



Fig. 1

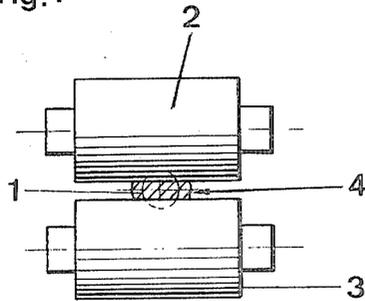


Fig. 2

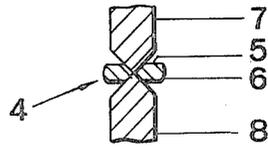


Fig. 3

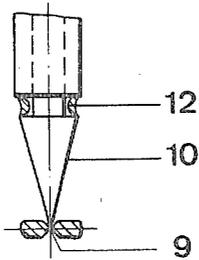


Fig. 4

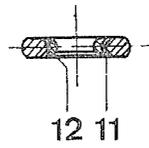


Fig. 5

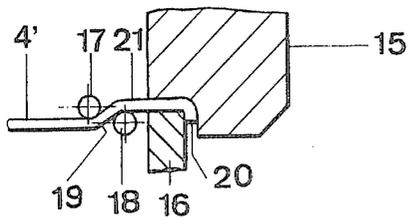


Fig. 6

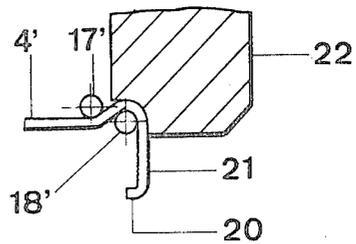


Fig. 7

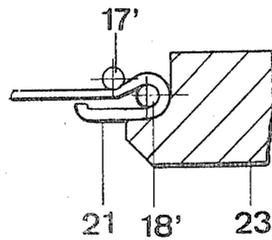


Fig. 8

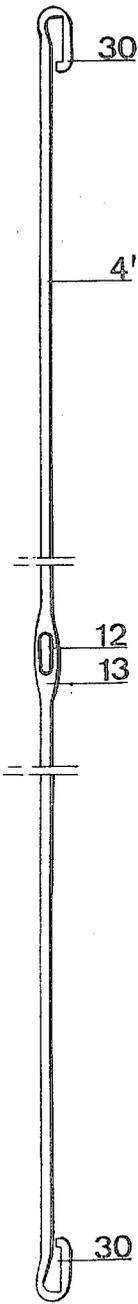


Fig. 9

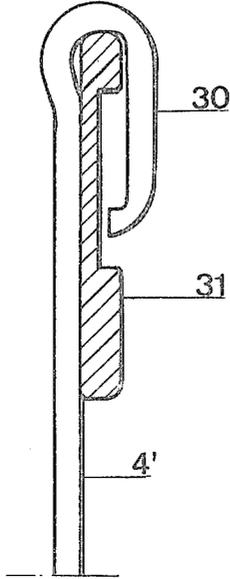


Fig. 11

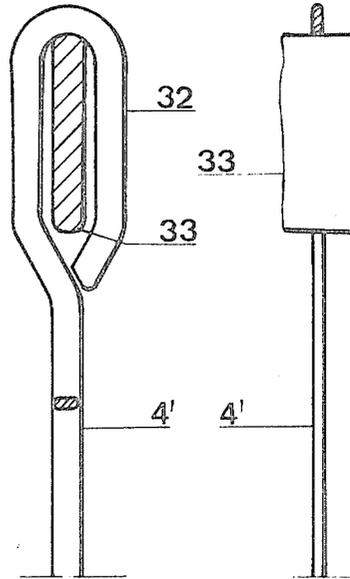


Fig. 12

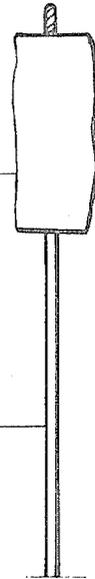


Fig. 10

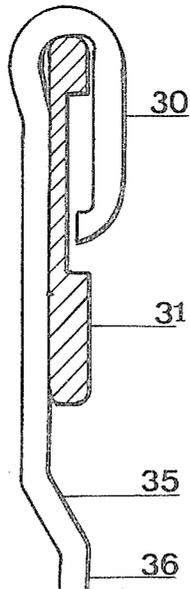


Fig. 13

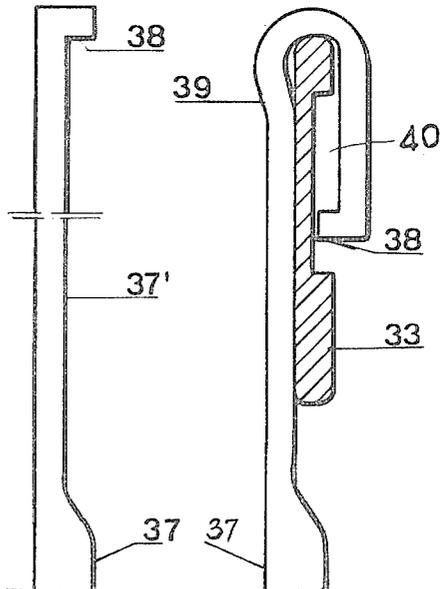
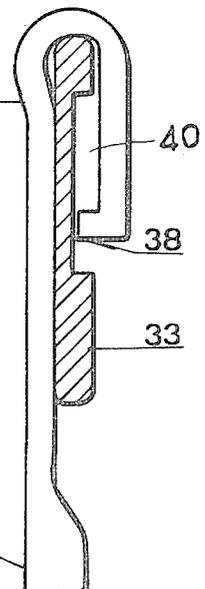


Fig. 14



# METHOD FOR THE FABRICATION OF WEAVING HEDDLES

## BACKGROUND OF THE INVENTION

This invention concerns an improved method for the fabrication of heddles, and particularly for the fabrication of heddles having an elongate cross section.

For some time now there has been considerable interest in flat steel heddles for use in looms with weaving harnesses. Compared with conventional round wire heddles or round steel heddles, such flat steel heddles have the advantage of requiring less space and can, therefore, be set in a row more closely to each other, thus allowing much tighter setting of the weave of the fabric. Furthermore, the terminal eyes of flat steel heddles are as a rule less subject to wear than those of round heddles. Finally, the flat steel heddles are better suited for use in conjunction with automatic threading machines than are round wire heddles.

Known flat steel heddles, however, are still subject to some serious drawbacks. In the case of conventional flat steel heddles, as well as in the case of those for harnesses without detector wires, the width of the steel band or the sheet metal blank out of which the heddles are made, depends upon the width of the material necessary for the forming of each terminal eye.

Within the relatively long central part of the heddle, between its terminal eyes, this full width is used only for the threading eye. However, this full width of material is superfluous in the two portions of the central parts connecting the terminal eyes with the threading eye; from the standpoint of strength, a smaller width would most of the time prove satisfactory. In the case of known flat steel heddles for harnesses without detector wires, these sections are, for reasons of weight, stamped or punched out to a smaller width than the eye portions. In any event, the blanks used to form known flat steel heddles require a relatively large quantity of material. This makes a considerable difference in cost, particularly when the heddles must be made of stainless material, which is becoming more and more the case in manufacturing such heddles.

The costs of production of known flat steel heddles for harnesses without detector wires are also relatively high because expensive tools are required for the stamping or punching operations. In addition, a stamping or punching operation produces sharp edges, extending along the full length of the heddles and which, therefore, must be removed carefully, as by filing. In operation, the relatively large weight of known flat steel heddles has an additional unfavorable defect because the drive members of the loom are correspondingly loaded by the increased weight. The relatively large width of the flat steel heddles also proves to be unfavorable for the servicing or operation of the loom.

## SUMMARY OF THE INVENTION

With the above background in mind, it is therefore a primary objective of the present invention to provide a method for the fabrication of heddles, which avoids the drawbacks of previously known methods. It is a further objective of this invention to provide such a method wherein substantially all of the stock material is utilized and little or no waste allowance is required, thereby considerably reducing the amount of material required and the consequent cost of production.

These as well as other objects of the invention which will become apparent as the description proceeds, are fulfilled by the provision of the method of the present invention wherein the terminal eyes are formed of the blank or stock material by edgewise bending the terminal sections thereof. More specifically, the inventive method for fabricating weaving heddles from wire stock contemplates passing the wire through a rolling mill to give the stock a comparatively thin and wide cross section, embossing a plurality of longitudinal notches in the stock spaced apart a distance generally equal to the desired length of the heddles, spreading each notch by means

of a wedging tool to form an eye and inserting an eyelet member therein, and cutting the individual heddles apart generally midway between consecutive eyes. Each end of the heddles is then formed into a terminal eye by bending between appropriate tool members.

The heddles may also be formed from precut sheet stock by bending the ends thereof into terminal eyes by means of appropriate tool members generally similar to those utilized in forming the heddles from wire stock.

## BRIEF DESCRIPTION OF THE DRAWINGS

The invention itself will be better understood, and additional objects and advantages thereof will be appreciated, from the following detailed description of a preferred embodiment of the invention, taken in conjunction with the accompanying drawings, wherein:

FIGS. 1, 2 and 3 illustrate the drawing, embossing and eye-expanding steps, respectively, of the method;

FIG. 4 is a cross-sectional view through the threading eye of the heddle formed according to this invention, showing the eyelet member inserted therein;

FIGS. 5 through 7 illustrate the manner in which the ends of the heddles are formed to terminal eyes;

FIG. 8 is a side elevational view of a heddle formed according to the instant invention;

FIG. 9 is an enlarged vertical elevational view of the upper terminal eye of the heddle, shown in position upon a heddle rail;

FIGS. 10 through 12 are vertical elevational views illustrating two modifications of the terminal eye; and

FIGS. 13 and 14 illustrate a modified method for forming terminal eyes in a heddle formed of precut sheet stock material.

## DETAILED DESCRIPTION OF THE INVENTION

The preferred method of fabricating the heddles according to this invention is depicted in FIGS. 1 through 7. The heddles are formed from a length of round steel wire stock 1, shown in section in dots and dashes in FIG. 1, having a diameter of 0.75 mm., for example, and a tensional strength of 150 to 250 kg./mm., for example. In a first working station, comprising a rolling mill and preferably comprising rollers 2 and 3, shown in FIG. 1, this wire stock 1 is rolled down to a thickness of, for example, approximately half the original diameter of the wire. This rolling results in a flat steel band, which in FIGS. 1 and 2, is generally indicated by reference numeral 4, and which comprises two parallel, comparatively wide longitudinal sides 5 and two rounded, comparatively narrow sides 6.

In a second working station, depicted in FIG. 2, the flat steel band 4 which is at this point still in the form of an indefinite length of stock material, is provided with an embossing or stamping. The embossing is created by a pair of opposing embossing tools 7 and 8, which produce longitudinal notches 9 extending along longitudinal sides 5 a distance approximately equal to the length of the desired threading eye. These notches are located approximately along the central axis of these sides and are located at a distance from each other somewhat larger than the length of the heddles to be produced.

In a third work station, depicted in FIG. 3, the portion of the flat steel band 4 in the vicinity of notches 9, is operated upon by a wedging or expanding tool 10 which is inserted into the notches 9 in such a way that these notches are expanded to form elongated slots extending completely through the thickness of the flat steel band 4, said slots being widened by deformation of the material of band 4. As shown in the cross section of the notched or indented portion of the flat steel band 4, depicted in FIG. 4, the widening of the notches 9 produces an elongated slot 11. At the same time, the width of the flat steel band 4 is increased in the vicinity of this notched section. Expanding or wedging tool 10 carries thereupon rearwardly of the wedging section, an eye insert member 12 which is pressed into the slot 11 and which is retained therein by con-

cavely curved or bent outer edges of the thread eye insert member 12 which edges engage the inner edges of slot 11. Each thread eye insert 12 is thereby prevented from falling out of the slot until it is permanently fastened in a separate operation, as for example, by soldering.

Following insertion of the thread eye or eyelet member insert 12, the individual heddles are separated by cutting through the band material 4 generally midway between the expanded eye portions of consecutive heddles. FIGS. 5 through 7 depict the three work steps which serve to bend the end of these heddles into terminal eyes. In these Figures, the individual heddles are referred to by reference numeral 4'. One end portion of section 4', which is inserted into the first set of bending tools 15, 16 in an upright or edgewise position, as shown in FIG. 5, is bent between pins 17 and 18, which are movable towards each other, to form an offset portion 19 and a leg 21. In the meantime, by the closing of tools 15 and 16, the end of leg 21 is formed into a hook 20. In the second work step, depicted in FIG. 6, the offset portion 19 is held between pins 17' and 18', similar to pins 17 and 18 of FIG. 5, and leg 21 is bent at a 90° angle by tool 22. In the third work step, depicted in FIG. 7, this leg 21 is then bent through an additional 90° by tool 23, so that now it extends back parallel to the flat steel section 4'. During the bending operations shown in FIGS. 6 and 7, the radius of the bends is determined by pin 18'. In the course of all of these bending operations depicted in FIGS. 5 through 7, which bending operations are in the plane of the material, the flat steel band 4' is supported laterally along the sections to be bent by additional tool parts, not illustrated, in order to prevent a deviation or deflection from the bend plane, and restrained against movement parallel to pins 17, 18 and 17', 18'.

Using steel stock having suitable qualities, it is easily possible to perform the bending operations of FIGS. 5 through 7 when the flat steel wire is cold. It may, of course, in certain instances, be desirable to bend this material in a heated condition or, under certain circumstances, to additionally anneal the stock, after bending it in a cold condition.

Following the above bending operations to form the terminal eyes, said eyes are additionally treated to give them a precise inner cross section. For this purpose, a punching or cutting stamp is passed through the eye while the stock forming the eye is kept immobile in a die or the like, not depicted.

FIG. 8 is a vertical or elevational view of a finished heddle, fabricated by the work steps according to FIGS. 1 through 7 and having its terminal eyes punched to a precise dimension as described above. The thus gauged or calibrated eyes 30 which are formed on both ends of the flat steel band 4', are constructed in the contour depicted in FIG. 9 on an enlarged or magnified scale, in order to engage a conventional heddle support rail 31, shown in section. The heddle of FIG. 8, constructed according to the method depicted in FIGS. 1 through 7 does not require any finishing or smoothing operations or to be reworked because it does not, especially in its central part, exhibit sharp edges. The only exception to this is in the interior of each terminal eye which has been punched out, which requires slight smoothing, as by filing.

The method described above may also be used to fabricate heddles having differently formed terminal eyes, for example, those shown in FIGS. 10 and 11. FIG. 10 depicts a terminal eye 30 which is connected to the central part 36 of the heddle by a bent or offset part 35, but which otherwise exhibits the same form as the terminal eye 30 of FIG. 9. The embodiment of the terminal eye shown in FIGS. 11 and 12 corresponds, in this case, more to the form of heddle still used in forming round wire heddles; the terminal eye 32 thereof completely embraces or surrounds the heddle support rail 33.

Savings in material of this method, as compared to flat steel heddles punched out of band steel, sheet steel or other flat material, can amount to as much as 60 percent for heddles fabricated according to this procedure; this is of importance also because of the corresponding reduction in weight. A simplification of the process with respect to the embossing or

stamping operation for the fabrication of the slot 11 results from the fact that one starts with a drawn profiled wire, exhibiting longitudinal notches, provided for on both sides of the wire.

5 The procedure described above can also successfully be used with punched bands or other blank heddles, which are provided with a widened middle section, because an essential saving in material is also in this instance possible by means of the method of edgewise bending of the terminal eye sections in the plane of the material as opposed to the known method of punching out these eye sections. Such a procedure is illustrated in FIGS. 13 and 14. FIG. 13 depicts a blank or unfinished part, which is punched out of band steel, wherein the width of the band steel stock corresponds to the width of the middle part 37 of the heddle. The narrowed or tapered terminal eye section 37', as well as the hook 38, have been previously formed out of the band steel during the punching operation. In a manner corresponding to the bending operations according to FIGS. 6 and 7, a terminal eye section 37' can be formed or bent into the terminal eye 39, shown in FIG. 14, by bending in the direction of the wide or larger cross section dimension. The hook 38 formed thereby engages in the lateral groove 40 of the heddle support rail 33.

20 It can easily be seen from the above description that the difference in width of the terminal eye 39, as opposed to the width of the middle part 36, determines the saving in material, which can be achieved by the edgewise bending of the terminal eye, as opposed to the conventional method of punching out this eye.

It should now be apparent from the above detailed description of the method of fabrication of the heddles according to this invention, that all of the objects set forth in the introduction have been successfully fulfilled.

What is claimed is:

1. A method of fabricating weaving heddles from wire stock of indefinite length, comprising the steps of rolling the wire stock to a comparatively wide and thin cross section, having two parallel wide longitudinal surfaces and two rounded narrow surfaces; embossing longitudinal notches along said wide surfaces; spreading said notches to form elongated slots extending through said stock, said stock being widened in the vicinity of said slots; cutting through said stock generally midway between said slots to form individual heddles; and bending each end portion of each heddle to a terminal eye.

2. The method of claim 1, further comprising the step of inserting an eyelet member into each said slot.

3. The method of claim 2, further comprising the step of passing a punching stamp through each said terminal eye after formation thereof, to thereby impart a precise internal dimension to said terminal eye.

4. A method for the fabrication of weaving heddles having terminal eyes at at least one end thereof from a unitary metal blank possessing a substantially elongate cross section, wherein said terminal eyes are formed by bending the end portions of each heddle in the plane of the material of the metal blank.

5. A method as defined in claim 4, wherein said blank comprises flat profiled steel stock.

6. A method as defined in claim 5, wherein a punching stamp is passed through each said terminal eye following formation thereof, to thereby impart a precise internal dimension to said terminal eye.

7. A method as defined in claim 5, wherein said blank is formed from a length of wire stock of substantially circular cross section by passing said wire stock through a roller mill and thereby imparting to said wire stock a comparatively wide and thin cross section.

8. A method as defined in claim 5, wherein said flat profiled steel stock is obtained by a drawing operation.

9. A method as defined in claim 5, wherein a threading eye is formed in each said heddle by embossing a longitudinal notch in said heddle and thereafter spreading said notch to form an elongated slot extending through said blank.

10. A method as defined in claim 9, wherein said embossing and spreading steps precede the formation of said terminal eyes.

11. A method as defined in claim 9, wherein an eyelet member is inserted into said elongated slot during said spreading step. 5

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