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FEED MEANS FOR SEWING MACHINES

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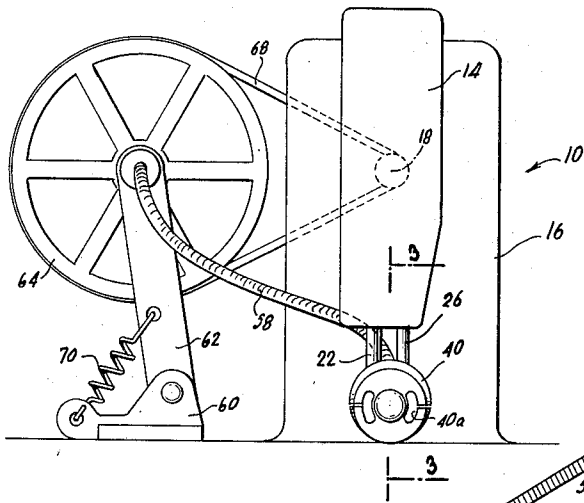


FIG. 1.

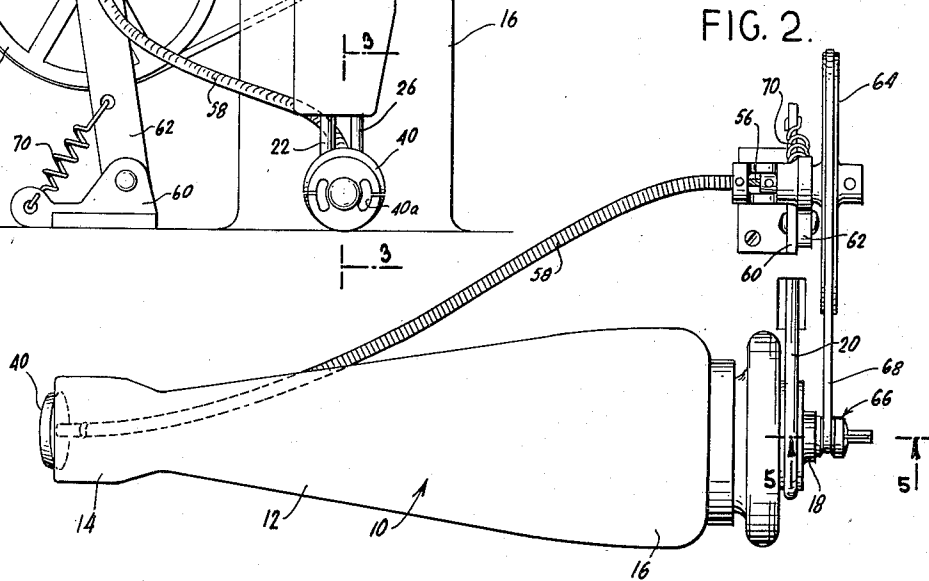


FIG. 2.

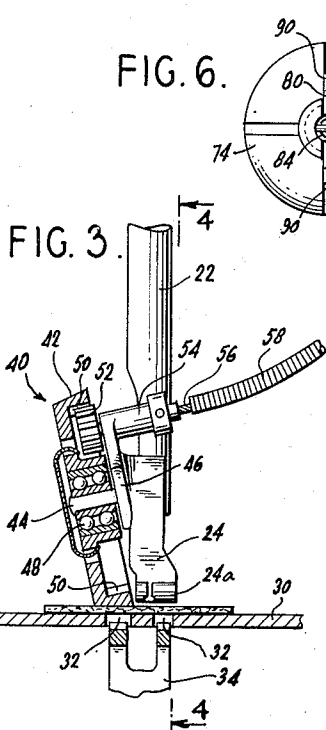


FIG. 3.

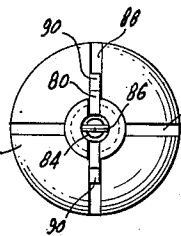


FIG. 6.

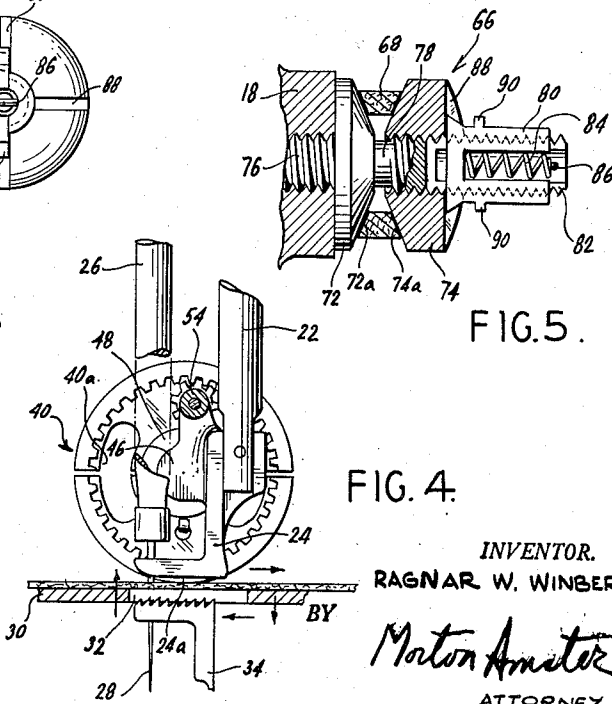


FIG. 5.

FIG. 4.

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FEED MEANS FOR SEWING MACHINES

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16 Claims. (Cl. 112—214)

The present invention relates to sewing machines, in particular to improved work-feeding mechanisms for such machines. Within the contemplation of the present invention are improved feeding means, integral with or as an attachment to a drop-feed sewing machine for advancing multiple-ply assemblies along a feed path.

In a variety of plural-layer assemblies, it is frequently necessary to augment the feeding action of the conventional feed-dog of the drop-feed sewing machine with manual feed by the operator. For example, and as is well understood, in feeding a two-layer assembly to be stitched through a sewing machine, the operator must retard the lower or under layer which is in direct contact with the feed dog to preclude gathering or bunching. The problem becomes more pronounced when feeding composite assemblies, such as one layer of a relatively smooth or slick material, and a further layer of a rather coarse or rough material. Here again, to obtain tandem or in unison feed it is necessary for the operator to restrain one of the layers in accordance with his judgment. Further, and in the event that the operator desires to attain a gathered effect, it is necessary to supplement the action of the powerized feed-dog. Although numerous devices are known for intermittently pulling or exerting a feed action on such assemblies, their action is frequently inflexible, limited in respect to attaining and withstanding high speeds, complicated, difficult to service, and incompatible with existing equipment.

Accordingly, it is an object of the present invention to provide an improved work-feeding mechanism for a sewing machine. In accordance with features of the invention, the cyclic feeding motion of the conventional feed-dog acting on an under layer of an assembly to be sewn is supplemented by a further feed mechanism such that feeding motions may be selectively imparted to an upper layer of the assembly.

It is a further object of the invention to provide an auxiliary feeding mechanism which may be associated simply and directly with standard drop-feed sewing machines most prevalent in present day use. In this sense, the several advantages of the standard drop-feed machine in respect to high-speed operation, simplicity to repair and service, and lower cost, may be retained with the addition of compound or top and bottom feed.

In an illustrative embodiment demonstrating certain aspects of the invention, a rotary feed wheel is disposed in operative relation to the throat plate of a drop-feed sewing machine and driven to advance the upper ply or layer of an assembly to be sewn in timed relation to advance of an under ply or layer. Means are provided for adjusting the feeding rate or advancing action of the rotary feed wheel in dependence upon the materials being fed and/or the desired final configuration of the stitched assembly.

As a feature of the invention, the use of a driven rotary feed-wheel exhibits the several advantages attendant to the use of known rotary presser-foots, for example, as

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disclosed in my U. S. Patent No. 2,600,597. The power feed wheel eliminates sliding friction, such as is incident to use of a fixed or stationary presser-foot. The power feed wheel, with its line contact to the work, allows for greater maneuverability and at the same time provides the desired compound and positive drive to the multiple-layer assembly. This contrasts markedly to the rotary presser-foot which merely serves as an abutment against which the feed-dog comes to bear during its forward or driving stroke.

In accordance with a still further aspect of the invention, the rotary feed wheel may be part of an external attachment for a standard drop-feed sewing machine, requiring no material modification of said machine; in the alternative, the rotary feed wheel may be an integral or internal assembly with said machine, as by being incorporated during manufacture.

Advantageously, in accordance with the illustrative embodiment of the invention, dual or compound feeding of the material to the sewing machine is accomplished simply, without material modification of the basic design of the sewing machine, and without interfering with or causing difficulty in running of the sewing machine.

The above objects and still further features and advantages of the present invention will best be understood by reference to the following detailed description of an illustrative embodiment, when taken in conjunction with the accompanying drawings:

Fig. 1 is an end elevation of a drop-feed sewing machine including an improved feeder embodying features of the present invention;

Fig. 2 is a plan view of the assembly of Fig. 1;

Fig. 3 is an enlarged elevation, with parts sectioned for the sake of clarity, showing the details of a power feed wheel in accordance with the present invention;

Fig. 4 is an elevation taken substantially along the line 4—4 of Fig. 3 and looking in the direction of the arrows;

Fig. 5 is an enlarged fragmentary detail taken substantially along the line 5—5 of Fig. 2 and looking in the direction of the arrows; and,

Fig. 6 is an elevation taken from the right of Fig. 5.

Referring now specifically to the drawings, the numeral 10 generally designates a conventional drop-feed sewing machine including machine body 12 having a head section 14 and a drive section 16. Extending longitudinally of the machine body 12 is a drive shaft 18 connected via appropriate belt and pulley means 20 to a drive motor. Within the head section or end 14 of the machine 10 is a vertical reciprocable presser-foot bar 22 which removably supports thereon a presser-foot 24. Arranged in side by side relation with the presser-foot bar 22, is a needle bar 26 carrying the usual needle 28 which is movable through a stitch-forming stroke in association with the stationary presser-foot 24. Spaced below the stationary presser-foot 24 is a throat plate 30 forming part of the bed of the machine. The throat plate 30 is formed with a pair of side by side feed slots 32 substantially coextensive with the presser-foot 24. Operatively disposed in relation to the presser-foot 24 is a feed-dog 34 which is effective through the feed slots 32 to periodically advance material to be stitched along a predetermined path in relation to the assembly of the presser-foot 24 and the needle 28. Cyclic motion, generally designated by the arrows of Fig. 4, is imparting to the feed-dog 34 by well known means in association with the drive of the sewing machine. Further description of the known mechanisms and equivalents thereof will be dispensed with in the interests of simplicity. For the present purposes it will suffice to point out that

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the arrangement is characteristic of most commonly used sewing machines.

In accordance with features of the present invention, a feed wheel 40 is disposed in operative relation to the feed-dog 34. Specifically, the feed-wheel 40 is of frusto conical configuration having a relatively wide periphery or contact face 42 which provides a line of work contact generally below the work-engaging face 24a of the stationary presser-foot 24. The work-engaging face or periphery 42 of the feed wheel 40 may be knurled to increase its gripping tendency. It will be appreciated that the major work-feeding pressure is exerted between the feed wheel 40 and the feed-dog 34. Further, there is a substantial reduction of pressure of the work on the work-engaging face 24a of the presser-foot 24 with a substantial reduction in friction between the work and the presser-foot 24 during the feeding operation.

The feed-wheel 40 is supported for rotation on an inclined stub shaft 44 fixed to a bracket 45 secured to or integral with the presser-foot 24. An appropriate ball-bearing 48 is employed in mounting the feed-wheel 40 on the stub shaft 44. With the mounting arrangement described, the position and angle of the feed-wheel 40 may be arranged such that the edge of the wheel will be close to the adjacent side of the presser-foot 24 and in position to cooperate with the feed-dog 34.

Operatively connected to the feed-wheel 40 is a drive for rotating the feed-wheel 40 in timed relation to the feed-dog 34. In this disclosure it is to be expressly understood that the drive of the feed-wheel in timed relation to or in dependence upon the feed-dog 34 encompasses drive in unison, at a faster rate, or a slower rate. The rate of drive between the feed wheel 40 and the feed-dog 34 will depend upon the materials being sewn, and/or the effect desired. For example, if the feed wheel is driven at a faster rate, the top ply or layer will be gathered in relation to the bottom ply or layer to give the final assembly fullness. Other and varied stitched assembly may be attained in accordance with principles which are well understood in the art. The adjustable speed drive for the feed wheel 40 is obtained from the sewing machine drive, for example from the drive 18. The specific means illustrated includes the provision of an internal gear track 50 on the hollow or dished out body of the feed wheel 40 which is in meshing engagement with a gear 52 supported in a sleeve bearing 54. The axis of rotation for the gear 52 is parallel to the main axis of the feed wheel 40, as seen best in Fig. 3. Connected to the gear 52 is an elongated flexible coupling 56 which is received in an appropriate flexible covering 53 and extends toward the drive section or end 16 of the sewing machine 10.

As a feature of the invention, the drive for the feed wheel 40 is obtained without material modification of the standard sewing machine and by mechanisms which may be readily associated with the wide variety of machines in use. Specifically, an external bracket 60 is secured to the machine base at a location rearwardly of the machine body 12. The bracket 60 supports a pivoted arm 62 on which is mounted a pulley 64 which has a driving connection to the adjacent end of the flexible coupling or shaft 56. Disposed in coplanar relation to the pulley 64 is a further pulley 66, the aligned pulleys being coupled together with an appropriate V-belt 68. Belt tension is obtained by a spring 70 connected to the pivoted arm 62 and biasing the pulley 64 away from the pulley 66. The belt and pulley connection provides an effective speed selection means which can be adjusted by changing the pulley ratio. In the illustrative embodiment, and as seen best in Figs. 5 and 6, the pulley 66 is constructed of side by side pulley-forming elements 72, 74 formed with opposed and conical belt-engaging faces 72a, 74a. The pulley-forming element 72 includes a threaded supporting shaft 76 within an appropriate tapped hole axially of the machine shaft 18. The pulley-

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forming element 72 replaces a standard machine component normally at this location, and requires no change in the machine construction. The pulley-forming element 74 is adjustable toward and away from the pulley-forming element 72 by supporting the element 74 on an extension shaft 78 which has an appropriate external portion extending through a tapped centrally located opening in the element 74. The pulley-forming element 74 may be locked in selected positions of its adjustment by provision of a catch 80 on the shaft extension 78 which is selectively engageable with the pulley-forming element 74. As seen best in Fig. 5 the shaft extension 78 is longitudinally cut away to provide a guideway 82 extending inwardly from its free end. The catch or lock member 80 is slidably mounted within the guideway 82 by provision of a spring 84 received within and urged engagement with the lock member 80. The spring 84 is fixed to the shaft extension 78 by a pin 86 and biases the forward end of the lock or catch into engagement with radially extending locking slots or seats formed on the outer face of the pulley-forming element 74. Appropriate nail grips or finger pieces 90 are provided on the lock member 80 such that the same can be pulled back from engagement with the pulley-forming element 74 when the latter is to be adjusted toward and away from the pulley-forming element 72.

The driving connection to the feed wheel 40 includes the adjustable diameter pulley 66 fixed to the machine drive shaft 18, the pulley 64, the belt 68, the flexible coupling 56, the driven gear 52 and the gear rack 50. The cloth or assembly to be stitched is engaged by the non-rotating presser-foot 24 and the rotary feed wheel 40, both of which are yieldably urged toward the feed mechanism 34 by the usual presser bar spring (not shown). The degree of this pressure may be adjusted in accordance with the principles well understood. It will be appreciated that the assembly of the feed wheel 40 and the presser-foot 24 may be regulated relative to the throat plate 30 such that the sewing machine may accommodate different thicknesses of material. The frictional contact between the feed wheel 40 and the material exerts a drag on the feed wheel 40 such that the flexible shaft 56 periodically develops a torsional moment in response to operation of the drive. Intermittently, this drag is overcome, as by movement of the feed-dog 34 through its forward or driving stroke, such that the flexible coupling shaft 56 imparts motion to the feed wheel 40. In this sense the loading and unloading of the flexible coupling shaft serves as a means for converting the continuous drive of the sewing machine into intermittent drive for the feed wheel 40.

A typical cycle of operation involves the adjustment of the feed wheel 40 and presser-foot 24 to accommodate an assembly to be sewn between the feed wheel 40 and the throat plate 30. In this connection, the presence of the drive does not interfere with the up and down adjustment of the feed wheel 40 and the presser-foot 24. This is due to the flexibility of the coupling member 56. Thereupon, the operator correlates the motion imparting mechanisms for the feed wheel 40 to accomplish the desired operation by adjusting the effective diameter of the pulley 66. If the feed rate of the upper ply or layer is too slow, the diameter of the pulley 66 is increased by moving the pulley-forming element 74 closer to the pulley-forming element 72; in the alternative, if the drive is too fast, the pulley ratio may be increased by decreasing the effective diameter of the pulley 66. These adjustments are made by the operator for a particular project, and when once made the machine is ready for continuous operation.

The presence of the power feed wheel 40 and associated mechanisms does not interfere with normal operation of the sewing machine. The needle 28 can be threaded through the arcuate cutouts 40a provided in the body of the feed wheel 40. When the machine is running the

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presence of the feed wheel does not obstruct the operator's vision or curtail maneuverability as is frequently characteristic of intermittent pullers which are only good for straight line stitching operations. Although the feed wheel 40 is shown laterally disposed at the left side of the presser-foot 24 and needle 28 (when viewed from the operator's position), the feed wheel 40 may be disposed to the right of the same with equal facility.

The form of the invention illustrated in the drawings is particularly adapted for external attachment to standard sewing machines. From the foregoing disclosure it will be appreciated that the illustrated construction is highly advantageous in this application since the sewing machine does not have to be modified and the attachment does not interfere with normal operation.

When the illustrative embodiment is used in conjunction with further attachments, such as the binding and folding means conventionally employed with standard sewing machines, the powered feed wheel of the present invention assures a more positive and reliable drive. Usually, folding and binding attachments create a drag on the sewing machine and the operator must assist the feeding action, as for example by pulling the work from behind as previously described. The presence of the driven feed wheel precludes resort to this cumbersome expedient, or the use of compound-feed machines and the like. Further, the top and bottom feed avoids distortion of the bound or folded edge, through curling or twisting, as aforesaid.

There has been described an excellent but none the less illustrative embodiment of the present invention. A range of alternative, modification, omissions and additions will be readily apparent to those skilled in the art. It is accordingly appropriate that the appended claims be accorded a latitude of interpretation as is consistent with the spirit and scope of the invention.

What I claim is:

1. In combination with a sewing machine having a drive, a throat plate having a feed slot, and an oscillating feed dog operative through said feed slot for periodically advancing one ply of a multiple-ply assembly along a feed path, a rotary feed wheel disposed in operative relation to said throat plate, and means connecting said rotary feed wheel to said drive whereby a further ply of said multiple-ply assembly is advanced along said feed path in timed relation to the periodic advance of said one ply, said means including an elongated flexible coupling placed in torsion in response to operation of said drive and arranged to unload intermittently to impart motion to said feed wheel.

2. In a sewing machine, a feed bed, an oscillating feed-dog, a needle, a presser-bar, a presser-foot having a work-engaging face attached to said presser bar and extending both in front of and behind said needle, an oblique shaft operatively connected to said presser-bar, a conically-faced feed wheel journaled on said oblique shaft and having its work-engaging face adjacent and confronting said feed bed, said feed wheel being in transverse alignment with said needle with its work-engaging face of a substantial width for engagement with the work passing over said feed bed between said feed dog and said feed wheel, and means for rotating said feed wheel at a rate dependent upon the rate of oscillation of said feed dog whereby said work is driven top and bottom for movement in relation to said needle, said means including an elongated coupling shaft capable of developing a torsional moment and arranged to periodically unload.

3. In a sewing machine, a feed-bed, and oscillating feed-dog, a needle, a presser-bar, a presser-foot having a work-engaging face attached to said presser bar, an oblique shaft operatively connected to said presser-bar, a conically-faced feed wheel journaled on said oblique shaft and having its work-engaging face adjacent said feed bed, said feed wheel being in transverse alignment with said needle with its face of a substantial width for engagement

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with work passing over said feed-bed between said feed-dog and said feed wheel, said feed wheel having its line of work contact disposed slightly below the work-engaging face of said presser foot, and means for rotating said feed wheel at a rate dependent upon the rate of oscillation of said feed dog whereby said work is driven top and bottom for movement in relation to said needle, said means including an elongated coupling shaft which develops a torsional moment and imparts motion to said feed wheel when said moment is sufficient to overcome a resisting force developed due to frictional contact between said feed wheel, the feed dog and interposed materials.

4. For combination with a sewing machine having a drive shaft, a throat plate having a feed slot, and an oscillating feed dog operative through said feed slot to engage the bottom ply of a multiple-ply assembly for periodically advancing said assembly along a feed path, a rotary feed wheel disposed in operative relation to said throat plate, and means connecting said rotary feed wheel to said drive shaft whereby the top ply of said assembly is advanced along said feed path with said bottom ply, said means including an elongated flexible coupling member operatively connected at one of its ends to said drive shaft and at the other of its ends to said rotary feed wheel and arranged to periodically develop a torsional moment in response to operation of said drive shaft.

5. In combination with a sewing machine having a drive shaft, a throat plate having a feed slot, and an oscillating feed dog operative through said feed slot for periodically advancing one ply of a multiple-ply assembly to be sewn along a feed path, a rotary feed wheel disposed in operative relation to said throat plate, and means connecting said rotary feed wheel to said drive whereby a further ply of said multiple-ply assembly is advanced along said feed path in timed relation to the periodic advance of said one ply, said means including a first pulley connected to said drive shaft, a standard, a second pulley pivotally mounted on said standard in coplanar relation to said first pulley and operatively connected to said feed wheel, a drive belt trained over said pulleys, and a spring operatively connected to said second pulley for placing said drive belt under tension.

6. In combination with a sewing machine having a drive shaft, a throat plate having a feed slot, and an oscillating feed-dog operative through said feed-slot to engage the bottom ply of a multiple-ply assembly for advance along a feed path, a rotary feed wheel disposed in operative relation to said throat plate, and means connecting said rotary feed wheel to said drive whereby the top ply of said multiple-ply assembly may be engaged for advance along said feed path in tandem relation to advance of said bottom ply, said means including an elongated coupling member capable of being placed in torsion, a belt and pulley drive for said coupling member, and an adapter forming part of said belt and pulley drive and connected to said drive shaft, said adapter including a pair of pulley-forming elements arranged in side by side relation and movable relative to each other whereby the effective diameter of said elements as a pulley may be adjusted.

7. For use with a sewing machine having a drive, a needle movable through a stitch-forming stroke, and an oscillating feed-dog movable in relation to said needle and engageable with the bottom ply of an assembly to be sewn for advancing said assembly along a feed path, a feed-wheel having a peripheral surface arranged to contact the top ply of said assembly, and means operative from said drive for rotating said feed wheel in timed relation to movement of said feed dog and at a rate selected such that the top ply is advanced along said feed path in substantial unison with the bottom ply, said means including an elongated flexible coupling arranged to periodically develop a torsional moment in response operation of said drive.

8. For use with a sewing machine having a main drive, a needle movable through a stitch-forming stroke, and an oscillating feed dog movable in relation to said needle

and engageable with the bottom ply of an assembly to be sewn for advancing said assembly along a feed path, a feed wheel having a peripheral surface arranged to contact the top ply of said assembly, and a drive for rotating said feed wheel in timed relative to movement of said feed dog and at a rate selected such that the top ply is advanced along said feed path in substantial unison with the bottom ply, said drive including an elongated flexible coupling placed in torsion in response to operation of said main drive and arranged to unload and intermittently impart motion to said feed wheel substantially in unison with oscillation of said feed dog, and adjustable motion-transfer means interconnected between coupling and said main drive.

9. In combination with a sewing machine having a drive, a throat plate having a feed slot, and an oscillating feed dog operative through said feed slot for intermittently advancing one ply of a multiple-ply assembly along a feed path, a rotary feed wheel disposed in operative relation to said throat plate, and intermittent motion transfer means connecting said rotary feed wheel to said drive for advancing a further ply of said multiple-ply assembly along said feed path, said intermittent motion transfer means includes an elongated flexible coupling arranged to periodically develop a torsional moment.

10. An attachment for use with a sewing machine of the type including a drive, a throat plate having a feed slot, and a feed dog operative through said feed slot for bottom feed on an assembly to be stitched, said attachment including a rotary feed wheel adapted to be disposed in operative relation to said throat plate for frictional contact with and top feed of said assembly, and a flexible coupling adapted to be operatively connected adjacent its opposite ends between said drive and said rotary feed wheel, the frictional contact between said rotary feed wheel and said assembly serving temporarily to hold the adjacent end of said flexible coupling against turning whereby drive of the other end of said flexible coupling twists the same about its longitudinal axis and places a torsional load on said flexible coupling, said flexible coupling being arranged to impart rotation to said rotary feed wheel when said torsional load overcomes the frictional load between said rotary feed wheel and said assembly.

11. The combination with a sewing machine of the type including a drive, a throat plate having a feed slot, and a feed dog operative through said feed slot for bottom feed on an assembly to be stitched, of a rotary feed wheel disposed in operative relation to said throat plate for frictional contact with and top feed of said assembly, and a flexible coupling operatively connected adjacent its opposite ends between said drive and said rotary feed wheel, the frictional contact between said rotary feed wheel and said assembly serving temporarily to hold the adjacent end of said flexible coupling against turning whereby drive of the other end of said flexible coupling twists the same about its longitudinal axis and places a torsional load on said flexible coupling, said flexible coupling being arranged to impart rotation to said rotary feed wheel when said torsional load overcomes the frictional load between said rotary feed wheel and said assembly.

12. The combination with a sewing machine of the type including a drive, a throat plate having a feed slot, and a feed dog operative through said feed slot for bottom feed on an assembly to be stitched, of a rotary feed wheel adapted to be disposed in operative relation to said throat plate for frictional contact with and top feed of said assembly, a flexible coupling adapted to be operatively connected adjacent its opposite ends between said drive and said rotary feed wheel, and speed-selection means interposed between said drive and said flexible coupling for adjusting the rate of drive of said flexible coupling, the frictional contact between said rotary feed wheel and said assembly serving temporarily to hold the adjacent

end of said flexible coupling against turning whereby drive of the other end of said flexible coupling twists the same about its longitudinal axis and places a torsional load on said flexible coupling, said flexible coupling being arranged to impart rotation to said rotary feed wheel when said torsional load overcomes the frictional load between said rotary feed wheel and said assembly.

13. An attachment for use with a sewing machine of the type including a drive, a throat plate having a feed slot, and a feed dog operative through said feed slot for bottom feed on an assembly to be stitched, said attachment including a rotary feed wheel adapted to be disposed in operative relation to said throat plate for frictional contact with and top feed of said assembly, a flexible coupling adapted to be operatively connected adjacent its opposite ends between said drive and said rotary feed wheel, and speed-selection means adapted to be interposed between said drive and said flexible coupling for adjusting the rate of drive of said flexible coupling, the frictional contact between said rotary feed wheel and said assembly serving temporarily to hold the adjacent end of said flexible coupling against turning whereby drive of the other end of said flexible coupling twists the same about longitudinal axis and places a torsional load on said flexible coupling, said flexible coupling being arranged to impart rotation to said rotary feed wheel when said torsional load overcomes the frictional load between said rotary feed wheel and said assembly.

14. An attachment for use with a sewing machine having a drive shaft, a throat plate having a feed slot, and an oscillating feed-dog operative through said feed-slot to engage the bottom ply of a multiple-ply assembly for advance along a feed path, said attachment including a rotary feed wheel adapted to be disposed in operative relation to said throat plate, and adjustable speed coupling means connecting said rotary feed wheel to said drive whereby the top ply of said multiple-ply assembly may be engaged for advance along said feed path, said adjustable speed coupling means including an elongated flexible coupling member capable of being placed in torsion, a belt and pulley drive for said coupling member, and an adapter forming part of said belt and pulley drive and adapted to be connected to said drive shaft, said adapter including a pair of pulley-forming elements arranged in side by side relation and movable relative to each other whereby the effective diameter of said pulley-forming elements may be adjusted.

15. In combination with a sewing machine having a drive shaft, a throat plate having a feed slot, and an oscillating feed-dog operative through said feed-slot to engage the bottom ply of a multiple-ply assembly for advance along a feed path, a rotary feed wheel disposed in operative relation to said throat plate, and adjustable speed coupling means connecting said rotary feed wheel to said drive whereby the top ply of said multiple-ply assembly is engaged for advance along said feed path, said adjustable speed coupling means including an elongated flexible coupling member capable of being placed in torsion, a belt and pulley drive for said coupling member, and an adapter forming part of said belt and pulley drive and connected to said drive shaft, said adapter including a pair of pulley-forming elements arranged in side by side relation and movable relative to each other whereby the effective diameter of said pulley-forming elements may be adjusted.

16. An attachment for use with a sewing machine having a drive shaft and a throat plate over which a multiple-ply assembly is advanced, said attachment including a rotary feed wheel adapted to be disposed in operative relation to said throat plate, and adjustable speed coupling means connecting said rotary feed wheel to said drive whereby the top ply of said multiple-ply assembly may be engaged for advance along said feed path, said

adjustable speed coupling means including a coupling member, a belt and pulley drive for said coupling member, and an adapter forming part of said belt and pulley drive and adapted to be connected to said drive shaft, said adapter including a pair of pulley-forming elements arranged in side by side relation and movable relative to each other whereby the effective diameter of said pulley-forming elements may be adjusted.

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