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(71) Applicant: **ZELTRON - Istituto Zanussi per la  
Ricerca S.p.A.  
Via Principe di Udine n. 66  
Campoformido Udine(IT)**

(72) Inventor: **Brunitto, Luigi  
Via Vecchia di Corva 4  
I-33170 Pordenone(IT)  
Inventor: Ros, Alessandro  
Via Bidoggia 32  
I-31010 Ormelle (Treviso)(IT)  
Inventor: Savadori, Aurelio  
Via G. Carducci 30  
I-33074 Fontanafredda (Pordenone)(IT)**

(74) Representative: **Patentanwälte Grünecker,  
Kinkeldey, Stockmair & Partner  
Maximilianstrasse 58  
D-8000 München 22(DE)**

(54) **Method for manufacturing baskets for dishwashing machines and baskets made by this method.**

(57) The baskets for dishwashing machines particularly of the domestic type are made of metal wires which are cut, bent and welded to provide a basket of suitable shape. The thus formed baskets are subsequently coated with a plastic resin, usually a polyamide-based resin, in a fluid bed process.

According to the invention, the coating is made of a modified polypropylene, with the baskets being pre-heated to a reduced temperature, and without the need of an adhesive base coating.

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## Method for Manufacturing Baskets for Dishwashing Machines and Baskets made by this Method

The present invention relates to baskets to be mounted in the washing chamber of a dishwashing machine, particularly of the domestic type, which are suitably configured (upper baskets for tableware and lower baskets for pots and the like) to act as supports for the different types of kitchen-and tableware to be washed.

Known baskets for this purpose are made of wires which are cut, bent and welded to the shape of the basket, which is subsequently coated with a layer of a plastic material for protection under the operating conditions within the machine.

The coating is normally accomplished by the use of polyamide powders in a fluid bed after a pre-treatment of the metal wire involving sand-blasting and pre-heating.

The coating with polyamide resins requires the wire to be pre-heated to a high temperature (340 - 370°C) for ensuring adequate fluidization of the powder, as a result of which the process involves a considerable energy consumption. In addition, for ensuring sufficient adhesion of the coating to the metal wire, it is convenient to use an adhesive base (primer), whereby the manufacturing process is rendered more complicated and costly.

The polyamide resin coating finally presents two rather unsatisfactory characteristics, namely, the variability of its rigidity in response to temperature variations, and a noticeable steam-permeability. By way of example, the elasticity module varies from about 17,000 kg/cm<sup>2</sup> at room temperature to about 5,000 kg/cm<sup>2</sup> at the washing temperature (70°C), while the steam permeability amounts to about 25g/24h/m<sup>2</sup> at the washing temperature for a coating having a thickness of 0.5 mm.

The multiple shortcomings cited above were conducive to the search for and experimentation with other materials for the plastic-coating of dishwasher baskets, keeping in mind the requirements of hygienic and non-toxic characteristics in view of the intended use of the baskets, during which they come into contact with food-handling utensils.

This search and experimentation did not in the end lead to any positive results; polypropylene has been found to be rather unsuitable for this purpose due to inadequate adhesion to the metal wire (thus still requiring an adhesive base coating), brittleness (due to its crystalline structure), and a tendency to get permanently discoloured by the action of certain alimentary substances (e.g. tomato juice).

Recently, however, there have been developed novel types of modified polypropylenes which, while presenting favourable mechanical characteristics and sufficient resistance against organic solvents, have a lower melting temperature than

stereo-regular polypropylene and a lower degree of crystallinity.

Such a novel modified polypropylene is marketed for instance by the firm of HIMONT under the commercial name POLISIVE, for use mainly as an outer coating for pipe conduits in view of its outstanding characteristics of stability and resistance against atmospheric influences under different ambient conditions.

In addition, experiments carried out at the present applicant's laboratories have shown that these modified polypropylenes are suitable for use also under the operating conditions prevailing in a dishwasher, being able to withstand relatively high temperatures and the aggressive action of vapours and detergent solutions.

It is therefore an object of the present invention to substitute the polyamide resins in the coating of dishwasher baskets to thereby obtain an improved and more reliable performance, and to provide a simplified manufacturing method involving a reduced energy consumption.

These objects are attained according to the invention in a method for manufacturing baskets of sand-blasted metal wire, comprising the steps of cutting, bending and welding the wires, pre-heating the thus formed baskets, and coating them with a plastic resin in a fluid bed, characterized in that the pre-heating step comprises heating the baskets to a temperature of no more than 320°C, and the coating step in the fluid bed involves the use of a modified polypropylene which is directly deposited on the sand-blasted wire.

This process is more simple than the one employing polyamide resins, because it does not necessitate the intermediate step of applying the adhesive coating to the wire prior to its immersion in the fluid bed. This process also involves a reduced energy consumption, because this type of a modified polypropylene has a considerably lower melting temperature (300 - 320°C) than the polyamide resin (340 - 370°C).

The present invention is also directed to dishwasher baskets manufactured by the novel method.

Also of interest in view of this particular employment, that is, as a coating for dishwasher baskets, is the mechanical characteristic represented by the elasticity module, which in the case of propylene modified with ethylene and maleic anhydride varies rather insignificantly in response to temperature variations (from about 6,000 - 7,000 kg/cm<sup>2</sup> at room temperature to about 4,000 to 5,000 kg/cm<sup>2</sup> at 80°C), in contrast to what happens in the case of polyamide resins, the latter having in fact an elasticity module which decreases rapidly as the tem-

perature rises from 20 to 80 °C.

As the temperature within the washing chamber of a dishwasher rises to a maximum of about 70°C, the polypropylene modified with ethylene and maleic anhydride proves to be better adapted to withstand the temperature variations of repetitive washing cycles.

The most important advantage resulting from the employ of the modified polypropylene is due, however, to the low steam-permeability of this substance, which amounts to about 15g/24h/m<sup>2</sup> at 80°C and is thus, all other conditions being equal, much lower than the permeability of polyamide amounting to 25g/24h/m<sup>2</sup>.

This results in an improved durability under operating conditions, in view of the steam or vapours generated in a dishwasher, particularly during the final rinsing and sterilization stages.

As already stated, the determination of polypropylene modified with ethylene and maleic anhydride as a substance which, in contrast to polyamide resins, presents advantageous characteristics for employ as a coating for dishwasher baskets, has been arrived at by suitable experimentation.

In this context it is to be noted that there is a wide range of modified polypropylenes differing from one another by their molecular structure and individual performance.

The extensive experimentation carried out has thus permitted to precisely determine the ranges within which the principal physical parameters of the modified polypropylene for use in attaining the stated object of the invention are preferably contained.

These parameters, as determined according to the appropriate ASTM methods, are the following:

melt flow index	20-50 g/10 min
density	0.945 - 1.000 g/cm <sup>3</sup>
elastic module	700 - 800 M Pa
tensile strength	17 - 22 M Pa
Izod resiliency (at 23°C)	50 - 100 J/m
Izod resiliency (at 0°C)	30 - 60 J/m
Izod resiliency (at -40°C)	10 - 30 J/m.

Merely by way of reference it is pointed out that the already named polypropylene POLISIVE of the HIMONT company satisfies the above enumerated requirements.

The dishwasher baskets made of sand-blasted metal wire and coated with modified polypropylene without the interposition of an adhesive have been subjected to the tests prescribed by national and international standards, and have been found to be fully satisfactory under every aspect.

## Claims

1. A method for manufacturing sand-blasted metal wire baskets for dishwashing machines, particularly of the domestic type, comprising the steps of cutting, bending and welding the metal wire, of pre-heating the thus formed baskets, and of coating them with a plastic resin in a fluid bed process, characterized in that in the pre-heating step the baskets are heated to a temperature of no more than 320°C, and the fluid bed coating step involves the employ of a modified polypropylene which is directly deposited on the sand-blasted wire.

2. A method according to claim 1, characterized in that the temperature attained in the step of pre-heating the baskets is preferably 300 °C.

3. A method according to claim 1, characterized in that the modified polypropylene employed in the fluid bed coating step has the following physical characteristics:

melt flow index	20 - 50 g/10 min
density	0.945 - 1.000 g/cm <sup>3</sup>
elastic module	700 - 800 M Pa
tensile strength	17 - 22 M Pa
Izod resiliency (at 23°C)	50 - 100 J/m
Izod resiliency (at 0°C)	30 - 60 J/m
Izod resiliency (at -40°C)	10 - 30 J/m.

4. A basket for a dishwashing machine, characterized by being manufactured by the method according to any of the preceding claims.