

N. MAGNUSON.  
 AUTOMATIC CONTROLLING MECHANISM.  
 APPLICATION FILED APR. 13, 1911.

1,005,251.

Patented Oct. 10, 1911.

3 SHEETS—SHEET 1.

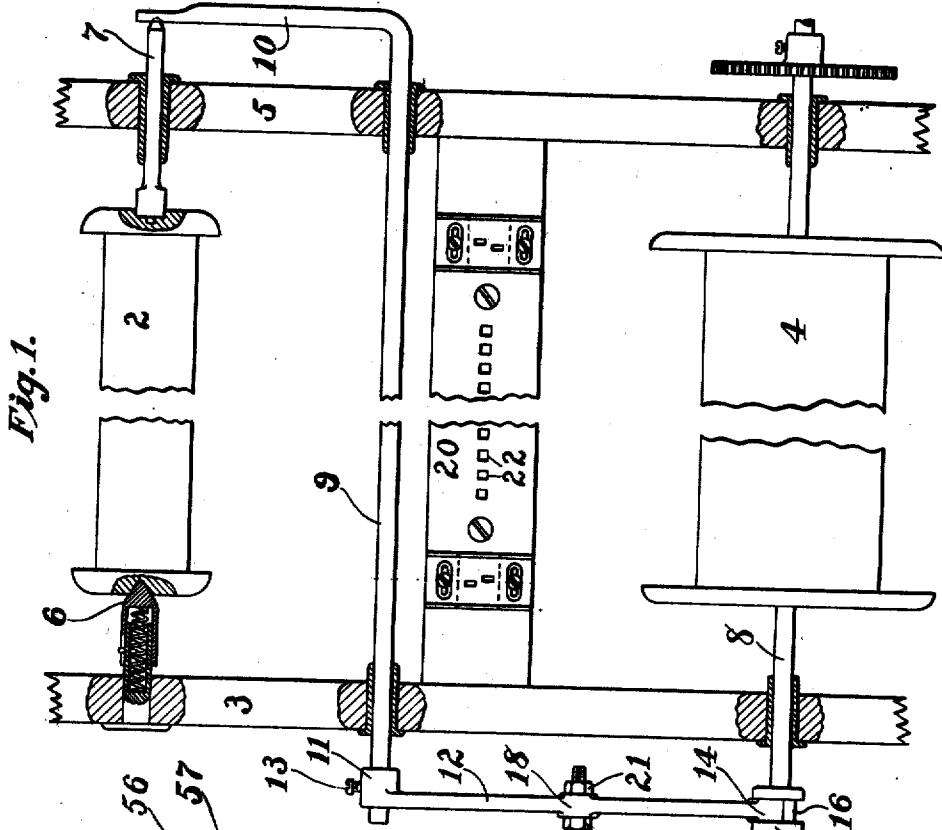


Fig. 1.

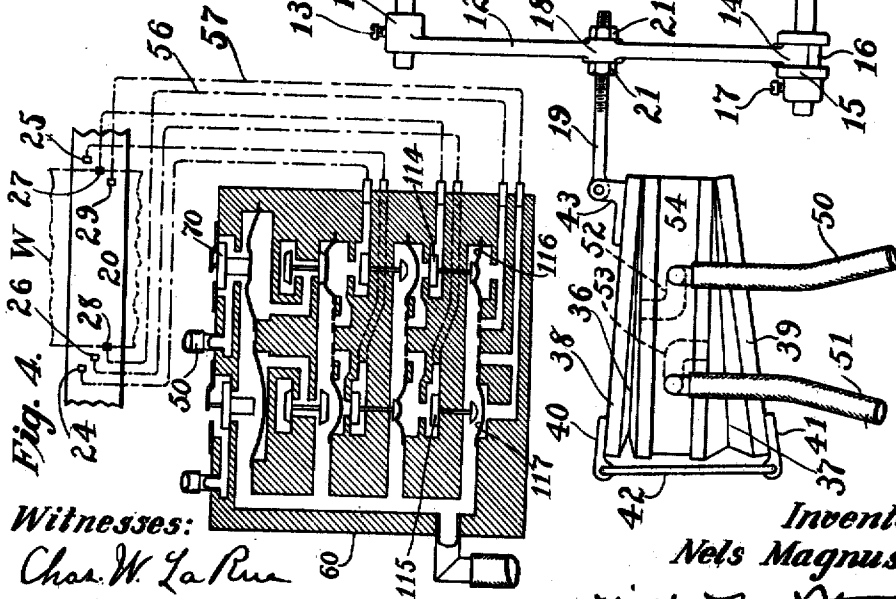


Fig. 4.

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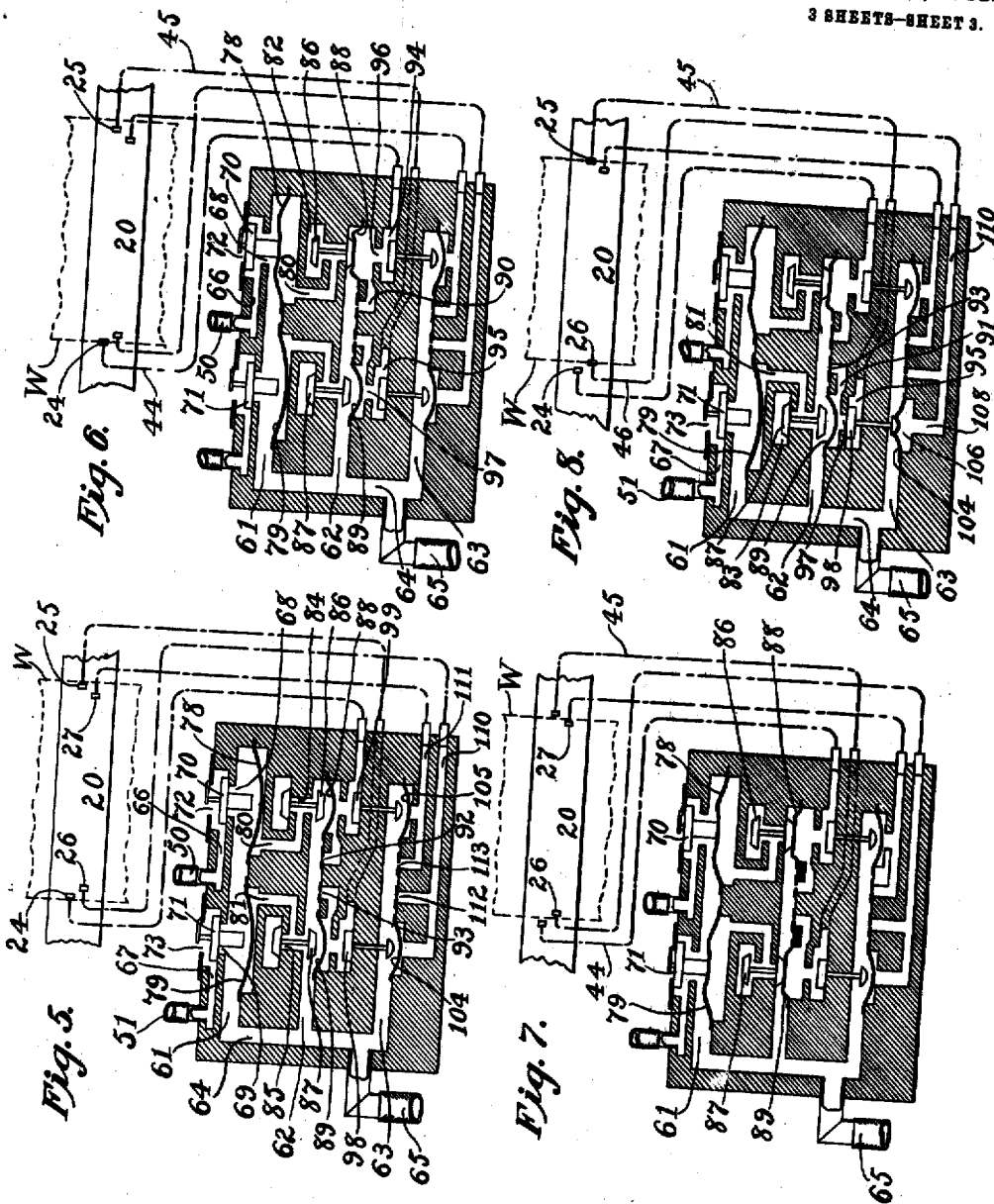


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3 SHEETS—SHEET 3.



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# UNITED STATES PATENT OFFICE.

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## AUTOMATIC CONTROLLING MECHANISM

1,005,251.

Specification of Letters Patent.

Patented Oct. 10, 1911.

Application filed April 13, 1911. Serial No. 620,813.

To all whom it may concern:

Be it known that I, NELS MAGNUSON, a citizen of the United States, and a resident of Fort Wayne, in the county of Allen and State of Indiana, have invented certain new and useful Improvements in Automatic Controlling Mechanism, of which the following is a specification.

5. This invention relates to automatic controlling mechanism and particularly to that class of such mechanism as is adapted for use in mechanical musical instruments for the control of the relative movements of two or more contacting parts.

10. The object of my improvements is to furnish a mechanism simple in construction, reliable in action and having small liability to derangement.

15. I have illustrated my improvements as applied to the shifting of the web or perforated music sheet relative to the tracker board.

20. To these ends my improvements comprise parts and combinations shown in their preferred form in the accompanying drawings wherein:

25. Fig. 1 is a front elevation of the tracker board and a portion of the traveling web mechanism of a player piano embodying a portion of my improvements. Fig. 2 is a front elevation of a portion of what is shown in Fig. 1 and including a sectional view of my improved valve mechanism.

30. Fig. 3 is an edge view partly in section of one end of the tracker board. Fig. 4 is a diagrammatic sectional elevation of a modification of my improved valve mechanism. Figs. 5, 6, 7 and 8 are diagrammatic sectional elevations of the valve mechanism of

35. Fig. 2 illustrating the operation thereof.

40. The usual music rolls 2 and 4 are axially supported in frames 3 and 5 and may be rotated by some well known means not shown. Upper roll 2 is removable by compressing springs supported center 6 thus freeing said roll from driving shaft 7. Said roll 2 is shiftable laterally axially by means of said shaft 7. Roll 4 is fixed to shaft 8, rotatively and slidably mounted in boxes in side frames 3 and 5. Between rolls 2 and 4 is

45. tracker board 20 supported from frames 3 and 5. Roll 2 and 4 may be shifted axially in synchronism by the following means: Rod 9 is slidably mounted in boxes in side frames

50. 3, 5 and has the upper end of right angle portion 10 in engagement with the outer end of upper roll shaft 7. The left hand out-board end (Fig. 1) of rod 9 pierces ear 11 of arm 12 and is fixed therein by set screw 13. The lower end 14 of arm 12 is bifurcated and straddles necked portion 16 of collar 15 fixed to shaft 8 by set screw 17. Thus by moving arm 12 to the right or left rolls 2 and 4 are similarly and synchronously shifted axially, and a web or music sheet carried by said rolls will be similarly moved relative to tracker board 20. Said tracker board may be provided with the usual row of orifices as 22 from which ducts as 23 lead to operating pneumatics, not shown. Arranged at either end of said row of orifices are a plurality of pairs of guide orifices or indicators as 24, 25 for engagement with the marginal surfaces of the web or music sheet. In Figs. 1, 2, 5, 6, 7 and 8 two pairs of such orifices 24, 25 and 26, 27 are shown. In Fig. 4 a third pair 28, 29 are included. Said guide orifices are preferably mounted in adjustable blocks 30, 31. Block 30 carries all the left hand members of the several pairs of orifices and block 31 all the right hand members of said pairs. Said blocks may be held in position by set screws as 32 in slots as 33 in block 30, said set screws being threaded into tracker bar support 58. Said support 58 has mortise 35 therethrough for the passage of ducts or connections as 44, 46. Tracker board 20 is shown as mounted on the same supports, 58, 59, as blocks 30, 31 and it will be understood that instead of shifting rolls 2, 4 relative to said tracker board, as illustrated, said tracker board could equally well be shifted relative to said rolls as shown for instance in U. S. Patent No. 967,983 of August 23, 1910, to Scott and Sampere.

60  
65  
70  
75  
80  
85  
90  
95

100  
105  
110

matic guidance will be operative within the arbitrary limits established in the building of the apparatus.

The maximum ungoverned widthwise deviation of web W is measured by the width of an individual gage opening as 24. For instance assuming said width of opening to be  $1/32$  of an inch and assuming a certain portion of said web W to have a width equal to the distance center to center of opening 24 from opening 25 said web can move to the right  $1/64$  of an inch before opening 25 is covered and the automatic governing means put into operation to shift the web to the left. Then from that extreme position to the right, said web may move to the left  $1/32$  of an inch before opening 24 is covered and the automatic governing means put into operation to shift the web to the right. The ungoverned widthwise deviation of the web is reduced directly as the width of the web varies more or less from a width equal to the distance center to center between the members of one pair of gage openings.

In the diagrammatic views of Figs. 4 to 8 inclusive the guide openings are shown as spaced abnormally far apart laterally and the widthwise movement of the web is greatly exaggerated to more clearly illustrate the operation of the apparatus.

For moving arm 12 I preferably provide a pair of oppositely acting pneumatics or motors 36, 37 preferably mounted on a common backing 54 fixed to any suitable support not shown. Said pneumatics comprise the usual hinged members 38, 39 having ears 40, 41 respectively fixed to the free ends thereof. Said ears are pivotally connected to opposite ends of link 42. Duct 50 is connected through passage 52 with upper pneumatic 36 and duct 51 is similarly connected through passage 53 with lower pneumatic 37. One hinged member as 38 has ear 43 thereof pivotally connected to threaded rod 19 which penetrates hub 18 midway the length of arm 12. Said rod 19 is adjustably fixed to said arm by opposing nuts 21, 21. Thus when the air is exhausted from pneumatic 36, arm 12 and rolls 2 and 4 will be moved to the left (Fig. 1) and when the air is exhausted from pneumatic 37, arm 12 and rolls 2 and 4 will be moved to the right.

Referring now directly to my improved valve mechanism for controlling the exhaust to pneumatics 36 and 37, said mechanism comprises valve box 60 having horizontal exhaust channels 61, 62 and 63 therein all communicating with vertical exhaust channel 64 from which main suction or exhaust pipe 65 leads to any suitable source of exhaust, not shown. Above channel 61 and communicating therewith through openings 68, 69 are valve chambers 66, 67 having main valves 70, 71 therein, all respectively, alter-

nately operable for closing said valve chambers against said channel 61 and the atmosphere. Said valve chambers as 66 connect with the atmosphere through openings as 72 and said valves as 70 are guided by pins as 74 downwardly reaching from top plates as 76.

Main valve 70 is actuated by the usual flexible diaphragm 78 thereunder. Said diaphragm forms a top wall for suction channel 80, which is connected with suction channel 62 therebelow and with air channel 82 by opening 84. Primary auxiliary valve 86 is operable to alternately close suction channel 62 and air channel 82 from channel 80. Said valve 86 is actuated by flexible diaphragm 88 thereunder and said diaphragm forms a top wall for channel 90 normally under tension through bleed hole 92 connecting said channel 90 with tension channel 62. Channel 90 is connected with channel 94 and duct 44 by passage 96 and within said channel 94 is secondary auxiliary valve 99 operable for closing said passage 96. Said valve 99 has stem 101 penetrating into exhaust channel 63 and has button 103 for engagement with diaphragm 105. Said diaphragm 105 forms a top wall for chamber 107 connected by passage 109 with channel 111 and duct 47. Said channel 111 is normally under tension through bleed hole 113 connecting it with exhaust channel 63.

Adjoining the set of vertically arranged valves and valve operating mechanisms in valve box 60, just described, is a second and similar set beginning with primary valve 71 and which valve is operable by diaphragm 79 thereunder. Said diaphragm is in turn operated through channel 81 thereunder connected with both air channel 83 and with exhaust channel 62 by opening 85. Primary auxiliary valve 87 is operable to alternately close exhaust channel 62 and air channel 83 from channel 81. Said auxiliary valve 87 is in its turn actuated from below by diaphragm 89 over channel 91 connecting with channel 95 and duct 45 by opening 97. Within channel 95 is secondary auxiliary valve 98 operable for closing opening 97. Said valve 98 is in turn operable by diaphragm 104 engaging button 102 on the lower end of stem 100 of said valve 98. Diaphragm 104 is over chamber 106 connecting with channel 110 and duct 46 by means of passage 108. Bleed hole 93 connects tension channel 62 with channel 91 and bleed hole 112 connects tension channel 63 with channel 110.

In Fig. 4 I have illustrated a modification of my improved device comprising the addition of another pair of oppositely disposed guide orifices 28, 29 in tracker board 20 and a pair of tertiary auxiliary valves 114, 115 and of diaphragms 116, 117 in valve box 60

connected, with said orifices by ducts 56, 57 respectively. Said Fig. 4 is illustrative of an indefinite expansion of my improvements by the addition of successive pairs of guide openings and their connecting mechanisms. In practice however I find that two pairs or possibly three meet all commercial requirements.

The operation of my improved controlling mechanism is as follows and said operation will be best understood by reference to the diagrammatic views of Figs. 5 to 8 inclusive. In Fig. 5 a web W of sufficient width to cover outer guide orifices 24, 25 is shown in dotted lines symmetrically disposed over said orifices and tracker board 20. It being understood that pipe 65 and the channels connected therewith are under exhaust tension, diaphragms 78, 79 are at rest as shown and main valves 70, 71 are seated by atmospheric pressure closing openings 68, 69 and permitting air to enter both pneumatics 36, 37 (Fig. 1) through openings 72, 73, channels 66, 67 and ducts 50, 51, all respectively. Said diaphragms 78, 79 are at rest because both sides of each thereof are subject to the same tension; on their upper sides through channels 64 and 61 and on their lower sides through channels 64 and 62 and openings 84, 85 and channels 80, 81 all respectively. Also diaphragms 88, 89 and valves 86, 87 are at rest as shown in said Fig. 5 because said diaphragms are under equal tension on both sides thereof respectively through channels 64, 62 and bleed holes 92, 93. Inner guide orifices 26, 27 being also covered by web W the exhaust from pipe 65 through channels 64, 63 is operable above diaphragms 105, 104 and, through bleed holes 113, 112 and channels 111, 110, below said diaphragms respectively, whereby said diaphragms are under equal tension above and below and therefore at rest as are valves 99, 98 thereover respectively. If now said web W deviates widthwise from its normal and symmetrically disposed path of travel, as for instance to the right as shown in Fig. 6, guide opening 24 will be uncovered or partially uncovered, thereby admitting air through duct 44, channel 94 and opening 96 into chamber 90 below diaphragm 88, causing said diaphragm to rise abruptly, driving valve 86 upwardly, thus closing the passage from exhaust channel 62 to channel 80 and opening the passage from air channel 82 to channel 80 whereby air is admitted below diaphragm 78 causing said diaphragm to rise abruptly driving valve 70 upwardly, thus closing passage 72 from the outer air to channel 66 and opening passage 68 from exhaust channel 61 to channel 66 and thus through duct 50 to pneumatic 36, causing said pneumatic to collapse, thereby pulling rod 19 and rolls 2, 4, carrying web W, to the left (Fig. 1), whereby said web is restored

to its normal path of travel covering both guide openings 24, 25 as in Fig. 5. If however web W deviates to the left a sufficient amount to uncover or partially uncover guide opening 25, air will be admitted through duct 45, channel 95 and passage 97, causing diaphragm 89 to rise and lift valve 87, whereby diaphragm 79 will be caused to rise and lift valve 71, thus causing pneumatic 37 to collapse and shift web W to the right. If now a portion of web W narrower than the distance between the outer edges of openings 24 and 25 passes thereover (Fig. 7), it will permit air to enter both of those passages and thence to the underside of both diaphragms 88, 89 whereby, by means already described, valves 70, 71 will both be raised allowing tension to act on both pneumatics 36, 37. Said pneumatics being thus in equilibrium under tension no endwise shifting of rolls 2, 4 will occur, any more than when said pneumatics were in equilibrium under atmospheric pressure. If now said narrow portion of web W deviates widthwise from its normal and symmetrical path of Fig. 7, as for instance to the right as shown in Fig. 8, inner guide opening 26 will be uncovered (outer guide openings 24, 25 remaining uncovered) thereby admitting air through duct 46, channel 110 and opening 108 into chamber 106 below diaphragm 104, causing said diaphragm to rise abruptly, driving valve 98 upwardly, thus closing passage 97 against the entrance of air from chamber 95, duct 45 and uncovered guide opening 25, to chamber 91. Thereupon the exhaust from channel 62 through bleed hole 93 will equalize the tension on both sides of diaphragm 89 allowing the air pressure in channel 83 to drive valve 87 downwardly, closing the passage from said air channel 83 to channel 81 and opening the passage from exhaust channel 62 to said channel 81. Diaphragm 79 is thus under equal exhaust tension on both sides thereof and the air pressure from above will drive main valve 71 downwardly, closing the passage from exhaust channel 61 to channel 67 and admitting air through opening 73, channel 67 and duct 51 to pneumatic 36 destroying the equilibrium of tension previously existing in pneumatics 36 and 37 and permitting the exhaust tension in pneumatic 37 to collapse that pneumatic, thereby pulling rod 19 and rolls 2, 4, carrying web W, to the left (Fig. 1), whereby said web is restored to its normal path of travel covering both guide openings 26, 27 as in Fig. 7, and said pneumatics 36, 37 are again in equilibrium under tension.

Referring now directly to Fig. 4 I have therein illustrated web W as of a width sufficient to cover both of the inner pair of openings 28, 29 but of a width insufficient to cover either of the next outer pair 26, 27,

when said web is traveling symmetrically to said openings. I have however illustrated said web in Fig. 4 as deviating widthwise to the right in its travel thus uncovering opening 28 and admitting air to duct 56 and thence below diaphragm 116, causing said diaphragm to rise and close valve 114 and, through the train of diaphragms and valves thereover, main valve 70 whereby exhaust is permitted to act through duct 50, to collapse pneumatic 36 thereby shifting web W to the left to again cover opening 28.

It will be obvious to those skilled in the art that my improvements are equally applicable to means for relatively adjusting the web and the tracker board other than those illustrated and described herein. Therefore while I have illustrated my improvements in their preferred embodiment only, considering it unnecessary in view of the well known prior art to burden this application with a variety of intermediary means for applying my improvements, I do not limit myself to such preferred embodiment but have formulated my claims to cover the invention not only as specifically illustrated but as broadly as said invention may obviously be applied by those skilled in the art.

The problem of correlating the perforated music web and the tracker board openings is a fundamental problem in instruments of the class specified and I am aware that numerous devices have been heretofore employed directed toward a solution of that problem. I am familiar with many devices of this character and my improvements have a wide application relative thereto and may be applied to the betterment of substantially all said devices.

I claim:—

1. Automatic controlling mechanism including in combination, a tracker board, two pairs of oppositely disposed guide openings therein, the members of the first pair of openings being farther apart than the members of the second pair thereof, two sets of valve actions each comprising a main valve, a main diaphragm for actuating said valve, a primary auxiliary valve for alternately admitting pressure and tension below said main diaphragm, a primary auxiliary diaphragm for actuating said primary auxiliary valve, a primary duct for admitting air below said primary auxiliary diaphragm, a secondary auxiliary valve for closing said air duct, a secondary auxiliary diaphragm for actuating said secondary auxiliary valve, a secondary duct for admitting air below said secondary auxiliary diaphragm and means for controlling said valve actions from said guide openings.

2. Automatic controlling mechanism including in combination, a tracker board, two pairs of oppositely disposed guide openings therein, the opposite members of the one

pair having their inner edges and the opposite members of the other pair having their outer edges in the same planes respectively normal crosswise said tracker board; two sets of valve actions each comprising a main valve, a main diaphragm for actuating said valve, a primary auxiliary valve for alternately admitting pressure and tension below said main diaphragm, a primary auxiliary diaphragm for actuating said primary auxiliary valve, a primary duct for admitting air below said primary auxiliary diaphragm, a secondary auxiliary valve for closing said air duct, a secondary auxiliary diaphragm for actuating said secondary auxiliary valve, a secondary duct for admitting air below said secondary auxiliary diaphragm and means for controlling said valve actions from said guide openings.

3. Automatic controlling mechanism including in combination, a tracker board, two pairs of oppositely disposed guide openings therein, the members of the first pair of openings being farther apart than the members of the second pair thereof, two sets of valve actions each comprising a main valve, a main diaphragm for actuating said valve, a primary auxiliary valve for alternately admitting pressure and tension below said main diaphragm, a primary auxiliary diaphragm for actuating said primary auxiliary valve, a primary duct for admitting air below said primary auxiliary diaphragm, a secondary auxiliary valve for closing said air duct, a secondary auxiliary diaphragm for actuating said secondary auxiliary valve, a secondary duct for admitting air below said secondary auxiliary diaphragm, a tertiary auxiliary valve for closing said secondary air duct, a tertiary auxiliary diaphragm for actuating said tertiary auxiliary valve and a tertiary duct for admitting air below said tertiary auxiliary diaphragm and means for controlling said valve actions from said guide openings.

4. Automatic controlling mechanism including in combination, a tracker board, two pairs of oppositely disposed guide openings therein, means for feeding a web thereover, a pair of oppositely acting pneumatic means for laterally shifting the web feeding means relative to the tracker board, the members of the first pair of openings being farther apart than the members of the second pair thereof, and pneumatically operably connected with said oppositely acting means respectively, and means for reversing the action of the means for actuating said oppositely acting means, the members of the second pair of openings being pneumatically operatively connected with said reversing means, respectively.

5. Automatic controlling mechanism including in combination, two pairs of oppositely disposed guide openings, a tracker

board, means for feeding a web over said guide openings and said tracker board, a pair of oppositely acting pneumatic means for relatively shifting laterally the web feeding means and the tracker board, the members of the first pair of openings being farther apart than the members of the second pair thereof, and pneumatically operably connected with said oppositely acting means respectively, the members of the second pair of openings being pneumatically operatively connected with means for reversing the action of the means for actuating said oppositely acting means respectively.

6. Automatic controlling mechanism including in combination, a roll shiftable axially, a pair of oppositely acting means for shifting said roll, a tracker board, two pairs of oppositely disposed guide openings therein, the members of the first pair of openings being farther apart than the members of the second pair and pneumatically operatively connected with means for actuating said pair of oppositely acting means respectively, the members of the second pair of openings being pneumatically operatively connected with means for reversing the action of the means for actuating said oppositely acting means, respectively.

7. Automatic controlling mechanism including in combination, two pairs of oppositely disposed guide openings, means for feeding a web thereover, a pair of oppositely acting means for shifting the web feeding means relative to said guide openings, the members of the first pair of openings being farther apart than the members of the second pair thereof and operatively connected

with means for actuating said pair of oppositely acting means and the members of the second pair of openings being operatively connected with means for reversing the action of the means for actuating the oppositely acting means, all respectively.

8. Automatic controlling mechanism including in combination, a plurality of pairs of oppositely disposed guide openings, means for feeding a web thereover, a pair of oppositely acting means for shifting the web feeding means relative to said guide openings, means for reversing the action of said oppositely acting means, the members of that pair of openings which are farthest apart being operatively connected with means for actuating said pair of oppositely acting means respectively, the members of that pair of openings which are next farthest apart being operatively connected with said means for reversing the action of the means for actuating the oppositely acting means, all respectively and means for reversing the action of the means for reversing the action of said oppositely acting means, the members of that pair of openings which are next farthest apart being operatively connected with said means for reversing the action of the means for reversing the action of the means for actuating the oppositely acting means, all respectively.

Signed this 6 day of April nineteen hundred and eleven before two subscribing witnesses.

**NELS MAGNUSON.**

Witnesses:

**HERBERT W. BOND,  
J. M. KUHNS.**