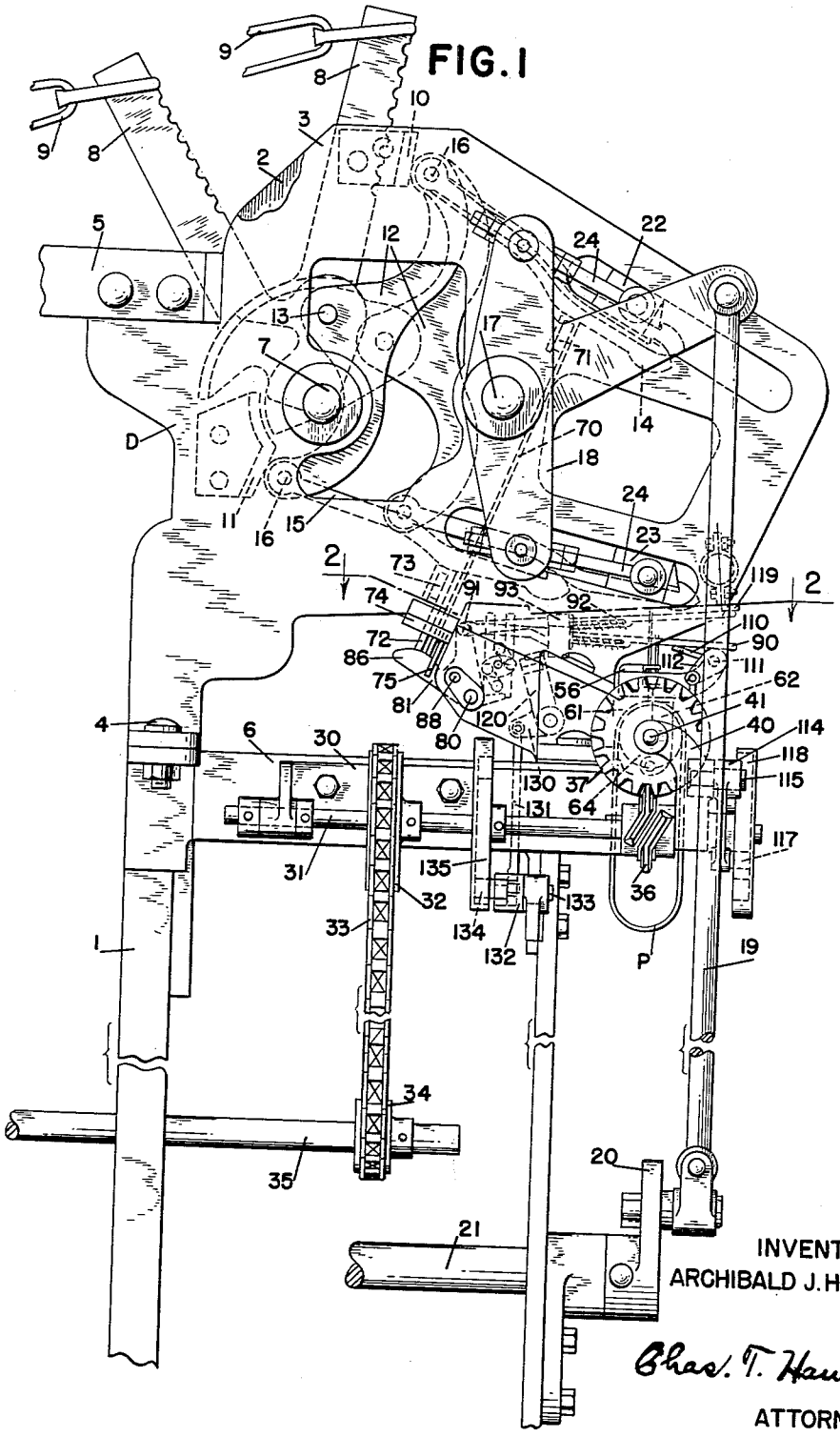
July 12, 1955 A. J. HERARD, JR 2,712,832

PAPER PATTERN INDICATED DOBBY

Filed Feb. 16, 1954

4 Sheets-Sheet 1

FIG. 1



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FIG.2

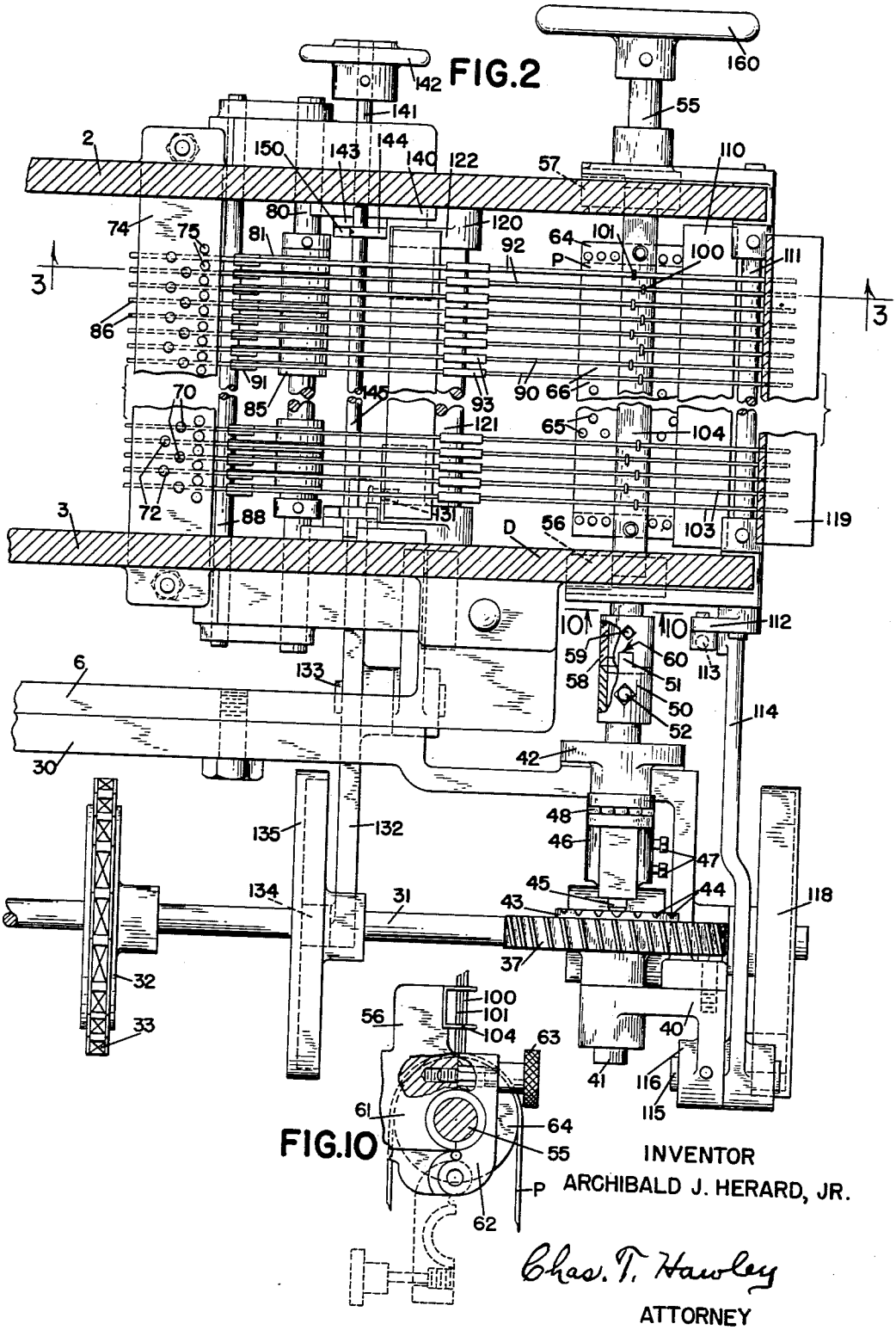


FIG.10

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FIG.3

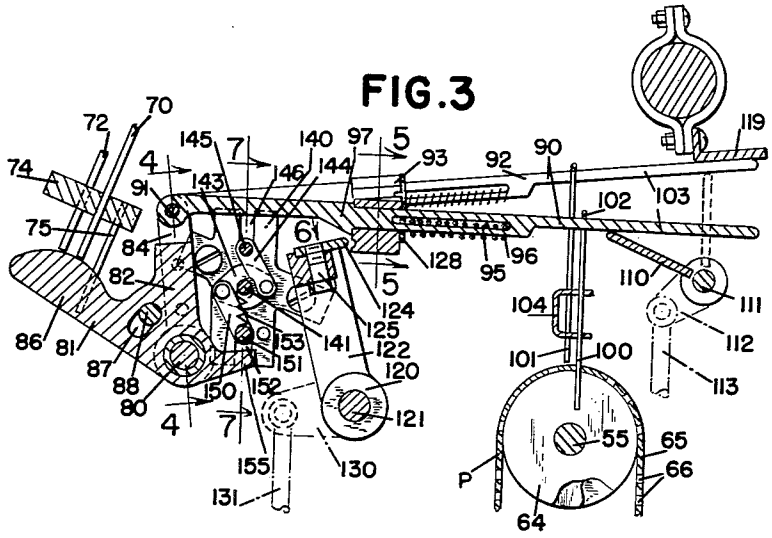


FIG.11

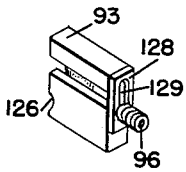


FIG.4

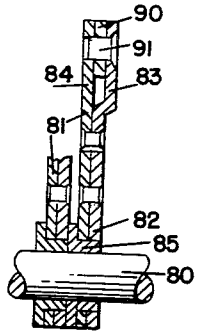


FIG.5

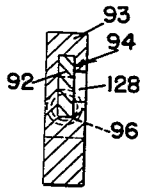


FIG.6

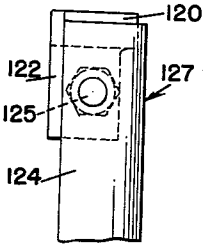


FIG.7

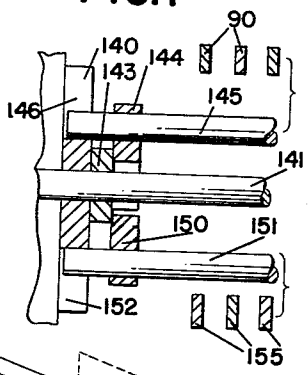
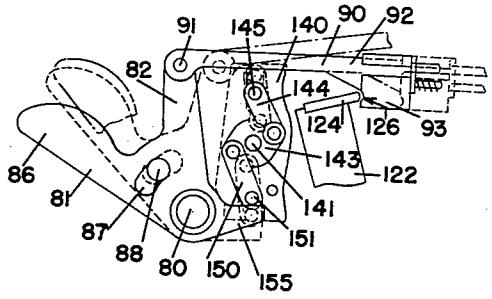


FIG.8



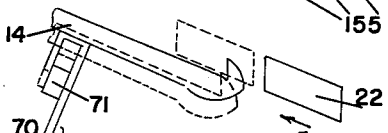
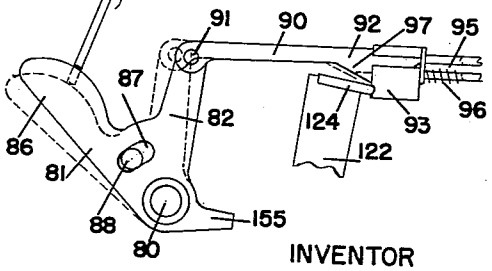


FIG.9



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FIG. 12

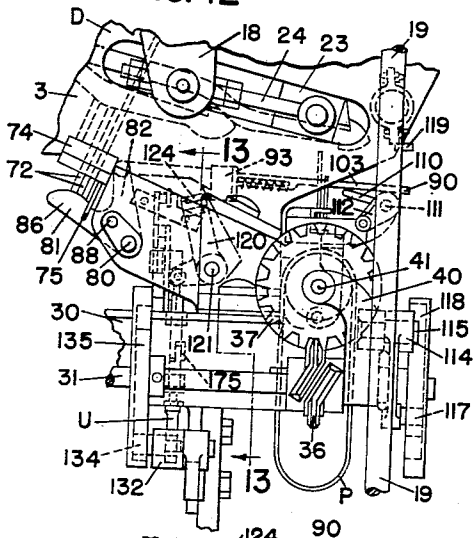


FIG. 14

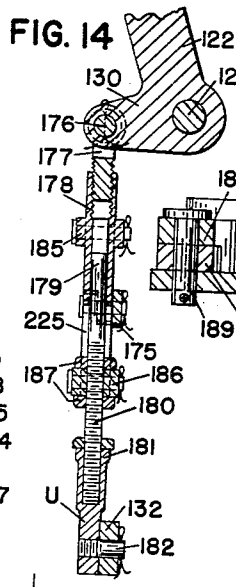


FIG. 15

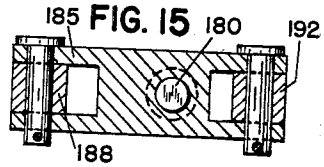


FIG. 16

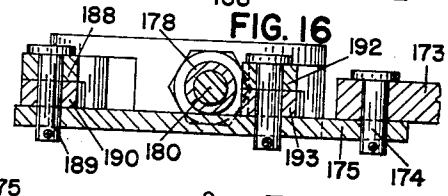


FIG. 18

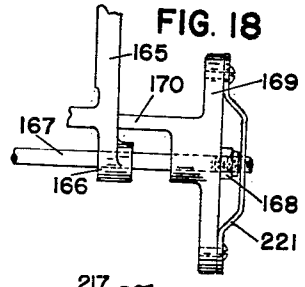


FIG. 13

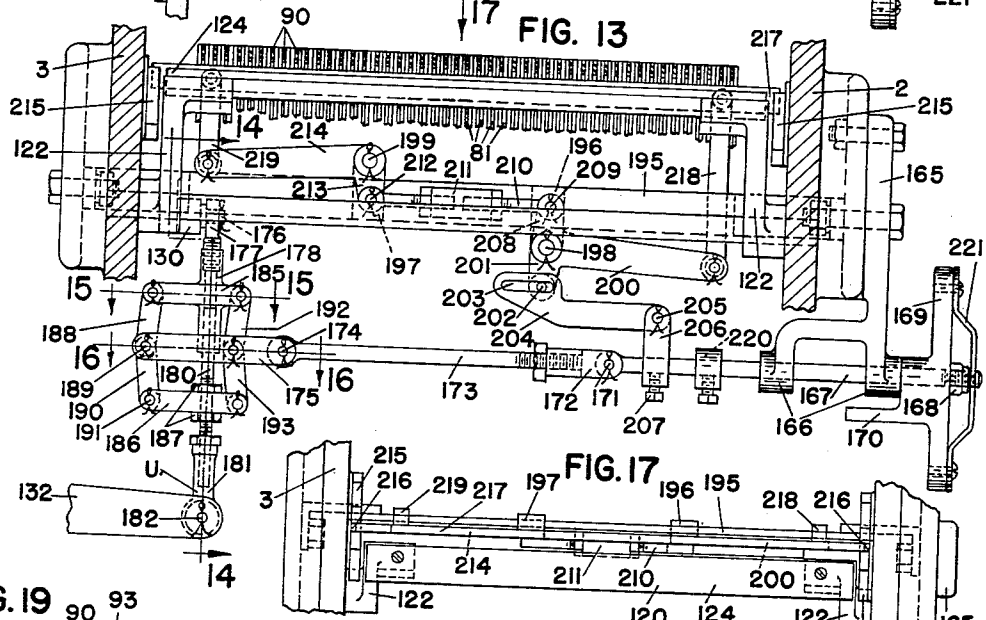
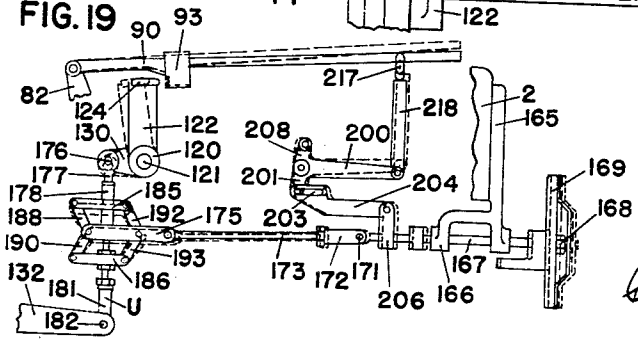


FIG. 17

FIG. 19



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United States Patent Office

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Patented July 12, 1955

2,712,832

PAPER PATTERN INDICATED DOBBY

Archibald J. Herard, Jr., Worcester, Mass., assignor to Crompton & Knowles Loom Works, Worcester, Mass., a corporation of Massachusetts

Application February 16, 1954, Serial No. 410,483

35 Claims. (Cl. 139—68)

This is a continuation in part of my co-pending application Serial No. 281,850, filed April 11, 1952 now abandoned.

This invention relates to warp shedding mechanism more particularly of the dobby type and it is the general object of the invention to provide a paper pattern indicating mechanism for the hooks which cooperate with the reciprocating knives to lift the harness frames.

The usual dobby operates with a pattern chain made of wood cross bars carrying pegs to lift fingers or the like which control the position of the hooks with respect to the harness frame lifting knives. For a long pattern the chain becomes of such a length as to be unwieldy and considerable power is required for its movement to present the bars one at a time to indicating position. Paper patterns have been proposed heretofore as substitutes for the wood bar pattern chain but they have not been entirely satisfactory due to the difficulty of reading the pattern from the paper and transmitting it to the hooks.

It is an important object of the present invention to provide an improved form of paper pattern indicated dobby wherein the pattern readers are raised and lowered onto the pattern at regularly recurring intervals by means of an operator connected to lifter fingers for the hooks. The readers are thin wires but the operators which lift them and are positioned by them are larger and much stronger and are able to lift the fingers and the hooks when acted on by a regularly moving actuator.

When the paper pattern is of the double index type it has a movement every second pick of the loom to bring a new pair of rows of holes into reading position with respect to the readers. The knives of the dobby move in opposite directions, each knife having a working stroke while the other knife has a return stroke and each knife requires two picks of the loom for a complete reciprocation. When double index indication is used and the hooks are positively lifted into the paths of the knives the latter on their return stroke momentarily depress any hooks previously lifted into their paths. It is a further object of the present invention to provide the aforesaid operator with a sliding block or the like for cooperation with the actuator and hold the block yieldingly in normal position by a spring or the like on the operator so placed that momentary depression of an indicated hook can move the associated operator even though the corresponding block is engaged with the actuator.

It is desirable from time to time to be able to level the harnesses by an operation which requires that all of the hooks be in non-indicating position. It is another object of the invention to provide a control which will effect relative movement of the actuator with respect to the blocks in a direction which will facilitate the leveling operation.

Preparatory to a leveling operation some of the previously mentioned blocks may be engaged with the actuator and it is a further object of the invention to provide leveling mechanism which first effects relative separation of the actuator and the operators in a direction to disengage them from the actuator and the operators in a direction to disengage them from the actuator and thereafter moves to lift the operators so that none of them can indicate their hooks. Two forms of leveling means are shown, one of which the blocks are moved away from the actuator, and the other in which the actuator is moved away from the blocks.

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

Fig. 1 is a side elevation of part of a loom having applied thereto a dobby made according to the preferred form of the present invention,

Fig. 2 is an enlarged horizontal section on line **2—2**, Fig. 1,

Fig. 3 is a vertical section on line **3—3**, Fig. 2, showing two of the operators and associated parts in positions they assume after a pattern reading operation has been completed but before a lifting operation begins,

Figs. 4 and 5 are detailed enlarged vertical sections on lines **4—4** and **5—5**, respectively, Fig. 3,

Fig. 6 is a fragmentary plan looking in the direction of arrow **6**, Fig. 3, showing one end of the actuator,

Fig. 7 is an enlarged fragmentary vertical section on line **7—7**, Fig. 3, showing part of the leveling mechanism,

Fig. 8 is a diagrammatic view showing successive positions of the preferred form of leveling mechanism during a leveling operation,

Fig. 9 is a diagrammatic view indicating the manner in which an indicated hook when depressed by a knife having a return stroke causes movement of an operator with respect to the actuator,

Fig. 10 is an enlarged detailed vertical section on line **10—10**, Fig. 2, and shows a capped bearing for the cylinder for the endless paper pattern,

Fig. 11 is a perspective view of one of the sliding blocks mounted on the operators,

Fig. 12 is a view similar to a part of Fig. 1, but showing a modified form of leveling mechanism,

Fig. 13 is a vertical section on line **13—13**, Fig. 12,

Fig. 14 is an enlarged vertical section on line **14—14**, Fig. 13,

Figs. 15 and 16 are enlarged horizontal sections on lines **15—15** and **16—16**, respectively, Fig. 13,

Fig. 17 is a detailed plan view looking in the direction of arrow **17**, Fig. 13, certain of the parts being omitted,

Fig. 18 shows the handle for manipulating the leveling mechanism in the position to hold such mechanism in leveled position, and

Fig. 19 is a diagrammatic view illustrating the operation of the modified form of the invention.

Referring particularly to Figs. 1 and 2, one of the loom sides **1** of the loom supports the dobby mechanism which is designated generally at D. This mechanism comprises front and back side plates **2** and **3** each of which is secured to the loom frame as at **4** and has a brace **5** for attachment to a loom arch not shown. The dobby also includes a horizontally extending support **6** and has a horizontal rod **7** on which harness jacks **8** are pivoted. These jacks are connected by conventional means indicated at **9** to the harness frames (not shown). Springs (not shown) are employed for lowering the harness frames. Extending back and forth between the plates **2** and **3** are upper and lower stop bars **10** and **11**, respectively, for dobby back levers **12**. A back lever is pivoted to each harness lever **8** at **13** and has upper and lower hooks **14** and **15** pivoted thereto as at **16**.

Mounted for rocking movement in the side plates **2** and **3** is a shaft **17** which has rocker levers secured thereto. In the present instance one of these levers is shown at **18** and is connected to a vertically extending rod **19** pivoted at its lower end at a crank **20** on the bottom shaft **21** of the loom. This latter shaft rotates once every second beat of the loom so that the rocker lever **18** rocks first in a right hand direction as viewed in Fig. 1 on one beat of the loom and then in a left hand direction for the next beat of the loom.

Upper and lower harness lifter knives **22** and **23** re-

spectively extend between the plates 2 and 3 and by means of connectors 24 are rocked back and forth as lever 18 oscillates, the top knife 22 moving outwardly on a working stroke, or to the right in Fig. 1, on one beat of the loom while the lower knife 23 moves inwardly on a return stroke. The direction of the knives is then reversed for the next beat. The hooks 14 and 15 are normally under the paths of movement of their respective knives but when indicated are lifted into the paths of their knives.

The support 6 has mounted thereon a bearing member 30 in which is rotatably mounted a shaft 31 having secured thereto a sprocket wheel 32 for a chain 33 driven by a sprocket wheel 34 secured to the top or crank shaft 35. The latter shaft rotates once for each beat of the loom and sprocket wheel 32 is of twice the diameter of sprocket wheel 34 so that the latter shaft rotates every second beat of the loom. Secured to the right end of the shaft as viewed in Fig. 1 is a driving worm 36 meshing with a worm wheel 37 and giving the latter an angular motion every second beat of the loom.

The matter thus far described is of common construction and except as noted hereinafter operates in the usual manner.

The member 30, see Fig. 2, has mounted thereon a bearing 40 in which is journaled one end of a shaft 41 the other end of which turns in a second bearing 42 on the member 30. The worm wheel 37 turns freely on a shaft 41 and has a flange 43 provided with detents 44 to receive a spring plunger 45 slidable in a hub 46 secured to shaft 41 at 47. If desired a thrust bearing 48 may be located between the hub 46 and the bearing 42. The inner end of shaft 41 is provided with a drive clutch member 50 having a driving tooth 51 and held on the shaft 41 by a set screw 52.

A second shaft 55 axially aligned with shaft 41 turns in bearings 56 and 57 supported by the end plates of the dobby. A second clutch member 58 is pinned at 59 to one end of shaft 55 and has a notch 60 to receive the tooth 51. When the parts are in their normal position the tooth 51 fits into the slot 60 and rotation of the spring plunger hub 46 by the worm wheel will turn both of the shafts 41 and 55.

The bearings 56 and 57 are alike, bearing 56 being shown in Fig. 10 as comprising a stationary part 61 and a hinged cap 62 normally held in shaft supporting position by a screw 63. A paper pattern cylinder 64 is secured to shaft 55 and when it is desired to remove the cylinder to change the endless paper pattern P set screw 52 is loosened and clutch member 50 is slid along shaft 41 out of engagement with clutch member 58. The cap bearing 62 is then released to move to the dotted line position shown in Fig. 10, after which the paper cylinder can be removed. The paper pattern will have transverse rows of perforations and blank spaces, the perforations being indicated at 65 and the blank parts at 66. The effect of the turning of shaft 31 is to advance the cylinder 64 progressively in a step by step movement every second beat of the loom to present two parallel rows of perforated and unperforated parts of the paper in pattern reading position over the cylinders.

The upper set of dobby hooks 14 are provided with lifters 70 normally supported at their upper ends by cross bar 71, see Fig. 1. The lower dobby hooks 15 are similarly supported by shorter lifters 72 supported by a cross bar 73. The lower ends of the lifters 70 and 72 pass through a guide 74 fixed to the dobby frame and having depending therefrom guide pins 75 which are spaced from each other along the width of the dobby as shown for instance in Fig. 2. The lower ends of the lifters 70 and 72 project downwardly from the under side of the guide 74.

The operating mechanism for the lifters 70 and 72 is shown in Fig. 3. A rod 80 is held in fixed position and extends between the dobby plates 2 and 3 and has pivotally mounted thereon a series of lifter fingers 81, one for each of the lifters 70 and 72. These fingers may be made as shown in Fig. 4 and each comprises a flat plate 82 having an offset upper end 83 and a second plate 84. The plates 82 and 84 are secured to each other in any approved manner and are fastened to a bushing or sleeve 85 rotatable on the rod 80. As viewed in Fig. 3 each finger 81 has an arm 86 for a hook lifter. Alternate fingers are provided for the long lifters 70 and the intermediate fingers are provided for the shorter lifters 72. Each finger has a slot 87 concentric with bar 80 and a stop rod 88 held in fixed position on the dobby frame passes through the slots 87 to limit angular motion of the fingers.

Each finger has pivoted thereto an operator designated generally at 90. The left end of each operator as indicated in Fig. 3 is pivoted as at 91 to the associated finger and includes an elongated body 92 extending to the right. Each operator may be of rectangular cross section with the greater dimension extending vertically and has slidably mounted thereon a block 93 provided with a vertical slot 94 to receive the operator body 92. An elongated slot 95 is formed in each body 92 and a compression spring 96, threaded through one part of the body at one side of the slot, exerts a force on the block 93 urging the latter toward the corresponding finger. A stop 97 on the body 92 limits movement of the block 93 toward its finger. The right end of the spring 96 as indicated in Fig. 3 engages the body 92 at the end of slot 95 and it is by this arrangement that the spring holds the block against the stop 97 but permits the block to slide along the body 92.

As shown in Fig. 3 the operators are associated with pattern readers for the pattern chain P. These readers comprise thin preferably round wires 100 and 101 the upper ends of which are provided with eyes 102 through which the reduced ends 103 of the body 92 extend. The wires 100 and 101 slide vertically through a guide 104 held in stationary position on the dobby. When a wire or pattern reader is supported by a blank part of the pattern P it will be held in high position and will support its corresponding operator in elevated position, but when a wire passes through a perforation in the pattern its corresponding operator is in low position as shown in cross section in Fig. 3.

An elevator means for the operators and pattern readers, shown in Figs. 1, 2 and 3, includes a vane 110 fixed with respect to a cross shaft 111 rockable in the dobby frame and having secured thereto an arm 112 for pivotal connection with a depending rod 113. The latter rod has the lower end thereof pivoted to one end of a lever 114 pivoted on a stud 115 secured in a hub 116 forming part of the bearing member 40. Lever 114 has a roll 117 for actuation by a cam 118 secured to shaft 31. The cam 118 lifts rod 113 at two-pick intervals to move the elevator from the full line to the dotted line position shown in Fig. 3 to hold the operators 90 and their pattern readers in raised position during angular movement of the pattern chain. A stationary stop 119 limits upward movement of the operators, see Fig. 3. As soon as the pattern comes to rest in a new position the cam 118 returns the elevator 110 to the full line position shown in Fig. 3 and the operators fall by gravity so that the readers 100 and 101 can read the part of the pattern under them and either move through perforations to low positions or engage blank parts of the pattern to be held in high position.

An actuator mechanism for the operators, see Figs. 1, 2, 3 and 6, is designated generally at 120 and includes a shaft 121 rockable in the frame of the dobby and having upright arms one of which is shown at 122 in Fig. 3. A bar 124 secured to the tops of arms 122 at 125 is provided for cooperation with the blocks 93. These blocks may if desired be provided with notches 126, see Fig. 8, to receive the operating edge 127, see Fig. 6, of the actuator bar 124. If desired a small

pressure plate 128 may be placed between the spring 96 and the block 93. This plate has a vertical slot 129, see Fig. 11, which receives the operator 90.

An arm 130 is secured to shaft 121 and is connected to a depending actuator rod 131 the lower end of which is pivoted to one end of a lever 132 rockable about a stationary pivot 133, see Fig. 2. A roll 134 on the other end of lever 132 cooperates with a cam 135 secured to shaft 31.

In the operation of the mechanism thus far described the elevator 110 will lift all of the operators and readers after which the pattern chain will move to a new position by operation of the worm 36 in the worm wheel 37. The elevator will then lower the operators and readers at a time when the actuator will be in the non-working position shown in full lines in Fig. 3 to permit the blocks on the indicated operators to move down into the path of the actuator. The latter is then moved to the right, Fig. 3, and will engage the blocks of the operators which are in low indicated position to move these operators to the right to rock their associated fingers in a clockwise direction, Fig. 3. The ends 86 of the fingers which are thus rocked will raise their lifters 70, 72 to the corresponding hooks 14, 15 into the paths of their reciprocating knives. This action will ordinarily occur when one of the knives, for instance the lower knife 23, is in its in position preparatory to the beginning of a working stroke and while the other knife, knife 22, for instance, is in its out position at the end of its working stroke and is about to start a return stroke. The knife 23 will immediately engage the hooks 15 which have been raised into its path and rock the corresponding harness levers 8 to raise the associated harness frames. The indicated hooks 14 will also be in the path of the return stroke of the top knife but will not be moved on that beat of the loom.

As the top knife 22 moves to the left, Fig. 1, on its return stroke it will momentarily engage and depress the raised hooks 14. The lifters of these latter hooks will thereupon be pushed down to rock the associated fingers 81 counter-clockwise as viewed in Fig. 3 and move their operators 90 to the left, Fig. 3. It is to be understood that the actuator will be in its operating position at this time, to the position shown in Fig. 9, and remain in this position until after the top knife picks up its hooks shortly after the start of its working stroke on the second beat of the loom. The blocks of the operators which are moved to the left will therefore be prevented by the actuator from moving to the left and their springs 96 will be compressed. As soon, however, as the top knife passes beyond the indicated hooks 14 the previously compressed springs 96 will expand and return their operators, fingers, lifters and hooks 14 to indicated position. This action is indicated in Fig. 9 where the full lines show an operator 90, its finger 81, lifter 70 and hook 14 in indicated position while knife 22 is moving in the direction of arrow *a* on its return stroke. The dotted lines show the positions momentarily occupied by the hook 14, finger 81 and operator 90 when the knife depresses the hook.

Another feature of the invention relates to means for leveling the dobby, the parts for accomplishing this result by the preferred form being shown more particularly in Figs. 1, 2, 3, 7 and 8. Each of the side plates of the dobby has secured thereto a guide member 140 and these members support a shaft 141 having a hand wheel 142 secured thereto. Near each member 140 the shaft 141 has secured thereto a two-arm lever 143, one of these levers being shown in Fig. 3. Both of the levers 143 and their connections are alike, and one of them will be described. As shown in Fig. 3 the right end of lever 143 is connected to links 144 which extends upwardly and is secured to one end of a lifter bar 145 movable in a vertical guide slot 146 in the

member 140. Similarly, the opposite end of each lever 143 is connected to a depending link 150 and the lower end of this link is connected to a second cross bar 151 movable in a second vertical slot 152 in member 140. A spring 153 between shaft 141 and 151 normally holds the levers 143 in the position shown in Fig. 3. Each lifter finger 81 has a short arm 155 extending under the bottom bar 151.

In normal operation of the dobby the top bar 145 is in low position and does not interfere with the rising and falling movements of the operators 90, and the lower bar 151 is in high position and out of the path of normal movements of the short arms 155 of the fingers 81. When it is desired to level the dobby the hand wheel 142 will be turned to turn shaft 141 in a counter-clockwise direction as viewed in Fig. 3, thereby raising the top bar 145 and lowering the bottom bar 151. During this turning of the shaft 141 the bottom bar 151 will engage the arms 155 and rock the fingers 81 from the full line to the dotted line position shown in Fig. 8, thereby moving the operators to the right from the full line to the dotted line position, so that the blocks of the operators will be spaced to the right of and out of engagement with the actuator. Bar 151 is normally nearer to the arms 155 than bar 145 is to the operators 90, see Fig. 3, and arms 155 will therefore be engaged by bar 151 to rock fingers 81 while bar 145, although rising, is still out of engagement with the operators 90. Further turning of shaft 141 in the same direction causes the upper bar 145 to engage all of the operators and lifts them to the dot and dash line position shown in Fig. 8. This will be accompanied by a slight additional clockwise rocking of the fingers 81 to the dot and dash line position, Fig. 8. This leveling mechanism therefore first moves the fingers in a direction to move the blocks 93 away from the actuator and then after the blocks are free to move without interference on the part of the actuator the operators are lifted so that all of the blocks will be out of the path of the actuator when the latter moves incident to manual operation of the dobby as may be required incident to the leveling operation. After the latter operation has been completed the hand wheel 142 is given a reverse turn the effect of which is to return the parts to the position shown in Fig. 3 so that normal weaving operations may be resumed.

If during the time that the dobby is leveled it is desired to move the pattern this can be accomplished by means of a hand wheel 160 on shaft 55. As the latter shaft turns it will move the cylinder 64 either backwardly or forwardly as desired and the spring plunger 45 will slip with respect to the flange 43, the worm wheel 37 being held against rotation by the worm 36.

Each of the operators has been described hereinbefore as having the closed slot 95 in the block and spring 96 threaded through the part of the operator under the slot to urge the block toward its corresponding finger. The block 93 and spring 96 together may be considered to be a resilient force transmitting mechanism. The spring need not necessarily be used on those operators which indicate the bottom hooks 15 and the blocks can be fixed on these operators if the dobby operates as described, that is, with the bottom knife starting on its working stroke very shortly after indication has been given by a new part of the paper pattern. The spring is also shown as extending partly at least into the slot 95 but the invention is not necessarily limited to this manner of mounting the spring on the operator. The pressure plate 128, which is slidably mounted on the operator, has been shown to insure the exertion of a more nearly uniform pressure by the spring on the block, but it need not be used in all instances. Also, for convenience in constructing the parts which transmit the indication from the operator up to its corresponding hook each finger 81 is held down in its normal position by the weight of the associated lifter and hook and is movable

from this position to an operating position by the operator, but it is not essential that the finger be held in its normal position in this manner, although such an arrangement simplifies the design. Furthermore, the actuator **120** is shown herein as moving about an axis to have regularly recurring working and return strokes, but it is not essential that the actuator have an angular motion, although its working strokes should occur at regular intervals. When the actuator is at the end of its working stroke it occupies a working position for an appreciable interval to hold the indications for the top hooks until the top knife can begin its working stroke.

The leveler or leveler means is normally at rest and is mounted as shown herein for angular movement of the shaft **141** with respect to the dobby but it will be sufficient if an equivalent for the shaft is utilized to depress the lower bar **151** to rock the fingers before the upper bar **145** lifts the operators. The lower bar effects movement of the operators in the direction of the working stroke of the actuator to a position beyond the end of the working stroke prior to upward movement of the operators by the upper bar. By turning the shaft **141** in a given direction, clockwise as viewed in Fig. 3, the operators can be moved to leveling position and by turning the shaft in the opposite direction the operators can be returned to their working position. The pattern readers have been shown as thin round wires to illustrate a form of pattern control means which is lifted by the operators and in turn determine under control of the paper pattern whether the operators shall remain above or fall into the path of the actuator.

The modified form of leveling control or mechanism is shown in Figs. 12–19 and effects a relative separation of the actuator bar or member **124** from the force transmitting members or blocks **93** by motion of the bar away from the blocks. The modified form also shows means for holding the operators or members **90** in leveled position. The greater part of the dobby mechanism already described will be used with the modified leveling mechanism, but the short arms **155** on the fingers **81** can be omitted if desired.

One of the dobby plates has secured thereto a bearing **165** having hubs **166** in which is slidably mounted a rod **167**. The right hand end of this rod as shown in Fig. 13 is provided with a nut **168** and between the latter and the right hand hub **166** there is located an operating handle **169** for the modified leveling mechanism. This handle is freely rotatable on the rod **167** and has a finger **170** which will normally be in the position shown in Fig. 13 when the dobby is in operation. The left hand end of the rod **167**, as shown in Fig. 13, is pivoted at **171** to rod head **172** of a rod **173** the left hand end of which is pivoted at **174** to a link operator **175**.

The modified form of the invention uses the rocking arm element **122** and the operating lever element **132**, but instead of the rod **131** there is utilized a connector unit designated generally at U and shown at the left hand part of Fig. 13 and in section in Fig. 14. The arm **130** has pivoted thereto at **176** a rod head **177** which is screw threaded into a tubular member **178**. The lower part of the interior of member **178** is smooth and receives the upper smooth end **179** of a rod **180** the lower end of which is screw threaded and has attached thereto a rod head **181** carrying a stud **182** to which the lever **132** is pivoted. The tubular member **178** is made integral with an upper cross head **185** and the rod **180** is provided with a lower cross head **186** which is held to rod **180** in adjusted vertical position between nuts **187** on rod **180**.

The left hand end of cross head **185** has pivoted thereto a link **188** the lower end of which is pivoted at **189** to the left end of the link operator **175** and also to the upper end of another link **190** the lower end of which is pivoted at **191** to the lower cross head **186**. In similar manner the right hand ends of the cross heads are provided with links **192** and **193** pivoted to each other and also to the link operator **175**. The links are preferably of the same length and the upper pair **188**, **192** are parallel, as are also the lower pair **190**, **193**.

The means for elevating the operators **90** is operatively connected to the rod **167** and is supported in part by a cross girt **195** held in fixed position on the dobby having a downwardly extending arm **196** and an upwardly extending arm **197** providing pivots **198** and **199**, respectively. Mounted on pivot **198** for rocking movement is a lever **200** having a depending arm **201** provided with a pin **202** extending through a slot **203** in a lifter link **204** pivoted at **205** to a support **206** fixed by set screw **207** to the rod **167**. The upper arm **208** of lever **200** is pivoted at **209** to a rod **210** provided with a turnbuckle **211** and pivoted at **212** to a downwardly extending arm **213** of a lever **214** on the pivot **199**.

The side plates **2** and **3** of the dobby are provided with vertical guides **215** grooved at **216** to receive the opposite ends of a vertically movable cross bar **217** which serves as a lifter for the operators **90**. The bar **217** is connected to the levers **200** and **214** by links **218** and **219**, respectively.

Under normal conditions the leveler mechanism will be as shown more particularly in Fig. 13 with the rods **167** and **173** in their left hand position and with pin **202** in the right hand part of the slot **203**. When it is desired to level the dobby the handle **169** will be moved to the right, Fig. 13, and will act by means of nut **168** to move the rods **167** and **173** in a right hand direction. The first effect of this movement is to change the position of the links **188**, **190**, **192** and **193** from the position shown in Fig. 13 to that shown in full lines in Fig. 19, thereby rocking the arms **122** from the full line to the dotted line position, Fig. 19, to move the actuator bar **124** in a left hand direction away from the blocks **93** on the operators **90**. The modified form thus differs from the preferred form in that the relative separation of the actuator bar **124** and the blocks **93** is effected by movement of the actuator bar away from the blocks rather than by movement of the operators to the right as in the preferred form.

By the time the rods **167** and **173** have reached the position shown in full lines in Fig. 19, the pin **202** will be at the left end of slot **203**, and further movement of the handle **169** to the right, Fig. 13, will cause rocking of the levers **200** and **214** in directions to raise their respective links **218** and **219**, thus elevating the lifter bar **217** to raise the operators **90** from the full line to the dotted line position, Fig. 19. The handle can then be given a half turn so that its finger **170** will engage the bearing **165** as shown in Fig. 18 to hold the handle **169** and link operator **175** to the right and also hold the actuator bar **124** to the left, dotted lines in Fig. 19, and the lifter bar **217** is raised position.

When the dobby is to be returned to its normal position the handle will be given another half turn and pushed to the left, Fig. 13, back to the position shown in that figure. The handle **169** by its engagement with the right hand hub **166** will limit movement of the links **188**, **190**, **192** and **193** to the left, Fig. 13, and the lifter bar **217** and parts connected to it will by their weight return to the position shown in Fig. 13. If desired a stop collar **220** can be secured to rod **167** for engagement with the left hand hub **166** to limit right hand movement of the handle **169**.

During normal dobby operation the connector unit U shown in Fig. 14 will rise and fall under action of lever **132** as already described in connection with the preferred form of the invention, and this rising and falling will be permitted by the pivots between the rods **167** and **173**, and between the rod **173** and the link connector **175**. The slotted link **204** is supported in part by the pin **202**. A guard **221** may if desired be secured to handle **169** to protect the operator's hand from the right hand end of rod **167**.

From the foregoing it will be seen that the invention sets forth a form of paper pattern indicated dobby wherein an elevator moves to lift all of the operators to permit turning of the paper pattern and then has a reverse motion to permit the readers to read the pattern as determined by the paper. The actuator thereupon moves any operators in its path to rock the asociated fingers for the purpose of moving the corresponding hooks upwardly into the paths of their respective knives. The block **93** and spring **96** acting as a resilient force transmitter can yield with respect to the operator if the latter corresponds to an upper hook which is depressed on the return stroke of the top knife. The leveler performs two operations in succession by a single turning of shaft **141**, the first operation being to move the operators beyond the working stroke of the actuator and the second operation being to lift the operators. Also, the invention sets forth a novel form of finger operator including an elongated body having a block and spring mounted thereon, the spring being sufficiently strong to effect lifting of the corresponding hook, but being overpowered by the hook when the latter is depressed by a return stroke of the corresponding knife. Furthermore, the finger **81** and operator **90** pivoted thereto constitute a novel unit for controlling the hooks wherein the sliding block is normally held against the stop by a spring which acts to move the block toward the finger. Also, it will be seen that the modified form of the invention provides a variation in the leveling mechanism utilizing a connector unit U between the arm **122** and the lever **132** so constructed that it can be moved from its normal force transmitting given length shown in Fig. 13 to the shortened length shown in Fig. 19 to move the actuator bar **124** away from the blocks **93**. The slot **203** in link **204** permits a time loss when the handle **169** is moved to the right, Fig. 13, which will enable the actuator bar **124** to clear all of the blocks **93** before the lifter **217** comes into action to raise the operators **90**.

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 dobby operating with a paper pattern having perforated and unperforated parts and having a reciprocating knife and a hook below and normally in low position out of the path of the knife but capable of being raised into said path by a lifter, a finger for the lifter held in the normal position thereof by the weight of the lifter and hook when the latter is in low position but movable to operating position to raise the lifter to cause the hook to move upwardly into the path of the knife, an actuator having regularly recurring working strokes along a given path, an operator connected to the finger for movement relative to the actuator to be in or out of the path of the actuator, a pattern reader over the paper pattern mounted on and controlling the position of the operator relative to said path of the actuator and registerable with either the perforated or unperforated part of the paper pattern, depending upon the position of the paper pattern, and an elevator for the operator effective first to lift the operator out of the path of the actuator and move the reader away from the paper pattern and thereafter prior to a working stroke of the actuator to effect movement of the operator into the path of the actuator, provided the reader registers with the perforated part of the pattern, the reader if registering with the unperforated part of the pattern holding the operator above said path of the actuator, and said operator if in the path of the actuator being moved by the latter on a working stroke thereof to move the finger and cause the latter to raise the lifter to move the hook into the path of the knife.

2. In a loom dobby operating with a paper pattern having perforated and unperforated parts and having a reciprocating knife and a hook below and normally in low position out of the path of the knife but capable of being raised into said path by a lifter, a finger for the lifter movable from the normal position thereof to operating position to raise the lifter to cause the hook to move upwardly into the path of the knife, an actuator having regularly recurring working strokes along a given path, an operator connected to the finger for movement relative to the actuator to be in or out of the path of the actuator, a pattern reader over the paper pattern mounted on and controlling the position of the operator relative to said path of the actuator and registerable with either the perforated or unperforated part of the paper pattern, depending upon the position of the paper pattern, and an elevator for the operator effective first to lift the operator out of the path of the actuator and move the reader away from the paper pattern and thereafter prior to a working stroke of the actuator to effect movement of the operator into the path of the actuator, provided the reader registers with the perforated part of the pattern, the reader if registering with the unperforated part of the pattern holding the operator above said path of the actuator, and said operator if in the path of the actuator being moved by the latter on a working stroke thereof to move the finger and cause the latter to raise the lifter to move the hook into the path of the knife.

3. In a loom dobby operating with a paper pattern having perforated and unperforated parts and having a reciprocating knife and a hook below and normally in low position under the path of the knife but capable of being raised into said path by a lifter, a pivot on the dobby, a finger for the lifter mounted for angular movement on said pivot from the normal position thereof to operating position to raise the lifter to cause the hook to move upwardly into the path of the knife, an actuator having regularly recurring working strokes along a given path, an operator connected to the finger for movement relative to the actuator to be in or out of the path of the actuator, a pattern reader over the paper pattern mounted on and controlling the position of the operator relative to said path of the actuator and registerable with either the perforated or unperforated part of the paper pattern, depending upon the position of the paper pattern, and an elevator for the operator effective first to lift the operator out of the path of the actuator and move the reader away from the paper pattern and thereafter prior to a working stroke of the actuator to effect movement of the operator into the path of the actuator, provided the reader registers with the perforated part of the pattern, the reader if registering with the unperforated part of the pattern holding the operator above said path of the actuator, and said operator if in the path of the actuator being moved by the latter to move the finger and cause the latter to raise the lifter to move the hook into the path of the knife.

4. In a loom dobby operating with a pattern and having a reciprocating knife having working and return strokes and a hook below and normally in low position under the path of the knife but capable of being raised into said path by a lifter and when in said path being momentarily depressed by the knife when the latter is having said return stroke thereof, a finger for the lifter mounted for movement from the normal position thereof to operating position to raise the lifter to cause the hook to move upwardly into the path of the knife, an actuator having a working stroke along a given path and being in working position when said hook is depressed, an operator pivoted to the finger including a resilient force transmitter tending to move along said operator toward said finger but movable along said operator away from said finger, means controlled by the pattern to locate the operator with the force transmitter either in or out of said given path of the actuator, the force transmitter if in said given path being moved by the actuator to move the operator and finger in a given direction to effect movement of the hook into the path of the knife prior to de-

pressing of the hook by the knife, the hook when depressed causing movement of the finger to move the operator in a direction opposite to said given direction and the force transmitter being prevented from moving with the operator by the actuator and moving relatively to the operator away from said finger, the force transmitter subsequent to said depressing of said hook and due to engagement with the actuator effecting return of the hook into said path of the knife.

5. The loom dobby set forth in claim 4 wherein the force transmitter comprises a block slidable on the operator and a spring operatively interposed between the operator and block urging the latter toward said finger.

6. In an operator for the hook lifter operating finger of a dobby which operates with an actuator and a paper pattern reader, an elongated body one end of which has provision for attachment to the finger and the other end of which is formed to support the pattern reader, a block for engagement with the actuator slidably mounted on said body intermediate the ends thereof, a spring supported by said body having one end thereof engaging said body and having the other end thereof exerting a force against said block urging the latter toward said one end of the body, and a stop on the body limiting movement of the block by said spring toward said one end of the body.

7. In an operator for the hook lifter operating finger of a dobby which operates with an actuator and a paper pattern reader, an elongated body one end of which has provision for attachment to the finger and the other end of which is formed to support the pattern reader, a resilient force transmitter on the body including a part for engagement with the actuator and a spring urging the part toward said one end of the body, and a stop on the body limiting movement of said part by said spring in a direction toward said one end of the body.

8. The operator set forth in claim 7 wherein the body is formed with a closed slot extending lengthwise of the body adjacent to said part and said spring is coiled around part of the body adjacent to said slot and extends partly into the latter.

9. The operator set forth in claim 7 wherein a pressure plate surrounds said body and is located between said part and said spring and is slidable on said body.

10. The operator set forth in claim 7 wherein said body is of substantially rectangular cross section and said part has a slot therein fitting said body to prevent substantial angular motion of said part around an axis parallel to the length of said body.

11. In an operator and finger unit for a dobby provided with a pivot and a lifter for a knife engaging hook and an actuator, said unit comprising an operator having an elongated body, a resilient force transmitter on the body including a part for engagement with the actuator, and a finger pivotally connected to said one end of the body and having provision for pivotal mounting on said pivot, said part of the force transmitter mounted on the body to slide therealong in a direction away from said finger and tending to move on said body toward said finger.

12. The operator and finger unit set forth in claim 11 wherein the elongated body is provided with a stop intermediate the finger and said part of the force transmitter to limit movement of said part toward said finger.

13. In a dobby provided with a reciprocable knife and a harness lifting hook to be either in or out of the path of the knife, a paper pattern having perforated and unperforated parts, an actuator having working strokes along a path during operation of the dobby, an operator having a pattern reader controlled by the pattern enabling the operator to be in the path of the actuator to be moved by the latter if the reader is in a perforated part of the pattern, the operator being held out of the path of the actuator by the reader if the latter engages an unperforated part of the pattern, a finger pivoted to the operator effective when the latter is moved by the actuator to move the hook into the path of the knife, and leveler means normally at rest but mounted on the dobby for movement relative thereto and when having said movement being effective first to move the operator beyond the working stroke of the actuator and thereafter move the operator to move the reader in a direction away from the pattern.

14. In a dobby as set forth in claim 12 wherein the finger has a part which is engaged by the leveler means to move the operator beyond the working stroke of the actuator prior to movement of the operator by the leveler means to move the reader away from the pattern.

15. In a dobby provided with a reciprocable knife and a harness lifting hook to be either in or out of the path of the knife, a paper pattern having perforated and unperforated parts, an actuator having working strokes along a path during operation of the dobby, an operator operatively connected to the hook, a pattern reader on the operator to control the position of the latter with respect to the actuator and effective when passing through a perforated part of the pattern to locate the operator in the path of the actuator to be moved by the latter and effective in engaging an unperforated part of the pattern to locate the operator out of the path of the actuator, the operator if in the path of the actuator and moved by the latter being effective to move the hook into the path of the knife, and a leveler mounted for movement on the dobby effective when moved first to move the operator beyond the working stroke of the actuator and thereafter move the operator in a direction to move the reader away from the paper pattern.

16. In a dobby as set forth in claim 15 wherein the leveler includes a shaft and two bars operatively connected to the shaft, the shaft when turned in a given direction effective first to cause one of said bars to effect movement of the operator beyond the working stroke of the actuator and effective thereafter to cause the other bar to move the operator to move the reader away from the pattern.

17. In a dobby as set forth in claim 16 wherein guides are provided for said bars and lever and link connections are operatively interposed between the shaft and said bars.

18. In a dobby provided with a reciprocable knife and a harness lifting hook to be moved into or out of the path of the knife, a paper pattern having perforated and unperforated parts, an actuator having a working stroke along a path during operation of the dobby, an operator extending over the pattern and having the pattern reader thereon depending therefrom toward the pattern and controlled by the latter and effective if passing through a perforated part of the pattern to locate the operator in the path of the actuator to be moved by the latter and effective if engaging an unperforated part of the pattern to hold said operator out of the working stroke of the actuator, a finger mounted for movement on the dobby operatively connected to said hook and to said operator and effective when the latter is moved by the actuator to move the hook into the path of the knife, and leveler means normally at rest mounted for movement on the dobby and when having said movement being effective first to move the operator beyond the working stroke of said actuator and thereafter lift said operator to elevate said reader to a position in which said reader is out of control of the paper pattern.

19. In a dobby as set forth in claim 18 wherein the operator includes a force transmitter movable into and out of the path of the actuator and the leveler mechanism is effective to move said force transmitter beyond the working stroke of the actuator.

20. In a dobby provided with a reciprocable knife and a harness lifting hook to be moved into and out of the path of the knife, a paper pattern having perforated and unperforated parts, an operator operatively connected to the hook and effective when moved from the

normal position thereof to effect movement of the hook into the path of the knife, an actuator for the operator having working strokes during operation of the dobby, pattern controlled means controlling the position of the operator relative to the actuator and effective if registered with an unperforated part of the pattern to hold the operator out of operative position with respect to the actuator but effective if registered with a perforated part of the pattern to locate the operator in the path of the actuator, and leveler means for the operator to effect movement of the operator in the direction of the working stroke of the actuator to move the operator beyond said working stroke of the actuator and thereafter move said operator to move the pattern controlled means away from the pattern.

21. In a dobby provided with a reciprocable knife and a harness lifting hook to be either in or out of the path of the knife, a paper pattern having perforated and unperforated parts, an actuator member reciprocating along a path and having working strokes during operation of the dobby, an operator member operatively connected to the hook, a pattern reader on the operator member to control the position of the latter with respect to the actuator member and effective when passing through the perforated part of the pattern to locate the operator member in the path of the actuator member to be moved by the latter and effective if engaging an unperforated part of the pattern to locate the operator member out of the path of the actuator member, the operator member if in the path of the actuator member and moved by the latter being effective to move the hook into the path of the knife, and a leveler mounted for movement on the dobby effective when moved first to effect relative separation of said actuator and operator members in the direction of said path of the actuator member and thereafter move the operator member in a direction to move the reader away from the paper pattern.

22. The dobby set forth in claim 21 wherein the operator member is provided with a laterally extending force transmitter member and the actuator member includes a bar for engagement with the transmitter and said leveler effects movement of the actuator member in a direction away from the force transmitter.

23. The dobby set forth in claim 21 wherein the leveler when operating moves the actuator member in a direction away from that part of the operator member engaged thereby.

24. The dobby set forth in claim 21 wherein the operator member is provided with a force transmitter positioned for engagement with the actuator member during normal operation of the dobby and wherein the leveler when operating moves the actuator member in a direction away from the force transmitter.

25. A connector unit for the leveling mechanism of a dobby provided with an operating lever element and a rocking arm element, said unit including a tubular member having provision for connection to one of said elements, a rod member one end of which is slidable in the tubular member and the other end of which has provision for connection to the other element, spaced cross heads on said members, one cross head for each member, a pair of links pivoted to each cross head, and a link operator pivoted to all of said links.

26. The connector unit set forth in claim 25 wherein the cross heads are parallel to each other and the links are all of the same length.

27. In a connector unit set forth in claim 25 wherein the link operator is intermediate the cross heads.

28. In a connector unit for the leveling mechanism of a dobby provided with lever and arm elements, said unit including a tubular member for pivotal connection for one of said elements and having a laterally extending cross head fixed thereto, a rod member having one end mounted for sliding within the tubular member and having the other end formed for pivotal connection with the other element and having a cross head fixed thereto spaced from the cross head on the tubular member in the direction of the length of a connecting unit, a pair of links pivoted to the first cross member, a second pair of links pivoted to the second cross member, and a link operator intermediate the cross heads pivotally connected to all of the links supported by the latter for movement transverse of the length of the connector unit.

29. The connector unit set forth in claim 28 wherein the rod member remains within the tubular member for all angular positions of the links induced by said transverse movement of the link operator.

30. In a dobby provided with a reciprocable knife and a harness lifting hook to be either in or out of the path of the knife, a paper pattern having perforated and unperforated parts, an operating lever having regular movements during operation of the dobby, an actuator, a connector unit intermediate the lever and the actuator causing the latter to have working strokes along a path during operation of the dobby due to movements of the operating lever, to move the operator, provided the latter is in the path of the actuator, an operator operatively connected to the hook, a pattern reader on the operator to control the position of the latter with respect to the actuator and effective to locate the operaor in said path or out of said path, depending upon whether the reader passes through the paper pattern or engages an unperforated part thereof, the operator if in the path of the actuator being moved by the latter to effect movement of the hook into the path of the knife, and a leveler mounted for movement on the dobby effective when moved first to cause relative separation of the operator and the actuator in the direction of said path of the actuator and thereafter move the operator in a direction to move the reader away from the paper pattern.

31. The dobby set forth in claim 30 wherein said connector unit is capable of having the length thereof varied and is of a given length during normal operation of the dobby and the leveler when in operation effects a shortening of said connector unit to move the actuator in a direction opposite to the direction of said working stroke.

32. The dobby set forth in claim 31 wherein the connector unit is controlled by a handle which is in normal position when the unit is of said given length but is movable in a direction transverse of and in a direction away from the unit to effect said shortening of the length of the unit.

33. The dobby set forth in claim 32 wherein the handle is rotatable and has a part to engage the dobby after the handle has been rotated to prevent the handle from moving toward the unit.

34. The dobby set forth in claim 31 wherein said connector unit comprises two members each having a pair of links pivoted thereon and a link operator pivoted to all of the links and capable of having a movement from the normal position thereof in a direction transverse of the length of the connector unit when the leveler operates to effect shortening of the connector unit.

35. The dobby set forth in claim 34 wherein the link operator is controlled as to position by a movable handle which when in normal position prevents movement of the link operator in a direction opposite to said direction of transverse movement, the handle when moved away from the normal position thereof causing the link operator to have said transverse movement and being rotatable to locate a part thereof in engagement with the dobby to prevent return of the link operator to the normal position thereof.

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