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METHOD FOR SMOOTHING AND EVENING OUT THE SURFACES OF PRE-MOULDED PARTS CONSISTING OF INORGANIC OR ORGANIC FIBERS AND RESULTING PRODUCT

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FIG. 1

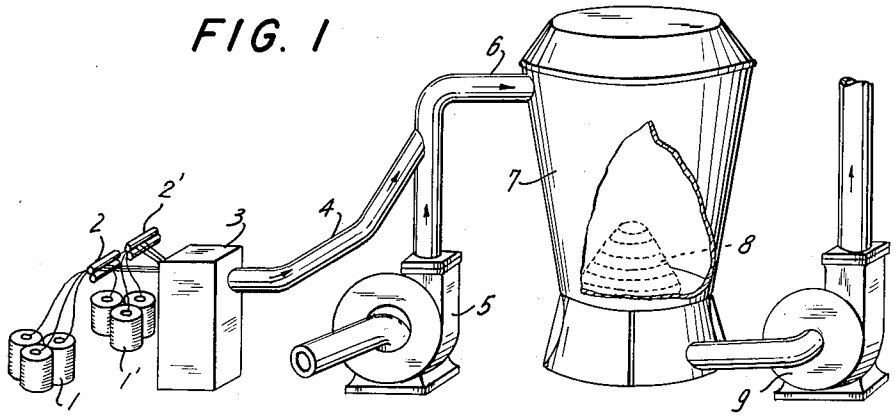


FIG. 2

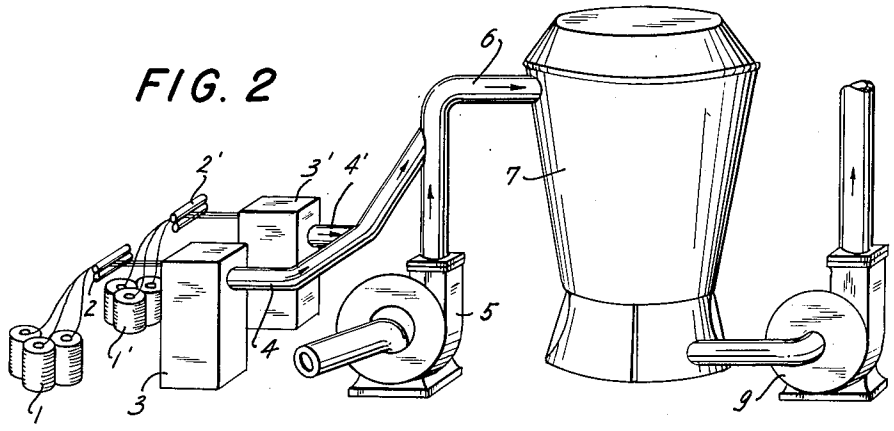
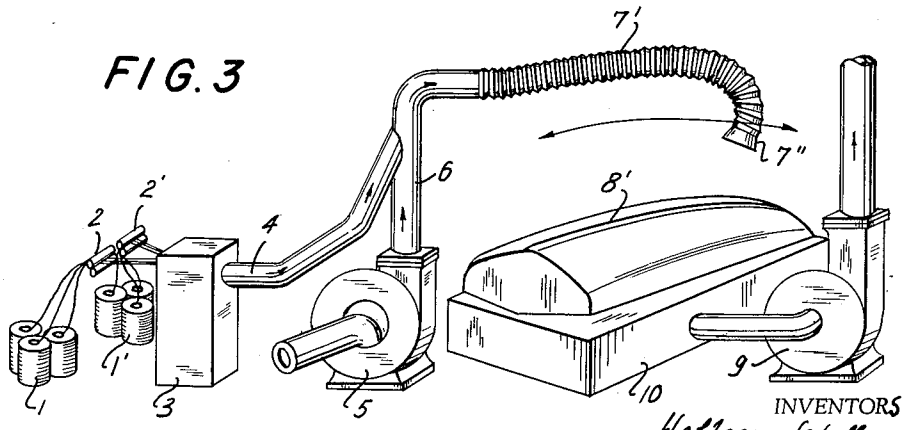


FIG. 3



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METHOD FOR SMOOTHING AND EVENING OUT THE SURFACES OF PRE-MOULDED PARTS CONSISTING OF INORGANIC OR ORGANIC FIBERS AND RESULTING PRODUCT

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The present invention relates to a method for smoothing and evening out the surfaces of pre-moulded parts consisting of inorganic or organic fibers. Such parts are used as reinforcing material in preparing moulded bodies of synthetic materials, e.g. polyester resins.

Such pre-moulded parts may for example consist of cotton or of cellulose fibers, linen fibers or synthetic organic fibers. As especially well suited have proved inorganic fibers, preferably glass fiber products.

The pre-moulded parts may be prepared e.g. of mats made of chopped glass fiber strands. However, the pre-moulded parts most frequently used are made of chopped rovings. These rovings consist of numerous untwisted adjacently lying glass fiber strands each of which contains a great number, mostly 102 or 204, filaments, joined by a binding agent. The rovings are mostly cut into lengths of about 25–50 mm. (about ½–2″), the chopped strands thus provided are conveyed by air to a sieve-like mould, generally exposed to a sub-atmospheric pressure, and are by this means deposited on the mould. The body thus provided is sprayed with a binding agent and then removed from the mould. After the solvent of the binder has been evaporated and/or cured in an oven, the pre-moulded part is ready for further treatment with plastic material.

The pre-moulded parts made according to this method from mats or rovings, however, have the disadvantage of an unsmooth and uneven surface. These often transfer themselves on to the finished articles which have been reinforced by those pre-moulded parts.

To overcome this disadvantage the surfaces of the pre-moulded parts have already been covered by thin surfacing mats consisting of single glass fibers. This, however, leads to difficulties on irregular or bent surfaces, encountered on helmets or in motorcar-bodies for example. To avoid the formation of creases to the surfacing mats, it is necessary to cut these to the special shape of the pre-moulded part which method requires much time and is expensive.

According to another known method, pre-moulded parts are prepared of rovings in such a way that at the beginning and/or at the end of the pre-moulding step, the chopped strands are subjected to a separating process before being deposited on the sieve mould. This, however, proved successful only to a limited extent, since, to achieve high strength, in the case of glass fiber reinforced plastics, there can only be used glass fibre strands which filaments have been firmly bonded and which have a low volume. These, however, when cut to short lengths, on the other hand cannot be split or separated into single fibers for covering the surfaces to any desired degree. Furthermore this procedure is tedious and expensive, since the action of covering the surfaces should only take a comparably short time, while changing from cutting of the roving to separating the strands into single fibers takes a certain switchover time.

FIGURE 1 is an isometric view of one form of the invention with parts shown in section; FIGURE 2 is a view similar to FIGURE 1 but shows a modification involving a separation of the cutting apparatus; and FIGURE 3

is a view similar to that shown in FIGURE 1, but shows a modification involving the production of large molded parts.

This invention shown in the accompanying drawing, consists in three stages of operation in FIGS. 1–3, respectively, of uniformly distributing on the surfaces single staple fibers completely separated to smooth out the surfaces of pre-moulded parts of fiber mats or rovings.

Organic fibers of the kind mentioned above, preferably however, inorganic fibers, especially glass fibers, are suitable for this purpose.

The individual staple fibers to be used according to the invention are suitably produced by separating staple fiber slivers, for example glass staple fiber slivers of 500–10,000 yds./lb. Such slivers which as defined in Webster's New Unabridged International Dictionary consist of fibers in a loose untwisted state, have the advantage that the fibers are not in the form of a bonded strand but are contained in the sliver mostly in the form of single fibres in loose unbonded connection.

The further separation of the sliver can be achieved by cutting, chopping or tearing. However, other separating procedures may be used as well, e.g. blowing or stretching.

For preparation of the separated fibers special separation means may be used. Alternatively the cutting or chopping means already available on the pre-moulding machine for the preparation of the pre-mould can be used, as shown in FIG. 2. To adapt a pre-moulding machine for this purpose it could be equipped with two cutters **3**, **3′**, and corresponding guide bar **2**, **2′** feeding the rovings needed for the body to the first one and glass staple fiber sliver to cover the surfaces to the second one from spools **1** and **1′** respectively. Alternatively the procedure may be carried out with only one cutter **3** which is equipped with two separate feeding means as shown in FIG. 1.

The cut short lengths of glass fiber material are transferred from the cutter **3**, or cutters **3**, **3′** to a molding chamber **7**. For this purpose, a blower **5** blows air into the chamber **7** through a duct **6** and thus creates suction in a tube **4**, or tubes **4**, **4′**, one end of which communicates with the duct **6** whereas the other end is connected to the output end of the cutter or cutters. The fiber material thus blown into the chamber **7** is drawn with the air stream toward a male mold **8** of air-permeable material the interior of which communicates with a suction fan **9**.

With particular advantage the procedure according to the invention is carried out fully automatically, e.g. in connecting two cutting machines by a control arrangement which starts and stops automatically.

If for example a pre-mould with a smooth surface on both sides has to be made for a motorcyclist's or a miner's helmet this can be done as follow:

(1) Starting the cutting means **3′** and depositing onto the mould **8** a layer of single staple fibers, e.g. of glass staple fiber slivers up to a certain thickness.

(2) Stopping the cutting means **3′**, starting the cutting means **3** and depositing chopped glass fiber strands onto the mould **8** in the well known manner.

(3) Stopping the cutting means **3**, restarting the cutting means **3′** and depositing again individual staple fibers onto the pre-moulded part as in (1).

(4) Spraying a binder onto the pre-moulded part, removing the part from the mould, and drying it in an oven.

The procedure according to the invention is, however, not confined to the application in connection with pre-moulding machines. As shown in FIG. 3, it may also advantageously be used, for example, in the production of big moulded parts. The deposition onto the surface

of the big moulded part may be carried out by creating a stream of glass fibers in conveying air in the same manner as shown in FIG. 1. A movable hose 7' provided with a discharge nozzle 7'' for the stream of fibers is directed toward the mold 8' of a large molded part, in this case the hull of a boat. Vice versa, with the nozzle being fixed, the big moulded part may be moved. In this connection it is advantageous, although not necessary, to mount the big part on a support 10, which is permeable to air and, if necessary, exposed to a sub-atmospheric pressure.

What we claim is:

1. In a method of forming on a preformed reinforcing body consisting essentially of haphazardly arranged multi-filament glass staple fibers, a smooth and even surface, the steps of suspending short lengths of monofilament glass staple fiber slivers in a stream of conveying fluid so as to distribute untwisted short monofilament glass staple fibers in said stream of conveying fluid; and directing said stream onto a surface of said preformed body consisting essentially of haphazardly arranged chopped multifilament glass staple strands so as to deposit on and entirely cover said surface with a layer consisting solely of said short monofilament glass fibers, whereby a smooth and even surface is formed on said preformed reinforcing body.

2. In a method of forming a reinforcing body for a plastic molded article said reinforcing body having a smooth and even surface, the steps of suspending short lengths of monofilament glass staple fiber slivers in a stream of conveying fluid; directing said short lengths of monofilament glass staple fibers-containing stream onto a matrix so as to deposit said short lengths of monofilament fibers thereon, forming on said matrix a thin layer consisting solely of said short lengths of monofilament glass fibers; covering said thin layer with haphazardly arranged, chopped, multifilament glass fiber strands; directing onto the free surface of said covering of multifilament glass fiber strands a further stream of said short lengths of monofilament glass staple fibers-containing fluid so as to deposit and entirely cover said free surface with a thin layer consisting solely of said short monofilament glass fibers, whereby a composite reinforcing body is formed having a smooth and even surface formed of said thin layers of short untwisted monofilament glass fibers and great mechanical strength due to said chopped multifilament glass fiber strands; and removing said composite body from said matrix.

3. A method according to claim 1, and including the step of spraying a binder onto said smooth surfaced reinforcing body so as to adhere the glass fibers thereof to each other.

4. A method according to claim 2, and including the step of spraying a binder onto said composite body prior to removal of the same from said matrix.

5. A preformed reinforcing body, comprising, in combination, a core portion consisting essentially of haphazardly arranged chopped multifilament glass fiber strands; and a cover layer covering said core portion, said cover layer having a smooth and even free surface and consisting solely of untwisted length cut slivers of monofilament glass staple fibers, said body having a smooth surface due to said cover layer of monofilament fibers and great mechanical strength due to said multifilament fibers of said core portion.

6. A preformed reinforcing body for plastic molded articles, comprising, in combination, a core portion of relatively large thickness consisting essentially of haphazardly arranged chopped multifilament glass fiber strands and of a binder binding said strands together; and a relatively thin cover layer completely covering said core portion, said cover layer having a smooth and even free surface and consisting solely of cut slivers forming short lengths of untwisted monofilament glass staple fibers and of a binder biding said monofilament glass fibers to each other and said cover layer to said core portion, said body having a smooth surface due to said cover layer of monofilament fibers and great mechanical strength due to said multifilament fibers of said core portion.

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