A pair of feed rolls are provided, which comprise a lower feed roll and an upper feed roll defining a nip with said lower feed roll. A lower perforated plate has one end adjacent to the upper portion of the periphery of said lower feed roll and is formed with a multiplicity of perforations. An upper perforated plate is disposed over said lower plate to define a space therewith and has one end adjacent to the lower portion of the periphery of said upper feed roll and is formed with perforations which are aligned with those in said lower plate. Said feed rolls are operable to feed a non-woven fiber web through said nip into said space. A plurality of blades are carried by and protrude like teeth of a comb from said one end of one of said plates toward the adjacent portion of the periphery of the adjacent one of said feed rolls. Said adjacent feed roll is formed in its periphery with annular grooves receiving said blades.

4 Claims, 4 Drawing Figures
This invention relates to apparatus for feeding non-woven fiber webs into needle punching machines which comprise a multiplicity of needles arranged in rows and columns and moved up and down to pierce the non-woven fiber web which is delivered by an endless belt conveyor or the like and passes between a pair of feed rolls to be advanced to a working station between a lower bed plate and upper stripper plates. More recently, non-woven fiber webs have been made which have such a low internal cohesion that they cannot be processed further and cannot even be transported unless the non-woven fiber web has been needle-punched to increase its cohesion. But even the preliminary needle punching cannot readily be carried out.

In the manufacture of non-woven fiber webs, shingled layers are usually formed or a multi-layer web is formed by a laying operation. In both cases, the layers are thin and light in weight and lack virtually any bond to the respective underlying layer. When such a non-woven fiber web enters the needle punching machine, the web often bunches at the entrance to the needle punching zone. Whereas the pair of feed rolls which precede the needle punching zone continuously advance the non-woven fiber web, the latter is intermittently arrested whenever it is pierced by the needles. Because the pair of feed rolls cannot be disposed closely before the first needles but for design reasons there is a certain distance between the feed rolls and the needles, the non-woven fiber web can bulge in the space between the pair of feed rolls and the working station and is thus more or less destroyed before the desired and required cohesion is imparted to it by the needle punching operation. With non-woven fiber webs which are light in weight, this bulging may be effected also by the movement of the air caused by the needle boards or the like as they are moved up and down at a high speed. Similar difficulties will arise also with other non-woven fiber webs, although to a smaller degree. It is thus desired to introduce the non-woven fiber webs in an undamaged condition into the actual needle punching zone.

It is known from U.S. Pat. No. 3,621,540 to provide grates which consist of rods, which surround the feed rolls on the receiving side around an arc of about 90° and extend between the rolls into the area adjacent of the first needles. These rods are countersunk in annular grooves in the feed rolls. These grates hold the non-woven web together until it has been internally bonded by the needle punching operation. On the other hand, the grates add to the structural expenditure and have the further disadvantage that they brake the non-woven fiber material because the feed rolls do not exert a feeding action adjacent to each rod. Because the corresponding rods of the upper and lower grates are exactly vertically aligned and for strength reasons must have a diameter above a certain lower limit, the non-woven fiber web will be distorted in that longitudinal streaks are formed in the non-woven fiber web in the zones which correspond to the grate rods. In these zones, the non-woven fiber material lags to some extent the material in the adjacent zones so that the web lacks the desired uniformity.

It is an object of the invention to eliminate the disadvantages which have been pointed out and to provide an apparatus which is of the kind described first hereinbefore and which uses only very simple means and enables a satisfactory feeding of non-woven fiber webs, particularly of such webs having a low internal cohesion, into a needle punching machine without adversely affecting the uniformity of the non-woven fiber web.

This object is accomplished according to the invention in that the lower perforated bed plate and/or the upper perforated stripper plate is or are provided with blades which protrude like the teeth of a comb toward the feed rolls and on the delivering side of the feed rolls extend into annular grooves, known per se, formed in the associated feed rolls. The blades define an upper limit and/or a lower limit of the space otherwise provided between the perforated plates and the feed rolls so that a bulging or upsetting of the non-woven fiber web before the first needles is prevented. Because the grooves may be relatively deep so that the blades enter the grooves to a corresponding depth, there is no risk of particles of material being caught at the forward ends of the blades. The blades are relatively short and for this reason may be thin so that it will be sufficient if narrow annular grooves are provided in the feed rolls. A retarding of the non-woven fiber web in certain longitudinal zones need not be feared because the blades do not extend into the actual nip between the feed rolls. The blades may be secured to the perforated plates or may be integral with them so that a simple and inexpensive structure is obtained.

To prevent in any case a retarding of the material adjacent to the annular grooves and/or the blades, in apparatus in which both perforated plates are provided with blades the associated annular grooves in one feed roll are staggered from those in the other feed roll so that no blades are vertically aligned.

Practical experiments have confirmed that it will be sufficient in many cases to provide only the lower perforated plate with protruding blades and only the lower feed roll with annular grooves whereas the upper feed roll is preferably smooth, in the sense that it is free of annular grooves. This very simple design may be adopted because even non-woven fiber webs which are light in weight tend to sag under the force of gravity as they leave the feed rolls so that they must mainly be supported from below.

It will be desired if the blades have the basic configuration of a triangle, which has one side extending in or merging into the same plane defined by the perforated plate and another side which conforms to the bottom of the associated annular groove in the feed roll.

An embodiment of the invention is shown by way of example on the accompanying drawing, in which FIG. 1 is a diagrammatic view showing the essential parts of a needle punching machine provided with a feeding device. FIG. 2 is an enlarged view showing a detail. FIG. 3 is a corresponding elevation taken in the direction indicated by the arrow III in FIG. 2, and FIG. 4 is a sectional view taken on line IV—IV in FIG. 2. Needle boards are inserted in a needle beam 1 which is moved up and down at a high speed. The needle boards carry a multiplicity of needles 2 which are arranged in rows and columns. The needles pierce a non-woven fiber web which is not shown and which is advanced between a lower perforated bed plate 3 and an upper perforated stripper plate 4. The non-woven fiber
web is delivered by an endless belt conveyor 5 and moves through a pair of feed rolls, which comprises a lower feed roll 6 and an upper feed roll 7 and which are adjustable relative to each other to define a nip. Normally only the upper feed roll 7 is adjustable and the non-woven fiber web is compressed by the weight of the upper roll. The two perforated plates 3, 4 are provided with blades 8, 9, respectively, which protrude like the teeth of a comb toward the feed rolls 6, 7 and extend into annular grooves 10, 11 in the rolls. As indicated in FIG. 4, the annular grooves 10 of the lower feed roll 6 are staggered relative to the annular grooves 11 in the upper feed roll 7.

In many applications it will be sufficient to provide only the lower perforated plate 3 with blades 8 and to provide only the lower feed roll 6 with grooves 10 so that the blades 9 of the upper perforated plate 4 and preferably also the associated grooves 11 in the upper feed roll 7 are omitted.

The blades 8, 9 have the basic configuration of a triangle having one side which lies in or merges into the plane defined by the perforated plate and another side which conforms to the bottom of the respective annular groove 10 or 11.

What is claimed is:

1. In a needle punching machine which comprises an upper stripper plate, a lower bed plate, the plates defining a needle punching space therebetween, a pair of superposed feed rolls being formed with peripheral annular grooves and defining a nip therebetween, an upper one of the feed rolls having a lower peripheral portion and a lower one of the feed rolls having an upper peripheral portion, each of the plates having one end facing a respective one of the feed rolls, and the feed rolls being operable to feed a non-woven fiber web through the nip into the space, the improvement of a plurality of blades carried by, and protruding like teeth of a comb from, the one end of the lower bed plate, the one lower bed plate end being adjacent the upper peripheral portion of the lower feed roll and the blades extending to, and being received in, the annular grooves of the lower bed plate.

2. In the needle punching machine of claim 1, a plurality of blades carried by, and protruding like teeth of a comb from, the one end of the upper stripper plate, the one upper stripper plate end being adjacent the lower peripheral portion of the upper feed roll and the blades extending into, and being received in, the annular grooves of the upper stripper plate, the annular grooves in one of the feed rolls being staggered from the annular grooves in the other feed roll whereby no two of the blades carried respectively by the bed and stripper plates are superposed.

3. In the machine as set forth in claim 1, in which each of said annular grooves has a bottom, said bed plate defines a plane, and each of said blades has the basic configuration of a triangle having one side which conforms to the bottom of the groove into which the blade extends and another side which lies in said plane.

4. In the machine as set forth in claim 1, in which each of said annular grooves has a bottom, said bed plate defines a plane, and each of said blades has the basic configuration of a triangle having one side which conforms to the bottom of the groove into which the blade extends and another side which merges into said plane.