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Bennison

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[54] **MATERIAL STITCHING APPARATUS**

[75] Inventor: **Michael Newstead Bennison,** Leeds, England

[73] Assignee: **W. J. Clarkson Limited,** Leeds, England

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Oct. 29, 1970 Great Britain.....51,441/70

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[51] **Int. Cl.**.....**D05b 21/00**
[58] **Field of Search**.....112/27, 86, 90, 103, 112/118, 119, 121.11, 121.12, 121.15, 207

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Primary Examiner—Werner H. Schroeder
Attorney—Richard K. Stevens et al.

[57] **ABSTRACT**

Apparatus for facilitating the stitching together of layers of material comprising in combination, a template capable of holding superposed layers of material, and being formed with a guide track; and a sewing machine having a guide member engageable with said guide track, and driving means for driving said template so that said guide track moves about said guide member, said driving means comprising a member pivotally mounted on a fixed bed of said sewing machine, a roller rotatably mounted on said member, biasing means for biasing said roller in a direction such that it can frictionally engage an edge of said template, and means for driving said roller in a given sense of rotation, the arrangement being such that when said roller is in engagement with said template, the angle between (a) the line joining the axis of rotation of said roller and the joint of contact between said roller and said template, and (b) the line joining said axis of rotation and the pivotal axis of said member, measured in the sense of rotation of said roller, lies between 190° and 270°. This relationship ensures good frictional engagement between the roller and the template. The drive means may include two or more concentric rollers of different diameter, and said template then has a guide track including straight and curved sections, an edge lying outside said guide track and shaped substantially complementary to said guide track, and drive parts in the region of said curved sections and displaced from said edge; one of said rollers being engageable with said edge and the other engageable with one or more of said drive parts, said edge and drive parts being shaped so that when one is engaged by one of said rollers the other is not engaged by any of said rollers. This arrangement can be designed to ensure that the speed of the guide track past the sewing machine needle is constant whether drive is applied to a straight or to a curved section of the template.

17 Claims, 5 Drawing Figures

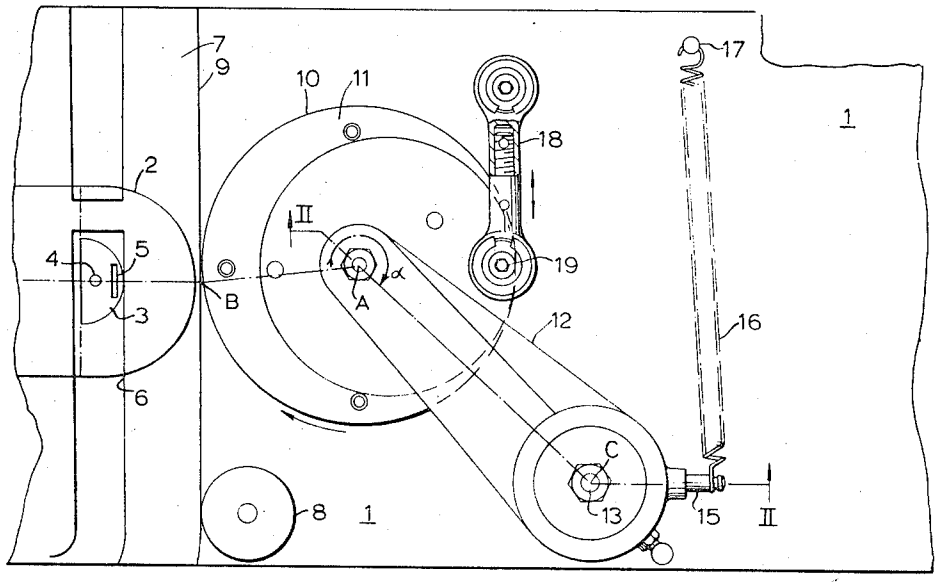
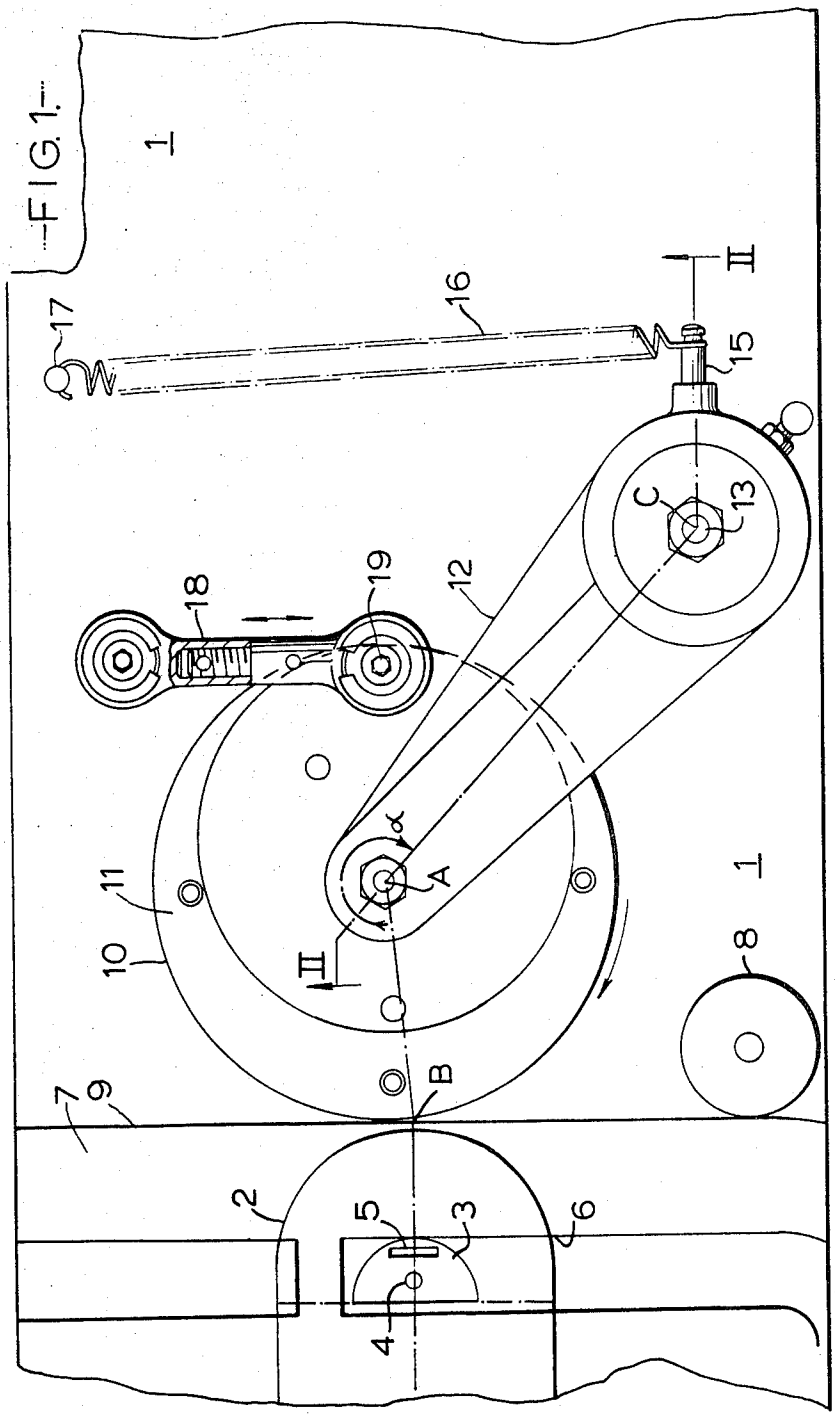


FIG. 1



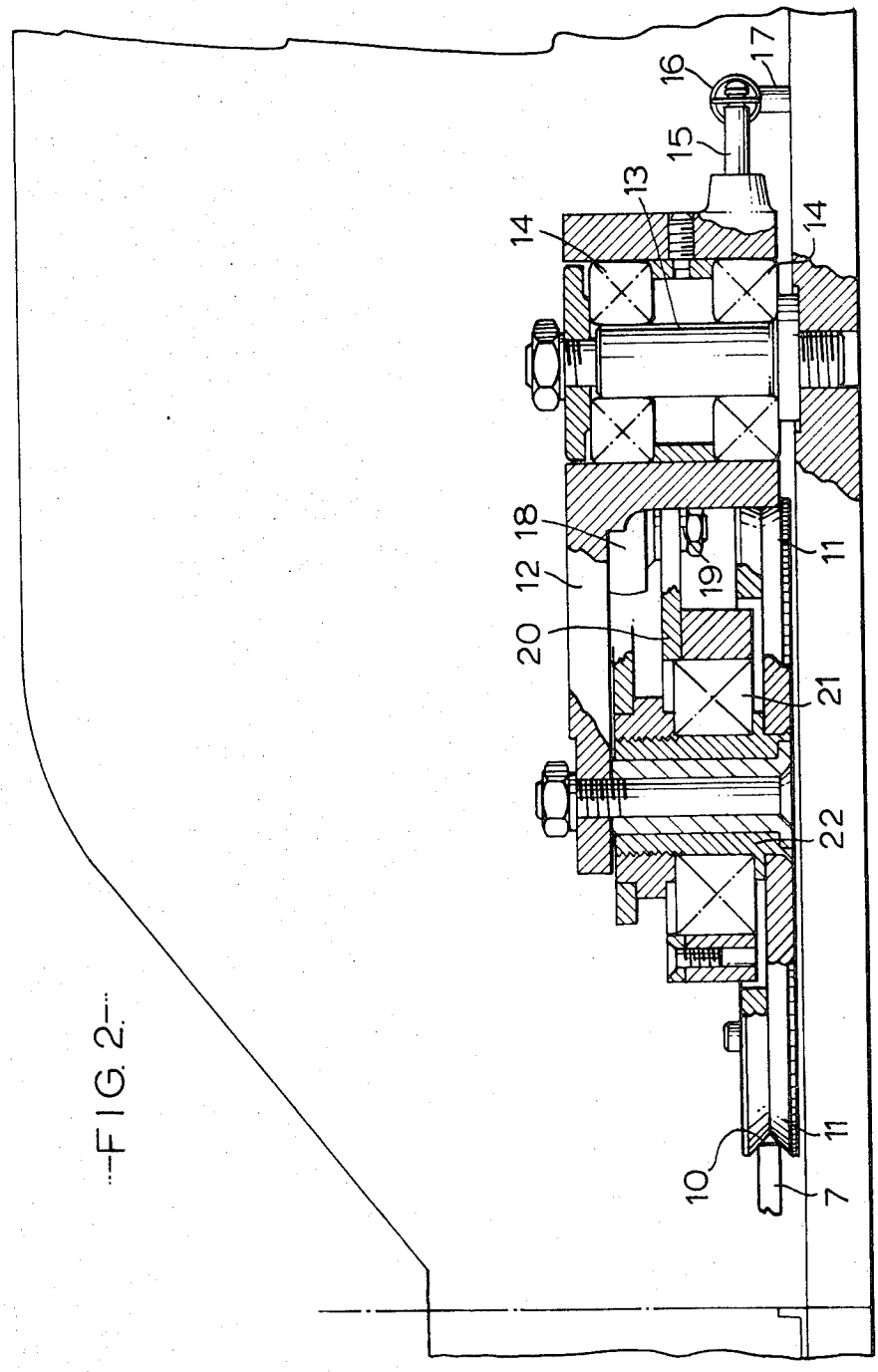


FIG. 2

FIG. 3

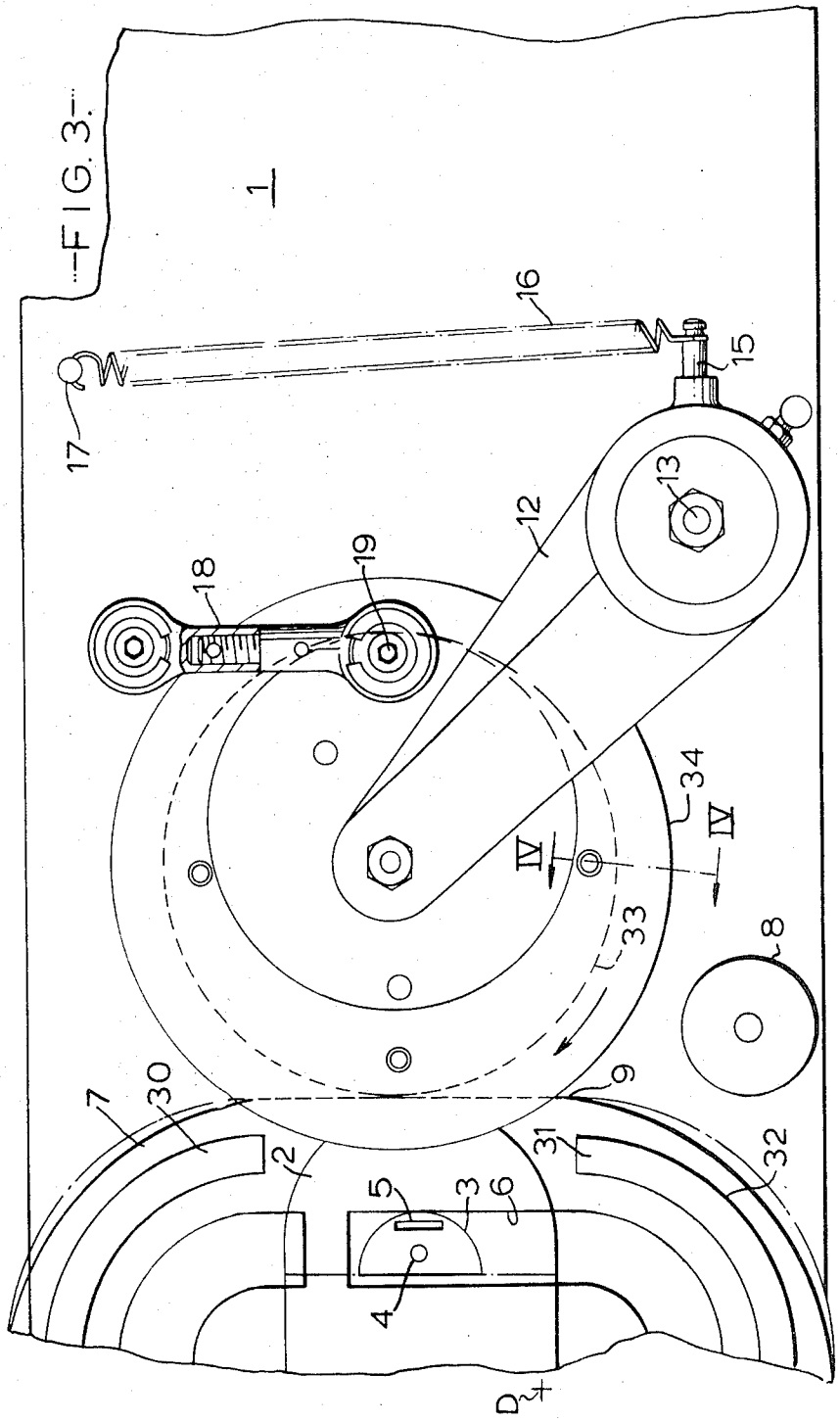


FIG. 4

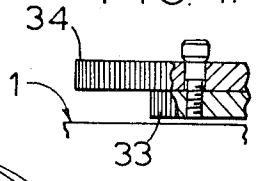
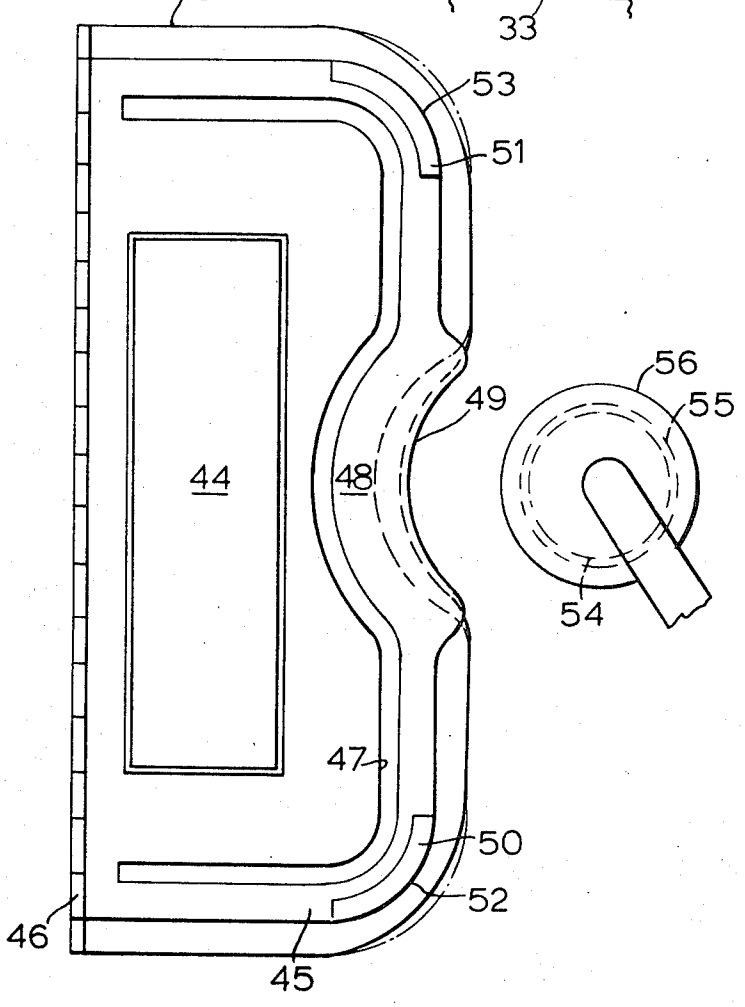


FIG. 5



MATERIAL STITCHING APPARATUS

This invention relates to apparatus for facilitating the stitching together of material.

In the manufacture of some articles, particularly parts of garments, certain operations involve the stitching together of at least two layers of material along a desired stitching line. It is known to hold the layers of material in superposed relationship on a template having a guide track engageable with a guide element on a sewing machine. The arrangement is such that by moving the template so that the guide track moves about the guide element the layers of material are moved beneath the needle of the machine, which passes through material exposed in the guide track so that the material is stitched together along the desired line.

The present invention is concerned with means for driving the template about the guide element and, according to the invention in a sewing machine for use in conjunction with a template as aforesaid, such means comprises a member pivotally mounted on the bed of the sewing machine, a roller rotatably mounted on said member, for biasing the roller in a direction such that it can frictionally engage an edge of an associated template, and means for driving the roller in a given sense of rotation, in which the parts are arranged so that when the roller is in engagement with an associated template, the angle between (a) the line joining the axis of rotation of the roller and the point of contact between the roller and the template, and (b) the line joining said axis of rotation and the pivotal axis of said member, measured in the sense of rotation of the roller, lies between 190° and 270°.

In use, with the roller driving the template, the driving force creates a reaction acting at the axis of rotation of the roller, and this reaction acts to move the member about its pivot. The particular positioning of this pivot ensures that the reaction will act to move the member towards the template and the drive is thus self-tightening, i.e., the mere fact of driving increases the engagement pressure between the roller and the template. Consequently the drive to the template is at all times transmitted with little or no slipping. This enables untoothed members to be used for both the roller and the template while still obtaining an effective drive. Although toothed members may be used, untoothed members are preferable from an economic standpoint, and also because the templates driven by the roller may have an edge of any shape dictated by the desired stitching line. This shape may have linear, convex and concave sections and difficulties may be encountered in attempting to use a drive relying on engaging teeth. To improve the positiveness of the drive in the drive means of the invention the driving edge of the roller may be knurled.

Desirably the angle between the two aforesaid lines lies between 210° and 240°. The value of the angle will be dependent on the radius of the roller, and this is chosen to be suitable for the size and shape of template to be used.

Preferably the member is a lever having the roller rotatably mounted at the end of one arm thereof, and having one end of a tension spring anchored to the end of the other arm thereof, the other end of the tension spring being anchored to the bed of the machine, and the spring constituting the said biasing means.

Such a drive arrangement is generally designed so that when the roller or pinion engages a straight section of the edge of the template, the template is moved at the same linear speed as material would be moved by the usual material feed means of the sewing machine. The diameter of the roller or pinion used in this drive will generally dictate that there be a certain distance between the track and the outer edge of the template. Engagement of this edge with the roller or pinion will, when the edge and the track are straight, drive the edge and track sections at the same linear speed. Certain profile stitching, however, requires that the line of stitching turn a right angled or other sharp corner. As the edge of the template lies outside the track the length of the edge round a corner convex towards the roller or pinion will be greater than the length of the track, and thus the linear speed of the track will be less than the linear speed of the edge if the roller or pinion is driven at constant speed. Thus, on convex corners the material will move under the needle more slowly than it does on the straight sections, resulting in a greater stitch density in the corner regions, which may be undesirable. Similarly, in concave areas the material will move under the needle more rapidly to give lower stitch densities.

According to a further feature of the invention, therefore, the apparatus includes two or more concentric rollers of different diameter for driving a template having a guide track including straight and curved sections, an edge lying outside the guide track and shaped substantially complementary to the guide track, and drive parts in the region of the curved sections lying either inside or outside of the edge, one of said rollers being engageable with the edge and the other engageable with one or more of the drive parts, the edge and drive parts being shaped so that when one is engaged by a driving means the other is not.

From a further aspect apparatus according to the invention comprises a template for holding the material, the templates having a guide track engageable by means on the sewing machine and including straight and curved sections, an edge lying outside the guide track and shaped substantially complementary to the guide track, and drive parts in the region of the curved sections lying either inside or outside of the edge; and at least two commonly driven concentric template driving means of different diameter, one engageable with the edge and the other engageable with one or more of the drive parts, the edge and drive parts being shaped so that when one is engaged by a driving means the other is not.

In such apparatus a normal diameter driving means will be arranged to engage the straight sections of the edge of the template to drive the template at a normal speed. Driving means having a diameter greater than the normal diameter will be arranged to engage drive parts lying inside of the edge, i.e., between the track and the edge, in areas where the track presents a convex curve to the drive means. The peripheral speed of this driving means will be greater than that of the normal diameter driving means and the template will thus be driven more quickly round the corner. The speed will of course depend on the diameter of the drive means and on the spacing between the track and the drive parts, which will be selected so that the speed of the track below the needle round the curve is similar to

that along the straight sections. There will thus not be too great a difference in stitch density in the two regions.

In areas where the track presents a concave curve to the drive means the template must be driven more slowly, and in such regions the drive parts on the template lie outside the edge thereof and may be engaged by drive means having a smaller than normal diameter. Again, the diameter and the exact position of the drive parts will be chosen to give substantially even stitch density.

For a stitching profile having both convex and concave curves it will be apparent that three concentric drive means may be used in conjunction with drive parts lying both inside and outside of the template edge.

The invention also includes a template per se for use in the apparatus, the template having the guide track, edge and one or more guide parts lying to the inside and/or to the outside of the edge. Preferably the drive parts are secured to, or formed integral with, the upper surface of a lower plate of the template, the guide track being formed as a slot in the lower plate, engageable with a guide member secured to the throat or needle plate of the machine. A top plate of the template may then be hinged to the lower plate, and may have a peripheral edge shaped complementary and closely adjacent to the inner edge of the guide track slot in the lower plate. Alternatively both top and lower plates of the template may be formed with aligned slots forming the guide track. The guide means may then be secured to the needle plate as already mentioned, or may be a roller carried by the presser foot and engageable in the slot in the top plate, the needle passing through a bore in the roller. In this case the edge of the top plate may be shaped differently to the edge of the lower plate, and the edge of the top plate may form the drive parts in the curved regions of the template, the lower plate providing the edge for drive in the straight regions.

The apparatus of the invention is designed to be fitted to a conventional industrial sewing machine, and the drive means for the driving means is preferably a one-way sprag-type clutch driven by an oscillating member from the rocker shaft of the sewing machine. The clutch converts the oscillatory movement into a unidirectional intermittent rotation of the driving means, synchronized with the action of the needle of the sewing machine. The driving means movement is transmitted to the template to move this intermittently, the synchronization ensuring that the template only moves when the needle is out of material held by the template and is stationary when the needle is in the material.

The drive arrangement may be used in conjunction with a pure sewing machine, or with the type of machine that, as well as stitching, simultaneously cuts the material being worked along a line complementary to and outside the stitching line.

A particular embodiment of a drive according to the invention will now be described in more detail, by way of example only, with reference to the accompanying drawings in which:

FIG. 1 is a plan view of a first form of the apparatus;

FIG. 2 is a section on the line II—II of FIG. 1 with some parts omitted for the sake of clarity;

FIG. 3 is a plan view of a second form of the apparatus;

FIG. 4 is a section on the line III—III of FIG. 3; and

FIG. 5 is a plan view of a third form of the apparatus.

The apparatus is mounted on the bed **1** of a conventional sewing machine having a throat or needle plate **2**. A part-cylindrical guide member **3** is secured to the needle plate **2** and has a hole **4** and a slot **5** therein for receiving respectively a needle and a knife. The guide member engages in a guide track **6** in the lower plate **7** of a template, also having an upper plate (not shown) with an edge which follows the inner edge of the track **6**. A further plate may be interposed between the upper and lower plates to impart fulling to one or more of the layers of material placed in the template to be stitched. The outer edge **9** of the lower member of the template is smooth, and both the edge and the track **6** are shaped to suit the stitching line required in the material held in the template. A stop **8** is secured to the bed of the sewing machine to prevent the template rotating about the guide member **3** beyond a certain position.

The outer edge **9** of the template is engaged by the edge **10** of a roller **11** rotatably mounted at the end of one arm of a lever **12** pivoted at **13** to the bed **1** of the machine, the pivot including roller bearings **14** to ensure low frictional resistance to pivotal movement. The other arm **15** of the lever **12** has one end of a tension spring **16** anchored thereto, the other end of the spring being anchored at **17** to the bed **1**. The spring biases the lever anti-clockwise about its pivot to press the roller **11** into engagement with the edge **9** of the template. The edge **10** of the roller is formed with a V-shaped cross-section so that the edge **9** of the template is wedged within the V when the roller is biased into engagement with the template.

The roller **11** is driven in a clockwise direction as seen in FIG. **1**, from the conventional rocker shaft of the sewing machine. A vertical arm secured to the rocker shaft is also pivotally secured to one end of a horizontal arm **18** which is thus driven from the rocker shaft to oscillate in the direction shown by the double ended arrow. The other end of the arm **18** is pivoted at **19** to a drive input member **20** of a one-way sprag-type clutch **21**, the output member **22** of which is connected to rotate the roller **11**. The clutch is of a known type and acts so that as the input member **20** is driven clockwise by the arm **18** the output member **22** and thus the roller **11** are also driven clockwise, but when the input member is driven anti-clockwise this free wheels relative to the output member so that the roller **11** remains stationary.

The roller **11** is designed to have a diameter suitable for use with a variety of templates, and the pivot point **13** of the lever **12** is located so that at all times the angle α measured in the direction of the roller **11**, i.e., clockwise as shown in FIG. **1**, between the line AB from the axis of rotation of the roller to the point of contact of the roller with the template and the line AC from said axis of rotation to the pivot point **13** always lies between 190° and 270°. As shown, the angle is substantially 225°. Thus, as the roller applies a driving force to the template at point B in the direction of the arrow, and as the template is held against the stop **8**, this will cause a reaction at the axis A in the direction of the arrow. This will impart an anti-clockwise move-

ment to the lever 12 about the pivot 13 to force the roller 10 against the edge 9 of the template. Thus, the mere fact of driving the template increases the pressure between the roller and the template, thus improving the frictional engagement and reducing or eliminating the possibility of slipping. The spring 16 will maintain engagement between the roller and the template when there is no drive.

It will thus be seen that the intermittent rotation of the roller 11 from the sewing machine drive, gives a positive, intermittent driving movement to the template to drive this so that the track 6 follows the guide member 3. This movement will be synchronized to the machine needle movement so that the template is stationary when the needle is in material held by the template and is moving when the needle is raised out of the material. The material exposed in the track 6 of the template is thus stitched by the needle as the template is driven by roller 6. The drive is, of course, effective whether the roller engages a straight part of the edge 6 of the template, or a convex or concave curved part. The template may be shaped so that, during the driving operation, the roller moves clockwise and/or anticlockwise about the pivot 13 from the position shown. Clockwise movement will reduce the angle α, anticlockwise movement will increase this angle. However, the self-tightening effect of the drive will occur as long as this angle lies between the limiting values of 190° and 270°, although preferably the range is confined to 210° to 240°.

The apparatus shown in FIGS. 3 and 4 is designed to drive the template 9 so that the guide track 6 follows the guide member 3 and moves at a substantially constant speed past the guide member.

To this end, in the curved areas of the template the upper surface of the lower plate 7 is formed with drive parts 30 and 31 each lying between the track 6 and the edge 9, i.e., inside of the edge 9, and having an outer face which is complementary to the shape of the track in the respective curved area. As shown the track, at each corner of the template, follows an arc of a circle drawn about center D, and the outer face 32 of the drive part 30 is an arc of greater radius about the same center. In each corner area the edge 9 of the template is cut away so that it lies inside a further arc drawn about the center D, this further arc being shown in broken lines.

A pair of rollers 33 and 34 are provided for driving the template. The rollers are secured to rotate together, are concentric and both have knurled edges. The roller 33, having what will be termed a normal diameter, lies below the roller 34, which is of larger diameter. The rollers are rotatably mounted at the end of one arm of the lever 12 in a similar manner to the apparatus as shown in FIG. 1, and are driven in a clockwise direction from the rocker shaft of the sewing machine as already described.

When a straight section of the track 6 is moving about the guide the lower roller 33 is in driving engagement with the straight edge of the template, and the upper roller 34 is free from any engagement with the template. The edge of the template is thus driven at a normal linear speed related to the angular velocity and the diameter of the roller 13. The roller speed is related to machine speed and stitching at a set density will take place in that part of the material exposed by the track 6.

When the template has moved a distance sufficient to bring a curved section into the region of the rollers, the upper roller 34 will engage the outer face 32 of the drive part 30 at the same time as the lower roller 33 is disengaged from the edge 9 by virtue of the cutting away of this edge. The peripheral speed of the roller 34 is greater than that of roller 33, and the length of the outer face 32 of the drive part is shorter than the length of the edge 9 around the curve. The template will thus be driven round the guide in the region of the curve at a higher peripheral speed than it is driven along the straight sections. The diameter of roller 34 and positioning of surface 32 are selected so that the higher peripheral driving speed of the template drives the shorter center line of the track 6 past the needle at the same speed as the speed of the straight sections of the track past the needle, so that the stitch density along both curved and straight sections is the same. At the end of the curved section the roller 34 moves off the part 30 or 31 at the same time as the roller 33 re-engages a new straight section of the edge of the lower template, so that normal driving is resumed.

It will be appreciated that curves of differing radii can be accommodated by a single larger diameter roller 34, using drive parts such as 30 and 31 having surfaces 32 spaced different distances from the track 6.

FIG. 5 shows a different type of template having both convex and concave curves facing the driving rollers. This template comprises a lower plate 43, an intermediate fulling plate 44 and a top plate 45 hinged at 46 to the lower plate. Both top and lower plates have aligned tracks 47 through which the needle and knife of the machine may pass. The lower plate 43 has an edge which is, in the region of the curved sections, cut away from an exact contour complementary and parallel to the track, this exact contour being shown in chain lines. The top plate 45 has an edge which, for most of its length lies inside the edge of the lower plate 43, but in the region of the concave area 48 the edge 49 of the top plate overlaps the edge of the lower plate and runs complementary to the concave section of the track 47. At each convex corner of the template additional drive parts 50 and 51 are provided upstanding from the upper surface of the top plate 45 and having outer faces 52 and 53 complementary and parallel to the convex parts of the track 47. This form of template is used in conjunction with three concentric driving means, a lower one 54 of normal diameter for engaging the edge of the lower plate 43, a center one 55 of smaller diameter for engaging the edge 49 of the upper plate, and a top one 56 of larger diameter for engaging the faces 52 and 53 of the drive parts 50 and 51.

It will readily be seen that along straight sections of the template the lower drive means 54 engages the edge of the lower plate 43 to drive at a normal peripheral speed, in the concave sections of the template the drive means 55 engages the edge 49 of the top plate to drive at a lower peripheral speed, and in the convex sections of the template the drive means 56 engages the drive parts 50 and 51 to drive at a higher peripheral speed. The diameters of the drive means and the positioning of drive parts 50 and 51 and edge 49 relative to the edge of the lower plate are selected to

give substantially constant speed of the center of the track 47 beneath the needle.

It will be understood that the type of template shown in FIG. 3 wherein the top plate lies wholly within the track may also be designed to give the required speed adjustment in concave areas by forming the upper surface of the lower plate with drive parts projecting to outside the edge of the lower plate.

With any of the forms of template described the drive means may be a roller as described, preferably having a V-shaped or knurled edge. It is also possible to use pinions for the drive means engaging teeth on the template edges and drive parts. However, difficulty may be experienced in applying a toothed drive to templates having concave sections.

In the examples described with reference to FIGS. 3 to 5 the additional drive parts lie above the lower template having the normal drive edge. This is desirable as it is preferred to have a flat surface in engagement with the bed of the sewing machine, and to maintain as low as possible the overall thickness of the template. However, arrangements may be possible with the additional drive parts wholly or partly below the normal drive edges.

What I claim is:

1. Apparatus for facilitating the stitching together of layers of material comprising in combination, a template capable of holding superposed layers of material, and being formed with a guide track; and a sewing machine having a guide member engageable with said guide track, and driving means for driving said template so that said guide track moves about said guide member, said driving means comprising a member pivotally mounted on a fixed bed of said sewing machine, a roller rotatably mounted on said member, biasing means for biasing said roller in a direction such that it can frictionally engage an edge of said template, and means for driving said roller in a given sense of rotation, the arrangement being such that when said roller is in engagement with said template, the angle between (a) the line joining the axis of rotation of said roller and the point of contact between said roller and said template, and (b) the line joining said axis of rotation and the pivotal axis of said member, measured in the sense of rotation of said roller, lies between 190° and 270°.

2. Apparatus according to claim 1 in which said edge of said roller is knurled.

3. Apparatus according to claim 1 in which said edge of said roller is of V-shaped cross-section.

4. Apparatus according to claim 1 in which said angle is from 210° to 240°.

5. Apparatus according to claim 1 in which said pivotally mounted member is a lever having said roller rotatably mounted at the end of a first arm thereof, and having one end of a tension spring anchored to the end of a second arm thereof, the other end of said tension spring being anchored to said bed of said sewing machine, and said spring constituting said biasing means.

6. Apparatus according to claim 1, said drive means including two or more concentric rollers of different diameter, and said template having a guide track including straight and curved sections, an edge lying outside said guide track and shaped substantially complementary to said guide track, and drive parts in the region of said curved sections and displaced from said edge; one of said rollers being engageable with said edge and the other engageable with one or more of said drive parts, said edge and drive parts being shaped so that when one is engaged by one of said rollers the other is not engaged by any of said rollers.

7. Apparatus for facilitating the stitching together of layers of material on a sewing machine, comprising a template for holding the material, said template having a guide track engageable by guide means on the sewing machine and including straight and curved sections, an edge lying outside said guide track and shaped substantially complementary to said guide track, and drive parts in the region of said curved sections and displaced from said edge; and at least two commonly driven concentric template driving means of different diameter, one engageable with said edge and another engageable with one or more of said drive parts, said edge and said drive parts being shaped so that when one is engaged by a driving means the other is not.

8. Apparatus according to claim 7 in which at least one of said drive parts lies inside of said edge, and two commonly driven concentric template driving means are provided, a larger diameter one engaging said drive parts and a smaller one engaging said edge.

9. Apparatus according to claim 7 in which at least one of said drive parts lies outside of said edge, and two commonly driven concentric template driving means are provided, a smaller diameter one engaging said drive parts and a larger one engaging said edge.

10. Apparatus according to claim 7 in which first ones of said drive parts lie inside of said edge, second ones of said drive parts lie outside of said edge, and three commonly driven concentric template driving means are provided, a larger diameter one engaging said first ones of said drive parts, an intermediate diameter one engaging said edge and a smaller diameter one engaging said second ones of said drive parts.

11. Apparatus according to claim 7 in which said template comprises a lower plate having a slot constituting said guide track and said drive parts are secured to, or formed integral with, an upper surface of said lower plate.

12. Apparatus according to claim 7 in which said template comprises a lower plate and a top plate hinged to said lower plate, both said plates being formed with aligned slots constituting said guide track, and the edge of the top and bottom plates being shaped differently so that one defines said edge, and the other, at curved sections of said edge is displaced from said edge to form said drive parts.

13. Apparatus according to claim 6 in which at least one of said drive parts lies inside of said edge, and two commonly driven concentric template driving means are provided, a larger diameter one engaging said drive parts and a smaller one engaging said edge.

14. Apparatus according to claim 6 in which at least one of said drive parts lies outside of said edge, and two commonly driven concentric template driving means are provided, a smaller diameter one engaging said drive parts and a larger one engaging said edge.

15. Apparatus according to claim 6 in which first ones of said drive parts lie inside of said edge, second ones of said drive parts lie outside of said edge, and

three commonly driven concentric template driving means are provided, a larger diameter one engaging said first ones of said drive parts, an intermediate diameter one engaging said edge and a smaller diameter one engaging said second ones of said drive parts.

16. Apparatus according to claim 6 in which said template comprises a lower plate having a slot constituting said guide track and said drive parts are secured to, or formed integral with, an upper surface of said lower plate.

17. Apparatus according to claim 6 in which said template comprises a lower plate and a top plate hinged to said lower plate, both said plates being formed with aligned slots constituting said guide track, and the edge of the top and bottom plates being shaped differently so that one defines said edge, and the other, at curved sections of said edge is displaced from said edge to form said drive parts.

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