March 1, 1955 N. N. PLOURDE 2,702,924

CAPSULE FORMATION

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FIG. 2

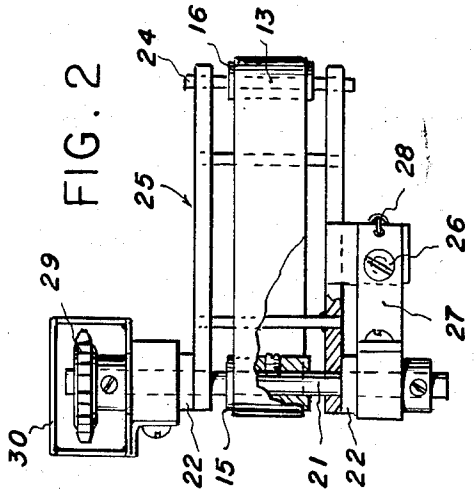


FIG. 3

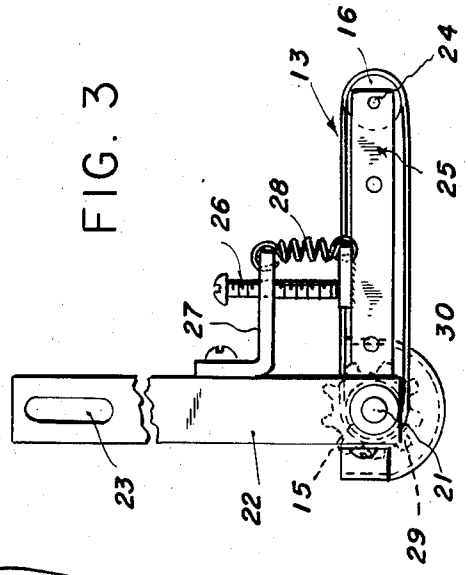
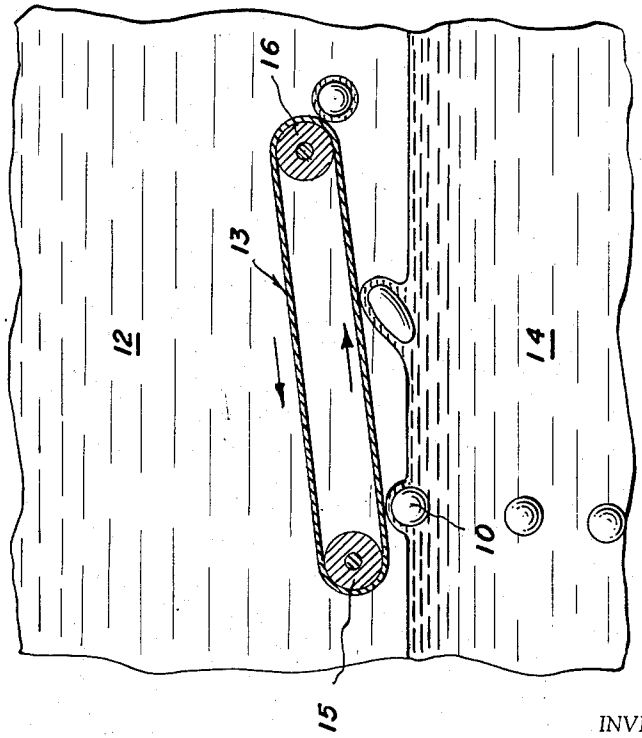


FIG. 1



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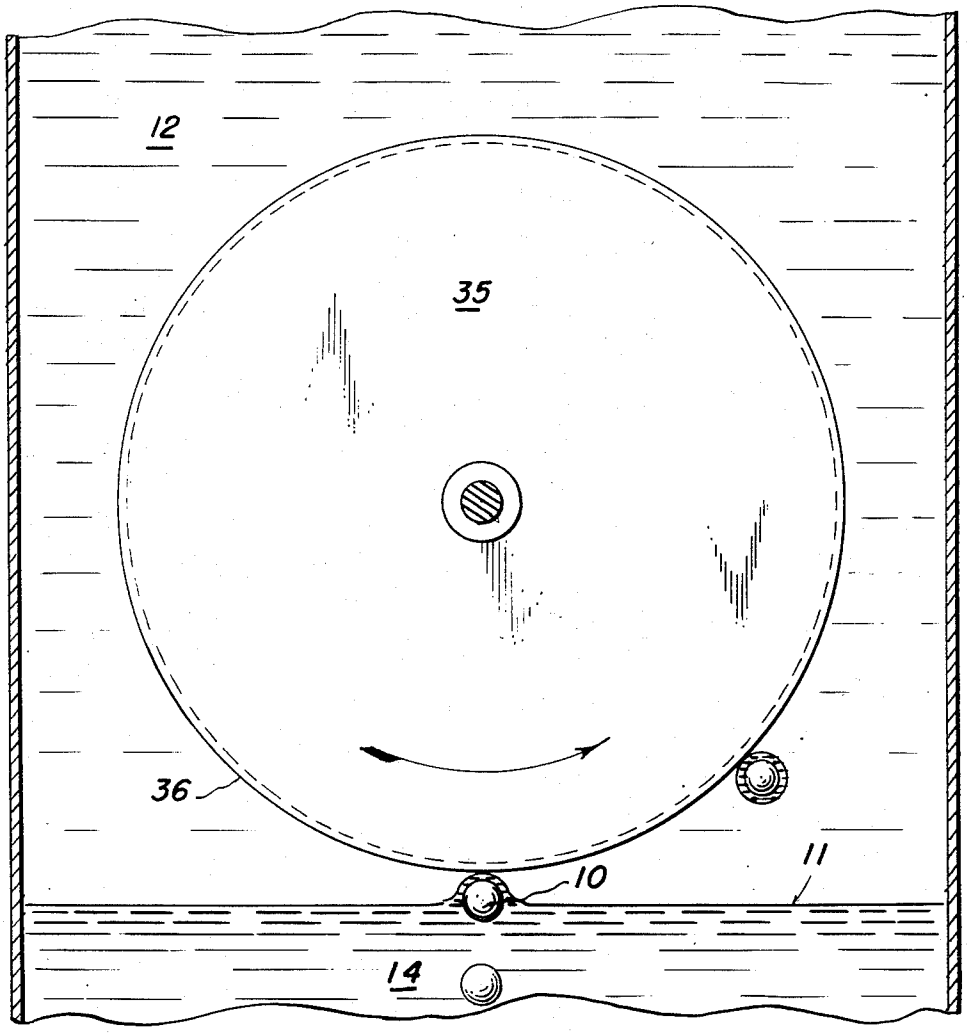
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CAPSULE FORMATION

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FIG. 4



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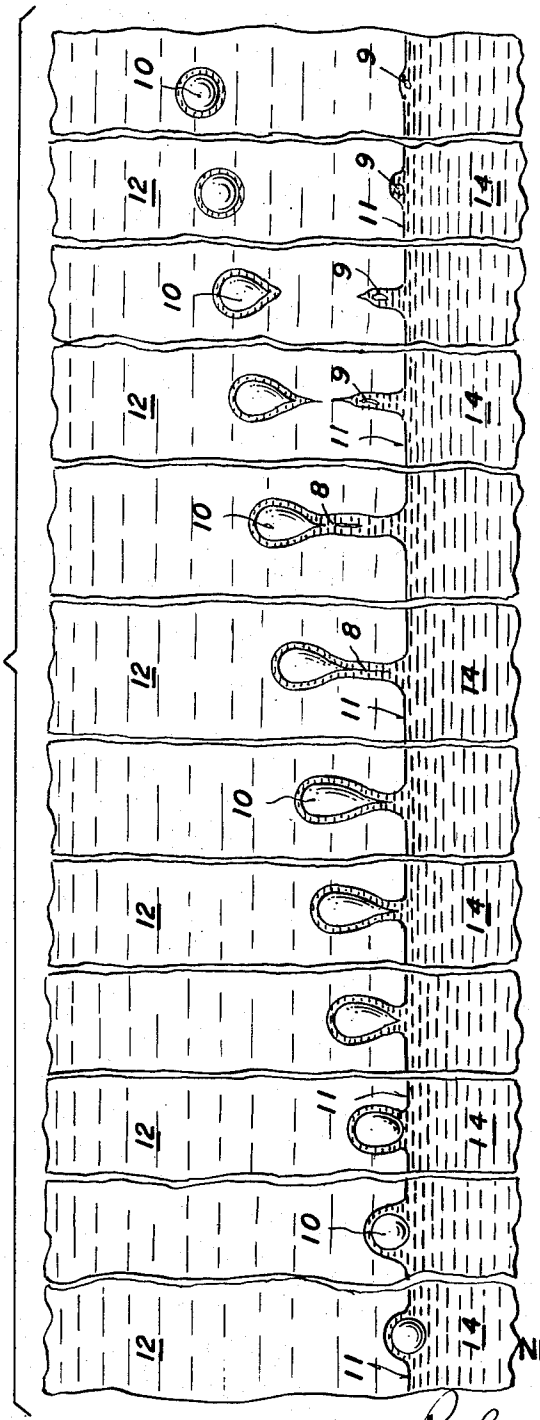
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CAPSULE FORMATION

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FIG. 5



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2,702,924

CAPSULE FORMATION

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Application April 11, 1952, Serial No. 281,740

7 Claims. (Cl. 18—48)

This invention relates to capsule formation.

The type of capsule here involved is one wherein the content or fill material of the capsule is provided with a covering or shell by passing the same through a bath of shell material in fluid condition, which shell is then set or hardened by passing the capsule through an adjacent cooling or hardening bath. According to the present invention the passage of the capsule through the interface between the two baths is controlled to prevent impairment of the capsule by the action of the surface or film tension at the interface.

The further nature of the invention and details thereof will readily appear from the following description of the illustrative embodiments of the invention shown in the accompanying drawings.

In said drawings:

Fig. 1 is a section elevation, somewhat diagrammatic in character, of a device for controlling passage of the capsule through the interface between the shell material and the cooling or setting bath;

Figs. 2 and 3 are respectively a plan and elevation of details of the aforesaid device;

Fig. 4 is a view similar to that of Fig. 1 showing in diagrammatic form a different assisting device; and

Fig. 5 is a diagram illustrating the tendency of surface tension at the interface to subdivide the capsule in its passage through the interface.

In the process of which the present invention is an improvement, measured quantities of capsule content or fill material are passed through a bath of shell material, such as gelatin in liquid form, thereby to collect thereon a seamless coating of shell material. In the case of gelatin, the content material is preferably cooled and congeals or partly congeals around it a seamless coating of gelatin. If the content material be in liquid or semi-plastic form, surface tension causes it to assume the shape of a sphere. If it be of less gravity than the shell material it is preferably introduced near or at the bottom of the bath of shell material and rises by displacement through the bath, as in Gunnell Patent 2,342,661. In such case, the cooling or setting bath of some liquid lighter than and immiscible with, the shell bath is superposed, or partly superposed, on the latter, and functions to treat the shell or coating material in such a way as to give it firmness, strength and durability. In the case of gelatin shell material, the bath cools and thereby hardens the shell as the capsule passes through it. Where relative gravities are reversed and the content or fill material is heavier than the shell material, the content material will fall through the shell bath, and the latter must then be superposed on the cooling or setting bath which must be heavier than as well as immiscible with the shell material.

In either case the rate of travel of the content material through the shell bath depends on the relative gravities of the shell and capsule content material and to some extent on the size of the capsule. Similar considerations influence problems encountered in passing of the capsule through the interface into the cooling or setting bath. The surface tension of the interface tends to retard small capsules or those displaced with a low force because of slight gravity differences with the shell bath. Indeed, when such differences are small, the passage of the capsule through the interface is so slow as to retard production to the point where it is commercially impractical. Also, collection of more than one capsule in contact at the interface causes them to stick or weld

together, making a twin or double capsule which must be discarded as waste. Where the capsules are large or their relative gravity is greater, the passage through the interface may be sufficiently rapid (see Fig. 5) to stretch out behind the capsule a long tail **8** and to sever a portion of said tail, leaving behind a globule **9** of content material. All such capsules must be discarded as not having a specified amount of content material. The severed globules being too small to pull away from the interface, may attach themselves to other capsules as they arrive at the interface, resulting in an imperfect capsule which must be discarded.

In one illustrative method wherein the content material is lighter than the shell material the nascent capsule **10** is assisted through the interface **11** by physically contacting the same as it reaches the interface and moving the same along the interface. This not only moves the capsule out of the path of succeeding capsules which might adhere if contact were permitted in the plastic condition of the shell material at this point, but controls the rate at which the capsule travels through the interface, and thereby prevents the drawing out of a tail so rapidly that it might be severed, as aforesaid.

In Fig. 1 such contacting means is represented by a variable speed traveling belt or chain **13** having an adjustable inclination to the interface and located in the cooling bath **12** to engage the capsule **10** as it attempts to pass from the shell bath **14** through the interface. As here shown, the belt is supported by and travels between pulleys **15** and **16**. The belt assembly is preferably also vertically adjustable relative to the interface to permit engagement of the capsule at any desired degree of emergence through the interface, without being close enough to disturb the shell bath on the opposite side of the interface. The degree of inclination of the belt controls the rate at which the capsule passes through the interface, and this in turn is influenced by the forces acting on the capsule, the surface tension at the interface, and the tenderness of the capsule shell at this point. For small capsules, for example, it is preferable to adjust the belt more nearly parallel to the interface. In moving capsules laterally out of the path of ensuing capsules, the capsules are rotated as they pass through the interface. This, as well as control of the rate of travel through the interface, prevents the drawing out of any tail containing content material, as aforesaid.

In Figs. 2 and 3 are illustrated details of one illustrative belt driving, supporting and adjusting means. As there shown, pulley shaft **21** is suspended on vertically adjustable side frame members **22** which extend downwardly through the bath. Adjacent their upper ends they are slotted as at **23** to permit vertical adjustment of the entire assembly for purposes above stated. Driving pulley **15** is fixed to shaft **21** and driven pulley **16** is carried on shaft **24** adjacent the end of supporting frame **25** whose inner end is supported on shaft **21**. Inclination of belt **13** relative to the interface is adjusted, in the present instance, by adjusting screw **26** carried by bracket **27** on a side frame member **22** and bearing against the belt frame **25**. A spring **28** exerting tension between bracket **27** and frame **25** holds the latter against the screw. Shaft **9** is driven in this instance by sprocket **29** from a downwardly extending sprocket chain which advantageously passes through a housing **30** to protect the sprocket and chain from contact with the liquids.

Various forms of capsule controlling means may be employed. Another such means is illustrated in Fig. 4 in the form of a rotating cylinder **35** whose periphery **36** is adjusted to engage the capsule **10** as it attempts to pass through interface **11**. The frictional drag of the surface of the cylinder laterally displaces the capsule and assists it through the interface in the same manner as belt **13** in Fig. 1. Due to the curvature of the cylinder, the passage of the capsule through the interface may be somewhat accelerated as compared with the action of a flat belt, as in Fig. 1. Preferably the cylinder axis is vertically adjustable, and its surface speed variable for the same purposes as the adjustments for belt **13**.

Obviously the invention is not limited to the details of the illustrative embodiments since these may be variously modified. Moreover, it is not indispensable that

all features of the invention be used conjointly since various features may be used to advantage in different combinations and sub-combinations.

Having described my invention, I claim:

1. In the method of making capsules wherein a capsule moves by the action of gravity through superposed baths of liquid coating and setting materials separated by an interface, the steps which comprise introducing measured quantities of content material in succession into the coating liquid to pass in succession through said liquid to said interface, and engaging said capsules in succession at the interface with a laterally moving member to move the same laterally out of the path of succeeding capsules.

2. In the method of making capsules wherein a capsule moves by the action of gravity through superposed baths of liquid coating and setting materials separated by an interface, the steps which comprise introducing measured quantities of content material in succession into the coating liquid to pass in succession through said liquid to said interface, and engaging said capsules in succession at the interface with a member moving in a direction laterally of and normal to said interface to move the capsules laterally out of the path of succeeding capsules, and to control the rate of passage of the capsule through the interface.

3. In the method of making capsules wherein a capsule is formed in superposed baths of liquid coating and setting materials separated by an interface, the steps which comprise covering capsule content material with coating material by introducing the content material into the bath of coating material, allowing the coated capsule to travel toward the interface by the action of gravity, and engaging the capsule at the interface with a moving surface and by said moving surface rotating the capsule as it passes through the interface to prevent drawing out of the coating material as the capsule passes through the interface.

4. In the method of making capsules wherein a capsule moves by the action of gravity through superposed baths of liquid coating and setting materials separated by an interface, the steps which comprise introducing measured quantities of content material in succession into the coating liquid to pass in succession through said liquid to said interface, and rotating the capsules in succession as they pass through the interface.

5. In the method of making capsules wherein a capsule moves by the action of gravity through superposed baths of liquid coating and setting materials separated by an interface, the steps which comprise introducing a measured quantity of content material into the coating material bath to coat said content material as it passes through the coating bath to said interface, and engaging the coated capsule as it passes through the interface with a laterally moving surface to control the passing of the capsule through the interface.

6. In the method of making capsules wherein a capsule moves by the action of gravity through superposed baths of liquid coating and setting materials separated by an interface, the steps which comprise introducing a measured quantity of content material into the coating material bath to coat said content material as it passes through the coating bath to said interface, and engaging the coated capsule as it passes through the interface with a laterally moving surface to rotate the capsule as it passes through the interface.

7. In the method of making capsules wherein a capsule moves by the action of gravity through superposed baths of liquid coating and setting materials separated by an interface, the steps which comprise introducing measured quantities of content material in succession into the coating liquid to pass in succession through said liquid to said interface, and engaging the coated capsule as it passes through the interface with a laterally moving surface to rotate the capsules in succession and to move the same laterally out of the path of ensuing capsules as they pass through the interface.

References Cited in the file of this patent

UNITED STATES PATENTS

2,342,661	Gunnell	Feb. 29, 1944
2,468,060	Gunnell	Apr. 26, 1949