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2,544,526

LOOM

Filed April 18, 1949

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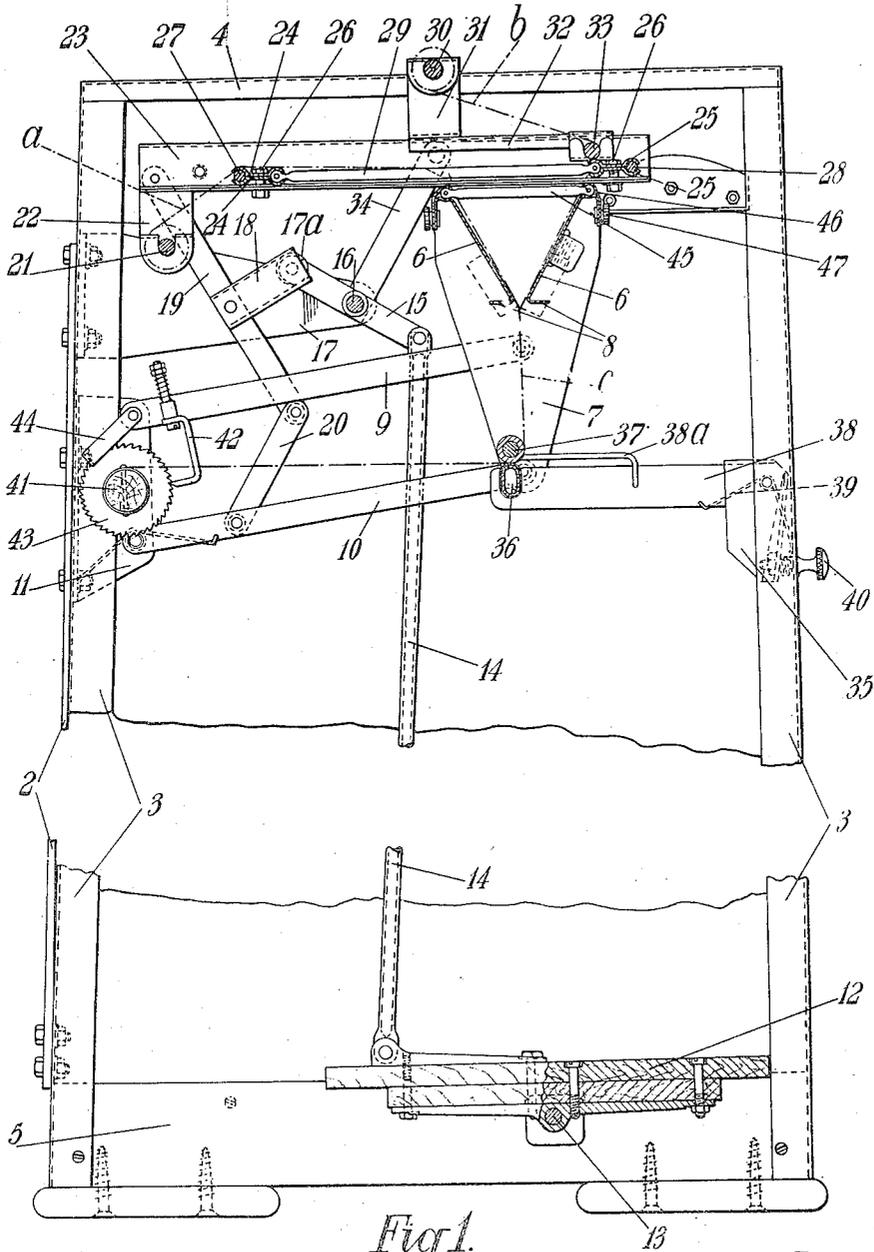


Fig. 1.

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4 Sheets-Sheet 3

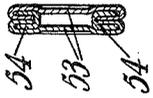


Fig. 5.

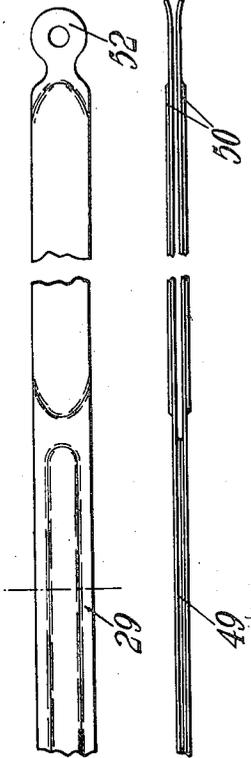


Fig. 3.

Fig. 4.

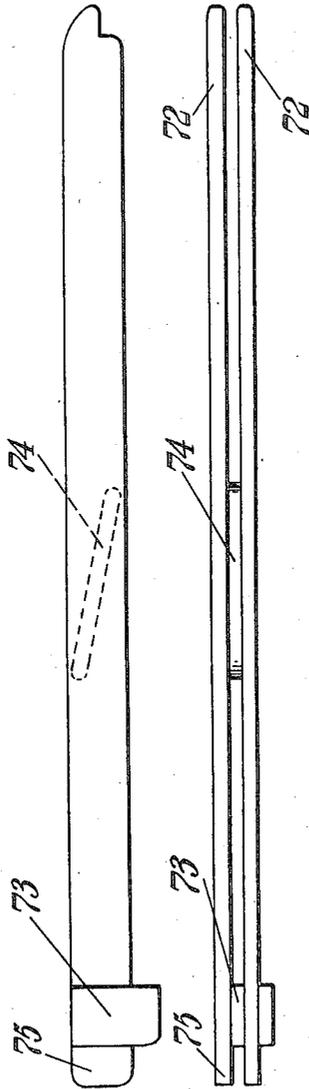


Fig. 11.

Fig. 12.

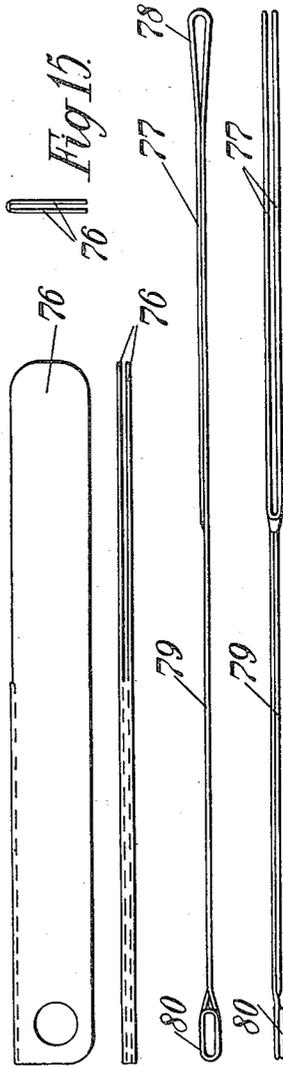


Fig. 13.

Fig. 14.

Fig. 16.

Fig. 17.

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March 6, 1951

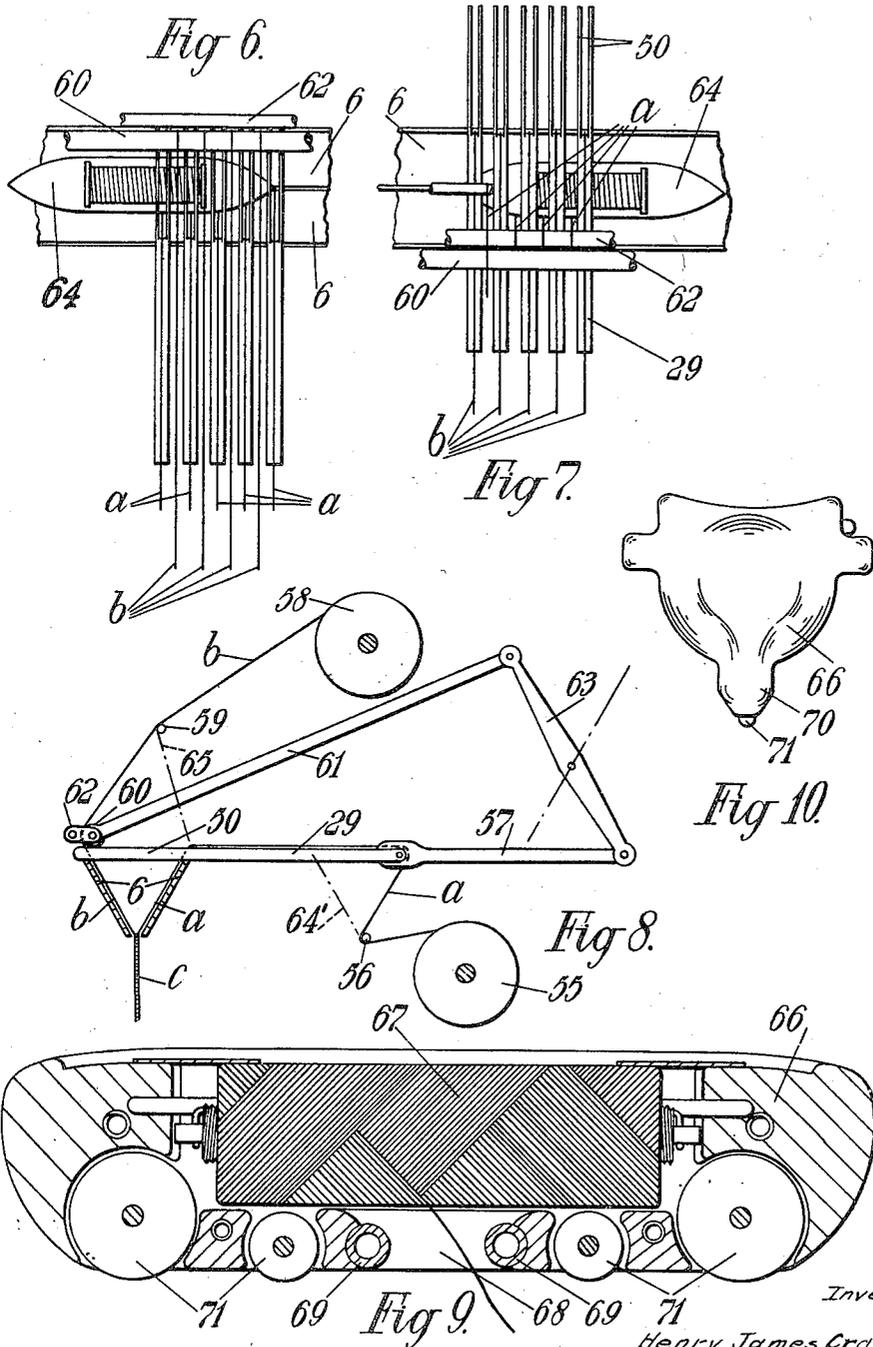
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# UNITED STATES PATENT OFFICE

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LOOM

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In Great Britain April 20, 1948

20 Claims. (Cl. 139—18)

1

This invention relates to weaving and is particularly concerned with looms for the weaving of various types of fabric such for example as cotton, wool, or artificial silk and the like, and may be applied either to hand or power looms.

The object of the invention is to provide an improved and simplified construction of loom and to achieve greater economy in the preparation of the loom for weaving. Another object is to provide a loom in which the parts requiring expert adjustment and control are greatly reduced compared with looms as employed heretofore, thereby requiring a lesser degree of skill on the part of the operative. Another object is to provide an improved form of member for effecting the shedding of the warp threads and to replace the usual heddle or heald employed for this purpose. A further object is to provide an improved form of shuttle for use in looms according to the invention.

The invention comprises shed forming means including a series of fork-like members having spaced tines or blades joined to a shank, warp threads of one set being engaged between the tines of said members and the length of said tines or blades being such that the warp thread always remains between them during shedding which is effected by displacing the said members transversely with respect to the warp threads. It will be understood that the second set of warp threads pass between the adjacent fork-like members and cannot enter the space between the tines or blades of individual members by reason of the length of said tines or blades. The second set of warp threads may be displaced for shed forming purposes by a second series of fork-like members disposed in opposition to the first series, the two series of members being displaced simultaneously in opposite directions in parallel planes for the shedding operation. Preferably, however, instead of a second series of fork-like members the required displacement of the second set of warp threads is effected by a displaceable bar or like member extending across the threads. Preferably the said displaceable member comprises a pair of parallel bars or members between which the warp threads pass.

The invention also comprises a trough-like formation through which the warp threads pass and forming a track for the shuttle, the warp when divided by means in accordance with the preceding paragraph being brought to rest on the sides or walls of said formation through which the shuttle is passed after each shed forming operation. Such trough-like formation may be

2

constituted by a pair of rollers placed side by side, but preferably and in accordance with a further feature of the invention, a pair of plates or similar members are arranged in V formation with an opening at the bottom through which the woven material is drawn out, preferably between rollers or between a roller and a bar held together under spring loading. The fork-like members are arranged horizontally above the trough-like formation and are displaceable from side to side by suitable means, the members being proportioned so that the distance from the tips thereof to the point where the tines or blades unite at the shank is greater than the distance required for the conveyance of the warp threads from one side to the other of the trough-like formation.

According to a further feature of the invention, the trough-like structure forming the shuttle track carries a reed and is given a downward motion to beat the weft thread laid by the shuttle into the fell of the cloth. The reed may conveniently comprise a series of thin metal or other strips secured on edge across the upper edges of the trough structure.

In an alternative arrangement according to the invention, the reed can be omitted and the shuttle so constructed that it places the weft thread at the bottom of the V formation created by the divided warp threads. According to a further feature of the invention, the shuttle is formed with wheels or skids to facilitate its travel, and said wheels or skids are so arranged that they cause the weft to be embedded in the fell of the fabric.

A further feature of the invention comprises an arrangement of the warp beam supports so as to avoid undue strain on the warp in forming the shed. According to one arrangement, the warp beams are carried upon and move with the means for displacing the warp threads from side to side of the trough-like formation. According to an alternative arrangement in which the warp beam supports are stationary, the warp threads from each beam pass over a fixed guide and thence upwardly and downwardly respectively to a point which has a backward and forward motion equivalent to the motion required by the means for conveying the threads alternately from one side to the other of the trough-like formation. As the points constituted by the movable means bear a fixed relation to each other by virtue of their equivalent motion, it follows that the angle traversed by the warp in the trough-like formation is similar to that traversed by the warp situ-

3

ated between either of the guides and the movable means, so that the warp is drawn away in two approximately parallel lines having a similar angle of motion. The position of the fixed guides may be varied in relation to the aforesaid movable means as desired.

In a hand operated loom, a treadle may be provided for actuating the shed forming devices and the warp beam carriers through suitable linkage, and in addition may actuate the V-shaped trough and reed in a vertical direction, and also a take-up roll.

The invention also comprises a fork-like member for shed forming in a loom, having spaced tines or blades joined to a shank, the length of said blades or tines exceeding the longitudinal displacement of the member necessary for forming the shed. The member may be formed from any suitable material, the arrangement being such that a warp thread can pass between the tines or blades in a defined position for the purpose of displacing such threads in shed forming. The fork-like member may conveniently comprise parallel blades and may be formed by folding or moulding suitable material into a narrow U-shaped section, with a portion of the fold removed to constitute blades.

According to a further feature of the invention, the fork-like member comprises a pair of blade elements welded or otherwise secured together along part of their length.

For use in high-speed looms, it is necessary to avoid risk of cutting the threads and for this purpose the edges of the fork-like members are suitably rounded.

The invention also comprises a fork-like member in which the tines, and preferably also the shank, are formed from rounded material such as wire. Thus the member may be made from two lengths of wire each of which is folded to a narrow U-shape, and the folded portions are soldered or otherwise secured together over part of their length to constitute the shank. Eyes may be formed at the extremities of the tines and at the end of the shank for securing the member to carrier bars or their equivalent.

Fork-like members in accordance with the invention are referred to in the following description as heddles.

Referring to the accompanying drawings,

Figure 1 is an end elevation, partly in section, of a hand operated loom constructed in accordance with the invention;

Figure 2 is a front elevation of the loom;

Figure 3 is an elevation of a heddle;

Figure 4 is a plan view of the heddle;

Figure 5 is a cross section of a body part of a similar heddle showing an alternative mode of construction;

Figures 6 and 7 are diagrammatic plan views of a modified arrangement of loom constructed in accordance with the invention, showing the two alternative positions of the warp threads;

Figure 8 is a diagrammatic view showing the modified arrangement of loom in end elevation;

Figure 9 is a side elevation, in section, of a shuttle constructed in accordance with the invention;

Figure 10 is an end view of the shuttle;

Figures 11 and 12 are an elevation and plan respectively of a modified form of heddle;

Figures 13, 14 and 15 are a side elevation, plan and end elevation respectively of another modified form of heddle;

Figures 16 and 17 are an elevation and plan

4

respectively of a further modified form of heddle.

In carrying the invention into effect according to one convenient mode, as applied by way of example to a hand operated loom as shown in Figures 1 and 2, there is provided a supporting structure comprising end frames 1 and crossed brace members 2, each of the end frames consisting of vertical members 3 and upper and lower horizontal members 4 and 5 respectively. A shuttle track is constituted by a V-shaped trough formed by sheet metal plates 6 which are secured to a pair of end plates 7. The lower ends of the plates 6 are bent outwardly as shown at 8, leaving an opening at the bottom of the trough. The end plates 7 are each supported by a pair of parallel levers 9 and 10, the opposite ends of which are pivotally mounted on a bracket 11. A treadle 12 is pivoted at 13 at the bottom of the supporting structure and is connected at each end by a link 14 to one end of a lever 15 mounted on a spindle 16 carried in brackets 17. The other end of each lever 15 carries a roller 17a engaging a groove in an arm 18 secured to a link 19 pivoted to brackets 17, the lower end of which is connected by a link 20 to a pivoted lever 10. A lower warp beam is carried upon a spindle 21 supported at its ends by brackets 22 depending from a pair of carriages 23 which are slidable horizontally in guides in the frame structure, and one end of each link 19 is pivoted to a carriage, so that by operation of the treadle the carriages will be displaced horizontally. The carriages 23 form supports for heddle clamping plates 24, 25 which extend between the carriages across the loom and are secured together in pairs by bolts 26. The edges of the aforesaid heddle plates are of curved channel form and the outer edges of each pair are clamped over rods 27 and 28. The inner edges of the heddle plates engage and support a series of heddles 29, details of which will be described later. An upper warp beam is carried by a spindle 30 supported in brackets 31 which are secured to a second pair of carriages 32 slidable upon the first mentioned carriages 23. Mounted at one end of the carriages 32 is a bar 33 which extends across the loom. Motion is transmitted to the carriage 32 by levers 34 secured to the spindles 16.

A pair of arms 38 pivoted upon brackets 35 carry a rubber-covered bar 36 extending across the loom, and a rotatable roller 37 mounted on said arms is held in engagement with the said bar by springs 38a. The arms 38 are maintained in the position shown in Figure 1 by springs 39, the tension of which can be adjusted by finger screws 40. A take-up roll 41 for the woven fabric is rotatably mounted in the brackets 11 and is operated by a ratchet 42 carried by the lever 9 which coacts with a ratchet wheel 43 secured to the roll, reverse motion of the wheel being prevented by a pawl 44. The ratchet 42 is spring mounted, so that if the tension of the fabric becomes too great it will not be operated. A reed 45 is secured across the upper edges of the V-shaped trough formed by the plates 6, and is held in place by clamping plates 46 and finger nuts 47. The reed consists of thin metal strips arranged on edge. A pair of trays 48 of V section are secured on either side of the loom and are aligned with the trough 6 in the position in which it is shown in Figure 2. These trays serve to support and guide the shuttle.

The form of heddle used on the above machine is shown in detail in Figures 3, 4 and 5. Each heddle comprises a shank portion 49, a pair of

5

parallel blades 50, and a pair of parallel tails 51. The ends of the tails 51 and the ends 52 of the blades are formed as eyes and these portions are held in the clamping plates 24, 25, previously described. A possible mode of construction of the heddles is shown in Figure 5. A pair of metal strips 53 have their edges bent inwardly as shown and are connected by a pair of U-shaped strips 54 the length of which is equal to that of the shank portion 49. The assembly is flattened and secured by welding or in other suitable manner. Alternatively the connecting U-strips may be omitted and the strips 53 merely welded or soldered together.

The warp threads *a* from the lower warp beam pass over the bar 27 and are engaged between the blade portions 59 of the heddles 29 and thence pass downwardly over the left-hand trough plate 6 as seen in Figure 1. The warp threads *b* from the upper warp beam pass round the bar 33 and thence down the right-hand trough plate 6. The woven fabric *c* passes downwardly and between the bar 33 and the roller 37 and thence to the take-up roller 41. Upon operation of the treadle 12 the V trough formed by the plates 6 is lowered by means of the levers 9, 10 and at the same time the heddles 29 are displaced to the right as viewed in Figure 1 so that the warp threads *a* are carried across between the heddle blades until they reach the inclined plane previously occupied by the warp threads *b*. Simultaneously the warp threads *b* are moved, by the displacement of the carriage 32, to the left so that they reach the plane previously occupied by the warp threads *a*. The motion of the links 19 and 20 under the operation of the lever 15 is such that the V trough 6 is moved downwardly and returned to its original position at each actuation of the treadle, and this also performs the shedding operation as previously described. Thus after each treadle operation a shuttle can be passed through the V trough by hand in the usual manner and the weft thread will be pressed into the fell of the cloth by the reeds 45 when the V trough moves downwardly. The finished fabric *c* is drawn over the roller 37 by the take-up roll 41 as previously mentioned.

It is not essential that the warp beams should move back and forth at each shedding operation, and a modified arrangement in which the warp beams are relatively fixed is shown in Figures 6, 7 and 8, in which similar parts are given the same reference characters as in the previous example. Warp threads *a* from the lower warp beam 55 pass over a fixed guide bar 56 and thence over the ends of the heddles 29 which are secured to a reciprocating carrier 57. The warp threads pass through the heddle blades 50 and down one of the sides 6 of the V trough. Warp threads *b* from the upper fixed warp beam 58 pass over a fixed guide bar 59 and over a reciprocating bar 60 actuated by a rod 61. A second bar 62 is secured in spaced relation to the bar 60 to prevent the threads being displaced. After passing over the bar 60 the threads *b* pass down the opposite side of the V trough. The heddle carrier 57 and the rod 61 are connected to opposite ends of an oscillating lever 63. Figure 6 is a plan view of the arrangement with the parts in the positions shown in Figure 8. In this position a shuttle 64 may be passed through the V trough and will lay a weft thread in the V formed by the warp threads *a* and *b*. By operating the lever 63 the warp threads *a* will be transferred to the opposite side of the V trough within the

6

blades of the heddles 29, and simultaneously the bars 60, 62 will transfer the warp threads *b* to that side of the trough previously occupied by the threads *a*, the position of the parts being shown in Figure 7. The required shedding operation is thus performed, and the shuttle can then be passed through the trough in the opposite direction. It will be noted from Figure 8 that after a shedding operation, the warp threads leaving the fixed bar 56 will occupy a position indicated by the broken line 64', and similarly the warp threads leaving the bar 59 will occupy the position indicated at 65. The straight portions of warp thread leaving the fixed bars 56 and 59 thus have a movement which is similar to that of the straight portions of warp thread lying within the V trough, and strain on the warp threads during shedding is thereby eliminated or greatly reduced. In other words, the warp leaving the warp beams is drawn away in the form of approximately parallel lines having a similar angular motion. The position of the fixed points 56 and 59 may be varied in relation to the heddles 29 and bars 60, 62, so as to afford a difference in length during the said motion so that the woven material can be freely drawn away with each beat of the shuttle, without imparting a strain to the warp during this period.

A shuttle which may be used with the loom previously described is shown in Figures 9 and 10, and comprises a hollow body 66 within which the cop 67 is suitably supported. The thread passes out through an opening 68 in the underside of the body defined by the guides 69. The lower portion 70 of the body is narrowed and within the body are mounted wheels 71 which project below the body part 70. These wheels facilitate the travel of the shuttle and also ensure that the weft is embedded in the fell of the cloth. It will be understood that the wheels may be replaced by skids of arcuate form which perform the same function.

Various forms of heddle may be employed according to the invention, depending upon the type of loom and the kind of material to be woven. Figures 11 and 12 show a heddle for carpet looms, and may be constructed of wood or other suitable material. It comprises a pair of strips 72 joined by a connecting piece 73 and an intermediate guide piece 74, leaving a pair of tails 75.

Figures 13 and 14 show another form made by folding a piece of metal, or moulding suitable material, into a narrow U-shape and removing a part of the fold to provide blades 76.

For use in high speed looms it is necessary to avoid sharp edges in the heddles which might have a tendency to cut or tear the warp threads, and this can be avoided by suitably rounding the edges, as in Figures 3, 4 and 5 for example. Such constructions are relatively expensive to make, and the form shown in Figures 16 and 17 avoids the disadvantage whilst enabling costs to be reduced. The heddle comprises folded lengths of rounded material such as wire which are secured together to form tines 77 having loops 78 at their extremities. The remaining portions of the wire lengths are pressed together and soldered or otherwise secured together to form a shank 79. A loop 80 is formed on the end of the shank for fitting to a carrier bar, and the loops 78 at the ends of the tines may also be secured to a second carrier bar so that the heddle can be pulled in both directions for shed forming and is thus under tension. If de-

sired, the material of which the tines are made can be twisted in such a manner as to form an eye between the butt of the shank and the cross-over.

It is to be understood that whilst in the forms of heddle illustrated, two tines only are provided, each heddle can be formed with a larger number of tines if desired.

The invention is not restricted to the examples described, since details of the loom, and of the heddles, may be modified to suit particular circumstances. Thus for example, the shuttle track may be formed by parallel rollers instead of the V plates, the diameter of the rollers being chosen to provide an approximately V-shaped space between them of suitable size. Also for the weaving of certain types of cloth, selected warp threads suitably held may be brought forward as a group and passed into each heddle and thence through the trough-like formation. The other part of the warp is similarly treated, except that the corresponding threads are passed between the heddles. Also the passage of the shuttle may be effected by picking mechanism.

I claim:

1. A loom having shed forming means for sets of warp threads, comprising a series of displaceable fork-like members each having spaced tines or blades joined to a shank for receiving warp threads of one set between the tines or blades and arranged so that warp threads of a second set can lie in the spaces between adjacent members, and means for displacing the warp threads of said second set alternately in opposite directions whilst said fork-like members are displaced oppositely to said means to effect a corresponding displacement of the warp threads of the first set to form successive sheds, the length of said tines or blades being such that the warp threads engaged therein remain between them during shedding.

2. A loom as claimed in claim 1, wherein the means for displacing warp threads of the second set comprises a bar-like member.

3. A loom as claimed in claim 1, wherein the means for displacing warp threads of the second set comprises a series of displaceable fork-like members oppositely disposed with respect to the first said series.

4. A loom as claimed in claim 1, comprising also a trough-like formation through which the warp threads pass and forming a track for a shuttle, the warp when divided being brought to rest on the sides of said formation through which the shuttle is passed after each shed forming operation.

5. A loom as claimed in claim 1, comprising a trough-like formation including a pair of plates in V arrangement through which the warp threads pass and forming a track for a shuttle, the warp threads when divided being brought to rest on said plates which are arranged with an opening at the bottom through which the woven material is withdrawn.

6. A loom as claimed in claim 1, comprising a trough-like structure through which the warp threads pass and forming a track for a shuttle, the warp threads when divided being brought to rest on the sides of said structure through which the shuttle is passed after each shed forming operation, a reed carried upon said trough-like structure, and means for displacing the said structure to beat the weft thread into the fell of the material.

7. A loom as claimed in claim 1, comprising a

trough-like structure through which the warp threads pass and forming a track for a shuttle, the warp threads when divided being brought to rest on the sides of said structure through which the shuttle is passed after each shed forming operation, a shuttle, and means on said shuttle arranged to engage and embed the weft thread into the fell of the fabric during shuttle travel.

8. A loom as claimed in claim 1, comprising a trough-like structure through which the warp threads pass and forming a track for a shuttle, the warp threads when divided being brought to rest on the sides of said structure through which the shuttle is passed after each shed forming operation, a shuttle, and wheels on said shuttle to facilitate its travel and arranged to engage and embed the weft thread into the fell of the fabric during shuttle travel.

9. A loom as claimed in claim 1, comprising warp beams carried upon and moving with the means for displacing the warp threads, the arrangement being such that undue strain on the threads is avoided.

10. A loom as claimed in claim 1, comprising stationary warp beam supports, fixed guide means for the respective warp threads, and the said warp threads passing from said guide means to guides which have a backward and forward motion equivalent to the motion required for conveying said threads from side to side of the trough-like formation, the angle moved through by the threads between said fixed guide means and said moving guides being approximately the same as that moved through by the threads in the trough-like formation, the arrangement being such as to avoid undue strain on the warp threads.

11. A loom as claimed in claim 1 and intended for hand operation, comprising a V-shaped trough for receiving the warp threads, a reed mounted on the upper part of the trough, parallel levers supporting the trough for up and down movement thereof, a treadle connected to an oscillating shaft, linkage means operatively connecting said shaft and said parallel levers, slidable carriages upon which are mounted the means for displacing the warp threads, and linkage means operatively connecting said shaft with said carriages.

12. A loom as claimed in claim 1 and intended for hand operation, comprising a V-shaped trough for receiving the warp threads, a reed mounted on the upper part of the trough, parallel levers supporting the trough for up and down movement thereof, a treadle connected to an oscillating shaft, linkage means operatively connecting said shaft and said parallel levers, slidable carriages one of which carries the series of fork-like members and a warp beam support, and the other of which carries the other means for displacing the warp threads and a second warp beam support, and linkage means operatively connecting said shaft with said carriages.

13. A loom as claimed in claim 1 and intended for hand operation, comprising a V-shaped trough for receiving the warp threads, a reed mounted on the upper part of the trough, parallel levers supporting the trough for up and downward movement thereof, a treadle connected to an oscillating shaft, linkage means operatively connecting said shaft and said parallel levers, slidable carriages each carrying the series of fork like members and also a warp beam support, and linkage means operatively connecting said shaft with said carriages.

9

14. A fork-like member for shed forming in a loom, comprising spaced tines or blades joined to a shank and having the tines or blades closely spaced and of thin cross section such that a parallel series of said members can receive warp threads alternately between the tines or blades and between the tines or blades of adjacent members and the members can be displaced longitudinally to engage warp threads at the join of the tines or blades for shed forming, the length of said tines or blades exceeding the longitudinal displacement of the member so that said threads remain between them during shed forming.

15. A member as claimed in claim 14, comprising flat blades lying parallel and closely spaced.

16. A member as claimed in claim 14, comprising flat blades forming part of a narrow U-shaped section and having the bend of the U-section removed for a portion of its length.

17. A member as claimed in claim 14, comprising parallel flat blades secured together along part of their length.

18. A member as claimed in claim 14, comprising a pair of blade elements having inwardly folded edges, a pair of U-shaped strips connecting said inwardly folded edges, and means such as soldering for securing the blade elements and strips together.

10

19. A member as claimed in claim 14, comprising tines and a shank portion of rounded material such as wire.

20. A member as claimed in claim 14, comprising two lengths of wire folded to a narrow U-shape and secured together over part of their length to constitute the shank.

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