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SEWING MACHINE AND METHOD

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2 Sheets-Sheet 2

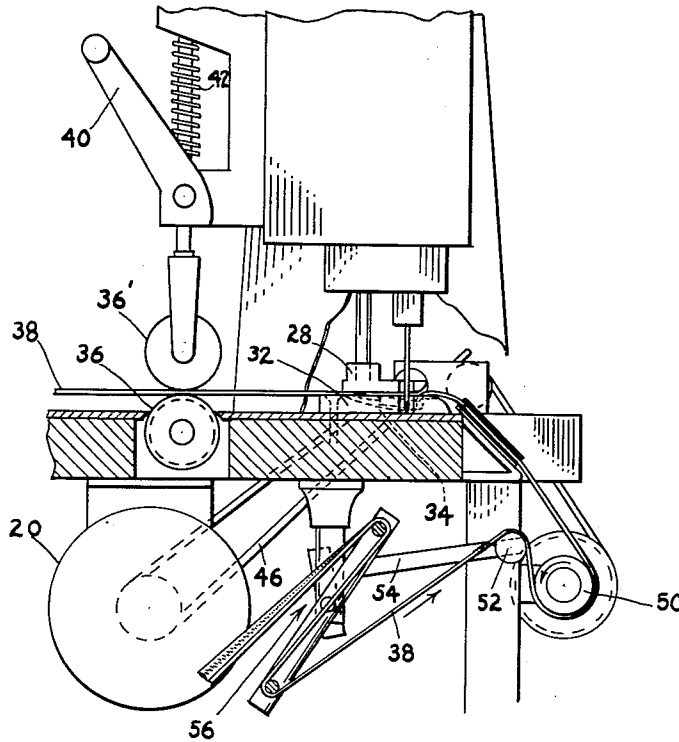


Fig. 2.

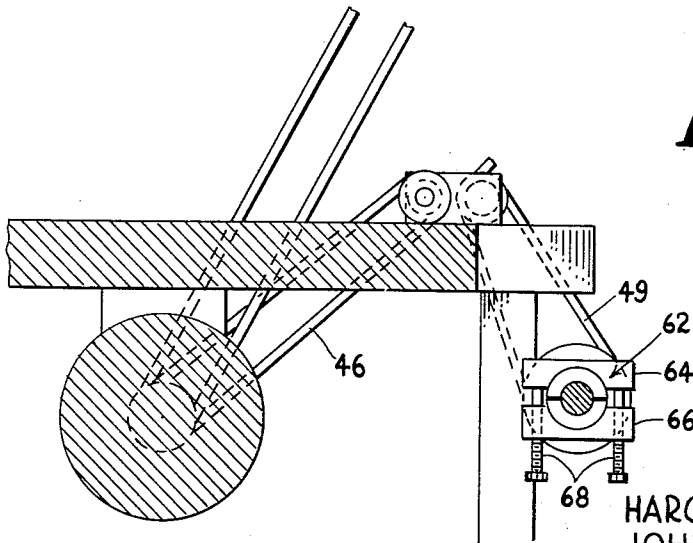


Fig. 4.

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SEWING MACHINE AND METHOD

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This invention relates to apparatus for automatically attaching strips of one type of material to strips of another type of material and more particularly to a sewing machine mechanism for automatically setting zippers in garments, cases, and other materials.

Heretofore various machines have been devised for sewing different types of materials together and particularly for sewing a zipper to a piece of material such as one side of a placket for a garment bag or the like but they have generally consisted of rather complicated machinery and have required the attention of at least one operator. Most zippers, because of the bias tape they are made on, the bulk of the metal elements and the slide itself are difficult if not impossible to sew, on the conventional sewing machine, without careful attention of the operator and interruption of the sewing mechanism to allow the passage of the slider itself. Also it has been found that the drag on the zipper tape itself is highly important in getting an even and proper stitching of the zipper to the garment. This has required considerable experience on the part of the operator such that a new girl cannot be trained rapidly to set zippers and it takes a considerable period of time before sufficient skill is acquired to set zippers in a garment with any appreciable speed. Consequently the zipper setting operation in the garment industry in particular and in the sewing industry generally has been an expensive and time-consuming process.

According to the present invention we have devised a machine for automatically setting a complete zipper fastener into a dress, garment or other article in a faster and far superior manner to that which can be done manually by a skilled operator. We have accomplished this by providing a novel tension controlling mechanism that ensures that just the correct amount of tension is applied together with a novel feeding mechanism that permits feeding of different types of material as well as the bulk of the zipper and the slider itself without interfering with the sewing mechanism.

Accordingly it is an object of the present invention to provide a method and machine for sewing together different types of material in a smooth seam. It is another object of the present invention to provide a machine for automatically setting slide fasteners in material in one operation. It is another object of the present invention to provide a machine for automatically setting zippers in garments, bags, cases, and the like without the necessity of manual attention. It is a further object of the present invention to provide a novel tensioning means for regulating the feed of a slide fastener tape as it is fed to a sewing machine head. It is a further object of the present invention to provide a sewing machine mechanism that will handle slide fasteners and zipper tapes without interruption of the sewing motion. It is a further object of the present invention to provide a completely automatic machine that is simple and reliable in operation and that will continuously set zippers in fabric without manual operation once they are started. It is a still further object of the present invention to provide a machine for automatically setting slide fasteners in material that is extremely simple in operation and easy and economical to manufacture. These and other and further objects will be in part apparent and in part pointed out as the specification proceeds.

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In the drawings:

FIGURE 1 is a perspective view of a machine according to the present invention;

FIGURE 2 is a view of line II—II partially in section of the machine of the present invention;

FIGURE 3 is a partial sectional view taken on line III—III of FIGURE 1; and

FIGURE 4 is a partial sectional view taken on line IV—IV of FIGURE 1.

Referring now to FIGURE 1, the present invention is shown applied to the specific illustrative application of setting zippers. The mechanism 10 according to the present invention comprises generally a table 12 having mounted thereon a sewing machine 14 of essentially conventional construction with the usual base 16, head portion 18, a drive motor 20 (see FIGURE 2), work moving mechanism 22, tension controlling mechanism 24 and supply reel 26 for the slide fastener tape 38.

As may be seen in more detail in FIGURES 2 and 3 the sewing machine 14 has essentially a standard head 18 together with a smooth, flat stripper or presser foot 28 and, in this instance, a pair of sewing needles 30. Other needle configurations could of course be utilized if desired. A throat plate 32 is provided but unlike conventional sewing machines there is no material advancing or feeding dogs in the plate 32. Instead the plate 32 has cut therein a groove 34 which is somewhat wider than the metal zipper elements and the slide fastener itself that is to be sewn and which extends from the front edge of the stripper foot 28 to beyond the rear edge of the stripper foot 28. Unlike conventional machines the stripper or presser foot 28 is not spring loaded downwardly into contact with the plate to keep the material in feeding contact with the feeding dogs. The foot 28 is in effect floating and just touches the top of the material being sewn to prevent "flagging" of the material during withdrawal of the sewing needle without imparting any substantial frictional drag to the material passing thereunder.

Primary movement of the material to be sewn is accomplished by the draw rollers 36 and 36' of the feeding mechanism 22. Since this feeding is applied after the various materials (zipper tape and dress, for instance) are sewn together, an equal, uniform feed is applied to both upper and lower layers. Also, as the stripper 28 is just floating and there is no feed in the throat plate, the usual differential drag on the layers of material as they pass the sewing head is eliminated.

Roller 36, as may be seen in FIGURE 2, is driven from the prime power source 20 in any suitable manner (not shown) such as by a set of gears from motor 20 or by a series of levers from one of the usual reciprocated shafts within the bed of the standard sewing machine. Upper roller 36' rotates upon contact with the material and frictional contact therethrough to roller 36. Roller 36' may be raised to and from contact with the zipper tape 38 by lever 40. Roller 36' is normally urged into contact with roller 36 by spring 42. Supplementary feeding, particularly of the top material, is effected by imparting a feeding motion to the needles 30. This is of necessity intermittent and is adjusted to compensate for the small friction on the top layer of the material due to the light pressure of foot 28. It should be noted that while, as stated above, draw rollers 36 and 36' impart an equal feed to both materials, this feed must be carefully adjusted to an average rate approximately equal to the feeding imparted by the motion of the needles. Too great a difference between the average rates of feed will, of course, break the needles or otherwise damage the materials but some variation in the average rates may be desirable to overcome friction as pointed out above or to feed additional quantities of one material relative to the other. The needle feed is, of course, of intermittent character as in any conventional needle feed sewing machine so that

draw rollers 36 and 36' may be most easily synchronized if driven intermittently, also. Conventional sewing machines, of course, include various mechanisms well known to those skilled in the art interposed between the driving motor and the feeding mechanism for providing such intermittent feeds. This method permits much better control of the feeding and tension of the materials as pointed out herein.

Tension control mechanism 24 comprises a variable speed drive mechanism 44 which is driven by a belt 46 from the prime power source and which in turn through belt 49 drives shaft 48 which has mounted on the end thereof adjacent sewing machine head 18 a roller 50 which is of a generally hard, resilient material such as rubber or other plastic-like material. Variable speed drive 44 is arranged so as to rotate roller 50 in the direction of the travel of the zipper tape 38 which is as shown by the arrows in FIGURE 2. The amount of surface of roller 50 that engages the tape 38 is controlled by a second idler roller 52 mounted on arm 54 of tape guiding assembly 56. Tape guiding assembly 56 comprises an H frame tape guide that enables control of the frictional drag on the tape from the supply reel 26 as well as assists in lateral positioning relative to the sewing head as may be seen in FIGURE 3. H frame 58 may be positioned at any desired angle by adjustment of arm 60. Tension control mechanism 24 also includes a brake mechanism 62 which engages shaft 48 adjacent the speed control mechanism 44. This may be seen more clearly in FIGURE 4 and consists essentially of a pair of brake shoes 64 and 66 which are adjustably engaged about the shaft by clamping screws 68.

The zipper tape 38 is fed from the supply reel 26 which is located on the rear leg of the table 12 through a curved guiding ring 70 to the tape guiding assembly 56 over roller 52 around roller 50 and through the tape chute 72 between stripper foot 28 and plate 32 and thence between rollers 36 and 36' on to a material take-up station (not shown). The material to which the tape 38 is to be joined, such as strips 74 and 76, is fed from supply reels (not shown) to between the stripper 28 and plate 32 in proper alignment with the zipper tape 38.

In operation the zipper tape 38 is fed through the configuration as just described until it is engaged by the draw wheels 36 and 36'. Similarly the material to be fastened thereto which may be small plackets such as 74 and 76 or which may be the sides of a dress, garment bag or other item are fed through until they too are engaged by the feeding rolls 36 and 36'. The speed of rotation of roll 36 is set such that the desired length of stitch is obtained for the speed of the sewing machine and the material to be sewn. The tension device 24 is then set such that the roller 50 rotates in the same direction as the direction of feed of the tape 38 but at a somewhat slower average speed than the actual feeding of the tape by the rollers 36 and 36'. There is thus set up a controlled slippage or drag about the roller 50 which may be varied under the control of variable torque control mechanism 44 and the positioning of roll 52. By moving roll 52 up and around a greater surface of contact is obtained around the roll 50 and by moving it downwardly a lesser surface contact is obtained. Thus by adjusting the speed control 44 and the roller 52 the desired tension may be placed on the strip 38 as it feeds through the sewing mechanism between the stripper 28 and the plate 32.

The correct tension on the strip 38 is highly important as improper tension will cause the strip to bunch or curl in one direction or the other such that eventually an improper alignment will be obtained that will cause the garment or other article to be rejected. In certain applications it has been found that insufficient tension control is obtained by the foregoing so that the brake mechanism 62 is engaged for those conditions where additional friction is necessary.

As the tape 38 and the material 74 and 76 are being fed through the sewing machine as described they are drawn

smoothly forward by the draw rollers 36 and 36' between the stripper 28 and the throat plate 32. The needles 30 go through the customary holes in the stripper and plate to sew the strip 38 to the material strips 74 and 76. Material strips 74 and 76 would be fed from their supply in the usual manner and with the tension mechanism 24 controlling the feed of the zipper tape 38 it is fed smoothly between the presser foot 28 and plate 32 with the metal portions of the zipper and the slide fastener itself passing through the groove or slot 34 in plate 32. As may be seen in FIGURE 3 the groove permits the passage of the slider itself underneath the stripper without appreciably moving it from the plate 32. Also no spreading stress is applied to the top layers of material to pull them out of alignment. Rather the tape 38 which is a bias tape stretches to permit the zipper to pass and then returns to normal resulting in a perfect seam. This facilitates the smooth, precisely aligned action of the feeding mechanism and ensures a uniform, unstressed stitching of the tape to the materials in which it is being inserted.

Referring now to FIGURE 1 it will be obvious that as the supply reel of the zipper varies in mass the power necessary to pull the zipper therefrom varies also. By utilizing the driven friction roller 50 as previously described a further advantage is obtained over the conventional frictional drag type mechanisms. With a heavily loaded reel the drag on roller 50 pulling backward therefrom is greatly increased. This increases the friction between the roller and the tape and since the roller 50 is actually driven, power is supplied to the tape to help unwind it from the reel 26. This relieves the rollers 36 and 36' from the necessity of supplying the power to overcome initial inertia and starting friction of a tape reel whence the draw rollers 36 and 36' need supply only the moderate power required to slightly increase the speed of the tape and thus allows them to readily maintain a constant, even when intermittently fed, average rate of speed of the material past the sewing head. The additional power necessary to produce the major portion of the motion of the large supply reel is thus provided by the driven roller 50. Similarly as the load on the reel 26 lightens the friction between the tape 38 and the reel 50 lessens and less power is added and the tape does not bunch up or tend to feed past the rollers 36 and 36'. There is thus provided a very accurate feeding mechanism that ensures the smooth, continuous and automatic feeding of a zipper tape to a sewing head where it is automatically and continuously joined to the material in which it is being inserted.

While there is given above a certain specific example of this invention and its application in practical use, it should be understood that this is not intended to be exhaustive or to be limiting of the invention. On the contrary, this illustration and explanation herein are given in order to acquaint others skilled in the art with this invention and the principles thereof and a suitable manner of its application in practical use, so that others skilled in the art may be enabled to modify the invention and to adapt and apply it in numerous forms each as may be best suited to the requirement of a particular use.

We claim:

1. An automatic sewing machine for setting slide fasteners and the like in a piece of material comprising in combination a base member, a sewing machine mechanism including actuating means and sewing head, a throat plate mounted beneath said sewing head, a stripper member adapted to be selectively lowered into floating engagement with said plate, material feeding means for feeding the slide fastener and the like and the material past said sewing head comprising a first plurality of positive feed rollers mounted on the output side of said sewing head, a second plurality of slipping friction feed rollers mounted on the input side of said sewing head, means for rotating said first and second pluralities of feed rollers, means for regulating the feeding of the slide

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fasteners and the like and the material by said second plurality of rollers to a predetermined average rate less than, but approximately equal to the rate of said first plurality of positive feed rollers whereby a positive non-slipping feeding force is applied on the output side and a slipping friction feeding force is applied on the input side resulting in a predetermined constant tension in the zipper tape at the sewing head regardless of variations in material composition or quantity.

2. A device as described in claim 1 wherein said second plurality of slipping friction feed rollers comprises a main friction roller adapted to receive about a portion of the periphery thereof the slide fastener tape, an idler roller adjustably mounted adjacent to but spaced from said friction roller, variable speed driving means connected to said friction roller, friction brake means operatively connected to said friction roller for retarding the rotation thereof, and a pivotally adjustable H frame adapted to receive thereabout the tape to be sewn, said H frame being adjustable laterally and angularly to permit proper alignment of the tape with the sewing head and to aid in the frictional drag thereon.

3. A sewing machine mechanism for automatically setting zippers in articles comprising a sewing machine having a driving means and a sewing head portion, a flat table portion disposed beneath said sewing head portion, a flat plate member mounted on said table having a plurality of holes therein adapted to receive the sewing needles from said sewing head, a stripper foot adapted to selectively contact said plate, a narrow elongated slot having a width greater than the zipper slider to be set and a length approximately equal to the length of said stripper foot, zipper tape and article draw rollers mounted on the output side of said sewing head for positive feed of said tape and article with the line of contact therebetween approximately in the plane of said flat table portion, a tension controlling assembly comprising a main slipping friction roller, variable speed drive means therefor, adjustable auxiliary rollers mounted adjacent to but spaced from said main friction roller, a supply reel for the zipper tape to be set, an at least partially arcuate guide ring mounted between said supply reel and said friction control assembly and power means for rotating said draw rollers and said main friction roller so that the average rate of rotation of said draw rollers is greater than the average rate of rotation of said main friction roller whereby a positive non-slipping feeding force is applied on the output side and a slipping friction feeding force is applied on the input side resulting in a predetermined constant tension in the zipper tape at the sewing head regardless of variations in material composition or quantity.

4. A sewing machine mechanism for automatically setting zippers in articles comprising a sewing machine having a driving means and a sewing head portion including a stripper foot and needle assembly, a flat plate member having a plurality of holes therein adapted to receive the sewing needle from said sewing head and a narrow elongated slot having a width greater than the zipper slider to be set and a length approximately equal to the length of the stripper foot of said sewing head, zipper tape and article draw rollers mounted on the output side of said sewing head with the line of contact therebetween approximately in the plane of said plate member, a tension controlling assembly comprising a main slipping friction roller, variable speed drive means therefor and adjustable auxiliary rollers mounted adjacent to but spaced from said main friction roller, a supply reel for the zipper tape to be set, a D shaped guide ring mounted between said supply reel and said friction control assembly, and motor means for powering said sewing machine, said draw rollers and said tension controlling assembly, said motor means being operatively connected to said main friction roller to rotate it in the same direction as the movement of said tape but at a slightly slower speed.

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5. An automatic sewing machine for setting slide fasteners and the like in a piece of material comprising in combination a base member, a sewing machine mechanism including driving means and sewing head, a smooth flat plate mounted beneath said sewing head in said base and having therein a narrow elongated slot; a stripper member adapted to be lowered into floating engagement with said plate; draw roller means positioned on the output side of said plate and stripper member; means for rotating said draw roller means at a predetermined rate; a tension control assembly mounted on the other side of said plate and stripper member, including a driven control roller adapted to receive thereabout the slide fastener tape and drive the tape toward the sewing head by frictional coupling only; means for rotating said control roller; said draw roller and control roller rotating means being operatively interconnected so that the average rate of feed of said draw roller means is a predetermined amount greater than the average rate of feed of said control roller; whereby a slipping frictional feeding force will be applied to said tape and a predetermined tension will be imparted to and maintained on the slide fastener tape at all times while it passes beneath the sewing head.

6. Device as described in claim 5, wherein said tension control assembly includes an idler roller adjustably mounted adjacent to but spaced from said driven control roller, and adapted for angular movement about said control roller whereby the amount of surface contact between said control roller and said slide fastener tape may be varied.

7. In a sewing machine including a sewing mechanism for sewing zipper tape to other materials, the tape being fed to the mechanism from a reel having appreciable starting friction and initial inertia which varies with the amount of tape on the reel, the combination which comprises means for pulling the materials from the sewing mechanisms as the sewing operation is performed, power driven means coupled to the tape by friction only for feeding the tape from the reel to the sewing mechanism at a rate approximating but a predetermined amount less than the rate at which the materials are pulled from the sewing mechanism, means for adjusting the frictional coupling between the power driven feeding means and the tape whereby the tension on the tape while passing through the sewing mechanism is accurately controlled, and power to overcome the inertia and friction of the reel is supplied by the tape feeding means.

8. In a sewing machine including a sewing mechanism for sewing zipper tape and the like to other materials the zipper tape and the like being fed to the mechanism from a continuous supply thereof having appreciable friction and inertia which vary with the amount of the tape supply; the combination which comprises a pair of puller roller members mounted on the output side of said mechanism for pulling the sewn material and tape from the sewing mechanism after the sewing operation is performed; power driven roller means coupled to the tape by friction only and mounted adjacent the input side of said mechanism for feeding the tape from the supply thereof to the sewing mechanism; said power driven roller means being adjusted to feed said tape at an average rate approximating, but a predetermined amount less than, the average rate at which the materials are pulled from the sewing mechanism; means for adjusting the frictional coupling between the power driven feeding means and the tape; variable torque means for varying the amount of power applied to said power-driven roller means to overcome the inertia and friction of the tape supply whereby the tension on the tape while passing through the sewing mechanism is accurately controlled.

9. The method of sewing together strips of different types of materials which comprises the steps of presenting the strips to be joined from one side of a sewing machine; applying a first non-slipping feeding force to the

strips at a point displaced from underneath the sewing machine head to pull the material from the head after sewing together thereof; applying a second slipping feeding force directed toward the sewing head to at least one of said strips at a point displaced from underneath the sewing machine head and before sewing together thereof; and regulating the rate of said slipping feeding force to an average predetermined rate less than but approximately equal to that of said non-slipping feeding force whereby said strips are fed past the sewing machine by two active feeding forces and one of said active feeding forces also applies a frictional drag to provide the desired tension in the strips.

10. The method of claim 9 further characterized by applying an auxiliary feeding force to the strips of material not engaged by said slipping supply feeding force.

11. The method of claim 9 wherein said slipping supply feeding force is further regulated in proportion to the mass of unused supply of material strip engaged thereabout.

12. The method of sewing a zipper tape to a strip of material comprising the steps of presenting the zipper tape and material to a sewing machine from the front thereof, pulling said zipper tape and material past the sewing head of said sewing machine by a single non-slipping feeding force displaced behind said sewing head; applying a slipping feeding and tension force to said zipper tape in front of the sewing head of said machine and directed toward the sewing head and regulating said feeding function instantaneously in accordance with variations in material, machine, and the like, and over the long term in accordance with variations in the supply of the zipper tape whereby a constant tape tension is obtained.

13. The method of claim 12 wherein said strip of material is guided to the sewing head and an auxiliary feeding motion is applied thereto.

14. The method of setting a zipper tape in a piece of material which comprises feeding a zipper tape and the material to be joined thereto through a pair of non-slip drive rollers, positioned behind the sewing head of the sewing machine, passing said material and said zipper tape under the sewing machine sewing head invoking engagement of the sewing head assembly; applying a controlled slippage feed and friction force directed toward the sewing head to at least the zipper tape prior to its entry under the sewing head of the sewing machine and adjusting the average rate of feed of said controlled slippage feed to a predetermined rate less than but approximately equal to that of the drive rollers.

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