LOOM EQUIPMENT FOR WEAVING IN SYMBOL SEQUENCES

Fig. 4

Fig. 4a

Fig. 4b

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This invention relates to weaving, and more particularly, to devices for weaving in, sequences of symbols such as characters, figures and punctuation marks.

In the weaving of material involving zones of varying bindings corresponding to sequences of characters, figures, or similar symbols, up to now the usual Jacquard looms have been used. These looms use punched cards in which each sequence of symbols must be specially prepared, or at least specially rearranged. As much as the punching of the cards or the ever-varying rearrangement of these cards is very time consuming, it has not been possible, from an economic point of view, to weave in such sequences of characters, figures, punctuation marks or other symbols, except where production in large quantity was involved.

It is an object of the present invention to provide equipment whereby to weave in very rapidly changing sequences of symbols, provided the type of symbols remains the same, so a time loss for preparing the loom large enough to affect the cost of the operation, is eliminated, and it is therefore possible to manufacture the product even in very small quantities.

Other objects, and the manner in which the same are attained, will become apparent as this specification proceeds.

The invention contemplates providing weaving looms with equipment for weaving in sequences of symbols such as characters, figures, punctuation marks and the like, wherein stencil carriers are scanned and the result from such scanning is transmitted to the warp threads, and wherein a stencil carrier is provided for each symbol to be woven in, the stencil carriers being actuated by a searching instrument in a sequence predeterminated by a selector.

In the drawings attached with this specification and forming part thereof, one embodiment of the invention is illustrated diagrammatically by way of example.

In the drawing:

FIG. 1 shows how FIGS. 2–5 should be assembled to show the whole of the installation.

FIG. 2 shows the searching instrument and the selector systems,

FIG. 2a shows a detail of FIG. 2, namely a section along line X–X in FIG. 2.

FIG. 3 is a diagrammatic representation of the searching system,

FIG. 4 shows diagrammatically some portions of the weaving in equipment including the correlated control system,

FIG. 4a is a side view of the cam shaft,

FIG. 4b is a top view of the cam shaft, the contact springs being omitted for clarity,

FIG. 5 is a diagrammatic representation of a metering and cut-off device.

FIG. 6 is a diagrammatical representation of those parts of the searching instrument and the selector which are correlated with an ornamenting roller, as well as of the said ornamenting roller, while,

FIG. 7 shows the manner in which FIG. 6 should be assembled with FIG. 4 to provide an integrated showing of the part of the installation.

Referring now to the drawings wherein like elements are denoted by identical reference numerals, 1 indicates a searching instrument only such parts of which are shown in the drawing as are necessary for an understanding of the invention. These parts include a drum 2 having an electrically conductive mantle 3, on the exterior of which a predetermined number, y, of axially extending pairs of contact laminae 4 are mounted by one of their ends, the length of the contact laminae being such that they extend with their free ends beyond one of the faces of the drum 2.

The number y corresponds to the maximum number of symbols of a sequence, which symbols may be characters, figures, punctuation marks or the like. The number y may be any number dependent on the particular use to which the installation is to be put. The free ends of the laminae of each pair 4 are provided with mutually juxtaposed contact pieces which together form y contacts 5', 5", 5‴, etc. All these contacts (three of which only are shown in the drawing) are disposed all around the cylindrical surface of the drum 2. Also on the exterior of the drum and in the same manner, three laminae of the drum 2 shown at 6, jointly constituting a double contact 6' and 6" and these at a point where they are the last in the direction of travel (indicated by the arrow b) of the search arm 7 which is firmly mounted on the shaft 6 of the drum and the free end of which carries a roller 7a. The length of the search arm and the diameter of the roller are so dimensioned that whenever the arm extends radially toward a pair of contact laminae, or toward the three laminae 4, the respective contact is closed. Also mounted on the shaft 6 is a ratchet wheel 8, which collaborates with a resilient ratchet 9, the ratchet arm 10 being provided as a double lever pivoted at 13, the other end of which serves as armature 14 for a search magnet 12.

Under the influence of the spring 10a, the ratchet arm 10 abuts against the stop 10b. When the search magnet 12 pulls, the ratchet 9 slides across the tooth of the ratchet wheel 8 in front of it, into the tooth gap in front of this tooth, whereas following the drop of the search magnet, the spring 10a returns the ratchet arm 10 into the position of rest shown in the drawing, so that the ratchet wheel is turned in the direction of the arrow b by one tooth pitch. The dimensions are so selected that after each drop of the search magnet 12, the drum 2 is turned in the direction of the arrow b about an angle so that it corresponds to the angular distance between two adjacent contacts, so that following each drop of the search magnet 12 the next following contact 5', 5″, etc. or else the contacts 6 are closed.

The contacts 5', 5", 5‴ are individually connected with contact pieces of a selector 14, which in the embodiment illustrated in the drawing, is in the nature of a plug-in board but which may be provided in the form of any other type of selector known in the communication industry, such as a dial selector, for example. The plug-in board 14 comprises essentially two rows of parallel, electrically conductive rails disposed at right angles to one another and in spaced superposition.

The two rows are indicated at 15 and 16 in FIG. 2.

The number of rails 16 corresponds to the number y of contacts 5', 5", 5‴, etc., and the number of rails 15 corresponds to the number of symbols which might be woven in (alphabet, figures, punctuation marks, etc.), plus two additional rails. One of these additional rails 15 is correlated with an empty roller, and the other with the ornamenting rollers in a manner to be described below.

Each of the rails 16 is electrically connected with a contact of the search instrument, i.e. the rail 16' with the contact 5', the rail 16" with the contact 5", the rail 16‴ with the contact 5‴, etc. At the point of intersection of the rails 15', 15″, etc. of the upper, and the rails 16', 16", etc. of the lower series, all rails are provided with bores 17 wherein, for the purposes of connecting electrically a rail of the upper series with one of the lower,
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3, plugs 18', 18", 18‴', may be inserted. The electrical connections thus obtained may connect, for example, rails 10", 15", 16" and 15", and 16" and 15".

The embodiment illustrated in FIG. 3, includes a number of symbol-bearing stencils and ornamenting stencils, as well as an empty or plain stencil. The number of symbol-bearing stencils corresponds to the number of symbols which may be available to be woven in, and each symbol-bearing stencil is correlated with one particular symbol, whereas the number of ornamenting stencils corresponds to the number of ornaments desired. In the embodiment illustrated in the drawing, these stencils are provided in the form of rollers 20", 20‴, 20‴′, etc. As all these rollers, apart from differences to be noted below, are based on the same design, only one roller, namely the roller 20‴′, has been illustrated with all its essential details, and the correlated description is valid also for all the other rollers. Every roller is electrically conductive and carries conductive control pins 22 which radially project from the roller mantle. These pins 22 are disposed on circumferential rings 23 which extend transversely to the axis of the roller, and in rows 24 which extend in parallel to the roller axis. As will be explained below, apart from two exceptions, each rim of a roller corresponds to a warp thread, and there are provided as many rows as woofs are required for weaving in the particular symbol involved. The pins 22 are arranged on the rims beneath and above the ring, that is, when they reach a predetermined position, per woof, the correlated warp threads are directed to assume a position which effects a binding corresponding to the symbol to be woven in. In a manner to be described below, one complete rotation of each roller 20‴ effects all control procedures required for the weaving in of one symbol; once the rotation is completed, the roller correlated with the next following symbol is set to rotate, as will be explained below. In order that the symbols are woven in so they are properly spaced from one another, a spacing which is, for all symbols and which is determined by esthetic considerations, the weaving in of the next following symbol must not commence before the interspace has been woven. In the embodiment of the invention illustrated, this problem is solved by coordinating with each symbol a field which includes the symbol plug in order of the symbol itself, and plain, marginal portions on both sides of the symbol, the size of these marginal portions being adapted to the particular symbol flankedy thereby. The total field allotted to the symbol, therefore, covers an area varying from one symbol to the other. The symbol is disposed in the center of this field, and the marginal portions precede and follow the symbol, adjacent marginal portions of consecutive symbols thus forming the interspace between the symbols.

Insofar as the control of the weaving operation is concerned, the action of a symbol marking roller is limited to the weaving in of the symbol itself, whereas the weaving of the marginal portions is controlled by means and in a manner to be described below. As, however, the completion of one full rotation of a roller results in the actuation of the roller correlated with the next following symbol, the full rotation of the first-named roller must not be permitted to be completed before the marginal portions are woven. For this purpose, the rows 24 immediately preceding and immediately following the position of rest of each roller, are provided empty, i.e. without any control pins 22. With the roller 20‴′ the row which in the position of rest illustrated, faces the laminate 25, is denoted with 24a. As will be explained below, each row corresponds to a woof. If it is assumed that the marginal portions of the symbol correlated with the roller 20‴′, have a width of 4 woofs each, it follows that in addition to the row of symbols defining the position of rest, another seven adjacent rows must be provided empty, i.e. without control pins; more particularly, these empty rows must be provided to one, and four empty rows to the other side of the row defining the rest position.

In addition to the control pins 22 to control the weaving operation there are provided, on two additional rings 23a and 23b (foremost in the drawing), pins 22a and 22b which have other functions, the pins 22a being a stepping pin, and the pins 22b synchronizing pins. These additional pins, the stepping pin 22a is disposed on the foreside of the ring 23a in the direction of rotation (arrow d), just precedes the row 24a corresponding to the position of rest. The synchronizing pins 22b are arranged on the second rim, 23b, from the front, mutually displaced by four rows. With each of the rims 23a and 23b, a contact laminate 25 is coordinated, while with the rims 23a and 23b, contact laminate 25a or 25b, respectively, are correlated. The laminae are so arranged with respect to the rollers that when they face a pin 22, 22a or 22b, an electrical connection between the respective laminate and the roller is established. This connection is referred to below as a "pin contact," also as with a control relay 47. Across the diagrammatically indicated junctions 21, all rollers are connected with the positive pole of a battery 39 so that on closing of a pin contact, the positive potential is transmitted to the correlated relay 47. The same as laminate 25a, also laminate 25a, on the one hand, and all laminate 25b, on the other hand, are interconnected, the laminate 25a being connected with one of the contact pieces of relay contact 83a and 84a, respectively, while the laminate 25b are connected with the sole contact piece of the synchronizing contact 85.

The stepwise rotation of the rollers is effected by a stepping magnet 36 correlated with each roller. Every stepping magnet, on the one hand, is connected with that rail 15 which is correlated with the roller corresponding to the stepping magnet. Every rail 16, on the other hand, is electrically connected with the corresponding pair of contacts 5′, 5″, 5‴″ etc. of the searching instrument. The center laminate of the double contact 5a is connected with a plug-in board 92, and by insertion of a contact pin 5a into any of the three sockets 92a, can be connected with the stepping magnet of any one of three ornamenting rollers (not shown), which rollers mount pins 5a so disposed as to effect, by a control procedure to be described below, the weaving of an ornamental design. A further electrical connection exists between the rails 15 and the contact pins 5a of the ornamental roller, and the plug-in board 92. The wires leading to the stepping magnets are shown at 92b. The armature 40 of the stepping magnet 36 forms one arm of a two-armed ratchet lever 41 which is pivotally supported at 42, is influenced by a spring 43 and carries, at its free end, a ratchet 44 which collaborates with a ratchet wheel 45 mounted on the shaft of the roller 20‴′, the spring 43 forcing the ratchet lever 41 against a stop 41a. In consequence, whenever the magnet 36 pulls, the roller 20‴′ is rotated by one tooth pitch of the ratchet wheel, the rotary angle being so selected that consecutive axial rows 24 of control pins 22 are moved into reach of the contact pieces of the contact laminate 25. Accordingly, when the roller has completed a full turn, all control pins have been scanned by the corresponding contact laminate 25.

As shown in FIG. 4, the actuating mechanism for the weaving loom includes a stepping control magnets 47 responding to the number of pin bearing rims 23, and the magnets 47a, 47b etc. of these control relays are connected with a corresponding laminate 25 of each roller. The armature of each control relay is pivotally supported and influenced by a spring 49; it is provided as a double lever 46, an arm 46a of which is influenced by the spring 49, while the other arm 46b, the end of which is bent to form an abutment 50, is provided as a magnet armature.
When the control relay 47 is not excited, the abutment 50, under the influence of the spring 49, assumes a position (shown in dashes in FIG. 4) disposed in the path of a searching needle 51 which is supported for sliding vertical displacement; the top of this searching needle forms an eye which is traversed by the abutment 50, this searching needle being supported for pivotal and sliding displacement at 52. The free end of the thrusting needle 53 rests on a lifting rail 54 which, as is customary in weaving looms, alternately moves up and down so as to move the thrusting needles 53 into or out of range of a control prism 55 which, though replacing the usual thrusting rail, is moved back and forth just the same, in a well known manner, at right angles to the searching needles.

The control prism 55 is provided in the form of a roller having square section which not only can move back and forth but also can rotate. Each lateral surface of the prism displays two rows of perforations 86. The relative position of the control prism 55, the thrusting needles 53 and the lifting rail 54 is so selected that the ends of the thrusting needles facing the prism are disposed at the level of the upper or the lower row of perforations 86 dependent on whether the correlated searching needle is in its upper position (shown in full lines in FIG. 4) or in its lower position (shown in full lines in FIG. 4). This arrangement has the result that with every thrust (toward the right in FIG. 4) of the control prism all those thrusting needles 53 are moved, the prism-facing ends of which cannot enter into a perforation 86 so that they are carried along by the effective lateral wall of the control prism. The distribution of the perforations in the upper and lower rows alternates in the sense that the lower row has perforations wherever no perforations are provided in the upper row. In the embodiment illustrated in FIG. 4, these perforations are arranged in repeated groups of four, of which one perforation is disposed in the upper row whereas the remaining three are in the lower row. In the embodiment shown in FIG. 4, the three consecutive perforations in the lower row are combined into a single perforation of correspondingly increased width, i.e. a perforation as three times as wide as the usual individual perforation. Inasmuch as the width of any one perforation is so selected that adjacent thrusting needles can enter also adjacent perforations, it results from the arrangement of the perforations in the upper row, as shown in the drawing, that when all the relays 47 are without current so that all thrusting needles are disposed in their upper positions (shown in dashes in FIG. 4), the first, fifth, ninth, etc. needles will enter perforations on a thrusting motion of the control prism, whereas the remaining thrusting needles are pushed. This has the result, as will be apparent from the explanation given below, that of a group of four consecutive warp threads only one, namely the first, is lifted, while the remaining three are dropped from the center position.

The control prism can be stepwise rotated, each step involving an angular displacement of 90°, by means of a Maltese cross transmission 87, the driving disk 88 being driven through a transmission gear (not shown) by the main control shaft 89; in consequence, on each quarter turn the next following lateral surface of the prism is placed into an effective position with respect to the ends of the thrusting needles. From one lateral surface of the prism to the next following in the direction of rotation (arrow e), the perforations are mutually displaced by one graduation (toward the right as shown in FIG. 4), so that on the next thrust motion of the control prism the second, sixth, tenth, etc. thrust needle enters a perforation so that it cannot be pushed forward. On completion of the next quarter turn the third, seventh, eleventh, etc. needle enters a perforation, until with the first lateral surface return to the effective position, the cycle recommences. In view of the effect on the warp threads mentioned above, it results that by the described control of the thrusting needles when the control relay 47 is without current, i.e. in the absence of any control impulses of the control rollers, a smooth twill binding is obtained.

By a corresponding variation of the control prism it is of course possible to produce other types of bindings. If, for example, the control prism has a regular pentagonal section, the control prism is stepwise rotated about 72° and the perforations of a lateral surface are so disposed that of any group of five, the same is always disposed in the upper row whereas the four others are disposed in the lower row. The control procedure described above results, in an analogous manner, in an atlas binding.

In the situation just mentioned where all that matters is to obtain a certain type of fabric when the control relay 47 is without current, the lower perforations do not play any part. They serve exclusively the purpose of weaving, in collaboration with the control relays 47, any optional design.

The control prism is further equipped with a cam 90 having a circular in section, in the path of which there extends a pin 91 of a resilient contact lamina of the synchronizing contact 85, so that this contact is closed whenever the cam 90 comes within reach of the pin 91. The respective contact lamina is connected via the disconnecting magnet 81, with the negative pole of a battery 37.

As mentioned above, the control prism moves back and forth in the direction of the axis of the thrusting needles so that those needles, which do not enter a perforation when the control prism moves toward the hook 56, abut by means of the head 52e against one shank 56a of the hook 56 so as to move the bent top end 56c thereof out of reach of the knife 57. The free end of the other shank 56b of the hook is likewise bent and is disposed within reach of the lower knife 58. As usual, the knives 57 and 58 are driven for vertical back and forth motion, the upper knife moving from the center position shown in full lines, into the upper position (shown in dashes in FIG. 4) and back, whereas the lower knife 58 is arranged to move from the center position to a lower position (shown in dashes in FIG. 4) and back. On each hook 56 a chord thread 59 is secured, and on this strand 60, the loop 68e of which is traversed by the warp thread 61. The free end of the strand 60 is connected, through a spring 62, with a stationary part of the installation so that the hook is pulled downward at all times and is subjected to upward displacement only by the upward motion of the knives, overcoming the force of the spring 62.

In addition to their connection with the contact lamina 25, the relays 47 are electrically connected with the switch 63 which, the same as switches 38 and 64, is formed by a pair of contact laminae. The three contact laminae are disposed within reach of a cam roller 66, mounted on the main control shaft 89 and provided on its circumference, with three radially projecting cams 66a, 66b and 66c which are displaced relative to one another in axial direction. In the path of each of the cams 66a, 66b and 66c, one lamina of each of the switches 38, 63 and 64 is disposed, so that when the cams 66a-66c abut against the respective laminae, the correlated switch is closed. Remaining details of the electrical connections will be apparent from the wiring diagram in the drawing.

It was explained above that every pin-carrying rim 23 is scanned by a contact lamina 25 correlated therewith. The result of the scanning depends on whether in the scanned row 24, a control pin 22 correlated with the respective contact lamina is inserted or not. The contact laminae for corresponding pin-carrying rims 23 of the various rollers 20", 20", 20"", are electrically interconnected.

The contacts between the contact lamina correlated with each pin-carrying rim of every roller, and a control pin of the respective rim, control through a relay 47 and a hook 56, a warp thread 61 so that, as mentioned above,
the number of rims corresponds to the number of warp threads required for the weaving in of the particular symbol involved, while the number of rows 24 of pins is equal to the synchronizing number of warp threads required. If, for example, it is intended to weave into a towel the sequences marking up the design in cooperation with plugs 18', 18'' and 18''', then these plugs are plugged into the plug-in board so that the first rail (16') of the series 16 is connected with that rail (15') of the series 15 (plug 18''), which in its turn is connected with the stepping magnet of that roller (20') which corresponds to the first part of the design which is in three parts because of the plugs. In order to facilitate the procedure, the rails of the series 16 are consecutively numbered from the left toward the right corresponding to the sequence of symbols, while the rails of the series 15 are marked from top to bottom with the symbols (A, B, C, etc.). The second rail (16'') of the series 16 is connected by means of the next plug 18'' with that rail (15'') of the series 15, which corresponds to the second roller (20'') and the third (16'''') with that (15'''') which corresponds to the third roller (20'''). If with respect to the searching instrument, the position shown is assumed to be the starting position, the search arm 7 closes the contact 5', so that when the main switch 39 is closed, the main control shaft 89 revolves and the cam shaft 66 has now rotated to a point where the cam 66b closes the stepping magnet 36 of the first roller 20' is connected, on the one hand, through the plug-in board 14, the pair of contacts 5' and the mantle of the drum 2 with the plus pole, and, on the other hand, through the switch 64 with the minus pole of the battery 37. In consequence, the magnet 36 pulls and rotates the first roller to the next row 24. As mentioned above, however, the first four rows contain no pins 22, except for the synchronizing pins 22b disposed in the second row counted from the position of rest. In view of the absence of pins 22 in the first row, none of the control magnets 47 pulls and all searching needles remain in their upper position (shown in dashes in FIG. 4). The control prism 55 which is driven by the main control shaft 89 in rotary fashion as well as back and forth in a translatory manner in the direction of the thrusting needles 53, now pushes forward, in the manner described above, the three last thrusting needles of every group of four. As soon as the main control shaft 89 has been subjected to rotary displacement to a point where the cam 66b permits the switch 64 to open, the stepping magnet drops, to rotate again, on a further rotary displacement of the main control shaft, the A-roller 20' by another further row; this new row which now faces the laminae 25, also is not provided with any pins. While this went on, the control prism has moved, in a well-known manner, toward the left in FIG. 4 and at the same time, has been subjected to an angular displacement of 90°, so that now the adjacent lateral surface provided with perforations 86 which are displaced by one graduation toward the right in FIG. 4, faces the thrusting needles 53. In the same manner, the thrusting needles, now, however, with the exception of the second one of each group of four, are pushed forward. The same motions and control functions are repeated until the A-roller has rotated to a point where the contact pin 91 has been set free by the cam 90, with the result that the synchronizing contact 85 opens. The circuit of the connecting magnet 51 thus remains interrupted. On the next but one rotation of the roller 20', the laminae 25 face a row provided with pins 22, and the marginal portion in front of the character A has been completed in the form of a plain twill binding. It is evident that the synchronizing of the movements of the rollers and the control prism has a signal importance. The synchronism is controlled, on the one hand, by synchronizing pins 22b and the correlated contact laminae 25b, and on the other hand by the cams 90 and the synchronizing prism 85. The lamina corre-
follows the knife 58 from the center into the lower position.

As soon as the cam 66a has left the region of the contact laminae of the switch 63, the previously excited control relays 47 drop and their armatures return under the influence of the springs 49 into their starting position (shown in dashes in FIG. 4). The further rotation of the cam shaft 64, which causes the stepping magnet 36 to pull and the empty roller to rotate about the angular distance between two rows of pins so that now the next following row of control pins is subjected to scanning. The cam 66a thereupon again effects closing of the circuits of the control relays 47, which results in the manner already described, in the corresponding control of the hooks 56 and consequently, the warp threads 61. The successive scanning of the rows of control pins of the stepping magnets, selected by the selector 14 and energized by the scanning instrument 1, of a roller renders possible to so control the warp threads, that on principle any optional binding can be produced, and in particular one where a woven in symbol appears. When in the manner described above, all rows of control pins of the first roller have been scanned, the laminae are again faced by a succession of empty rows, i.e. rows containing no control pins, and the control prism controls directly and with no pull of the relay contact 50 has been arranged in the manner described in FIG. 4a and 4b, without any previous opening of the switch 63. The switch 38 now closes the circuit: negative pole of battery—main switch 39—switch 63—second winding of relay 82—contact 83a—lamina 25a—stepping pin 22a—roller 20—positive pole of battery, and closes the contacts 82a and 83b. In further rotation of the cam shaft, the cam 66c closes the switch 38 and this, as derived from the angles at the centers of these cams shown in FIGS. 4a and 4b, with or without any previous opening of the switch 63. The switch 38 now closes the circuit: negative pole of battery—main switch 39—switch 82b—first winding of relay 82—positive pole of battery, so that the relay 82 is held even if now the switch 63 opens, and the cam 66c closes the switch 64, which causes the stepping magnet 36 of the first roller to pull so as to rotate the same into its position to rest. When the relay 82 pulls, however, the closing of the switch 64 further results in the pulling of the search magnet 12, by the circuit: negative pole of battery—main switch 39—switch 64—contact 83b—lamina 25b—positive pole of battery, but this does not effect the rotation of the search arm as this pivots, because of the ratchet arrangement selected, only when the search magnet drops. A further rotation of the main control shaft 89 with the cam shaft displaces the cams 66a and 66c simultaneously out of reach of the correlated contact laminae, so that the switches 64 and 38 both open. This causes the relay 82 to drop, the search magnet 12 is deprived of current and the search arm is pivoted about the angle between two adjacent pairs of contact laminae. In the embodiment of the invention described, the search arm now closes the contact 50, whereby the relay 16 and with it, by the plug 18", the relay 15" of the 15 series is energized, so that in place of the stepping magnet of the first roller, now that of the second roller 20" is energized, so that this roller is driven and starts to control, corresponding to the arrangement of its pins, the hooks 56.

The control procedures described above are repeated until the sequence making up the design from the plugs which are selected on the plug-in board is woven, by causing the search arm to effect the operation of the rollers corresponding to these characters, the marginal portions of the letter fields being the absence of relay control, by means of the control prism. If, for example, an inscription consisting of several words is to be woven in, a plug 18 is so plugged in on the board that the relay 16 following the relay 16 corresponding to the last letter of the first word, is connected with the empty or plain roller with the result that when the first word is finished this empty or plain roller is rendered operative. This empty roller is provided with no pins other than the stepping pin 22a and the synchronizing pins 22b, so that the control of the thrusting needles is not assumed by the control roller, but in the weaving of the marginal portions. Otherwise the empty roller operates the same as any symbol-bearing roller, its diameter, i.e. the number of rows, necessarily being adapted to the desired width of the empty space between successive words, in the inscription to be woven in.

It may be required to weave an ornamental design following the sequence of symbols woven in. For this purpose, a corresponding plug is plugged into the board 14 so as to connect the next following pair of contacts 5 through a rail 16, with the rail 15 correlated with the ornamenting rollers. The ornamenting rollers, on principle, are constructed in precisely the same manner as the symbol rollers, so each has associated with it a stepping magnet 36, a synchronizing pin 22b and a stepping pin 22a, with the last-named pin designed to cooperate with a lamina 25c in the same manner as explained with reference to the symbol rollers. This lamina 25c is connected with other parts of the device exactly the same as the corresponding laminae of the symbol rollers. The only difference in the control of these rollers resides in that with the ornamenting rollers, the stepping magnet is not directly connected with a rail 15, as is the case with the symbol rollers, but is connected with a plug-in board 92 which in turn is connected with a rail 15 as well as with the center contact of the double contact 5a. The respective rail 15 is connected with another plug-in board 92 of each of whose sockets 92a is connected with the stepping magnet of an ornamenting roller. By plugging a plug into one of the sockets 92a it is thus possible to effect the connection of the respective rail 15 with the stepping magnet of a selected one of a number of ornamenting rollers. This renders possible to select any one of a whole series of ornamental designs. In the direction of travel of the search arm 7, in the last place on the drawing ornamenting rollers, which operate much the same as the symbol-bearing rollers described above. It results that the search arm successively closes the contacts 5', 5"... whereas the individual rollers are set to operate. When the sequence of symbols to be woven in is completed, the remaining, unused rails 16 are connected by a corresponding insertion of plugs, with the rail corresponding to the ornamenting rollers. When all these contacts 5', 5"... of the series of symbols have been actuated by the search arm, the search arm encounters finally the contact 5e the closure of which results in establishing a direct connection to the plug-in board 92. The closure of the contact 5e further results in the pulling of relay 83 and the consequent opening of the contact 83a. The effect, to be explained below in detail, of the pull of relay 83 consists in that the ornamenting roller selected by insertion of a plug into one of the sockets 92a of the plug-in board 92 can effect an optional number of rotations while when the stepping magnet is energized by a rail 16, the search arm effects further stepping following each full rotation of the ornamenting roller. This continuous further stepping is also the reason for the fact that when an ornamental design is to be woven before the search arm has actuated all pairs of contacts, the continuation of the weaving of
the ornamental design must be effected by the introduction of plugs.

FIG. 5 illustrates a stopping and metering mechanism which permits determining the lines of separation between continuously woven yet later to be separated cloth (such as towels, for example), as well as the disposition of the woven in inscription between these lines of separation, and which permits moreover a stopping of the loom following completion of a certain number of pieces of material.

The metering device comprises two co-axial drums 94 and 95, of which the drum 95 is firmly mounted on their joint shaft, which may be driven by any appropriate component of the loom, whereas the drum 94 is merely forced against the face of the first mentioned drum by a spring 97 which may be adjusted by a screw 96, this drum 94 being carried along by the first mentioned drum yet being capable also of rotary displacement relative thereto. The drive of these drums is so selected that a complete rotation of these drums corresponds, for example, to the length of a towel to be made. The drum 94 is provided with radially projecting contact pin 98, which during each rotation of this drum closes once the double contact 99. The closure of the contact 99 effects the pulling of the relay 100, the winding of which is connected to the negative pole of the battery while the positive pole of the drum 94 is connected with the positive pole of the battery. The armature 100A connected with the positive pole of the battery, of the relay 100, is so designed that when the relay pulls, all laminae 25 are short-circuited, and thus all relays 47 are caused to pull. This results in a pulling of all thrusting needles into their lower position so that only the lower rows of perforations on the control prism are operative. Thus, as long as the contact 99 is closed, which because of the continuous rotation of the drum 94 does not last long, faulty bindings are produced which are visible in the finished goods in the form of markings indicating where the length of cloth is to be cut, for example, into individual towels. As soon as the contact 99 opens again the relay 100 drops and the normal weaving operation is resumed. A further consequence of the closure of contact 99 is the pulling of the metering relay 75 the armature of which is provided in the form of a ratchet lever 74, which whenever the metering relay 75 pulls, rotates the ratchet wheel 73 including a pointer 77 firmly mounted thereon, by one tooth pitch. The pointer 77 moves across a dial 76. In the beginning of the weaving operation, the pointer is adjusted to the number of pieces, e.g. towels, to be produced, and on every rotation of the drum corresponding to the length of the towel, it approaches by one dial division equaling one tooth pitch, the zero position represented in FIG. 5, in which a contact pin 72 mounted on the ratchet wheel 73 closes the contact 79. This causes the stopping magnet to pull, with the result that the loom is stopped.

The drum 95 has disposed on three rims, a pin 101 and two pairs of pins 102a and 102b, and 103a and 103b, the single pin as well as the two pairs of pins being designed to collaborate with correlated resilient laminae of contacts 104, 105 and 106, respectively. These resilient laminae are all connected with the positive pole of the battery, while the counter-laminae of these contacts are connected with the plug-in board 107 where they can be connected, by insertion of a plug, across a second winding of the relay 84 with the negative pole of the battery. Adjacent marginal portions of the mintles of the drums 95 and 94, are provided with a scale 108 and a marker 109, respectively.

When the pin 101 abuts against the correlated contact spring lamina, which happens once during each rotation of the drum 95, and if a plug is inserted in the bottom socket of the plug-in board 107, as shown in FIG. 5, the relay 84 is energized by the circuit: positive pole of the battery—plug-in board—second winding of the relay 84—negative pole of the battery, and closes the contacts 84a and 84b. The contact 84a is a self-holding contact for the relay 84. This self-holding contact serves the purpose of making sure that the relay 84 is energized until a stepping pin 23e of the ornamenting roller is rendered operative regardless whether the contact 104 remains closed during this time. The closure of the contact 84b effects, when the switch 63 is closed, the contact 83e is open and when a stepping pin 23e of the ornamenting roller contacts the corresponding lamina 25a, the pulling of the relay 82 by the circuit: negative pole of battery—main switch 39—switch 63—second winding of relay 82—contact 84b—lamina 25a—stepping pin 23e—roller 20'—positive pole of battery. This has as consequence, however, as previously remarked, that with the switch 83 closed, the search magnet 12 can pull and the search arm 7 can be rotated. Thus, the closure of the contact 104 has the result that when an ornamenting roller is operative and therefore, by pulling of the relay 83, the contact 83e is opened, i.e. a stepping of the search by a stepping pin cannot occur, this stepping across relay 84 is now initiated so the weaving in of symbols can commence.

In order to cause the sequence of symbols to be woven in to be disposed in the center of the towel, i.e. in the center between two cutting marks produced by means of the pin 98, it is necessary to provide for the possibility, dependent on this symbol, of varying the relative positions of the pims 98 and 101, i.e. of the drums 94 and 95. This possibility is afforded by the rotary displacability of the drum 94 relative to the drum 95, the extent of this relative rotary displacement of the two drums being visualized by a reading of the marker 109 on the scale 108. A table should be provided indicating for given lengths of material and varying numbers of symbols to be woven in, the scale value of the rotary displacement.

The pins 102a and 102b of the second rim, and the pins 103a and 103b of the third rim determine, the same as pin 101, the commencement of the weaving in of symbols and this in cases, where, in contrast to the pin 101 which merely permits one weaving in operation per length of a piece of fabric, such as a towel, the sequence of symbols is to be woven in twice. The pins 102a and 102b are released relative to one another by 180°, so that the sequence of symbols is woven in at regular intervals. The pins 103a and 103b, however, are displaced about an angle deviating from 180° so that the distance between the first and second sequence of symbols is smaller than that between the second and third sequence.

This latter arrangement is useful in connection with relatively short sequences of symbols which are disposed in the vicinity of one another, e.g. on a towel near the center thereof.

From a purely electrical point of view, all these pins serve the same purpose, namely to initiate the beginning of the weaving in of the symbols. Depending on whether per length of the individual piece of fabric produced, a single sequence of symbols, or two regularly distributed sequences of symbols, or finally two irregularly distributed sequences of symbols are to be woven in, a plug is inserted in the plug-in board 107 in the bottom, center or top sockets respectively.

It is apparent from the above description that the time consuming punching operations on punched cards used up to now, are eliminated by the invention which simply requires an appropriate connection of the rails 15", 15"", etc. and 16"", 16", etc., respectively, i.e. by a corresponding insertion of the plugs 18", 18", etc., renders operative the appropriate stencil carriers in a predetermined and readily selectable sequence. The time gain obtained by the invention is so material that in contrast to the equipment known up to now, the invention renders commercially feasible to weave in inscriptions or any other sequences of symbols even in small quantity.

It is evident that the stencil carriers are not necessarily provided in the form of rollers but may be of any other
well known type. Thus, the rollers might be replaced by a continuous paper roll or an endless metal foil with perforations, a pin-carrying disk or a correspondingly premagnetized ribbon which corresponds to a predetermined symbol. It is essential, however, that means are provided which permit the energizing of the control magnets at the right time and in the correct sequence.

I wish it to be understood that I do not desire to be limited to the details of construction, design and operation shown and described as numerous variations falling within the scope of the following claims and involving no departure from the spirit of the invention nor any sacrifice of the advantages thereof, may occur to persons skilled in the art.

I claim:

1. Equipment for weaving looms for interweaving warp and weft threads to form sequences of symbols, including stencil carriers correlated with each symbol, means for scanning the stencil, and means for transmitting the scanning result to the warp threads, comprising in combination, a searching instrument for rendering the stencil carriers operative, and a selector for predetermining the sequence in which said searching instrument renders the stencil carriers operative.

2. The device according to claim 1, wherein the stencil carriers comprise rollers and control pins on said rollers, and the scanning means comprise contact laminae adapted to make contact with said control pins.

3. The device according to claim 2, wherein the rollers comprise stepping pins, the searching instrument comprises a search magnet, said stepping pins being adapted, when scanned by the correlated contact laminae, to cause pulling of said search magnet.

4. The device according to claim 2, wherein the stencil rollers are subdivided into circumferential rims with said rims carrying said control pins in rows arranged parallel to the roller axis, one control pin being insertable at the intersection of each rim and row, one contact lamina being correlated with each rim, whereby to scan all control pins disposed in any one row simultaneously.

5. The device according to claim 4, comprising control relays, windings on said relays, raising and lowering means for the warp threads controlled by said relay windings, and wherein the contact lamina of corresponding rims of all stencil rollers are electrically connected with one another, and with the winding of one of said relays.

6. The device according to claim 5, comprising a control prism having an equilateral polygonal cross-section, the number of sides of said prism depending on the prevailing number of picks required to repeat the weave, and thrusting needles extending toward said prism so as to be controlled by said prism.

7. The device according to claim 6, wherein each lateral face of the control prism comprises two rows of perforations, said thrusting needles being arranged in groups, the number of needles in each group corresponding to the number of warp threads in one pattern, and the number of groups of needles corresponding to the number of repeats, warpwise of the pattern, said rows of perforations being spaced apart and arranged to alternately control said needles.

8. The device according to claim 7, wherein the two rows of perforations on the respective lateral faces of the control prism are superposed and disposed in levels corresponding to the positions of the thrusting needles as displaced by said raising and lowering means.

9. The device according to claim 6, including an electrical loom shut-off means, contacts in the circuit of said loom shut-off means, the stencil carriers and the control prism comprising control means, said control means being adapted to influence said contacts to actuate said loom shut-off means.

10. The device according to claim 1, wherein the selector comprises a plug-in board, two series of intersecting, yet spaced rails on said board, means for electrically connecting said rails at the points of intersection; the searching instrument includes a plurality of contacts, and means are provided for electrically connecting each rail of one series with a stencil carrier, and each rail of the other series with a contact of said searching instrument.

11. The device according to claim 10, including a stepping magnet for actuating each stencil carrier, the stencil correlated series of rails being connected with said stepping magnets.

12. The device according to claim 1, wherein the stencil carriers include ornamenting rollers, stepping means are provided for actuating said ornamenting rollers, and the searching instrument includes contacts correlated with said ornamenting rollers, said contacts, when closed, being adapted to render said stepping means inoperative.

13. Equipment for weaving looms for interweaving warp and weft threads to form sequences of symbols, including stencil carriers correlated with each symbol, means for scanning the stencil, and means for transmitting the scanning result to the warp threads, comprising in combination, a searching instrument for rendering the stencil carriers operative, and a selector for predetermining the sequence in which said searching instrument renders the stencil carriers operative, and further including means for determining the position of the symbol to be woven in, on the fabric, comprising two members jointly driven by the loom yet displaceable relative to one another, one of said members including means for initiating the weaving in of a symbol, and the other member including means for producing cutting marks.

14. The device according to claim 13, comprising a metering means and a loom shut-off means, the cutting marks producing means on one of said loom driven members being adapted to actuate said metering and said loom shut-off means.

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