Title: AUTOMATED PROCESS FOR MANUFACTURING ITEMS OF FURNITURE IN AN INTEGRATED MANUFACTURING CELL AND INTEGRATED CELL FOR MANUFACTURING ITEMS OF FURNITURE

Abstract: Patent of invention for "automated process for manufacturing items of furniture in an integrated manufacturing cell and integrated cell for manufacturing items of furniture". There is described an automated process for manufacturing items of furniture in an integrated manufacturing cell, the process comprising the following steps: a) Initial machining of plate (P) according to a manufacturing program, generating channels and holes; b) Installing inserts in the holes generated in the initial machining and applying resin in at least one side hole of the insert; c) Applying edging resin inside the channels generated in the initial machining; d) Curing the edging resin and resin of the inserts in a heated environment; e) Final machining of plate (P) generating at least one item of furniture. There is also described an integrated cell for manufacturing items of furniture (100), comprising a machining station (200) and a curing station (50) associated with each other by way of a transfer module (30).
wo 2016/082011 Ai

Published:
— with international search report (Art. 21(3))

"AUTOMATED PROCESS FOR MANUFACTURING ITEMS OF FURNITURE IN AN INTEGRATED MANUFACTURING CELL AND INTEGRATED CELL FOR MANUFACTURING ITEMS OF FURNITURE"

[001] The present invention refers to an automated process for manufacturing items of furniture in an integrated manufacturing cell, particularly used in the production of primary parts on a large scale and with precision and also refers to an integrated manufacturing cell that enables the performance of various types of operations on the items of furniture in an automated, integrated and precise manner, this integrated manufacturing cell being used in the automated process for manufacturing items of furniture.

Description of the state of the art

[002] The manufacture of furniture, particularly aeronautical furniture, makes use of a raw material made of fiberglass with epoxy resin and polyaramide. As fiberglass sheets with epoxy resin form outer surfaces which comprise, in the gap between the sheets, the polyaramide forming a porous, sandwich-like combination. This combination can also be made entirely of aluminum depending on the effort demanded by the item.

[003] This process of manufacturing items of furniture that uses the fiberglass material or the aluminum comprises various steps that need to be carried out with precision so that the items produced have final measurements within the tolerance specifications, enabling precise encasement when building and installing furniture.

[004] This is why various difficulties are found in the production of items of furniture known today, including the following: the long manufacturing cycles that result in low productivity, high rates of scrap, rework and repair, high manpower cost and increasingly expensive end product, difficulty in guaranteeing the quality of the process and reliability of the results.

[004] These drawbacks are the results of an almost artisan process of manufacturing items of furniture known in the state of the art. Since it is not automated, the already-known process of manufacturing items of furniture is labor intensive, since each operator is responsible for one of the many steps in the process. Accordingly, a significant lack of repetitiveness and lack of standardization of the steps is noted, as is a very protracted learning curve.

[005] Additionally, the technologies employed in each step of manufacturing are obsolete, demanding much more physical effort from each operator, and sometimes this may lead to ergonomic problems.

[006] An evaluation of the already-known methods of manufacturing items of furniture revealed a shortfall in automation and lack of integration between all the steps
of the process. Furthermore, the manufacturing is performed using conventional, non-customized machines, requiring adaptations that adversely affect precision.

[007] In this sense, the document of the state of the art CN101380748 describes an automated process for manufacturing sandwiched panels made of wood, paper and resin, that is, it describes the manufacture of the raw material for the items of furniture, but does not refer to the process of manufacturing these items of furniture per se.

[008] Document CN 203062239 refers to a CNC (Computer Numerical Control) machining center, endowed with a working platform and various cutting and machining tools connected to a master control. It is possible to machine plates in series at this machining center, but the document does not describe the use of this machine for performing the specific steps of manufacturing items of furniture, such as installing inserts, resin curing, and final cut, among others.

[009] Accordingly, although machining centers and automated machining methods already exist, it is not yet possible to find automated methods and customized and specific integrated manufacturing cells for manufacturing items of furniture, capable of integrating the various necessary steps, each having its own particular aspect.

**Objectives of the invention**

[010] It is therefore an objective of the present invention to provide an automated process for manufacturing items of furniture in an integrated manufacturing cell capable of integrating the necessary steps for this manufacturing.

[011] It is also an objective of this invention to provide an integrated manufacturing cell capable of performing all the necessary operations for manufacturing a part all in one place and in an automated fashion.

**Brief description of the invention**

[012] The object of the present invention is an automated process for manufacturing items of furniture in an integrated manufacturing cell, the process comprising the following steps:

a) Initial machining of a plate according to a manufacturing program, generating channels and holes;

b) Installing inserts in the holes generated in the initial machining and applying resin in at least one side hole of the insert;

c) Applying edging resin inside the channels generated in the initial machining;

d) Curing the edging resin and resin of the inserts in a heated environment;

e) Final machining of the plate generating at least one item of furniture.

[013] Another object of the present invention consists of an integrated cell for manufacturing items of furniture, comprising a machining station and a curing station
associated with each other by means of a transfer module.

**Summarized description of the drawings**

[014] The present invention will, hereinafter, be described in greater detail based on an execution example represented in the drawings. The drawings show:

[015] Figure 1 - is a flowchart of the automated process for manufacturing items of furniture in an integrated manufacturing cell that is the object of this invention;

[016] Figure 2 - is a general schematic view of the integrated cell for manufacturing items of furniture that is the object of this invention. Figure 2 presents two cells;

[017] Figure 3 - is a perspective view and in detail of the vacuum table comprised in the integrated manufacturing cell;

[018] Figure 4 - is a perspective view of the portico comprised in the integrated manufacturing cell;

[019] Figure 5 - is a perspective view of the robotic arm that is part of the integrated manufacturing cell;

[020] Figure 6 - is a first perspective view of the insert assembly device comprised in the integrated manufacturing cell;

[021] Figure 7 - is a second perspective view of the insert assembly device comprised in the integrated manufacturing cell;

[022] Figure 8 - is a view of the lead track that is part of the integrated manufacturing cell;

[023] Figure 9 - is a perspective view of the curing station comprised in the integrated manufacturing cell; and

[024] Figure 10 - is a perspective view of the transition module that is the object of the integrated manufacturing cell.

[025] Photo 1 - illustrates a plate disposed on the vacuum table and endowed with targets of the vision system;

[026] Photo 2 - illustrates a steel sheet disposed on the drawer of the oven of the curing station;

[027] Photo 3 - illustrates an inserts tray with some inserts;

[028] Photo 4 - illustrates the adhesives that fasten the inserts on the plate (P);

[029] Photo 5 - illustrates the vision system that is part of the integrated manufacturing cell; and

[030] Photo 6 - illustrates the insert manipulator comprised in the integrated manufacturing cell.

**Detailed description of the invention**

[031] According to a main embodiment and as can be seen in figures 2 to 10 and
photos 1 to 5, an integrated cell for manufacturing items of furniture 100, object of this invention, comprises a machining station 200 and a curing station 50 associated with each other by way of a transfer module 30 (figure 2).

[032] To coordinate all the functions of the components and stations of the integrated manufacturing cell 100, it comprises a supervisory system endowed with a manufacturing program. This manufacturing program is carried out by the operator of the integrated manufacturing cell 100 and comprises command instructions for all the components of the integrated manufacturing cell 100. Once the manufacturing program has been finalized and simulated, the data are inserted into the supervisory system which sends them to each element of the integrated manufacturing cell 100.

[033] The machining station 200 illustrated in figure 2 comprises a portico 203 formed by horizontal structures 213, perpendicularly associated to vertical structures 214 which are fastened to the floor. Under the portico 203, more precisely under the horizontal structures 213, there is disposed a vacuum table 201, which receives and fastens work plate P.

[034] As can be seen in figure 3 and in detail A, this vacuum table 201 is formed by a plurality of sideward rods 212 parallel to each other, on which a plurality of vacuum nozzles 215 are installed. The rods 212 with vacuum nozzles 215 are supported on a supporting structure 217, securely fastened to the floor by way of multiple fasteners 211 disposed along the length of the table 201.

[035] Along the upper surface of the vacuum table 201 there are disposed reference stops 216, used to assist the positioning of plate P during the referencing step of plate P, that is, when plate P to be machined is disposed on a vacuum table 201, the sides of this plate P are placed at the reference stops 216 which give the notion of alignment when plate P is withdrawn from the vacuum table 201 and returns thereto, for instance, after resin curing.

[036] The vacuum nozzles 215 are disposed along the rods 212, side by side and so as to cover the entire surface of the vacuum table 201. The vacuum of these vacuum nozzles 215 makes them suction the surface of plate P keeping it securely fastened to the vacuum table 201 during the machining steps and other steps of the process.

[037] The vertical structures 214 of the portico 203 support the horizontal structures 213 and assist in keeping the entire integrated manufacturing cell 100 rigid.

[038] There are fastened on the horizontal structures 213 a robotic arm 202, a vision system 204, an insert manipulator 205, a machining mandrel 208, an insert resin applier 206 and an edging resin applier 207, as can be seen in figure 4.

[039] The robotic arm 202, illustrated in detail in figure 5, moves sideward on a track 218 - which is also fastened to one of the horizontal structures 213 of the portico -
and angularly by means of pivots 221 or articulations which enable it to rotate. The sideward and angular movements can be simultaneous and occur above the vacuum table 201, where plate P is fastened. An electric motor 219 is responsible for relaying power to the robotic arm 202, enabling it to move sideward and angularly.

[040] For the robotic arm 202 to grasp the tools required for manufacturing plate P, the robotic arm 202 comprises a grasping element 220 disposed at its free end 240, and which enables the encasement of this robotic arm 202 with the tools of the manufacturing process of the item of furniture depending on the operation to be carried out. Among others, these tools consist of the vision system 204, an insert manipulator 205, a machining mandrel 208, an insert resin applier 206 and the edging resin applier 207, all these tools necessary for the process of manufacturing items of furniture that will be described ahead.

[041] In this sense, the vision system 204 comprises means of identifying targets A which, during the manufacturing process of the item of furniture are fastened to plate P. More specifically, the vision system 204 consists of an optical system formed by a camera which is guided by the robotic arm 202 to targets A fastened to plate P (photo 1). This camera visualizes targets A which are metallic and reflective, identifying them by way of a computer program inserted into the supervisory system of the integrated manufacturing cell 100 (photo 5). The data obtained by the vision system 204 from identifying targets A are sent to the supervisory system which can alter the manufacturing program based on the location coordinates of plate P.

[042] The insert manipulator 205 is formed by a plurality of vacuum tips 222 interconnected amongst themselves and to a same base 227, such that as vacuum tips 222 turn as they grasp or release the inserts 230 as illustrated in photo 6. Therefore, by means of the grasping element 220, the robotic arm 202 carries the insert manipulator 205 and provides the rotation of the vacuum tips 222 to obtain or release the inserts 230 in certain places, that is, each vacuum tip 222 transports an insert 230 from a tray of inserts 223 to a hole in plate P by way of the robotic arm 202.

[043] The machining mandrel 208 comprises a cutting tool of the milling type (not illustrated), used by the robotic arm 202 for the initial machining and final machining of the item of furniture. Following the commands of the manufacturing program, the robotic arm 202 associated to the machining mandrel 208, opens up channels and holes in plate P.

[044] Additionally, the integrated manufacturing cell 100 comprises two types of resin appliers: the insert resin applier 206 and the edging resin applier 207. The insert resin applier 206 consists of a fine tip that inject resin into open holes on the side proximities of the holes that receive the inserts, whereas the edging resin applier 207 is a longer tip having a wider diameter, which fills with the appropriate resin the channels made in plate P during initial
machining.

[045] The machining station 200 of the integrated manufacturing cell 100 further comprises an insert assembly device 300 (figures 6 and 7) which prepares a plurality of inserts 230 and provides them on a plurality of insert trays 223 (photo 3) which are then disposed on a guide track 226 (figure 8) for access by the insert manipulator 205 conducted by the robotic arm 202.

[046] This insert assembly device 300 is formed by a support structure 310 covered by a protection lid 320 forming a machine separated from the integrated manufacturing cell 100. The support structure 310 comprises a supporting platform 311, on which there is a tray carrier of inserts 312 which receives the insert tray 223 to be prepared, a CO₂ laser set 313 and an adhesive film applier (not illustrated). The protection lid 320 covers the support structure 310 giving access to the insert tray carrier 312 and a panel with numerical commands 314 to set up the insert preparation parameters 230.

[047] The insert trays 223 are standard-sized parallepipeds blocks, endowed with at least an RFD-type sensor 231 disposed on one of its corners and endowed with a plurality of through holes 241, each through hole 241 comprising a recess 242 having a larger diameter, concentric to the through hole 241 and having the function of acting as template for recutting an adhesive film which is applied to the inserts 230. The diameter of the through holes 241 vary from one inserts tray 223 to another owing to the different inserts 230 used in the items of furniture.

[048] The guide track 226 comprises a supporting structure 245 fastened near the vacuum table 201 of the integrated manufacturing cell 100. This guide track 226 comprises a free end 233 and a clamped end 234. Positioned near the clamped end 234 is a reader 232 which identifies the passage of one inserts tray 223 through the sensor 231 disposed on this inserts tray 223. The data received by the reader 232 consists of information on the type and amount of inserts 230 disposed on the tray 223 and are sent to the supervisory system.

[049] The supervisory system receives the data from the reading of the sensor 231 of the insert tray 223, identifies the type and amount of inserts 230 disposed on that tray 223 and, depending on the step of the manufacturing process of the part, sends a command to the robotic arm 202 for association with the insert manipulator 205 and conducts it to the site of the trays 223 so that each vacuum tip 222 obtains an insert 230 from the tray 223.

[050] Besides the machining station 200, the integrated manufacturing cell 100 is also formed by the curing station 50 illustrated in figure 9.

[051] The curing station 50 comprises at least an oven 51 endowed with multiple drawers 52 moved between open and closed position by means of an electric motor 56, one for each drawer 52.
[052] As can be seen in photo 2, each drawer 52 comprises, internally, a flat steel sheet 53 endowed with a plurality of vacuum points 57. When the plate P is disposed on the steel sheet 53 of the drawer 52 to be inserted into the oven 51, the vacuum points 57 apply a vacuum to the surface of plate P with which they are in contact, fastening it securely to the steel sheet 53. Accordingly, while plate P is curing inside the oven, it does not run the risk of warping, as it is kept fastened on a flat surface.

[053] By virtue of the plurality of drawers 52, it is possible to insert into the oven 51 a plurality of plates P to cure the resin applied thereto during machining.

[054] However, for machined plate P to be transferred from the machining station 200 to the curing station 50, a transfer module 30 must be used.

[055] This transfer module 30 is disposed between the machining station 200 and the curing station 50 and is formed by a first frame 31 disposed parallel under a second frame 32.

[056] According to figure 10, the first frame 31 and the second frame 32 consist of metallic structures forming a rectangular framework of the frame type with a hollow center. Next to the longer side structures there is disposed a plurality of vacuum points 54 which fasten the plate P during transfer of plate P from the vacuum table 201 to the drawer 52 of the oven 51 or vice-versa.

[057] In this sense, the second frame 32 transfers machined plate P from the vacuum table 201 to the drawer 52 of the curing station 50, for example, and afterwards, the same second frame 32 transfers plate P from the drawer 52 to the first frame 31, maintaining itself constantly fastened to plate P so as to form a combination: first frame (31), plate (P) and second frame (32). This combination is then rotated 180° such that the surface of plate P on which the resin was cured returns to the vacuum table 201 downwards, in contact with the vacuum nozzles 215, for the other surface of plate P to be machined.

[058] Finalizing the turnover, the first frame 31 is now on the second frame 32 and carries out, according to the manufacturing program, the functions carried out in the prior cycle on the second frame 32.

[059] As can be seen in figure 1, the present invention also refers to an automated process for manufacturing items of furniture in an integrated manufacturing cell, and this process comprises the following essential steps:

a) Initial machining of a plate P according to a manufacturing program, generating channels and holes;

b) Installing inserts in the holes generated in the initial machining and applying resin in at least one side hole of the insert;

c) Applying edging resin inside the channels generated in the initial machining;
d) Curing the edging resin and resin of the inserts in a heated environment;
e) Final machining of plate P generating at least one item of furniture.

Step a: initial machining of plate P according to a manufacturing program, generating channels and holes

[060] The initial machining of plate P is done by the robotic arm 202 using a machining mandrel 208, with plate P fastened to the vacuum table 201.

[061] However, before positioning plate P on the vacuum table 201, the manufacturing program of the item of furniture is prepared and simulated through a specific software that generates a file, this file is loaded onto the supervisory system of the integrated manufacturing cell 100. This manufacturing program comprises commands and parameters of all the steps of the process.

[062] Once the manufacturing program of the part is loaded onto the supervisory system, plate P is positioned on the vacuum table 201, at the stops 2016 that assist with the correct positioning of this plate P.

[063] After insertion of the manufacturing program and with plate P positioned on the vacuum table 201, the referencing step of plate P occurs through optical system of the vision system 204. in this step, the robotic arm 202, using the machining mandrel 208, makes specific holes where targets A are fastened. These targets A are parts manufactured specifically for use of the vision system 204 and, as can be seen in photo 1, comprise a dark cylindrical body with a metallic cylindrical area, associated to an elongated neck that is screwed into the hole by the robotic arm 202.

[064] With targets A positioned on the holes of plate P, the robotic arm 202 carries the vision system 204 to each of the targets A, identifies them and, accordingly, identifies the positioning of plate P on the vacuum table 201 to adjust the reference point (point zero). The references obtained are inserted into the supervisory system and the manufacturing program is updated or adjusted based on these coordinates.

[065] Whenever plate P leaves the vacuum table 201 and returns to the vacuum table 201, the robotic arm 202 makes the reference of plate P by means of the vision system 204 cooperating with targets A.

[066] With plate P positioned on the vacuum table 201 and referenced, the supervisory system corrects the positioning of the robotic arm 202 immediately prior to initial machining. By means of a software, a small difference (tenths of a millimeter) is corrected in the positioning of the robotic arm 202 caused by a minor deformation, but one that results in imprecise machining of plate P. The manufacturing program is altered based on this correction of positioning.

[067] Having made this correction, the robotic arm 202 carries the machining
mandrel 208 and performs the machining on plate P, according to the manufacturing program in the supervisory system. During this initial machining, channels and holes are generated along plate P.

Step b: Installing the inserts in the holes generated in the initial machining and applying resin in at least one side hole of the insert

[068] Once the step of initial machining is finalized, the robotic arm 202 changes the machining mandrel 208 for the insert manipulator 205, goes to the inserts tray 223 next to the guide track 226 and carries the insert manipulator 205 with inserts 230 by way of vacuum.

[069] With the insert manipulator 205 loaded with inserts 230, the robotic arm 202 takes these inserts 230 to the specific holes generated in the initial machining, depositing one insert 230 in each hole (photo 4).

[070] Since the inserts 230 comprise a cylindrical adhesive 243 glued to one of its outer surfaces, when this insert 230 is inserted into the holes of plate P the body of the insert 230 is inside the hole and the upper surface of the insert 230, which touches the surface of plate P, is covered by the cylindrical adhesive 243. This adhesive 243 guarantees the flatness of the upper surface of the insert 230 with the surface of plate P, since there may be through holes and blind holes on plate P.

[071] After positioning the inserts 230 on the holes, the robotic arm 202 makes at least two holes on plate P, on the sides of each insert 230, very close to the hole that houses the insert 230. Thereafter, the robotic arm 202 carries the insert resin applier 206 and applies resin in one of these side holes. The resin spreads involving the insert 230 and glues it to plate P while the second hole acts as a vent for air to escape as the resin fills the hole.

Step c: Applying edging resin inside the channels generated in the initial machining

[072] Once the inserts 230 are installed, the robotic arm 202 carries the edging resin applier 207 and crosses the length of the channels opened up on plate P during initial machining, completely filling these channels with resin. The function of this resin is to finish the edges of the part when it is cut in the final machining step.

[073] In this step of applying the edging resin, a conventional machine pumps the resin and the catalyst in separate ducts, calculates the dose of each one and the flow for filling the channels of plate P. The resin is formed by glass microspheres to guarantee low density of this resin applied to plate P (about 0.58 g/cm³), so as not to increase the weight of the final item of furniture.

[074] The pumped resin and catalyst are conducted inside twenty meters of tubing until they reach the edging resin applier 207. In order for the glass spheres not to break
during this transport, which would result in a significant increase in the density of the resin and increased weight of the furniture, a metallic tube is used, heated to approximately 40°C to conduct the resin, guaranteeing greater fluidity of the resin and less attrition with the transport tubing walls.

[075] The catalyst is transported in tubing made of rubber, and does not need to be heated.

[076] The resin is mixed with the catalyst in the edging resin applier 207, just before it is deposited in the machined channel

**Step d: Curing the edging resin and resin of the inserts in a heated environment**

[077] With the resin applied to the side holes of the inserts 230 and in the channels of plate P, this plate P is transported to an oven 51 for the step of curing the resin. Accordingly, the second frame 32 of the transfer module 30 moves to the vacuum table 201 and secures plate P by way of vacuum nozzles 54 which suction the surface of plate P keeping it fastened to the second frame 32. With plate P secured, the second frame 32 moves plate P to one of the drawers 52 of the oven 50 and deposits plate P on the metal sheet 53 with other vacuum nozzles 57. The vacuum nozzles 57 of the drawer 52 keeps plate P upright and fastened to the metal sheet 53. Upon curing, depending on the heat of the oven, the part needs to be well fastened on a rigid and flat surface to avoid warping.

[078] Once inside the drawer 52, the edging resin and the resin of the inserts 230 are cured in the oven 50, at a temperature in the range from 40°C to 55°C for 1 to 3 hours.

[079] Depending on the part, it is necessary to machine both sides of plate P. In this case, after the curing step, plate P is rotated, by way of the transfer module 30, for machining the second side,

[080] This rotation is made by the transfer module 30. The second frame 32 of the transfer module 30, with the use of vacuum nozzles 54, grasps plate P in the drawer 52, moves plate P to the area of the transfer module 30, positions plate P next to the vacuum nozzles 54 of the first frame 31, but does not release plate P whereby forming a combination (first frame, plate P and second frame) which is rotated 180° such that the unmachined surface of plate P faces upwards.

[081] With the rotation, the first frame 31 is thereafter on a second frame 32. After the rotation, the second frame 32 is kept where it is and the first frame 31 moves on top thereof, taking with it plate P which is moved and positioned on the vacuum table 201, with the unmachined part facing upwards.

[082] Plate P being positioned on the vacuum table 201, the robotic arm 202 again makes the referencing of plate P with the vision system 204 identifying targets A. The new positioning of plate P is inserted into the supervisory system and the machining steps.
installation of the inserts, application of the resin to the inserts, application of the edging resin and curing, already described in detail above are made on this second side of plate P.

[083] Targets A are fastened on plate P at the start of the process and are only withdrawn when the part is finally cut, that is, targets A remain on plate P during all the steps, including the curing step. Additionally, the identification ends of targets A are identical under the vision system 204, therefore, when plate P is turned for machining on the other side, targets A are adjusted for referencing of plate P under the system.

Step e: Final machining of plate P generating at least one item of furniture

[084] Therefore, after curing the resins applied to one or two sides of the plate P, it returns from the oven 50 to the vacuum table 201. The robotic arm 202 makes the referencing of targets A with the vision system 204 setting in the supervisory system the new positioning of plate P on the table 201. The robotic arm 202 then carries the machining mandrel 208 and machines the channels filled with resin to detach one or more parts from plate P.

[085] This step comprises the real dimension cut of the part until half of the channel machined and filled with resin. Plate P is turned by the transfer module 30, referenced on the vacuum table 201 and the cut is finalized, detaching one or more parts from plate P.

[086] The automated process for manufacturing items of furniture in an integrated manufacturing cell 100 and the very integrated manufacturing cell 100 are all part of the manufacturing procedures of primary furniture parts in a complete manner, since all the steps of the process are carried out in a same work station, the integrated manufacturing cell. The manufacturing program inserted into the supervisory system and the use of the robotic arm 202 guarantee precision and greater productivity to the manufacturing process, as well as enabling the achievement of finished parts at the end of the process. Therefore, the difficulties found in the currently-known manufacturing processes of items of furniture are overcome, such as the lack of interaction between the steps, labor intensiveness, lack of repetitiveness and lack of standardization of the steps, lack of automation and adaptations which adversely affect precision, among others.

[087] Having described an example of a preferred embodiment, it should be understood that the scope of the present invention encompasses other possible variations, being limited solely by the content of the claims, potential equivalents being included therein.
CLAIMS

1. An automated process for manufacturing items of furniture in an integrated manufacturing cell, the process being characterized by comprising the following steps:
   a) Initial machining of a plate (P) according to a manufacturing program, generating channels and holes;
   b) Installing inserts in the holes generated in the initial machining and applying resin in at least one side hole of the insert;
   c) Applying edging resin inside the channels generated in the initial machining;
   d) Curing the edging resin a resin dos inserts in a heated environment;
   e) Final machining of plate (P) generating at least an item of furniture.

2. The process as claimed in claim 1, characterized wherein prior to the initial machining, there occurs the step of preparation and insertion of the manufacturing program of the item of furniture in a supervisory system of the integrated manufacturing cell, this manufacturing program comprising commands and parameters of all steps of the process.

3. The process as claimed in claim 2, characterized wherein after inserting the manufacturing program and prior to the initial machining, plate (P) is positioned in the integrated manufacturing cell and is referenced by way of a vision system (204) cooperating with a plurality of targets (A), the references obtained are inserted into the supervisory system and the manufacturing program is updated.

4. The process as claimed in claim 3, characterized wherein immediately prior to the initial machining, the supervisory system corrects the positioning of a robotic arm (202) and alters the manufacturing program based on this correction of positioning.

5. The process as claimed in claim 1, characterized wherein after installing the inserts (230) into the holes generated in the initial machining and before applying the resin on at least one side hole of the insert, at least two holes are made in plate (P), to the side of the insert (230).

6. The process as claimed in claim 1, characterized wherein the edging resin and the resin of the inserts is cured in an oven at a temperature in the range of 40°C to
55°C for 1 to 3 hours.

7. The process as claimed in claim 1, characterized wherein optionally, after the curing step, a step of plate (P) rotation occurs by way of the transfer module (30), for machining on both sides of the plate (P).

8. The process as claimed in claim 7, characterized wherein after rotation, plate (P) is again positioned in the integrated manufacturing cell with the unmachined side facing upwards and is referenced through a vision system (204) cooperating with a plurality of targets (A), the references obtained are inserted in a supervisory system and the manufacturing program is updated.

9. The process as claimed in claims 2 to 8, characterized wherein after the plate (P) is again referenced with the unmachined side facing upwards, the following steps occur: initial machining, installation of inserts in the holes generated in the initial machining and application of resin on at least one side hole of the insert, application of edging resin inside the channels generated in the initial machining and curing the edging resin and resin of the inserts,

10. The process as claimed in claim 1, characterized wherein the final machining is made of the resin deposited and cured in the channels generated in the initial machining.

11. The process as claimed in claim 9, characterized wherein the final machining is made on the resin deposited and cured in the channels generated in the initial machining, on both sides of the plate (P).

12. An integrated manufacturing cell of items of furniture (100), characterized by comprising a machining station (200) and a curing station (50) associated with each other by means of a transfer module (30).

13. An integrated manufacturing cell, characterized by comprising a supervisory system endowed with a manufacturing program, said manufacturing program comprising command orders for all the components of the integrated manufacturing cell sent by the supervisory system.

14. The integrated manufacturing cell as claimed in claim 12, characterized
wherein the machining station (200) comprises a portico (203) formed by horizontal structures (213) perpendicularly associated to vertical structures (214) fastened to the floor, under the horizontal structures (213) there is disposed a vacuum table (201) which receives and fastens plate (P).

15. The integrated manufacturing cell as claimed in claim 14, characterized wherein the vertical structures (214) the horizontal structures (213) on which there are associated a robotic arm (202), a vision system (204), an insert manipulator (205), a machining mandrel (208), an insert resin applier (206) and an edging resin applier (207).

16. The integrated manufacturing cell as claimed in claim 14, characterized wherein the vacuum table (201) comprises a plurality of linear rulers (212) and parallel to each other, on which there is installed a plurality of vacuum nozzles (215), plate (P) is disposed on the plurality of vacuum nozzles (215) and fastened thereby.

17. The integrated manufacturing cell as claimed in claim 15, characterized wherein the robotic arm (202) moves sideward on a track (218) disposed next to the horizontal structures (213) of the portico (203) and at angles by means of swivel joints (221), and the sideward and angular movement may be simultaneous.

18. The integrated manufacturing cell as claimed in claim 17, characterized wherein the robotic arm (202) comprises a grasping element (220) on which there can be fastened the vision system (204), the insert manipulator (205), the machining mandrel (208), the insert resin applier (206) or the edging resin applier (207) depending on the operation to be carried out.

19. The integrated manufacturing cell as claimed in claim 15, characterized wherein the vision system (204) comprises means of identifying targets (A) fastened to the plate (P) and the data obtained by the vision system (204) from identifying the targets (A) are sent to the supervisory system which can alter the manufacturing program.

20. The integrated manufacturing cell as claimed in claim 15, characterized wherein the insert manipulator (205) consists of a plurality of interconnected vacuum tips (222) and from a same base (227), each vacuum tip (222) transporting an insert (230) from one tray of inserts (223) to a hole in the plate (P) by way of the robotic arm (202).
21. The integrated manufacturing cell as claimed in claim 20, characterized by further comprising an insert assembly device (300) that prepares a plurality of inserts (230) and provides them on a plurality of insert trays (223) disposed on a guide track (226) for access by the insert manipulator (205).

22. The integrated manufacturing cell as claimed in claim 20, characterized wherein the plurality of insert trays (223) comprises a sensor (231) identified by a reader (232) positioned in a region near the clamped end (234) of the guide track (226), the data received from the reader (232) are sent to the supervisory system.

23. The integrated manufacturing cell as claimed in claims 12 and 13, characterized wherein the curing station (50) comprises at least an oven (51) endowed with multiple drawers (52) on which the plates (P) with resin for curing are disposed.

24. The integrated manufacturing cell as claimed in claim 23, characterized wherein each drawer (52) comprises a flat steel sheet (53) endowed with a plurality of vacuum points (57), said vacuum points (57) fasten the plate (P) on the steel sheet (53).

25. The integrated manufacturing cell as claimed in claims 12 to 24, characterized wherein the transfer module (30) is disposed between the machining station (200) and the curing station (50), being formed by a first frame (31) disposed parallel under a second frame (32), the second frame (32) transferring the machined plate (P) from the vacuum table (201) to the drawer (52) of the curing station (50).

26. The integrated manufacturing cell as claimed in claim 25, characterized wherein the second frame (32) transfers the plate (P) from the drawer (52) to the first frame (31) maintaining itself fastened to the plate (P) such that the first frame (31), plate (P) and second frame (52) combination is rotated 180°.

27. The integrated manufacturing cell as claimed in claim 26, characterized wherein the first frame (31) and the second frame (32) are endowed with a plurality of vacuum points (54) that support the plate (P) during transfer.
Initial machining

Installation of inserts and application of resin

Application of edging resin

Curing of edging resin

Final machining

FIG. 1
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER

INV. B29C70/02 B29C70/70

ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B29C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
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</table>
| A        | US 3 328 218 A (HOWARD NOYES) 27 June 1967 (1967-06-27) "The sheet may be pre-dried or punched," adhesive is fed from a reservoir 43 into the roller 41 and creates the adhesive lines 45 "More specifically, it may be used in aircraft and missile structures, building panels, truck bodies, aircraft radar domes, crash helmets, insulating containers, furniture cushions, supports, and supports where vibration is required." col umn 4, line 70 - line 75 col umn 1, line 65 - line 72 ---- ---- 1

[See patent family annex.]

Further documents are listed in the continuation of Box C.

Date of actual completion of the international search 19 February 2016

Date of mailing of the international search report 25/02/2016

Name and mailing address of the ISA
European Patent Office, P.B. 5815 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040,
Fax: (+31-70) 340-3016

Boone, John

PCT/BR2015/000173

Form PCT/ISA/210 (second sheet) (April 2005)
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<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
<tbody>
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<td>A</td>
<td>US 5 832 594 A (AVI LA STEVEN J [US]) 10 November 1998 (1998-11-10) FIGS. 18-20 illustrate my pin inserti on tool that I can use to form detail parts having pin stubble or to make Pannel’s precured stripes. My tool 1800 includes a housing 1805 holding a sliding piston 1810 which can reciprocate between a loading position for receiving a pin-carrying foam 1815 in a cavity 1820 and an inserti on position where the piston 1810 moves upwardly to crush the foam and to insert the pins 1825. The foam 1815 is of the Foster-Miller type previously described and is loaded onto the piston in cavity 1820. Seal 1830 permits the piston 1810 to slide along the walls of housing 1805 when pneumatic pressure is applied through inlet 1835 to chamber 1840 behind the piston. Motion of the piston 1810 toward removable cure tool 1845 is arrested with a stop 1850 which also serves to control the depth of insertion of the pins 1825 in the pin-carrying foam 1820 into the uncured detail part 1855 (or Pannel prepregs). The stop 1850 contacts replaceable stop 1860 that seats in the fixed support frame of the cure tool 1845 that is rigidly attached to the housing 1805 at the fixed wall defining cavity 1820. The replaceable stop 1860 allows adjustment of the depth of penetration of the pins into the detail part 1855. The cure tool 1845 fits rigidly in a matching receiving surface in the frame and does not move when piston 1810 moves upwardly. Yet, cure tool 1845 is replaceable to permit control of insertion of different Z-pin ori entations into the detail part 1855. During pin insertion through movement of the piston 1810, the detail part 1855 is held rigidly on the surface of the cure tool 1845 so that the Z-pins 1825 are positioned correctly. All parts of the pin inserti on tool 1800 are designed to withstand the temperatures and pressures associated with autoclave curing of the resin composite detail parts. Any necessary release films can be used between the pin-carrying foam 1815 or the detail part 1855 and the working parts of the inserti on tool; column 19, line 31 - line 59; figures 18-20</td>
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<td>X</td>
<td>EP 2 067 570 A1 (CASAL TUBET FRANCISCO [ES]) 10 June 2009 (2009-06-10) claims 1-3</td>
<td>12-14</td>
</tr>
<tr>
<td>A</td>
<td>DE 20 2009 001846 U1 (THEURL LEIMHOLZBAU GMBH [AT]) 20 May 2009 (2009-05-20) figure 1</td>
<td>1</td>
</tr>
<tr>
<td>A</td>
<td>DE 10 2005 024408 A1 (AIRBUS GMBH [DE]) 30 November 2006 (2006-11-30) figures 3,4</td>
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<td>Publication date</td>
<td>Patent family member(s)</td>
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<tr>
<td>US 3328218 A</td>
<td>27-06-1967</td>
<td>NONE</td>
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<td>US 5919413 A</td>
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<td>Wo 2013009915 A2</td>
<td>17-01-2013</td>
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<td>WO 2009071274 A</td>
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<td>NONE</td>
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<tr>
<td>DE 102005024408 AI</td>
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<td>CA 2604572 A</td>
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<td>EP 1883526 A</td>
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<td>US 2009252917 A</td>
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<td>WO 2006125561 A</td>
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