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METHOD OF MAKING ARCHERY TARGET BUTTS AND MACHINERY THEREFOR

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3 Sheets-Sheet 3

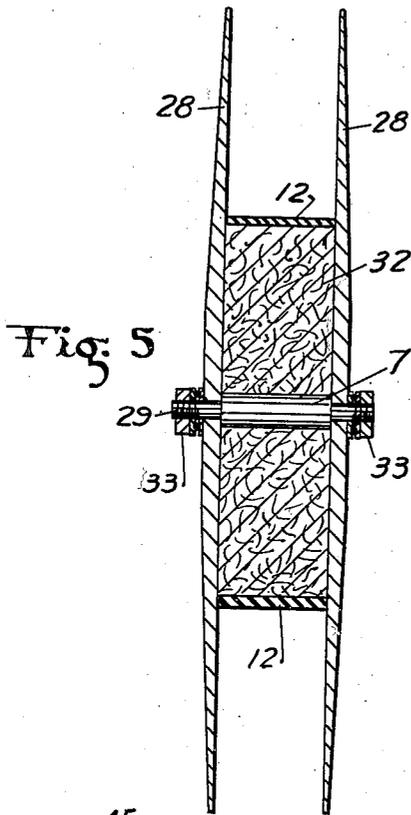


Fig. 5

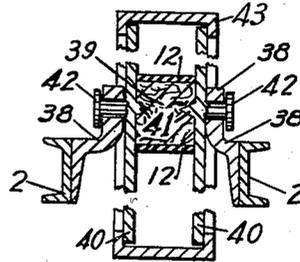


Fig. 9

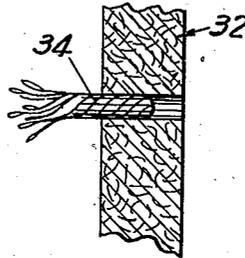


Fig. 6

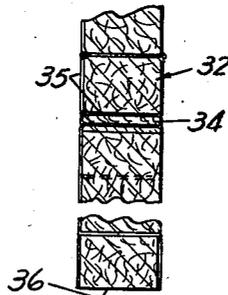


Fig. 7

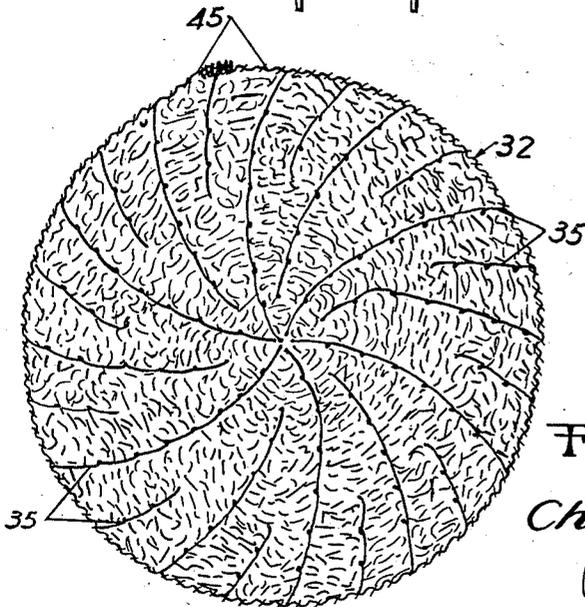


Fig. 8

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# UNITED STATES PATENT OFFICE

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## METHOD OF MAKING ARCHERY TARGET BUTTS AND MACHINERY THEREFOR

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6 Claims. (Cl. 19—149)

This invention relates to improved methods for the manufacture of archery target butts and to apparatus for making such butts and other articles formed by coiling straw, wood shavings, cotton linters, or the like.

While the invention has a broad field of usefulness, I have found it of particular utility in the construction of archery target butts and the like, and I therefore find it convenient to describe the invention in connection with the manufacture of such articles, it being understood, however, that such limited fields of specific application are employed purely for purposes of illustration, and that the method and the machinery of the present invention are adapted to be utilized in the manufacture of a wide variety of other articles.

Archery target butts hitherto have been made by hand without the assistance of special machinery. According to the method of the prior art, a handful of straw is twisted into a small spiral coil, from which the ends of the stalks protrude tangentially. The coil is stitched to hold it together. Thereafter the ends of another handful of straw are placed against the coil under the tangentially protruding portion, and both said protruding previous portion and the newly added straw are wrapped about the periphery of the coil, the ends of the preceding portion covering the beginning of the newly added portion. The free ends of the previously added portion are pulled tautly against the coil with one hand, and the body of said portion is hammered into place by means of a mallet wielded in the other hand. While still pulling on the free ends of the previously added portion with one hand, the body of said portion and the underlying ends of the newly added portion are fastened to the coil by means of a needle and twine manipulated with the other hand. Because of the resilient nature of the felted mat, it is necessary to fasten each handful of straw in position immediately after hammering it into place. The above described series of operations is repeated until a butt of the desired size has been made.

Not only is hand manufacture slow, tedious, and expensive, but in addition considerable difficulty is encountered in making the rim of the butt circular. Hand-made butts have the following principal defects: (1) They are not sufficiently dense, and accordingly wear out too rapidly under the pounding of the arrows. (2) The center region, where most of the arrows strike, is less tightly wound than the peripheral region, whereas it ought to be more tightly wound, since

it is exposed to the greater wear. (3) The butt has a tapered rim, and arrows striking the thin portion thereof may pass completely there-through and be stripped of their feathers or otherwise injured. (4) The striking surface is not sufficiently smooth and uniform.

Target butts made according to the method of the present invention do not have the above deficiencies. In my improved method, the straw or other raw material is coiled, compressed, shaped, and continuously maintained in shape and under compression, by means of a taut, moving endless belt which substantially encircles the work while the article is being made.

The straw is coiled about a mandrel (which however may consist of straw twisted into the necessary shape) rotated by the movement of the encircling belt. Suitable guides are provided to control the width of the butt, and to insure that the faces thereof are plane and relatively smooth.

The work is maintained in the desired shape and under suitable compression by the guides and the encircling belting throughout the course of manufacture, so that it is not necessary to interrupt the coiling operation to fasten down the work. After the work has attained the desired size, the otherwise complete butt may be sewed at one time while it is still in the machine. Or, if desired, a strip of fabric may be fed into the machine and thereby wrapped around the periphery of the butt. After the annular casing thus formed has been joined together in any suitable manner, the article may be removed from the machine and sewed at leisure, the annular casing meanwhile preventing expansion of the compacted mass comprising the article.

It is a principal object of the present invention to provide a method whereby archery target butts and similar articles may be fabricated by machinery.

Another object is to provide machinery for fabricating coiled mats without interrupting the coiling operation to sew down the partly completed work.

Another object is to provide a method for continuously coiling resilient material into a spiral mat maintained under pressure throughout the entire coiling operation.

Another object is to provide apparatus whereby the distribution of density in the finished article may be controlled in a predetermined manner.

Another object is to provide a method for fabricating archery target butts whereby there will be a radial gradation in the density of the article.

Another object is to provide apparatus for constructing an archery target butt which has a relatively hard, densely packed midsection impermeable to arrows and relatively soft, smooth, uniform striking surfaces adapted to prevent arrow bounce outs.

Another object is to provide apparatus for constructing a spirally coiled mat which is more densely packed near the center than near the periphery.

Another object is to provide machinery for constructing an unsewn archery target butt maintained under tension for purposes of storage by means of a suitable wrapping.

Another object is to provide a machine into which straw or like material may be fed, which conveys said materials to a form and there compresses it, crushes it, and winds it about a spool between retaining end members to form a spiral mat.

Other objects are to provide methods and apparatus of maximum simplicity, economy, ease of use, and safety.

The foregoing and such other objects, advantages and capabilities as may appear herein or be pointed out as this description proceeds, or as are inherent in the present invention, are illustrated in the accompanying drawings, in which:

Figure 1 is a central vertical longitudinal sectional view taken on line 1—1 of Figure 2.

Figure 2 is a plan view of a machine constructed according to the present invention, the frame thereof being shown in broken lines to avoid confusion.

Figure 3 is a fragmentary detail view in central vertical longitudinal section and illustrates the mat-forming portion of the machine shown in Figures 1 and 2 at the beginning of the cycle of operation.

Figure 4 is somewhat similar to Figure 3, and illustrates a later stage in the manufacturing process.

Figure 5 is a vertical transverse sectional view taken on line 5—5 of Figure 4.

Figure 6 is a fragmentary sectional view taken on a diameter of an archery target butt constructed by the method of the present invention, and illustrates the manner in which the center of the butt may be stuffed.

Figure 7 is a fragmentary elevational view of the periphery of a completed target butt constructed according to a process of the present invention.

Figure 8 is a front elevational view of the face of a completed target butt fabricated in accordance with the present invention.

Figure 9 is a fragmentary detail view in central vertical transverse section and illustrates a modification of the invention which dispenses with the use of a mandrel between the guide plates.

Like reference characters are used to designate similar parts in the drawings and in the description of the invention which follows.

Referring now more particularly to the drawings, Figures 1 and 2 illustrate one form of a machine constructed according to the present invention and suitable for use in practicing the novel processes disclosed herein.

The machinery is arranged on a suitable framework 2 having legs 8, 8 and a shelf or table portion 3. Movably arranged upon the framework 2 near one end thereof is a belt tightener, exemplified by the sliding carriage 4 mounted

upon the rails 37, 37 and carrying the pulley 6. Near the opposite end of the frame 2 the mandrel 7 is positioned. The framework supports a superstructure or scaffold 9. Upon this scaffold is suitable means for driving a belt, exemplified by the electric motor 10. Attached to said motor 10 is the drive wheel 11. Passing over the pulley 6, the mandrel 7, and the drive wheel 11 is the endless belt 12.

To the belt tightener is attached a suitable tensioning device, exemplified by the weight 13 which is attached to the carriage 4 by means of the cord 14, which passes over the pulley 15. Alternatively one end of a spring may be attached to the carriage 4 and the other end may be attached to some fixed portion of the framework 2 whereby motion of the carriage to the observer's right is yieldably resisted. Or, if desired, the pulley 6 may be fixed, and the necessary tension may be obtained by making the belt 12 of elastic material and stretching it tautly between said pulley 6 and the mandrel 7.

If desired, an idler pulley 16 may be placed near the drive wheel 11 so as to guide the belt 12 to avoid slipping between the belt 12 and the drive wheel 11.

The ledge 3 is inclined somewhat to the right. To it is joined the mouth of the hopper or feeding guide 17. The discharge end of said hopper empties upon the belt 12 slightly in front of the mandrel 7. Said mandrel is supported by the idler 18 which is carried by a movable carriage 19 which moves along the ways 20, 20 forming an extension of the framework 2. Said carriage may be manually slidable or, if desired, it may be attached to a worm 21, operated by the synchronous motor drive 22. In the latter arrangement, the motor 22 progressively moves the idler carriage 19 and the pulley 18 thereon at a uniform rate to the right.

Mounted upon the scaffold 9 is the pivotal guide arm 23. The said guide arm 23 is slotted, and the brace 30 passes through said slot and limits the movement of said guide arm 23 to a vertical plane. Attached to the free end of said guide arm 23 is the guide roller 25, which rests upon the belt 12. Projecting from the scaffold 9 is the fixed guide arm 26, which likewise carries a guide roll 27 under which the belt 12 passes.

Fixed to the mandrel 7, on each side of the belt 12, are the circular guide plates 28, 28. Said guide plates 28 are spaced by the mandrel 7, and said plates and said mandrel are mounted concentrically on the center stud 29 (see Figure 5).

Figure 9 illustrates a modification of the apparatus, in which the frame 2 is provided with brackets 38. The upper surface of each of said brackets 38 follows the arc defined by the center of the butt as the work increases in size. The mandrel 7 and the center stud 29 are dispensed with, and the straw or the like is coiled about a plug 39 formed of the same material. If desired, the end guides 40, 40 may be provided with points 41, 41 to be anchored in said plug 39. Protruding outwardly from the center of each guide plate 40 is a bearing 42, which, if desired, may be flanged as shown. One or more spacer clamps 43 may be employed to prevent the guide plates 40, 40 from becoming separated too far while the butt is under construction.

For purposes of illustration, the operation of my improved machine in producing an archery target butt of straw will now be described. It is distinctly to be understood, however, that the machine may be used in the same manner with

materials other than straw, and for the purpose of fabricating articles other than archery target butts.

At the beginning of the cycle of operation, the machine is in the condition illustrated in Figures 1, 2, and 3, the pulley carriage 4 being in its extreme position to the left. The mandrel 7 floats upon the idler 18. The guide plates 28, 28 are rotatably attached to the mandrel. The subassembly consisting of the mandrel, center stud, and guide plates is held in place by the guide arm 26, the end of which projects between the two guide plates 28. The idler pulley 27 at the end of the guide arm 26 rests upon the belt 12 and causes said belt almost completely to surround the mandrel 7. The pivotal guide arm 23 is supported suitably, so that the roller 25 is maintained a few inches above the belt 12.

A supply of straw is placed upon the table 3. The motor 10 moves the belt 12 in the directions indicated by the arrows. An operator manually feeds the straw into the hopper or feed funnel 17. If desired, the straw may be twisted into a rope before being fed into the hopper 17, or while being so fed.

The straw passes through the hopper and is fed upon the belt 12 through the discharge end of said hopper, said discharge end being adjacent the guide pulley 27. The motion of the belt feeds the straw between the mandrel 7 and the belt 12. When the machine begins to operate, the mandrel 7 is rotated by frictional engagement with the moving belt 12. As more straw is fed into the machine, it is wrapped spirally about the mandrel 7. At this stage, the mandrel and the work rotate, but the guide plates 28, 28 usually do not.

As the work becomes larger, frictional engagement of the coiled straw with the guide plates causes the latter to rotate with the work and the mandrel. Also, the work will raise the belt 12 until it makes contact with the roller 25 and floats the pivotal guide arm 23 off its support. Thereafter said roller 25 will rest upon the work and assist in compressing the same. If desired, said guide arm 23 may be suitably loaded, as shown at 44, to increase the pressure upon the work. The guide arm 23 maintains the guide plates 28, 28 in vertical position, and prevents said guide plates from wobbling.

The weight 13 keeps the belt 12 under tension at all times. As the work progresses, the parts take the relative positions shown in Figure 4. It is to be noted that the belt 12 almost completely surrounds the work 32 throughout the course of operation, and that the tension of the belt serves to compress the work at all times. This is necessary because a resilient material like straw would spring out into a relatively porous mass if the tension were removed.

The tension upon the belt exerts a force against the work in the form. At the beginning of the operation the total force is distributed over the relatively small peripheral area of the work, for which reason the pressure (force per unit area) is greatest when the size of the object is smallest. As the coiling operation proceeds and the unfinished butt becomes larger, the total force due to the belt tension is distributed over a larger peripheral area, and the pressure, therefore, is less. Thus my improved machine automatically varies the pressure upon the work so as to construct an article which is densely packed near the center, and in which the density of felting

progressively increases from the periphery to the center.

As the butt increases in size, the quantity of belt in peripheral contact therewith likewise increases. This causes the carriage 4 to be drawn to the right and the weight 13 to be lifted.

The work is supported by the idler 18. As the coiling proceeds, the mandrel 7 will be displaced upwardly and to the right. Since the center of gravity of the work follows the mandrel 7, it is desirable to move the idler 18 to the right also, as the work progresses. This may be done manually. Alternatively, the mandrel and the idler may be connected with suitable linkage (not shown) so as to maintain said idler under said mandrel at all times. The preferred arrangement, however, is to mount the idler carriage 19 upon a screw 21, so that said carriage may be translated by rotation of said screw. Preferably, said screw is revolved by a synchronous electric motor 22 at such a rate that the idler 18 moves to the right somewhat more rapidly than the mandrel 7. This causes the work to be cradled between the guide roller 27 and the idler 18, as shown in Figure 1 in dotted lines. This arrangement is effective in preventing rocking of the work, as might be the case if it were supported only by the idler. Further, this arrangement increases the clearance between the bottom of the belt 12 and the roller 27, making it possible to increase the rate at which straw is fed to the work as the latter increases in size.

I prefer to use a crowned idler 18 having a peripheral width somewhat less than the space between the guide plates 28, 28. The weight of the work tends to crush the straw against the idler, and the arrangement above mentioned results in the formation of an article having a midsection more densely packed than the surface layers. The relatively loose surface layers are easily penetrated by arrows, so that arrow rebounds are minimized; whereas the densely packed central layer prevents the arrows from passing there-through. This effect can be heightened by feeding the straw to the center of the belt, which is readily effected by appropriate adjustment of the discharge end of the hopper 17.

The pressure upon the work crushes the straw against the guide plates 28, 28, with the result that the striking surfaces of the butt are planar, smooth, and uniform. This improves the appearance of the article, and causes the faces to remain usable for longer periods of time than has heretofore been possible.

The coiling operation may be continued until the butt has been built up to any desired size. At the end of this operation, the pulley carriage will be in the position shown in Figure 1 at 4', the pivotal guide arm will be in the position shown at 23', the mandrel will be in the position shown at 7', the idler support carriage will be in the position shown at 19', and the idler will be in the position shown at 18', the guide plates will be in the position shown at 28', and the work will have the size and position indicated at 32'. The motors 10 and 22 are then stopped. One or both of the guide plates 28, 28 may be removed, and the butt may be sewed while it is in the machine, in order to maintain the article in compressed condition. Alternatively, the guide plates 28 may be perforated in such manner as to permit the butt to be sewed without removing said plates.

After the sewing operation has been completed, the tension on the belt is relieved, as for example, by disconnecting the weight 13 from the pulley

carriage 4. Then the guide plates 28, 28 are removed, and the mandrel and butt are removed from the machine. The center stud 29 is knocked out, the mandrel is filled with a portion of tightly twisted straw, and thereafter the mandrel is knocked out of the butt, care being taken to drive the straw out of the mandrel into the space being vacated by the mandrel itself. As the mandrel is withdrawn from the butt 32, more straw is stuffed into the hollow core left by the mandrel, in order to provide a solid butt having a tightly packed center.

Figure 9 illustrates an alternative arrangement whereby the butt may be fabricated with a solid center from the beginning. A small quantity of straw is twisted or compacted into a plug 39 which serves in place of the mandrel. This plug or small coil may be suitably fastened together, as by stitching, if desired. Said plug 39 is encircled by the belt 12, and the guide plates 40, 40 are pinned to it as shown, the points 41, 41 being inserted in the ends of the plug along the axis thereof. Each guide plate 40 is supported upon a bracket 38 by means of a bearing 42. Said bearings 42, 42 may be flanged as shown to engage the bracket sides and prevent wobbling of the guides 40, 40. One or more spacer clamps 43 may be employed to prevent the peripheral edges of the guides 40, 40 from separating too far from each other. It will be understood that said clamps 43 do not rotate with said guides 40, 40. As the work grows larger, the bearings 42, 42 will move along the brackets 38, 38, following substantially the same trajectory as the mandrel 7 does in the previously discussed embodiment. In other respects, the operation is the same under both arrangements, except, of course, that, in the arrangement shown in Figure 9, it is not necessary to remove any mandrel and stuff the hollow core left thereby.

Figure 7 is a fragmentary central section along a diameter of the finished butt, and shows the stitching 35, the stuffed core 34, and the flat peripheral edge 36 produced by the action of the belt 12, the pulley 27, the roller 25, and the idler 18. My improved target butt has a relatively flat rim, which is much to be preferred over the rounded peripheral edge of the target butts of the prior art, because arrows which strike near the periphery of my improved butt will be caught, instead of passing through a thin edge region and thereby being stripped of their feathers.

Instead of stitching the butt while it is under compression in the machine, the following alternative procedure (which is the preferred procedure) may be followed. When the butt has reached the desired size, a strip of burlap or other suitable material is fed into the hopper 17, whereupon the movement of the belt 12 causes said strip to be wound around the periphery of the butt 32. Thereafter, the ends of the burlap are joined together in any suitable manner, as for example, by means of buckles. Or the fabric may be passed several times around the butt and the overlapping layers of fabric may be sewed together. Thus the coiled butt is prevented from uncoiling by the fabric belt in which it is retained. The butt and its surrounding fabric belt may now be removed from the machine. The article may be sewed in the usual manner at any time thereafter. It will then present the appearance shown in Figure 8, in which the fabric casing is designated at 45, and the stitching at 35. If desired, the casing 45 may be removed after the straw has been sewed down, but I prefer to sew said casing 45 to the rest of

the butt in order to utilize it as a permanent reinforcement.

Thus it will be seen that I have invented a machine which coils resilient material while maintaining the entire mass of the resilient material under tension through the course of the coiling operation. Obviously the use of my improved machine multiplies the rate of production over hand methods, and in addition enables the manufacturer to control the density of packing and to graduate the density in various parts of the same butt. The method of construction disclosed herein has the prime advantage of simplicity, and furthermore makes it possible to fabricate an unstitched target butt at very low cost and to encase it conveniently and quickly in the machine with a suitable binding so that it may be shipped in an unstitched condition to the archer, who can complete the butt by stitching it by hand at his leisure. The opportunity for economy thus extended to the toxophilist is obvious.

Comparison of target butts constructed in the apparatus of the present invention with ordinary hand-made target butts conclusively demonstrates the superiority of the former. My method of construction assures that the article will have a round flat surfaced peripheral rim, and that the faces will be planar, parallel, and smooth. Since the straw in my improved article is packed far more densely than is possible by hand methods, a target of tournament quality and having the standard diameter and weight will be substantially thinner than the articles of the prior art, and therefore is more convenient to handle, and takes up less storage space. Since the butt is all stitched at one time, the stitching is more uniform than in prior art constructions. And as has already been pointed out, my targets are particularly long wearing because the density is greatest where the wear is greatest.

While I have illustrated my invention by describing the details of one form of operative machine, and have outlined the steps in my new process with particularity, it will be apparent to those skilled in the art that numerous modifications and variations therefrom may be made without departing from the scope of my invention. The specific method of feeding the raw material into the machine, of supporting the work, and of maintaining tension upon the belt system are all capable of substantial modification within the scope of my invention.

While the invention has been illustrated and described herein with special reference to a machine particularly adapted to manufacture butts for archery purposes, it is distinctly to be understood, nevertheless, that the present invention contemplates and embraces a general method for manufacturing butts, pads, mats, mattresses and other articles fabricated by coiling and compressing strands, fibers or reeds into circular disks, from which it will be apparent that the instant invention has a wide field of industrial utility.

Having thus described my invention and illustrated its utility, I claim:

1. Machinery for making archery target butts or the like, comprising a mandrel, a plate on each end of said mandrel, a frame, a guide arm pivoted upon said frame and adapted to minimize side thrust of said mandrel, an endless belt passing around said mandrel, means for driving said belt, a belt tightener to accommodate said belt to changes in the size of the butt under fabrication on said mandrel, means connected to said

belt tightener for maintaining tension upon said belt, an idler arranged upon said frame to cause said belt substantially to encircle said butt, a second idler movably mounted upon said frame and adapted to support said butt, means for continuously maintaining said second idler under said butt, and a hopper for guiding straw or the like between said mandrel and said belt.

2. Machinery for making archery target butts or the like, comprising a floating spool with detachable flanges, a frame, a member on said frame for maintaining said spool in position, an endless belt turning around said spool, means for maintaining said belt under tension, means for driving said belt, a belt tightener to accommodate said belt to changes in the size of the butt under fabrication on said spool, an idler arranged upon said frame to cause said belt to encircle a major portion of the periphery of said butt, a second horizontally displaceable idler adapted to be maintained under said butt for supporting the same, and means for feeding straw or the like between said spool and said belt.

3. Machinery for coiling straw or the like, comprising a mandrel, two guide plates, each detachably connected to one end of said mandrel, an endless belt arranged substantially to encircle the coil upon said mandrel, means for maintaining said belt under tension, means for driving said belt, means continuously accommodating said belt to the size of said coil, an idler translatable under said coil for supporting the same, and means for guiding straw or the like between said mandrel and said belt.

4. Apparatus for forming fibrous material or the like into a compressed mat, comprising a mandrel, a guide plate on each end of said mandrel, a frame, a guide arm hinged upon said frame and extending between said guide plates to minimize side thrust, a roller on the free end of said guide arm and adapted to bear against the work on said mandrel, means connected to

said guide arm whereby the load upon the work may be increased, a belt tightener movably mounted upon said frame, an endless belt passing around said belt tightener and around said mandrel between said guide plates, means connected to said belt tightener for maintaining tension upon said belt, means for driving said belt, an idler fixed to said frame and causing said belt to substantially encircle the work upon said mandrel, a second idler movably mounted upon said frame and adapted to support the work, means for continuously maintaining said second idler under the work, a table on said frame, and a hopper adjacent said table for feeding fiber or the like upon said belt adjacent the work.

5. Machinery for making archery target butts or the like, comprising a frame, a pair of substantially parallel brackets on said frame defining the trajectory of the butt axis as the butt is built up, two plates, each rotatably supported by one of said brackets and slidable thereon, means on each of said plates for fixing the same to the butt under construction, a driven endless belt passing between said plates and around said butt, guide means for causing said belt substantially to encircle said butt, means for causing said belt to compress said butt, horizontally adjustable rotatable means for continuously supporting said butt as the same expands, and means for feeding fibrous material or the like between the periphery of said butt and said belt.

6. The method of making an archery target butt which comprises twisting fibrous strands into rope-like lengths, coiling said lengths spirally about a central support while maintaining the work under peripheral compression, flattening and smoothing the faces and rim of said butt while the same is being formed, sewing said butt while the same is under compression, and removing said central support and replacing the same with fibrous strands.

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