The

DUO-ART

Reproducing Piano

SERVICE
MANUAL

1925

Duo-Art Service Department

The AEOLIAN COMPANY

Aeolian Hall

NEW YORK

The

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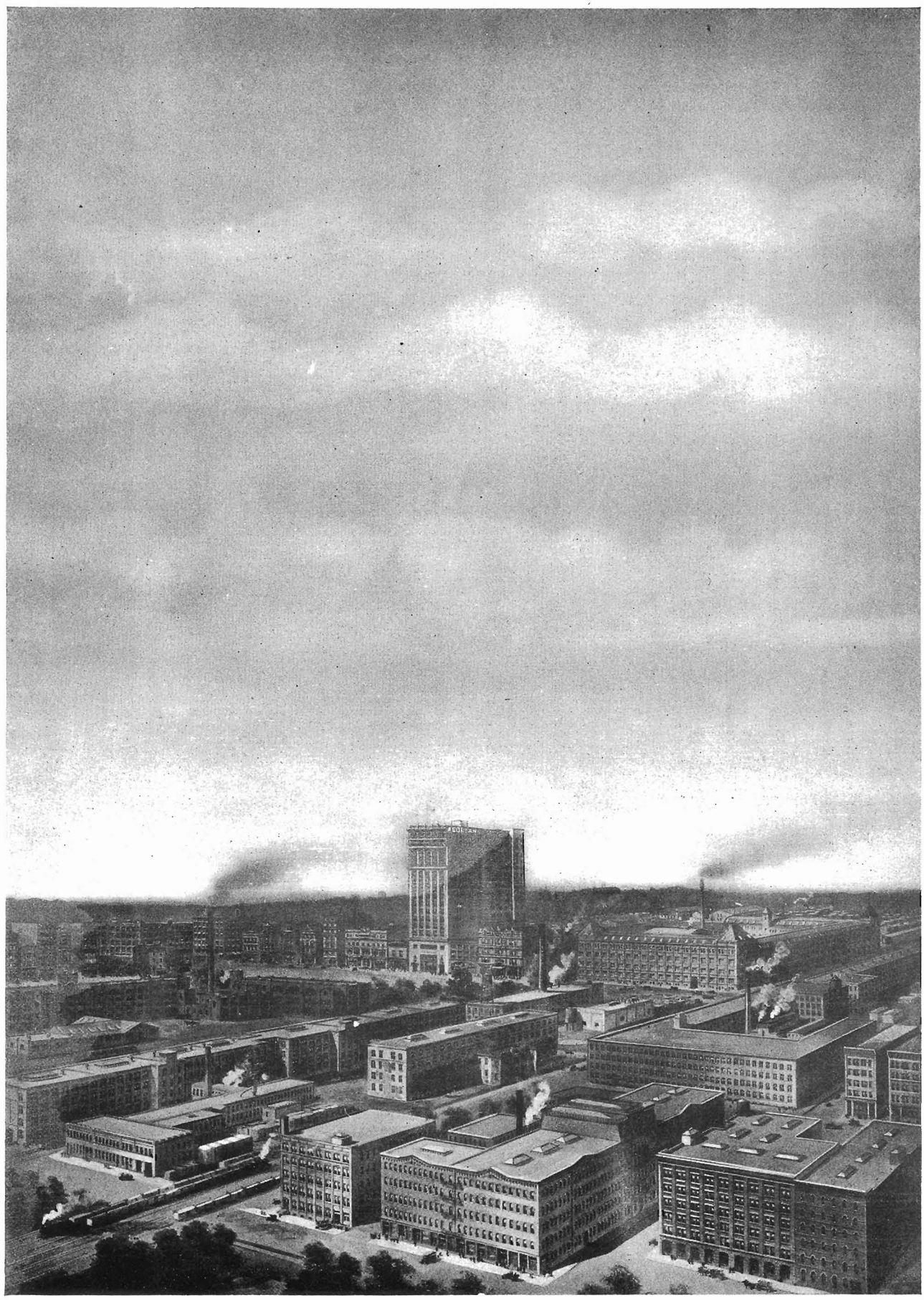


AEOLIAN CITY

Manufactories and Warerooms of the Aeolian Company throughout the World in assembled group.

FOREWORD

The purpose of this manual is to explain the fundamental principles upon which the Duo-Art reproducing mechanism is based and the method to be followed in its adjustment and regulation. The cause of trouble can be readily located, and the proper remedy applied once a mechanic understands the principles upon which any mechanism functions. From time to time certain units in the Duo-Art may be redesigned, simplified or otherwise altered, but the basic principle upon which the instrument operates must remain the same and it is only necessary to learn the principle once to know it for all time.

In case any Duo-Art mechanism is not working properly, we would caution the mechanic against immediately taking the unit apart, without first carefully diagnosing the trouble as it is nearly always possible to adjust the Duo-Art mechanism and correct any defect in its operation from the exterior. By employing a progressive system of elimination, the seat of trouble is quickly located which means that it is two-thirds remedied. Quickly locating the seat of trouble lends an air of efficiency to the work of the mechanic which is appreciated by the owner and employer alike. Only the best quality of material and the most skillful labor are employed in the manufacture of the Duo-Art reproducing action. All pneumatic units receive a series of very careful inspections before being installed in the instrument.

All pianos and player pianos should be tuned and adjusted at least twice a year and the Duo-Art is no exception. Keep the tracker bar cleaned out and the junction blocks screwed tight. Never attempt to adjust the Duo-Art mechanism with the piano action damp and sluggish, dry out the action first.

The Aeolian Company from time to time will conduct schools of instruction on the Duo-Art reproducing mechanism in the larger cities of the United States and player mechanics desiring to attend these schools should forward their address to the Duo-Art Service Department, New York City, and they will be notified when the school will be in their vicinity.

It is absolutely necessary that the mechanic has a thorough knowledge of the basic principles involved in the operation of the ordinary pneumatic action before he is qualified to work intelligently upon the Duo-Art.

The sale of Duo-Art Reproducing Pianos is increasing in volume and there is a constant demand for mechanics who thoroughly understand them.

No one, unless thoroughly understanding the Duo-Art mechanism, should attempt to make any adjustments upon it nor should any regulations be made upon the expression mechanism without the use of the Duo-Art test roll.

The Duo-Art is the least complicated reproducing instrument manufactured today and yet it has no equal in its power to reproduce with absolute fidelity the recordings of the master pianists, the majority of whom record only for the Duo-Art.

These instructions are based upon the upright Duo-Art but would apply generally to the grand, as it differs only in design.

Diagrams and illustrations of Duo-Art mechanisms shown in this manual have been more or less distorted in order to illustrate more clearly the principles of operation.

The Duo-Art Service Department is ready at all times to give any information or assistance to all persons engaged in the care, maintenance and distribution of the Duo-Art Reproducing Piano.

The Duo-Art Dynamic Control System

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-hand 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, at the same time any degree of power may be given to the Accompaniment.

This method of expression control is the outstanding feature of the Duo-Art dynamic system, it admits of an unlimited variety of musical effects and greatly simplifies recording of the most difficult musical compositions. It must be thoroughly understood before a clear conception of the Duo-Art dynamic system is possible. The large illustration B upon the next page shows the expression tubing layout from the tracker bar and the Duo-Art expression box with channels and valves exposed. With a little study this dynamic system is readily comprehended.

The Duo-Art is without doubt the simplest reproducing medium manufactured today. It has no complicated or intricate valve systems peculiar to other instruments of this character. Notwithstanding its simplicity, Josef Hofmann, the great pianist, states: "The extraordinary variety of dynamic effects, as well as the rhythmic values of the Duo-Art and the ease by which these two principal means of pianistic expression may be altered at will, result in a likeness of the pianist's playing which I have never heard approached by any other Reproducing Piano."

Crescendo or diminuendo effects are obtained in the Duo-Art not by sharp, abrupt jumps or arbitrary mechanical measurements, but in accordance with the artist's playing.

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 D page 10. 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 crescendos or diminuendos are easily obtained. 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 pass through the Accompaniment or Theme regulator.

With the Accompaniment and Theme control mechanisms it is possible by alternately using either mechanism to secure innumerable fine shadings.

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.

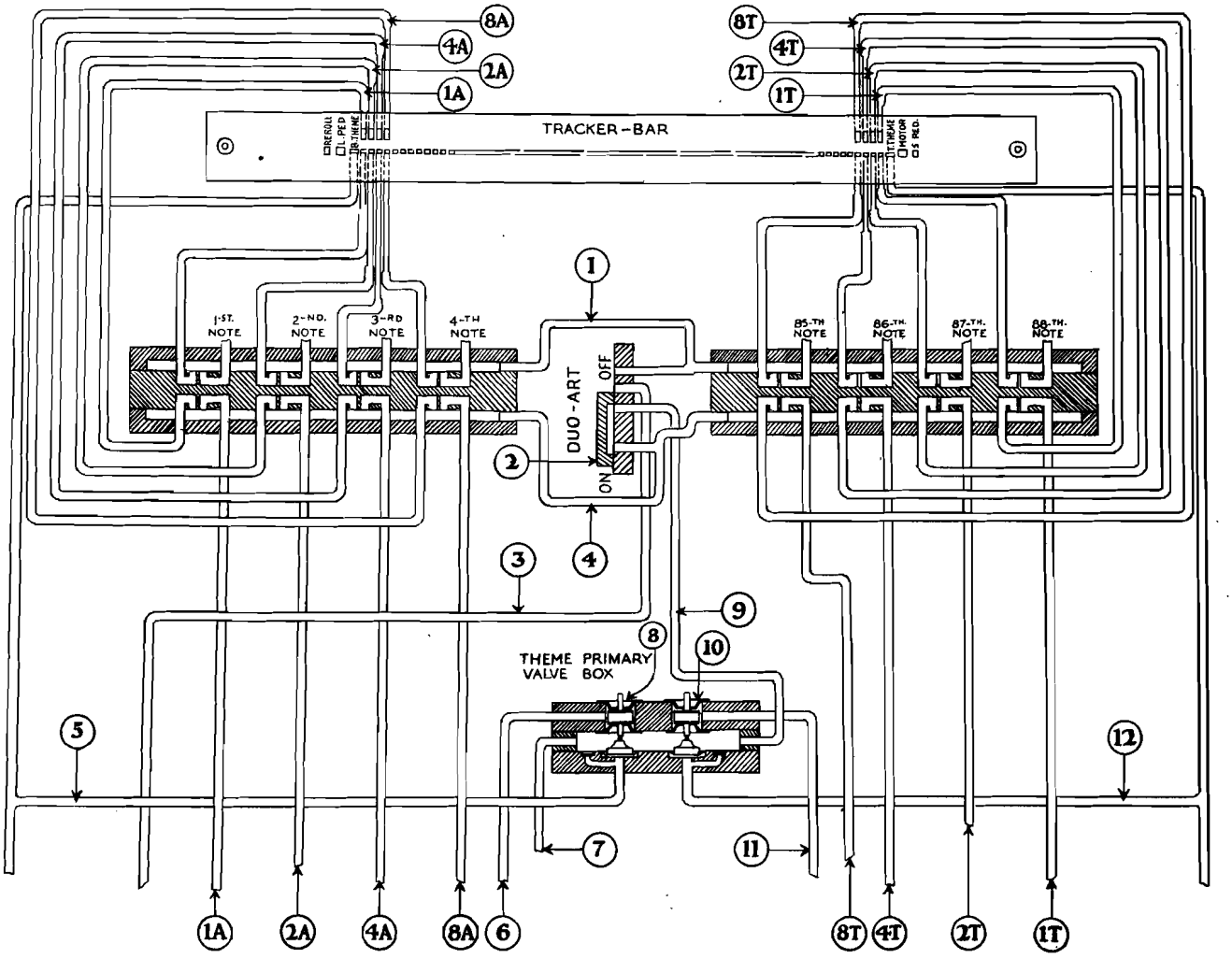
The zero degrees might be termed the foundation of the dynamic structure, as all of the higher or louder gradations in the Accompaniment and Theme mechanisms are built upon them. Each gradation in the Theme registers slightly louder than the corresponding gradation in the Accompaniment mechanism.

Upright Duo-Art Expression Box and Connections Illustration "B"

Key Chart to Expression Mechanism

1. Note Coupler Supply Tube.
2. Duo-Art "On" and "Off" Block.
3. Duo-Art "Off" Pneumatic Supply.
4. Duo-Art Coupler Supply Tube.
5. Theme Primary Bass Tube.
6. Theme Secondary Bass Tube.
7. Primary Valve Box Supply.
8. Theme Primary Bass Valve.
9. Pouch Blocks Supply Tube.
10. Theme Primary Treble Valve.
11. Theme Secondary Treble Tube.
12. Theme Primary Treble Tube.
13. Accompaniment Regulator Spring.
14. Accompaniment Accordion Pneumatics.
15. Adjusting Nuts.
16. Accompaniment Adjusting Screws.
17. Accompaniment Regulator Chamber.
18. Tension Springs.
19. Bass Theme Secondary Nipple.
20. Bass Theme Secondary Valve.
21. Bass Action Nipple.
22. Bass Action Chamber.
23. Bass Flap Valve.
24. Accompaniment Chamber.
25. Treble Flap Valve.
26. Treble Action Chamber.
27. Treble Action Nipple.
28. Action Reroll Cut-out Valve.
29. Treble Theme Secondary Nipple.
30. Treble Theme Secondary Valve.
31. Channel Into Theme Regulator.
32. Theme Regulator Chamber.
33. Accordion Adjusting Screws.
34. Theme Accordion Pneumatics.
35. Theme Regulator Spring.
36. Dynamic Valve Box.

Tubes in line diagram marked 1-A, 2-A, 4-A, 8-A and 1-T, 2-T, 4-T and 8-T control the Accompaniment and Theme gradations and connect with tubes similarly marked on dynamic valve box #36.



The Duo-Art Gradation Control

Refer to Illustration "B"

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 in the upper left-hand corner of illustration.)

The Theme-gradation control ports in the tracker are shown in the upper right-hand corner of this illustration and are marked 1-T, 2-T, 4-T and 8-T. They control the Theme in conjunction with the holes in the tracker bar marked "B Theme" and "T Theme."

Pressure Chart Showing Gradation Adjustments for Correct Settings

Pressure #1 zero setting adjusted to play piano as softly as possible.

Pressure	#2	Holes	in	tracker	open	#1	Accordion	pneumatics	collapsed	#1— 1/16"
"	#3	"	"	"	"	#2	"	"	"	#2— 2/16"
"	#4	"	"	"	"	#1-2	"	"	"	#1-2— 3/16"
"	#5	"	"	"	"	#4	"	"	"	#4— 4/16"
"	#6	"	"	"	"	#1-4	"	"	"	#1-4— 5/16"
"	#7	"	"	"	"	#2-4	"	"	"	#2-4— 6/16"
"	#8	"	"	"	"	#1-2-4	"	"	"	#1-2-4— 7/16"
"	#9	"	"	"	"	#8	"	"	"	#8— 8/16"
"	#10	"	"	"	"	#1-8	"	"	"	#1-8— 9/16"
"	#11	"	"	"	"	#2-8	"	"	"	#2-8—10/16"
"	#12	"	"	"	"	#1-2-8	"	"	"	#1-2-8—11/16"
"	#13	"	"	"	"	#4-8	"	"	"	#4-8—12/16"
"	#14	"	"	"	"	#1-4-8	"	"	"	#1-4-8—13/16"
"	#15	"	"	"	"	#2-4-8	"	"	"	#2-4-8—14/16"
"	#16	"	"	"	"	#1-2-4-8	"	"	"	#1-2-4-8—15/16"

It will be noticed that each number in the Accompaniment and Theme controls 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) and connect with tubes on valve box marked similar to those at tracker bar. These tubes control the accordion pneumatics (No. 14) and (No. 34). 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. (See No. 33.)

Accompaniment Control

The air is exhausted from the bass and treble sides of the pneumatic top action to nipples (No. 21) and (No. 27). The bass air enters the expression box through nipple (No. 21) and the treble air through nipple (No. 27). The air then enters chambers (No. 22) and (No. 26) and passes through flap valves (No. 23) and (No. 25) into the accompaniment chamber (No. 24). 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.

The degree to which the knife valve has been opened by the accordion pneumatics determines the loudness of playing. The Theme secondary valves (No. 20) and (No. 30) are always closed, except when the Theme is operating on the bass or treble side. Normally the instrument is under the Accompaniment control.

Theme Control

The Theme accordion pneumatics (No. 34) control the degree with which accented notes are struck either in the bass or treble, but it is the valves (No. 20) and (No. 30) which are controlled by the holes in the tracker bar marked "B Theme and T Theme," operating through the Theme primary valves (No. 8) and (No. 10) that determine when the Theme shall function. The air is exhausted from the bass and treble of the top action into chambers (No. 22) and (No. 26) 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. 8) and (No. 10), raising them. This action puts suction on the two Theme secondary valves in the expression box (No. 20) and (No. 30), causing them to drop, thereby making a passage for the air to the Theme regulator pneumatic (No. 32). The air then passes through the knife valve port and proceeds to the pump, where it is exhausted. (No. 31) shows the channel leading into the Theme regulator and it is situated just back of the Accompaniment channel (No. 24).

On top of the accordion pneumatics is a wire which leads to an arm. When pulled down, it opens a knife valve in the expression box. The knife valves in the Accompaniment and Theme controls are exactly alike. These valves operate over port holes leading to the pump. The degree to which these ports are opened by the accordion pneumatics controlling the knife valves determines the loudness of playing. Illustration (D), page 10, shows a side view of one of these knife valves and it gives a good idea of their operation.

Theme Control of Bass or Treble

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. 20) or the Treble Theme valve (No. 30) and the Theme regulator pneumatic will control accented notes on either side that is opened, while the Accompaniment regulator will control the accompaniment notes.

Operation of the Atmosphere Intake or Spill

(Refer to Illustration C, page 8.)

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.

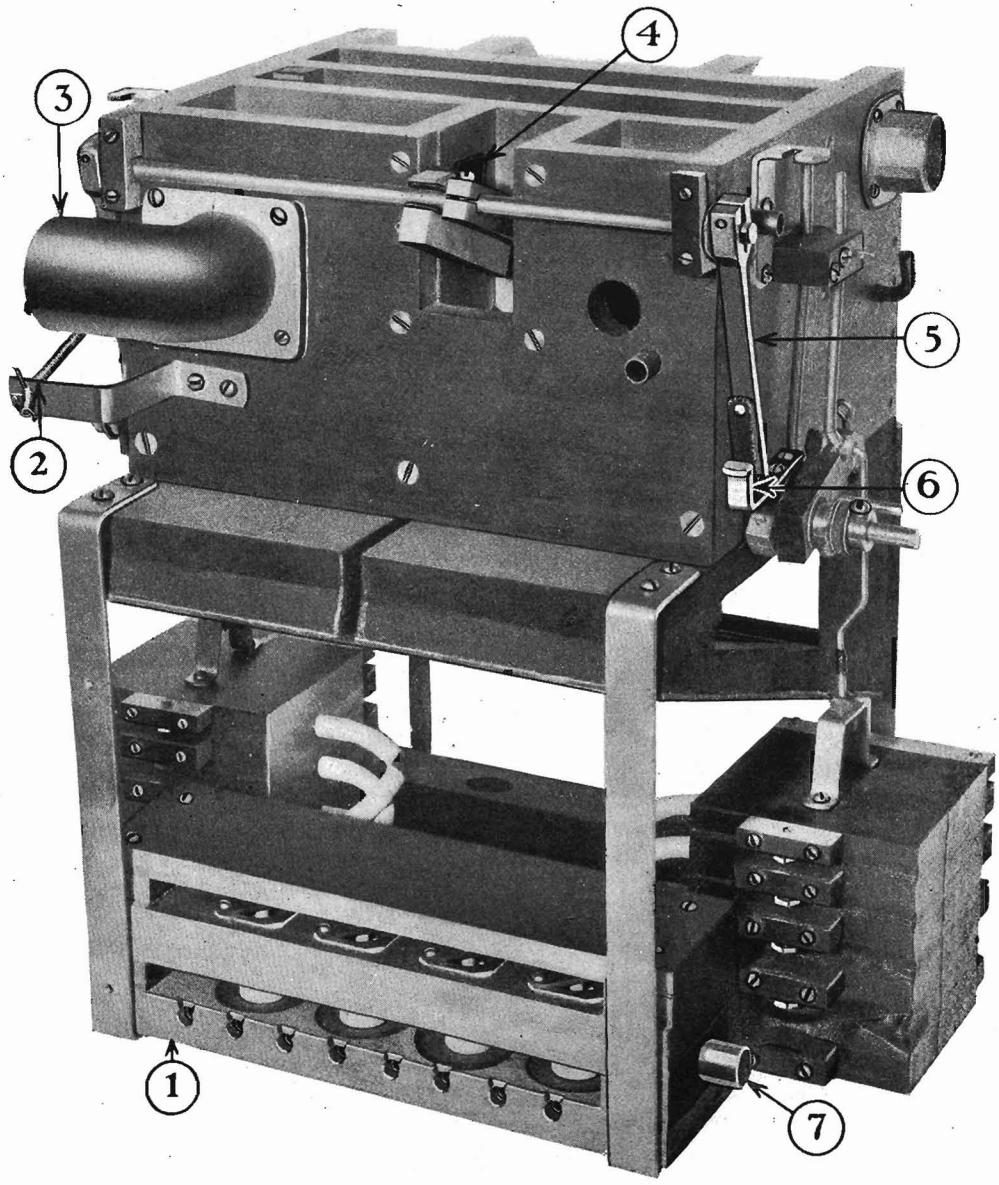
In Illustration (C), it will be seen the valve No. 4 is attached to a rod extending across the back of the expression box, and to this rod an arm, No. 5. As the accordion pneumatics collapse, they push the bracket No. 6 forward, and No. 6 in turn pushes arm No. 5 forward and the valve No. 4 closes off 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.

Atmosphere Intake or Spill Valve

ILLUSTRATION "C"

Key Chart

1. Dynamic Valve Box.
2. Spill Valve Spring.
3. Main Supply Nipple.
4. Spill Valve.
5. Spill Valve Connecting Arm.
6. Spill Valve Bracket.
7. Supply to Valve Box.



How to Test and Adjust the Duo-Art

(Refer to Illustration "B," page 5.)

This test will be a series of steps, twelve in number, and will cover all points necessary for a thorough inspection of the Duo-Art. This test is based upon the 1921 Duo-Art test roll.

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 12-14. Also read over instructions for proper adjustment of player action to piano action on page 16.

Step 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.

Step 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 detailed instructions on electric motors and pumps on pages 18-19 of this treatise.

Step No. 3, Tracking Device

This subject is fully covered on page 20 by diagram and text.

Step No. 4, Tempo

Duo-Art Lever Off

Follow tests on roll in rotation. With tempo indicator at 70, roll should run seven feet per minute or 3½ 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.

Step 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 22, controls the speed of the loud and soft pedals in the upright Duo-Art, and spring (No. 19) in illustration "P," page 24, 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.

Step No. 6, Dynamics

Duo-Art Lever On

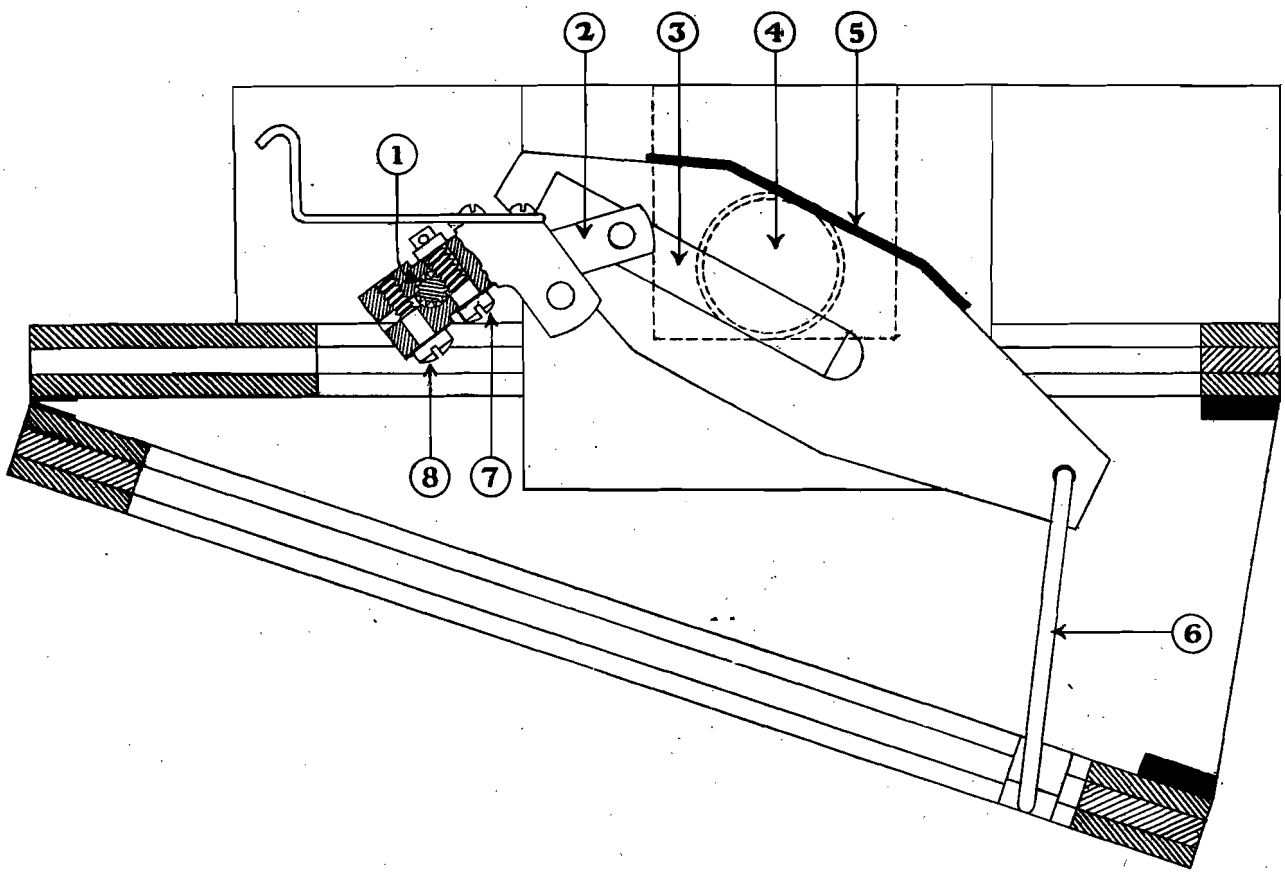
The Accompaniment dynamics are operated from the bass end of the tracker bar above the regular piano notes and are numbered No. 1, No. 2, No. 4, and No. 8. These dynamics should work in order given.

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

Duo-Art Knife Valve—Side View

ILLUSTRATION "D"

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



Step No. 7, Accompaniment Setting of Zero Dynamic

(Tempo at 80)

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 regulator springs (No. 13) 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 (C) the spill valve spring (No. 2) is shown. It also should have a little tension.

The little leather nuts (No. 15) should never be tampered with, as they are set to remove the 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, then on again with the next run. 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. 16). 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 10 (Illustration D.) 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 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).

On uprights, to soften, turn screw (No. 7) to left, and to right to make louder. On grand Duo-Arts having the cabinet type pump, turn adjusting screws in opposite direction from that noted in instructions given above, as expression boxes in these instruments are installed just the reverse of uprights. It only takes a slight turn of the adjusting screw to make considerable difference in the zero degree. Watch accompaniment regulator penumatic while setting adjusting screw; softening causes it to open and loudening causes it to collapse. Adjustment can be gauged accordingly.

Step No. 8, Theme Setting of Zero Dynamic

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. Naturally, the conception of one degree will vary with the individual, but a uniformly safe rule to follow is to have the Theme pneumatic collapse one-eighth of an inch more than the Accompaniment pneumatic. When adjusting the Theme regulator, always be sure that the Theme primary valves are working properly. Keep the junction block (See Illlustration "I," No. 11, page 17) screwed tight, also the large junction block under the key bed on the grand. This is very important and never should be neglected.

Adjusting screws for the Theme on the Duo-Art grand are shown at (No. 7) Illustration "Q," page 25, and the Accompaniment screws are in same relative position on opposite side of the expression box.

Step No. 9, Dynamic Chord Test

Chord tests show if dynamics build up evenly. If Accompaniment and Theme zero dynamics were properly set, 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. 13) and (No. 35) is permissible, but any radical adjustments should be made on the regulating screws of the Accompaniment or Theme regulators.

Step No. 10, Notes

All notes should strike evenly and soft on this test. Text covering the operation of the pneumatic top action will be found on page 16.

Step 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.

Step 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 "Reroll" and "Repeat" and Switch cutout devices will be found on page 23.

Regulation of the Upright Piano Action

(Refer to illustration "E" covering this subject on page 13.)

Very few mechanics have had the opportunity to go into a piano factory and learn the regulation of grand and upright piano actions. It is very important that the piano action be in proper regulation before proceeding to test the pneumatic action, and we believe the subject warrants some consideration here.

No. 1. Have key fronts No. 14 and centers No. 12 free but not excessively loose.

No. 2. Remove lost motion between jack-fly No. 9 and butt No. 4 by screwing up capstan screw No. 11. Do not let hammer No. 1 leave rail No. 3 in making this adjustment.

No. 3. Space hammers No. 1 to strings. Hammer tongs or lamp should be used.

No. 4. Let off hammers. Set let-off rail No. 7 so that jack-fly No. 9 hits center of let-off rail button. Have hammers let-off 5/32 inch from strings in bass end and gradually shorten to a scant ⅛ inch in extreme treble. This adjustment made with screw No. 7.

No. 5. Square up keys and level to a straight edge, making sure you have a full ⅜ inch key dip before doing this work. If necessary, paper under balance rail No. 13 to get this key-dip.

No. 6. Space keys so that all are same distance apart, both sharps and ivories.

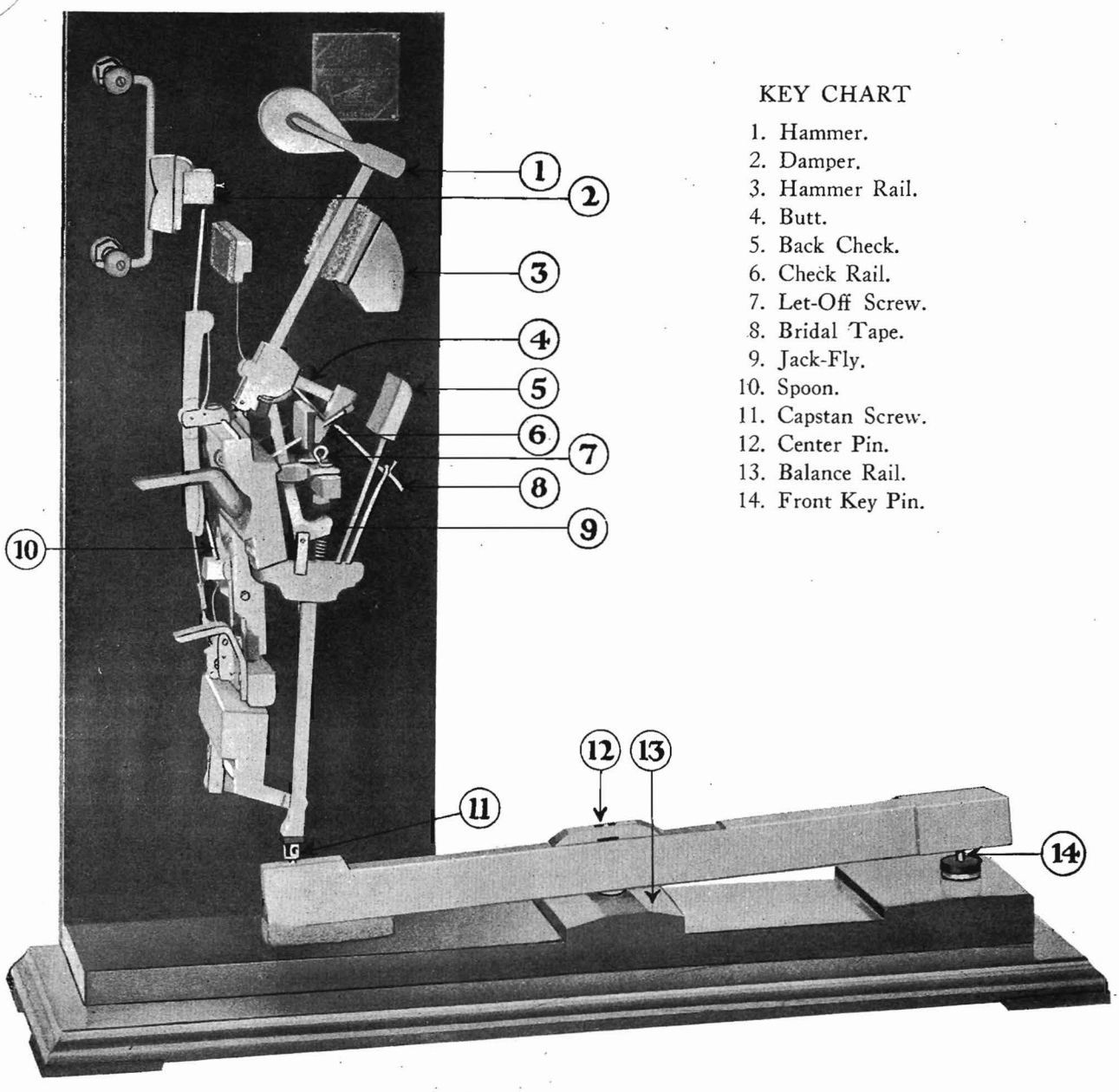
No. 7. Space and even up dampers No. 2 so that all lift evenly from strings.

No. 8. Set trials for touch on each section of action, line up back checks No. 5 and space to butts No. 4. Have all hammers check off evenly about ⅝ inch from strings and lay touch as near as possible to ⅜ inch key dip.

No. 9. Go over spoons No. 10 and have dampers No. 2 start from string at one-half the hammer travel to strings.

Upright Piano Action

ILLUSTRATION "E"



KEY CHART

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

No. 10. Block off the loud pedal to distance that spoon lifts dampers. Block off soft rail about 1 inch from strings. Regulate bridal tapes No. 8 so that all slack is taken out of tape when soft rail is up to 1 inch from strings.

To adjust check rail No. 6, push down on piano key which brings jack-fly No. 9 forward at the top, then adjust screw on rail No. 6 so there is 1/16 inch clearance between jack-fly and rail. This check rail is an aid to quick repetition as it retards the unnecessary movement of the jack-fly.

Regulation of the Grand Piano Action

(Refer to Illustration "F" covering this subject)

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

2. Space hammers to the strings, removing the let-off rail No. 14 from the action allows the hammers to come up to the strings, and the spacing can then be done more exactly and easily.

3. Regulate jack-fly No. 3 to hammer knuckle No. 9. The best practice locates the back edge of the jack-fly in line with the back edge of the wood in the knuckle; although some regulate the jack-fly back further under the knuckle, thinking to thus get a stronger blow, and this has to be compensated for in the key travel. Use adjusting screw No. 12.

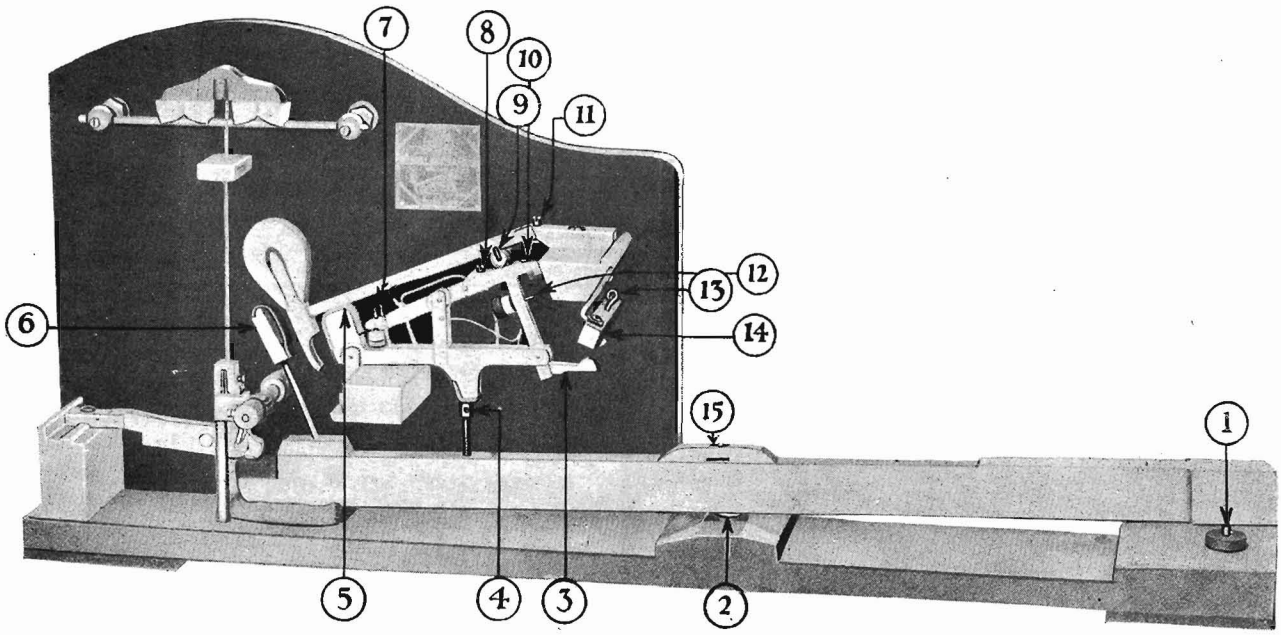


ILLUSTRATION "F"

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. Under Hammer.
11. Drop-Off Screw.
12. Jack-Fly Adjusting Screw.
13. Let-Off Button.
14. Let-Off Rail.
15. Center Pin.

4. Level jack-fly No. 3 and under hammer No. 10 by screw No. 7. This should be very exact in the upper treble hammers, and the best practice allows a little lower position of the jack-fly gradually to the lower bass notes, to compensate for the heavier weight in the larger hammers.

5. Regulate capstan No. 4 on keys to raise hammer stems from the hammer cushion rail No. 5 a scant one-eighth of an inch. The cushion rail is placed in the best practice to allow a two inch hammer travel.

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

7. Regulate key travel on front rail by increasing or diminishing the height of the punchings No. 1. General practice allows three-eighths of an inch dip at center of the ivory head, although different makers vary this somewhat, in the location of the balance rail, or in the regulation of the jack-fly.

8. Regulate back checks No. 6 on the keys to catch hammers at a little less than half-stroke.

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

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

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 soft pedal and wind motor on right and left of spool box.

Detach lyre, then remove all screws from main junction block under key frame.

Lower all manual control levers in front of keys so that top of levers are flush with top of key bed. It is not necessary to entirely remove screws from brackets attached to levers.

Piano action now is easily 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 entirely and the raised lever plates removed, also a small junction block at extreme left of spool box should be disconnected.

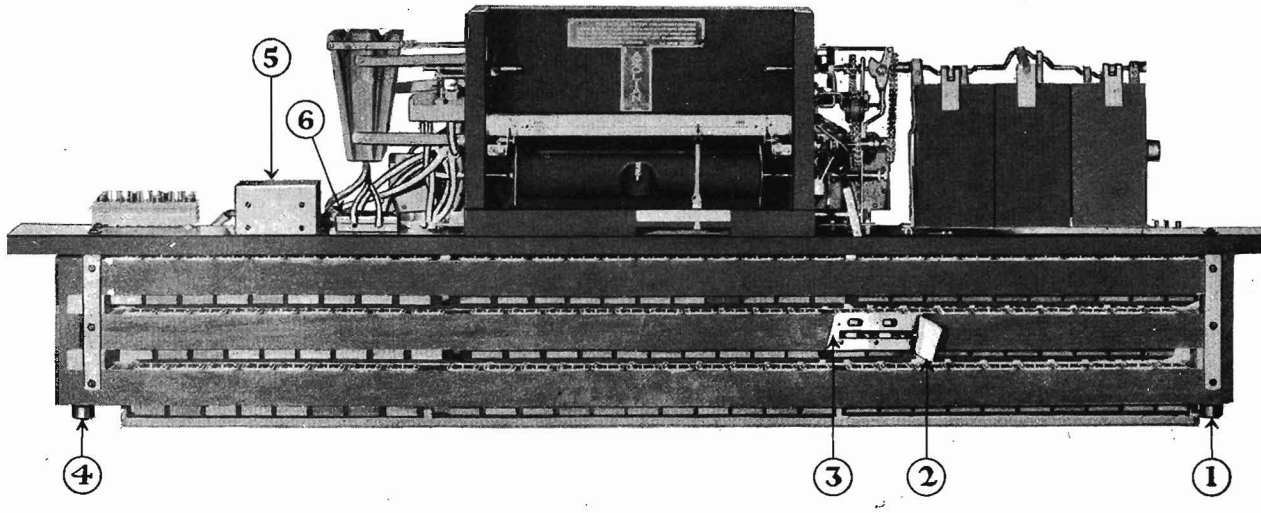


ILLUSTRATION "H"

Top Action. Front View.

Adjustment of Pneumatic Top Action

(Refer to Illustration "G")

After the piano action has been properly adjusted, the pneumatic top action should be inspected to see that it also is in good regulation.

First examine action for excessive lost motion between Pitmans No. 4 on pneumatic action and Whippens No. 3 on piano action. By removing the large screws holding the action in place and tipping the action forward a little, the amount of lost motion can be determined. A little lost motion between Pitmans and Whippens is desirable, about 1/64 inch.

Next adjust leather nuts No. 5 so that the pneumatic stroke brings the piano hammers 5/8 inch from strings, the same as in piano action regulation. Put test roll in spool box and set it at start of note test; have screws holding top action removed and with supply tubes to top action in place, start electric motor; then by sliding action backward and forward on end supports, adjustments may be made on nuts No. 5 for stroke.

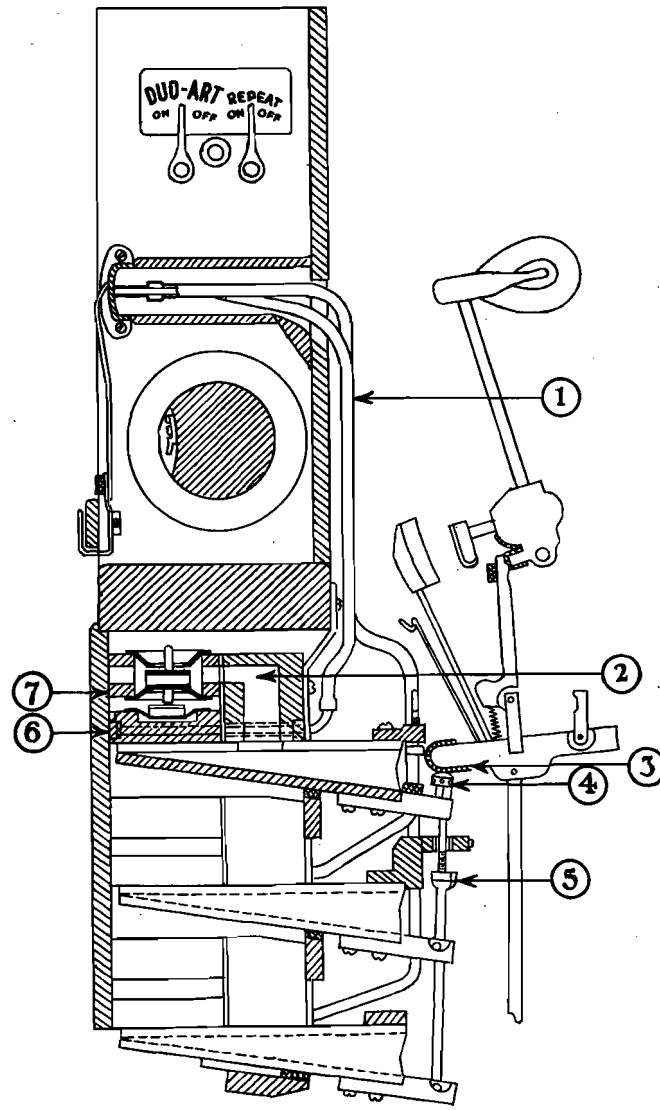


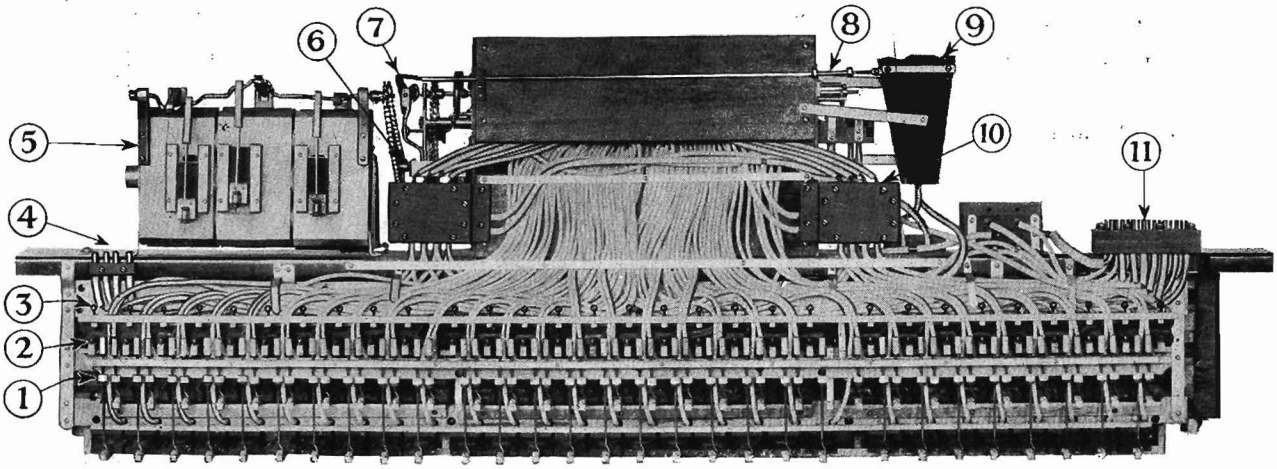
ILLUSTRATION "G"
Top Action. End View.

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.

Back View, Top Action

ILLUSTRATION "I"



1. Stroke Adjusting Nuts.
2. Pitmans.
3. Stroke Adjusting Capstan.
4. Switch, Repeat and Reroll Tubes.
5. Wind Motor.
6. Right Cutout Block.
7. Tracker Cam.
8. Tracker Turnbuckle.
9. Tracker Pneumatics.
10. Left Cutout Block.
11. Expression Tube Junction Block.

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 the 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 tight.

Upright Duo-Art Electric Wiring Diagram

(Refer to Illustration "J" covering this subject)

The electric wiring on the Duo-Art is very simple, as the illustration shows. No. 1 shows the switch control plunger which makes and breaks the circuit manually. No. 2 shows the power supply plug which is inserted in conduit No. 3. Always make sure you have A. C. electric current for an A. C. motor and D. C. for a direct current motor, before inserting No. 2 plug into No. 3. The grand Duo-Arts are not equipped with an electric light but aside from that the wiring is very similar to the upright. No. 4 shows the electric motor plug.

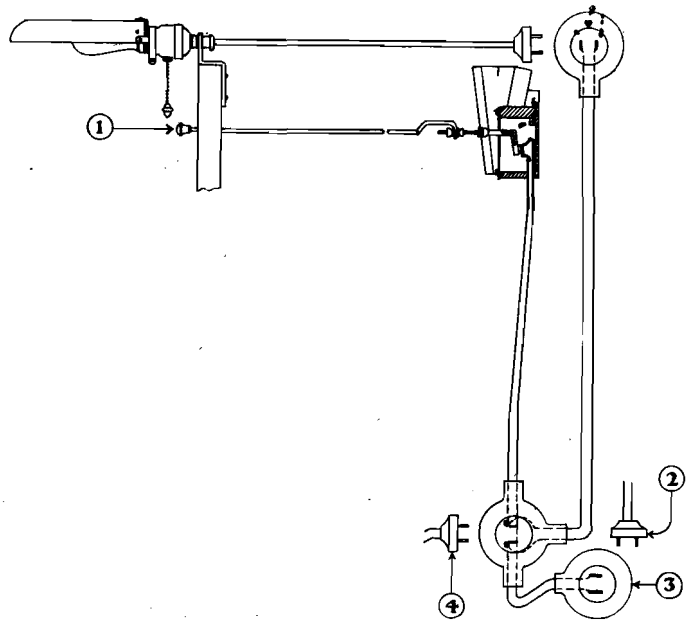


ILLUSTRATION "J"
Upright Wiring Diagram

Electric Motors

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 makes of motors be used.

A one-fourth H. P. motor turning 1150 R.P.M. is furnished with the six point pump. The D. C. motor requires a 2⅝ inch pulley and the A.C. motor requires a 2½ inch pulley to develop the 70 or 72 pulsations required for this type of pump.

A motor rated at about one-eighth H. P. is furnished with the rotary type pump. It turns at 1150 R.P.M. and with a 2 inch pulley the pump will turn at 120 revolutions per minute. Pulley on rotary pump should always turn in direction indicated by arrow cast in face plate of pump.

To change rotation of D.C. motors, reverse leads at brushbox.

To change rotation of A.C. motors, interchange two leads coming through bushing in cover.

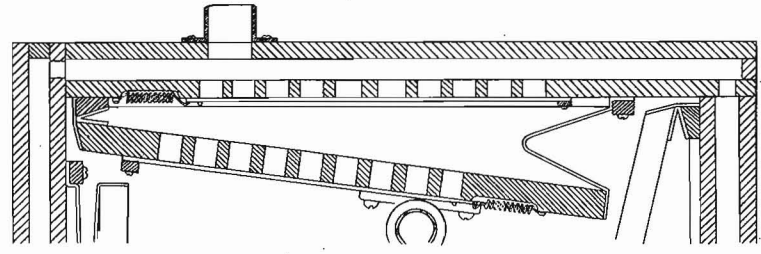
Always keep set screw in motor pulley tight.

Rotary Pump and Spring Motor Mounting

(Refer to Illustration "K" covering this subject)

With a 2 inch pulley on the electric motor, the rotary pump will turn at 120 revolutions per minute and develop sufficient power for the Duo-Art. This type of pump has ball bearing centers and the lubrication originally supplied to these bearings is sufficient to last for years; in fact, indefinitely.

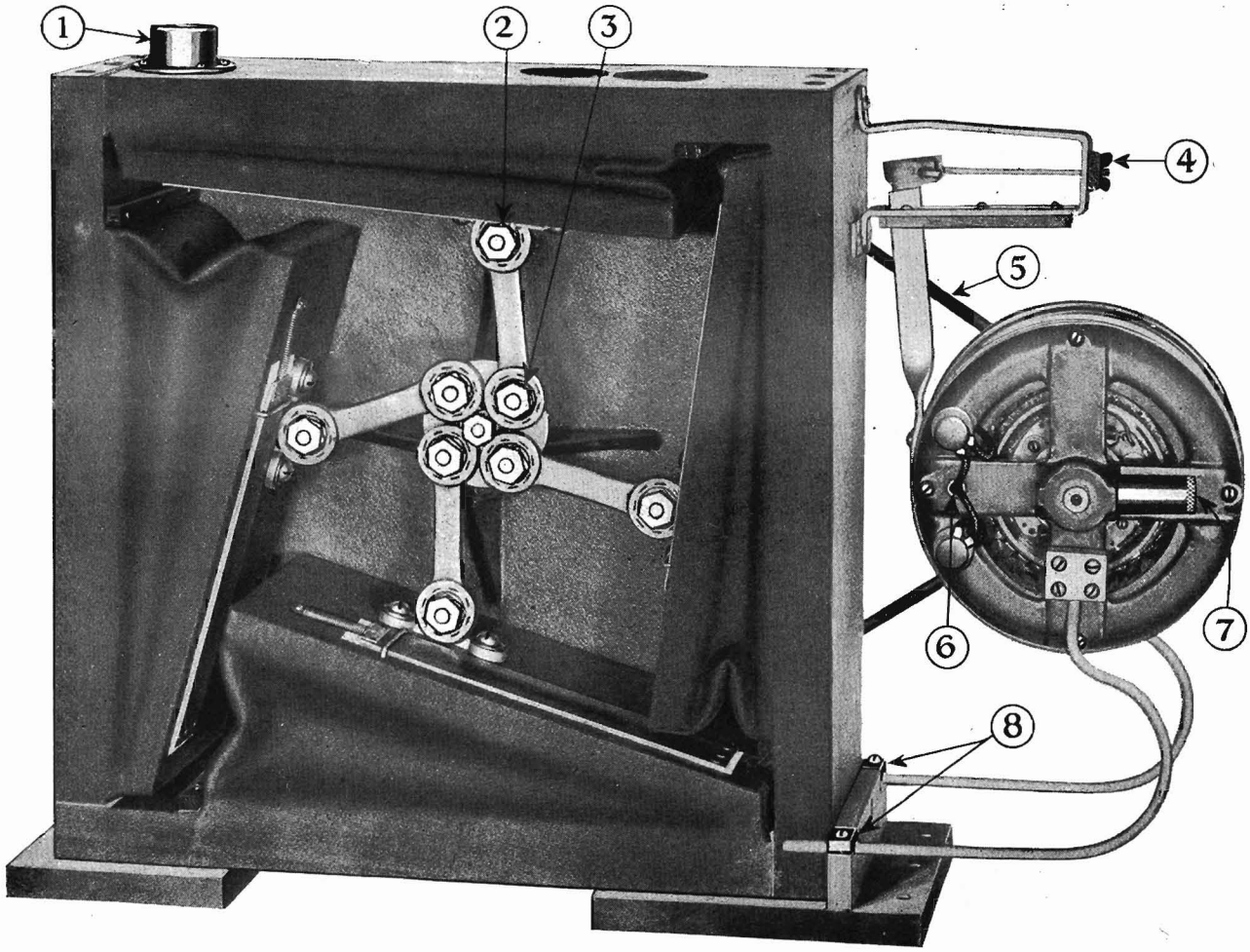
ILLUSTRATION "K-1"



Point No. 1 shows the large nipple which is connected to the modulator pneumatic. Points No. 2 and No. 3 show two of the eight ball bearing connecting arm centers.

The line diagram shows the interior channeling of the pump and the valve construction.

ILLUSTRATION "K"



Spring Motor Mounting

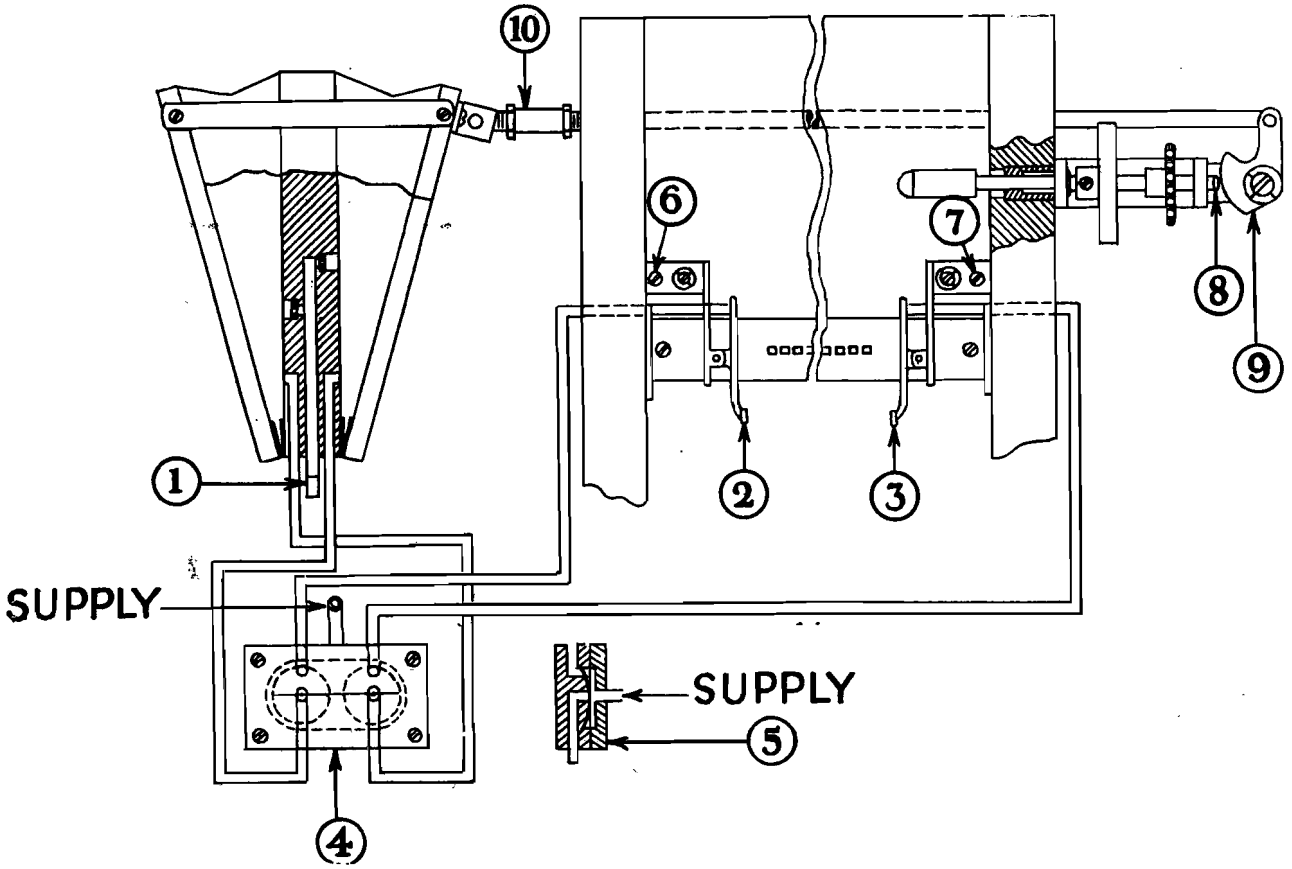
The spring motor mounting shown in illustration "K" is a very simple and efficient device and easily adjusted. By loosening screws at point No. 8 and removing wing nut No. 4, motor may be easily removed. To obviate the possibility of excessive strain at points covered by No. 8, have the electric motor far enough away from the pump to remove all slack in belt No. 5 before tightening screws No. 8. For slight adjustment of belt tension, use wing nut No. 4. Point No. 6 shows motor leads. Point No. 7 shows lubrication cup.

Tracking Device

(Refer to Illustration "L" covering this subject)

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 tube No. 1 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 to align the music roll. If both tracker triggers No. 2 and No. 3 were open at once, the pneumatics would remain neutral, as they would still be perfectly balanced. No. 4 shows the neutralizing pouch block which cuts out the tracker pneumatics on reroll. No. 5 shows an end view of this block.

ILLUSTRATION "L"



Tracking Device Adjustment

Insert a test roll or music roll measuring 11¼ inches in width in spoolbox. Loosen up screws No. 6 and No. 7 on tracker triggers and push triggers away from music roll. Hold the tracker pneumatics at center and note if shaft No. 8 is at center of cam No. 9, as shown in diagram; if not, adjust turnbuckle No. 10. Turn on electric current and set tempo at 70, then adjust tracker triggers so they almost touch roll and tighten screws No. 6 and No. 7. It would be well to try a few rolls to see that adjustment averages up well. By keeping a very loose brake on the takeup spool and a rather slow speed on reroll, the music roll edges will not be torn.

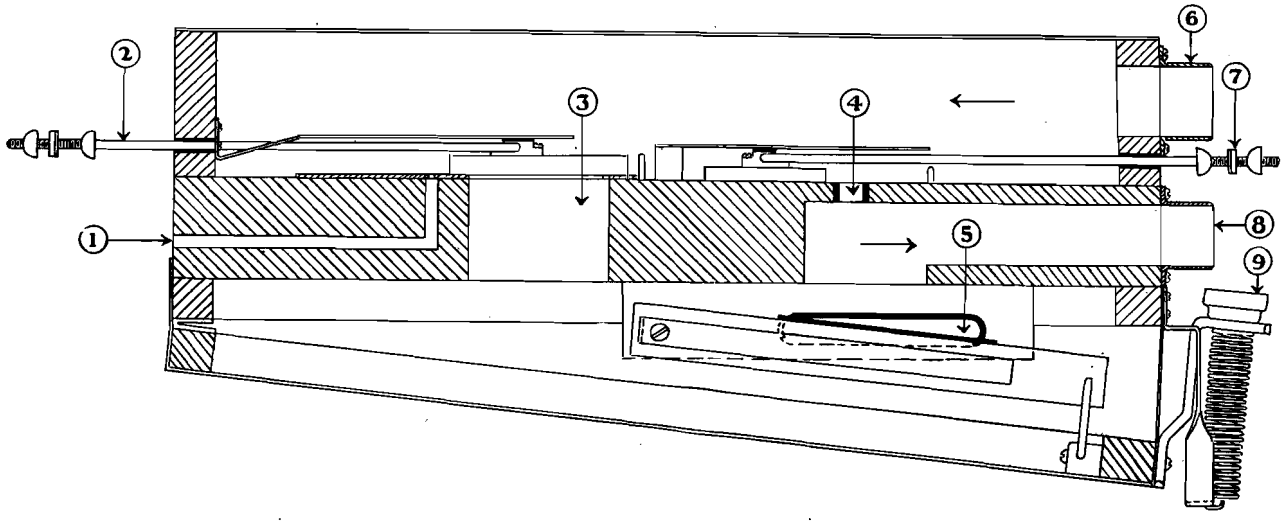
Upright Duo-Art Governor

(Refer to Illustration "M" covering this subject)

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.

ILLUSTRATION "M"



Governor Key Chart

1. Atmosphere Intake Channel.
2. Tempo Slide.
3. Tempo Channel.
4. Reroll Channel.
5. Knife Valve Port.
6. Channel to Wind Motor.
7. Reroll Valve.
8. Channel to Pump.
9. Governor Spring.

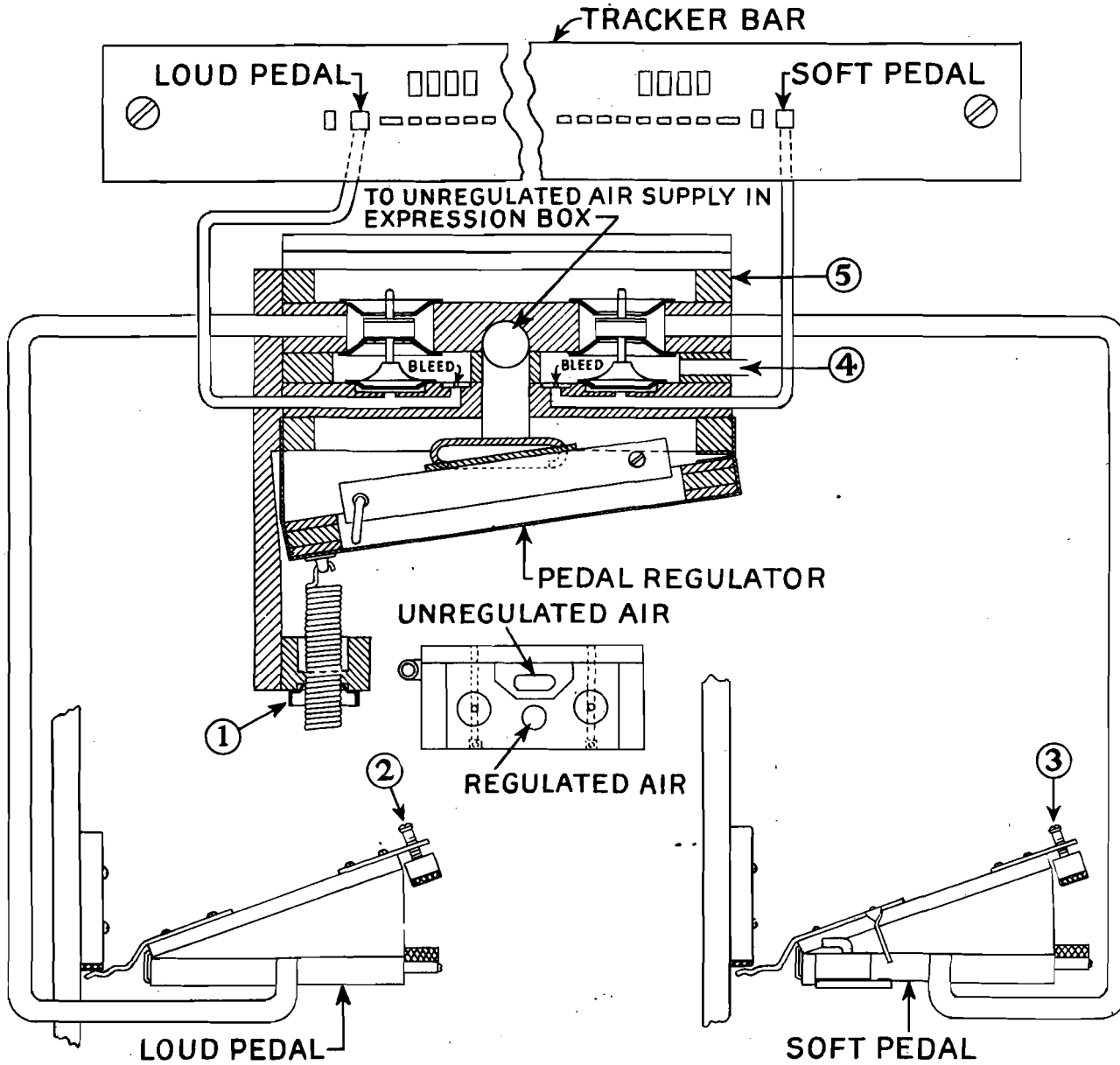
Upright Loud and Soft Pedal Control

(Refer to Illustration "N" covering this subject)

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 a pedal regulator pneumatic (No. 5), 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. No. 4 is the supply tube to the accordion pneumatics. 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.

ILLUSTRATION "N"

Upright Loud and Soft Pedal Control



Reroll, Repeat and Switch Cutout Devices

(Refer to Illustration "O" covering these subjects)

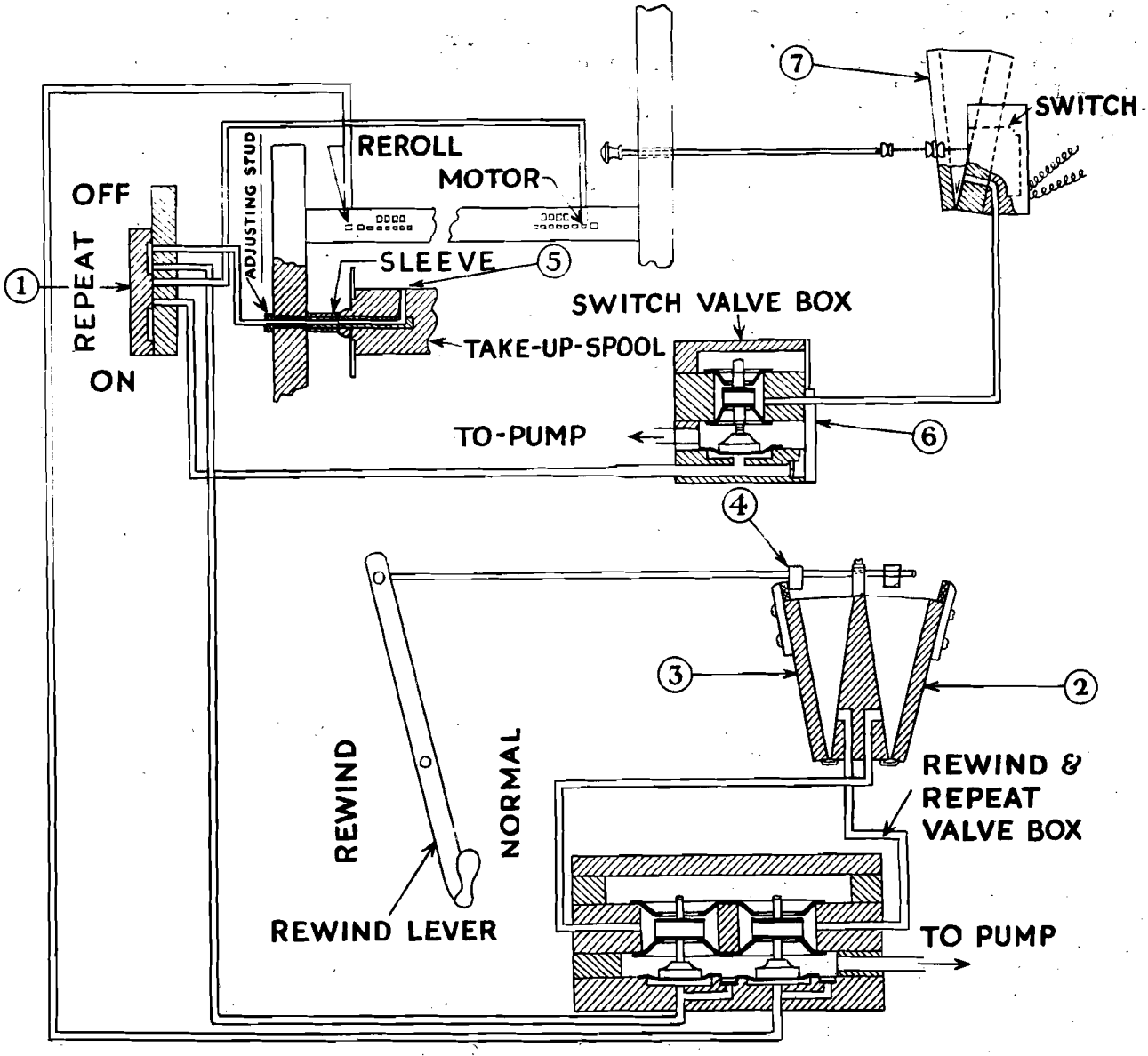


ILLUSTRATION "O"
Reroll and Repeat Device

Reroll

The reroll mechanism is controlled by the first hole in the bass end of tracker bar. It controls the reroll pneumatic No. 3 which throws the spoolbox gearing into reverse and operates the cutout valve to top action.

Adjustment: Have the metal block No. 4 on connecting rod to rewind lever in such position that it will travel very near the full movement of the reroll pneumatic. Also see that spoolbox gears mesh properly.

Repeat and Switch Cutout

The repeat mechanism is controlled by the hole in left end of takeup spool No. 5; 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 on to the valve operating "Repeat" pneumatic No. 2. This pneumatic throws the spoolbox gearing into "Play" 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 at the "Off" position, the block slides over and connects the motor hole in tracker bar with valve box No. 6, operating switch pneumatic No. 7, and electric current is cut off when hole is exposed.

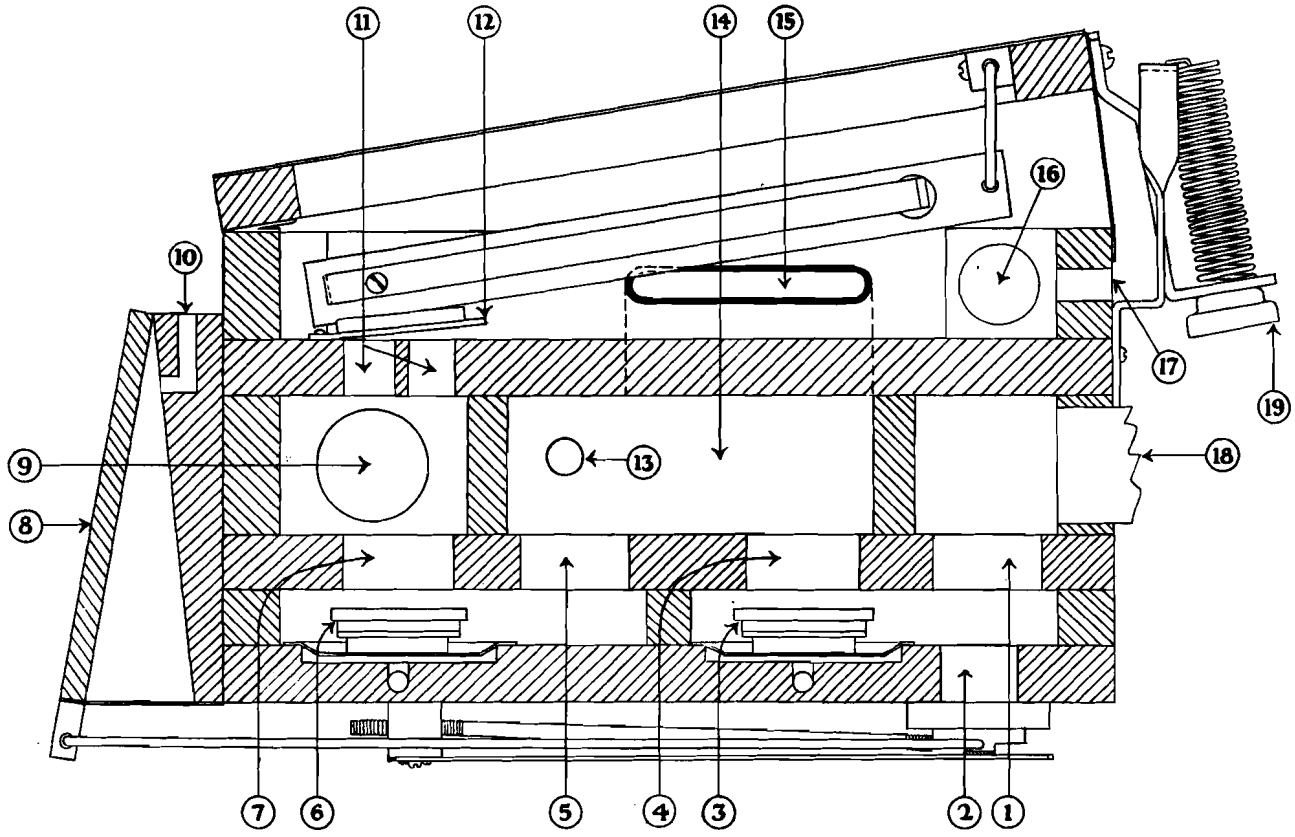
Grand Duo-Art Modulator Pneumatic

(Refer to Illustration "P" covering this subject)

The Modulator covered by illustration "P" will be found only in the Grand Duo-Arts and only on instruments of recent manufacture. 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 is equipped with a cutout valve for the pneumatic action on reroll.

The illustration has been distorted somewhat to show channel No. 5 which actually is back of channel No. 7.

ILLUSTRATION "P"



With the "Dynamic Lever" in front of Duo-Art at the "Concert" or normal position, the modulator valve No. 6 is open and allows the air entering chamber No. 9 to pass down through channel No. 7, then up through channel No. 5 into chamber No. 14, where it passes down channel No. 4 and up channel No. 1 to outlet No. 18, then it passes to the pump and is exhausted.

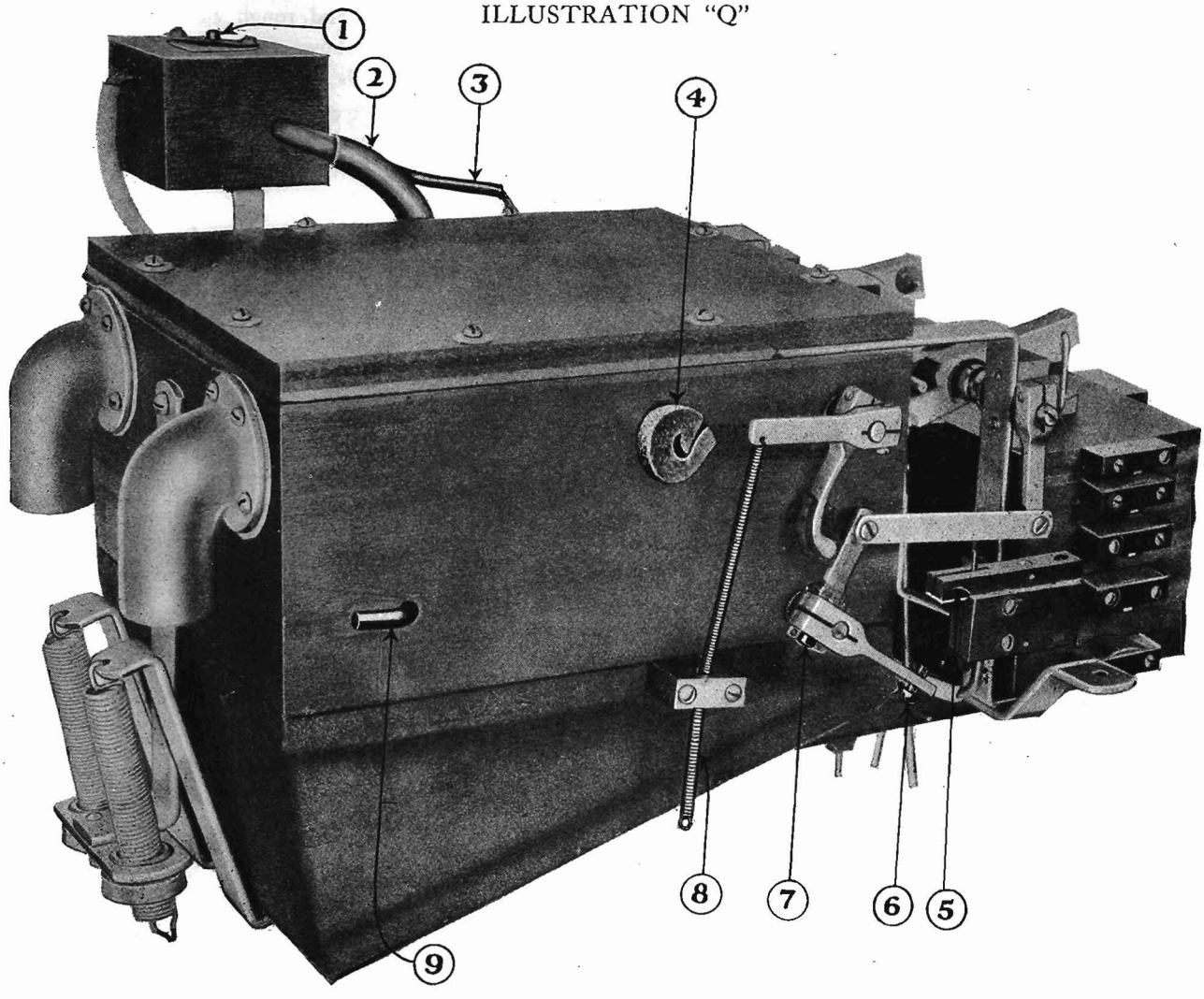
With the "Dynamic Lever" in front of Duo-Art at "Soft" or modulated position, valve No. 6 raises and closes channel No. 7. The air entering chamber No. 9 now passes up through channels covered by No. 11 and the flap valve No. 12, "which is closed when valve No. 6 is open," is now raised and the air passes to the knife valve port No. 15 where the pressure is cut down or softened. From channel No. 15 the air passes to chamber No. 14, then down No. 4, up No. 1 and out No. 18 to the pump. The spring No. 19 controls the degree of modulation which should be one-half the full volume of the Duo-Art. 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. 3 closes on "reroll" and pneumatic No. 8, which operates slide covering channel No. 2, collapses, which lets in the outside air and eliminates any excessive load on the electric motor.

The loud pedal is supplied from port No. 16 and the accordion pneumatics from No. 17. The reroll valve which controls pneumatic No. 8 by channel No. 10 gets its supply from port No. 13.

Crash Valve, Grand Expression Box

ILLUSTRATION "Q"



Crash Device, Grand Expression Box

(Refer to Illustration "Q" covering this subject)

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 "Q" 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. There is one on the bass side of the box also. The adjustment of the grand expression box is exactly the same as the upright and is fully covered in "The Duo-Art Test."

Bottom View of Duo-Art Grand

(Refer to Illustration "R" covering this subject)

Illustration "R" shows the position of the various control units in the Duo-Art Grand. This illustration will be of considerable assistance to new men working upon the Duo-Art in locating and identifying parts. The illustration shows the Grand turned upside down. Points covered by No. 1 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.

ILLUSTRATION "R"

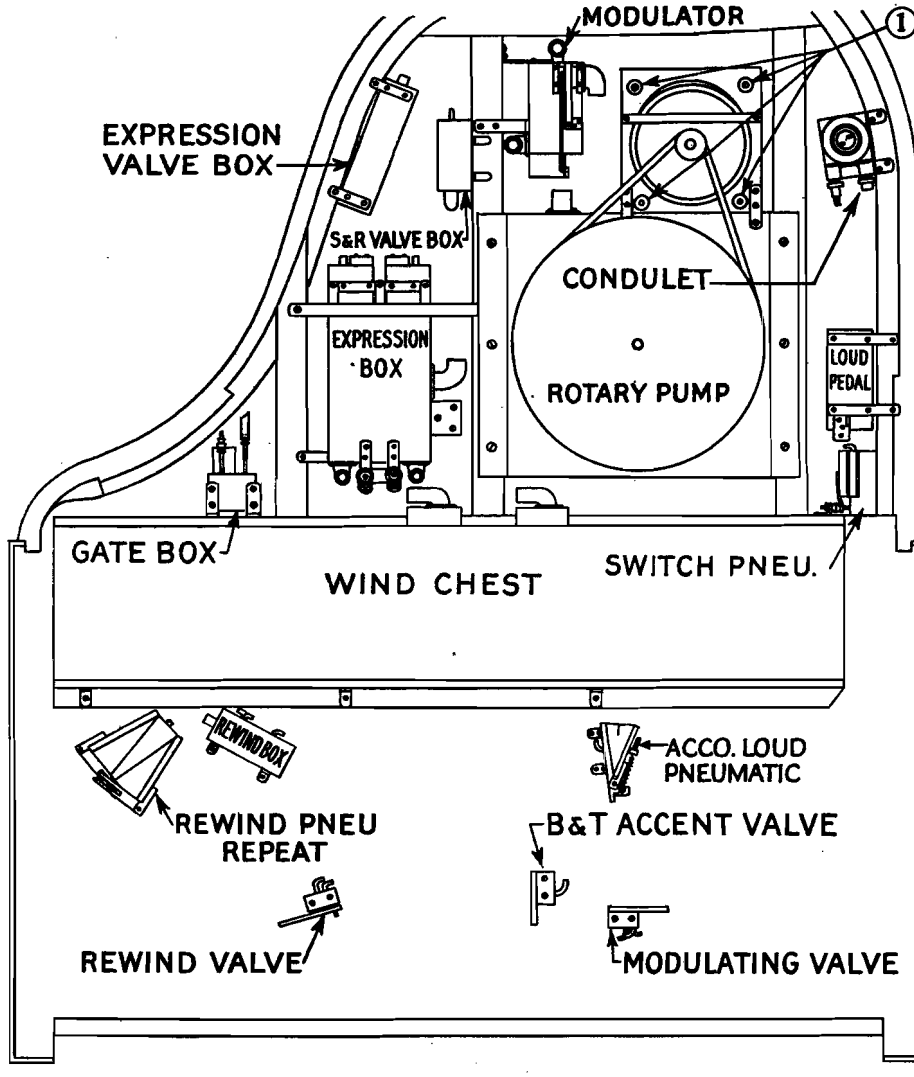


ILLUSTRATION "B"