An insertion controller for alternate weaving with different wefts on a fluid jet loom.

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Proprietor: TSUDAKOMA KOGYO KABUSHIKI KAISHA
18-18 5-chome, Nomachi
Kanazawa-shi Ishikawa-Ken(JP)

Inventor: Shin, Tokuiro
136 Sougo-machi
Matsutou-shi Ishikawa-ken(JP)
Inventor: Ida, Yoshi
6-30 Undou koen 2-chome Mikuni-machi
Sakai-gun Fukui-ken(JP)
Inventor: Maenaka, Koyu
75 Yotsuya-machi, Matsutou-shi
Ishikawa-Ken(JP)

Representative: Nithardt, Roland
CABINET ROLAND NITHARDT Y-PARC Ch. de la Saliaz C.P. 3347
CH-1400 YVERDON-LES-BAINS(CH)

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Description

The present invention relates to an insertion controller according to the preamble clause of claim 1, and more particularly relates to an improvement in a weft insertion control system for alternate weaving with different wefts on a fluid jet loom on which different wefts are inserted into sheds following a regular sequential weft selection pattern via different main nozzles by sequential drive of a weft inserting unit in accordance with commands from an automatic weft selector.

In the case of the above-described type of fluid jet loom, weft insertion is carried out following the regular sequential weft selection pattern fixed by the commands given by the automatic weft selector and no special trouble starts in this mode of weaving as long as the loom performs its normal running.

At stoppage of the loom, however, it is sometimes required to perform weft insertion in a sequence independent of the regular sequential weft insertion pattern fixed by the commands from the automatic selector for the purpose of, for example, repair of weft defects on any main nozzles. With the conventional weft selection system, however, such a free weft insertion is quite infeasible because the sequence of weft insertion is exclusively fixed by the commands from the automatic weft selector. Thus, repair of weft defects cannot be duly performed in the case of fluid jet looms equipped with such a conventional weft selection system.

It is the object of a first improvement to enable free weft insertion, at stoppage of loom, in a sequence independent of a regular sequential weft insertion pattern fixed by commands from an automatic weft selector without any ill influence upon such a fixed pattern.

In accordance with the above-mentioned first improvement a signal reservation circuit is interposed between an automatic weft selector and a driver circuit, a control box of the loom and a manual weft selector are connected to the signal reservation circuit and to the driver circuit, the driver circuit is made to operate following a regular sequential weft selection pattern fixed by commands from the automatic weft selector during normal running of the loom, and, at stoppage of the loom, the driver circuit is made to operate following a free selective weft selection pattern fixed by commands from the manual weft selector with priority to the regular sequential weft selection pattern.

In practical alternate weaving with different weft, it is sometimes required to intercept the regular sequential weft selection pattern even during normal running of the loom for adjustment of weft insertion, in addition to the above-described sequence interception at stoppage of the loom. Such adjustment includes adjustment in, for example, fluid pressure, timing of fluid ejection, position of the nozzles and other process factors influencing the state of weft insertion.

In the case of ordinary weaving with same wefts, such adjustment can be carried out quite easily. For example, a stroboscope may be used for measurement of the state of weft insertion. In the case of alternate weaving with different wefts, a number of wefts different in type are inserted following a regular sequential weft selection pattern and, as a consequence, it is quite impossible to measure the state of weft insertion of a particular weft repeatedly in succession.

Japanese Utility Model Opening Sho.62-114080 proposes a system to perform such a measurement even in the case of alternate weaving. In the case of this earlier proposal, a stroboscope is activated in synchronism with insertion of a particular weft only in order to selectively measure the state of weft insertion of that particular weft. When alternate weaving is carried out following a given regular sequential weft selection pattern, some wefts may appear in sheds at short intervals and some wefts may appear in sheds at long intervals. Thus, depending on the selection pattern, the wefts of long intervals require a long time for measurement of their state of weft insertion. For these reasons, the system of the earlier proposal is unsuited for measurement of the state of weft insertion following some types of regular sequential weft selection patterns.

In the case of the insertion controller in accordance with the above-mentioned first improvement, shift in weft selection mode, that is from the regular sequential to the free selective weft selection pattern, is caused depending on the state (H/L) of the output signal from the control box of the loom. So, the free selective weft selection can be introduced only at stoppage of the loom when the output signal is at the H-level.

For introduction of the free selective weft selection during normal running of the loom, it is also thinkable to replace a regular sequential weft selection pattern in the memory with a free selective weft selection pattern. After adjustment of weft insertion, the free selective weft selection pattern in the memory may be again replaced by the initial regular sequential weft selection pattern. However, this system entails much labour and time for adjustment of weft insertion.

EP-A-0 114 339 shows a weft reservoir controller comprising a central processing unit which controls weft reservation following a stored program, in connection with a weft insertion command generator. This central processing unit is provided with a
manual release switch which is used for operating the weft reservoirs quite independently of the program followed by the central processing unit. However the release switch does not change operation of the weft insertion command generator.

It is an object of the present invention to enable free weft insertion, regardless of the running condition of the loom, in a sequence independent of a regular sequential weft insertion pattern fixed by commands from an automatic selector for the purpose of adjustment weft insertion at any time required.

An insertion controller according to is characterized in that a signal reservation circuit is interposed between said automatic weft selector and said driver circuit in order to control transmission of said commands from said automatic weft selector, in that said manually operated means comprise a manual weft selector provided with push buttons in connection with said signal reservation circuit, and in that, on manual selection of one said push button, said manual weft selector on one hand passes a drive signal to an input terminal of said driver circuit which corresponds to said one push button and, on the other hand, passes a signal to said signal reservation circuit in order to inhibit transmission of said commands from said automatic weft selector.

The present invention will next be explained in more detail in reference to the accompanying drawings, in which

Fig.1 is a block diagram of the general construction of a weft inserting system on a fluid jet loom incorporating the insertion controller in accordance with the above-mentioned first improvement,

Fig.2 is a block diagram of one embodiment of the detailed construction of the weft inserting system shown in Fig.1,

Fig.3 is a timing chart of the operation of the controller having the construction shown in Fig.2,

Fig.4 is a block diagram of another embodiment of the detailed construction of the weft inserting system shown in Fig.1,

Fig.5 is a timing chart of the operation of the controller having the construction shown in Fig.4,

Fig.6 and 7 are schematic views of some examples of the weft inserting unit used for the controllers shown in Figs.2 and 4,

Fig.8 is a block diagram of the general construction of a weft inserting system on a fluid jet loom incorporating the insertion controller in accordance with the present invention,

Figs.9 and 10 are block diagrams of one embodiment of the detailed construction of the weft inserting system shown in Fig.8, and

Fig.11 is a block diagram of another embodiment of the detailed construction of the weft inserting system shown in Fig.8.

Fig.1 shows the general construction of a weft inserting system on a fluid jet loom incorporating an improved insertion controller which enables free weft insertion at stoppage of the loom.

Like the conventional ones, the system includes a driver circuit 20, a weft inserting unit 30 electrically connected to the driver circuit 20 and an automatic weft selector 40. A signal reservation circuit 100 is interposed between the automatic weft selector 40 and the driver circuit 20. A control box 10 and a manual weft selector PB are electrically connected to the signal reservation circuit 100 and to the driver circuit 20. The driver circuit 20 is also electrically connected to weft reservoirs RS1 to RSn. By operation of the weft inserting unit 30, wefts W1 to Wn are sequentially delivered from the weft reservoirs RS1 to RSn in order to be inserted into corresponding sheds via main nozzles N1 to Nn which are hydraulically connected to the weft inserting unit 30 in a known manner.

Fig.2 shows one embodiment of the detailed construction of the weft inserting system shown in Fig.1. The control box 10 issues a two-value signal A which assumes a H-level during normal running and a L-level at stoppage of the loom. This control box 10 is connected on one hand to one input terminal of an AND-gate 121 via an inverter 101 and on the other hand to one input terminal of an OR-gate 112.

The manual weft selector PB includes n sets of push buttons PB1 to PBn and a reset push button PBR, n corresponding to the number of the main nozzles N1 to Nn, i.e. the number of the different wefts W1 to Wn. When on button is pushed, a signal of L-level is issued on its corresponding line. The push buttons PB1 to PBn are connected one hand to the input terminal of an OR-gate 111 via respective inverters 102 to 104 and, on the other hand, to the input side of the driver circuit 20 in series therewith. The reset push button PBR is connected to the other terminal of the OR-gate 112.

The AND-gate 121 is connected to a one-shot circuit 131 which issues an output signal D. The one-shot circuit 131 is connected to the S-terminal of a flip-flop circuit 141 and to a one-shot circuit 132 which issues an output signal E. The one-shot circuit 131 is further connected to one input terminal of an OR-gate 113 which issues an output signal J. The one-shot circuit 132 is connected to the driver circuit 20 as later described in more detail.

The OR-gate 112 is connected on one hand to the R-terminal of the flip-flop circuit 141 and, on the other hand, to the other input terminal of the
OR-gate 113. The OR-gate 113 is also connected to the driver circuit 20. The flip-flop circuit 141 is connected to the driver circuit 20 and issues an output signal F.

The automatic weft selector 40, which issues output signals (colour signals) C1 to Cn, includes n sets of weft selections. The automatic weft selector 40 is connected, in parallel, to the driver circuit 20 via AND-gates 122 to 124 which issue output signals G1 to Gn. The above-described flip-flop circuit 141 is also connected to the AND-gates 122 to 124.

The driver circuit 20 includes n sets of similar drive units for the wefts W1 to Wn, only the drive unit I being illustrated in Fig.2.

The drive unit I includes an AND-gate 125 whose input terminal is connected to the one-shot circuit 132 and the push button PB1. The AND-gate 125 is connected to the S-terminal of a flip-flop circuit 142 which issues an output signal K. The R-terminal of this flip-flop circuit 142 is connected to the OR-gate 113.

The AND-gate 122 is connected, in parallel, to one input terminals of AND-gates 21 and 22 whose other input terminals are connected, respectively, to setters 27 and 28 via comparators 25 and 26. An encoder 11 on the main shaft of the loom is connected to the comparator 25 and 26 for detection of angle of shaft rotation. The angle of shaft rotation is compared with the weft inserting period set by the setters 27 and 28 for issue of H-level signals from the comparators 25 and 26 during weft insertion. The Q-terminal of the flip-flop circuit 142 is connected to one input terminals of OR-gate 14 and 115. The other input terminals of the OR-gates 114 and 115 are connected to the AND-gates 21 and 22.

The weft inserting unit 30 includes n sets of similar sub-units for the wefts W1 to Wn, only the sub-unit I being illustrated in Fig.2.

The sub-unit I includes a gripper 31 connected to the OR-gate 114 via an amplifier 23 and an electromagnetic valve 32 connected to the OR-gate 115 via an amplifier 24.

The operation of the controller shown in Fig.2 will next be explained in reference to Fig.3, in which time is taken on the abscissa.

When no weft insertion is performed during normal running (a period from t1 to t2) of the loom, a signal A of L-level is issued by the control box 10. At the weft insertion cycle of the weft W1, the colour signal C1 assumes a H-level, the output signals B1 to Bn all assume L-level and, as a consequence, the output signal F from the flip-flop circuit 141 assumes a H-level. As a result, the output signal G1 from the AND-gate 122 assumes a H-level. However, since no weft is to be inserted and the output signals from the comparators 25 and 26 both assume L-levels, the weft inserting unit 30 does not operate at all and no weft is inserted.

Next, it is assumed that the weft W1 is to be inserted following a command given by the automatic weft selector 40 during normal running of the loom. In this case, the colour signal C1 assumes a H-level, the output signal F from the flip-flop circuit 141 assumes a H-level and, as a consequence, the output signal G1 from the AND-gate 122 assumes a H-level. Since a weft is to be inserted, the output signals from the comparators 25 and 26 both assume H-levels. Thus, the OR-gate 114 and 115 both issue output signals of H-level to activate the sub-unit I of the weft inserting unit 30. Under this condition, the colour signals C2 to Cn all assume L-levels and the output signals G2 to Gn all assume L-levels so that the sub-units II to n should not operate.

When the manual weft selector PB is not yet operated during stoppage (a period from t2 to t5) of the loom, the output signal A from the control box 10 assumes a L-level. Provided that only the colour signal C2 assumes a H-level at this very moment, the output signal F assumes a H-level whereas the output signal J assumes a L-level. Thus, only the output signal G2 from the AND-gate 123 assumes a H-level. When the angle of shaft rotation of the loom is just in the weft inserting period set by the setters 27 and 28 in the drive unit II of the driver circuit 20, the subunit II of the weft inserting unit 30 is put under an operable condition.

Assuming the push button PB1 of the manual weft selector PB is depressed for practice of, for example, repair of weaving defects, the output signal B1 from the manual weft selector PB assumes a H-level and the output signal F from the flip-flop circuit 141 assumes a L-level. As a result, the output signal G2 from the AND-gate 123 is made to assume a L-level and only the output signal K from the flip-flop circuit 142 of the drive unit I assumes a H-level. As a result, only the sub-unit I of the weft inserting unit 30 is put under an operable condition and the weft W1 is passed to the main nozzle N1 by means of a proper manual operation such as depression of a foot pedal. In this case, the regular sequential weft selection pattern fixed by the commands from the automatic weft selector 40 is provisionally ignored and reserved at the signal reservation circuit 100.

After repair of weaving defect is over, the reset push button PBR is depressed for example at a moment t4 and the output signal J assumes a H-level. The output signal F from the flip-flop circuit 141 assumes a H-level, the output signal G2 from the AND-gate 123 assumes a H-level and, as a consequence, the output signal K from the flip-flop circuit 142 assumes a L-level. Thus, the sub-unit I is deactivated and the sub-unit II is activated in the
weft inserting unit 30. As a result, at restart of the normal running of the loom at a moment t5, the regular sequential weft selection pattern fixed by the commands from the automatic weft selector 40 is resumed for insertion of the weft W2.

Fig.4 shows another embodiment of the detailed construction of the weft inserting system shown in Fig.1. Although basically same as the foregoing embodiment, this construction is different in the following points.

(I) When one of the push buttons PB1 to PBn is depressed in the manual weft selector PB, a corresponding sub-unit in the weft inserting unit 30 is kept in operation during the period of depression only. As a consequence, no reset push button is needed.

(II) An inverter 201 and an OR-gate 211 are connected to the driver circuit 20 only via a NAND-gate 221.

(III) The inverter 201 is also directly connected to the driver circuit 20 in parallel to the connection in (II).

(IV) Each sub-unit in the weft inserting unit 30 includes an auxiliary electromagnetic valve 33 in addition to the gripper 31 and the electromagnetic valve 32.

(V) An AND-gate 225 is connected to the auxiliary electromagnetic valve via an amplifier 231.

(VI) The AND-gate 225 is also directly connected to OR-gates 214 and 215.

The operation of this weft inserting system is shown in Fig.5 in which time is again taken on the abscissa. The loom runs normally during a period from t1 to t2 and is at stoppage during a period from t2 to t5. In the case of the illustrated example, the push button PB1 is depressed during a period from t3 to t4.

Some detailed constructions of the weft inserting unit 30 in the foregoing embodiments are shown in Figs.6 and 7. In these cases, water is used for fluid ejection. For example in Fig.6, a lever L2 is pivoted to a shaft in connection with a foot pedal FP. During normal running of the loom, the lever L2 is placed outside operative zone of a lever L1. When the foot pedal FP is depressed, the lever L2 lowers and a roller carried thereby pushes down one end of the lever L1 for suction by pumping. When depression on the foot pedal FP is removed, the lever L2 resumes its initial position via spring force for ejection by pumping (ejection of water).

Needless to say, the above-described controllers are similarly usable for a weft inserting system on an air jet loom too.

Fig.8 shows the general construction of a weft inserting system on a fluid jet loom incorporating the insertion controller in accordance with the present invention. A signal reservation circuit 300 is interposed between an automatic weft selector 40 and a driver circuit 20' and a manual weft selector PB' is connected to the signal reservation circuit 300 and to the driver circuit 20'. The driver circuit 20' is electrically connected to a weft inserting unit 30 and weft reservoirs RS1 to RSn. By operation of the weft inserting unit 30, wefts W1 to Wn are sequentially delivered from the weft reservoirs for insertion via main nozzles N1 to Nn which are hydraulically connected to the weft inserting unit 30 in a known manner.

Figs.9 and 10 show one embodiment of the detailed construction of the weft inserting system shown in Fig.8. In the following description, it is assumed that four types of different wefts are inserted in alternate sequence.

In Fig.9, relay contacts R1 to R4 in the driver circuit 20' are controlled by a relay sequence circuit of the manual weft selector PB' shown in Fig.10. Relays R1 to R4 in Fig.9 are activated by switches S1 to S4 in the manual weft selector PB'.

Dot lines in Fig.10 connecting switches to S1 to S4 and SR in Fig.10 indicate that contacts of these switches are mechanically coupled to each other. In the case of the illustrated example, manual operation exclusively closes one switch only. Once closed, the switch is mechanically kept closed until another switch is closed or the reset switch SR is closed.

During normal running of the loom, the switches S1 to S4 are kept open as shown in Fig.10 and the relay contacts R1 to R4 are set as shown in Fig.9. As a consequence, colour signals C1 to C4 pass through the signal reservation circuit 300 so as to be issued in the form of output signals B1 to B4 via the relay contacts R1 to R4 in the driver circuit 20'. Wefts are inserted following a regular sequential weft selection pattern fixed by these output signals.

It is assumed that weft insertion of the weft W1 corresponding to the colour signal C1 is now to be adjusted. The switch S1 in the manual weft selector PB' is first closed and, as the relay R1 is activated thereby, the relay contact R1 in the driver circuit 20' establishes a connection to a constant voltage source +V. Since the relay R5 is activated too, the relay contacts R5 in the signal reservation circuit 300 are all made open so that the colour signals C1 to C4 from the automatic weft selector 40 should be all blocked at the signal reservation circuit 300. Due to the connection of the relay contact R1 to the constant voltage source +V in the driver circuit 20', only the output signal B1 always assumes a H-level. As a consequence, only the weft W1 corresponding to this output signal B1 is repeatedly inserted in succession quite independently of the regular sequential weft selection pattern given by the automatic weft selector 40.

After adjustment of weft insertion is over, the
reset switch SR is manually closed so that the switch S1 should be made open. As a result, the connection to the constant voltage source +V is canceled and the relay contact R1 in the driver circuit 20 resumes the condition shown in Fig.9, i.e. the condition during the normal running of the loom.

In the case of the foregoing embodiment, relays are used for constructing the circuits. Another embodiment of the detailed construction of the weft inserting system is shown in Fig.11, in which logic elements are used for construction circuits.

The signal reservation circuit 300 includes four sets of AND-gates and the driver circuit 20 includes four sets of OR-gates. The manual weft selector PB includes five sets of switches S1 to SR and a NOR-gate connected, in parallel to these switches.

During normal running of the loom, the colour signals C1 to C4 are issued by the automatic weft selector 40 following a regular sequential weft selection pattern and each of them at a H-level is passed to the signal reservation circuit 300. Since the switches S1 to SR in the manual weft selector PB are all left open at this moment, a signal at a H-level is issued by the NOR-gate. As a consequence, signals at H-levels are passed to both input terminals of each AND-gate in the signal reservation circuit 300. On receipt of corresponding signals from the signal reservation circuit 300, the driver circuit 20 issues the signals B1 to B4 in alternate sequence.

When weft insertion of the weft W1 corresponding to the colour signal C1 is to be adjusted, only the switch S1 is closed in the manual weft selector PB and the NOR-gate issues a signal at a L-level in response to an output signal from the constant voltage source +V. Thus, the signal reservation circuit 300 is blocked and issues a signal at a L-level. In the driver circuit 20, only the OR-gate corresponding to the output signal B1 receives a signal at a H-level corresponding to the output signal from the constant voltage source +V. As a consequence, the driver circuit 20 always issues the signal B1 only independently of the regular sequential weft selection pattern given by the automatic weft selector 40.

In accordance with the present invention, adjustment of weft insertion can be performed at any time required regardless the running condition of the loom.

Claims

1. An insertion controller for alternate weaving with different wefts on a jet loom having an automatic weft selector (40) generative of colour signals (C1 to Cn) as command, a driver circuit (20) which controls the sequence of weft insertion following a regular sequential weft selection pattern fixed by said commands from said automatic weft selector (40), and manually operated means for changing operation of the insertion controller, characterized:

   in that a signal reservation circuit (100;300) is interposed between said automatic weft selector (40) and said driver circuit (20) in order to control transmission of said commands from said automatic weft selector (40),

   in that said manually operated means comprise a manual weft selector (PB) provided with push buttons (PB1 to PBn) in connection with said signal reservation circuit, and

   in that, on manual selection of one said push button (PB1), said manual weft selector (PB) on one hand passes a drive signal to an input terminal of said driver circuit (20) which corresponds to said one push button (PB1) and, on the other hand, passes a signal (G1) to said signal reservation circuit in order to inhibit transmission of said commands from said automatic weft selector (40).

2. An insertion controller as claimed in claim 1, characterized in that said signal reservation circuit includes relay switches (R5).

3. An insertion controller as claimed in claim 1, characterized in that said signal reservation circuit includes AND-gates (G1-Gn).

4. An insertion controller as claimed in claim 1, characterized in that said manual weft selector (PB) disenses its push buttons (PB1 to PBn) on receipt of a signal from a control box (10) of said loom.

Reversions

1. Dispositif de commande d’introduction pour un tissage alterné avec différentes trames dans un métier à jet de fluide comportant un sélecteur automatique de trame (40) qui produit des signaux de couleur (C1 à Cn) constituant des commandes, un circuit pilote (20) qui commande la séquence d’introduction de trame suivant un motif séquentiel régulier de sélection de trame, déterminé par lesdites commandes issues du sélecteur automatique de trame (40), et des moyens à actionnement manuel agencés pour changer le fonctionnement du dispositif de commande d’introduction, caractérisé :

   en ce qu’un circuit de réservation de signaux (100; 300) est interposé entre le sélecteur automatique de trame (40) et le circuit pilote (20) afin de commander la transmission
desdites commandes issues du sélecteur automatique de trame (40),
en ce que lesdits moyens à actionnement manuel comportent un sélecteur manuel de trame (PB) pourvu de boutons-poussoirs (PB1 à PBn) en connexion avec le circuit de réservation de signaux, et
en ce qu’en cas de sélection manuelle sur l’un (PBi) desdits boutons-poussoirs, le sélecteur manuel de trame (PB) transmet d’une part un signal d’excitation à une borne d’entrée du circuit pilote (20) qui correspond à ce bouton-poussoir (PBi) et, d’autre part, transmet un signal (Gi) au circuit de réservation de signaux afin d’empêcher la transmission desdites commandes issues du sélecteur automatique de trame (40).

2. Dispositif selon la revendication 1, caractérisé en ce que le circuit de réservation de signaux comporte des commutateurs à relais (R5).

3. Dispositif selon la revendication 1, caractérisé en ce que le circuit de réservation de signaux comporte des portes ET (G1 à Gn).

4. Dispositif selon la revendication 1, caractérisé en ce que le sélecteur manuel de trame (PB) déclenche ses boutons-poussoirs (PB1 à PBn) quand il reçoit un signal issu d’une boîte de contrôle (10) du métier.

Patentansprüche

1. Einsetzungssteuergerät für ein abwechslendes Weben mit verschiedenen Schüssen auf einer Düsenwebmaschine, die einen automatischen Schußfadenselektor zur Erzeugung von Farbsignalen (C1 bis Cn) als Befehl besitzt, einer Treiberschaltung (20), die die Folge eines Schüseintrages steuert, der einem regulären sequenziellen Schuß selektionsmuster folgt, das durch die genannten Befehle von dem automatischen Schußfadenselektor (40) festgelegt ist, und einer manuell betätigten Einrichtung zum Ändern des Betriebes des Einsetzungssteuergerätes
dadurch gekennzeichnet, daß eine Signalreservationschaltung (100,300) zwischen dem automatischen Schußfadenselektor (40) und der Treiberschaltung (20) zwischen-geschaltet ist, um die Übertragung der Befehle von dem automatischen Schußfadenselektor (40) zu steuern, daß die manuell betätigte Einrichtung einen manuellen Schußfadenselektor (PB) aufweist, der mit Druckknöpfen (PB1 bis PBn) in Verbindung mit der Signalreservationschaltung versehen ist und daß auf eine manu-

elle Selektion einer der Druckknöpfe (PBi) der manuelle Schußfadenselektor einerseits ein Treibersignal an ein Eingangsterminal der Treiberschaltung (20) überträgt, das mit dem Druckknopf (PBi) korrespondiert und andererseits ein Signal (Gi) zu der Signalreservationschaltung überträgt, um eine Übertragung der Befehle von dem automatischen Schußfadenselektor (40) zu hemmen.

2. Einsetzungssteuergerät nach Anspruch 1, dadurch gekennzeichnet, daß die Signalreservationschaltung Relaischalter (R5) beinhaltet.

3. Einsetzungssteuergerät nach Anspruch 1, dadurch gekennzeichnet, daß die Signalreservationschaltung UND-Gatter (G1 bis Gn) beinhaltet.

4. Einsetzungssteuergerät nach Anspruch 1, dadurch gekennzeichnet, daß der manuelle Schußfadenselektor (PB) auf Empfang eines Signales von einer Steuerbox (10) der Webmaschine seine Druckknöpfe (PB1 bis PBn) äußer Funktion setzt.
Fig. 1
Fig. 3
Fig. 5

[Diagram showing waveforms labeled A, C1, C2, ..., Cn, B1, P, G1, G2, ..., Gn, Q, 33, 31, 32 with time intervals t1, t2, t3, t4, t5]