

Nov. 8, 1938.

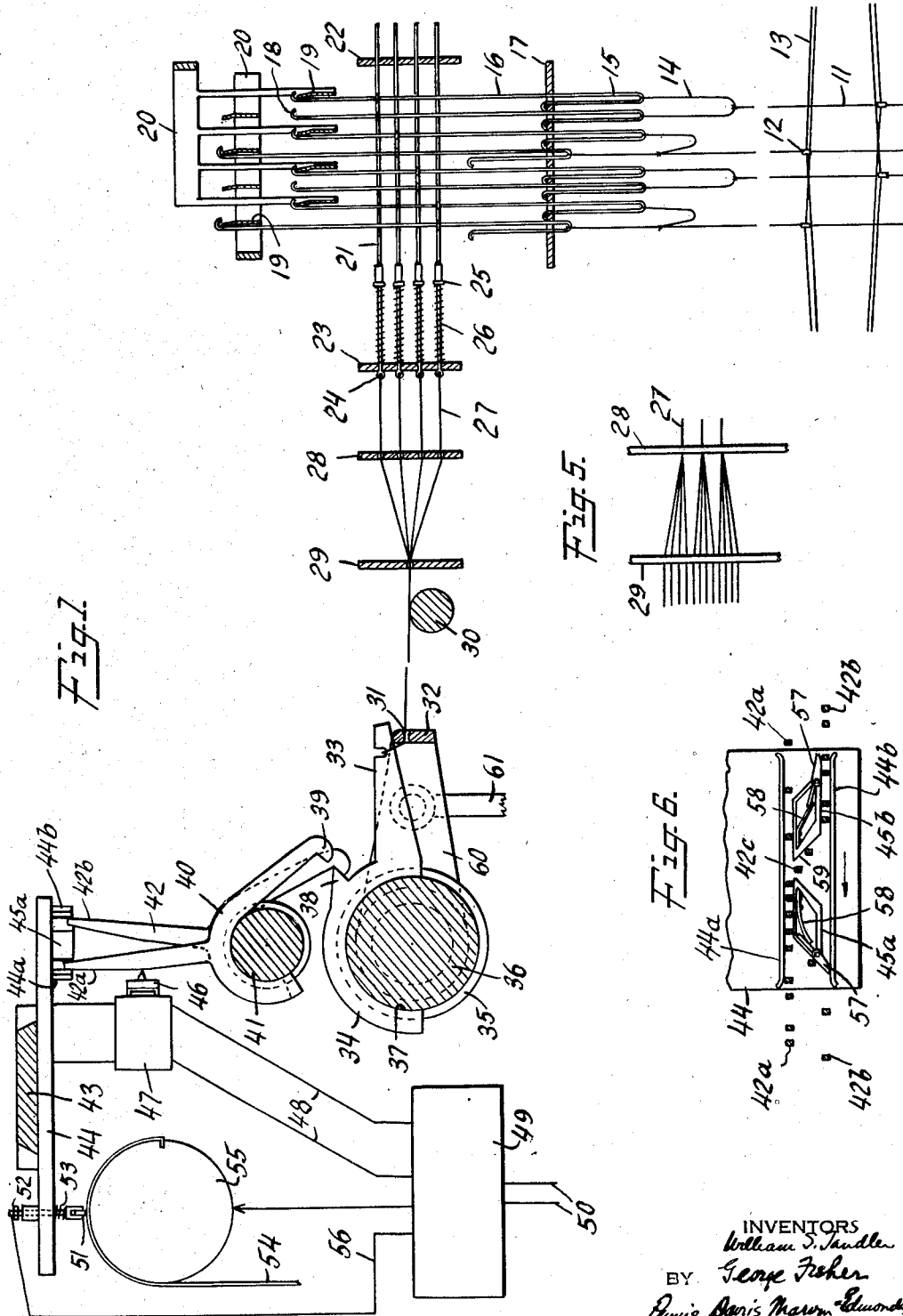
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2,136,064

TEXTILE MACHINE

Filed Sept. 17, 1936

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

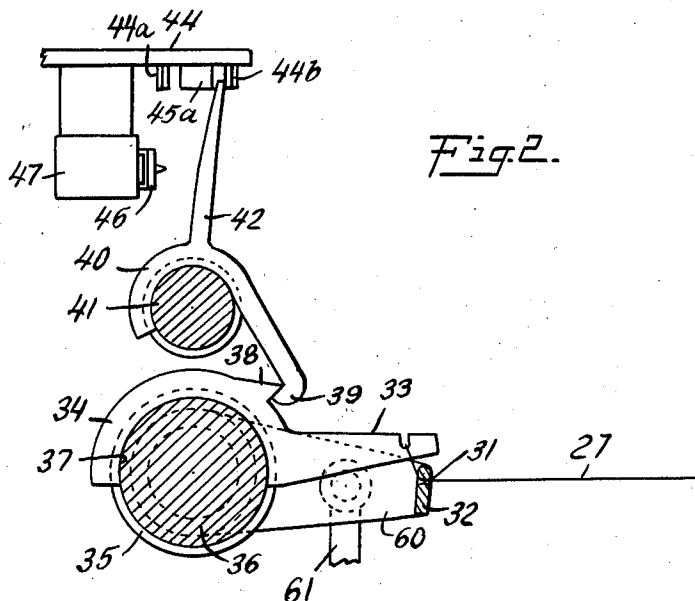


Fig. 2.

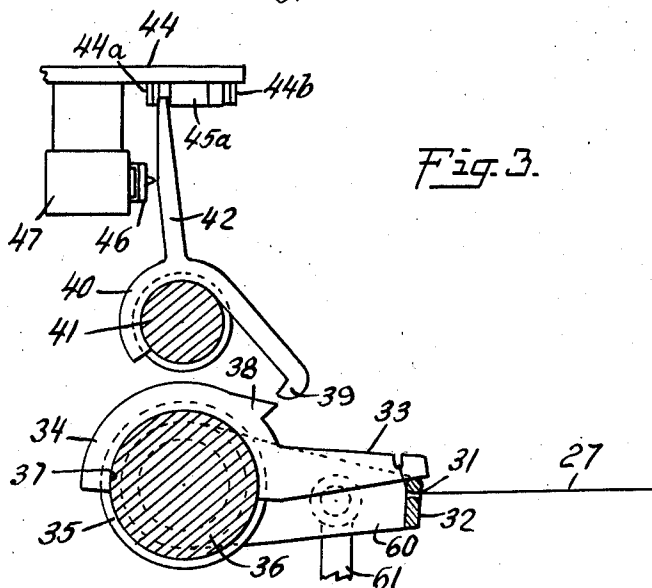


Fig. 3.

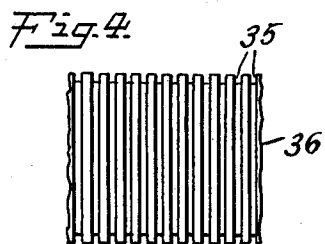
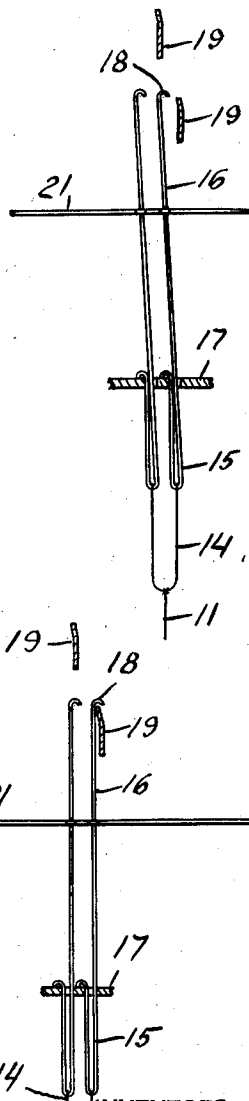


Fig. 4.



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TEXTILE MACHINE

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25 Claims. (Cl. 139—55)

This invention relates to apparatus used in connection with looms for controlling the operation thereof in weaving figured fabrics, and is concerned more particularly with a novel pattern control mechanism of the electro-mechanical type which functions to control the heddles of a loom so as to effect the formation of sheds of warp threads selected in accordance with a pattern. The new device employs a pattern sheet carrying a representation of the design which is to appear on the fabric, and includes selecting devices, the operation of which is controlled by mechanism scanning the sheet. The apparatus of the invention thus obviates the necessity of preparing a set of punched cards, such as are used with a Jacquard mechanism, for each pattern to be reproduced, and consequently simplifies and reduces the cost of manufacturing patterned fabrics.

The principles of the invention may be embodied in various types of apparatus as, for example, in one form, the mechanism may be used to control the needles and hooked wires attached to the heddles of the loom, thus taking the place of the cards, card barrel, and associated elements of a Jacquard mechanism, while, in a modified form, the mechanism may be employed to shift selected heddles directly. For purposes of explanation, the first type of apparatus referred to will be illustrated and described in detail, but it is to be understood and will be readily apparent that the utility of the invention is not restricted to that particular form of embodiment.

In looms equipped with a Jacquard mechanism as now commonly constructed, the heddles are attached to hooked wires, each of which is controlled by a needle, and these needles are engaged by punched cards which are brought successively into operation. As each card is advanced to the needles, selected needles are moved and their associated wires are thus displaced out of the path of the lifting knives, the needles being restored to their original positions by springs, when the card is removed. With such a mechanism, therefore, a card must be provided for each shedding operation, and the cost of preparing the cards is, accordingly, an important item in the cost of the finished fabric, particularly when the pattern is elaborate and requires a large number of cards.

According to the present invention as embodied in the form of apparatus to be described in detail, the pattern control mechanism includes a plurality of control devices, one for each heddle or for each group of heddles to be actuated in unison, and each such device includes a control member connected to the heddle or group of heddles

through the hooked wire to which the heddle or group of heddles is connected and the needle associated with that wire. Means are provided operable to impart a movement to all the control members, once for each shedding operation, and the selection is accomplished by selectively operated elements which are brought into action in accordance with the pattern and alter the operation of the moving means on the selected control members. Whenever a selecting element functions, the operation of the moving means thereafter is effective through the control device associated with that element to prevent the corresponding heddle or heddles to be raised by displacing the hooked wire controlled by the device from the path of a lifting knife. The moving means is, however, without such effect with respect to the heddles under the control of devices whose respective selecting elements have not functioned. The selecting elements are then selectively operated by means of an electromagnetic device which is supplied with current under the control of a scanning mechanism which scans the pattern sheet.

For a better understanding of the invention, reference may be made to the accompanying drawings, in which

Figure 1 is a view, partly in vertical section and partly in elevation, of the control mechanism and the loom parts controlled thereby;

Figures 2 and 3 are fragmentary sectional views illustrating the operation of the control mechanism;

Figure 4 is a fragmentary elevational view of a part of the control mechanism;

Figure 5 is a plan view of a portion of the flexible connectors employed in the control mechanism; and

Figure 6 is a fragmentary bottom plan view of a cam employed in the control mechanism.

Referring now to the drawings, the control mechanism is shown in Figure 1 employed in connection with a loom which includes the usual heddles 11 each having an eye 12 through which passes a warp thread 13. These heddles are attached by loops 14 of cord to loops 15 formed in hooked wires 16 normally resting on a supporting board 17. The wires are provided at their upper ends with hooks 18 which may be engaged by knives 19 of a pair of lifting frames 20 and the position of each wire relative to the path of knives is controlled by a needle 21 operatively connected to the wire by a loop through which the wire passes. The needles 21 are supported at opposite ends by the boards 22, 23 and each needle is

formed with an eye 24 lying beyond the outer face of the board 23. On the other side of this board, each needle carries a collar 25 and is encircled by a spring 26 bearing at one end against the collar and at the other against the inner face of the board 23. The springs thus serve to hold the needles with their eyes 24 tight against the outer face of the board 23 and with the hooks of their associated wires in the paths of the knives.

Connected to the eye of each needle is a flexible connector 27, which may be a wire, cord, or the like, and these connectors pass through individual openings in a guide board 28 and then through openings arranged in a single straight line in a guide board 29. The connectors are then led over a guide rod 30 and through individual openings 31 in an operating bar 32 and are connected, respectively, to the ends of arms 33 of control members 34.

The control members 34 are preferably flat plates of metal resting in circumferential slots 35 formed in a spindle 36, and the members have inner curved surfaces 37 which conform to the surfaces of the bottoms of their slots. Each control member is provided with a projection 38 which may be engaged by a hook 39 on a selecting element 40, the selecting elements being mounted in circumferential channels in a spindle 41. Each selecting element is provided with an operating arm 42 by which the element may be swung to place its hook in position to engage the projection 38 on its associated control member, and the elements are so shaped and mounted that they are substantially balanced.

Mounted on a support 43 extending lengthwise of the group of selecting elements is a carriage 44 provided with a pair of cams 45^a, 45^b, shown more clearly in Figure 6, and also mounted on the carriage is an electromagnetically operated hammer 46 which acts on the arms 42 of selected elements 40 and moves those elements on their spindle 41 as the carriage is moved along the support 43 by suitable means. The hammer and its operating mechanism which may be designated, for convenience, an electromechanical translating device, may take various forms, and in one form, which may be advantageously employed, the hammer is a bar which serves as the armature of an electromagnet 47 and is provided with a stud, the bar being also acted on by a spring which opposes the action of the electromagnet on the bar. When the electromagnet is energized, the bar is moved toward the selector elements so that the stud strikes the arm of any element to which the stud is opposed and moves the element on its spindle. Upon deenergization of the electromagnet, the spring restores the bar to its initial position, in which the stud is ineffective to act on the selecting elements.

Current is supplied to the electromagnetic hammer through lines 48 from an amplifier 49 receiving power through lines 50 from a suitable source, and the flow of amplified current to the hammer is under the control of a scanning mechanism scanning a sheet carrying a representation of the pattern which is to appear in the fabric. The scanning mechanism may be of either the photoelectric or direct contact electrical types, such as are disclosed in the copending application of Fisher, Tandler, and Carlisle, Serial No. 92,112, filed July 23, 1936, and, for purposes of explanation, a simple direct contact scanning device is illustrated diagrammatically in Fig. 1. This device includes a roller 51 mounted in a spindle 52 supported in the carriage 44 and

pressed lightly by a spring 53 against the surface of a pattern sheet 54 which is attached at one end to a cylindrical support 55 rotated with a step by step movement by means not shown. The sheet 54 is of electro-conductive material, such as thin copper, and carries a representation of the pattern thereon with the background bare and the figures formed of insulating material, such as varnish or paint. The support 55, sheet 54, roller 51, spindle 52, and amplifier 49 are in a circuit with the source of power through lines 56, and as the roller moves over the sheet, the circuit is closed whenever the roller is in contact with a conductive area on the sheet, and is open when the roller contacts with an insulated area. Each time the circuit is closed, amplified current is supplied to the electromagnet of the hammer, and the hammer strikes the arm or arms 42 of one or more of the selector elements and shifts the ends of the arms into the path of cams 45^a, 45^b. Thus, if the roller contacts with a bare or conductive area of considerable extent on the pattern sheet, the electromagnet will remain energized for a period of time in which the hammer is moved past several selector elements and so long as the electromagnet continues in energized condition, the hammer will remain in a position in which it will strike and shift the ends of the selector elements, as it is moved past them. When the circuit is opened, the hammer is moved by its spring to a position in which it does not act on the selector elements.

Each of the cams 45^a, 45^b on the carriage 44 is generally diamond-shaped and each cam is provided with a pivoted tongue 57 acted on by a spring 58, these tongues operating alternately for purposes presently to be described. The carriage is also provided with a pair of spaced ribs 44^a, 44^b lying on opposite sides of the group of arms 42 of the selecting elements 40.

In the operation of the device, the control members 33 are initially supported in an upper position on top of the bar 32, and all the needles 21 have been forced to the right (Fig. 1) by their springs 26 so that the hooked wires associated with the needles are all in the paths of the lifting knives 19. At this time, certain of the selector elements 40 may be in a position in which their arms 42 are inclined to the left (Fig. 1) as indicated at 42^a, and out of the path of travel of the cams 45^a, 45^b, while other elements may be so disposed that their arms 42 are inclined to the right in the position indicated at 42^b.

As the carriage is moved along the group of selector elements, for example, in the direction indicated by the arrow in Fig. 6, the tongue 57 on the leading cam, in this case cam 45^a, engages the arms which lie in the position 42^b and the ends of these arms move up the sloping front surface of the cam and are restored to the position 42^a in contact with the guide rib 44^a. During the movement of the carriage, current is supplied to the hammer to actuate it at different times as determined by the pattern sheet, and whenever the hammer operates, it strikes one or more of the arms of the selector elements and moves these arms to the position indicated at 42^c, Fig. 6. This movement of a selected element causes the end of its arm to be placed in the path of the inclined front surface on the trailing cam, in this case surface 59 on cam 45^b, and as the carriage advances, the end moves along that surface until the arm is swung to the position indicated at 42^b in contact with the rib 44^b. The tongue 57 rides over the ends of the arms in con-

tact with the rib 44^b and the selected elements then remain in a position in which their hooks 39 lie in front of the projections 38 on the corresponding control members.

5 The bar 32 is movable up and down, and for this purpose is preferably mounted on arm 60 pivoted on the spindle 36 and moved by a link 61 attached to one of the arms and operated in any suitable way as by a cam. As soon as the carriage has completed its travel along the group of selector elements, the bar is moved down and the control members which are not restrained by their respective selector elements move with it. This downward movement of the bar and of the
10 unrestrained control members has no effect on the needles attached to those control members because the top of the guide rod 30 engaged by the connectors is substantially in the same horizontal plane as the axis of spindle 36, so that the connectors merely swing about the top of rod 30 as an axis. The downward movement of bar 32 does produce a pull, however, on the connectors of those control members which have been selected and restrained, and the pull on the
20 connectors referred to moves their associated needles so that the hooked wires controlled thereby are displaced from the paths of the knives.

When the selecting devices have thus operated, the parts remain in the position described until the knives have risen and engaged the hooks of the wires which have not been displaced. The lifting of the wires raises the heddles and produces a shed of selected warp threads through
35 which the shuttle is passed in the usual way. As soon as the knives have engaged the selected hooks, the bar 32 rises, releasing the needles which it has previously caused to be pulled, and replacing the members 33 in their original positions, so that another selecting operation may be started at once. In this operation, the carriage moves back along the series of selector elements with the tongue 57 on the leading cam first restoring all the selector elements to the position 42^a and selected elements being then engaged and moved by the hammer as previously described.

The apparatus of the invention thus provides a selecting device for each heddle or each group of heddles which are to be operated in unison and makes it possible to produce any shed required by the pattern. In the construction illustrated and described, each such selecting device includes a selector element, a control member, a connection between the control member and the heddle or heddles to be controlled thereby, and the operating member 32. The mechanism thus performs the functions of the cards, card barrel, and associated devices of a Jacquard mechanism, and may be used to replace those parts of such a mechanism. If desired, however, the principles of the invention may be utilized in a modified form of apparatus in which the connectors 27 are connected directly to the heddles so that a pull on any connector causes its associated heddle or heddles to be raised. With this type of mechanism, therefore, the needles, hooked wires, and lifting knives may be dispensed with.

In both forms of the apparatus, any suitable type of scanning mechanism may be employed, but preferably the selection and movement of the elements 40 is accomplished in part by the action of a hammer and in part by cam means. By the use of that arrangement, only a small movement of a selecting element need be pro-

duced by the hammer in the selecting operation and the hammer can thus be made to function in an extremely short period of time so that the carriage can be moved rapidly along the series of selecting elements, and the selecting operation can be carried on at a rapid rate.

In a loom in which there are a large number of heddles to be controlled, space limitations are extremely important. In the present apparatus, difficulties of this kind are overcome by spreading out the connectors for the heddles in a straight line and operating the heddles by pulling on the connectors. With this arrangement, congestion is avoided and the mechanism is greatly simplified. Another important feature of the apparatus is the use of selector elements and control members made of thin sheet material, and the mounting of these members in circumferential channels formed in spindles. A control mechanism for controlling a loom of standard size may require a large number of selector elements and control members, and by using thin elements and members and mounting them in the channels, the cost of these parts and their mountings is greatly reduced.

We claim:

1. In a loom, the combination of a plurality of heddles, a plurality of control members, connections between the control members and the heddles to be controlled thereby, a plurality of selecting elements one for each member, means operating normally to cause said control members to reciprocate in unison, and means for operating selected elements to cause them to render said moving means ineffective to bring about said movement of the control members associated with said selected elements, said operating means including an electromechanical translating device and means for giving said device and selecting elements a relative movement in which the elements are brought successively into cooperative relation with said device.

2. In a loom, the combination of a plurality of heddles, a plurality of control members, connections between the control members and the heddles to be controlled thereby, a plurality of selecting elements one for each member, means operating normally to cause said control members to reciprocate in unison, and means for operating selected elements to cause them to engage their associated members and prevent said members from being given said movement by said moving means, said operating means including an electromechanical translating device and means for giving said device and selecting elements a relative movement in which the elements are brought successively into cooperative relation with said device.

3. In a loom, the combination of a plurality of heddles, a plurality of control members, connections between the control members and the heddles to be controlled thereby, a plurality of selecting elements one for each member, means operating normally to bring about movement of all the control members without affecting the heddles, and means for operating selected elements to cause them to render said moving means effective to alter the operation of the heddles of their associated members, said operating means including an electromechanical translating device and means for giving said device and selecting elements a relative movement in which the elements are brought successively into cooperative relation with said device.

4. In a loom, the combination of a plurality of

heddles, a plurality of control members, connections between the control members and the heddles to be controlled thereby, a plurality of selecting elements one for each member, means effecting movement of the control members without producing a movement of their associated heddles, and means for moving selected elements to cause them to engage their respective control members and render the moving means effective to draw upon the connections of the heddles associated with said control members.

5. In a loom, the combination of a plurality of heddles, a plurality of control members, connections between the control members and the heddles to be controlled thereby, a plurality of selecting elements one for each member, means operating normally to cause said control members to reciprocate in unison, and means for operating selected elements to cause them to restrain their associated control members from receiving said movements from said moving means, said operating means including an electromechanical translating device and means for giving said device and selecting elements a relative movement in which the elements are brought successively into cooperative relation with said device.

6. In a pattern control mechanism for controlling the heddles of a loom, the combination of a plurality of control members connected to the heddles, a plurality of selecting elements, one for each control member, means operable to impart a movement to said control members without acting effectively on the heddles through the connections, and means for operating selected elements to cause them to restrain their associated control members and thereby cause said moving means to act effectively on the heddles associated with the restrained control members.

7. In a loom, the combination of heddles, a plurality of control members movably mounted and connected to the heddles to be controlled thereby, a plurality of selecting elements, one for each control member, means engaging the control members and connections and normally operating to act on said members and connections without affecting their associated heddles, and means for operating selected elements to cause them to render said first-named means ineffective to act on their associated members and effective to act on their associated connections to alter the operation of the heddles connected thereto.

8. In a loom, the combination of heddles, a plurality of control members, connections between the members and the heddles to be controlled thereby, a plurality of selecting elements, one for each control member, means engaging the control members and connections and normally operating to move said members and connections without affecting their associated heddles, and means for operating selected elements to cause them to engage and restrain their respective control members and thereby alter the operation of the moving means to cause it to act on the connections of the restrained control members and alter the operation of the heddles associated therewith.

9. A pattern control mechanism for controlling the operation of the heddles of a loom which comprises a plurality of movable control members, connections between the control members and the heddles to be controlled thereby, a plurality of selector elements, one for each member, operable to engage and restrain their associated members, means for moving the unrestrained control mem-

bers and their associated connections without affecting the heddles associated therewith, said means operating through the connections of restrained control members to alter the operation of their respective heddles, and means for selectively operating the selector elements including a pattern sheet and mechanism for scanning said sheet.

10. A pattern control mechanism for controlling the operation of the heddles of a loom which comprises a plurality of movable control members, connections between the central members and the heddles to be controlled thereby, a plurality of selector elements, one for each member, operable to engage and restrain their associated members, means for moving the unrestrained control members and their associated connections without affecting the heddles associated therewith, said means operating through the connections of restrained control members to alter the operation of their respective heddles, and means for selectively operating the selector elements including an electromagnetic actuating device, means for supplying current to said device including a pattern sheet and mechanism for scanning said sheet, and means producing a relative movement of the device and elements during which the elements come successively into operating relation with said device.

11. In a pattern control mechanism for controlling the heddles of a loom, the combination of a plurality of control members mounted for movement and connected, respectively, to the heddles to be controlled thereby, a plurality of selector elements, one for each member, operable to restrain their associated members against movement, a bar engaging the members and normally operating to bring about a movement thereof in unison, and means for operating said elements selectively, said operating means including an electromechanical translating device and means for giving said device and elements a relative movement in which said elements are brought successively into cooperative relation to said device.

12. In a pattern control mechanism for controlling the heddles of a loom, the combination of a plurality of control members mounted for movement, flexible connections between the control members and the heddles to be controlled thereby, a plurality of selector elements, one for each member, operable to restrain their respective members against movement, a bar engaging the members and their connections and operable to bring about a movement thereof in unison without affecting their associated heddles, and means for operating said elements selectively, said bar being effective through the connections of the members restrained by the selected elements to alter the operation of the heddles associated with said members.

13. In a pattern control mechanism for controlling the heddles of a loom, the combination of a plurality of control members mounted for movement, flexible connections between the control members and the heddles to be controlled thereby, a plurality of selector elements, one for each member, operable to restrain their respective members against movement, a bar supporting the members and having openings through which said connections pass, means for moving said bar to effect a movement of said members and their associated connections without affecting the heddles associated with said members, and means for operating said elements selectively, said bar

operating on the connections of restrained members to alter the operation of the heddles associated therewith.

14. In a pattern control mechanism for controlling the heddles of a loom, the combination of a plurality of control members mounted for movement and connected to the heddles to be controlled thereby, means for moving the members, a plurality of selector elements, one for each member, operable to restrain their associated members from being moved by the action of said moving means, and means for selectively operating said elements including a pattern sheet, mechanism for scanning said sheet, an electromagnetic actuating device supplied with current under the control of the scanning mechanism and operable to move said elements toward restraining position, cam means for completing said movement of the elements and restoring them to their initial positions, and means for producing a relative serial movement of said elements and said device and cam means.

15. In a pattern control mechanism, the combination of selector elements arranged in a series, and means for selectively actuating said elements including a carriage, means for producing a relative movement of said carriage and elements, a pattern controlled actuating device on said carriage operable to effect a partial movement of said selected elements, and a cam on said carriage, said cam having a spring-pressed tail operable during relative movement of said support and elements in one direction.

16. In a pattern control mechanism, the combination of selector elements arranged in a series, and means for selectively actuating said elements including a carriage, means for moving the carriage along the series of elements alternately in opposite directions, an actuating device on the carriage operable to effect a partial movement of selected elements, pattern mechanism for controlling the operation of said device and cam means on said carriage for completing the movement of said selected elements and restoring previously selected elements to their initial positions, said means including a pair of cams, each having a spring-pressed tail operable during movement of said carriage in one direction only.

17. In a loom, the combination of a plurality of heddles, a plurality of control members, connections between the control members and the heddles to be controlled thereby, a plurality of selecting elements one for each member, a movable support for the control members, means for moving said support, said members normally moving with the support, and means for operating selected elements to cause them to restrain their associated members and prevent said members from being moved with said support, said operating means including an electromagnetic actuating device, and means for giving said device and selector elements a relative movement in which said elements are brought successively into cooperative relation to said device.

18. In a loom, the combination of a plurality of heddles, a plurality of control members, connections between the control members and the heddles to be controlled thereby, a plurality of selector elements one for each member, a movable member engaging the control members and acting to maintain them in an initial position, means for moving said member to and from a different position, said control members normally moving in unison therewith, and means for operating selected elements to cause them to en-

gage their associated control members and prevent said members from being moved with said movable member, said operating means for the elements including an electromagnetic actuating device, and means for giving the device and selector elements a relative movement in which said elements are brought successively into cooperative relation to said device.

19. In a loom, the combination of a plurality of heddles, a plurality of control members, connections between the control members and the heddles to be controlled thereby, a plurality of selector elements one for each member, an abutment bar engaging the control members and maintaining them in position, means for moving said abutment bar, said members normally moving in unison therewith, and means for operating selected elements to cause them to prevent their associated members from moving with said bar, said operating means including an electromagnetic actuating device, and means for giving said device and selector elements a relative movement in which said elements are brought successively into cooperative relation to said device.

20. In a loom, the combination of a plurality of heddles, a plurality of control members, connections between the control members and the heddles to be controlled thereby, a plurality of selecting elements one for each member, an abutment bar engaging said control members and maintaining them in position, means for moving said bar to and from a different position, all said control members normally moving with said bar to and from said different position, means for operating selected elements to cause them to maintain their associated control members in their initial position, said means including an electromagnetic actuating device, and means for giving said device and elements a relative movement, in which said elements are brought successively into cooperative relation to said device, and means for returning said selected elements to ineffective condition ready for the next selecting operation.

21. In a loom, the combination of a plurality of heddles, a plurality of control members mounted for swinging movement on a common support, connections between the control members and the heddles to be controlled thereby, a plurality of selector elements, one for each member, said elements being mounted for swinging movement on a common support, springs acting on the control members and tending to move them in one direction, a movable member engaged by the control members, means for moving the movable member between two positions, the control members normally moving with said movable member, and means for operating selected elements to cause them to engage their associated control members and restrain said control members against movement with said movable member, said operating means including an electromagnetic actuating device operable to engage and move said elements to restraining position.

22. In a pattern control mechanism for controlling the operation of the heddles of a loom, the combination of a plurality of control members connected to the heddles to be controlled thereby, means for actuating the control members selectively to cause the heddles of selected members to be displaced to form a warp shed, and means for selecting the control members, including a series of selector elements, one for each control member, and means for operating selected elements to cause them to engage and prevent

movement of their respective members in one direction, including a carriage movable along the series of selector elements and an electromechanically operated hammer on said carriage
5 operable to engage said elements and render them effective.

23. In a pattern control mechanism for controlling the operation of the heddles of a loom, the combination of a plurality of control members connected to the heddles to be controlled
10 thereby, means for actuating the control members selectively to cause the heddles of selected members to be displaced to form a warp shed, and means for selecting the control members, including a series of selector elements, one for each
15 control member, and means for operating selected elements to cause them to engage and prevent movement of their respective members in one direction, including a pattern sheet, a scanning
20 mechanism for scanning said sheet, an actuating device operated under the control of said scanning mechanism, and means for causing a relative movement of the device and the series of selector elements.

24. A pattern control mechanism for controlling the heddles of a loom, which comprises a plurality of movable control members connected to the heddles to be controlled thereby, a plurality of selector elements, one for each member,
25 operable to engage and restrain their associated members, means for moving the unrestrained

control members and their associated connections without affecting the heddles associated therewith, said means operating through the connections of restrained control members to alter the operation of their respective heddles, and
5 means for selectively operating the selector elements.

25. In a pattern control mechanism for controlling the heddles of a loom, the combination of a plurality of control members connected respectively to the heddles to be controlled thereby,
10 a plurality of selecting elements, one for each member, said elements being movable into and out of engagement with their respective members and operable when in such engagement to
15 restrain said members against movement, means for moving the control members not restrained by their associated elements, and means for segregating the selector elements into two groups, the elements in one group restraining
20 their associated members and those in the other group being out of contact with their associated members, said segregating means including an electromechanical translating device, a pattern controlling the operation of said device, and
25 means for giving the device and elements a relative movement in which the elements are successively in cooperative relation to said device.

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