



The Wobbly Science

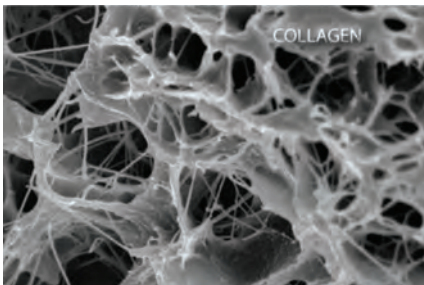
What is jelly made of?

- Water – Jelly is mainly water
- Gelatin – comes from boiling animal bones and skin, which extracts an animal protein called collagen
- Sugar
- Flavours
- Colours
- Preservatives – citric acid, acidity regulator (sodium citrate), acetic acid

Why does jelly set?

- The key to jelly setting is down to the protein collagen!

Collagen as seen under a scanning electron microscope:



Computer generated image of the helical protein chains:

Image from www.3dchem.com

- About 25% of the protein in your body is collagen which is made of three protein fibres twisted round each other – triple helix

- Collagen in animal skin and bones is broken down by heat and treatment with acids and alkalis. Bonds between collagen molecules (**intermolecular bonds**), bonds in the molecules (**intramolecular bonds**) and hydrogen bonds are broken down, making gelatin.
- When protein loses its shape it **denatures**.
- When the gelatin is heated and mixed with water the protein fibres come apart and unravel. As it cools they coil up again and intertwine trapping the water molecules between them. This mixture of water molecules spread evenly in a collagen matrix is known as a **hydrocolloid**.

- The concentration of gelatin needs to be about **1%** to form jelly

- The strength of a gelatin-based gel is its **bloom strength** and can be measured with a **penetrometer** or **gelometer**.

- Bloom strength even has its own formula (for those who think it isn't science without a formula) for different types of gelatin;

$$C_1(B_1)^{1/2} \div (B_2)^{1/2} = C_2$$

C = Concentration (g/ml)

B = Bloom strength

- Jelly has a melting temperature below 35°C. Our body has a temperature around 37°C.

This means jelly has that perfect melt in the mouth sensation releasing the flavour trapped in the jelly.

June 9, 1925.

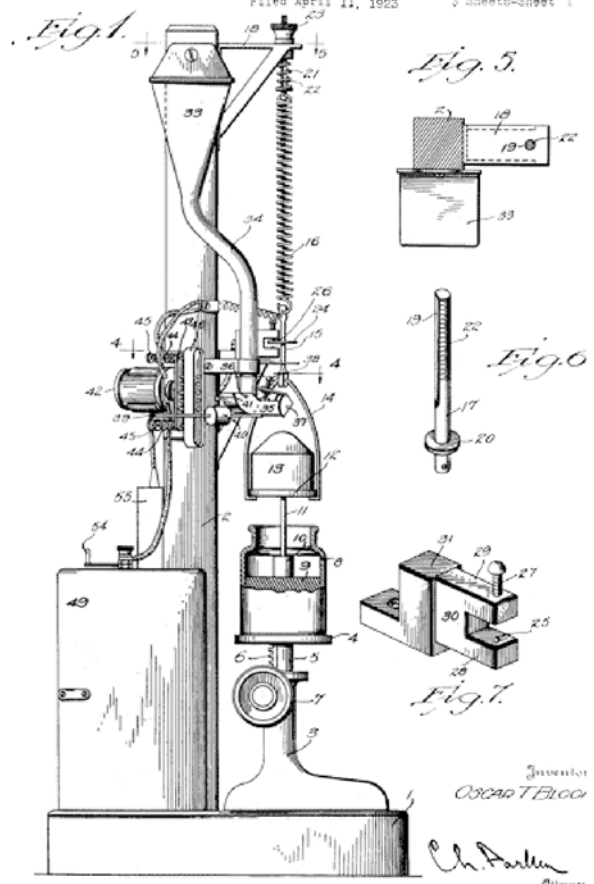
O. T. BLOOM

1,540,979

MACHINE FOR TESTING JELLY STRENGTH OF GLUES, GELATINES, AND THE LIKE

Filed April 11, 1923

3 Sheets-Sheet 1





Facts

Gelatin has many uses apart from jelly – in confectionery, yoghurt and cheese, pharmaceuticals, cosmetics, lighting and photography

Gelatin has an E number E441

Vegetarian gelatin is made from seaweed, pectin or konnyaku, and fish gelatin has been developed for Muslim and Jewish diets.

Gelatin is used to stick the layers together in Liquorice Allsorts[™]

Purified gelatin comes as sheets, powders or granules

Gelatin was used to harden paper

Blocks of gelatin are used to test firearms as a substitute for muscle

Paintball pellets shells are made from gelatin

Gelatin is used to bind the heads of matches together

Specialised coloured spotlights use filters made from gelatin; maybe you have been bathed in light from a 'jelly' on a night out.

Frozen jelly will often lose much of the water and collapse on defrosting. However, gelatin is often added in small amounts to ice lollies to make them smoother.

It is not possible to nail jelly to a wall and we do not recommend you try. Turn over to see the results of nailing jelly to a wall.



- More jelly nailing experiments can be found at www.myscienceproject.org/j-wall.html and <http://graeme.woaf.net/otherbits/jelly.html>



- Collagen protein has been turned into a sculpture by the artist Julian Voss-Andrea.

More facts can be found on the Jelly Vision website @ www.ifr.ac.uk/jellyvision/jellyfacts.html

Refs:

Harold McGee On Food & Cooking : An Encyclopedia of Kitchen Science, History and Culture, 2004, Hodder & Stoughton.