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(54) **Method of operating an electronic dobby loom.**

(57) According to the method the heddle frames (5) of the loom are selected and assigned to a plurality of groups. In each of a plurality of picking cycles a group of heddle frames (5) is moved and leveled into the weaving position (up arrow, down arrow) according to the weaving pattern to be woven. During this operation the loom is preferably run at lower speed compared to the selected normal picking speed. This allows for avoiding excessive load of the drive motor and further remarkably reduces warp yarn breakes. The method thus provides for remarkably improved start up conditions of looms.

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Fig. 1

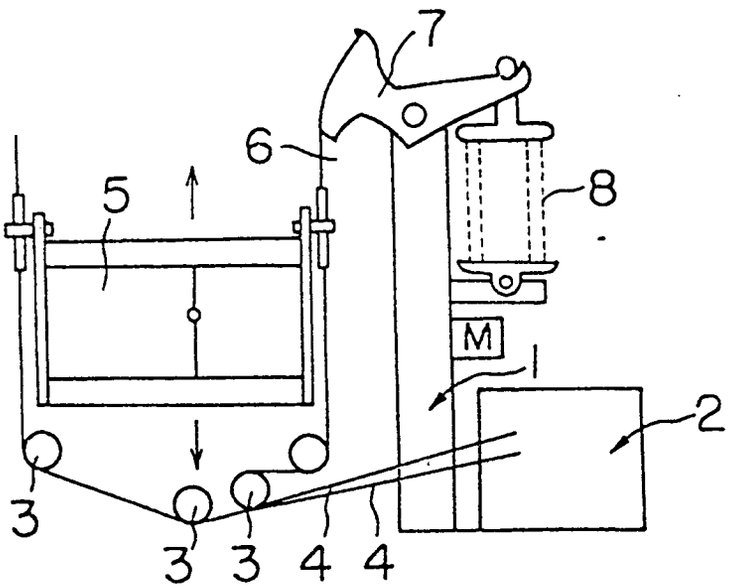
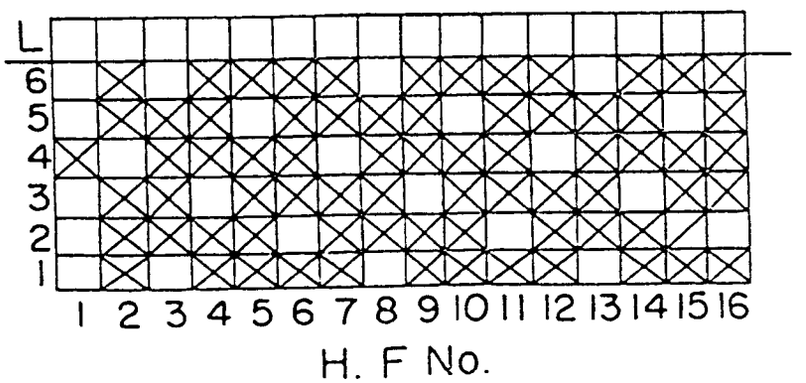


Fig. 2

(A)

H. F No.	Pick Number		
	1	2	3
1 ~ 5	OFF	→	→
6 ~ 10	OFF	→	→
11 ~ 16	OFF	→	→

(B)



The present invention relates to a method of operating an electronic dobby loom and, more particularly, to a method of operating an electronic dobby loom capable of controlling a plurality of heddle frames urged toward a first shedding position according to a program stored in a storage device so that the heddle frames are shifted to a second shedding position or a split shedding position.

In mounting heddle frames on a dobby loom, as well as an those not equipped with any dobby, or in drafting warps through heddles, all the heddle frames are arranged for leveling on a fixed level to facilitate the work for mounting the heddle frames on the loom or for drafting warps through the heddles of the heddle frames.

Particularly, when all the heddle frames are urged toward a first shedding position for negative shedding, all the hedle frames, in general, are released free so that all the heddle frames are arranged at the first shedding position. However, in some case, the heddle frames must be leveled at a second shedding position opposite the first shedding position or at a split-shedding position. If all the heddle frames are shifted simultaneously in such a case, load on the loom, particularly on the drive motor, is excessively large. Therefore, the heddle frames are divided, for example, into four groups, i.e.,

a first group of the first to the fifth heddle frames,

a second group of the first to the ninth heddle frames,

a third group of the first to the twelfth heddle frames and

a fourth group of the first to the sixteenth heddle frames,

and the heddle frames are shifted sequentially in four shedding cycles one group of heddle frames in each shedding cycle to reduce load on the drive motor. Such a technique is disclosed in JP 60 (Sho)-225342. Incidentally, in shifting the heddle frames of an electronic dobby loom to a leveling position for leveling, the loom is operated at a full speed and the power supplied to the drive motor must be increased to operate the loom at a high speed for instantaneous leveling when the drive motor has a capacity insufficient for the simultaneous leveling of all the heddle frames, and then, after leveling all the heddle frames simultaneously, the loom is started at the full speed or at a highest possible speed, because it is possible that a large load acts on the drive motor in shifting the heddle frames from the leveling position to the shedding position.

In the in the forgoing described loom in which the heddle frames of each group are controlled merely simultaneously by a control rib formed on the circumference of a control rod, it is impossible to discriminate the heddle frames according to the weave of a fabric to be woven on the loom regardless of the group and to shift the heddle frames of each group selectively, and it is impossible to control the load properly during the leveling operation because the large power required for shifting the heddle frames from the leveling position to the shedding position cannot be reduced.

Furthermore, it is dangerous and many warps are broken in leveling the heddle frames and in starting the loom after leveling the heddle frames to the leveling position, because of the loom is operated at the full speed or at a highest possible speed.

The present invention has been made to solve the foregoing problems and it is therefore an object of the present invention to provide a method of operating an electronic dobby loom in leveling the heddle frames and in starting the loom after leveling the heddle frames, at a safe, low speed without excessively loading the drive motor.

According to the present invention this problem is solved by the teaching contained in claim 1. The depending claims are related to particular embodiments of the invention.

As described, to achive the object, the present invention provides a method of operating an electronic dobby loom equipped capable of controlling the shedding motion of a plurality of heddle frames urged toward a first shedding position according to a program previously stored in a storage device so that the heddle frames are shifted to a second shedding position or to a split-shedding position.

According to the method the heddle frames are shifted in groups of a plurality of heddle frames, and against the force urging the heddle frames toward the first shedding position, to the second shedding position, or to the split-shedding position in a plurality of shedding cycles one group of heddle frames in each shedding cycle in leveling the heddle frames and in starting the loom.

According to the present invention, the heddle frames are shifted in a plurality of groups in a plurality of picking cycles in shifting the heddle frames against force urging the heddle frames in a direction opposite to the shifting direction. Accordingly, the drive motor of the loom is not excessively loaded, the loom can be operated at a low speed for leveling and the loom can be started at a low staring speed, so that the warps are not broken.

Follwing the method of operating an electronic dobby loom capable of controlling the shedding motion of a plurality of heddle frames according to a program and sequence previously stored in a storage device, the required and slected heddle frames are shifted against the force urging the same in groups each of a plurality of heddle frames, in a plurality of shedding cycles, thereby leveling the heddle frames and staring the loom.

Accordingly, the drive motor is not loaded excessively when the number of heddle frames to be shifted

simultaneously in each shedding cycle is determined previously taking into consideration the capacity of the drive motor, so that the loom can be operated at a comparatively low speed. Since the heddle frames are controlled selectively and individually for shedding motion, the heddle frames can be shifted from the leveling position respectively to shedding positions corresponding to the weave (pattern/design) of a fabric to be woven on the loom, the loom can be started at a comparatively low speed, and hence the frequency of warp breakage when starting the loom can significantly be reduced compared with the frequency of warp breakage in starting the loom by the conventional method.

A method in a preferred embodiment according to the present invention will be described hereinafter as applied to an electronic dobby loom with reference to the accompanying drawings, which show the following:

Fig. 1 is a schematic front view of an essential portion of a electronic dobby loom for carrying out the present invention;

Fig. 2(A) is a table of assistance in explaining the arrangement of the heddle frames at a leveling position;

Fig. 2(B) is a diagram of a weave, showing steps of shifting the heddle frames arranged according to a weave for up leveling;

Fig. 3(A) is a table of assistance in explaining steps of shifting the heddle frames arranged at an up leveling position to start weaving operation according to a weave;

Fig. 3(B) is a diagram of a weave showing steps of shifting the heddle frames for starting weaving operation of Fig. 3(A);

Fig. 4(A) is a table of assistance in explaining steps of shifting the heddle frames arranged according to a weave for plain weave leveling; and

Fig. 4(B) is a diagram of assistance of a weave showing steps of shifting the heddle frames for the leveling operation of Fig. 4(A).

Referreing to Fig. 1, a loom 1 is provided with a drive motor M and a dobby 2 of a known type. The dobby 2 comprises components, not shown, such as cams, links and solenoids. Ropes 4 are extended through guide rollers 3 between heddle frames 5 and swing levers, not shown. Each rope 4 has one end connected to the heddle frame 5 and the other end connected to the free end of the swing lever. When the swing levers are attracted to the corresponding solenoids, the corresponding heddle frames 5 are pulled down by the ropes 4. Generally, the number of the heddle frames 5 is in the range of sixteen to thirty-two. The heddle frames 5 excluding those operated in common are urged through flexible members 6 and sectorial swing levers 7 by springs 8 to an upper shedding position. Accordingly, while the solenoids of the dobby 2 are in an off state, namely, solenoids 2 are not energized and the swing levers are not attracted to the solenoids, the heddle frames 5 are at the upper shedding position. Therefore, an over shed is formed by energizing some of the solenoids to pull down the corresponding heddle frames 5.

Suppose that a shedding program is designed according to a weave diagram shown in Fig. 2(B). The heddle frames 5 are controlled by the dobby 2 so as to form sheds according to the weave for first to sixth picking cycles.

In shifting the heddle frames 5 for a leveling cycle L, the dobby 2 releases all the heddle frames 5 free and, consequently, all the heddle frames 5 are shifted to the over shed position by the springs 8 for so-called over shed leveling. As shown in Fig. 2(A), first to third picking cycles are performed with all the heddle frames 5 released free from the control of the dobby 2 for the leveling cycle L in an up leveling mode. Since the heddle frames 5 are shifted in the urging direction of the springs 8 for the leveling cycle L, the loom is operated at a low speed, namely, in an inching mode, for safety and for avoiding warp breakage without requiring additional power for leveling.

Fig. 3(B) shows a weave diagram for controlling the heddle frames 5 in starting the loom for weaving with the heddle frames 5 arranged at the up leveling position. Leveling is completed in a leveling cycle L_0. Then, the first to fifth heddle frames 5 are controlled according to the weave diagram for a first picking cyle L_1, in which the second, fourth and fifth heddle frames 5 are shifted, the sixth to tenth heddle frames 5 are controlled according to the weave diagram for a second picking cycle L_2 without changing the positions of the first to fifth heddle frames 5, the eleventh to sixteenth heddle frames 5 are controlled according to the weave diagram for a third picking cycle L_3 without changing the position of the first to tenth heddle frames 5, a fourth picking cycle L_4 is performed likewise, and then the operating speed of the loom is raised from the low speed to the normal operating speed for normal weaving operation from a fifth picking cycle. The arrangement of all the heddle frames 5 in the weaving condition is completed through the three picking cycles in which the loom is operated at the low speed, and the state is maintained until the heddle frames 5 are controlled according to the weave of the fabric.

Figs. 4(A) and 4(B) show a manner of controlling the heddle frames 5 for leveling after the interruption of weaving operation, namely, after fifth and sixth picking cycles (Fig. 4(B)). Only the heddle frames of odd numbers are selected, the heddle frames of odd numbers are divided into a first group of the first, third, fifth and seventh heddle frames and a second group of the ninth, eleventh, thirteenth and fiftheenth heddle frames. The heddle frames of the first group are shifted down (on) in the first leveling cycle L_1, and then

the heddle frames of the second group are shifte down (on) in the third leveling cycle L_3. Consequently, all the heddle frames are arranged for plain weave in four pcking cycles, in which the loom operates at the low speed.

In shifting the heddle frames 5 down against the resilience of the springs 8, for example, in starting the weaving operation with all the heddle frames 5 arranged at the up leveling position or in arranging the heddle frames 5 for plain weave leveling, the heddle frames are divided into groups, the groups of heddle frames 5 are shifted down sequentially one group for each picking cycle and held at the lower position. Accordingly, the motor M of the loom 1 is not overloaded even if the motor M is such as for a loom of a tappet shedding system, and the loom 1 can be operated at the low speed in leveling the heddle frames 5 and in staring the loom 1 after leveling.

According to the method the heddle frames (5) of the loom are selected and assigned to a plurality of groups. In each of a plurality of picking cycles a group of heddle frames (5) is moved and leveled into the weaving position (up arrow, down arrow) according to the weaving pattern to be woven. During this operation the loom is preferably run at lower speed compared to the selected normal picking speed. This allows for avoiding excessive load of the drive motor and further remarkably reduces warp yarn breakes. The method thus provides for remarkably improved start up conditions of looms.

Claims

1. A method of operating an electronic dobby loom capable of controlling the shedding motion of a plurality of heddle frames (5) urged toward a first shedding position (up arrow), according to a program previously stored in a storage device (2) so that the heddle frames (5) are shifted to a second shedding position (down arrow) or to a split-shedding position, characterized in that, in leveling the heddle frames (5) and in starting the loom, the heddle frames (5) urged toward the first shedding position are shifted selectively in groups each of a plurality of heddle frames (Fig. 2(A)) against the force (8) urging the heddle frames toward the first shedding position (up arrow), in a plurality of shedding cycles one group of heddle frames (Fig. 2(B)) in each shedding cycle.

2. A method of operating an electronic dobby loom capable of controlling the shedding motion of a plurality of heddle frames (5) according to a previously stored program from an urged first shedding and leveling position (up) to a second shedding and leveling position (down) or to a split-shedding leveling position, comprising the steps of starting the loom by shifting one selected group of the heddle frames against the force (8) urging the heddle frames in said first shedding position (up) to said second shedding or split-shedding position (down) in each of a plurality of picking cycles.

3. Method as claimed in claim 1 or 2, where the loom is started at a reduced speed, compared to the set running speed.

4. Method as claimed in one of claims 1 to 3, where the selected groups of heddle frames (8) are brought into the weaving pattern position (up, down) in a plurality of picking cycles while the loom is operated at a reduced speed and where the heddle frames are controlled thereafter according to the weaving pattern of the fabric to be woven and where the speed of the loom is increased to the non reduced set running speed.

5. Method as claimed in one of claims 1 to 4, where the selected groups of consecutively enumerated heddle frames (5) include heddle frames with odd (Fig. 4 (A) and (B)) or even numbers only.

Fig. 1

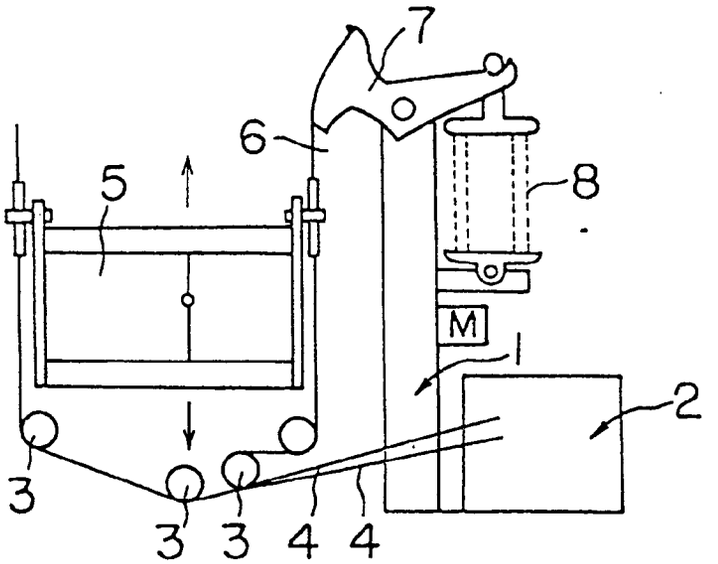


Fig. 2

(A)

H. F No.	Pick Number		
	1	2	3
1 ~ 5	OFF	→	→
6 ~ 10	OFF	→	→
11 ~ 16	OFF	→	→

(B)

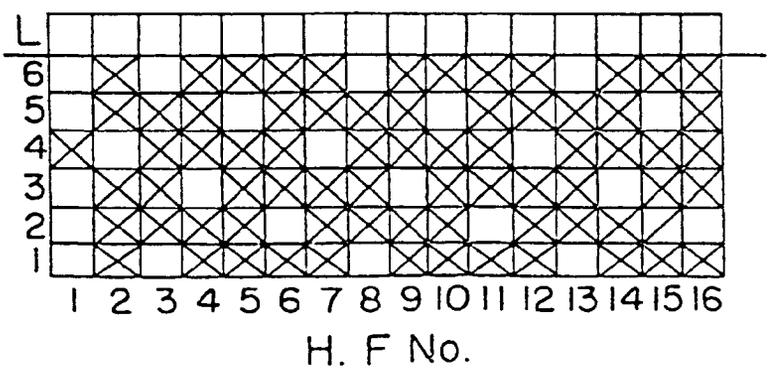


Fig. 3

(A)

H. F No.	Pick Number				
	1	2	3	4	5
1 ~ 5	ON	ON	ON	ON	→
6 ~ 10	OFF	ON	ON	ON	→
11 ~ 16	OFF	OFF	ON	ON	→

(B)

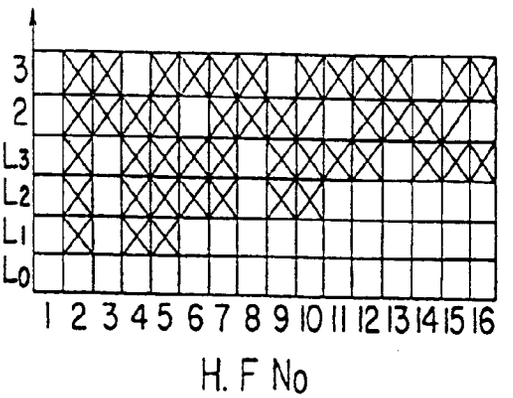
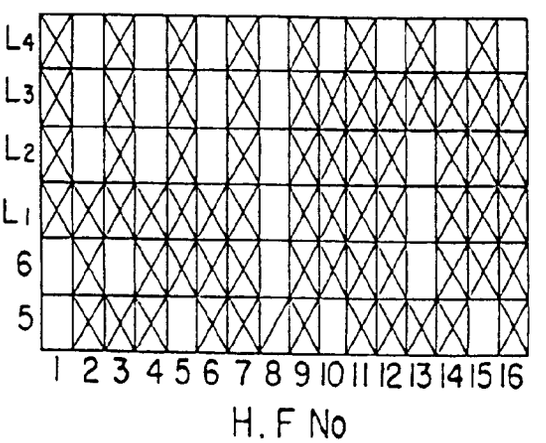


Fig. 4

(A)

H. F No.	Pick Number			
	1	2	3	4
1,3,5,7	ON	ON	ON	ON
2,4,6,8	OFF	ON	ON	ON
9,11,13,15	OFF	OFF	ON	ON
10,12,14,16	OFF	OFF	OFF	ON

(B)



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EUROPEAN SEARCH REPORT

Application Number

EP 91 81 0415

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	DE-A-3 542 650 (STROMAG GMBH) * column 1, line 43 - line 56; figure 3 *	1,2	D03C1/14 D03D51/00
A	EP-A-0 086 999 (FIMTESSILE FABBRICA ITALIANA) * claim 1; figures 1-6 *	1,2	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

D03C
D03D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	21 OCTOBER 1991	HENNINGSEN O.

CATEGORY OF CITED DOCUMENTS

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