Aug. 27, 1963 E. PFARRWALLER 3,101,749

PATTERN CARD MECHANISM FOR A DOBBY

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Fig. 1

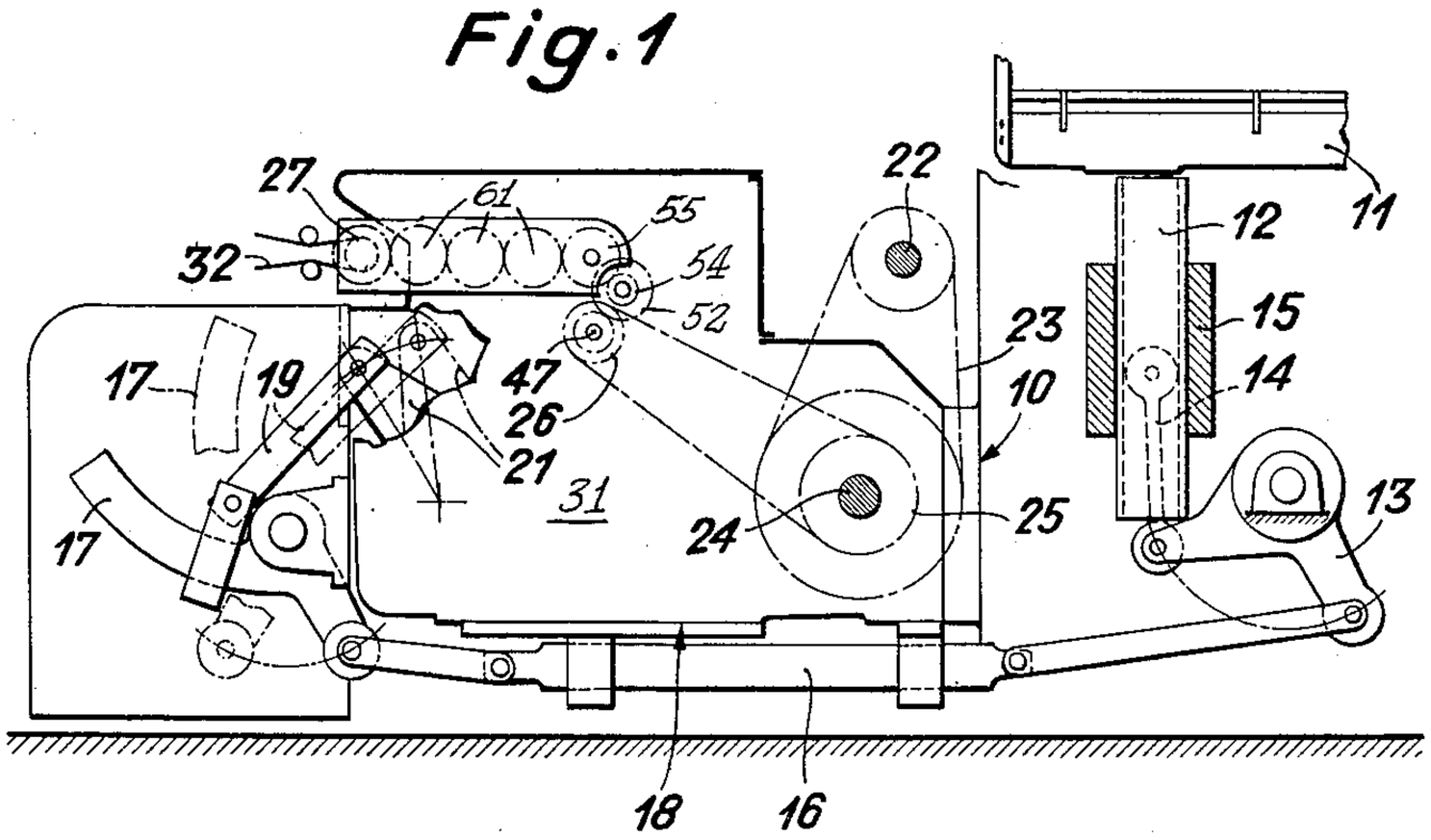

Fig. 5

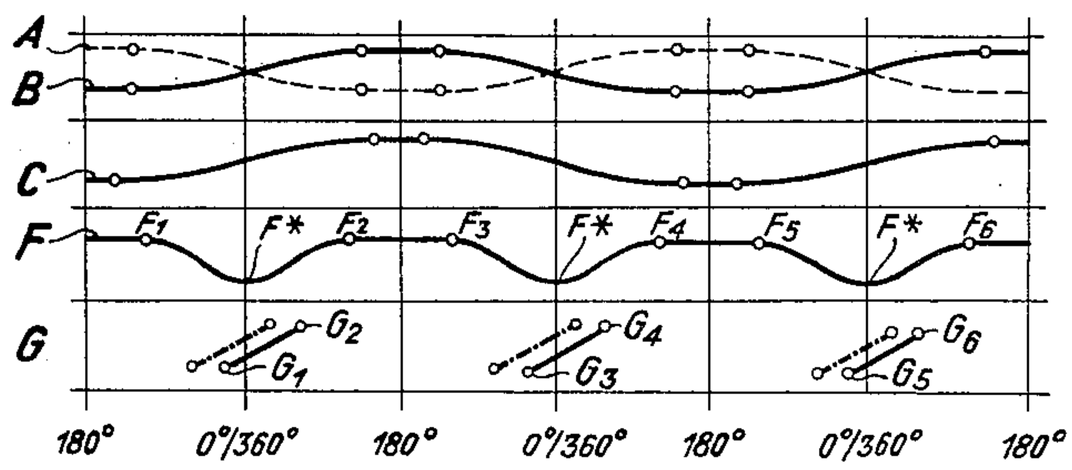

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Fig. 2

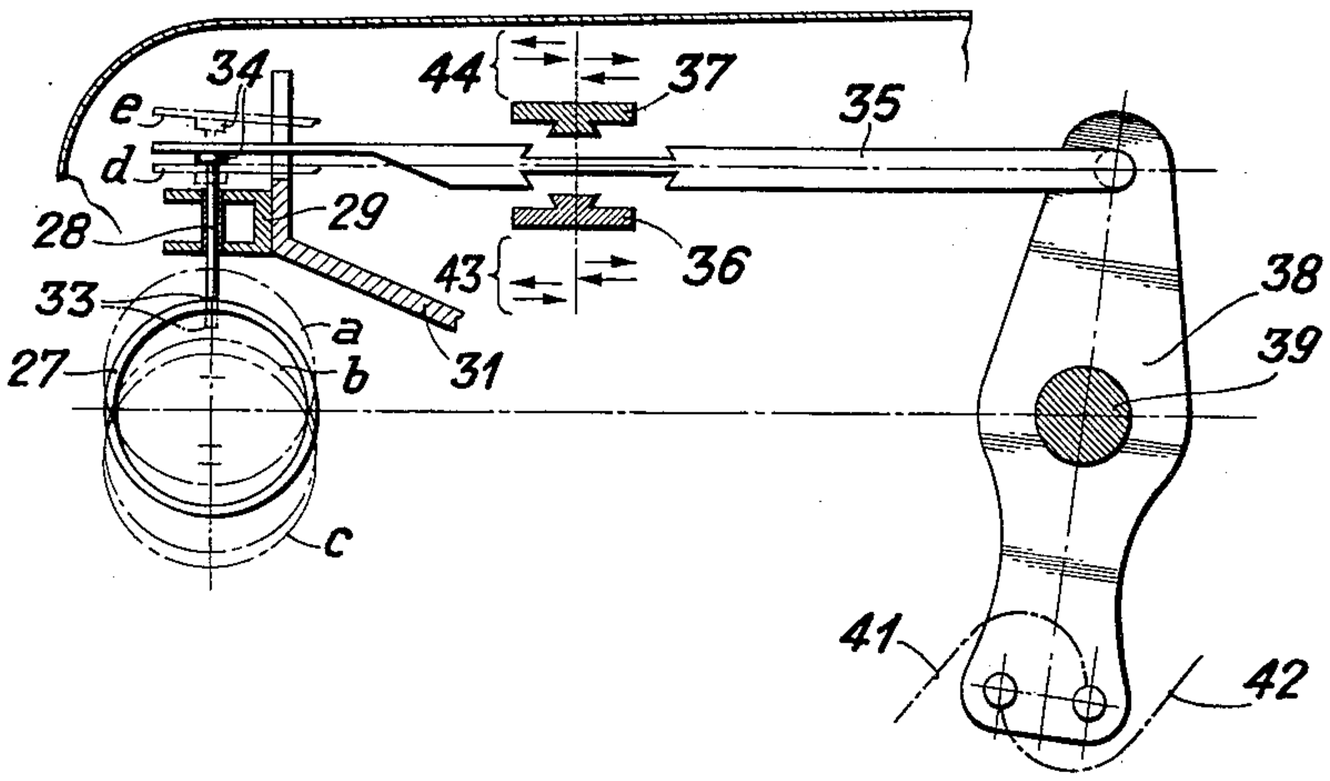

Fig. 3

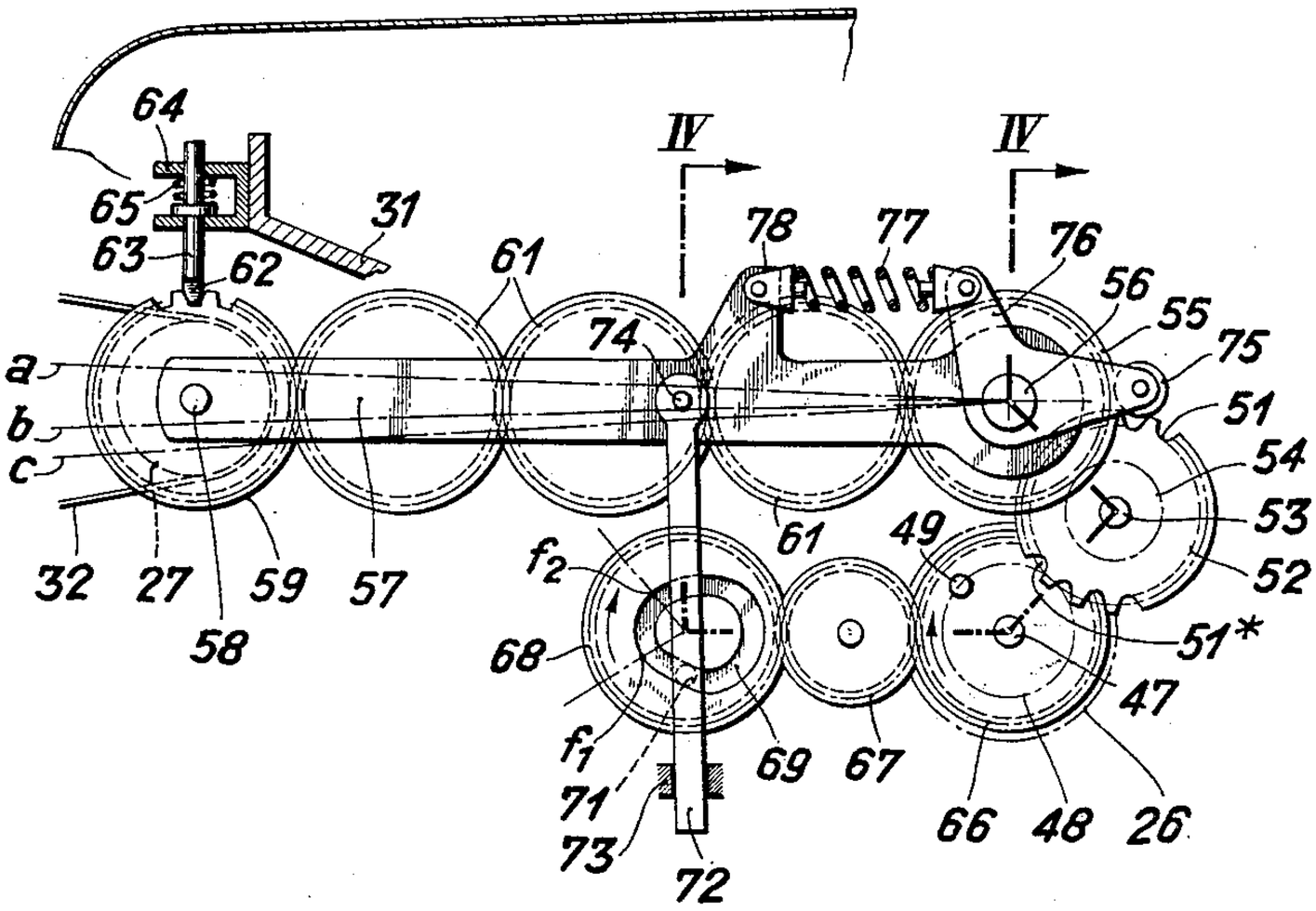

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Fig. 4

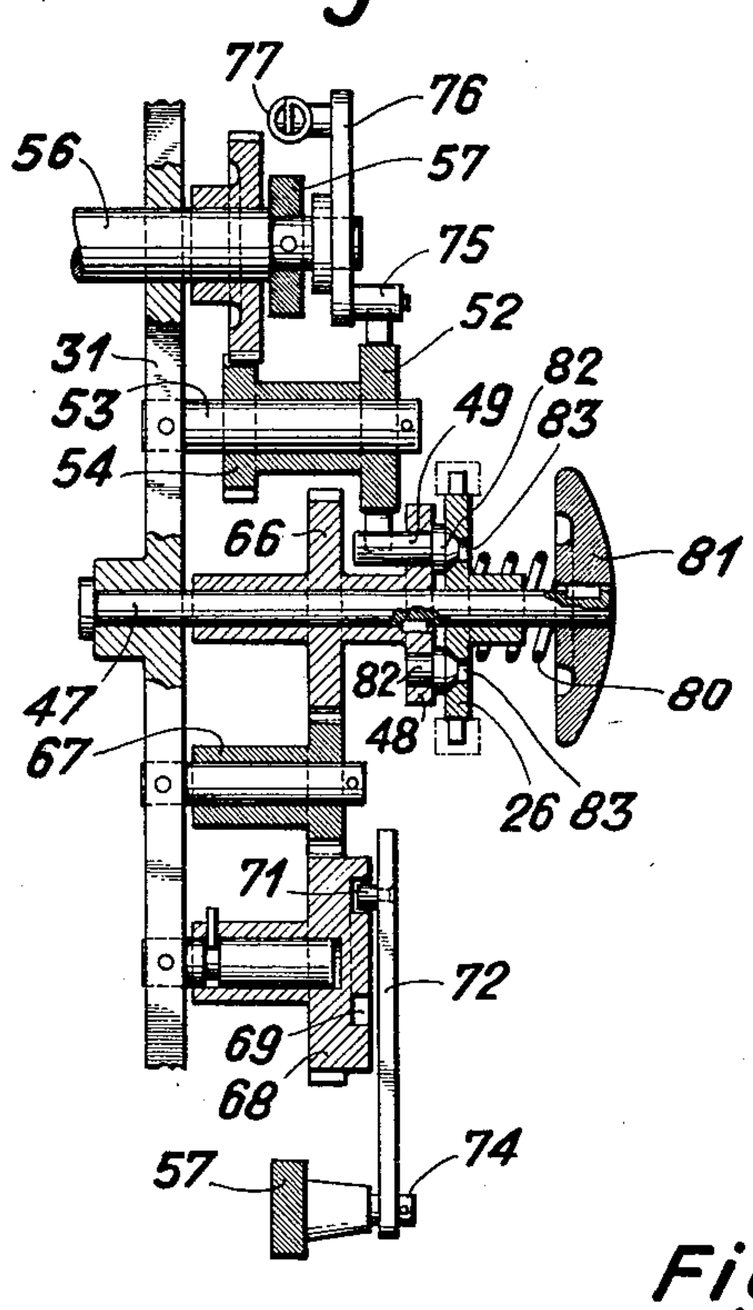


Fig. 6

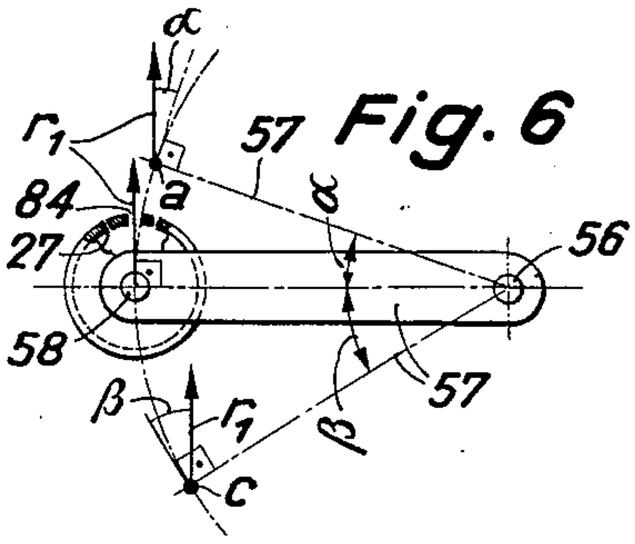


Fig. 7

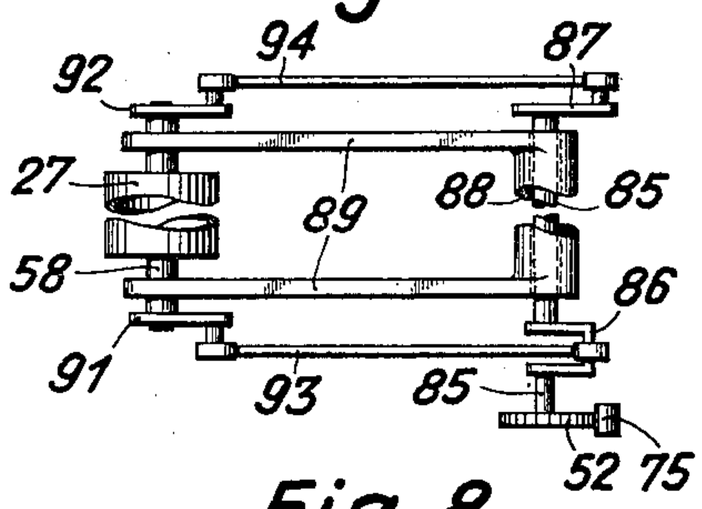


Fig. 9

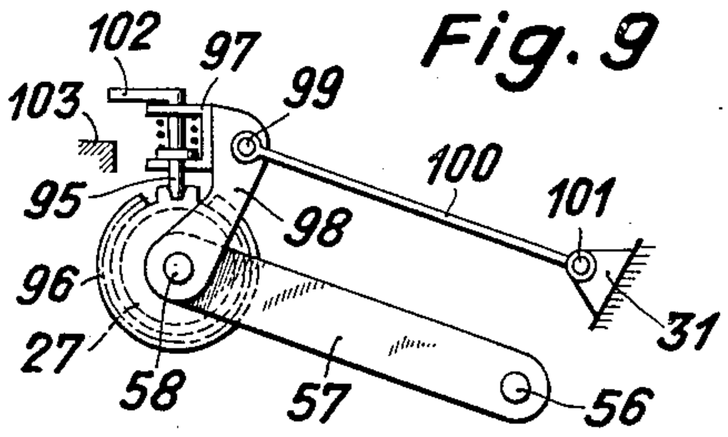
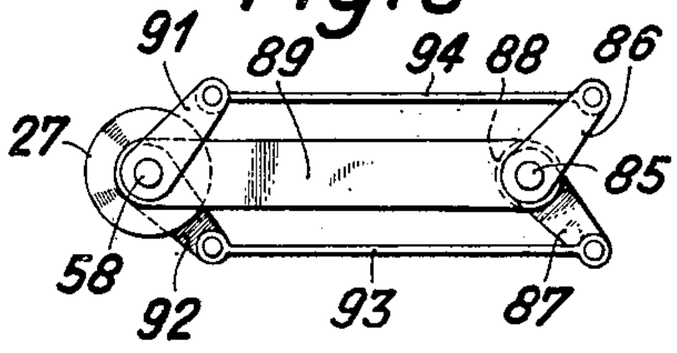


Fig. 8



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United States Patent Office

3,101,749

Patented Aug. 27, 1963

3,101,749

PATTERN CARD MECHANISM FOR A DOBBY

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Filed Feb. 1, 1961, Ser. No. 86,487
Claims priority, application Switzerland Feb. 12, 1960
6 Claims. (Cl. 139—329)

The present invention relates to a dobby for actuating heddle frames in a weaving machine which dobby is controlled by a pattern card having perforations adapted to be scanned by feeler needles. The invention relates more particularly to a mechanism for advancing the pattern card by stepwise rotation of a card cylinder, including means for swinging the card cylinder out of the way of the feeler needles to permit rotation of the cylinder and for swinging the card cylinder towards the needles for affording scanning of the perforations in the pattern card by the feeler needles.

It is an object of the present invention to provide a mechanism for advancing the pattern card controlling the operation of a dobby for actuating the heddle frames of a weaving machine and means for moving the pattern card cylinder to a position permitting stepwise rotation of the card cylinder for advancing the pattern card and to a position permitting feeler needles to scan the holes in the pattern card whereby the row of holes which is on top of the card cylinder and ready to be scanned performs a translatory or compensating movement with the card cylinder upon lowering and lifting of the latter so that the holes in the pattern card can be made less wide and the rows of holes can be placed closer together whereby the pattern card can be made shorter than is possible with mechanisms having no provisions for effecting a translatory movement of the card cylinder.

In the mechanism according to the invention the card cylinder is carried by a support which is swingable on a stationary fulcrum and compensating means are provided having a parallelogram motion effect whereby swinging of the support produces rotation of the card cylinder through an angle which is equal to the swing angle of the support, the direction of said rotation of the card cylinder being opposite to the swing direction of the support. This effect need not be produced during the entire swinging of the support but may be restricted to the movement of the card cylinder between the position where the pattern card can be scanned by the feeler needles and the position where the card cylinder is out of reach of the feeler needles.

The novel features which are considered characteristic of the invention are set forth with particularity in the appended claims. The invention itself, however, and additional objects and advantages thereof will best be understood from the following description of embodiments thereof when read in connection with the accompanying drawing wherein:

FIG. 1 is a diagrammatic part sectional elevation of a portion of a weaving machine and of a pattern-card-controlled dobby for controlling the movement of the heddle frames connected thereto.

FIG. 2 is a large scale part sectional elevation of the pattern-card-responsive mechanism of the dobby.

FIG. 3 is a part sectional elevation of a mechanism for advancing the pattern card and positioning the pattern card cylinder.

FIG. 4 is a sectional view of the mechanism shown in FIG. 3 in rolled out representation, the section being taken along line IV—IV of FIG. 3.

FIG. 5 is a diagram showing the movements of the heddle frames, of the mechanism for actuating the heddle frames, and of the mechanism for advancing the pattern card.

FIG. 6 is a diagrammatic illustration showing the angular movements of a part of a mechanism according to the invention.

FIG. 7 is a plan view of a modification of a mechanism according to the invention.

FIG. 7 is an elevation of the mechanism shown in FIG. 7.

FIG. 9 is an elevation of a further modification of a mechanism according to the invention.

Referring more particularly to FIG. 1 of the drawing, numeral 10 designates a weaving machine having a heddle frame 11 supported by an element 12 which is reciprocatingly movable in a vertical guide 15 and actuated by an angle lever 13 to which it is connected by a link 14. The lever 13 is connected by a linkage 16 to an actuating lever 17 forming part of a dobby 18 and connected by a link 19 to a rocking lever 21. The solid lines show the heddle frame actuating mechanism in lower shed position. The broken line representation of the lever 17 shows this part in position corresponding to the upper shed position of the heddle frame.

Numeral 22 designates a shaft which is driven by the main shaft of the weaving machine 10 at the same speed as the main shaft of the loom. A shaft 24 is connected to the shaft 22 by means of a chain 23 and is driven at half the speed of the shaft 22. The shaft 24 drives a lifting mechanism, usually comprising reciprocating lifter rails with which lifting blades are selectively engaged by a control mechanism, which will be described later, in response to the apertures in a pattern card. The lifting blades actuate the rocking levers 21 either directly or indirectly. A suitable heddle frame lifting mechanism is disclosed in my copending application Serial No. 86,492, filed on the same day as the present application. A rocking lever 21 is provided for each heddle frame of the weaving machine.

A sprocket wheel 25 mounted on the shaft 24 drives, by means of a chain, a sprocket wheel 26 which actuates a mechanism for rotating and for lifting and lowering a pattern card cylinder 27.

The pattern card reading device shown in FIG. 2 comprises the card cylinder 27 and reading needles or pegs 28 which are vertically movable in a guide bar 29 mounted on the frame 31 of the pattern-card-controlled dobby 18 for scanning the apertures in a pattern card 32 (FIG. 3). The card cylinder may be rotated for advancing the pattern card when the cylinder is in the lower position shown by a broken line *c*. FIG. 2 shows the card cylinder 27 in an intermediate position between an extreme low position *c* and an extreme upper position *a*. FIG. 2 shows a needle 28 resting on an unperforated portion of the pattern card. When the card cylinder is in the position *b* the pattern card is adjacent to the lower ends 33 of the needles 28 when the latter have dropped to their lowermost position.

The upper end of each needle 28 is provided with a head 34 on which rests the end of a control rod 35. The latter are adapted to be selectively engaged and reciprocatingly moved by control rails 36, 37 for swinging a control lever 38 on a stationary fulcrum 39 to its end positions. The lever is connected by links 41 and 42 to lifting blades, not shown, in the manner shown in my copending application Serial No. 86,492, filed on the same day as the present application. Depending on whether the lever 38 is in the right extreme position shown in FIG. 2 or in the left extreme position, the lifting blade connected to the link 41 or the lifting blade connected to the link 42 is engaged by a lifter rail (not shown).

If a needle 28 meets with a hole in the pattern card 32 the needle drops in the guide 29 until the head 34 of the needle rests on the guide whereby the control rod 35 assumes its lowermost position *d* and is engaged by the actuating rail 36. If the needle end 33 is opposite an unperforated portion of the pattern card and the card cylinder is lifted from the position *c* to the position *a*, the needle 28 is lifted in the guide 29 whereby the control rod 35 resting on the head 34 of the needle is moved to the upper position *e* wherein it can be engaged by the actuating rail 37. The rails 36 and 37 are shown in their middle positions in FIG. 2. They are reciprocatingly moved in opposite direction by a mechanism, not shown, and disclosed in my copending application Serial No. 86,492 of the same date as the present application. The rail 37 moves consecutively in the directions shown by arrows 44 and the rail 36 moves consecutively in the directions shown by arrows 43.

The mechanism shown in FIG. 3 for rotating the card cylinder 27 comprises a shaft 47 which is rotatably mounted in the frame 31 of the dobby 18 and to which a wheel 48 carrying a pin 49 is rigidly connected. The sprocket wheel 26 is rotatable and axially movable on the shaft 47. The pin 49 is adapted to be received in gaps 51 between teeth of a wheel 52 which is rotatable on a shaft 53 mounted on the frame 31. A gear 54 engaging a gear 55 is rigidly connected to the gear 52.

The gear 55 is rotatable on a shaft 56 rotatably mounted on the frame 31. Two support arms 57 are fast on the shaft 56. The free ends of the arms 57 carry a rod 58 supporting the card cylinder 27. A gear 59 driven by the gear 55 through gears 61 rotatably mounted on at least one of the arms 57 is coaxially connected to the card cylinder.

A point 62 at the lower end of a locking pin 63 guided for vertical movement by a guide 64 mounted to the frame 31 and urged to move downward by a spring 65 fits into the gaps between the teeth of the gear 59.

A gear 66 is made fast on the shaft 47 and drives a gear 68 through a gear 67 in the direction indicated by an arrow in FIG. 3. The gear 68 is provided with a groove 69 receiving a roller 71 mounted on a rod 72. The latter is guided for substantially vertical movement by a guide 73 mounted to or forming part of the frame of the dobby. The upper end of the rod 72 is pivotally connected at 74 to the arm 57.

A locking lever 76 swingable on the shaft 56 has an arm whose end carries a locking roller 75 adapted to engage the gaps 51 between the teeth of the gear 52. The lever 76 is urged to swing clockwise by means of a spring 77 interposed between the end of a second arm of the lever 76 which second arm is placed at an angle to the first arm, and an abutment 78 mounted on the arm 57.

FIG. 4 shows a section of the mechanism shown in FIG. 3 in rolled out representation showing the lateral relative position of the aforedescribed elements. A clutch is interposed between the sprocket wheel 26 and the wheel 48. The wheel 26 is freely rotatable on the shaft 47 to the right end of which a hand wheel 81 is mounted. A spring 80 interposed between the hand wheel 81 and the sprocket wheel 26 presses the latter against pins 82 mounted on the wheel 48 and having conical heads fitting into conical cavities 83 in the sprocket wheel 26.

Operation of the device is now explained with reference to the diagram FIG. 5.

The abscissa in the diagram FIG. 5 represents the angular positions of the main shaft of the weaving machine 10. The ordinates represent the strokes of individual elements of the system. Lines A and B represent the movements of two heddle frames. Since a weft thread is inserted in the shed formed by warp threads during each revolution of the main loom shaft, certain heddle frames are in the upper shed position during one revolution and are in the lower shed position during another revolution of the loom shaft, depending on the weave pattern. The drive shaft 24 of the dobby rotates at one half of the speed of the loom shaft and the lifter rails actuating the heddle frames make one stroke in one direction and one stroke in the opposite direction during two revolutions of the drive shaft of the weaving machine. Since there are two lifter rails, if the rails move in the same direction, and since there are two lifting blades for each heddle frame, the lifting blades may be so moved to be engaged by the lifter rails that each heddle frame may be moved according to the line A or according to the line B, whether the lifter rails move in one direction or in the opposite direction.

The pattern card 32 is provided with a row of holes for each shuttle pick and is usually advanced from one row of holes to the next row of holes. The sprocket wheel 26 has half as many teeth as the sprocket wheel 25 so that the shaft 47 and the wheel 48 rotate at the same speed as the main loom shaft. The wheel 52 is rotated by one tooth pitch and the pattern card 32 is advanced by one hole row at each passage of the pin 49. Since the tooth pitch of the gear 52 is greater than the spacing between the rows of holes in the pattern card and since the diameter of the pitch circle of the gear 52 is greater than the diameter of the card cylinder 27, a corresponding speed reduction must be provided between the gears 54 and 55.

Scanning of a row of holes of the pattern card 32 takes place upon lifting of the card cylinder from the position *c* to the position *a* (FIG. 2). This is illustrated by line F in FIG. 5. At point F_1 the roller 71 in FIG. 3 is in the position f_1. Each needle 28 which is in lowermost position (FIG. 2) with the head 34 resting on the guide 29 must have left the respective hole in the pattern card 32 before the card can be advanced at point G_1 of the line G in FIG. 5 which represents the movement of the pattern card. Thereupon the pin 49 enters the gap 51* of the gear 52 which is advanced by one tooth pitch and fixed in that position by the locking roller 75 which has entered a new tooth gap. The new position is illustrated by point G_2 in FIG. 5. In the meantime the card cylinder 27 has reached its lowermost position *c* at F* and has already been lifted before the pattern card has reached the new position G_2.

The card cylinder 27 must not reach position *b* in FIG. 2 before the pattern card has reached the position G_2 shown in FIG. 5. When the card cylinder continues to move upward from the position *b* the needles 28 enter holes in the pattern card and the advance of the latter must be completed before this happens.

Since the locking lever 76 arrests the gear 52 the gear 55 is also arrested.

When the gear 55 stands still the first gear 61, which is engaged by the gear 55, rolls on the latter upon continued swinging of the lever 57 from the position *b* to the position *a*. Rotation of the first gear 61 is transmitted through a second and third gear 61 to the gear 59. Therefore, the gear 59 and the card cylinder 27 perform a translatory movement whereby the row of holes 84 (FIG. 6) at the upper part of the cylinder 27 moves through the same angle as the axis 58 which, in the arrangement shown in FIG. 6, is moved upward to about the extent of the radius of the cylinder 27. Holding the gear 55 for allowing rolling of the gear 61 thereon during a swing of the arms 57 effects rotation of the card cylinder in a way to compensate for the lateral dislocation of the card cylinder caused by the swing of the arms 57. This compensating effect is produced by the elements 55, 61 and 75 to 78 which are operatively connected to the arms 57 and to the card cylinder 27.

During the scanning operation the lower ends 33 of the vertical needles 28 enter the holes of the row 84. Because of the aforedescribed counterclockwise rotation of the cylinder 27 the row of holes 84 is not farther moved to the right than the axis 58. Upon clockwise swinging of the arm 57 from the horizontal position through the

angle α, the cylinder **27** and the vertical radius r_1 extending through the holes **84** move counterclockwise through the same angle α. Therefore, the radius r_1 remain vertical. Upon counterclockwise swinging of the arm **57** from the horizontal position through an angle β the cylinder **27** is rotated in clockwise direction through the same angle β so that the radius r_1 retains its vertical position.

In the modification of the invention shown in FIGS. 7 and 8 the gear **52** is fast on a shaft **85** which is provided with cranks **86** and **87**. Support arms **89** for supporting the card cylinder **27** extend from a hollow shaft **88** surrounding the middle portion of the shaft **85**. The shaft **58** which is keyed to the card cylinder **27** is provided with cranks **91** and **92** placed outside of the arms **89** and connected to the cranks **86** and **87**, respectively, by connecting rods **94** and **93**. The cranks **86** and **87** and the cranks **91** and **92** are set at an angle with respect to each other. The gear **52** can be arrested by a roller **75** as in the modification shown in FIG. 3.

FIG. 9 shows a further variation of a parallelogram motion arrangement. Numeral **95** in FIG. 9 designates a locking pin adapted to be received in the gaps between the teeth of a gear **96** connected to the card cylinder **27**. The pin **95** locks the gear **96** and the cylinder **27** as long as the ends **33** of the feeler needles **28** are in apertures in the cylinder **27**. The pin **95** is vertically guided in a guide **97** which is mounted on an arm **98** which is swingable on the axis **58** of the card cylinder. One end of a connecting rod **100** is swingably connected to the arm **98** by means of a pin **99**. The other end of the connecting rod **100** is pivoted at **101** to the frame **31** of the dobby. The distance between the pins **99** and **101** is equal to the distance between the shafts **56** and **58**, and the distance between the shaft **56** and the pin **101** is equal to the distance between the shaft **58** and the pin **99** so that the gear **96** is moved translatorily upon swinging of the arm **57** and as long as the point of the pin **95** is in a gap between the teeth of the gear **96**.

The locking pin **95** is provided with an arm **102** which is adapted to engage an abutment **103** connected to the frame **31** of the dobby for pulling the pin **95** out of the tooth gaps of the gear **96** and permitting rotation of the card cylinder **27** when the arm **57** is swung counterclockwise below the position *b*, shown in FIG. 2.

Whereas in the mechanism shown in FIG. 3 a collar on the pin **63** rests on the guide **64** and prevents the point **62** of the pin **63** to follow the gear **59** when the card cylinder moves below the position *b*, shown in FIG. 2, so that the cylinder can be rotated, the arm **102** on the pin **95** in FIG. 9 prevents the pin **95** to follow the gear **96** when the card cylinder moves below the position *b* shown in FIG. 2, so that the cylinder can be rotated.

I claim:

1. A pattern card mechanism for a dobby for selectively actuating the heddle frames in a weaving machine, said mechanism comprising a support arm swingable on a stationary fulcrum, a card cylinder rotatably mounted on the free end of said support arm, a perforated pattern card laid around said cylinder, vertically movable feeler needles having a lower end adapted to rest on an unperforated portion of said pattern card or to penetrate a perforation thereof, drive means operatively connected to said card cylinder for stepwise rotation of said cylinder and advancing said pattern card, means operatively connected to said drive means for periodically swinging said support arm to move said card cylinder out of the way of said feeler needles for permitting rotation of the card cylinder and for swinging said support arm to move said card cylinder toward said needles for permitting scanning of the perforations of said pattern card by said needles, and compensating means operatively connected to said arm and to said card cylinder for rotating the latter in opposite direction to the swing direction of said support arm and through the same angle.

2. A pattern card mechanism as defined in claim 1 wherein said compensating means includes an element rotatable coaxially of the swing axis of said support arm, locking means operatively connected to said support arm and to said element for preventing rotation of said element during swinging of said support arm, and means operatively interconnecting said element and said card cylinder.

3. A pattern card mechanism according to claim 2 and wherein said element has two cranks set at an angle with respect to each other, and said means interconnecting said element and said card cylinder includes two cranks set at the same angle as the two cranks of said element and rigidly connected to said card cylinder, and two connecting rods placed in parallel relation and pairwise interconnecting the cranks of said element and the cranks rigidly connected to said card cylinder.

4. A pattern card mechanism as defined in claim 1 wherein said compensating means includes a gear rotatable coaxially of the swing axis of said support arm, locking means operatively connected to said support arm and to said gear for preventing rotation of said gear during at least a part of the swinging of said support arm, a second gear connected to and rotatable with said card cylinder and having the same number of teeth as said first gear, and an odd number of gears interposed between said first gear and said second gear.

5. A pattern card mechanism according to claim 4 wherein all said gears are mounted on said support arm.

6. A pattern card mechanism as defined in claim 1 wherein said compensating means includes a swing arm connected to said card cylinder, locking means connected to said swing arm, means connected to said card cylinder and adapted to be engaged by said locking means during part of the swinging of said support arm, and a connecting rod having one end pivoted to said swing arm and having a second end swingable on a stationary fulcrum, the distance between the rotation axis of said card cylinder and the pivot axis of the first end of said connecting rod being equal to the distance between the fulcrum of said support arm and the fulcrum on which said second end of said connecting rod is swingable, and said support arm having the same length as said connecting rod.

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