# Rawhide-free/ Rawhide alternate compositions in manufacture of pet chews

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# RAWHIDE ASSOCIATED PROBLEMS

Rawhide is generally included in pet chews to make it long-lasting so that chewing it for a long time would help clean teeth and promote oral health. However, the use of rawhide in pet chews has inherent issues such as the below:

- Existing chew types have inherent flaws with the base material used.
- Rawhide as such, doesn't add any nutritional value for the pet, and therefore, the chew has to be sprayed with vitamin additives to provide nutritional value.
- The methodology and lack of regulations on the production of rawhide pose a concern to customers. Rawhide being a by-product of the leather and tannery industry, the extent of chemicals and other potential additives within it are unknown and have high probability of contamination by toxic chemicals and bacteria such as Salmonella or E. coli. These can occasionally put humans who handle the treats at risk as well.
- Some dogs are sensitive or allergic to rawhide or other substances used in their manufacture which could cause problems such as diarrhea, vomiting, pancreatitis, and digestive blockage, which would need surgical removal.
- Rawhide is inherently difficult to digest, and can cause swelling or blockage in an animal.
- Hence, there is a need for rawhide alternatives that can replace it well with similar textural and structural properties.

# PLANT PROTEIN AS RAWHIDE ALTERNATIVE

## Nestle S.A. – PURINA US7579038B1

**Nestle manufactured edible pet chew with thermoplastic composition, an alternative to rawhide as base ingredient. The thermoplastic composition includes plant based protein in major portions and also additives that help in promoting healthy teeth and gums. Also, a vertical injection molding machine is used for manufacturing the pet chew thereby reducing the manufacturing cycle time.**

- A thermoplastic, **protein-based**, **edible pet chew** (molded article) is produced by mixing a **protein-based thermoplastic composition**, heating the composition via an extruder, drying the resulting extrudate and heating the dried extrudate and injecting the heated previously dried extrudate into one or more molds.

- **Preferred Composition**: The **plant protein** includes **wheat gluten, wheat gluten isolate, rice gluten, or rice gluten isolate**. The protein-based portion of the composition may additionally include **animal protein** that preferably is **gelatin** at about 0 to 8 wt.% of the pre-mold, thermoplastic composition. The selections of the plant-derived protein ingredients are made to include **starch** from **0 to not more than about 4.9 wt.%** resulting in less than **2.5 wt% starch in finished product**. To maintain **processing flowability** of the thermoplastic composition, **water** (10 – 18 wt%) and **edible plasticizers** (10 – 25 wt%) are **included in the composition**. Edible plasticizers include glycerin (10-22wt%) and propylene glycol (0-3wt%). The **preferred flavorings** are chicken liver concentrate (about 0 to 4 wt.%), chicken oil (0 to 1 wt.%), and vegetable oil (0 to 1 wt.%).

- **Preferred Process**: The thermoplastic ingredients for molding are mixed uniformly to form homogeneous composition and fed into an **extruder** i.e. **an auger screw device** which provides **additional mixing of the composition**. The mixture is placed **under pressure** in the **extruder** and **exits through holes** (3mm diameter) within pellet die, then the outflow to the end of die is cut into pellets of 3-5 mm length. Pellets formed are dried in a **stainless steel barrel or drum** which is rotated concurrently and heated along with the volume of air within it. Dried pellets are then used to form **molded articles** by **vertically oriented injection molding devices** where there is no need for bolt fasteners and hydraulic pistons to maintain mold integrity. This enables device operator to easily swap molds providing a **shortened manufacturing cycle**. Thus, the pellets are placed in a **gravity hopper at the top of the device** to **release** the **preferred shot size of pellets** into the barrel of the machine which gets heated, causing the injected mass to become a molten mass having temperature of about 80-125 $^{0}$C. **Molten pellets** then **exit** through a 5mm nipple into a **horizontal mold** and further **cooled in post-injection phase via a chiller**.
- The pellets formed during extrusion of manufacturing process preferably have a moisture content of approximately **16 to 18 percent by weight**. Water weight % is reduced during processing, molding and drying of the article. The final molded and dried article preferably has from **8 to 14 wt.%** water.

# PROCESS FLOW CHART

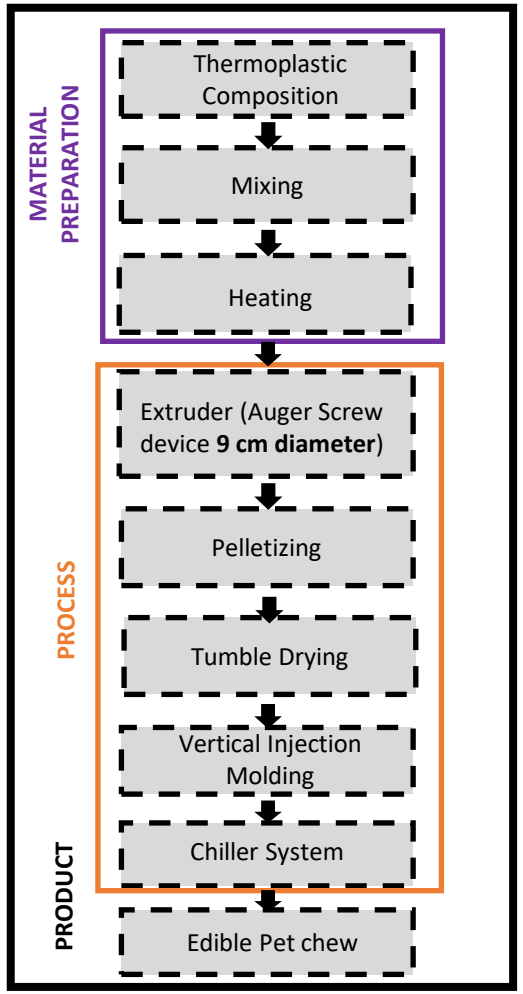
- Ribbon blenders may be used to evenly mix the ingredients of the composition.
- Mixing may also be effected by agitated blenders and high-speed mixers.

Preferable temperature: **60°C**
Pressing Force Tonnage: **15-20 Tons** for typical extruder

Rotating barrel temperature: **60-70°C**
Time: **4-5 hours**
Dried to moisture content of **8-11% by weight**

Preferable Barrel operating temperature: **130°C**
Preferable Mold Temperature: **130°C**
Pressing Force: **15-20 tons**
Capacity: **4 (60 grams chew articles)**
i.e. **480 chew toys per hour**

Chiller temperature: **0-20°C**
Time: **5- 10 minutes**

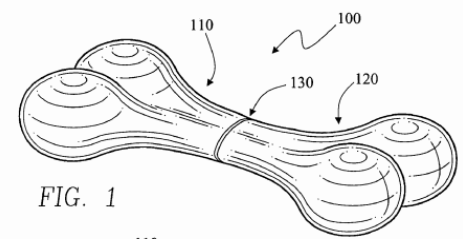



- 45 -63 % plant-derived protein: wheat gluten, wheat gluten isolate, rice gluten, or rice gluten isolate;
- 0-8 % animal-derived protein;
- 10-18% water;
- 0.5-6% flavoring;
- 10-25% edible plasticizer;
- 0-15% fiber reinforcement; 0-1% modifier; 0-1% mineral additive; 0-2% hygiene additive; 0-0.5% coloring agent

Exemplary hygienic additives that may be included to promote healthy teeth and gums, and anti-tartar agents and breath-fresheners to render a breath pleasing to the pet's human companion.
Preferably, **chlorophyll** is selected as a **hygienic additive** which acts as **breath-freshener** for inclusion in the thermoplastic composition, and one or more additional hygienic additives such as dementholized peppermint oil, spearmint oil, sorbitol, and sorbitan, for example, may also be selected for inclusion as breath-fresheners.

For pelletizing the extrudate, there may be attached or proximate to the end of the die, a cutting blade, preferably having a cutting periodicity adjusted to the extruder outflow so that the blade cuts the extrudate into pellets, preferably **3 to 5 mm** in length.

Vertical molding: To easily swap molds providing a **shortened manufacturing cycle.**




100. Molded article
110. First Portion
120. Second Portion
130. Notch


## Busy Bone Original Chew Treats for Small/Medium Dogs

- ✓ No Rawhide
- ✓ Meaty middle made with real pork
- ✓ No artificial FD&C colors
- ✓ Easily digestible
- ✓ Long-lasting with a twisted shape for more chewing fun

# PLANT PROTEIN AS RAWHIDE ALTERNATIVE

## Sergeant's Pet Products Inc – US6672252B2

**Sergeant manufactured pet chew, replacing rawhide with a polymeric material which is natural or at least perceived to be natural. The requirement for a chew without rawhide and also a chew that does not readily crumble, degrade in water and pose any hazard by shattering unlike starch compositions, led to this invention of a ductile pet chew made of protein polymer and inclusions.**

- **Preferred Composition**: The polymer material is preferably edible, with **water activity less than 0.9** and **total moisture content less than or equal to 25 wt%**. The material is either starch or protein based composition. A preferred protein is derived from wheat. A preferred starch is one that is not chemically modified and contains significant levels of amyl pectin. To **ensure** that the **polymeric material has sufficient ductility**, it is often required to add a softener, or plasticizer. Inclusion component includes hard or fibrous components of natural origin. The inclusions or compound will work in conjunction with the ductile substrate material to perform as a tooth-cleaning component or components. Fibers of length ranging between 1800 -2500 microns is preferred. Hard component particles of size ranging between (2 X 5) mm to 37 microns is preferred.
- The composition will have a **tensile strength** equal to between **200 psi and 750 psi**. **Flexular strength** of the composition should range between **3 lbs. and 75 lbs.**, which causes a 1/2 inch deflection. The **shear strength** should range between **80 lbs. and 175 lbs.** The **hardness** of the composition should measure between **68 and 90 rockwell**. The **penetration characteristics** of the polymeric composition should measure between **2 lbs. and 28 lbs**.

- **Example 1:** A **polymeric blend is extruded** into a animal chew. It is desired to develop a formula that is ductile in nature and could hold either hard components or fibers for use in cleaning teeth. A suitable protein polymer is developed and is of the dry formula listed here. A liquid mixture is then added to the above dry constituents. The liquid mixture is a plasticizer comprising of 0.126 pounds (lbs.) of metabisulfite, 23 lbs. of propylene glycol, and 2.52 lbs. of water. The wheat gluten is a protein polymeric material. The powder is a processing aid. The glycerol compounds are added as plasticizers to increase ductility of the product. The pellets formulated according to the above formula are extruded into an excellent animal chew. In particular, the chew is **edible and ductile,** and does **not readily degrade in water**.

- The resultant pet chew comprises **70% to 90% by weight** of **polymeric material.**

| Constituent | % By Weight |
|---|---|
| Wheat Protein | 87.87 |
| Flavor | 4.36 |
| Sodium Tri-metaphosphate | 2.49 |
| Cellulose Powder | 2.49 |
| Mono and Diglycerides | 1.40 |
| Magnesium Stearate | 0.80 |

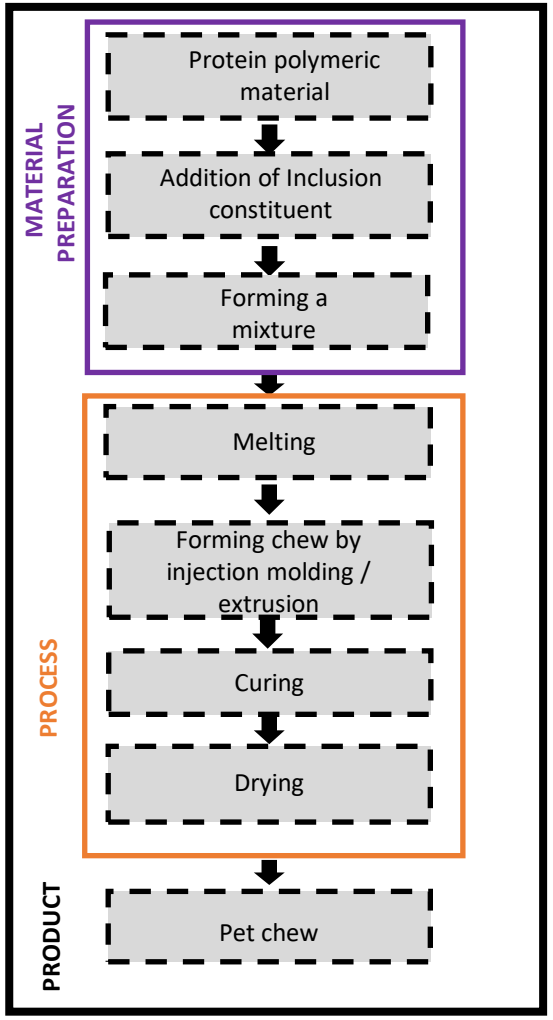
# PROCESS FLOW CHART

- Protein polymer water activity: less than 0.9
- Hardness of inclusion component: 2.0 - 9.0 Mohs

- Polymeric melting temperature: 155-210 $^0$F
- Extruding Temperature: 180- 210 $^0$F
- Screw rpm: 20-200 rpms

It is necessary to thermal set the pet chew after shaping which can be accomplished by heating with hot air, steam, or ionized energy. Other methods for thermal setting extruded pet chews include dipping in hot oil or boiling water. Preferably, the chews are cured after extrusion. This includes thermal setting and drying.

- Chew tensile strength: 200-1050 psi
- Flexular strength: 3 -75 lbs
- Shear strength: 80-175 lbs
- Hardness:
- Penetration:
- Moisture content: 10-25% by weight




- Polymeric material ( 70-90wt%): wheat, soy, corn, barley, other plant proteins, and combinations thereof; Starch polymer derived from wheat, rice, tapioca, potato, corn, and combinations thereof.
- Inclusions: Fiber components ( 4-8wt%) include synthetic fibers, cellulose, sisal, cotton, and combinations thereof;
- Hard components ( 10-35 wt%) include whole grains, ground grains, processed grains, legumes, minerals, and combinations thereof.

**Advantage**: Cleaning various animals' teeth, as the fibers and hard inclusions are held in contact with the animal's teeth during the chewing process.

- Injection molding is used for a three-dimensional shape, while extrusion is used for co-extrusion, or two-dimensional shape.
- Injection-molded shapes: Bone-shaped, pet treat shaped, and toy-shaped.
- Extrusion-processed shapes: Cookie-type shapes, bar type shapes, and multi-textured, colored, or flavored shapes.

**Sergeant's Pet Care Products Inc. purchased the facility of MGP Ingredients, Inc. located at Kansas City, Kan, in 2009. The sale includes all equipment used for the production and packaging of pet-related products, which principally include extruded plant-based resins and finished pet treats.**

# PLANT PROTEIN AS RAWHIDE ALTERNATIVE

## Spectrum Brands Pet Group Inc – US9968117B2

**Spectrum Brands' edible pet chew has a hardened outer layer of chewy plant based material with an inner layer of actual dried or cured animal flesh with no rawhide.**

- **Preferred composition**: The **first sheet** is made from an initially malleable and hardenable **mixture of wheat protein**. A small percent of **gelatin** (**5%** of composition by weight) is added **to provide enough malleability for extrusion**, **molding and other bending and forming**. The **second sheet** is made from **a plant based material** having **flavor infused or a meat composite bound** with a binder or a jerky of dried or cured animal flesh.

- **Preferred Process**: **A plant protein** composition is desirably **extrudable** to a foil, the first sheet. A **small percent of gelatin** (5% of composition by weight) is added to **provide enough malleability**. **The first and the second sheets** are **superimposed** forming **alternate layers** in the composite assembly, **flattened, wrapped into a roll** to form an **interleaved spiral shape** with aligned edges. The ends of the **rolled chew** are **tied into knots** to stimulate the bone. The **first sheet is hardened** by heat or drying. In an alternate embodiment instead of placing a single second sheet, multiple **elongated strips of sheet are spaced apart onto first sheet**. In another embodiment, **outer portion** of plant based material is **injection molded into** an **outer casing, forming cavities** within which jerky can be inserted.

- Avoiding all the concerns regarding the use of rawhide, a chewing layer comparable with rawhide and greater in duration is provided. The plant based material used has inherent nutrition. The second layer used provides a taste incentive for the pet.

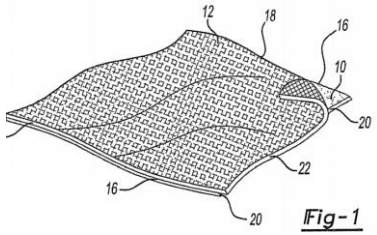


Fig-1

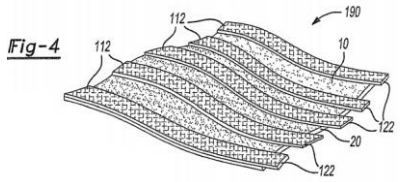


Fig-4

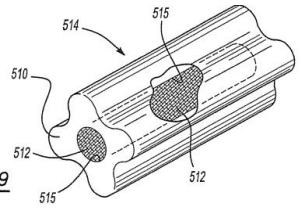


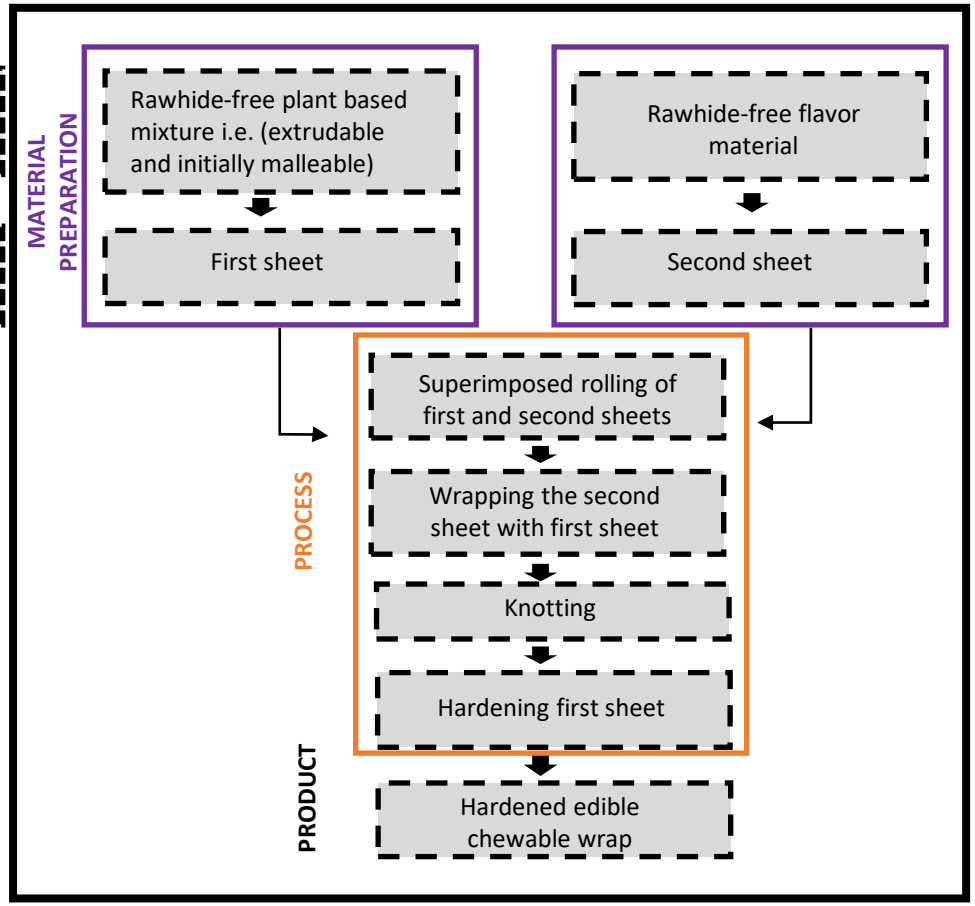
Fig-9

**10** First sheet
**12** Second sheet
**16, 18** Side edge
**20, 22, 122** Front edge
**112** Narrow sheets or strips
**190** composite sheet assembly
**510** Molded cavity
**512** Filler
**514** Pet chew
**515** Longitudinal extended cavity

# PROCESS FLOW CHART

First sheet dimensioned large and thin enough to be used as a wrap by **flexing, folding, rolling**

First sheet and second sheet forming alternative layers with no intervening rawhide layers




- Plant protein composition: Plant base and Gelatin 5%
- Flavor material: Meat jerky or plant material impregnated with meat or merely infused with flavors

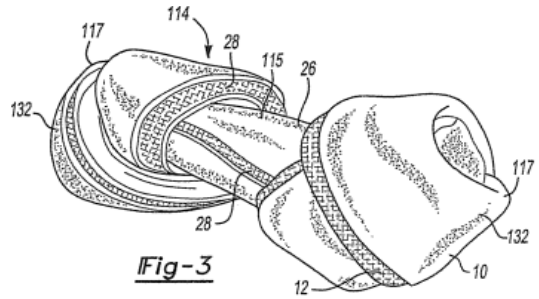
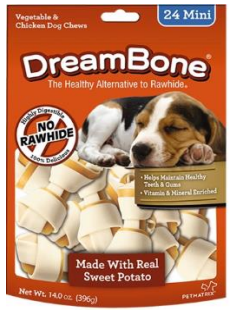



Fig-3

10. First sheet
12. Second Sheet
26. Outer Layer
28. Lip
114. Edible Pet chew
115. Elongated Middle Section
117. Epiphyses
132. Knots




## Sweet Potato Classic Bone Chews - Mini

- ✓ Rawhide-free
- ✓ Made with real sweet potatoes, chicken and vegetables
- ✓ Easy to digest
- ✓ Vitamin & mineral-enriched
- ✓ Chewing helps maintain healthy teeth

# DAIRY INGREDIENT AS RAWHIDE ALTERNATIVE

## GLOBALONE PET PRODUCTS LLC – US20170273336A1

**GlobalOne manufactured a pet chew replacing rawhide with a dairy material which includes inherent nutrients, also providing palatability and digestibility benefits. The exact hardness of the product is controlled by the amount of pressure or cooling or drying.**

- **Preferred composition**: The **outer material** of pet chew is primarily a **dairy base** i.e. a single dairy ingredient or a mixture such as **whey, cheese, casein, milk, yogurt**, etc. and combining at least one dairy ingredient with a binding agent such as starch, gelatin, wheat gluten and preservatives such as vegetable glycerin to increase shelf-stability. The **second layer** of a **flavored material** may be dehydrated poultry, meat, or fish or combination of ingredients such as meats and other binding agents.

  Three possible **examples** for the **dairy based chew** include:

  Example 1: Cheese (Skim milk, Enzymes, Salt), Potato starch, Glycerin, Sorbitol

  Example 2: Whey, Casein (Milk protein), Glycerin, Gelatin, Cheddar cheese powder, Natural liver flavor, Smoke flavor, Cheese flavor, Sodium propionate

  Example 3: Casein (Milk protein), Potato starch, Glycerin, Gelatin, Cheddar Cheese powder, Water sufficient for manufacturing, Natural chicken liver flavor, Palm oil, Smoke flavor, Titanium dioxide, Sodium, FD & C Yellow # 5

- **Preferred Process**: **Dairy based chew material** is formed into **thin sheets** through **extrusion, compression, rolling or dehydrating** the material on large trays until a semi-pliable or non-pliable state occurs. **Sheets** are **rolled into a cylindrical shape** or **cut into strips** which are later tied, **twisted or rolled**. In another embodiment, chew is formed **using injection or compression molding**. The **material is heated and forced** through an injection nozzle into a cavity of a mold, **cooled and hardened**. In compression molding, material is pre-heated and placed onto an open heated mold cavity. The mold is then **closed** and **pressure is applied to** force the material into contact with all mold areas. The heat and pressure is maintained until the dairy-based material has been cured. Once this material is cured, it is removed from the mold. In an alternative embodiment, material is heated and forced through a die and **extruded, and cut** to appropriate lengths and dried. A **second layer of flavored material** is **added** to the molded or sheet that is formed or extruded first material of these embodiments and **formed together into chews**. Chews are then **hardened through baking, dehydration** or other manufacturing techniques to create a chew/treat combination. While extruding, the mixtures are heated to a **temperature which does not burn**, **yet fluid enough** to be forced through the extruder. The strips formed are **dried to a moisture content of not more than 25 %.**

# PROCESS FLOW CHART

**PREPARATION**

- Dairy based material and binding agent
- Heating the mixture to form liquid

- Dairy-based material: Milk, cheese, yogurt, casein, whey, etc.
- Flavor material: Meats from poultry, mammals, or fish
- Binding agent: Starches such as potato, sources of animal origin such as gelatin or plant-based such as wheat gluten

**SHEET FORMING PROCESS**

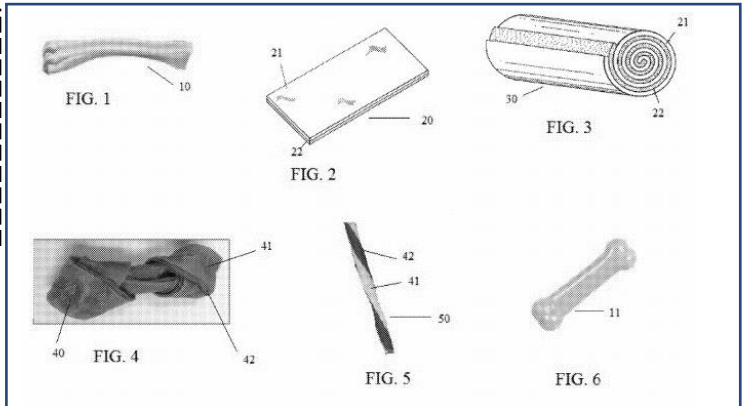
- Liquid mixture into thin sheets
- Cooling and drying the sheets into a semi-pliable state
- Flavoring material sheet on top of dairy sheet and rolled together
- Cylindrical chews / cutting sheet into strips
- Twisting or tying strips together

**MOLDING PROCESS**

- Forcing mixture into Injection nozzle / Compression mold
- Creating a secondary cavity within the mold
- Filling the secondary cavity or hole with flavoring material
- Cooling and hardening the mixture within the mold
- Opening the mold and obtaining the final product

**EXTRUSION PROCESS**

- Forcing liquid mixture through extruder
- Forming extruded strips of dairy-based material
- Forming thin strips of meat-based material
- Tying or twisting both strips into desired shape
- Baking shapes (drying up to moisture content of 25%)




10, 11, 21, 41 Dairy based chew
22. Sheet of meat or jerky
30. Cylindrical dog chew
40. Bone shape
42. Strips
50. Twists


## Cheezie Chews Cheese Knots - small

- ✓ 100 % Rawhide Free
- ✓ Made with naturally great tasting, easily digestible, lactose and fat-free Himalayan brand cheese
- ✓ Fulfill a dog's natural chewing instinct
- ✓ Useful in cleaning teeth like any other rawhide or alternate chews