July 14, 1936. G. LIWSCHUTZ 2,047,377

DISPLAY FIGURE

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Fig. 7.

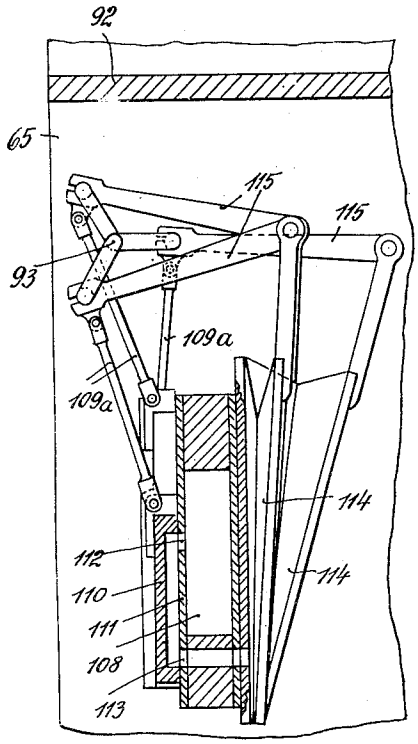


Fig. 1.

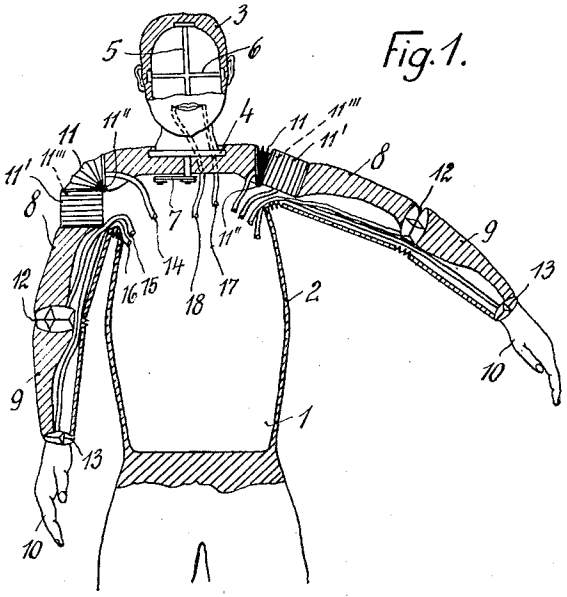
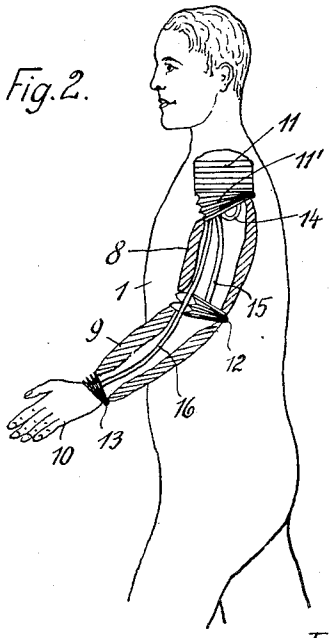


Fig. 2.



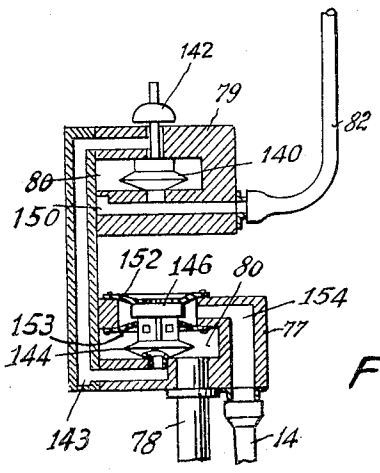


Fig. 8.

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DISPLAY FIGURE

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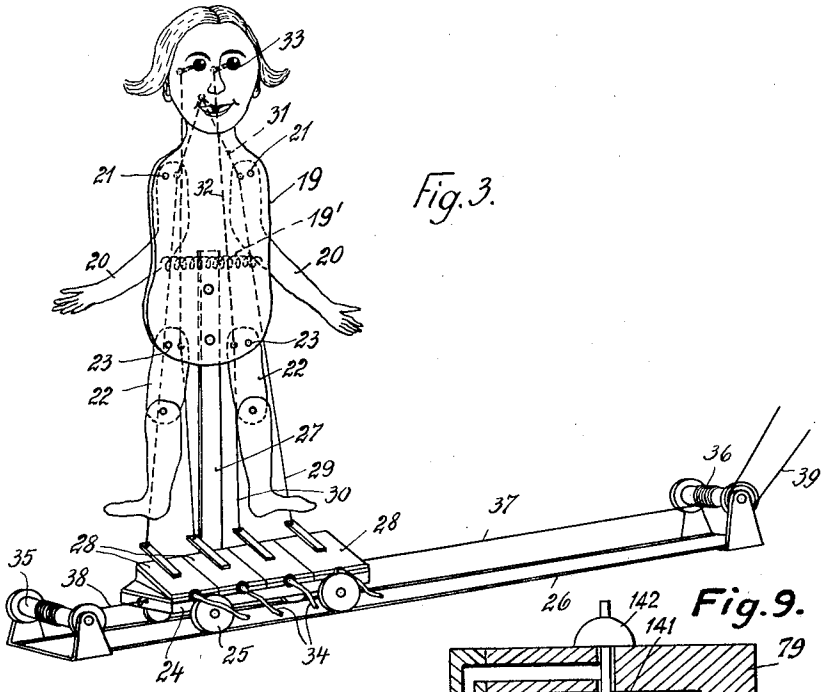


Fig. 3.

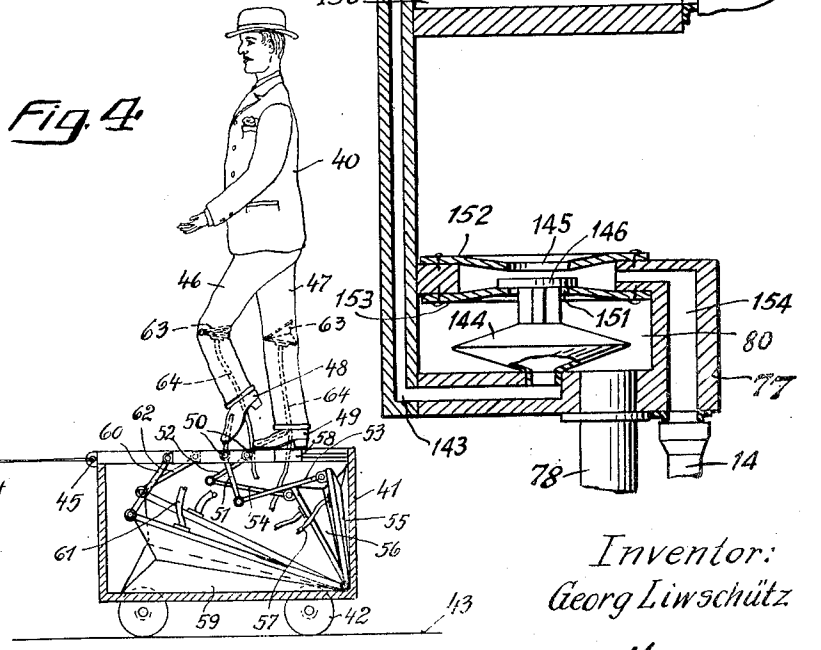


Fig. 9.

Fig. 4

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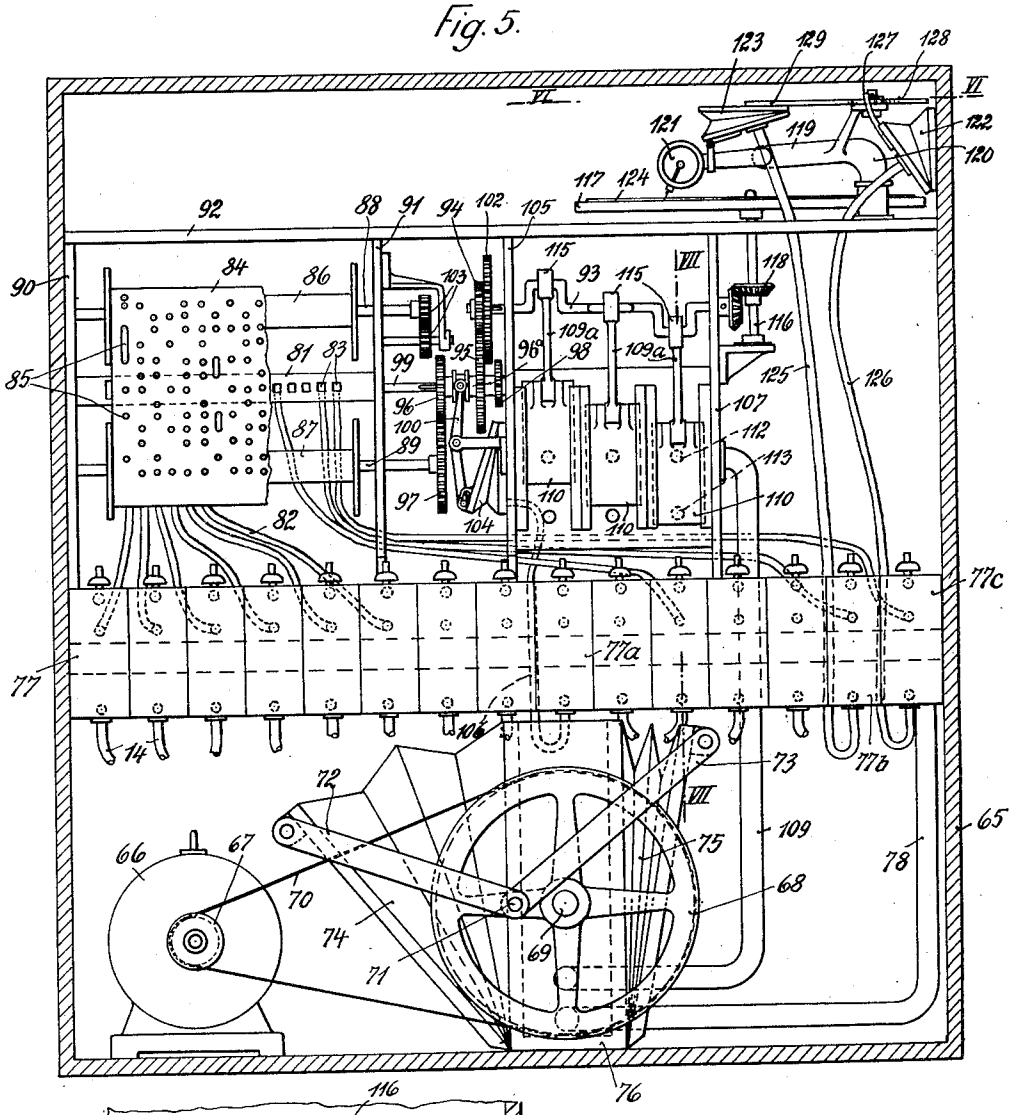
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DISPLAY FIGURE

Filed Feb. 1, 1932 3 Sheets-Sheet 3

Fig. 5.



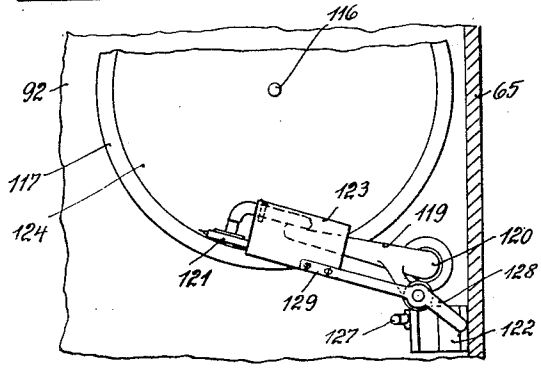


Fig. 6.

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Patented July 14, 1936 2,047,377

UNITED STATES PATENT OFFICE

2,047,377

DISPLAY FIGURE

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Application February 1, 1932, Serial No. 590,118
In Germany February 2, 1931

8 Claims. (Cl. 46—120)

My invention relates to movable figures such as human or animal display figures and it is one of the objects of my invention to provide mechanism which is particularly suitable for the operation of the limbs of such figures.

According to the present invention I connect the movable limbs of the display or other figure with pneumatically controlled means such as bellows which expand and/or contract under the action of variations of pressure within the pneumatic controlling system and I thereby control the limbs, raising or lowering and otherwise moving them as desired.

In a preferred embodiment of my invention I effect the pneumatic control of the limbs by means of pneumatic mechanism such as hitherto used in connection with musical instruments of the "pianola" type comprising a tracker bar and a perforated sheet (note sheet) traveling in contact with the tracker bar and past the air holes arranged therein, this sheet by means of variously arranged holes and slots alternately covering and uncovering certain of the air holes and thereby creating predetermined differences of pressure in the pneumatic system, which are utilized to control and actuate the movable limbs of the figures.

It is another object of my invention to combine with the figures thus controlled and actuated a sound instrument such as a talking machine and to have this machine also controlled by pneumatic means, preferably those controlling the figures.

In the drawings affixed to this specification and forming part thereof various embodiments of my invention are illustrated diagrammatically by way of example.

In the drawings

Fig. 1 is a front elevation and

Fig. 2 is a side elevation, both partly in section, of a human figure having movable and articulated arms operated by bellows,

Fig. 3 is a perspective illustration of a figure resembling a jumping jack, with pivoted arms and legs,

Fig. 4 is an elevation of a human figure which has movable legs and appears to mark time,

Fig. 5 is a partly sectional elevation of a vacuum control for the bellows which may be housed in the body of the figure illustrated in Fig. 1,

Fig. 6 is a section on the line VI—VI in Fig. 5,

Fig. 7 is a section on the line VII—VII in Fig. 5, drawn to a larger scale, showing the mechanism for operating the bellows 14, and

Figs. 8 and 9 are similar views of a valve of the wind chest in open and closed positions, respectively.

Referring now to the drawings, and first to Figs. 1 and 2, 1 is the body of a display or toy figure representing a man, with a cavity 2 in which the mechanism illustrated in Fig. 5 may be housed. 3 is the head of the figure which is preferably hollow and has a flange 4 at its lower end by which it is inserted in a depression of the body 1, 5 and 6 are vertical and horizontal bracing members in the head, and 7 is a bar at the lower end of the vertical member 5 for varying the angular position of the head relatively to the body.

8, 8 are the upper arms, 9, 9 are the fore-arms, and 10, 10 are the hands of the figure. Each shoulder joint is formed by bellows 11 which impart a rocking movement to the arms so as to swing them up and down. Each upper arm 8 is connected to the shoulder bellows 11 by another bellows 11' arranged at right angles to the bellows 11. In this manner a universal joint is provided at each shoulder, the bellows 11' controlling the forward and rearward swinging of the arms. 12 and 13 are bellows provided at the elbow and wrist joints, respectively. The bellows are individually connected to a supply of air under pressure or to a vacuum tank, as the case may be, by flexible tubes. The tubes 14, 15 and 16 for the bellows 11, 12, and 13, respectively, are shown in Figs. 1 and 2, the tubes for the bellows 11' having been omitted for the sake of clearness.

The bellows are designed in the usual way, i. e. with a pair of hinged members connected by a joint 11'' or 11''', as shown for the bellows 11 and 11', respectively, in Fig. 2. Means such as springs are provided which tend to return the bellows into a given initial position. In the present instance it has been assumed that the bellows are controlled by air under pressure and held inflated or expanded in the normal or initial position of the parts to which they are connected.

If, by any suitable control, the air in the inflated bellows is allowed to escape to a greater or lesser extent, the springs contract the bellows in proportion. Thus in Fig. 1 the right arm of the figure hangs down, all its bellows being fully inflated. If it is desired to raise the arm, the tube 14 at the corresponding side of the body is opened by the aforesaid control for a shorter or longer period, a portion of the air, or all the air in the bellows being allowed to escape and the springs contracting the bellows, rocking the arm upwards about the hinge 11'' of the bellows 11, as shown for the left arm in Fig. 1. The arm is now raised to a given position. If it is desired to swing it forwards, the pressure in the bellows 11' is reduced, these bellows being also connected to a flexible tube (not shown) whereby the bellows are made to contract under the action of their springs and the arm rocks about the hinge 11'''. In a similar manner the bellows at the elbow and at the wrist joints are operated by their respective tubes 15 and 16.

If the figure is operated by a vacuum control,

as will be described with reference to Figs. 5 and 7, a vacuum is maintained in the bellows so that they are normally held contracted by atmospheric pressure and allowed to expand if the vacuum in the bellows is reduced. Obviously in this instance the springs of the bellows tend to expand the bellows, and by regulating the vacuum the bellows are permitted to expand to a greater or lesser extent, so that the members or limbs, to which they are connected, will move in the manner described.

The figure may also be designed with a movable lower jaw, movable lips and eyes, and a talking machine may be connected to it, as will be described with reference to Figs. 5 and 6. The bellows for operating the lower jaw, the lips and the eyes are not shown in Fig. 1, but two of the flexible tubes for their control are indicated at 17 and 18. The operation is similar to that described for the arms and will be understood without illustration.

Referring now to Fig. 3, 19 is the body of a toy figure here shown as a jumping jack. 20 are its arms which are pivoted to the body at 21, and 22 are its legs which are pivoted to the body at 23. The figure is secured to a truck 24 with wheels 25 moving on a race or track 26, 27 being an upright extending from the truck, 24 to the body 19 of the figure. 28 are four bellows controlling the arms and legs.

Only the mechanism for one side of the body will be described. 29 is a cable or the like by which the bellows 28 at the right are connected to a point near the pivot 21 of the left arm 20 and 30 is a cable connecting the other bellows to a point near the pivot 23 of the left leg 22. 31 is a cable extending from the end of cable 29 to a lever for moving the mouth, and 32 is a cable extending from the end of cable 30 to the left eye 33 of the figure. The two other bellows 28 are connected in a similar manner to the arms and legs at the right. 34 are flexible tubes connecting the bellows 28 to a control. 19' is a guide, here shown as a coiled spring, for preventing interference of the several cables.

Means may be provided for moving the truck to and fro on its track 26. Winding drums 35 and 36 are mounted in suitable brackets at the ends of the track and cables 37 and 38 are connected to opposite ends of the truck. Rotation is alternately imparted to the drums by suitable means such as a belt 39 on a pulley on the shaft of drum 36.

Referring now to Fig. 4, 40 is the body of a figure which is secured by suitable means (not shown) to a casing 41 having wheels 42 running on a track 43. 44 is one of the cables which is attached to the casing 41 at 45 for moving it to and fro on the track, as described with reference to Fig. 3. In the example illustrated only the legs 46 and 47 of the figure are movable, but obviously means such as illustrated in Figs. 1 and 2 might be provided for moving its arms, lips, eyes, etc., as desired.

The operating mechanism for the legs of the figure is housed in the casing 41. The feet 48 and 49 are mounted to rock about pivots 50 in slides 58 which are reciprocated in the top plate of the casing 41. 51 is an arm on the pivot 50 for the left foot 48 and 52 is an arm on the pivot 50 for the right foot 49. The feet are mounted to slide on extensions of the arms beyond their pivots. 55 and 56 are bellows near the rear wall of the casing. 53 is a rod connecting the bellows 55 to the arm 51 for the left foot 48, and 54 is a rod connecting the bellows 56 to the arm 52 for the right foot 49. 57 is a flexible pipe connected to the bellows.

Reciprocation is imparted to the slides 58 by means of two bellows in the base of the casing 41, one of the bellows being shown at 59. 60 is a rod by which the bellows are connected to the slide 58 for the foot 48 and 61 is a flexible tube for supplying air under pressure to the bellows 59. A similar arrangement, with a connecting rod 62, is provided for the other slide 58 and its bellows (not shown).

Bellows 63 are inserted at the knees of the figure to which flexible pipes 64, 64 are connected. The feet 48, 49 are alternately reciprocated horizontally by means of the slides 58 under the control of their bellows 59 while at the same time they are rocked about their pivots 50 in the slides 58 by the bellows 55 and 56. The bellows 63 at the knees are inserted in order to complete the imitation of walking or marking time by raising and lowering the feet.

A vacuum control for use in connection with the figures above described will now be described with reference to Figs. 5, 8, and 9.

The illustrated control is of the vacuum type and corresponds substantially to the well known pneumatic control of musical instruments of the "pianola" type. In a vacuum control the bellows are normally held contracted by the vacuum existing within them, as described, and means such as springs are provided for expanding them against the vacuum. In a control which regulates the admission of compressed air to the bellows, these are expanded by increasing the pressure existing within them and means must be provided for contracting them when the pressure is taken off.

Referring now to Figs. 5, 8, and 9, 65 is a casing which, if desired, may be housed in the cavity 2 of the figure illustrated in Figs. 1 and 2. 66 is an electric motor on the bottom plate of the casing, 67 is a pulley or sprocket on the motor shaft, 68 is a pulley or sprocket on a driven shaft 69, and 70 is a belt or chain connecting the pulleys or sprockets 67 and 68. 71 is a crank pin on the pulley or sprocket 68, 72 and 73 are links, which are pivoted to the crank pin 71 at one end and at their other end are connected to bellows 74 and 75, respectively, which are connected to opposite sides of a vacuum chamber 76. 77 is a wind chest and 78 is a pipe connecting the wind chest to the vacuum chamber 76. The wind chest 77 is subdivided into as many compartments as controlling operations are to be performed. Each compartment is equipped with a relay 79 and a valve chamber 80. The valve chamber of each compartment is connected to the flexible tube for one of the bellows, for instance to the tube 14 for the bellows 11 in Fig. 1. While Fig. 8 illustrates the position of the parts at the moment, when a perforation of the perforated sheet is in register with the tube 82, Fig. 9 illustrates the valves in the position of the sheet, where the tube is closed by a solid portion of the sheet. The suction device connected to the tracker bar creates permanent reduced pressure in the conduits of the wind chest, in which the small leather bags 140 and 144 are arranged, which control the valves proper by lifting them, when expanding, and lowering them, when collapsing. Both these bags operate in a partial vacuum. The air which may be contained in these bags escapes through the pores of the leather and the bags then assume the flat form shown in

Fig. 9. Thus, if the control sheet covers the opening in the tracker bar, the leather bag 140 is flattened down and the wooden valve disc 141 mounted on the bag, being acted upon by the outer air and carrying the head 142, closes the conduit 143. The other leather bag 144, being not supplied with air, is flattened down also and by lowering the valve disc 146, which may alternately close the apertures 145 and 151 in the discs 152 and 153, respectively, allows atmospheric air to flow through the aperture 145 and tube 14 into the corresponding bellows connected therewith. This means that the bellows is filled with atmospheric air whenever a solid portion of the control sheet covers the aperture in the tracker bar. On the other hand, if a perforation of the sheet registers with such an aperture, the atmospheric air flows through tube 82 into the leather bag 140 (Fig. 8), which is now expanded and lifts the valve 141 and its head 142, thereby uncovering the conduit 143, which is now connected with the atmosphere. The air flowing through the conduit 143 into the bag 144 causes same to expand, whereby the disc 146 is lifted off its seat connecting tube 14 and conduit 154 with the evacuated chamber 80. In consequence thereof, the air escapes from the tube 14 and from the bellows connected therewith. The pressure in this bellows being reduced, it will collapse under the pressure of the atmospheric air, thereby producing the desired mechanical effect. This condition lasts only until the perforation in the sheet has passed over the aperture in the tracker bar, whereupon the supply of air to the bag 140 is interrupted, so that the bag is evacuated and flattened under the influence of the partial vacuum surrounding it. In consequence thereof, valve 141 and head 142 descend and close the conduit 143, the bag 144 being now also evacuated and collapsing. Disc 146 now descends and severs the connection between tube 14 and the vacuum chamber 80, while allowing atmospheric pressure to enter tube 14 through the aperture 145, whereby the bellows connected to tube 14 is opened by a permanently acting force such as a spring. In other words, whenever the solid part of the perforated sheet covers the aperture in the tracker bar, the corresponding bellows is held open by a spring or the like, while, when a perforation in the sheet comes to register with the aperture, the bellows collapses. The relays 79 of all compartments are connected to a tracker bar 81 by tubes 82. The tracker bar has an opening 83 for each tube 82 and these openings are controlled by a control sheet 84 which corresponds to the note sheet of the musical instrument referred to and has openings 85 by which the openings 83 in the tracker bar are connected to the atmosphere as the control sheet moves past them.

86 is an upper and 87 is a lower cylinder for supporting the control sheet. 88 and 89 are the shafts of the upper and lower cylinders, respectively, which are mounted to rotate in vertical plates 90 and 91 depending from the top plate 92 of the casing.

Rotation is imparted to the shafts 88 and 89 by the crank shaft 93 of a vacuum motor under the control of a reversing gear. The sheet is normally operated by one of the cylinders 86 or 87. In the position illustrated rotation is imparted to the lower shaft 89 from the shaft 93 through a train of gears 94, 95, 96, and 97. The spur gear 96 is mounted on a sleeve 96*a* with a pinion 98. The sleeve is adapted to be displaced on a slide bar 99 by a lever 100. When the lower end of lever 100 is rocked to the right the pinion 98 is moved into mesh with the spur gear 102 on the crank shaft 93 and the spur gear 96 on the sleeve 96*a* engages intermediate gearing 103 by which the cylinder 86 is rotated in the opposite direction to and at higher speed than the cylinder 87, for returning the sheet 84 to its initial position. The lever 100 is connected to bellows 104 which are attached to the inner vertical bearing plate 105 of the motor. The bellows are connected to the compartment 77*a* of the wind chest by a tube 106.

The crank shaft 93 of the motor which has three throws, is mounted to rotate in the vertical plate 105 and a parallel vertical plate 107. 108 (Fig. 7) is a vacuum chamber in the motor which is connected to the principal vacuum chamber 76 by a tube 109. Each of the three throws has a connecting rod 109*a* and a slide valve 110, which move on a port face 111 at one side of the vacuum chamber 108 and control ports 112 and 113. Port 112 opens into the vacuum chamber, port 113 is connected to bellows 114. Three bellows 114 are provided and connected to the respective throws by rods 115.

In the position illustrated in Fig. 7 the slide 110 of the throw which is almost at the lower dead centre, connects port 112 to port 113 so that the interior of the corresponding bellows 114 is connected to the vacuum chamber 108 and the bellows are folded up by the pressure of the atmosphere. The bellows for the throw which is almost at the upper dead centre, are also folded up, but the corresponding slide 110 is in such a position that it closes the port 112 and lays open the port 113, admitting atmospheric air to the interior of the bellows which therefore are free to expand. The bellows for the third throw are fully expanded.

In the example illustrated in Fig. 5 a talking machine of the gramophone type a detail of which is shown in Fig. 6 is combined with the pneumatic control. 116 is the vertical shaft of the record plate 117 which is connected to the outer end of the crank shaft 93 by bevel gearing 118. 119 is the sound arm which is mounted to rock at 120 in the usual manner, and 121 is the sound box. The gramophone is controlled from the compartments 77*b* and 77*c* of the wind chest through the medium of bellows 122 for rocking the sound arm and 123 for lowering the stylus of the sound box 121 onto the record 124 on the plate 117. The compartment 77*b* is connected to the sound box control bellows 123 by a tube 125. Compartment 77*c* is connected to the bellows 122 for rocking the sound arm 119 by the tube 126. 127 is an arm at the movable member of the bellows and 128 is a lug on the sound arm which is arranged to be engaged by the arm 127. The sound box control bellows 123 are secured to a horizontal plate 129 which may be attached to the inner end of the sound arm.

In operation the openings 83 in the tracker bar 81 are alternately opened and closed by the sheet 84 in conformity with the disposition of the holes in the sheet. When a hole registers with the opening 83 of a definite tube 82, the vacuum in the compartment of the wind chest 77 to which this particular tube is connected, is reduced to a greater or lesser extent as determined by the area exposed. Several holes 85 may be combined into a slot so that the corresponding opening 83 in the tracker bar is exposed for a longer period. On the other hand certain holes may be smaller than

others, and so on. Consider, for instance, the compartment at the extreme left of casing 65 which is connected to the tube 14 for the bellows 11 at the right shoulder of the figure illustrated in Figs. 1 and 2. This figure is shown for operation by air under pressure, i. e., it will move its arms when the pressure in the bellows is reduced so that the bellows contract. In combination with the vacuum mechanism illustrated the bellows would obviously have to be so designed that they are contracted under a vacuum. If the vacuum is reduced the bellows 11 are allowed to expand to a greater or lesser extent under the action of their return springs, and this expansion causes the figure to lower the corresponding arm. In the position illustrated in Fig. 5 a normal (circular) hole registers with the tracker-bar opening 83 and the arm will be raised only for a short period. If, however, a longitudinal slot exposes the opening 83 for a longer period, the figure will hold its arm raised for a corresponding time and during this period the fore-arm and hands may be operated under the control of other holes in the sheet moving past the corresponding holes 83.

The cylinders 86 and 87 are under the control of the compartment 77*a* to which the bellows are connected by the tube 106. The compartment 77*a*, as will be understood from the foregoing, is connected to a hole 83 in the upper bar 81 by one of the tubes 82. This tube has been omitted in Fig. 5 for the sake of clearness.

The record plate 117 rotates continuously but its sound arm and sound box are controlled by the bellows 122 and 123 and the compartments 77*b* and 77*c*, which are in turn controlled by holes in the sheet 84, as described. Normally the bellows are contracted by the vacuum existing within them. Fig. 5 shows both bellows expanded, i. e., in the position they will assume when a hole or slot in the control sheet 84 registers with a hole 83 in the tracker bar. A spring (not shown) or other suitable means is provided for normally holding the sound arm 119 in inactive position with respect to the record 124 on the plate 117. When the vacuum in the bellows 122 is reduced in the manner described by a hole or slot in the sheet 84 registering with a hole 83 in the tracker bar 81, the bellows expand and rock the sound arm into active position with respect to the record 124. Obviously the sound box 121 with its stylus must be lowered onto the record only after the sound arm has been moved into active position. When it has arrived in the active position, the bellows 123 must be allowed to expand by the hole 83 allotted to it being uncovered by a slot or hole in the sheet 84. If this occurs, the bellows 123 expand as the vacuum therein is reduced, and the sound box 121 is lowered, causing the stylus to engage in the groove of the record 124. The possibility of raising and lowering the sound box 121 through the medium of the bellows 123 also permits interrupting the speech or music at any desired moment without returning the sound arm 119 to its initial position. As soon as the hole 83 corresponding to the bellows 123 is closed the bellows contract and lift the sound box off the record, interrupting the speech. The speeches are resumed as often as the corresponding hole of the tracker bar is exposed by a slot or hole in the sheet 24.

The term "limbs" used in the claims is intended to include all parts of the human body, for instance the lips, eyes etc.

I wish it to be understood that I do not desire to be limited to the exact details of the construction shown and described, for obvious modifications will occur to a person skilled in the art.

I claim:—

1. In combination with a figure, movable legs and feet jointed to said figure, a pair of slides arranged for horizontal reciprocation, a bellows operatively connected to each slide, a lever pivoted to each slide and operatively connected to a foot, a bellows operatively connected to each lever so as to rock it, bellows connecting the feet to the figure and tubes for connecting the individual bellows to perforated-sheet-controlled pneumatic means.

2. In a figure in combination, a body, a movable limb, a pneumatic device attached to said body and supporting said limb and perforated-sheet-controlled pneumatic means arranged to control said device.

3. In a figure in combination, a body, a movable limb, a bellows attached to said body and supporting said limb and perforated-sheet-controlled pneumatic means arranged to control said bellows.

4. In a figure in combination, a movable limb in at least two parts, a bellows forming the connection between adjacent parts and perforated-sheet-controlled pneumatic means arranged to control said bellows.

5. In a figure in combination, a body, a movable limb in at least two parts, separate pneumatic means connecting said limb with said body and adjacent parts of said limb with each other, a perforated-sheet-controlled pneumatic device and means connected with said device for separately controlling each pneumatic means.

6. A figure, comprising movable limbs, a plurality of bellows for moving said limbs, each bellows moving a different limb, pneumatic means for actuating said bellows, and a control sheet comprising various sets of perforations, each set being correlated with a bellows and adapted to impart a series of predetermined independent movements to the limbs correlated with said bellows.

7. A figure comprising movable limbs, a plurality of bellows for moving said limbs inserted at the movable joints of said figure, pneumatic means for actuating said bellows, and a control sheet comprising various sets of perforations, each set being correlated with a bellows and adapted to impart a series of predetermined independent movements to the limbs correlated with said bellows.

8. A figure, means for imparting motion and supplying accompanying sound to such figure, comprising movable limbs attached to said figure, and a sound producing apparatus having a movable stylus cooperating with a record, a plurality of bellows, certain of said bellows being adapted to move said limbs and others being adapted to bring said stylus into contact with said record, pneumatic means for actuating said bellows, and a control sheet having various sets of perforations, each set being correlated with a bellows, said control sheet being adapted to control the motion of said bellows, thereby imparting a series of related simultaneous movements to said limbs and said stylus and to thereby coordinate the motion and the sound supplied to said figure.

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