July 17, 1951 E. F. SMITH 2,561,147

COMB FOUNDATION

Filed May 29, 1947

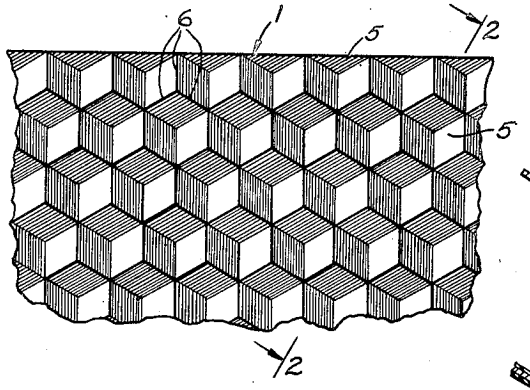

FIG. 1

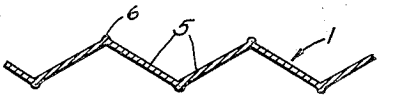

FIG. 2

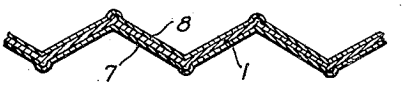

FIG. 3

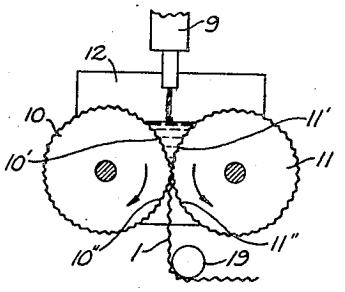

FIG. 4

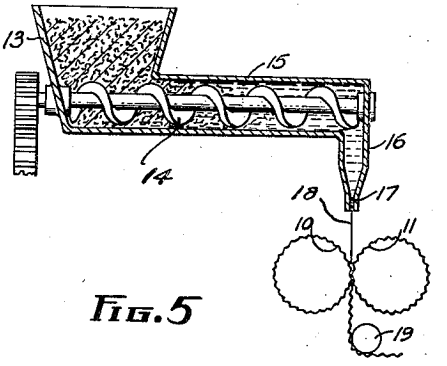

FIG. 5

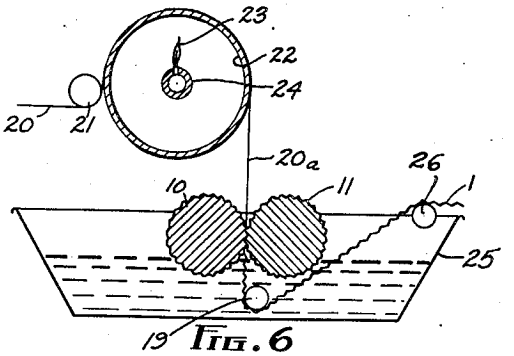

FIG. 6

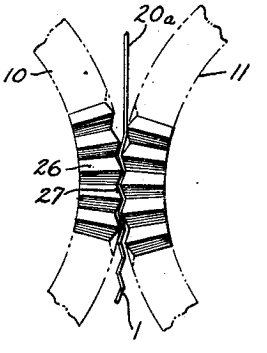

FIG. 7

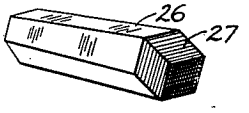

FIG. 8

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COMB FOUNDATION

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4 Claims. (Cl. 6—11)

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This invention relates to an improvement in comb foundation for use in bee hives, thus indicating the principal objects.

It has previously been proposed to make comb foundation with its well known characteristic polyhedral pattern from moldable plastic material other than beeswax. Thermosetting synthetic resin (phenol formaldehyde) is one instance. It has also been proposed to make comb foundation using, as a center ply, material on the order of that sold by E. I. du Pont de Nemours & Co. under the trade-mark "cellophane."

We have found that saturated polymers, particularly polyethylene (thermoplastic in the usual sense and uniformly blendable with beeswax in various proportions), may be used practically as comb foundation without requiring reinforcement such as wires in order to be sag-proof and repeatedly to withstand rough handling during extraction of honey from the combs in a centrifugal extractor machine.

The material (polyethylene) can be made readily acceptable to the bees by blending, for example, up to 25% by weight of beeswax therewith (any percentage that does not too greatly weaken the composition); and, whether or not the foundation contains or is overlaid with beeswax, sheets of polyethylene properly embossed with the characteristic foundation pattern will remain adequately strong to support the comb in the bee hives and later during power extraction of the honey. The above discussion indicates further objects hereof.

A specific object is to provide a honeycomb foundation, or core material therefor, made in sheet form directly from a plastic substance which is stronger than beeswax, is permanently warp-proof, will not become brittle in a few seasons, and is acceptable to the bees, whereby foundation made therefrom does not require reinforcement for practical use.

Other objects and features of the invention will become apparent from the following description of illustrative forms and methods.

Fig. 1 is an enlarged main face view of a fragment of comb foundation made, for example, from the thermoplastic material discussed above;

Fig. 2 is a sectional view of the foundation in its simplest form, taken as along the line 2—2 on Fig. 1;

Fig. 3 is a view similar to Fig. 2, showing a molded (embossed) plastic sheet used as a core for an overlay on each side of beeswax;

Figs. 4, 5 and 6, respectively, are diagrammatic side views of various apparatus for making comb

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foundation from thermo-plastic material in accordance herewith;

Fig. 7 is an enlarged sectional view through portions of two embossing rollers and a sheet of plastic material being formed therebetween; and

Fig. 8 is a perspective view of one of the embossing dies according to Fig. 7.

Comb foundation, in order to be suitable for use in extractor frames, has to be made into fairly large sheets of approximately uniform strength throughout. The sheets do not usually bridge an entire extractor type frame, since the bees require a passage through the frame around the foundation in order to enable completion of the comb on both sides. Accordingly, the embossed sheets are usually suspended from the top frame bars and connected with the end bars in some suitable way. Reinforcement of some sort is necessary, for example, wires. The present foundation may be firmly secured to the frames by the usual edge-fastening method and, if desired, can be additionally secured by application of heat and pressure (heat determined by plasticising point), and no reinforcement has to be used. A split (two piece) botom bar can be used, in addition to the usual mounting means, to hold bottom edge portions of the foundation sheet.

Referring to Fig. 1, the illustrated fragment of foundation has a uniform pattern or hollow triangular pyramids struck alternately toward opposite sides, the hexagonal areas 5 being partly raised and partly depressed with reference to the principal plane of the sheet, as usual. The pyramids, as shown by Fig. 2, preferably have ribs as at 6 at their hexagonal boundaries or ridge definitions for the purpose of assisting the bees in starting the comb cells. The sheet may be wholly polymerized ethylene or may contain, for example, any desired percentage of beeswax blended with the polyethylene. The tensile strength of the product is, of course, lowered as the beeswax content is increased. A relatively small percentage of beeswax (for example 25%) imparts to the foundation an easily detected beeswax aroma. The bees, in addition to erecting honey cells on the ribs 6, usually coat each face of the foundation with beeswax.

An alternative construction is illustrated by Fig. 3, wherein the sheet (e. g. wholly polyethylene) is coated on both sides with beeswax layers 7 and 8. Such coating may be effected: (*a*) by dipping the embossed core sheet 1 into melted beeswax, (*b*) by introducing rolled sheets of beeswax into the foundation mill simultaneously with introducing a highly plastic sheet of poly-

ethylene thereto, or (c) the beeswax may be sprayed against the embossed plastic sheet from a suitable gun (not illustrated) in which the beeswax is maintained above its melting temperature.

Polyethylene is fluid at about 300° F. and beeswax will blend uniformly with the plastic at that temperature, remaining blended therewith during embossing of the composition into the illustrated foundation pattern. Being a saturated plastic, the polyethylene will not become brittle with age and can be reused in the comb for many years.

One method of producing comb foundation from thermo-plastic material such as polyethylene (with or without beeswax) is suggested by Fig. 4, wherein the fluid plastic is introduced from a supply source 9 of molten material between mating, i. e. pattern-registering, foundation mill rolls 10 and 11 provided with additional confining walls, one being indicated at 12. A stripper roll is shown at 19, representing part of a conveying means to remove the finished foundation. Cooling means may be provided as illustrated at the bottom of Fig. 6, described later. A paper leader (not shown) is usually required in order to start flow between the rolls. The method according to Fig. 4, while simple in arrangement, requires continuous maintenance of a considerable heat differential between the nip or bight portions 10' and 11' of the forming rolls and the delivery portions 10'' and 11'' in order to prevent adherence of the embossed sheet to one or the other of the rolls. Accordingly, the methods illustrated by Figs. 5 and 6 are recommended as preferable.

In Fig. 5, the raw plastic (e. g. polyethylene and/or polyethylene containing the desired percentage of beeswax) is contained in a hopper 13 and conveyed by a power driven extrusion screw 14, supported for rotation in an extrusion chamber or barrel 15, to an accumulator or pressure chamber 16 having an outlet in the form of a sheeting throat or slit (at 17) of the desired proportions such that the still highly plastic sheet 18 emerging from the elongated throat or slit is pressure-molded or embossed by the rolls 10 and 11 and delivered therefrom to suitable receiving or conveying means represented diagrammatically by the roll 19. Cooling means may be provided in accordance with Fig. 6 as mentioned in connection with Fig. 4. Heat control for the various parts of the extrusion mill is in accordance with known practice in plastic manufacture, modified as necessary in accordance with the percentage of the relatively low melting point beeswax in case such mixtures as indicated are used.

In the method according to Fig. 6, a preformed sheet 20 of plastic stock (e. g. polyethylene or polyethylene blended with beeswax) is supplied as beneath a guide roll 21 to the upper surface

of a heated drum 22. The drum may, for example, be heated by a series of flames 23 (one shown) issuing from jets in the wall of a pipe 24 extending within the drum. The drum in such case would be open at least at one end to discharge products of combustion. The sheet 20, rendered soft by contact with a relatively large part of the surface of the heated drum 22, practically flows downwardly as at 20a, to the nip or bight of the foundation rolls 10 and 11 which produce the embossed foundation sheet 1. The embossing rolls 10 and 11, as illustrated, are cooled by continuous partial immersion in water or other coolant contained in a suitable tank 25. A conveyor roll 26 cooperates with the stripper roll 19 in removing the foundation sheet 1 from the tank.

By way of further illustration, Fig. 7 shows one form of mating die arrangement of a foundation mill roll surface. Identical dies 26, like type slugs, may be secured in compact form on a suitable cylindrical support so as to present the hexagonal and pyramidal working surfaces 27 in solid mass arrangement with the working faces of the two rolls spaced apart at the nip or bight a distance representing the desired thickness of the comb foundation 1.

I claim:

1. A comb foundation comprising a sheet of thermoplastic material composed of polymerized ethylene and beeswax.

2. A comb foundation comprising a sheet of thermoplastic material composed of a blend of polymerized ethylene and beeswax.

3. A comb foundation comprising a sheet of thermoplastic material composed of polymerized ethylene and having a coating of beeswax on one of its sides.

4. A comb foundation according to claim 3 wherein the thermoplastic sheet has the beeswax coating on its opposite sides.

EDGAR F. SMITH.

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