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COMPLETE SPECIFICATION

Improvements in or relating to Machines for Attaching Sliding Clasp Fastener Interlocking Members to a Carrier Tape

I, JOSEF RUHRMANN, trading as Dr. Ing Josef Ruhrmann, of 24, Bahnhofstrasse, Stuttgart-Vaihingen, Germany, a Citizen of the Federal Republic of Germany, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The invention relates to a machine for attaching sliding clasp fastener interlocking members to a carrier tape, and more specifically to a machine for attaching fastener members forming an interconnected string, the machine being such that the fastener members which are bent so that each is substantially of U-shape are positioned on the carrier tape before they reach the stage where they are secured to the carrier tape.

The machine may be a modified sewing machine or alternatively a modified high frequency welding machine.

The invention consists in a machine for securing sliding clasp fastener members forming an interconnected string to a carrier tape, comprising means for feeding the carrier tape and the string to a place where the string is applied to the tape, the said means including a feed wheel adjacent the said place and having a periphery toothed to engage the individual fastener members and to apply them at the said place in their correct positions relative to one another to the carrier tape.

At the place where string of fastener members is applied to the tape it may be fixed thereto by sewing or by high frequency welding. In preferred embodiments of the invention the carrier tape is fed to the feed wheel with the general plane of the tape substantially perpendicular to the axis of the feed wheel at the said place.

In machines according to the invention means may be provided for severing the said string when a predetermined length of string has been applied to the carrier tape, a fresh length of string being fed through the machine in such manner that consecutive lengths of string are applied to the same continuous length of carrier tape with gaps, each of a predetermined length, between them.

In order to make the invention clearly understood reference will now be made to the accompanying drawings which are given by way of example and in which:—

Fig. 1 is a front view of a modified sewing machine according to the invention, the casing of which has been removed;

Fig. 2 is a side view of the same sewing machine;

Fig. 3 is a plan view showing portions of a feeding device for the carrier tape and the string of fastener members, the view being to a larger scale than Figs. 1 and 2;

Fig. 4 is a sectional view taken along the line IV—IV of Fig. 3;

Fig. 5 illustrates a portion of Fig. 3 to still larger scale;

Fig. 6 illustrates a portion of Fig. 3 to a still larger scale;

Fig. 7 diagrammatically illustrates a dividing device in which some parts have been modified as compared with the embodiment of Figs. 1 to 6 but are provided nevertheless with the same reference numerals.

The portion of a sewing machine to which the invention relates essentially comprises a sewing head 100 known *per se*, a feeding device 200 for individual parts of the sliding clasp fastener stringer to be connected, namely a carrier tape 201, a string 202 of fastener members, a first holding cord 203, and a second holding cord 204, a finished sliding clasp fastener stringer being indicated by reference numeral 205, and a cutting mechanism 300. All the parts are driven by a

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common driving motor 401 through a driving belt 403 acting on a main shaft 402.

On the sewing head 100, a needle rod 101 of which is movable by a crank disc 102 by means of a linking rod 103, a shaft 104 is provided which is connected to the main shaft 402 through a roller chain 105. Looptakers 108 and 109 cooperating with needles 106, 107 are driven by the main shaft 402 over two pairs of helical gears 110, 111 and two shafts 112, 113 with twice the rotational speed of the main shaft.

The individual fastener parts to be connected together are guided across a needle aperture plate 210, means including spring-loaded guide 400 (Fig. 3 and 4) being provided for ensuring an accurate feed of the carrier tape 201 and the string 202 of fastener members and for conducting away the finished sliding clasp fastener stringer 205.

The carrier tape 201 passing through a guide slot 220, and between rollers 221, 222 is guided across the needle aperture plate 210 by feed rollers 223, 224 acting on the carrier tape 201.

Between the roller 223 and the roller 222 the carrier tape forms a loop 225 held under tension by a roller 226 and a weight suspended therefrom. If passage of the carrier tape 201 through the guide slot 220 is prevented for any reason, then the size of the loop 225 is reduced and the roller 226 eventually operates a switch 227 for stopping the sewing machine. The feed rollers 223, 224 are rotatable intermittently by a Maltese cross gear 228 driven by the main shaft 402, the rollers 221, 222 being geared to the roller 223. In order to ensure that the carrier tape 201, during the sewing process, lies evenly on the needle aperture plate 210, the diameter of the feed roller 224 lying behind the needle is larger than that of the front feed roller 223 so that the carrier tape 201 is tensioned.

A feeding device 230 for the string 202 of fastener members is driven by the Maltese cross gear 228 over a toothed wheel 232 acting on a shaft 231. A pair of bevel gears 233 acts on shaft 234 in which is fitted a feed wheel 235 which has a toothed peripheral profile which corresponds to the shape of the string of fastener members. A toothed wheel 236 is fixed on the shaft 234.

On a lever 237 rotatable about the shaft 234, an intermediate toothed wheel 239 is provided which idles on a stud 238 and permanently meshes with the toothed wheel 236. A further feed wheel 241 for the string 202 of fastener members, and a toothed wheel 242 with which the intermediate toothed wheel 239 meshes during the feed of the string 202 of fastener members are mounted on a shaft 240 similar to the shaft 234. The rotatable lever 237 causing the engagement of the intermediate toothed wheel 239 with the toothed wheel 242 is operated by a magnetic core 245 extending through two solenoids 243, 244, the core 245 acting at 247, Fig. 3, on the lever 237 through a further lever 246. Between the feed wheels 235 and 241 a pair of knives 248, 249 are provided which are under the action of the lever 246 of the magnetic core 245 and which cut the string 202 of members as required for subdividing string 202 into individual pieces of predetermined lengths.

After the piece of string 202 of fastener members has been positioned on the carrier tape 201, the piece 202 is connected to the carrier tape 201, and the cords 203, 204 by preferably as shown, two seams extending at a small distance from each other.

A takeoff roller 257 driven synchronously by the feed roller 224 through an intermediate toothed wheel 258 enables a uniform intermittent removal of the finished sliding clasp fastener stringer 205. In order to ensure that the stringer 205 is in use carried away without substantial interruption by the feed rollers 224, 257, pressure rollers 250, 251, 252 are provided which co-operate with the feed rollers 224, 257. The string 202 of fastener members fixed to the carrier tape 201 causes a thickening at one of the edges of the carrier tape which in turn is interrupted by portions of the carrier tape 201 between the individual pieces of the string 202 of fastener members corresponding to the length of fasteners to be manufactured, which portions of the carrier tape 201, after cutting of the fastener tape, form the projecting ends of the carrier tape at the beginning and end of an individual fastener stringer. These portions of the carrier tape 201 not occupied by the pieces of the string 202 of fastener members would render a uniform removal of successive fasteners impossible. In order nevertheless to enable the fastener tape to be uniformly removed, as required, an annular groove is provided in the feed roller 257 in which an annular disc 253 is arranged so as to be freely movable eccentrically with respect to roller 257. A resiliently mounted roller 254 permanently presses the annular disc 253 against two pressure rollers 255, 256 which are driven synchronously with the feed roller 257. The distance between the two pressure rollers 255, 256 is greater than the maximum distance between two separated pieces of the string 202 of fastener members sewn onto the carrier tape 201, so that at all times during use at least one of the two pressure rollers 255, 256 co-operates with portions of the string of fastener members on the carrier tape, irrespective of the gaps between adjacent pieces of the string.

By a pair of bevel wheels 301 a shaft 302 is driven at the same rotational speed as the shaft 104 driven by the main shaft 402 through the roller chain 105. On the shaft

302 a worm 303 is provided with which a worm wheel 304 for determining the length of an individual piece of the string of fastener members and a worm wheel 305 for determining the length of gap on the carrier tape free of fastener members alternately engage. The two worm wheels 304 and 305 are rotatably mounted on shafts 306, 307 arranged on a rotatable lever 309. The lever 309 is rotatable about a pivot point 308, a magnetic core 312 connected to lever 309 passing through two solenoids 310, 311. The worm wheel 304 for the sliding clasp fastener members comprises an abutment stud 313 which when the worm wheel 304 does not engage the worm 303 abuts against an indicator 318 displaceably arranged relatively to a scale 317 for indicating the length of the piece of string or fastener members under the action of a tension spring 314 and a pull cable 316 surrounding a cable pulley 314. The worm wheel 305 is analogously provided with an abutment stud 319, rotation spring 320, cable pulley 321, cable 322 and a scale 323 with a displaceable indicator 324 for indicating the length of the gap. A rotatable control lever 330 is depressed by the abutment stud 313 when moving downwards with the worm wheel 304 and acts in each case on a starting switch 331 for engaging the solenoid 243 and a stopping switch 332. The abutment stud 319 of the worm wheel 305 has the same influence on a control lever 333, a starting switch 334 for energising the solenoid 244 and a stopping switch 335. A rocking spring 336 arrests the lever 308 in its end position in each case, a further rocking spring 337 similarly arresting the magnetic core 245. The magnetic core 245, in its end positions, operates a starting switch 338 for energising the solenoid 310 or a starting switch 339 for energising the solenoid 311.

In the following the control device illustrated in Fig. 7 will be described:—

The worm wheel 305 for the gap engages the worm 303 as illustrated, the abutment stud 319 moving downwards, as shown, onto the control lever 333; the worm wheel 304 for the length of the fastener member piece is out of engagement with the worm 303. Owing to the displacement of the magnetic core 245 in the direction of the starting switch 338 the toothed wheel 239 is brought out of engagement with the toothed wheel 242 and the feed wheel 241 is thereby at rest. The permanently rotatable feed wheel 235 feeds the piece of the string 202 of fastener members which has already been cut off by the cutting knives 248 and 249 onto the carrier tape 201 where it is fixed by seams of stitching. The cords 203, 204 simultaneously applied are not illustrated in Fig. 7 for the sake of clarity. When now the abutment stud 319 engages the lever 333 and depresses the same, contacts of the starting switch 334 are closed and through the now closed current circuit of the current source 340 the solenoid 244 is energised. Under the action of the solenoid 244 the core 245 moves into the opposite end position and connects the contacts of the starting switch 339 with each other so that also the current circuit of the current source 340 is closed through the solenoid 311, the core 312 consequently moving into the opposite end position and the lever 309 being turned into a position in which the worm wheel 304 provided thereon engages the worm 303; simultaneously the worm wheel 305 is disengaged from the worm 303. After the disengagement of the worm wheel 305 the same returns into its initial position under the action of the tension spring 320 which acts through the cable 322 on the cable pulley 321, the abutment stud 319 abutting against the displaceable indicator 324 in the said initial position.

By movement of the magnetic core 245 in the direction towards the switch 339 the cutting knife 249 reaches such a position that the string 202 of fastener members can pass through the recess of the cutting knife 249, the feed of members being effected by the simultaneous coupling of the intermediate toothed wheel 239 to the toothed wheel 242 and the rotational movement of the feed wheel 241.

The cycles caused by the rotation of the worm wheel 304 are analogous to the cycles described in connection with the worm wheel 305.

Cut outs 332, 335 which lie in the feed circuit for the driving motor 401 protect against overloading of the feed wheels 235, 241. If for example a string of members 202 jams in the feed wheels or is not properly cut or jams in the cutting tool, then the intermediate toothed wheel 239 can not be engaged owing to the increased resistance, the magnetic core 245 is held back and the starter switch 339 is not short circuited. Consequently the lever 309 is not turned and the stud 319 presses the movable control lever 333 so far downwards that the cut out 335 operates and stops the machine. For the cut out 332 the arrangement is analogous. The cut outs 332 and 335 protect against an overload caused by disturbances in the operation of the solenoids 310, 311, the starting switches 331, 334 and the levers 330, 333.

When a fastener stringer of indefinite length without intermediate gaps is to be manufactured, it is only necessary to arrest the lever 309 in its centre position, so that neither of the two worm wheels 304, 305 engages the worm and the feed wheel 241 remains in the engaged condition.

Modifications of the arrangement described are possible. For example, the construction of the machine renders it possible to insert welding electrodes instead of the

sewing needles 106, 107 and the looptakers 108, 109, for welding a thermoplastic string of fastener members to a carrier tape of thermoplastic material or coated or impregnated therewith.

WHAT I CLAIM IS:—

1. A machine for securing sliding clasp fastener members forming an interconnected string to a carrier tape, comprising means for feeding the carrier tape and the string to a place where the string is applied to the tape, the said means including a feed wheel adjacent the said place and having a periphery toothed to engage the individual fastener members and to apply them at the said place in their correct positions relative to one another to the carrier tape.

2. A machine as claimed in Claim 1 wherein means are provided for fixing the fastener members to the carrier tape at the said place.

3. A machine as claimed in Claim 1 or 2 wherein the feed means includes an arrangement for feeding the carrier tape to the feed wheel with the general plane of the tape substantially perpendicular to the axis of the feed wheel at the said place.

4. A machine as claimed in any one of the preceding claims wherein a spring-loaded guide is provided for guiding the carrier tape in the vicinity of the said place.

5. A machine as claimed in any one of the preceding claims wherein means are provided for severing the said string when a predetermined length of string has been applied to the carrier tape, and for feeding a fresh length of string through the machine in such manner that consecutive lengths of string are applied to the same continuous length of carrier tape with gaps, each of a predetermined length, between them.

6. A machine as claimed in Claim 5 wherein two feed rollers are provided, which are disposed, when viewed in the direction of the feed, one in front of and the other behind the said place and arranged for feeding the carrier tape past the said place.

7. A machine as claimed in Claim 6, wherein the feed roller behind the said place is of larger diameter than the feed roller in front of the place.

8. A machine as claimed in Claim 6 or 7 wherein a further carrier tape feed roller is disposed in front of the first mentioned roller and arranged to form a tensioned loop of carrier tape of adjustable size and tape tension.

9. A machine as claimed in Claim 8 wherein means are associated with the tension loop for stopping the machine automatically should the size of the loop decrease below a predetermined limit.

10. A machine as claimed in any one of Claims 5 to 9 wherein means are provided for feeding to the said place a holding cord for at least partly covering the fastener members.

11. A machine as claimed in any one of Claims 6 to 10 wherein a take off roller and at least one pressure roller arranged at the circumference of the take off roller are provided for the removal of carrier tape with the applied string from the machine.

12. A machine as claimed in Claim 11 wherein at least two pressure rollers are provided and arranged to engage the fastener members or the holding cord, the distance apart of the respective areas of engagement of the pressure rollers being greater than the longest gap between adjacent ends of consecutive strings of fastener members applied to the same continuous length of carrier tape.

13. A machine as claimed in any one of Claims 5 to 12 wherein means are provided for presetting the length of string to be applied to the carrier tape and the length of the gaps between consecutive lengths of string.

14. A machine as claimed in any one of Claims 5 to 13 wherein a further feed wheel is provided which is peripherally toothed for engagement with the string of fastener members and disposed, when viewed in the direction of feed of the string, in front of the first feed wheel, means being provided for automatically disconnecting a drive to the further feed wheel, and means being provided for severing the string between the two feed wheels while the drive is disconnected.

15. A machine as claimed in Claim 14 wherein means are provided for driving the first feed wheel continuously, the first feed wheel permanently engaging a gear wheel, a mechanical linkage being provided whose movement throws the gear wheel into or out of mesh with the driving means for the further feed wheel and actuates a knife arrangement for severing the string of fastener members.

16. A machine as claimed in Claim 14 or 15 wherein the teeth of the feed wheels are dimensioned with respect to the dimensions and spacing of the fastener members in such manner as to maintain the string of fastener members in tension between the feed wheels prior to the string being severed.

17. A machine as claimed in any one of Claims 13 to 16 wherein a worm geared to a main drive of the machine and two worm wheels alternatively engaging with the worm are provided, one of the worm wheels being arranged to control the length of the string of fastener members to be secured to the carrier tape, and the other worm wheel being arranged to control the length of gap between consecutive strings of fastener members.

18. A machine as claimed in Claim 17 wherein adjustable abutment means are associated with each of the worm wheels for

sewing needles 106, 107 and the looptakers 108, 109, for welding a thermoplastic string of fastener members to a carrier tape of thermoplastic material or coated or impregnated therewith.

WHAT I CLAIM IS:—

1. A machine for securing sliding clasp fastener members forming an interconnected string to a carrier tape, comprising means for feeding the carrier tape and the string to a place where the string is applied to the tape, the said means including a feed wheel adjacent the said place and having a periphery toothed to engage the individual fastener members and to apply them at the said place in their correct positions relative to one another to the carrier tape.

2. A machine as claimed in Claim 1 wherein means are provided for fixing the fastener members to the carrier tape at the said place.

3. A machine as claimed in Claim 1 or 2 wherein the feed means includes an arrangement for feeding the carrier tape to the feed wheel with the general plane of the tape substantially perpendicular to the axis of the feed wheel at the said place.

4. A machine as claimed in any one of the preceding claims wherein a spring-loaded guide is provided for guiding the carrier tape in the vicinity of the said place.

5. A machine as claimed in any one of the preceding claims wherein means are provided for severing the said string when a predetermined length of string has been applied to the carrier tape, and for feeding a fresh length of string through the machine in such manner that consecutive lengths of string are applied to the same continuous length of carrier tape with gaps, each of a predetermined length, between them.

6. A machine as claimed in Claim 5 wherein two feed rollers are provided, which are disposed, when viewed in the direction of the feed, one in front of and the other behind the said place and arranged for feeding the carrier tape past the said place.

7. A machine as claimed in Claim 6, wherein the feed roller behind the said place is of larger diameter than the feed roller in front of the place.

8. A machine as claimed in Claim 6 or 7 wherein a further carrier tape feed roller is disposed in front of the first mentioned roller and arranged to form a tensioned loop of carrier tape of adjustable size and tape tension.

9. A machine as claimed in Claim 8 wherein means are associated with the tension loop for stopping the machine automatically should the size of the loop decrease below a predetermined limit.

10. A machine as claimed in any one of Claims 5 to 9 wherein means are provided for feeding to the said place a holding cord for at least partly covering the fastener members.

11. A machine as claimed in any one of Claims 6 to 10 wherein a take off roller and at least one pressure roller arranged at the circumference of the take off roller are provided for the removal of carrier tape with the applied string from the machine.

12. A machine as claimed in Claim 11 wherein at least two pressure rollers are provided and arranged to engage the fastener members or the holding cord, the distance apart of the respective areas of engagement of the pressure rollers being greater than the longest gap between adjacent ends of consecutive strings of fastener members applied to the same continuous length of carrier tape.

13. A machine as claimed in any one of Claims 5 to 12 wherein means are provided for presetting the length of string to be applied to the carrier tape and the length of the gaps between consecutive lengths of string.

14. A machine as claimed in any one of Claims 5 to 13 wherein a further feed wheel is provided which is peripherally toothed for engagement with the string of fastener members and disposed, when viewed in the direction of feed of the string, in front of the first feed wheel, means being provided for automatically disconnecting a drive to the further feed wheel, and means being provided for severing the string between the two feed wheels while the drive is disconnected.

15. A machine as claimed in Claim 14 wherein means are provided for driving the first feed wheel continuously, the first feed wheel permanently engaging a gear wheel, a mechanical linkage being provided whose movement throws the gear wheel into or out of mesh with the driving means for the further feed wheel and actuates a knife arrangement for severing the string of fastener members.

16. A machine as claimed in Claim 14 or 15 wherein the teeth of the feed wheels are dimensioned with respect to the dimensions and spacing of the fastener members in such manner as to maintain the string of fastener members in tension between the feed wheels prior to the string being severed.

17. A machine as claimed in any one of Claims 13 to 16 wherein a worm geared to a main drive of the machine and two worm wheels alternatively engaging with the worm are provided, one of the worm wheels being arranged to control the length of the string of fastener members to be secured to the carrier tape, and the other worm wheel being arranged to control the length of gap between consecutive strings of fastener members.

18. A machine as claimed in Claim 17 wherein adjustable abutment means are associated with each of the worm wheels for

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presetting the angle of their rotation, electric switch means being operable by the respective wheel on completion of its preset angle of rotation for changing over the drive to the other worm wheel.

19. A machine as claimed in Claim 18 wherein two pairs of electromagnets are controlled by the electric switch means.

20. A machine as claimed in Claim 19 wherein one pair of electromagnets is arranged for changing over the drive between the worm wheels.

21. A machine as claimed in Claim 20 wherein the other pair of electromagnets is arranged for interrupting and restarting the drive for feeding the string of fastener members and for severing the string.

22. A machine as claimed in any one of Claims 18 to 21 wherein means are provided for holding both worm wheels out of engagement with the worm.

23. A machine as claimed in any one of the preceding claims wherein a Maltese cross gear is arranged for transmitting an intermittent drive from a main, uniformly rotating shaft of the machine to a drive for feeding the carrier tape and the string of fastener members.

24. A machine as claimed in 23 wherein needle means are provided for sewing the carrier tape and the string of fastener members together.

25. A machine for securing sliding clasp fastener members to a carrier tape, constructed, arranged and adapted to operate substantially as hereinbefore described with reference to, and as illustrated in, the accompanying drawings.

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