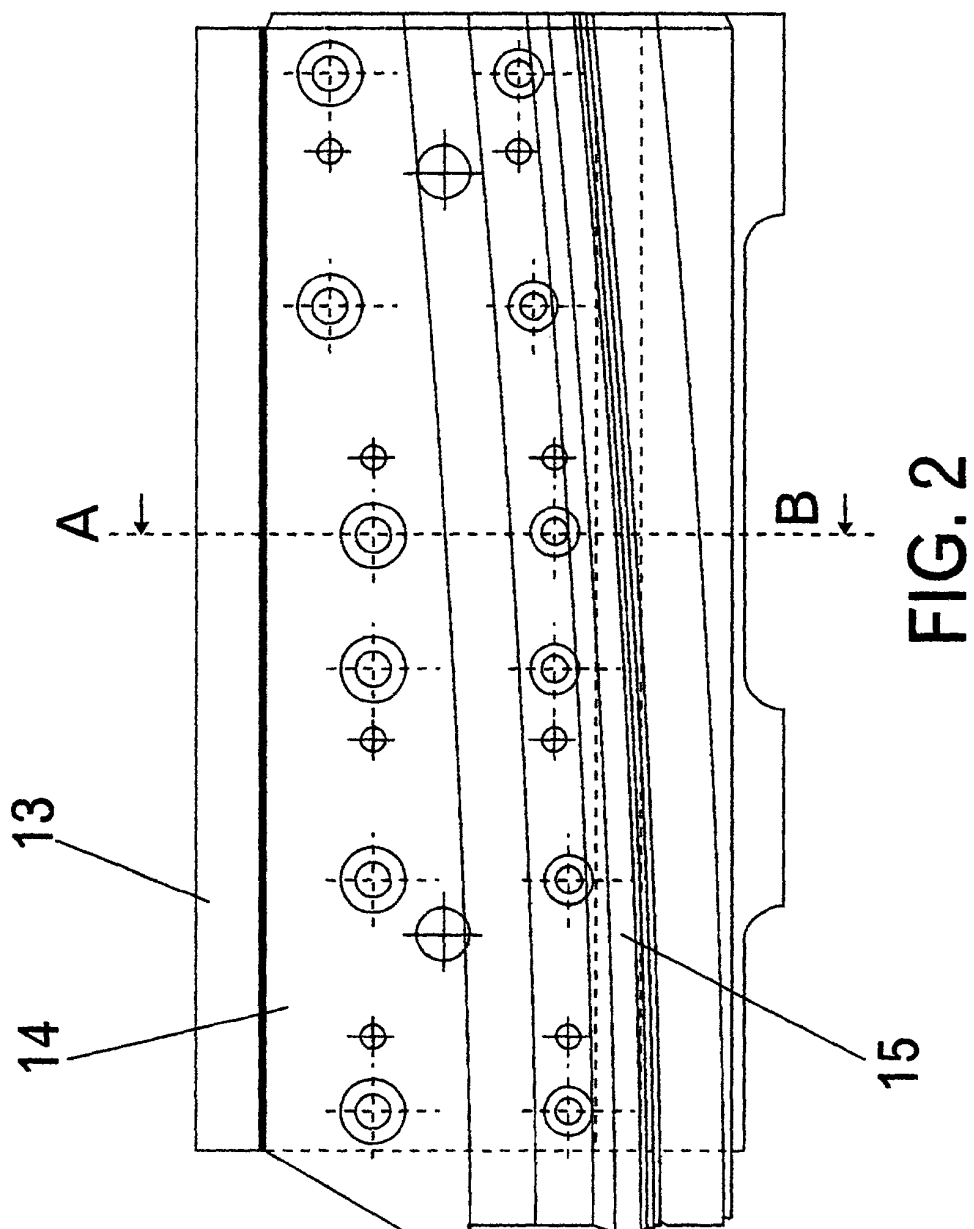


FIG. 1



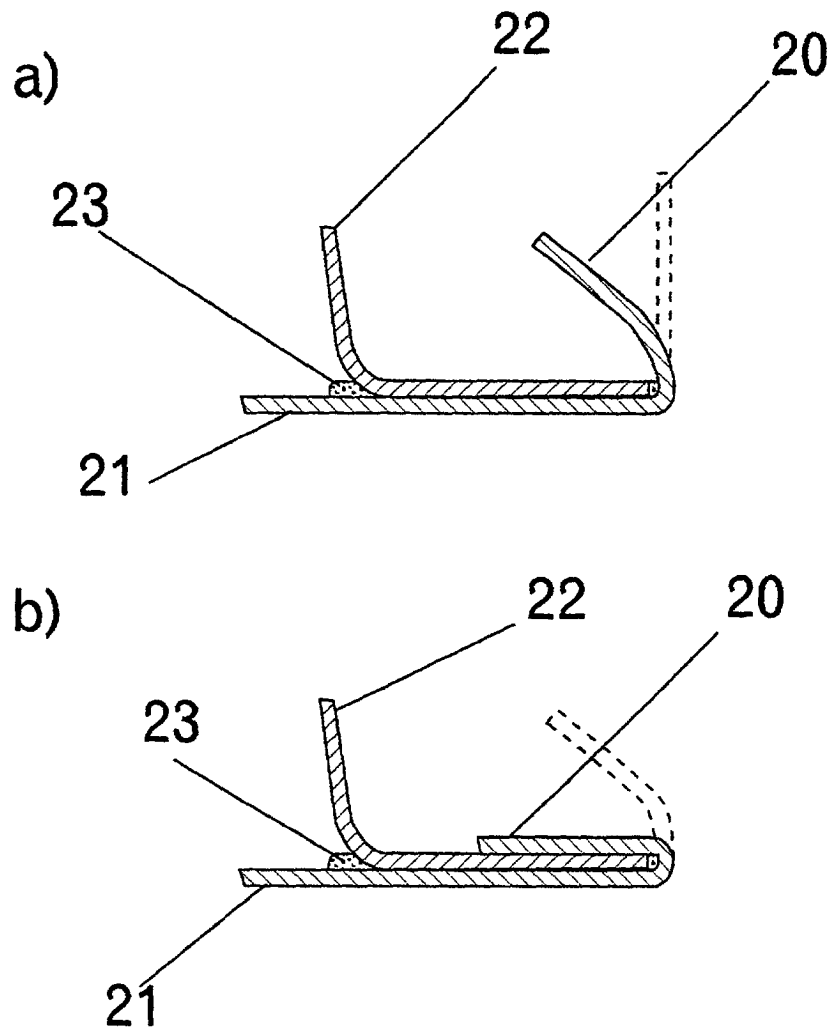


FIG. 4