# MULTI-PLY CLEANING SHEET

## BACKGROUND OF THE INVENTION

1. Field of the Invention:

The present invention relates to a cleaning sheet and, more particularly, to a multi-ply cleaning sheet which is easy to use and capable of catching dirt efficiently.

2. Description of the Related Art:

Various cleaning sheets made of fibers have been in general use. Among others, a disposable cleaning sheet of nonwoven fabric, which is attached to a mop or the like when in use, is common on the market because of its handiness.

These cleaning sheets need good cleaning efficiency.

An example of them is disclosed in Registered Japanese Utility Model Publication No. 3003082. It is capable of absorbing water and scrapes and absorbs dirt efficiently; however, it has a disadvantage of getting hands and the mop holder soiled with dirt passing from the face to the reverse through holes made therein.

## SUMMARY OF THE INVENTION

It is an object of the present invention to provide a multi-ply cleaning sheet which is easy to use and capable of catching dirt efficiently.

It is another object of the present invention to provide a multi-ply cleaning sheet to be attached to a mop or the like when in use.

The present invention provides a multi-ply cleaning sheet comprising at least a first layer with a plurality of holes passing

therethrough and a second layer, the first and second layers being placed on top of the other and bonded together so that the holes are open at one surface of the first layer and closed by the second layer at the other surface of the first layer.

In the multi-ply cleaning sheet according to the present invention, the first layer having the holes is used as a wiping surface. The holes formed on the first layer can efficiently scrape off dirt by steps at their edges. Being closed by the second layer, these holes can hold the scraped dirt therein without permitting it to penetrate to the reverse of the cleaning sheet. In addition, the multi-layer structure imparts sufficient stiffness to the cleaning sheet, facilitating its handling at the time of cleaning.

In its preferred embodiment of the present invention, the cleaning sheet has the second layer held between two of the first layer.

According to the present invention, it is preferred that the first layer is of nonwoven fabric 0.4-1.0 mm thick with a basis weight of 10-100 $g/m^2$. In addition, the holes should preferably be formed by water jet or needle punch. The holes formed by water jet should preferably be elliptic, 1-5 mm in major axis and 0.2-3 mm in minor axis. There should preferably be 10-100 holes per $cm^2$ in the first layer.

In this case, the first layer has one surface made fuzzy by water jet or needle punch. In order to enhance the collecting effect of fine dirt and hairs, the other surface of the first layer than the fuzzy surface is preferably bonded to the second layer. In order to enhance the scraping effect of dirt, the fuzzy surface is preferably bonded to the second layer.

The multi-ply cleaning sheet of the present invention can be used

for dry wiping as well as wet wiping. It is desirable that the nonwoven fabric for the first layer be composed of at least one kind of absorbent fibers (selected from rayon and cotton) and at least one kind of hydrophobic fibers (selected from polyethylene, polypropylene and polyester). It is also desirable that the first and second layers contain a thermoplastic resin and are bonded together with a plurality of fusion-bonding lines formed by fusion-bonding. The second layer should preferably be a thermal bond nonwoven fabric with a basis weight no less than 30 $g/m^2$.

## BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1(A) is a partial perspective view showing the structure of a multi-ply cleaning sheet according to the present invention;

Fig. 1(B) is a partly enlarged perspective view illustrating the structure of a multi-ply cleaning sheet according to the present invention;

Fig. 2 is a partly enlarged perspective view illustrating one example of the structure of a multi-ply cleaning sheet according to the present invention;

Fig. 3 is a plan view showing one example of the pattern of bonding lines of a multi-ply cleaning sheet according to the present invention;

Fig. 4 is a plan view showing another example of the pattern of bonding lines of a multi-ply cleaning sheet according to the present invention; and

Fig. 5 is a perspective view showing one way in which a multi-ply cleaning sheet of the present invention is used.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention will be described in more detail with reference to the drawings. Fig. 1(A) is a partial perspective view showing the structure of a multi-ply cleaning sheet according to the present invention. Fig. 1(B) is a partly enlarged perspective view illustrating in more detail the structure of the multi-ply cleaning sheet shown in Fig. 1(A).

Referring to Fig. 1(A), the multi-ply cleaning sheet indicated by "S" is composed of a first layer 1 with a plurality of holes 3 passing through it and a second layer 2 without holes. The first layer 1 constitutes a wiping surface at the time of cleaning.

The structure of the multi-ply cleaning sheet "S" is shown enlarged in Fig. 1(B). It is to be noted that the first layer 1 is placed on the second layer 2 so that the holes 3 passing through the first layer 1 are open at one surface of the first layer 1 and closed by the second layer 2 at the other surface of the first layer 1. This structure permits the holes 3 to scrape dirt and to hold the scraped dirt therein, without allowing the scraped dirt to pass through the second layer 2. Therefore, the hand or mop handle holding the second layer 2 does not soil at the time of cleaning. In this way, the cleaning sheet "S" can be used with comfort.

According to the present invention, the multi-ply cleaning sheet "S" is not limited in structure to the double-layer structure as shown in Figs. 1(A) and 1(B). It should preferably be of triple-layer structure having an additional first layer 1 attached to the lower side of the second layer 2, as shown in Fig. 2. In this case, the multi-ply cleaning sheet "S" has the first layers 1 and 1 on both sides thereof,

so that it can be turned over for cleaning. Moreover, a multi-layer structure with four or more layers is possible, in which two or more of the second layer 2 are interposed between two of the first layer 1. The resulting multi-ply cleaning sheet will have an adequate strength and elasticity if the individual layers constituting it are properly selected.

The first layer 1 is not specifically restricted so long as it is strong enough for cleaning. It includes nonwoven fabric and cloth of synthetic fibers. Preferable among them is nonwoven fabric, particularly, fiber-interlaced nonwoven fabric such as spunlace nonwoven fabric, which permits the holes 3 to be made comparatively easily and is economical in production.

Nonwoven fabric as the first layer 1 may be produced from fibers of polyethylene (PE), polypropylene (PP), polyester (PET), nylon, rayon, cotton, etc. When the first layer 1 contains absorbent fibers, such as of rayon and cotton, the first layer 1 becomes water-retentive. Therefore, the water-retentivity of the multi-ply cleaning sheet "S" as a whole can be improved when it is used for wet wiping. Furthermore, when the first layer 1 contains hydrophobic fibers, such as of PE, PP and PET, the first layer 1 permits dirty water to be retained by the intermediate second layer 2 and prevents the dirty water from flowing back to the surface of the multi-ply cleaning sheet "S" during wet wiping.

The nonwoven fabric as the first layer 1 should preferably have a basis weight of 10-100 $g/m^2$, more preferably about 40 $g/m^2$, so that it permits the holes 3 to be made easily.

In addition, the first layer 1 should preferably be 0.3-2.0 mm thick, more preferably 0.4-1.0 mm thick, so that it permits the holes 3 to be

made easily.

When the first layer 1 is made of nonwoven fabric, the holes 3 can be made in the production process of the nonwoven fabric by applying water jet, needle punch, steel match emboss or perfojet to a fibrous web. Of these processes, water jet and needle punch are desirable because of their easy operation to make the holes 3 with a desired shape, size and number. For example, in the case of using water jet, a spunlace nonwoven fabric as the first layer 1 is produced by applying water jet to a fibrous web placed on a mesh with a desired opening pattern, thereby interlacing fibers to have the holes 3.

The holes 3 should preferably be 1-5 mm in diameter. The holes 3 may be elliptic if they are formed by using water jet. Such elliptic holes 3 should have a major axis of about 1-5 mm (in the machine direction in which the web runs) and a minor axis of about 0.2-3 mm. The first layer 1 should have 10 to 100 holes per $cm^2$ so that the multi-ply cleaning sheet "S" catches dirt effectively.

When the holes 3 are made in the production process of the nonwoven fabric by using water jet or needle punch, the nonwoven fabric becomes fuzzy (fluffy), with fuzz 4 projecting from the periphery of each hole 3 in the direction of water jet or needle punch, as shown in Fig. 2. The multi-ply cleaning sheet "S" may be assembled such that the fuzz 4 faces either outward or inward. In the former case, the fuzz 4 facing outward can enhance collecting effect of fine dirt and hairs significantly. In the latter case, on the other hand, since the fuzz 4 faces inward (to the second layer 2), the edges of the holes 3 are so clear that the scraping effect of adhering dirt by using the edges of the holes 3 can be enhanced. In the latter case, furthermore, the

multi-ply cleaning sheet has a good appearance.

The second layer 2 may be made of any material, such as nonwoven fabric, plastic film, cloth of synthetic fibers, sponge and polyurethane, which endures cleaning work. It may be used alone or in combination with another one of the same or different kind. A preferred example of the second layer 2 is a thermal bond nonwoven fabric having a basis weight no less than 30 $g/m^2$. It will impart additional strength and elasticity to the multi-ply cleaning sheet "S", improving ease of use.

The second layer 2 may contain absorbent fibers and hydrophilic fibers in order that the multi-ply cleaning sheet "S" as a whole is improved in water retentivity at the time of wet wiping.

In the case where both the first layer 1 and the second layer 2 are nonwoven fabrics, they should preferably contain a thermoplastic resin so that they are fusion-bonded together easily by thermal embossing or ultrasonic welding. In this case, it is preferred that bonding lines 5 are formed by fusion-bonding as shown Fig. 3. Because the cleaning sheet "S" is recessed at the bonding lines 5 due to fusion-binding, the bonding lines 5 can further improve the wiping effect of the cleaning sheet "S". A desired pattern of the bonding lines 5 is shown in Fig. 3. Such bonding lines 5 can further enhance the strength of the multi-ply cleaning sheet "S". Another preferred pattern of the bonding lines 5 is shown in Fig. 4. Because the pattern of fusion-bonding is not specifically restricted, any pattern such as dot pattern can be adopted. However, in the present invention, continuous boding lines of wavy or sawtooth pattern as shown in Fig. 3 and short intermittent bonding lines as shown in Fig. 4 are desirable, because these bonding lines extending in different directions can improve the wiping effect. Alternatively,

the first and second layers of the multi-ply cleaning sheet "S" may be bonded together by means of an adhesive.

The multi-ply cleaning sheet "S" of the present invention may be used in such a way as shown in Fig. 5. The multi-ply cleaning sheet "S" is attached to a mop 10 consisting of a plate 11 and a handle 12, such that the first layer 1 faces outward and rubs the floor or any object to be cleaned. Both sides of the cleaning sheet "S" is folded back onto the upper side of the plate 11 and fastened thereto by clips 13, 13.

Moreover, the multi-ply cleaning sheet "S" of the present invention may be used by holding with hands or a handy mop. It may be used for both dry wiping and wet wiping.

The multi-ply cleaning sheet "S" of the present invention may be incorporated with an agent to promote dirt attraction if it is used for dry wiping. Examples of the agent include mineral oil such as paraffin oil, synthetic oil such as polyolefin oil, silicone oil, and surfactant.

Other agents than mentioned above may also be used to enhance the wiping effect or produce the lustering effect or the like. Their examples include surfactants, alkalis, abrasives, coatings (acrylic resin and latex), lustering agents, wax, antistatic agents, deodorants, humectants, and antibacterial agents.

While in the foregoing specification this invention has been described in relation to preferred embodiments and many details have been set forth for purpose of illustration it will be apparent to those skilled in the art that the invention is susceptible to additional embodiments and that certain of the details described herein can be varied considerably without departing from the basic principles of the invention.

Further, 'comprises/comprising' when used in this specification is taken to specify the presence of stated features, integers, steps or components but dose not preclude the presence or addition of one or more other features, integers, steps, components or groups thereof.

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What is claimed is:

1. A multi-ply cleaning sheet comprising at least a first layer with a plurality of holes passing therethrough and a second layer, said first and second layers being placed on top of the other and bonded together so that said holes are open at one surface of said first layer and closed by said second layer at the other surface of said first layer.

2. A multi-ply cleaning sheet as defined in Claim 1, wherein said second layer is held between two of said first layer.

3. A multi-ply cleaning sheet as defined in Claim 1, wherein said first layer is a nonwoven fabric.

4. A multi-ply cleaning sheet as defined in Claim 3, wherein said holes are formed by water jet or needle punch.

5. A multi-ply cleaning sheet as defined in Claim 4, wherein said holes are elliptic ones which are formed by water jet and have a major axis of 1-5 mm and a minor axis of 0.2-3 mm.

6. A multi-ply cleaning sheet as defined in Claim 5, wherein the density of said holes in said first layer is 10-100 per $cm^2$.

7. A multi-ply cleaning sheet as defined in Claim 4, wherein said first layer has one side thereof made fuzzy by water jet or needle punch and the other side thereof bonded to said second layer.

8. A multi-ply cleaning sheet as defined in Claim 7, wherein said nonwoven fabric contains at least one kind of absorbent fibers selected from the group consisting of rayon and cotton and at least one kind of hydrophobic fibers selected from the group consisting of polyethylene, polypropylene and polyester.

9. A multi-ply cleaning sheet as defined in Claim 8, wherein said nonwoven fabric has a basis weight of 10-100 $g/m^2$ and a thickness of

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0.4-1.0 mm.

10. A multi-ply cleaning sheet as defined in Claim 8, wherein said first and second layers contain a thermoplastic resin and are bonded together with a plurality of bonding lines formed by fusion-bonding.

11. A multi-ply cleaning sheet as defined in Claim 10, wherein said second layer is a thermal bond nonwoven fabric having a basis weight no less than 30 $g/m^2$.

12. A multi-ply cleaning sheet as defined in Claim 4, wherein said first layer has one side thereof made fuzzy by water jet or needle punch and bonded to said second layer.

13. A multi-ply cleaning sheet as defined in Claim 12, wherein said nonwoven fabric contains at least one kind of hydrophilic fibers selected from the group consisting of rayon and cotton and at least one kind of hydrophobic fibers selected from the group consisting of polyethylene, polypropylene and polyester.

14. A multi-ply cleaning sheet as defined in Claim 13, wherein said nonwoven fabric has a basis weight of 10-100 $g/m^2$ and a thickness of 0.4-1.0 mm.

15. A multi-ply cleaning sheet as defined in Claim 13, wherein said first and second layers contain a thermoplastic resin and are bonded together with a plurality of bonding lines formed by fusion-bonding.

16. A multi-ply cleaning sheet as defined in Claim 15, wherein said second layer is a thermal bond nonwoven fabric having a basis weight no less than 30 $g/m^2$.

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