

Dec. 27, 1932.

H. STÄUBLI

1,892,323

DOBBY

Filed July 28, 1930

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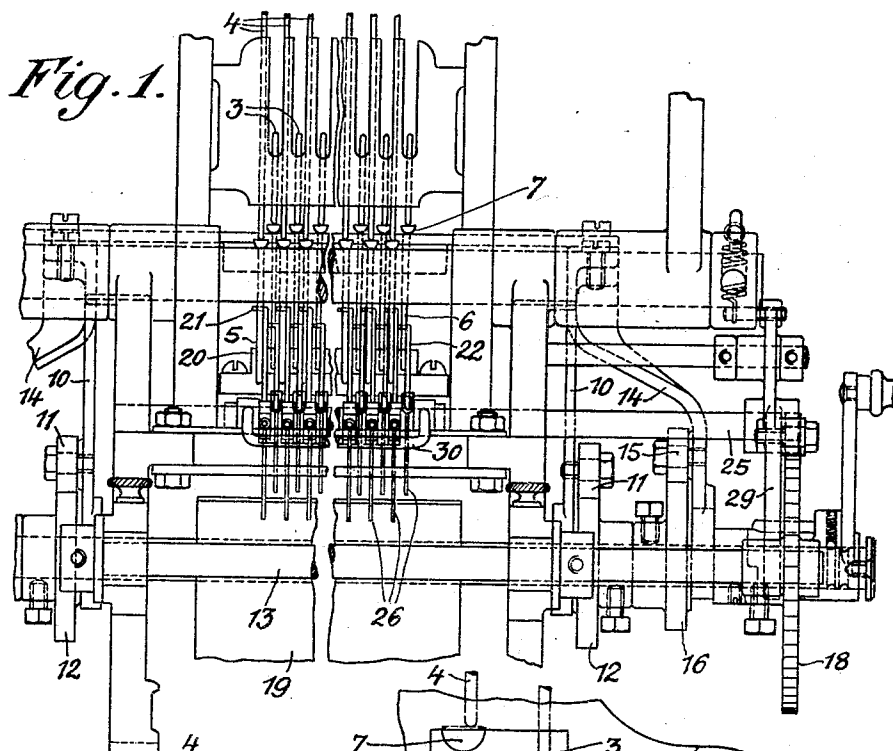
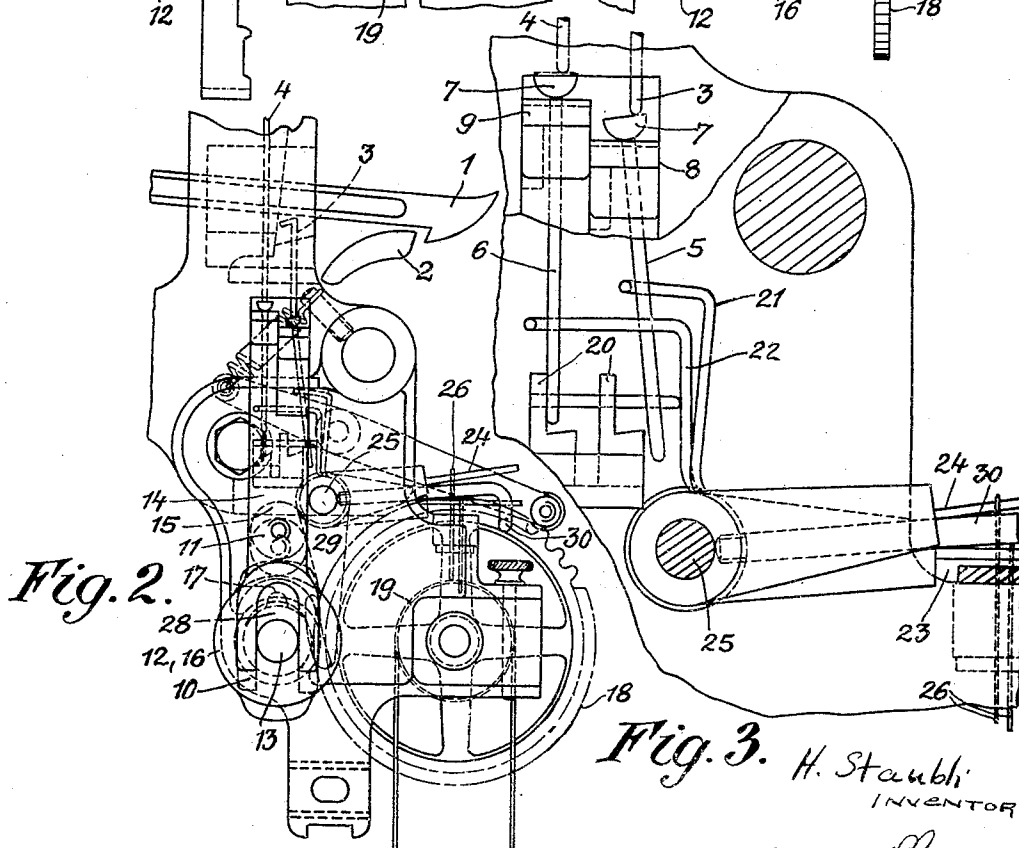


Fig. 3. H. Staubli
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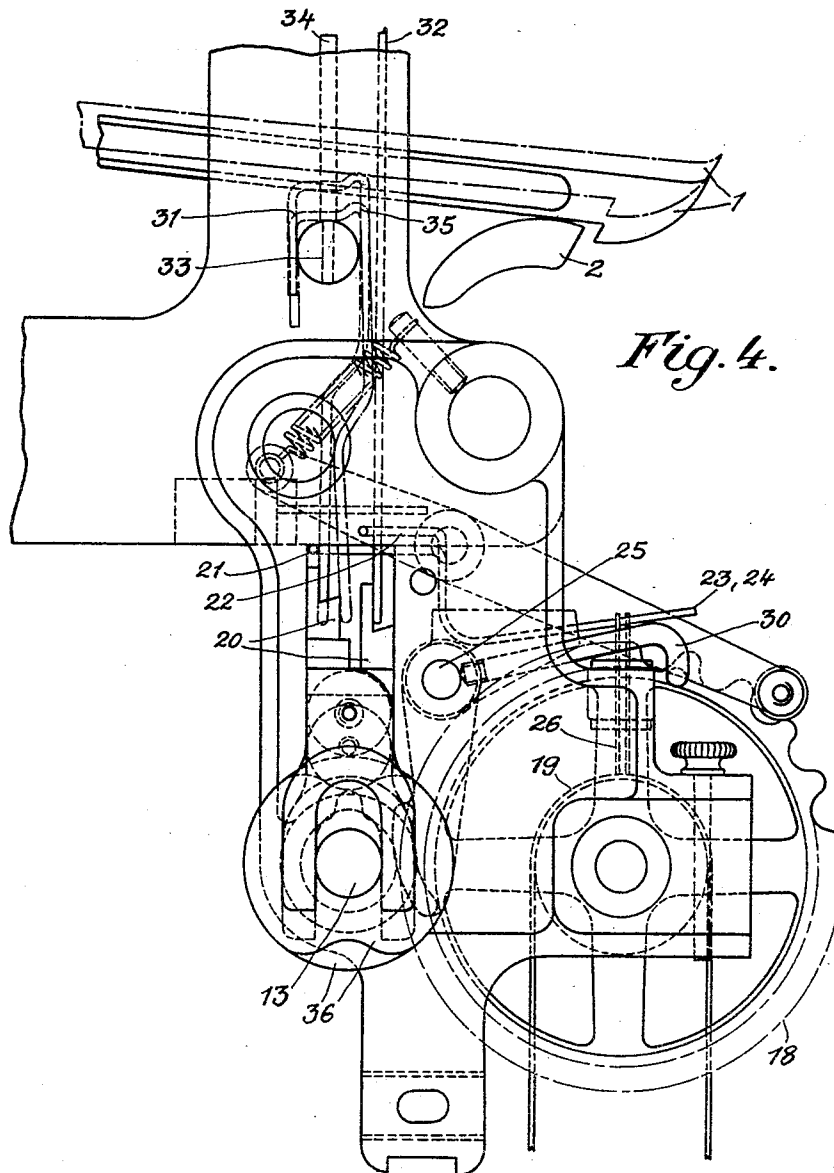
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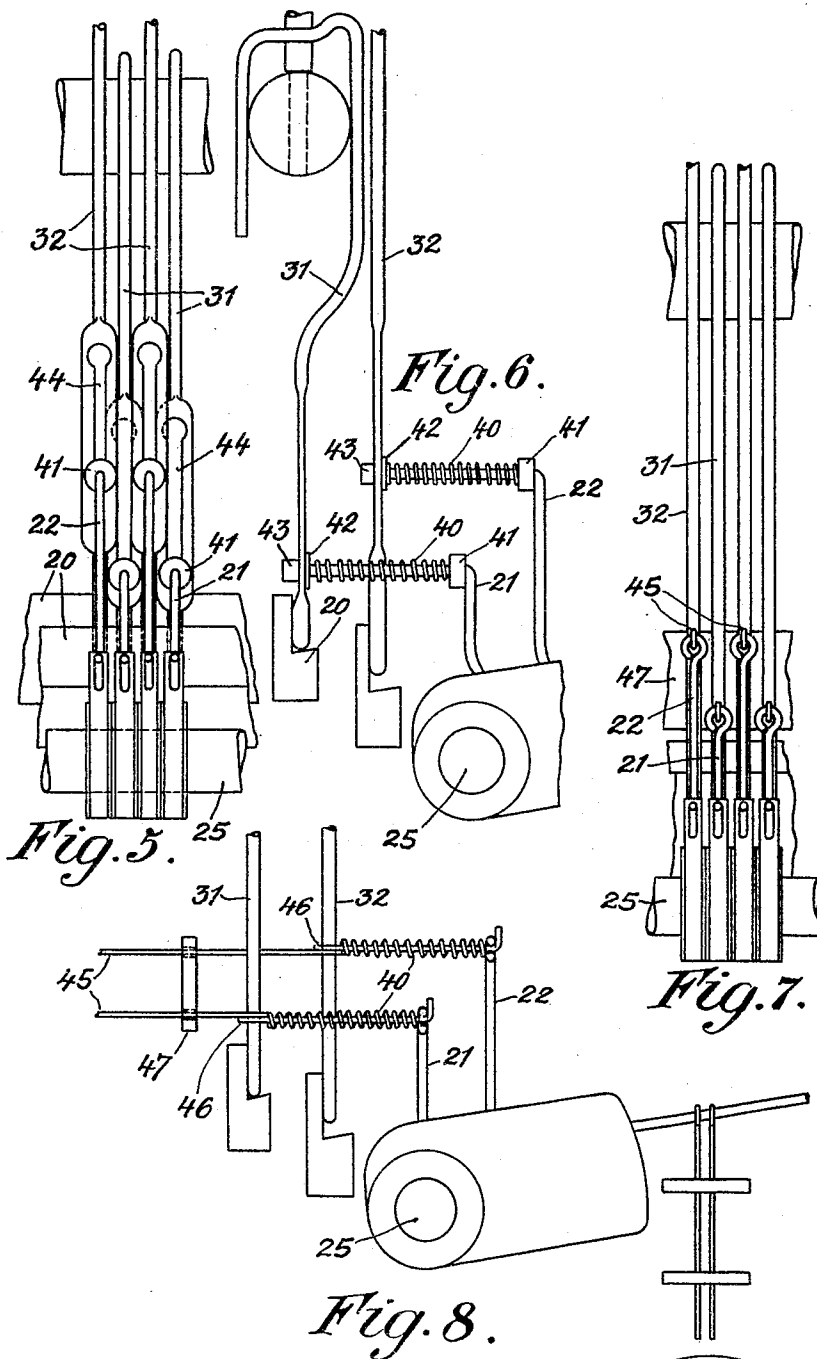
H. STÄUBLI

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DOBBY

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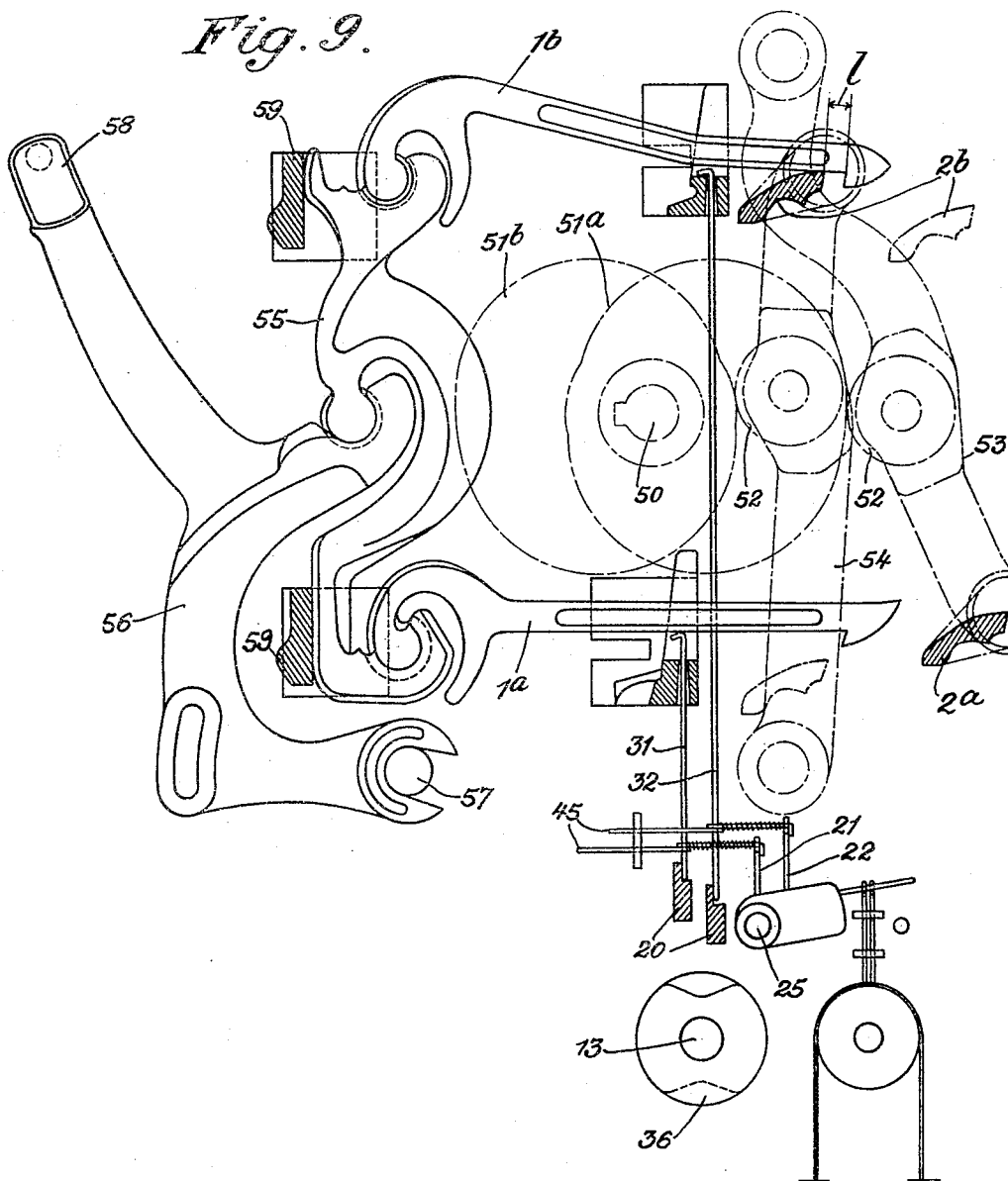
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Fig. 9.



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UNITED STATES PATENT OFFICE

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Application filed July 28, 1930, Serial No. 471,350, and in Switzerland November 6, 1929.

The present invention relates to dobbies with endless paper pattern cards, and its object is to bring the number of parts required between the reading needles and the hooks for the adjustment of the latter to a minimum, and to construct the machine in such a way that it can also be rotated backwards, and that when this is done the picks open again.

For this purpose supporting needles which are intended for supporting the hooks during certain intervals of time are oscillatably supported and are so placed directly under the influence of the carriers of the reading needles that when the reading needles drop into holes in the pattern card in reading a pick the supporting needles, are swung by those carriers into a position in which the associated hook, during the next forward movement of the lifting knife, lies within reach of the latter, and out of which position they afterwards swing back again into their initial position.

Various constructional examples of the invention are illustrated in the accompanying drawings in which:

Figure 1 is a front elevation and Figure 2 a side elevation of one constructional form. Figure 3 shows part of Figure 2 on a larger scale. Figure 4 is a side elevation of a second constructional example. Figures 5 and 6 and Figures 7 and 8 illustrate in partial front elevation and in side elevation two further constructional examples, and Fig. 9 is a complete side elevation of the arrangement shown in Figs. 7 and 8.

By 1 are denoted the lower hooks, which, when they are in the lower position, shown in full lines in Figure 2 and in Figure 4, are pulled along in a known manner by a forwardly moving lifting knife 2. In the first constructional example each hook 1 is supported upon a vertical supporting needle 3. Similar only correspondingly longer supporting needles 4 are provided for the support of the upper hooks, not shown. These supporting needles 3 and 4 stand eccentrically upon the upper surfaces of hemispherical heads 7 of lower supporting needles 5 and 6, which are so supported in bars 8 and 9 that they can deflect forwards and backwards.

The bar 8 is carried by two arms 10, which are each supported by means of a roller 11 upon a cam disc 12, which is mounted upon a shaft 13, on which the arms 10 are guided by their forked lower ends. The bar 9 is held by two arms 14, which are likewise guided by means of their forked ends upon the shaft 13, and which each carries a roller 15, which rests upon the periphery of a cam disc 16. The cams of the cam discs 16 differ in phase by 180° from those of the cam discs 12. From the shaft 13 the ratchet wheel 18 of the paper card cylinder 19 is driven by means of a cam 17.

When the bars 8 and 9 are in their highest position the lower ends of the supporting needles 5 and 6 are located a little above the horizontal webs of bars 20 of angle-shaped cross section, and bear, under the eccentrically acting pressure of the upper supporting needles 3 and 4 against the upright webs of these bars. The needles 5 and 6 are loosely embraced by the eye-shaped upper ends of wires 21, 22, which each form one arm of a bell-crank lever. These levers are mounted loose upon a pivot 25, and with their other arms they hold wires 23 and 24, from which the reading needles 26 are suspended. The pivot 25, at each complete revolution of the shaft 13, receives an angular rotation from the latter by means of a cam disc 28 and a lever arm 29 bearing thereon and mounted fast upon the pivot 25. The pivot 25 also carries fixedly a stirrup 30, the central portion of which passes underneath all the wires 23, 24 for the purpose of lifting the reading needles 26 out of the paper card cylinder 19 at a given time.

The method of operation of the machine described is as follows, starting from the position of the parts indicated in the drawings, and firstly for the case in which a reading needle could not drop into a hole in the paper pattern card, which applies to the reading needle carried by the wire 24.

The bar 9 and the supporting needle 4 are located in their uppermost position and the supporting needle 4 presses eccentrically upon the head 7 of the supporting needle 6 located underneath, and thereby holds the lower end of the latter in contact with the

upright web of the bar 20. Hence if the bar 9 subsequently descends, while the cam on the cam disc 16 slips away underneath the roller 15, the needle 6 can go with it only until it stands upon the horizontal web of the bar 20. The hook located above the associated supporting needle 4 can therefore not descend so far that it could be drawn out by the lifting knife.

If on the other hand a reading needle 26 drops into a hole in the paper pattern card, the associated wire 21 deflects under the weighted part of the lever arm carrying it and takes with it by its end eye the supporting needle 5. The lower end of the latter therefore takes up a position in front of the bar 20 located underneath it. If the bar 8 then sinks, the needle 5 therefore follows it right into the lowest position as shown in Figure 3, on the right. To the same extent the supporting needle 3 descends, so that the hook 1 sinks so far that it is carried along by the lifting knife 2 as shown in Figure 2 during the following forward stroke.

From Figure 2, it will be seen that at each feeding movement of the paper card cylinder two pick readings occur. Starting from the position of the parts there indicated the operations proceed in the following manner, rotation of the shaft 13 in the clockwise direction being assumed. The eccentric part of the cam disc 28 begins to act upon the lever arm 29 and the shaft 25 begins to revolve in an anti-clockwise direction. Consequently the stirrup 30 lifts the wires 23 and 24 so that dropped reading needles 26 pass out of reach of the pattern card cylinder 19. Just after this has occurred, the cam 17 feeds the ratchet wheel 18, and with it the cylinder 19, one tooth forward. Subsequently the eccentric part of the cam disc 28 slips off the lever arm 29, so that the stirrup 30 sinks again, and the reading needles 26 become free to read the two coming picks. The bars 8 and 9 are at first raised one after the other by the cam discs 12 and 16 in order to bring the supporting needles 3 and 4 into the position of readiness, whereupon, in the time up to the next cylinder feeding movement, for both groups of bars and needles, the operations described above then take place. It is to be observed that those wires 21, 22 which were deflected during the preceding pick reading return into their basic position before the bars 8 and 9 are raised, so that the supporting needles 5 and 6, at this raising, can immediately swing back into their basic position again without being held up or pushed by the wires 21 and 22. The reading of the paper pattern card occurs at the moment when the two lifting knives intersect.

The cylinder feed can be uncoupled from the shaft 13, so that the cylinder admits of being actuated without simultaneous actuation of the bars described.

Thanks to the circumstance that to each lifting knife a lifting bar 8, 9 is allotted, the machine described can work positively, that is to say, backwards with correct releasing of the picks, as soon as the card cylinder 19 is adjusted to the two preceding picks previously to the reversing of the machine as a whole, and upon weaving being resumed the two coming picks are read again, previously to the forward movement of the machine. This special feeding of the card cylinder is not necessary if the raising of the reading needles, the subsequent feeding of the card cylinder, the reading of the pattern card, and the associated preparation of the swinging supporting needles, which takes place, in the case of the constructional form described, during the intersection of the lifting knives, is transferred to the time of lost motion of the latter, and likewise the working of the cam disc 8 or 9 allotted to the knife in question and following upon the said operations. The duration of the said lost motion is in this case somewhat lengthened, which is easily possible in eccentric machines, that is to say, in machines in which the levers carrying the lifting knives are accentuated by eccentrics.

In the constructional form of the invention just described the bars 8 and 9, during a definite portion of the working cycle, have to carry all the hooks 1, and those of these hooks which belong to dropped reading needles are let down on to the lifting knife under the loading of the supporting needles and of the bar carrying the latter. The working cycle may be regarded as beginning where all the hooks are held up by the supporting needles 3 and 4. In the constructional form according to Figure 4, however, the action of the supporting needles is directed towards raising the hooks. It begins at the moment when all the hooks are lying upon the lifting knives. Subsequently, however, only those supporting needles are then loaded, which belong to reading needles which have not dropped into a hole in the pattern card and which therefore have to lift the associated hook out of reach of the lifting knife. In this manner, as compared with the first constructional form, a substantial economy of power is here obtained.

The supporting needles for the lower hooks 1 are denoted in Figure 4 by 31, those for the upper hooks, not shown by 32. All the supporting needles are stirrup-shaped at their upper ends and are hung loose over rods, so that they can swing freely about the latter, and in the unloaded condition of rest they bear with their lower ends, owing to excess weight of their longer limbs, against the upright web of the associated angle-shaped bar 20. The lower supporting needles 31 hang from a rod 33, which is fixedly supported in the machine frame, and which, in conjunction with upwardly extending pins 34 inserted

therein, between which the hooks 1 are guided, form a rake. At the point of transition from the central part of the stirrup to the longer limb of the stirrup, each supporting needle 31 forms an upwardly projecting cam 35, which, if the associated hook 1 is resting upon the lifting knife 2 located in the rear basic position, is at a distance of about 2 millimetres from the lower edge of the hook, thus guarding against any rubbing of the forwardly moving hook against the supporting needle, whereas during the ascent of the supporting needle the said cam serves as a support for the hook. Thanks to this eccentric supporting of the hook upon the supporting needle, the lower end of the latter is reliably held in contact with the bar 20. The two bars 20 are raised and lowered by means of cam discs 36 in the same manner as the bars 8 and 9 in the case of the first constructional form. The lower ends of the supporting needles 31 and 32 are embraced by the eye-shaped ends 21 and 22 of bell-crank levers, which, as in the first constructional form, are rotatably mounted upon a pivot 25, and, with their other arms 23 and 24, carry loosely the reading needles 26. So long as such a needle has not dropped into a hole in the pattern card, and the associated bar 20 is located in its lowest position, as is indicated for the bar on the right-hand side, the lower end of the associated supporting needle 31, by virtue of the excess weight of the longer limb of the latter, bears against the upright web of the bar 20, while the horizontal part of stirrup of the supporting needle rests upon the rod 3. During the ascent of the bar 20 this supporting needle is raised, and by it the associated hook 1 is brought into the position shown in dot-and-dash lines, and therefore out of reach of the lifting knife 2, which subsequently moves forward again. If however a reading needle 26 drops into a hole in the paper pattern card, the associated bell-crank lever 21, 23 pulls the supporting needle towards the right, so that its lower end, as indicated in dot-and-dash lines for the needle 31, takes up a position in front of the bar 20, and the latter does not take the supporting needle with it in its ascent.

During the raising of a hook, the pressure exerted by the latter on the cam 35 eccentrically to the supporting needle, and the upward inclination of the thrust surface of the bar 20 in a forward direction, ensure the supporting needle bearing against the upright web of the bar.

The principle adhered to in this second constructional form of the invention of letting all the hooks normally be carried by the lifting knives, and of these latter only lifting off those hooks which belong to reading needles that have not dropped in, also admits of being carried out in the first constructional form, by securing the bars 8 and 9 in the lower

positions indicated in Fig. 3, and arranging the bars 20 movably.

In the constructional form according to Figs. 5 and 6 the limbs of the bell-crank lever arms 21 and 22 attached to the supporting needles 31 and 32 are each surrounded by a helical spring 40, which is interposed between a ring 41 mounted fast upon the arm 21 or 22 and a ring 42 which is slidable upon the arm 21 or 22 and is pressed by the spring against the supporting needle 31 or 32. The supporting needles are flattened at this position into a surface perpendicular to the axis of the spring and provided with a longitudinal slot 44. The slot is widened into a circle at the upper end for the passage of a head 43, which forms the extremity of the lever arm 21 or 22. The spring 40 is so designed that it presses the lower end of the supporting needle only quite lightly against the upright web of the carrying bar 20 when the associated reading needle is touching the paper pattern card. The length of the spring is dimensioned to suit the minimum pressure exerted by the reading needle upon the paper pattern card, so that the card cannot be injured by the reading needle.

The supporting needles 31 and 32 are at their upper ends constructed and supported in the same way as those according to Figure 4.

In the constructional form according to Figures 7 and 8 the upper ends of the bell-crank lever arms 21 and 22 displaceably carry horizontal wires 45, which form eyes 46 for the guidance of the supporting needles 31 and 32 and are slidably guided in a slope 47. Between the arms 21, 22 and the eyes 46 the wires 45 carry helical springs 40, which, as described above with reference to Figures 5 and 6, during the standing of the reading needles upon the paper, serve as a protection against the supporting needles slipping off the bars. In the position shown, however, they exert no pressure.

In other respects this constructional form is similar to those according to Figures 5 and 6. These two methods of connecting the carriers of the reading needles with the supporting needles also admit however of being applied to supporting needles which are not pendulously hung.

In Fig. 9 there is illustrated two series of movable hooks 1a, 1b and the mechanism to produce the lost motion of the lifting knives. On a shaft 50 are mounted, in a manner known from existing dobbies, at each end of the machine, two cam discs 51a, 51b which through the medium of rollers 52, actuate oscillating arms 53, 54 respectively which carry the lifting knives 2a, 2b. Within reach of these knives are located the hooks 1a, 1b each connected with one end to the same balance 55 whilst the other end lies free. The balance engages with a swing 56 which is

movably mounted upon a rod 57 and to the arm 58 of which a shaft is connected in a known manner. In the position shown the balance 55 bears against stationary ledges 59, the hooks 1a, 1b therefore are at rest. From the moment where the hooks 1b have come to rest the knife 2b has continued its backward motion, the roller 52 on the arm 54 bearing now against the part of smallest diameter of the cam disc 51b. The amount of this short movement of the knife 2b relative to the hooks 1b, viz. the so called dead motion of the knife is indicated on Fig. 9 by the letter 1. In the same manner the lower knife 2a receives a movement relative to the hooks 1a on the other end of its stroke.

The movable bars 20 may be carried by swing levers and may act impulsively upon one end of the reading-needle carriers, which are in this case formed by displaceable needles, and which actuate supporting needles or the like attached at the other end to the hooks.

What I claim is:

1. A dobby, comprising an endless pattern card, two series of movable hooks for lifting the threads of the warp, a lifting knife for each of said series of hooks adapted to engage with these hooks and to perform a reciprocating movement together with the hooks engaged with it and a short movement relatively to these hooks at one of its dead points, a series of movable members for each series of hooks to temporarily hold said hooks out of engagement with the associated lifting knife, one movable supporting means for each of said two series of members adapted to carry these members and to control the position of the lifting hooks relatively to the lifting knife and to receive that movement which is determinative for the engagement of said hooks on the associated lifting knife during the lost motion of the corresponding lifting knife pick reading needles associated with the pattern card, and operable connections between the needles and the movable members.

2. A dobby, comprising an endless pattern card, movable hooks for lifting the threads of the warp, a lifting knife adapted to engage with these hooks and to perform a reciprocating movement with the hooks engaged with it and a short movement relatively to these hooks at one of its dead points, oscillatably supported members for supporting said hooks, a movable bar serving as an abutment for these members in a definite position thereof and adapted to be actuated both when the dobby is moving forward and when it is moving backward during the lost motion of the lifting knife for the purpose of adjusting the hooks relatively to this knife, and means adapted to be operated according to the pattern card in such a manner so as to oscillate said members to have them brought

to a position where an abutting with the movable bar is prevented.

3. A dobby, comprising an endless pattern-card, two series of movable hooks for lifting the threads of the warp, a lifting knife for each of said series of movable hooks adapted to engage with such hooks and to perform a reciprocating movement together with the hooks engaged with it, a series of oscillatably supported members for each of said series of hooks, these members being adapted to temporarily hold the lifting hooks of one series of hooks out of engagement with the associated lifting knife, a movable bar for each series of oscillatably supported members which bar serves as an abutment for these supporting members in a definite position thereof, a series of pick-reading members for each series of lifting hooks, movable carriers for these pick-reading members adapted to act upon the oscillatably supported members during the movement of the pick-reading members so as to alter the position of the oscillatably supported members relatively to said movable bar.

4. A dobby, comprising an endless paper-pattern card, two series of warp lifting hooks, a lifting knife for each of these two series of hooks adapted to engage with these hooks and to perform a reciprocating movement together with the hooks engaged, a series of needles for each series of hooks adapted to read the picks from the paper-pattern card, an oscillatably supported member beneath each warp lifting hook adapted to temporarily support and move this hook, a movable carrier for each pick-reading needle adapted to oscillate one of said oscillatably supported members so as to control the position of the associated lifting hook relatively to the lifting knife.

5. A dobby, comprising a perforated endless pattern-card, at least one series of movable warp lifting hooks, a lifting knife for each of these series of hooks adapted to engage with such hooks and to perform a reciprocating movement together with the hooks engaged, pick reading needles arranged above the perforated pattern card adapted to read the picks therefrom in unloaded condition, an oscillatably arranged member beneath each lifting hook adapted to temporarily support it, a lifting bar serving as a means for supporting and raising each oscillatably arranged member, means for mounting each of said bars so that they will perform a motion upwardly and downwardly, and means connecting the pick reading needles with the oscillatably arranged members so that when a pick-reading needle drops into a hole in the perforated pattern card or rests upon this card, the associated lifting hook is in or out of reach of the lifting knife at the next forward stroke thereof.

6. A dobby, comprising an endless perforated

rated pattern-card, two series of movable warp lifting hooks, a lifting knife for each of these series of hooks adapted to engage with these hooks and to perform a reciprocating movement together with the hooks engaged, oscillatably mounted needles for temporarily supporting said hooks a lifting bar for supporting each of said needles, means for mounting each of said bars so that they will perform a motion upwardly and downwardly, pick-reading needles arranged above the perforated pattern card, and means connecting said pick reading needles with said supporting needles in such a way as to cause them to be oscillated in consequence of the dropping of such pick-reading needles into holes of the perforated pattern-card, and the nonperforated parts of the pattern card being loaded during the pick-reading by the weight of the pick-reading needles only.

7. A dobby, comprising an endless pattern-card, two series of movable warp lifting hooks, a lifting knife for each series of these lifting hooks adapted to engage with these hooks and to perform a reciprocating movement together with the hooks engaged, and a short movement relatively to these hooks at one of its dead points, oscillatably mounted needles for temporarily supporting said hooks, a movable bar for each lifting knife adapted to receive a movement determinative for the engagement of the associated lifting hooks on the lifting knife during the lost motion of the latter, pick-reading needles, means connecting these needles with said oscillatory mounted needles so as to oscillate them when the pick-reading needles drop into a hole of the pattern card and to influence their position relatively to the movable bar and the associated lifting hook in such a way that at the end of the next movement of said bar said hook is in a position to be engaged by the lifting knife at its next forward stroke.

8. A dobby, comprising an endless pattern card of thin material, two series of movable hooks for lifting the threads of the warp, a lifting knife for each of these series of hooks adapted to engage with these hooks and to perform a reciprocating movement with the hooks engaged and a short movement relatively to these hooks at one of its dead points, a pendulously supported and eccentrically loaded member displaceable in vertical direction mounted beneath each of said hooks in such position relatively to this hook that it can oscillate in one direction by reason of its eccentric loading, a bar for each series of hooks mounted below said oscillatable members to serve as an abutment therefor in a definite position thereof and adapted to perform a reciprocating up and down movement determinative for the engagement of the associated lifting hooks on the lifting knife during the idle motion of the latter, a series of pick-reading needles for each lifting knife

arranged above the pattern-card, balanced bell-crank levers forming the carriers for said pick-reading needles and being connected on the other hand with the pendulously supported members in such a manner as to swing them, when the pick-reading needle drops into a hole of the pattern card, in such a position that at the end of the next movement of said bar the associated lifting hook is in a position to be engaged by the lifting knife at its next forward stroke.

9. A dobby, comprising a perforated movable pattern card, two series of warp-lifting hooks, a lifting knife for each of such series of hooks adapted to temporarily engage with these hooks and to perform a sliding movement with the hooks engaged, a supporting bar for each series of warp lifting hooks adapted to periodically perform an up and down movement, a pendulously supported needle inserted between each of these hooks and said bar and adapted to periodically lift the associated hook out of engagement with the corresponding lifting knife at the upward movement of said supporting bar, movable means inserted between said needle and the pattern-card adapted to work in dependence of the perforations of the pattern-card and to swing the unloaded needle out of the path of the supporting bar or to let it in this path according to whether it coacts with a perforated or a nonperforated part of the pattern card.

10. A dobby, comprising a perforated pattern-card, two series of warp-lifting hooks, a lifting knife for each of these series of hooks adapted to temporarily engage with these hooks and to perform a reciprocating movement with the hooks engaged and a short motion relatively thereto at one of its dead points, a supporting bar for each series of lifting hooks adapted to perform a reciprocating up and down movement during the idle movement of the lifting knife, a bell-crank lever for each lifting hook, a pick-reading needle freely hanging down from one arm of this lever above the perforated pattern card, a supporting needle below each lifting hook adapted to be either swung out of the path of the rising supporting bar by said bell-crank lever when the corresponding pick-reading needle has dropped into a perforation of the pattern-card or to be lifted by the rising bar and to lift the associated hook out of engagement with the lifting knife.

11. A dobby, comprising a perforated movable endless pattern card of thin material, two series of warp lifting hooks, a lifting knife for each of these series of hooks adapted to temporarily engage these hooks and to perform a reciprocating movement with the hooks engaged, a supporting bar of angle-shaped cross section for each of said series of lifting hooks, adapted to periodically per-

form a reciprocating movement in vertical direction, a pendulously and eccentrically supported needle below each of said lifting hooks tending to normally bear with its lower end, owing to its eccentric bearing in unloaded condition against the upright web of said bar a little above the horizontal web thereof so as to be lifted by the raising bar and to lift the associated lifting hook out of engagement with the lifting knife, needles for reading the picks on the perforated pattern card and means for bringing the associated pendulously suspended needle out of the path of the raising bar when the pick-reading needle drops into a hole of the pattern card.

12. A dobby, comprising a movable perforated endless paper-pattern card, two series of movable warp lifting hooks, a lifting knife for each of these series of hooks, these hooks tending to rest upon the knives, a lifting bar of angle-shaped cross section for each series of hooks adapted to periodically perform a reciprocating up and down movement, a fixed rod extending underneath each series of hooks, a series of supporting needles having stirrup-shaped upper ends pendulously supported on said rod and adapted to bear, with their lower ends, towards the upright web of the lifting bar owing to the greater weight of their longer limbs, a balanced bell-crank lever for each supporting needle loosely connected therewith, a pick-reading needle hanging down from the other arm of this lever over the pattern card, means for periodically lowering these pick-reading needles unto the pattern card so as to allow them to drop into a hole of this card or to rest upon it, the bell-crank levers being adapted to follow the movement of the pick-reading needles in such a way that dropping in of a needle into a hole of the pattern card causes the associated lever to swing the corresponding supporting needle out of the path of the lifting bar whilst the other supporting needles are lifted so as to lift the associated lifting hooks out of engagement with the lifting knife.

13. A dobby, comprising at least one series of movable warp lifting hooks, a lifting knife for each of these series of hooks, a lifting bar of angle-shaped cross-section underneath each series of hooks, a series of pendulously suspended supporting needles disposed between this lifting bar and series of lifting hooks in such a manner that the lower end of these supporting needles bears against the upright web of the lifting bar owing to the eccentric bearing of the needle, a loosely mounted bell-crank lever for each supporting needle provided with an upstanding arm, guiding means connecting this arm with the supporting needle, a perforated pattern card of thin material, a pick reading needle depending from the sec-

ond arm of said bell-crank lever, a spring interposed into the connection between the bell-crank lever and the associated supporting needle in such a manner that when the reading needle stands upon the pattern-card the spring only exerts upon the supporting needle a pressure directed towards the upstanding web of the lifting bar when this supporting needle shows a tendency to swing away from this web, but so long as the supporting needle bears against the said web the spring pressure is equal to zero.

14. A dobby, comprising two series of movable warp lifting hooks, a lifting knife below each of these series of hooks for temporarily supporting these hooks, a lifting bar of angle-shaped cross section underneath each series of hooks adapted to periodically receive a movement in the direction towards the hooks with a view to lift them out of reach of the lifting knife, a series of pendulously suspended supporting needles disposed between each of said lifting bars and the associated series of lifting hooks in such a manner that the lower end of each of these needles is normally held in the path of the raising lifting bar by the action of the weight of the needle, a perforated pattern card of thin material, a series of loosely mounted bell-crank levers in front of each series of supporting needles, a pick-reading needle freely depending from one arm of each of said bell-crank levers above the pattern card, a guiding wire loosely connecting the other arm of each bell-crank lever with one of said supporting needles, a spring surrounding this connecting wire between the bell-crank lever and the supporting needle for controlling the position of this needle relatively to said lifting bar without practically exerting a pressure upon the pattern card, by the associated pick-reading needle, the supporting needles being pendulously supported by their upper ends in such a way that the lifting hooks lying upon them exert an eccentric pressure upon them, by which the lower ends of the supporting needles are pressed against the upright web of the lifting bar.

15. A dobby, comprising an endless perforated pattern card of thin material, two series of pivotally mounted warp lifting hooks, a lifting knife underneath each series of hooks, these hooks normally resting upon said knives in a position to be drawn out therefrom on their forward-stroke, a lifting bar of angle-shaped cross-section arranged underneath each series of hooks and adapted to periodically perform a reciprocating movement in vertical direction, a rod fixedly mounted in the machine frame underneath each series of lifting knives, a series of supporting needles pendulously suspended with their upper ends on this rod in such a way that the lower ends of these needles lightly bear against the upright web of the associated lifting bar owing to the eccentric bearing of

the needles which are unloaded whilst the associated lifting hooks rest upon the lifting knife, a bell-crank lever for each of said supporting needles and loosely connected therewith, a pick-reading needle suspended on the other arm of such lever above the perforated pattern card, means for periodically lowering these pick-reading needles to the pattern-card, the arrangement being such that dropping of a pick-reading needle into a hole of the pattern card causes the bell-crank lever to move the lower end of the associated supporting needle out of the path of the rising lifting bar whilst the other supporting needles rest in a position to be lifted by said lifting bar and to lift the associated lifting hooks out of reach of the lifting knife.

In testimony whereof I affix my signature.

HUGO STÄUBLI.