Oct. 17, 1961 C. R. KRONOFF 3,004,562

WARP CONTROL IN A HIGH SPEED LOOM

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FIG. 1

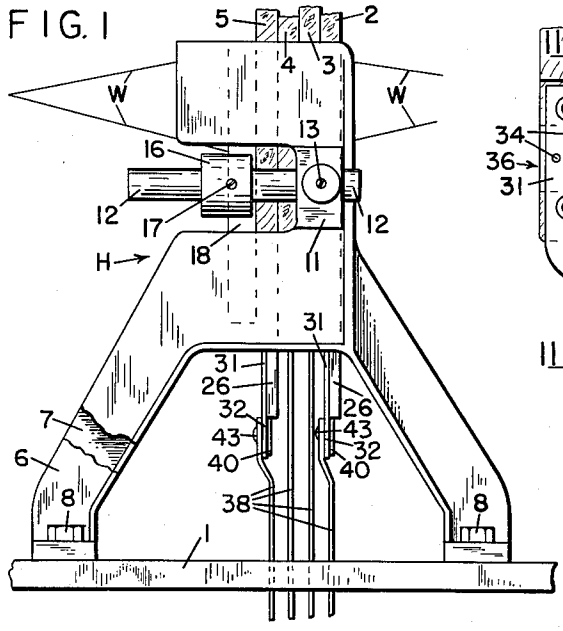


FIG. 10

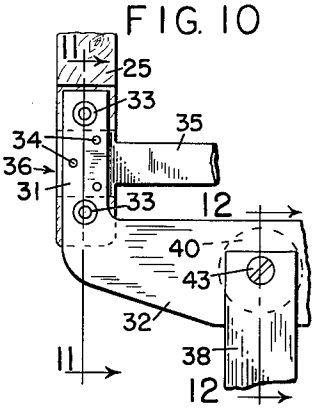


FIG. 11

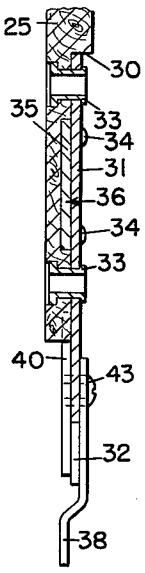


FIG. 12

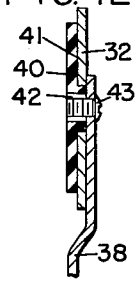


FIG. 13

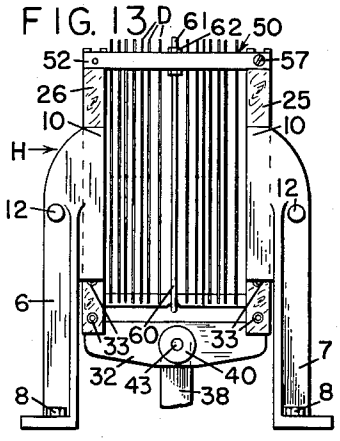


FIG. 2

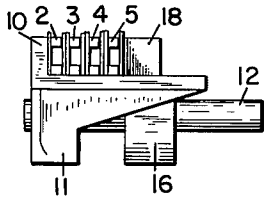


FIG. 14

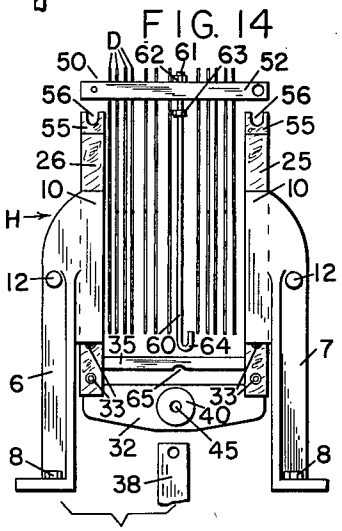
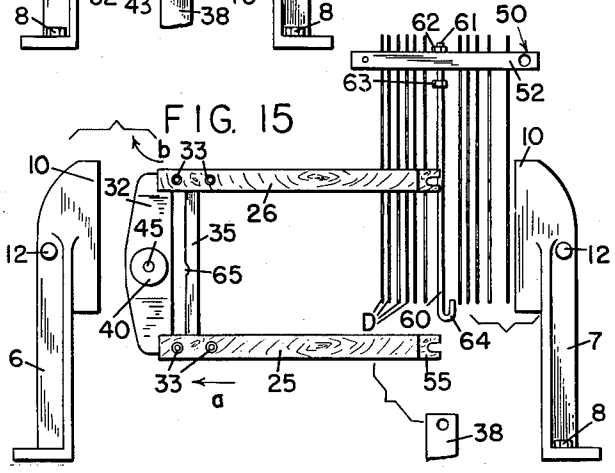


FIG. 15



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FIG. 3

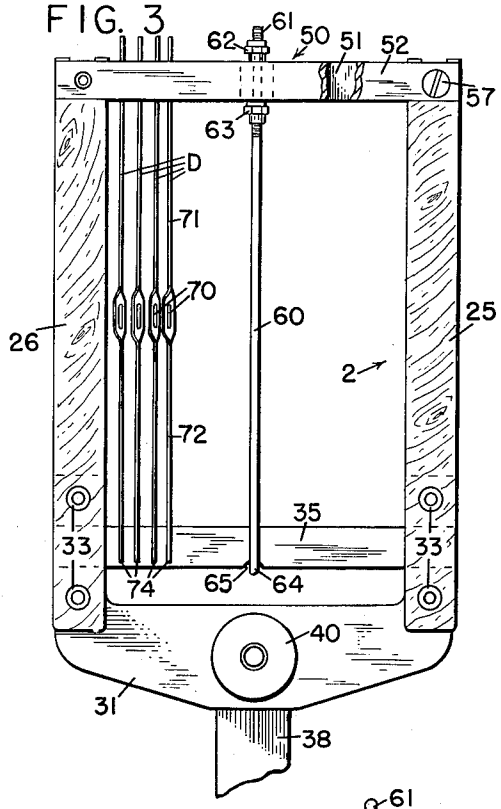


FIG. 7

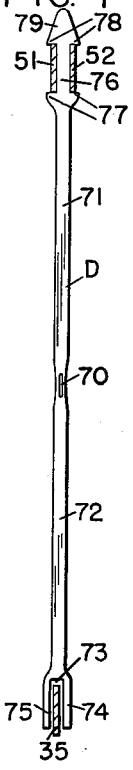


FIG. 8

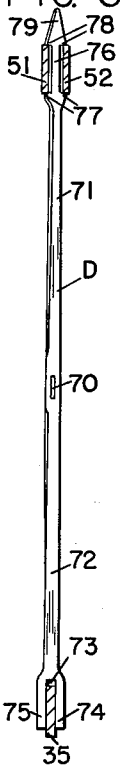


FIG. 9

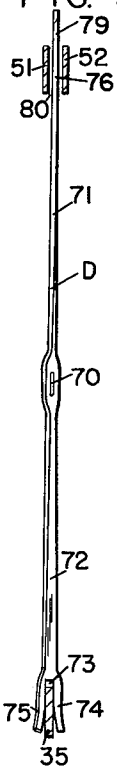


FIG. 4

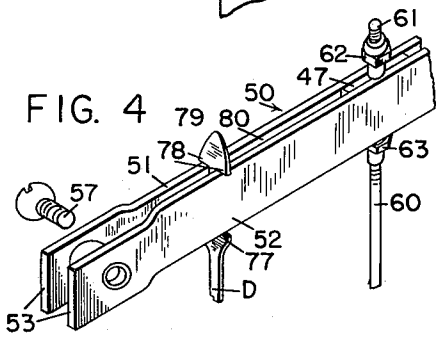


FIG. 6

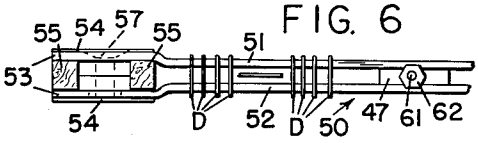
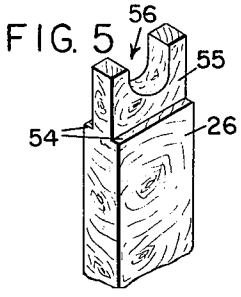


FIG. 5



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3,004,562

WARP CONTROL IN A HIGH SPEED LOOM

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Filed June 23, 1960, Ser. No. 38,329
15 Claims. (Cl. 139—91)

This invention relates to improvements in warp control means for high speed looms.

Narrow ware goods can be woven either on a gang loom in which a number of shuttles operate simultaneously, or on a single unit loom. In order to operate efficiently, looms of the latter type must operate at high speeds such for instance as 1400 picks or sheds per minute. In looms of this kind down time of as much as five minutes can mean a loss of 7,000 picks and it is consequently important that the loom be designed so as to permit rapid repair and renewal of parts in order to reduce down time to a minimum.

One of the conditions which can develop in a high speed narrow ware loom is a defect in a heddle due to wear or malfunction. As heretofore made, the heddles and the harness frames which hold them have been so constructed that in order to remove a defective heddle it has been necessary in many instances to remove many good heddles before the faulty one is reached. It is an important object of the present invention to make a harness frame and heddle in such manner that a defective heddle can be removed from where it is on the heddle rail merely by twisting it a ¼ turn without removing any of the other heddles, after which it can be lifted out of the harness frame and a new heddle inserted by a reverse operation. This result is attained as set forth hereinafter by having the upper end of the heddle formed with lobes or ears which engage the tops and bottoms of a pair of harness frame members and having lower end of the heddle provided with a downwardly opening slot which can fit around or straddle a heddle rail secured to the lower end of the harness frame.

In looms of the type mentioned it occasionally happens that a defect will develop in one of the harness frames requiring that the latter be either removed and repaired, or be replaced with a new frame. It is a further object of the present invention to provide a harness frame made with a removable top member which carries the aforesaid heddles but can be detached from side members of the harness frame while the warp threads are threaded through the heddle eyes. The harness frame can then be turned and removed by a sidewise motion, leaving the top frame member and the heddles in the loom, the removal being made without disturbing any of the warp threads.

It is a further object of the present invention to provide a harness frame which has the advantages already mentioned and wherein the frame has side members connected across their tops by a combined harness frame forming member and heddle rail or bar. In this feature of the invention detachable connections are provided between the ends of the combined member and rail and the harness frame side members so constructed that by detaching the connections and relieving the tension on a holding or tie rod which extends to the bottom heddle rail the top member can be lifted clear of the remainder of the harness frame and carry the heddles and their warps with it. After the frame has been disconnected from its reciprocating driving member it can be removed as already mentioned. The important part of this feature of the invention is the fact that the member across the top of the harness frame serves the dual function of completing the frame and also providing a support for the upper ends of the heddles. In all known harness frames these functions are performed by separate parts, namely, a cross piece connecting the sides of the frame, and a separate heddle rail beneath it for the heddles.

In order that the invention may be clearly understood reference is made to the accompanying drawings which illustrate by way of example the embodiments of the invention and in which:

FIG. 1 is a side elevation of part of a loom having my invention applied to it,

FIG. 2 is a plan view of part of the structure shown in FIG. 1,

FIG. 3 is a front elevation of one of the harness frames made according to the invention, parts being broken away,

FIG. 4 is an enlarged perspective view of one end of the upper member of the harness frame showing it detached from the side members and showing the upper end of the improved heddle,

FIG. 5 is a perspective view of the upper end of one of the side members of the harness frame,

FIG. 6 is a plan view of one end of a harness frame showing the top member attached to one of the side members and with several heddles in proper position, but with one of them turned to a position for removal,

FIGS. 7, 8 and 9 are views showing successively the steps to be followed in removing a heddle from the harness frame,

FIG. 10 is a fragmentary front view of a lower corner of a harness frame,

FIGS. 11 and 12 are vertical sections on lines **11—11** and **12—12**, respectively, FIG. 10, and

FIGS. 13–15 show the steps in removing a harness frame.

Referring more particularly to FIGS. 1 and 2, plate **1** represents parts of a narrow ware loom of the type shown for instance in Turner Patent No. 2,625,959 and supports a harness mechanism designated generally at H. In the present instance four harness frames are shown which from front to back are designated at **2**, **3**, **4** and **5**. The mechanism H has two spaced guides **6** and **7** which are removably bolted as at **8** to the plate **1**. Each guide has a front harness frame guide rib **10** which engages a side of the front frame **2** and has a boss **11** which receives a stud **12** extending horizontally and held in fixed adjusted position by a screw **13**. Mounted on each stud **12** is a hub **16** held in adjusted position along the stud by screw **17**. Each hub **16** has a vertically extending guide rib **18** similar to rib **10** except that it is adjustable and as shown herein engages a side of the rear harness frame **5**. The hub **16** can be adjusted along the stud **12** to accommodate as many harness frames as are needed. The mechanism shown and described in connection with FIG. 1 is duplicated but of the opposite hand on the other side of the mechanism H, as indicated in FIG. 2.

Each harness frame, such as **2** shown in FIG. 3, has two vertical parallel laterally spaced side members **25** and **26** which are preferably made of wood, such as treated maple preferably having incorporated therein some anti-friction material or lubricant, such as paraffin. The lower end of each side member is undercut as at **30**, see FIG. 11, to receive a vertical part **31** of a cross bar **32** made preferably of sheet metal and having attachment to the lower end of the side member by means of hollow rivets **33**. Each part **31** has riveted thereto at **34** an end of a bottom heddle rail **35** fitting into a slot **36** in the side member. The bottom rail **35** is above the cross bar **32**, see FIG. 10. The lower end of each side member **25—26** will be formed substantially as shown in FIGS. 10 and 11, and all parts of the harness frame thus far described will be fastened to each other rigidly but detachable with respect to each other.

Each harness frame is connected to a driver 38 which extends downwardly through the plate 1 to driving connections (not shown) which effect vertical reciprocation of the driver and its harness frame. In order to avoid the need for lubricating the connection between the driver and the cross bar 32 a construction similar to that shown in FIG. 12 may be employed wherein a rubber washer 40 is bonded as at 41 to one side of the cross bar and has an internally threaded bushing 42 also bonded thereto. A screw 43 passing through the upper end of the driver 38 is tapped into the bushing 42 and holds the bushing, the screw and the driver together as a unit, the slight angular motion needed to accommodate movement of the actuating means for the driver resulting in a slight shear deformation of the part 44 of the washer 40 which is bonded in a hole 45 in the cross bar. The construction shown in FIG. 12 is one example of a way to connect a harness frame with a driver therefor, but the invention is not limited to such a connection. Removal of screw 43 disconnects the harness frame from its driver.

The upper part of the harness frame is formed with a cross member 50 which as shown in FIG. 4 and 6 comprises two spaced horizontal substantially flat metal strip elements 51 and 52 which are connected adjacent their longitudinal centers by a block 47 which is welded, brazed, or otherwise secured to the elements 51 and 52. Each end of each element 51—52 is offset and adjacent offsets 53 are proportioned to receive between them the upper reduced end 55 of a side member, as 26 shown in FIG. 5. The end 55 has an upwardly opening slot 56 therein through which a clamping screw 57 passes. This screw, of which there is one at each end of the member 50, is threaded into one of the elements and clamps the offsets against the upper end 55 of the corresponding side member.

Extending vertically through the block 47 is the upper end of a tie rod 60 which is screw threaded at 61 to receive top and bottom adjusting nuts 62 and 63 for engagement with the top and bottom respectively of the block 47. The lower end of rod 60 is formed as a hook 64 to fit into a notch 65 formed in the under edge of the bottom cross rail 35. When rod 60 is tightened in position by nut 62 it forces the offsets 53 firmly against shoulders 54 on the side members, see FIG. 5.

In assembling the harness frame, connection with the driver 38 may first be established, after which the top member 50 will be fitted down over the upper ends of the side members 25 and 26 and the hook 64 caught under the rail 35 in the notch 65. The nut 62 will then be turned down on the upper threaded end 61 of the rod to draw against rail 35 and form a tight fitting relation between the elements 51 and 52 and the side members, the nut 63 having previously been run down on the screw sufficiently to permit this operation. The screws 57 are then set in position to clamp the offsets of elements 51 and 52 against the reduced end 55 and the nut 63 run up against the under side of the block 47. The harness frame now has all of its parts in rigid connecting relation and along with others similar to it will be fitted between the ribs 10 and 18. After application of heddles D the harness frames will be in readiness for reciprocation incident to loom operation.

The warp controlling heddles D form an important part of the present invention and are shown more particularly in FIGS. 3, 4 and 6 to 9. Each heddle is formed of spring sheet metal, such as steel, having a central warp eye 70 between upper and lower shanks 71 and 72 respectively. The heddles are alike and one of them will be described in detail. The lower end of shank 72 is formed with a downwardly opening slot 73 forming two depending fingers 74 and 75 which fit around or straddle the bottom rail 35.

The upper end of each heddle has a part 76 which fits between the elements 51 and 52 and has two lower ears 77 extending in opposite directions and engageable with the under sides of the elements 51 and 52 and has similar upper ears 78 for engagement with the tops of elements 51 and 52 and form part of a head 79. The distance between the bottom and top ears is only slightly more than the height of the elements 51 and 52 so that there is a good driving fit between each heddle and its cross member 50. The part 76, ears 77 and 78 and adjacent part of shank 71 are normally in a common plane transverse of member 50.

The fingers 74 and 75 of each heddle cooperate with the bottom rail 35 to keep the ears 77 and 78 normally crosswise of member 50 so that as each harness frame is raised and lowered by its driver 38 the heddles on it will move with it to form top and bottom sheds in the warp threads W, FIG. 1, which are threaded through the eyes 70.

It is believed that the operation of the heddle and harness frame will be apparent from the foregoing description, the harness frames moving in whatever sequence the pattern of the fabric being woven requires, this sequence being determined by the actuator means below plate 1. The harness frames are confined to their operating zone in the loom by mutual engagement by the guides 6—7, and by the ribs 10 and 18.

As already mentioned, looms of the type described operate at high speed and because of that fact wear or breakage can result with the harness frames and/or heddles, in which event it is necessary to stop the loom and make a repair or replacement. If a heddle has become bent out of shape, or badly worn, its head 79 will be grasped by the weaver's fingers, or pliers, or other suitable tool, and given a ¼ turn from the position shown in FIG. 7 through the position shown in FIG. 8 to the position shown in FIG. 9. When in the latter position the bottom ears 77 are located in line with the slot 80 between the elements 51 and 52, and the heddle can be lifted out of the harness frame, since the slot at the bottom of the heddle is open and the fingers 74 and 75 can slip up along the sides of the bottom rail 35. During removal of the heddle the fingers 74 and 75, being resilient, bend on rail 35.

A new heddle can then have its lower end inserted down through slot 80 and have its fingers 74 and 75 manipulated to straddle the rail 35 while the head 79 is twisted and pushed down in place until the heddle by its own inherent resilience snaps into position with its ears transverse of member 50 and in the normal working position relative to elements 51 and 52. The warp thread, previously broken, can then be rethreaded and retied, after which weaving can be resumed. It will be appreciated that this is a rapid repair made possible by the nature of the heddle and the top member 50, and that the defective heddle can be removed without disturbing or removing other heddles.

If some defect, such as excess wear, should develop in a harness frame it can be removed as indicated in FIGS. 13–15. While in the position of FIG.13 its screws 57 can be slackened to relieve their clamping effect between the upright side members and the cross member 50 and the nut 62 can be run up on the threaded end 61 of rod 60 until the hook 64 can be pushed down and detached from the bottom rail 35. The nut 62 can then be run down on the screw, and if need be the nut 63 run down, to raise the hook 64 to a position which will prevent it from moving under the rail 35.

If the defect is in member 50 it can be lifted a short distance and the heddles given one-quarter turns to release them from the member. While the heddles are still straddling rail 35 the member 50 can then be removed with its tie rod 60, and be replaced by another member 50. During this replacement the heddles, which are still threaded with their warps, can be twisted, as by grasping the lower ears 77, and passed up through slot 80. The wedge shaped heads 79 facilitate twisting of the upper ends of the heddles as the latter are moved upwardly relatively to member 50.

If the defect is in the lower part of the harness frame the screw **43** can then be removed to disconnect the driver **38** from the harness frame after which the cross bar **50**, the rod **60** and the heddles will be disconnected from the remainder of the harness frame and can be raised as in FIG. 14. Support **6** can then have its screw **8** removed and be moved laterally to the left away from the warp threads, see FIG. 15, thus exposing the left-hand sides of all the harness frames. The frame which has been disconnected from its driver **38** and cross member **50** can then be turned clockwise in its plane until its side members are horizontal, side member **26** above and member **25** below the heddle eyes and warps corresponding to raised member **50**. The partial frame can then be moved to the left, see arrow *a*, FIG. 15, and then turned upwardly, arrow *b*, and removed. This removal is effected without disturbing any of the warp threads. During this operation the heddles and the member **50** associated with the defective frame will not share in the turning of the harness frame and the heddles will remain threaded with their warps.

If frame **2** is the one being removed its cross member **50** can be supported by the reed (not shown) at the right of FIG. 1. If, however, frame **5** is the one being removed its member **50** can be moved back for support by the warp threads. If, on the other hand, frame **3** or **4** is being removed its member **50** will be kept in place in part at least by the adjacent frames. In any event it may be desirable to pass an elastic band around the heddle heads **79** and the upper end of rod **60** to hold the ears or lobes **77** and **78** transverse of member **50** and slots **75** in position for restraddling of rail **35**.

Replacement of a harness frame can be accomplished by procedures the reverse of those described for the removal of the frame. After the new frame has been placed with its side members first horizontal and then turned to vertical position the screw **43** can be replaced to connect the frame to its driver and then the lower ends of the heddles made to straddle cross bar **35**. The hook **64** will then be tightened and the screws **57** clamped in place. Side guide frame **6** will then be returned to its normal position. The steps for removal of a frame need not necessarily follow the exact order already outlined.

It will thus be seen that repair of the warp manipulating parts of the loom can be made very rapidly so that down time may be held to a minimum. The heddle is constructed in such manner that it can be removed and be replaced merely by a ¼ twist, and the harness frame is so made that it can be disconnected from its top member **50** and the driver **38** and then after removal of support **6** or **7** can be turned sufficiently to be removed from the loom without disturbing any of the warp threads. The ears, lobes or extensions **77** and **78** provide twice as much contact area with the member **50** as that found in the ordinary heddle and rail.

Having now particularly described and ascertained the nature of the invention and in what manner the same is to be performed, what is claimed is:

1. In a loom harness frame to support warp heddles, two vertically extending spaced substantially parallel side members, a bottom cross bar secured to the lower ends of the side members, a lower heddle rail extending across the lower part of the harness frame secured to the latter above the cross bar, a combined top heddle rail and frame forming member extending across the top of the harness frame connected to the upper ends of the side members to complete the harness frame and provide support for the upper ends of heddles when the lower ends of the latter are enaged wtih the lower heddle rail, and a driver operatively connected to the bottom cross bar, said combined top rail and member being detachably connected to the side members and when detached is liftable upwardly from the remainder of the frame and the driver.

2. The harness frame set forth in claim 1 wherein the top member is detachably connected to the side members and a tension rod with its lower end hooked under the lower heddle rail has its upper end secured to the top member.

3. In control means for the warp of a loom, a harness frame having two upper spaced parallel heddle engaging elements at the upper end thereof and a single lower heddle rail at the lower end thereof, a resilient sheet steel heddle having a warp eye between the ends thereof and having a lower end formed with a downwardly opening slot straddling the single rail and having a flat part near the upper end thereof fitting between and held transverse of the parallel elements by engagement of the lower rail with the heddle, lobes on the heddle above said part of the latter extending over said two elements, and other lobes on the heddle below said part extending under said two elements.

4. In control means for the warp of a loom, a harness frame having two upper spaced parallel heddle engaging elements at the upper end thereof and a single lower heddle rail at the lower end thereof, a resilient sheet steel heddle having a warp eye between the ends thereof and having a lower end formed with a downwardly opening slot straddling the single rail and having a flat part near the upper end thereof fitting between and transverse of the parallel elements, an extension on the heddle extending over one of said two elements and a second extension on the heddle extending under one of said elements normally effective to prevent upward displacement of the heddle relative to the elements, the upper end of the heddle being twistable on itself to align the second extension with the space between the two elements, whereupon the heddle can be lifted upwardly from said two elements and from the single bar.

5. The control means set forth in claim 4 wherein the first extension reaches over both of said two elements and affords a hand hold by which the heddle can be manually twisted.

6. The control means set forth in claim 4 wherein said slot is between two fingers on the lower end of the heddle which engage opposite sides of said single rail and hold said part of the heddle near the upper end thereof and said extensions transverse of said two elements.

7. In control means for the warp of a loom, a harness frame having two upper spaced parallel heddle engaging elements at the upper end thereof and a single lower heddle rail at the lower end thereof, a resilient sheet steel heddle having a warp eye between the ends thereof and having its lower end engaging the single bar but removable therefrom by upward movement and having its upper end extending between said two elements and held against upward displacement relative to said elements by extension means engageable with the bottom of at least one of said elements, the upper end of the heddle having an extension over at least one of said elements, and the heddle being twistable on itself to align the extension means with the space between the two elements, whereupon the heddle can be lifted from said two elements and from a single rail.

8. In control means for the warp of a loom, a harness frame having two upper spaced parallel heddle engaging elements at the upper end thereof and a single lower heddle rail at the lower end thereof, a heddle extending between said upper elements engaging the latter and said lower rail and normally held against upward and downof said upper and lower portions of the heddle with at least one of said elements, the upper end of the heddle having formed therewith a hand hold above the elements by which the heddle may be twisted on itself to align said lower portion with the space between the two elements, whereupon the heddle can be lifted from said two elements and from the single rail.

9. A warp heddle for a harness frame having a single heddle rail and having also a pair of spaced parallel heddle engaging elements, the heddle being made of a single

piece of resilient flat sheet metal and having one end formed with an open slot to receive the single rail and having the other end formed with a part to fit between said pair of elements and having lobe means above and other lobe means below said part extending laterally from said part in position to engage at least one of said pair of elements when the single rail is in said slot, the upper end of the heddle being twistable on itself approximately 90° with respect to the lower end thereof.

10. The heddle set forth in claim 9 wherein the first lobe means has parts to extend over both of the elements and the other lobe means has parts to extend under both of said elements.

11. In a loom harness frame having vertical side members and a bottom cross bar secured to the lower ends of the side members, a bottom heddle rail fixed with respect to the side members above the cross bar, a top heddle supporting member, means detachably connecting the upper part of each side member to the adjacent end of the top member, heddles supported by the top member having downwardly opening slots in their lower ends straddling the bottom rail and having eyes to receive warp threads, the top member when detached from the side members enabling the latter and top rail to separate vertically while the heddles are engaged with the top rail and warp threads are in the eyes of the heddles, the bottom rail during the separation becoming disengaged from the heddles.

12. The harness frame set forth in claim 11 wherein the cross bar has a detachable connection with a driving means, said connection when detached enabling the side members and cross bar to move downwardly relative to the heddles.

13. In a loom harness frame having vertical side members and a bottom cross bar secured to the lower ends of the side members, a bottom heddle rail fixed with respect to the side members above the cross bar, a top heddle supporting member, means detachably connecting the upper part of each side member to the adjacent end of the top member, heddles supported by the top member having downwardly opening slots in their lower ends straddling the bottom rail and having eyes to receive warp threads, the top rail when detached from the side members enabling the latter and top rail to separate vertically while the heddles are engaged with the top members and the warp threads are in the eyes of the heddles, the bottom rail during the separation becoming disengaged from the heddles, the side members and bottom cross bar then being turnable to a position in which the side members are horizontal, one above and the other below the warp threads and then removable sideways without disturbing the warp threads.

14. In a loom harness frame having vertical side members and a bottom cross bar secured to the lower ends of the side members, a bottom heddle rail fixed with respect to the side members above the cross bar, a top heddle supporting member, means detachably connecting the upper part of each side member to the adjacent end of the top member, heddles supported by the top rail having downwardly opening slots in their lower ends straddling the bottom rail and having eyes to receive warp threads, the top rail when detached from the side members and raised relative to the bottom rail enabling the side members and bottom rail to be turned around an axis extending more or less parallel to the warp threads to locate the side members one above and the other below the warp with the bottom rail at one side of the warp and then be moved laterally without disturbing the warp threads.

15. In warp controlling harness mechanism for a loom having a base, a plurality of harness frames arranged side by side, guide means at each side of said frames limiting lateral movement of the latter and normally secured to said base, at least one of said guide means being removable laterally from said frames, drive means detachably connected to the lower end of each harness frame, a combined frame forming and heddle support member detachably connected to the top of each harness frame, heddles depending from each member normally supported by the latter and having eyes for warp threads, each harness frame when detached from its drive means and from its top member being turnable in a plane parallel to the other frames for removal without disturbing any warp threads, provided said one guide means has been removed laterally to enable the frame to turn.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,004,562 October 17, 1961

Clarence R. Kronoff

It is certified that error appears in the above identified patent and that said Letters Patent are hereby corrected as shown below:

Column 5, line 69, "enaged" should read -- engaged --. Column 6, line 65, after "down-" insert -- ward motion relatively to said elements by engagement --; line 66, cancel "said".

Signed and sealed this 13th day of January 1970.

(SEAL)
Attest:

Edward M. Fletcher, Jr.
Attesting Officer

WILLIAM E. SCHUYLER, JR.
Commissioner of Patents