

April 2, 1963

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3,083,658

DRIVE FOR ROTARY FEED ATTACHMENTS FOR SEWING MACHINES

Filed Oct. 13, 1960

FIG. 2.

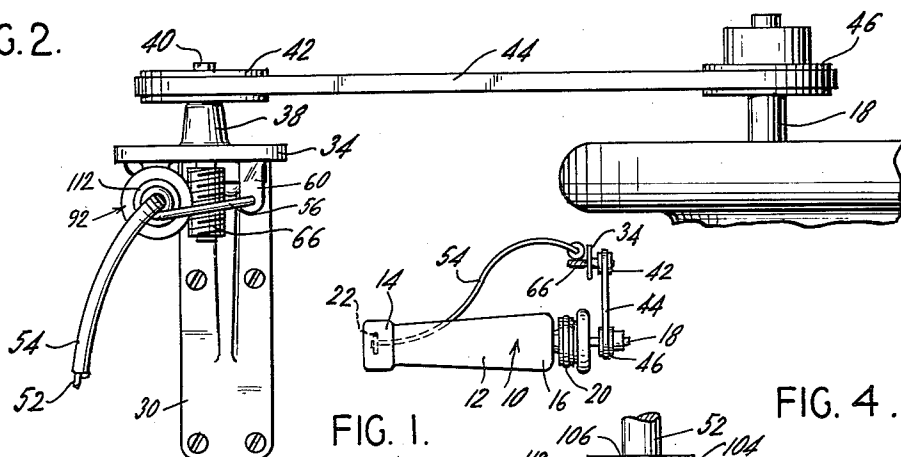


FIG. 1.

FIG. 4.

FIG. 3.

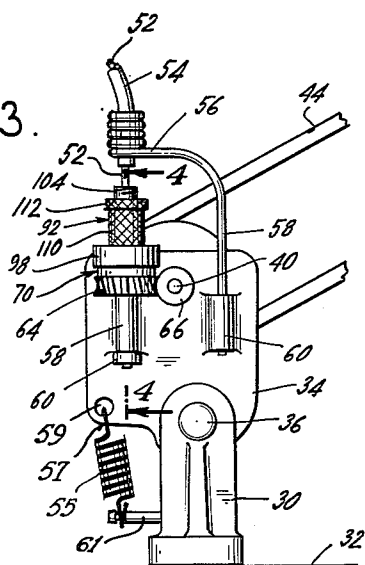
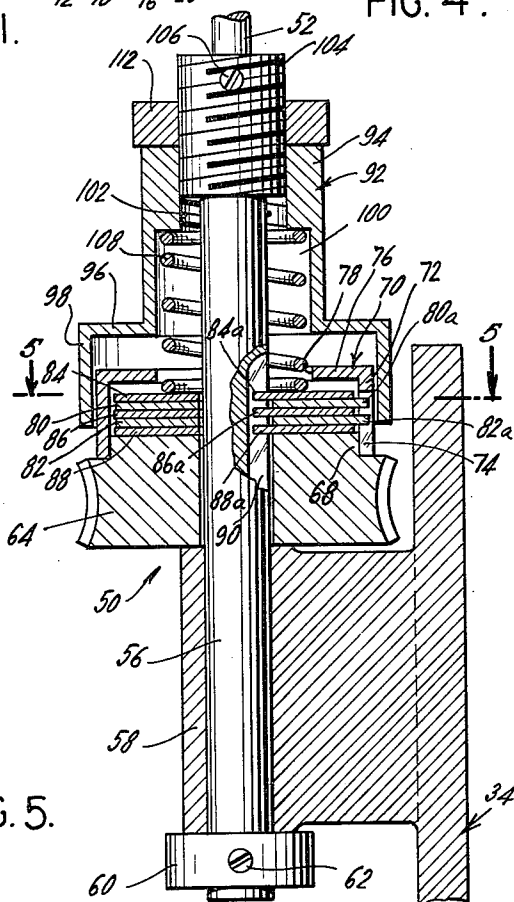
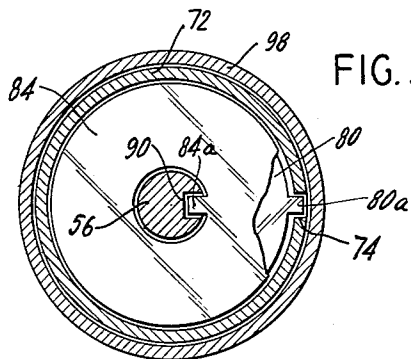


FIG. 5.



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DRIVE FOR ROTARY FEED ATTACHMENTS FOR SEWING MACHINES

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Filed Oct. 13, 1960, Ser. No. 62,346
2 Claims. (Cl. 112-214)

The present invention relates generally to improved work-feeding mechanisms for sewing machines, and in particular to an improved drive for a top feeding attachment of the rotary type which is operative in conjunction with the feed dog of the sewing machine to advance multiple-ply assemblies along a prescribed feeding or stitching path past the needle of the sewing machine.

The well known drop feed sewing machine comprises an oscillating feed dog which cooperates with a presser foot to advance multiple-ply assemblies along a feeding or stitching path in relation to the needle of the sewing machine. Due to the differential action of the feed dog and the presser foot on the multiple-ply assembly during manual feed, it is necessary for the operator to guide the multiple-ply assembly, usually by retarding the lower or under layer of the assembly in relation to the upper or top layer to preclude gathering or bunching and the consequent puckering of seams. This problem has become more pronounced with the advent of synthetic threads and/or synthetic materials which present a rather smooth or slick surface to the feeding mechanisms.

With a view to overcoming the problem of puckering or gathering, and to facilitate the stitching with synthetic threads on synthetic materials, such as of nylon, Orlon, and the like, I have devised rotary feed attachments of the type disclosed in my U.S. Patent No. 2,777,409 of January 15, 1957 entitled "Feeding Means for Sewing Machines," Patent No. 2,741,197 of April 10, 1956 and entitled "Dual Rotary Feed" and the further type of attachment shown in pending application Serial No. 855,105 of November 24, 1959 entitled "Combined Pressure Foot and Feeder," now Patent No. 3,018,746, granted January 30, 1962. In the rotary feed attachments shown in these patents and in the pending application, a flexible coupling in the form of an elongated torsion shaft is operatively connected between the drive of the sewing machine and the one or more rotary feed wheels. The frictional contact between the rotary feed wheel or wheels and the multiple-ply assembly temporarily serves to hold the adjacent end of the flexible coupling against turning whereby the drive imparted to the other end of such flexible coupling twists the same about its longitudinal axis and places a torsional load thereon. The flexible coupling is arranged to impart rotation to the one or more rotary feed wheels when the torsional load overcomes the frictional force between the rotary feed wheel and the multiple-ply assembly which occurs when the feed dog moves through its forward or feeding stroke. Accordingly, there is substantially concurrent upper and lower feed imparted to the multiple-ply assembly which effectively advances the assembly through the stitching zone under optimum conditions for stitching. Upon appropriate adjustment of the drive imparted to the upper or top surfaces of the assembly, the stitching may go forward under conditions which will assure the provision of seams which are substantially free of pucker or gathering.

Although such attachments represent a notable advance in the stitching of multiple-ply assemblies, it has been found that the flexible coupling or cable of itself is not entirely suitable for top feeding over the entire range of stitch lengths. Practical experience indicates that the selection of a flexible coupling or cable which provides optimum conditions for the lower range of stitch

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lengths (i.e. from a medium length stitch to a relatively short length stitch which may be of the order of twelve to sixteen stitches per inch), is not suitable for longer length stitches and a lesser number of stitches per inch.

There is a tendency for the torsional shaft to begin to unload and impart drive to the rotary feed wheel in advance of the positive or forward feeding stroke of the feed dog. This may cause marring or scuffing of the material assembly. Further, such premature operation of the rotary feed wheel in advance of the feeding stroke of the feed dog may result in dissipation of the torsional drive for the feed wheels and consequent improper top feed. Still further, field experience indicates that it is not uncommon for an operator to adjust the spring pressure with which the top feeding wheel or wheels bear against the material assembly such that a substantial torsional load is required to drive the rotary feed attachment. This requires the variable speed drive to the attachment to be operated at the upper range of its adjustment such that there may be a tendency for the flexible cable to be overloaded, with the attendant risk of damage to the attachment.

Broadly, it is the object of the present invention to provide an improved rotary feed mechanism for a sewing machine which obviates one or more of the aforesaid difficulties. Specifically, it is within the contemplation of the present invention to provide a drive for a rotary feed attachment of the type including one or more rotary feed wheels wherein the intermittent drive, imparted to rotary feed wheel or wheels may be selectively adjusted by the machine operator in accordance with stitching requirements. Advantageously, different rates of feed may be established for the rotary feed attachment in accordance with the stitch setting of the sewing machine such that there is a properly coordinated operation of the rotary feed attachment and the feed dog of the sewing machine.

It is a further object of the present invention to provide an improved rotary feed attachment for sewing machines having provision for precluding overload and/or possible damage to the attachment incident to the drive thereof from the sewing machine.

In accordance with an illustrative embodiment demonstrating objects, features and advantages of the present invention, there is provided an attachment for use with a sewing machine of the type which includes a drive, a throat plate having a feed slot, and a feed dog operative through the feed slot for intermittent bottom feed of an assembly to be stitched. The attachment includes one or more rotary feed wheels adapted to be disposed in operative relation to the throat plate and to the feed dog for frictional contact with the top feed of the assembly, which rotary feed wheel or wheels are intermittently driven by a flexible coupling adapted to be operatively connected adjacent one end to said rotary feed wheel or wheels. The frictional contact between the rotary feed wheel and the assembly serves temporarily to hold the one end of the flexible coupling whereby drive of the other end thereof twists the same about its longitudinal axis and places a torsional load on the flexible coupling. Periodically and depending upon the dimensions of the flexible coupling or cable, and the selection of material from which it is manufactured, the torsional load overcomes the frictional load between the rotary feed wheel and the assembly to impart rotation to the rotary feed wheel. A slip clutch is operatively connected to the other end of the flexible coupling and is adapted to be connected to the drive, with provision for adjusting the torsional load at which the clutch will slip and will effectively decouple the drive from the flexible coupling or cable. Accordingly, by adjusting the load at which the clutch slips, it is possible to vary the period of

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intermittent drive to the rotary feed wheel such that the requisite relationship can be established between the top and bottom feeds for the assembly to be sewn or stitched.

The above brief description, as well as further objects, features and advantages of the present invention, will be more fully understood, by reference to the following detailed description of an illustrative embodiment according to the invention, when taken in conjunction with the accompanying drawings, wherein:

FIG. 1 is a plan view of a typical sewing machine incorporating a rotary feed attachment embodying features of the present invention;

FIG. 2 is a fragmentary plan view, on an enlarged scale, showing the improved drive for the rotary feed attachment;

FIG. 3 is a side elevational view showing further details of the improved drive;

FIG. 4 is a sectional view, on an enlarged scale taken substantially along the lines 4—4 of FIG. 3 looking in the direction of the arrows, and showing the internal construction of the slip clutch incorporated in the improved drive; and,

FIG. 5 is a sectional view taken substantially along the line 5—5 of FIG. 4 looking in the direction of the arrows.

Referring now specifically to the drawings, a conventional drop feed sewing machine 10 is illustrated which includes a 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 which is connected via an appropriate belt and pulley means 20 to a drive motor (not shown). Within the head section 14 of the machine is the usual vertically reciprocating presser foot bar which removably supports a presser foot. Arranged in side by side relation to the presser foot bar is a needle bar which carries the usual needle movable through the stitch-forming stroke. Spaced below the presser foot bar is a throat plate forming part of the bed of the machine over which the four-motion feed dog or other intermittent feed means is periodically operative to advance the material assembly along a predetermined stitching or feeding path in relation to the presser foot and needle. Details of a typical arrangement of this type may be found in U.S. Patent Nos. 2,777,409, and 2,741,197 and in said pending application. Disposed in operative relation to the feed dog of the sewing machine is at least one feed wheel 22 (see FIG. 1) which is constructed and mounted in accordance with the teachings of the aforementioned patents and applications, it being appreciated that showing of but a single feed wheel 22 is merely illustrative. Operatively connected to the feed wheel or roller 22 is a drive for rotating the feed wheel in timed relation to oscillation of the feed dog of the sewing machine. The drive of the feed wheel or wheels may be in unison with, at a faster rate, or at a slower rate to the motion imparted to the material assembly by the feed dog and will depend upon the materials being sewn and/or the effects desired. The drive for the feed wheel may be obtained without material modification of the standard sewing machine by an attachment which is readily associated with the various drop feed sewing machines presently in use. Specifically, and as is seen best in FIGS. 2 and 3, a standard or mounting bracket 30 is secured to the machine bed 32 at a location rearwardly of the machine head 12. The standard or bracket 30 supports a pulley plate 34 which is pivoted on a pin 36 carried by the standard or bracket 30 to rock in a vertical plane about the horizontal axis provided by the pin. The pulley plate 34 is provided with an integral hub 38 projecting outwardly therefrom in which is journaled a driven pulley shaft 40. The driven pulley shaft 40 carries a driven pulley 42 which is coupled by a belt 44 to a drive pulley 46 fixed to the machine shaft 18. The drive pulley 46 may be constructed in accordance with the showing of U.S. Patent No. 2,777,409 to provide for a variable speed drive from the sewing machine shaft 18 to the present rotary feed attachment.

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In accordance with the present invention, the driven pulley shaft 40 is coupled to a slip clutch, generally designated by the reference numeral 50, which in turn is connected to a flexible coupling or torsion shaft 52 is encased with a protective sheath 54 which is appropriately supported at the end adjacent the clutch by a flexible mounting 55 in the form of a coil spring having a mounting arm 57 anchored on the pulley plate 34 in a strike-out or socket 59 provided therein. The other end of coil spring 55 is connected to a lug 61 on bracket 30. (See FIG. 3.) The other end of the flexible coupling or torsion shaft 52 is connected to the one or more feed wheels 22.

The slip clutch 50, shown in detail in FIG. 4, includes an upstanding clutch shaft 56 which is journaled within an upstanding bearing 58 provided on the pulley plate 34. At its lower end, the clutch shaft carries a thrust collar 60 which is secured thereto by a set screw 62. Overlying the bearing 58 and surrounding the clutch shaft 56 is a driven worm gear 64 which is loosely journaled on the clutch shaft 56. The worm gear 64 is urged against the adjacent end of the bearing 58, as will subsequently be described, to preclude axial displacement of the clutch shaft 56 in relation to the bearing 58. The worm gear 64 is driven from the variable speed drive via the pulley shaft 40 through a worm 66 (see FIG. 2) fixed to the pulley shaft 40 on the side thereof remote from the hub 38 of the pulley plate 34 and in intermeshing engagement with the worm gear 64.

The worm gear 64 is provided with an integral upwardly directed shoulder 68 over which is force fitted or otherwise secured a cylindrical disc housing 70. The disc housing 70 includes a cylindrical wall 72 formed at one side with a longitudinally-extending keyway 74 and an upper end wall 76 formed with a central opening 80. Disposed within the disc housing are a plurality of driving clutch discs or plates, two discs 78, 82 being shown for the purposes of illustration. The clutch discs or plates 80, 82 are provided with radially outwardly projecting integral keys 80a, 82a which extend into the longitudinally-extending keyway 74 such as to effectively couple the driving clutch discs or plates 80, 82 to the worm gear 64. Interdigitated with the driving clutch discs 80, 82 are driven clutch discs, three discs 84, 86, 88 being illustrated. The driven clutch discs or plates 84, 86 and 88, which are in stack relation with the driving clutch disc or plate 80, 82, are provided with radially inwardly projecting integral keys 84a, 86a and 88a. The keys (see FIG. 4) extend into a longitudinally extending keyway 90 provided in the clutch shaft 56. The respective interdigitated or stack driving and driven clutch discs or plates are fabricated of appropriate frictional material such that a slip coupling is provided from the driving worm gear 64 to the clutch shaft 56, which slips as a function of the spring pressure applied to the stack of discs, as will now be described.

Encircling the shaft in a position above and partially surrounding the disc housing 70 is a spring housing 92 which includes an adjustment collar 94 terminating at its lower end in a radially extending flange or shoulder 96, and a depending skirt 98. The flange 96 and the depending skirt 98 form an enclosure about the disc housing 70. Opening into this enclosure is an internal counterbore 100 provided in the adjustment collar 94. Axially aligned with the counterbore 100 is an internally threaded bore 102 which is in engagement with a threaded stub 104 fixed to the clutch shaft 56 and secured to the coupling shaft 52 by a set screw 106. Within the spring housing 92 is disposed a coil spring 108 which coil spring extends into the counterbore 102 and bears at one end against the adjacent internal wall of the adjustment collar 94 and at its other end extends through the opening 78 and bears against the stack of friction discs or clutch plates. The tension exerted by the spring 108 on the clutch discs or plates may be selectively varied to control the slip of the clutch 50 by adjustment of the spring housing 92 in rela-

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tion to the threaded stub shaft 104. To this end, the outer periphery of the adjustment collar 94 is externally knurled, as indicated at 110 in FIG. 3, such that the operator may grasp the adjustment collar 94 and turn the same to various adjusted positions. The spring housing 92 is locked in various adjusted positions by the provision of a lock nut 112 which is internally threaded and mounted on the stub shaft 104 in position to backup the spring housing 94.

From the foregoing it will be appreciated that there is provided in accordance with the present invention a selectively adjustable drive or rotary feed attachment wherein overload is effectively precluded. Further, the period or intermittency of the unloading of the torsional coupling shaft and the corresponding drive of the one or more rotary feed wheels may be selected under the control of the operator with a high degree of precision, thereby enabling various feeding effects to be obtained and further permitting the adjustment of the top feeding action in accordance with the stitch length as established by the stitching mechanisms of the sewing machine.

A latitude of modification, change and substitution is intended in the foregoing disclosure and in some instances some features of the invention will be employed without a corresponding use of other features. Accordingly it is appropriate that the appended claims be construed broadly and in a manner consistent with the spirit and scope of the invention herein.

What I claim is:

1. An attachment for use with a sewing machine of the type including a drive, a throat plate having a feed slot and intermittent feed means operative through said feed slot for bottom feed of an assembly to be stitched, said attachment including at least one rotary feed wheel adapted to be disposed in operative relation to the throat plate for frictional contact with the upper surface of the material being fed through the machine by the intermittent feed means, a flexible coupling operatively connected at one end to said rotary feed wheel, and a slip clutch operatively connected to the other end of said flexible coupling and adapted to be connected to said drive, said slip clutch including a clutch shaft secured to said flexible

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coupling, a driving gear journaled on said clutch shaft, a stack of clutch discs, means splining alternate ones of said clutch discs to said driving gear, means splining the remaining ones of said clutch discs to said clutch shaft, a spring encircling said clutch shaft and bearing against said stack of clutch discs, and means for selectively adjusting the bias exerted by said spring on said stack of clutch discs so that the slip of said clutch may be adjusted in accordance with stitching requirements to prevent movement of said rotary feed wheel before the operative feed stroke of the intermittent feed means.

2. An attachment for use with a sewing machine of the type including a drive, a throat plate having a feed slot and intermittent feed means operative through said feed slot for bottom feed of an assembly to be stitched, said attachment including at least one rotary feed wheel adapted to be disposed in operative relation to the throat plate for frictional contact with the upper surface of the material being fed through the machine by the intermittent feed means, a flexible coupling operatively connected at one end to said rotary feed wheel, and a slip clutch operatively connected to the other end of said flexible coupling, said slip clutch including a clutch shaft secured to said flexible coupling, a driving gear journaled on said clutch shaft for connecting said clutch shaft to said drive, spring means exerting a bias on said slip clutch, and means for selectively adjusting the bias exerted by said spring means so that the slip of said clutch may be adjusted in accordance with stitching requirements to prevent movement of said rotary feed wheel before the operative feed stroke of the intermittent feed means.

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