

Fig. 1.

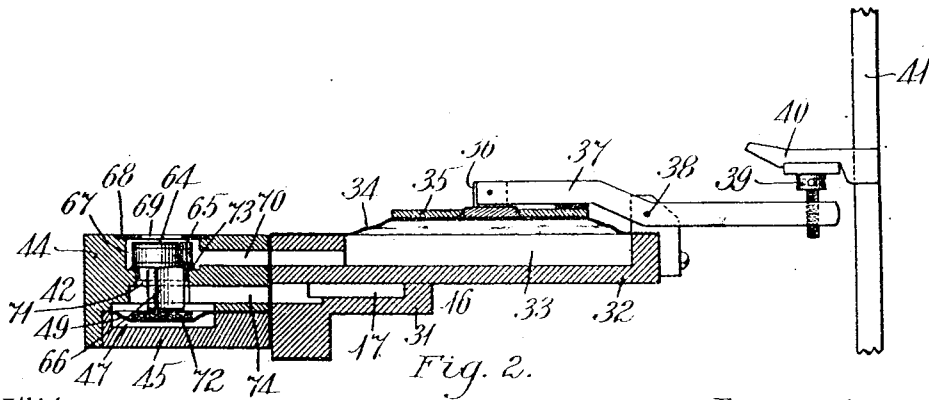


Fig. 2.

Witnesses.

Franklin E. Low.  
 David V. McCarthy

Inventors.

Gustaf W. Paulson  
 and Rudolf Paulson

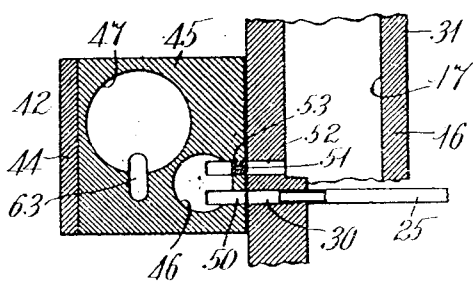
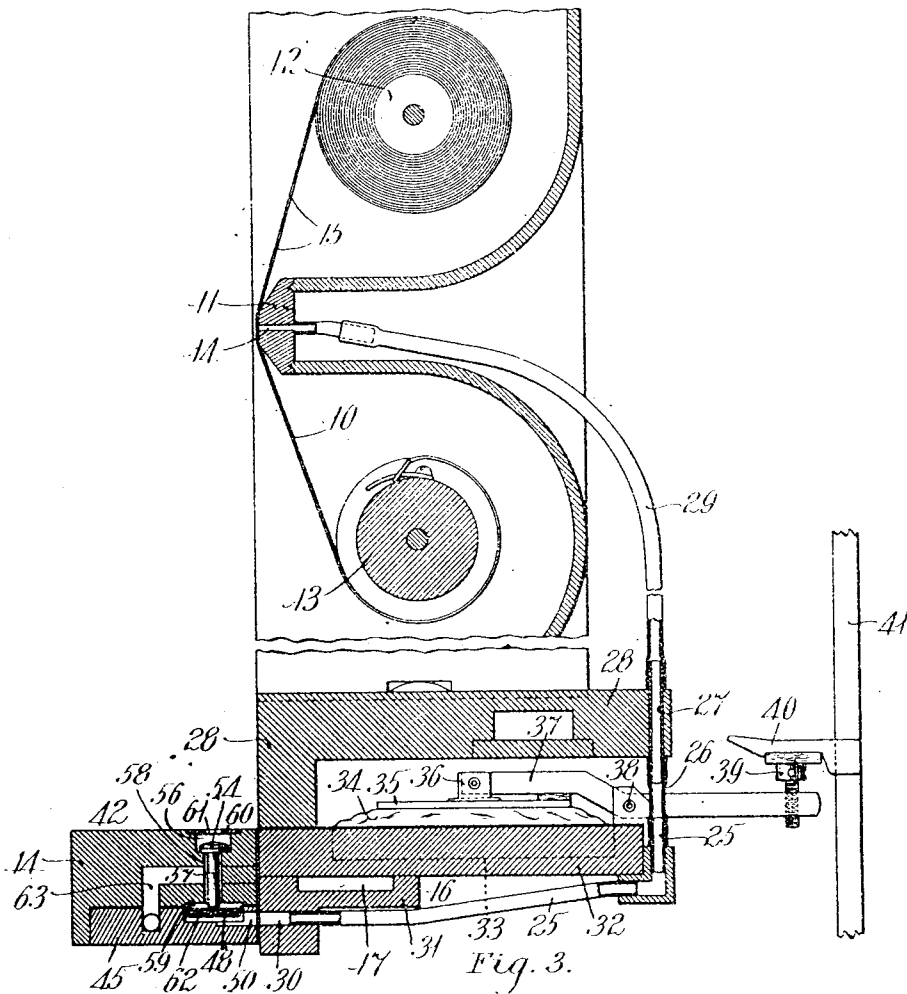
By their attorney, Charles S. Furley

G. W. & R. PAULSON.  
 PNEUMATIC PLAYER ACTION.  
 APPLICATION FILED OCT. 18, 1909.

1,094,808.

Patented Apr. 28, 1914.

3 SHEETS-SHEET 2.



Witnesses. *Franklin E. Low*  
*Sadie V. McCarthy* by their attorney, *Charles S. Gooding.*

Inventors.  
*Gustaf W. Paulson*  
*and Rudolf Paulson*

1,094,808.

Patented Apr. 28, 1914

3 SHEETS-SHEET 3.

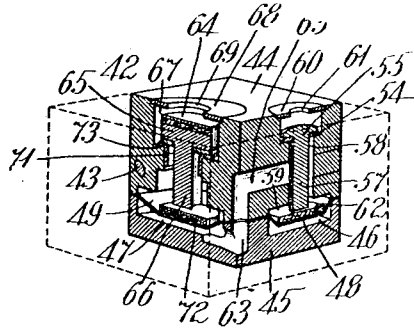


Fig. 5.

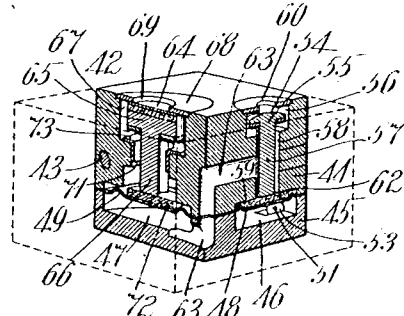


Fig. 6.

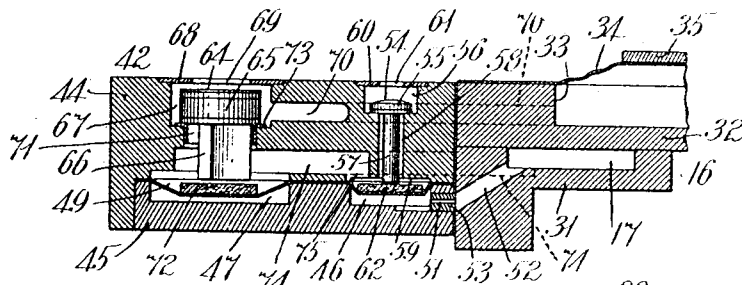


Fig. 7.

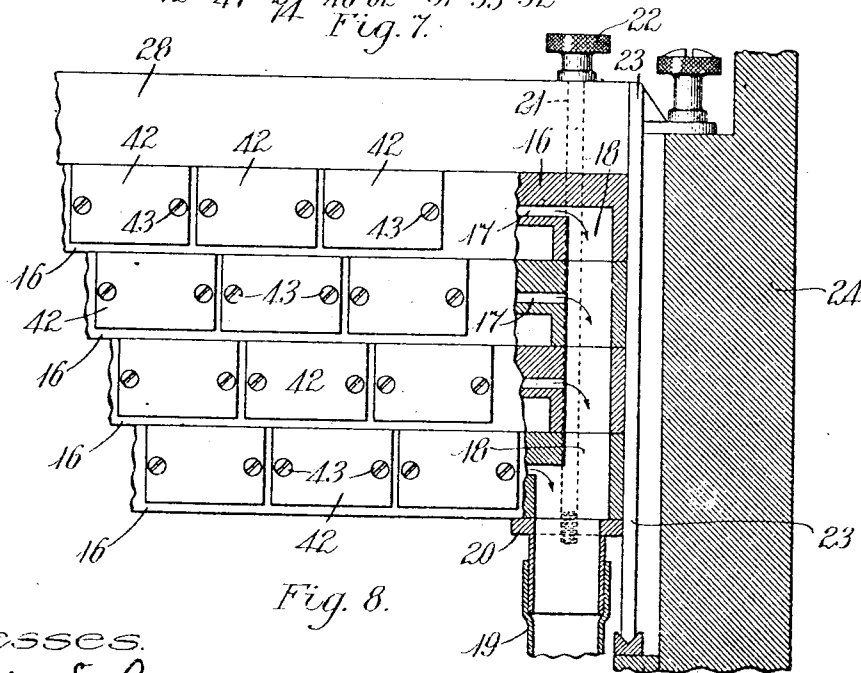


Fig. 8.

Witnesses.  
 Franklin E. Low  
 Sade V. McCarthy

Inventors.  
 Gustaf W. Paulson  
 and Rudolf Paulson  
 by their attorney, Charles J. Gooding.

# UNITED STATES PATENT OFFICE.

GUSTAF W. PAULSON, OF BELMONT, AND RUDOLF PAULSON, OF BOSTON, MASSACHUSETTS, ASSIGNORS TO HENRY F. MILLER & SONS PIANO COMPANY, A CORPORATION OF MASSACHUSETTS.

PNEUMATIC PLAYER-ACTION.

1,094,808.

Specification of Letters Patent.

Patented Apr. 28, 1914.

Application filed October 18, 1909. Serial No. 523,277.

*To all whom it may concern:*

Be it known that we, GUSTAF W. PAULSON, a citizen of the United States, residing at Belmont, in the county of Middlesex, and RUDOLF PAULSON, a citizen of the United States, residing at Boston, in the county of Suffolk, both in the State of Massachusetts, have invented new and useful Improvements in Pneumatic Player-Actions, of which the following is a specification.

This invention relates to an improved pneumatic player action for pianofortes and other key-board instruments, and one of the objects of the invention is to provide an apparatus of this class in which the valves for controlling the action of the pneumatics according to changes of pressure within the conduits leading to the tracker board or bar shall be embodied in individual units detachably connected to said conduits and to the power chamber so that each unit may be removed independently of the others to inspect, adjust, repair or replace the unit or any of its component parts without dismounting any other part of the player action.

The invention has for its object further to provide a player action which shall be simple in its construction and which shall occupy a minimum amount of space and shall be capable of being placed above the key-board of an upright piano, and the object is still further to make it possible to provide a more direct connection between the pneumatics and the abstracts of the pianoforte action and to eliminate much of the leakage and friction which have contributed toward the lack of sensitiveness of operation of player actions heretofore.

The invention consists in the novel features of construction and in the combination and arrangement of parts set forth in the following specification and particularly pointed out in the appended claims.

Referring to the drawings: Figure 1 is a plan, partly in section, of a portion of a pneumatic player action embodying our invention. Fig. 2 is a sectional view taken on line 2-2 of Fig. 1, looking toward the left. Fig. 3 is a vertical sectional view of the player action. Fig. 4 is a detail horizontal section of one of the units which con-

tain the primary and secondary valves showing the connection between the chamber beneath the primary diaphragm and the conduit leading to the tracker board and showing also the connection between said chamber and the air tension or power chamber. Fig. 5 is a sectional perspective view of one of the units containing the primary and secondary valves and their actuating diaphragms with the parts in their normal positions. Fig. 6 is a sectional perspective view similar to Fig. 5 except that the parts are shown in their abnormal positions. Fig. 7 is a developed sectional view taken on the irregular line 7-7 of Fig. 1. Fig. 8 is a front elevation showing the arrangement of the units containing the primary and secondary valves and showing the arrangement of said units with relation to the casings which form the air tension or power chambers and showing also the means for supporting said casings upon the piano casing.

Like numerals refer to like parts throughout the several views of the drawings.

In the drawings, 10 is a music sheet extending across the tracker bar or board and conveyed across said tracker board by a music roll 12 and take-up spool 13 in the usual and well known manner. The tracker board 11 is provided with the usual passages 14 to which atmospheric air is admitted intermittently by slots 15 in the music sheet brought into register with the passages 14 as the music sheet is fed thereacross in the usual manner. A series of superposed casings 16 similar to each other in construction are provided, respectively, with air tension or power chambers 17 communicating with a vertical passage 18 which is connected by a conduit 19 to the well known wind chest, not shown.

The casings 16 are detachably connected to each other in any suitable manner and are connected to a plate 20 beneath the lowermost casing by a vertical bolt 21 having at its upper end a thumb-nut 22. The casings 16 are supported on and detachably secured at each end thereof to two brackets 23 secured to the piano casing in any suitable manner. Each of the casings 16 has secured to its under side a series of conduits 25, preferably formed of metal, and at-

2  
 2 attached to the casings in such a manner that when the casings are dismantled it is unnecessary to remove said conduits from said casings. Each of the conduits 25 of one casing 16 is connected by a flexible conduit 26 to a preferably metallic conduit 27 secured to a casing 28 thereabove, the latter conduits being connected by flexible conduits 29 to the tracker board 11 in the usual manner.

10 The conduits 25 lead into passages 30 in the casings 16. By connecting the tracker board to the passages 30, as just described, instead of providing continuous flexible conduits forming the sole connection therebetween, the assembling and dismantling of the player action is very easily and conveniently accomplished. Each of the casings 16, for convenience of manufacture, is preferably made up of two boards 31 and 32, each board 31 being grooved in its upper side to form the air tension or power chamber 17 and the board 32 being secured thereto in such a manner as to form the upper wall of said chamber.

25 Each board 32 is provided with a series of recesses 33 in the upper side thereof, these recesses being covered by flexible diaphragms 34 and thus constituting a series of power or striking pneumatics. It will be observed that the upper side of each diaphragm 34 is exposed to the atmosphere at all times and the arrangement is such that the player action is rendered very compact especially vertically and this arrangement makes it possible to place the player action above the key-board as well as permitting a more direct connection between the diaphragms 34 and the abstracts of the piano action.

40 Secured to the upper side of each of the diaphragms 34 is a reinforcement 35 having ears 36 thereon to which is pivotally connected a lever 37 fulcrumed at 38. The rear end of each lever 37 carries an adjustable abutment 39 preferably consisting of a screw having screw-threaded engagement with said lever and each of these screws engages a cushioned projection 40 upon one of the abstracts 41 of the piano action.

50 Secured to the front face of each of the casings 16 are a series of casings 42 each of which is held in place by two screws 43. Each of these casings, for convenience of manufacture, is formed of two blocks of wood 44 and 45 placed together, as clearly shown in Fig. 3, the block 45 being provided with a primary diaphragm recess 46 and a secondary diaphragm recess 47, the former being covered by a flexible primary diaphragm 48 and the latter by a secondary diaphragm 49.

60 The primary recess 46 communicates with the passage 30 through a passage 50 registering therewith and said recess communi-

70 cates with the air tension chamber 17 through a pin hole 51 and a passage 52, said pin hole, for convenience of manufacture, being formed in a plug 53 inserted in the block 45. It being understood that at all times during the operation of the player action there exists within the chamber 17 an air tension, it will be evident that an air tension will normally exist within the recess 46 and in the passages leading therefrom to the tracker board 11 and that air is being constantly drawn from these passages through the pin hole 51 during the operation of the usual exhausters, not shown.

75 Located above the primary diaphragm 48 is a primary valve 54 having a head 55 located in a recess 56 and having a shank 57 located in a passage 58 which connects said recess to a recess 59 located above the primary diaphragm 48. A washer 60 which is located above the primary valve is provided with an aperture 61 so that the recess 56 is open to the atmosphere at all times. The communication between the passage 58 and the recess 59 is controlled by a valve 62 resting upon and preferably secured to the primary diaphragm 48 and this valve supports the stem 57. Forming the valve 62 separate from the stem 57 not only cheapens the cost of manufacture and renders easy the assembling of the parts, but it also permits the primary valve 54 to be lifted from its place by simply removing the washer 61 and inverting the casing 42, thus making it possible to clean dust from the seat of the primary valve.

90 When in action, the stem 57 and valve 62 move as one piece and the valve 62 in effect constitutes a part of the primary valve 54 since when the parts are in the position shown in Figs. 3, 5 and 7, the head 55 shuts off communication between the recess 59 and the outer atmosphere through the passage 58 and recess 56, and when the air tension below the diaphragm 48 is removed the valve 62 closes and cuts off such communication by lifting into contact with the upper wall of the recess 59. The passage 59 communicates through an irregular passage 63 formed partly in the block 41 and partly in the block 45 with the secondary recess 47 and thus it is apparent that when the primary valve 54 is lifted by the action of the primary diaphragm 48 air at atmospheric pressure is admitted through the aperture 61 and connecting passages to the recess 47 to act on the under side of the secondary diaphragm 49.

115 Located above the secondary diaphragm 49 is a secondary valve 64 consisting of a head 65 and a fluted shank 66. The head 65 is located in a recess 67 and the upward movement thereof is limited by a washer 68 having an aperture 69. The recess 67 communicates with one of the recesses 33

through a passage 70 formed partly in the block 44 and partly in the board 32 so that when the secondary valve is in its normal position, as shown in Figs. 2, 5 and 7, the recess 33 is in communication with the outer atmosphere and the atmospheric pressure acts upon both the upper and lower sides of the diaphragm 34.

The passage 66 of the secondary valve 64 extends downwardly through a passage 71 and is adapted to be lifted by a cushion 72 secured to the upper side of the diaphragm 49. The passage 71 may be and preferably is provided with an annular metallic seat 73 for the secondary valve 64. The passage 71 communicates with the air tension passage 17 through a passage 74 formed partly within the block 44 and partly in the board 31 and thus it will be evident that when the secondary valve is lifted from the position shown in Figs. 2, 5 and 7 to the position shown in Fig. 6, said valve is adapted to cut off communication between the recess 33 and the outer atmosphere and open communication between said recess and the air tension chamber 17 through the passages 70, 71 and 74, the consequence being that an air tension is then created in the recess 33 and the diaphragm 34 is forced downwardly by the atmosphere acting upon the upper side thereof. The passage 74 communicates at all times with the recess 39 through a short passage 75 so that the diaphragm 48 is normally balanced, or in other words, there is an equal tension on both sides thereof and the primary valve 54 is held closed by the combined action of gravity and the atmosphere.

Each of the casings 42 with the parts contained therein constitutes a distinct unit, there being one of these units for each striking pneumatic. This construction has two important advantages. In the first place, by thus arranging all of the parts controlling each striking pneumatic in the form of a unitary structure independent of the others, if any particular note is imperfectly struck by its respective pneumatic, the particular demountable casing which contains all of the parts controlling that particular striking pneumatic may be removed for inspection, repair or replacement. In the second place, by this arrangement of the parts the connecting passages are made so short that the action is thereby made more responsive than has heretofore been possible.

The general operation of the player action hereinbefore specifically described is as follows: Assuming that an air tension normally exists in the passages leading from the tracker board 14 to the under side of the primary diaphragm 48, the parts will occupy the positions shown in Figs. 2, 3, 5 and 7. When a slot 15 in the music sheet 10 comes into register with one of the passages

14 in the tracker board 11, atmospheric air rushes inwardly therethrough to the under side of the primary diaphragm 48 and the area of said diaphragm being greater than the area of the head of the primary valve 54 and for the further reason that an air tension exists above the primary diaphragm, said diaphragm is lifted and thus lifts the primary valve 54. The lifting of the primary valve admits atmospheric air, as hereinbefore described, to the under side of the secondary diaphragm 49 and as there exists an air tension above said diaphragm the same is lifted thereby lifting the secondary valve 64 from its seat 73 and seating the upper side of said valve against the washer 68. In this way the atmosphere is cut off from the passage 70 and recess 33 and said passage and recess are then in communication with the passages 71 and 74 and the air tension chamber 17, the consequence being that the pressure is reduced in the recess 33 below atmospheric and the atmospheric pressure on the upper side of the diaphragm 34 forces the same downwardly, thereby acting through the lever 37 to lift the abstract 41 thus causing the hammer of the piano, not shown, to strike in the well known manner. When the passage 14 is subsequently closed by the music sheet 10, air is drawn from the connections leading from said passage to and through the pin hole 51 and through the air tension chamber 17 to the wind chest and exhausters, not shown. A tension having thus been created in the recess 46, the primary diaphragm 48 drops and the primary valve closes communication between the under side of the secondary diaphragm 49 and the outer atmosphere so that the secondary valve 64 then cuts off communication between the recess 33 and the air tension or power chamber 17 and opens communication between said recess and the outer atmosphere and the diaphragm 34 being then in equilibrium is lifted by the weight of the abstract 41 and the other parts of the piano action, not shown, connected thereto.

The construction described herein not only has the advantage of making it possible to easily remove the units containing the primary and secondary valves for inspection and repair, but in addition the construction of the pneumatics is such that there are no sliding stems which require packing and which would cause more or less leakage in the system, and moreover the parts operate with less friction. This construction also has the further advantage that it is much more simple than player actions heretofore and is more compact, occupying less space vertically. This construction also makes it possible to place the player action above the key-board and to permit more direct connections between the pneumatics and the piano abstracts.

Having thus described our invention, what we claim and desire by Letters Patent to secure is:

1. In a pneumatic action for musical instruments, the combination of a main casing forming a vacuum chamber, a series of striking pneumatics, a tracker provided with a series of ports, said casing being provided with a series of ports leading from said vacuum chamber; a series of ports respectively leading from said pneumatics, and a series of ports respectively connected to said ports of said tracker, a series of distinct unitary independently demountable casings each provided with a port registering with one of said ports leading from said vacuum chamber, a port registering with one of said ports leading from said pneumatics, and a port registering with one of the ports connected to said tracker, and means comprising a primary valve and a secondary valve located in said demountable casings respectively for controlling the communication between said striking pneumatics and said vacuum chamber.

2. In a pneumatic action for musical instruments, a wind chest provided with a vacuum chamber, a striking pneumatic and a tracker in combination with a distinct unitary demountable casing provided with a plurality of ports adapted to register with a plurality of ports located in the walls of said wind chest, said wind chest ports connected to said vacuum chamber, to said striking pneumatic and to said tracker, respectively, and means comprising a primary valve and a secondary valve located in said demountable casing, respectively, for controlling the communication between said striking pneumatics and said vacuum chamber.

3. In a pneumatic action for musical instruments, the combination of a main casing forming a vacuum chamber, a series of striking pneumatics, a series of tubes leading to the tracker, said casing being provided with a series of ports leading from said vacuum chamber, a series of ports respectively leading from said pneumatics, and a series of ports respectively connected to said tracker tubes, a series of distinct unitary independently demountable casings, each provided with a port registering with one of said ports leading from said vacuum chamber, a port registering with one of said ports leading from said pneumatics, and a port registering with one of the ports connected to said tracker, and means located in said demountable casings for controlling the communication between said striking pneumatics and said vacuum chamber.

4. In a pneumatic action for musical instruments, a wind chest provided with a vacuum chamber, a striking pneumatic and a tube leading to the tracker, in combination

with a distinct unitary demountable casing provided with a plurality of ports adapted to register with a plurality of ports located in the walls of said wind chest, said wind chest ports connected to said vacuum chamber, to said striking pneumatic and to said tracker tube, respectively, and means located in said demountable casing, for controlling the communication between said striking pneumatics and said vacuum chamber.

5. In a pneumatic action for automatic musical instruments, the combination of a wind trunk, a main pneumatic, a controlling pneumatic supported independently of the main pneumatic and communicating therewith through a part carried by the wind trunk and also communicating with the wind trunk, said controlling pneumatic being provided with main pneumatic controlling devices embodying a diaphragm chamber, and a tracker board duct communicating directly with said diaphragm chamber through the wind trunk, and a tracker board connection having communication with the said duct and being free from and independent of the controlling pneumatic.

6. In a pneumatic action for automatic musical instruments, the combination of a controlling pneumatic embodying a diaphragm chamber, a passage having communication only with said chamber and leading therefrom through the back of the controlling pneumatic, a wind trunk communicating with said controlling pneumatic, a passage formed in the wall of the wind trunk out of communication with the trunk and communicating with the first said passage of the controlling pneumatic, a tracker board connection for the second said passage, and a main pneumatic communicating with the controlling pneumatic through the wall of the wind chest, said controlling pneumatic being detachably secured to the wind chest.

7. In a pneumatic action for automatic musical instruments, the combination of a wind trunk, a main pneumatic, two passages formed in the wall of the wind trunk and extending through the outer face thereof, one of said passages communicating with the wind trunk and the other directly with the main pneumatic, a controlling pneumatic having registering passages communicating with the first two said passages respectively, means for clamping the controlling pneumatic directly and removably against the wall of the wind trunk, said controlling pneumatic embodying a diaphragm chamber, a passage extending directly from the diaphragm chamber through the inner face of the controlling pneumatic, said wind trunk embodying a third passage and out of communication with the trunk and communicating with the last said passage, a tracker board connection free from the con-

trolling pneumatic and communicating with the said third passage and means within the controlling pneumatic for controlling communication between the first two said passages of the controlling pneumatic associated with a diaphragm in said diaphragm chamber.

In testimony whereof we have hereunto

set our hands in presence of two subscribing witnesses.

GUSTAF W. PAULSON.  
RUDOLF PAULSON.

Witnesses:

LOUIS A. JONES,  
SADIE V. McCARTHY.