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(54) METHOD OF AND APPARATUS FOR THE THERMOFIXING OF SLIDING CLASP FASTENER INTERLOCKING ELEMENTS

(71) We, OPTI-HOLDING AG., a Company organised under the Laws of Switzerland, of Burgstrasse 24, Glarus, Switzerland, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed to be particularly described in and by the following statement:—

This invention relates to a method of and apparatus for the setting of sliding clasp fastener interlocking members and, more particularly, to a system for the thermal fixing of continuous interlocking members, especially helical coils or meanders.

Previously it has been the practice to set thermally synthetic plastics monofilament, after an initial shaping, to form the interlocking members for sliding clasp fasteners by subjecting it to a temperature in the region of its softening point or, at any rate, a temperature at which the synthetic resin becomes plastically deformable. Such interlocking members are generally in the form of coils which may be helical or of flattened configuration with the individual turns forming respective coupling heads interfittable with the coupling heads of a mating interlocking member on the other stringer tape when a slider is drawn along the interlocking members.

The heads may be formed in part by a deformation of the plastics mono-filament at each turn so as to flatten the heads somewhat and allowing the coupling heads of the opposed interlocking members to engage behind one another and restrict relative lateral displacement and resist forces tending to separate the interlocking members.

Another form of interlocking member, to which the present invention is applicable, is a so-called "meander" again of plastics monofilament but deposited or bent in zig-zag or undulating configuration so as to form a row of coupling heads with intervening spaces. Here again the couplings

heads of one of the meanders are designed to interfit with the coupling heads of the mating meander when the slider is drawn in one direction along the sliding clasp fastener, and to separate when the slider is drawn in the opposite direction.

Both the undulations of the meander and the turns of a helical interlocking element, have shanks extending away from the coupling heads, which may be flattened or enlarged as described earlier, the shanks being affixed to a stringer tape which is in turn stitched to a garment or other fabric or non-fabric article having an opening adapted to be closed by the sliding clasp fastener. Of course, such fasteners may be used in other applications as well and need not be confined to use as closures of garment openings and the like.

It is desirable, in connection with such interlocking members (helical coils or meanders) to constitute them from a thermoplastic monofilament of the molecularly oriented type and advantageously of nylon or some other polyamide synthetic resin, a polyester or other resin capable of being drawn or spun into a monofilamentary strand. Since the monofilament has substantial inherent resiliency, the bending or coiling of the strand to form the meander or helical coil, usually exceeds the elastic limit so that the newly created shape is retained with, possibly, a limited spread or creep.

Moreover, the turns resulting from a deformation operation are under stress and it has, therefore, been the practice to perform a thermal setting operation adapted to relieve the stresses and permanently fix the new orientation of the filament in these turns.

In prior-art apparatus, the interlocking element is fed along the periphery of a drum or wheel and there exposed to heat deriving from a radiant heating element juxtaposed with the periphery of the drum or with

hot gases contacting the turns of the element in a convective-heating arrangement. As a practical matter, neither of these heating techniques is found to be satisfactory, inasmuch as the turns are heated non-uniformly, with portions of each turn proximal to the heating source or more remote from the drum surfaces, being heated to an extent in excess of the heating of those portions of the member proximal to the wheel and remote from the heating source.

Another disadvantage is that the wheel acts as a heat sink and draws thermal energy away from the member in the heating zone to maintain the portions of the turns which are remote from the heating source in a somewhat cooler condition than the portions of the turns proximal to the source. Aside from the obvious disadvantage that the proximal portions of the coupling element may be overheated at temperatures sufficient to bring the distal portions to the level necessary to relieve stress and permanently set the synthetic resin, there is the disadvantage that thorough and uniform heating of the entire coil is a time-consuming operation greatly slowing the rate of production of the interlocking members or requiring processing apparatus of considerable size.

It is, therefore, the principal object of the present invention to provide an improved method of fixing interlocking members of the helical coil or meandering type for a sliding clasp fastener, which produces a coupling element uniformly free from stress at relatively low cost.

Another object of the invention is to provide an apparatus for thermally fixing synthetic plastic monofilament in coiled or meander form at relatively high rates.

According to the present invention a method of making sliding clasp fasteners wherein a continuous interlocking member is affixed to a stringer tape, comprises the steps of forming the continuous interlocking member from a continuous strand of a thermoplastic synthetic resin by repetitive bending of the continuous strand to form a multiplicity of interconnected coupling heads therealong, destressing said interlocking member by subjecting it to ultrasonic vibration and thereafter cooling said interlocking member.

While ultrasonic vibration has been used to weld members together at an interface, it has not heretofore been recognised that with ultrasonic vibrations it is possible to set a stressed filament to its new configuration nor has it been recognised that ultrasonic vibrations may be used to uniformly heat the turns of an interlocking member regardless of the fact that some portions of each turn inevitably will be closer to the source of the ultrasonic vibrations than

others parts. It is indeed most unexpected to find that proximal portions of each turn, i.e., portions which lie closer to the source of ultrasonic vibration are heated as uniformly as the more distal portions, and further that the heating occurs without an interface between two thermoplastic materials.

The term "ultrasonic vibration" is used here to refer to the generation of vibrations of supersonic frequency, generally above 15 kHz and preferably to a maximum of about 10 MHz. Such vibrations are generated by ultrasonic transducers which may be of the magnetostrictive type, supplied with the energizing current by a high-frequency oscillator. The transducers, also known as sonotrodes, may also be of the vibrating-reed type. Suitable ultrasonic vibrators are described in U.S. Patents 3,302,277, 3,330,026 and 3,333,323.

Thus between anvil means providing support for the interlocking member and the ultrasonic transducer of the heating and fixing device, a uniform heating of the thermoplastic monofilament can be obtained, in spite of the fact that the geometry of the turns of the coil or the undulations of the meander is extremely complex. Preferably the plane of each coupling head (together with the associated turn) lies transverse to the gap between the anvil means and the transducer. It has been found that this system greatly simplifies the thermal fixing of the interlocking members so that the process can be carried out in a continuous manner without the disadvantages previously encountered with nonuniform heating.

The system of the present invention permits a reduction in the thermal fixing time of the coupling element to a fraction of a second (e.g., about 0.3 second) and a corresponding increase in the production speed.

Furthermore, it has been discovered that the fixing or setting process, when using ultrasonic transducers of the character described, is unaffected by atmospheric influences (e.g., room temperature) and is able to accomplish thermal setting operations with ultrasonic energy in a well-defined and narrow temperature range. This results in a further advantage in that it is no longer a concern that some parts of the coupling element may be heated excessively while other parts remain unheated or are heated to a level insufficient to destress the synthetic resin.

According to a further feature of this invention the coupling heads on the turns of the coil or undulations of the meander can be made with highly precise dimensions in a full reproducible and repetitive manner when the interlocking member is compressed and shaped simultaneously with thermal

setting by pressing the member between anvil means supporting the member and the ultrasonic transducer. The compression, of course, can be applied generally in the radial direction as the member is fed continuously past the heating arrangement which includes a generally circular anvil or ultrasonic transducer bearing against the member to hold it under compression. The anvil or transducer can be formed to shape the coupling heads as they clamp the interlocking element between them, while the periphery of the anvil may likewise be shaped to maintain the predetermined configuration of the interlocking member which is nevertheless provided with a configuration close to that desired in the final product. The compression creates an effective energy-transfer coupling between the transducer, interlocking member and anvil and ensures rapid and efficient heating of the interlocking member.

It has also been found that this system may be used at least in part to affix the remaining parts of a sliding clasp fastener half in place. Thus, when a stringer tape and/or a filler cord is used, it is fed together with the coupling element past the ultrasonic heating station to form a bond in the boundary areas between interlocking member and stringer tape and between interlocking member and the filler cord. In general, the interlocking member will be attached to the stringer tape with a double-chain stitch or the like and the thermal setting of the synthetic resin used to lock the threads to the tape. The bond between the interlocking member and the fastening threads, the filler cord and the stringer tape may be made effectively even when these latter members are composed of a nonresin.

It has been observed, with respect to this aspect of the invention, that the ultrasonic generation of thermal energy has a tendency to concentrate its effect at the boundary between two bodies which may be joined, e.g., the interlocking member and the stringer tape, the filler cord and/or the stitching securing the interlocking member to the stringer tape. This boundary or interface generation of heat appears to occur without any substantial internal heating of the interlocking member to a level sufficient to bring the surface of the interlocking member at the interface to its softening or heat-bonding point. It has already been noted that ultrasonic vibration of the interlocking member permits a uniform distribution of heat through the crosssection of the interlocking member in spite of the fact that some portions of the interlocking member may be located further away from the sonotrode than other portions, and that this uniform heating occurs in spite of a complicated geometry of the turns or undulations

of the interlocking member. When, however, the interlocking member is used in conjunction with another part of the fastener half, namely a synthetic resin stringer tape, a synthetic resin thread for stitching the interlocking member to the stringer tape and/or a synthetic resin filler cord, there is created an interface with the interlocking member at which a substantially higher temperature is generated by the ultrasonic vibrations, this temperature being of a level sufficient to cause fusion of the interlocking member to the other member. Surprisingly, this generation of fusion heat does not occur anywhere but at the interface so that substantially no distortion or damage to the interlocking member occurs. Reference has been made to stringer tapes, filler cord and stitching thread or yarn composed of synthetic resin materials and it is intended here to identify as those members which may be used, stringer tapes, filler cords and threads composed in whole or in part of the synthetic resin, generally in the form of a thermoplastic of the same type as constitutes the interlocking member. The synthetic resin may be present in the form of a film-like coating on animal or mineral fibres, as a thermoplastic fibre in a fibre blend with animal, vegetable or mineral fibres and even synthetic resin fibres incapable of thermal fusion, or the like.

Surprisingly, it is found that effective bonding occurs between the thermoplastic interlocking member and stringer tapes, filler cords, and attachment threads, even when the latter are not composed of synthetic resins or have no thermoplastic characteristics in themselves. While the theoretical rational for this surprising result has not been fully evaluated, it appears that the interlocking member is in frictional contact with the nonthermoplastic member and, as a result of mechanical vibration at the interface and the friction forces developed there, considerable heat is developed to induce the thermoplastic to penetrate the nonthermoplastic materials and create a fusion of intermingling of the thermoplastic and the nonthermoplastic fibres. Thus, while a true thermal fusion occurs when the stringer tapes, filler cords and attachment stitches are composed of thermoplastic material, an intimate mechanical bond as a result of interpenetration occurs at the interface of the thermoplastic interlocking member with non-thermoplastic stringer tapes, filler cords and stitching threads. In spite of the relatively high temperature developed at the contact points or interfaces, there is no detriment to the interlocking member itself.

Another aspect of this invention resides in the provision of an apparatus for the setting of thermoplastic interlocking members in the form of coils or meanders as

described generally above, the apparatus comprising a transport wheel drum or disc provided along its periphery with a multiplicity of seats for receiving successive bends of said interlocking member and means forming a heating station along the periphery of said drum, and including means for subjecting said interlocking member to ultrasonic vibration to heat said member, there being an after-treatment chamber along the periphery of said drum and downstream of said station for controlled cooling of said interlocking member.

Preferably, the transport wheel forms an anvil against which the sonotrode or ultrasonic transducer is juxtaposed. The sonotrode is generally radially displaceable according to this invention towards and away from the periphery of the wheel disc or drum and may be formed with a mating die configuration such that the turns of the interlocking members are pressed and shaped while being heated by ultrasonic vibrations. An arrangement of this type is found to be relatively simple and effective without a tendency toward breakdown and with the ability to process interlocking members at high rates.

While it has been pointed out that the preferred construction provides the transport wheel as the anvil and the counter-element shifted toward and away from the periphery of the transport wheel as the sonotrode or ultrasonic transducer, the kinematic opposite of this construction, wherein the sonotrode is provided on the wheel and the anvil is radially displaceable toward and away from the periphery of the wheel, is also possible.

To maintain the interlocking member tightly in the respective seats, there may be provided along the periphery of the transport wheel one or more pressure rollers upstream from the setting station and designed to urge the coupling heads into the respective seats of the wheel.

The above and other objects, features and advantages of the present invention will become more readily apparent from the following description, reference being made to the accompanying drawing in which:—

Figure 1 is a side-elevational view, partly broken away and partly diagrammatic in form, of an apparatus for carrying out the thermal fixing of interlocking members in accordance with the present invention;

Figure 2 is a top view of the apparatus of Figure 1, partly broken away;

Figure 3 is a cross section taken along the line III-III of Figure 1;

Figure 4 is a plan view of the region shown in Figure 3 with the sonotrode removed;

Figure 5 is a section taken along the line V-V of Figure 1;

Figure 6 is a view generally similar to

Figure 1, but showing the use of the present invention for the simultaneous thermal fixing of the interlocking members and the bonding thereof to a stringer tape;

Figure 7 is a plan view similar to Figure 2, but constituting a top view of the device of Figure 6;

Figure 8 is a cross-section taken along the line VIII-VIII of Figure 6;

Figure 9 is a plan view of the region of Figure 8; and

Figure 10 is a cross-sectional view taken along the line X-X of Figure 6.

In Figures 1 and 2, there is shown an apparatus for the thermal fixing of a sliding clasp fastener interlocking member which is represented diagrammatically at 1 and can be a coil or meander of a thermoplastic monofilament whose heads 1' are interconnected by bights 1'', the interlocking member being formed by coiling the monofilament on a mandrel or depositing undulations upon a carrier.

Basically, the apparatus comprises a transport wheel, disc or drum 2, which, as can be seen in Figure 3, is provided with a multiplicity of die heads or beds 3 in which the individual undulations or turns (shown at 4) can be received. To maintain the gauge of these turns between them the bed 3 of the transport wheel 2 is provided with radially extending teeth 2a of a height h which is less than the width w of the turns 4 as measured in a plane perpendicular to the direction of advance of the interlocking member and to the axis thereof.

The wheel 2 is driven by a chain 2b passing over a sprocket wheel 2c rigid with this disc from a motor shown diagrammatically at 30. The motor is, in turn controlled by a programmer 31 which reciprocates the sonotrode devices 7a-7c as will be apparent hereinafter. Along the path of the interlocking member 1 which is applied against the periphery of the transport wheel 2 by a pressure roller 10, rotated as shown by arrow A in a sense opposite the sense of rotation (arrow B) of the transport wheel 2, the interlocking member is brought to a heating station 5 extending over a limited portion of the periphery of the transport wheel.

In the embodiment illustrated in Figure 1, the heating station occupies approximately 30° of the periphery of the disc which has, at the heating station, a radius represented as R.

As previously noted, the transport wheel may be provided as the ultrasonic transducer, in which case an anvil is provided adjacent the periphery of the wheel. However, it is preferred to constitute the wheel 2 as the anvil for coaction with the ultrasonic transducer in the form of a sonotrode assembly, here shown to consist of three

shaped sonotrode bodies 7a, 7b and 7c spaced one ahead of the other in the direction of advance of the interlocking member (arrow B). As is also evident from Figure 1, the sonotrode bodies 7a-7c are orientated with a slight inclination to the radius of the wheel in lagging relationship. The vibration forces of these sonotrodes thus act with a component in the direction of rotation to facilitate such rotation.

In principle, the sonotrodes (or the single sonotrode illustrated in Figure 6) may be inclined to the radius R in the lagging relationship illustrated in Figure 1 so as to provide a contribution in the sense of rotation of the drum or in a leading relationship in which the sonotrode acts as a continuous ultrasonically heated shaping press. Furthermore, the inclination is relatively slight, e.g., of a maximum of about 30°, so that the sonotrode assemblies can be considered as oriented and vibrating generally in a radial direction.

The sonotrodes 7a-7c are radially displaceable into and out of engagement with the coupling element as it is transported past, as represented by the arrow C in Figure 1, via an electromagnetic device such as the solenoid 8 under the control of programmer 31. The sonotrode assembly 7, 8 may, moreover, have the magnetostrictive characteristics, energization, circuitry and construction described and illustrated in one of the aforementioned U.S. patents.

As is best seen from Figures 3-5, the sonotrode assembly is so displaced that the distance between the periphery of the wheel 2 and the face of the sonotrode confronting the wheel periphery, is less than the width w as measured from the bottom of the bed 3 and illustrated at d in Figure 5. Consequently, the sonotrode member 7a-7c constitutes press rams which may have formations (e.g. 7' in Figure 5) which directly engage the run of the interlocking member to compress the turns of the interlocking member simultaneously with the vibration thereof at ultrasonic frequencies to set and destress the coils. Consequently the anvil and transducer arrangement also functions as a press imparting the final shape to the interlocking member.

In Figures 4 and 5 it has been shown that it is also possible to insert a filler cord 32 in the interlocking member, the interlocking member being squeezed at 4' against this filler cord. As has also been noted earlier, the heat generated at the interface 33 between the filler cord and the interlocking member generally suffices to bond the two together firmly when the filler contains some thermoplastic fibres or consists entirely thereof. When the filler cord is composed of nonthermoplastic fibres, a heat seal does not occur at the interfaces 33, but

rather a bond is formed by interpenetration of thermoplastic material into the interstices between the fibres of the cord and by penetration of the fibres of the cord into the interlocking member. At the conclusion of the heating operation, the filler cord is maintained under compression. It should also be clear, however, that the filler cord may be omitted entirely or, as will be apparent from Figures 6-10, can be joined by the stringer tape etc. in the heating zone.

In the heating zone 5, heat is generated at the contact surfaces of the sonotrode and anvil throughout the turns of the interlocking member in the heating zone in a uniform and surprisingly rapid manner. The heating time takes only a fraction of a second (e.g., 0.3 seconds).

Downstream of the heating zone 5 along the periphery of the transport wheel 2, there is provided an aftertreatment chamber represented at 9 in which the loss of heat from the turns 4 of the interlocking member is restricted by reflection or controlled cooling. The length of the aftertreatment chamber 9 is selected such that the setting of the coil or meander is complete by the time the interlocking member 1 passes from this chamber. As shown in Figure 1, the cooled interlocking member may be affixed to a stringer tape 34 by interweaving, stitching or the like in any conventional manner at a station 35 downstream of the transport wheel 2.

Figures 6-10 show a modified arrangement wherein the interlocking member 1, whose individual turns are represented at 4 as previously described, is fed with a stringer tape 11 of fabric consisting entirely of nonthermoplastic fibre or entirely of thermoplastic thread, or partly of thermoplastic and partly of nonthermoplastic thread. The stringer tape 11 is fed between the roll 10 and the drum 2 as can be seen in Figure 6 to move with the interlocking member 1 past the sonotrode 7, here shown as a single ultrasonic transducer spanning an arc of about 30° along the periphery of the drum 2 and lying along a radius thereof.

From Figure 8 it can be seen that the bed 103 in which the interlocking member 1 and the tape or band 11 is fed, is provided with a cylindrical shoulder 102a along which the tape can extend axially away from the interlocking member 1 at the sides thereof underlying the bights 1' of the coupling element. The interlocking member 1 may be stitched to the tape 11 by chain stitches represented at 13 of a nonthermoplastic thread or a thread containing thermoplastic fibres, the running loops of the thread being shown at 13' beneath the tape 11.

To accommodate the running loops 13' the cylindrical portion 12a of the wheel 2 is

formed with a groove 102b. As will also be apparent from Figures 8 and 10 the bed 103 is provided with sprocket teeth to maintain the spacing of the heads 1' of the interlocking member. A filler cord 12 runs through the interlocking member and is stitched through by the chain stitching 13 to firmly anchor the interlocking member in place. When the sonotrode 7 descends (Figure 10), it compresses the right portion of the interlocking member about the filler cord 12 and heats the interlocking member 1 to a point at which all stresses therein are relaxed as previously described. Simultaneously, high temperatures are developed at the contact region 13a and 13b between the thread and the interlocking member and the thread and the tape 11 so that a fusion is permitted at this point. Similarly the interface 14 between the interlocking member 1 and the tape 11 generates an elevated temperature to fuse the interlocking member to the tape while similar interfacial heating causes fusion at the contact points 12' between the turns of the interlocking member and the filler cord 12.

WHAT WE CLAIM IS:—

1. A method of making sliding clasp fasteners wherein a continuous interlocking member is affixed to a stringer tape, comprising the steps of forming the continuous interlocking member from a continuous strand of a thermoplastic synthetic resin by repetitive bending of the continuous strand to form a multiplicity of interconnected coupling heads therealong, destressing said interlocking member by subjecting it to ultrasonic vibration and thereafter cooling said interlocking member.

2. A method as in Claim 1, wherein the interlocking member is in the form of a coil.

3. A method as in Claim 1, wherein the interlocking member is in the form of a meander.

4. A method as in any of Claims 1 to 3, wherein the plane of each coupling head (together with the associated turn) lies transversely to the gap between anvil means providing support for the interlocking member and the transducer.

5. A method as in any of Claims 1 to 4, further comprising the step of compressively deforming said interlocking member concurrently with the application of ultrasonic vibrations thereto.

6. A method as in any of Claims 1 to 5, further comprising the step of inserting a filler cord into said interlocking member prior to subjecting same to ultrasonic vibrations, and bonding said interlocking member to said filler cord at least in part with the energy of said ultrasonic vibrations.

7. A method as in any of Claims 1 to 6, further comprising the steps of juxtaposing said interlocking member with a stringer tape, and subjecting said interlocking member and said stringer tape to said ultrasonic vibration to bond said interlocking member to said stringer tape at least in part with the energy of said ultrasonic vibration.

8. A method as in any of Claims 1 to 6, wherein said interlocking member is transfixed by a row of stitches prior to subjecting same to ultrasonic vibration, further comprising the step of subjecting said stitches and said interlocking member to ultrasonic vibration to bond said stitches to said member at least in part with the energy of said ultrasonic vibration.

9. Apparatus for setting repetatively bent thermoplastic filament in the form of an interlocking member to produce a continuous interlocking member for a sliding clasp fastener, comprising a transport wheel drum or disc provided along its periphery with a multiplicity of seats for receiving successive bends of said interlocking member and means forming a heating station along the periphery of said drum and including means for subjecting said interlocking member to ultrasonic vibration to heat said member, there being an after-treatment chamber along the periphery of said drum and downstream of said station for controlled cooling of said interlocking member.

10. Apparatus as in Claim 9, wherein said means forming said heating station includes an ultrasonic transducer having an end juxtaposed with the periphery of said wheel drum or disc said wheel, drum or disc forming an anvil co-operating with said transducer.

11. Apparatus as in Claim 10, wherein said end of said transducer is profiled to impart a complementary profile to said interlocking member, which is compressed between said end and said wheel, drum or disc.

12. Apparatus as in any of Claims 9 to 11, further comprising a presser roller upstream of said station in the direction of advance of said interlocking member for applying said interlocking member to the periphery of said wheel, drum or disc.

13. Apparatus as in any of Claims 9 to 12, wherein said seats constitute a bed formed in the periphery of said wheel drum or disc drum and of a depth less than the width of said interlocking member.

14. Apparatus as in any of Claims 10 to 13, wherein said transducer is displaceable toward and away from said periphery of said wheel, drum or disc in the region in which said end of said transducer is juxtaposed with said wheel, drum or disc.

15. Apparatus as in Claim 14, wherein said transducer is inclined to a radius of



formed with a groove 102b. As will also be apparent from Figures 8 and 10 the bed 103 is provided with sprocket teeth to maintain the spacing of the heads 1' of the interlocking member. A filler cord 12 runs through the interlocking member and is stitched through by the chain stitching 13 to firmly anchor the interlocking member in place. When the sonotrode 7 descends (Figure 10), it compresses the bight portion of the interlocking member about the filler cord 12 and heats the interlocking member 1 to a point at which all stresses therein are relaxed as previously described. Simultaneously, high temperatures are developed at the contact region 13a and 13b between the thread and the interlocking member and the thread and the tape 11 so that a fusion is permitted at this point. Similarly the interface 14 between the interlocking member 1 and the tape 11 generates an elevated temperature to fuse the interlocking member to the tape while similar interfacial heating causes fusion at the contact points 12' between the turns of the interlocking member and the filler cord 12.

WHAT WE CLAIM IS:—

1. A method of making sliding clasp fasteners wherein a continuous interlocking member is affixed to a stringer tape, comprising the steps of forming the continuous interlocking member from a continuous strand of a thermoplastic synthetic resin by repetitive bending of the continuous strand to form a multiplicity of interconnected coupling heads therealong, destressing said interlocking member by subjecting it to ultrasonic vibration and thereafter cooling said interlocking member.

2. A method as in Claim 1, wherein the interlocking member is in the form of a coil.

3. A method as in Claim 1, wherein the interlocking member is in the form of a meander.

4. A method as in any of Claims 1 to 3, wherein the plane of each coupling head (together with the associated turn) lies transversely to the gap between anvil means providing support for the interlocking member and the transducer.

5. A method as in any of Claims 1 to 4, further comprising the step of compressively deforming said interlocking member concurrently with the application of ultrasonic vibrations thereto.

6. A method as in any of Claims 1 to 5, further comprising the step of inserting a filler cord into said interlocking member prior to subjecting same to ultrasonic vibrations, and bonding said interlocking member to said filler cord at least in part with the energy of said ultrasonic vibrations.

7. A method as in any of Claims 1 to 6, further comprising the steps of juxta-

posing said interlocking member with a stringer tape, and subjecting said interlocking member and said stringer tape to said ultrasonic vibration to bond said interlocking member to said stringer tape at least in part with the energy of said ultrasonic vibration.

8. A method as in any of Claims 1 to 6, wherein said interlocking member is transixed by a row of stitches prior to subjecting same to ultrasonic vibration, further comprising the step of subjecting said stitches and said interlocking member to ultrasonic vibration to bond said stitches to said member at least in part with the energy of said ultrasonic vibration.

9. Apparatus for setting repetatively bent thermoplastic filament in the form of an interlocking member to produce a continuous interlocking member for a sliding clasp fastener, comprising a transport wheel drum or disc provided along its periphery with a multiplicity of seats for receiving successive bends of said interlocking member and means forming a heating station along the periphery of said drum and including means for subjecting said interlocking member to ultrasonic vibration to heat said member, there being an after-treatment chamber along the periphery of said drum and downstream of said station for controlled cooling of said interlocking member.

10. Apparatus as in Claim 9, wherein said means forming said heating station includes an ultrasonic transducer having an end juxtaposed with the periphery of said wheel drum or disc said wheel, drum or disc forming an anvil co-operating with said transducer.

11. Apparatus as in Claim 10, wherein said end of said transducer is profiled to impart a complementary profile to said interlocking member, which is compressed between said end and said wheel, drum or disc.

12. Apparatus as in any of Claims 9 to 11, further comprising a presser roller upstream of said station in the direction of advance of said interlocking member for applying said interlocking member to the periphery of said wheel, drum or disc.

13. Apparatus as in any of Claims 9 to 12, wherein said seats constitute a bed formed in the periphery of said wheel drum or disc drum and of a depth less than the width of said interlocking member.

14. Apparatus as in any of Claims 10 to 13, wherein said transducer is displaceable toward and away from said periphery of said wheel, drum or disc in the region in which said end of said transducer is juxtaposed with said wheel, drum or disc.

15. Apparatus as in Claim 14, wherein said transducer is inclined to a radius of



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said wheel, drum or disc in said region.

16. Apparatus as in any of Claims 10 to 15, further comprising means for displacing said wheel, drum or disc and said transducer in synchronism.

17. Apparatus as in any of Claims 9 to 16, wherein said wheel, drum or disc constitutes an ultrasonic transducer and said heating means includes an anvil displaceable toward and away from the periphery of said wheel, drum or disc.

18. A method of making sliding clasp fasteners substantially as hereinbefore described with reference to the accompanying drawings.

19. Apparatus for setting repetitively bent thermoplastic filament in the form of an interlocking member to produce a continuous interlocking member for a sliding clasp fastener substantially as hereinbefore described with reference to the accompanying drawings.

20. A sliding clasp fastener when formed by the method of any of Claims 1 to 8.

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