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Müller

[11] **3,834,426**

[45] **Sept. 10, 1974**

[54] **METHOD AND APPARATUS FOR CONNECTING THE ONE ENDS OF HEDDLES OR RATHER SPRING TIE-RODS TO ELASTIC DRAW CORDS IN A JACQUARD MACHINE**

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Dec. 2, 1971 Switzerland 17515/71

[52] **U.S. Cl.** **139/85,** 139/90, 28/3, 140/72

[51] **Int. Cl.** **D03c 3/40,** D03c 3/44

[58] **Field of Search** ..... 139/90, 85, 59, 93, 1 R, 139/1; 28/3; 140/72

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Attorney, Agent, or Firm—Woodhams, Blanchard and Flynn

[57] **ABSTRACT**

A method and apparatus for connecting the ends of heddles and of spring tie-rods to elastic draw cords in a Jacquard machine. The elastic cord material is clamped into a tight engagement with the bent portion of a heddle. The apparatus utilized for accomplishing this connection is a roller mechanism having a cord brake and two fixed guide rollers which are arranged so that they are spaced from one another. A movable guide roller is arranged between the fixed guide rollers and serves to supply cord at a known tension and at a fixed length to the cord clamping and cutting mechanism. A heddle-holding mechanism places a hook-shaped end of a heddle in close association with the elastic cord. The cord is subsequently received in the hook on the heddle and clamped therein.

8 Claims, 10 Drawing Figures

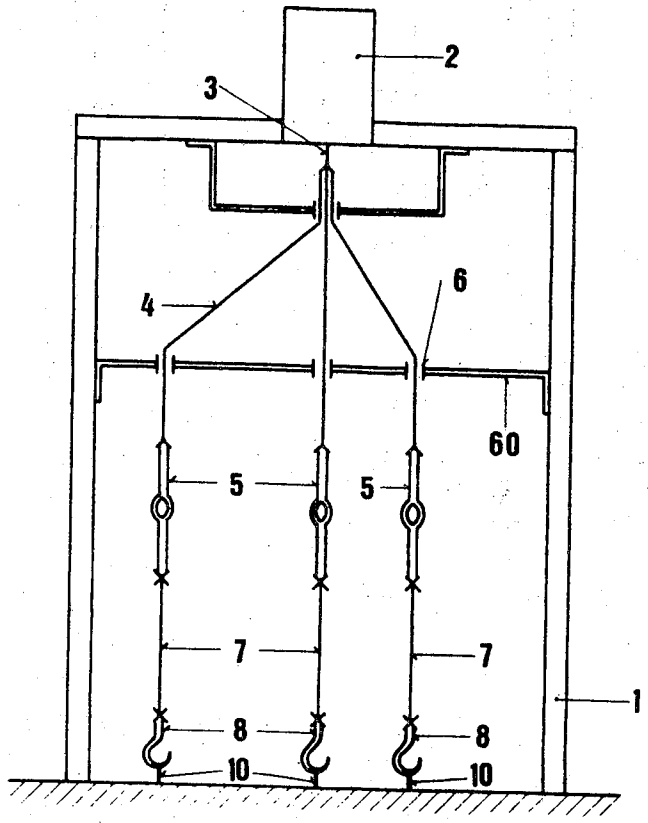


Fig.1

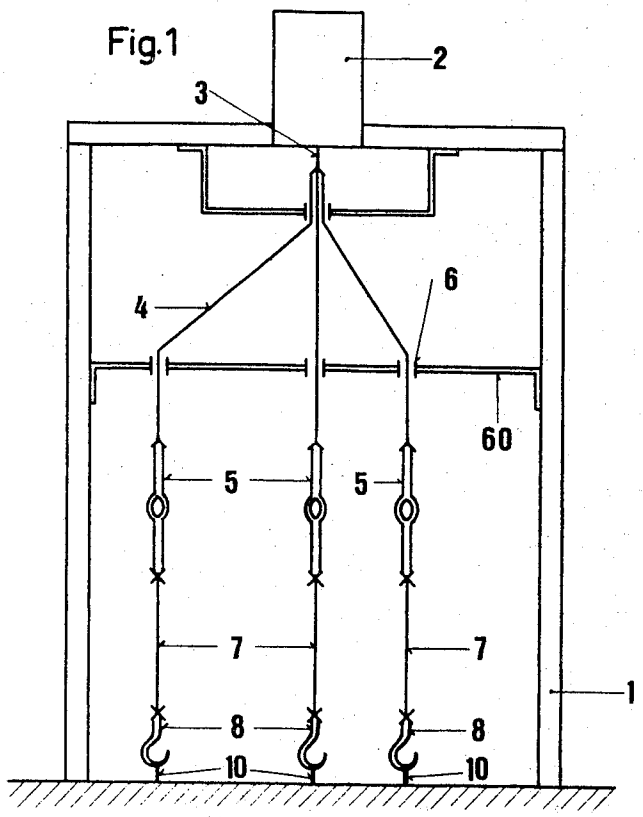


Fig. 2

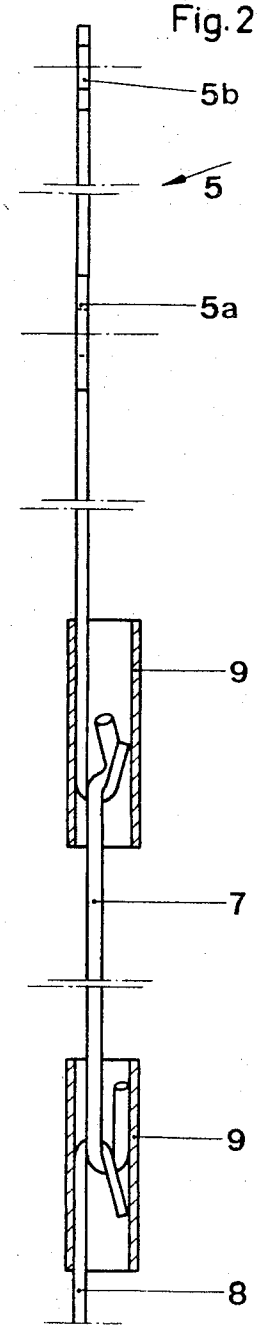


Fig. 3

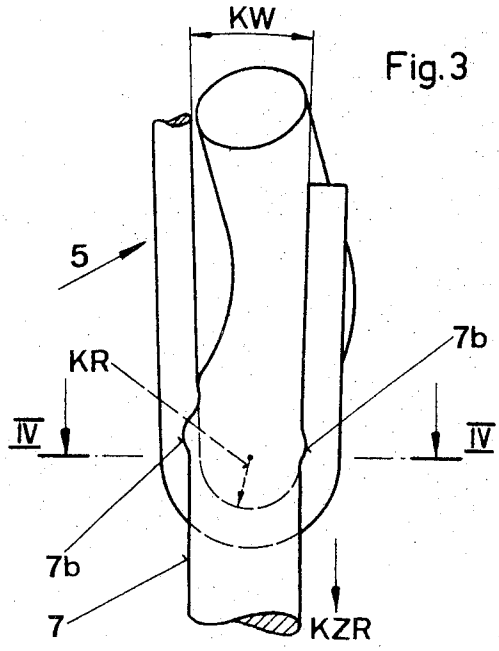
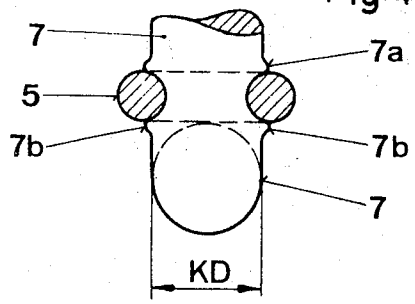


Fig. 4



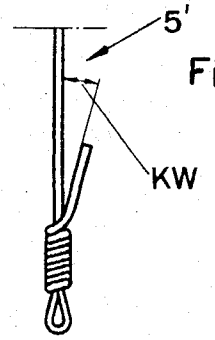


Fig. 5

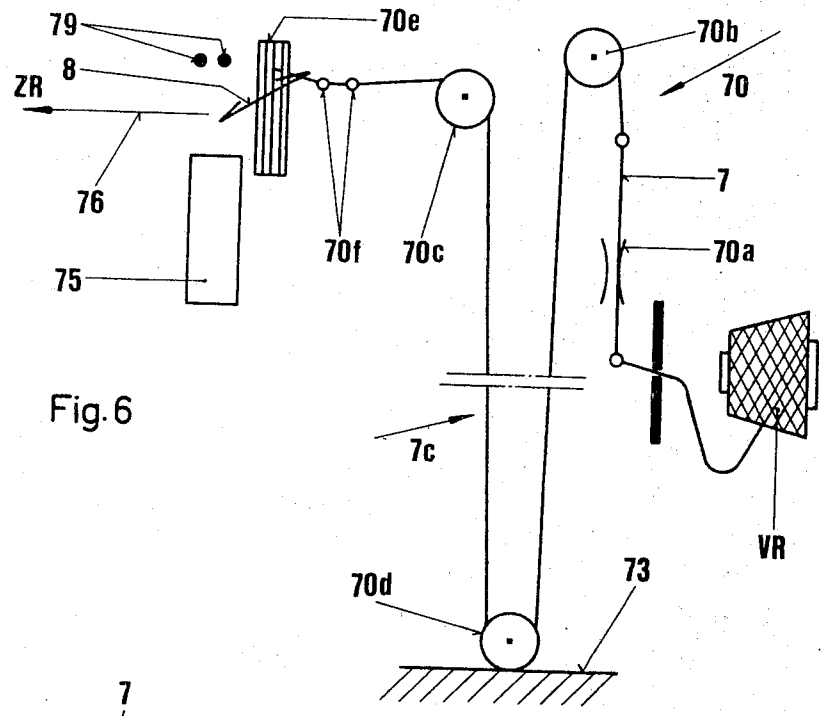
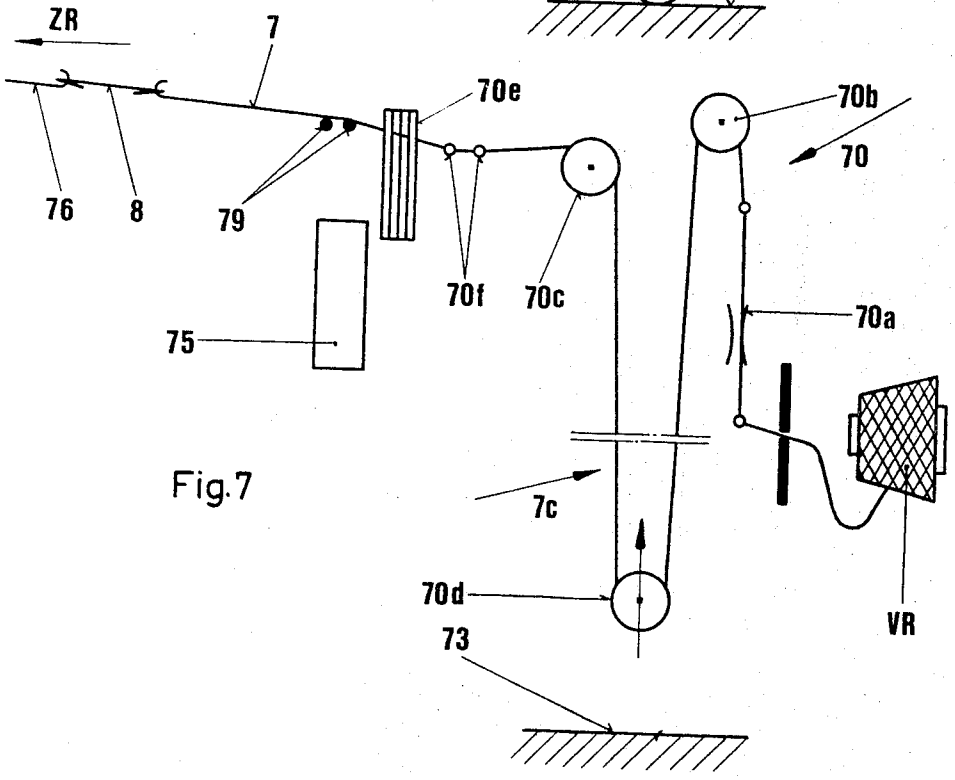

79
8
ZR
76
75
70e
70f
70c
70b
70
7
70a
7c
VR
70d
73

Fig.6


ZR
7
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70f
70c
70b
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70a
7c
VR
70d
73

Fig.7

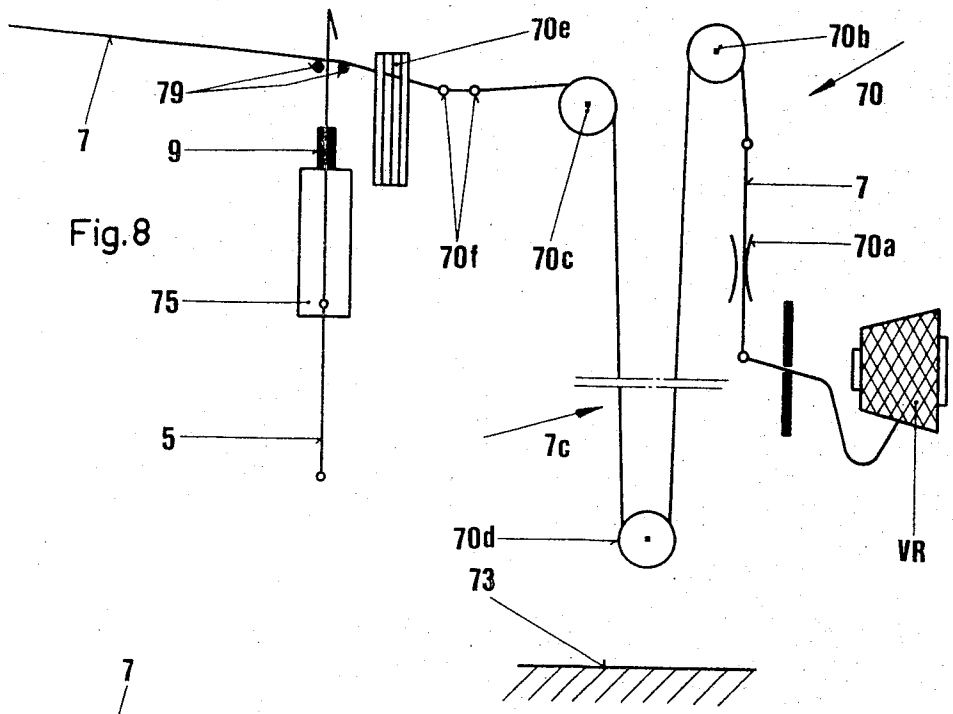
7
79
9
75
5
70e
70f
70c
70b
70
7
70a
7c
70d
VR
73

Fig.8

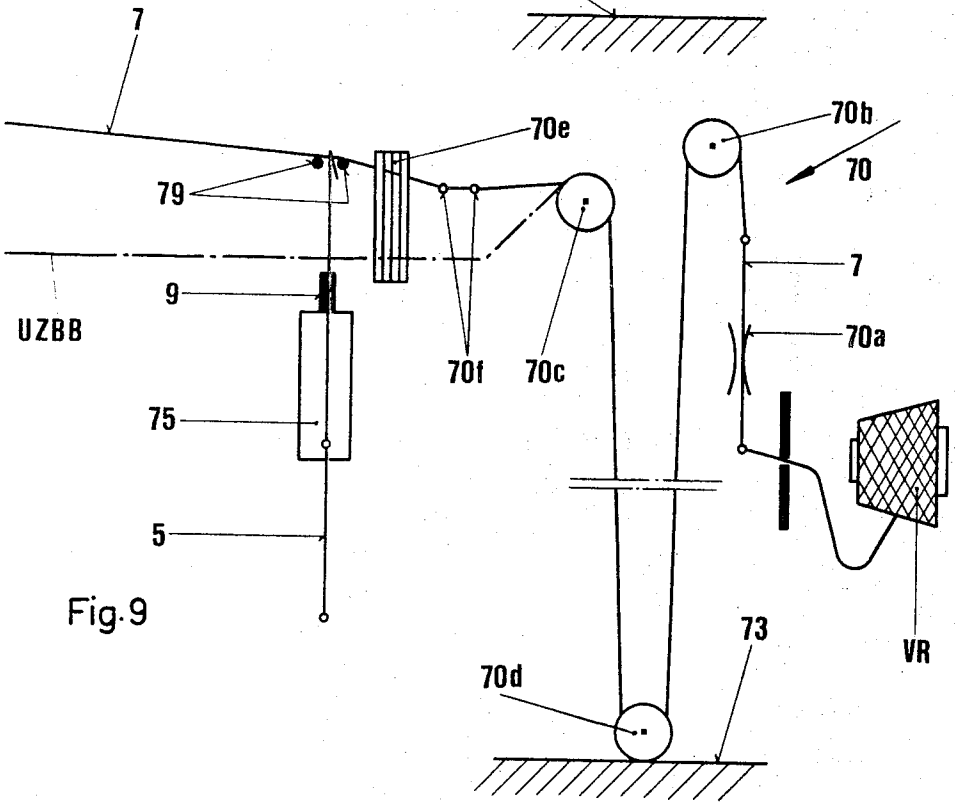
7
79
9
UZBB
75
5
70e
70f
70c
70b
70
7
70a
70d
73
VR

Fig.9

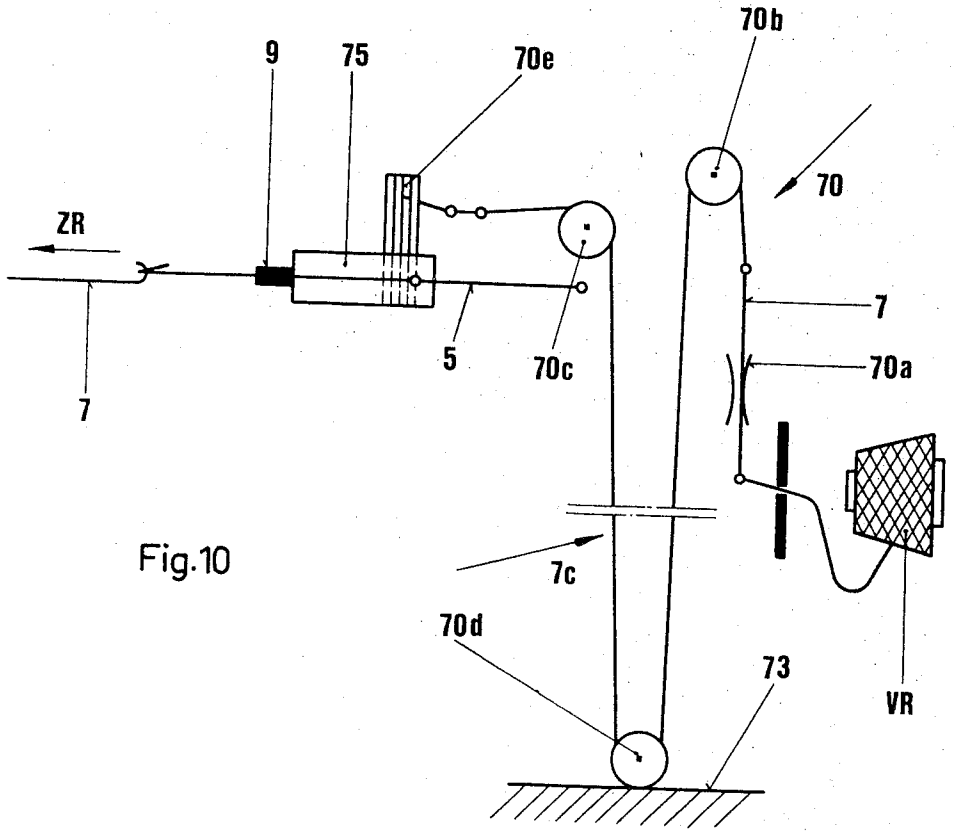

Fig.10

METHOD AND APPARATUS FOR CONNECTING THE ONE ENDS OF HEDDLES OR RATHER SPRING TIE-RODS TO ELASTIC DRAW CORDS IN A JACQUARD MACHINE

According to the presently known method of the mentioned type (German Offenlegungsschrift No. 1,785,025) a tubular braided material of a thermoplastic plastic is moved over the connecting point and is impregnated by a solvent, for example, acetone or chloroform, which subsequently evaporates which causes a cross-sectional shrinkage of the plastic tube. The end zone enclosed by the plastic tube is compressed by the tube shrinkage in such a manner that it receives no further deformation under the action of the drawing forces existing during the normal operation of the Jacquard machine and remains fixedly connected to the heddle end. However, this connection is, based on the applied method technique, only a frictional connection, the solidity of which is, in view of the hardening tendency of most rubber materials used for the elastic cords, exposed to a continuous change and can therefore not be determined exactly. Moreover, this frictional connection can be created only at the expenditure of a considerable amount of time and expense by trained, skilled labor. However, in spite of using the greatest degree of care, one cannot always prevent the rubber material of the elastic cords from contacting the solvent of the plastic tubes and thus create an elasticity reduction and embrittlement which can be identified as the main cause for many cord ruptures in the harness members which are connected according to the conventional methods. These many cord ruptures cause not only economic loss due to downtime of the Jacquard machine but also cause moreover, for restoring its operation, a considerable amount of work and time expense since an exchange of the torn cord and the creation of the positive connection between a new cord and the heddle, and if necessary the spring tie-rod, cannot take place on the machine itself. Rather, it is necessary to insert a new, operatively premanufactured harness member consisting of heddle, cord and if necessary spring tie-rod in place of the damaged member into the machine. The basic purpose of the invention lies pre-eminently in producing a method of the type mentioned in the beginning which can be carried out economically by a structurally simple apparatus and moreover assures an increase of economy of the Jacquard machine. This is achieved in such a manner that the one end zones of the heddles or rather spring tie-rods are each deformed hooklike forming a wedge angle which is open toward the other heddle or rather tie-rod end and which is smaller compared with the static friction angle between the cord and heddle or tie-rod material and the end zones of the cords are each pressed into the hook mouth of the associated heddle or rather tie-rod end until a deformation of the cord cross section occurs.

As can be taken from these characteristics, the inventive method is directed to a final effect which is completely different from the frictional connection caused by the known method between the heddle or rather the spring tie-rod and the elastic cord, namely, to a frictional connection which can easily be released against the cord drawing direction but in all other directions is a positive connection between the elastic cord and the heddle or rather the spring tie-rod. Through this, however, considerable advantages are assured. The end zones of both the heddles and also of the spring tie-rods can be deformed hooklike with the least amount of apparatus, time and work expense, for example, by bending back or back twisting, whereby during the bending backward attention must only be paid that this is done with a radius of curvature which is smaller compared with half of the cord diameter. Since the elastic cord material is relatively incompressible, through the cross-sectional deformation on both sides of the hook mouth of the heddle or rather the spring tie-rod, ridgelike projections are formed on the cord sheath, which projections assure the positive connection of the cord with the hook end of the heddle or rather the spring tie-rod in all directions with the exception of a direction opposite to the cord drawing direction. Therefore, for creating the connection, no aggressive impregnating means or solvent is required so that elasticity reductions or rather embrittlements of the cord material are prevented and the cord ruptures are reduced to a minimum. If cord ruptures occur, the cord ends which remain in the hook ends of the heddles or rather of the spring tie-rods can in the simplest manner easily be removed against the original cord drawing direction and new cords can be inserted. Since hereby the heddles and possibly spring tie-rods can remain on the machine, this exchange can take place very quickly by untrained labor which reduces at an optimum the uneconomical standstill times and the maintenance costs of the Jacquard machine so that their economy of operation is considerably increased.

At a close side-by-side arrangement of the heddles or rather spring tie-rods in the Jacquard machine, it is advantageous, if after pressing the cord end zone into the hook mouth, a tubular section of a conventional type, which can be widened at most up to the width of the hook mouth, is moved onto the hooklike heddle or rather tie-rod end until the tubular ends project on both sides over the free hook arm end. This tubular section has with respect to the actual connection between the elastic cord and the heddle or rather spring tie-rod no function whatsoever, however, it prevents with certainty reciprocal catching of the hook ends of the heddles which work closely side-by-side on the Jacquard machine. The tubular section is furthermore anchored against movement on the heddle by the end of the free hook arm, which end rests against the inner wall of the tubular section, so that no adhesive is required which could possibly come in contact with the rubber material of the elastic cord.

A further, although subordinate, purpose of the invention is the production of a structurally simple apparatus for carrying out the afore-described method. Such an apparatus consists in a conventional manner of a roller mechanism and a drawing mechanism for the cord and holding mechanism for the heddles and spring tie-rods. This apparatus is suitable for carrying out the afore-described method because the roller mechanism has a cord brake and two fixed guide rollers which are arranged spaced from one another after said cord brake which has a movable guide roller arranged therebetween to define a cord loop and a pre-tensioning weight. A cord clamping and cutting mechanism is arranged after the roller system and has an eyelet guide arrangement arranged at a distance in front thereof. The latter and the cord clamping and cutting mechanism is supported movably from out of the drawing

movement path of the cord and that the holding mechanism is constructed for a heddle mounting which fixes the respective heddle which has a longitudinal zone spaced from the hooklike heddle end transversely of the drawing movement path of the cord and is supported swingably with the heddle into the drawing direction of the cord.

With this apparatus, it is possible to unwind exactly equally dimensioned lengths of cord from a cord roller and such cord length can be connected at the longitudinal zone defined by the holding mechanism for the heddle to the heddle or rather at the longitudinal zone determined by the eyelet guide arrangement to the spring tie-rod. The support of the holding mechanism for the heddle, which support can be swung in direction of the drawing direction of the cord, makes it possible that the heddle can be pulled in longitudinal direction from the holding mechanism by the cord drawing mechanism. Through this it is possible to economically manufacture in a quick sequence absolutely identical harness members.

The invention will be explained more in detail hereinafter in connection with the attached drawings, in which:

FIG. **1** is a schematic illustration of a weaving machine having a Jacquard machine mounted thereon and three heddles operated by one hook,

FIG. **2** is a schematic side view of one of the aforedescribed harness members having two connecting variations,

FIG. **3** is an enlarged schematic side view of a portion of the harness member according to FIG. **1**,

FIG. **4** is a cross-sectional view along the line IV—IV of FIG. **3**,

FIG. **5** is a schematic side view of a changed embodiment of one harness portion, and

FIGS. **6** to **10** are each schematic side views of an apparatus for the manufacture of the harness portion according to FIG. **1** in various operating stages.

The weaving machine according to FIG. **1** has two supports **1** on which the Jacquard machine **2** is mounted. Only one single drawing member **3** of the many drawing members or hooks installed in the Jacquard machine is here illustrated and is shown here to operate, through the three cables **4**, three heddles **5** for the warp threads. The number of the cables (and of the heddles) per hook secured thereon, can vary depending on the use of the machine. The cables are guided in holes **6** through the lower hole board in such a manner that the heddles can move only at their predetermined places in the weaving machine. Each heddle is pulled downwardly by a spring-loaded drawing member **7**, such as an elastic band or spiral spring. The spring-loaded member is connected through a connecting means **8** to an anchor **10**. The elements **3, 4, 5, 7** and **8**, which form one entire drawing unit, are connected at the points which are marked by a cross X to one another according to the inventive method.

FIG. **2** illustrates fragmentary portions of a heddle **5** in a scale which is a multiple of the actual scale for reasons of a better understanding and illustrates a one-end connection with one end of an elastic draw cord **7** and the connection between the draw cord **7** and a spring tie-rod **8**, all forming a connection to the harness portion for a Jacquard machine.

The heddle **5** has, adjacent the central longitudinal zone, a thread guide **5***a* for receiving a warp thread of a weaving machine and further has, at the upper end, an eyelet **5***b* which serves as a connecting point to the single illustrated (FIG. **1**) drawing member or hook of the Jacquard machine.

As can be seen from FIGS. **3** and **4**, the lower end of the heddle **5** is bent into a hooklike form to form a wedge angle KW which opens upwardly toward the upper heddle end. The radius of curvature KR is less than half of the diameter KD of the elastic cord **7**. Furthermore, the wedge angle KW is chosen to be smaller than the static friction angle between the heddle material and the cord material. The end zone of the elastic cord **7**, which end zone is associated with the hook portion or mouth at the lower heddle end, is pressed into said hook mouth spaced from the cord end until a deformation of the cord cross section occurs. Due to the relatively incompressibility of the elastic cord material, two ridges **7***a*, **7***b* are formed in the cord sheath on both sides of the hooklike heddle end. Said ridges assure a good connection between the heddle **5** and the draw cord **7** which, with the exception of a cord drawing direction KZR, in all other directions is positive connection. Due to the already earlier mentioned dimension of the wedge angle KW, there exists a self-locking frictional connection between the heddle **5** and the cord **7** against its drawing direction KZR which can be released by overcoming the frictional resistance of the cord in the hook mouth. The aforesaid is also true for the connection between the elastic cord **7** and the spring tie-rod **8**, the upper end of which is bent hooklike in the same manner as the lower end of the heddle **5** and grips around the lower end zone of the cord **7** near the cord end by compressing the cord cross section. After connecting the cord **7** to the heddle **5** and, if necessary, the spring tie-rod **8**, a conventional protection, for example, in the form of an elastic tubular section, can be mounted over either or both of the hook-shaped heddle end and the spring tie-rod end. The tubular section can be widened in cross section at most to the width of the hook mouth and is dimensioned in its length in such a manner that it encloses the free hook arm end on both sides.

Instead of the end of the cord **7***c*, after the clamping in the hook-shaped part, extending in the same direction in the tube **9** as the unbent part as is illustrated at the upper connection in FIG. **2**, it can also be bent 180° as at **7***d* in accordance with the illustration in the lower connection in FIG. **2**.

FIG. **5** illustrates a portion of a modified embodiment of a heddle **5'**, the lower end zone of which is deformed hooklike by wrapping the heddle material about itself so that the free end of the hook material defines with the heddle the wedge angle KW which is open toward the other end of same.

An apparatus for the economical manufacture of the harness members consists, according to FIGS. **6** to **10**, of a roller mechanism **70** and a drawing mechanism **76**, for example, a hand drawing mechanism, for the cord **7**, and also of a holding mechanism **75** for a heddle **5** and **5'** according to FIGS. **2** and **5**, respectively. The roller mechanism **70** has a cord brake **70***a* and a roller system which consists of two fixed guide rollers **70***b*, **70***c* which are spaced from one another and are arranged after the cord brake **70** a (roller **70***b* also being a plate, or disk, brake). The roller system also consists of a movable guide roller **70**d which is arranged be-

tween said fixed guide rollers as a pre-tensioning weight in a cord loop 7*c*.

The roller mechanism **70** is furthermore equipped with a cord clamping and cutting mechanism **70***e* which is arranged after the roller system **70***b*, **70***c*, **70***d*, and which has arranged at a distance in front thereof an eyelet guide arrangement **70***f*. The fixed guide roller **70***b* which is arranged in front of the movable guide roller **70***d* is advantageously constructed as a plate brake for the cord **7**. The cord **7** is pulled off from a storage roller VR and is led through the cord brake **70***a* and through the roller system **70***b*, **70***c*, **70***d* through the eyelet guide arrangement **70***f* to the cord clamping and cutting mechanism **70**e and clamped on same. The loose guide roller **70***d* is lowered onto a stop **73** when the plate brake **70***b* is open and when the cord brake **70***a* is open so that a certain length of the cord **7** is unwound from the storage roller VR.

After the plate brake **70***b* has been closed, one of the spring tie-rods **8** is connected in the afore-described manner to the cord **7** between the cord clamping and cutting mechanism **70***e* and the eyelet guide arrangement **70***f* and according to FIG. **7** is pulled by a drawing mechanism **76** having a drawing direction ZR together with the cord **7** through the open cord clamping and cutting mechanism **70***e* so that the movable guide roller **70***d* is lifted off from the stop **73** and feeds an exact length of the cord **7** and lends the cord **7** a known pretension. The cord **7** is supported along its drawing movement path in the zone of the holding mechanism **75** against an abutment, for example, an inserting fork **79.**

During a subsequent standstill period of the cord **7,** a heddle **5** is inserted according to FIG. **8** in the holding mechanism **75,** onto which heddle the tubular section **9** can, if necessary, already be placed. The holding mechanism **75** is constructed in such a manner that it fixes the heddle **5** with a longitudinal zone projecting from the hook-shaped heddle end transversely of the drawing movement path of the cord **7,** as this can also be seen in FIG. **8.**

According to FIG. **9** the abutment, or rather the inserting fork **79,** and the cord clamping and cord cutting mechanism **70***e* are supported for movement together in the sense of an axial settling out from the original drawing movement path to the path UZBB (indicated in dash-dotted lines in FIG. **9**). Through this in an already earlier described manner, the cord **7** is pressed into the hooklike end of the heddle **5** and is connected to same. The abutment or rather the inserting fork **79** is furthermore also supported in such a manner that it, after the connection of the hooklike end of the heddle **5** with the cord **7,** is movable to totally release the latter.

After the connection of the heddle **5** with the cord **7** and its total release by the inserting fork **79,** the cord clamping and cord cutting mechanism **70***e* is operated to effect a separation of the cord portion connected to the heddle **5** from the cord portion held by the clamp on the roller side. According to FIG. **10,** a swingable support of the holding mechanism **75** permits same to be swung with the heddle **5** by the portion of the cord **7** connected therewith and being under drawing tension into its drawing direction ZR.

During the operation stages of the apparatus described in connection with FIGS. **9** and **10,** the plate brake **70***b* and the cord brake **70***a* are advantageously released so that the movable guide roller **70***d* effects an unwinding of the cord from the storage roller VR and is lowered onto the stop **73.** After the positions of the apparatus elements as illustrated in FIGS. **6** to **8** are again restored, the above-described working cycle can be repeated.

The connecting points between the hook **3** and the cable **4** and between the cable **4** and the heddle **5** can be constructed in the described manner. Attention must thereby be paid that the cable **4** is not elastic like the cord **7.** The clamping, however, can in spite of this occur as described. Also in the case of the cable, the material can give way, i.e., deform, at the clamped point.

The embodiments of the invention in which exclusive property or privilege is claimed are defined as follows:

1. Method for connecting an end of at least one of a heddle member and a spring tie-rod member to an elastic draw cord in a Jacquard machine, comprising deforming said end of said member hooklike until a hook mouth with a wedge angle opening toward the other end of said member is formed and which wedge angle is smaller than the static friction angle between the cord and member material, and pressing an end zone of the cord transversely into the hook mouth of the associated member until a deformation of the cord cross section occurs.

2. Method according to claim **1,** including bending said end of said member backwardly at an inner curvature radius which is smaller than half of the cord diameter.

3. Method according to claim **1,** including, after the cord end zone has been pressed into the hook mouth, moving a tubular section of width at most corresponding to the width of the hook mouth onto said member hooklike end until the ends of the tubular section project on both sides over the free extremity of said member hook-like end.

4. Apparatus for connecting an end of at least one of a heddle member and a spring tie-rod member to an elastic cord in a Jacquard machine, comprising a roller mechanism and a drawing mechanism for the cord and a holding mechanism for the heddle, said roller mechanism having a cord brake and two fixed guide rollers spaced from one another along said cord and after said cord brake, said roller mechanism further including a movable guide roller arranged between said fixed guide rollers in a loop of said cord as a pretensioning weight, said roller mechanism further including a cord clamping and cutting mechanism which is arranged along said cord after said rollers and an eyelet guide arrangement arranged at a distance in front thereof along the cord, said cord being movable away from said clamping and cutting mechanism along a drawing path, said eyelet guide arrangement and said cord clamping and cutting mechanism being supported movably from out of said drawing movement path of the cord, said heddle member having a hooklike end, said holding mechanism comprising a heddle mounting which fixes the respective heddle member with a longitudinal zone of the heddle member, spaced from the hooklike heddle end, arranged transversely of the drawing movement path of the cord, said holding mechanism being swingably supported for swinging said heddle into the drawing direction of the cord.

5. Apparatus according to claim 4, including an abutment associated with the cord and which supports the side of the cord facing the holding mechanism in said longitudinal zone of said heddle member, said abutment being supported movably both for axial settling from the holding mechanism out of the original drawing movement path of the cord and also for total release of said cord.

6. Apparatus according to claim 5, in which the one of said fixed guide rollers preceding said movable guide roller comprises a disk brake for the cord.

7. Method according to claim 1, including feeding the cord as a continuous length past a location of said member, orienting said member at said location to extend transversely across said cord and relatively shifting said member and said cord along the length dimension of said member to bring said cord into said hook mouth while tensioning said cord, to achieve said pressing of said cord into said hook until deformation of the cord cross section occurs.

8. Method according to claim 1, including advancing the free end of a continuous length of said cord to a clamping station and clamping same, applying a first one of said members to said cord upstream and adjacent the clamped end of said cord, unclamping said cord and pulling said first member beyond said clamping location to feed a preselected length of said cord past said clamping location and then reclamping said cord, applying a second one of said members to said cord adjacent and downstream of said clamping location, severing said cord between said second member and said clamping location and then further advancing the cutoff length of cord with said first and second members attached thereto away from said clamping location.

* * * * *