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(71) Demandeur/Applicant:
SPALDING SPORTS WORLDWIDE, INC., US

(72) Inventeurs/Inventors:
COVELLO, DIANE F., US;
KENNEDY, THOMAS J., III, US

(74) Agent: MACRAE & CO.

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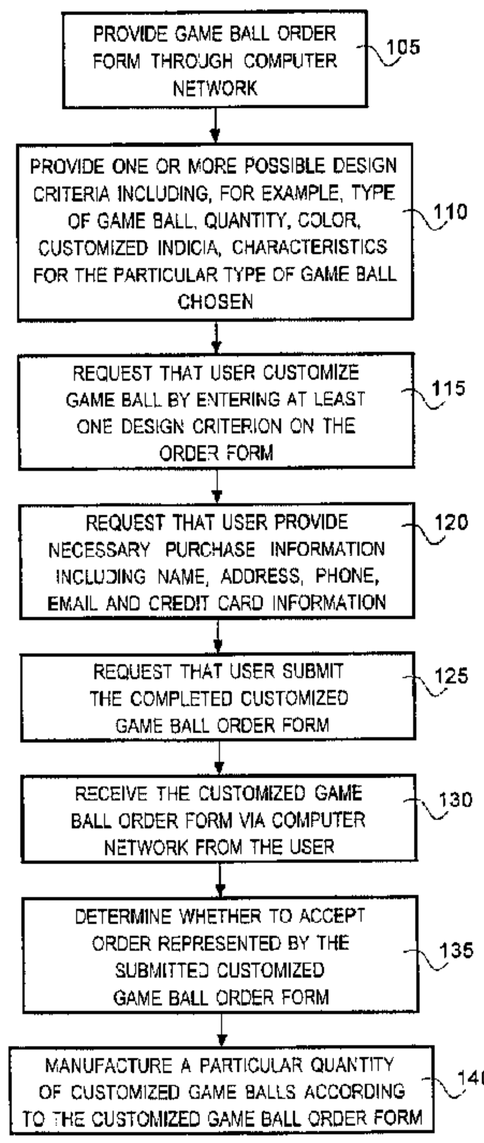

(57) Abrégé/Abstract:
The present invention is a method for soliciting orders for customized game balls. The present method includes providing a game ball order form accessible through a computer network by one or more users from one or more remote sites. The present method further includes providing one or more possible design criteria, requesting the user to customize a game ball by entering at least one of the design criteria on the order form, requesting the user to submit the order form through the computer network, and receiving the order form. The design criteria may include customizing indicia to be printed on the surface of the game ball. Ink jet printing is the preferred method of printing indicia on a game ball. The present method may also include the step of manufacturing game balls according to the customized game ball order form. An advantage of the present method is that the manufacturing step may be integrated into the overall customization process. This integration may be accomplished by, for example, translating the design criteria data into manufacturing control data to be used directly by the apparatuses at a manufacturing facility.

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(71) Applicant: SPALDING SPORTS WORLDWIDE, INC. [US/US]; 425 Meadow Street, P.O. Box 901, Chicopee, MA 01021–0901 (US).

(72) Inventors: KENNEDY, Thomas, J., III; 3 Mirick Lane, Wilbraham, MA 01095 (US). COVELLO, Diane, F.; P.O. Box 901, Chicopee, MA 01021–0901 (US).

(74) Agents: COVELLO, Diane, F. et al.; Spalding Sports Worldwide, Inc., 425 Meadow Street, P.O. Box 901, Chicopee, MA 01021–0901 (US).

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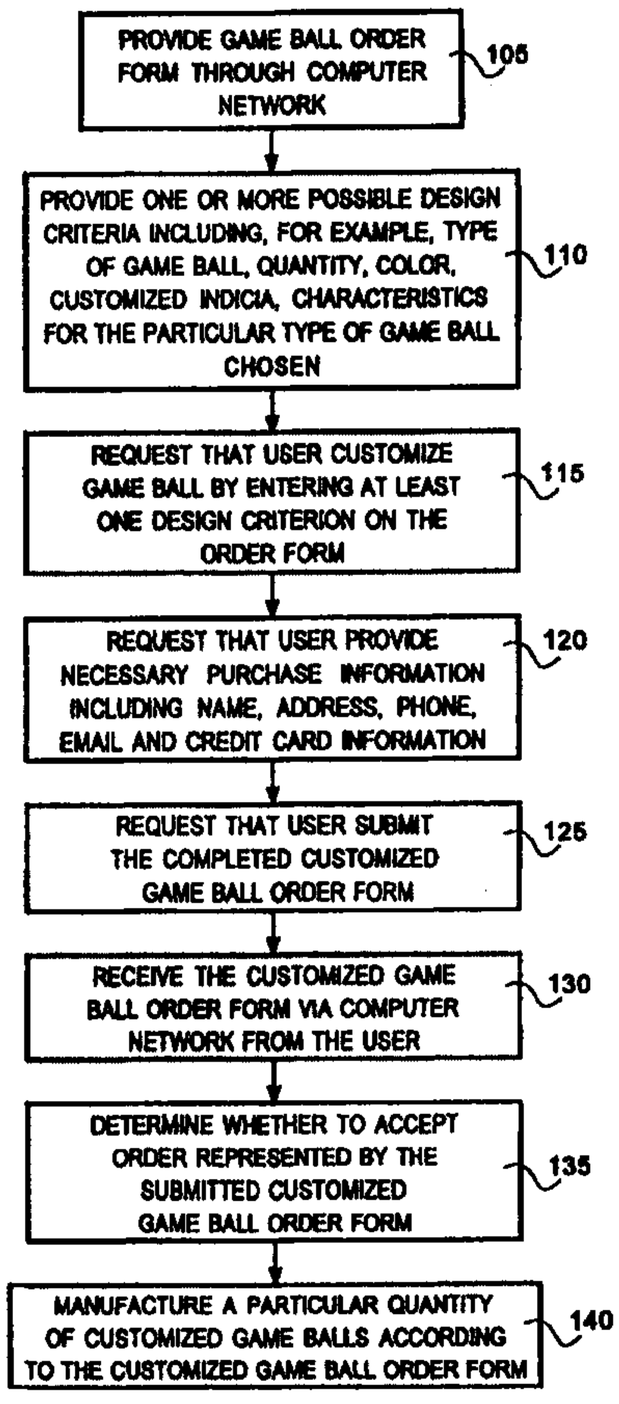
(57) Abstract

The present invention is a method for soliciting orders for customized game balls. The present method includes providing a game ball order form accessible through a computer network by one or more users from one or more remote sites. The present method further includes providing one or more possible design criteria, requesting the user to customize a game ball by entering at least one of the design criteria on the order form, requesting the user to submit the order form through the computer network, and receiving the order form. The design criteria may include customizing indicia to be printed on the surface of the game ball. Ink jet printing is the preferred method of printing indicia on a game ball. The present method may also include the step of manufacturing game balls according to the customized game ball order form. An advantage of the present method is that the manufacturing step may be integrated into the overall customization process. This integration may be accomplished by, for example, translating the design criteria data into manufacturing control data to be used directly by the apparatuses at a manufacturing facility.



COMPUTERIZED GAME BALL CUSTOMIZATION SYSTEM

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation-in-part of U.S. Ser. No. 09/166,970, filed October 6, 1998, now pending. That application is hereby incorporated herein by reference.

BACKGROUND OF THE INVENTION

The present invention is directed to a method for customizing game balls. More particularly, the present invention relates to a method, using a computer network, for soliciting orders for customized game balls, including, for example, allowing a user to transmit to the supplier, manufacturer or retailer customized indicia to be printed on the customized game balls.

Presently, ordering customized game balls requires telephoning or physically going to a supplier, manufacturer or retailer to discuss and order game balls with the desired characteristics. Furthermore, pad printing, the currently used method of forming customized indicia on a game ball, is a time consuming, labor intensive and very expensive process. Thus, use of pad printing to form indicia on game balls makes customizing game balls over a computer network difficult if not impossible.

With pad printing, the desired image is first etched onto a metal plate or masked onto a photopolymer plate. This is a time consuming, labor intensive, expensive process. Also, polymeric silicone printing pads of the correct shape and hardness must be supplied to the stamping machine on a regular basis to replace worn polymeric silicone printing pads. Furthermore, a different plate must be etched for each different color desired to be

printed on the ball. For each different color, either a color separation process must be performed on a computer into a Munsell, Pantone or other color matching system, or the desired color of ink must be mixed off line, diluted to the correct viscosity, and set up on a pad print machine. The pad print machine must then be cleaned and set up for each successive printing job.

Computerized order systems are commonly used to customize purchases. However, such computer customization systems have been unsuitable for ordering game balls because of the technical nature of the design criteria for game balls, and because of the burdensome process by which game balls are currently marked with custom indicia.

BRIEF SUMMARY OF THE INVENTION

The present invention is a method for soliciting or placing orders for customized game balls. The present method includes providing a game ball order form accessible through a computer network by one or more users from one or more remote sites. The present method further includes providing one or more possible design criteria, requesting the user to customize a game ball by entering at least one of the design criteria on the order form, requesting the user to submit the order form through the computer network, and receiving the order form.

The design criteria may include customizing indicia to be printed on the surface of the game ball. Ink jet printing is the preferred method of printing the indicia on a game ball. Ink jet printing technology, described in Appendix A below, as well as in U.S. Ser. No. 09/166,970, allows the manufacturer or printer to quickly customize the indicia to be printed on the game ball. This is because the image can simply be generated on or scanned into a computer and printed on the game ball as it appears on the screen. No dedicated printing plate needs to be etched. This quick and simple ink jet printing process

makes it easy to solicit orders for customized game balls on which custom indicia are desired. Furthermore, with ink jet printing, no color separation process is necessary for complex images/colors. Thus, multi-color indicia patterns may be easily applied to game balls, as the different colors may be printed at the same time, without having to execute the printing process separately for each different color.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a flow chart showing a preferred embodiment of the present method for soliciting orders for customized game balls using a computer network.

Fig. 2 is a flow chart showing an integrated manufacturing process for customizing the dimple type on a golf ball.

Fig. 3 is a flow chart showing an integrated manufacturing process for customizing the compression value of a golf ball.

Fig. 4 is a flow chart showing an integrated manufacturing process for customizing the indicia on a golf ball.

Fig. 5 is a flow chart showing an alternative integrated manufacturing process for ordering, customizing and delivering game balls with custom indicia via a computer network.

Fig. 6 shows a golf ball having indicia comprising ink jet printable ink in accordance with the present invention.

Fig. 7 is a flow chart showing two methods for applying ink jet printable indicia to a game ball by indirect transfer.

Fig. 8 is a flow chart showing a method for applying ink jet printable indicia to a game ball using a direct printing method.

Fig. 9 depicts a method for applying indicia to a game ball via a logo stamping machine using ink jet printed ink.

Fig. 10 depicts the adaptations made to the drive system of an ink jet printer to allow for accommodation of a game ball.

Fig. 11 depicts a golf ball with an indicia imprinted by an ink jet printer using solvent-based (non-aqueous) ink after being subjected to the wet barrel durability test.

Fig. 12 depicts a golf ball with indicia imprinted by custom stamping – by pad printing using a conventional solvent-borne pad printable ink – after being subjected to the wet barrel durability test.

DETAILED DESCRIPTION OF THE INVENTION

While the invention will be described in connection with one or more embodiments, it will be understood that the invention is not limited to those embodiments. On the contrary, the invention includes all alternatives, modifications, and equivalents as may be included within the spirit and scope of the appended claims.

The preferred method of the present invention for soliciting or placing orders for customized game balls using a computer network is shown in the flow chart of Fig. 1. The preferred method generally includes the step 105 of providing a game ball order form accessible through a computer network by one or more users from one or more remote sites, the step 110 of providing one or more possible design criteria, the step 115 of requesting the user to customize a game ball by entering at least one of the design criteria on the order form, the step 125 of requesting the user to submit the order form through the computer network, and the step 130 of receiving the order form. The preferred method may also include the step 135 of determining whether to accept the order represented by

the customized game ball order form, and the step 140 of manufacturing one or more customized game balls according to the customized game ball order form.

The step 105 of providing a game ball order form accessible through a computer network by one or more users from one or more remote sites may be accomplished by including such an order form on a manufacturer's, supplier's or retailer's website on the Internet. Alternatively, the order form may be sent to users via e-mail. The present method may include the step 120 of requesting various information from the user including, but not limited to, his or her name, address, place of business, work and home phone number(s), fax number, e-mail address, and credit card number and expiration date. In some circumstances, a user may be asked to provide a predetermined identification number. In an embodiment where a pro shop or retailer is placing the order with a manufacturer, this step 120 may also include requesting a predetermined identification number corresponding to that pro shop or retailer.

In accordance with the present method, the manufacturer, supplier or retailer may carry out the step 110 of providing to the user one or more possible design criteria which may be used to customize game balls. As explained below, these design criteria generally define the characteristics of a specific game ball or game balls in general. The design criteria which generally apply to all types of game balls may include the color, quantity and type of game balls. The user is then asked to customize the desired game ball by entering at least one design criterion on the order form to be applied to the customized game balls (step 115). The user may enter the desired design criteria by either typing in the desired values for each criterion, or by selecting one value from a choice of values.

In the preferred embodiment, the user may choose the particular type of game ball that he or she desires to customize. For example, the user may choose to customize golf balls, footballs, basketballs, baseballs, softballs, volleyballs, soccer balls, tennis balls, or

other types of game balls. The user may then further customize the game ball by entering additional desired design criteria, including design criteria specific to the chosen game ball. For example, a user may select a golf ball as the desired type of game ball to customize. Because there are certain design criteria that apply specifically to golf balls but not to other types of game balls, the present method may include providing a specific set of design criteria corresponding to golf balls. This set of golf ball design criteria may include, but is not limited to, amount of compression, coefficient of restitution, level of spin, dimple pattern, shape of dimples, number of dimples, dimple size, overall dimple volume, percent of dimple coverage, distance level, core type, cover material, cover appearance, level of control, and trajectory level. Each of these design criteria will be discussed below.

One advantage of the present invention is that a user can select any value within a range of acceptable values for certain design criteria. For example, compression may be such a customizable design criterion. Standard golf balls are generally sold with a PGA compression of 70-110. However, the present invention may allow a user to specify any compression value from within a given range of acceptable values. The acceptable values will generally be determined based on acceptable manufacturing criteria or limitations. For example, a user may be able to choose any PGA compression in multiples of 5 from within the range of 70-110, thus allowing the user to obtain a golf ball that will perfect his or her personal golf game.

The acceptable manufacturing criteria or limitations may dictate that the desired value of compression, hardness, etc. must be rounded to the nearest 10, nearest 5, nearest integer or nearest tenth of an integer. For example, if a user believes a Shore D cover hardness of 56.4 is ideal, this user would select 60 if the manufacturing criteria call for a multiple of 10, 55 if the manufacturing criteria call for a multiple of 5, 56 if the

manufacturing criteria require an integer-value, or 56.4 if the manufacturing criteria allow increments of one tenth of an integer for the Shore D hardness value. This ability to select any value is discussed further below with regard to other customizable design criteria.

For the level of spin of a golf ball, the possible choices may include, for example, extra high, high, medium, low, or extra low, for a specific set of conditions such as, for example, launch, speed, or club type. Alternatively, the user may identify a specific value of maximum 8-iron spin such as, 8100 RPM, or a maximum driver spin such as 3400 RPM. This option to specify a maximum 8-iron or driver spin value is advantageous as it allows a user to tweak the value of spin in order to perfect his or her own golf game. The selected value for the maximum 8-iron spin may be chosen from a range of values such as, for example, 6000 – 10000 RPM, with acceptable manufacturing criteria being increments of 500. Similarly, the selected value for the maximum drive spin may be chosen from a range of values such as, for example, 2000 – 5000 RPM, with acceptable manufacturing criteria being minimum increments of 500.

For the dimple pattern, the possible choices may include, for example, icosahedron, dodecahedron, single radius icosadodecahedron, dual radius icosadodecahedron, tetrahedron, and counter rotating double helix. The possible choices for the shape of the dimples on the golf ball may include, for example, circular, tear-drop, ellipsoid, or any combination of these shapes. The possible choices for the distance level of the customized golf ball may include, for example, average, long or extra long. The possible choices for core type include, for example, wound, solid or liquid, single layer, or multi-layer.

The cover material design criterion for each layer of the cover may allow a user to select among several different materials such as, for example, balata, polyurethane, metallocene catalyzed polyolefin, polyamide, elastomer, titanium, ionomer, or particular

blends containing ionomer or other materials, for example, Zinthane™ II (Trademark of Spalding Sports Worldwide, Inc., Chicopee, MA), Terthane™ (Trademark of Spalding Sports Worldwide, Inc., Chicopee, MA), Surlyn® (Registered Trademark of E.I. Du Pont, Wilmington, DE), or Iotek® (Registered Trademark of Exxon Corp.). For the level of control, the user may select, for example, low, average, high or extra high. The trajectory level is another possible design criterion, allowing a user to select, for example, an ultra low, low, medium, high, or ultra high trajectory level.

The "cover appearance" referred to above may include the incorporation of clear "windows" in the outer cover of the ball, allowing the underlying layer, such as a mantle layer, to be partially visible. Non-limiting examples of such windows are provided in U.S. Des. Nos. 410,511; 410,979; 411,599; 412,193; 410,512; 412,543; and 412,954, and U.S. Patent Application No. 09/049,868, the contents of which are incorporated herein by reference.

Other golf ball design criteria not already mentioned above, which the present method may allow a user to customize, include, but are not limited to, cover thickness (e.g., .03 - .10 inches in increments of .01 inches), construction type (e.g., two-piece, wound, multi-layer), and cover Shore D hardness (e.g., 40 – 70, increments of 1) for various parts of the ball.

One important advantage of the present method is the ability for a user to quickly and easily order game balls personalized with custom indicia or logos. As explained above, the preferred method of applying custom indicia or logos to a game ball is to use an ink jet printer. This method of forming indicia on a game ball is fully discussed and disclosed in U.S. Ser. No. 09/166,970, which is the parent application to this application. Ink jet printing allows multi-color indicia patterns to be easily applied to game balls,

because the different colors may be printed at the same time, without having to execute the printing process separately for each different color.

Generally, there are two ways indicia may be applied to a game ball using an ink jet printer. The indicia may be printed directly onto the game ball by the ink jet printer. Alternatively, the indicia may be printed onto a pad, then is transferred from the pad onto the game ball. Since the pad is just a transfer medium, not a custom-etched part, the same pad can be used to print many different indicia. This facilitates a short-run custom manufacturing facility. A further advantage of the present invention is that rather than applying indicia onto a completely finished game ball, the indicia may be applied to a game ball before any clear finishing or protective layers are applied to the ball. For example, golf balls are often manufactured with a clear protective top coat to maximize durability. It is possible to apply custom indicia either directly onto the top coat of the golf ball, or onto the golf ball before the top coat is applied. The latter method is more advantageous because the durability of the indicia or logo itself, in addition to the durability of the golf ball, is maximized. Because a preferred embodiment of the present method includes the step of manufacturing a certain number of customized game balls according to the customized game ball order form, it is easy to apply the indicia or logo before applying any desired protective layer.

The next step 120 of the present method is to ask the user to provide any information to complete the current order. For example, the user may be asked to provide his or her name, address, place of business, work and home phone number(s), fax number, e-mail address, and credit card number and expiration date. In some circumstances, a user may be asked to provide a predetermined identification number.

Once all of the relevant and/or necessary information has been provided by the user on the game ball order form, the user is asked to submit the completed order form to

the manufacturer, retailer or supplier over the computer network, thus placing the order (step 125). In a preferred embodiment, the user may be given alternative options before submitting the completed form. For example, the user may be able to clear the form and start over, revise the form, save the form in a database for a predetermined amount of time before actually placing the order, or cancel the order altogether. Once the order form is submitted by the user, the present method includes the step 130 of receiving the completed order form by a second party, generally the party who will fill the order (e.g., the manufacturer, supplier or retailer).

In a preferred embodiment of the present invention, the party who receives the completed order form (i.e., manufacturer, supplier, retailer) may carry out the step 135 of determining whether or not to accept the order. This feature of the present invention prevents the manufacturer, supplier or retailer from attempting to fill an impracticable or impossible order, or from filling an order for a user who has provided a false, invalid or cancelled credit card. After the party who receives the completed order form decides to accept the order (step 135), the order may be filled (step 140).

One advantage of the present invention is that the manufacturing process may be integrated as part of the overall customization process. This integration may be accomplished by, for example, translating the design criteria data into manufacturing control data to be used directly by the machinery at a manufacturing facility. The manufacturing facilities, which operate to create the customized game balls, generally comprise different machines operated in a series for making the game ball. For example, there may be a ball-molding apparatus which can mold a golf ball with the dimple type selected by the user on the game ball order form. Figure 2 illustrates an integrated manufacturing process for customizing the dimple type on a golf ball.

After the customized order form is accepted (step 135 of Figure 1), the order may then be received by the manufacturing facility (step 210). This may be accomplished by, for example, sending the order to the manufacturing facility via e-mail or by loading the data from the order form onto a data base accessible by the manufacturing facility. The manufacturing facility can alternatively receive the order directly from the original sender or user, without intermediate transfers. The present invention may include the step 220 of reading the specific data or information corresponding to the dimple type chosen by the user. Generally, this specific data would be read by the ball-molding apparatus, so the ball-molding apparatus may then carry out the step 230 of selecting an appropriate mold for the golf ball corresponding to the dimple type chosen by the user.

The next step 240 may include setting up the ball-molding apparatus with appropriate values to prepare the machine to mold the custom balls. For example, once the appropriate mold is selected according to the custom dimple type data, the ball-molding apparatus should put the corresponding mold into place for molding. Further, the apparatus should be set up to make the proper number of molded golf balls. Finally, the present method may include the step 250 of activating or running the ball-molding apparatus to physically mold the balls as desired by the user.

Another example of the manufacturing process being integrated into the overall customization process is shown in Figure 3. Figure 3 illustrates an integrated manufacturing process for customizing the compression value of a golf ball.

As with Figure 2, after the customized order form is accepted (step 135 of Figure 1), the order may then be received by the manufacturing facility (step 310). As already explained, this may be accomplished by, for example, sending the order to the manufacturing facility via e-mail or by loading the data from the order form onto a data base which may be accessed by the manufacturing facility. The present invention may

also include the step 320 of reading the specific data or information corresponding to the compression value chosen by the user. This specific data may be read by, for example, a polymer forming apparatus. Next, the polymer forming apparatus may carry out the step 330 of selecting and making an appropriate polymer formulation for the golf ball corresponding to the compression value chosen by the user.

The next step 340 may include preparing the polymer forming apparatus to create the appropriate formation. For example, once the appropriate formulation is selected (step 330) according to the custom compression value, the polymer forming apparatus should set various values to make the proper amount of polymer for the desired number of golf balls. Finally, the present method may include the step 350 of activating or running the polymer forming apparatus to physically compound the polymer corresponding to the desired compression value.

Another example illustrating an integrated manufacturing process is shown in Figure 4. Figure 4 illustrates a general manufacturing process for customizing indicia on a game ball. As in Figures 2 and 3, after the customized order form is accepted (step 135 of Figure 1), the order may then be received by the manufacturing facility (step 410). The present method may also include the step 420 of reading the specific data or information corresponding to the desired custom indicia submitted by the user. This specific data may be read and saved into a file accessible by the ink jet printer which will be used to form the indicia on the game ball.

Next, the ink jet printer is activated (step 430) for printing indicia on the customized game ball. This activation step 430 may include, for example, loading the data or information which defines the indicia into the printer memory, placing the appropriate game ball in place for printing, and running a preliminary check on the printer. Then the

printer may print the indicia directly or via an intermediate pad onto the game ball (step 440).

Another example illustrating an integrated manufacturing process of the present invention is shown in Figure 5. Figure 5 illustrates a general manufacturing process for ordering, customizing and delivering game balls with custom indicia, via a computer network. As described with respect to Figures 2-4, after the customized order form is accepted (step 135 of Figure 1), the order may then be received by the manufacturing facility (step 510). Then, the data corresponding to the desired indicia is uploaded into a data spooling system connected to the game ball manufacturing facility (step 515). The data spooling system may be, for example, a database or other memory storage device. Next, the user is provided with an order identification number associated with the particular order (step 520), after which the printing data is queued in a printer system via software or human interface (step 525). Based on the data uploaded to the data spooling system (see step 515), the appropriate game balls (e.g., the type of game balls and the number ordered) are allocated to a printing system (step 530), and the printer prints the desired indicia onto the game ball(s) (step 535). This printing system is preferably an ink jet printing system which is described in detail in Appendix A below.

According to the present invention, subsequent steps 540-560 may include placing the printed game balls in the proper packaging via a computerized system (step 540), checking the user's present game ball order for accuracy (step 545), shipping the game balls to the user via a predetermined system such as, for example, ground, overnight or hand delivery (step 550), and notifying the user, via the computer network, that the order has been shipped, including providing the user with the order identification number and the shipping tracking number (step 555). The present invention may also include the step 560 of storing in memory information provided by and identifying the user. This

information may include, for example, the user's name, address, phone, occupation, and prior orders. This information may then be accessed for various purposes such as, for example, to speed up future orders, or for future promotional e-mails or postal mailings from the manufacturer.

The present invention as described in this specification has numerous advantages over the prior art. For example, the present method of ordering custom game balls is more efficient, even for relatively small orders, because the order may be accessed by the manufacturing facility itself. Further, the present method of customizing game balls is much more flexible than prior customization methods in that there are many more choices available to the user. In addition, the present invention allows for a consumer to order custom golf balls from a computer terminal in a golf pro shop after the consumer has received the advice of the golf professional on what type of golf ball will suit the consumer's game. This advice may be coupled with a hitting net and feedback system in the golf pro shop.

APPENDIX A – INK JET PRINTING INDICIA ON A GAME BALL

One method of forming an image on a game ball using ink jet printing is an indirect printing technique which involves printing indicia on a transfer medium using an ink jet printer and then transferring the image from the transfer medium to the game ball surface. Another method is to print directly on a specially treated surface of a game ball using an ink jet printer.

As indicated in Fig. 6, a golf ball 608 has a central core 610, which can be solid, liquid, gas, gel, wound, or a combination of these, and a dimpled cover 612 surrounding the core. Indicia 614 formed from an ink jet printable ink are formed over the cover 612. Optionally, an indicia receiving layer 615 is positioned between the indicia 614 and the

cover 612. A protective top coat 616 is formed over the indicia 614. This top coat 616 may cover the entire ball 608, though a partial topcoat 616 covering only a somewhat larger area than the indicia 614 is also contemplated.

Two methods of indirectly ink jet printing on a golf ball surface are depicted in Figure 7. As shown at 730, a golf ball is primed with an ink retaining primer. An image is ink jet printed onto a transfer sheet, as shown at 732, or transfer pad, as shown at 734. If the image is printed onto a transfer sheet, it is then transferred to a transfer pad on a stamping machine at 734'. The transfer pad, which is configured for printing on the surface of a golf ball, subsequently stamps the image on a golf ball surface at 736. After the image is applied, the surface of the ball and the indicia optionally can be coated with a suitable top coat at 738.

A method for directly ink jet printing on a golf ball is shown in Figure 8. As shown at 840, a golf ball is primed with an ink retaining primer. After the coating has been applied, an image is ink jet printed directly onto the surface of the primer at 842. After the image has been applied, the surface of the ball and the indicia optionally can be coated with a suitable top coat at 844.

The method of ink jet printing as described herein can be used on curved surfaces of game balls such as golf balls, basketballs, baseballs, softballs, and the like, and is particularly useful on golf balls. It can be difficult to print on the curved and dimpled surface of a golf ball because the dimples tend to distort an image printed thereon and because the plastic cover of a golf ball, which typically is made of ionomer, balata, or polyurethane, has a low surface energy. The low surface energy of the ionomer cover makes adhesion difficult and also causes ink to form into beads when placed on the cover, thereby blurring the printed image. One way to overcome the beading problem is by applying a primer coat to at least the portion of the ball surface upon which the indicia are

to be printed, the primer coat containing a material which promotes absorption, adhesion, and/or clarity of the indicia. Suitable materials of this type to use in the primer coat of a game ball such as a golf ball include talc, amorphous silica, bentonite clay, magnesium silicate, or the like, or a combination of these.

According to a second means of overcoming the beading problem, the material which promotes absorption, adhesion, and/or clarity of the indicia is incorporated into the cover itself. When the cover is formed from ionomer, polyurethane or balata, for example, suitable materials of this type which can be incorporated therein include talc, amorphous silica, bentonite clay, magnesium silicate, or the like, or a combination of these.

The ink which is used in ink jet printing as herein described is one which is suitable for use in an ink jet printer. Typically, the ink contains a coloring agent, a carrier, and additives. The coloring agent usually is a dye and/or pigment and can be fluorescent. Alternately, the ink can contain a fluorescent material as the coloring agent instead of or in addition to an ordinary dye. As another alternative, the ink can contain a selective absorber of infrared or microwave radiation. The carrier or vehicle for the coloring agent may be water or an organic solvent. The physical characteristics of the substrate and the other ink components determine the type and quantity of carrier to be used. Examples of useful additives include materials to control pH, viscosity, light fade and surface tension. Furthermore, the ink can contain a polymer resin or resin components. Examples of polymer resins or resin components which are used in conventional ink jet printing inks include polyurethanes, polyesters, polyketones and polyacrylates. In the case of a UV curable ink, the resin components could be, for example, oligomers. The ink composition and the composition of the ball cover or primer layer to which the indicia are to be applied may be selected such that the surface tension of the ink is appropriately related to the surface properties of the substrate to which it is to be adhered. Inks contemplated to be

suitable for ink jet printing typically have a viscosity of from about 1 to about 20 cps measured at the temperature of application.

As indicated above, UV curable inks can be used in accordance with the method of ink jet printing as described herein. Most commercially available UV inks are not suitable for ink jet printing due to the high concentration and size of the pigments and fillers in these formulations. To facilitate flow through the ink jet printer, a UV ink suitable for an ink jet printer should incorporate very finely divided pigments (about 0.1 micron or alternatively less than 100 Angstroms), dissolved dyes, or combinations of dyes and finely divided pigments. Flow additives, surface tension modifiers, extra solvent, etc. may be added to the ink formula to improve ink jet printability and prevent clogging of the ink jet printer. UV curable inks are described below in further detail in a separate section of this document.

If a primer coating layer is applied to a game ball cover, the coating typically is a solvent borne or water borne polyurethane material. Non-limiting examples of suitable coatings are described in detail in commonly assigned U.S. Patent Nos. 5,409,233, 5,459,220 and 5,494,291, the contents of which are incorporated herein by reference.

It is useful for a top coat to be applied over the indicia to protect the indicia unless the indicia have sufficient adhesion to the surface to which they are applied, e.g., the cover or a primer layer, to render the use of a top coat unnecessary. The adhesion between the ink and the top coat and/or substrate is contemplated to be sufficiently strong so that the indicia remain substantially intact when the game ball is used. Standards for image retention vary depending upon the intended use of the game ball and the degree and frequency of impact that the image is required to withstand. When applied to a golf ball, the ink durability desirably is sufficient that after the ball is subjected to the wet barrel durability test procedure described below, at least about 50% of the surface area of the

original image remains, optionally at least about 70%, optionally at least about 80%. Excellent durability results when more than about 85% of the image remains.

As indicated above, in one method of ink jet printing herein described, the indicia are printed onto a transfer medium using an ink jet printer and are subsequently transferred to the game ball surface. A suitable transfer medium is one which has a surface that allows for good clarity of the indicia printed thereon while providing for transfer of the image onto the game ball surface. One contemplated transfer medium is a silicone pad. If necessary, an absorptive filler can be added to the silicone pad to promote flow-out of the ink, and to prevent beading on the surface of the silicone pad. Additionally or alternatively, the surface of the pad can be roughened to an extent necessary to achieve the desired surface energy. When the image is to be printed on a curved and dimpled surface of a golf ball, using a pad rather than a flat sheet for the transfer substrate may facilitate the application of ink inside the dimples. One contemplated type of silicone pad is that which is used in conventional golf ball pad printing.

Although any ink jet printer may be used, two types of ink jet printers specifically contemplated for printing on game balls are continuous ink jet printers and drop on demand ink jet printers. In a continuous ink jet printer, a stream of ink drops is electrically charged and then deflected by an electronic field either directly or indirectly onto the substrate. In a drop on demand ink jet printer, the ink supply is regulated by an actuator such as a piezoelectric actuator. The pressure produced by the actuation forces a droplet through a nozzle or nozzles onto the substrate.

UV curable inks

The UV curable ink described below can be used for printing indicia on golf balls, softballs, baseballs, other game balls, as well as other sporting goods, including but not

limited to softball and baseball bats, tennis and racquetball rackets, and golf clubs. The ink also can be applied to a variety of materials, including but not limited to ionomers, polybutadiene, composite materials, metals, etc.

As indicated above, the ink comprises a UV curable resin, a coloring agent, such as a pigment or dye, one or more photoinitiators, and possibly a solvent. The ink may also include aluminum trihydroxide. A thinning agent that includes a monomer and/or a solvent can be added. A wetting agent also can be included.

The UV curable resin may comprise an oligomer. Non-limiting examples of the oligomer include one or more epoxies, acrylics, acrylate urethanes, elastomeric acrylates, unsaturated polyesters, and polyethers. Specific examples of suitable oligomers include methacrylates such as bisphenol A ethoxylate dimethacrylate and acrylated epoxies. Blends of different oligomers can be used. The oligomer can provide the ink with characteristics of flexibility and impact resistance that are sufficient to withstand the conditions to which the substrate is to be subjected. For example, if the substrate is a golf ball, the oligomer may impart to the ink more flexibility than is inherent in the underlying substrate, which is contemplated to provide good durability. When a top coat is to be placed over the ink, the ink desirably is not so highly cross-linked that adhesion of the top coat to the ink is substantially hindered.

The uncured ink can comprise about 10 - 90 wt % oligomer, optionally about 20 - 80 wt % oligomer, optionally about 50 - 70 wt % oligomer.

The coloring agent can be any type of pigment, dye or the like which will withstand UV treatment, i.e., which is not UV labile. Furthermore, the coloring agent is contemplated to permit sufficient passage of UV light through the ink, by any combination of transmission, reflection, or refraction mechanisms, to initiate photocrosslinking. Liquids or powders can be used. One non-limiting example of an ink is a powder which is

dispersed in a liquid monomer. Carbon black and iron oxide black are non-limiting examples of suitable pigments for making black inks. Red lake and quinacrydones are non-limiting examples of suitable pigments for making red inks. Blends of different pigments and/or dyes can be used. The uncured ink can contain about 2 - 60 wt % pigment, alternatively about 5 - 30 wt % pigment, alternatively about 5 - 10 wt % pigment.

The photoinitiator is selected to respond to the wavelength of UV radiation to be used for photoinitiation. It is also important to consider the color of the ink in selecting the photoinitiator because, as indicated above, it is necessary for the UV light to penetrate the ink composition to initiate the cure. More specifically, penetration is sometimes required in order to cure the portion of the ink which is beneath the surface. Penetration typically is most difficult when black or white pigments are used. Non-limiting examples of photoinitiators to be used in conjunction with black pigment include sulfur-type photoinitiators such as isopropyl thioxanthone, and benzophenone and its derivatives including acetophenone types and thioxanthones. Photoactivators can be used in conjunction with one or more photoinitiators. Non-limiting examples of suitable photoactivators are amine-type photoactivators such as ethyl 4-dimethylamino benzoate. The uncured ink may contain about 0.3 - 5 wt % photoinitiator, alternatively about 1 - 4 wt % photoinitiator, alternatively about 3 - 4 wt % photoinitiator. Blends of different photoinitiators, or photoinitiators and photoactivators, can be used.

A thinning agent can be added to lower the viscosity of the uncured ink composition or to contribute to impact resistance or flexibility. When a monomer is used as a thinning agent, it optionally can be a photopolymerizable monomer that forms a polymeric structure upon irradiation. In contrast, when solvents are used as thinning agents, they evaporate during curing. The monomer can be a monofunctional, difunctional or multifunctional acrylate. Non-limiting examples of suitable monomers include 1,6

hexanediol diacrylate, butanediol diacrylate, trimethylol propane diacrylate, tripropylene glycol diacrylate and tetraethylene glycol diacrylate.

The uncured ink may contain about 10 - 70 wt % monomer, alternatively about 10 - 60 wt % monomer, alternatively about 10 - 55 wt % monomer. The combination of monomer plus oligomer may constitute about 45 - 80 wt % of the uncured ink, optionally about 50 - 80 wt %, optionally about 60 - 80 wt % of the ink.

Non UV curable quick-drying resins which help in ink transfer from the pad to the ball can be added. Non-limiting examples of such resins are vinyl resins, nitrocellulose, acrylic resins, and other quick-drying, film-forming resins. One contemplated resin is an acrylic-OH functional resin made by McWorther, Inc. of Carpentersville, IL, sold as Resin 975. Typically, if such resins are used, they are added in an amount up to about 30 parts by weight based upon 100 total parts by weight of uncured ink composition.

When a solvent is used in the UV curable ink, it typically is a liquid with a fast to moderate evaporation rate which, upon partial evaporation causes the ink to be tacky, and thereby promotes transfer onto and off an ink pad. A solvent also can be the medium in which a photoinitiator is dissolved. Non-limiting examples of suitable solvents include aromatic solvents such as toluene, xylene, and ester types such as butyl acetate. The uncured ink may include about 1 - 30 wt % solvent, optionally about 5 - 20 wt % solvent, optionally about 8 - 10 wt % solvent.

Wetting agents can be added to prevent beading of the ink upon application to the golf ball. Suitable wetting agents include, but are not limited to, silicone surfactants and fluorocarbon surfactants. The uncured ink may include about 0 - 2 wt % wetting agent. Other additives that do not adversely affect the pad transfer and impact resistance of the ink also can be incorporated into the ink composition.

As long as sufficient durability is maintained, extender pigments such as talc, barium sulfate and the like can be added to improve transferability. For use in ink jet printers, the particle size of the extender pigments should be small enough to facilitate passage through the orifices of the printer. This would include finely divided (about less than 0.1 micron or alternatively less than 100 Angstroms) silicas, clays, or talcs, or combinations of these. Typically, if such materials are used, they constitute about 10 - 40 wt %, alternatively 20 - 30 wt %, of the uncured ink formulation.

It has been found that by replacing part or all of the extender pigments such as talc and barium sulfate with aluminum trihydroxide ($Al(OH)_3 \bullet 3H_2O$) (ATH) filler, a number of significant improvements to the UV ink will result with respect to printing, curing and processing. Additionally, the inclusion of ATH will have minimal effect on the color of the ink. Furthermore, ATH has low oil absorption, thus ink viscosity is increased very little. When up to 50 wt % ATH based upon the total (uncured) weight of ink is added, ink transfer from a pad to a substrate is improved. Significantly, ATH does not absorb UV light so curing of the ink is not impeded. For use in ink jet printing, ATH particle size should be small enough to facilitate passage through ink jet orifices.

When ATH is used in a UV curable game ball ink, it generally is included in an amount of 10 - 50 wt % based upon the total weight of the ink prior to curing. ATH may be employed in an amount of 10 - 32 wt %, alternatively 20 - 30 wt %. It is believed that ATH loadings up to at least 50 wt % based upon the weight of (uncured) ink may be useful for providing an overall balance of properties. Greater quantities of ATH can be used when a low cost ink is desired and durability requirements are not stringent. Lower quantities of ATH are useful when higher durability is needed. The ATH can be used in a quantity appropriate to impart to the ink a balance of properties such as pad transfer and durability of the ink.

If ATH is used in combination with talc, barium sulfite, or the like, the ratio of ATH to talc, etc., may be about 1:1.

The use of ATH does not impede the curing process. The surface tension of the ink affects the wetability of the substrate. The surface tension of the ink desirably is not substantially higher than the surface tension of the substrate upon which it is printed. The viscosity of the ink is one factor that will affect the thickness of the indicia on the cover. If the indicia are too thick, the UV radiation may not penetrate the indicia and complete curing may become difficult. On the other hand, if the indicia are too thin, the durability of the ink layer may be insufficient for conditions of play. The indicia have thickness of less than about 100 microns, optionally about 10 - 40 microns, optionally about 13 - 30 microns, optionally about 20 - 25 microns.

The cured ink is contemplated to be sufficiently flexible to exhibit good impact resistance. It is advantageous for the top coat which is applied over the ink to react with the ink to hold the ink in place, or to have adhesion by hydrogen bonding and/or van der Waals forces. As a non-limiting example, the ink can be used in conjunction with a two-component polyurethane top coat, such as a top coat based on polyester or acrylic polyols and aliphatic isocyanates such as hexamethylene diisocyanate or isophorone diisocyanate trimers.

As one non-limiting example, a UV curable ink formulation which may be used for marking golf balls can be prepared and used in the following way. The photoinitiator is dissolved in the thinning agent, which is then mixed with an oligomer, and a pigment. The mixture is placed in a dispenser for use in direct or indirect ink jet printing. A primed but unfinished golf ball is obtained. The ball includes, for example, a core, and a durable cover having a dimpled surface. Alternatively, the core and cover can be formed in one piece. Indicia formed from the UV curable ink are ink jet printed onto the golf ball cover

either directly or indirectly by use of a transfer medium. The unfinished golf ball is then subjected to UV treatment under conditions sufficient to at least commence curing of the ink. After photoinitiation, curing of the ink is substantially complete within a time period of between less than one second and a few seconds.

A top coat layer is placed over the indicia. The top coat is optionally applied at least partially, and optionally completely, after the ink is cured. The top coat layer assists in keeping the indicia on the golf ball surface, as indicated above, and therefore the adhesion of indicia to the golf ball does not need to be as strong as will be required if the ink constitutes the outer layer of the ball. The top coat typically has a thickness of 10 - 40 microns.

The conditions of UV exposure which are appropriate to cure the ink can be ascertained by one having ordinary skill in the art. For example, it has been found that when a golf ball passes through a UV treatment apparatus at a rate of about 10 ft./min. (about 3 m/min.) at a distance of about 1¼ - 1¾ inches (about 3.2 – 4.4 cm) from a UV light source which has an intensity of e.g. 200 - 300 watts/in^2 (31 – 47 watts/cm^2), the indicia may be exposed to UV radiation for no more than a few seconds, optionally no more than about 1 second, optionally no more than about 0.7 seconds. Higher and lower UV lamp intensities, distances, and exposure times may be used as long as the cured ink meets the applicable durability requirements. Excess UV exposure is avoided to prevent degradation of the substrate. The ink can be UV cured prior to application of any top coat.

The pad to be used for transfer of the UV ink may contain silicone. This type of pad has good elasticity, durability and softness and an appropriate surface tension. Other types of pads also can be used.

The ink can be applied on a non-UV-labile surface of a game ball. It is generally not necessary to pretreat the surface prior to application of the ink. If it is desired to apply

the UV curable ink on an extremely smooth surface upon which transfer is poor, the portion of the surface to be stamped can be chemically or physically etched or abraded in order to provide an ink-receptive surface.

The ink described herein has a Sward hardness (ASTM-D 2134-66) after curing of about no more than 55, alternatively about no more than 40, alternatively about no more than about 20.

The UV curable ink described herein provides for durability sufficient to meet stringent durability standards required for commercial grade golf balls. The durability of the ink can be determined by testing stamped golf balls in a variety of ways, including using the wet barrel durability test procedure.

Durability according to the wet barrel durability test procedure is determined by firing a golf ball at 135 ft/sec (at 72 F) (41 m/s (at 22 C)) into 5-sided steel pentagonal container, the walls of which are steel plates. The container 110, which is shown schematically in Figure 4, has a 19 ½ inch (49.5 cm) long insert plate 112 mounted therein, the central portion 114 of which has horizontally extending square grooves on it which are intended to simulate a square grooved face of a golf club. The grooves, which are shown in an exaggerated form in Figure 5, have a width 130 of 0.033 inches (0.084 cm), a depth 132 of 0.100 inches (0.25 cm), and are spaced apart from one another by land areas 134 having a width of 0.130 inches (0.330 cm). The five walls 116 of the pentagonal container each have a length of 14 ½ inches (36.8 cm). As shown in Figure 4, the inlet wall is vertical and the insert plate is mounted such that it inclines upward 30 degrees relative to a horizontal plane away from opening 120 in container 110. The ball travels 15 ½ - 15 ¾ inches (39.4 – 40 cm) horizontally from its point of entry into the container 110 until it hits the square-grooved central portion 114 of insert plate 112. The angle between the line of trajectory of the ball and the insert plate 112 is 30 . The balls

are subjected to 70 or more blows (firings) and are inspected at regular intervals for breakage (i.e., any signs of cover cracking or delamination). If a microcrack forms in a ball, its speed will change and the operator is alerted. The operator then visually inspects the ball. If the microcrack cannot yet be observed, the ball is returned to the test until a crack can be visually detected. The balls are then examined for adhesion of the ink.

The following examples are included for further reference:

EXAMPLE 1

Referring to Figure 9, an ink jet printer (Epson Stylus Color 640) 900 was used to print an image from a JPEG computer file onto a polysilicone coated sheet of paper (Dow Corning HS2) 902. This resulted in an ink jet logo 904 on the silicone coated paper 902.

An ionomer covered golf ball 906 was obtained which had been coated with an ink retaining primer coat formed from 100.00 parts by weight of Witcobond 935 (Witco), which is a water borne polyurethane primer, and 7.0 parts by weight of amorphous silica (Hi-Sil 915, PPG, Pittsburgh, PA). After the primer coating had dried, the image 904 on the silicone paper 902 was transferred to the surface of the golf ball 906 using a golf ball logo stamping machine 908.

More particularly, the ball logo stamping machine 908 has a horizontal arm 910 to which is attached a plunger 912 carrying a transfer pad 914. The silicone coated paper 902 holding the logo 904 was placed underneath the transfer pad 914. The plunger 912 advanced the transfer pad 914 against the logo 904, lifting the logo image 904 onto the transfer pad 914. The transfer pad 914 retracted, moving along the arm 910 to a second position beneath which a golf ball 906 was held. At this second position, the plunger 912 advanced the transfer pad 914 against the primed golf ball 906, stamping the newly imprinted image onto the ball 906.

After the ink was dry, the primed golf ball 906 with the stamped image was then coated with a top coat 916 of the following formulation:

	Parts by Weight
Polyol (Desmophen 670-80, Bayer Corp.)	100.0
Isocyanate (Desmodur N-3200, Bayer Corp.)	30.0
Methyl amyl ketone solvent	50.0
Butyl acetate solvent	25.0
Methyl isobutyl ketone solvent	25.0
UV absorber (Sandoz 3206)	2.0
UV stabilizer (Tinavin 292, CibaGeigy)	1.0
	233.0

After the top coat was cured at an elevated temperature, as shown at 918, the ball was durability tested using the wet barrel test described above. About 80% of the ink logo remained. This process produced a multi-color logo with good distinction, recognition and durability on a dimpled and curved surface of a golf ball.

EXAMPLE 2

An ionomer covered golf ball was obtained which had been coated with an ink retaining primer coat formed from 100.00 parts by weight of Witcobond 235 (CK Witco, Stamford, CT), which is a water borne polyurethane primer, 10.0 parts of talc (magnesium silicate), 1.0 part by weight of amorphous silica (Hi-Sil 532EP, PPG, Pittsburgh, PA), and

5 parts by weight of polyaziridine (Zeneca Resus, Wilmington, MA). The primer coating was allowed to dry.

A solvent-based printing ink of the following formulation was prepared:

50.0 parts by weight isopropanol,

2.0 parts by weight ethylene glycol monobutyl ether,

15.0 parts by weight methyl isobutyl ketone (MIBK),

6.0 parts by weight Savinyl Dyes, solvent soluble metal complex dyes, sold by Clariant Corp., Coventry, R.I., and

3.0 drops BYK 346, a polyether modified polydimethyl siloxane, sold by BYK Chemie, Wallingford, Connecticut.

The above ink formulation was ink jet printed directly onto the primed golf ball using an Epson Stylus Color 640 ink jet printer, a drop on demand piezoelectric printer. The drive system of the ink jet printer was physically adapted to allow for printing directly on to the golf ball as shown in Figure 10. The adaptation was constructed in such a manner that the game ball had the identical indexing or rotational speed as paper that is driven through the printer. Referring to Figure 10, a rotational system 198 consisting of a series of shafts connected by belts and pulleys rotated the main drive shaft 190. A game ball 194 was held by two suction units 192 that rotated with the main drive shaft 190. The rotational system 198 advanced the main drive shaft 190 at such a rate that the game ball 194 advanced at a rate identical to the index speed of a piece of paper. The ink jet printhead 196 advanced horizontally across the game ball 194, printing the desired image onto the game ball 310 in a series of passes.

The ink had a viscosity of about 6 cps at the time of application.

The resulting golf ball had a clean, durable and opaque image found thereon.

After the ink was dry, the golf ball with the image thereon was then coated with a solvent-borne two-part aliphatic polyurethane top coat which is described in U.S. Patent No. 5,459,220. The opacity, clarity and color of the image did not change upon application of the top coat.

The ball was durability tested using the wet barrel test, breaking after 197 blows. The results after durability testing are shown in Figure 11. After testing, the balls were examined and it was found that about 80% of the ink logo remained. This process produced a multi-color logo with good distinction, recognition and durability on a dimpled and curved surface of a golf ball.

This result can be compared to the results after durability testing a golf ball that was custom stamped by pad printing using a conventional solvent-borne pad printable ink. Figure 12 depicts a golf ball that has been subjected to wet barrel testing after an indicia was imprinted via custom stamping. The ball broke after 186 blows. After wet barrel durability testing, far less of the ink logo remained on the custom stamped ball in Figure 12 than the ink jet printed ball in Figure 11.

EXAMPLE 3

The procedure of Example 2 was repeated with the exception that a water-based printing ink of the following formulation was substituted:

50.0 parts by weight water,

5.0 parts by weight isopropanol,

6.0 parts by weight Sandovac-L Dyes, sold by Clariant Corp, Coventry, R.I., and

3.0 drops BYK 346, a polyether modified polydimethyl siloxane, sold by BYK Chemie, Wallingford, Connecticut.

The resulting golf ball had a clear and durable image formed thereon. While the opacity of this image was slightly less than that of the image on the ball of Example 2, the

opacity could be improved by using a larger quantity of dye or by increasing the mixing intensity of the formula during preparation in order to better disperse the dye.

COMPARATIVE EXAMPLE 1

The procedure of Example 2 was repeated excepting that a commercially available glycol-based ink formulation, found in conventional ink jet ink cartridges, namely Epson Ink Jet Printer ink formulation found in ink cartridges for use with the Epson Stylus Color 640 ink jet printer, was used. The ink had a viscosity of about 5 or 6 cps. This process did not produce an acceptable image.

EXAMPLE 4

A golf ball printing ink was prepared which contained Formula C. To prepare Formula C, Formulas A and B were first prepared:

FORMULA A

	parts by wt.
Epoxy-acrylate oligomer[1]	70.0
Polyester-acrylate oligomer[2]	30.0
Butyl acetate	100.0
Methyl isobutyl ketone (MIBK)	100.0
Isopropyl thioxanthone[8]	0.7
Ethyl 4-dimethylamino benzoate[9]	1.5
	302.2

[1] Ebocryl 3700 (Rad-Cure, Smyrna, GA).

[2] Ebocryl 80 (Rad-Cure, Smyrna, GA).

[8] ITX (distributed by Aceto Chemical, Lake Success, NY).

[9] EDB (distributed by Aceto Chemical, Lake Success, NY).

FORMULA B

	parts by wt.
Formula A	40.0
Savinyl Dye*	1.0
	41.0

* E.g., One of the following: Savinyl Blue GLS, Savinyl Yello RLS, Savinyl Black RLSN, or Savinyl Pink 6BLS (Clariant Corp., Coventry, R.I.).

FORMULA C

	parts by wt.
Formula A	20.0
Formula B	20.0
MIBK	10.0
	50.0

The ingredients of Formula C were mixed and ink jet printed directly onto a golf ball primed with the same primer as described in Example 2, using the ink jet printer of Example 2. The drive system of the ink jet printer, a piezoelectric printer, was physically adapted to allow for printing directly on to the golf ball.

The balls containing the stamped indicia were passed through a Uvex UV treatment apparatus at a rate of about 10 feet/min. (3 m/min.), using a lamp intensity of about 235 watts/in^2 (36.4 watts/cm$^{2)}$ and wavelength range of about 200 - 400 nm with the indicia being located about 1 ¾ inches (4.4 cm) from the UV light source.

The indicia on the ball were distinct and durable.

PROPHETIC EXAMPLE 5

A golf ball printing ink is prepared which contains:

	parts by wt.
Epoxy-acrylate oligomer[1]	20.0
Acrylic –OH functional resin[2]	30.0
Acetate and aromatic hydrocarbon solvent blend[3]	15.0
Black Dye[4]	15.0
Polyester-acrylate oligomer[5]	15.0
Isopropyl thioxanthone[6]	1.0
Ethyl 4-dimethylamino benzoate[7]	1.5

[1] Ebocryl 3700 (Rad-Cure, Smyrna, GA).

[2] McWorther Resin 975 (McWorther, Inc., Carpentersville, IL).

[3] Summit Ink Reducer (Pt#910527, Summit Screen Inks, No. Kansas City, MO).

[4] E.g., Savinyl Black RLS (Clariant Corp., Coventry, R.I.).

[5] Ebocryl 80 (Rad-Cure, Smyrna, GA).

[6] ITX (distributed by Aceto Chemical, Lake Success, NY).

[7] EDB (distributed by Aceto Chemical, Lake Success, NY).

The ingredients are mixed. The ink is sufficiently diluted with solvent, e.g., butyl acetate, to constitute a viscosity of between about 1 to 20 cps, optionally between about 5 to 10 cps, optionally between about 5 to 6 cps.

The above ink formulation is ink jet printed directly onto the primed golf ball using the ink jet printer of Example 2. The drive system of the ink jet printer, a piezoelectric printer, is physically adapted to allow for printing directly on to the golf ball.

The balls containing the stamped indicia are passed through a Uvex UV treatment apparatus at a rate of about 10 feet/min. (3 m/min.), using a lamp intensity of about 235 watts/in^2 (36.4 watts/cm^2) and wavelength range of about 200 – 400 nm with the indicia being lcoated about 1 ¾ inches (4.4 cm) from the UV light source.

The golf balls are then coated with a solvent-borne polyurethane top coat formed from a polyester type hexamethylene diisocyanate.

PROPHETIC EXAMPLE 6

The procedure of Example 3 is repeated excepting that a Hewlett Packard 693C bubble jet printer, a drop on demand printer, is substituted for the Epson Stylus Color 640 ink jet printer.

PROPHETIC EXAMPLE 7

The procedure of Example 3 is repeated excepting that 10 parts by weight of black pigment, Microlith Black C-WA (CIBA Specialty Chemicals Corp. USA, Newport, DE), is substituted for the Sandovac-L Dyes. The pH of the composition is increased to at least 8.5 by adding an amine such as triethanol amine.

CLAIMS

What is claimed is:

1. A method, using a computer network, for soliciting or placing orders for customized game balls, comprising the steps of:

providing a game ball order form through the computer network to be accessed by at least one user from a remote site;

providing one or more possible design criteria;

requesting said at least one user to customize a game ball by entering at least one design criterion, from said one or more possible design criteria, on said order form;

requesting said at least one user to submit said customized game ball order form through said computer network; and

receiving said customized game ball order form.

2. A method according to claim 1, wherein said step of providing one or more possible design criteria includes providing one or more design criteria customizable by selecting from a range of values, wherein each of said customizable design criteria can be any value within said range, acceptable as a manufacturing criterion.

3. A method according to claim 1, wherein said step of providing a game ball order form comprises providing a golf ball order form.

4. A method according to claim 3, further comprising the step of providing as a possible design criterion the level of spin for a golf ball.

5. A method according to claim 3, further comprising the step of providing as a possible design criterion the dimple pattern for a golf ball.

6. A method according to claim 3, further comprising the step of providing as a possible design criterion the shape of dimples for a golf ball.

7. A method according to claim 3, further comprising the step of providing as a possible design criterion the number of dimples for a golf ball.

8. A method according to claim 3, further comprising the step of providing as a possible design criterion the distance level for a golf ball.

9. A method according to claim 3, further comprising the step of providing as a possible design criterion the core type for a golf ball.

10. A method according to claim 3, further comprising the step of providing as a possible design criterion the cover material for a golf ball.

11. A method according to claim 3, further comprising the step of providing as a possible design criterion the level of control for a golf ball.

12. A method according to claim 3, further comprising the step of providing as a possible design criterion the trajectory level for a golf ball.

13. A method according to claim 3, further comprising the step of providing as a possible design criterion the amount of compression for a golf ball.

14. A method according to claim 1, further comprising the step of providing as a possible design criterion the color of said game ball.

15. A method according to claim 1, further comprising the step of providing as a possible design criterion the indicia to apply to said game ball.

16. A method according to claim 1, wherein said method comprises using the Internet for soliciting said orders for customized game balls.

17. A method according to claim 1, further comprising the step of manufacturing one or more customized game balls according to said customized game ball order form.

18. A method according to claim 1, further comprising the step, responsive to said receiving step, of determining whether to accept the order represented by said customized game ball order form.

19. A method according to claim 18, wherein said determining step is carried out automatically by applying acceptance criteria to information provided on said order form.

20. A method according to claim 19, wherein each accepted order is added to a game ball manufacturing schedule.

21. A method according to claim 20, wherein the design criteria specified in each accepted order control the operation of game ball manufacturing machinery to provide game balls having the design criteria specified on said order form.

22. A method, using a computer network, for soliciting orders for customized game balls, comprising the steps of:

providing a game ball order form through the computer network to be accessed by at least one user from a remote site;

providing one or more possible design criteria, wherein one of said possible design criteria includes applying customized indicia to said customized game balls;

requesting said at least one user to customize a game ball by entering at least one design criterion, from said one or more possible design criteria, on said order form, wherein at least one of said entered design criteria includes providing customized indicia to apply to said game ball using an ink jet printer;

requesting said at least one user to submit said customized game ball order form through said computer network; and

receiving said customized game ball order form.

23. A method according to claim 22, wherein said method comprises using the Internet for soliciting said orders for customized game balls.

24. A method according to claim 22, further comprising the step of manufacturing one or more customized game balls according to said at least one design criterion entered by said user.

25. A method according to claim 24, wherein said step of manufacturing comprises manufacturing one or more customized golf balls according to said at least one design criterion entered by said user.

26. A method according to claim 25, wherein said step of manufacturing one or more customized golf balls comprises applying a clear protective top coat onto said golf ball after applying said customized indicia using an ink jet printer.

27. A method according to claim 22, wherein said step of manufacturing one or more customized game balls comprises applying said customized indicia directly onto said game balls from an ink jet printer.

28. A method according to claim 22, wherein said step of manufacturing one or more customized game balls comprises applying said customized indicia onto a pad from an ink jet printer, and subsequently transferring said indicia from said pad to said customized game balls.

29. A method according to claim 22, wherein said step of requesting said at least one user to place an order for said customized game ball comprises requesting an order for at least two different types of game balls.

FIG. 1

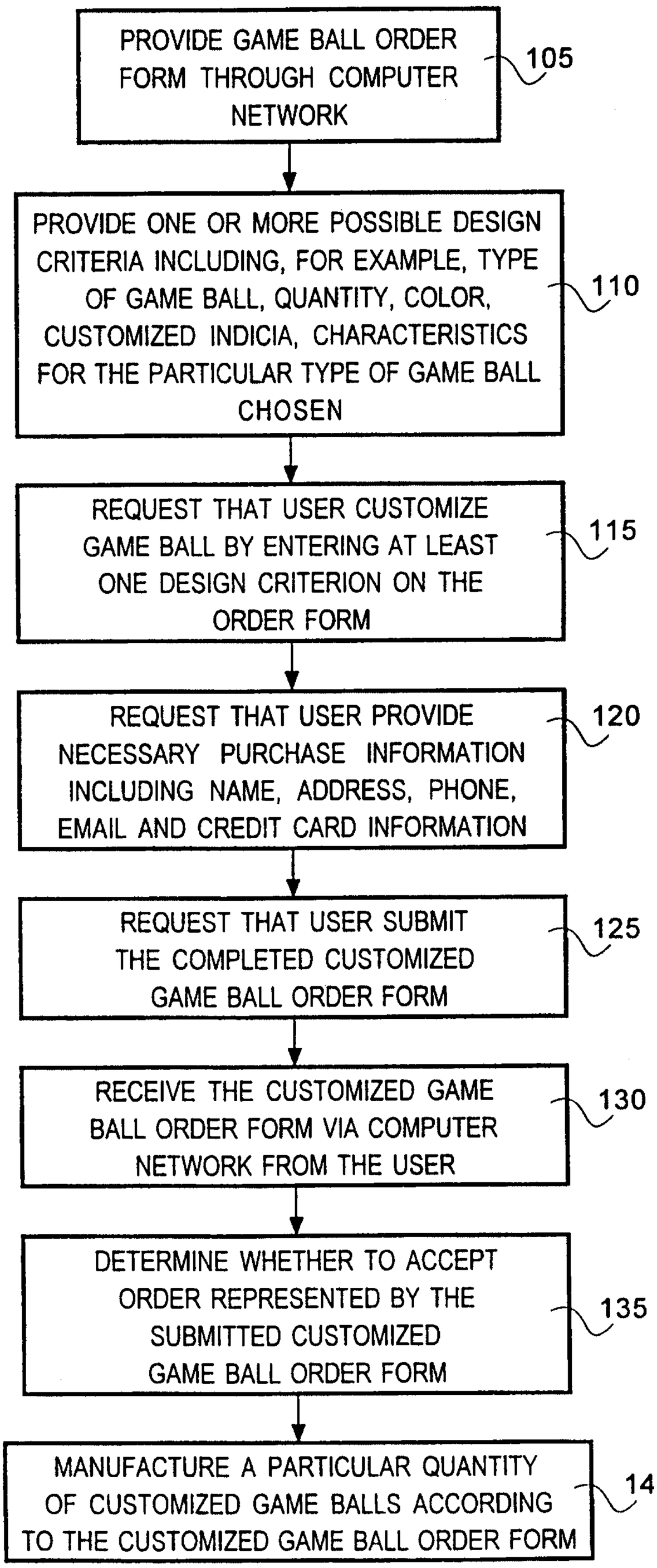

PROVIDE GAME BALL ORDER FORM THROUGH COMPUTER NETWORK
105
PROVIDE ONE OR MORE POSSIBLE DESIGN CRITERIA INCLUDING, FOR EXAMPLE, TYPE OF GAME BALL, QUANTITY, COLOR, CUSTOMIZED INDICIA, CHARACTERISTICS FOR THE PARTICULAR TYPE OF GAME BALL CHOSEN
110
REQUEST THAT USER CUSTOMIZE GAME BALL BY ENTERING AT LEAST ONE DESIGN CRITERION ON THE ORDER FORM
115
REQUEST THAT USER PROVIDE NECESSARY PURCHASE INFORMATION INCLUDING NAME, ADDRESS, PHONE, EMAIL AND CREDIT CARD INFORMATION
120
REQUEST THAT USER SUBMIT THE COMPLETED CUSTOMIZED GAME BALL ORDER FORM
125
RECEIVE THE CUSTOMIZED GAME BALL ORDER FORM VIA COMPUTER NETWORK FROM THE USER
130
DETERMINE WHETHER TO ACCEPT ORDER REPRESENTED BY THE SUBMITTED CUSTOMIZED GAME BALL ORDER FORM
135
MANUFACTURE A PARTICULAR QUANTITY OF CUSTOMIZED GAME BALLS ACCORDING TO THE CUSTOMIZED GAME BALL ORDER FORM
140

FIG. 2

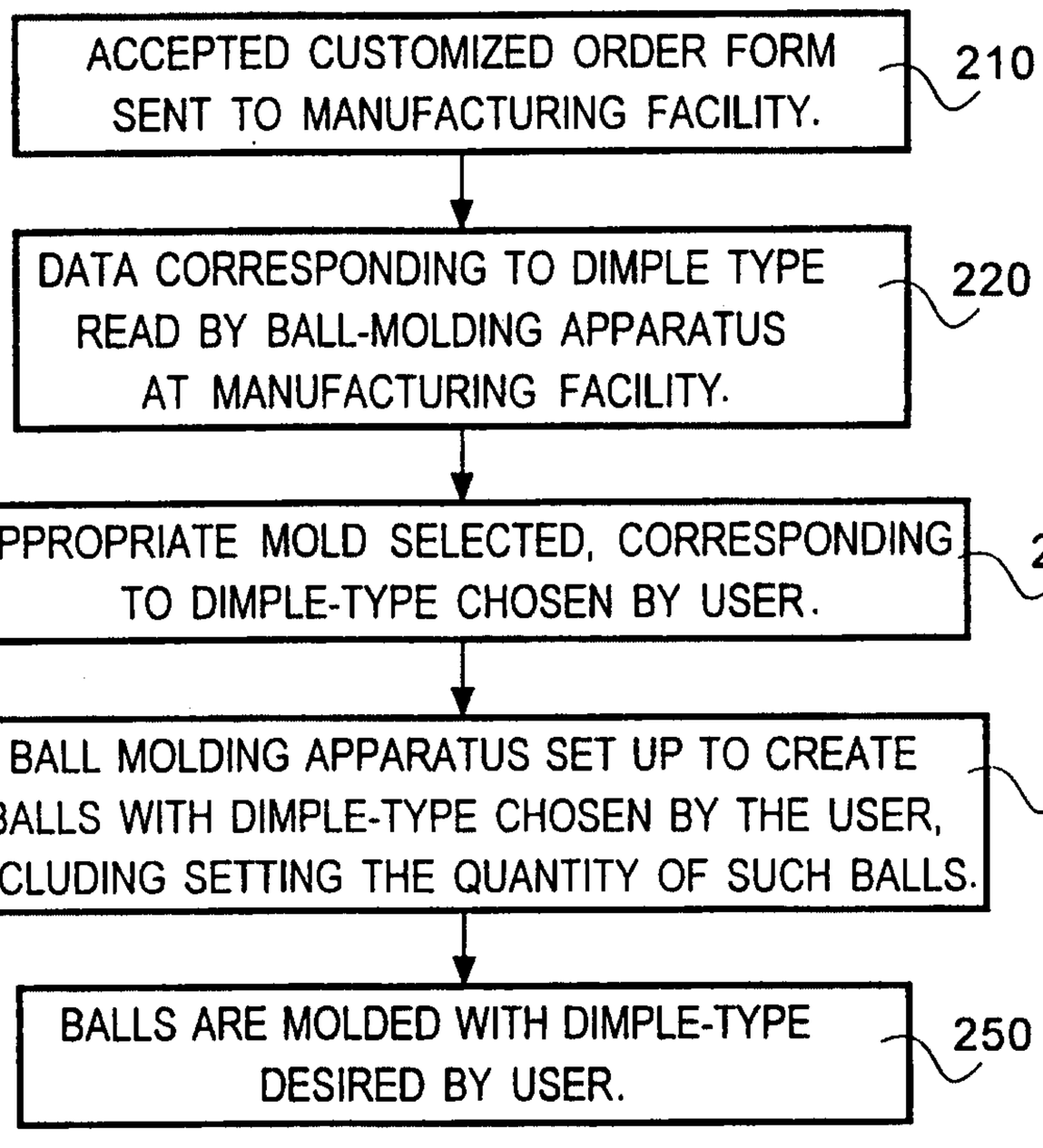

ACCEPTED CUSTOMIZED ORDER FORM SENT TO MANUFACTURING FACILITY.
210
DATA CORRESPONDING TO DIMPLE TYPE READ BY BALL-MOLDING APPARATUS AT MANUFACTURING FACILITY.
220
APPROPRIATE MOLD SELECTED, CORRESPONDING TO DIMPLE-TYPE CHOSEN BY USER.
230
BALL MOLDING APPARATUS SET UP TO CREATE BALLS WITH DIMPLE-TYPE CHOSEN BY THE USER, INCLUDING SETTING THE QUANTITY OF SUCH BALLS.
240
BALLS ARE MOLDED WITH DIMPLE-TYPE DESIRED BY USER.
250

FIG. 3

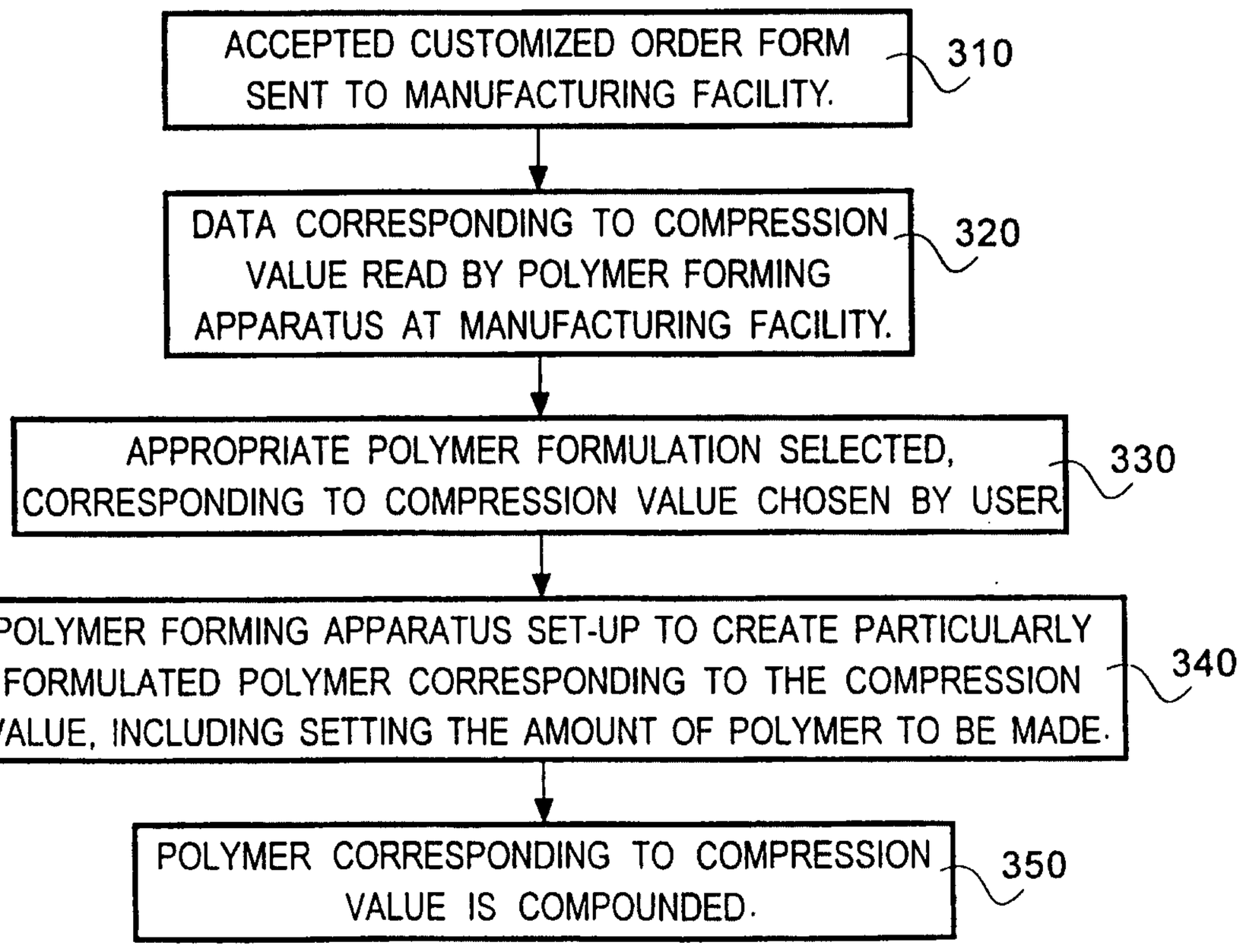

ACCEPTED CUSTOMIZED ORDER FORM SENT TO MANUFACTURING FACILITY.
310
DATA CORRESPONDING TO COMPRESSION VALUE READ BY POLYMER FORMING APPARATUS AT MANUFACTURING FACILITY.
320
APPROPRIATE POLYMER FORMULATION SELECTED, CORRESPONDING TO COMPRESSION VALUE CHOSEN BY USER
330
POLYMER FORMING APPARATUS SET-UP TO CREATE PARTICULARLY FORMULATED POLYMER CORRESPONDING TO THE COMPRESSION VALUE, INCLUDING SETTING THE AMOUNT OF POLYMER TO BE MADE.
340
POLYMER CORRESPONDING TO COMPRESSION VALUE IS COMPOUNDED.
350

FIG. 4

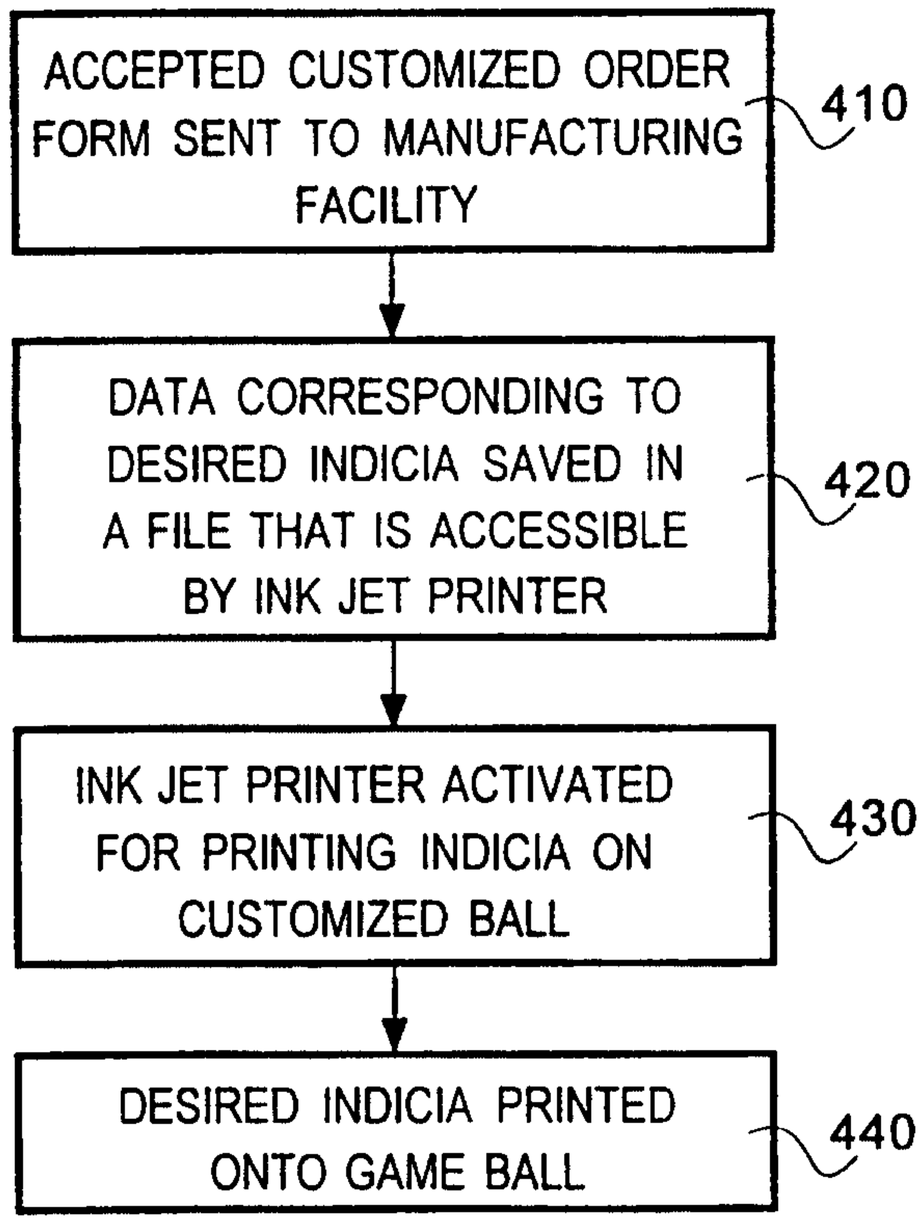

ACCEPTED CUSTOMIZED ORDER FORM SENT TO MANUFACTURING FACILITY
410
DATA CORRESPONDING TO DESIRED INDICIA SAVED IN A FILE THAT IS ACCESSIBLE BY INK JET PRINTER
420
INK JET PRINTER ACTIVATED FOR PRINTING INDICIA ON CUSTOMIZED BALL
430
DESIRED INDICIA PRINTED ONTO GAME BALL
440

FIG. 5

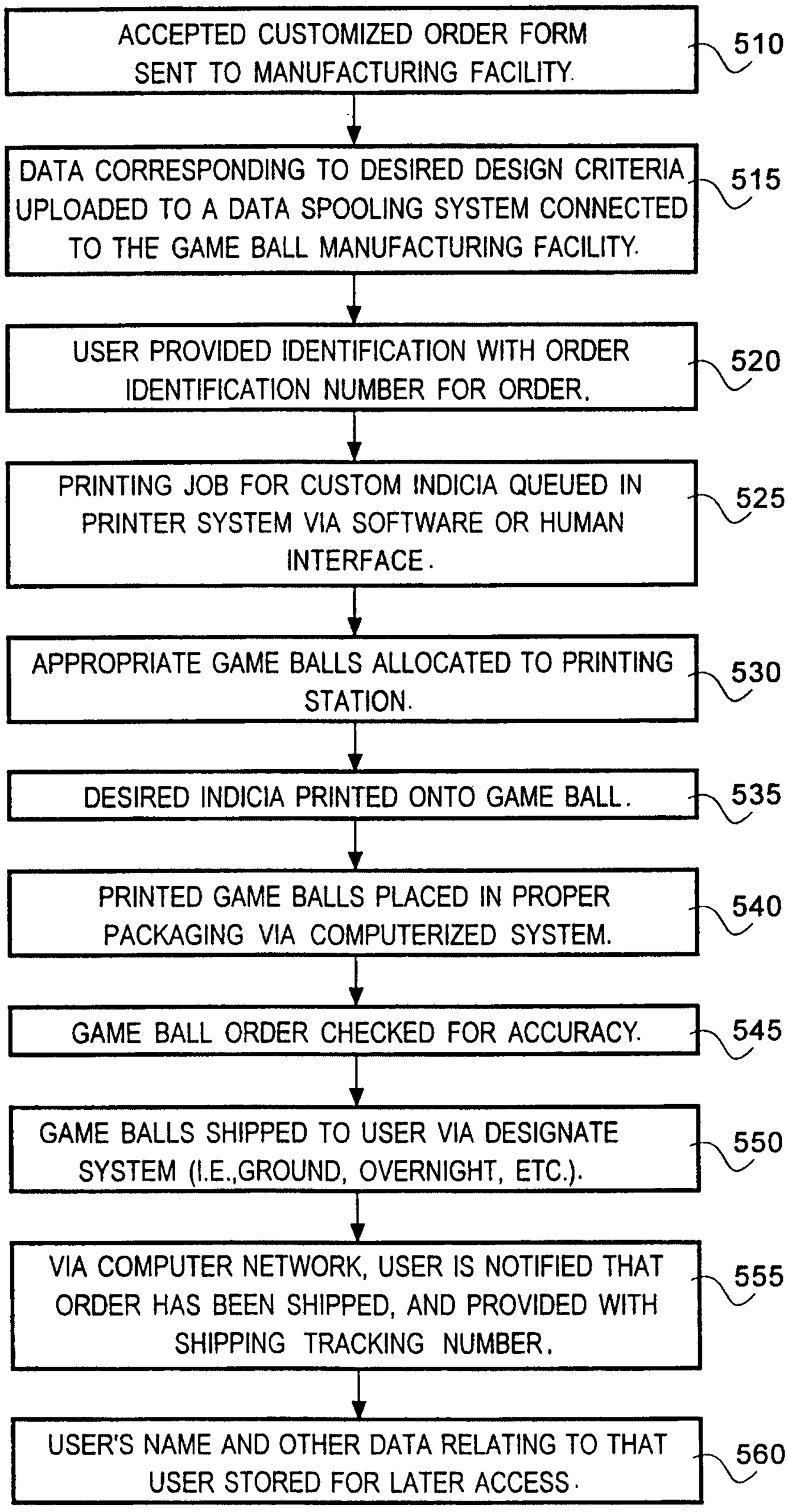

ACCEPTED CUSTOMIZED ORDER FORM SENT TO MANUFACTURING FACILITY.
510
DATA CORRESPONDING TO DESIRED DESIGN CRITERIA UPLOADED TO A DATA SPOOLING SYSTEM CONNECTED TO THE GAME BALL MANUFACTURING FACILITY.
515
USER PROVIDED IDENTIFICATION WITH ORDER IDENTIFICATION NUMBER FOR ORDER.
520
PRINTING JOB FOR CUSTOM INDICIA QUEUED IN PRINTER SYSTEM VIA SOFTWARE OR HUMAN INTERFACE.
525
APPROPRIATE GAME BALLS ALLOCATED TO PRINTING STATION.
530
DESIRED INDICIA PRINTED ONTO GAME BALL.
535
PRINTED GAME BALLS PLACED IN PROPER PACKAGING VIA COMPUTERIZED SYSTEM.
540
GAME BALL ORDER CHECKED FOR ACCURACY.
545
GAME BALLS SHIPPED TO USER VIA DESIGNATE SYSTEM (I.E.,GROUND, OVERNIGHT, ETC.).
550
VIA COMPUTER NETWORK, USER IS NOTIFIED THAT ORDER HAS BEEN SHIPPED, AND PROVIDED WITH SHIPPING TRACKING NUMBER.
555
USER'S NAME AND OTHER DATA RELATING TO THAT USER STORED FOR LATER ACCESS.
560

FIG. 6

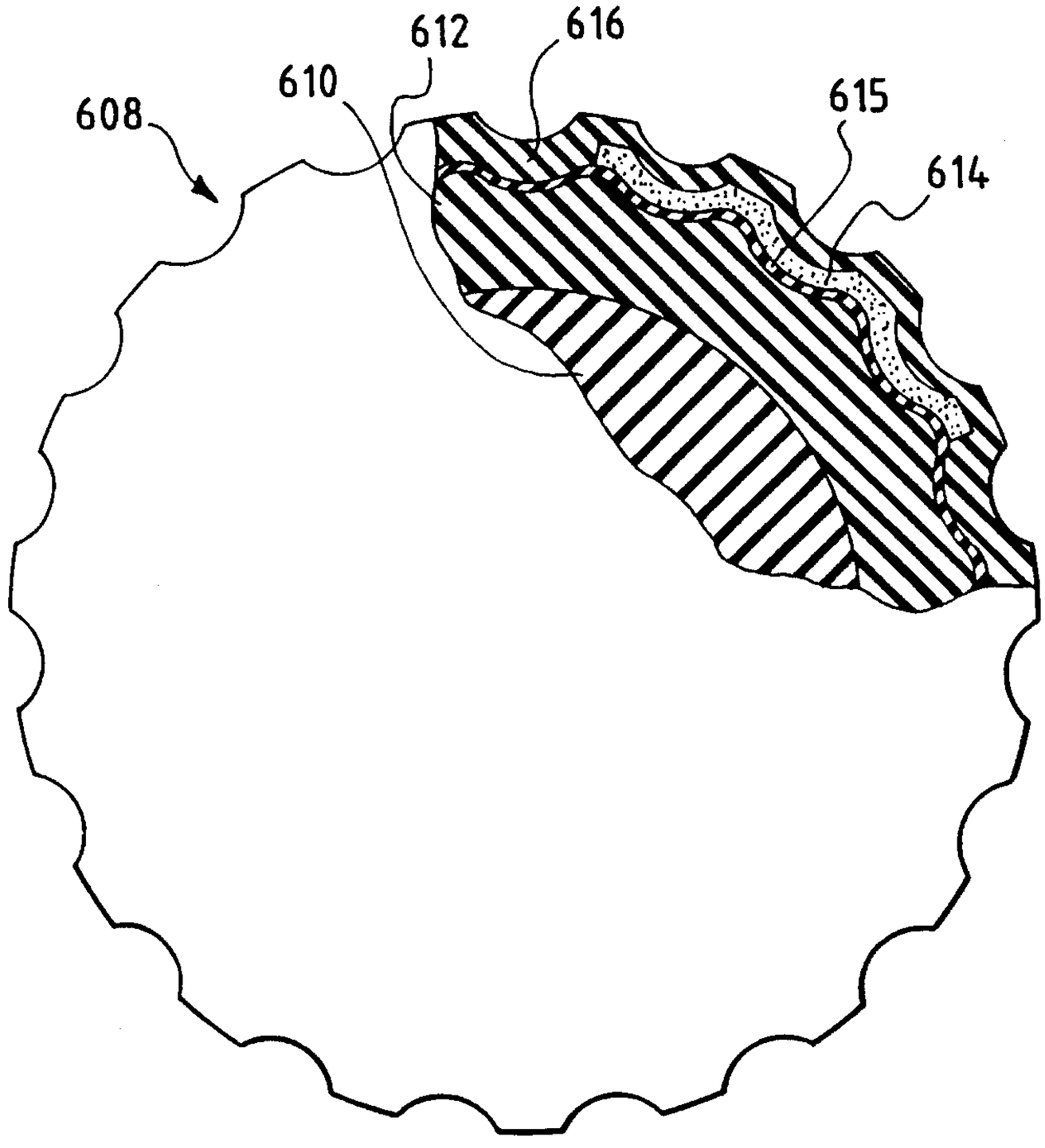


FIG. 7

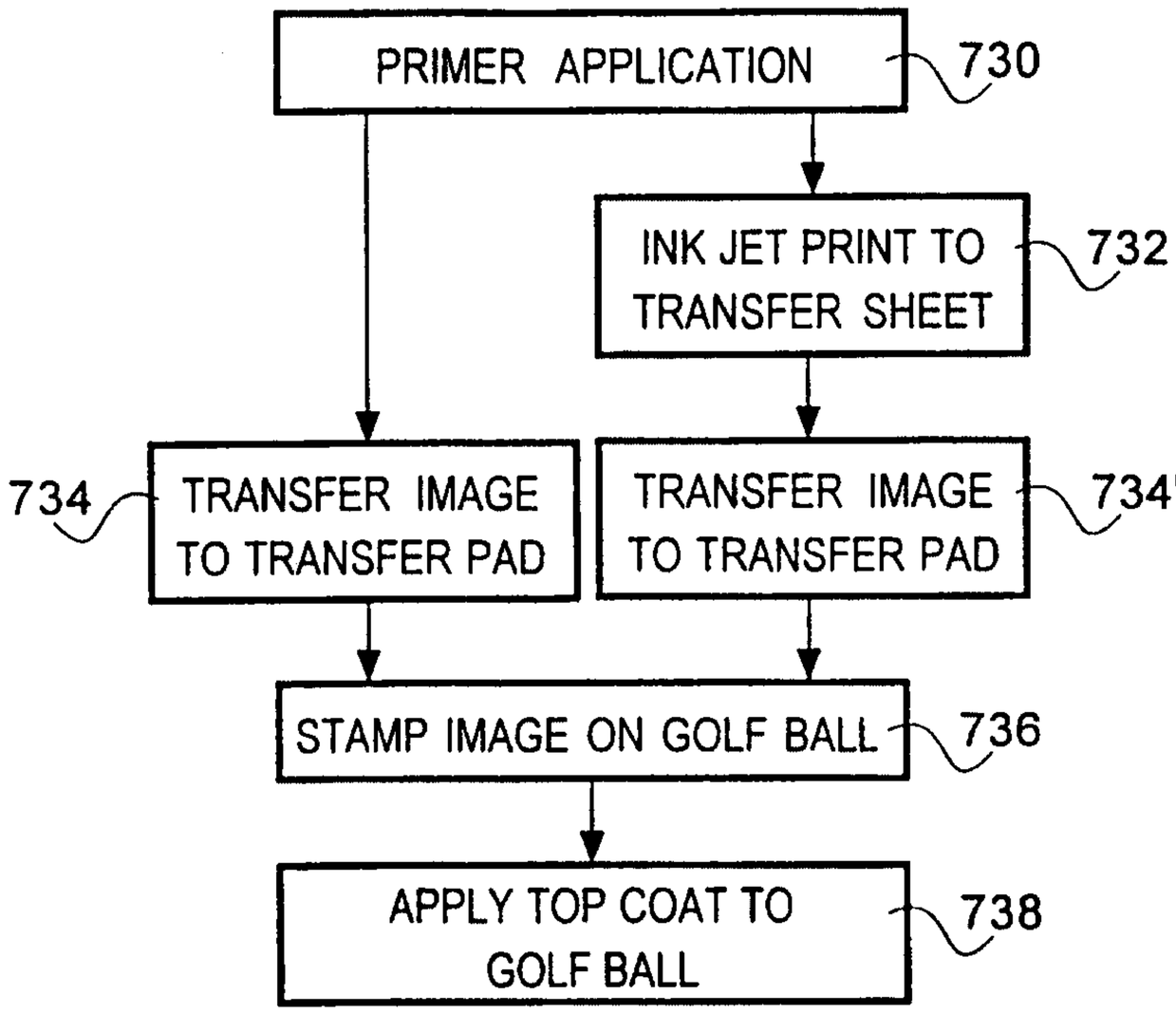

PRIMER APPLICATION
730
INK JET PRINT TO TRANSFER SHEET
732
734
TRANSFER IMAGE TO TRANSFER PAD
TRANSFER IMAGE TO TRANSFER PAD
734'
STAMP IMAGE ON GOLF BALL
736
APPLY TOP COAT TO GOLF BALL
738

FIG. 8

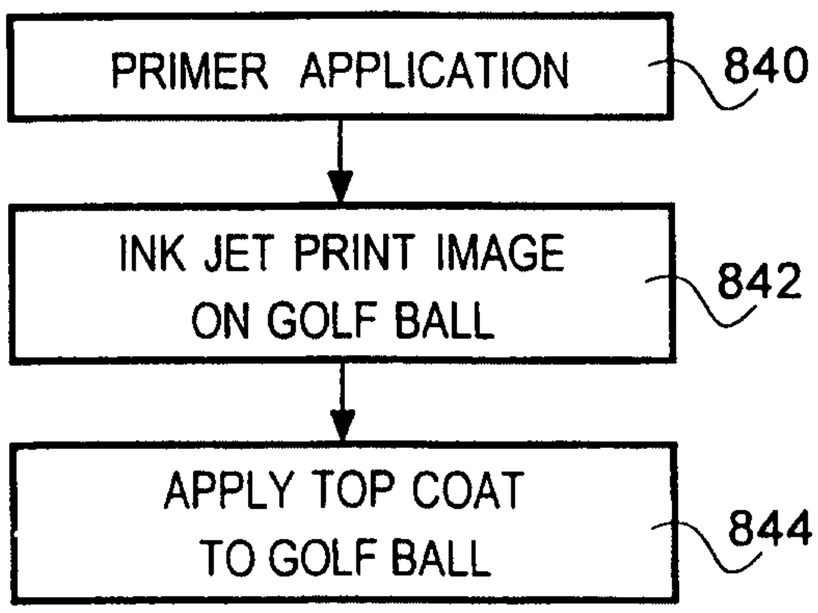
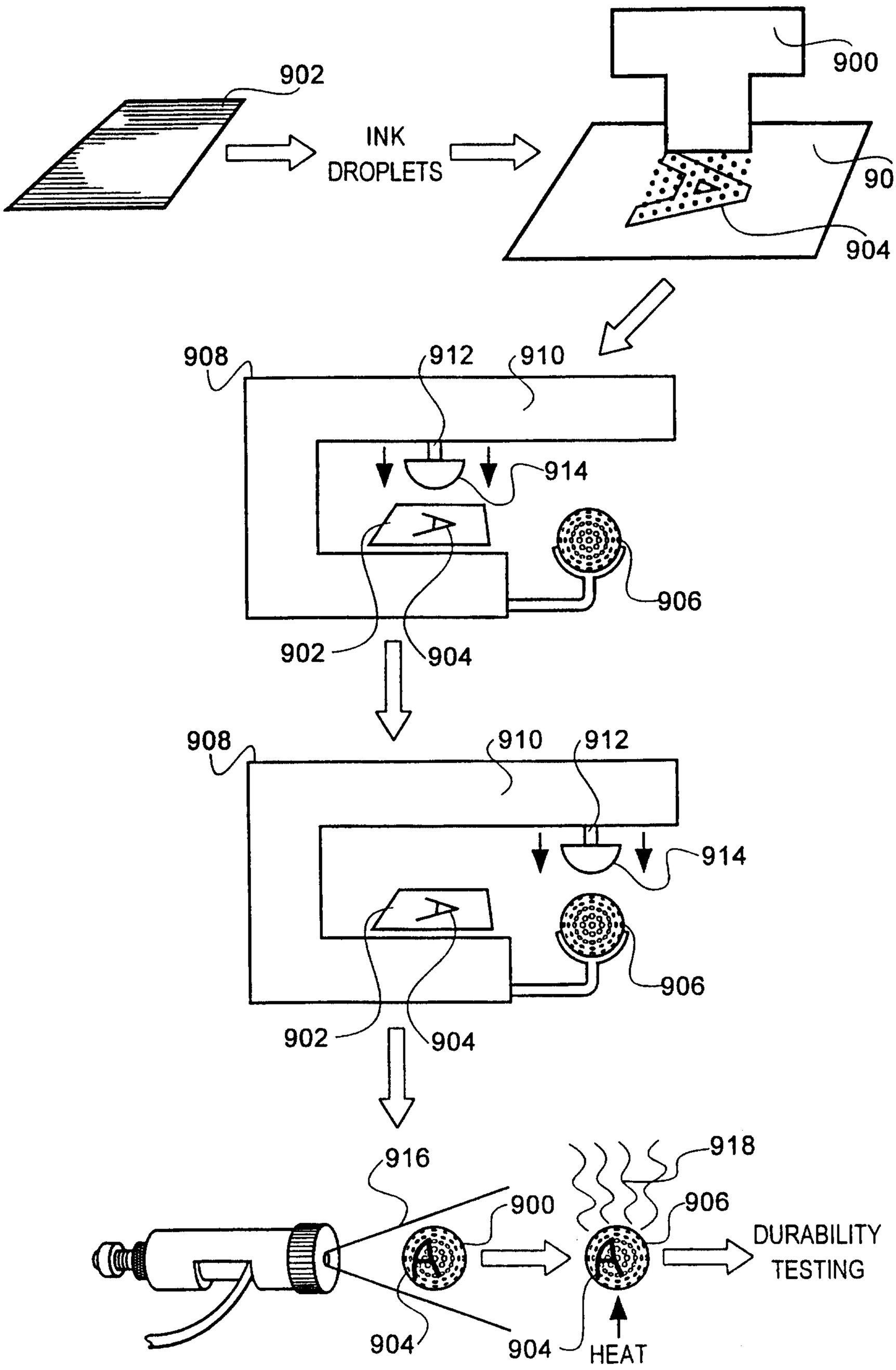

PRIMER APPLICATION
840
INK JET PRINT IMAGE ON GOLF BALL
842
APPLY TOP COAT TO GOLF BALL
844

FIG. 9


902
INK
DROPLETS
900
902
904
908
912
910
914
906
902
904
908
910
912
914
906
902
904
916
900
906
918
DURABILITY
TESTING
904
904
HEAT

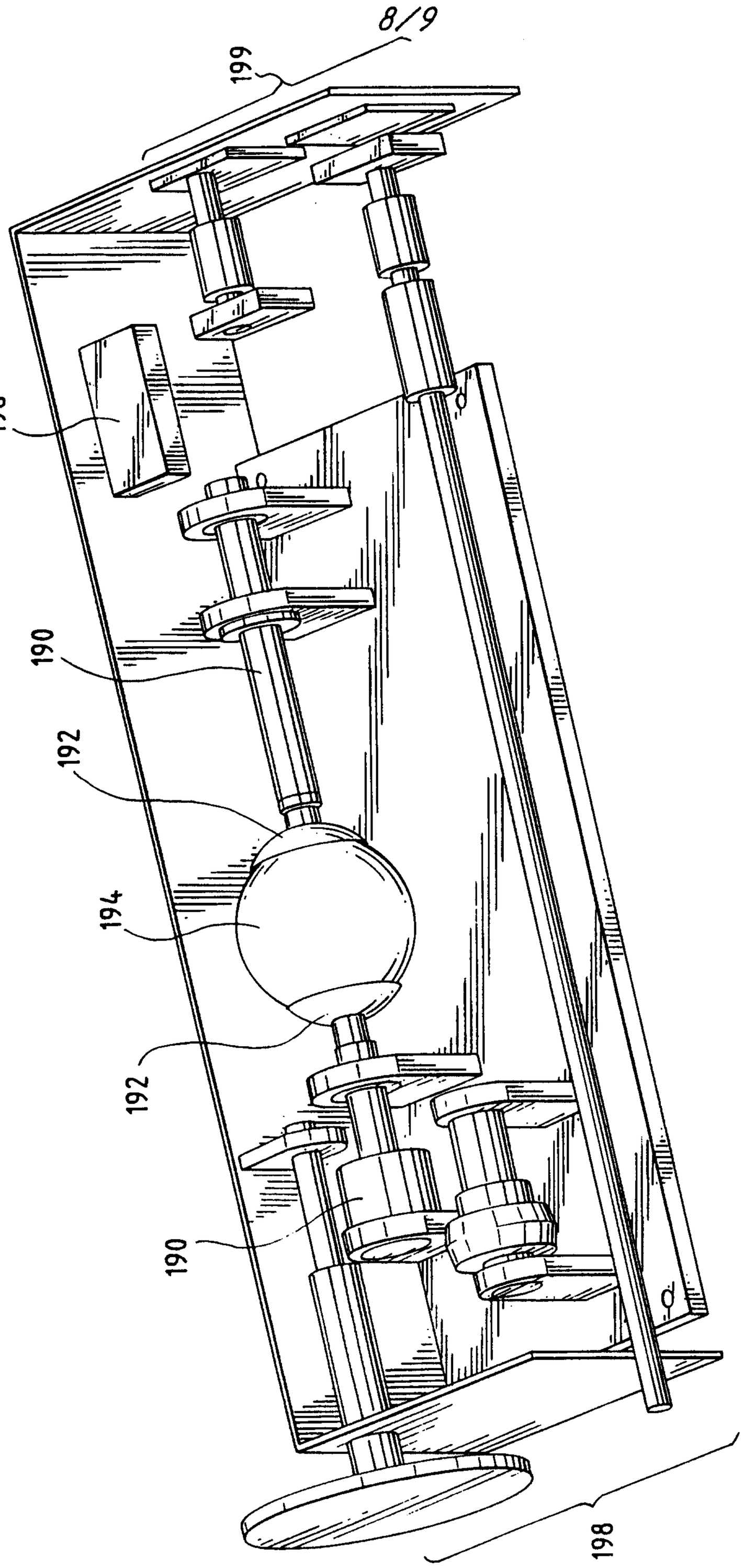
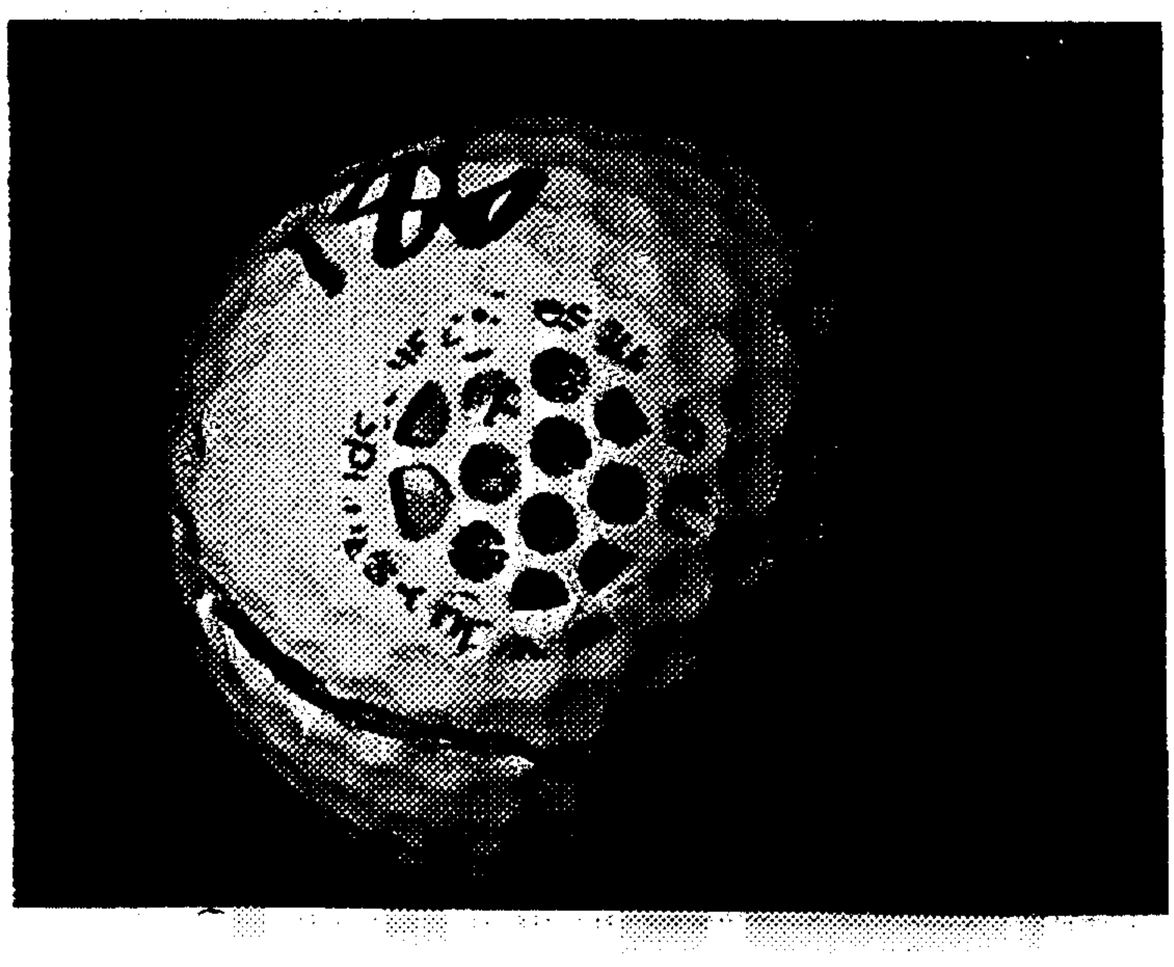
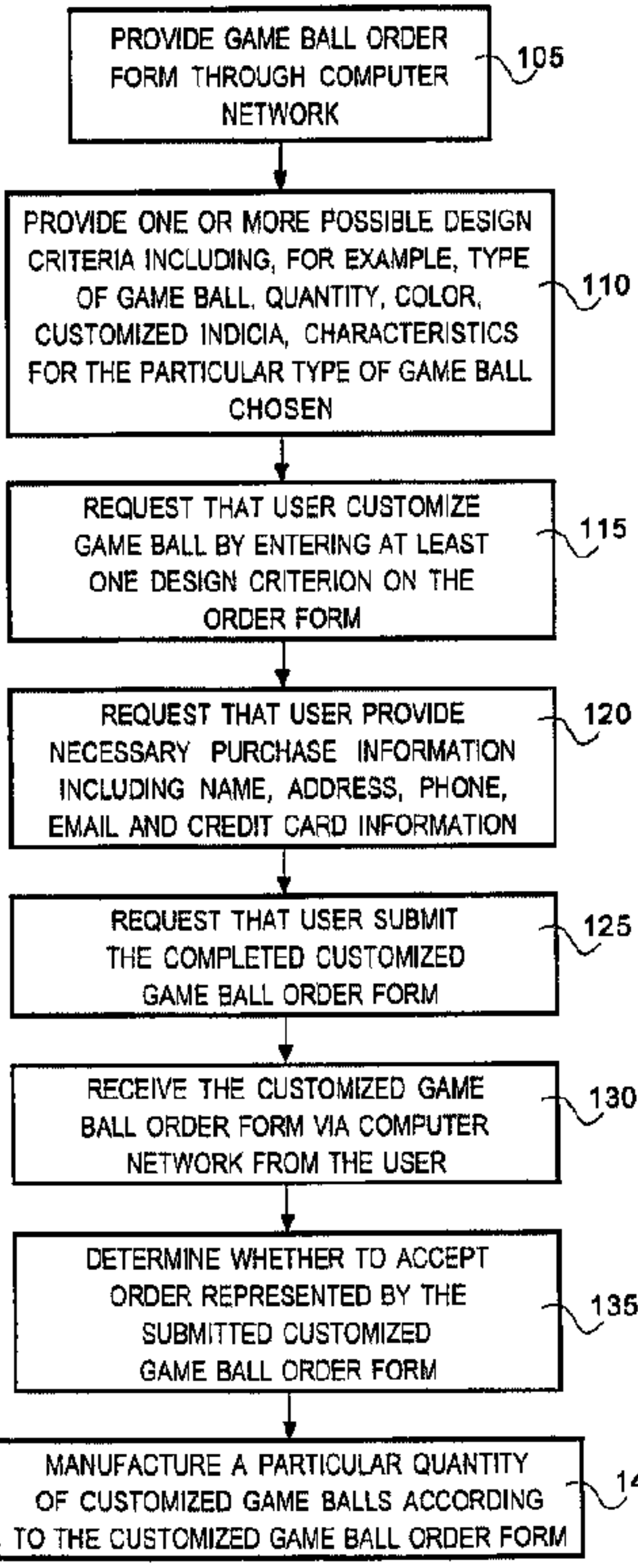


FIG. 10

FIG. 11

FIG. 12

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