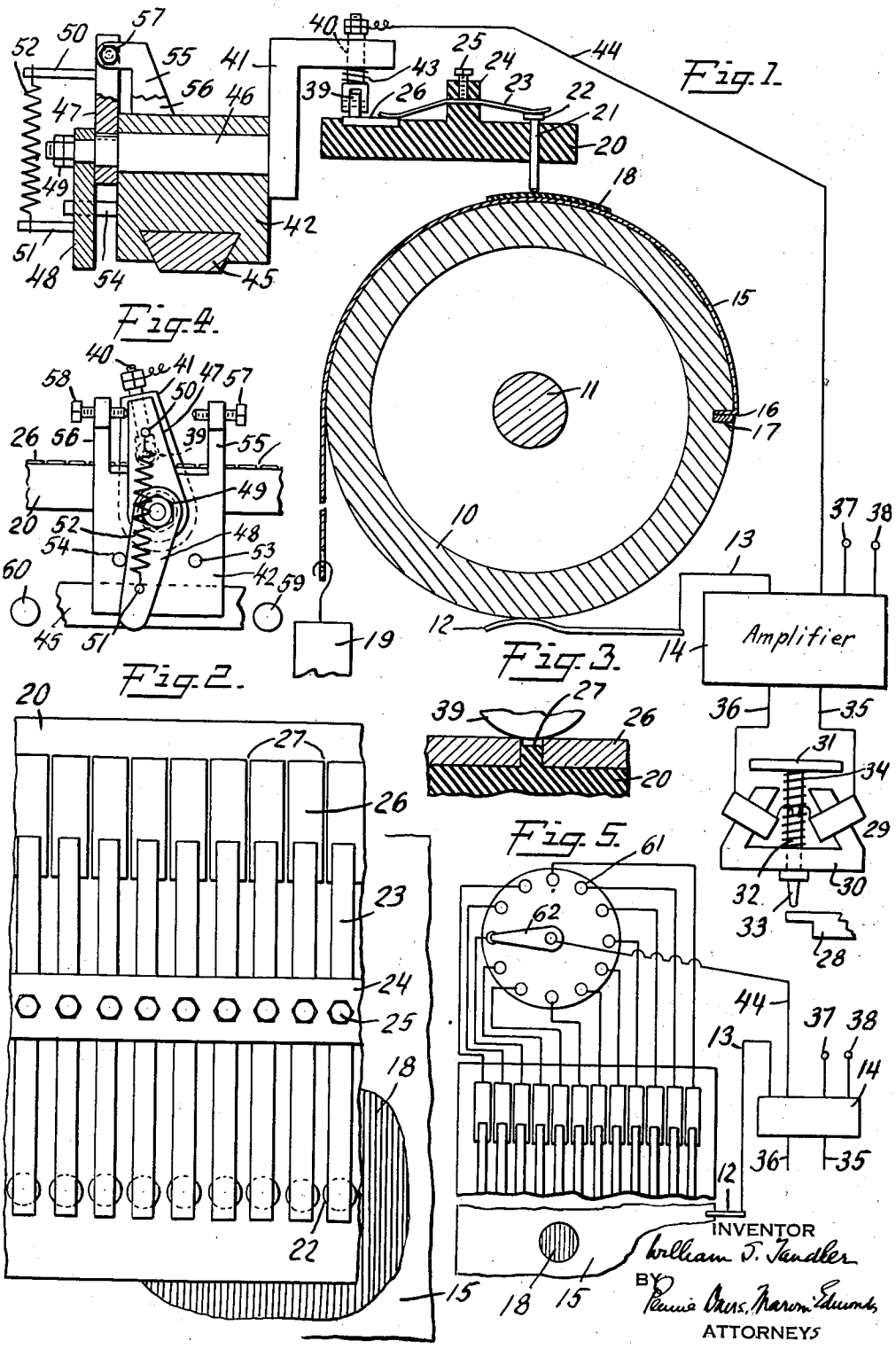
March 9, 1937. W. S. TANDLER 2,072,969

PATTERN MECHANISM

Filed July 6, 1936



Patented Mar. 9, 1937

2,072,969

UNITED STATES PATENT OFFICE

2,072,969

PATTERN MECHANISM

William S. Tandler, New York, N. Y., assignor to Lefier Patent Company, Inc., New York, N. Y., a corporation of New York

Application July 6, 1936, Serial No. 89,152

19 Claims. (Cl. 66—154)

This invention relates to mechanisms for controlling the operation of a machine in accordance with a pattern, an example of the use of such a mechanism being the control of a textile machine to cause the machine to produce a fabric with a design determined by the pattern. More particularly, the invention is concerned with a novel electro-mechanical pattern control mechanism used for the purposes described and capable of exercising a close and accurate control over the machine being governed, so that intricate patterns may be employed and followed without error.

The mechanism of the invention is adapted for the control of machines of a wide variety of types, but as it is especially suited for use in connection with textile machines, such, for example, as a knitting frame, an embodiment of the invention appropriate for that use will be illustrated and described in detail for purposes of explanation. It is to be understood, however, and will be readily apparent that the utility of the invention is not limited to its employment with machines of any particular kind.

In knitting machines of either the circular or flat bed types as now constructed, patterned fabrics may be produced by the use of yarns of different colors, and in the operation of these machines, the yarns from the different supplies are delivered successively to the needles, each yarn by its own yarn guide, and the needles are selectively actuated so that stitches of yarns of the different colors are knitted in the fabric at the proper places. The selective control of the needles is effected by the use of devices of various kinds, and one such control mechanism is disclosed in Ruinnet Patent No. 1,795,235, issued March 3, 1931. The Ruinnet apparatus includes a plurality of control members, one for each needle, mounted in a support in the form of a grill, and each control member may assume two different positions in the grill. Initially, all the control members are held in an elevated position in the grill by means of associated latches, and an electromagnet movable along the grill and supplied with current under the control of a pattern operates to unlatch control members determined by the pattern. When the electromagnet has completed its travel along the grill and has thereby selected the control members corresponding to needles which are to come into action for the next row of stitches, the grill is advanced toward the needles and the latter are engaged by their associated control members and moved to knitting position.

In the Ruinnet apparatus and various other similar devices which include a pattern sheet, the pattern is connected in a circuit which includes a source of power and the selecting device, such as the electromagnet used by Ruinnet. The pattern sheet may then be of electroconductive material with the design thereon formed of insulated areas, and the pattern sheet may be scanned by suitable means, such as a traveling roller connected in the circuit and moving across the sheet once for each traverse of the electromagnet along the group of control members, that is, once for each row of stitches in the fabric. At the completion of each row, the pattern sheet is advanced one step and the roller makes the next traverse of the sheet as the electromagnet again moves along the group of control members.

While such a pattern scanning mechanism including a roller, feeler, or other member which moves in contact with the pattern is satisfactory for many purposes, it has certain disadvantages. For example, knitting frames are rapidly operated and the contact member must, therefore, move over the pattern sheet at a relatively high rate of speed. Such rapid movement of the contact member causes the insulating material which forms the design on the sheet to wear out quickly, and, in addition, the slight elevations on the sheet made by the insulating material cause the contact member to jump free of the sheet so that accurate control of the knitting frame is impossible. Also, with such a pattern sheet, it is difficult to ascertain the location on the pattern of the spot which governs the action of a particular knitting needle during the knitting of a specific row of stitches, and accordingly, if changes in the pattern as it appears in the fabric are desired, these changes cannot be made on the pattern sheet with certainty but only after a series of trials. Because of these disadvantages, particularly the jumping of the contact member, the use of such a scanning mechanism limits the speed of operation of the knitting frame and consequently restricts its output.

The present invention is directed to the provision of an electromechanical pattern control mechanism which overcomes the disadvantages above pointed out, permits intricate patterns carried on the pattern sheet to be followed with great accuracy, and makes it possible to operate the controlled machine at a higher speed than that heretofore permissible. These results are obtained in the apparatus of the invention by

eliminating the engagement of the traveling scanning element with the pattern sheet, and, instead, causing it to move over a series of stationary contacts or bars, constituting a part of a pick-up device and conveniently termed a commutator. These stationary contacts are connected electrically to the pattern sheet by a plurality of conductive elements, one for each bar, and during each relative movement of the scanning element and commutator, the contacts are charged or dead, depending upon whether or not their associated conductive elements bear against conductive or insulated areas on the pattern sheet. At each period of rest in the advance of the pattern sheet, therefore, the bars of the commutator represent the charged and dead areas of that portion of the pattern sheet along which the scanning element would ordinarily have to move, but since the bars are mounted with their upper surfaces in a plane, the scanning element may move along the bars at a high rate of speed without jumping and consequent loss of control. Also, since the conductive elements bear lightly against the pattern sheet, the relative movement between the sheet and the elements does not produce any substantial wear on the sheet. Moreover, the use of the commutator makes it possible to identify the spots on the pattern which govern the action of a specific needle in the operation of the knitting machine.

For a better understanding of the invention, reference may be had to the accompanying drawing, in which,

Figure 1 is a view, partly in transverse section and partly in diagram, illustrating the new apparatus,

Figure 2 is a plan view of a portion of the commutator forming part of the new apparatus,

Figure 3 is a transverse sectional view through a portion of the commutator,

Figure 4 is a fragmentary elevational view showing a part of the new apparatus, and

Figure 5 is a fragmentary plan view of a modified form of the mechanism.

Referring now to Figure 1, the apparatus illustrated includes a movable support in the form of a roll **10** mounted on a shaft **11** supported for rotation in suitable bearings and advanced with a stepwise rotation by any convenient means, such as a ratchet and pawl device not shown. The roll is made of conductive material and current is supplied to it in any convenient manner, as by means of a brush **12** bearing against the surface of the roll and connected by a line **13** to a terminal in an amplifier **14**. A pattern sheet **15** is attached at one end **16** to the roll, as by having one end held in a slot in the roll by a wedge **17**. This pattern sheet is of conductive material, as, for example, thin sheet copper, and a design is formed thereon by areas **18** of insulating material, produced by the use of insulating paint or by applying insulating tape to the face of the sheet. The sheet is kept taut by one or more weights **19** attached to the free end thereof.

In the control mechanisms employing a pattern sheet, as heretofore constructed, it has been the practice to provide a scanning element, such as a roller or feeler, which moves along in contact with the pattern sheet, and this leads to wear on the sheet and inaccurate control as above pointed out. I overcome these difficulties in the present apparatus by the use of a pick-up device which includes contact elements connected electrically to areas on the pattern, these elements being progressively engaged by the scanning element and taking the wear of the latter.

This pick-up device in the construction illustrated includes a plate **20** of non-conducting material, such as that known commercially as "bakelite", and this plate is formed with a plurality of openings therethrough lying in a row. A pin **21** having an enlarged head **22** at its upper end extends through each opening with the lower end of the pin contacting with the face of the pattern sheet. A plurality of leaf springs **23** are mounted in a rib **24** extending lengthwise of the plate **20**, with each spring held in place by a screw **25**, and each spring bears at one end against the head of a pin **21**. The plate **20** carries a plurality of contact bars **26** arranged in a lengthwise row, each of these bars being of conductive material and engaged by one of the springs **23**. Each of the bars is seated in a recess in the top of the plate **20** and the bars are separated by portions **27** of the non-conducting material of which the plate is formed, as illustrated in Figure 3. The bars constitute what I have referred to as a commutator, and it will be apparent that during each period of rest in the movement of the pattern sheet with the roll **10**, each bar is electrically connected or disconnected from the pattern sheet, depending on whether the pin associated with the bar bears upon the pattern sheet proper or upon one of the insulated areas thereon.

The commutator described is appropriate for use with a flat bed knitting machine, and it, accordingly, includes as many commutator bars as there are needles in a bank on the machine, and each bar takes part in controlling the action of a single needle. The actual segregation and operation of the selected needles may be effected in various ways, as, for example, a control member **28** may be provided for each needle and so actuated as to advance the needle into knitting position. The control members may then be selectively brought into operation by an electromechanical translating device generally designated **29**, which is operated under the control of the pattern. In some knitting machines, the control members may be an integral part of the machine and ordinarily actuated by cams, while in other instances, the control members may be a part of the pattern mechanism. These control members are segregated for selective operation by the translating device as follows:

The translating device includes an electromagnet **30** having an armature **31** to which is attached a rod **32** extending through an opening in the electromagnet and provided at its lower end with a hammer **33**. A spring **34** encircling the rod **32** normally holds the armature elevated above the pole pieces of the electromagnet, but whenever current is supplied to the electromagnet from the amplifier through the lines **35**, **36**, the armature **31** is pulled down. The control members **28** are arranged in a row, one for each needle in the bank on the machine, and the translating device and control members move relatively. At appropriate instants in this movement, the electromagnet receives current under the control of the pattern, and the energization of the electromagnet causes the hammer to move down with the armature and engage and move the control member of the selected needle. Thereafter, the control members so selected are actuated by means not shown to cause their respective

needles to take part in the knitting of the next row of stitches.

The electromagnet of the translating device is energized under the control of the pattern sheet by power derived from a source of energy, the terminals of which are indicated at 37, 38. This source of power is in a circuit through the pattern sheet and commutator, and the circuit includes a scanning element 39. The scanning element and commutator move relatively and the scanning element may conveniently take the form of a roller of conductive material which moves along the commutator. In the construction illustrated, the roller is mounted in the end of a rod 40 supported in a bracket 41 attached to a block 42, and is held in light contact with the commutator bars 26 by means of a spring 43 encircling the rod. The rod is connected by a line 44 to a suitable terminal in the amplifier, so that whenever the roller 39 bears against a commutator bar 26 whose pin rests upon a conductive area on the pattern sheet, current may flow from the source of power through line 13, brush 12, roll 10, pattern sheet 15, pin 21, spring 23, bar 26, roller 39, and line 44 to the amplifier. Amplified current is then supplied by the amplifier to the electromagnet through the circuit including lines 35, 36, and the coils of the electromagnet. Whenever the roller 39 is in contact with a commutator bar 26, the associated pin 21 of which is in contact with an insulated area on the pattern sheet, the circuit through the pattern sheet is broken and no current is supplied to the electromagnet.

The block 41 is moved lengthwise along a rail 45 by any appropriate means not illustrated and the block moves in synchronism with the translating device 29. The translating device makes a traverse along the group of control members 28 and the roller 39 makes a traverse along the commutator once for each row of stitches being knitted, and at the completion of each such traverse, the selected needles take part in the knitting operation.

In the mechanism illustrated, in which there is a reversal in the direction of movement of the translating device 29 and roller 39 for each row of stitches, it has been found that there is a lag between the contact of the roller with a charged commutator bar and the corresponding action of the translating device because of the time required for building up current in the electromagnet, and because of the inertia of the parts, etc. It is, therefore, necessary that the roller 39 should be given a lead in its movement along the commutator, so that the lag in the operation of the translating device will not cause a distortion in the pattern being produced. For this purpose, the bracket 41 is mounted on one end of a shaft 46 extending through the block 42, and at the other end of the shaft an arm 47 is keyed thereto. Beyond the arm 47 another arm 48 is mounted loosely on the shaft and is held in place by nuts 49. The arm 47 is provided with a pin 50 at a distance from the shaft 46, and arm 48 is provided with a similarly located pin 51, the pins 50 and 51 being connected together by a spring 52. On either side of the arm 48 are stop pins 53, 54, projecting outwardly from the face of the block 42 and the block is also provided with extensions 55, 56 carrying adjustable stop pins 57, 58 engageable by the arm 47. At either end of the path of travel of the block 42 are stops 59, 60 mounted on a convenient part of the apparatus in position to be engaged by the arm 48, and serving to move the arm from its position in contact from one of the pins 53, 54 to the other.

As illustrated in Figure 4, the parts are in the condition which they assume at the beginning of a traversing movement of block 42 to the left, and arm 48 is in contact with stop pin 54. The pull of the spring 52 has caused arm 47 to move against the adjustable stop pin 58, and this has caused bracket 41 to swing in the direction of movement of the block 42 so that the roller 39 is slightly advanced beyond the vertical plane through shaft 46. When the block 42 approaches the end of its path to the left, the arm 48 will be engaged by the stop 60 and swung into contact with pin 53. The pull of the spring 52 will then cause the arm 47 to move into engagement with the adjustable stop pin 57 and this will give the roller 39 a lead for the return traverse to the right. The amount of lead given the roller 39 is determined in each case by the adjustment of the pins 57, 58, and it is just sufficient to correct for the time lag previously mentioned.

As illustrated in Figure 3, the bars of the commutator are closely adjacent, and when a scanning element such as a roller is employed, the insulating material 27 separating neighboring bars preferably does not extend quite to the plane of the upper surfaces of the bars. With this arrangement, the roller 39 which is forced downwardly by the spring 43 will contact with each bar before passing out of contact with the preceding bar. This arrangement is desirable because if the insulating material 27 extends to the plane of the upper surfaces of the bars, the circuit through the pattern sheet is broken whenever the roller passes from one bar to the next, and even though there is a group of successive bars which are all charged, the electromagnet is energized and the translating device operates once for each bar. With the arrangement shown in Figure 3 in which the roller 39 contacts with one bar before leaving the preceding bar, the repeated operation of the electromagnet for a series of charged bars is avoided and wear on the mechanism is reduced.

The construction illustrated in Figure 5 is appropriate for use in connection with a circular knitting machine, and in this construction, the commutator bars are connected to contact members 61 arranged in a circle and engaged successively by a contact on a rotating arm connected to a terminal in the amplifier by line 44. The arm operates in timed relation with the knitting machine, so that the needles of the machine are progressively selected and brought into action by the translating device in a manner determined by the pattern sheet 15. With the construction shown in Figure 5, a lead is given to the arm 62, forming a part of the scanning means, by initially starting the arm slightly ahead of the means for actuating the needles, the amount of the lead being determined by the time required for building up current in the electromagnet of the translating device and overcoming the inertia of the parts.

In both forms of the apparatus, the current supplied to the pattern sheet is relatively light and it is amplified so that a more powerful current is supplied to the translating device. Positive action of the translating device may thus be obtained without the use of current through the pattern sheet which would give trouble because of arcing.

With the new mechanism, it will be evident

that the pick-up device, including the conductive elements engaging the pattern sheet and the commutator bars, serves as an intermediary between the pattern sheet and the scanning element, and at each period of rest in the movement of the pattern sheet, the commutator bars assume electrical conditions determined by the pattern sheet and thus represent a succession of areas in a row across the pattern sheet. Since these bars lie with their top surfaces all in a plane, the scanning element may move along the series of bars at as rapid a rate as may be desirable without jumping, and wear on the pattern sheet is avoided because it is engaged only by the pins 21 which bear lightly against it. The new mechanism offers the further advantage of facilitating the determination of the spot on the pattern which governs the action of a specific needle in the operation of the knitting machine, since each conductive element or pin of the pick-up device corresponds to a particular needle. Accordingly, when changes in the pattern as reproduced in the fabric are desired, these change can be readily made on the pattern sheet.

While I have described the new control mechanism in a form appropriate for use in connection with knitting machines, it will be evident that the mechanism may be used for controlling machines of various other types, such, for example, as looms, card punching machines, etc. It is also to be understood that the control members, the action of which the new mechanism governs, may be an integral part of the machine being controlled or may be added thereto for the purpose of effectuating control.

I claim:

1. In a mechanism for controlling the operation of a machine having a group of members to be selectively actuated, the combination of an electromechanical translating device for progressively segregating selected members, and an electric circuit through said device including a source of power, a pattern sheet having conductive and insulated areas, a pick-up device having a plurality of conductive elements engaging said sheet, each element corresponding to one of said members, and a stationary contact connected to each element, and a scanning element engaging said contacts progressively.

2. In a mechanism for controlling the operation of a machine having a group of members to be selectively actuated, the combination of an electromechanical translating device for progressively segregating selected members, said device and members being relatively movable, and an electric circuit through said device including a source of power, a pattern sheet having conductive and insulated areas, a pick-up device having a plurality of conductive elements, each corresponding to one of said members, said elements engaging said sheet, and a stationary contact connected to each element, and a scanning element engaging said contacts progressively, said scanning element and contacts being relatively movable at a rate corresponding to the rate of relative movement of said device and members.

3. In a mechanism for controlling the operation of a machine having a group of members to be selectively actuated, the combination of an electromechanical translating device for progressively segregating selected members, an electric circuit through said device including a source of power, a pattern sheet having conductive and insulated areas thereon, a pick-up device having a plurality of conductive elements engaging said sheet in a row across the sheet, each element corresponding to one of said members, and a stationary contact connected to each element, and a scanning element engaging said contacts progressively, and means for advancing said sheet in a direction at an angle to the row of conductive elements.

4. In a mechanism for controlling the operation of a machine having a group of members to be selectively actuated for each operation of said group, the combination of an electromechanical translating device for progressively segregating selected members, an electric circuit through said device including a source of power, a pattern sheet having conductive and insulated areas thereon, a pick-up device having a plurality of conductive elements engaging said sheet in a row, each element corresponding to one of said members, and a stationary contact connected to each element, said contacts being arranged in a series, and a scanning element engaging said contacts progressively, said scanning element and contacts being relatively movable and said device and members being relatively movable, and means for advancing said pattern sheet lengthwise, one step for each operation of said group of members.

5. In a mechanism for controlling the operation of a machine having a group of members to be selectively actuated, the combination of an electromechanical translating device for progressively segregating selected members, an electric circuit through said device including a source of power, a pattern sheet having conductive and insulated areas thereon, a pick-up device having a plurality of conductive elements engaging said sheet and lying in a row extending across said sheet, each element corresponding to one of said members, a series of stationary contacts supported with their upper faces in a plane, each contact being connected to one of said elements, and a scanning element movable along said series and engaging said contacts successively, and means for advancing said sheet lengthwise with a stepwise movement.

6. In a mechanism for controlling the operation of a machine having a group of members to be selectively actuated, the combination of a pattern sheet having conductive and insulated areas, a plurality of conductive elements engaging the sheet and lying in a row transverse thereto, a series of stationary contacts, each connected to one of said elements, a scanning element progressively engaging said contacts, a source of power connected to said sheet, and means for advancing the pattern sheet lengthwise.

7. In a mechanism for controlling the operation of a machine having a group of members to be selectively actuated, the combination of a movable support, a pattern sheet mounted thereon and movable therewith, said sheet having conductive and insulated areas thereon, a plurality of conductive elements engaging the sheet and lying in a row transverse thereto, a series of stationary contacts, each connected to one of said elements, a scanning element progressively engaging said contacts, and a source of power connected to said sheet.

8. In a mechanism for controlling the operation of a machine having a group of members to be selectively actuated, the combination of a movable support, a pattern sheet mounted thereon and movable therewith, said sheet having conductive and insulated areas thereon, a plurality of conductive elements engaging the sheet and lying in a row transverse thereto, a

series of stationary contacts, each connected to one of said elements, a scanning element movable along said series and progressively engaging the contacts, and a source of power connected to said sheet.

9. In a mechanism for controlling the operation of a machine having a group of members to be selectively actuated, the combination of a pattern sheet having conductive and insulated areas and mounted for endwise movement, a plurality of conductive elements engaging the sheet and lying in a row across the direction of movement of the sheet, a plurality of stationary contacts, one connected to each element, said contacts being supported in a row, a scanning element reciprocable along the row of contacts and engaging them successively, and a source of power connected to the sheet.

10. In a mechanism for controlling the operation of a machine having a group of members to be selectively actuated, the combination of a pattern sheet having conductive and insulated areas and mounted for endwise movement, a plurality of conductive elements engaging the sheet and lying in a row across the direction of movement of the sheet, a plurality of stationary contacts, one connected to each element, said contacts being supported in a row, a scanning element, a reciprocating support for said scanning element bringing it successively into engagement with the stationary contacts, means for shifting the scanning element in the direction of each reciprocation of the support, said means operating before said reciprocation is started, and a source of power connected to the sheet.

11. In a mechanism for controlling the operation of a machine having a group of members to be selectively actuated, the combination of a pattern sheet having conductive and insulated areas and mounted for endwise movement, a plurality of conductive elements engaging the sheet and lying in a row across the direction of movement of the sheet, a plurality of stationary contacts, one connected to each element, said contacts being supported in a row, a support reciprocating along the row of contacts, a scanning element mounted in said support and yieldingly engaging said contacts successively as the support reciprocates, means operating before each reciprocation of the support to shift the scanning element relative to said support in the direction of said reciprocation, and a source of power connected to the sheet.

12. In a mechanism for controlling the operation of a machine having a group of members to be selectively actuated, the combination of a pattern sheet having conductive and insulated areas thereon, a support extending across said sheet, a plurality of conductive elements mounted in said support in a row and yieldingly engaging said sheet, a series of stationary contacts mounted in said support with each connected to one of said elements, said contacts lying with their upper faces substantially in a plane, a scanning element movable along the series of contacts engaging the latter successively, and a source of power connected to the pattern sheet.

13. In a mechanism for controlling the operation of a machine having a group of members to be selectively actuated, the combination of a pattern sheet having conductive and insulated areas thereon, a plurality of conductive elements mounted in a row across the sheet and engaging the latter, a series of stationary contacts mounted out of electrical contact with one another and with their upper surfaces in a plane, each contact being connected to one of said conductive elements, a scanning roller movable along the series of contacts to engage them successively, said roller engaging the next contact in series before losing contact with the one before, and a source of power connected to the sheet.

14. In a mechanism for controlling the operation of a machine having a group of members to be selectively actuated, the combination of a pattern sheet having conductive and insulated areas thereon, a commutator having a plurality of bars each connected to an area on the pattern sheet, said areas lying in a row across the sheet, a scanning element movable along the commutator and progressively engaging the bars thereof, and a source of current connected to the sheet.

15. In a mechanism for controlling the operation of a machine having a group of members to be selectively actuated, the combination of a pattern sheet having conductive and insulated areas thereon, a commutator having a plurality of bars each connected to an area on the pattern sheet, said areas lying in a row across the sheet, a support movable along the commutator, a roller mounted in said support and engaging the commutator bars successively as the support moves, and a source of current connected to the sheet.

16. In a mechanism for controlling the operation of a machine having a group of members to be selectively actuated, the combination of a pattern sheet having conductive and insulated areas thereon, a commutator having a plurality of bars each connected to an area on the pattern sheet, said areas lying in a row across the sheet, a support reciprocable along the commutator, a roller mounted in said support and engaging the commutator bars successively as the support reciprocates, said roller being shiftable relative to said support in the direction of reciprocation of the latter, means operating at the ends of the reciprocations of the support for shifting the roller, and a source of current connected to the sheet.

17. In a mechanism for controlling the operation of a machine having a group of members to be selectively actuated, the combination of a pattern sheet having conductive and insulated areas thereon, a plurality of conductive elements mounted in a row across the sheet and engaging the latter, a plurality of stationary contacts arranged in a circular series, each contact being connected to one of said conductive elements, a scanning element movable along said circular series to engage the contacts successively, and a source of current connected to the sheet.

18. In a mechanism for controlling the operation of a machine having a group of members to be selectively actuated, the combination of a pattern sheet having conductive and insulated areas thereon, means for moving said sheet lengthwise, a support extending across said sheet, a plurality of conductive elements carried by the support and engaging the sheet, said elements lying in a row lengthwise of the support, a plurality of stationary contacts mounted out of electrical contact with one another and in a row, each contact being electrically connected to a conductive element, a scanning element traveling along the row of stationary contacts, said element including a roller yieldingly bearing upon

the contacts successively, and a source of current connected to the sheet.

19. In a mechanism for controlling the operation of a machine having a group of members to be selectively actuated, the combination of an electromechanical translating device for progressively segregating selected members, a pattern sheet having conductive and insulated areas thereon, a pick-up device having a plurality of conductive elements engaging said sheet, each element corresponding to one of said members, a stationary contact connected to each element, a scanning element engaging said contacts progressively, a source of power connected to said pattern sheet, and an amplifier connected to said scanning element and delivering amplified power to said translating device.

WILLIAM S. TANDLER.