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(54) Title: METHOD OF MANUFACTURING GAME BALL

(57) Abstract: The present invention relates to a method for manufacturing a game ball, in which the game ball is molded in one shot by injection press foaming of a compound material of EVA alone or blends thereof. The method comprises the steps of: providing a mold for use in injection press foaming, which has a size of 0.85-0.75 times the size of the game ball; compounding EVA alone or blends thereof as base polymer with an azodicarbonamid-, sulfonyl hydrazide- or urea-based foaming agent, a peroxidized-type crosslinking agent, a dispersant of steric acid or wax, and an inorganic filler selected from the group consisting of CaCO₃, MgCO₃ and mica, so as to be uniformly dispersed; mounting the mold on an injection press; transferring the compounded material into an injector cylinder of the injection press; performing injection molding of the compounded material on the injection press at an injector temperature of about 80-90 °C, a press plate temperature of about 150-190 °C, and a curing time of about 400-2000 seconds; and cooling the injection-molded material for about 10-30 minutes at about 40 °C, thereby manufacturing a game ball.

METHOD OF MANUFACTURING GAME BALL**Technical Field**

5 The present invention relates in general to a process for manufacturing a game ball. More specifically, this invention relates to a process for producing a game ball that has good safety characteristics with similar playing characteristics to a conventional game ball and that can be used as
a baseball or softball, etc. for child, for exercise and for toy.

10

Background Art

In general, a game ball such as baseball or softball is composed of an inner core, an intermediate layer and an outer skin.

15 The inner core is made from kapok or cork, and the outer skin has the form of two-piece covers made of leather, rubber or vinyl, which was stitched with each other.

The intermediate layer has a form where yarn or thread is wound around the core in order to keep sound, elasticity and strength upon hitting against a bat.

20 In this conventional game ball, tearing of the cover and breaking of the wound thread can occur as the number of use of the game ball increases. Also, the core cannot keep the proper circle form.

In addition, since the thread, cork or kapok is apt to absorb moisture, the conventional ball, when it's wet with foreign substances, is likely to decrease in
25 strength or to distort.

Also, where baseball players play with the conventional baseball of a weight defined in the regular league, it is so dangerous that the player, in

particular children, can receive a fatal wound. Therefore, there have been continued requirements for a baseball having good safety characteristics.

Some manufacturers have attempted to produce a single ball or a ball of 2-
or 3-layer construction, using polyurethane or thermoplastic copolymer blend
5 materials.

The ball made of polyurethane foam has some defects. That is, it has too high elasticity and thus, on hitting, it flies so far that it can be dangerous to the player. Also, in producing this ball, it is difficult to control polyurethane foaming within a mold and thus to obtain a uniform spherical ball.

10 In order to keep the uniform circular form of the game ball, in some manufacturers, methods were attempted, in which instead of winding with yarns or threads, ionomer or thermoplastic resin blend materials are injected into the form of hemispheres and two of the hemispheres are fused on the core.

However, these ball-manufacturing methods involve a complex process
15 and require many costs. For these reasons, there have been demands for a new method of manufacturing a ball, which can keep uniformity of products and reduce production costs.

Disclosure of Invention

20

Accordingly, the present inventors have conducted a study in an attempt to develop a producing method of game balls capable of overcoming various problems occurring in the prior game ball and the producing method thereof, and consequently invented a producing method of game balls game ball for child,
25 exercise and toy, which have remarkably reduced danger as compared to balls currently used in the Little League while exhibiting a uniformly circular form, playing characteristics, and high productivity.

Therefore, an object of the invention is to provide a method of manufacturing a game ball, which allows production of the game ball having the same appearance as the conventional baseball, in one shot, by injection press foaming of a compound material of EVA alone or blends thereof.

5 Hereinafter, the method for manufacturing game ball in accordance with the present invention has been illustrated and described in detail with reference to examples below.

That is, the invention concerns the process of manufacturing a game ball by injection press foaming, wherein the compound material of EVA alone or
10 blends thereof is injected into a mold which is then pressurized for a desired period of time at the temperature at which the compound material can be crosslinked and foamed. Then, entrapped foaming gas is diffused on opening of the mold, thereby producing the ball in one shot.

Since the injection press foaming process allows uniform control of
15 temperature and pressure, so that the foaming gas is uniformly diffused upon opening of the mold, and thus the complete spherical ball can be obtained in one shot.

The method for manufacturing ball by injection press foaming can be composed of three procedures as follows, namely, mold design, material
20 compounding and injection working. These procedures will now be described in more detail.

(1) Mold design

First, a mold having a size reduced to a determined size is designed in such a manner that the compound material will have the same shape and size as the
25 actual ball when the material is foamed.

That is, the foaming magnification needs to be selected in consideration of weight, strength, sound and safety, etc. that are characteristic required in a game

ball.

If the foaming magnification is too high, strength gets weak, and if the foaming proportion is too low, the time required for foaming gets longer to decrease productivity. Thus, considering these points, the foaming magnification
5 must be selected.

A size of the injection foaming mold relative to the actual ball size is generally in the range of 0.9 to 0.6 times, and more preferably, 0.85 to 0.75 times.

(2) Material compounding

Base polymer of the composition used in the present invention is based
10 on EVA and the derivatives thereof, to which polyolefinic resin or elastomer, polystyrenic elastomer, natural rubber and synthetic rubber such as SBR, BR, NBR and IR may be blended.

The composition used in this invention contains a foaming agent, a crosslinking agent and a dispersant in addition to the base polymer. Also, an
15 inorganic filler may be added to the compound material.

As the foaming agent, an azodicarbonamid-based forming agent is typically used, and other materials such as sulfonyl hydrazide- and urea-foaming agents may also be used.

As the crosslinking agent, peroxide type is commonly used and, as a
20 disperant, steric acid and waxes are used.

As the inorganic filler, CaCO_3 , MgCO_3 or mica, etc. can be used.

The compound material used in according to this invention is dispersed uniformly by using a kneader, a banbury mixer and a single- or twin-screw extruder, and is made into the form of palletized chips such that it can be used in
25 an injection machine.

(3) Injection working

The mold made to have a proper magnification is mounted on an injection

press, and the compound material was transferred into an injector cylinder, thereby performing the injection working.

In the injection working, the machine is operated at properly set press temperature and cure time, and the working can be executed manually or
5 automatically.

After curing for a desired period of time at the set press conditions, the mold is opened to obtain the circular game ball. At this time, the obtained ball gets inflated as much as the foaming gas gets inflated, but it shrinks as the ball is cooled, and the size of the ball product is determined when it is completely cooled.

10 Since uniform cooling of the foamed ball can result in the uniform size of the ball, and the working with the cooling chamber installed is preferred.

Injection working conditions depend on properties of the compound material but general conditions are as follows:

- injector temperature : 80-100 °C
- 15 - press plate temperature : 150-190 °C
- curing time : 400-2000 seconds
- cooling : 40 °C for 10 to 30 minutes

While the method for manufacturing the game ball by injection press foaming has been described, the method of the invention is not to be restricted by
20 only the foaming through the injection machine and also can include the method that uses the material of the invention by a common steam press machine.

The method for manufacturing the game ball by the steam press machine bears the inferior precision and uniformity to the method for manufacturing the game ball by the injection machine but there is a merit that installation cost of
25 machine is cheap.

The method for manufacturing the game ball according to the invention can produce the ball with a variety of hardness depending on the material and

proper ball can be selected and used in accordance with the age of player.

Preferred examples in accordance with the present invention will now be described.

(Example 1)

5 After the composition of table 1 that uses EVA as a base resin is kneaded in a kneader, an extruded palletized compound is produced using an extruder.

A mold is made by reducing its size to a size of 0.85 times the actual ball, and the injection foaming process is performed in the condition mentioned below, thereby obtaining an integral ball in one shot.

- 10
- press temperature :180 °C
 - cure time : 100 sec
 - cooling : 40 °C x 20 minutes
 - mold diameter : 62 m/min

The obtained ball is 74 cm in diameter, 60 in hardness shore A, 147 g in
15 weight, 40% in resilience and shows the same appearance as the conventional baseball. Also, the safety characteristic of the ball is superior when the ball hits on the body, compared to conventional baseball.

(Example 2)

20 With the composition of table 1 that uses polyethylene resin and EVA resin, a ball was produced in the same method as that of example 1.

The obtained ball is 74 cm in diameter, 80 in hardness shore A, 147 g in weight, 38% in resilience and is harder than the ball of example 1.

[Table 1]

Composition of game ball

chemicals	Example 1	Example 2
EVA(VA 21%)	100	70
Polyethylene	-	30
Steraic acid	1.0	-
Polyethylene wax	-	1.0
DCP	1.4	1.5
Azodicarbonamide	3.8	4.5

Industrial Applicability

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As described above, the invention provides the process of manufacturing a game ball wherein products with the same appearance as the conventional baseball can be obtained in one shot by injection press foaming of the material of EVA alone or blends thereof. Accordingly, the process can decrease a danger of the ball currently used in the Little League greatly and provide a process of producing the game ball for child, exercise and toy that displays the uniform circular form and playing characteristics and has the high productivity and therefore, is very is useful invention.

While the present invention has been described with reference to the particular illustrative embodiments, it is not to be restricted by the embodiments but only by the appended claims. It is to be appreciated that those skilled in the art can change or modify the embodiments without departing from the scope and spirit of the present invention.

20

What Is Claimed Is:

1. A method of manufacturing a game ball, in which the game ball is molded in one shot by injection press foaming of a compounded material comprising EVA alone or blends thereof, the method comprising the steps of:

5 providing a mold for use in injection press foaming, which has a size of 0.85-0.75 times the size of the game ball,

compounding EVA alone or blends thereof as base polymer with an azodicarbonamid-, sulfonyl hydrazide- or urea-based foaming agent, a peroxide-type crosslinking agent, a dispersant of steric acid or wax, and an inorganic filler
10 selected from the group consisting of CaCO₃, MgCO₃ and mica, so as to be uniformly dispersed;

mounting the mold on an injection press;

transferring the compounded material into an injector cylinder of the injection press;

15 performing injection molding of the compounded material on the injection press at an injector temperature of about 80-100 °C, a press plate temperature of about 150-190 °C and a curing time of about 400-2000 seconds; and

cooling the injection-molded material for about 10-30 minutes at about 40°C, thereby manufacturing a game ball.

20

2. The method of Claim 1, in which the base polymer is based on EVA and derivatives thereof, to which at least one selected from the group of polyolefinic resin or elastomer, polystyrenic elastomer, natural rubber and synthetic rubber such as SBR, BR, NBR, IR is blended.

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INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER IPC7 A63B 45/00 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) IPC7 A63B		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched KR, JP: IPC as above		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
E, X	KR 2002-87207 A (LEE, SUNG-YULL) 22 NOVEMBER 2002 See the whole document	1, 2
A	US 6,261,400 B1 (SPALDING SPORTS WORLDWIDE, INC.) 17 JULY 2001 See the whole document	1, 2
A	US 4,568,083 A (RICHARD E. MILLER) 4 FEBRUARY 1986 See the whole document	1, 2
A	US 4,529,200 A (RICHARD E. MILLER) 16 JULY 1985 See the whole document	1, 2
<input type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family annex.		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of citation 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 "&" document member of the same patent family		
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