May 7, 1968 M. FAVRE 3,381,719

DOUBLE LIFT DOBBIES

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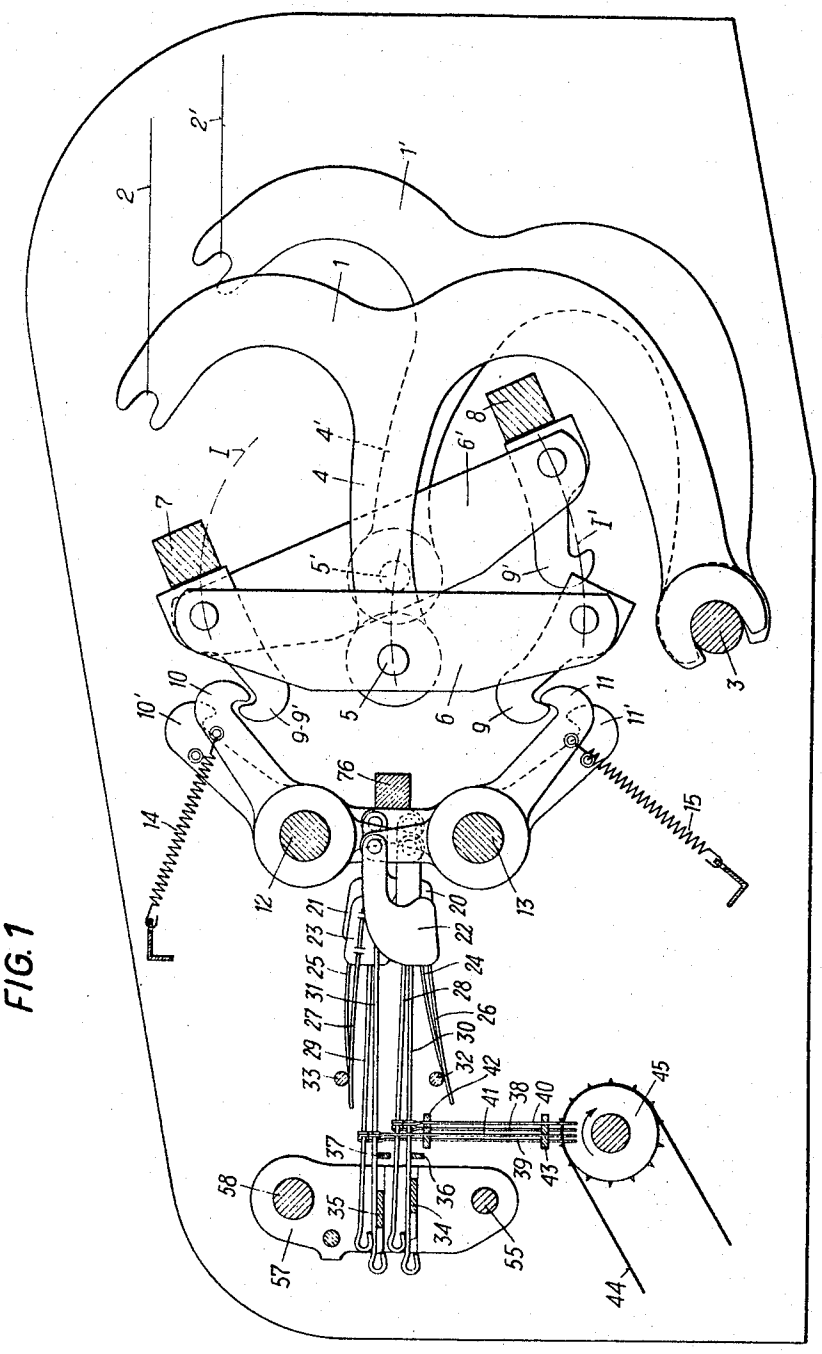


FIG. 1

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DOUBLE LIFT DOBBIES

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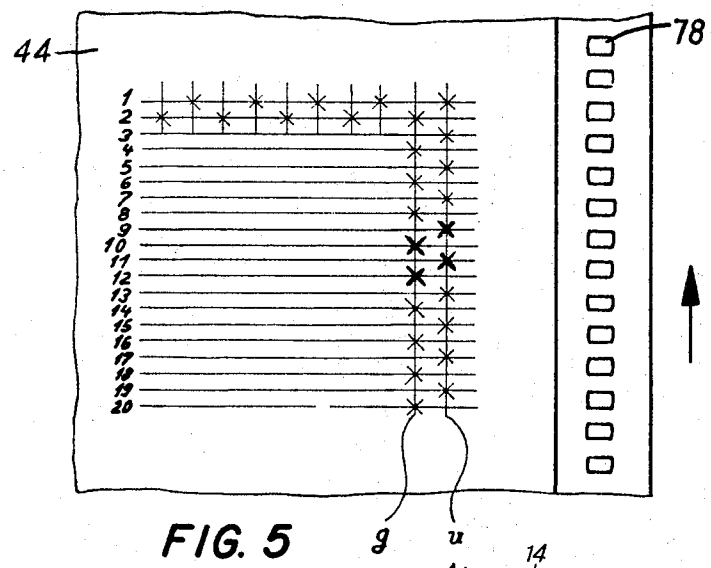


FIG. 5

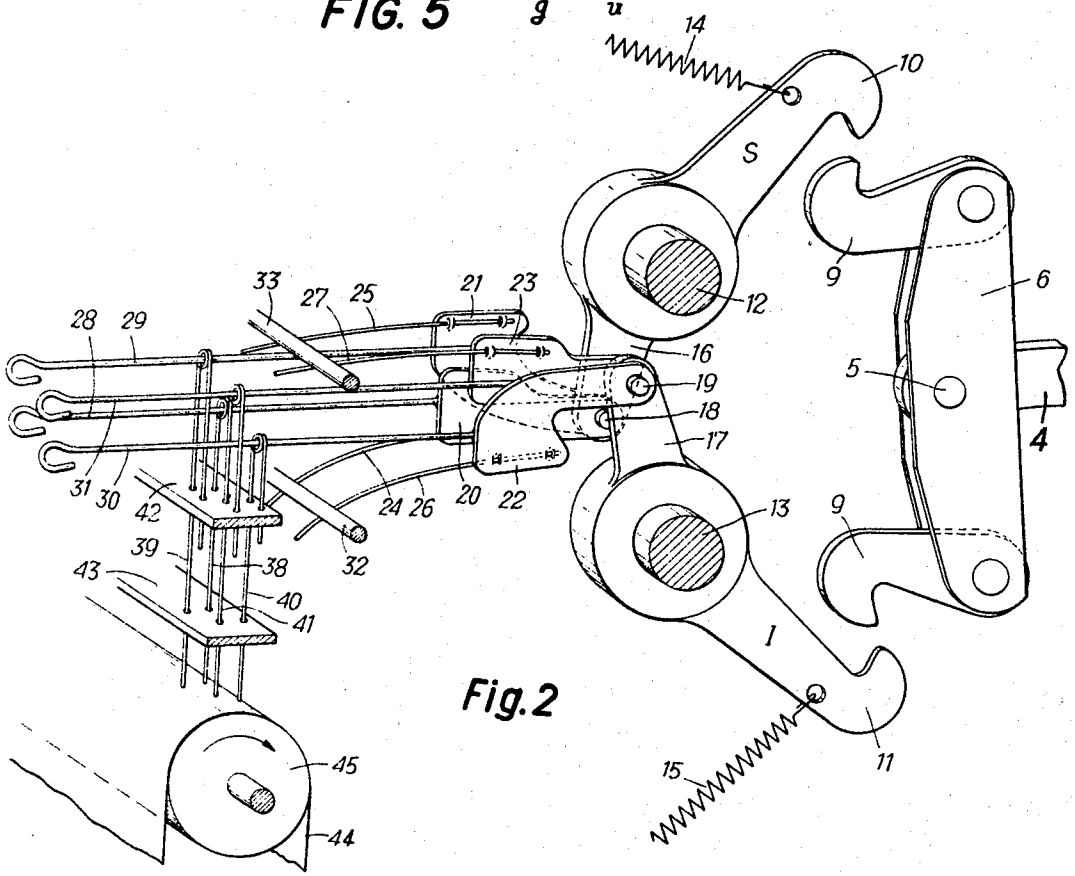


Fig.2

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DOUBLE LIFT DOBBIES

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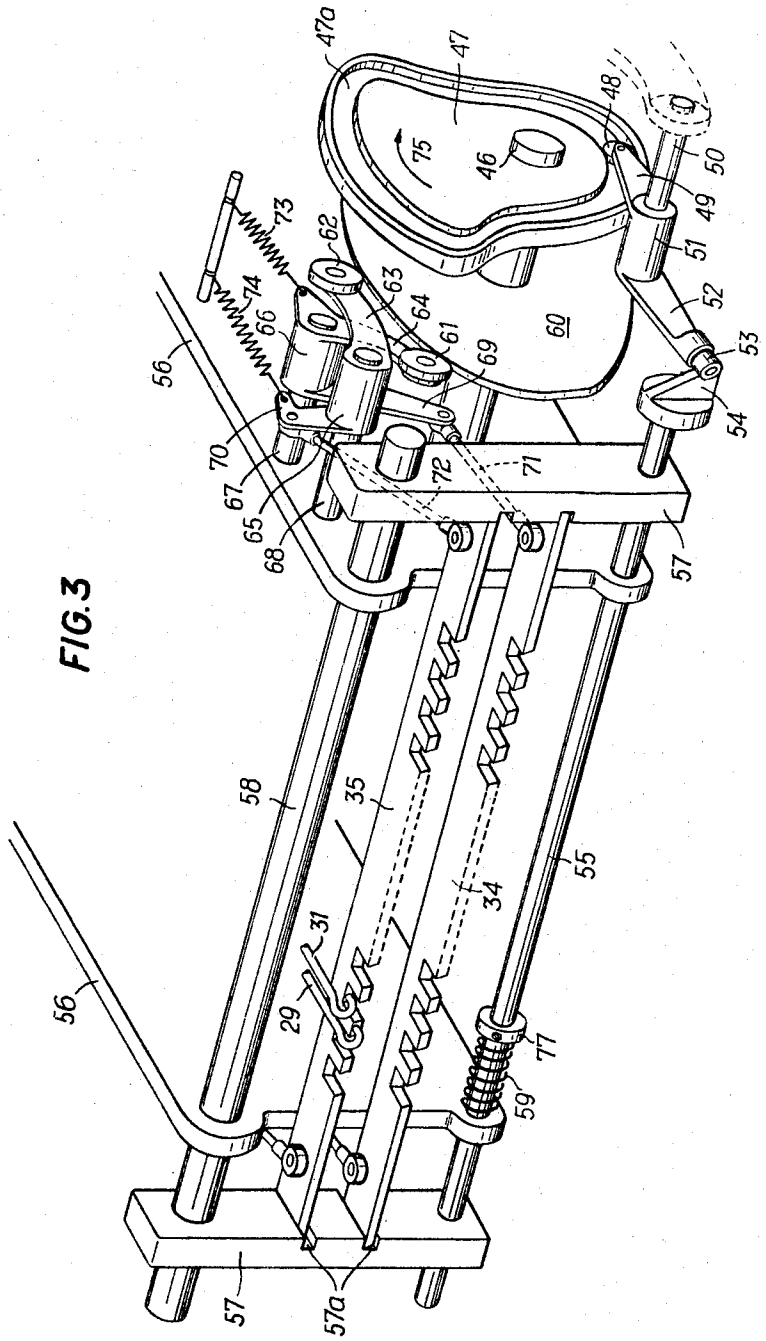
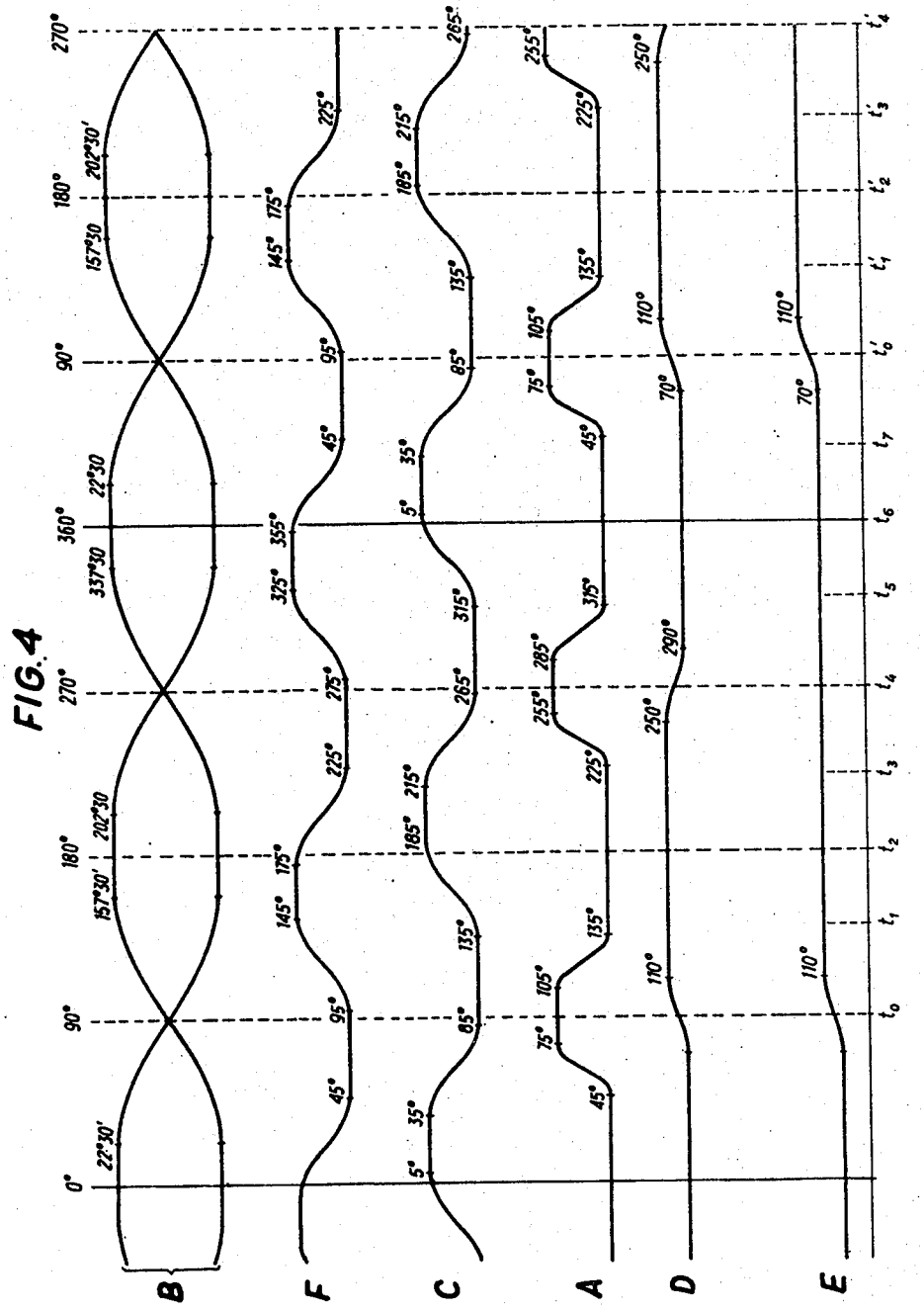


FIG. 3

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DOUBLE LIFT DOBBIES

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DOUBLE LIFT DOBBIES

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5 Claims. (Cl. 139—68)

ABSTRACT OF THE DISCLOSURE

A double lift dobby in which the baulks are arrested by arrester hooks actuated by two groups of draw needles. Each group is made of a pair of these needles and each needle of the pairs is associated with only one of the two arrester hooks arresting a respective baulk. The draw needles are actuated by draw rails operating out of phase with one lagging the other slightly by a double pick and the draw needles of a same group by one pick in the working cycle of the dobby. The working cycle of the dobby is equivalent to two picks corresponding to 360°. The draw needles of the various groups are actuated without a jerky operation of the arrester hooks. The baulks are actuated at respective ends by pusher rails driven reciprocably out of phase 180° for each double pick. The draw needles themselves are associated with reading needles reading a pattern card so that the desired baulks are arrested in a forward position corresponding to a raised heald position under control of the pattern card.

The present invention relates to a double lift dobby, wherein a baulk is associated with each jack of a heald shaft. The ends of each baulk have on the one-hand pivoted attachment hooks and on the other hand are movable in opposite directions of movement by two pusher rails swinging to-and-fro, which contact the same and are angularly offset 180° per double pick of the 360° working cycle of the dobby. The attachment hooks with their baulk ends are capable of being arrested by arrester hooks for the purpose of raising the heald shaft, and each arrester hook is controllable by a pair of draw needles. Four draw needles associated with each heald shaft and cooperate with reading needles and being subdivided into two groups for forward and reverse run, each comprising two reading needles. These groups read the rows of perforations of a pattern card in conjunction with, but offset relative to, one another by a double pick unit, the draw needles together with their associated reading needles of one and the same group being thus controllable in succession by one and the same draw rail, offset by one pick relative to one another.

The two arrester hooks associated with each baulk or with each heald shaft, respectively, are divided into one arrester hook for the even numbered picks, and one arrester hook for the odd numbered picks, one working cycle of the dobby corresponds to two picks.

An object of the invention is to provide a dobby, wherein there are returned into the starting position the arrester hooks, which had been adjusted for hooking-on, controlled by the dobby mechanism, so that this returning movement takes place at a predetermined velocity, which gradually diminishes to a standstill, without causing any jerks.

This is attained according to the invention such that the driving movement of the draw rail of the group of draw needles for the forward run lags behind by a certain rotational angle of the working cycle of the dobby relative to the driving movement of the draw rail of the group for the reverse run. All draw needles are lifted off twice per working cycle by a needle lifter such that in the forward

run the reading by the reading needles and their associated draw needles for the forward run has taken place before the drawing-out movement of the associated draw rail, and the drawing-out movement of the draw rail for the associated draw needles for the reverse run takes place before the reading by the corresponding reading needles. These operations take place in the inverse order during the reverse run.

Moreover these arrester hooks, which are to remain in the hooked-on position during several consecutive working cycles, are to be kept in this position during the transition from one cycle to the other, and this should be achieved without any appreciable see-sawing of the arrester hooks.

In order to fulfill these requirements, the working sequences of the various components are conveniently so timed to one another, that their movements run absolutely symmetrically, and are identical for the forward run as well as for the reverse run.

The angular offset of the working sequences between the movements of the two draw rails may be controlled in such a manner that—during a forward run and with an arrester hook, which has been moved into the arresting position for the upper shed position of the heald shaft and which has to be restored to the initial lower shed position—at the moment of this arrester hook being relieved from the pressure of the pusher rail on the attachment hook, the draw rail of the draw rails for the reverse run is in the drawn-out position, whereby the corresponding draw needles of this arrester hook are engaged and are returned in a controlled manner, which prevents the arrester hook from rebounding. Moreover, while the arrester hook remains in the attachment position beyond one working cycle the draw rail of the draw needles for the reverse run engages the draw needles of this arrester hook and thus retains in the engagement position the arrester hook, which has been relieved of the force of the pusher rail, until the draw rail itself of the draw needles for the forward run takes over the retaining by means of its draw needles, so that substantially a see-saw-free transition of the arrested position can take place from the draw rail for the reverse run to the draw rail for the forward run. The control members allowing the same working sequences for the reverse run.

A main advantage of the aforesaid offset of the driving movements of the two draw rails consists in that a controlled return of an arrester hook, which is in the attachment position and is released by the attachment hook, is attained in the forward run (and conversely in the reverse run), so that the arrester hook is either restored gradually and without jerk to its initial position, or—when this same arrester hook is to be rested-in again in the following working cycle—is engaged by the mechanism for the reverse run, viz, at the moment, when the draw rail for the forward run begins to recede. Any jerky receding is thus prevented.

In the accompanynig drawing an embodiment of the dobby according to the invention is illustrated by way of example, wherein:

FIG. 1 is a diagram of heald control mechanism in longitudinal section;

FIG. 2 is a detail of FIG. 1 in a perspective view, illustrating reading needles with associated draw needles and the arrester hook co-operating therewith;

FIG. 3 is another detail of FIG. 1 in perspective view illustrating the drive mechanism of the draw needles;

FIG. 4 is a graph of the movements of the various principal components of the dobby in the course of two consecutive working cycles; and

FIG. 5 is a section view of a pattern card.

In FIG. 1, two adjacent jacks of the dobby are denoted by 1 and 1', which are connected by chains 2 and 2' or

the like, illustrated diagrammatically with two associated heald shafts (not shown) of the dobby. The heald shaft corresponding to the jack 1 is in a raised position, while the heald shaft corresponding to the jack 1' is in the lowered position hereinafter referred to as the rest position of the heald shaft and jack. The jacks 1 and 1' are mounted movably on a common axle 3, against which they are biased by the action of weights or springs associated with the heald shafts. Each jack has a middle arm 4 or 4', respectively, which is pivotally attached at 5 and 5', respectively, on a baulk 6 or 6', respectively. The baulks of all the jacks of the dobby are subject to the action of two pusher rails 7 and 8 performing arcuate motions of travel on the two arcs I and I' in opposite directions. The arcs are symmetrical relative to a horizontal plane, and have centers which coincide with the pivot point 5', which corresponds with the position of the jack 1' in its rest position.

The pusher rails 7 and 8 act on the rear ends of movable attachment hooks 9 and 9', which are pivotally attached on each baulk end. The hooks protrude forwardly, i.e., on the sides remote from the jacks 1 and 1' (in FIG. 1 to the left), the upper hooks are open upwardly, and the lower hooks open downwardly.

Considering the baulk 6' associated with the jack 1', which is in the rest position, the baulk ends (or more particularly the rear ends of the attachment hooks) contact the pusher rails 7 and 8, respectively, and swing with the same without the centre 5' being displaced, namely in such a manner that this centre 5' and the jack 1' are retained in the aforesaid rest position, without requiring for this purpose a system of fixed abutments as in dobbies having conventional hooks.

The four movable attachment hooks 9 and 9' cooperate alternatively with two upper arrester hooks 10 and 10' and with two lower arrester hooks 11 and 11', which are pivotally mounted on two axles 12 and 13, respectively, and are biased by springs 14 and 15 into their initial positions. Each of these arrester hooks has a lever 16, 17, respectively (FIG. 2), which is directed downwardly on the upper hooks, and upwardly on the lower hooks.

As shown in FIG. 2, each lever 16, 17 has a pin 18, 19, respectively, which protrudes on both sides of the lever and on both sides of which anchorages 20, 21 and 22, 23, respectively, are pivotally attached. Each anchorage 20, 21, 22, 23 is at the same time the carrier of a draw needle 28, 29 and 30, 31, respectively, and of a wire spring 24, 25 and 26, 27, respectively. The end of each draw needle is turned up in the shape of a hook.

For the sake of clarity, in FIG. 2 only those anchorages, springs and draw needles are shown, which are associated with the arrester hooks 10 and 11 and cooperate with the baulk 6. Accordingly, the components associated with the second baulk 6' illustrated in FIG. 1 are omitted in FIG. 2.

As illustrated in FIG. 1, the wire springs 24 and 26 rest on a transverse bar 32, and the wire springs 25 and 27 rest on a transverse bar 33, so as to pull the corresponding draw needles 28–31 downward. The free ends of the draw needles accordingly rest on the two draw rails 34 and 35, which are mounted reciprocatably one above the other. The lower draw rail carries the draw needles 28 and 30, and the upper draw rail 35 carries the draw needles 29 and 31.

Moreover two needle lifters 36 and 37 are mounted vertically movable underneath the draw needles in order to lift the same, i.e., the needle lifter 36 lifts the draw needles 28 and 30, and the needle lifter 37 lifts the draw needles 29 and 31. Both needle lifters 36 and 37 move simultaneously and lift all reading needles off the pattern card.

On each of the draw needles 28–31 one reading needle 38–41 is suspended. As shown in FIG. 2, each reading needle is guided in a vertical direction by two perforated needle guides 42 and 43. Each reading needle is coiled one-and-a-half-times about the associated draw needle, and its end penetrates through the upper needle guide 42 as a safeguard against turning. The lower ends of the reading needles 38–41 read a perforated pattern card 44, which is advanced stepwise by the usual pattern card cylinder 45.

As shown in FIGS. 1 and 2, the reading needles are arranged in four rows, the first row comprising the reading needles 39 co-operating with the draw needles 29, which are in operative connection with the upper draw rail 35 and accordingly also with the upper arrester hooks 10. The second row comprises the reading needles 41 cooperating with the draw needles 31 which are in operative connection with the same upper draw rail 35, but cooperate with the lower arrester hooks 11. The third row comprises the reading needles 38 of the associated draw needles 28, which co-operate with the lower draw rail 34 and with one of the upper arrester hooks 10. Finally, the fourth row comprises the reading needles 40 of the associated draw needles 30, which co-operate with the lower draw rail 34 and with one of the lower arrester hooks 11. Summing up, the first and third row of reading needles co-operates with the upper arrester hooks, while the second and fourth row cooperates with the lower arrester hooks; in other words, the first and second rows are associated with the upper draw rail, while the third and fourth rows are associated with the lower draw rail.

The guiding and advancing of the pattern card 44, which is provided with driving holes 78 (FIG. 5), is effected by the cylinder 45, whose teeth engage in these driving holes. After every second revolution of the crank shaft of the dobby the cylinder advances the card by two picks, the pattern card 44 having for each pick a row 1–20 (FIG. 5) of reading points, and two lines of reading points u and g, running in the direction of movement of the card, associated with odd numbered and even numbered picks, respectively. In FIG. 5 the reading points are each marked by a cross, the reading needles 40, 38, 41 and 39 just reading for example the 9th, 10th, 11th and 12th pick. The picks 9 and 10 had been read before the last preceding advance of the card by the reading needles 41 and 39 for the forward run, thus controlling the position of the draw needles 31 and 29 which in turn controlled the position of the arrester hooks 11 and 10. Depending on the position of the arrester hooks, the attachment hooks 9 were either released or switched back, whereby through the baulk 6 and the lever 4 the heald was brought into the position corresponding to the pattern card. After the advance step of the card into the position shown, these same reading needles 41 and 39 read the next two picks 11 and 12 for the forward run. The control of the same heald shaft is effected in the manner described hereinabove. While the reading needles 41 and 39 now read the picks 11 and 12 for the forward run, the reading needles 40 and 38 for the reverse run read the reading points for the rows of picks 9 and 10. These latter reading needles 40 and 38 control, in accordance with the invention, the return of the arrester hooks 11 and 10 through their associated draw needles 30 and 28.

The needle lifters 36 and 37 periodically lift through the draw needles 28–31 all the reading needles 38–41 beyond the pattern card, namely shortly before any advance step of the pattern card cylinder; then the reading needles are lowered again, in order that the reading can be performed and that the reading needles dropping into the perforations of the card control again the draw needles. Those draw needles, which are retained in the upper position by the pattern card, are exempt from the action of the draw rails 34 and 35, while those draw needles, whose reading needles drop into perforations of the pattern card, are carried along by the draw rails and

are pulled to the left, whereby the corresponding arrester hooks **10** and **11** are tipped and accordangly come into operative connection with the attachment hooks **9**. These attachment hooks **9** are thereby arrested and connot return together with their associated pusher rail. Consequently, when the opposite end of the baulk **6** is pushed forward by the corresponding pusher rail, the middle joint **5** of the baulk will be displaced, and will raise the associated heald shaft through the jack **1**, which is pivotally attached to it. In the position of FIG. 1, the lower attachment hook **9** is detained by the lower arrester hook **11**, so that the forward movement of the upper pusher rail **7** effects a movement of the jack **1**, which through chain **2** raises the corresponding heald shaft.

Lifting off of the needles takes place pick after pick, while the advancing of the cylinder takes place only after every second pick. At every pick the draw needles are lowered by the needle lifters, so that the reading needles contact the pattern card and drop in the corresponding perforations thereof.

The draw rails **34**, **35**, which draw out the lowered draw needles, are constructed as toothed racks (FIG. 3). Their pitch corresponds to the pitch of the dobby, i.e. to the pitch of the heald shafts. Accordingly the toothed rack has one tooth and one interstice or recess for each pitch. The lateral distance of two draw needles lying side by side and associated with one and the same heald shaft amounts to half a pitch, alternately one draw needle controlling the upper arrester hook and attachment hook, respectively, and the other draw needle controlling the lower arrester hook and attachment hook, respectively. The toothed racks **34**, **35** are then moved to-and-fro pick after pick in the sense of a drawing-out movement of the draw needles. Prior to any drawing-out movement a lateral displacement of the toothed rack takes place by one half pitch, so that at the reciprocating drawing-out movement only one half of the associated draw needles is engaged by a tooth of the toothed rack. In one lateral position—depending on the reading of the reading needles—the draw needles of the upper arrester hooks and attachment hooks, respectively, are accordingly engaged by the teeth of the toothed racks, while the other draw needles remain ineffective due to their dipping into the recesses for the control of the arrester hooks and attachment hooks, respectively, and thus of the heald shafts.

Since all the reading needles are lowered twice by the needle lifters **36** and **37** for each working cycle and the same position of the pattern card for the purpose of reading, the draw rails have to perform likewise two to-and-fro movements per working cycle, controlling once one arrester hook and the other time the other arrester hook for each baulk.

In FIG. 3 there are illustrated the draw rails **34** and **35** with their control mechanism and the draw needles **29** and **31** of the upper row lying side-by-side. In the drawn-out position as shown the draw rail **35** can act only on the draw needle **29**, since the draw needle **31** is located in front of a recess; the draw rail **35** is capable of being displaced half a pitch transversely of the dobby in its non-drawn position, so that in the next subsequent drawing-out movement the draw needle **31** is engaged, while the draw needle **29** stands in turn in front of an interstice or recess.

The eccentric shaft **46**, which turns at half the speed of the crankshaft of the dobby, i.e. makes one revolution per any two picks, carries a first cam **47** having a cam groove **47***a*, in which engages a follower roller **48** journalled on an arm **49**, which is pivotally mounted on a fixed axle **50**. A double-armed lever comprising the arm **49**, hub **51** and a second arm **52** carries at one arm the follower roller **48** engaging in the cam groove **47***a*, and on the other arm the control roller **53**, which through a wedge **54** and push rod **55** and acting against the bias of a compression spring **59**, displaces the two draw rails **34** and **35** half a pitch in the transverse direction.

A push rod **55** slides in two lateral jaws **56** of the dobby frame. On this push rod **55** two lugs **57** are keyed, which are mounted slidably on fixed connecting bar **58** of the jaws **56**. The juxtaposed surfaces of the lugs **57** have horizontal grooves **57***a* serving as guides for the ends of the draw rails **34** and **35**. The spring **59** arranged on the push rod **55** between the jaws **56** and collar **77** on the rod constantly biases the wedge **54** against the control roller **53**.

Moreover the eccentric shaft **46** carries on each side of the dobby frame a cam **60**, which is contacted by two follower rollers **61** and **62**. These rollers are associated with two levers **63** and **64** arranged crosswise, whose hubs **65** and **66** are pivotally mounted on two pins **67** and **68** rigidly mounted on the adjacent jaw **56**. Each hub **65**, **66** carries a second lever **69**, **70** respectively connected by a push rod **71**, **72**, respectively, with the adjacent end of the draw rail **34** and **35**, respectively. Two return springs **73** and **74** are provided, which ensure the contact of the follower rollers **61** and **62** with the cam **60**. The mounting of the push rods **71** and **72** is so arranged, that they are pivotable by a certain rotational angle, in order to allow a lateral displacement of the draw rails **34** and **35**. Due to the angular offset of the follower rollers **61** and **62** relative to the cam **60**, which rotates in the direction of the arrow, the second follower roller (which corresponds to the draw rail **35**) slightly lags behind the first one (which corresponds to the draw rail **34**).

When the eccentric shaft **46** rotates, the controlling roller **53** is oscillated by the cam **47**, and accordingly moves the two draw rails **34** and **35** to-and-fro transversely of the dobby through the action of the wedge **54** and the lugs **57**. The cam **47** is so shaped, that during this alternating movement the two draw rails come to a short standstill any time they reach the ends of their path. At the same time, the cam **60** effects, by means of the follower rollers **61** and **62** and of the push rods **71** and **72**, a fore-and-aft movement of the draw rails in the longitudinal direction of the dobby, likewise with a short standstill at each end position, this movement taking place twice for each revolution of the eccentric shaft **46**, since the cam **60** has two maxima. Moreover this movement has a relative phase offset, the draw rail **35** lagging slightly behind the draw rail **34**. The relative position of the cams **47** and **60** is such, that—with the aforesaid phase offset—the draw rails **34** and **35** move transversely during their standstill periods in the non-drawn position.

In order to explain the manner of operation of the dobby according to the invention, be it assumed that a single draw needle is associated with each attachment hook, e.g. the draw needles **29** and **31**, which correspond to the upper draw rail. In this case the lower draw rail **34** with its draw needles **28** and **30** and corresponding components is omitted.

In the motion graph A of FIG. 4, the needle lifter (i.e. then only the needle lifter **37**) has lifted at the moment to the draw needles **29** and **31**, whereby simultaneously the associated reading needles **39** and **41** are lifted, and the pattern card **44** on the cylinder **45** is released. At this moment the pusher rails **7** and **8** are half way on their path, as shown in the double graph B. The draw rail **35** is then in its non-drawn position (graph C) and in the middle of its transverse displacement (graph D). At the same time the pattern card cylinder **45** advances a new double pick unit, as follows from graph E.

For the sake of simplicity be it assumed, that all the arrester hooks **10** and **11** are in their initial positions **10'** and **11'**, in which their levers **16** and **17** contact the abutment **76** (FIG. 1).

At the moment t_1 the needle lifter has lowered itself (graph A), and the reading needles have read the new double pick unit of the pattern card, which then stands still on the cylinder **45**. The reading needles of the draw needles **29** and **31** have dropped into perforations of the card. The pusher rails **7** and **8** have almost reached the

end of their movement (graph B), while the draw rail 35 stands yet in its non-drawn position (graph C).

While the pusher rails 7 and 8 have arrived in their end positions and remain there (i.e. for example in the position of FIG. 1, wherein the pusher rail 7 is advanced and the psher rail 8 is redrawn), the draw rail 35 advances (graph C) and acts in this case on the draw needle 29 of the upper arrester hook which at this moment is located in front of a tooth of the toothed rack (FIG. 3). Those draw needles, whose reading needles have dropped into a perforation of the pattern card, are accordingly pulled out, which effects a resting-in of the corresponding upper arrester hook 10. This corresponds to the moment t_2, in which the draw rail 35 reaches the end of its forward movement (graph C).

At the moment t_3 the pusher rails 7 and 8 begin their return movement, rail 7 receding and 8 advancing (graph B). Almost at the same time the draw rail 35 begins its return movement (graph C) and releases again the arrester hook 10, so that the hook 10 could be raised by the bias of the spring 14. However, this arrester hook has in the meantime rested-in in the corresponding attachment hook 9, and connot respond to the spring bias. It remains accordingly in the working position and retains the corresponding hooked-on end of the baulk 6, so that the lower pusher rail 8 effects the advance of the pivot point 5 and the raising of the heald through the jack 1.

Shortly after the moment t_3 the needle lifter begins to lift the draw needles (graph A). After release of the draw rail 35 from the draw needles this rail begins its transverse displacement (graph D). In this way the moment t_4 is reached, at which the pusher rails 7 and 8 (graph B) are again half-way on their path, however, in the inverse working movement as compared with t_0.

Thus the end of the first half of the working cycle of the draw needle 29 is attained, which cooperates with the reading needle 39.

Then a new half working cycle begins, still with the same reading, wherein this time the draw needle 31, which during the first half cycle had remained inactive, is involved, namely with its reading needle 41 for the second row of perforations of the pattern card. The needle lifter lowers itself again (graph A), and at the moment t_5 also the reading needle is lowered so as to read again the pattern card. The draw rail 35 moves forward a second time (graph C); however, since it had been displaced transversely, it engages only the draw needle 31.

At the moment t_6 the draw rail has terminated its forward movement, and the lower arrester hook is in a position for resting-in in the corresponding attachment hook 9. The same operation is repeated as described hereinabove, but this time it is the upper pusher rail 7, which by its advance effects the raising of the heald.

The needle lifter rises again (graph A), the draw rail 35 recedes (graph C) and then displaces itself transversely (graph D). The card cylinder 45 advances by a double pick unit (graph E). The complete working cycle, which comprises two picks, is accordingly finished, and the starting moment t_0 is reached again.

In the course of the working cycle described, the draw rail 35 alone has set in operation, in succession, the draw needle 31 for the ninth (FIG. 5) or odd numbered pick of the dobby, and subsequently the draw needle 29 for the tenth or even numbered pick.

At the beginning of the explanation of the manner of operation of the dobby according to the invention, it had been assumed, that the pattern card was perforated throughout. This is, however, not the case in practice. Consequently, any time the needle lifter lowers itself, some reading needles 39 and 41 are kept in the upper position, so that their draw needles 29 and 31 are not influenced and the corresponding heald shafts are not raised, the reading taking place once for the odd numbered pick, and a second time for the even numbered pick.

From the preceding explanations it might be deduced, that the dobby could theoretically function normally without the lower draw rail 34, the draw needles 28 and 30 and the reading needles 38 and 40. This manner of operation does not demand either, that the needle lifters 36 and 37 are set in motion twice per double pick unit, since the reading by the reading needles immediately before the moment t_1 suffices, and need not be repeated immediately before the moment t_5. A dobby so equipped would however have serious disadvantages in practice which would badly affect its use. Considering the case of an arrester hook, which in the course of the cycle described had been brought into the engagement position (e.g. arrester hook 10). The same could return in the next cycle, depending on its control by the pattern card, to its initial position or, on the contrary, remain in the engagement position.

In the first case (always assuming the lower draw rail 34 and associated components to be omitted) the corresponding draw needle 29 would be lifted shortly after the moment t_7 and before the beginning t_1' of the following cycle. since the corresponding arrester hook is at this moment rested-in in the attachment hook, it does not react to the spring 14 which tends to release it. However, at the moment t_0' the pusher rail pushes the attachment hook 9 beyond its position of engagement with the arrester hook 10, whereby a temporary disengagement of the attachment hook 9 from the arrester hook 10 occurs, so that with the assumed arrangement the arrester hook 10 with its draw needle would suddenly jerk back by the action of the spring 14, which would cause an undesirable jerky movement of the control mechanism of the dobby. In order to obviate this, bulky and sensitive shock absorbers would have to be provided for the arrester hooks 10 and 11.

When however the arrester hook 10 should remain in the engagement position during the subsequent cycle, the situation would be even more unfavorable. At the moment t_1' the arrester hook would be released, while the corresponding draw rail 35 were just beginning its forward movement in order to act on the draw needle 29 and to bring the attachment hook into the engagement position. Thus results a blow of the turned-up end of the draw needle on the corresponding tooth of the draw rail. Tests made with such an arrangement have shown, that at the working speeds of modern dobbies this leads to the destruction of materials, particularly of the draw needles.

Finally a dobby so constructed could not perform a reverse run as required for the mechanical dissolution of weaving faults in the fabric. From FIG. 4 it will be seen, that in a reverse run (i.e. proceeding from the right to the left) the needle lifter 37 (graph A) is lowered only after the draw rail 35 (graph C) has begun to advance. This draw rail cannot therefore influence its associated dropped-in draw needles 29 and 31, i.e. these dropped-in draw needles would rest on top of the draw rail instead of being carried along by it. In other words, the dropped-in position of the draw needles would be annulled, since the draw rail does not carry along the draw needles in its to-and-fro movement. Accordingly neither a selection of the arrester hook nor the appropriate opening of the shed can be carried out.

In order to counter these disadvantages, the additional provision of the draw rail 34, draw needles 28 and 30 and reading needles 37 and 40 has been made. As follows from FIG. 4, the draw rail 34, which could be called the draw rail for the return run, in the normal run of the dobby (i.e. from left to right in FIG. 4) begins the drawing-out movement slightly before the draw rail 35 (or draw rail for the forward run); in the embodiment described, the phase advance of the drawing-out movement of the draw rail 34 relative to the draw rail 35 amounts

approximately to 40° in relation to the eccentric shaft **46** of the dobby. Hence the draw rail **34** for the reverse run advances (graph F) before the needle lifter **36** and **37** (graph A) has been lowered in order to carry out the reading by the reading needles. Consequently it slides through underneath the turned-up ends of the draw needles **28** and **30** without affecting the same. In principle, everything occurs, as if the entire reverse run arrangement **34–28–30–38–40** did not exist. The manner of operation of the dobby is theoretically the same as described hereinabove.

In the reverse run (i.e. from right to left in FIG. 4) the working sequences of the two arrangements for forward- and reverse-running are exactly the inverse. The drawing-out movement of the draw rail **35** (graph C) begins before the beginning of the lowering movement of the needle lifters **36** and **37** (graph A), while on the other hand the dropped-in draw needles are carried along by the draw rail **34**. In order that the heald shafts move in the right sequence in the reverse run, consequently the reading needles **38** and **40** for the reverse run have to read the same point in the pattern card, which previously had been read by the needles **39** and **41** during the forward run. Due to the double action of the needle lifters **36** and **37** the reading takes place between the moments t_3 and t_2, analogous to the moments t_1 and t_2 at the forward run.

If a vertical line drawn at the moment t_4 of FIG. 4 is considered an axis of symmetry for the movement of the pusher rails **7** and **8** (graph B) it will be realised, that this vertical line is also an axis of symmetry for the movements of the needle filters **36** and **37** (graph A), and that the graphs C and F for the draw rails **35** and **34** have a phase offset, namely the draw rail **34** (graph F) by 40° compared with the draw rail **35** (graph C) (FIG. 4, 275° to 315°). There exists accordingly symmetry of the working sequences in the sense, that each graph C or F for the forward run (or reverse run) is identical with the graph F or C for the reverse run (or forward run), respectively. When, as assumed before, each card shows the pattern for the needles reading the reverse run, which the preceding card contain for the needles reading the forward run, this symmetry exists also for the reading, so that the shed formation is identical for the reverse run and for the forward run.

In this manner and with suitable adjustment the aforesaid disadvantages, such as destruction of material and jerky movements, are obviated by a dobby having two draw rails and two draw needles associated with each arrester-hook.

Moreover, a dobby so constructed allows at any time a change of the sense of rotation from forward running to reverse running and vice versa, while maintaining the right sequence of heald shaft movements and without requiring any interference by the operative personnel with the mechanism.

In a working cycle, wherein the arrester hook **10** is in engagement with the attachment **9** (cycle t_0–t_7) and wherein these hooks are to be disengaged from each other in the subsequent cycle, the draw rail **34** for the reverse run is in the advanced position at the moment t_1' (graph F) at which the arrester hook is released by the pushing movement of the pusher rail **7**. Since on the other hand the reading needles **38** and **40** for the reverse run read the pattern for the for forward run of the preceding pattern card, the needle **38** is lowered; consequently, when the hooks are disengaged, the associated draw needle **28** for the reverse run will at once abut the almost drawn-out draw rail **34**, which retains the draw needle for a moment and subsequently brings it gradually again into the starting position, without any jerky movements occurring at all.

When however the arrester hook **10** has to remain in the engagement position in the following working cycle (i.e. in the cycle beginning at the moment t_0'), the corresponding draw needle **28** for the reverse run is retained by the draw rail **34** for the reverse run, namely until the moment t_2' when the draw rail **35** for the forward run (graph C) arrives at the drawn-out position, in order to take over the arresting of the attachment hook for the forward run. The arrester hook **10** has accordingly not returned to the initial position, but is simply retained in the engagement position, the draw rail **35** taking over the retaining from the draw rail **34**. Thus a jerky movement of the arrester hook **10** and associated components, as well as any unnecessary intermediate movement is obviated, since in the transiton from one working cycle to the next one a controlled return movement of the attachment hook, or its remaining in the engagement position, is safeguarded.

What I claim is:

1. In a double lift dobby, a plurality of jacks for operating respective healds, a plurality of baulks associated with respective jacks, pusher rails driven to-and-fro out of phase 180° for each double pick corresponding to a 360° working cycle of the dobby and engaging respective ends of each baulk to drive its ends in opposite directions, attachment hooks pivotally mounted two each on respective baulks for arresting of respective ends of said baulks, arrester hooks actuatable for arresting respective ones of said attachment hooks in extreme forward positions of said ends of said baulks, said extreme forward positions of said ends of said baulks corresponding to a position in which a respective heald is operated to a raised position, said arrester hooks comprising two arrester hooks for each baulk, for each baulk for arresting thereof four draw needles comprising two groups of draw needles having for each arrester hook a pair of draw needles each connected thereto and belonging to a separate one of said groups and operable when being drawn-out forwardly for actuation of a respective arrester hook to a position arresting a respective baulk end, a plurality of reading needles each associated with a respective draw needle for in operation reading pattern means controlling drawing-out of said draw needles thereby to control arresting of said baulk ends, needle lifters for lifting said reading needles clear of said pattern means twice in each working cycle of said dobby, draw rails operable for drawing-out said draw needles to effect actuation of the respective arrester hooks for engaging respective attachment hooks for arresting said ends of said baulks in said extreme forward position, means operating said draw rails to effect drawing-out forwardly of said groups of draw needles of a given baulk out of phase by a double pick and the draw needles of a same group out of phase by one pick in the working cycle of said dobby to arrest the respective baulk ends in dependence upon the readings of said reading needles, said draw rails comprising a draw rail operable reciprocably effective for forward operation of said dobby drawing-out draw needles of one group of said groups of draw needles corresponding to reading needles for forward operation of said dobby and a draw rail operable reciprocably effective for reverse operation of said dobby drawing-out forwardly draw needles of the other group of said group of draw needles corresponding to reading needles for reverse operation of said dobby, means in said means operating said draw rails drawing out said rails reciprocably forwardly and operating them backwardly and for effecting drawing-out forwardly of the draw needles associated therewith when the corresponding reading needles have effected reading of said pattern, means restoring said draw needles to a retracted position from which they are drawn out forwardly, means for causing a sequence in forward operation of said dobby of reading of said pattern by said reading needles for forward operation, drawing-out forwardly of said rail effective for forward operation of said dobby, drawing-out forwardly of said rail effective for reverse operation of said dobby, reading of said pattern by said reading needles for reverse operation, and including means reversing said sequence in reverse operation of said dobby.

2. In a double lift dobby according to claim 1, in which said means operating said draw rails comprises means driving said draw rails reciprocably drawing-out said draw needles in one direction of movement, said draw rails and said drawing needles being disposed relatively for a given draw rail drawing-out a same pair of drawing needles corresponding to a same group of draw needles connected to the arrester hooks of a given baulk.

3. In a double lift dobby according to claim 2, in which said draw rails comprise two draw rails and in which said means operating said draw rails comprises means driving said two draw rails reciprocably and a given draw rail drawing-out draw needles of a given group only and alternately with smooth transfer from one draw needle to the other draw needle of said group to smoothly actuate a respective arrester hook for arresting a respective baulk end and retaining it arrested under alternate control of both of said draw needle groups in dependence upon readings of said reading needles.

4. In a double lift dobby according to claim 3, in which said means driving said draw rails comprises means operative in timed relation with said needle lifters and said pusher rails drawing-out draw rails of a given group and returning said draw needles to a position to which a respective arrester hook is returned smoothly to a rest

position in which it is out of engagement with a respective attachment hook and corresponding to a condition in which a heald associated with a respective baulk is in a lowered position, and means constantly biasing the individual arrester hooks to said rest position.

5. In a double lift dobby according to claim 3, in which said means driving said draw rails comprises means operative in timed relation with said needle lifters and said pusher rods and operative to effect out-of-phase reciprocation of said draw rails with one draw rail lagging the other, and in which said pattern means is advanced for reading by said reading needles at completion of each cycle of said dobby.

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