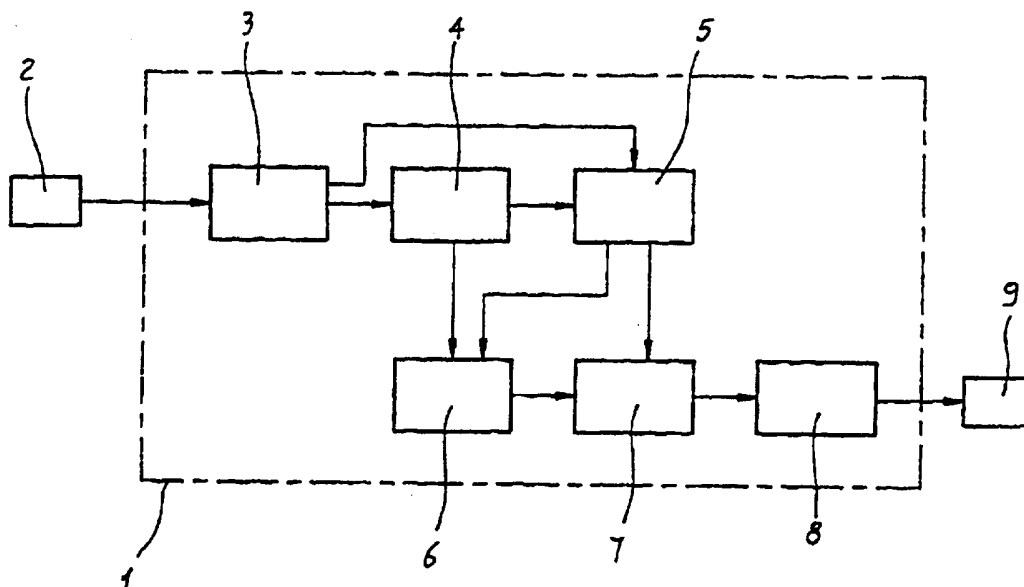




INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<p>(51) International Patent Classification ⁶ : G05B 19/4099, 19/42</p>	<p>A1</p>	<p>(11) International Publication Number: WO 97/46927</p> <p>(43) International Publication Date: 11 December 1997 (11.12.97)</p>
<p>(21) International Application Number: PCT/IT97/00065</p> <p>(22) International Filing Date: 24 March 1997 (24.03.97)</p> <p>(30) Priority Data: BO96A000309 7 June 1996 (07.06.96) IT</p> <p>(71) Applicant (for all designated States except US): SOCI-ETA' EMILIANA PARCHI ATTRAZIONI RAVENNA S.E.P.A.R. S.R.L. [IT/IT]; Via Popilia, 239, I-47037 Rimini (IT).</p> <p>(72) Inventor; and (75) Inventor/Applicant (for US only): TIGANO, Jorge, Pascual, Sergio [IT/IT]; Via Meldola, 41, I-47037 Rimini (IT).</p> <p>(74) Agent: MONTEBELLI, Marco; Bugnion S.p.A., Via Cairoli, 107, I-47037 Rimini (IT).</p>		<p>(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, HU, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ARIPO patent (GH, KE, LS, MW, SD, SZ, UG), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).</p> <p>Published With international search report.</p>

(54) Title: DEVICE FOR CONTROLLING ANTHROPOMORPHIC ROBOTS



(57) Abstract

The present invention falls within the technical sector of process control devices and relates to a device for controlling anthropomorphic robots so as to produce artistic works on the basis of detection from a figure, three-dimensional processing by a PC of the points detected, modelling carried out by means of a workstation and interfacing of said points with a robot, the anthropomorphic arm of which physically performs all the movements so as to produce the figure detected.

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Description

Device for controlling anthropomorphic robots.

Technical Field

The present invention falls within the technical sector of process control equipment and relates in particular to a device for controlling anthropomorphic robots.

5

Background Art

As is known, in order to perform the reproduction, to scale, of artistic works by means of cutting and boring, use is generally made of the normal skill of craftsmen in the sector who, from a free-hand drawing, using resins cast in moulds, are able to reproduce, by means of carving operations and fretwork, artistic works which, in some cases, are of a fairly complex nature.

10

This type of activity, however, involves, for each production stage, a great deal of time, a lot of waste material, defects in reproduction due to human error in approximation, and unnecessary costs, not only for the process as such, but also because the specialized labour in the sector has a high cost, being a dying profession.

15

As regards reproduction on a small scale, on the other hand, moulding equipment is used which, however, is not very precise and does not always provide a perfect reproduction of the artistic work recorded.

20

Disclosure of the invention

In this situation, a technical problem underlying the present invention is that of eliminating substantially the aforementioned limitations by producing and providing a device for controlling anthropomorphic robots, which, in an automatic manner and depending on the incoming inputs, allows one to produce, to scale, without error and rapidly, a reproduction of an artistic work.

25

The aforementioned object and others as well which will emerge more clearly below are achieved by a device for controlling anthropomorphic robots as claimed in the following claims.

Further characteristics and advantages will emerge more clearly from the description of an embodiment of a device for controlling anthropomorphic robots.

This description will be provided hereinbelow, with reference to the accompanying drawing, provided purely by way of a non-limiting example, in which Figure 1 shows a block diagram of the device according to the invention.

With reference to Figure 1, 1 denotes globally and surrounded by a broken line a device for controlling anthropomorphic robots, in its structural entirety.

2 denotes a source for detecting drawings, photographs, sketches, etc.

From this source 2, by means of a scanner 3, photo CD, telecamera or similar equipment, an optical recording of the object to be reproduced is performed and then the corresponding form detected is digitalized point by point.

At this point there is a personal computer station 4, connected to a similar and successive PC station 5, where the mathematical and geometric processing operations are performed for obtaining the measurements and the basis of a corresponding three-dimensional mathematical model.

In short, in these stations the spatial points are processed into ASCII files, by means of which mathematical movement references may be serially transmitted to the robot.

A workstation 6 and the PC 5 then allow the parts which are to be milled to be processed using a plurality of software which determine the formats to be executed on the basis of the data acquired.

From the workstation 6 or from the PC 5 it is then possible to transmit the data to a further PC station 7 which processes all the execution procedures to be transmitted, as interface data, to an anthropomorphic robot 8 so as to provide a physical product 9 corresponding to the figure reproduced in the drawing 2.

The PCs 4, 5 and 7 and the workstation 6 are linked via an ethernet board. After describing the general features of the device according to the present invention from a structural point of view, a functional explanation thereof is now provided.

5 In brief, starting from a photograph 2 or any other medium (drawing, sketch, etc.), the latter is digitalized by means of a scanner 3 and sent to computer stations shown in the figures by the blocks 4 and 5 both directly and indirectly, so that the forms and the measurements of the object to produced are acquired. The transfer may be direct or indirect depending on the complexity of the figure
10 to be detected and hence the type of points to be considered with respect to the system of three-dimensional axes.

Via a workstation 6 or the PC 5 it is then possible to model grids, verifying the correctness of the processed object by means of the interfacing personal computer 7.

15 This personal computer 7 serves as a physical and logic interface for the robot 8 of the anthropomorphic type, since the latter requires suitably coded data, and is therefore supplied by means of cartesian coordinates with all the horizontal, vertical, oblique and starting or stopping and gripping movements of the arm of a milling cutter for machining a material in order to provide the finished object.

20 As regards the robot 8, with respect to the existing embodiment, it is a JS10 KAWASAKI robot which is structured so that, once the data has been acquired, it processes the spatial points by means of dedicated software so as to make the anthropomorphic arm with which it is provided (not shown in the Figure) perform a series of operations.

25 The execution software for the workstation 6 are those of the CAD-CAM type, which serve for the modelling and five-axis milling of products of various types. This software has been developed in order to perform the aforementioned functions.

As regards the personal computers 4, 5 and 7, they are currently 486 processors

which perform the measurement, modelling and transmission of the data serially to the robot 8 and use modelling software products such as Fotomodeller, Art Cam and Autocad, which are personalized for operations of this kind.

5 In particular, the PC 7 is provided with interfacing software for the robot 8 which otherwise would not be able to interpret the data received.

From the scanner 3 it is possible, as already mentioned before, to pass into the PC4 and then pass to the PC5 and then to the PC7, or else pass to the PC5, and then to the workstation 6 and consequently to the PC7. It is also possible to transfer from the PC4 directly to the workstation 6. All this depends on the
10 complexity of the work to be produced and hence whether several processing operations are necessary in order to calculate the points which are used in space. The invention thus achieves the preset objects. In fact, with such a device, it is possible to perform in a correct, rapid and safe manner, without any major wastage of material, any artistic work obtained from a photograph or sketches,
15 adapting it also to any complexities.

Obviously further parametric and system-related advantages are possible, all of which falling within the inventive scope of the present invention.

Claims

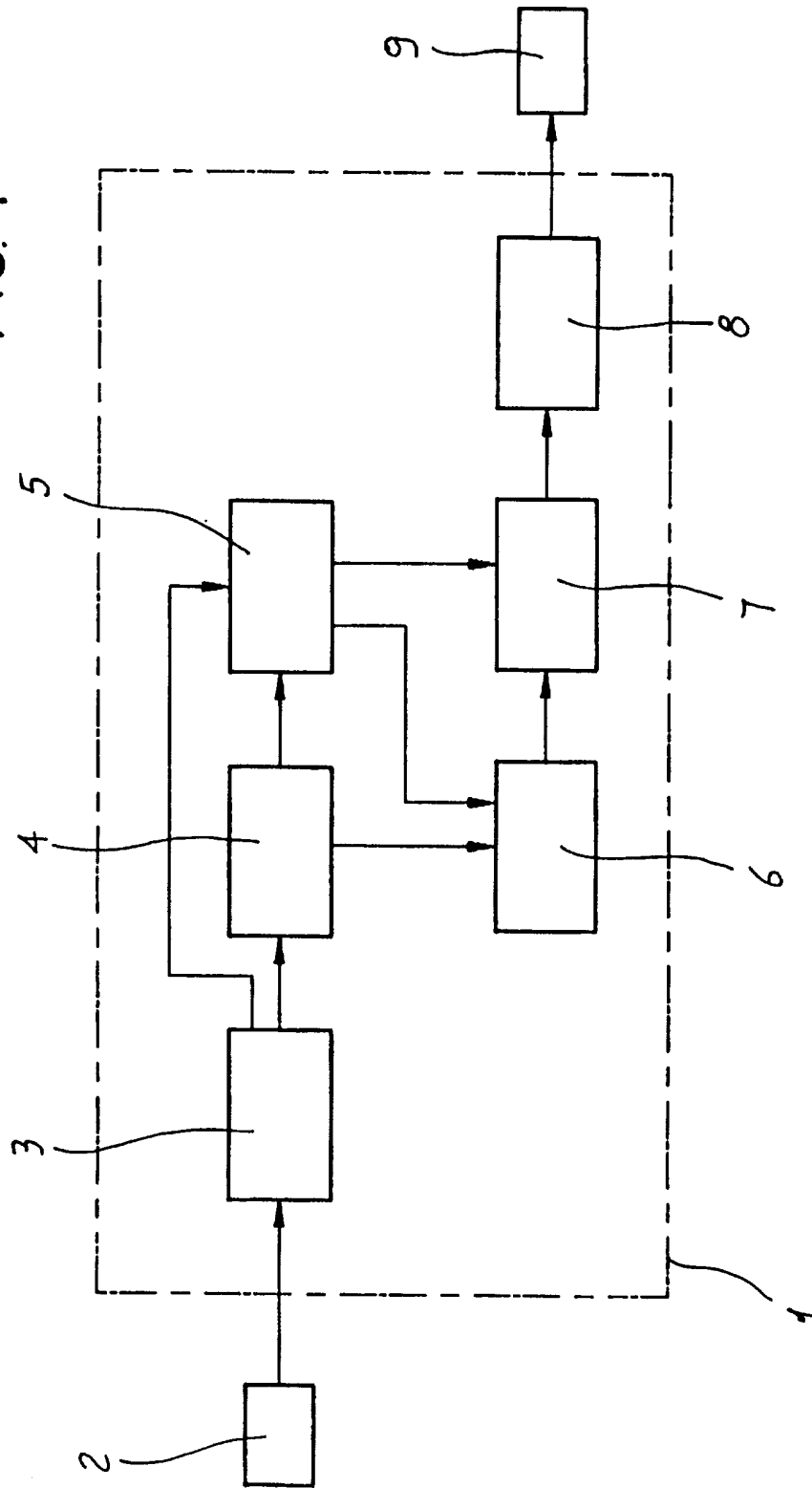
1. Device for controlling an anthropomorphic robot, characterized in that it comprises optical detecting means connected with its circuitry and logic via processing and interfacing means to an anthropomorphic robot, said processing and interfacing means and said robot also comprising modelling, spatial point calculation and form digitalization procedures for the three-dimensional representation of objects in order to produce artistic objects.
2. Device according to Claim 1, characterized in that said device comprises scanner equipment as the detecting means.
3. Device according to Claim 1, characterized in that said device comprises a photo CD as the detecting means.
4. Device according to Claim 1, characterized in that said device comprises a telecamera as the detecting means.
5. Device according to Claim 1, characterized in that said processing means consist of several personal computers and a workstation connected to each other via an ethernet board and each enabled for calculation and modelling of three-dimensional points, which serve to define the points of the model and represent, in ASCII files, the points detected and processed from a photograph, sketch or the like.
6. Device according to Claim 1, characterized in that the personal computer arranged in series with the workstation or another PC forms the physical and logic interface of the digital signals detected and processed for an anthropomorphic robot.

7. Device according to Claim 1, characterized in that said anthropomorphic robot performs a vertical, horizontal, oblique, starting or stopping and gripping movement of its arm on the basis of the signals received from the personal computer which represents its serial interface for producing the work detected, by means of holes and incisions performed by a milling cutter with which it is provided.

8. Device according to Claim 1, characterized in that said processing and interfacing means, said anthropomorphic robot and said workstation comprise modelling and execution software for producing the figures detected.

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FIG. 1



INTERNATIONAL SEARCH REPORT

Intern. Application No
PCT/IT 97/00065

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 G05B19/4099 G05B19/42

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)
IPC 6 G05B

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 practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	COMPUTER AIDED DESIGN, vol. 26, no. 11, 1 November 1994, pages 814-821, XP000490042 HEEDONG KO ET AL: "FACE SCULPTURING ROBOT WITH RECOGNITION CAPABILITY"	1-4,6-8
Y	see the whole document ---	5
Y	US 5 197 013 A (DUNDORF DAVID M) 23 March 1993 see abstract see column 15, line 29 - line 54 ---	5
A	US 4 888 713 A (FALK EDWARD K) 19 December 1989 see abstract see column 8, line 30 - line 41 ---	4,5
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Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

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Date of the actual completion of the international search

11 June 1997

Date of mailing of the international search report

15.07.97

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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