

## Description

The invention relates to a machine tool, in particular a machine for working with punches and dies parts formed from sheet material, comprising is essentially C-shaped frame made up of two parallel-connected, essentially C-shaped frame parts, each having a top arm and a bottom arm, the first frame part being designed to absorb the reaction forces from forces exerted by tools placed between the arms of the C-shaped frame parts, and the second frame part being designed to hold the the tools in a desired position relative to each other the top arms of the C-shaped frame parts being connected to each other by means of a connecting element which is movable relative to the top arm of the second C-shaped frame part in the working direction of the tools.

A machine a tool of this type. is known from JP-A-52-20479. In this known machine tool that bottom arms of the C-shaped frame parts are connected to each other by means of the bed plate, while also major parts of the bottom arms of the C-shaped frame parts are connected to each other. The connection between the bottom arms of the C-shaped frame parts is such that the two C-shaped frame parts cannot function independently of each other. A deformation of the C-shaped frame part which absorbs the reaction forces from forces exerted by tools placed between the arms of the C-shaped frame parts will have influence on the relative position of the axes of the tools. In punching machines this is undesirable, as the relative position of the axes of the punch and die affects the size of the necessary clearance between punch and die and thus the accuracy of the working.

The object of the invention is to provide a machine tool of the abovementioned type, in which even during the exertion of very considerable forces the tools are held in the predetermined position relative to each other, so that the dimensions of the parts of the tool mating with each other can be adjusted more accurately to each other. The invention also aims at completely eliminating bending moments which have a negative influence on the accuracy of the working.

This object is achieved according to the invention by a machine tool of the abovementioned type which is characterized in that the bottom arms of the C-shaped frame parts are connected to each other only by means of a hinge joint near the ends of the arms and in that the connecting element between the top arms of the C-shaped frame parts is hingedly connected to the top arm of the first C-shaped frame part by means of a hinge joint, the axes of the hinge joints being essentially at right angles to the principal plane of the first C-shaped frame part, and intersecting the common axis of

tools placed between the arms of the C-shaped frame parts.

Preferred embodiments of a machine tool according to the invention are claimed in dependent claims 2 and 3.

The invention also relates to a frame for a machine tool comprising two parallel-connected, essentially C-shaped frame parts, each having a top arm and a bottom arm, the top arm of the C-shaped frame parts being connected to each other by means of a connecting element which is movable relative to the top arm of one of the C-shaped frame parts, in a direction towards the bottom arms of the C-shaped frame parts, characterized in that the bottom arms of the C-shaped frame parts are connected to each other only by means of a hinge joint near the ends of the arms and in that the connecting element between the top arms of the C-shaped frame parts is hingedly connected to the top arm of the first C-shaped frame part by means of a hinge joint being essentially at right angles to the principal plane of the C-shaped frame parts.

The invention will be explained in greater detail by the description of an example of an embodiment with reference to the appended drawings.

Figure 1 shows a schematic illustration of the device according to the invention, with reference to which the principle of the invention is explained;

Figure 2 shows an embodiment of the device according to the invention in vertical section;

Figure 3 shows a view of the device of Figure 2, in a cross section, along the line III-III in Figure 2;

Figure 4 shows a detail of Figure 3, on an enlarged scale;

Figure 5 shows another detail of Figure 3, on an enlarged scale.

Figure 1 shows a machine tool 1, for example a punching machine. This machine has an essentially C-shaped frame 2, comprising two parallel-linked, essentially C-shaped parts 3 and 4. The first part 3 is designed to absorb the punching and reaction forces of forces exerted by punching tools placed between the arms of the two frame parts, while the second part 4 is designed to hold the punching tools (not shown in any further detail in this figure) in their correct position relative to each other, as is known per se.

The first frame part 3 is in the form of a body with a flange. The second frame part 4 is a box structure lying round the first frame part 3.

The two frame parts can move independently of each other. They are only hingedly connected to each other. At the bottom side the bottom arm 5 of the first frame part is hingedly connected to the bottom arm 6 of the second frame part by means of a bottom hinge joint 7. At the top side the top

arm 8 of the first frame part is connected by means of a top hinge joint 9 to a connecting element 10. This connecting element 10 is connected to the top arm 11 of the second frame part so that it is movable in the working direction of the tools in a way to be described in greater detail. The tools, which are not shown in any further detail, can be a punch 12 and a die 13. The punch 12 is driven by a piston 14 which is hydraulically movable in a cylinder 15. The die 13 is essentially immobile; it is connected to the bottom hinge joint 7 by means of an assembly 16 of parts which will be described further below.

It can be seen clearly that the common axis of the tools 12, 13 and the bottom and top hinge points 7, 9 are in line with each other.

If a punching force is now exerted by the piston/cylinder device 14, 15 on the punch 12, the latter comes into contact with the die 13 via a workpiece (not further shown) placed thereon. A reaction force which is equal to the force exerted by the piston/cylinder device 14, 15 is produced. These two forces are transmitted to the hinge points 7, 9. Through the action of these forces the frame 3 will gape, as is known. The arms 5, 8 of the first frame part 3 will be moved apart, while the back part 17 of the first frame part will be moved inwards, all this as shown by dashed lines in Figure 1.

The punch 12 is guided in a straight line in the cylinder 15, which is fixed on the top arm 11 of the second frame part 4. The die 13 is held straight through the fact that the assembly 16 of parts is guided in the bottom arm 6 of the second frame part. The second frame part 4 absorbs neither the force exerted by the piston/cylinder device 14, 15 nor the reaction force.

Due to the fact that the hinge joints 7, 9 are aligned with the common axis of the tools 12, 13, no couple tending to move the arms 6, 11 of the second frame part apart occurs. The alignment of the tools 12, 13 relative to each other is thus fully retained. It is, however, pointed out that this effect requires the axes of the hinge joints 7, 9 to be at right angles to the principal plane of the first frame part 3.

The other figures show an embodiment of the invention. The same reference numbers are used for parts shown in the other figures which correspond to parts shown in Figure 1.

The machine tool to be described is a punching machine with a hydraulic drive 14, 15. The first C-shaped frame part 3, lying inside the second C-shaped frame part 4, can be seen clearly. The bottom arms 5, 6 of the first and second frame parts respectively are attached to each other by means of a hinge joint 7. The top arm 8 of the first frame part 3 is hinged at 9 to a cover 10

(which will be described below), which serves as a connecting element for connecting the top arm 8 of the frame part 3 to the top arm 11 of the second frame part 4 by means of the cylinder 15. A punch 12 and a die 13 are mounted in the machine in a known manner. A table 18 is present, which is intended only to bear the weight of the workpiece during the machining, and does not absorb any other forces. A known stripper 19 which prevents the workpiece from hanging onto the punch is also provided. The hydraulic drive is known per se, and is not described in any further detail. A cylinder positioning plate 20 is used for accurate positioning of the cylinder 15, and thus of the punch 12 relative to the die 13.

An assembly 16 of parts is provided and transmits the punch forces exerted on the die 13 to the hinge joint 7. The assembly 16 of parts is explained with reference to Figure 4.

The die 13 is placed in a die holder 21, comprising a centering ring 22, a gauge ring 23, and a supporting ring 24, the gauge ring and supporting ring being selected depending on the size of the die 13.

The die 13 rests via the supporting ring 24 on a top wedge 26, which in turn rests on a counterwedge 25. The angles of inclination of these wedges complement each other, so that the bottom and top bearing faces can be absolutely parallel. The height of the supporting ring 24, and thus of the die 13 resting thereon, can be set by moving the counterwedge 25 in the horizontal direction.

A piston 27 in a hydraulic cylinder 28 presses the counterwedge 25 against the spring force of a return spring (not shown), in such a way that the wedge 26 is forced upwards through the centering ring 22 and against the supporting ring 24. The supporting ring 24 goes upwards until the counterwedge 25 presses against a threaded spindle. The die can be set to the correct height by screwing or unscrewing the threaded spindle by means of a knob 29 (for the hydraulic oil there is an accumulator, which is not shown).

It can be seen from the above that the wedge 26 also centers the die holder 21. The wedge 26 and the counterwedge 25 are in a centering tube 30. The wedge 26 can move only upwards along the axis of the tools 12, 13 and downwards, and the counterwedge 25 only at right angles to said axis.

The punching force hitting the die is transmitted directly to the bottom arm 5 of the first frame part 3 via the supporting ring 24, the wedge 26, the counterwedge 25, a positioning plate 31, fillers 32, a ball joint bearing and a shaft 33 (connected by bolts 34 to fillers 32). All this is connected only via a positioning plate 31 by means of adjustment bolts (not shown) to the second frame part 4. The function of the positioning plate 31 is therefore to

position the above parts in the common axis of the tools 12, 13 placed between the arms 5, 6, 8, 11 of the C-shaped frame parts 3 and 4. The positioning plate also transmits the weight of the first frame part 3, the hinge joints 9 and 7, the connecting element 10, the supporting blocks 34, the positioning plate 31, the wedge 26, the counterwedge 25, the centering tube 30, the supporting ring 24, the centering ring 22, the die 13 and the die holder 21 to the second frame part 4.

It is clear from the above description that the punching forces exerted by the punch 12 are transmitted directly by the assembly 16 of parts to the bottom hinge joint 7, and not directly to any part of the second frame part 4.

A space is recessed inside all parts forming part of the assembly 16 of parts (the die holder 21, the wedge 26 with counterwedge 25, the positioning plate 31, the fillers 32). This means that the punched material can fall downwards. A sloping plate 35 is used to guide the punched material out of the machine, for example, to a waste bin (not shown).

The hinge joint 7 comprises a pin 33 which is essentially at right angles to the principal plane of the first C-shaped frame part 3. The pin 33 is rotatably mounted in the bottom arm 5 of the first frame part 3 by means of a ball joint bearing 36. The top hinge 9 is of a corresponding design.

The connection of the hydraulic cylinder 15 to the top arm of the first C-shaped frame part 3 will now be described with reference to Figure 5.

The hinge pin 9 is mounted in the top arm 8 of the first frame part 3 by means of a ball joint bearing 37. Ball joint bearings are preferably used as the bearings of the two hinge pins 7 and 9, because they permit a slight angular movement, so that the two hinge pins 7, 9 can be set absolutely at right angles to the principal plane of the first frame part 3. The hinge pin 9 is fixed to a cover 10 of the hydraulic cylinder 15 by means of bolts 38. This cover 10 can be moved in the axial direction of the cylinder coinciding with the working direction of the tools relative to the part of the cylinder 15 connected to the second C-shaped frame part 4. It is possible in this way, if hydraulic fluid is introduced into the space 39 between the piston 14 and the cover 10 and the punch 12 is moved against the workpiece, that the top arm 8 of the first frame part 3 moves upwards through the influence of the reaction force and as a result will gape. The cylinder 15, and thus the second frame part 4, is not loaded by any force and will therefore not gape.

## Claims

1. Machine tool, in particular a machine for working with punches and dies parts formed from

sheet material, comprising an essentially C-shaped frame (2) made up of two parallel-connected, essentially C-shaped frame parts (3, 4), each having a top arm (8, 11) and a bottom arm (5, 6), the first frame part (3) being designed to absorb the reaction forces from forces exerted by tools (12, 13) placed between the arms of the C-shaped frame parts, and the second frame part (4) being designed to hold the tools in a desired position relative to each other, the top arms (8, 11) of the C-shaped frame parts (3, 4) being connected to each other by means of a connecting element (10) which is movable relative to the top arm (11) of the second C-shaped frame part (4) in the working direction of the tools, characterized in that the bottom arms (5, 6) of the C-shaped frame parts (3, 4) are connected to each other only by means of a hinge joint (7) near the ends of the arms (5, 6) and in that the connecting element (10) between the top arms of the C-shaped frame parts (3, 4) is hingedly connected to the top arm (8) of the first C-shaped frame part (3) by means of a hinge joint (9), the axes of the hinge joints (7, 9) being essentially at right angles to the principal plane of the first C-shaped frame part (3), and intersecting the common axis of tools (12, 13) placed between the arms (5, 6, 8, 11) of the C-shaped frame parts (3, 4).

2. Machine tool according to Claim 1, characterized by a hydraulic piston/cylinder combination (14, 15) for driving the tool (12) which is movable relative to the frame (2), the axial direction of the piston/cylinder combination coinciding with the working direction of the tools, the hydraulic cylinder (15) being fixed on the top arm (11) of the second C-shaped frame part (4) and having a cover (10) on the top side, which cover (10) can be moved in the axial direction of the cylinder (15) relative to the part of the cylinder (15) connected to the second C-shaped frame part (4), and is connected to the top arm (8) of the first C-shaped frame part (3) by means of the hinge joint (9), the cover (10) thus forming the connecting element between the top arms (8, 11) of the C-shaped frame parts (3, 4).

3. Machine tool according to Claim 1 or 2, characterized in that the hinge joints (7, 9) each consist of a pin (33, 40) which is essentially at right angles to the principal plane of the first C-shaped frame part (3), which pin (33, 40) is rotatably mounted in at least one of the C-shaped frame parts (3, 4) to be connected in each case, preferably by means of a ball joint



position the above parts in the common axis of the tools 12, 13 placed between the arms 5, 6, 8, 11 of the C-shaped frame parts 3 and 4. The positioning plate also transmits the weight of the first frame part 3, the hinge joints 9 and 7, the connecting element 10, the supporting blocks 34, the positioning plate 31, the wedge 26, the counterwedge 25, the centering tube 30, the supporting ring 24, the centering ring 22, the die 13 and the die holder 21 to the second frame part 4.

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## Claims

1. Machine tool, in particular a machine for working with punches and dies parts formed from

sheet material, comprising an essentially C-shaped frame (2) made up of two parallel-connected, essentially C-shaped frame parts (3, 4), each having a top arm (8, 11) and a bottom arm (5, 6), the first frame part (3) being designed to absorb the reaction forces from forces exerted by tools (12, 13) placed between the arms of the C-shaped frame parts, and the second frame part (4) being designed to hold the tools in a desired position relative to each other, the top arms (8, 11) of the C-shaped frame parts (3, 4) being connected to each other by means of a connecting element (10) which is movable relative to the top arm (11) of the second C-shaped frame part (4) in the working direction of the tools, characterized in that the bottom arms (5, 6) of the C-shaped frame parts (3, 4) are connected to each other only by means of a hinge joint (7) near the ends of the arms (5, 6) and in that the connecting element (10) between the top arms of the C-shaped frame parts (3, 4) is hingedly connected to the top arm (8) of the first C-shaped frame part (3) by means of a hinge joint (9), the axes of the hinge joints (7, 9) being essentially at right angles to the principal plane of the first C-shaped frame part (3), and intersecting the common axis of tools (12, 13) placed between the arms (5, 6, 8, 11) of the C-shaped frame parts (3, 4).

2. Machine tool according to Claim 1, characterized by a hydraulic piston/cylinder combination (14, 15) for driving the tool (12) which is movable relative to the frame (2), the axial direction of the piston/cylinder combination coinciding with the working direction of the tools, the hydraulic cylinder (15) being fixed on the top arm (11) of the second C-shaped frame part (4) and having a cover (10) on the top side, which cover (10) can be moved in the axial direction of the cylinder (15) relative to the part of the cylinder (15) connected to the second C-shaped frame part (4), and is connected to the top arm (8) of the first C-shaped frame part (3) by means of the hinge joint (9), the cover (10) thus forming the connecting element between the top arms (8, 11) of the C-shaped frame parts (3, 4).
3. Machine tool according to Claim 1 or 2, characterized in that the hinge joints (7, 9) each consist of a pin (33, 40) which is essentially at right angles to the principal plane of the first C-shaped frame part (3), which pin (33, 40) is rotatably mounted in at least one of the C-shaped frame parts (3, 4) to be connected in each case, preferably by means of a ball joint



bearing (36, 37).

4. Frame for a machine tool comprising two parallel-connected, essentially C-shaped frame parts (3, 4), each having a top arm (8, 11) and a bottom arm (5, 6), the top arms (8, 11) of the C-shaped frame parts (3, 4) being connected to each other by means of a connecting element (10) which is movable relative to the top arm (11) of one (4) of the C-shaped frame parts, in a direction towards the bottom arms (5, 6) of the C-shaped frame parts (3, 4), characterized in that the bottom arms (5, 6) of the C-shaped frame parts (3, 4) are connected to each other only by means of a hinge joint (7) near the ends of the arms (5, 6) and in that the connecting element (10) between the top arms of the C-shaped frame parts (3, 4) is hingedly connected to the top arm (8) of the first C-shaped frame part (3) by means of a hinge joint (9), the axes of the hinge joints (7, 9) being essentially at right angles to the principal plane of the C-shaped frame parts (3, 4).

#### Patentansprüche

1. Werkzeugmaschine, insbesondere Maschine zum Bearbeiten von aus Blechmaterial geformten Teilen mittels Stempeln und Matrizen, umfassend ein im wesentlichen C-förmiges Gestell (2), bestehend aus zwei parallel gekoppelten, im wesentlichen C-förmigen Gestellteilen (3, 4), von denen jedes einen oberen Arm (8, 11) und einen unteren Arm (5, 6) aufweist, wobei das erste Gestellteil (3) so gestaltet ist, daß es die Reaktionskräfte von Kräften aufnimmt, die von Werkzeugen (12, 13) ausgeübt werden, welche zwischen den Armen der C-förmigen Gestellteile angebracht sind, und wobei das zweite Gestellteil (4) so gestaltet ist, daß es die Werkzeuge in einer gewünschten Lage relativ zueinander hält, wobei die oberen Arme (8, 11) der C-förmigen Gestellteile (3, 4) mit Hilfe eines Verbindungselements (10) miteinander verbunden sind, das in Arbeitsrichtung der Werkzeuge relativ zum oberen Arm (11) des zweiten C-förmigen Gestellteils (4) bewegbar ist, **dadurch gekennzeichnet**, daß die unteren Arme (5, 6) der C-förmigen Gestellteile (3, 4) nur mit Hilfe einer Gelenkverbindung (7) nahe den Enden der Arme (5, 6) miteinander verbunden sind, und daß das Verbindungselement (10) zwischen den oberen Armen der C-förmigen Gestellteile (3, 4) mit Hilfe einer Gelenkverbindung (9) schwenkbar mit dem oberen Arm (8) des ersten C-förmigen Gestellteils verbunden ist, wobei die Achsen der Gelenkverbindungen (7, 9) im wesentlichen

im rechten Winkel zur Hauptebene des ersten C-förmigen Gestellteils (3) ausgerichtet sind und die gemeinsame Achse von zwischen den Armen (5, 6, 8, 11) der C-förmigen Gestellteile (3, 4) angebrachten Werkzeugen (12, 13) schneiden.

2. Werkzeugmaschine nach Anspruch 1, **gekennzeichnet durch** eine hydraulische Kolben/Zylinder-Kombination (14, 15) zum Antreiben des Werkzeugs (12), das bezüglich des Gestells (2) bewegbar ist, wobei die axiale Richtung der Kolben/Zylinder-Kombination mit der Arbeitsrichtung der Werkzeuge zusammenfällt, wobei der Hydraulikzylinder (15) auf dem oberen Arm (11) des zweiten C-förmigen Gestellteils (4) befestigt ist und auf der Oberseite einen Deckel (10) aufweist, wobei dieser Deckel (10) in axialer Richtung des Zylinders (15) relativ zu dem mit dem zweiten C-förmigen Gestellteil (4) verbundenen Teil des Zylinders (15) bewegt werden kann und mit Hilfe der Gelenkverbindung (9) mit dem oberen Arm (8) des ersten C-förmigen Gestellteils (3) verbunden ist, womit der Deckel (10) das Verbindungselement zwischen den oberen Armen (8, 11) der C-förmigen Gestellteile (3, 4) bildet.

3. Werkzeugmaschine nach Anspruch 1 oder 2, **dadurch gekennzeichnet**, daß die Gelenkverbindungen (7, 9) jeweils aus einem Bolzen (33, 40) bestehen, der im wesentlichen im rechten Winkel zur Hauptebene des ersten C-förmigen Gestellteils (3) ausgerichtet ist, wobei dieser Bolzen (33, 40) vorzugsweise mit Hilfe eines Kugelgelenklagers (36, 37) in mindestens einem der in jedem Fall zu koppelnden C-förmigen Gestellteile (3, 4) drehbar gelagert ist.

4. Gestell für eine Werkzeugmaschine, umfassend zwei parallel gekoppelte, im wesentlichen C-förmige Gestellteile (3, 4), von denen jedes einen oberen Arm (8, 11) und einen unteren Arm (5, 6) aufweist, wobei die oberen Arme (8, 11) der C-förmigen Gestellteile (3, 4) mit Hilfe eines Verbindungselements (10) miteinander verbunden sind, das relativ zum oberen Arm (11) eines (4) der C-förmigen Gestellteile in Richtung auf die unteren Arme (5, 6) der C-förmigen Gestellteile (3, 4) zu bewegbar ist, **dadurch gekennzeichnet**, daß die unteren Arme (5, 6) der C-förmigen Gestellteile (3, 4) nur mit Hilfe einer Gelenkverbindung (7) nahe den Enden der Arme (5, 6) miteinander verbunden sind, und daß das Verbindungselement (10) zwischen den oberen Armen der C-förmigen Gestellteile (3, 4) mit Hilfe einer Gelenkverbindung (9) schwenkbar mit dem oberen Arm



(8) des ersten C-förmigen Gestellteils (3) verbunden ist, wobei die Achsen der Gelenkverbindungen (7, 9) im wesentlichen im rechten Winkel zur Hauptebene der C-förmigen Gestellteile (3,4) ausgerichtet ist.

# Revendications

1. Machine-outil, en particulier une machine pour façonner, avec des poinçons et des matrices, des pièces formées à partir d'un matériau en feuille, comprenant un bâti (2) sensiblement en forme de C, constitué de deux parties de bâti sensiblement en forme de C (3, 4) montées parallèles, ayant chacune un bras supérieur (8, 11) et un bras inférieur (5, 6), la première partie de bâti (3) étant destinée à absorber les forces de réaction dues aux forces exercées par des outils (12, 13) placés entre les bras des parties de bâti en forme de C, et la seconde partie de bâti (4) étant destinée à maintenir les outils dans une position désirée entre eux, les bras supérieurs (8, 11) des parties de bâti en forme de C (3, 4) étant reliés l'un à l'autre au moyen d'un élément de liaison (10), qui est mobile par rapport au bras supérieur (11) de la seconde partie de bâti en forme de C (4) dans le sens de travail des outils, caractérisée en ce que les bras inférieurs (5, 6) des parties de bâti en forme de C (3, 4) sont reliés l'un à l'autre uniquement au moyen d'un joint articulé (7) à proximité des extrémités des bras (5, 6) et en ce que l'élément de liaison (10) entre les bras supérieurs des parties de bâti en forme de C (3, 4) est relié de manière articulée au bras supérieur (8) de la première partie de bâti en forme de C (3) au moyen d'un joint articulé (9), les axes des joints articulés (7, 9) étant sensiblement à angles droits par rapport au plan principal de la première partie de bâti en forme de C (3) et intersectant l'axe commun des outils (12, 13) placés entre les bras (5, 6, 8, 11) des parties de bâti en forme de C (3, 4).

2. Machine-outil selon la revendication 1, caractérisée par une combinaison piston/cylindre hydraulique (14, 15) pour entraîner l'outil (12) qui est mobile par rapport au bâti (2), le sens axial de la combinaison piston/cylindre coïncidant avec le sens de travail des outils, le cylindre hydraulique (15) étant fixé sur le bras supérieur (11) de la seconde partie de bâti en forme de C (4) et ayant un couvercle (10) sur le côté supérieur, lequel couvercle (10) peut être déplacé dans le sens axial du cylindre (15) par rapport à la partie du cylindre (15) qui est reliée à la seconde partie de bâti en forme

de C (4), et il est relié au bras supérieur (8) de la première partie de bâti en forme de C (3) au moyen du joint articulé (9), le couvercle (10) formant ainsi l'élément de liaison entre les bras supérieurs (8, 11) des parties de bâti en forme de C (3, 4).

3. Machine-outil selon la revendication 1 ou 2, caractérisée en ce que les joints articulés (7, 9) consistent chacun en un axe (33, 40), qui est sensiblement à angles droits par rapport au plan principal de la première partie de bâti en forme de C (3), lequel axe (33, 40) est monté à rotation dans au moins l'une des parties de bâti en forme de C (3, 4) à relier dans chaque cas, de préférence au moyen d'un palier à rotule (36, 37).

4. Bâti pour une machine-outil, comprenant deux parties de bâti sensiblement au forme de C (3, 4), montées parallèles, ayant chacune un bras supérieur (8, 11) et un bras inférieur (5, 6), les bras supérieurs (8, 11) des parties de bâti en forme de C (3, 4) étant reliés l'un à l'autre au moyen d'un élément de liaison (10) qui est mobile par rapport au bras supérieur (11) de l'une (4) des parties de bâti en forme de C, dans un sens en direction des bras inférieurs (5, 6) des parties de bâti en forme de C (3, 4) caractérisé en ce que les bras inférieurs (5, 6) des parties de bâti en forme de C (3, 4) sont reliés l'un à l'autre uniquement au moyen d'un joint articulé (7) à proximité des extrémités des bras (5, 6), et en ce que l'élément de liaison (10) entre les bras supérieurs des parties de bâti en forme de C (3, 4) est relié de manière articulée au bras supérieur (8) de la première partie de bâti en forme de C (3) au moyen d'un joint articulé (9), les axes des joints articulés (7, 9) étant sensiblement à angles droits par rapport au plan principal des parties de bâti en forme de C (3, 4).