Cabin machine tool, with structure bearing monocoque body.

Priority: 10.09.90 IT 3351790 U
Date of publication of application: 25.03.92 Bulletin 92/13
Publication of the grant of the patent: 01.02.95 Bulletin 95/05
Designated Contracting States: AT BE CH DE ES FR GB LI NL SE

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Description

The present invention relates to a machine tool and in particular a machine to realise three-dimensional models, having a carrying structure of the closed monocoque body type.

In particular the invention relates to a cabin machine tool for making three dimensional models, of the type having a structure made of box elements in sheet metal steel of appropriate thickness, which are welded to each other so as to form an integral box-like body, said structure having all the edges continuous, all the devices of the machine, namely the parts which support and move the tool and the workpiece, being placed inside the structure, and directly connected to it, this structure forming also the cabin of the machine, the said structure also having, on one side, a couple of vertical members and on the opposite side a couple of columns with a couple of cross pieces each supported by a column and a vertical member and along which runs a support sleeve of a tool head, in which that the said vertical members, which are larger than the columns, are sized so as to absorb the most part of transversal thrusts and the said columns have the main function of supporting the cross pieces.

Due to this feature it is possible to give the machine a form such as to improve its manageability and viewing clarity in relation to the work zone, as will be illustrated in detail below in the description.

Thanks to this detail, the machine according to the invention is particularly suitable for use in offices, design studios or similar places.

Automatic or robot machine tools are well known to be able to carry out machinings, even complex ones, in a completely automatic way, under the control of a computerised structure. Many of these machines have a mobile support along a triad of cartesian axes, on which there is mounted a tool head, in its turn equipped with two or more degrees of freedom, to which are applied the tools necessary for the different machinings. Naturally this involves machines which, with respect to size and weight, are not suitable for being used inside offices.

The Italian patent application 44804 A/90 describes a machine tool for realising three dimensional models, to which there can be applied tools of different types to obtain the model from a surface defined using a CAD system.

This need to translate into practical terms a project defined only on paper is an ever more frequent occurrence, for example in design or planning offices, where once a design has been performed it is necessary to quickly realise a model at low cost to see how it looks in reality and then, once all the necessary modifications have been carried out on the model, carry these over to the CAD surface, for the subsequent production phase, mould pressing etc.

Technical progress, which makes available to the users ever more sophisticated software management systems, systems capable of being installed even in micro computers, has extended still further the range of possible application for these apparatuses.

To be used advantageously in a planning studio, however, these machines must not only be small, silent and fast, but they must also be sufficiently accurate, able to carry out machinings with tolerances of a few microns.

This involves needs which are difficult to resolve in a single package, given that it is necessary, with a support structure that is as light as possible, to endure without any deformation the high accelerations involved in machining at high speed.

Whilst with regard to the mechanical and electronic part significant results have already been achieved, there are still different limitations, particularly with regard to the structure carrying the machine.

SU-A-1 380 915, which discloses the subject-matter of the pre-characterising portion of claim 1, relates to a machine for performing different operations at the same time on a workpiece. To this end the workpiece is held by several manipulators 8, mounted on side columns 1 of a parallelepipedal frame and inwardly directed, and is worked by spindles having the axes perpendicular to the sides of the machine.

The present invention proposes a machine tool for realising three dimensional models, having the special feature that it has a monocoque carrying structure.

This feature means it is possible to significantly lighten the machine’s weight, whilst maintaining the features of rigidity.

It is further possible to reduce the sizes of several parts, or remove some edges etc. so as to obtain better visibility in relation to the machine’s work zone.

This and other features will become clearer in the following detailed description, provided simply as an example, with particular reference to the figures enclosed in which:

- fig. 1 shows the perspective view of a machine with the invention;
- figs. 2 and 3 are perspective views of the carrying structure of the machine;
- figs. 4 and 5 are sections of the monocoque carrying structure;
- fig. 6 shows a detail in the system of locking the doors;
- fig. 7 is a detail of the monitor support in a machine with the invention.

With reference to figure 1, the machine according to the invention includes a base 1 which has inside a movable platen 2 to support the piece to be machined and whose structure includes, on the top, a couple of guides along which a sleeve 4 runs, at the lower end of which there is a tool head 5.

In the figure there are axes X, Y, and Z along which movements are developed by respectively the sleeve, platen 2 and the head support 5 which, in its turn, preferably has 2 or more further degrees of freedom.

All these movements are controlled by a numeric control (CNC) as described, for example, in the above-mentioned application 44804 A/90 to which the reader is directed for further details.

At one end of the machine there is a compartment, indicated in overall terms by the number 6, inside which there are all the control systems. The work zone is accessible from two sides, through doors 7 and 8.

The structure of the machine has a support base 9 made up of a box element of appropriate dimensions, to which are welded in relation to one of the minor sides a couple of columns 10 and 11 and, on the opposite side, a couple of vertical members 12 and 13 of larger dimensions.

Two cross-pieces 14 and 15 connect respectively column 10 with the vertical member 12 and the vertical member 11 with the body 13.

All these elements, columns 10 and 11, vertical members 12 and 13 and cross pieces 14 and 15, are made from box elements in sheet steel of appropriate thickness, welded to each other in such a way as to form, together with base 9, a closed monolithic or monocoque structure.

The part included inside this structure is the machine work zone, while the guides 3 along which the sleeve 4 runs, are welded to the cross pieces 14 and 15. The lower part of the sleeve 4, with the tool head 5, thereby projects below the cross pieces, moving along the X and Y axes.

The vertical members 12 and 13 delimit a zone, included between them, which serves to house the machine electronics and the various devices necessary for its functioning.

Of course this zone is appropriately closed by a casing or similar structure. The machine is then closed in relation to the cross piece 15, while it is open on the two remaining sides, to permit access to the interior part.

In this zone closing can be effected using doors which can be opened and which will be illustrated below.

One of the cross pieces - in the specific case the front cross piece 14 - has an inclined wall thereby allowing better visibility of the internal part of the machine.

The vertical member 12 has, in its upper part, a recess 16 which defines a seat to house a board containing a monitor and a push button panel.

To have a better visibility of the work zone of the machine from several sides, vertical members 12 and 13 have been dimensioned with a high moment of inertia, so that the transversal thrusts due to the movements of the sleeve 4 along the X axis are absorbed for the most part by the vertical members 12 and 13, without appreciable deformations in their structure, and columns 10 and 11 (in particular column 10) can be of dimensions as reduced as possible to allow better visibility within the machine.

Here, in the central internal zone, there is a trellis structure 17, which constitutes the only trelliswork part of the machine and which includes four rectified supports 18, which form the supports for the sliding table 2.

At the sides of structure 17 a couple of folded sheets 19 define corresponding slipways to gather the shaving, which during the machining falls to the sides of the table and which is removed by devices of a known type, by means of canalisations arranged below the said walls 19.

The doors 7 and 8, in transparent material, can be separated or preferably, as in the case described, they can form a single body.

Figure 6 shows the system of opening for the doors.

Door 7 is hinged to a couple of arms 20, only one of which is illustrated in the figure, rigidly connected by a shaft 21 mounted on supports 22 welded to the front cross piece 14.

The lower part of the door is hinged to a couple of connecting rods-guides 23.

The door opens by moving along the arc of a circle, so as to move away first slightly from the machine and subsequently raising itself. A gas shock absorber 24 or similar, absorbs the movements of the door.

For better acoustic insulation of the machine there are provided appropriate support fittings along the whole perimeter of the doors.

The control unit including the monitor and the control push button panel, indicated with N. 25 in figure 1, is arranged so as to be entirely contained in the housing 18 of the vertical member and can be rotated so as to facilitate the operator's task.

The operator is usually positioned in front of the door 7, to be able to observe the machine movements.

To this end there is a support 27 fixed to the machine structure, at the end of which there are hinged a couple of connecting rods 28 to which there are in turn hinged corresponding arms 29.
(fig. 6) to which the control unit 25 is fastened.

This system allows the control unit to carry out a roto-translation movement which allows it to slightly move away from the walls of the housing 16 and subsequently be rotated into the position that is most convenient for the operator.

As will be clear from the description above, the fact of providing the monocoque structure permits a significant reduction in the machine's weight, whilst maintaining unaltered the rigidity specifications. It is then possible to modify the shaping of the boxed items and in particular the cross pieces to give them a form such which thereby permits better viewing of the work zone.

Obviously, the dimensions, as with the material used, can vary with the specific needs involved.

Claims

1. Cabin machine tool for making three dimensional models, of the type having a structure made of elements, so as to form an integral box-like body, in particular a parallelepipedal body, said structure having all the edges continuous, all the devices of the machine - namely the parts (2, 5) which support and move the tool and the workpiece - being placed inside the structure, the devices (2, 5) which move the tool and the workpiece being directly connected to it, this structure forming also the cabin of the machine, the said structure also having, on one side, a couple of vertical members (12, 13) and on the opposite side a couple of columns (10, 11) with a couple of cross pieces (14 and 15) each supported by a column and a vertical member and along which runs a support sleeve (4) of a tool head (5), characterised in that the said vertical members (12, 13), which are larger than the columns (10,11), are sized so as to absorb the most part of the transversal thrusts and the said columns (10, 11) have the main function of supporting the cross pieces, the space included between the said vertical members (12 and 13) being assigned to contain the electronics and the machine control devices and that the elements which form the integral box-like body are box elements in sheet metal steel of appropriate thickness, which are welded to each other.

2. Machine tool according to claims 1, characterised by the fact that the cross piece (14) positioned on the operator side has an inclined wall, designed to allow better viewing in the machine work zone.

3. Machine tool according to the claim 1, characterised in that lockable doors (7, 8) are provided, mounted on connecting rod couples (20) hinged to the machine structure so as to allow the said door to carry out movements along an arc of a circle in a vertical plane, means (24) being also provided to absorb the shocks from the said movements.

4. Machine tool according to claim 3, characterised in that said door is hinged to a couple of connecting rods (20) integral with a shaft (21) parallel to the support cross piece of the said door, there being a further couple of connecting rods-guides (23) hinged to the lower part of the door.

5. Machine tool according to the claim 1, characterised in that at the sides of the work plane, inclined walls (19) are provided designed to define a slipway for the collection of chipping, the said slipway being connected to devices for the removal of the chipping.

6. Machine tool according to preceding claims, characterised by the fact of providing a control unit (25) of the type containing a monitor and push-button control panel, housed in a seat (16) in the upper part of one (12) of the said vertical members, there being means provided designed to allow rototranslation movement of the said control unit.

7. Machine tool according to claim 6, characterised in that the support of the said control unit (25) includes a couple of connecting rods (28) hinged on one side to the structure of the machine and on the other to the ends of a C support (29) integral to the said control unit.

Patentansprüche

1. Gekapselte Werkzeugmaschine zur Bearbeitung von 3D-Modellen in folgender Bauweise bestehend aus Elementen, welche einen kastenförmigen Körper in einzigem Stück bilden, insbesondere einen parallelepipedförmigen Körper. In der o.g. Struktur sind sämtliche Kanten beständig, alle Maschinengeräte - besonders die Teile (2, 5), welche das Werkzeug sowie das Werkstück tragen und bewegen - befinden sich innerhalb der Struktur, alle Geräte (2, 5), die das Werkzeug sowie das Werkstück bewegen, sind zur Struktur direkt verbunden, diese Struktur bildet auch die Maschinenstruktur, auf dieser Struktur befinden sich auf einer Seite zwei vertikale Elemente (12, 13) sowie auf der anderen Seite ein Säulen-
paar (10, 11) mit einem Traversenpaar (14, 15), jede Traverse durch eine Säule und ein vertikales Element getragen und den Traversen entlang sich ein Support-Schieber (4) eines Bearbeitungskopfes (5) bewegt. Die für die o.g. Maschine kennzeichnenden Bestandteile sind die o.g. vertikalen Elementen (12, 13), welche größer als die Säulen (10, 11) sind, sind so dimensioniert, daß die Querkkräfte größtenteils abgefangen werden, die o.g. Säulen (10, 11), welche die Hauptfunktion haben, die Traversen zu tragen, der Raum zwischen den o.g. vertikalen Elementen (12, 13), welcher die elektronischen- und Steuergeräte der Maschine enthält, und die Elemente, welche den kastenförmigen Körper in einzigem Stück bilden, welche kastenförmigen Elementen in Metallblech-Konstruktion mit geeigneter Dicke und einander geschweißt sind.

2. Werkzeugmaschine gemäß Anspruch 1, charakterisiert aus einer Traverse (14), welche sich an der Bedienersseite befindet, mit einer Schrägwand, die entworfen wurde, um eine bessere Sichtbarkeit in den Arbeitsraum zu ermöglichen.

3. Werkzeugmaschine gemäß Anspruch 1, charakterisiert aus klemmbaren Türen (7, 8), welche an, an der Maschinenstruktur festen Kurzelstangenaaren angebracht sind, damit die Bewegungen der o.g. Tür einem Kreisbogen entlang auf eine vertikale Ebene durchgeführt werden können. Es sind Stoßdämpfer vorhanden, um die o.g. Bewegungen zu dämpfen.

4. Werkzeugmaschine gemäß Anspruch 3, charakterisiert aus einer an einem Kurbelstangenpaar befestigten Tür. Das Kurbelstangenpaar ist an einer Welle fest, die parallel zur Support-Traverse der o.g. Tür ist. Ein weiteres am unteren Teil der Tür befestigte Führungs-Kurbelstangenaar ist vorhanden.


6. Werkzeugmaschine gemäß den vorherigen Ansprüchen, charakterisiert aus einer Steuereinheit bestehend aus einem Bildschirm und einer Steuerdruckkopfplatte, welche sich in einem Sitz im oberen Teil eines der zwei Ständer befindet. Es sind Mittels vorhanden, um eine Rototranslationsbewegung des o.g. Schrankes zu erlauben.

7. Werkzeugmaschine gemäß Anspruch 6, charakterisiert aus einem Support des o.g. Schrankes, welcher ein Kurbelstangenpaar enthält, das auf einer Seite an der Maschinenstruktur befestigt ist und auf der anderen Seite am Ende eines mit diesem Schrank einteiligen C-Supportes befestigt ist.

**Revendications**

1. Machine-outil cabine pour la production de modèles tridimensionnels, ayant une structure composée d’éléments constituant un corps en forme de caisson en une pièce unique, en particulier un corps parallélépipédique, cette structure ayant tous les bords continus, tous les dispositifs de la machine - en particulier les parties (2, 5) qui soutiennent et meuvent l’outil et la pièce - étant disposés à l’intérieur de la structure, les dispositifs (2, 5) qui meuvent l’outil et la pièce étant directement reliées à cette structure qui constitue également la structure de la machine qui a également d’un côté un couple d’éléments verticaux (12, 13) et de l’autre côté un couple de colonnes (10, 11) avec un couple de traverses (14, 15), chacune d’entre elles soutenue par une colonne et par un élément vertical et le long desquelles est mû un bélier de support (4) d’une tête porte-outil (5) caractérisée par le fait que ces éléments verticaux (12, 13) qui sont plus grands que les colonnes (10, 11) sont dimensionnées de façon à absorber la plupart des efforts transversaux et ces colonnes (10, 11) ont la fonction principale de soutenir les traverses, l’espace compris entre ces éléments verticaux (12, 13) qui sont destinés à contenir les dispositifs électroniques et de contrôle de la machine et que les éléments qui forment le corps en forme de caisson en une seule pièce sont des éléments en forme de caisson en tôle métallique d’épaisseur adéquate, soudés entre eux.

2. Machine-outil selon la revendication 1 caractérisée par le fait que la traverse (14) du côté de l’opérateur présente une paroi inclinée pouvant permettre une meilleure visibilité de la zone de travail de la machine.

3. Machine-outil selon la revendication 1 caractérisée par le fait qu’elle prévoit des portillons de fermeture (7, 8) montés sur des couples de bielles fixés (20) à la structure de la machine de façon à permettre à ce portillon d’effectuer des mouvements le long d’un arc de cercle sur un plan vertical; des moyens (24) permettant d’amortir ces mouvements sont prévus.
4. Machine-outil selon la revendication 3 caractérisée par le fait que ce portillon est fixé à un couple de bielles (20) solidaires à un arbre parallèle (21) à la traverse de support de ce portillon; un couple supplémentaire de bielles-guide (23) fixées à la partie inférieure du portillon est prévu.

5. Machine-outil selon la revendication 1 caractérisée par le fait qu'elle prévoit, sur les côtés du plan de travail, des parois inclinées aptes à définir une goulote pour la récolte des copeaux, cette goulote étant reliée à des systèmes d'aspiration de copeaux.

6. Machine-outil selon les revendications précédentes caractérisée par le fait qu'elle prévoit une armoire de contrôle (25) comprenant un moniteur et un pupitre de commande placée (16) dans la partie supérieure d'un des montants (12), des moyens permettant un mouvement de rototranslation de l'armoire sont prévus.

7. Machine-outil selon la revendication 6 pour laquelle le support de l'armoire (25) comprend un couple de bielles agrafées (28) d'un côté à la structure de la machine et de l'autre à l'extrémité d'un support en forme de C, solidaire à l'armoire.