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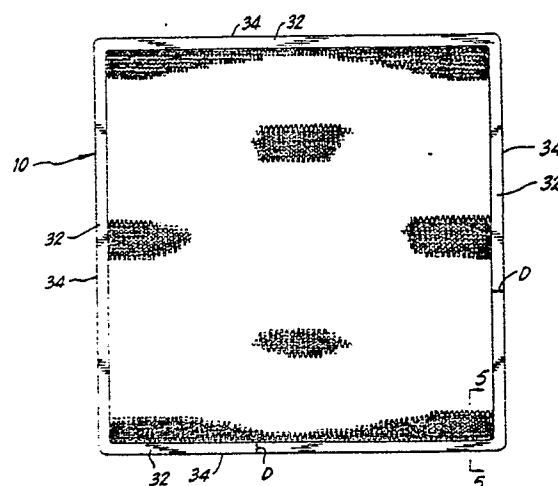
71 Applicant: **THE TEXWIPE COMPANY**  
**650 East Crescent Avenue**  
**Upper Saddle River New Jersey 07458(US)**

72 Inventor: **Paley, Steven J.**  
**86 Irongate Lane**  
**Aberdeen New Jersey 07747(US)**  
Inventor: **Eberhardt, Clifford A.**  
**43 Pehle Avenue**  
**Saddle Brook New Jersey 07662(US)**  
Inventor: **Paley, Edward**  
**38 Westerly Road**  
**Saddle River New Jersey 07458(US)**

74 Representative: **Jones, Michael Raymond et al**  
**HASELTINE LAKE & CO. Hazlitt House 28**  
**Southampton Buildings Chancery Lane**  
**London WC2A 1AT(GB)**

54 **Wipes for use in a cleanroom and a method of making them.**

57 There is described a wipe constructed at least partially from a thermoplastic fabric material and formed by severing the wipe along at least one peripheral edge from a sheet of such material, the wiper being capable of enabling the reducing of particulate contamination which otherwise might result from the use of known wipes in a controlled environment, such as that maintained in a cleanroom, and being provided with a fused border along its peripheral edges, the fused border extending inwardly into the wipe a distance great enough to provide the fused border with sufficient area and sufficient tear-strength to maintain within the border segments of the material of the wipe which otherwise might be released from the peripheral edges of the wipe during use of the wipe, yet small enough to maintain pliability and absorbency in the wipe for wiping procedures and there is also described a method for making such wipes.



**FIG. 1**

**EP 0 336 661 A2**

## WIPES FOR USE IN A CLEANROOM AND A METHOD OF MAKING THEM

The present invention relates generally to the prevention of particulate contamination in cleanrooms and pertains, more specifically, to the construction of wipers for use in a cleanroom, or another similar controlled environment, the construction being such that the wipers will not release contaminating particles into the controlled environment.

Cleanrooms are finding wider use in the manufacture, inspection and maintenance of precision products where it is essential that various operations be conducted in an environment as free of undesired small particles as possible. Cleanrooms can function effectively only when every effort is taken to maintain the close control necessary to preclude contamination of the controlled environment within the cleanroom. Such contamination most often is generated by the worker in the cleanroom and by items brought into the cleanroom. Rigorous standards have been established, and continue to be developed, for the operation of cleanrooms in such a manner as to exclude unwanted contaminants from the controlled environment. One potential source of particulate contamination in cleanrooms has been the wipers used extensively in connection with operations carried out in the controlled environment of a cleanroom. For example, in the fabrication of semiconductor wafers, wipers are used for cleaning up spills which can occur during the procedures carried out in the controlled environment of a cleanroom. In addition, wipers are used for wiping surfaces of various equipment and items in the cleanroom, as well as for wiping down the walls and other interior surfaces of the cleanroom itself. The very nature of a wiper, which requires a high degree of absorbency and pliability, militates against a construction which resists shedding and the concomitant release of small particles into the surrounding environment.

The present invention provides a wiper construction and a method by which a potential source of particulate contamination of a cleanroom environment, or another such controlled environment, is eliminated in that particles which otherwise might be generated by a wiper used in the cleanroom, or other such controlled environment, no longer are present for release into the controlled environment. The invention attains several objects and advantages, some of which are summarized as follows: Eliminates a potential source of particulate contamination of a controlled environment, such as a cleanroom, by precluding the introduction of particles through the use of wipers in the environment; provides a wiper structure which eliminates the release of unwanted particles into a controlled envi-

ronment, such as that found in a cleanroom, while enabling effective and efficient wiping procedures; enables the use of wiper materials having the desired pliability and absorbency characteristics in wipers employed in controlled environments, such as in cleanrooms, without risk of introducing particulate contamination into the controlled environment; promotes ease of use as well as effectiveness in wipers constructed for use in a controlled environment, such as a cleanroom; utilizes commonly available materials, thereby enabling economy of manufacture and use while eliminating a source of particulate contamination, as set forth above; provides a strong and durable as well as an aesthetically pleasing wiper which finds acceptance in a wide variety of manufacturing, inspection and maintenance procedures; and is readily manufactured economically in large numbers of consistent high quality.

The above objects and advantages, as well as further objects and advantages, are attained by the present invention, which may be described briefly as a method and a wiper for reducing particulate contamination which otherwise might result from the use of the wiper in a controlled environment, such as that maintained in a cleanroom, the wiper being of the type constructed at least partially from a thermoplastic fabric material by severing the wiper along peripheral edges thereof from a sheet of such material having indeterminate dimensions, the method and the wiper providing a fused border in the material along the peripheral edges of the wiper and extending inwardly into the wiper a distance great enough to provide the fused border with sufficient area and sufficient tear-strength to maintain therein segments of the material of the wiper which otherwise might be released from the peripheral edges of the wiper during use of the wiper, yet small enough to maintain pliability and absorbency in the wiper for wiping procedures. In one embodiment of the wiper, two plies of the material are joined along the fused border to establish a sealed envelope within which is placed an absorbent material isolated from the controlled environment by the plies of material and the fused border.

The invention will be understood more fully, while still further objects and advantages will become apparent, in the following detailed description of preferred embodiments of the invention illustrated in the accompanying drawing, in which:

FIG. 1 is a plan view of a wiper constructed in accordance with the invention;

FIG. 2 is a somewhat diagrammatic, highly enlarged view of a portion of the material from which the wiper is constructed;

FIG. 3 is a view similar to FIG. 2, but illustrating a step in the procedure for constructing a wiper;

FIG. 4 is a view similar to FIG. 3, but showing an alternate configuration;

FIG. 5 is an enlarged cross-sectional view taken along line 5-5 of FIG. 1;

FIG. 6 is a partially diagrammatic view illustrating a procedure for the manufacture of the wiper; and

FIG. 7 is a longitudinal cross-sectional view of an alternate wiper construction of the present invention.

Referring now to the drawing, and especially to FIG. 1 thereof, a wiper constructed in accordance with the invention is illustrated generally at 10. Wiper 10 is constructed of one of a variety of generally thermoplastic fabric materials which have found use in wipers. Among these materials are polyester, nylon, polypropylene and blends of these materials, as well as blends of natural materials, such as cotton, with synthetic thermoplastic materials. The materials are in the form of a knitted, woven or non-woven fabric. The preferred material, and the one described in connection with the embodiment of wiper 10, is a knitted polyester, preferably knitted from a continuous filament. As illustrated in FIG. 2, the material of wiper 10 is constructed of filaments 12 knitted together in interlocking loops 14. The loops 14 have a relaxed loop length L. Preferably, the length L is very small, in the order of about 0.75 mm and the filaments 12, which are made up of a plurality of fibrils, have a diameter of about 0.25 mm, so that the wiper 10 is provided with the requisite pliability and absorbency.

Wiper 10 is most economically manufactured by severing the wiper 10 from a larger sheet of the knitted fabric to establish a wiper of desired dimensions. However, as illustrated in FIG. 3, severing the fabric of a larger sheet 20 along a cut line 22 leaves a cut edge 24 along which there are free segments 26 of the filaments 12. These free segments 26 can be released into the ambient atmosphere and become contaminating particles when the wiper is utilized in a controlled environment, such as is found in a cleanroom. It has been suggested that cutting be accomplished with a hot knife or a hot wire so that the segments 26 will fuse and will remain in place within the remainder of the wiper; however, experience has shown that the localized melting of the segments 26 is insufficient to prevent the segments 26 from release when subjected to agitation and other manipula-

tions common in the use of the wiper. Moreover, during the severing operation, the larger sheet 20 usually is stretched and distorted, particularly when the material is a knitted fabric, so that the interlocking loops of the material are somewhat skewed and the cut line is less uniform, as seen at 28 in FIG. 4. The less-uniform cut line 28 produces odd-shaped free segments 30, in addition to the aforesaid free segments 26, at locations which do not lend themselves readily to capture of all of the free segments 26 and 30 within the wiper, thereby increasing the propensity for contamination by the release of free segments into the surroundings.

In order to preclude the release of severed segments from the remainder of the wiper, wiper 10 is provided with a fused border 32 along the peripheral edges 34 of the wiper 10, within which fused border 32 all of the severed segments are captured and retained throughout the useful service life of the wiper 10. As best seen in FIG. 5, as well as in FIG. 1, border 32 extends inwardly into the wiper 10, away from the peripheral edges 34, a distance D. The distance D is chosen so as to be large enough to accomplish the objective of capturing all of the segments 26 and 30 which otherwise could be free to escape into the ambient atmosphere and contaminate the controlled environment within which the wiper 10 is used, while resisting any tendency for tearing of the wiper 10 at the peripheral edges 34, yet is small enough to retain the desired degree of pliability in the wiper 10 and to resist any tendency toward abrasiveness in the wiper 10, while maintaining the necessary absorbency. In the illustrated wiper 10, the distance D is about 7L, that distance having been determined empirically as providing an optimum balance between attaining the complete capture of all of the otherwise free segments 26 and 30 along the peripheral edges 34 and establishing sufficient tear-strength, while maintaining pliability and resistance to abrasiveness. Thus, the selected distance D provides a border 32 of minimum area so as not to interfere with the requisite pliability and absorbency of wiper 10, while capturing potential contaminants in a construction having sufficient strength and durability to resist tearing and other deterioration during use. At the same time, abrasiveness is not introduced at the peripheral edges and an aesthetic appearance is maintained which provides a visual balance between the area of the border 32 and the area of the remaining absorbent portions of the wiper 10 to instill confidence in the user that the wiper 10 provides the necessary absorbency to accomplish any wiping job.

Turning now to FIG. 6, the preferred manufacturing technique for making a plurality of wipers 10 is to sever the wipers from a sheet 40 of indeterminate dimensions. The sheet 40 is advanced in the

direction of the arrow 42 along a predetermined path of travel 44. A pattern 46 is fused in the sheet 40, the pattern defining a plurality of latent wipers 10 including fused and unfused areas, and the sheet 40 is severed within the fused pattern 46, along sever lines 48 and 50, to establish each individual wiper 10 with a fused border 32 along the peripheral edges 34 of wiper 10. In this manner, dimensional stability is maintained for wiper manufacture, while the appropriate fused border 32 is established in each wiper 10.

An alternate wiper construction is illustrated in FIG. 7 wherein a composite wiper 60 includes two sheets of material in the form of outer plies 62 and 64 of a thermoplastic fabric material, chosen from the materials outlined above in connection with the description of wiper 10, and a third sheet, or inner ply, in the form of pad 66 of highly absorbent material, such as cotton, a blend of polyester and cellulose, tissue stock or the like, sealed within the envelope 68 provided by the outer plies 62 and 64. A fused border 70 extends along the peripheral edges 72 of the wiper 60, all around the periphery of the wiper, in much the same manner as that described in connection with wiper 10. In this manner, the fused border 70 secures together the outer plies 62 and 64 and at the same time precludes the release of any segments of the thermoplastic fabric material which forms the plies 62 and 64, and together with the remainder of the plies 62 and 64 isolates the pad 66 so that any particles which might otherwise emanate from the material of the pad 66 are maintained within the wiper 60 and are precluded from contaminating the environment within which wiper 60 is employed. It is noted that even in those instances where pad 66 is in the form of a sheet which extends all the way to the peripheral edges 72, as a result of the particular manufacturing process in which the pad 66 and the plies 62 and 64 all have essentially the same length and width and are placed into juxtaposition with one another prior to establishing the fused border 70, the fused border 70 will preclude the emanation of particles from the pad 66, as well as from the outer plies 62 and 64, while securing together the plies 62 and 64 and the interposed pad 66. Thus, wiper 60 makes available the use of highly absorbent materials in pad 66, while assuring that potentially contaminating particles, which are prevalent in such absorbent materials, are contained and are not released to the controlled environment within which wipers 60 are to be used.

It is to be understood that the above detailed description of preferred embodiments of the invention are provided by way of example only. Various details of design, construction and procedure may

be modified without departing from the true spirit and scope of the invention as set forth in the appended claims.

## Claims

1. A wipe constructed at least partially from a thermoplastic fabric material and formed by severing the wipe along at least one peripheral edge from a sheet of such material, the wipe being capable of enabling the reduction of particulate contamination which otherwise might result from the use of known wipes in a controlled environment, such as that maintained in a cleanroom, and being provided with a fused border along its peripheral edges, the fused border extending inwardly into the wipe a distance great enough to provide the fused border with sufficient tear-strength to maintain within the border segments of the material of the wipe which otherwise might be released from the peripheral edges of the wipe during use of the wipe, yet small enough to maintain pliability and absorbency in the wipe for wiping procedures.

2. A wipe according to claim 1, wherein the sheet of material includes filaments knit into interlocking loops having a relaxed loop length L and the distance over which the fused border extends inwardly into the wipe is a multiple of the length L.

3. A wipe according to claim 2, wherein the distance is at least about 7L.

4. A wipe according to claim 2 or 3, wherein L is about 0.75 mm.

5. A wipe according to claim 2, 3 or 4, wherein the filaments in the border are fused together.

6. A wipe constructed at least partially from a thermoplastic fabric material and formed by severing the wipe along at least one peripheral edge from a sheet of such material, the wipe being capable of enabling the reduction of particulate contamination which otherwise might result from the use of known wipes in a controlled environment, such as that maintained in a cleanroom, the wipe comprising:

first and second sheets of the material juxtaposed with one another;

a fused border along the peripheral edges of the wipe, the fused border extending inwardly into the wipe a distance great enough to provide the fused border with sufficient area and sufficient tear-strength to secure together the first and second sheets and maintain within the border segments of the material of the wipe which otherwise might be released from the peripheral edges of the wipe during the use of the wipe, yet small enough to maintain pliability and absorbency in the wipe for wiping procedures;

an envelope between the first and second sheets,

the envelope being sealed by the fused border;  
and

an absorbent material placed within the envelope  
and isolated from the controlled environment by  
the first and second sheets and the fused border  
such that particles from the absorbent material in  
the envelope will remain sealed within the en-  
velope.

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7. A wipe according to claim 6, wherein, the  
sheets of material include filaments knit into inter-  
locking loops having a relaxed loop length L and  
the distance over which the fused border extends  
inwardly into the wipe is a multiple of the length L.

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8. A wipe according to claim 7, wherein the  
distance is at least about 7L.

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9. A wipe according to claim 8, wherein L is  
about 0.75 mm.

10. A method of making a wipe severed from a  
sheet constructed of filaments of thermoplastic ma-  
terial, the filaments being knit into interlocking  
loops having a relaxed loop length L, the wipe  
being capable of being used in a controlled envi-  
ronment, such as that maintained in a cleanroom,  
without releasing unwanted particles of the knit  
filaments which otherwise might be formed in the  
vicinity of the peripheral edges of known wipes as  
a result of severing such wipes from such a sheet,  
which method comprises fusing the sheet along  
areas of the sheet to establish fused areas and  
unfused areas defining latent individual wipes, and  
severing the fused areas to form actual individual  
wipes having severed edges and a border in which  
the filaments are fused together, the border extend-  
ing from the severed edges inwardly into each  
wipe a distance which is a multiple of the length L  
so as to provide the border with sufficient tear-  
strength while maintaining within the fused border  
all segments of the filaments which otherwise  
might be present as a result of severing the fused  
areas, thereby precluding the release of severed  
segments into the controlled environment.

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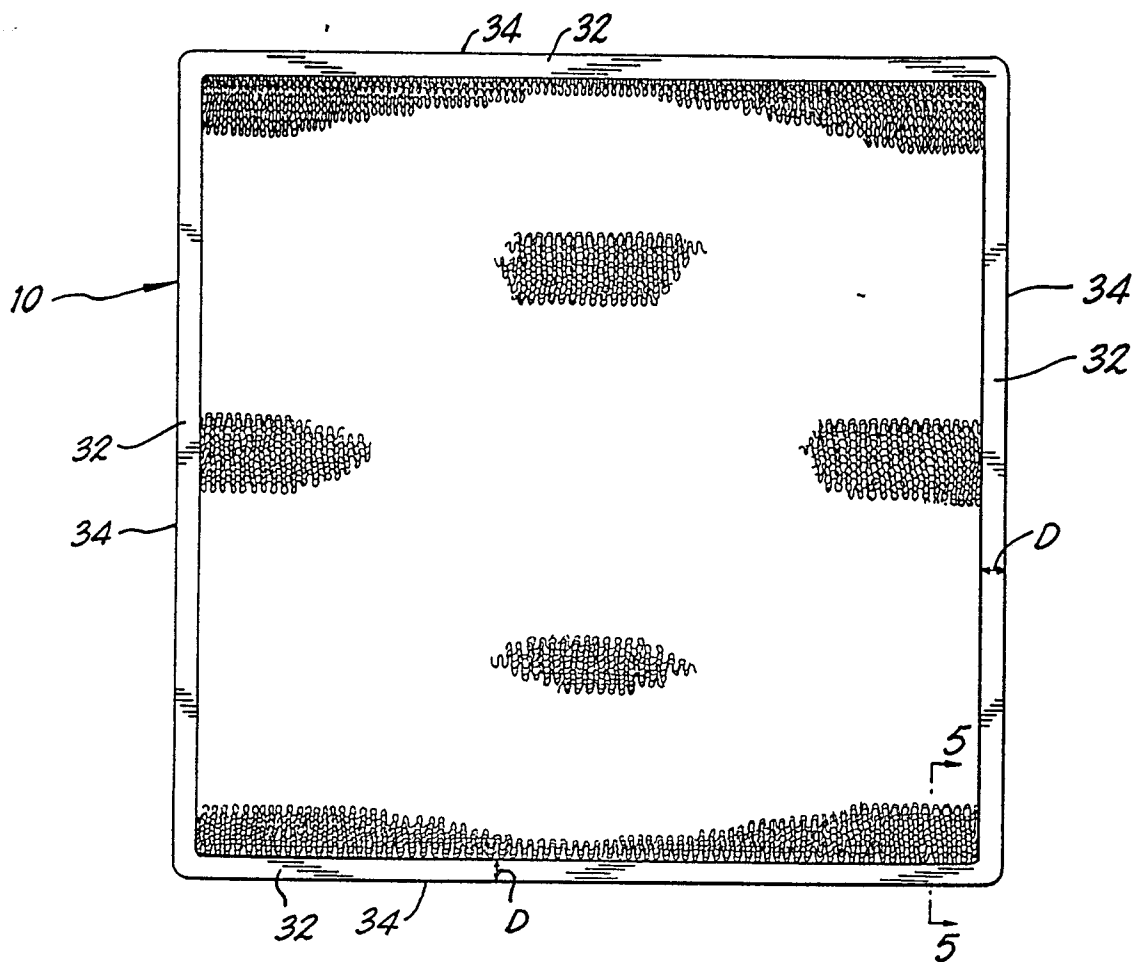


FIG. 1

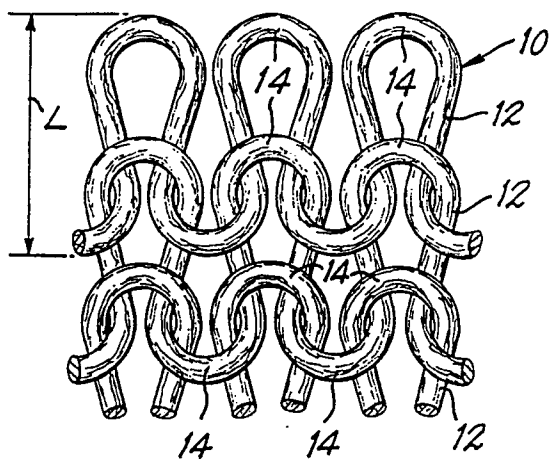


FIG. 2

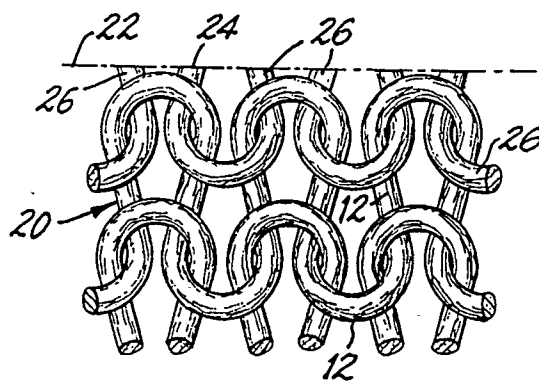


FIG. 3

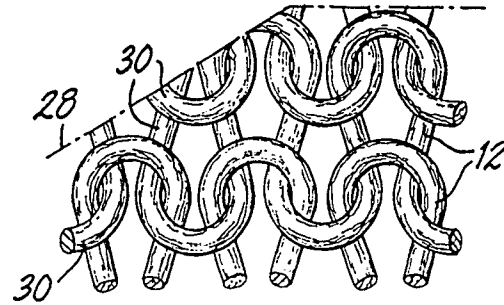


FIG. 4

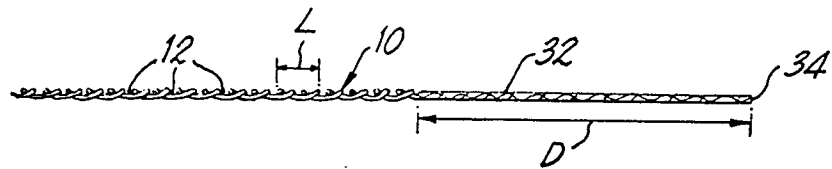


FIG. 5

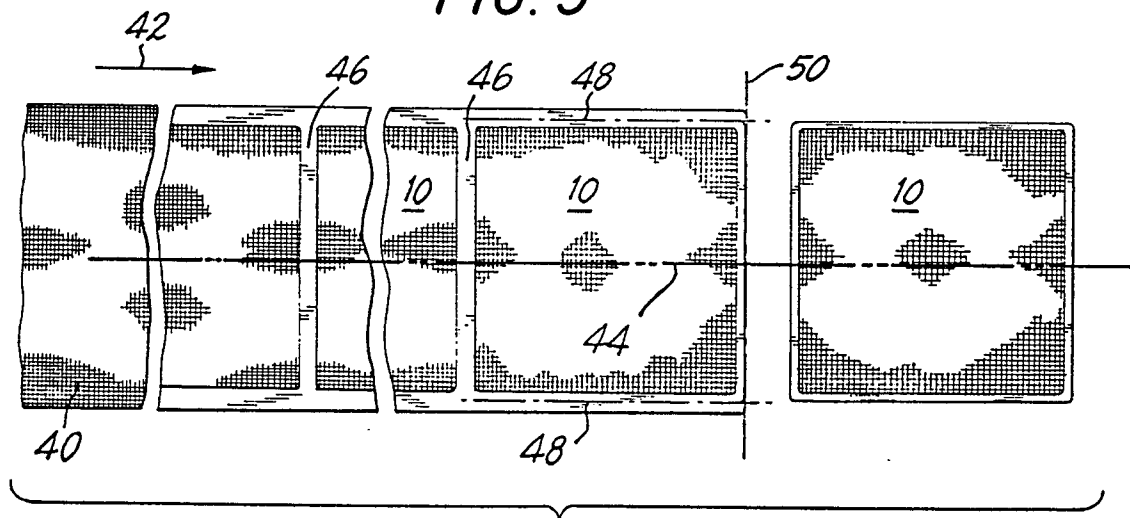


FIG. 6

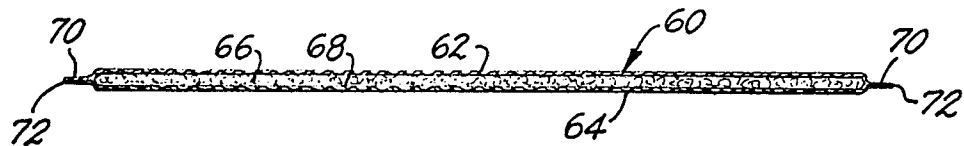


FIG. 7