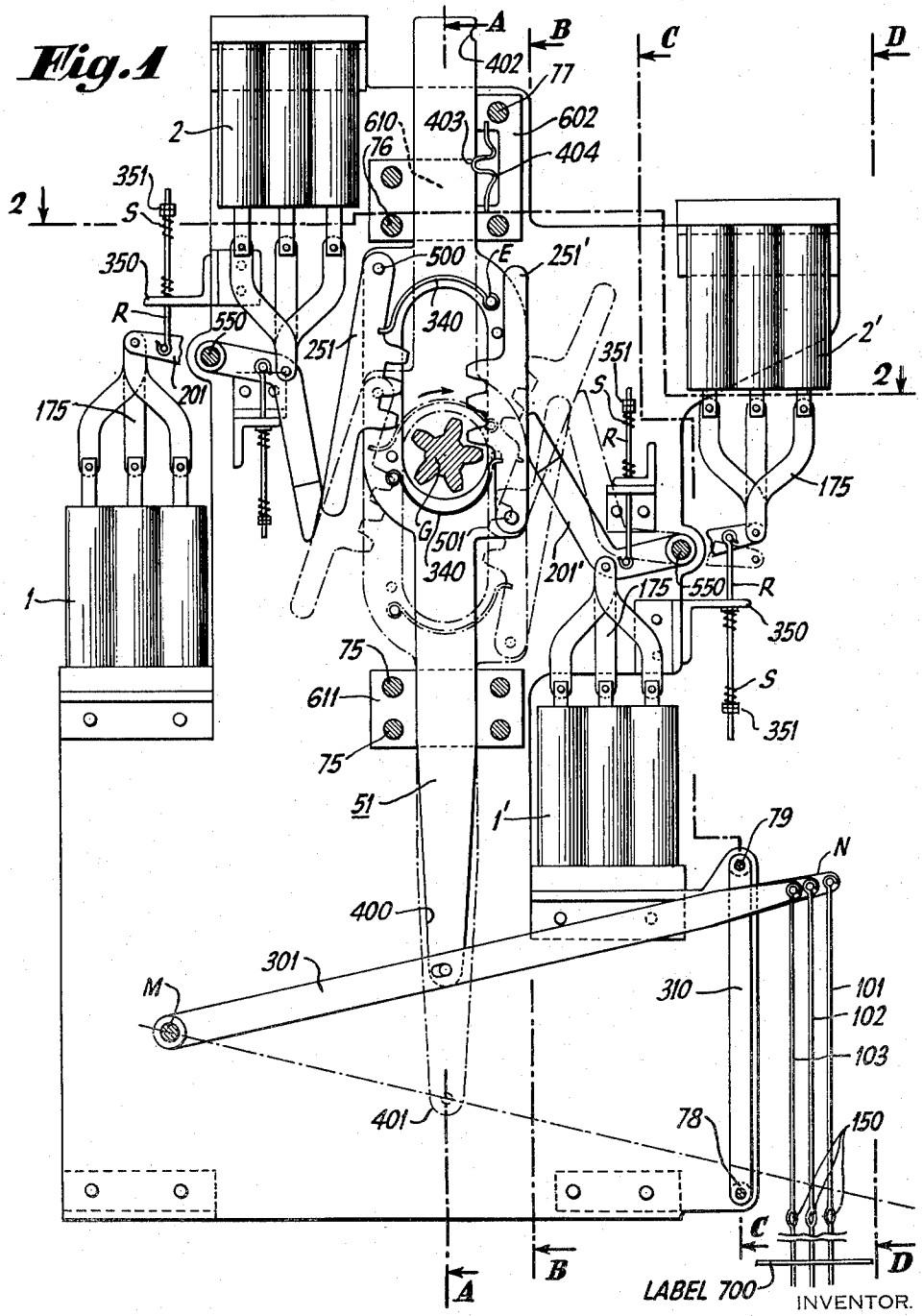
Sept. 9, 1952 A. J. MURPHY 2,609,840

LOOM

Filed Sept. 2, 1947 4 Sheets-Sheet 1

Fig. 1



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Sept. 9, 1952 A. J. MURPHY 2,609,840

LOOM

Filed Sept. 2, 1947 4 Sheets-Sheet 2

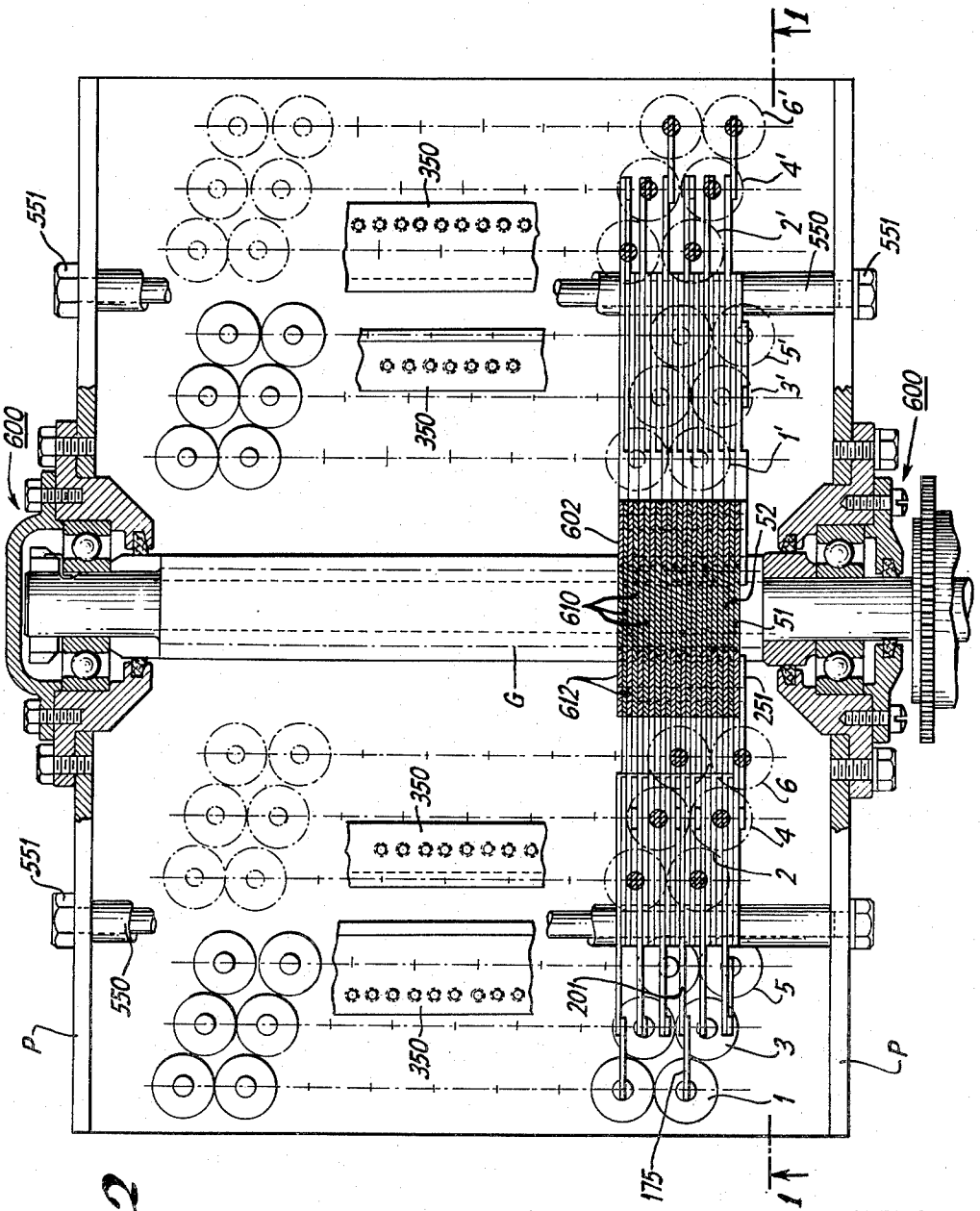

Fig. 2

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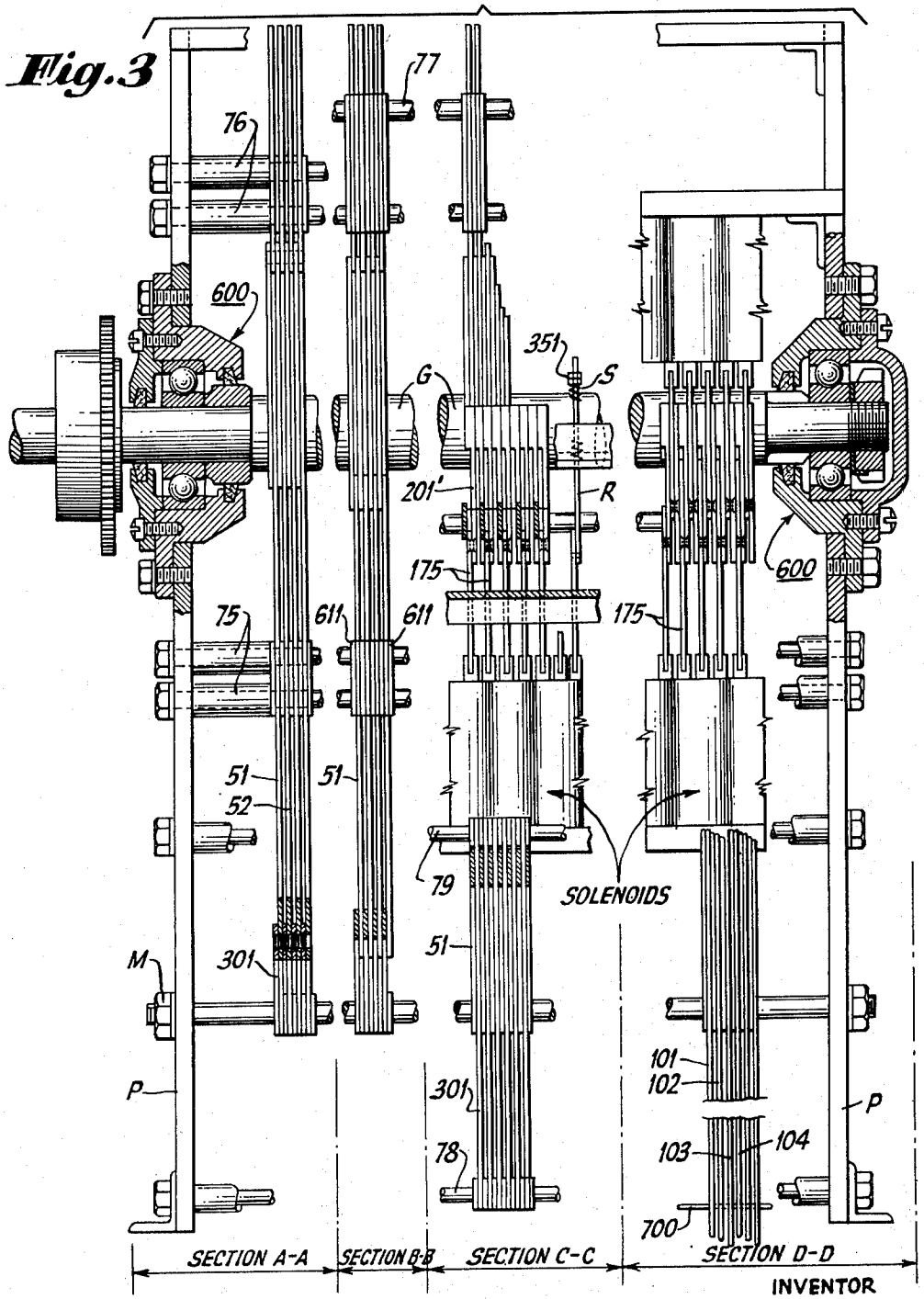
Sept. 9, 1952 A. J. MURPHY 2,609,840

LOOM

Filed Sept. 2, 1947 4 Sheets-Sheet 3

Fig. 3



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Sept. 9, 1952 A. J. MURPHY 2,609,840

LOOM

Filed Sept. 2, 1947 4 Sheets-Sheet 4

Fig. 4

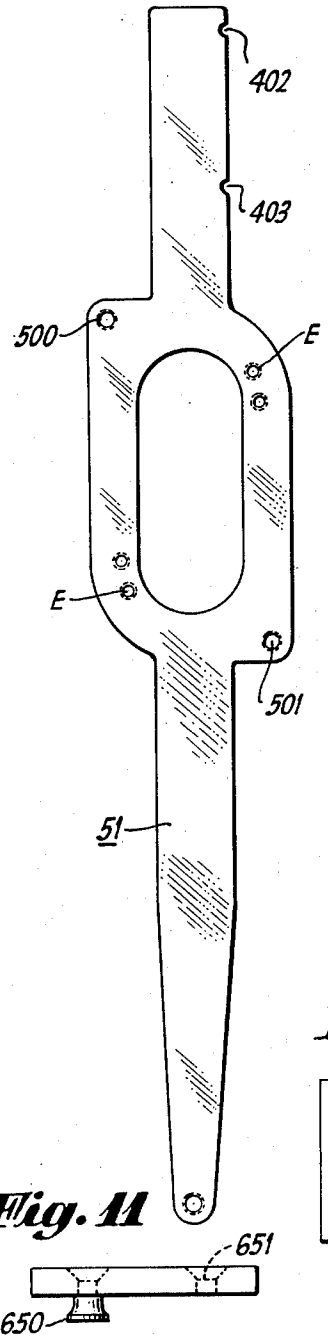

Fig. 5

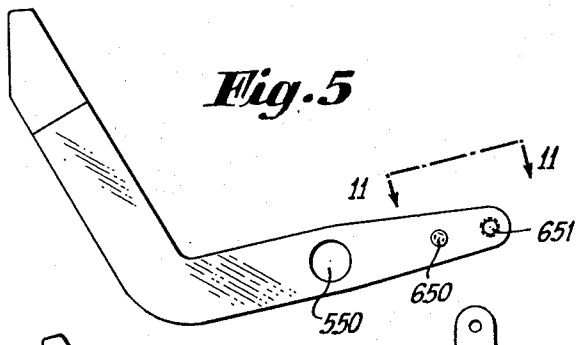

Fig. 10

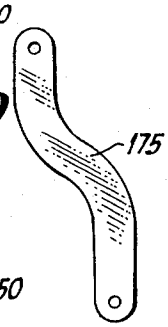

Fig. 6

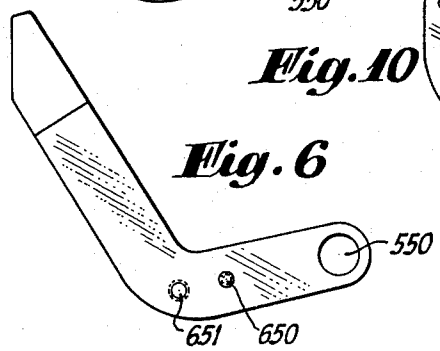

Fig. 7

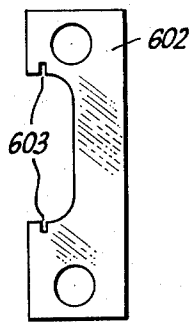

Fig. 8

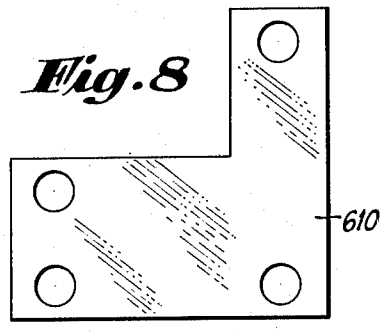

Fig. 9

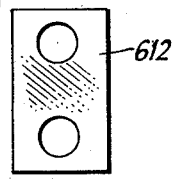

Fig. 12

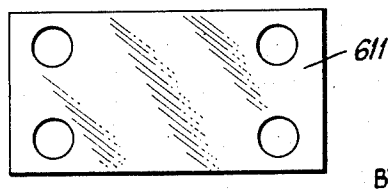

Fig. 11

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2,609,840

UNITED STATES PATENT OFFICE

2,609,840

LOOM

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Application September 2, 1947, Serial No. 771,685

15 Claims. (Cl. 139—55)

1

This invention relates to an electrically operated loom, and particularly to a novel method of and apparatus for raising and lowering the line threads employed in weaving labels, patterned ribbons and the like. These line threads, sometimes called warp threads, are raised and lowered in groups in accordance with a predetermined sequence determined by a selected pattern to enable the reciprocating shuttle to pass in a transverse direction. The article resulting from this weaving operation may be a label or patterned ribbon or other fabric having various colors woven therein in accordance with a desired selected pattern. The function and operation of the line threads and shuttle are well known to those familiar with Jacquard looms.

It has been proposed in the past to employ relays for operating the line or warp threads, but such proposals have contemplated machines subject to numerous disadvantages which the present invention overcomes. One such known proposal is disclosed in U. S. Patent 565,447, granted August 11, 1896 to E. Gates.

The present invention provides an improved, compact, fast-operating, electrically controlled loom which is characterized by an ability to weave a relatively small quantity of labels or ribbons in an economical and efficient manner.

An important feature of the invention lies in the mechanical construction involving a single rotating shaft for actuating individual reciprocating line thread holders through separate solenoid-controlled levers.

A better understanding of the invention may be had by referring to the following description which is accompanied by a drawing wherein:

Fig. 1 illustrates a view, in vertical cross-section, of the mechanical construction of the relay and line thread controlling mechanism of the invention. This cross-section is taken along the line 1—1 of Fig. 2;

Fig. 2 is a top plan view of the mechanical construction of the relay and line thread controlling mechanism of the invention, and is taken along the line 2—2 of Fig. 1;

Fig. 3 shows different sectional views, properly identified, of cross-sections taken along the lines A—A; B—B; C—C and D—D of Fig. 1; and

Figs. 4 to 12 inclusive show details of certain parts of the mechanism of Figs. 1 to 3.

Throughout the figures of the drawing, the same parts are represented by the same reference numerals.

The mechanism of the invention includes sets or pairs of solenoids 1, 1'; 2, 2'; 3, 3'; 4, 4'; 5, 5'; 6, 6', etc. for controlling the vertical movement of different slides or actuating members 51, 52, 53, 54, etc., in turn controlling the vertical movements of different line thread holders 101, 102, 103, 104, etc. Each slide, a detail of which is shown in Fig. 4, is provided at a location intermediate the ends with a substantially rectangular-shaped aperture or hollow portion through which passes a gear G. The slide has linked thereto a line thread holder in the form of a rod having an eye 150 for carrying or holding one of the warp threads. The fabric or label being woven is indicated as 700. There is a set or pair of solenoids 1 and 1' or 2 and 2', etc. for each line thread holder, and thus it will be seen that for any number of warp threads there are a corresponding number of sets of solenoids. The solenoids 1, 2, 3, 4, etc. control the rise (viz: the up movement) of the warp threads while the solenoids 1', 2', 3', 4', etc. control the descent (viz: the down movement) of the warp threads.

2

The two solenoids of each set or pair which control each slide (thereby controlling each line thread holder) are arranged on opposite sides of the slide and actuate separate bell-cranks 201, 201'. Each bell-crank is adapted to engage at its free end the smooth side of a rack 251 or 251'. The rack is pivoted at one end to one side of the slide associated with the solenoid controlling the bell crank. It will thus be noted that there are provided for each warp thread the following parts: a line thread holder (101 for example), a vertically moving slide (51 for example), a pair of solenoids (1, 1' for example), a bell crank for each solenoid of the pair (201 or 201') and a rack (251 or 251') for each bell crank. Each slide 51, 52, etc. is linked at its lower end to its associated line thread holder 101, 102, etc. by means of a lever 301, 302, etc. Each such lever is fastened at one end M to a bolt and is secured at its other end N to the line thread holder.

The racks 251, 251', etc. are provided with gear teeth which are adapted under certain conditions to engage the teeth of a continuously rotating gear shaft G which passes through the interior apertures of all slides stacked side by side. The direction of rotation of gear shaft G is given by the arrow. Shaft G is driven from a gear, or a motor, not shown. Each rack is normally held in a position away from the gear shaft G by means of a curved spring 340 which is fastened at one end E to the slide.

Each bell crank is fastened to one end of a rod R which passes through an aperture in a stationary angle iron 350. A portion of the rod

R is surrounded by a spiral compression spring S. One end of the spring S engages the fixed angle iron **350** while the other end of spring S engages a nut or collar **351** fixed on the rod R.

In the unactuated or unenergized condition of a solenoid, the associated bell crank is held in such position by the spring S and rod R that the particular rack contacted by this bell crank does not engage the rotating gear G, by virtue of the force exerted by spring **340** against the rack. In the actuated or energized condition of a solenoid, however, the associated bell crank is pulled toward the solenoid by the solenoid link **175**, in turn, pulled by the magnetized solenoid armature, as a result of which the bell crank moves toward the solenoid and overcomes the force exerted by the spring S and pushes the particular rack contacted by this bell crank against the force exerted by spring **340** and causes the rack to engage rotating gear G, whereby the teeth of the gear G mesh with the teeth of the rack.

It should be noted that the two racks associated with each slide; for example, racks **251** and **251'** associated with slide **51**, are pivotally fastened to opposite sides of the slide at locations **500** and **501** vertically displaced from each other. Hence, when solenoid **1** is energized, the bell crank **201** will be pulled by the solenoid armature in such direction as to force rack **251** into engagement with the gear G, as a result of which the slide **51** will rise vertically, and, by virtue of lever **301** linked to the lower end of the slide, will cause the line thread holder **101** and the warp thread carried thereby to rise. Each lever **301** is positioned within a comb type spacer **310** at the end nearest the line thread holder **101**. When, however, solenoid **1'** is energized, the bell crank **201'** will be pulled by the solenoid armature in such direction as to force rack **251'** into engagement with the gear G, as a result of which the slide **51** will descend vertically, and cause the line thread holder **101** and the warp thread carried thereby to descend. The different positions of the racks and slide are shown by the solid and dot-dash lines.

The solenoids are electrically operated by a suitable electrical circuit through brushes contacting a pattern card forming part of an endless belt which belt is constructed in accordance with known practice, such that at no time will more than one solenoid of any one set or pair associated with a slide be actuated. The pattern card has holes punched therethrough in accordance with a particular design to be reproduced on the fabric being woven by the machine of the invention. The pattern repeats itself over and over again as the endless belt pattern card advances. The holes in the pattern card are so arranged as to permit electrical contact therethrough between a brush on one side of the card associated with one terminal of each solenoid and a metallic roller on the other side of the card associated in common to the other terminals of the solenoids. In practice, the brushes on one side of the card which are associated with different solenoids are arranged in a straight line in a direction transverse to the motion of the pattern card. There are twice as many brushes as there are line threads (warp threads) in the machine because the particular position of each warp thread in the weaving operation is governed by a set of two solenoids and each solenoid has a separate brush.

It is preferred in practice that each brush on the pattern card associated with a solenoid first operate a weak or small current operating relay whose contacts control a stronger electrical current for the solenoid itself. The number of line threads is governed by the width of the label or fabric to be woven.

It should be noted from an inspection of Figs. 1 and 2 that the solenoids are staggered in their locations. Such an arrangement enables a maximum number of solenoids to be supported in a relatively small space, and provides a compact mechanical construction.

The upper limiting vertical position of any one slide is indicated in Fig. 1 by the solid line position of slide **51**, indicated more specifically at its lower end by **400**. The lower limiting vertical position of the slide is indicated in Fig. 1 by the dash-dot line position of slide **51** indicated more specifically at its lower end by **401**. These limiting positions are controlled by a pair of spaced notches **402** and **403** at the upper end of the slide into which a stationary curved resilient stop slider spring **404** is adapted to enter. The details of each slide are shown clearly in Fig. 4.

It should be noted from Fig. 2 that the slides and solenoids and associated parts are mounted between two spaced metallic supporting plates P, P which are rigidly secured to each other by means of bolts **550** threadedly engaging at their ends suitable nuts **551**.

The slides are stacked side by side along the length of the single gear shaft G passing through their interiors. These slides are separated from each other by upper and lower spacers **610** and **611**, respectively. Note Figs. 8 and 12. Secured to each upper spacer **610** to one side of the slide is a guide plate **602** having spaced slots **603** therein for accommodating the ends of the resilient limit stop slider spring **404**. This detail is shown in Fig. 7. Secured to each upper spacer **610** to the other side of the slide is a filler plate **612**. Note Figs. 2 and 9.

The single gear shaft G is supported in plates P, P by means of suitable bearings **600** mounted in suitable bearing housings.

Figs. 5 and 6 show two different constructions of bell cranks employed in the mechanism of the invention to force the associated racks against the gear shaft G. These different constructions for the bell cranks are necessary in view of the staggered positioning of the solenoids which are at different distances away from the slides.

The solenoid link detail **175** is shown in Fig. 10. Fig. 11 is a view along line **11—11** of Fig. 5 and shows the rivet **650** for linking the rod R to the bell crank. The details of Figs. 5 and 11 also show the location **651** at which the bell crank is secured to the solenoid link **175**.

Fig. 3 shows different cross-sectional views of the machine of the invention along sections A—A; B—B; C—C and D—D of Fig. 1. Various bolts, not hereinabove referred to, have been designated by reference numerals **75**, **76**, **77**, **78** and **79** in order to more clearly correlate the parts of the machine.

Although the machine of the invention has been illustrated with the line thread holders and the slides in the vertical plane, it should be understood that the component parts of the machine can be so arranged that these elements work in the horizontal plane or at any angle relative to the vertical or horizontal plane.

What is claimed is:

1. In a loom, in combinaton, a series of warp

thread carrying elements, a corresponding series of actuating members for said elements and capable of reciprocating motion, a single rotatable shaft for controlling the direction of movement of said actuating members, a pair of electrically operated devices associated with each actuating member, and a link between each electrically operated device and its associated actuating member, so constructed and arranged that the operation of one electrical device of each pair causes the movement of the associated member in one direction by means of said shaft, while the operation of the other electrical device of each pair causes the movement of the associated member in an opposite direction by means of said shaft.

2. In a loom, a line thread carrying element, an actuating member for said line thread carrying element and capable of reciprocating motion, said member having an aperture therein whose spaced sides join together and are linked to said line thread carrying element, a rotatable shaft located in said aperture between said sides and spaced therefrom, said shaft having projections thereon, levers pivotally fastened to both sides of said actuating member and oppositely disposed with respect to said shaft for engaging the projections on said shaft, and electrically operated devices for individually controlling the positions of said levers.

3. In a loom, a line thread carrying element, an actuating member for said line thread carrying element and capable of reciprocating motion, said member having an aperture at a location intermediate the ends thereof, a rotatable shaft in said aperture, levers pivotally fastened to both sides of said actuating member and oppositely disposed with respect to said shaft and adapted in one position to engage said shaft for movement thereby, and electrically operated devices for individually controlling the positions of said levers.

4. In a loom, a line thread carrying element, an actuating member for said line thread carrying element and capable of reciprocating motion, said member having a hollow portion at a point intermediate the ends thereof, a rotatable shaft positioned at right angles to the length of said actuating member and having gear teeth located in said hollow portion, racks pivotally fastened to said actuating member and oppositely located with respect to said shaft, said racks having teeth adapted to mesh with the gear teeth of said shaft, springs for normally causing said racks to disengage said shaft, bell cranks for forcing said racks to engage said shaft, and electrically operated devices for selectively operating said bell cranks.

5. In a loom, a series of line thread carrying elements, an actuating member in the form of a flat metallic plate for each line thread carrying element and capable of reciprocating motion in a vertical plane, said actuating members being stacked side-by-side and separated by spacers, a movement limiting stop for each member, said members each having an aperture at a location intermediate the ends thereof, the apertures of said members registering with each other, a single rotatable shaft passing through said apertures, a pair of levers pivotally fastened to each actuating member on opposite sides of said shaft for engagement with said shaft, whereby the actuating member associated with said levers may be driven by said shaft in either of two directions depending upon the positions of the levers, and a pair of solenoids linked to the respective levers of each actuating member.

6. In a loom, a series of line thread carrying elements, an actuating member in the form of a flat metallic plate for each line thread carrying element and capable of reciprocating motion in a vertical plane, said actuating members being stacked side-by-side and separated by spacers, a movement limiting stop for each member, said members each having an aperture at a location intermediate the ends thereof, the apertures of said members registering with each other, a single rotatable shaft passing through said apertures, a pair of levers pivotally fastened to each actuating member on opposite sides of said shaft for engagement with said shaft, whereby the actuating member associated with said levers may be driven by said shaft in either of two directions depending upon the positions of the levers, and a pair of electrically operated devices operatively associated with the respective levers of each actuating member.

7. In a loom, a series of line thread carrying elements, an actuating member in the form of a flat metallic plate for each line thread carrying element and capable of reciprocating motion in a vertical plane, said actuating members being stacked side-by-side and separated by spacers, a movement limiting stop for each member, said members each having an aperture at a location intermediate the ends thereof, the apertures of said members registering with each other, a single rotatable shaft provided with gear teeth passing through said apertures, a pair of racks pivotally fastened to each actuating member on opposite sides of said shaft for meshing with said shaft, whereby the particular actuating member associated with said pair of racks may be driven by said shaft in either of two directions depending upon the positions of the racks, and a pair of solenoids for each actuating member linked to the respective racks thereof.

8. In a loom, a series of line thread carrying elements, an actuating member in the form of a flat metallic plate for each line thread carrying element and capable of reciprocating motion in a vertical plane, said actuating members being stacked side-by-side and separated by spacers, a movement limiting stop for each member, said members each having an aperture at a location intermediate the ends thereof, the apertures of said members registering with each other, a single rotatable shaft provided with gear teeth passing through said apertures, a pair of racks pivotally fastened to each actuating member on opposite sides of said shaft for meshing with said shaft, whereby the particular actuating member associated with said pair of racks may be driven by said shaft in either of two directions depending upon the positions of the racks, and a pair of solenoids for each actuating member linked to the respective racks thereof, said solenoids being mounted in staggered relation for compactness of construction, said actuating members being identical in construction and said racks being of identical construction.

9. In a loom, a thread carrying element, a frame, a slide reciprocating within the confines of said frame, a link between said slide and said thread carrying element, means for driving said slide comprising a rotatable shaft and a pair of levers pivotally mounted on said slide and oppositely disposed adjacent to said shaft, and means for selectively engaging removably said levers with said shaft.

10. In a loom, a thread carrying element, a frame, a slide vertically reciprocating within the confines of said frame, a link between said slide

and said line thread carrying element, means for driving said slide comprising a rotatable shaft and a pair of levers pivotally mounted on said slide and oppositely disposed with respect to said shaft, individual springs for said levers normally preventing said levers from engaging said shaft, and electrically actuated devices for selectively causing said levers to engage said shaft against the pressure of said springs.

11. In a loom, the combination with a vertical thread carrying element, of a slide plate member vertically movable in opposite directions and linked to said thread carrying element, a rotatable shaft located adjacent said slide member and having its longitudinal axis at right angles to the length of said slide member, said shaft having projections thereon, a pair of levers pivotally mounted on said slide member and disposed on opposite sides of said shaft, and means for selectively causing said levers to removably engage said rotatable shaft.

12. In a loom, a thread carrying element, a frame, a slide reciprocating within the confines of said frame, a link between said slide and said thread carrying element, means for driving said slide comprising a rotatable shaft and a pair of levers pivotally mounted on said slide and disposed adjacent to said shaft, and means for selectively engaging removably said levers with said shaft.

13. In a loom, a thread carrying element, a movable slide, a link between said slide and said thread carrying element, means for driving said slide comprising a rotatable shaft and a lever pivotally mounted on said slide and disposed adjacent to said shaft, means for selectively engaging removably said lever with said shaft, and means for returning said slide to the position it occupied before being driven by said lever.

14. In a loom, a thread carrying element, a reciprocating slide, a link between said slide and said thread carrying element, means for driving said slide comprising a rotatable shaft positioned adjacent said slide, and means pivotally mounted on said slide for selectively engaging removably said shaft with said slide.

15. In a loom, a thread carrying element, a reciprocating slide, a link between said slide and said thread carrying element, means for driving said slide comprising a rotatable shaft positioned adjacent said slide intermediate the ends thereof and at right angles to the reciprocating motion of said slide and means pivotally linked to said slide and adapted to engage said shaft, and means for selectively engaging removably said shaft with said slide.

ARTHUR J. MURPHY.

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