Sept. 8, 1959 A. W. BATEMAN 2,902,746

APPARATUS FOR PRODUCING NEEDLED BATTS

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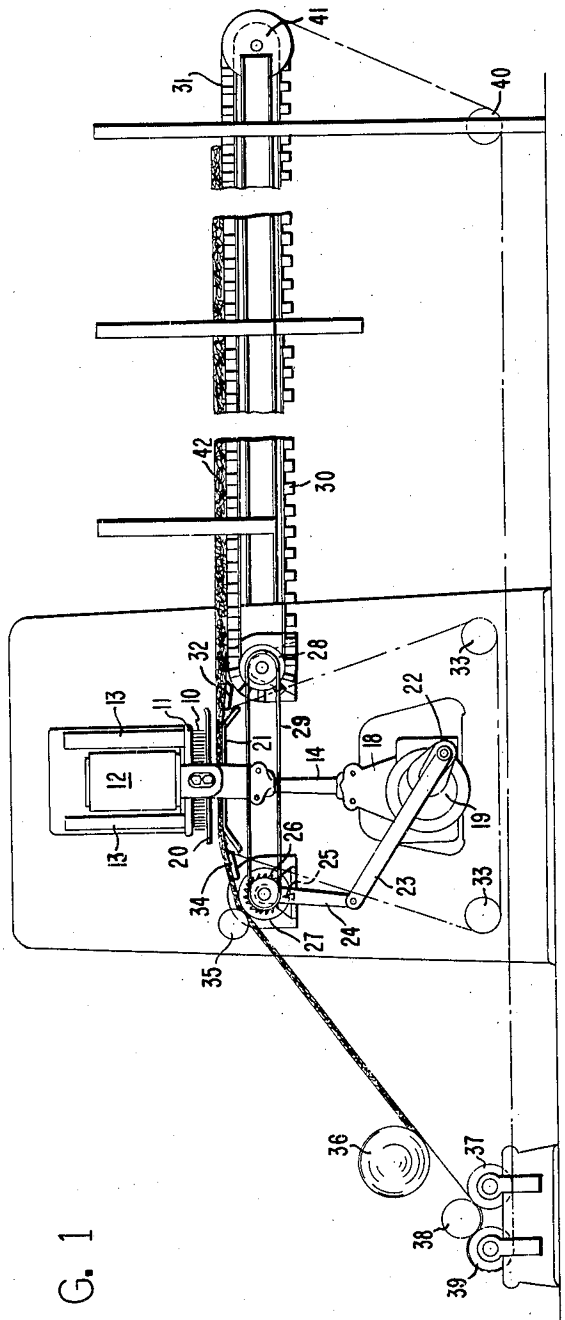

FIG. 1

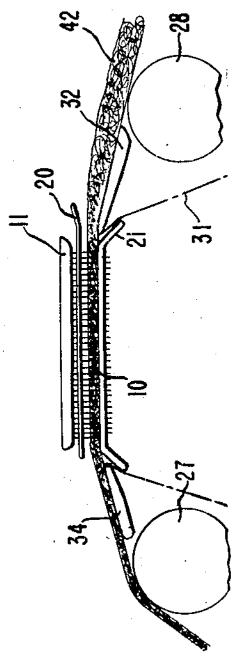

FIG. 3

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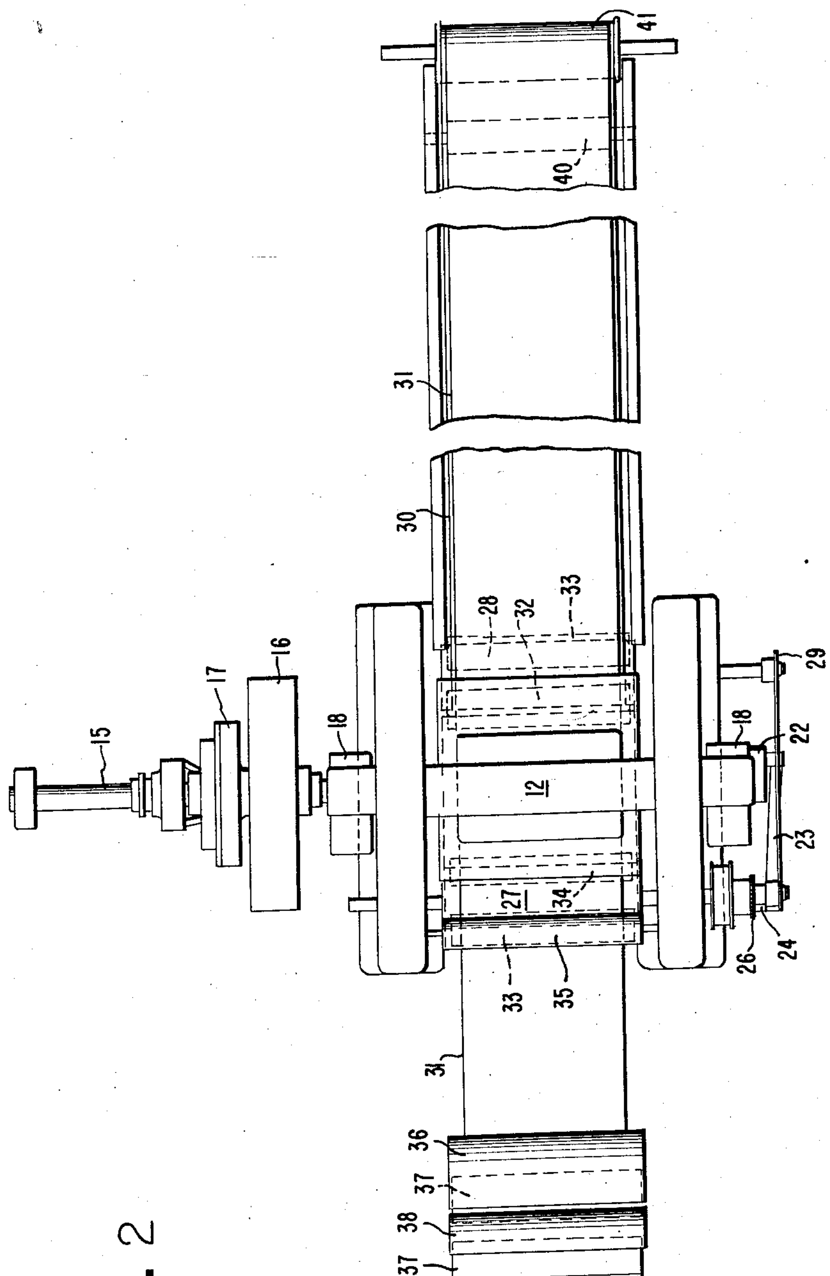

FIG. 2

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APPARATUS FOR PRODUCING NEEDLED BATTS

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1 Claim. (Cl. 28—4)

This invention relates to unwoven fibrous materials and more particularly to an improved apparatus and process for needle punching unwoven fibrous batts, especially thin batts of slippery fibers.

Needle looms have been used by the textile industry for many years in making punched felts from batts of carded or similarly oriented fibers such as hair, jute, sisal and other natural fibers. These punched felts have been used, for example, as carpet linings, insulating felts, slicker felts and cartridge wadding. Recently, needle looms have been used similarly in making unwoven batts of synthetic fibers.

Basically, these needle looms consist of a large number of closely spaced needles supported in position to be reciprocated into then out of a batt of fibers and means, such as draw rolls and moving feed aprons, to pass the batt through the loom. The batt is usually moved intermittently through the loom, being advanced only while the needles are drawn clear of the batt. This needle piercing or punching orients individual or small groups of fibers substantially perpendicular to the plane of the batt, thereby giving added strength to the unwoven structure.

Although they have been satisfactory for punching batts of many natural fibers, conventional needle looms greatly distort batts of synthetic fibers which have a low coefficient of friction and slide easily over one another. This is especially true of thin batts of such materials as polytetrafluoroethylene which stretch and pull apart on conventional looms. With some thin batts, for example, those less than 1/16 inch thick, the unwoven fibrous structure distorts when it is suspended under its own weight over a short distance.

I have discovered an improvement in conventional needle looms which makes it possible to use such looms for punching thin batts of slippery fibers without greatly distorting the batts. This improvement comprises an endless flexible carrier belt for the fibrous batts which runs from the feed side of the needle loom to a point immediately adjacent to the punching area, passes outside the punching area to a point immediately adjacent to the discharge side of the punching area, and proceeds away from the loom.

The invention is described in detail hereinafter by reference to a preferred embodiment shown in the accompanying drawings wherein:

Figure 1 is a view in side elevation of the needle loom and carrier,

Figure 2 is a plan view of the needle loom and carrier,

Figure 3 is an enlarged cross-section of the bridge plates and punching area shown in Figure 1.

As shown in the drawings, the loom needles **10** are held in the needle board **11** which, in turn, is fastened to the top beam **12**. The needle assembly consisting of the needles **10**, needle board **11** and top beam **12** is reciprocated substantially vertically between top-beam guides **13** by connecting rods **14** which are connected to drive shaft **15** through eccentric straps **18** and eccentrics

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19. As the drive shaft **15** is turned by a prime mover through pulley **16** and clutch **17**, eccentrics **19** rotate within the eccentric straps **18** which move the connecting rods **14** and the needle assembly. As the needles **10** reciprocate, they pass downwardly through holes in the stationary stripper plate **20**, through the punching area and finally through corresponding holes in the stationary bed plate **21**. Figure 1 shows the position of the needles **10** as they begin their downward stroke; Figure 3 shows the needles after they have passed through stripper plate **20**, the punching area and bed plate **21**.

In Figure 1, feed crank **22**, fastened to eccentric **19**, is rotatably connected to clutch lever **23** which is also rotatably connected to clutch pitman **24**. When the drive shaft **15** and eccentric **19** turn, clutch lever **23** causes clutch pitman **24** to oscillate back and forth. Ratchet **25** attached to clutch pitman **24** engages gear **26** and intermittently rotates rear draw roll **27**. The rear draw roll **27** intermittently rotates forward draw roll **28** through chain drive **29**. The slatted feed apron **30** is driven intermittently by frictional contact with forward draw roll **28**. Thus the needle assembly, the feed mechanism and the rear draw roll **27** are all driven from eccentric **19**.

The endless flexible carrier **31** runs along the top surface of the slatted feed apron **30** up to a point immediately adjacent to the punching area. Forward bridge plate **32** is inserted in the space between the feed end of bed plate **21** and draw roll **28** so that the carrier **31** is supported between the feed apron **30** and the bed plate **21**. From the feed apron **30**, the carrier **31** passes over the bridge plate **32** and downwardly through the small space between the bridge plate **32** and the bed plate **21**. The carrier then runs around lower girts **33**, thus avoiding drive shaft **15**, and passes upwardly through the slit between the discharge end of bed plate **21** and a second bridge plate **34** which, like forward bridge plate **32**, spans the gap between the bed plate **21** and the rear draw roll **27**.

From this point immediately adjacent to the discharge side of the punching area, the carrier **31** goes successively between draw roll **27** and riding roll **35**, under windup roll **36**, over roll **37**, under roll **38** and around pull roll **39** and guide roll **40** back to roll **41** at the end of the slatted feed apron **30**. Roll **38** controls the tension in the carrier **31**; by lowering this roll the tension is increased. Means are provided to synchronize the intermittent rotation of windup roll **36** and pull roll **39**, with that of draw rolls **27** and **28**.

The carrier **31** is driven by frictional contact with rear draw roll **27** and pull roll **39**. The carrier **31** can be made of any of a wide variety of fabrics and sheetings, natural or synthetic, that is flexible enough to be threaded through the loom; however, coated fibrous sheets and polymeric films, for example, drill lightly coated with plasticized polyvinyl chloride and polyester film such as 350–A gauge polyethylene terephthalate sheeting, are preferred.

In operation, a loose unwoven batt **42** of fibers to be needle punched is laid on the carrier **31** on the feed apron **30** and is borne up to bed plate **21**. As the batt **42** passes into the punching area between bed plate **21** and stripper plate **20**, it is punched by the reciprocating needles **10** which orient small groups of fibers substantially perpendicular to the plane of the batt. Stationary plates **20** and **21** limit the verticle movements of batt **42** while it is punched and prevent it from reciprocating unduly with the needles. When the punched batt **42** has passed through the loom it again meets the carrier **31** where the carrier comes upwardly between the discharge end of the bed plate **21** and the bridge plate **34**. From this point immediately adjacent to the discharge side of the punching area, the batt **42** is transported on the carrier **31** between draw roll **27** and riding roll **35** to roll **36** where it leaves the carrier **31** and is wound up.

Through the use of the improvement of this invention it is possible to manufacture thin punched batts, 1/16 inch or less thick, of such fibers, for example, as polytetrafluoroethylene, rayon, polyacrylonitrile, polyethylene terephthalate, nylon, and other synthetic polymers. With conventional looms, it is difficult to make batts of these materials without excessive distortion.

The following example is intended to illustrate the utility of the invention and is not intended to limit the invention in any way.

Example

A loose batt of 4½-inch, 6⅔-denier polytetrafluoroethylene fibers drawn ten times their extruded length was formed by cross-lapping from 13 to 15 layers of loose fibers. The loose batt was then fed to a needle loom equipped with a carrier of drill lightly coated with polyvinyl chloride. The carrier was threaded over the bridge plates and through the loom as shown in Figures 1, 2, and 3. The loom needles were 15 x 18 x 36 gauge, 3½ inches long, and close barbed and shallow barbed. In 18 passes through the loom, the batt was punched 3868 times per square inch. The resulting product weighted 17.6 ounces per square yard and was 1/16-inch thick. During the needle punching the batt stretched less than 15% in length and shrunk less than 10% in width; similar batts of polytetrafluoroethylene distort as much as 3 or 4 times this amount when they are punched on a conventional loom without a carrier.

I claim:

In a needle loom for punching unwoven fibrous batts which loom comprises a plurality of closely spaced needles, means to reciprocate said needles into and out of said batts, means for limiting the vertical movement of said batts as said needles pass therethrough, a feed apron, means to move said batts away from said loom comprising a draw roll, and a windup roll, the improvement which comprises a first bridge plate extending from the discharge end of said feed apron to a point on the feed side of said loom immediately adjacent to the area wherein said needles punch said batts, a second bridge plate extending from a point on the discharge side of said loom immediately adjacent to said area wherein said needles punch said batts to said draw roll, an endless, flexible carrier belt which runs along and in contact with the upper side of said feed apron, over the upper surface of said first bridge plate, downwardly over the edge of said first bridge plate immediately adjacent to said area where said needles punch said batts, outside said needles and said limiting means, upwardly over the edge of said second bridge plate immediately adjacent to said area wherein said needles punch said batts, over the upper surface of said second bridge plate and over said draw roll to said windup roll, and means to control the tension in said endless, flexible carrier belt.

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