Sept. 24, 1963 R. REEBER 3,104,639

WHEEL FEED DIFFERENTIAL CONTROL FOR SEWING MACHINES

Filed Feb. 10, 1961

FIG. 1

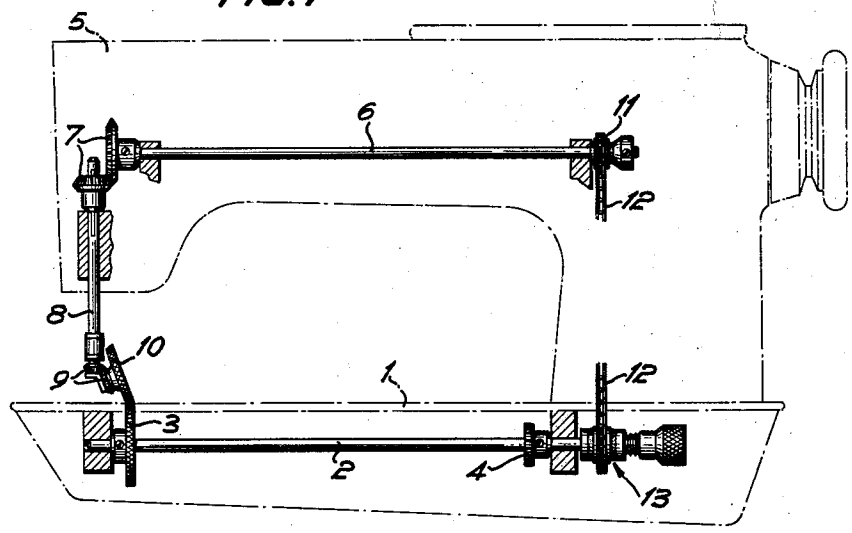
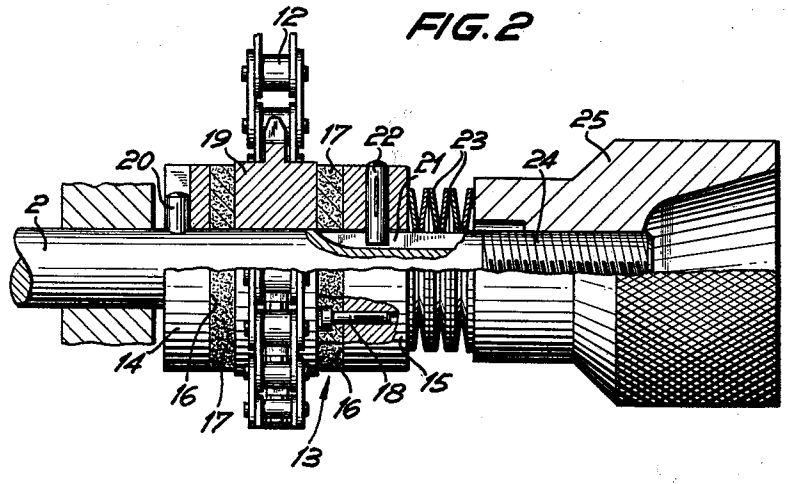


FIG. 2



INVENTOR:
Rudolf REEBER
BY
ATTORNEY

United States Patent Office 3,104,639 Patented Sept. 24, 1963

3,104,639

WHEEL FEED DIFFERENTIAL CONTROL FOR SEWING MACHINES

Rudolf Reeber, Kaiserslautern-Pfalz, Germany, assignor to G. M. Pfaff A.G., Kaiserslautern-Pfalz, Germany, a corporation of Germany

Filed Feb. 10, 1961, Ser. No. 88,466
Claims priority, application Germany Feb. 18, 1960
3 Claims. (Cl. 112—214)

The present invention relates to work feeding mechanism for sewing machines of the general type comprising lower and upper feed wheels or rollers for feeding a plurality of superposed work pieces or layers of sewing material to be operated on by the stitching tools, more particularly to feeding mechanism of the special character, wherein said rollers are operated at different predetermined speeds, to impart a differential feeding force to work pieces or layers being fed through the machine between successive stitching operations.

According to one use of differential work feeding mechanism of this type, a proper adjustment of the differential speed between a pair or work pieces or layers of sewing material, that is, such as to prevent slippage of said layers relative to one another and to the cooperating feed rollers, will result in a desired internal compressive or tensile stress to be imparted to the material, in such a manner as to cause the stitched or sewn layers, to assume a predetermined curved or vaulted shape or configuration. As an example, such an effect is desirable or required in the stitching of leather linings to the legs of boots, in which case the resultant structure, though initially consisting of flat or plane parts or sheets, automatically assume the configuration or contour of the size of the foot for which the boots are intended in use.

Difficulties have been encountered in the past with known differential work feeding mechanism of this type wherein a rigid speed differential is maintained between the feeding rollers by means of transmission means or gearing connecting the rollers with a common drive shaft and having fixed transmission ratios to result in a constant or rigid speed difference between the feed rollers or superposed layers, respectively. In such a case, variations in the physical characteristics of the sewing material, such as thickness, density or the like, or other irregularities, as well as the existence of a cross-seam or the like obstruction, are likely to result in the stresses imparted to the material exceeding the permissible limits, whereby to cause folding or bulging and the formation of permanent pleats or creases between successive stitches, or to result in damage to the material by the teeth of the rollers due to relative slippage between the layers and feeding rollers. Furthermore, a cross-seam or the like obstruction may result in a sufficient reactive force to be imposed on the gears or other transmission devices such as to cause breakage or other permanent damage to the parts of the feeding mechanism.

Accordingly, an important object of the present invention is the provision of improved differential roller feeding mechanism for sewing machines by which the above-noted and related difficulties and defects are minimized or substantially eliminated.

A more specific object of the invention is the provision of roller work feeding mechanism of this type wherein the differential feeding force on the work pieces or layers is continuously controlled to adapt itself to varying operating conditions such as to prevent excessive compressive and tensile stresses on or damage of the material being stitched.

Yet another object of the invention is the provision of means for regulating the compressive and tensile stress to be imparted to the material in a differential work feeding mechanism of the foregoing type, depending upon the characteristics of the material or work pieces and the effect to be obtained as a result of the different feeding operation.

Another object of the invention is the provision of improved differential roller feeding mechanism for sewing machines of the above-mentioned type which is both simple in construction and reliable as well as flexible in operation and which may be readily incorporated in the roller work feeding devices of conventional sewing machines.

Still another object of the invention is the provision of flexible or sufficiently yielding motion-transmitting or coupling means for at least one of the feeding rollers of a differential roller feeding mechanism of the above type, that is, the roller driven at the relatively higher speed, to prevent excessive internal stress on the work pieces or sewing material followed by permanent folding or creasing or damage to the material, while effecting a continuous control of the internal stress imparted to the material, to result in the desired final effect, such as curving or vaulting of the stitched pieces or layers.

The invention, both as to its ancillary objects and novel aspects, will be better understood from the following detailed description taken in conjunction with the accompanying drawing, forming part of this specification and wherein:

FIG. 1 is an elevational outline view of a conventional sewing machine embodying improved roller work feeding mechanism constructed in accordance with the principles of the invention; and

FIG. 2 is a sectional view on an enlarged scale, showing in greater detail and by way of example the construction of the friction slip coupling means forming part of FIG. 1.

With the foregoing objects in view, the invention involves generally the provision of resilient friction slip coupling or the like yieldable coupling means effectively connected in the motion-transmitting means or drive mechanism of the work feeding roller of a differential work feeding device of the above-mentioned general type driven at the higher speed relative to the cooperating feeding roller. By the proper design or adjustment of the slip coupling to produce a predetermined coupling pressure for a given type of material and a normal differential speed between the rollers, excessive internal stress on the material liable to result in permanent buckling or creasing of the layers between successive stitches will be substantially prevented, while at the same time enabling a close control of the desired compressive and tensile stresses to be imparted to the material to result in the desired final effect of curving or vaulting of the stitched pieces or layers, in the manner pointed out hereinabove. The yielding or friction coupling further acts as a safety device in preventing excessive reaction forces from being imposed upon the driving gears or other transmission means of the rollers liable to cause

permanent damage to the driving elements by irregularities of the material or by a cross-seam or the like obstructing the feeding path.

With a fixed or rigid speed differential between the upper and lower feeding rollers provided by the coupling or driving means of the prior art having fixed transmission ratios, such as gear drives or the like motion transmitting means, gathering up or creasing of the material, as well as permanent damage thereto and to the driving parts may result from even slight variations or irregularities of the material or obstructions in the feeding path. By the flexible or yielding coupling according to the present invention, the previous drawbacks and defects are substantially overcome in a most simple and reliable manner.

Referring to the drawing, the numeral **1** denotes the base supporting the work plate of a conventional sewing machine and having mounted therein a first rotatable or driving shaft **2** to which is connected a lower feeding wheel or roller **3**. The latter in a known manner projects continuously beyond the work plate while the shaft **2** may be driven by the drive motor (not shown) of the sewing machine by way of a gear drive **4** which may contain shifting or control means for varying the transmission ratio, to rotate the roller **3** at a desired operating speed.

Mounted in the overhanging arm **5** of the sewing machine is a further rotatable or driven shaft **6** being in operative driving connection with an upper feeding wheel or roller **10** resiliently engaging the roller **3**, the drive of the roller **10** comprising, in the example shown, a first pair of bevel gears **7** driven by the shaft **6**, a vertical shaft **8** and a second pair of bevel gears **9**. Suitable spring biasing means (not shown) may be operatively associated with the shaft **8** to urge the same in a downward direction such as to cause the rollers **3** and **10** to engage one another with an adequate operating pressure for feeding a plurality of superposed work pieces or layers of sewing material between successive stitching operations of the sewing machine. The shaft **6** is suitably driven by the shaft **2**, such as through a chain and sprocket drive comprising, in the example shown, a first sprocket wheel **11** mounted upon the shaft **6** and connected through a chain **12** to a second sprocket wheel **19** driven by the shaft **2** through a flexible friction slipping clutch or coupling **13**.

The slip coupling, in the example shown, FIG. 2, comprises a pair of outer coupling discs **14** and **15** having their opposing surfaces **16** covered with friction layers or linings **17** secured to the discs by any suitable means, such as by drive screw fasteners or pins **18**. The coupling disc **14** is fixedly mounted upon the shaft **2** by means of a locking pin **20** or the like, while the coupling disc **15** being secured against rotation is mounted upon said shaft in axially slidable relation by the provision of a groove and pin connection **21, 22** or equivalent slidable coupling means. Arranged between the discs **14** and **15** in freely rotatable relation to the shaft **2** is the hub of the sprocket wheel **19** forming a cooperating (driven) coupling member in friction driving engagement with the surfaces **16** of the driving members or discs **14** and **15**. Adequate friction coupling pressure between the discs **14, 15** and the member **19** is maintained by the provision of suitable resilient pressure applying or biasing means shown in the form of a stack of cupped or plate springs **23** encircling the shaft **2** and engaging the outer surface of the slidable coupling disc **15**, on the one hand, and the inner end surface of an adjusting screw or knob **25** which cooperates with the threaded end **24** of the shaft **2**, on the other hand. As a consequence, a proper adjustment of the knob **25** will result in a predetermined friction coupling pressure being applied between the discs **14, 15**, and the driven member **19**, resulting in a desired infinitely variable or continuous adjustment of the speed differential between the upper feeding roller **10** rotated at a higher speed relative to the lower feeding roller **3** by the proper design of the chain drive and bevel gearings **7** and **9**.

In order to arrest the feed movement during the stitching operations, there may be provided suitable intermittent coupling means such as in the form of a mutilated worm gear or the like, these and other details, such as the stitching tools proper, not being necessary for the understanding of the present invention having been omitted from the disclosure for the sake of simplicity.

As a consequence of the different feeding speeds of the work pieces or layers of sewing material, the upper layer being fed at a higher speed relative to the lower layer will be elastically compressed relative to the lower layer. A proper adjustment of the friction coupling pressure makes it possible to limit this compression or the internal stress imparted to the material to a value below the permissible upper limit, whereby to prevent folding or creasing of the material, as well as damage thereto due to slippage relative to the feeding rollers. In other words, exceeding of the upper limit of the stress on the material or relative feeding speed may result in permanent folding or creasing of the material between successive stitches, while a proper adjustment of the friction coupling pressure by the knob **25** makes it possible to control and maintain the required speed differential such as to result in the desired shaping or curving of the stitched layers or pieces to suit any practical conditions and requirements.

Moreover, if the sewing material includes a cross-seam or the like obstruction, it is necessary in passing the seam to reduce the speed of the roller **10** to about the speed of the roller **3** in order to prevent damage to the surface of the layers by the peripheral teeth of the roller. This speed reduction is automatically effected by the invention due to the sudden resistance offered to the movement of the roller by the cross-seam or other obstruction and reacting upon the friction coupling, in such a manner as to cause the same to slip sufficiently until after the seam has been passed by the roller. The same yielding or flexible operation will prevent an excessive reaction force upon the driving elements or parts liable to result in permanent damage as in the case of the mechanically rigid transmission means of the prior art.

In the foregoing the invention has been described in reference to a specific illustrative device. It will be evident, however, that variations and modifications, as well as the substitution of equivalent parts or elements for those shown for illustration may be made in accordance with broader scope and spirit of the invention, as set forth in the appended claims. The specification and drawing are accordingly to be regarded in an illustrative rather than in a restrictive sense.

I claim:

1. In combination with a sewing machine having a first and a second rotating feed wheel engaging and feeding a plurality of superposed workpieces, operating mechanism for effecting a variable differential feed between said wheels comprising a drive shaft for said first wheel, means to drive said shaft at a first speed in synchronism with a sewing operation of said machine, motion-transmitting means operably connecting said shaft with said second wheel, to drive said second wheel at a second speed higher than said first wheel by a predetermined speed differential, a friction slip coupling inserted in the path of said transmitting means, and means to continuously adjust the operating pressure of said coupling, to effect a continuous and infinitely variable differential feed control including zero differential between said wheels.

2. In wheel feed mechanism for sewing machines as claimed in claim 1, said coupling comprising a first coupling disc fixedly mounted upon said shaft, a second coupling disc mounted upon said shaft in axially slidable relation thereto and locked against rotation, an intermediate clutch member between said discs acting as input of said motion-transmitting means and mounted freely rotatable

upon said shaft, and said control means consisting of adjustable resilient means to apply a variable friction coupling pressure between said discs and member.

3. In wheel feed mechanism for sewing machines as claimed in claim 2, said resilient means being comprised of a stack of dished plate springs encircling said shaft and engaging said slidable coupling disc, and an adjusting screw cooperating with a threaded portion of said shaft and engaging said stack, to vary the friction coupling pressure produced thereby.

References Cited in the file of this patent

UNITED STATES PATENTS

615,752	Sanford	Dec. 13, 1898
2,317,762	Hale	Apr. 27, 1943
2,521,360	Gerstein	Sept. 5, 1950
2,782,813	Dudek	Feb. 26, 1957
3,083,658	Winberg	Apr. 5, 1963