United States Patent [19]

Bruner

[11] **3,900,778**

[45] **Aug. 19, 1975**

[54] **ARCHERY TARGET MATS OF STAGGERED CORRUGATED PLASTIC**

[75] Inventor: **Ralph C. Bruner**, Tulsa, Okla.

[73] Assignee: **Brunswick Corporation**, Skokie, Ill.

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[52] **U.S. Cl.** ..... **273/102 B**

[51] **Int. Cl.²** **F41J 3/00**

[58] **Field of Search** ..... 273/102 B, 102.4, 102 R

[56] **References Cited**

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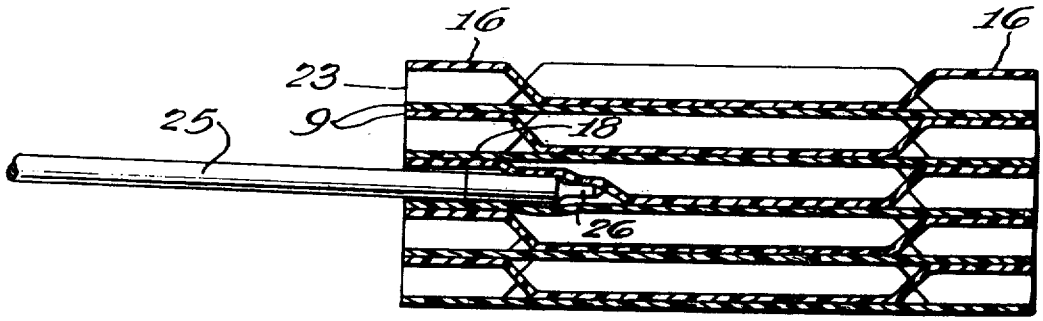
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Primary Examiner—Richard C. Pinkham
Assistant Examiner—Marvin Siskind
Attorney, Agent, or Firm—John G. Heimovics; Donald S. Olexa; Sheldon L. Epstein

[57] **ABSTRACT**

An improved target mat for projectiles comprising a roll of fluted corrugated material. The fluted material has a first corrugated sheet and a second flat sheet secured to the corrugated sheet to define a corrugated layer. This layer is spirally wound whereby layers of corrugations are superimposed to define the roll. Each corrugation has a cross-section such that the projectile can fit therein only by stretching the corrugation. This is made possible because the sheet of corrugated material has a plurality of longitudinally extending rows of staggered corrugations with the individual rows being corrugated along their lengths.

14 Claims, 17 Drawing Figures



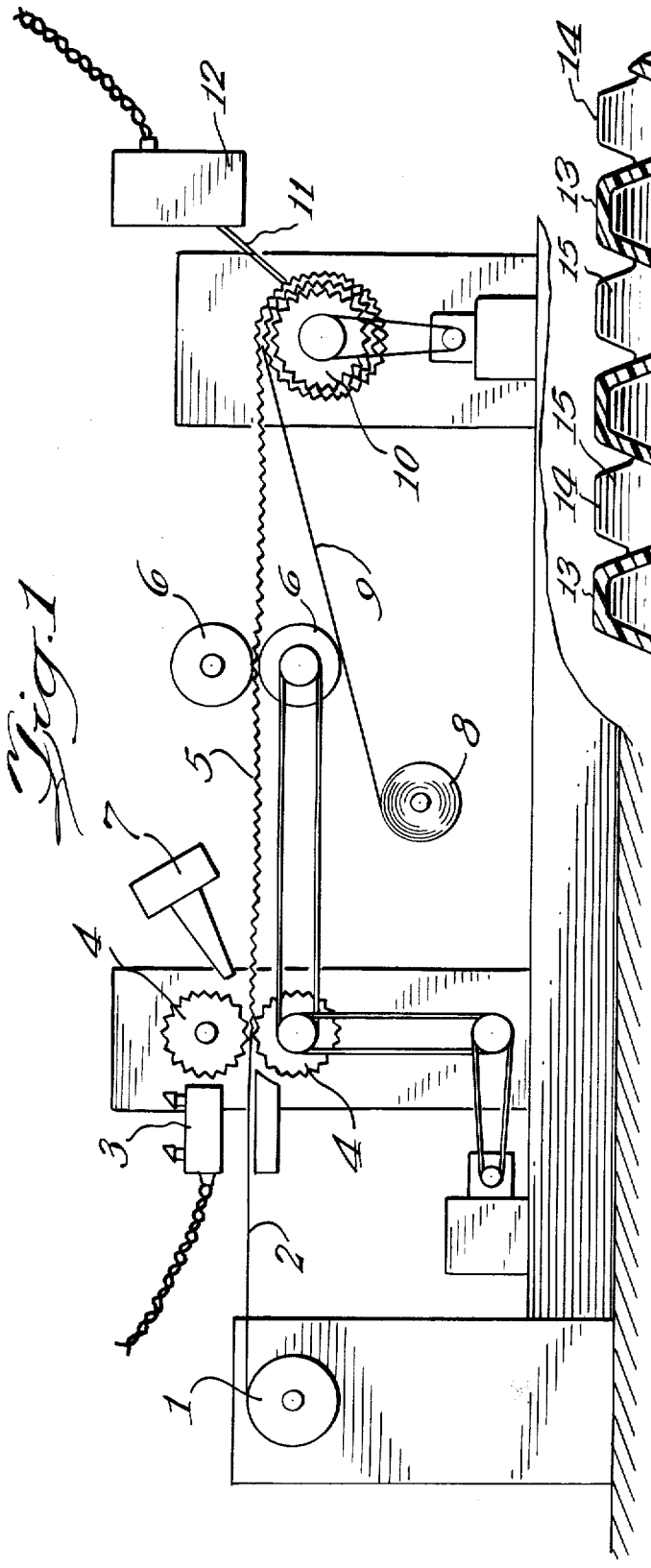


Fig. 1

Fig. 3

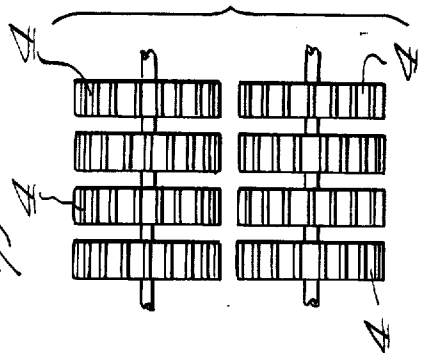


Fig. 16

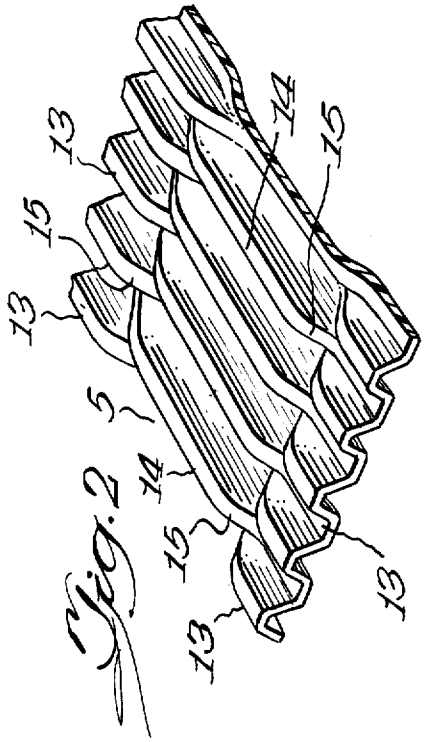


Fig. 2

Fig. 4

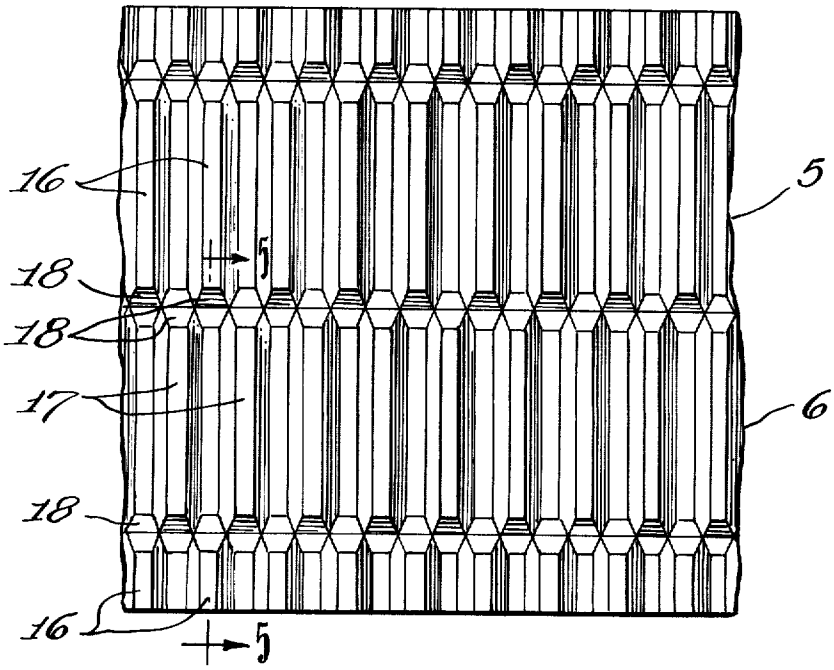


Fig. 5

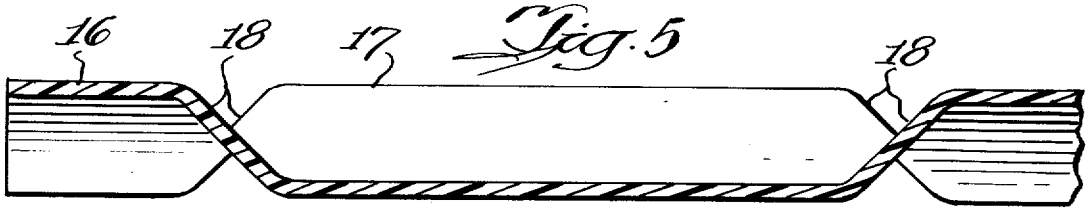
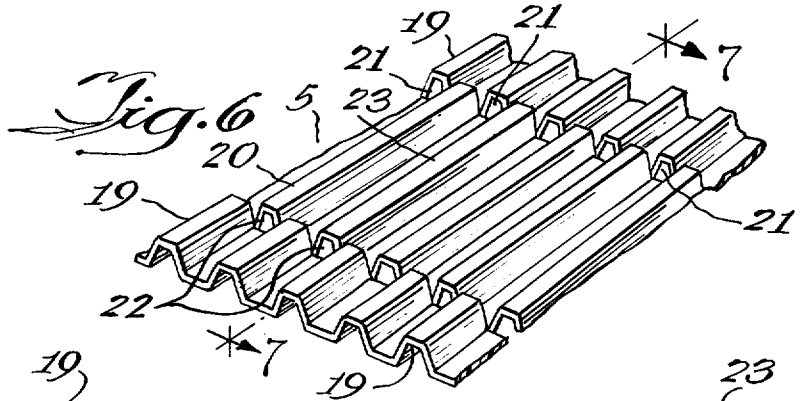


Fig. 6



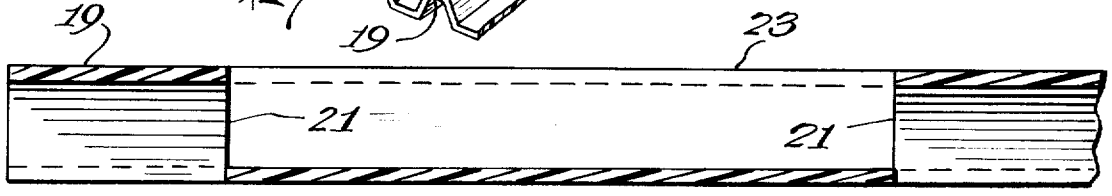


Fig. 7

Fig. 8

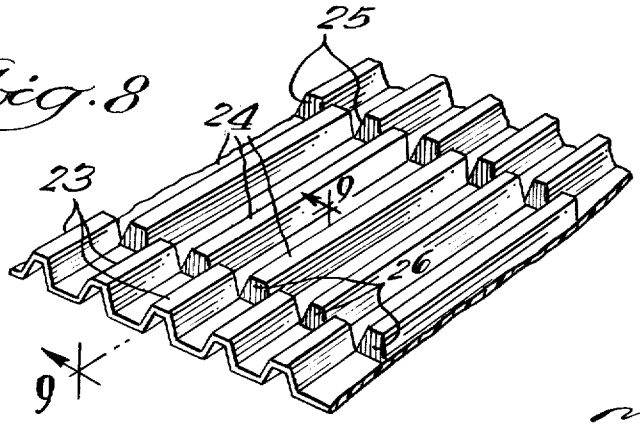
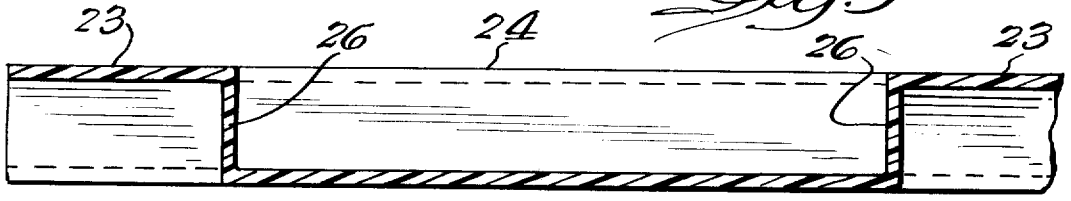


Fig. 9



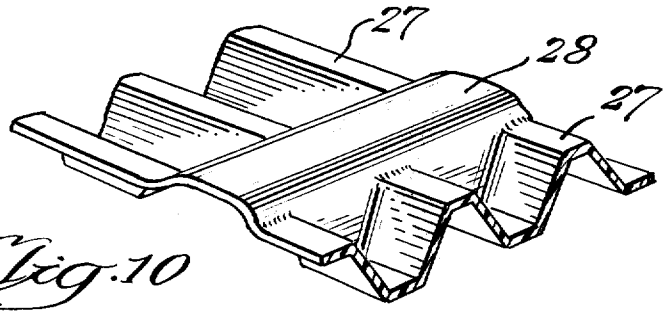


Fig. 10

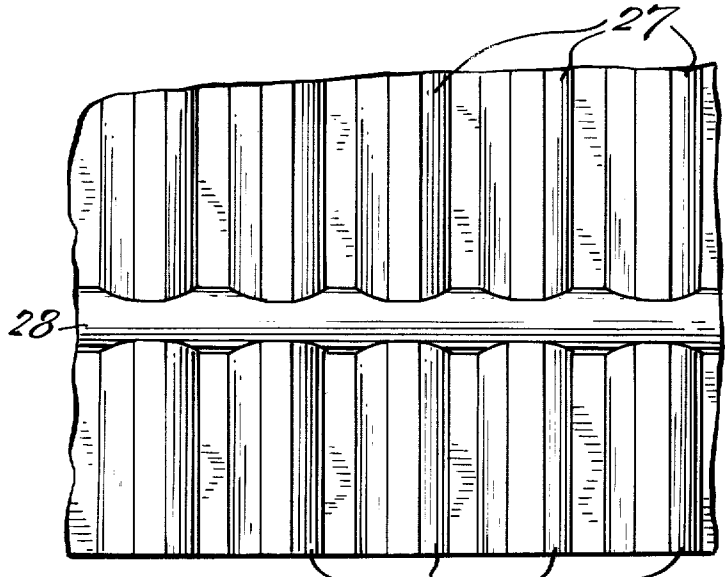


Fig. 11

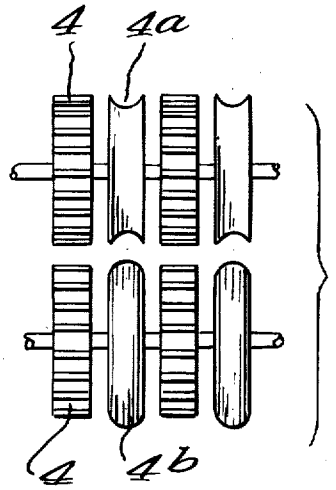


Fig. 17

Fig. 12

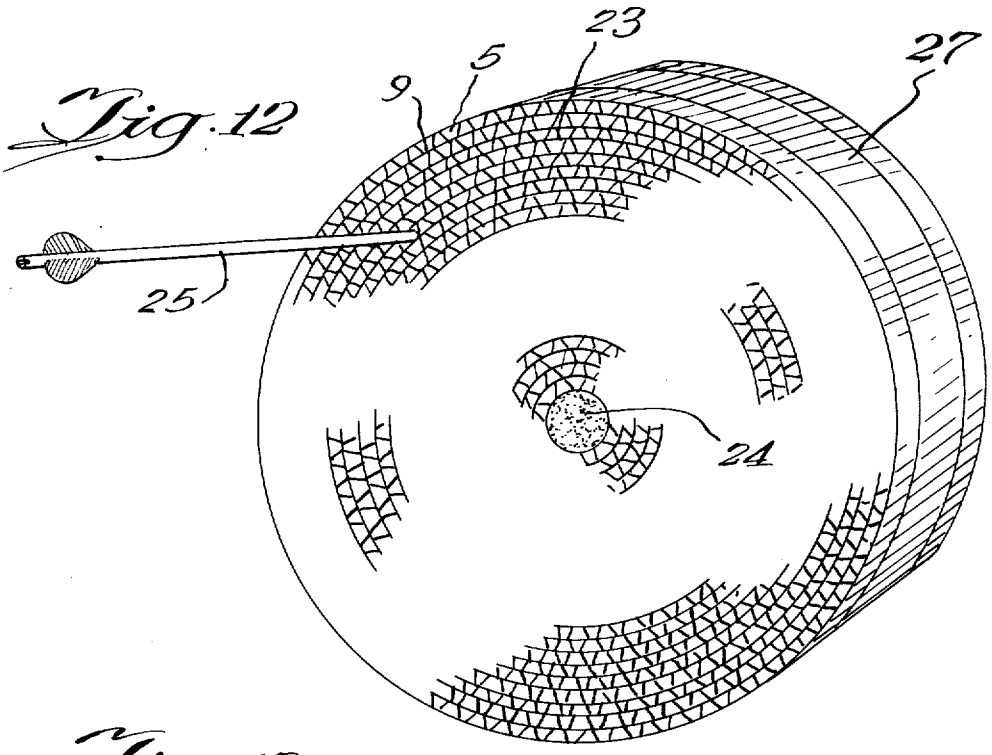


Fig. 13

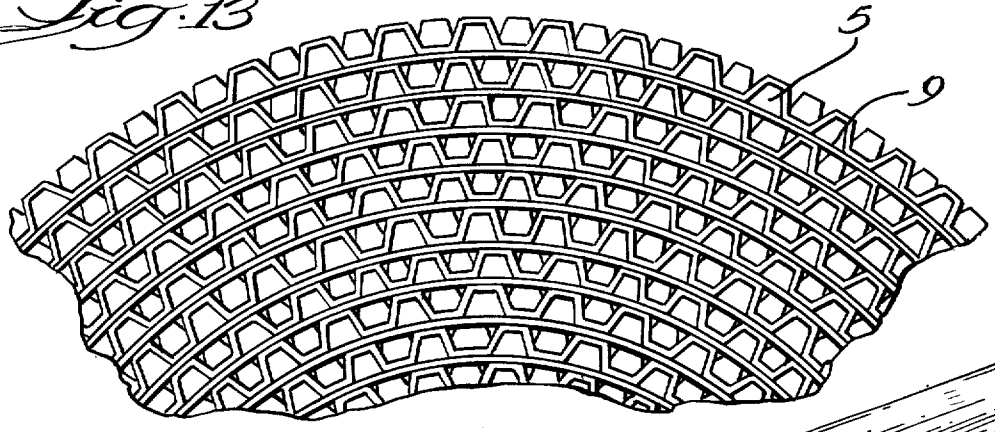
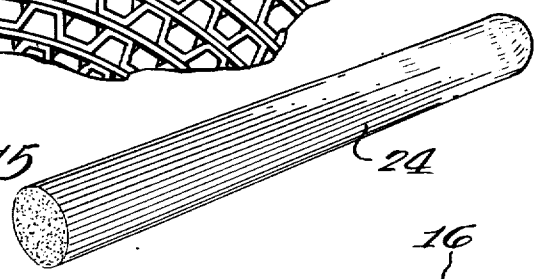


Fig. 15



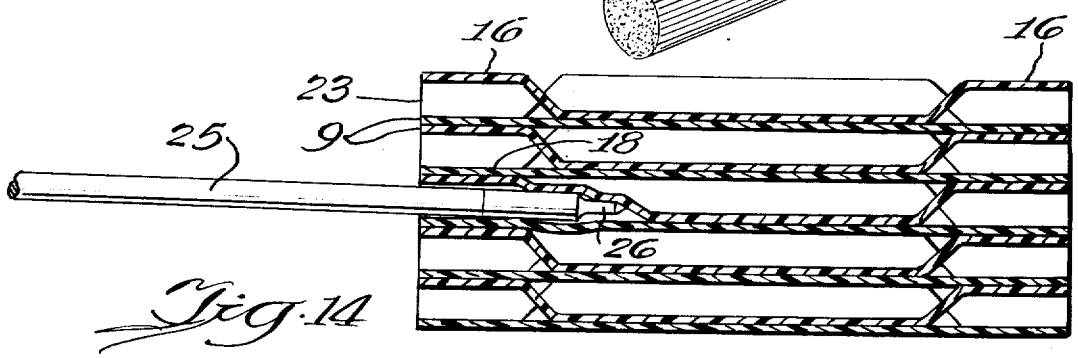


Fig. 14

ARCHERY TARGET MATS OF STAGGERED CORRUGATED PLASTIC

BRIEF SUMMARY OF THE INVENTION

This invention relates to a target mat for projectiles and more particularly to an archery target mat upon which an archery target may be mounted.

Archery mats are commonly made out of straw or matted grass tightly packed together into a rather large pad having a flat face to which the target is fastened. However, this type of mat has many disadvantages. It is subject to mildew and rot outdoors and tends to disintegrate if exposed to the elements for any length of time. Indoors, it is undesirable because it harbors insects, and often exudes an unpleasant odor. In addition, since it is composed of highly combustible material which becomes loose with time, it constitutes a fire harzard. In addition, the target mat is quite bulky and heavy and consequently is not readily movable.

In time, after a period of use, this type of mat becomes leaky, especially at the portion surrounding the bull's eye where a large number of the arrows shot land. The straw ultimately disintegrates under the repeated impact of the arrows, thus allowing some to pass through with resultant damage to objects behind the target and danger to persons unwittingly in back thereof.

It has been proposed to obviate at least some of these difficulties by providing mats made out of rolled up corrugate material. U.S. Pat. No. 1,837,627 shows mats made of cellular or corrugated paperboard, rolled in a spiral and having a renewable center. U.S. Pat. No. 3,048,401 shows a cellular structure and states that the material out of which the mat is made may be treated to render it weatherproof. However, in this prior art, the stopping ability of the mat depends on friction between the arrows and treated sides of the corrugations, an air cushioning effect when the rear of the corrugations are sealed, and a back stop at the rear of the mat to stop any arrows.

I have discovered that by making the corrugations out of thermoplastic sheet material, by having the corrugations smaller than the diameter of the arrow, and by staggering the corrugations along the thickness of the mats, or providing corrugations transverse to the path of the projectile, an improved target mat results. The staggered or transverse corrugations, and their smaller size, increase the resistance to penetration and serve to stop an arrow in a shorter distance, rendering a backstop unnecessary. The sheet material employed will not scratch the shafts or harm the points, and the corrugations tend to return to their original configuration when the arrow is removed.

THE DRAWINGS

FIG. 1 is a schematic view of the apparatus for making the mat.

FIG. 2 is a perspective view of a portion, one form of the corrugated structure.

FIG. 3 is a front elevation of a portion of the corrugation of FIG. 2, somewhat enlarged.

FIG. 4 is a plan view of a different form of the corrugations.

FIG. 5 is a section taken along line 5—5 of FIG. 4.

FIG. 6 is a perspective view of another form of the corrugations.

FIG. 7 is a view along line 7—7 of FIG. 6.

FIG. 8 is a perspective view of a third modification of the corrugations.

FIG. 9 is a view along line 9—9 of FIG. 8.

FIG. 10 is a perspective view of a fourth modification of the corrugation arrangement.

FIG. 11 is a plan view of a corrugation sheet of the modification shown in FIG. 10.

FIG. 12 is a perspective view of the target mat.

FIG. 13 is an enlarged section of a portion of the face of the mat.

FIG. 14 is a cross sectional view through the mat showing an arrow penetrating therein.

FIG. 15 is a perspective view of the fibrous core

FIGS. 16 and 17 are schematic view of different gear arrangements.

In the schematic drawing of FIG. 1, showing the fabrication of the mats, reference numeral 1 is a delivery reel holding the sheet material 2 to be corrugated. The width of 2 is that of the final target mat thickness, generally 4 to 6 inches wide, although this may be varied if desired. Sheet material 2 passes through heater 3 and toothed rollers 4,4 which form the corrugations, and emerges as corrugated sheet 5. Tension rollers 6,6 grip the corrugated sheet and are of the same diameter and rotate at the same speed as corrugation rollers 4,4. It will be appreciated that a number of gears are keyed to a common shaft, as will be discussed in more detail. After leaving the corrugated rollers, the now corrugated sheet must be cooled to 100°F or lower. One mode of doing this is to blow cold air on the side of the roller where the corrugated sheet 5 egresses, as shown at 7.

Interleafing or separation film 9 together with the corrugated sheet is fed to wind-up reel 10. The interleafing film serves to prevent any tendency of the corrugations to meet.

A compacted core of natural or synthetic fibers (FIG. 15) is firmly mounted at the center of wind-up reel 10 (not shown in FIG. 1) as by prongs or teeth guffing the core ends. Film 9 and corrugated sheet 5 are then wound around the core to form the target mat.

The separation film and the coiled corrugations must be spot attached to each other at least every ¼ revolution of wind-up reel 10 to prevent telescoping of the coiled sheets when they are removed from reel 10 and in subsequent use. In addition, adjacent layers of corrugated film must be attached to each other at the same intervals. This is accomplished in the schematic representation shown in FIG. 1 by a spot welding device which consists of an electrically heated pin 11, which enters and contacts the coiled sheet and interleaf at appropriate intervals. The driving mechanism for advancing and withdrawing the pin is housed in 12. Pin 11, which is about ⅛ inch in diameter, is heated to be above the fusion point of the employed thermoplastic material such as to a temperature of 600°–650°F. The pin penetrates the wrap at an angle of about 30° from a vertical line tangent to the coil on the wind-up reel. Pin 10 penetrates at least the two outermost layers of corrugated sheet and the combined dwell time and bending of the pin (depending on its stiffness and length) results in a weld bead of ⅛ to ½ inch.

Other means for causing the corrugated sheets to adhere to one another may be employed if desired. Among such means are spot gluing of heat fusing one side of the completed target. No matter what method

is employed, the main objective to be secured is the prevention of telescoping of the target mat.

After the desired diameter is reached, the mat is removed from reel **10.** If desired, a sheet of the same thermoplastic as sheet **2** may be fused over the ends to add to the stability and durability of the mat. A sheet of film **9** may be attached to the circumference of the mat to give it added strength and stability.

A plurality of corrugating rollers are mounted on a common shaft, and alternative gears are lined up peaks to valleys. In FIG. **16** a plurality of forming gears are shown. If the gears are spaced so that the adjacent gears touch each other the corrugation will be open at each end, as illustrated in FIG. **6.** If closed corrugations are desired, the gears are spaced apart a sufficient distance to effect this desideratum. Depending on the spacing, the closure will be normal to the base of the corrugations or at an angle thereto, as shown in FIGS. **8** and **2.** By interposing concave and convex rollers, as shown in FIG. **17,** a lengthwise corrugated sheet is formed, a section of which is illustrated in FIG. **10.**

A section of corrugated sheet having the ends closed in a sloping manner is shown in FIGS. **2** and **3.** As best shown in FIG. **2,** corrugations **13** in one row are staggered with corrugations **14** in the next row, so that the peaks of **13** are in line with the valleys of **14.** Each of the corrugations has at its maximum depth a depth smaller than the diameter of the arrow, and is staggered not only with respect to corrugations in the adjacent rows but also along the length of each row (the thickness of the target). The ends of the corrugations are downwardly sloping as shown at **15.** This form of corrugation is produced by having the gear teeth **4** (FIG. **16**) spaced apart on their shaft a sufficient distance to permit this shape to form.

Corrugated sheeting having steeper sloping closed ends is shown in FIGS. **4** and **5.** As shown therein, corrugations **16** are staggered with respect to corrugations **17.** The ends of the corrugations are sharply downwardly sloping as shown at **18.** This configuration is obtained by having the forming gears spaced closer togehter than that which forms the configuration of FIG. **2.**

FIGS. **6** and **7** show a configuration having open ends on the corrugations. Corrugations **19** and **20** are shown as staggered and ends **21** are open. This is produced by having the adjacent gears on the shaft touching.

FIGS. **8** and **9** show a configuration of the corrugated sheeting wherein the ends of the staggered corrugations **23** and **24** are closed with a vertical closure section **26.** This is produced by spacing the gears a small distance apart, i.e., less than that producing the sheets shown in FIGS. **2** and **4,** but more than the zero spacing producing the sheet shown in FIG. **6.**

FIGS. **10** and **11** show a different configuration wherein a lengthwise corrugation is interposed between the rows of transverse corrugations. In this modification the rows of transverse corrugations **27** are not staggered. These corrugations are joined to a lengthwise corrugation **28,** as best shown in FIG. **10.** The arrangement of gears and rollers to form this modification is shown in FIG. **17.** A roller **4***a* having a convex circumferential surface is opposed to a roller **4***b* having a concave circumferential surface.

From the foregoing, it is apparent that by varying the spacing of the gears on their shafts in FIGS. **16** and **17,** a variety of corrugation configurations may be obtained. If the gear teeth are displaced so that alternate gears line up peaks to valleys the corrugations will be staggered. If the gears are arranged to line up peak to peak, the corrugations will be aligned, as in the modification of FIGS. **10** and **11.**

The completed target mat is shown in FIG. **12.** The mat **23** is shown as being formed of the spirally wound corrugated sheet **5** and interliner **9.** At the center is compacted fiber core **24.** This is composed of natural and/or synthetic fibers which may be straight as shown in FIG. **5** or which may be twisted. In any event, the general direction of the fibers is normal to the face of the target mat. The fibers are compressed to resist penetration by a projectile, such as an arrow. One form of fiber which may be employed is a piece of rope, either natural, such as hemp, etc. or synthetic, such as nylon or polyolefin. A strip of plastic **27** may be fastened as by adhesive or fusion to the circumference of the mat.

FIG. **14** shows in cross section the effect of an arrow penetrating a target mat wherein the corrugations have the configuration shown in FIGS. **4** and **5.** Arrow **25** having a point **26** enters the open end of a corrugation at the face of the target **23.** Point **26** reaches slope **18** of the corrugation and forces the valley of the corrugation upward in a prying action. This energy-absorbing work, together with the friction occasioned by the gripping action of the walls of the corrugations against the arrow, limits its penetration and brings it to a stop. The arrow may strike the target so that closure ends of the corrugations are penetrated. This is a further energy-absorbing action, and results in further frictional resistance. It is apparent that the staggered arrangement of the corrugations further increases the frictional resistance to penetration. In the case of the modification having a longitudinal corrugation intersecting a transverse corrugation as in FIG. **10,** the arrow, which has been slowed down by frictional resistance, contacts the longitudinal corrugation and deforms it, thereby losing energy and is further slowed down or is halted.

After the arrow is removed, any corrugation walls distorted by the arrow will tend to resume their previous shape.

Since the core receives the greatest amount of use, it often becomes weakened and starts to disintegrate before the rest of the target mat. The old core may be removed and a new core forced into the resultant opening to extend the useful life of the mat.

Typically, the thermoplastic sheet from which the target mat is fabricated may be from 0.015 to 0.020 inches in thickness. The interliner film may be about 0.005 inches thick. As stated above, the dimensions of the corrugations must be smaller than the diameter of the arrow. A ¼ inch corrugation will satisfactorily hold a 5/16 inch diameter arrow.

The sheet material and interliner film may be any thermoplastic material such as polyethylene, polypropylene, polystyrene, polyolefines generally, nylon, etc.

What is claimed is:

1. A target mat for projectile comprising:

a roll of fluted corrugated material, the roll having a core portion,

the corrugated material comprising a first flat sheet of material adhered to a second sheet of corrugated material, the first and second sheets having side edges,

the corrugated material comprising a plurality of longitudinally extending rows of staggered corruga-

tions along the thickness of the corrugated material, with adjacent corrugations having common boundaries, the corrugations in each row staggered relative to the corrugations in any adjacent row,

wherein each corrugation has a cross section such that the projectile of a given diameter can fit therein only by stretching and deforming the corrugation,

the corrugated material being spirally bound in the roll, whereby layers of corrugations are superimposed one over the other,

means to fasten the layers together to prevent their coming apart, and

the side edges of the first and second sheets of the roll defining the target mat surface and back.

2. The target mat as recited in claim **1**, wherein the roll is made of thermoplastic material.

3. The combination of claim **2**, wherein the thermoplastic material is selected from the group consisting of polyolefines and nylon.

4. The combination of claim **3**, wherein the core or center portion of the roll is a cylinder of relatively small diameter comprising compacted fibers extending in a generally axial direction.

5. The combination of claim **4**, wherein the corrugations have open ends.

6. The combination of claim **5**, wherein the core is replaceable.

7. The combination of claim **4**, wherein the corrugations have closed ends.

8. The combination of claim **7**, wherein the core is replaceable.

9. The target mat of claim **1**, wherein the longitudinally extending rows have transverse corrugations which are transverse to the path of the projectile and which transverse corrugations in different rows are in line with each other.

10. The combination of claim **9**, wherein the roll is made of a material selected from the group consisting of polyolefines and nylon, and wherein the core is a cylinder of relatively small diameter comprising compacted fibers extending in a generally axial direction.

11. The combination of claim **10**, wherein the core is replaceable.

12. The target mat of claim **1**, wherein the staggered corrugations have open ends.

13. The target mat of claim **1**, wherein the corrugations have open ends.

14. An improved target mat for projectiles having a rol of fluted corrugated material, the fluted material comprising a first flat sheet material adhered to a second sheet of corrugated material to define a corrugated layer, with the corrugated layer being spirally wound whereby layers of corrugations are superimposed to define the roll, the spiral layers fastened at intermittent poins to prevent them from coming apart, each corrugation having a cross-section such that the projectile can fit therein only by stretching the corrugation, the improvement comprising:

a plurality of longitudinally extending rows of staggered corrugations along the thickness of the corrugated material with adjacent corrugations having common boundaries and the individual rows are corrugated along their lengths.

* * * * *