The DUO-ART Reproducing Piano

SERVICE MANUAL
No. 3

Duo-Art Service Department

The AEOLIAN COMPANY

Aeolian Hall

NEW YORK

The

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Reproducing Piano

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689 Fifth Avenue

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Foreword

THIS service manual has been compiled to assist tuners and mechanics in adjusting and regulating the Duo-Art Reproducing Piano.

From time to time various units in the Duo-Art may be redesigned or otherwise altered, but the basic principle upon which the instrument operates will always remain the same.

This manual should be studied very carefully by the Duo-Art mechanic so that he will thoroughly understand all regulations of the Duo-Art mechanism.

It is of convenient pocket size and should always be carried when servicing Duo-Arts.

Diagrams of the Duo-Art mechanisms illustrated in this manual have been more or less distorted to show the principle of operation.

The Duo-Art Service Department welcomes correspondence from all those engaged in the care and maintenance of the Duo-Art.

REGULATION OF THE UPRIGHT PIANO ACTION

Refer to illustration "B".

Before treating upon the pneumatic system of the Duo-Art and its adjustment the mechanic should thoroughly understand the regulation of the piano action in both Grand and Upright. If the piano action is in poor regulation it will be impossible to obtain satisfactory results from the pneumatic action.

First tighten all screws on action.

Have key pins No. 14 and centers No. 12 free but not excessively loose.

Remove lost motion between jack fly No. 9 and butt No. 4 by screwing up capstan screw No. 11, being careful not to raise hammer No. 1 off rail No. 3 in making this regulation.

Space hammer No. 1 to strings.

Let off hammers, adjusting screw No. 7 so that jack-fly No. 9 hits let-off rail button. Let off hammers 5/32-inch from the strings in the bass and graduate to 1/8-inch in the treble turning let-off screw No. 7.

Level and square up keys, see that there is full 3/8-inch key dip before doing so. If necessary, paper under balance rail No. 13 to get this dip.

Space keys same distance apart.

Space and regulate dampers No. 2 so that all lift evenly from strings.

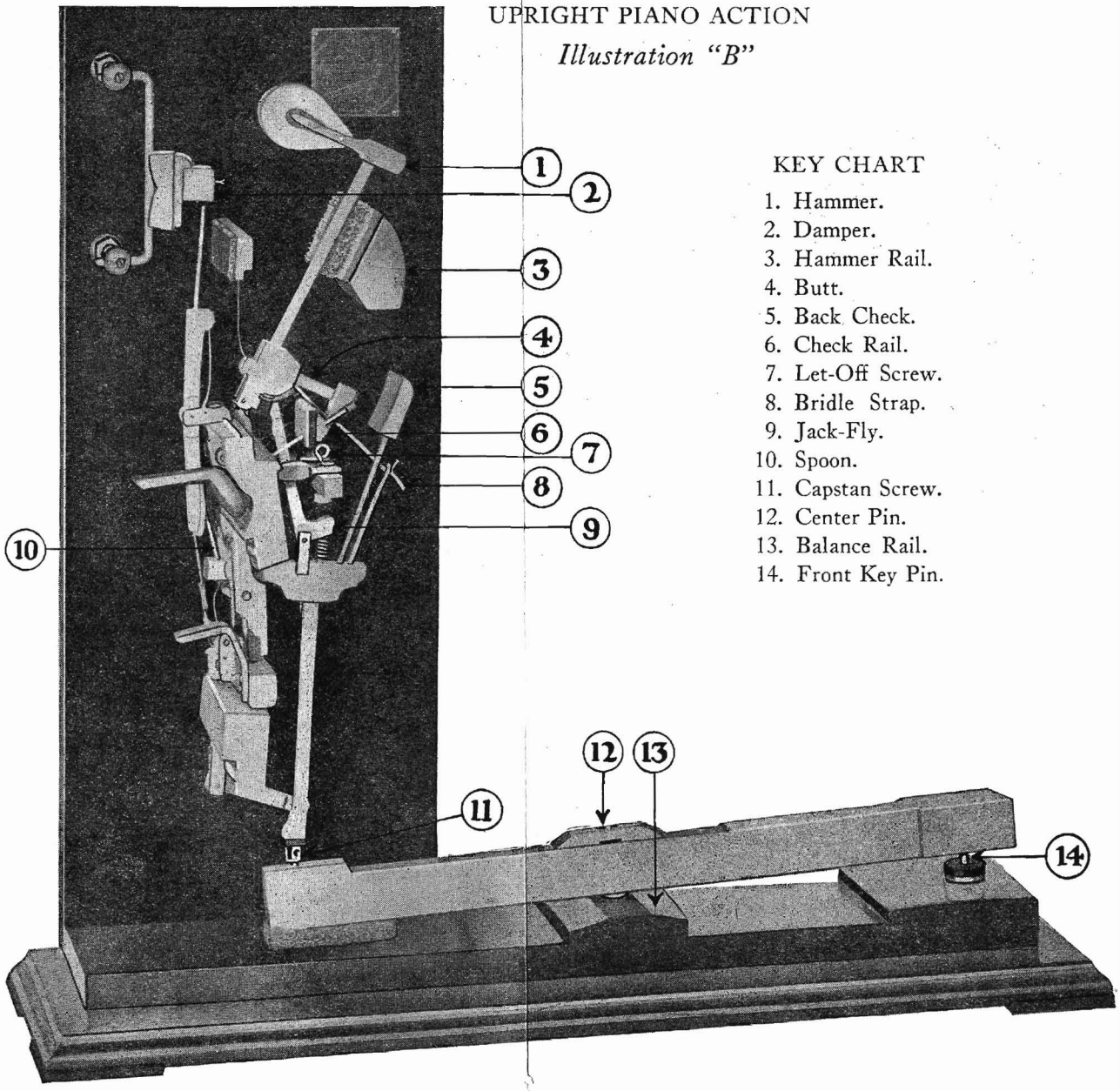
Line up back checks No. 5. Lay touch as near as possible to 3/8-inch key dip, hammers checking off about 5/8-inch from the string.

Block off loud pedal to distance that the spoon lifts dampers, and hammer rail No. 3 about 1 inch from strings, also regulate bridle straps No. 8 so that all slack is taken out of strap when soft rail is up to 1 inch from strings.

Adjust check rail No. 6 pressing down the key, obtaining a clearance between the jack-fly and the rail of about 1/16-inch by adjusting the screw on check rail No. 6.

UPRIGHT PIANO ACTION

Illustration "B"



KEY CHART

1. Hammer.
2. Damper.
3. Hammer Rail.
4. Butt.
5. Back Check.
6. Check Rail.
7. Let-Off Screw.
8. Bridle Strap.
9. Jack-Fly.
10. Spoon.
11. Capstan Screw.
12. Center Pin.
13. Balance Rail.
14. Front Key Pin.

REGULATION OF THE GRAND PIANO ACTION

Refer to illustration "C".

First tighten all screws on action.

Level keys from center rail No. 2 by increasing or diminishing the height of the punchings.

Space hammers to strings removing rail No. 14 which allows hammers to come up to the strings.

Regulate jack-fly No. 3 to hammer knuckle No. 9. Best practice locates the back edge of the jack-fly in line with the back edge of the wood in the knuckle with adjusting screw No. 12.

Regulate repetition No. 10 by screw No. 7 so that jack-fly No. 3 passes freely under hammer knuckle.

Regulate capstan No. 4 raising hammer stems from cushion rail No. 5 a scant one-eighth of an inch thus obtaining approximately a two-inch hammer travel.

Regulate let-off buttons No. 13 so that the jack-fly No. 3 comes from under hammer knuckle No. 9 when the hammer is a sixteenth of an inch from the string.

Regulate key dip on front rail by increasing or diminishing the punchings No. 1. General practice allows three-eighths of an inch key dip although different makers vary this somewhat.

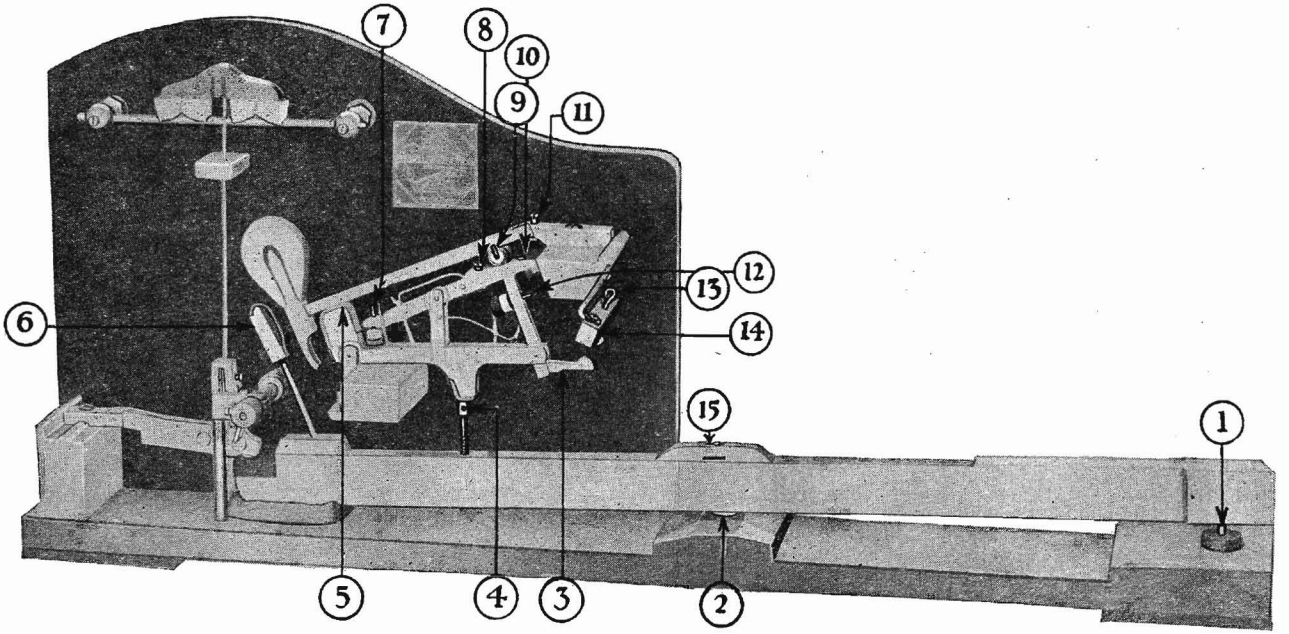
Bend back checks No. 6 on the keys so as to catch the hammers on return at a little less than half-stroke.

Regulate the repeating springs No. 8 so that the hammer will come up smartly when released from the back checks No. 6. This shows that the repetition spring is strong enough to raise the hammer and allow the jack-fly to go under the knuckle.

Regulate drop-off screw No. 11 so that the repetition No. 10 is held back to allow the hammer to drop about one-eighth of an inch after the jack-fly No. 3 lets off.

GRAND PIANO ACTION

Illustration "C"



GRAND PIANO ACTION — KEY CHART

1. Key Punchings.
2. Center Rail.
3. Jack-Fly.
4. Capstan Screw.
5. Hammer Cushion Rail.
6. Back Checks.
7. Adjusting Screw.
8. Repeating Spring.
9. Hammer Knuckle.
10. Repetition.
11. Drop-Off Screw.
12. Jack-Fly Adjusting Screw.
13. Let-Off Button.
14. Let-Off Rail.
15. Center Pin.

INSTRUCTIONS FOR REMOVING PIANO ACTION FROM STEINWAY AND WEBER GRANDS

Remove front and back key slips, then fallboard and key blocks.

Detach reroll and repeat rod at spool box, also disconnect tempo rod on left.

Disconnect supply tubes for theme primary valve box and wind motor on right and left of spool box.

If tracker box and wind motor are fastened to the wrest plank bar, remove wind motor and four screws from the angle irons on either side of the tracker box.

Detach lyre, then remove all screws from main junction blocks under key bed.

Lower all manual control levers in front of keys so that they do not interfere with removal of action.

Piano action may now be removed.

These instructions would hold good also on the Steck and Aeolian Grands except that where the rocker type control levers are used, they will have to be removed together with the raised lever plates. A small junction block attached to bass cheek of piano should be disconnected.

On the later instruments equipped with the rocker type interchangeable lever heads, it is not necessary to remove the plates.

FUNDAMENTAL PRINCIPLES OF PNEUMATIC POWER AS APPLIED TO PLAYER PIANOS

This earth upon which we live is entirely surrounded by a great atmospheric sea of an approximate depth of thirty miles. To us, air or atmosphere appears to be weightless, but scientists have proven that it has weight and that it produces a pressure of 14.75 pounds per square inch upon the earth's surface at sea level. This atmospheric pressure is of no annoyance to us as the air in our lungs and other organs is equal in pressure to that on the outside of our bodies.

Atmosphere being composed of various gases is highly flexible and elastic and will always try to equalize itself in space irrespective of the degree to which it is reduced, and it is this fundamental law of physics which is utilized to operate the pneumatic player action.

A subnormal pressure or "partial vacuum" is created within an air-tight chamber of the pneumatic action. Attached to this air-tight chamber are a number of small bellows or pneumatics, "one for each note." In their normal position these pneumatics are open and filled with air at the external atmospheric pressure. These pneumatics are connected to the subnormal or vacuum chamber by a channel. In this channel is a valve which is normally closed. When a perforation in the music roll exposes a hole in the tracker bar, outside atmosphere rushes down a tube to the low pressure chamber, and in doing so opens the valve connecting the pneumatic to the low pressure chamber. The air within the pneumatic now rushes to equalize with that in the low pressure chamber, thereby allowing the exterior air at normal pressure to push against the movable side of the pneumatic and cause it to collapse, and a note on the piano is struck.

The pneumatic player action might be termed a vacuum device as it operates on the vacuum principle. To secure the maximum power needed to operate the player action, it is only necessary to reduce the air within the action one pound or one pound and a half below the outside normal pressure of 14.75 pounds per square inch, "which remains constant."

OPERATION OF THE PNEUMATIC PLAYER ACTION

Refer to Illustration "D"

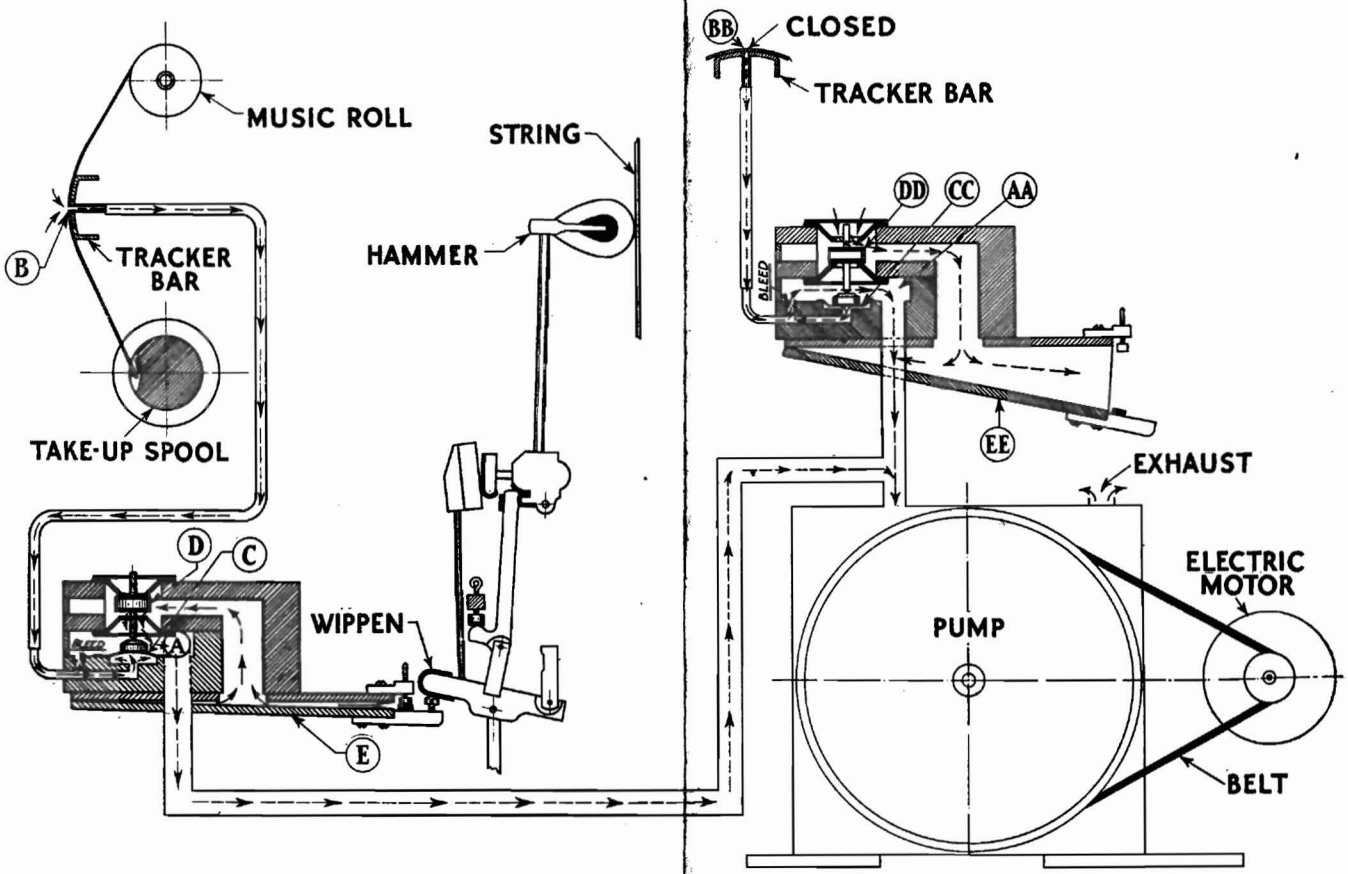
The first operation necessary in getting ready to play the pneumatic player action is to insert a music roll in the spool box, thus sealing all holes in the tracker bar so that no outside air may enter. If the instrument is electrically operated, we now turn on the switch starting the electric motor and the pneumatic pump is put into operation. The function of the pump is to reduce the pressure within the action and create what is termed a vacuum. With the tracker bar closed by the music roll, as at "BB", we have a vacuum in the action and tube right up to the tracker bar. There is a small bleed or vent which is set in a small channel connecting vacuum chamber "AA" to the tube leading to the tracker bar. This vent is about one-sixth the size of the hole in the tracker bar and it is very important in the operation of the pneumatic action.

At point "DD" is seen the valve down upon its seat and outside air passing over the top of the valve and down into striker pneumatic "EE".

Now to play a note on the piano, we must cause the striker pneumatic "EE" to collapse. This is done by a hole in the music roll exposing a hole in the tracker bar "B" which allows the outside air to rush into the tube leading down to the bleed and the underside of the thin leather pouch "C". Outside air is admitted in such quantity to the tube at point "B" that the small bleed at the front of low pressure chamber "A" cannot reduce it quickly, and the air pressure in the tube and under the thin leather pouch is raised nearer to the outside atmospheric pressure. We now have a high air pressure above it. As explained on page 11, atmosphere will always try to equalize itself in space, so the thin leather pouch "C" is now raised to a convex position by high pressure below trying to equalize with the low pressure above. As the pouch assumes a convex shape, it raises the valve "D" to its top seat, thereby cutting off outside air to striker pneumatic "E". The air within pneumatic "E" is now connected to low pressure chamber "A" and it also rushes to equalize in pressure. This operation allows the outside air to get in its work on the movable leaf of striker pneumatic "E" causing it to raise and hit the piano action wippen and the hammer to hit the string.

DIAGRAM OF PNEUMATIC PLAYER OPERATION

Illustration "D"



THE DUO-ART DYNAMIC CONTROL SYSTEM

Refer to Illustration "E"

The Duo-Art Reproducing Mechanism is built upon an entirely different mechanical principle than any other device of its kind. It is based upon the musical principle of dividing the music musically into Theme and Accompaniment, instead of dividing it mechanically into right and left sections, commonly called bass and treble expression controls.

The control of the Theme notes is independent of the Accompaniment notes. Through this control the Theme may be made to sing out clearly above the Accompaniment either in the bass, middle register or treble to any degree of expression desired and at the same time any degree of power may be given to the Accompaniment.

The dynamic perforations at the right and left hand edges of the Duo-Art music roll control the dynamic mechanism, and by their arrangement and dynamic value, determine whether notes shall be controlled by the Accompaniment or Theme regulator. The accordion pneumatics control the movement of the knife valve heel in both the Accompaniment and Theme regulators. At the front of these regulators is a rod attached to the movable board of each pneumatic. It is also fastened to the front or toe of each knife valve. See rod No. 6 in illustration "F", page 18. This rod conveys to the knife valve the equalizing or governing effect of the regulator pneumatic, and it is obvious that through the use of this ingenious device, very fine and delicate cresendos or diminuendos are easily obtained.

When we speak of the zero degrees in the Duo Art, we mean the gradation of loudness attained without the use of the accordion pneumatics, which control all of the gradations above zero. Their adjustment is independent of the other gradations and will be fully explained later.

The zero degrees might be termed the foundation of the dynamic structure, as all of the higher or louder gradations in the Accompaniment and Theme mechanisms are built upon them. Each gradation in the Theme registers slightly louder than the corresponding gradation in the Accompaniment mechanism.

THE DUO-ART DYNAMIC GRADATION CONTROL

Refer to Illustration "E"

The gradations in the accompaniment are controlled by the four large holes in the bass end of the tracker bar, set above the regular note ports. (See tubes marked 1-A, 2-A, 4-A and 8-A.)

The Theme gradation control ports in the tracker bar are shown in the lower right hand corner of the illustration and are marked 1-T, 2-T, 4-T, 8-T. They control the Theme in conjunction with the holes in the tracker bar marked 'B Theme' and 'T Theme.'

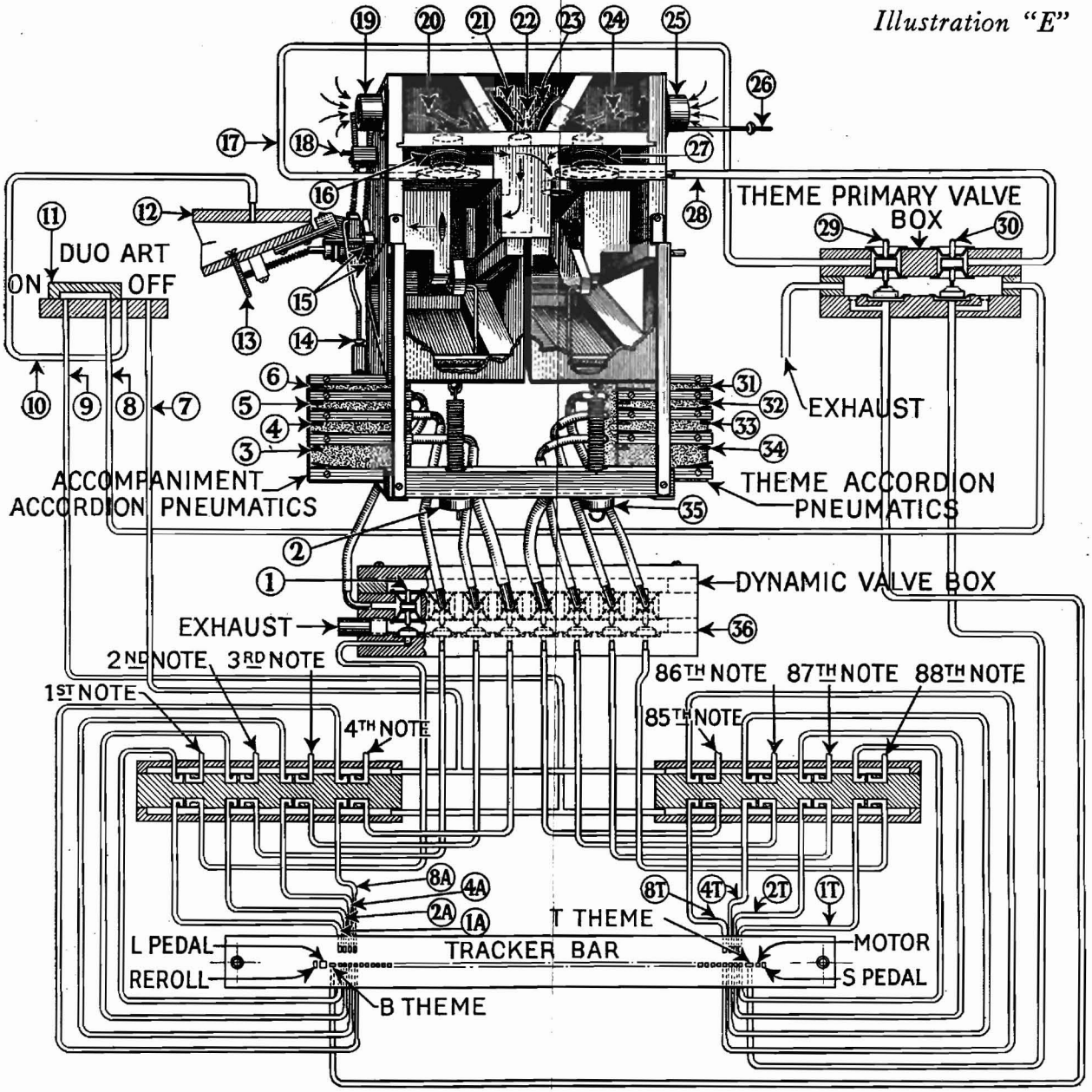
CHART SHOWING DYNAMIC GRADATIONS

No.	1	Zero setting adjusted to test roll					
"	2	Ports open	No. 1	Accordions	collapsed	No. 1—	1/16"
"	3	" "	2	"	"	No. 2—	2/16"
"	4	" "	1-2	"	"	No. 1-2—	3/16"
"	5	" "	4	"	"	No. 4—	4/16"
"	6	" "	1-4	"	"	No. 1-4—	5/16"
"	7	" "	2-4	"	"	No. 2-4—	6/16"
"	8	" "	1-2-4	"	"	No. 1-2-4—	7/16"
"	9	" "	8	"	"	No. 8—	8/16"
"	10	" "	1-8	"	"	No. 1-8—	9/16"
"	11	" "	2-8	"	"	No. 2-8—	10/16"
"	12	" "	1-2-8	"	"	No. 1-2-8—	11/16"
"	13	" "	4-8	"	"	No. 4-8—	12/16"
"	14	" "	1-4-8	"	"	No. 1-4-8—	13/16"
"	15	" "	2-4-8	"	"	No. 2-4-8—	14/16"
"	16	" "	1-2-4-8	"	"	No. 1-2-4-8—	15/16"

It will be noticed that each number in the Dynamic Gradation control is double its predecessor and that is exactly what they are in their dynamic power. From the tracker bar these dynamic control tubes lead through two cut-off pouch blocks. From these pouch blocks the tubes lead to the dynamic valve box No. 36. These tubes control the accordion pneumatics and each of these accordion dynamics has four small pneumatics, each set to collapse a certain distance by small adjusting screws. These pneumatics can work separately or in combination to reproduce every gradation of piano expression.

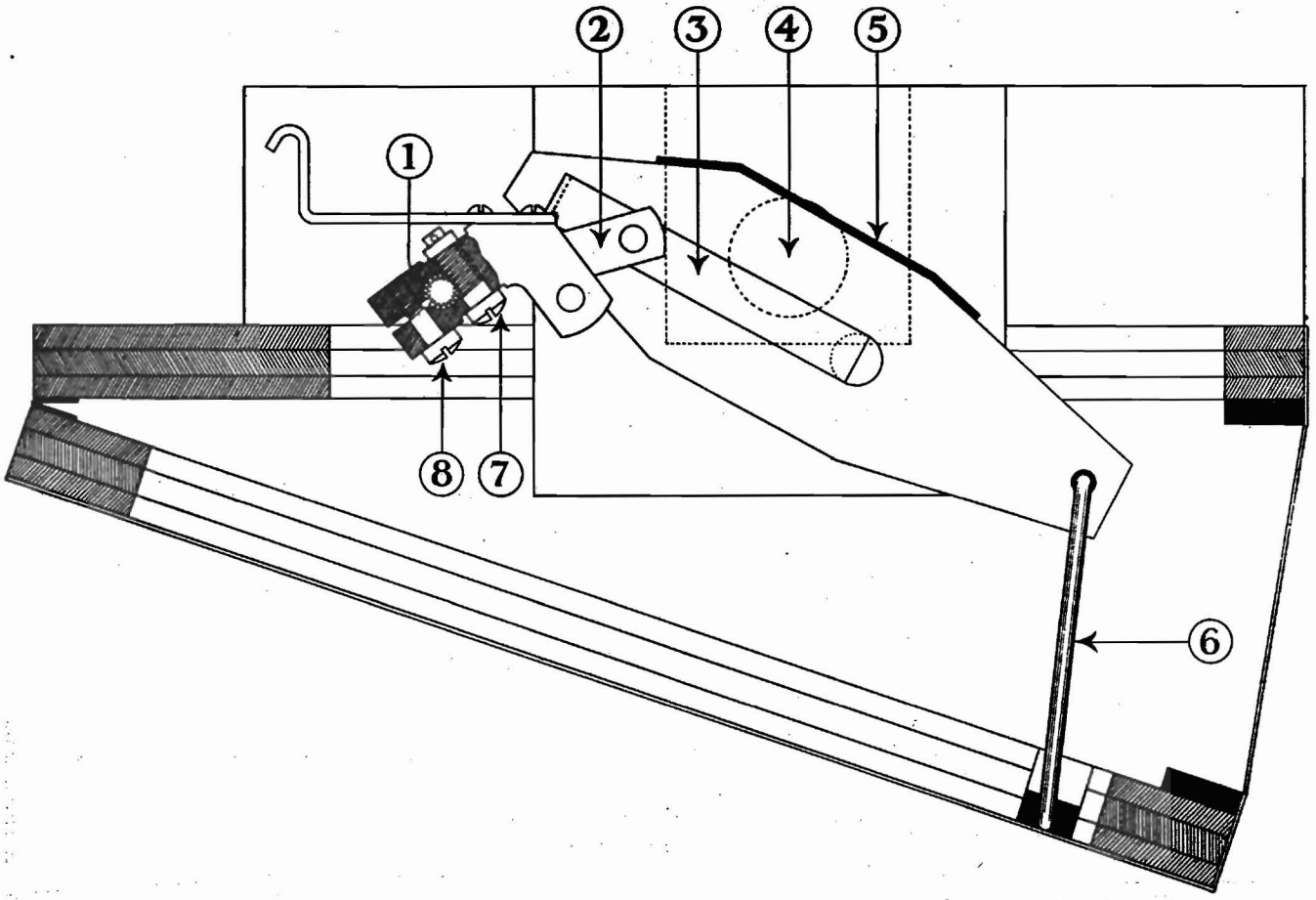
UPRIGHT DUO-ART EXPRESSION BOX AND CONNECTIONS

Illustration "E"



DUO-ART KNIFE VALVE—SIDE VIEW
Illustration "F"

1. Knife Valve Shaft.
2. Bracket connected to Shaft.
3. Pressure Spring.
4. Knife Valve Port.
5. Knife Valve.
6. Knife Valve and Regulator Pneumatic Connecting Rod.
7. Expression Adjusting Screw.
8. Lock Screw.



ACCOMPANIMENT DYNAMIC CONTROL

Refer to Illustration "E" Page 17

The air is exhausted from the bass and treble sides of the pneumatic top action to nipples No. 19 and No. 25. The bass air enters the expression box through nipple No. 19 and the treble flap valves No. 21 and No. 23 into the accompaniment chamber No. 22. Once in the accompaniment chamber, the air cannot return but must proceed down the channel into the accompaniment regulator pneumatic, where it passes the knife valve, and goes on to the pump to be exhausted. This illustrates how both sides of the pneumatic top action can be controlled by the accompaniment regulator on the left.

The degree to which the knife valve has been opened by the accordion pneumatics determines the loudness of playing. The Theme secondary valves No. 27 and No. 16 are always closed, except when the Theme is operating on the bass or treble side. Normally the instrument is under the Accompaniment control.

THEME DYNAMIC CONTROL

The Theme accordion pneumatics control the degree with which accented notes are struck either in the bass or treble, but it is the valves No. 16 and No. 27 which are controlled by the holes in the tracker bar marked 'B Theme and T Theme', operating through the Theme primary valves No. 29 and No. 30 that determine when the Theme shall function. The air is exhausted from the bass and treble of the top action into chambers No. 20 and No. 24 of the expression box, then the Theme control holes in the tracker bar are exposed by holes in the music roll, admitting atmosphere under the pouches of the Theme primary valves No. 29 and No. 30, raising them. This action puts suction on the two Theme secondary valves in the expression box No. 27 and No. 16 causing them to drop, thereby making a passage for the air to the Theme regulator pneumatic. The air then passes through the knife valve port and proceeds to the pump where it is exhausted. The channel leading into the Theme regulator is situated at the right toward the back of the Accompaniment channel No. 22.

On top of the accordion pneumatics is a rod which leads to an arm, and when pulled down, it opens a knife valve in the expression box. The knife valves in the Accompaniment and Theme controls are exactly alike.

THEME CONTROL OF BASS OR TREBLE

Illustration "E" Page 17

We have previously explained how it is possible for the Theme regulator to control every note in the piano register just as well as the Accompaniment regulator, but it is also possible for the Theme regulator to control either the bass or treble action individually. This is accomplished by opening the bass Theme valve No. 16 or the Treble Theme valve No. 27 and the Theme regulator pneumatic will control accented notes on either side that is opened, while the Accompaniment regulator will control the accompaniment notes.

ACCORDION DYNAMIC CONTROL OF THE KNIFE VALVE

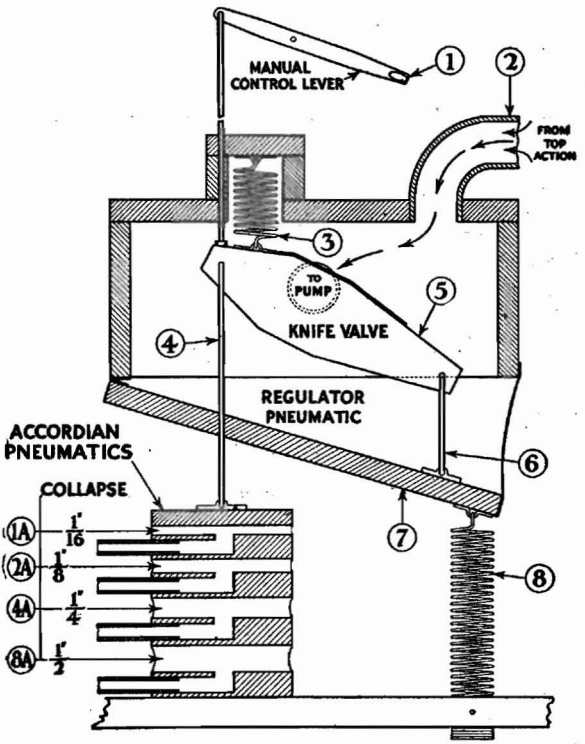
Refer to Illustration "G"

Illustration "G" shows the manner in which the knife valve is controlled in the Duo-Art. Attached to the back of the valve is a rod No. 4 which is pulled down by the collapse of the accordion pneumatics. Each of these pneumatics collapses a certain distance (see illustration). The collapse of the accordion pneumatics is controlled by the dynamic perforations in the Duo-Art music roll. By their arrangement and dynamic value the loudness of the music is gauged. As the heel of the knife valve is pulled down by the collapse of the accordion pneumatic more air is allowed to pass nipple No. 2 from the top action, the port marked 'to pump' is opened and the air in the top action rushes to equalize with the subnormal pressure induced by the pump.

Attached to the front of the knife valve is a rod No. 6. It is also fastened to the movable leaf of the regulator pneumatic No. 7. This rod tends to govern the movement of the valve at the front and operates in conjunction with spring No. 8. It is a miniature shock absorber. No. 1 shows the method by which the manual control lever is attached to the heel of the knife valve. As the heel of this valve is pushed down by the operation of this lever, the port marked 'to pump' is opened and the degree of loudness increases and this action is similar in effect to the movement of the accordion pneumatics. Illustration "G" covering this treatise does not picture the true design of the Duo-Art expression box, but it does in a simple manner illustrate the principle by which the knife valves in the Accompaniment and Theme regulators are controlled.

ACCORDION DYNAMIC CONTROL OF THE KNIFE VALVE SHOWING SIMPLICITY OF DUO-ART EXPRESSION CONTROL

Illustration "G"



Key Chart

1—Manual Control Lever.
2—Exhaust from Top Action.
3—Knife Valve Tension Spring.
4—Accordion Pneumatic and Knife Valve Connecting Rod.
5—Knife Valve.
6—Knife Valve and Regulator Pneumatic Connecting Rod.
7—Regulator Pneumatic.
8—Regulator Pneumatic Coil Spring.

HOW TO TEST AND ADJUST THE DUO-ART

Refer to Illustration "E" Page 17

This will be a series of tests, twelve in number, and will cover all points necessary for a thorough inspection of the Duo-Art.

Before beginning the Duo-Art test, it is advisable to see that the piano action is properly adjusted. As is well known, all piano actions are more or less affected by extreme dampness or dry weather, either of which tends to alter their regulation, thereby making it difficult for the instrument to function properly.

Refer to treatise on upright or grand action regulating, whichever the case may be, on pages 6 and 9.

Test No. 1, Spool Box Gearing and Connections

See that spool-box gearing is properly oiled, and all set screws tight. Set reroll and play brakes. Pump out tracker bar and insert test roll in spool-box.

Test No. 2, Electric Motor, Pump and Connections

Connect electric cord to conduit on Duo-Art and make sure electric current is right for motor installed. Have motor mounted level and be sure belts are not slipping. See that motor is properly lubricated and set screws in pulley tight. Read over carefully instructions on electric motors and pump on pages 29 and 30 of this treatise.

Test No. 3, Tracking Device

This subject is fully covered on pages 32 and 33 by illustration and treatise.

Test No. 4, Tempo Test

Push Duo Art Lever in "Off" Position

Follow tests on roll in rotation. With tempo indicator at 70, roll should run seven feet per minute or 3-½ feet in thirty seconds. Tempo should cut off with indicator at extreme left and just start at ten. To run faster, tighten spring on governor; to run slower, weaken spring. Refer to treatise on Motor Governor page 34 with illustration "M" page 35.

Test No. 5, Loud and Soft Pedals
(Tempo 70)

With loud pedal "on," wedge dampers should clear strings ⅛-inch. Dampers should come back to strings on each bridge in pedal test for speed. Spring No. 1 in illustration "N", page 37, controls the speed of the loud and soft pedals in the upright Duo-Art, and spring No. 20 in illustration "P", page 41, controls the speed of the loud pedal in the grands. On uprights, soft pedal should move hammers up to one inch from strings. On grands, soft rail should raise ⅝-inch from normal position.

Test No. 6, Accordion Dynamics
Their position and working order on tracker-bar.
Push Duo-Art Lever in the "on" position.

The Accompaniment dynamics are operated from the bass end of the tracker bar above the regular piano ports and are numbered No. 1, No. 2, No. 4 and No. 8. These dynamics should work in order given.

The Theme dynamics are operated by the four large holes in the treble end of the tracker bar above the piano ports and they also are numbered No. 1, No. 2, No. 4 and No. 8.

Test No. 7, Accompaniment Zero Setting
(Tempo at 80)

Refer to Illustration "E" Page 17

This is the most important regulation in the Duo-Art test and care must be taken in its adjustment. On its setting depends the ability of the instrument to play the soft runs and trills so much desired by all music lovers.

First throw off the electric switch and see that the regular springs No. 2 and No. 35 have a little tension on them when the pneumatic is wide open, just enough to keep them from rattling. Use the adjusting rings on springs. Now see that springs No. 18 have a little tension. There are two springs similar to these on the right side of the expression box, though not visible in the illustration, which should be inspected to see that they have a little tension on them. In illustration "J" page 28, the spill valve spring No. 2 is shown. It also should have a little tension.

The little leather nuts No. 14 illustration "E" should never be tampered with, as they are set to take up slack from the accordion pneumatics and seldom need resetting. Now throw on the electric switch and observe softness of notes on Accompaniment Arpeggio tests.

It will be noticed that the loud pedal is on with the first run of notes, making them easier to play, then off with the next run, making them harder to play because of the weight of damper lever. On the first run, notes should play very softly, and on the next run, most of them should miss or skip.

The third run of the Accompaniment Arpeggio test is similar to the first. If, on the second run, all notes should strike full, the setting is too loud and must be softened. The adjustment screws for the Accompaniment are located at point No. 15. The Theme adjustment screws are in the same relative position on the right side of the expression box but not visible in the illustration.

A special diagram of the adjusting screws and knife valve will be found on page 18 illustration "F". The adjusting screws No. 7 and No. 8 are similar in Accompaniment and Theme regulators. No. 8 is the lock screw and it must first be loosened before adjusting screw No. 7 which controls the knife valve. Do not try to turn adjusting screw No. 7 while lock screw No. 8 is tight, as the thread on No. 7 will be stripped if this is attempted. Tighten screw No. 8 immediately after setting screw No. 7.

Loosen lock screw by turning to the left. Start piano and turn regulating screw to the right to make soft, to the left loud on the Grand. On the Upright piano to the left to make soft, to the right, loud. When regulation is complete, tighten lock screw by turning to the right.

It only takes a slight turn of the adjusting screw to make considerable difference in the zero degree. Watch Accompaniment Regulator pneumatic while setting adjusting screw; softening causes it to open and loudening causes it to collapse. Adjustment can be gauged accordingly.

Test No. 8, Theme Zero Setting

After setting the Accompaniment properly, change to the other side of the expression box and make the Theme adjustment. The setting of the Theme is dependent upon the setting of the Accompaniment as, no matter where the latter is set, the Theme must be one degree louder. When adjusting the Theme regulator, always be sure that the Theme primary valves are working properly. Tighten junction blocks especially on the grands under the key-bed.

Test No. 9, Accordion Dynamic Chord Test

Chord tests show if dynamics build up evenly. If Accompaniment and Theme zero settings were properly regulated, chords will meet tests in roll. Some chords are not supposed to speak at all, or very softly, as the test roll states. To properly meet chord tests, a slight adjustment on regulator springs No. 2 and No. 35 is permissible, but if chords do not meet tests, inspect accordion pneumatics to see if they travel their full distance.

Test No. 10, Notes

See that all notes repeat in repetition test on test roll. Text covering the operation of the pneumatic top action will be found on page 12 with illustration "D" page 13.

Test No. 11, Reroll

The reroll is operated by the first hole in the bass end of the tracker bar and throws the spool-box gearing into reroll. For details see treatise on page 39 with illustration "O" on page 38.

Test No. 12, Repeat

With the 'Repeat' Lever in the spool-box set at the 'On' position, the roll will rewind to the front and when the hole in the take-up spool is exposed, the reroll lever will be moved to the 'Play' position and the roll will be repeated. Text and diagram covering 'Repeat' and Switch cutout devices will be found on pages 38 and 39.

POINTS RELATIVE TO ILLUSTRATION "H"

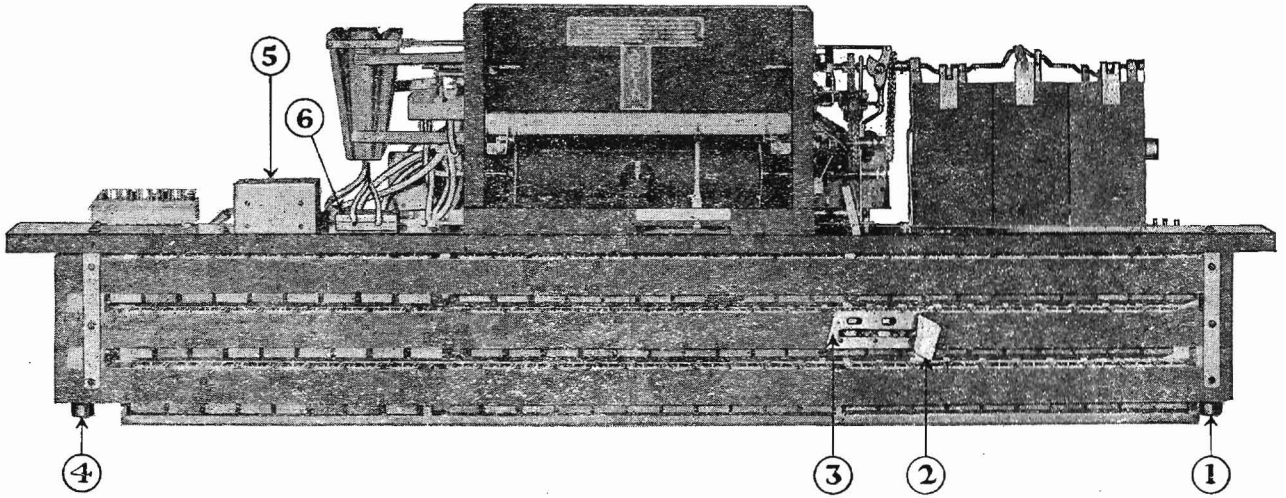
Illustration "H" shows a front view of the Duo-Art top action. No. 1 and No. 4 show the large supply tubes which connect direct to the expression box. No. 2 shows method of opening sealing cloth and the valves exposed. No. 3 shows a bar spacer and if it becomes necessary to inspect the valve system, cut the sealing cloth on bar spacer nearest valve to be examined. Metal valve seats, both top and bottom, are used. The bleed is also exposed and shows how accessible it is. No. 5 shows the Theme primary valve box and this device is explained in detail by treatise on Duo-Art Dynamic Control. No. 6 shows the tracker neutralizing box and is covered in detail by treatise on the tracking device.

POINTS RELATIVE TO ILLUSTRATION "I"

Illustration "I" shows a back view of the Duo-Art top action. No. 1 shows the leather adjusting nuts for the pneumatic stroke. No. 3 is also for adjusting the pneumatic stroke of the top row of pneumatics. No. 2 shows the pitmans which strike under whippens of piano action. No. 4 shows four tubes which connect with various devices. The first one to the outside supplies the tracker pneumatics and is on unregulated air. The next tube 'in' controls the electric switch. The next tube 'in' operates repeat device and the last tube, the reroll mechanism. No. 5 shows the wind motor and large nipple on side is connected direct to the governor which controls the speed of motor. No. 7 is the shifting cam for tracking device. No. 8 is the turn buckle for centering the tracker pneumatic. No. 9 is the tracker pneumatic. No. 6 and No. 10 are the pouch blocks which couple up the Duo-Art dynamics when 'Duo-Art' lever is at the 'On' position, and couple up the four notes in bass and treble with Duo-Art 'Off.' No. 11 is a junction block for the tubes leading from expression devices in the bottom of the instrument and it should always be screwed up very tightly.

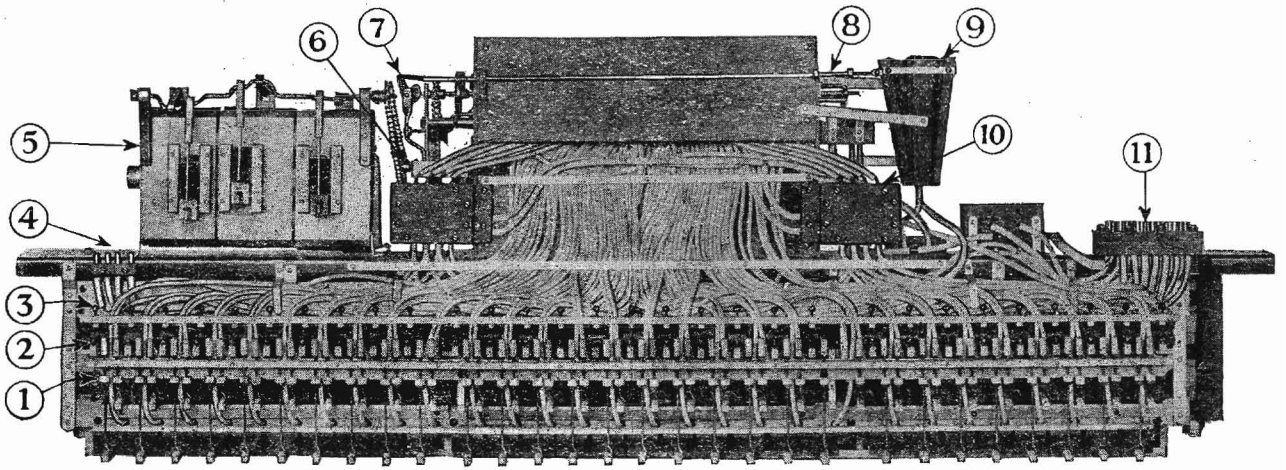
TOP ACTION—FRONT VIEW

Illustration "H"



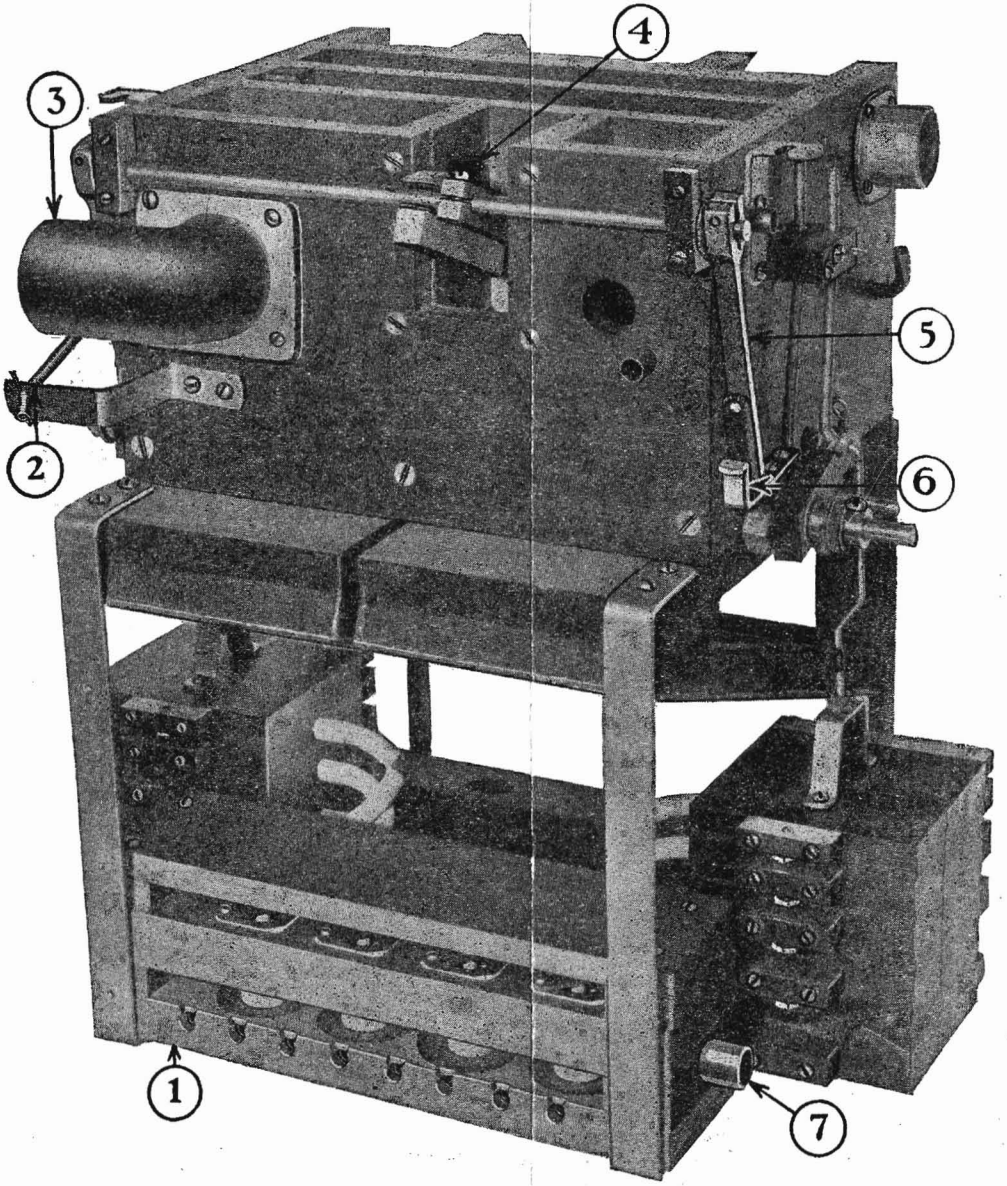
BACK VIEW—TOP ACTION

Illustration "I"



ATMOSPHERE INTAKE OR SPILL VALVE

Illustration "J"



OPERATION OF THE ATMOSPHERE INTAKE OR SPILL

Refer to Illustration "J"

The Duo-Art normally is under low pump tension. The pump is operating at a speed sufficient to maintain a high tension within the pneumatic action but at the back of the expression box there is an atmosphere intake valve which is open when there are no dynamics on, thereby relieving the pump from unnecessary strain. As the accordion pneumatics collapse, this intake valve closes and in so doing raises the tension in the action. The intake valve is adjusted to close off completely when power ten on Accompaniment or Theme side is on. Power ten is the collapse of accordion pneumatics eight and two on either side. The object of this valve is to increase or decrease the pump tension when needed and it is automatically controlled by the dynamic perforations in the music roll which govern the accordion pneumatics and they in turn control the intake valve.

In illustration "J", it will be seen the valve No. 4 is attached to a rod extending across the back of the expression box, and to this rod an arm, No. 5. As the accordion pneumatics collapse, they push the bracket No. 6 forward, and No. 6 in turn pushes arm No. 5 forward and the valve No. 4 closes off completely when power ten is reached. Spring No 2 constantly keeps arm No. 5 against bracket No. 6 and it should always have sufficient tension to pull valve No. 4 back to normal very quickly.

ELECTRIC MOTORS AND PULLEY SIZES INSTALLED IN DUO-ARTS

Electric motors require very little attention aside from lubrication. The average Duo-Art mechanic knows very little about electric motors, and in cases of serious motor trouble, we would recommend that a competent electrician be called in, or the Duo-Art Service Department consulted.

The Aeolian Company furnishes the proper motor with all Duo-Art instruments and under no circumstances should other motors be used.

Fifteen-inch rotary pump should rotate 120-125 R.P.M. Seventeen-inch rotary pump should rotate 110-120 R.P.M.

Piano inspectors and service men should always note Revolutions Per Minute stamped on the motor name plate and make certain that correct diameter pulley is used.

MOTOR PULLEY CHART

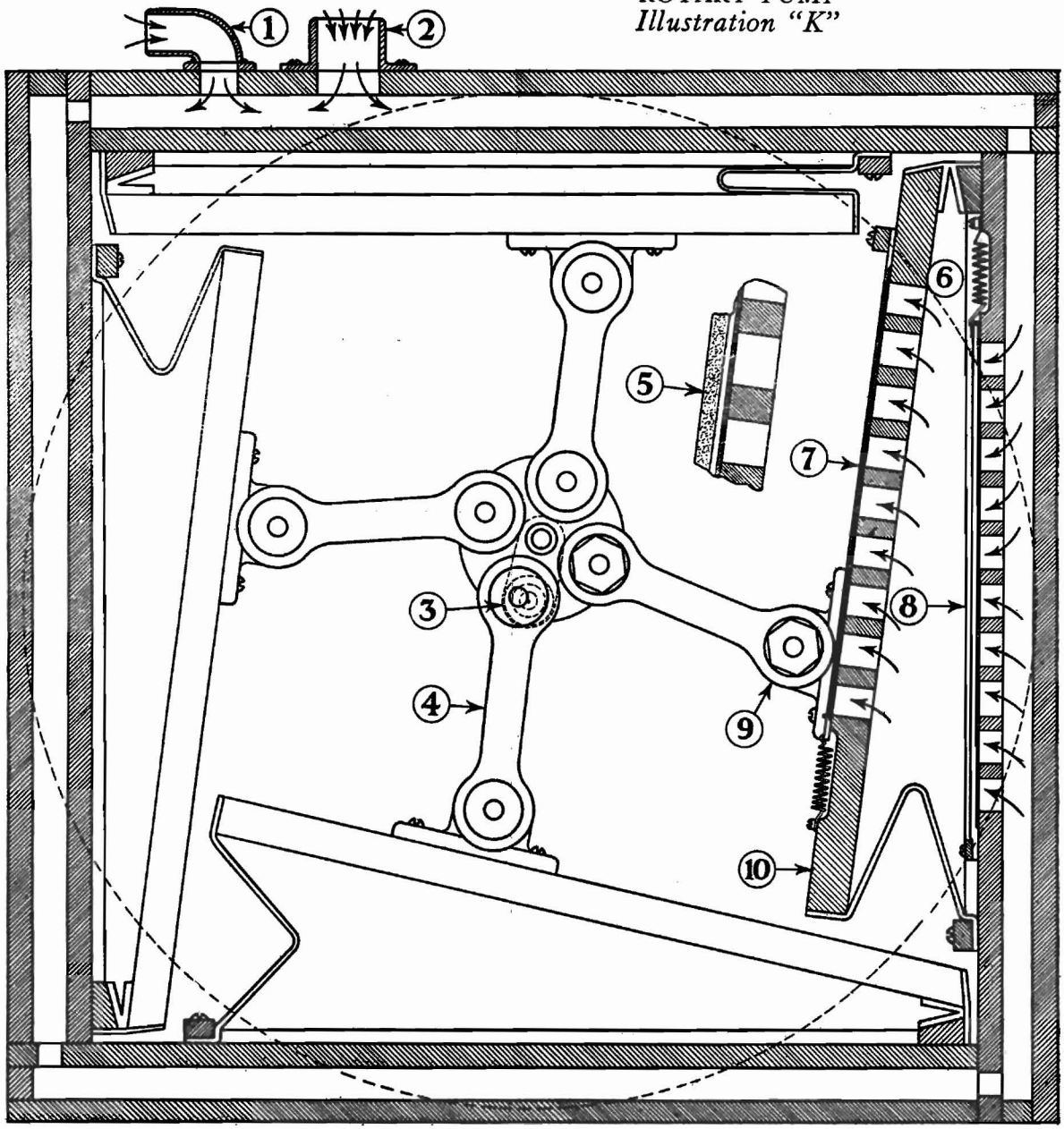
MOTOR		PULLEY SIZES outside diameter	
R.P.M.	Elec. Current	15-in. Blower	17-in. Blower
850	30 Cycle A.C.	2½-in.	2⅝-in.
1090	75 " "	2 -"	2⅛-"
1150	40 " "	2 -"	2 -"
1150	60 " "	2 -"	2 -"
1150	80 " "	2 -"	2 -"
1150	Direct Current	2 -"	2 -"
1200	83 Cycle A.C.	1⅞-"	2 -"
1300	90 " "	1¾-"	1⅞-"
1350	93 " "	1¾-"	1¾-"
1450	25 " "	1⅝-"	1¾-"
1450	50 " "	1⅝-"	1¾-"
1450	100 " "	1⅝-"	1¾-"

OPERATION OF THE ROTARY PUMP

Refer to Illustration "K"

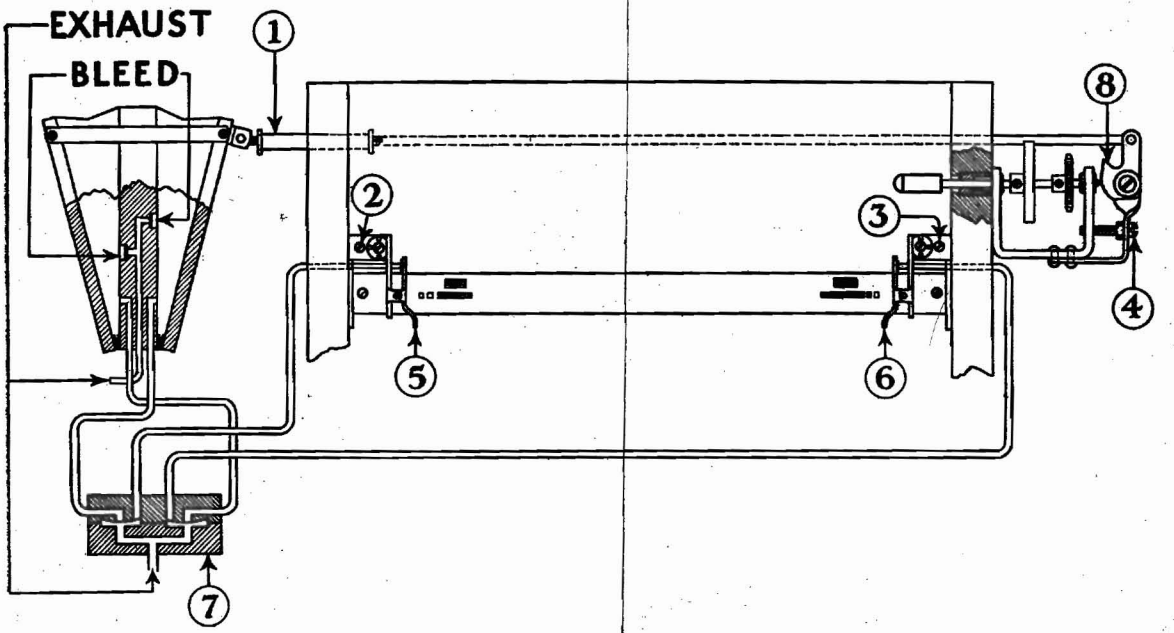
The pump in the Duo-Art is operated by an electric motor and to obtain sufficient power for the Duo-Art, it should rotate at a speed of 120 to 125 R.P.M. The function of the pump is to reduce or lower the air pressure in the pneumatic stack and auxiliary units. On the front side of the pump is a large pulley, attached to the pulley is a crank shaft No. 3. This crank shaft rotates as the pulley is turned and the four power pneumatics similar to No. 10 are alternately opened and closed by connecting arms to the crank shaft, see No. 4. As the power pneumatic opens, a partial vacuum is created within the pneumatic, outside atmospheric pressure keeps the leather pallet valve No. 7 closed and the air within the pneumatic stack and other units rushes to the pump and raises leather pallet valve No. 8, and enters chamber No. 6. As the movable leaf of power pneumatic closes by the movement of the crank shaft, valve No. 8 quickly closes and at the same time valve No. 7 opens and allows the air in the pneumatic to be exhausted from the pump.

ROTARY PUMP
Illustration "K"



TRACKING DEVICE

Illustration "L"



TRACKING DEVICE

Refer to Illustration "L"

The tracking device used in the Duo-Art operates on what is termed the balanced air principle and is very simple, both in design and adjustment. A vacuum is created in the tracker pneumatics by exhaust tube and the reason they do not collapse is due to the bracket connecting the movable board of each pneumatic, and the fact that the pressure is equal in each pneumatic. It is only by admitting outside air to one pneumatic at a time that this perfect balance is upset, causing the pneumatics to shift, and in so doing aligns the music roll. If both tracker triggers No. 5 and No. 6 were open at once, the pneumatics would remain neutral, as they would still be perfectly balanced. No. 7 shows the neutralizing pouch block which cuts out the tracker pneumatics on reroll. If the music roll should move to the right and open valve No. 6, atmosphere would be admitted to the left hand tracker pneumatic faster than the bleed could reduce it and the pressure would be raised nearer to the outside normal pressure and the balance between the two pneumatics would be upset, causing the right hand pneumatic to shift to the left. Rod No. 1 being attached to the shifting pneumatics and to cam No. 8, the right hand music spool carrier is moved to the left and the music is aligned to the tracker bar. At point No. 7 a side view of the tracker pouch cut off block is illustrated. The purpose of this block is to prevent the tracker pneumatics from operating on reroll. When the instrument is being played, there is exhaust on tube at bottom of block No. 7, when the music is being rewound outside air is admitted to this tube. The tracker pneumatics are under exhaust on both play and reroll. The bleeds in these pneumatics exhaust the air from the tubes leading to block No. 7 and pull up the pouches covering the end of the tubes so that it is impossible for any air from valves No. 5 and No. 6 to reach tracker pneumatics on reroll. The edges of the music roll do not damage if the tracker pneumatics are held on center during reroll.

TRACKING DEVICE ADJUSTMENT

Refer to Illustration "L"

Insert a test roll or music roll measuring 11¼-inches in width in the spool box. Loosen up screws No. 2 and No. 3 on tracker triggers and push away from music roll. Hold tracker pneumatics at center and note if right hand music spool carrier is at center of shifting cam No. 8 as shown in diagram, if not, adjust turnbuckle No. 1. Turn on electric current and set tempo at 70, then adjust set screw No. 4 so that holes in music or test roll align with holes in tracker bar. Next adjust tracker triggers No. 5 and No. 6 so that they almost touch edge of music roll, then tighten screws No. 2 and No. 3. It is advisable to play a few music rolls to make sure that tracker adjustments average up correctly. By keeping a very loose take up spool brake and a slow speed on reroll, the edges on the music roll will be materially preserved.

UPRIGHT DUO-ART GOVERNOR

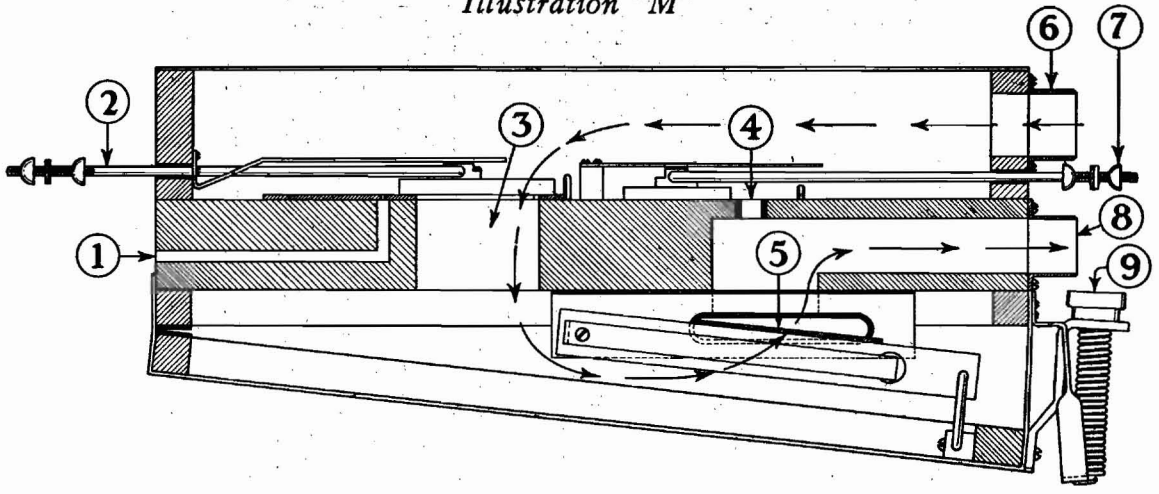
Refer to Illustration "M"

The purpose of the Governor is to assure an even speed to the music, regardless of the tempo in which it is played. All pneumatic player actions have a device of similar purpose. The Duo-Art Governor is very simple in design and sturdy in construction.

The air enters the Governor from the wind motor at channel No. 6 and passes down channel No. 3, providing the tempo port is open to point ten or more. The air then passes to the knife valve port No. 5 and out channel No. 8 to the pump. The spring No. 9 controls the Governor. Weakening it slows up the speed, and strengthening it speeds up the tempo. When the Duo-Art is in "play," the reroll port No. 4 is closed by slide No. 7, and when rerolling, it is open, making the reroll much faster than if the air had to pass through the tempo port only. The channel No. 1, connecting with the outside air, keeps the wind motor from creeping when the tempo is completely cut off, but is itself cut off when the tempo is advanced a few points.

UPRIGHT DUO-ART GOVERNOR

Illustration "M"



UPRIGHT LOUD AND SOFT CONTROL

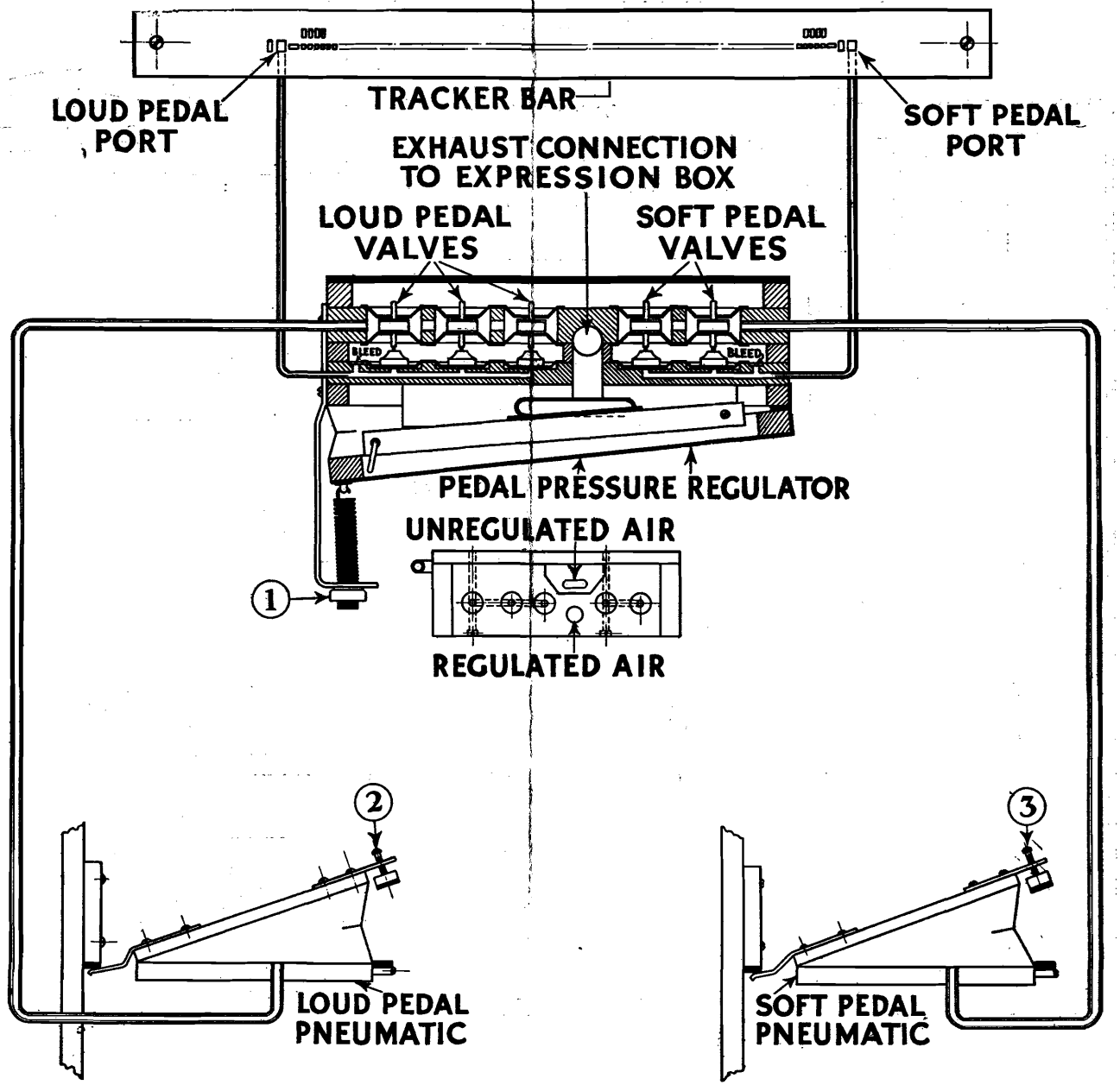
Refer to Illustration "N"

The loud pedal is controlled from the second hole (in) from bass end of tracker bar, and the soft pedal from last hole in treble end of bar. The supply to the loud and soft pedal pneumatics is controlled by the pedal pressure regulator, the purpose of which is to govern the air pressure operating the loud and soft pedals and the accordion pneumatics on Duo-Art expression box. Spring No. 1 controls pressure operating loud, soft and accordion pneumatics and should be set strong enough to operate these pneumatics fast and snappy but not noisily. Adjusting screws No. 2 and No. 3 on pedal pneumatic controls lift of dampers and soft rail.

It will be noted that there are three loud pedal valves. The reason for this is to shorten the valve motion insuring quietness and speed in loud pedal operation. The soft pedal does not operate as fast as the loud pedal, therefore, two valves are sufficient for this device. Illustrated below the pressure regulator pneumatic is a top view of the valve box showing the regulated air and unregulated air channels. Do not have spring No. 1 pulled too tight as the loud and soft pedals will operate in a noisy manner. On old instruments where the loud pedal functions noisily, shorten the valve travel.

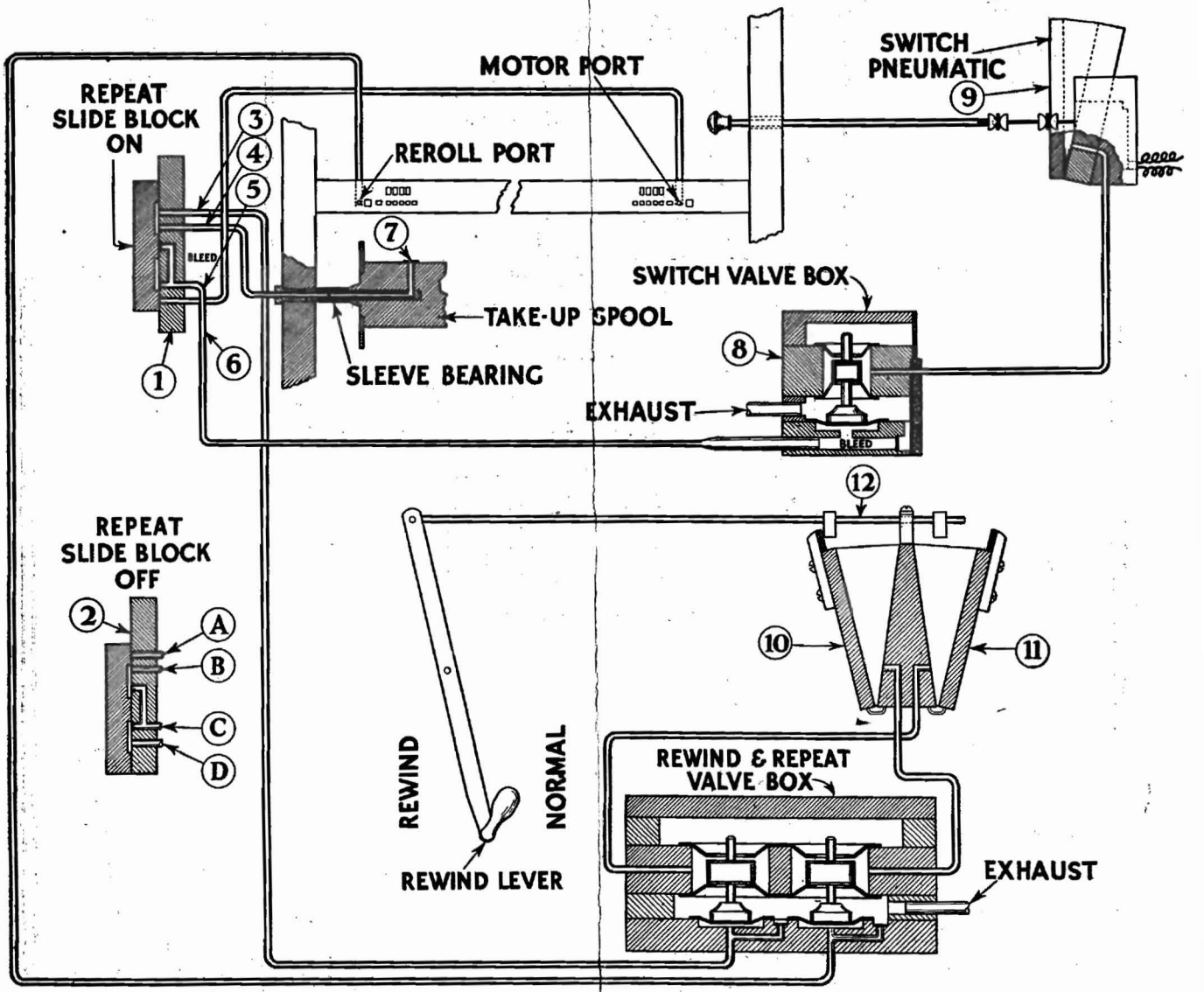
UPRIGHT LOUD AND SOFT PEDAL CONTROL

Illustration "N"



REROLL, REPEAT AND SWITCH CUTOUT DEVICES

Illustration "O"



REROLL

Illustration "O"

The reroll mechanism is controlled by the first hole in the bass end of the tracker bar and is tubed up direct to the reroll valve in the rewind and repeat valve box. It controls the reroll pneumatic No. 10 which throws the spool box gearing into reverse and operates the cutout valve to top action.

REPEAT AND SWITCH CUTOUT

The repeat mechanism is controlled by the hole in the left end of takeup spool No. 7; this hole is bored to center of spool and then proceeds to the left through a tubular bearing which supports spool, and on to the 'Repeat' block No. 1, which, if in the 'On' position, allows the atmosphere to go through tube No. 4 and down tube No. 3 to the valve operating 'Repeat' pneumatic No. 11. This pneumatic throws the spool box gearing into 'Normal' position and repeats playing of music. An examination of 'Repeat' block No. 1 shows that when it is placed 'Repeat On,' the electric motor controlled by the second hole 'in' on the right side of tracker bar cannot be shut off when the motor hole is exposed on reroll. This allows 'Repeat' hole in takeup spool to function and music is replayed.

With 'Repeat' block No. 2 at the 'off' position, the block slides over and connects the motor port in the tracker bar tube 'D' with tube 'C' that leads to switch valve in box No. 8. Tube 'C' has a bleed that reduces the atmosphere entering tube 'D' through motor port in tracker. This bleed, however, is smaller in size than the bleed in the switch valve so the atmosphere entering tube 'C' through tube 'D' is not sufficient to neutralize bleed in switch valve.

When port No. 7 is exposed by music roll, atmosphere enters through tube 'B' which also has a bleed, combined with the atmosphere entering bleed in tube 'C' neutralizes and overcomes the bleed in the switch valve in Box No. 8 and causes the valve to raise, thereby collapsing pneumatic No. 9 and cutting off electric switch.

GRAND DUO-ART MODULATOR PNEUMATIC

Refer to Illustration "P"

The Modulator covered by illustration "P" will be found only in the Grand Duo-Arts. The Modulator Pneumatic provides a means whereby the normal Duo-Art may be modified or softened without losing any of the dynamic gradations. It also acts as a supply regulator for the loud pedal and accordion pneumatics, and it equipped with a cutout valve for the pneumatic action on reroll.

The illustration has been distorted somewhat to show channel No. 8 which actually is back of channel No. 11.

With the "Dynamic Lever" in front of Duo-Art at the "Concert" or normal position, the modulator valve No. 10 is open and allows the air entering chamber No. 13 to pass down through channel No. 11, then up through channel No. 8 into chamber No. 7, where it passes down channel No. 6 and up channel No. 2 to outlet No. 1, then it passes to the pump and is exhausted.

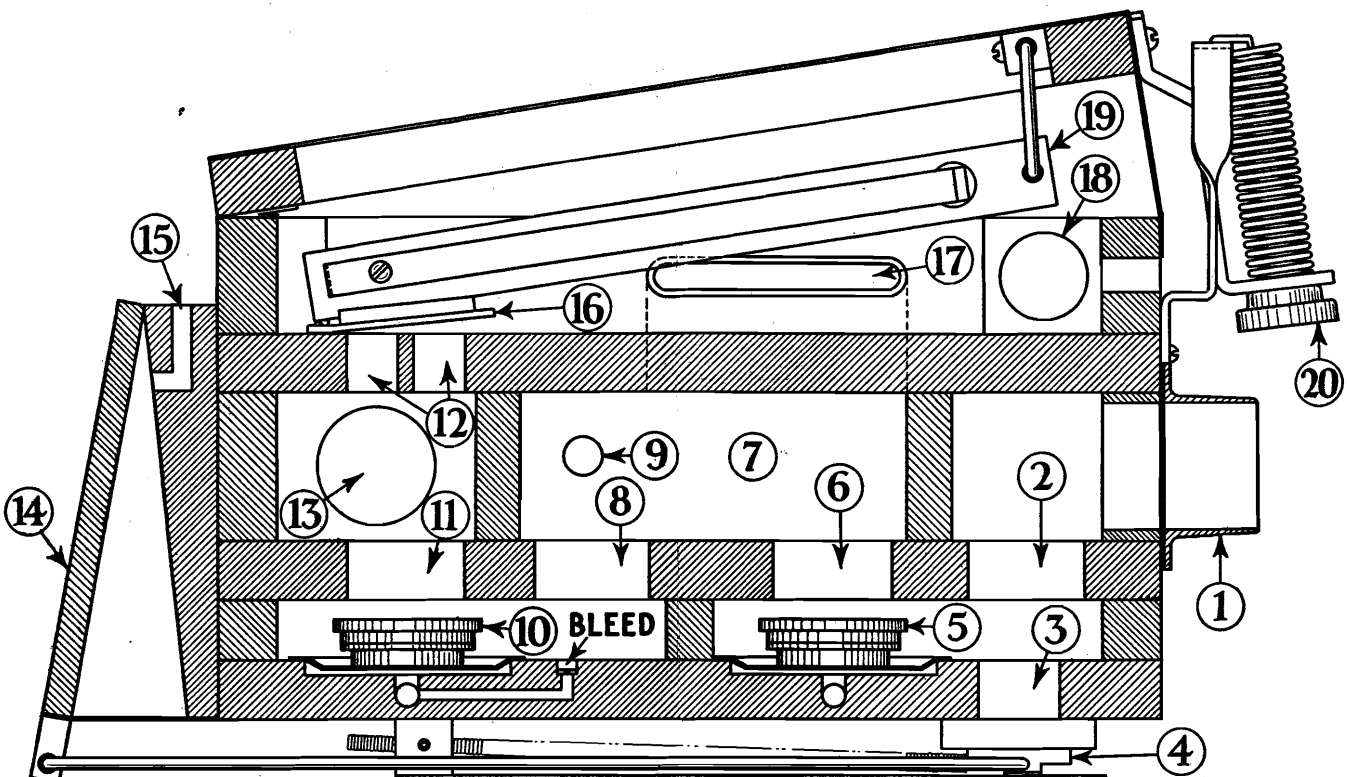
With the "Dynamic Lever" in front of Duo-Art at "Soft" or modulated position, valve No. 10 raises and closes channel No. 11. The air entering chamber No. 13 now passes up through channels covered by No. 12 and the flap valve No. 16, "which is closed when valve No. 10 is open," is now raised and the air passes to the knife valve port No. 17, where the pressure is cut down or softened. From channel No. 17 the air passes to chamber No. 7, then down No. 6, up No. 2 and out No. 1 to the pump. The spring No. 20 controls the degree of modulation which should be one-half the full volume of the Duo-Art. If the spring No. 20 is set so the degree of modulation is one-half the full volume of the Duo-Art, it will be found that there is enough spring tension to operate the loud pedal pneumatic and the Accompaniment and Theme Accordion pneumatics so they will work fast enough and still remain quiet in their operation. With the Dynamic Lever at "Concert" position, the modulator pneumatic has no effect upon the volume of the Duo-Art.

The action cutout valve No. 5 closes on "reroll' and pneumatic No. 14, which operates slide covering channel No. 3, collapses, which lets in the outside air and eliminates any excessive load on the electric motor.

The loud pedal is supplied from port No. 18.

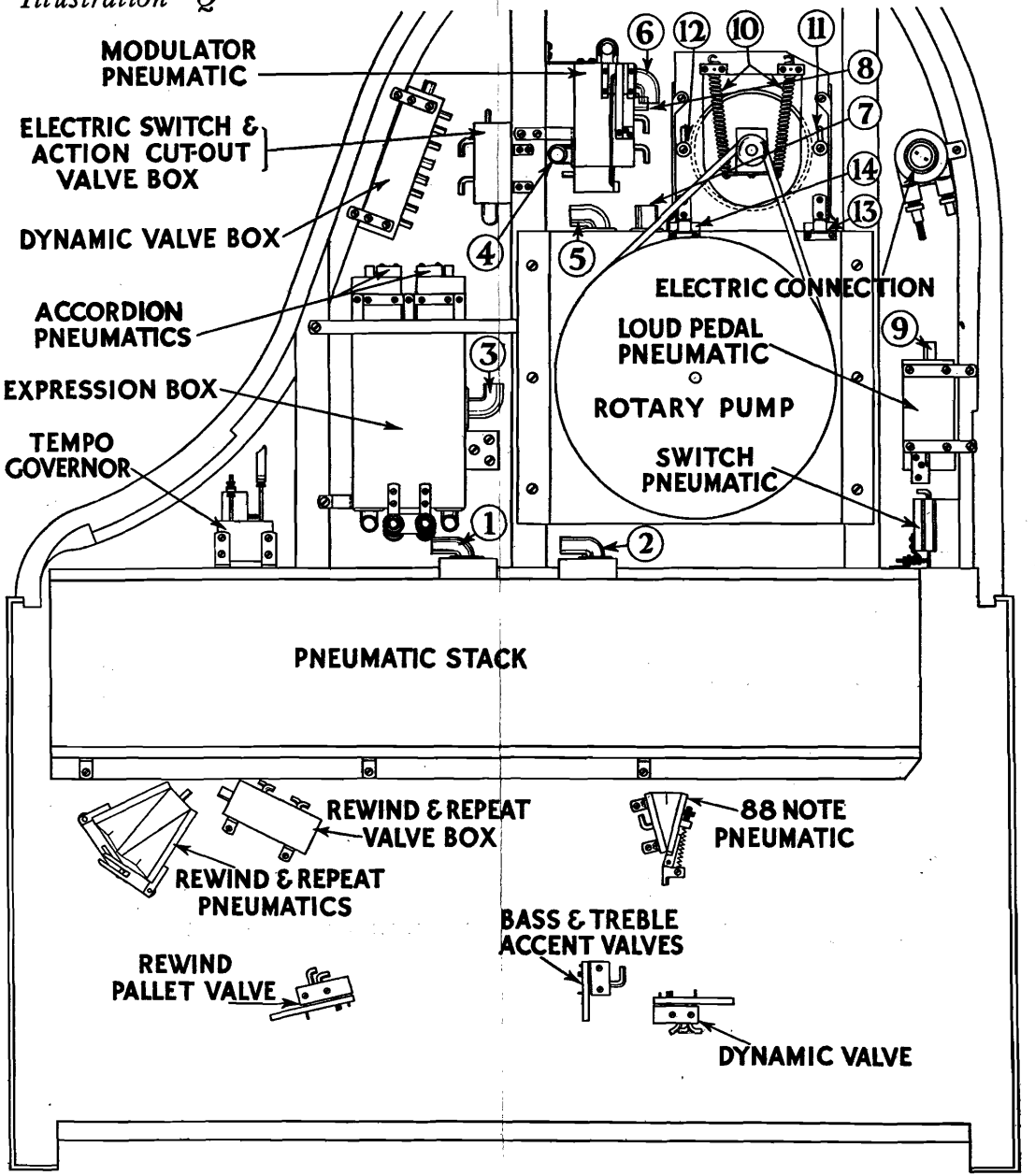
GRAND DUO-ART MODULATOR PNEUMATIC

Illustration "P"



BOTTOM VIEW OF DUO-ART GRAND

Illustration "Q"



KEY CHART TO ILLUSTRATION "Q"

No. 1—Treble Action Exhaust Nipple.
No. 2—Bass Action Exhaust Nipple.
No. 3—Expression Box Exhaust Nipple.
No. 4—Expression Box Connecting Nipple.
No. 5—Governor Exhaust Nipple.
No. 6—Pump Connecting Nipple.
No. 7—Main Exhaust Nipple.
No. 8—Loud Pedal Exhaust Nipple.
No. 9—Loud Pedal Nipple.
No. 10—Slack Take-up Springs.
No. 11—Top Cradle Fastening Screw.
No. 12—Top Cradle Fastening Screw.
No. 13—Motor Cradle Hinge.
No. 14—Motor Cradle Hinge.

BOTTOM VIEW OF DUO-ART GRAND

Refer to Illustration "Q"

Illustration "Q" shows the position of the various control units in the Duo-Art Grand. The illustration shows the Grand turned upside down. Points covered by No. 11 and 12 in the illustration show the screws which hold the loose top motor cradle to the bottom cradle, and they are used only in shipping the instrument or when turning it up on end, and they should always be removed when the instrument is turned down to play, as there is a very objectionable vibration if they are not removed.

Points covered by arrows No. 10 are the two springs which eliminate the slack in the belt. These springs should be removed when a change of motor is necessary by taking out machine screw fastening straight metal arm to motor on which the two springs are hooked.

There is no tube connections shown on illustration "Q" because it would complicate the simple layout intended.

The rewind Pallet Valve with the two tube connections connect to the two bent nipples on the Electric Switch and Action Cut-out Valve Box.

The Bass and Treble Accent Valves, although only one is shown in illustration, are connected to the two valves in the Theme Primary Valve Box shown on illustration "E" page 17.

The Dynamic Valve, showing three bent tube connections, is operated by the Dynamic Lever.

With lever at soft position one tube leads to modulator. One to soft pedal valve, the other to accompaniment accordion pneumatic No. 2.

CRASH DEVICE, GRAND EXPRESSION BOX

Refer to Illustration "R"

The Grand Duo-Art Expression Box is constructed differently from the upright box, due to the difference in design of the two instruments, but the basic principles are the same in both expression boxes. The grand expression box has a crash valve which functions when power No. 15 on the Theme side appears in the music roll. No. 1 in illustration "R" shows the crash primary valve box.

No. 6 shows the connecting arm and screw which is attached direct to the knife valve shaft and, as the accordion pneumatics collapse, it raises this arm closer to the pallet valve No. 5, but until power No. 15 appears in the Theme side, it should not operate. With the regulating screw No. 6, this adjustment can be made so that at power No. 14, the crash is "off" and at No. 15, it comes "on" and this adjustment should be made after any regulation of the Theme knife valve. When the crash valve operates it makes a channel direct from the pneumatic action to the pump cutting around the Theme knife valve, and very quick loud accents can be obtained with this device.

No. 2 shows the supply tube to the crash valve primary. No. 3 shows the tube which connects to the pallet valve No. 5. No. 7 shows the set screw on crash arm and rough adjustments can be made here of regulating screw No. 6 to pallet valve No. 5. No. 4 shows the atmosphere intake or "spill" on the grand expression box. No. 8 shows the spring which pulls the spill valve back to normal. No. 9 shows the nipple to the Theme secondary valve on the treble side.

GRAND PIANO KEY FRAME SHIFT

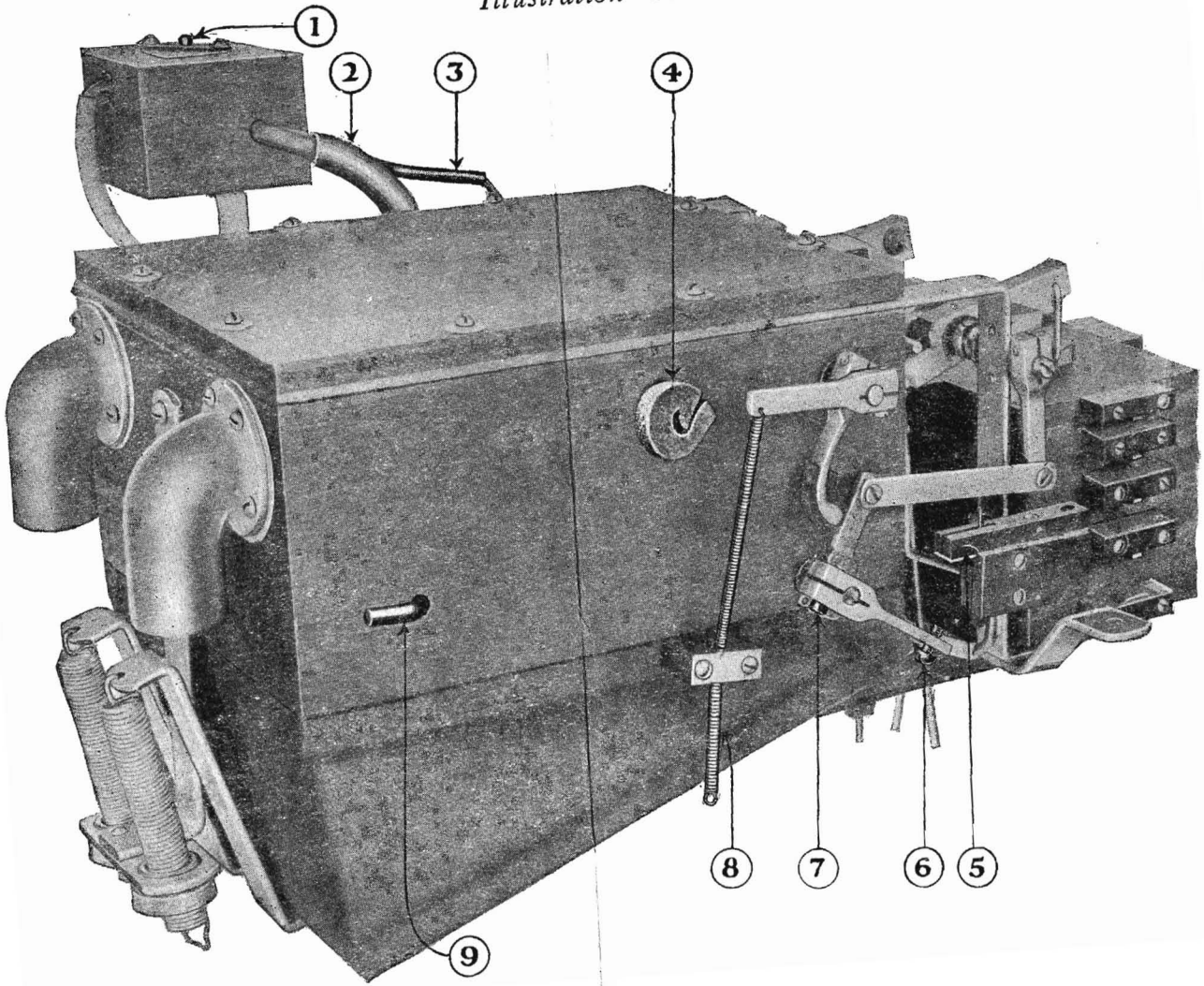
Refer to Illustration "S" Page 46

The key frame shift is controlled by the last port in the treble end of the tracker bar. The result is the same as obtained by the soft pedal on the grand.

No. 1 tube leads to last port in the tracker bar. No. 2 exhaust connection from loud pedal supply. No. 3 shifting pneumatic valves. No. 4 Key-frame shifting pneumatic located under key-bed. No. 5 point of pneumatic attack. Lost motion between No. 5 point of attack and pneumatic can be taken up by adjusting screw No. 6. No. 7 piano pedal rod shifting key frame. No. 8 flange shifting piano action key frame No. 9. No. 10 set screw securing position of key-frame shifting bracket.

CRASH VALVE, GRAND EXPRESSION BOX

Illustration "R"



GRAND KEY FRAME SHIFTING DEVICE

Illustration "S"