PROCESS FOR MAKING A DOLL'S HEAD LOOKING LIKE THE HEAD OF A LIVING PERSON

The process involves rotating the person (LPH) on a first rotatable support and scanning the rotating head with respect to both topography and color. The scanning output is digitized and fed to a computer with custom software. On a second rotatable support, forming means driven by the computer are used to fashion a partly finished doll's head (PFH) based on the topography input. The partly finished head is then transferred to a third rotatable support and as it rotates, ink jets also driven by the computer software colors the doll's head (DH) correspondingly.
### FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

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PROCESS FOR MAKING A DOLL'S HEAD

LOOKING LIKE THE HEAD OF A LIVING PERSON

BACKGROUND OF THE INVENTION

This invention relates to a process for making a three-dimensional doll's head looking like the head of a living person. More specifically, the invention relates to a process for scanning the head of a living person, digitizing the results and using them to drive separate means for forming and coloring a doll's head.

In my patent 5,314,370 issued May 24, 1994, I have disclosed the process for producing a doll's head having the face of a given person by directing a video camera at the person, digitizing the results and using them in a color transfer printer to form a wax image on a carrier. The wax image is then transferred to the cotton fabric of a doll's blank face. This process has enabled the production of a "look-alike" doll and has met commercial success.

While my invention has enabled the production of what is essentially a two-dimensional facial resemblance on a three-
dimensional stock doll head, there has been a need expressed by my customers for means to form a three-dimensional "look-alike" doll.

SUMMARY OF THE INVENTION

The invention, therefore, is a process for making a look-alike three-dimensional doll's head looking like the head of a living person. It involves the step of positioning the person on a first rotatable support and immobilizing the person's head relative to the support. This support and person are rotated, while from the fixed position a laser scanner vertically scans the rotating head with respect to topography and simultaneously a video camera scans for color. The digital results are fed into computer software.

On a second rotatable support forming means driven by the computer are used to fashion a partly finished doll's head. The forming may be done either simultaneously with the scanning of the living person's head or after the scanning at a time selected by the operator. The partly finished head is then
transferred to a third rotatable support and as it rotates, the computer drives means to color the doll's head correspondingly to the person's head based on the color input to the video camera. The rotation of the second and third supports are coordinated with the control signals so that the control signals are appropriate for the rotary positions of the head being made.

BRIEF DESCRIPTION OF THE DRAWINGS

Other features and objects of the invention will be apparent from the following specification with the appended drawings wherein the figure is a flow diagram of a process embodying the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

A flow diagram of a process embodying the invention is shown. In the drawing the living person's head is identified as LPH. At the start of the process the person is seated on a first support which rotates at a given rate. Means are
provided to hold the head still, for instance, in the form of a cradle partly embracing the head from the rear in a relatively inconspicuous way and anchored to a chair or other support on the turntable. The person wears a skull or bathing cap to eliminate the hair as the subject of the scanning.

A laser scanner which may be in the form of a "Replica" scanning system is stationed adjacent the rotating head LPH but is supported in a fixed position. Such a scanner is available from United Scanning Technologies, Inc. of Vancouver, British Columbia V6J 4S5. It is used to record the topography of the head LPH as it rotates to produce a digitized signal which is fed into the IBM-compatible computer as shown.

Simultaneously, a video camera may be used to produce a digitized color coordinate signal for the colors of the head LPH digitizing in the three separate primary colors (RGB or CYMK) as the head rotates.

Preferably the scanner and camera are close together and scan over the head LPH in unison; that is, the laser scanner
and the camera proceed together at the same rate focusing simultaneously on the same points on the head, moving together up and down as the head rotates. Ideally this may be accomplished by a system of lenses and moving motorized mirrors oscillating in uniform sweeps so that the effect is that the video camera and laser scanner work from the same source and measure the distance from the source to each surface point on the head and the color of the surface head at each point. The focusing of the video camera will be continuously effected by the output of the laser scanner depending on the distance measured to the target point at a given instant by the scanner.

The digitized signals from the scanning and video operation are fed as distance code and as raw color code into appropriate software in the computer. The information in the computer may be used to build the head as it comes in or may be stored for later use.

As shown in the drawing, also provided are a second and third rotatable support, the first of which may be referred
to as the build table. The build table rotates in a motion consistent with the speed of the signal produced by the scanner so that as it rotates, the signal is appropriate for the same rotary position on the partly finished head PFH as originated from that position on the head LPH.

A building gun is mounted in vertically moveable fashion and on a separate support adjacent the build table and builds up on a core or build surface as the table rotates a mass reflective of the contours of the head LPH. The building is done from a gun comprising two ink jet leads - one to deposit thermoplastic building material and the other to deposit a supporting wax which supports the thermoplastic till it is cured.

The deposited materials are ejected from the ink jets as a hot liquid which solidifies upon impact with the cooler build surface. This selective deposition process permits the traces to be placed adjacent one another to produce a uniform layer of materials. The ink jets deposit material along a line at rates up to 12 inches per second.
The first layers of material will be applied to the core, wooden or plastic, in a uniform layer and as the rotation continues only after the layers reach the thickness required to impact on the shape of the PFH will the depositing selectively cut off as the head begins to take the final desired exterior shape. When the signal from the computer indicates that there is no more depositing to be done, the head is partially finished, without color. Such building equipment is available under the trademark "MODEL MAKER" from Sanders Prototype Inc., Wilton, NH 03086.

As an alternate method, in a subtractive fabrication, a blank oversized head can be mounted on the build table and a milling tool driven by the software removes material from the blank head so that what is left corresponds to a replica of the contours of the head LPH. Such a process is available from Cyberware Laboratories Inc.

The partly finished head PFH, after the operation on the build table is removed and transferred to a second rotating support or print table. Adjacent the rotating print table is
a coloring ink jet assembly mounted on a separate support. The jet assembly is mounted to be spaced closely adjacent the head PFH and to deposit thereon as the assembly moves vertically depositing a primary color corresponding to the degree of its presence on the living head scanned by the video camera. A pass is necessary then for each of the primary colors.

The support of the jet assembly is shown only schematically as instructed by the digitized information in the computer in the drawing but is arranged so that the jets move in and out depending on the contour of the head PFH thereadjacent as directed by the digitized information in the computer file. This assures that the color reproduction by the color dots deposited by the ink jets will replicate the head LPH as accurately as possible. The ink jets may deposit as many as 4000 dots of color per inch. As stated, one rotation of the head for each of the primary colors RGB or CYMK is necessary for the coloration of the head. If desired or necessary, a validation circuit may validate that the ink
jets are depositing the appropriate amount of the correct material.

When the doll head DH is finished, its shape and color closely resemble those of the head LPH. An appropriate wig may be selected and applied to cause the head to more closely resemble the living person's head. The head DH may be applied to a doll body which can be clothed as desired to further imitate the living person subject.

It will be noted that by having separate build and print tables and the ability of the computer to store the video and the laser scanner input for playout into the ink jet appliers respectively the process described permits the operator to make the most efficient use of the apparatus. For instance, the build table can be used to build a head from a previous subject while the print table can be used to finish up the head of a still earlier subject and a new subject can be on the first support being scanned and videoed.

As indicated throughout, the process of the invention is not limited to the specific embodiment shown but is of a
scope defined by the following claim language which may be broadened by an extension of the right to exclude others from making, using or selling the invention as is appropriate under the doctrine of equivalents.
WHAT IS CLAIMED IS:

1. A process for making a doll's head looking like the head of a living person comprising the steps of:
   a. supporting the person on a first rotatable support and immobilizing the person's head relative to the support,
   b. rotating the support and person at a given rate of rotation,
   c. from a fixed position vertically scanning the rotating person's head with a laser scanner with respect to the typography of areas of the head and a video camera with respect to the color of areas of the head and recording the results on computer software,
   d. providing a second and a third rotatable support, the third support having an upstanding core,
   e. using a computer to drive means to form a partly finished doll's head on the second rotatable
support by applying plastic to the core as it rotates based on the topographic input from the laser scanner,
f. supporting the partly finished head on the third support and, as it rotates, using the software to drive means to color the doll's head correspondingly to the person's head based on the color input from the video camera.

2. A process as claimed in Claim 1 wherein the person is rotated only once.

3. A process as claimed in Claim 1 wherein the color scanner scans for three colors and the means to color is a three-discharge ink jet.

4. A process as claimed in Claim 1 wherein the build table and the print table are engaged to develop two different heads simultaneously.

5. A process for coloring a doll's head to look like a living person including rotating the living person and scanning a color video camera successively for primary
colors on the living person's head in successive adjacent lines to produce a color signal, rotating the doll's head and applying successively different primary color inks to successive adjacent lines on the head corresponding to the color signal.
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER
IPC(6) : G06F 19/00
US CL : 364/468.04, 468.25, 474.05
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)
U.S. : 364/468.04, 468.25, 474.05, 474.24, 514; 348/77; 156/58,59; 446/391, 372, 97

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)
APS, search terms: scanning, color, inkjet, doll, subject, three-dimensional

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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<td>US, A, 4,385,360 (YAMADA ET AL) 24 May 1983, see the entire document.</td>
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<td>US, A, 5,088,864 (YANAGIDA) 18 February 1992, see the entire document.</td>
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<td>US, A, 4,972,323 (CAUWET) 20 November 1990, see the entire document.</td>
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<td>US, A, 5,314,370 (FLINT) 24 May 1994, see the entire document.</td>
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☐ Further documents are listed in the continuation of Box C.  ☐ See patent family annex.

* Special categories of cited documents:
  "A" document defining the general state of the art which is not considered to be part of particular relevance.
  "E" earlier document published on or after the international filing date or later than the priority date.
  "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another document or other special reason (as specified).
  "O" document referring to an oral disclosure, use, exhibition or other means.
  "P" document published prior to the international filing date but later than the priority date claimed.

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention.

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone.

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

Date of the actual completion of the international search: 18 JULY 1996

Date of mailing of the international search report: 14 AUG 1996

Name and mailing address of the ISA/US Commissioner of Patents and Trademarks
Box PCT
Washington, D.C. 20231
Facsimile No. (703) 305-3230

Authorized officer: JOSEPH F. RUGGIERO
Telephone No. (703) 305-9600

Form PCT/ISA/210 (second sheet)(July 1992)*
# INTERNATIONAL SEARCH REPORT

**Box I** Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This international report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. □ Claims Nos.:
   because they relate to subject matter not required to be searched by this Authority, namely:

2. □ Claims Nos.:
   because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. □ Claims Nos.:
   because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

**Box II** Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

Please See Extra Sheet.

1. □ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. □ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. □ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. □ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

**Remark on Protest**

□ The additional search fees were accompanied by the applicant’s protest.

X No protest accompanied the payment of additional search fees.

Form PCT/ISA/210 (continuation of first sheet(1))(July 1992)*
BOX II. OBSERVATIONS WHERE UNITY OF INVENTION WAS LACKING
This ISA found multiple inventions as follows:

This application contains the following inventions or groups of inventions which are not so linked as to form a single inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fees must be paid.

Group I, claims 1-4, drawn to a computer controlled process for making a doll’s head.
Group II, claim 5, drawn to a process for coloring a doll’s head.

The inventions listed as Groups I and II do not relate to a single inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons: The doll-making process of Group I does not require the details of the doll’s head coloring process of Group I and the doll’s head coloring process can operate independently of the computer controlled doll’s head making process. Therefore, the inventions differ as they relate to special technical features.