This invention relates generally to a fastening device and more particularly to a hook and loop technique of disengagably fastening together items of fabric which may be made to overlap and to the method for manufacturing the hooks and loops.

It is known to the art to have hook and loop fasteners for holding together pieces of material. It is also known to the art to have hook-to-hook fasteners for holding together different pieces of material or fabric. In either case, the hook is formed from cutting a heated, and, therefore, relatively soft material of synthetic resin which has been woven into the base material in the form of a raised pile. The cut, stiffened, loops form hooks which when pressed against another piece of material that has either similar type hooks or a raised pile of looped threads will engage such loops or hooks so that a fairly considerable force will be necessary to separate the two pieces of material.

The advantage of the hook-to-hook arrangement is that the fastening surface on both pieces of material to be closed together is essentially the same and, therefore, economy of manufacture can be effected since it becomes unnecessary to manufacture two separate types of material. However, the disadvantage of the hook-to-hook type of fastener is that the two fastened parts can be separated by the application of relatively little force. For this reason, fasteners of the hook-to-hook type are seldom used.

The hook-to-loop type fastener, wherein one of the materials to be fastened has its surface covered with a multitude of small hooks formed as above described and the other material to be fastened has its surface covered with a multitude of loops as in the form of a raised pile, has the advantage of a relatively strong hooking ability. However, a major disadvantage of the hook-to-loop type of fastening closure is that in manufacture the fastener part having hooks must be prepared and handled separately from the fastener part having loops. Necessarily, this type of closure increases the difficulty of handling and the expense of manufacture.

Another difficulty with the present hook and loop fastener product is the relative bulkiness of the fastener which produces unsightly wrinkles when flexed any considerable amount. The bulkiness arises primarily from the need to have a fully thick pile of loops on one of the two fastener surfaces. Accordingly, it is the main object of this invention to provide a satisfactory hook and loop fabric fastener which will be similar for both fastener parts.

An equally important object of this invention is to provide a hook and loop fastener in accordance with the main object which will have a strong hooking ability and which will not separate without the application of deliberate manual force.

It is a further object of this invention to produce a hook and loop fabric fastener in which each of the surfaces to be fastened has a softer feel and has less tendency to snag on garments than the completely hooked surface previously known.

It is a further object of this invention to produce a hook and loop fastener which combines relatively strong hooking qualities with minimum bulkiness.

Other objects and features of this invention will become apparent in the following description and claims, and in the drawings, in which:
bow 14, with a corresponding cutting edge 15 for every other loop 10 in a row of loops only half the loops in that row would be cut. If then, the supporting elbows with their cutting edges 15 were moved laterally by a distance equal to the space between loops, the succeeding row of loops would be cut so as to start the formation of a checkerboard pattern of loops and hooks. By oscillating the pattern of alternate elbows back and forth (instead of up and down) as each row of loops comes along, a completed checkerboard pattern of loops and hooks would be created.

Thus, the arrangement of supporting elbows and cutting edges connected to a cutting device 12 which can be moved either up and down or sideways gives considerable flexibility in the pattern of hooks and loops that may be created on a strip of material. Regardless of the pattern of hooks and loops that is used, the major advantage of this invention is that the opposing parts of the fastener have an identical arrangement of hooks and loops. To have the maximum hook-to-loop engagement, it becomes preferable to use a pattern of hooks and loops wherein the number of loops equals the number of hooks.

Figure 6 illustrates, on an enlarged scale, the engagements of alternate hooks and loops on one of the surfaces to be fastened to the hooks and loops on the other surface to be fastened. The engagement illustrated results in a very strong shearing force so that the only practical way of separating the material is to apply a force roughly normal to the surface of the material. Thus, the material must be separated by peeling one layer from the other, much as is shown in Figure 7. The force required to peel one layer off of the other must equal the force necessary to straighten out the hooks row by row so that the loops will separate from the material.

The hardened and, therefore, upright loops avoid the need for a heavy mat or pile of loops which are typical in the prior known fasteners. The heavy pile was necessary to keep the very flexible loops upright. However, the heavy pile results in a bulky fastener which reduced the flexibility of the fastener strip. This invention avoids that problem and provides a thinner and smoother fastener which permits much greater flexibility without producing unsightly wrinkles.

Mono-filament auxiliary thread for forming the loops 10 has been found preferable for some applications, yet multifilament thread may also be used. Although the invention has been described with a certain degree of particularity and certain variations in the pattern of hooks and loops have been suggested, it is to be understood that the present disclosure is by way of example and that changes in the details of construction and method of manufacture will be apparent to one skilled in the art and can be made without departing from the scope and claims of the invention.

For example, a synthetic resins material such as nylon has been indicated as useful for the fiber threads constituting the loops and hooks. However, any material which has the requisite stiffness and resiliency may be used. Thus, Dacron can be used as well as other plastic materials. The fiber threads used, such as nylon or Dacron, have to be heat hardened. Other plastic materials which are made by an extrusion or casting process may also be used and the loops made from threads that are set in place and molded from a plastic material in a manner such that the loops project. In any case, if a synthetic resinous substance is used as the loop material, a heat hardening treatment must be carried out to form loops which are sufficiently stiff as well as sufficiently flexible. Although the preferred embodiment of the invention, it should be remembered, does not reside in the method of obtaining the intermediate product described above, but rather in the final product and the method of obtaining that final product from the intermediate product.

As it is possible to use the same material for the two parts of the fastener, dyeing can be done easily, uniformly and accurately. If both the hooks and the loops of the fastener are composed of appropriate synthetic resin "monofilament," it is possible to reduce breakage of fibers in the fastener, thereby markedly increasing the life of the fastener.

In the above description loops were first formed and then cut selectively to make hooks. Alternatively hooks and loops may first be prepared of, for example, plastic, and then fixed into the surface of cloth or a plastic plate in an appropriate arrangement by a flocking process or the like.

While the invention is described for a set pattern of hooks and loops, a random arrangement of hooks and loops would also produce a fully satisfactory product. A major virtue of the set pattern of hooks and loops is that the manufacturing process is particularly adapted to produce some pattern of hooks and loops.

It has been found preferable to have the number of hooks equal to the number of loops. However, a satisfactory product will be produced with a variation from equality of loops and hooks and the important point of novelty in this invention being to accomplish an arrangement of hooks and loops on a single surface so that the opposing surfaces to be fastened together can be made in one production run and so that two fastener materials need not be kept, or at least is simpler to apply a force roughly normal to the surface of the material. Thus, the material must be separated by peeling one layer from the other, much as is shown in Figure 7.

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What is claimed is:

1. Hook and loop fastener material having both hooks and loops on the same surface of a foundation piece, said hooks and said loops being intermingled substantially throughout the area of said surface, and said hooks and said loops being closely spaced in the form of a raised pile.

2. Hook and loop fastener material having both hooks and loops on the same surface of a foundation piece, said hooks and said loops constituting a fastener area, said hooks and said loops being intermingled substantially throughout said fastener area, and said loops being closely spaced in the form of a raised pile.

3. Hook and loop fastener material having both hooks and loops on the same surface of a foundation piece, said hooks and said loops constituting a fastener area, said hooks and said loops being intermingled substantially throughout the area of said surface.

4. Hook and loop fastener material having both hooks and loops on the same surface of a foundation piece, said hooks and said loops constituting a fastener area, said hooks and said loops being closely spaced in the form of a raised pile and intermingled in a predetermined pat-
tern so that both hooks and loops are distributed substantially throughout said fastener area.

5. Hook and loop fastener material having both hooks and loops on the same surface of a foundation piece, said hooks and said loops being closely spaced in the form of a raised pile and intermingled in a random fashion so that both hooks and loops are distributed substantially throughout the area of said surface.

6. Hook and loop fastener material having both hooks and loops on the same surface of a foundation piece, said hooks and said loops constituting a fastener area, said hooks and said loops being closely spaced in the form of a raised pile and intermingled in a random fashion so that both hooks and loops are distributed substantially throughout said fastener area.

7. Hook and loop fastener material comprising a foundation fabric including a plurality of weft threads, a plurality of warp threads, and a plurality of auxiliary warp threads in the form of raised pile threads, said raised pile threads forming both hooks and loops whereby hooks and loops are deployed on the same surface of a foundation piece, said hooks and said loops being intermingled substantially throughout the area of said surface.

8. Hook and loop fastener material comprising a foundation fabric including a plurality of weft threads, a plurality of warp threads, and a plurality of auxiliary warp threads in the form of raised pile threads, said raised pile threads forming both hooks and loops whereby hooks and loops are deployed on the same surface of a foundation piece, said hooks and said loops constituting a fastener area, said hooks and said loops being intermingled substantially throughout said fastener area.

9. A hook and loop fastener comprising two opposing and similar pieces of hook and loop fastener material, each of said pieces having both hooks and loops on the same surface of the piece, said hooks and said loops being intermingled substantially throughout the area of said surface of each of said pieces, said hooks and said loops being closely spaced in the form of a raised pile.

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