The

DUO-ART

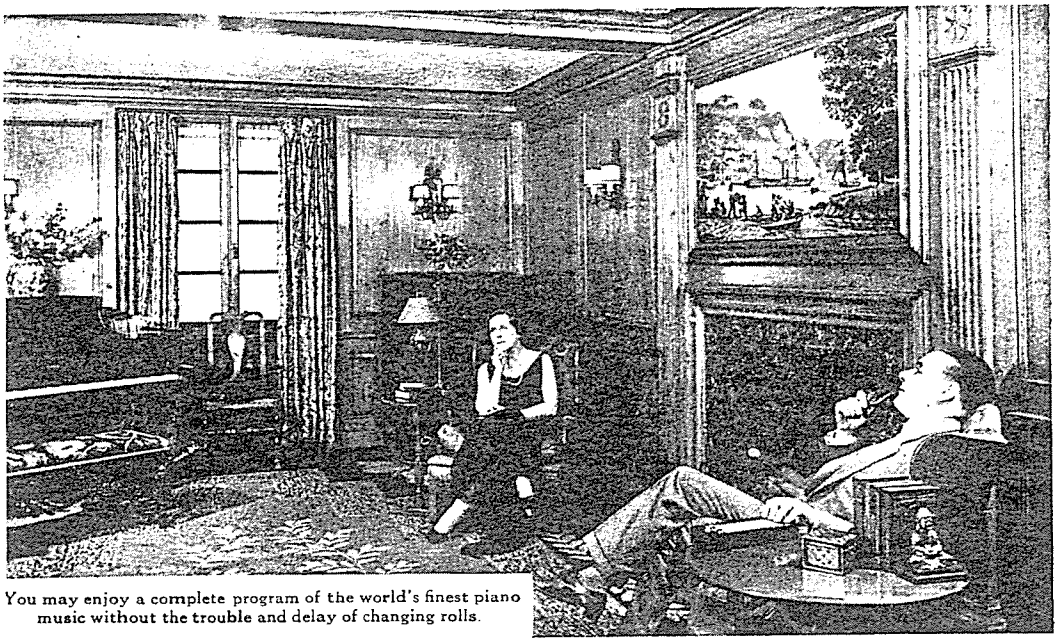
Reproducing Piano

Duo-Art Service Department

The AEOLIAN COMPANY

Aeolian Hall

NEW YORK



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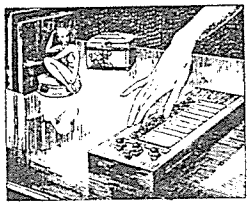


CONTROL TABLET

THE new Concertola gives fingertip control of the Duo-Art Piano from any part of the house without going near the instrument—without the trouble and delay of changing rolls. The musical program is controlled entirely from the tablet. Merely press the button beside the title of the selection desired, and magically the piano plays it, or the whole program may be played, with a repetition of all or any part of it. An attractive cabinet holds the recordings and may be played any distance from the piano.

AEOLIAN COMPANY

AEOLIAN HALL—689 FIFTH AVE. at 54th St.

NEW YORK

June 1930 advertisement from "The Tuners' Journal" for the Duo-Art Concertola. The Concertola was available in two models—a separate cabinet holding one long play Duo-Art Program Roll or a multiple changer holding 12 separate rolls.

INTRODUCTION

The object of this pamphlet is to give a clear and concise working knowledge of the Duo-Art Pianola Piano. It is obvious that in these few pages the aforementioned subjects will have to be treated briefly, and that a great deal necessarily will have to be taken for granted that the mechanic already knows, such as a general knowledge of pneumatics, and something of electricity. There is nothing really complicated or intricate about the Duo-Art and once its principles are understood it will be realized what a truly remarkable yet simple instrument it is. These instructions are based upon the upright Duo-Art but would apply generally to the Grand as it differs only in design.

OPERATION OF DUO-ART DYNAMIC CONTROL

The above subject will be treated under four sub-headings, namely:

1. Dynamic Step Control
2. Accompaniment Control
3. Theme Control
4. Manual Control

DYNAMIC STEP CONTROL

The Duo-Art dynamic control has 15 steps or degrees of loudness, and with the fundamental or zero degree, sixteen.

By zero degree is meant the normal Duo-Art. The zero degree is not called a step. To put it simply, it is the foundation or basis upon which all the higher degrees are built. As will be explained later in the Duo-Art test, this zero degree should be as low or soft, as possible.

The 15 steps are controlled by four holes in the tracker bar at both the treble and bass ends of bar, above the regular piano notes. (which are inoperative with the Duo-Art lever "ON") The four holes at bass end of bar control the accompaniment side of the expression box and the four in the treble end control the theme side of the box, in conjunction with additional holes in the bar (B Theme & T Theme - see diagram No. 1).

These holes in both bass and treble are numbered from the outside in (see diagram no. 1) Nos. 1, 2, 4, 8. It will be noticed that each number is double its predecessor and that is exactly what they are in dynamic power. From the tracker bar, these dynamic control tubes lead through two cut-off pouch blocks, (see diagram no. 2, no. 4) and from there to dynamic valve box, (no. 28) which controls the accordian dynamics (nos. 26, 27). Each of these accordian dynamics has four small pneumatics, each set to collapse a certain distance by small adjusting screws.

Number one in both accompaniment and theme controls the top or smallest pneumatic of the four and collapses 1/16".

Number two on each side controls the next pneumatic and collapses 1/8".

Number four on each side controls the next pneumatic and collapses 1/4".

Number eight on each side controls the bottom, or largest, pneumatic and collapses 1/2".

This makes a total, with all collapsed, of 15/16". These pneumatics can work separately or in combinations, or all together. There are 15 combinations possible with these dynamics.

COMBINATIONS

Step 1.	Valves open	No. 1
Step 2.	Valves open	No. 2
Step 3.	Valves open	No. 2 — 1
Step 4.	Valves open	No. 4
Step 5.	Valves open	No. 4 — 1
Step 6.	Valves open	No. 4 — 2
Step 7.	Valves open	No. 4 — 2 — 1
Step 8.	Valves open	No. 8
Step 9.	Valves open	No. 8 — 1
Step 10.	Valves open	No. 8 — 2
Step 11.	Valves open	No. 8 — 2 — 1
Step 12.	Valves open	No. 8 — 4
Step 13.	Valves open	No. 8 — 4 — 1
Step 14.	Valves open	No. 8 — 4 — 2
Step 15.	Valves open	No. 8 — 4 — 2 — 1

Number 1 collapses 1/16 inch
Number 2 collapses 1/8 inch
Number 4 collapses 1/4 inch
Number 8 collapses 1/2 inch
Total collapse, 15/16 inch.

It will be observed that the accordian dynamics are connected by a rod at the top of the dynamics to an arm, which when pulled down opens a knife valve (see nos. 16, 17). These knife valves operate over port holes leading to the pump, and the degree to which these holes are opened determines the loudness of the playing. The Duo-Art normally is under low pump tension, drawing in the atmosphere through a spill valve (see no. 18) and exhausting through the pump. This spill valve is completely cut off by either the accompaniment or theme dynamics at the 10th step. Note connection of spill valve to both the accompaniment and theme sides of expression box, and as either knife valve is pulled down, or opened, by dynamics, they push against rocker arms mounted on a shaft at the back of the expression box and the knife valve closes off the intake, or what is termed "spill".

ACCOMPANIMENT CONTROL

A very important feature of the Duo-Art dynamic control is that either the accompaniment or theme side of the expression box can control the entire keyboard, or one can control the bass while the other controls the treble, or vice versa. This gives great flexibility of control and the advantages of such a system are innumerable. This is a feature found only in the Duo-Art. The regular player action is divided between the 43rd & 44th notes.

The air is exhausted from player action into chambers Nos. 6 & 8 of expression box, through flap valves Nos. 9 & 10 into chamber 7, and down through channel 14 into accompaniment regulator. Here is passes through knife valve 16 and along channel to pump where it is exhausted.

The theme secondary valves (11 & 12) are normally closed.

As has been explained, the degree to which knife valve in the accompaniment regulator is opened determines the loudness of the playing.

THEME CONTROL

The theme dynamics (No. 27) control the degree with which accented notes are struck, but it is the valves (11 & 12) which are controlled by holes in tracker (marked B theme & T theme) operating theme primary valves (5) that determine when theme shall operate.

The air is exhausted from player action into chambers (6 & 8) of expression box. Now theme control holes in tracker bar are opened admitting atmosphere to pouches under primary valves (5) raising them, and putting secondary valves (11 & 12) under suction, causing them to drop and making a passage for air to channel 13 where it follows to passage 15 into theme regulator. Here it passes through knife valve (17) and into channel leading to the pump, where it is exhausted.

—Showing how accompaniment side can control the treble while theme side controls the bass, or vice versa.—

ACCOMPANIMENT CONTROL OF TREBLE

The air comes into chamber (8) from player action, and theme valve (12) being closed, passes through flap valve (10) into chamber (7) through channel (14) into accompaniment regulator, through knife valve (16) and to the pump.

THEME CONTROL OF BASS

Air comes into the chamber (6) from player action and theme valve (11) being open due to bass theme hole in tracker being opened, the air passes into channel 13 and then through passage 15 into theme regulator, on through knife valve 17, and to the pump. It should be understood that the air once in chamber 7 cannot return to chambers 6 & 8. A study of the flap valves 9 & 10 will be self-explanatory.

MANUAL CONTROL

Other remarkagle features of the Duo-Art Pianola Piano are the devices for its manual control. This system is equalled by few, if any, and surpassed by none. This system is controlled by five levers, four of which are in front of the keys and one in the spool box.

The first lever on key front to the left is called the theme modulating lever. This lever controls the degree at which theme notes are played, but unless worked in conjunction with the two little levers on the key front next to the right, one above the other, there is no noticeable result. As will be noticed in the diagram, the theme modulating lever is connected to the theme knife valve regulator, and as the lever is pushed to the right, it pulls down and opens knife valve (17) but as long as valves 11 & 12 are closed, it has no effect.

These two levers to the right, one above the other, control theme primary valves (5). The topmost one controls the bass, and the bottom one, the treble. The modulating lever controls the degree, and these bass and treble levers, the time, when the theme shall operate.

The next lever is called the Temponamic Lever. This controls the tempo by its side motion, and accompaniment expression by its rotating motion.

By turning this disc to the right, it pulls down on arm, regulating the knife valve, and opens a port leading to the pump. The more this port is opened, the louder the playing.

The fifth control is the Duo-Art lever in the spool box. This lever should be in the "Duo-Art ON" position for all Duo-Art rolls to be played automatically. To play Duo-Art rolls with personal expression, have this lever in the central position. For all other 88-note rolls, have this lever at "OFF".

When the Duo-Art lever is thrown to the center, or neutral position (or to the OFF position) the little pneumatic (25) collapses to the point adjusted to by the screw in the moveable board of the pneumatic and pulls down on the arm controlling the accompaniment knife valve, thus making the zero degree louder when the Duo-Art lever is at "OFF". It has no other function.

HOW TO TEST AND ADJUST THE DUO-ART

This test will be in a series of steps (12 in number) and will cover all points necessary for a thorough inspection and adjustment of the instrument.

STEPS IN TEST

Step 1.	Tracker box gearing and connections.
Step 2.	Electric motor, pump, and connections.
Step 3.	Tracking device.
Step 4.	Tempo.
Step 5.	Sustaining pedal.
Step 6.	Soft pedal. (Hammer-rail lift)
Step 7.	Dynamics.
Step 8.	Accompaniment zero setting.
Step 9.	Theme zero setting.
Step 10.	Notes.
Step 11.	Dynamic Chord test.
Step 12.	Re-roll.

IMPORTANT

Before beginning the Duo-Art test, it is advisable to see that the piano action is properly adjusted, and a few words here on that subject would not be out of place.

As is well known, all piano actions are more or less affected by extreme dampness or by dry weather, which tends to alter their regulation, thereby making it difficult for the player to function properly.

Push the hammer rail toward the strings and let it back quickly. If the hammers are slow in returning, the action is damp and swollen, and must be remedied before going further.

See that there is no lost motion in jacks. See that the hammer escapement (let-off) is properly adjusted; it should average 1/8" or less from the strings. Now see that the hammers check about 5/8" from the strings.

These are the most essential adjustments in relation to the player action and under no circumstances should they be overlooked. The more the mechanic knows of piano action regulation the finer results he can get from the player action. Now see that there is no lost motion between the player action pitmans and the wippens on the piano action. See that the stroke on the player is the same as the hammer check on the piano action. This is a common adjustment to all player actions and need not be explained here. Make sure player action is screwed fast; all tubes are secure, rods connected, and working freely.

SPOOL BOX GEARING AND CONNECTIONS

Step 1.

See that the gearing is properly oiled, and all set screws tightened.;

Set the re-roll and play brakes.;

See that the sprocket chains are not too loose nor tight.

Have all parts on wind motor free but not noisy. Use no oil on the wind motor.

Pump out tracker bar and insert test roll in spool box.

ELECTRIC MOTOR, PUMP AND CONNECTIONS

Step 2.

Connect electric cord to conduit in back of piano and make sure the current is on.

Be sure the motor is proper for local current.

Have motor hand level and with enough tension on belts so that they will not slip.

See that motor is properly lubricated and set screw in the pulley is tight.

See that the armature on the motor rotates freely.

Now turn on switch - if motor does not start instantly, turn off switch or motor will burn out.

Notes on Duo-Art Motors

There are two types of motors used; 1/4 horsepower motor being used with the six feeder type pump, and 1/8 horsepower with the four feeder pump. Both motors run at 1150 rpm in both AD and DC models.

All AC motors are 60 cycle.

To change rotation of DC motors, reverse leads at brush box.

To change rotation of AC motors interchange two leads coming through bushing cover.

(Step 2 continued)

After motor has been inspected, have idler on pump belts set reasonably tight and on slack side of belts. Now see that grease cups on pump are filled and turn plungers down a bit to force grease into bearings. Have pump quiet and time pulsations. A pulsation is the opening and closing once, of one feeder. Six feeder type pump should pulse 70 - 72 times per minute, and the four feeder type 120 times per minute.

To change speed either way it would be necessary to change the size of pulley on motor. Duo-Art motors are furnished with proper size pulley to give required pulsations, and before any change of pulley is made, it would be advisable to make certain that the voltage of current supplied is correct.

TRACKING DEVICE

Step 3.

Make sure your test roll measures eleven and one quarter inches in width. If not, use a roll that does. Have music spool shaft in center of shifting cam and shifting pneumatics centered. These are adjusted on shifting rod at back and left of spool box, by a small turnbuckle. Now with roll running, adjust tracker lugs so that they just barely touch the edge of the roll.

TEMPO
DUO-ART LEVER "OFF"

Step 4.

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

SUSTAINING PEDAL

Step 5.

The sustaining pedal is controlled by second hole in bass end of tracker bar. Flat dampers should clear strings about 1/8" with pedal on. Dampers should come back to strings between each bridge in the test roll with tempo set at 70.

It will be noticed that the sustaining pedal, soft pedal and dynamics get their supply from a pneumatic tension regulator. This regulator keeps their supply under even tension. This is done by a spring attached to it. Adjust spring so that pedals and dynamics work quickly but not noisily. To operate faster, strengthen spring; slower, weaken spring.

SOFT PEDAL

Step 6.

The soft pedal is controlled by the last hole in the treble end of the tracker. On uprights, rail should move to 1/8" from the strings. On grands, rail should lift 5/8 from normal position.

DYNAMICS

Step 7.

ACCOMPANIMENT (Duo-Art lever "ON")

The accompaniment dynamics are operated from the bass end of tracker bar, above ordinary piano notes, and are numbered 1,2,4,8. These dynamics should operate in order given.

THEME

These dynamics are operated by four holes in the treble end of tracker bar above piano notes and are the same as accompaniment dynamics, 1,2,4,8, and should operate in order given.

ACCOMPANIMENT SETTING OF ZERO DYNAMIC

Step 8.

Tempo at 80

Warning:

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

First throw off electric switch and see that regulator springs (21 & 22) have a little tension, just enough to keep them from rattling. Use adjusting rings (23 & 24). Now see that all tension springs on the expression box have a little tension on them. See that the rocker arms controlling spill valve when pushed back move forward again quickly. Also have arms regulating knife valves come back quickly.

Have all rods and shafts on expression box free from binding and squeaking. A very important thing to watch is that there is no pressure against knife valve regulating arms, otherwise the knife valves would open a little and this would make it impossible to properly adjust zero dynamics. Also, there should be no slack in arms resting on knife valve regulators as this is just as bad as the previous condition mentioned. The little leather adjusting nuts on top of accordion dynamics (26 & 27) on rod to knife valves should not be tampered with as they are set properly at the factory and seldom if ever need resetting. If the accordion pneumatics have a little slack or sag, from leather stretching, it is permissible to take this up on these leather nuts, being careful not to put too much tension on the rod as this will open knife valve and this adjustment **must** be made **before** setting accompaniment or theme regulators as it will throw out their setting if done after they are adjusted. It is, however, rare that these nuts will need any adjustment.

Throw on electric switch and observe softness of notes on accompaniment tests. It will be noticed that sustaining pedal is on with the first run of notes, making them easier to play and off with the next run. Notes should play very softly and on the next run should miss most of them, or strike an occasional note. The third run of accompaniment test is similar to the first.. If on the second run of notes in accompaniment setting of zero dynamic all notes strike full, playing is too loud and must be softened. To soften, adjustment is made on knife valve adjusting screw (19) and next to this adjusting screw is a small set screw (19-a). **This must be loosened before trying to turn adjusting screw or thread will be stripped. Immediately after adjusting screw is set, tighten lock screw as there is a little play in knife valve shaft unless this is tightened and it would be impossible with lock screws loose to make fine adjustment.**

On uprights, to soften, turn adjusting screws to left, and to the right to make louder.

On grands it is just the reverse, as the expression boxes are installed just the opposite way. It takes only a slight turn of the adjusting screw to make a great difference.

In making this adjustment always get a blank setting on the test roll, have motor running and tempo cut off. Watch accompaniment regulator pneumatic while setting screw; softening causes it to open and the reverse causes it to collapse. Adjustment can be gauged accordingly. Patience is required in making this adjustment, but with a little practice it comes readily. As will be observed, knife valve has to be adjusted to take first run of notes softly, but skip or miss most of notes on second run.

TO SET SOLO OR THEME DYNAMIC

Step 9.

The theme adjustment is made on adjusting screw similar to accompaniment side (see No. 20) It also has a set screw (20-a) **which must be loosened** while adjusting screw is being set, and tightened **immediately**

The setting of theme side is dependent upon the setting of the accompaniment as no matter where the latter is set, 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 regulator pneumatic collapse 1/8" more than the accompaniment pneumatic. **Never have theme pneumatic even with, nor opened more, than accompaniment.**

NOTES

Step 10.

Notes should all strike evenly and softly on this test. We will not go into a discussion here of the ordinary note troubles as the mechanic is unquestionably able to handle any trouble arising with them.

DYNAMICS CHORD TEST

Step 11.

These chord tests show if dynamics build up evenly. If accompaniment setting of zero dynamic was properly adjusted, the first three chord tests will be found very near right. A slight adjustment on the regulator springs (21 & 22) is permissible, but any radical adjustment will throw accompaniment setting of zero dynamic out, and care **must** be taken to avoid this. It may be necessary to meet chord tests to reset accompaniment and theme zero dynamics a little. The last eight chord tests show evenness of dynamics in building up, and if pump has been properly tested and all adjustments made correctly up to this point, instrument should meet these test.

Following on the test roll are two selections of music especially selected to try out the responsiveness of the dynamic mechanism.

RE-ROLL

Step 12.

The re-roll is operated by the first hole in the bass end of the tracker bar, and throws the gearing into reverse and cuts off air to action slide valve (29).

If slide valve (29) did not completely cover the port on re-roll, the piano would play in the re-roll mode. This seldom happens, but it is possible. The mechanic should always remember in locating trouble that there is only one sure method to follow without tearing everything to pieces, and that is to locate the trouble by a process of elimination.

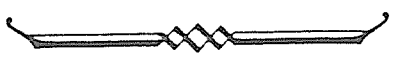
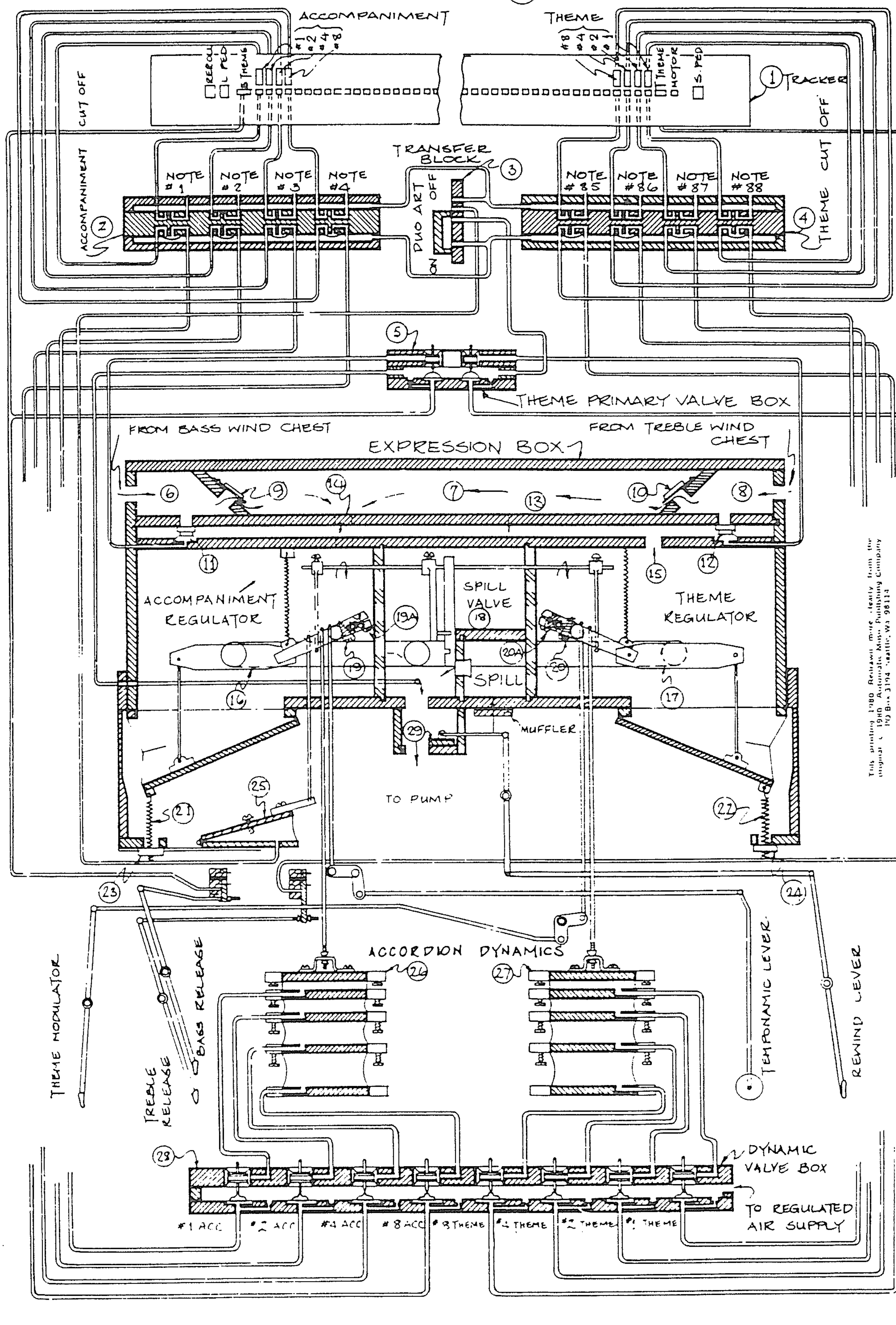
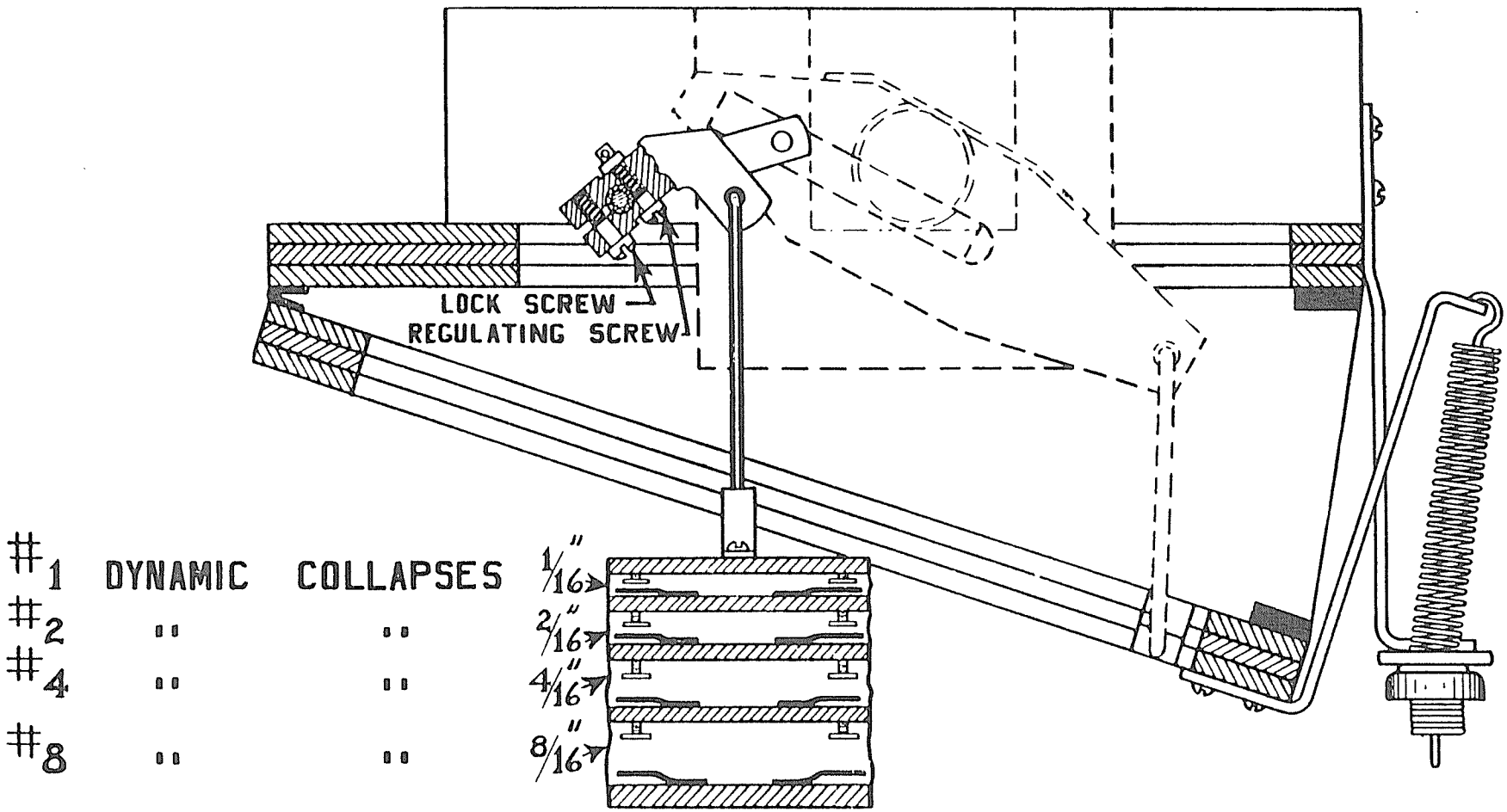


DIAGRAM OF DUO ART EXPRESSION CONTROL

DIAGRAM (A)





INSTRUCTIONS FOR ACCOMPANIMENT ZERO SETTING

First see that dynamic lever, on extreme left of keyboard, is on normal. All dynamics should be open. 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 completed tighten lock screw by turning to the right locking zero setting.

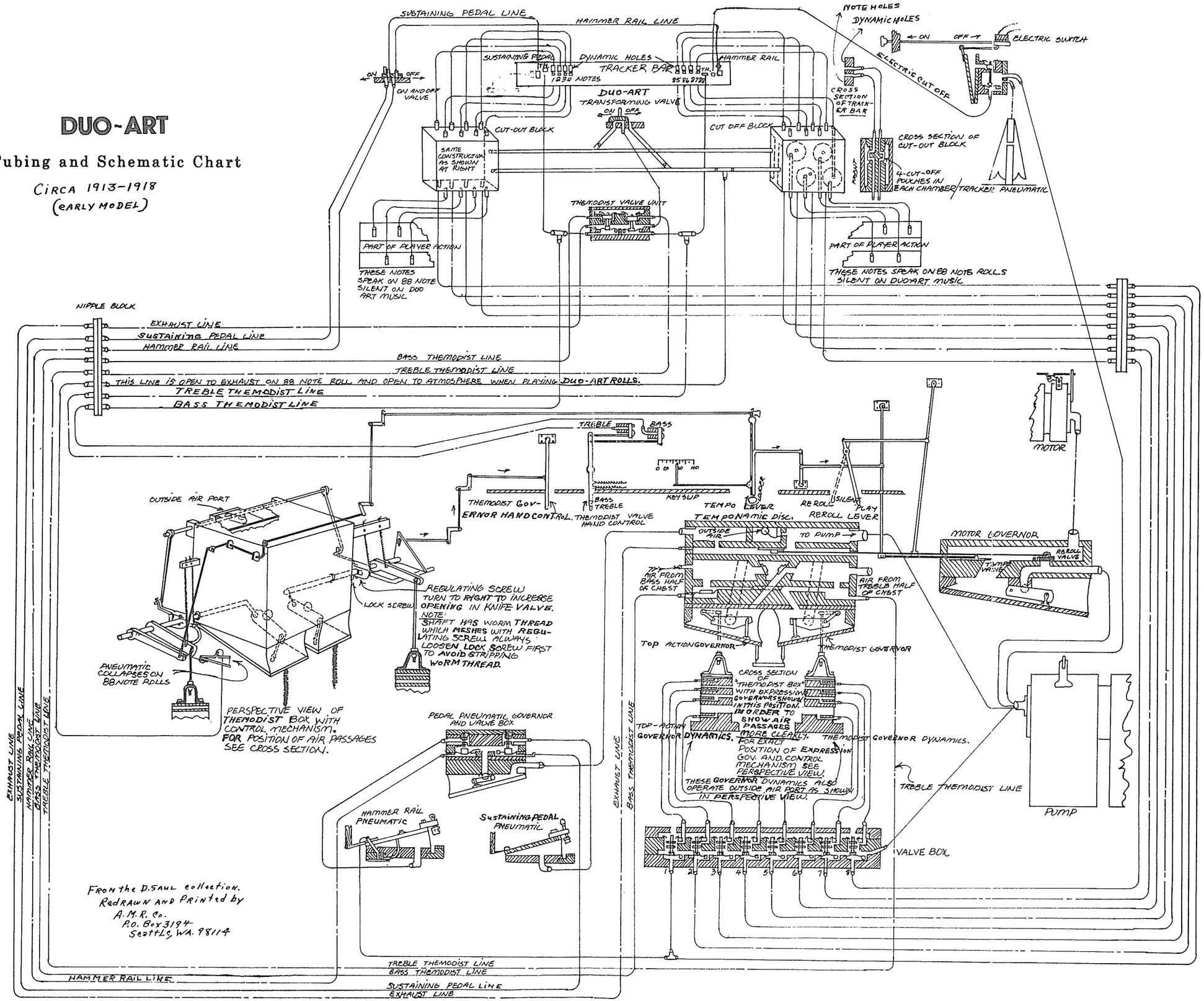
Manual No. 3.

ACCOMPANIMENT AND THEME ZERO SETTING ADJUSTMENT

DUO-ART

Tubing and Schematic Chart

CIRCA 1913-1918
(EARLY MODEL)



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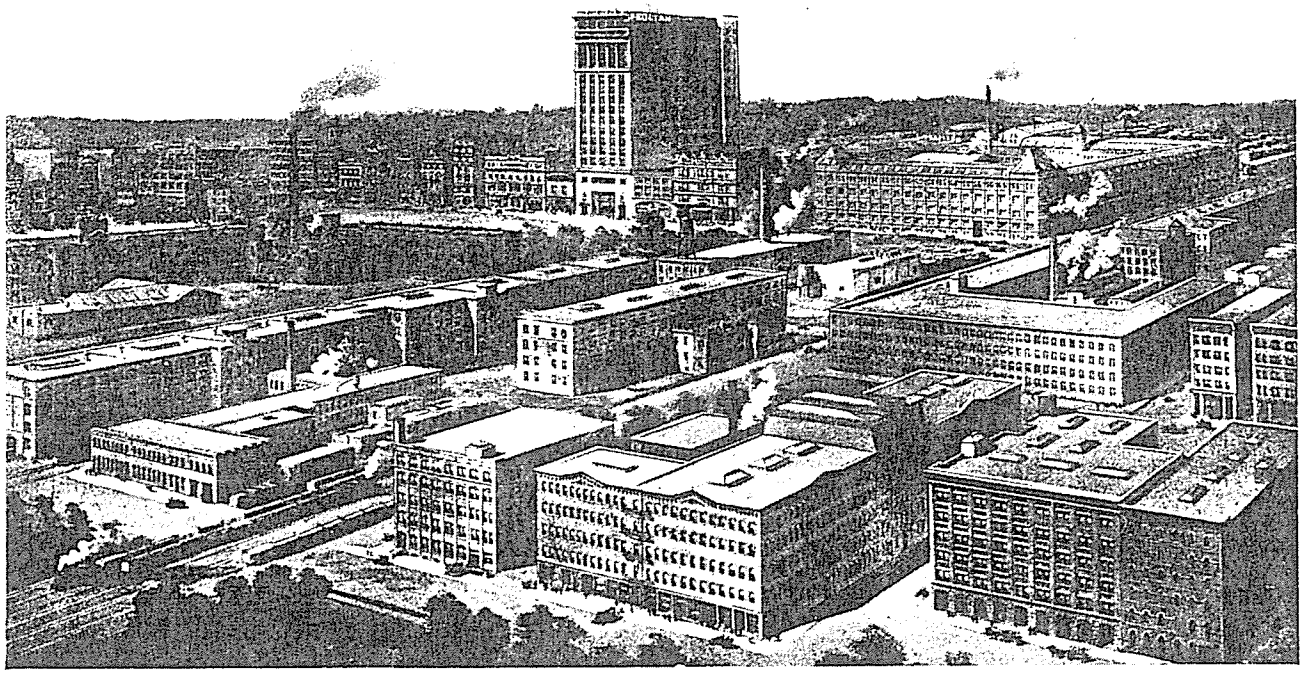


AEOLIAN CITY

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.

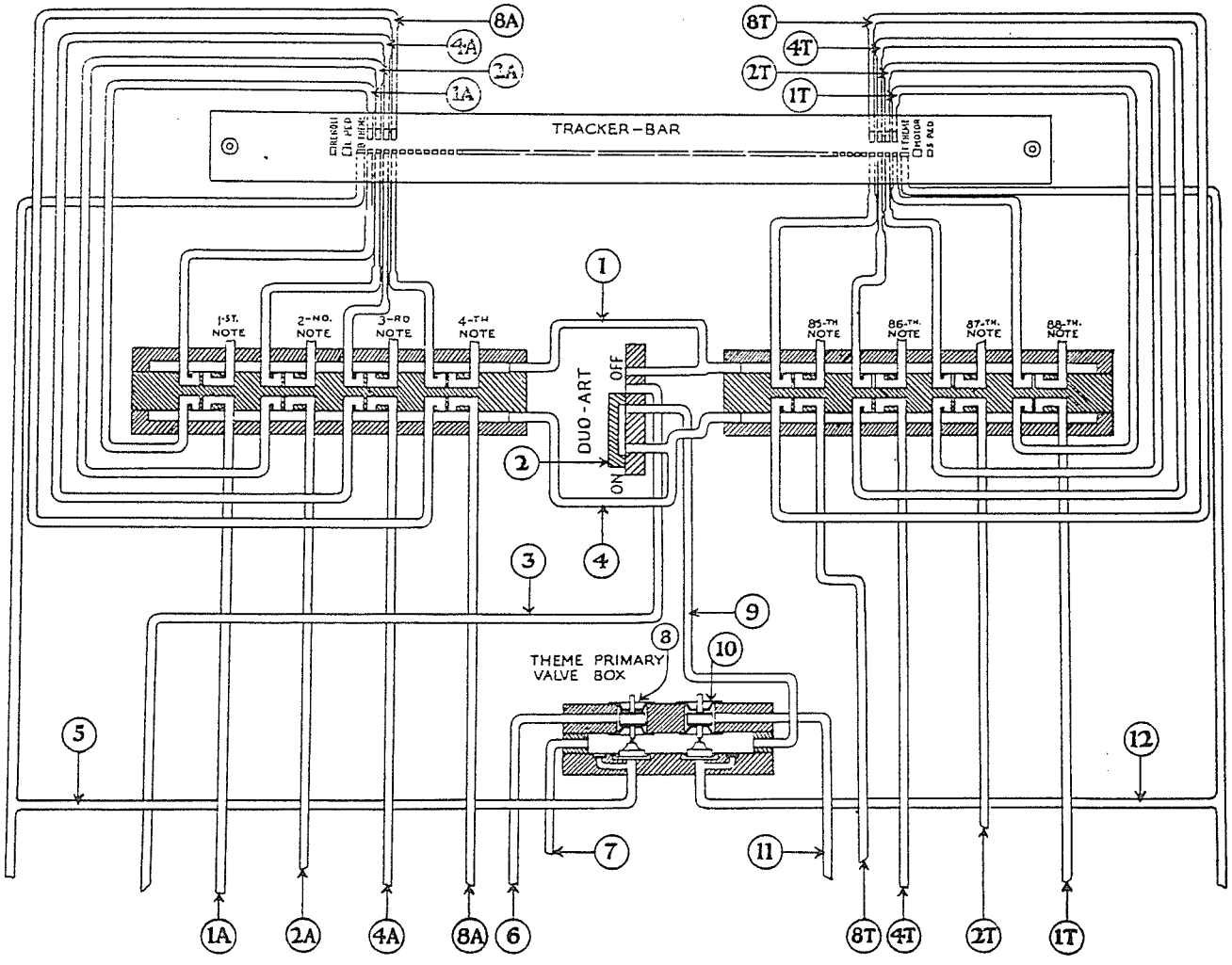
The zero degrees might be termed the foundation of the dynamic structure, as all of the higher or louder gradations in the Accompaniment and Theme mechanisms are built upon them. Each gradation in the Theme registers slightly louder than the corresponding gradation in the Accompaniment mechanism.

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.

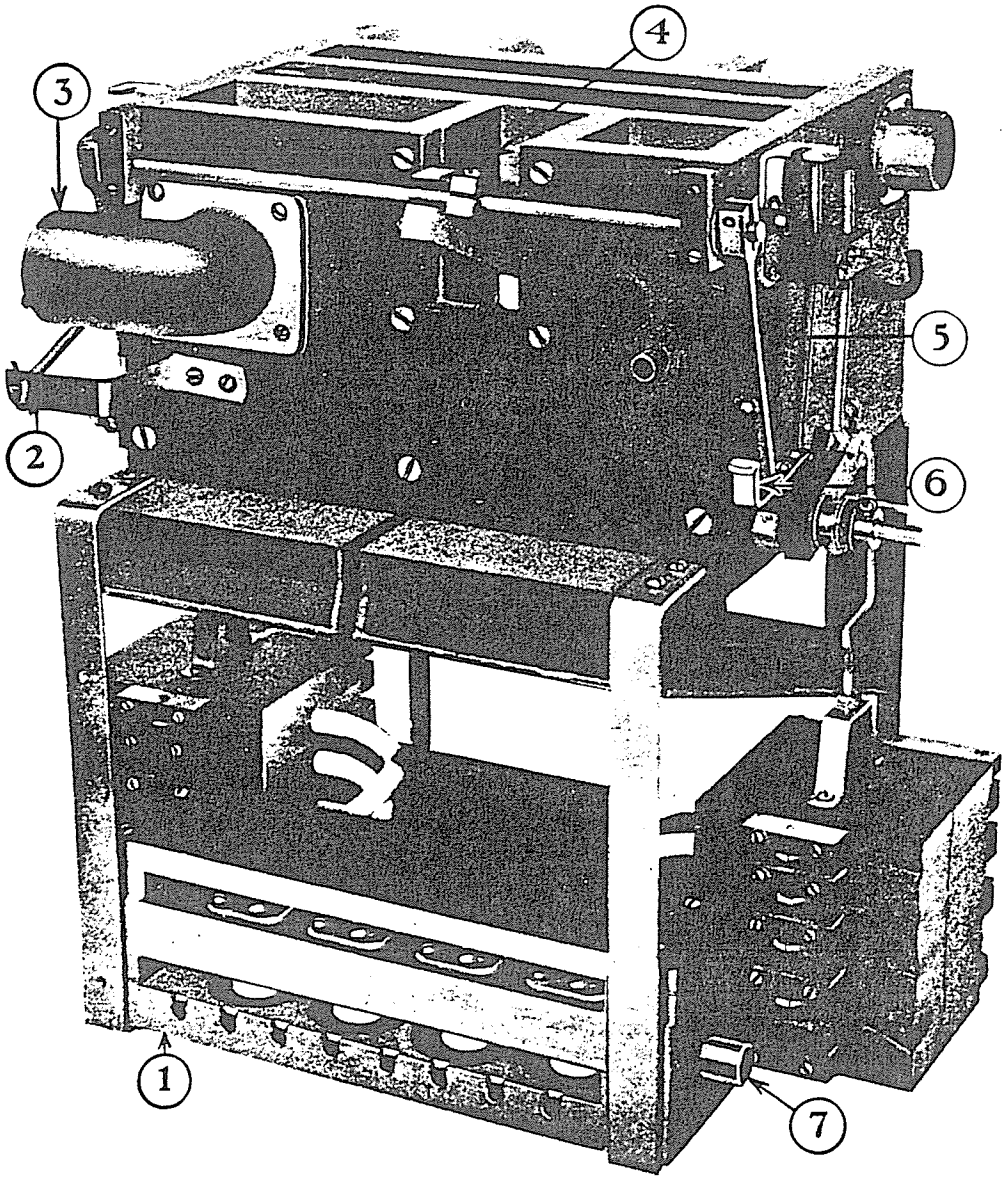
In Illustration (C), it will be seen the valve No. 4 is attached to a rod extending across the back of the expression box, and to this rod an arm, No. 5. As the accordion pneumatics collapse, they push the bracket No. 6 forward, and No. 6 in turn pushes arm No. 5 forward and the valve No. 4 closes off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

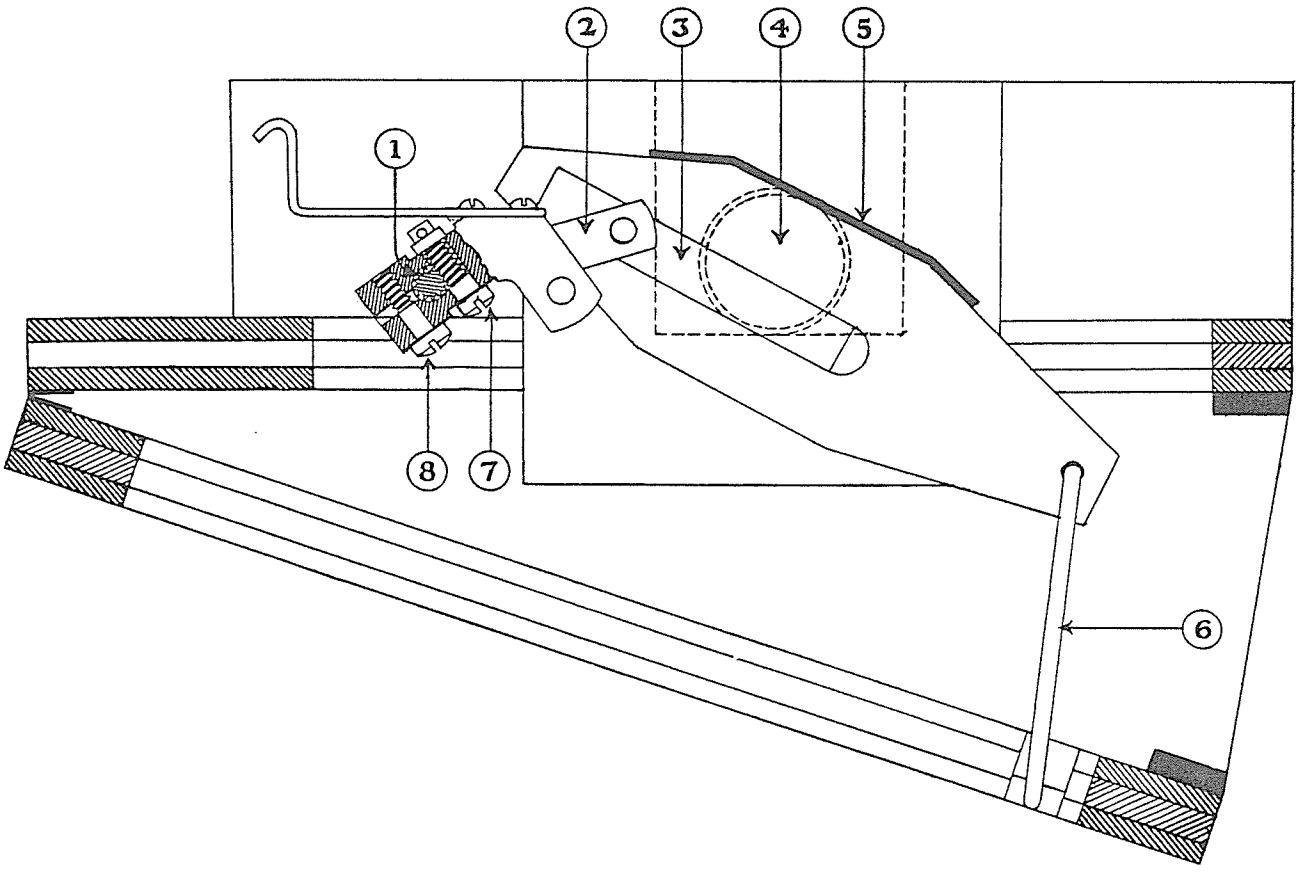
The Accompaniment dynamics are operated from the bass end of the tracker bar above the regular piano notes and are numbered No. 1, No. 2, No. 4, and No. 8. These dynamics should work in order given.

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 1/8 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 3/8 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.

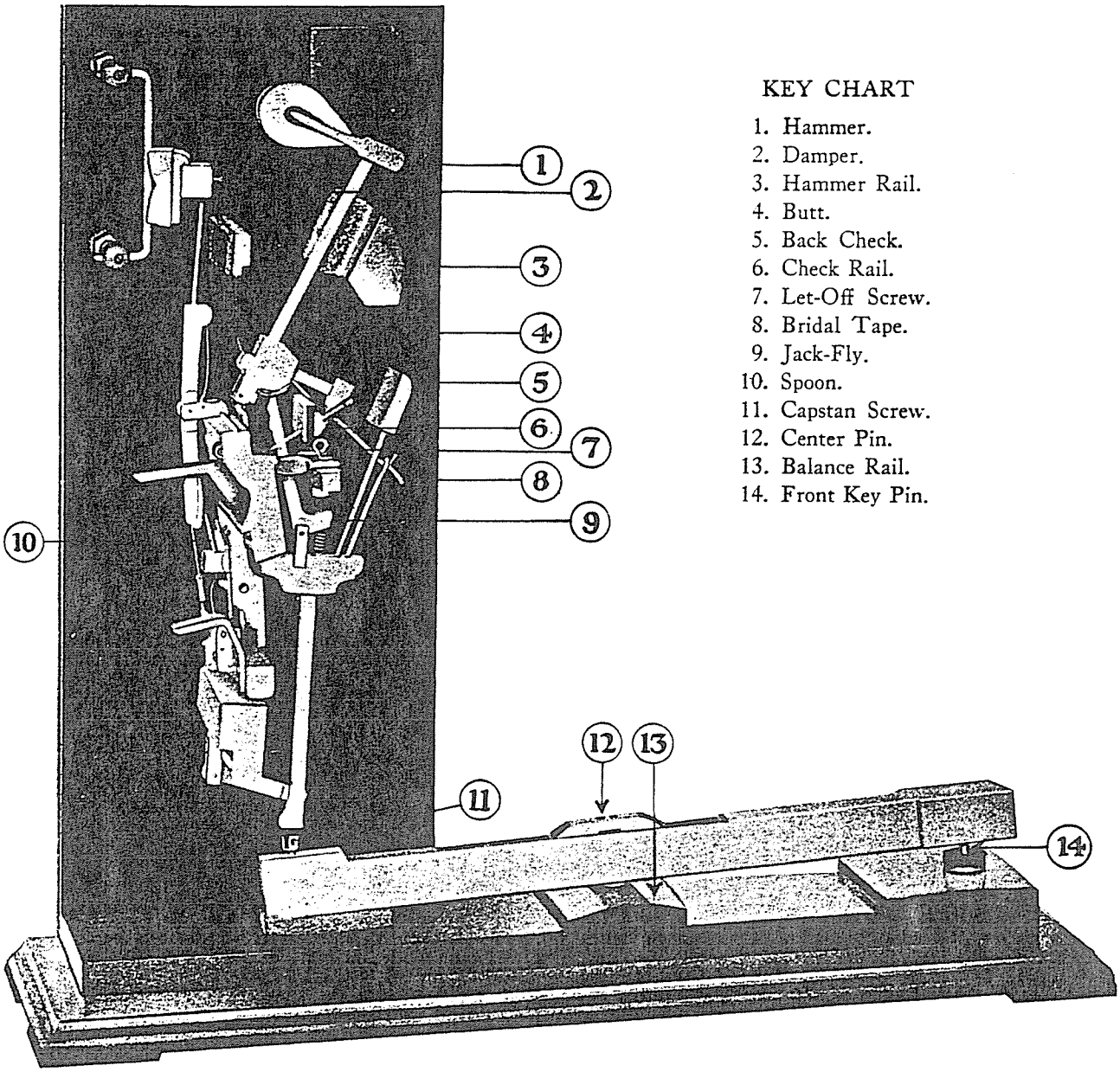
No. 7. Space and even up dampers No. 2 so that all lift evenly from strings.

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 5/8 inch from strings and lay touch as near as possible to 3/8 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.

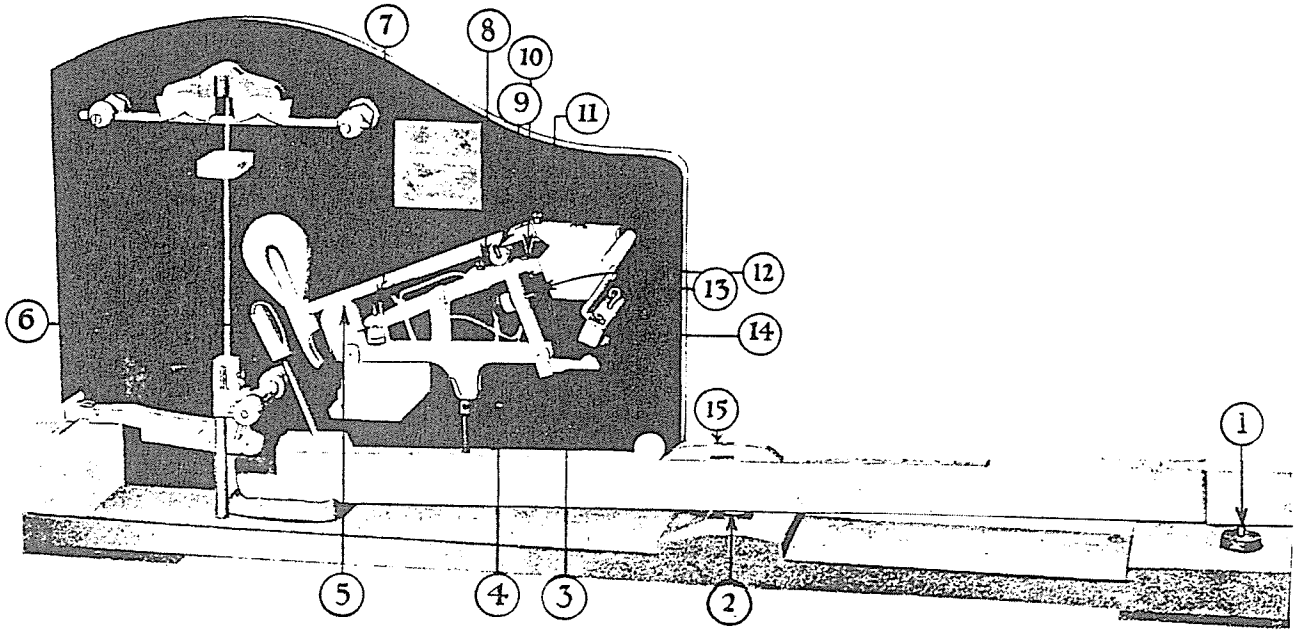


ILLUSTRATION "F"

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.

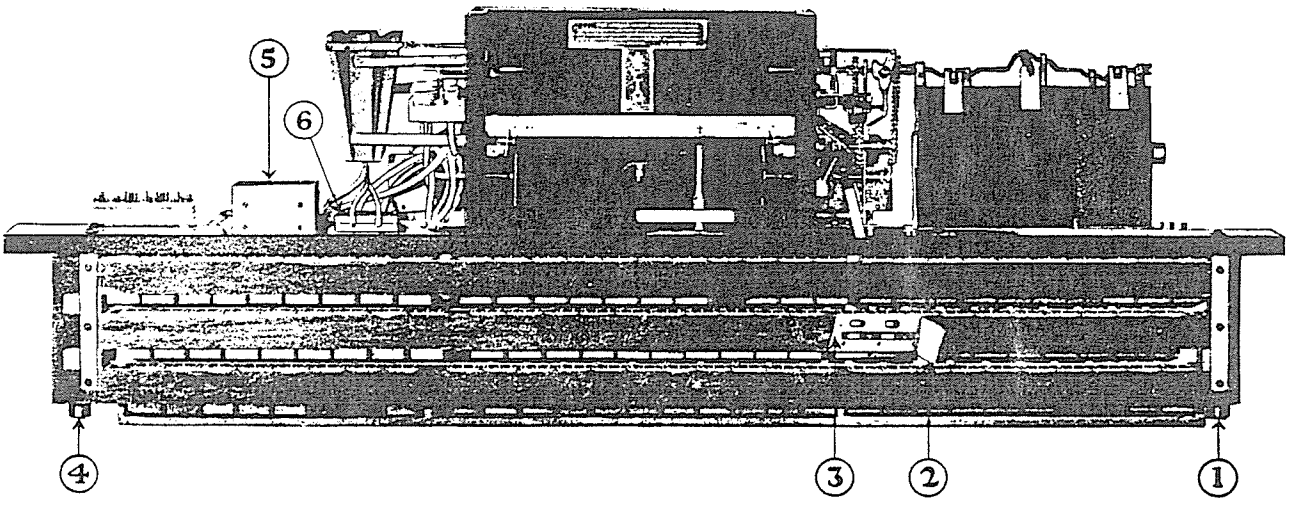


ILLUSTRATION "H"

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.

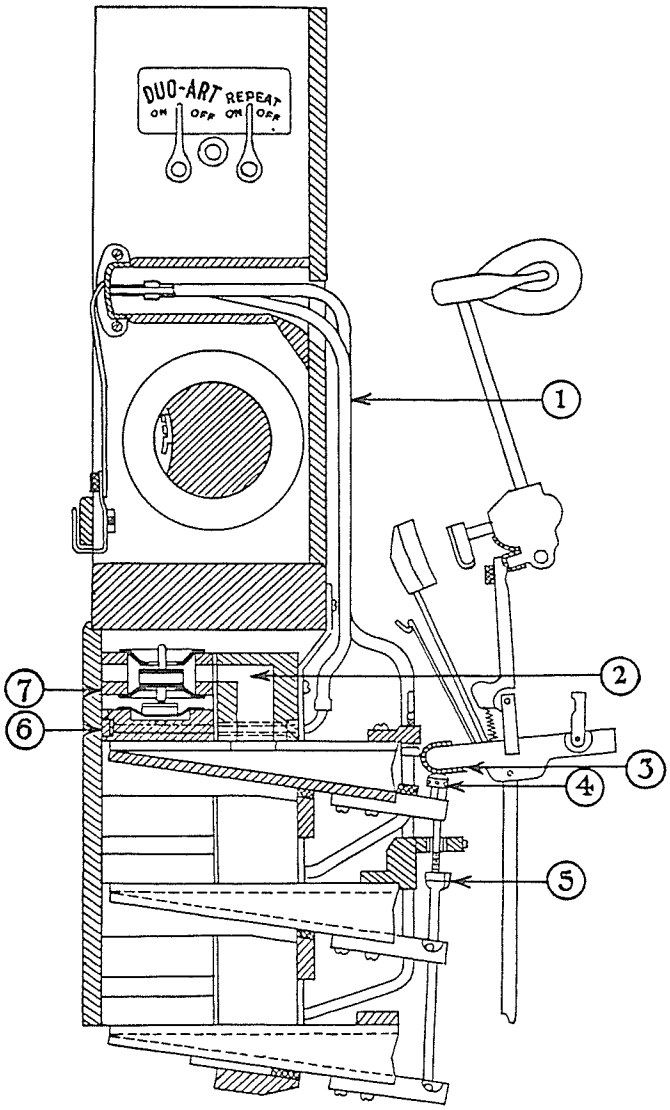


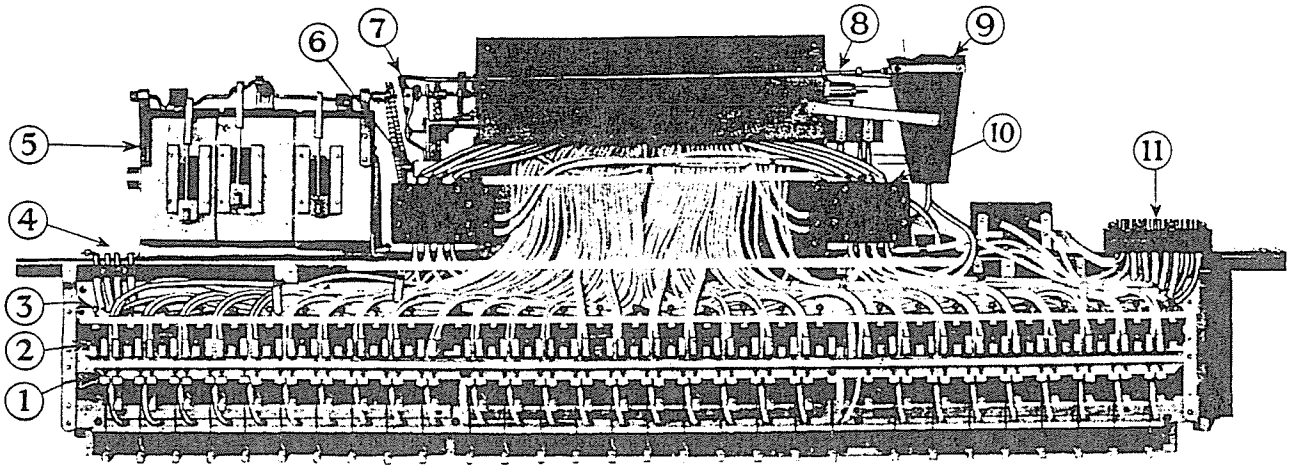
ILLUSTRATION "G"
Top Action. End View.

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.

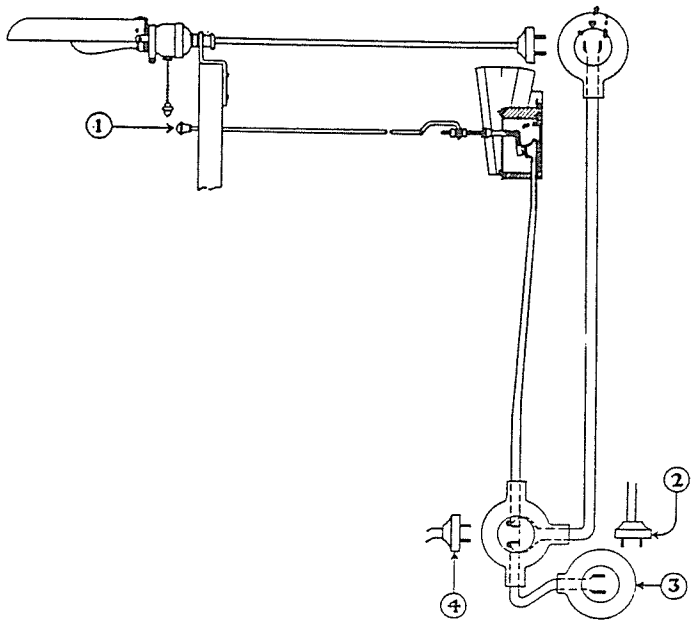


ILLUSTRATION "J"
Upright Wiring Diagram

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.

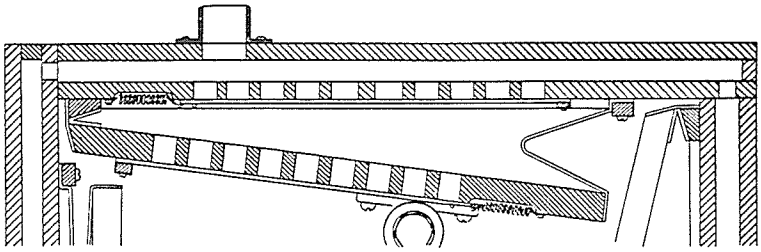
Always keep set screw in motor pulley tight.

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.

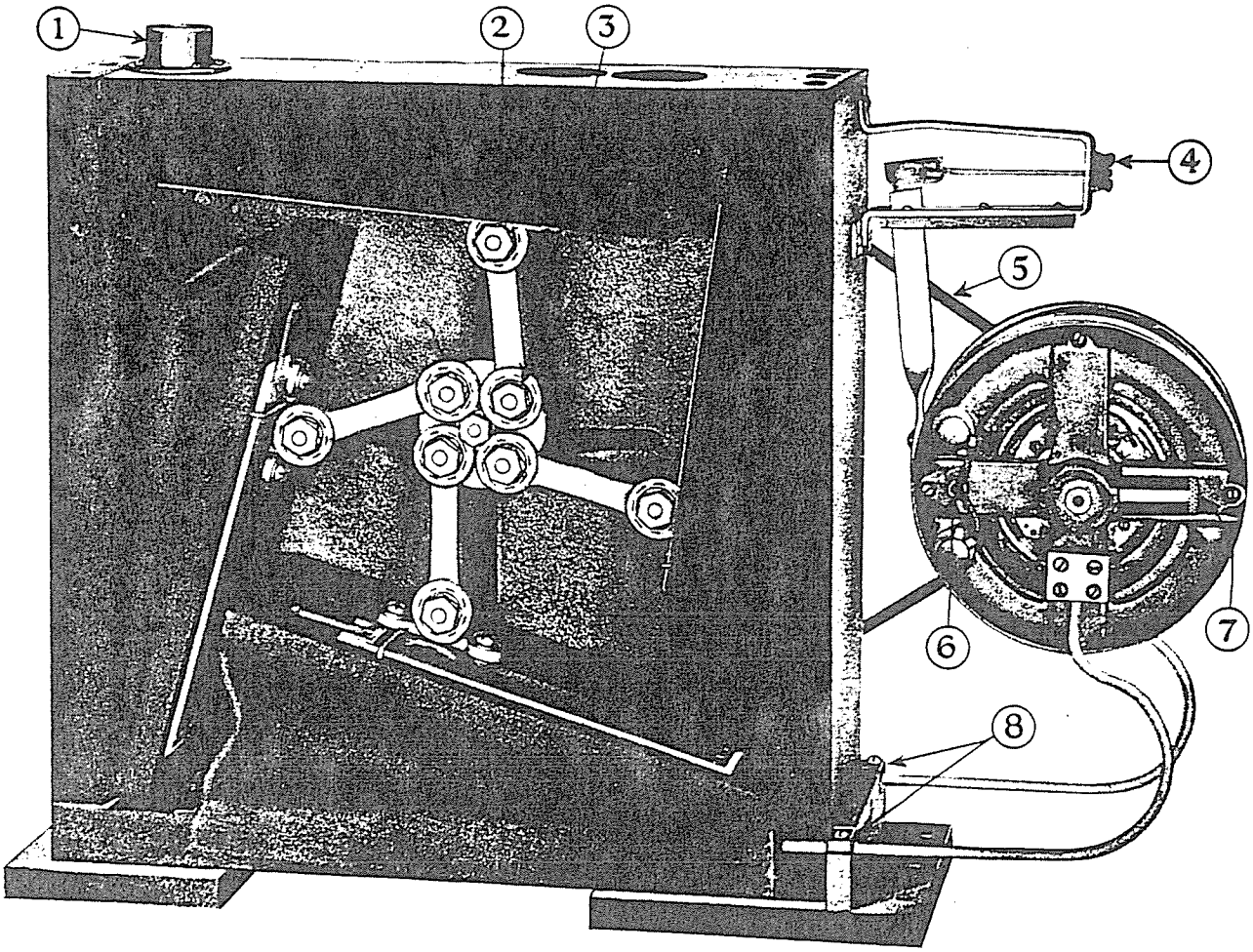
ILLUSTRATION "K-1"



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

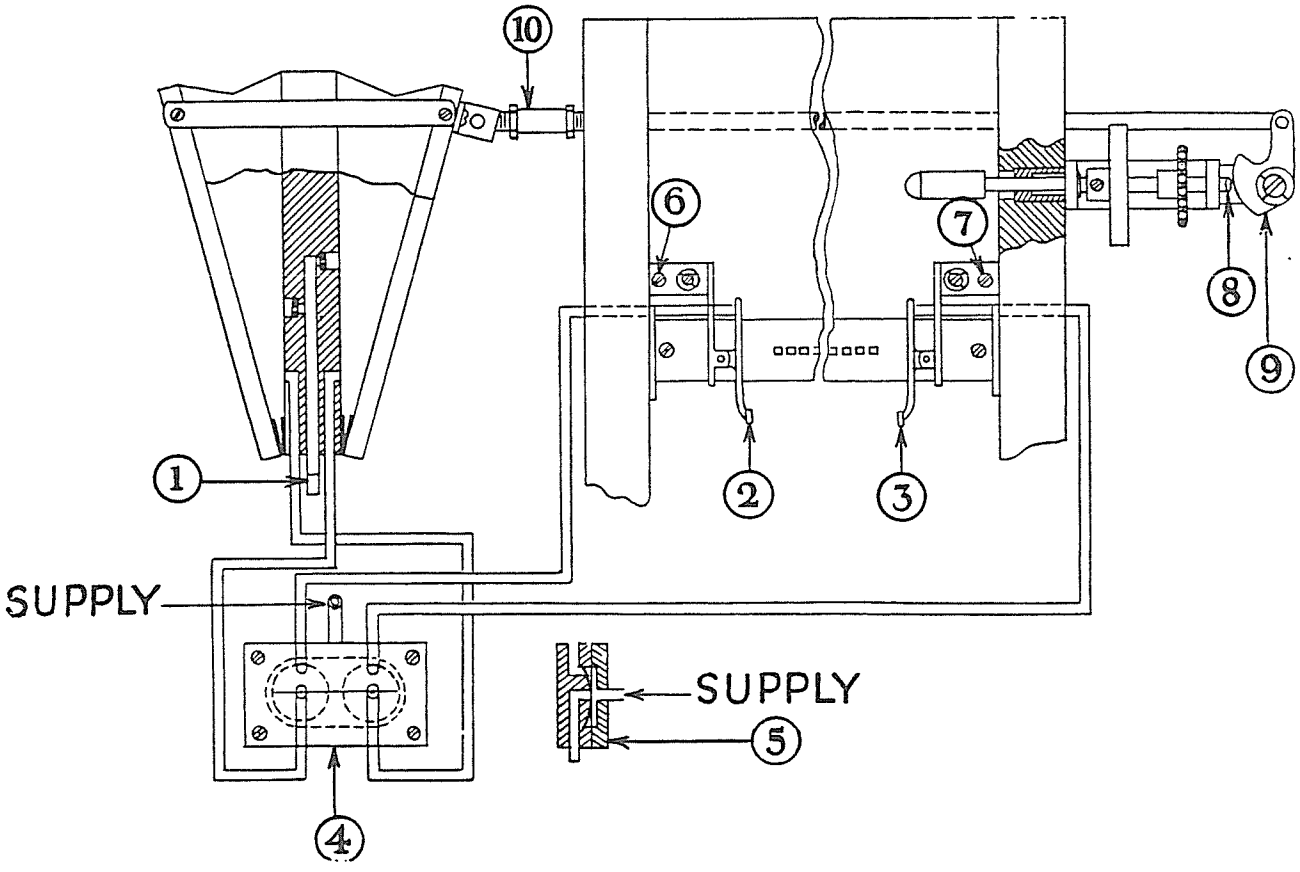
The spring motor mounting shown in illustration "K" is a very simple and efficient device and easily adjusted. By loosening screws at point No. 8 and removing wing nut No. 4, motor may be easily removed. To obviate the possibility of excessive strain at points covered by No. 8, have the electric motor 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.

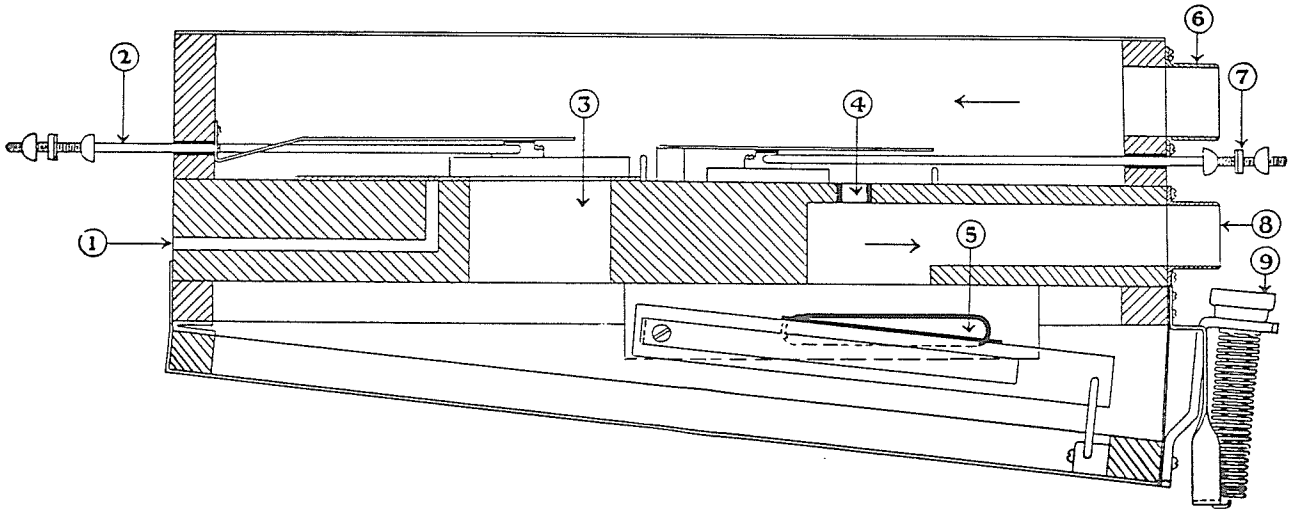
Upright Duo-Art Governor

(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.

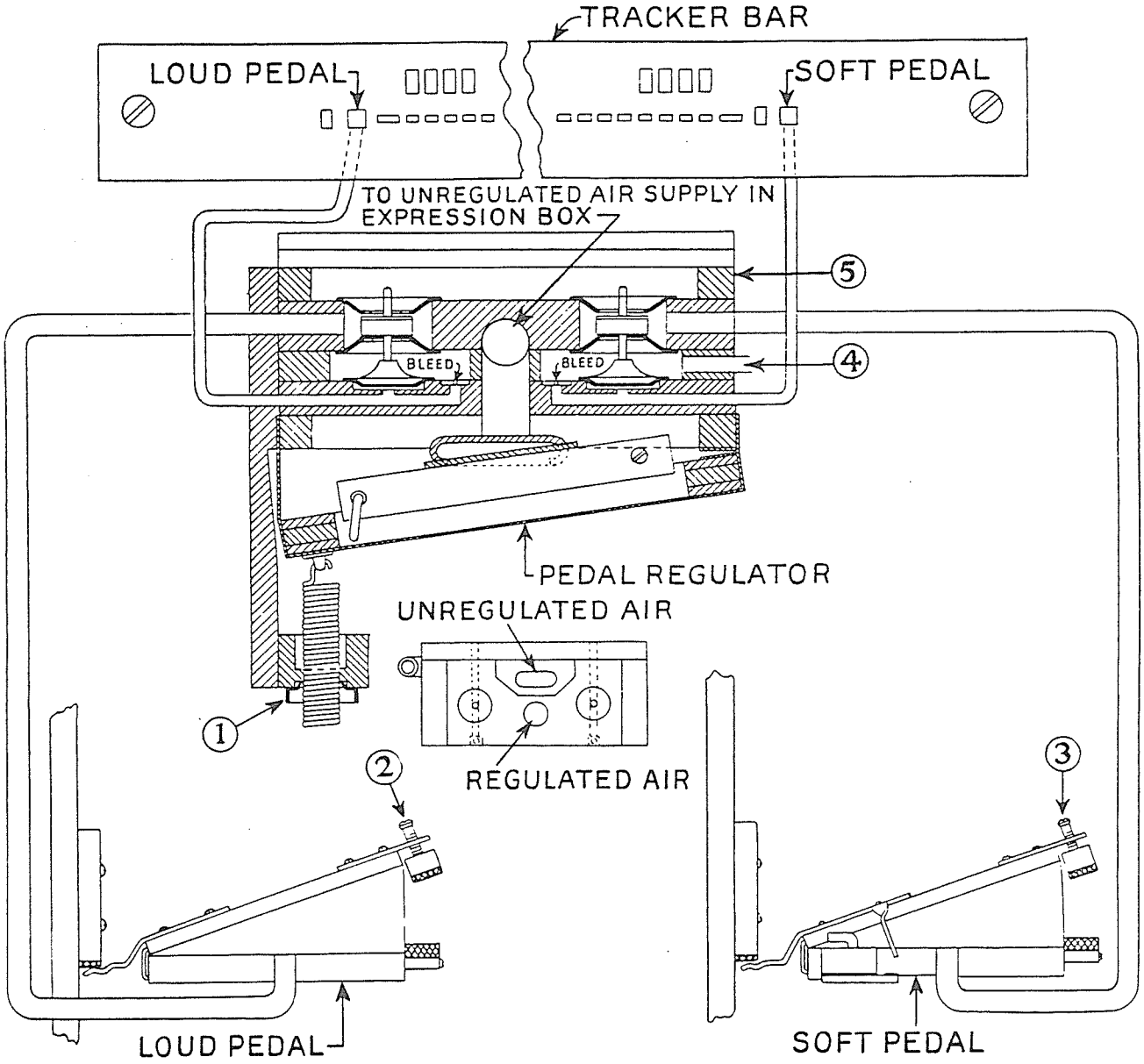
Upright Loud and Soft Pedal Control

(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)

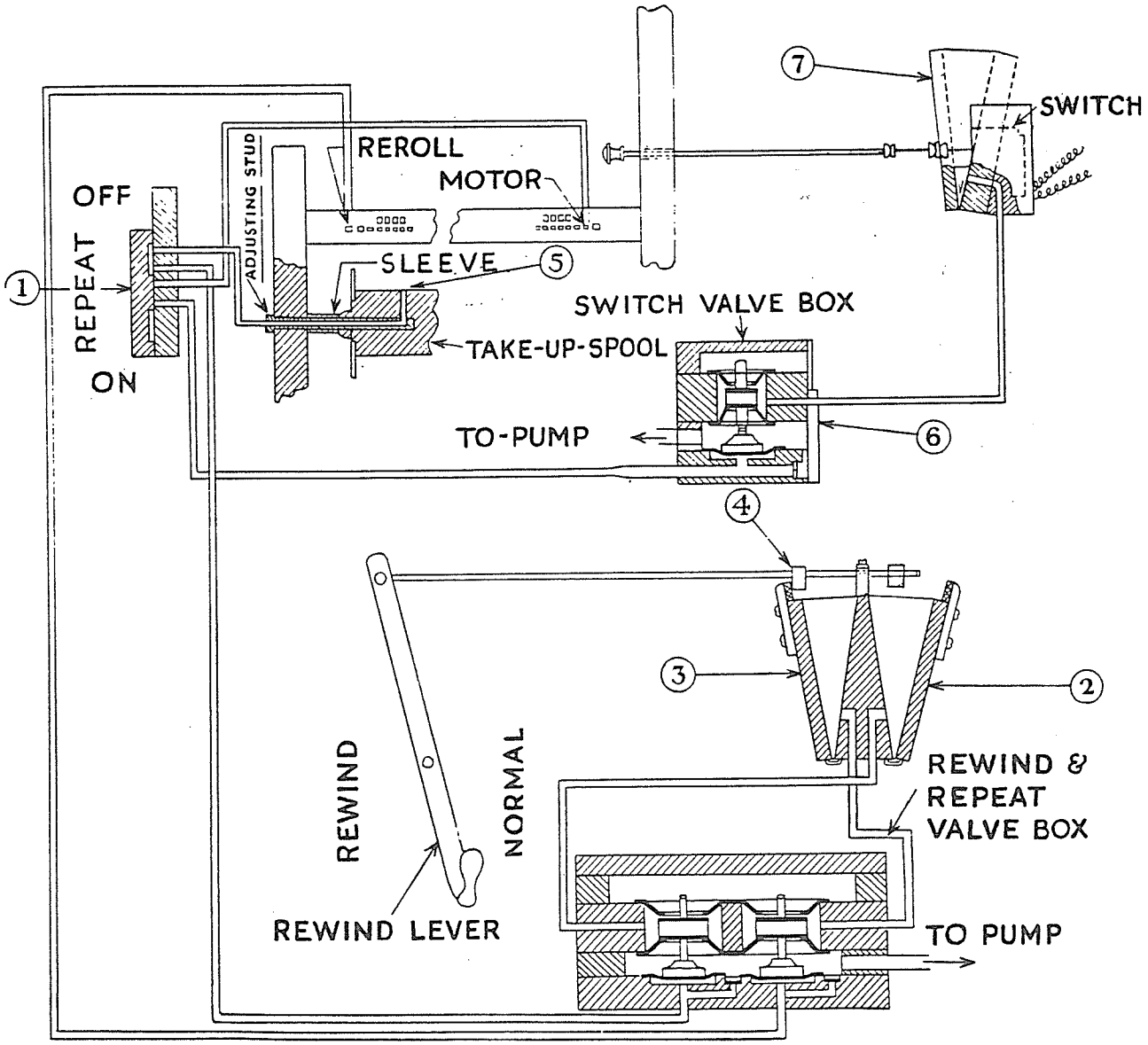


ILLUSTRATION "O"
Reroll and Repeat Device

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.

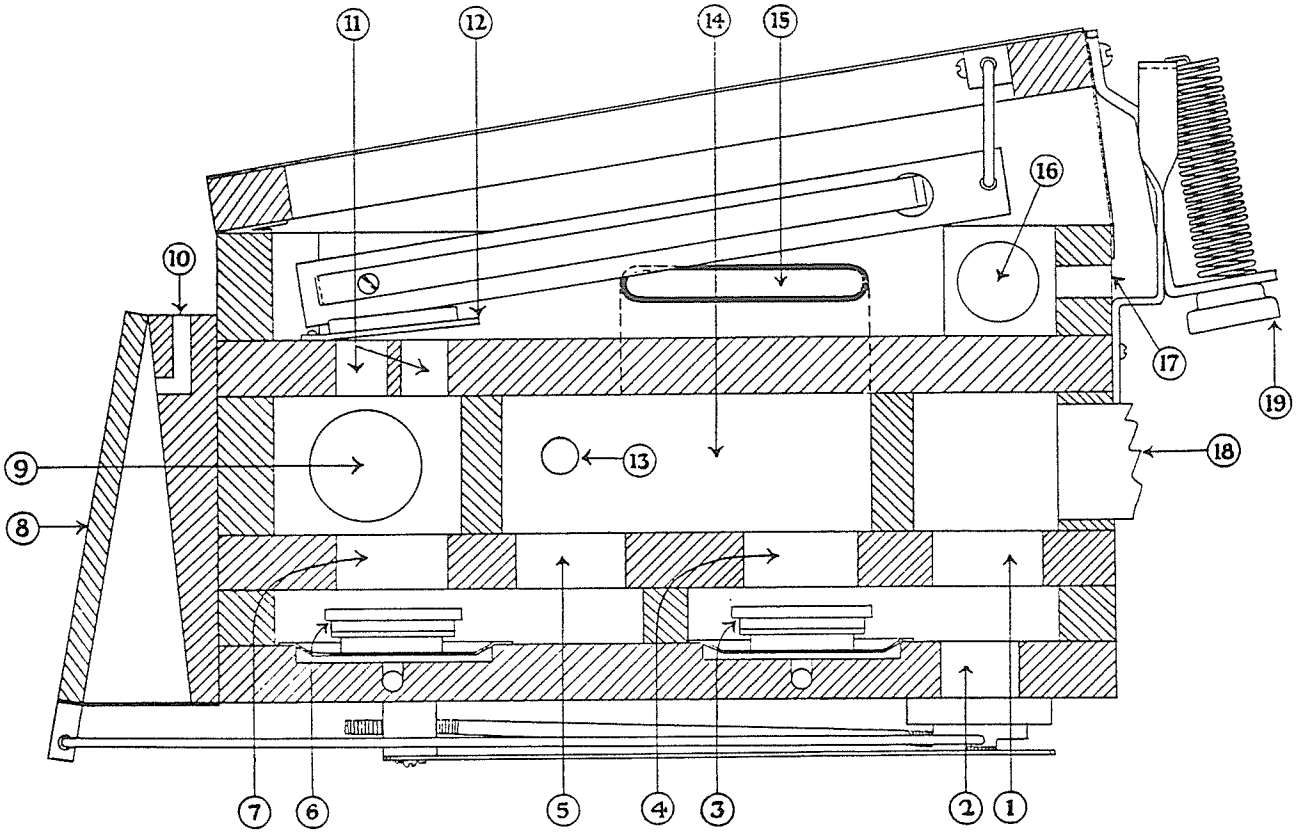
Grand Duo-Art Modulator Pneumatic

(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 reroil.

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.

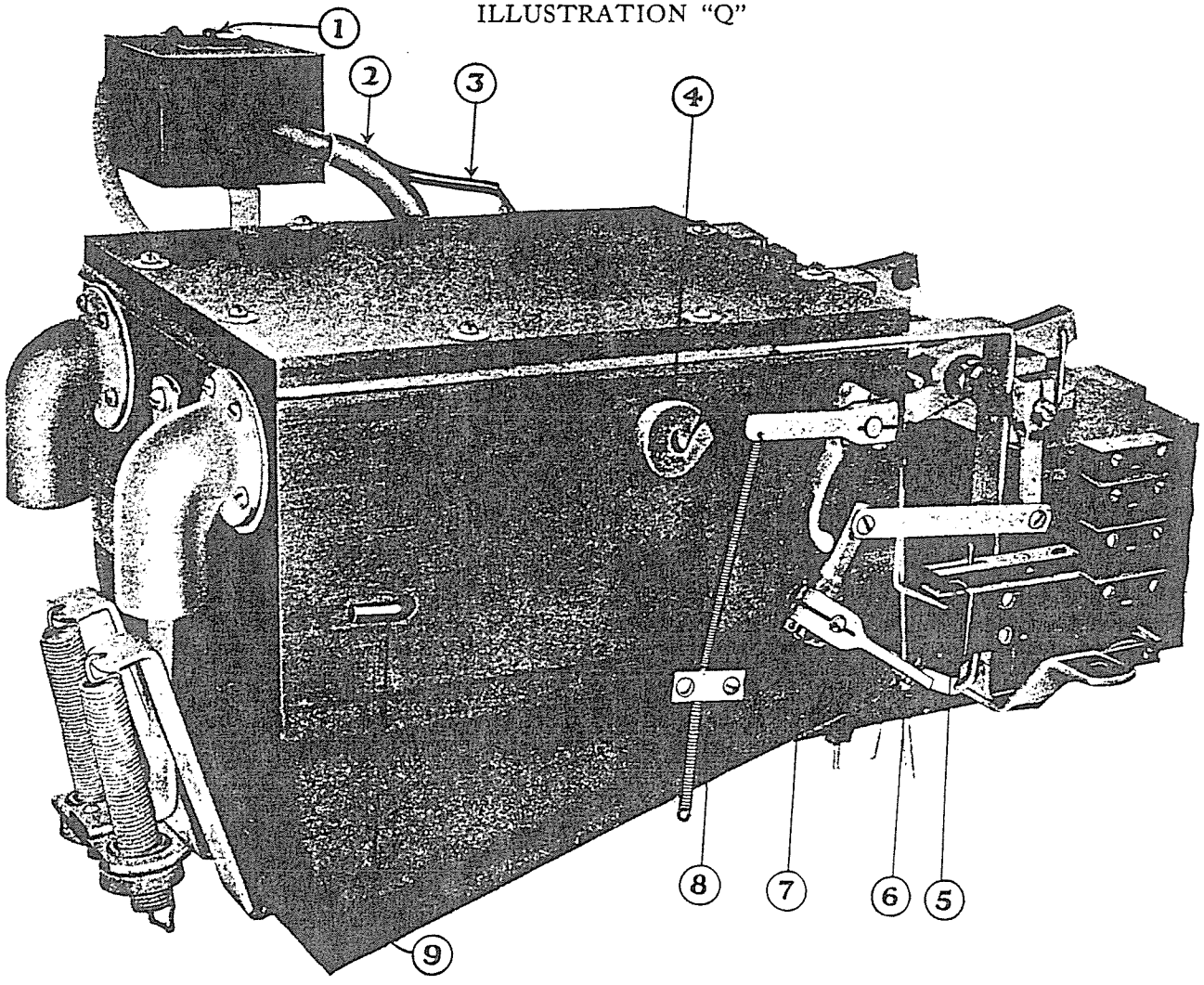
With the "Dynamic Lever" in front of Duo-Art at "Soft" or modulated position, valve No. 6 raises and closes channel No. 7. The air entering chamber No. 9 now passes up through channels covered by No. 11 and the flap valve No. 12, "which is closed when valve No. 6 is open," is now raised and the air passes 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"

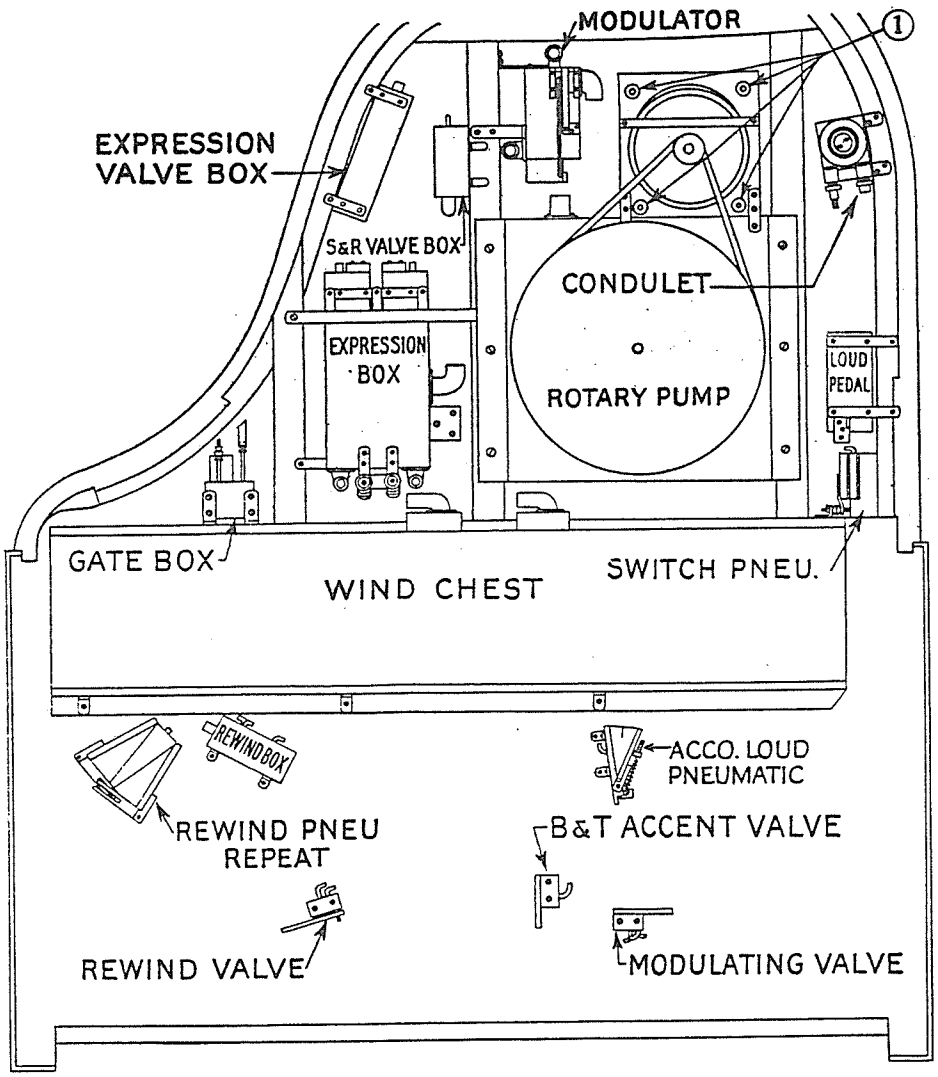
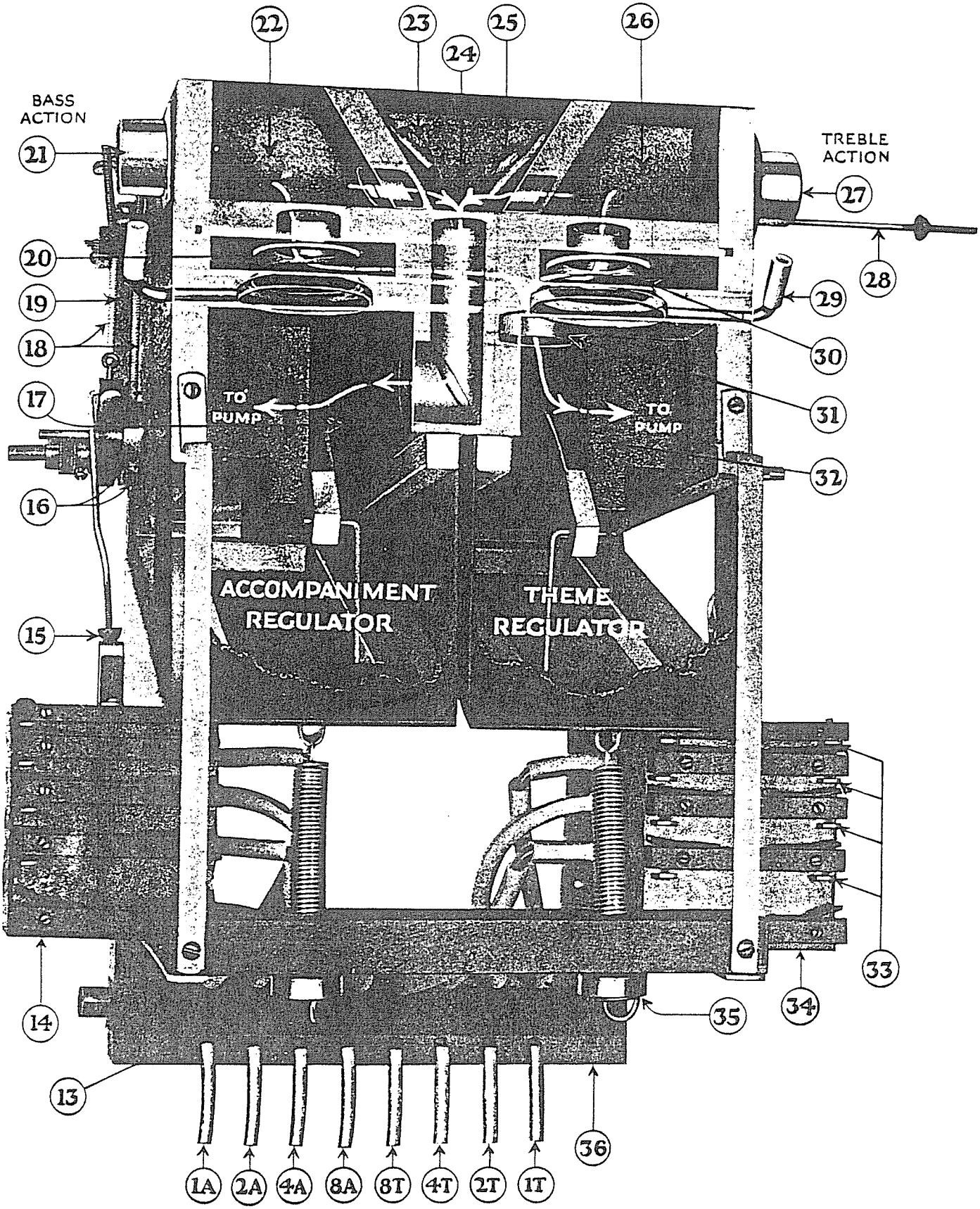
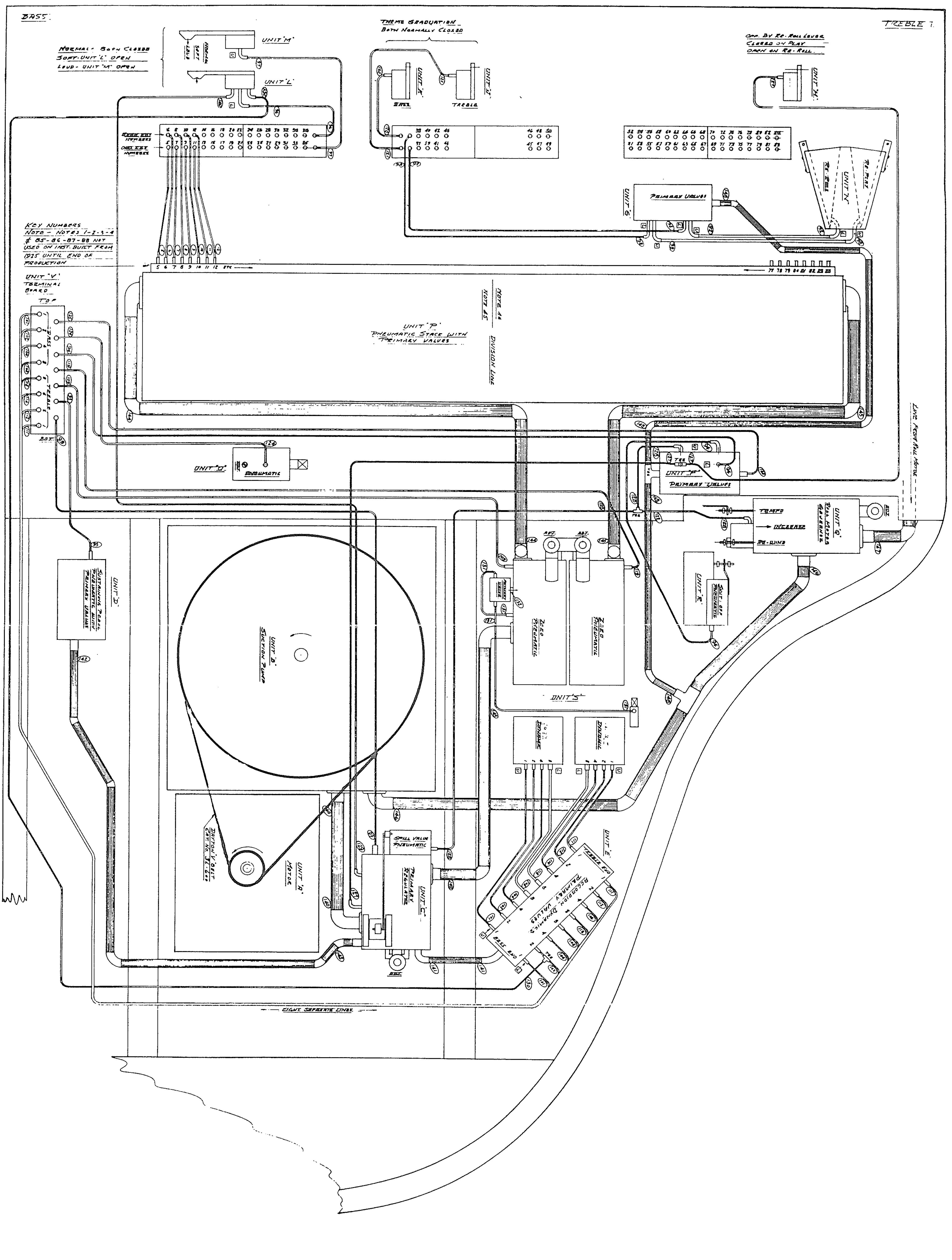


ILLUSTRATION "B"




BASS
TREBLE
NORMAL - BOTH CLOSED
SOFT - UNIT 'L' OPEN
LOUD - UNIT 'M' OPEN
UNIT 'M'
UNIT 'L'
THEME GRADUATION
BOTH NORMALLY CLOSED
UNIT 'K'
UNIT 'J'
BASS
TREBLE
OP. BY RE-ROLL LEVER
CLOSED ON PLAY
OPEN ON RE-ROLL
UNIT 'H'
UNIT 'G'
PRIMARY VALVES
UNIT 'N'
RE-PLAY
RE-ROLL
KEY NUMBERS
NOTE - NOTES 1-2-3-4
85-86-87-88 NOT
USED ON INST. BUILT FROM
1925 UNTIL END OF
PRODUCTION
UNIT 'V'
TERMINAL
BOARD
TOP
BASS
TREBLE
BOT.
NOTE 44
NOTE 45
DIVISION LINE
UNIT 'P'
PNEUMATIC STACK WITH
PRIMARY VALVES
UNIT 'O'
PNEUMATIC
UNIT 'F'
PRIMARY VALVES
UNIT 'Q'
ROLL MOTOR
GOVERNOR
TEMPO
INCREASE
RE-WIND
LINE FROM ROLL MOTOR
UNIT 'R'
SHUT-OFF PNEUMATIC
UNIT 'D'
SUSTAINING PEDAL
PNEUMATIC WITH
PRIMARY VALVES
UNIT 'B'
SUCTION PUMP
ZERO
PNEUMATIC
UNIT 'S'
UNIT 'A'
MOTOR
DAYTON 'V' BELT
CAT. NO. 3L-600
UNIT 'C'
PRIMARY
REGULATOR
SPILL VALVE
PNEUMATIC
UNIT 'E'
TREBLE END
BASS END
RECORDION DYNAMICS
PRIMARY VALVES
EIGHT SEPARATE LINES

The Duo-Art

Editor: Included in Wilberton Gould's series in ***The Tuners' Journal*** *on "Player Piano Mechanisms" is the following article on the servicing of the Duo-Art.*

Mr. Gould makes extensive reference to the 1927 ***Duo-Art Service Manual*** *in this discussion, especially to Illustration "E" therein. Illustrations and sections to which he refers—including Illustration "E"—are reproduced at the end of this section on the Duo-Art.*

THE DUO-ART

In the servicing of the Duo-Art mechanism, it is absolutely necessary that the technician understand the expression system and the principle under which it functions. The only tools required are a screwdriver, a Duo-Art test roll, and a musical ear. The mention of this last item might seem out of place in this technical series, but experience has proven it to be vital.

The expression box is the heart of the Duo-Art, through which the artist's musical thoughts may be reproduced, and it will be discussed thoroughly here. All references made to the expression box apply both to the grand and to the upright models, with one exception; this exception is referrred to in The 1927 Duo-Art Service Manual, and will be discussed later.

The adjustment of the various degrees of shading in the Duo-Art must be approached from a musical standpoint if effective results are to be achieved. Assuming, of course, that mechanical conditions are equal, it is possible through the unique dynamic control to control the entire register of the instrument either by the accompaniment regulator or the solo regulator.

The keyboard of the instrument is divided musically into theme, or solo, and accompaniment in the same manner as if it were played man-(or Ms.)-ually. For example, carrying the melody from the bass to the treble, or crossing the hands, or carrying the melody from the treble into the bass, is effected through the accompaniment regulator or the theme regulator. There is no duplicate control system in the Duo-Art, a control system for the bass and one for the treble. On the contrary, one regulator, either the accompaniment or the theme in conjunction with the theme valves, may control the entire register. In order to understand how this is accomplished, it is necessary to understand the travel of atmosphere from the pneumatic stack to and through the expression box and also to know what is taking place during the operation.

Referring to the phantom view on page 17 of The 1927 Service Manual (Illustration "E"). it will be noted that figures 19 and 25 are the main supply from the pneumatic stack to the expression box—bass and treble ends. Under normal conditions, when the theme secondary valves (figures 16 and 27) are up against their top seats, they cut off air channels from chambers 20 and 24. This causes the atmosphere entering the nipples (figures 19 and 25) from the pneumatic stack to enter the accompaniment chamber (figure 22) and pass down, as indicated by the arrows, into the accompaniment regulator, through the knife valve port and thence to the pump. By this it will be seen that air travel is through the accompaniment regulator, as long as the theme secondary valves remain against their upper seats, thus proving that normally the instrument is under accompaniment control.

The degree to which the strength of the blow is governed by the movement of the knife valve is controlled by means of the accordion pneumatics 6, 5, 4, 3, 31, 32, 33, and 34 in conjunction with the theme secondary valves 16 and 27. The collapsing travel of the accordion pneumatics being 1/16th, 1/8th, 1/4th, and 1/2 inches, as these accordion penumatics collapse

they control the opening of the knife valve port. The greater the area of the knife valve port the stronger the blow given.

There are adjusting screws on the cross bars of the accordion pneumatics. These should not be disturbed, as they are set correctly at the factory and should be adjusted only by a set of accurate gauge blocks that are made for that purpose. It is also necessary that there be just enough tension on the springs to bring the accordion pneumatics back to rest snappily, with not too much or too little tension. Care should be exercised in this operation; if there is too little tension, the accordions will not come to rest quickly enough, and if there is too much tension, the accordions will lag in their collapsing, with the result that the knife valve will not open enough, as it should. Likewise, the tension springs on the regulators should not be drawn down to a greater degree than is necessary, but should be just taut enough that they do not rattle. Pulling down the tension springs on the regulators is frequently done because of lack of knowledge. When this is done, it upsets the zero setting of the regulators *(Editor: also read "Steps in Test No. 8").* If this operation is carried to the extreme, it will ruin the springs for the fine setting of the accompaniment or the theme and it will be impossible to bring down the tone to that softness so much desired by real music lovers. If the springs have been ruined, the only remedy is new springs. Therefore, it is suggested that a player technician tread very softly along this path. *Editor: If new springs are being installed, it is very important that the correct tension, size, and gauge of the new springs be established before they are replaced.*

Before going further into the expression box, the expression control ports on the tracker bar should be explained, so that they may be better understood when referring to the expression box.

Referring to Illustration "E" in The 1927 Duo-Art Service Manual, we find the following:

Re-roll	Soft Pedal
Sustaining Pedal	Electric Cut-Off
Bass Theme	Treble Theme
No. 1 Dynamic Accompaniment	No. 1 Treble Theme
No. 2 "	No. 2 "
No. 4 "	No. 4 "
No. 8 "	No. 8 "

It will be noted that the note holes start at the fourth hole from the bass end and the fourth hole from the treble end, reading from the outer edge toward the middle, the first speaking note is No. 5 and the last is No. 84, making eighty speaking notes. This applies to the later type Duo-Art mechanisms. In the earlier models, the speaking scale is full eighty-eight notes on straight eight-eight note rolls, but still remains eighty speaking notes on the Duo-Art reproduction.

Note holes 1, 2, 3, and 4 at the bass end and 85, 86, 87, and 88 at the treble end have each directly above them a perpendicular oblong port. These oblong ports are the accordion dynamic control ports and are connected by tubing to the Duo-Art cut-out pouch blocks directly behind the spool box. These blocks contain a series of four pouches on either side of the blocks, one on the bass end and the other on the treble end, and are connected to the supply from the Duo-Art cut-out block on the left-hand end of the spool box; they are marked"Duo-Art On" and "Duo-Art Off." With the Duo-Art lever at the "On" position, atmosphere is admitted to the top side of the note pouches on the blocks marked 1, 2, 3, 4 notes and 85, 86, 87, 88 notes; this inflates the pouches and cuts off the note holes from the tracker bar. With the Duo-Art switch at the "On" position, atmosphere is admitted through any one of the accordion dynamic control ports above the note ports, passes through the pouch cut-out block, thence to the accordion primary valve box, from there to each of its respective primary valves, then to each of the accordion dynamic pneumatics on the expression box. In the upright model, the dynamic valve box is assembled on the expression box frame. In the grand model, it is attached to the frame of the case as closely as possible.

The theme valve ports on the tracker bar lead to the theme primary valve box (valves Nos. 29 and 30) and there to the theme secondaries in the expression box. (See figures 17 and 18 in Illustration "E.")

The re-roll port and the port in the take-up spool lead directly to the repeat and re-roll primary valve box underneath the key bed. These valves control the re-roll and repeat pneumatics In the upright model, the tube leading from the switch cut-out, or motor port, goes to the left and passes through the repeat slide block where if the slide block is in the off position, it con-

nects with the tube leading to the switch valve box (figure 8, Illustration "O" in the 1927 Duo-Art Service Manual).

The sustaining pedal port—*Editor: also known as the loud pedal port*—on the tracker bar leads directly to the sustaining pneumatic in the grand type and to the pedal regulator in the upright model. The soft pedal port leads to the soft pedal primary valve box in the grand model and to the pedal regulator in the upright model. In the later types of Duo-Art grands, the shifting of the action is accomplished by atmosphere being admitted through the soft pedal port in the tracker bar. The raising of the hammer rail is accomplished by placing the modulating lever, on the control slip, in the soft position.

We will now show how the air travel is changed within the expression box when a theme perforation appears on the music roll and what happens when this takes place.

Referring to the phantom view on page 17 of the Duo-Art Service Manual, figures 16 and 27 are the bass and treble theme secondary valves. *Editor: The author is referring to Illustration "E" on page 17 of the 1927 Duo-Art Service Manual. The same reference may be found in the 1925 Duo-Art Service Manual, Illustration "B," figures 20 and 30. Also, on the diagram that is part of the Duo-Art Preliminary Instruction Pamphlet, the same reference is figures 11 and 12.* They are controlled through the bass and treble theme primary valves located in the valve box on the top action, at the left of the tracker box. The theme primary valve box is shown at the right of the expression box on page 17. Figures 29 and 30 are the bass and treble theme valves respectively and are connected to the secondary valves in the expression box and to the tracker bar. As previously stated, under normal conditions the theme secondary valves are against their top seats, thus compelling the atmosphere from the pneumatic stack to travel through chambers 20 and 24, through the flap valves 21 and 23, into chamber 22, down through the channel, as indicated by the arrows and through the knife valve port of the accompaniment regulator and to the pump.

The question may arise: How do the secondary valves remain seated against their top seats? As stated above, there is a theme primary valve box located on the top action at the left of the tracker box. Under normal conditions, the valves in this box are at rest, or down against their bottom seats. Atmosphere is admitted over the tops of the valves, passes through connecting tubes and inflates the pouches under the secondary valves, thus holding these secodary valves tightly against their upper seats and preventing any passage of air from the pneumatic stack to the theme regulator. The inflation of the theme secondary pouches just mentioned is accomplished by the action of the theme regulator suction which entirely surrounds the top surfaces of both theme secondary pouches. The moment theme perforations appear on the music roll, atmosphere is admitted through the theme ports in the tracker bar to the primary pouches, inflating them and raising the primary valves to their upper seats. This action cuts off the atmosphere which was admitted through the top cups and permits the suction of the theme primary box to exhaust the secondary valve pouches through the bottom cups, causing the secondary valves to drop and thus momentarily open a channel between the pneumatic stack and theme regulator. The opening of this channel is the action whereby the air from the pneumatic stack is changed from the accompaniment regulator to the theme regulator.

The moment one or both of the theme secondary valves drop, since the theme regulator suction is usually of a higher intensity than that of the accompaniment regulator, this stronger suction will draw the flap valves (21 and 23) to their seats and cut off channel 22 from the pneumatic stack. Thus, momentarily, the stack may be entirely cut off from the accompaniment regulator. This occurs only when the stack is opened to the theme regulator. When this occurs, the air from the stack entering chambers 20 and 24 will pass down and over the theme secondary valves and into the channel underneath and directly behind the accompaniment channel (this channel is shown but is not numbered on the phantom view, but is indicated by the arrows from the theme secondaries), through the port shown leading into the theme regulator, and there to the pump and exhaust.

This condition can happen collectively or singly, as the case may be, according to the perforations on the music roll. The strength of the blow is governed by the movement of the knife valve within each of the regulators. This

movement is controlled by the collapse of the accordion dynamics. The theme valves determine the note or notes that are to be accented by accenting any note or group of notes whenever a direct passage is opened through the theme regulator to the pump.

If, as has been shown, the path of the atmosphere can be changed within the expression box, it is then proved that the theme regulator may control every note in the register. While the accompaniment regulator does likewise, the theme may accent any note without interference from the accompaniment regulator and may accent any individual note in either the bass or treble action, thus proving that this mechanism is truly based on a musical principle and that it will reproduce exactly the performance of the artist upon the keyboard of the instrument.

Manual control of the Duo-Art is obtained by means of a system of levers situated on the key control slip of the instrument. Normally, they are used only when a roll other than a Duo-Art is used and then only with the Duo-Art switch in the spool box at the "Off" position. *Editor: In this "Off" position, 88-note rolls of standard roll width, 11¼ inches, may be played.*

These levers give the operator direct control over the movement of the knife valves in both the accompaniment and the theme regulators as well as control over the theme valves. Illustration "G" (page 21 of the service manual) shows one of the regulators, accordion dynamics, and manual control lever. It must be remembered that the levers have a down pull on the heels of the knife valves the same as do the accordion dynamics, and the levers control the movement of the knife valves and the opening of the ports.

The more the levers are moved from their normal position, the greater is the intensity of the suction built up in the regulators and correspondingly the stronger will be the force of the blow of the striking pneumatic.

The theme levers control the movement of their respective pallet valves underneath the key bed, allowing atmosphere to be admitted through the ports of the pallet valves directly to the primary valves instead of through the tracker bar. By the use of these levers, it is possible to pick out any single note in either the accompaniment or the theme and accent it at will. This follows the same principle as the expression perforations cut in the Duo-Art music rolls.

The spill valve, or atmospheric intake, is located in the rear of the Duo-Art expression box. It is properly adjusted at the factory and should not be tampered with. As either the theme or accompaniment regulator intensities increase, this valve begins to close and when the intensity of either regulator reaches the tenth degree it is fully closed, remaining closed from this tenth degree through the fifteenth. Below the tenth degree, it is either closing or opening as the regulator intensities are increasing or decreasing, being fully open when no accordion dynamics are collapsed. This spill valve is returned to its normal position by the action of a coil spring, which should be adjusted just strong enough to give it a positive return motion. If it is adjusted too strong, it may retard the motion of the accordion dynamics and thus affect the normal expression. (See illustration "J" on page 28 for the method of connection and its operation.)

The tracking device shown in illustration "L" on page 32 is simple and positive in action, and when understood correctly is very easy to adjust. It should not be condemned if it fails to operate correctly. It should be remembered that not only this type of tracking device, but every other type, was tested under many and varied conditions and that when installed in the instrument it did its work. The greatest trouble encountered in adjusting any tracking device is lack of knowledge of the principle under which it operates. In adjusting the Duo-Art tracking device the power should be on and the tracker bar covered with a roll. The tempo should be set at zero and the tracker ears moved away from the edges of the paper. The tracker pneumatics should be centered exactly and the top drive shaft at the right of the spool box should be at center of the shifting cam (Figure 8). Figure 1 shows a turnbuckle, which adjusts the position of the cam. This turnbuckle has left and right threads and is supplied with lock nuts, which should always be set tight after the adjustment of the cam has been made.

When the tracker pneumatics have been centered and other adjustments made so that the note holes in the music roll align with those in the tracker bar, the tracker ears should be set. These ears should be so adjusted that they just touch the edges of the paper, and the screws (figures 2 and 3) should be tight. Under no condition should the tracker ears be bent into position with a pair of pliers or anything else. This would not only be bad practice and show a lack of knowledge on the part of the service man, but there would be danger of damaging the ears to such an extent that they might have to be replaced with a new set. Many music rolls have been ruined through faulty and incorrect setting of the tracker ears and the blame placed on the tracking device.

Editor: The section on the Duo-Art tracking device was printed in February, 1929. The 1929 model of the Duo-Art did not have ears protruding from the tracker bar. This was replaced by holes in each end of the tracker bar. For adjusting the tracking on either model, make sure the width of the roll you are using is exactly 11¼ inches wide. After tracking adjustments are completed, check that the perforations on the roll center directly over the holes in the tracker bar.

The Duo-Art Upright Governor

The Duo-Art governor is extremely sensitive and positive in operation. Reference to illustration "M" on page 35 of the Duo-Art 1927 Service manual will show that the atmosphere from the wind motor enters the governor at channel No. 6, passes through channel No. 3, provided the tempo port is open to ten or more, through knife valve port No. 5, and out through channel No. 8 to the pump. Spring No. 9 is the opposing suction in the governor pneumatic. Figure No. 3 is the tempo port, No. 2 is the tempo control slide valve, No. 4 is the reroll port and No. 7 is the reroll slide valve. Figure No. 1 is a bleed channel connecting with the outside air. Its function is to prevent the wind motor from creeping when the tempo is at O, but this channel is cut off when the tempo is advanced three or four points. Adjustment of the governor will be taken up later under the caption "Testing."

In the grand Duo-Art the governor is practically the same, except that the action cut-out is in the modulator box underneath the bed next to the rotary pump, and its function will be discussed under the heading "Duo-Art Grand Modulator Pneumatic."

Sustaining and Hammer Rail Lift

The entire layout of the tubing and control of the sustaining pedal and the hammer rail lift will be found in illustration "N" on page 37. There are three valves in the sustaining pedal valve chamber and two in the hammer rail valve chamber. Those who are familiar with the Duo-Art since its inception will readily see the advantage of this arrangement over the older model.

Quietness of operation is highly desirable; it is obtained through the medium of the multiple valve control in conjunction with the pressure regulator. A knife valve and a regulator spring are attached to the pressure regulator pneumatic. Adjustment of this spring will control the action of the sustaining pedal, the accordion pneumatics and the hammer rail lift as regards snappy action and quietness. The sustaining pedal and the hammer rail are also controlled through the stop buttons, figures 2 and 3. Too great a tension on the regulator spring No. 1 will cause noise and valve clatter. Too little tension will produce sluggishness of the action. In this unique control there is regulated and unregulated atmosphere.

In the upright Duo-Art, in conjunction with the soft pedal or hammer rail lift is a pallet valve (not illustrated). The function of this valve is to collapse No. 2 accompaniment accordion pneumatic on the expression box to compensate for the lost motion created by the hammer rail lift. In the grand model the sustaining and hammer rail lift pneumatics are controlled from the modulator pneumatic, performing the same duty as stated above.

In illustration "O" page 38, are shown the tubing layout, valve control and the position of the repeat slide valve block of the upright Duo-Art, located on the left side of the roll box. In this illustration the switch valve block is mounted on the right-hand side of the case, and shows the

pneumatic and the valve box as a unit. In the grand model, the switch unit and the switch pneumatic are separate units. The principle remains the same, no matter how the units are assembled.

Grand Duo-Art Modulator Control Pneumatic

The modulator control box (illustration "P," page 41) is shown only in the grand model and only in instruments of late manufacture. Its function is to modify, or soften the normal Duo-Art without affecting any of its dynamic gradations. It also controls and regulates the supply of atmosphere to the accordion dynamics and the sustaining pedal and contains the cut-off valve which cuts off the top action on reroll. A pallet valve block is situated underneath the key bed at the front, left-hand end of the case and is connected with levers marked "Concert," or Normal, "Soft," or Dance. This pallet valve block is known as the dynamic valve block, and is made up of two pallet valves, with four nipples on the later types, and three on the older types. When the dynamic lever is at the "Soft" position, the pallet is opened, and the atmosphere is admitted to the valves of the hammer rail and No. 2 accordion pneumatic on the accompaniment side. Through another nipple, atmosphere is also admitted to valve No. 10, which raises and forces the air entering chamber No. 13 to pass through the knife valve port No. 17, and cuts down the dynamic power of the expression one-half. When the dynamic lever is at the "Concert" position, it has no effect on the modulator control box, but collapses the accompaniment accordion pneumatic No. 8, so that the softest power of expression is power eight.

Attached to the grand governor tempo control box and to the grand modulator control box are two small pneumatics, one (No. 14) on the modulator box and the other on the governor box. Pneumatic No. 14 on the modulator box collapses and opens port No. 3 on the modulator box, and is a pump relief on reroll when these two pneumatics are teed together.

The spring No. 20 on the modulator is set correctly at the factory, and set so that the degree of modulation is one-half the full volume of the Duo-Art. This will correctly control the action of the accordion pneumatics on the expression box and the action of the sustaining pedal, and one should not tamper with it. Should it be necessary to get at valves No. 10 and No. 5 on the modulator box, access may be gained by removing the lower cap, where slide valve No. 4 is situated. As these valves are of considerable size, however, this should seldom be necessary.

Grand Crash Unit

While the expression box of the grand is constructed somewhat differently from that of the upright, due to the different designs of the pianos, there is no difference in the principles of the expression control. The grand expression box has a crash valve unit which acts only when power fifteen comes on, that is, when all the accordion pneumatics on the theme or solo side are collapsed. The action of the crash valve gives a direct passage to the pump, and when the crash comes on, it cuts around the theme knife valve direct to the pump. In this way, it causes the maximum hammer blow.

When the crash valve is set, all theme pneumatics should be collapsed, valve arm No. 6 (see illustration "R," page 45 of the Duo-Art service manual) should be up, and the adjusting screw in the arm should just raise pallet valve No. 5. Should it not be the case that the adjusting screw in the arm just raises pallet valve No. 5, one or two turns of regulating screw No. 6 should be sufficient. Rough adjustments may be made with regulating screw No. 7, and fine adjustments with screw No. 6. Care should be exercised that the upward travel of arm No. 7 is not so great that it will act when power fourteen comes on; in other words, the pallet valve should not rise more than one-sixteenth of an inch.

Key Frame Shift

As was previously stated, the key frame shift (see illustration "S" in the Duo-Art service manual) is installed only in the grand

Duo-Art and only in the later models. In conjunction with the hammer rail lift, however, this attachment permits very fine shading of the music. The key frame shift operates only when No. 1 treble end port is open. There is a separate valve box for this unit located in the rear of the case near the sustaining pedal pneumatic. Lost motion of the shift unit may be controlled by adjusting screw No. 6 on arm No. 5. This unit is silent, powerful, and positive in action.

Preparations for Test Roll Use

Before attempting to adjust the Duo-Art with the test roll, it is absolutely essential that the piano action be in proper regulation. See that the hammers travel correctly, that all flanges are tight, and that the junction block under the key bed on the grand is tight in order to avoid leakage. Inspect all supply tubings for leakage. Be careful not to overhaul any of the screws. Clean the spool box gearing of dirt, grease, and oil, and inspect the ladder chains for excessive lag. Do not squirt oil on the transmission. This is a bad practice, as oil is apt to reach the gum tubing and to destroy the body of the tubing. Use a good quality of lubricant, but not too much of it. Do not use oil or grease on the air motor.

On new set-ups or demonstrations, be sure that the correct type of electric motor is installed in the instrument and that the voltage and cycle are correct. Eliminate all undue motor noises. Also see that the belt travels true from the motor to the pump and that it is just tight enough that it does not slip on a full load. In the later types of the Duo-Art, the belt slack is taken care of automatically by springs, while in the older types, provision is made for taking care of this adjustment. Make sure also that the motor frame does not touch the piano frame, as this contact would cause an annoying hum.

Be sure to pump out the tracker bar ports with a reliable pump.

USING THE DUO-ART TEST ROLL

Place a Duo-Art test roll on the carrier shaft, and with the lever at "Play" and the tempo at 0, test for quietness. Eliminate any undue noise. Set the tempo at 70, and with the roll running, test the speed of the tempo; correct if necessary. For this test, the Duo-Art lever must be at the "Off" position, and the test roll should run seven feet a minute, or three and one-half feet in one-half minute. If the tempo is too fast, decrease the tension of the governor spring. If it is too slow, increase the tension of the spring. (Refer to illustration "M," page 35, of the 1927 service manual.) The tracking device may also be tested at this time. (Refer to pages 32 and 33 of the service manual.)

Sustaining and Soft Pedal Test

With the sustaining and soft pedals in the "On" position, the wedge dampers should clear the strings by at least one-eighth of an inch, and the hammer rail should move forward to within one inch of the strings. In the grand, the hammers should lift five-eighths of an inch from their normal position. Spring No. 1 (illustration "N," page 37 of the service manual) controls the speed of the sustaining and soft pedals in the upright, and spring No. 20 (illustration "P," page 41 of the service manual) controls the speed of the sustaining pedal in the grand. (See also above discussion of the Modular Control Pneumatic.)

Accordion Dynamics

With the Duo-Art switch lever at the "On" position, the accordion dynamics should collapse in the order, Nos. 1, 2, 4, 8, on both the accompaniment and the theme sides. Should they fail to operate in the given order, test directly at the primary accordion valve box, removing the tubing leading to the dynamic that is not operating, and correct.

Accompaniment Zero Setting, Tempo 80

As this setting is the most important, it is essential that on the first arpeggio test, the notes should speak evenly, distinctly, and softly. Watch for weak notes in the second run, and correct any that are too loud. When making adjustments, do not

tamper with the leather nuts on the accordion dynamic support rod. (See No. 14, illustration "E," page 17 in the service manual.) They are set correctly at the factory, and should be left alone. Regulator springs Nos. 2 and 35, as well as all other springs, were covered earlier in this series. Carefully read instructions on this test on pages 23 and 24 of the service manual.

Adjusting screws Nos. 7 and 8 are two different colors; one is blue metal, and the other is white. (See illustration "F," page 17 of the service manual.) Screw No. 8 is a lock screw, and must be loosened before it is possible to adjust the movement of the knife valve through the medium of screw No. 7. Failure to loosen screw No. 8 is apt to damage adjusting screw No. 7. After the arpeggio test is set correctly, tighten lock screw No. 8. In the upright model, turn screw No. 7 to the left to make the tone soft, and to the right to make it loud. On the grand, turn adjusting screw No. 7 to the left to increase, and to the right to decrease the volume.

In setting the arpeggio test as above, observe the movement of the accompaniment and theme regulator pneumatics. As the volume increases, the pneumatics tend to close, and as it decreases, they tend to open. This applies to both grand and upright models.

Theme Zero Setting

As was stated above, the theme zero setting is one degree louder than the accompaniment. When adjusting the theme zero setting, follow the same procedure as when setting the accompaniment. It will be noticed that the loud pedal is on with the first run of notes on the theme arpeggio, then off with the next run; this makes it considerably harder to play than the accompaniment run with the loud pedal off. The reason is that the notes are shorter and consequently play faster. In the second run of the accompaniment with the loud pedal off, there are nineteen notes played, and in the theme run, there are fifteen shorter notes played in one-half the space. It is easily seen that more pressure is needed to play the second run of the theme with the pedal off and the shorter notes. If the theme zero is then set so that it plays about every other note on the second run with the pedal off, the one degree louder has been obtained as described in test No. 8, Theme Zero Setting, page 24, of the service manual. If both accompaniment and zero settings are properly regulated, the accordion dynamic chord test which follows will meet the requirements of the chord test in the roll. Note tests carefully, and also test reroll and repeat in the order given in the service manual.

Key Slip Control Levers

Test key slip manual control levers to see that they move freely and do not bind. In extremely damp weather, the bushings may become swollen and the levers may bind. This binding must be eliminated, as any constraint on the freedom of these levers will affect the movement of the knife valves in both the accompaniment and theme regulators.

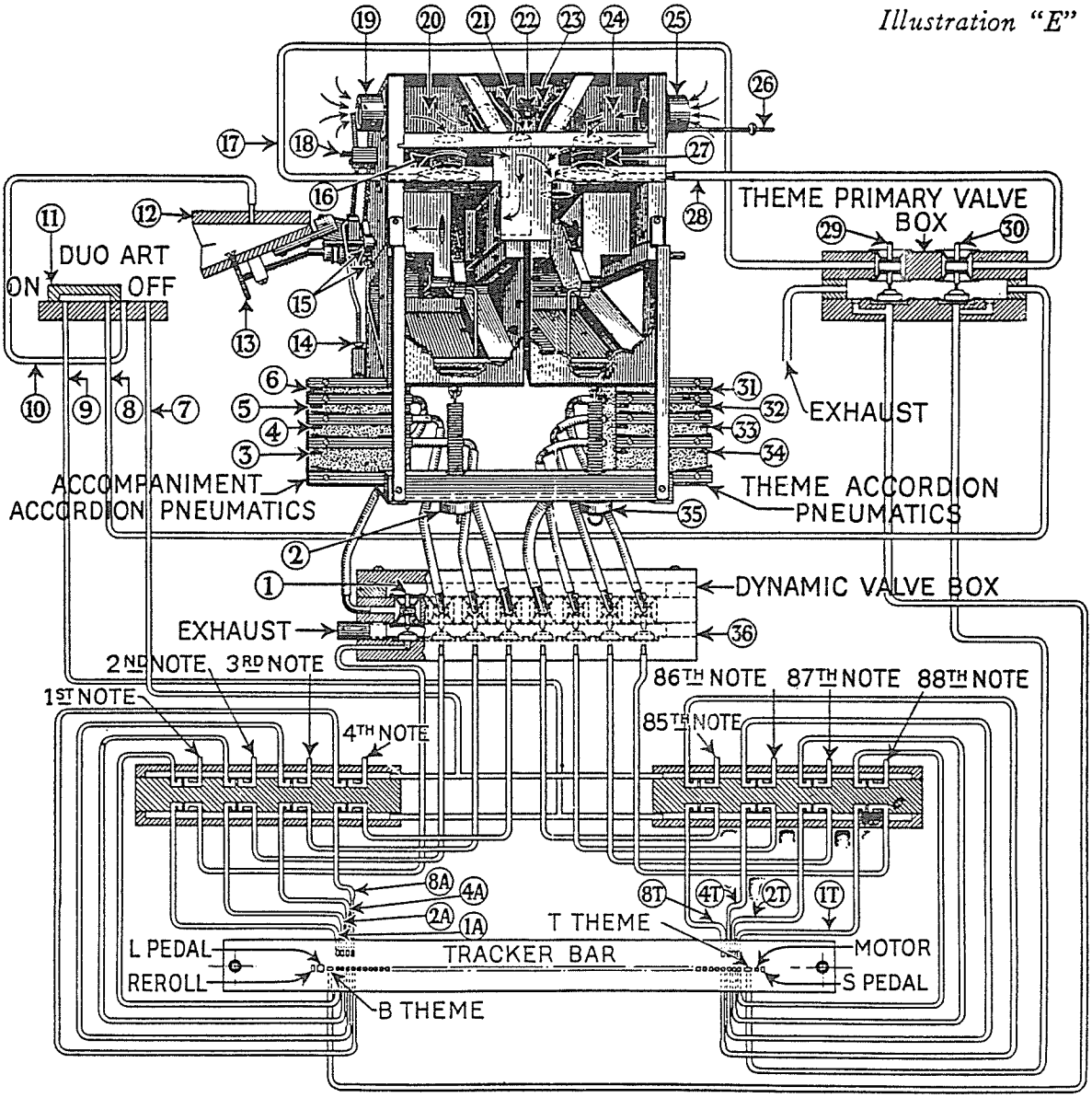
Now a final word about any and all adjustments and regulations of the reproducing mechanism: know what you are doing and why you are doing it. Be honest with yourself; if you do not know how to make the adjustments, do not attempt them. It will be safer.

Editor: This concludes Wilberton Gould's discussion of The Duo-Art. On the next pages will be found relevant reproductions from The 1927 Duo-Art Service Manual and other illuminating illustrations of The Duo-Art.

Illustration "E"
from the 1927 Duo-Art Service Manual (page 17)

UPRIGHT DUO-ART EXPRESSION BOX AND CONNECTIONS

Illustration "E"



EDITOR: Continuous changes were made to the Duo-Art system. For Duo-Art mechanisms produced prior to 1926 and for additional information on all Duo-Art systems, refer to

1. 1925 Duo-Art Service Manual; 2. Preliminary Instruction Pamphlet– Operation of Duo-Art Dynamic Contro and How To Test and Adjust. This pamphlet contains additional detailed information and a more detailed diagram of the Duo-Art control system; 3. For the combination foot impelled and electric Duo-Art, refer to Export Supplement To Service Manual, No. 3 of 1927. The expression box is different in this type from the standard Duo-Art expression box shown in the Illustration No. "E" on this page.

NOTE: 1, 2 and 3 are included in this publication.

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.'

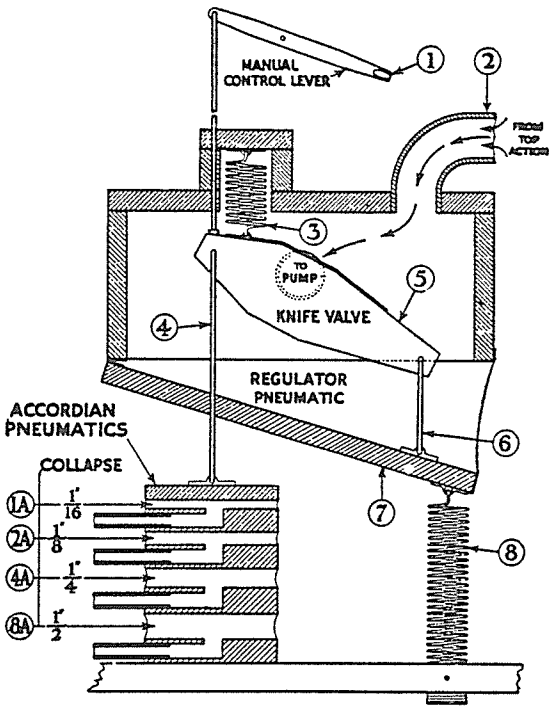
CHART SHOWING DYNAMIC GRADATIONS

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.

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

Illustration "G"

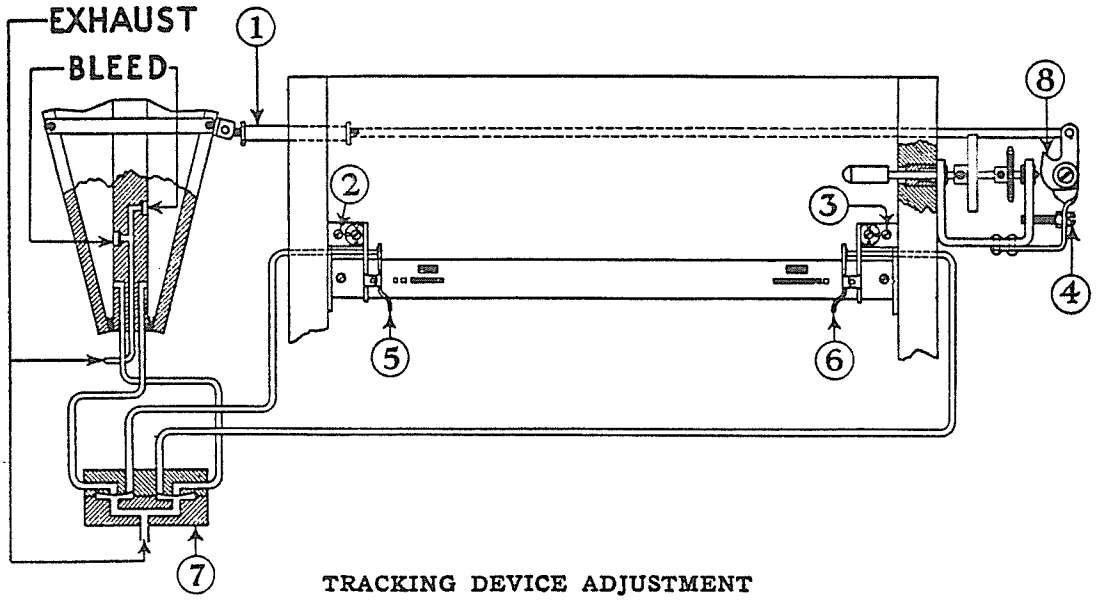


Key Chart

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.

TRACKING DEVICE

Illustration "L"



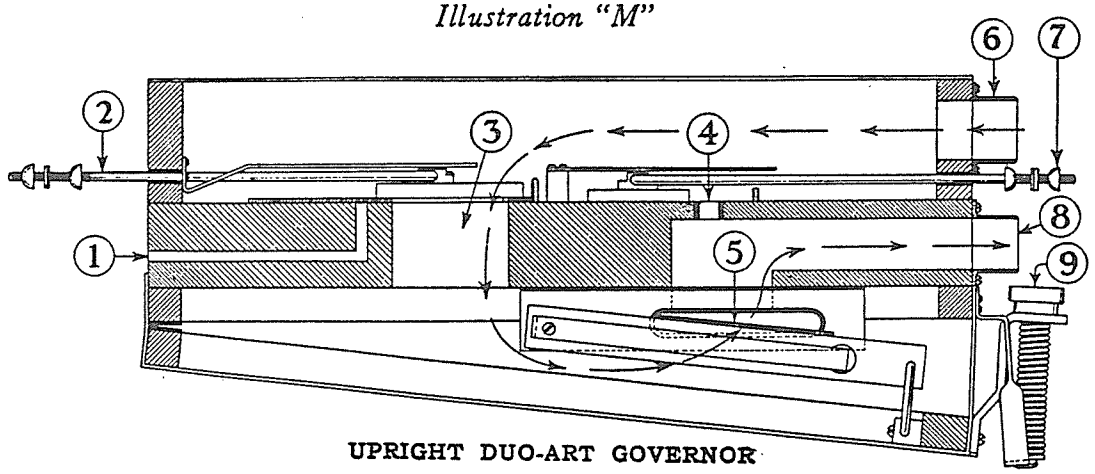
TRACKING DEVICE ADJUSTMENT

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

Illustration "M"



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

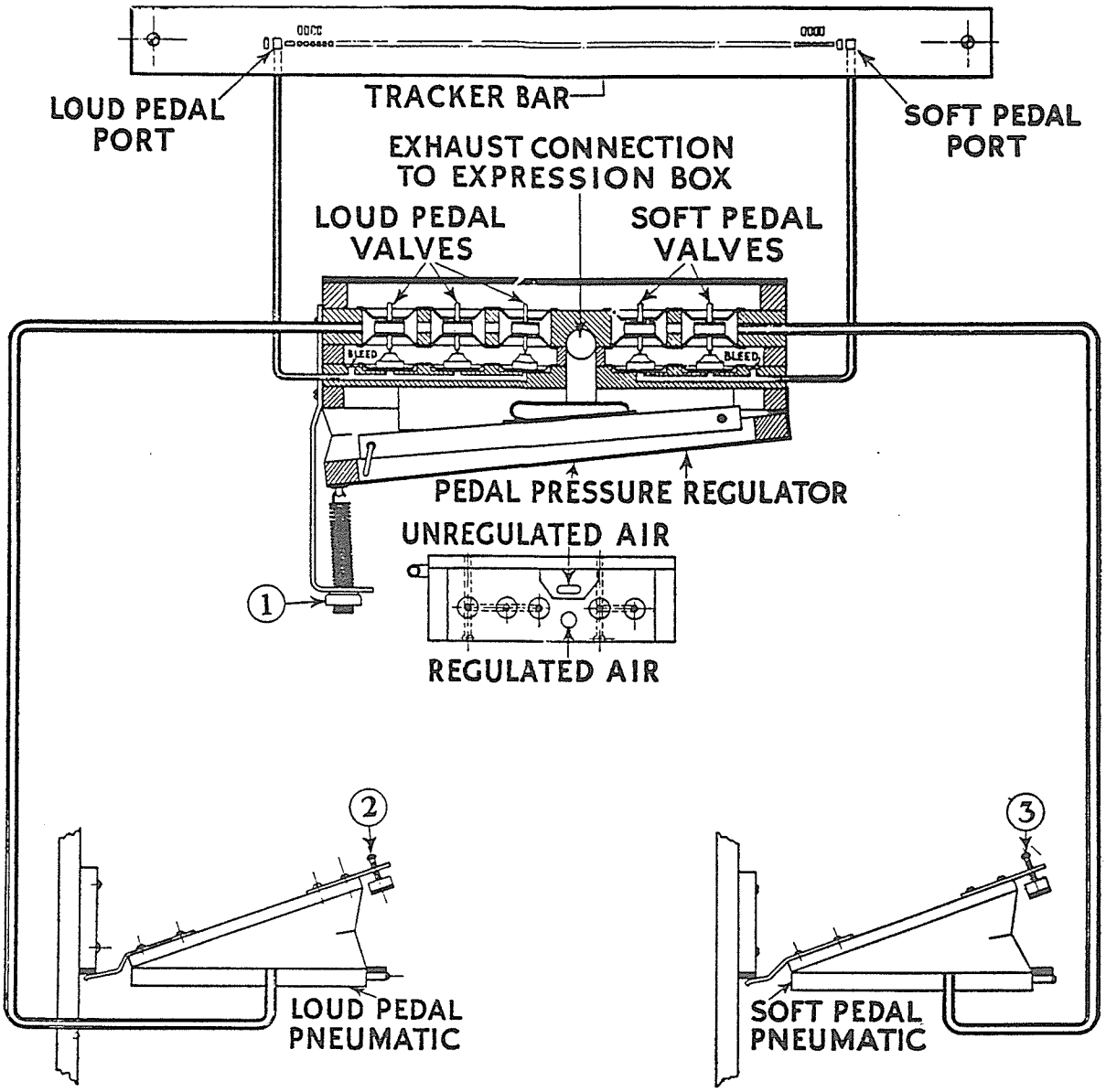
Test No. 4, Tempo Test

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.

UPRIGHT LOUD AND SOFT PEDAL CONTROL

Illustration "N"



UPRIGHT LOUD AND SOFT PEDAL 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.

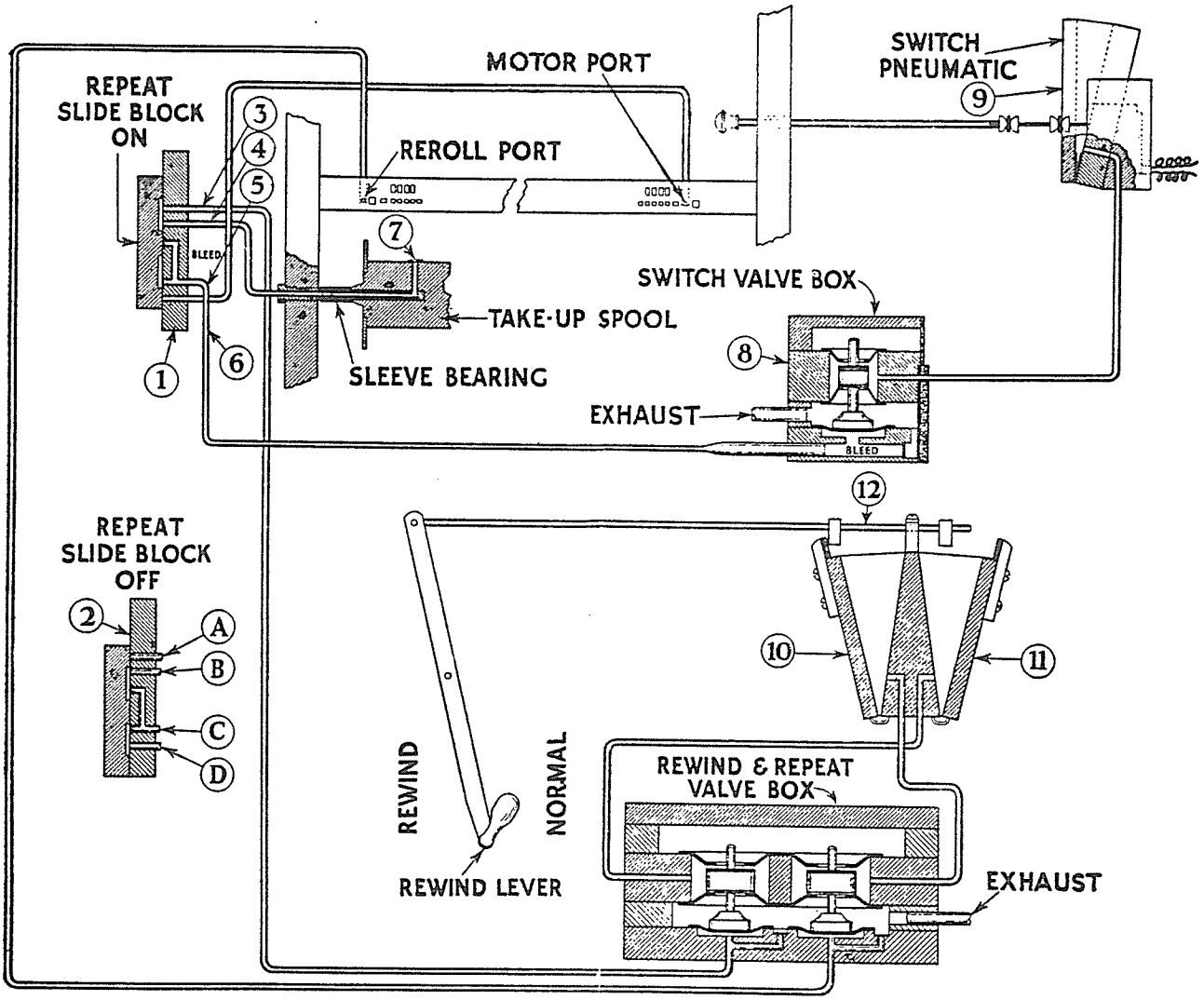
It will be noted that there are three loud pedal valves. The reason for this is to shorten the valve motion insuring quietness and speed in loud pedal operation. The soft pedal does not operate as fast as the loud pedal, therefore, two valves are sufficient for this device. Illustrated below the pressure 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.

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 ⅜-inch from normal position.

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.

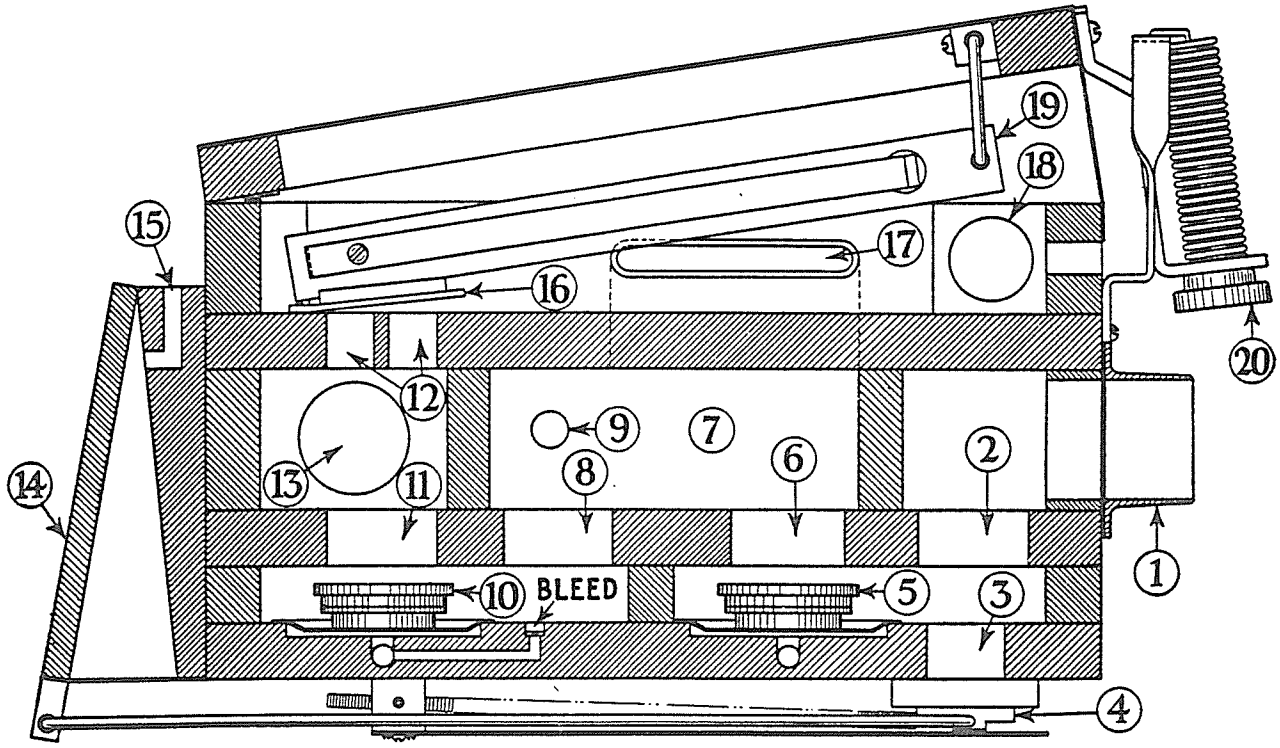
When port No. 7 is exposed by music roll, atmosphere enters through tube 'B' which also has a bleed, combined with the atmosphere entering bleed in tube 'C' neutralizes and overcomes the bleed in the switch valve in Box No. 8 and causes the valve to raise, thereby collapsing pneumatic No. 9 and cutting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

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.

GRAND DUO-ART MODULATOR PNEUMATIC

Illustration "P"



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.

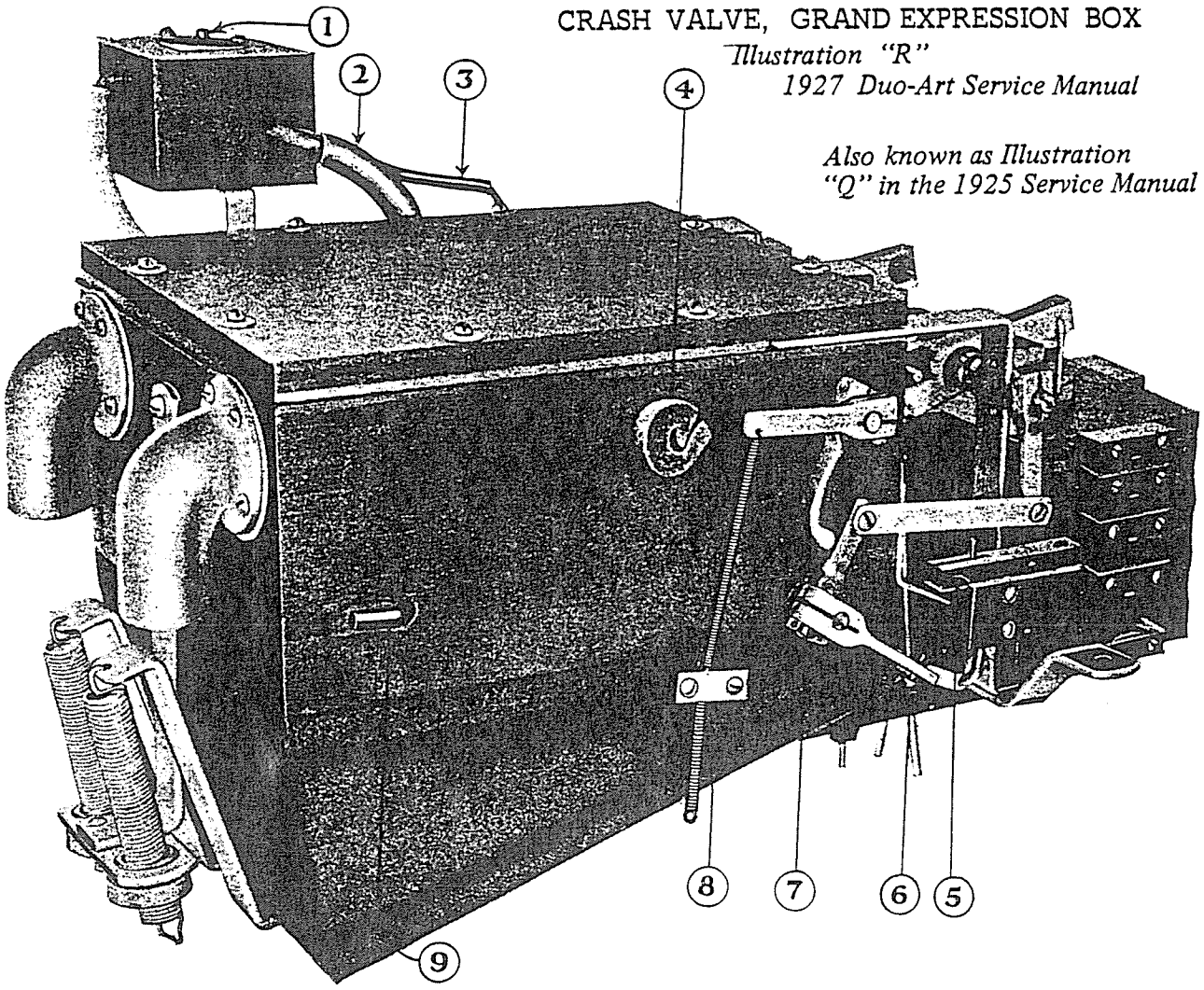
The action cutout valve No. 5 closes on "reroll' and pneumatic No. 14, which operates slide covering channel No. 3, collapses, which lets in the outside air and eliminates any excessive load on the electric motor.

The loud pedal is supplied from port No. 18.

CRASH VALVE, GRAND EXPRESSION BOX

Illustration "R"
1927 Duo-Art Service Manual

Also known as Illustration "Q" in the 1925 Service Manual



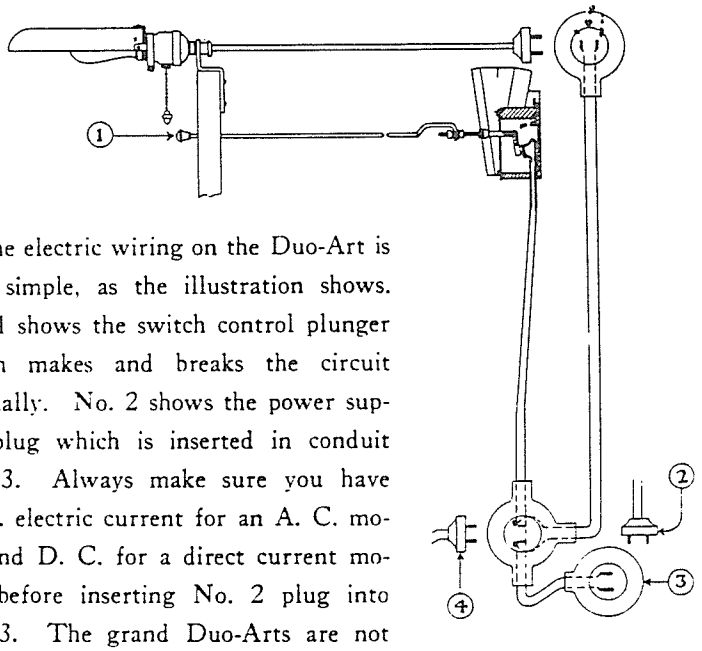
CRASH DEVICE, GRAND EXPRESSION BOX

Refer to Illustration "R"

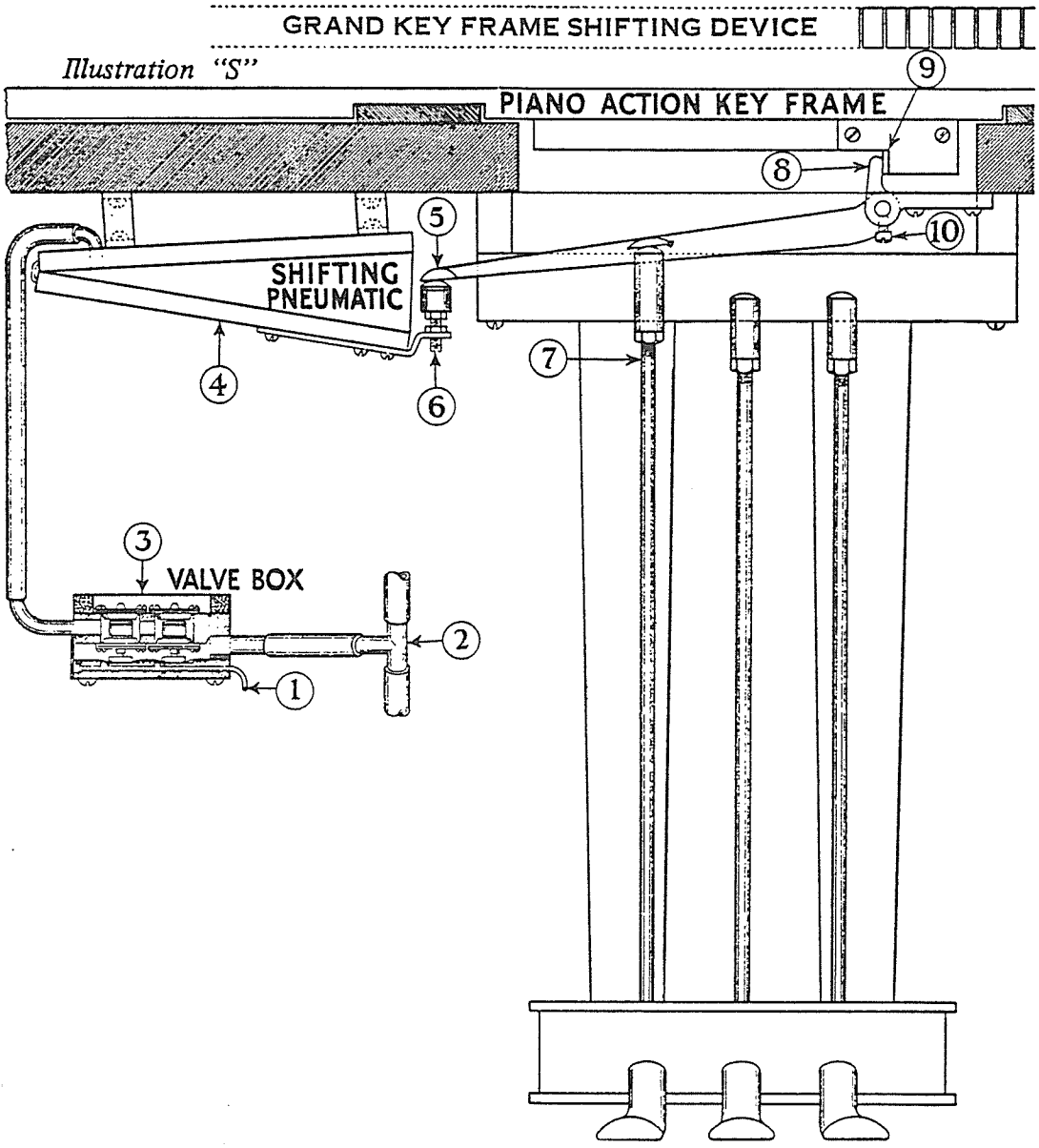
The Grand Duo-Art Expression Box is constructed differently from the upright box, due to the difference in design of the two instruments, but the basic principles are the same in both expression boxes. The grand expression box has a crash valve which functions when power No. 15 on the Theme side appears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



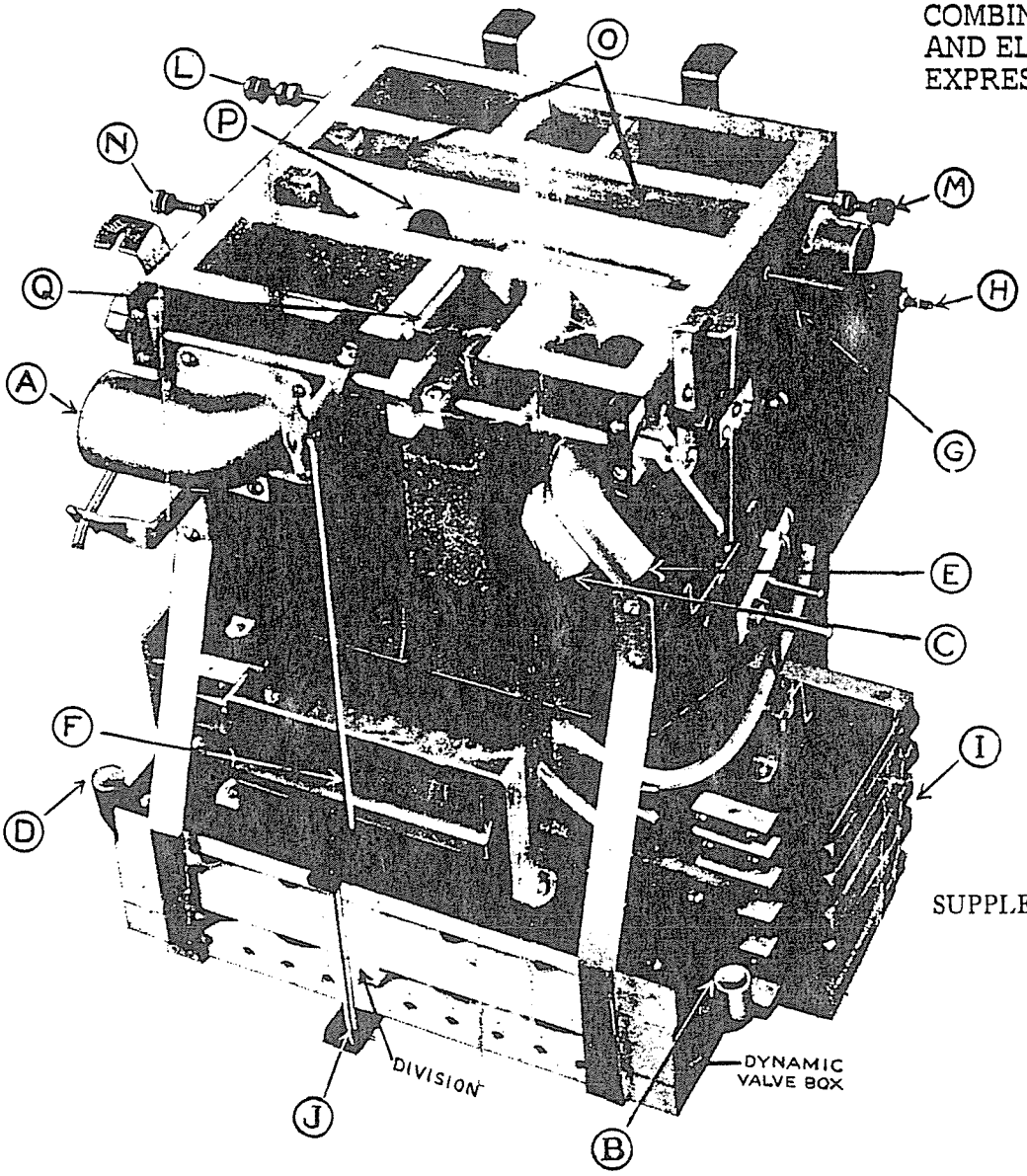
The electric wiring on the Duo-Art is very simple, as the illustration shows. No. 1 shows the switch control plunger which makes and breaks the circuit manually. No. 2 shows the power supply plug which is inserted in conduit No. 3. Always make sure you have A. C. electric current for an A. C. motor and 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.



Above illustration, "S," shows the grand key frame shifting device; this was installed only in the late model grand Duo-Art.

Illustration "T"

COMBINATION FOOT IMPELLED AND ELECTRIC DUO-ART EXPRESSION BOX



SUPPLEMENT TO SERVICE MANUAL
No. 3

COMBINATION FOOT IMPELLED AND ELECTRIC DUO-ART EXPRESSION BOX

REFER TO ILLUSTRATION "T"

The combination foot impelled and electric Duo-Art expression box is slightly different from the standard Duo-Art expression box found on page 17, illustration "E," with treatise on pages 19 and 20. The difference is as follows:

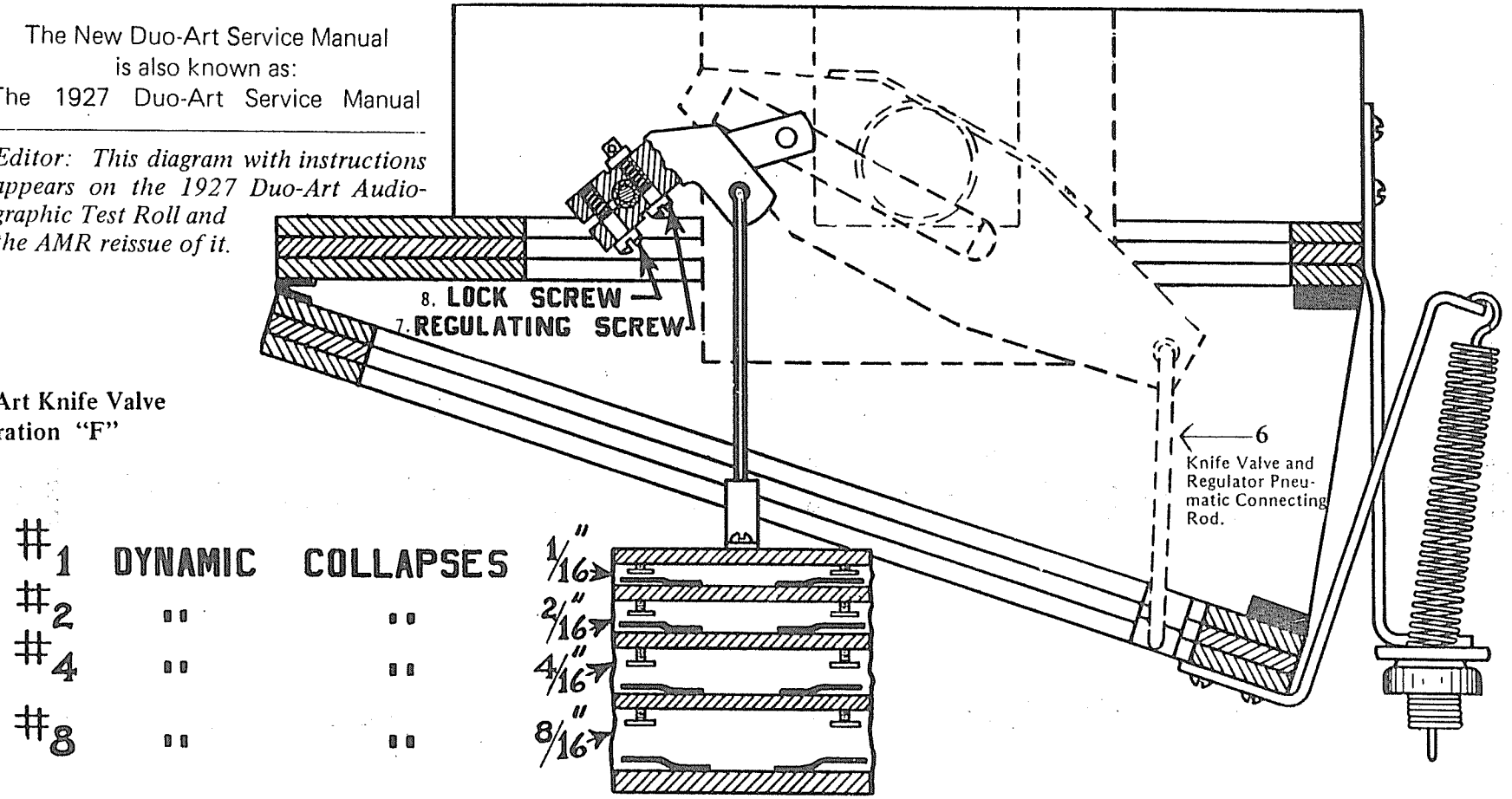
Spill valve pneumatic "F" with connections and pneumatic "G" which opens a channel between the unregulated supply and the Theme chamber with slide valve "H" opening port "P." The two ports "O" are used for graduated expression manually, with slide valves "L" and "M" which are connected to the "Bass" and "Treble" levers on the keybed, when used as a pianola piano. The Dynamic or Expression primary Valve Box is divided near the center with four valves on the Theme side and five on the Accompaniment side, adding an additional ¼ inch accordion pneumatic on the Accompaniment side. Nipple "B" is the exhaust supply for the Accompaniment side of the Dynamic Valve Box and nipple "D" the exhaust supply for the Theme side.

Further information on illustration "T" may be found in the special supplement to the 1927 Duo-Art service manual; this supplement is available through the publishers of this book.

The New Duo-Art Service Manual
is also known as:
The 1927 Duo-Art Service Manual

Editor: This diagram with instructions appears on the 1927 Duo-Art Audiographic Test Roll and the AMR reissue of it.

Duo-Art Knife Valve Illustration "F"



INSTRUCTIONS FOR ACCOMPANIMENT ZERO SETTING

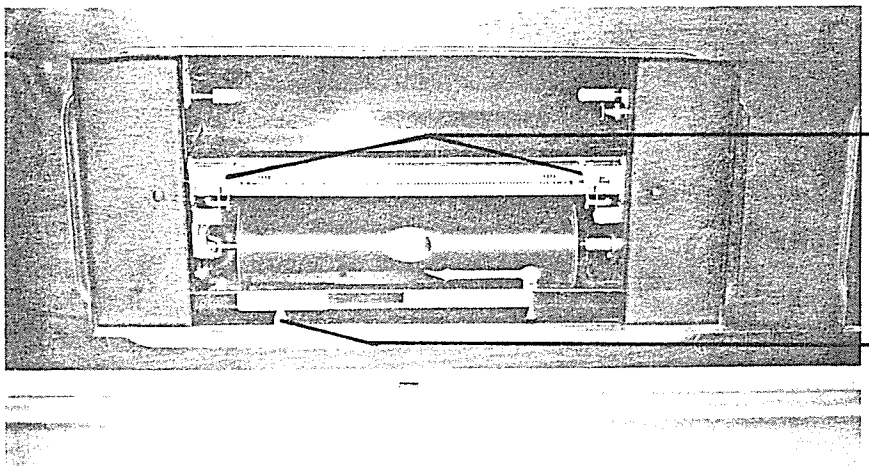
First see that dynamic lever, on extreme left of keyboard, is on normal. All dynamics should be open. Loosen lock screw by turning to the left. Start piano and turn regulating screw to the right to make "soft" to the left "loud" on the GRAND. On the UPRIGHT piano to the left to make "soft" to the right "loud." When regulation is completed tighten lock screw by turning to the right locking zero setting. For treatise explaining more detail of the zero setting see pages 23 and 24 New Duo-Art Service Manual No. 3.

From the 1927 Duo-Art Service Manual, No. 3, pages 23 and 24: "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." The next test is " . . . Theme Zero Setting . . . theme must be one degree louder."

ACCOMPANIMENT AND THEME ZERO SETTING ADJUSTMENT

THE PHOTOS ON THE FOLLOWING PAGES ARE OF AN ENGLISH DUO-ART UPRIGHT, IN THE COLLECTION OF MR. W. MURBACH OF GENEVA, SWITZERLAND.

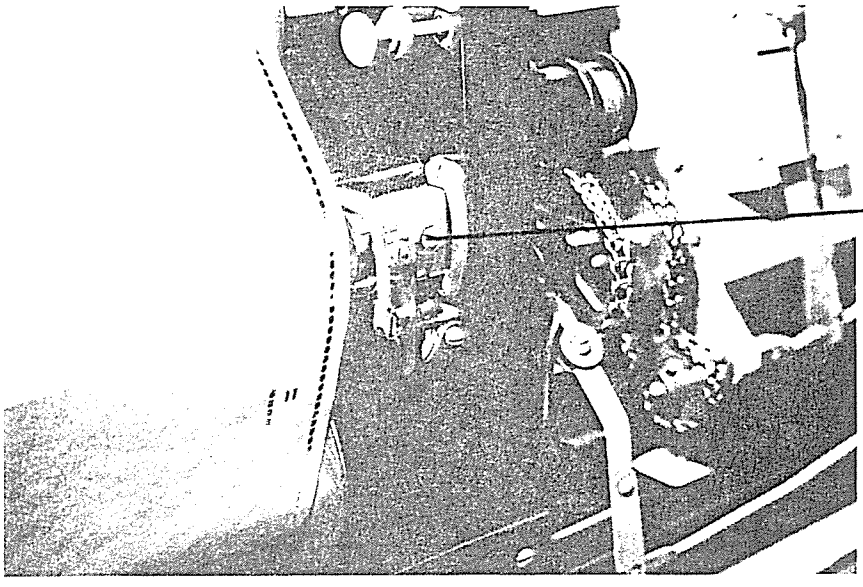
THE TRADEMARK OF DUO-ART PIANOS IN GREAT BRITAIN



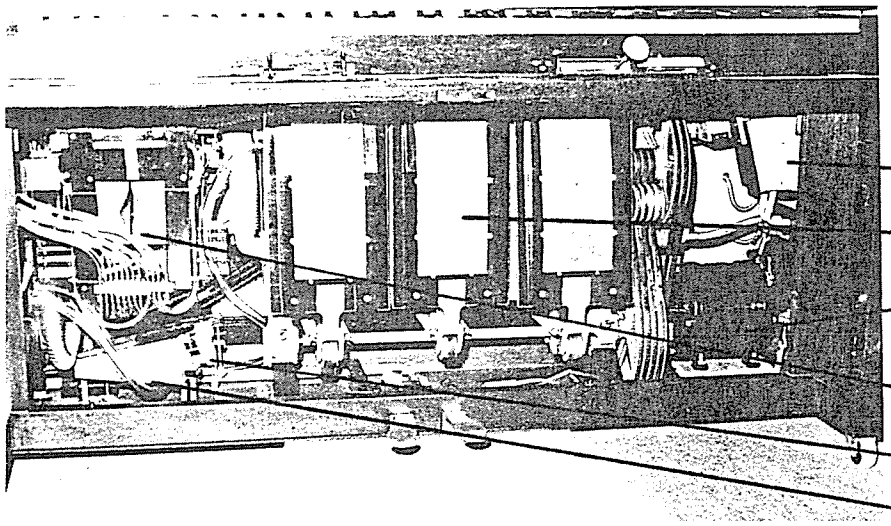
SPOOL BOX

TRACKER EARS

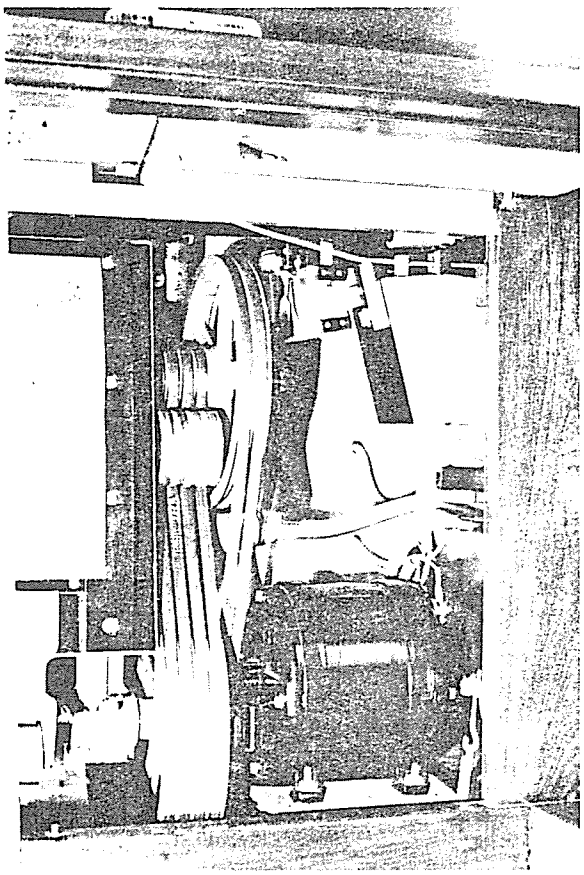
TRANSPOSING INDICATOR



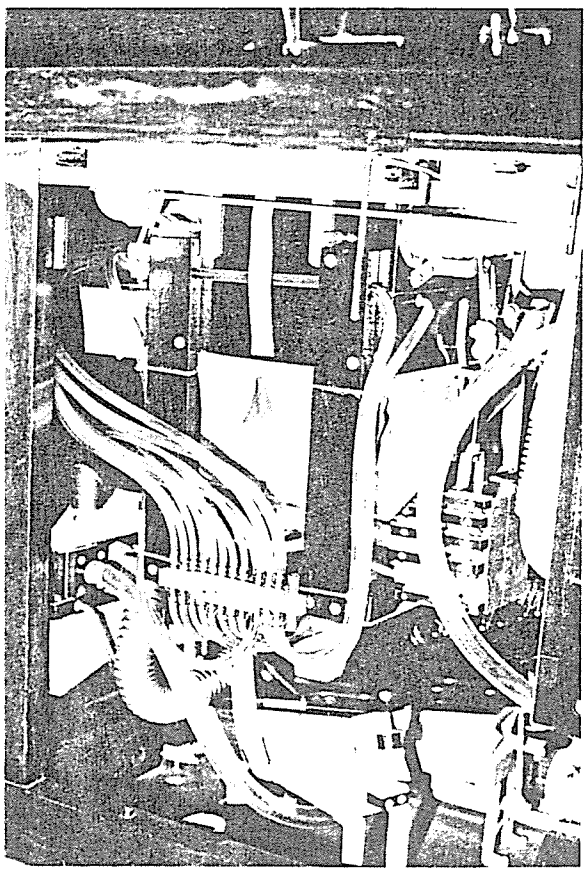
TRACKER EAR TREBLE SIDE

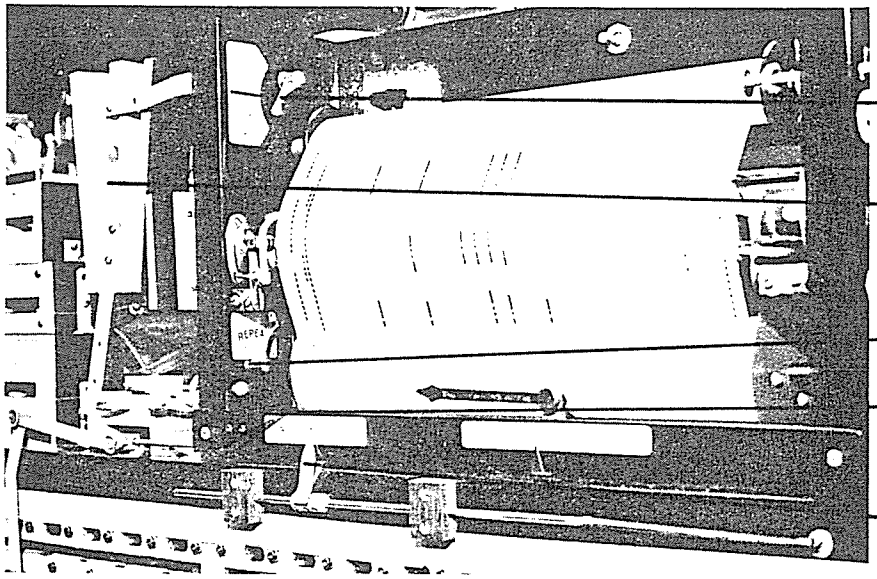


LOWER HALF OF THE PIANO



CLOSE-UP OF MOTOR
AND PULLEY ARRANGEMENT





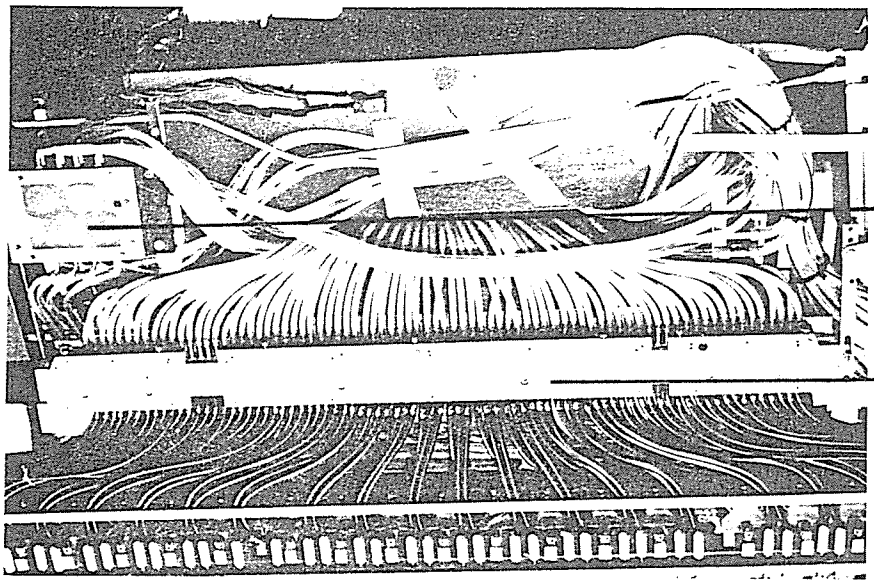
PLAYING MODE SWITCH

TRACKER PNEUMATIC

REPEAT ON - OFF SWITCH

A FINGERTIP ON THESE HOLES SHIFTS THE TRANSPOSING DEVICE ONE NOTE HIGHER OR LOWER.

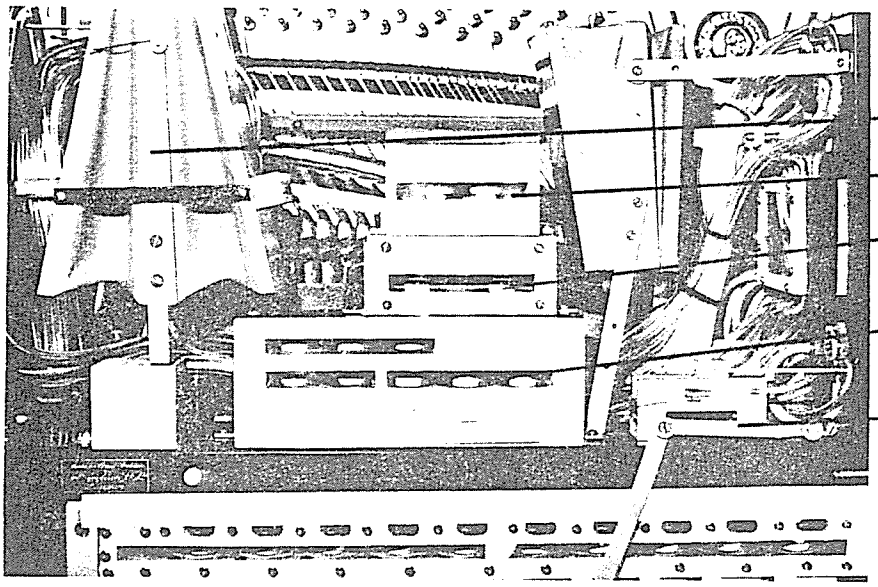
TRANSPOSING INDICATOR



VIEW FROM THE BACK SIDE OF THE SPOOL BOX

DUO-ART CUTOFF POUCH BLOCK

TRANSPOSING DEVICE. BY THE MOVEMENT OF THE TWO WOODEN BARS, THE PIANO CAN PLAY ONE NOTE HIGHER OR LOWER THAN NORMAL.



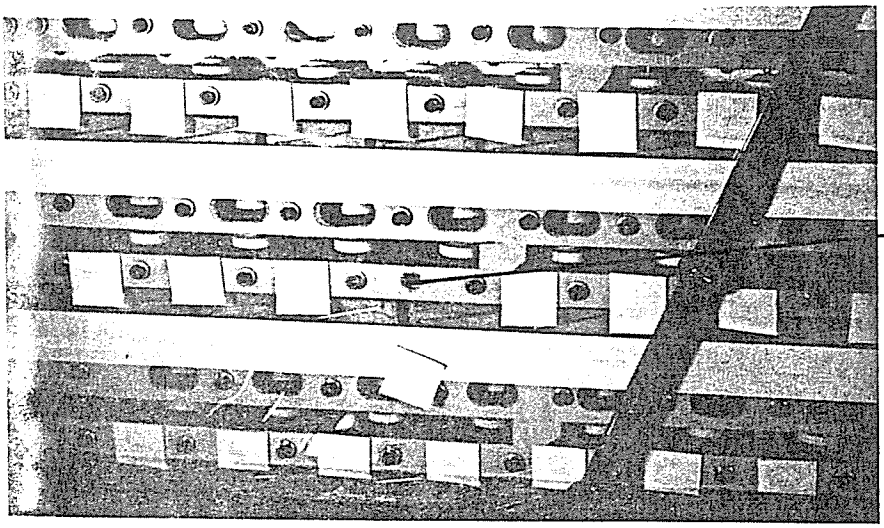
TRANSPOSING PNEUMATIC

TRANSPOSING PRIMARY VALVE BOX.

REWIND AND REPEAT ON - OFF PRIMARY VALVE BOX.

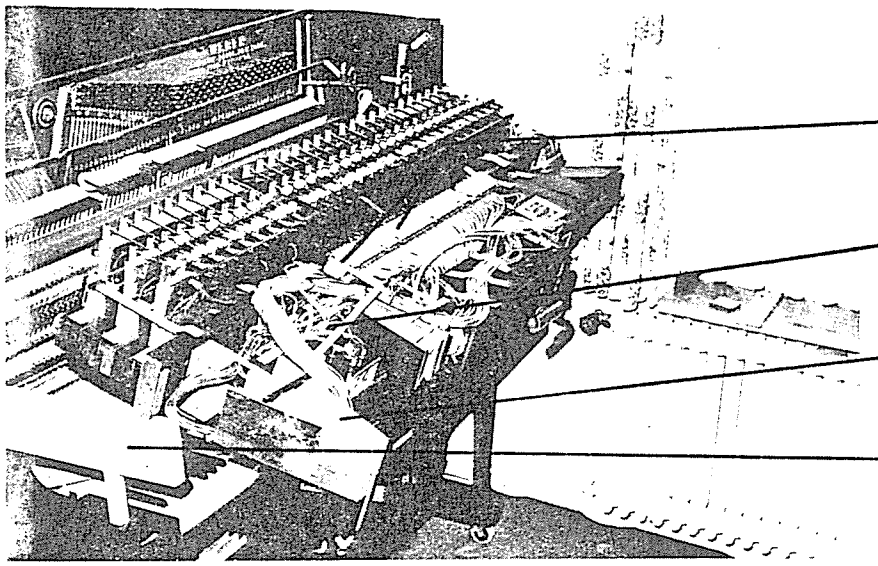
THEMODIST AND TRACKER PRIMARY VALVE BOX

ON-OFF SLIDE SWITCH FOR DISCONNECTING REWIND AND MOTOR SHUTOFF FUNCTIONS. THIS DEVICE IS VERY PRACTICAL FOR PLAYING ROLLS WITH TORN EDGES.



CLOSE UP PNEUMATIC STACK

ONE BLEED IS EXPOSED
FOR CLEANING

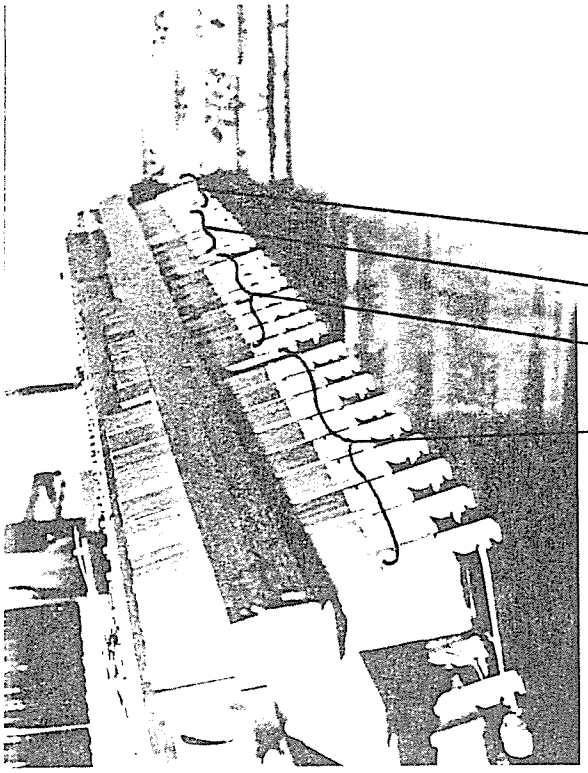


TRANSPOSING DEVICE

TRANSPOSING LEVER

TRANSPOSING PNEUMATIC

SPECIAL DEVICE SO THE WHOLE
PNEUMATIC STACK CAN BE REMOVED
FROM THE PIANO FOR MAKING
ADJUSTMENTS.



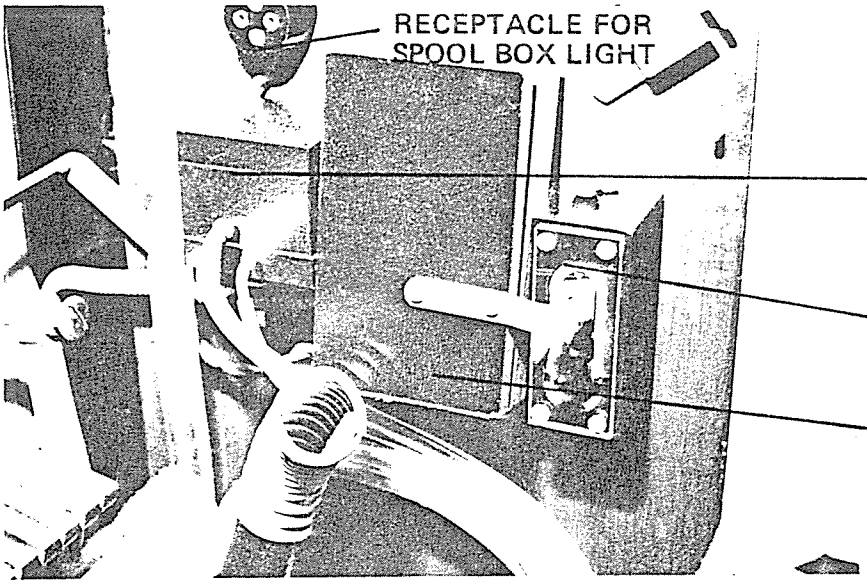
THIS PNEUMATIC STACK FEATURES
4 DIFFERENT GROUPS OF PNEUMATICS.
(4 DIFFERENT SIZES)

1st GROUP (SMALLEST)

2nd GROUP

3rd GROUP

4th GROUP (LARGEST)

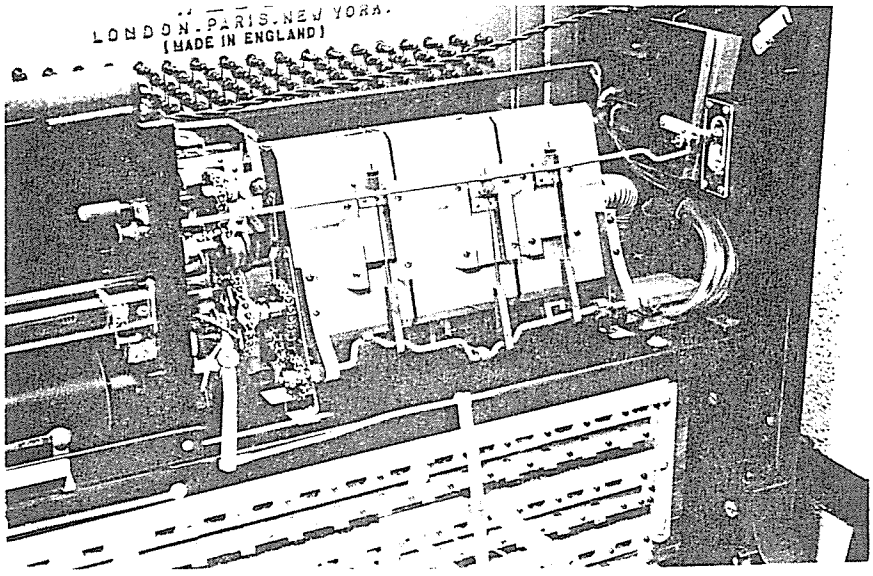


MOTOR SHUT OFF DEVICE

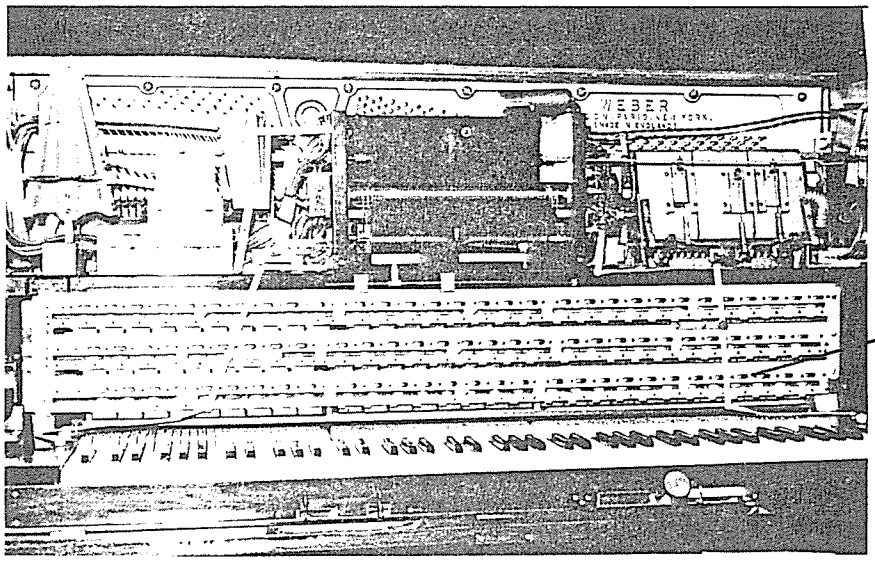
MOTOR SHUT OFF
MAIN VALVE

ELECTRIC SNAP SWITCH

MOTOR SHUT OFF PNEUMATIC



CLOSE UP: WIND MOTOR AND GEARING



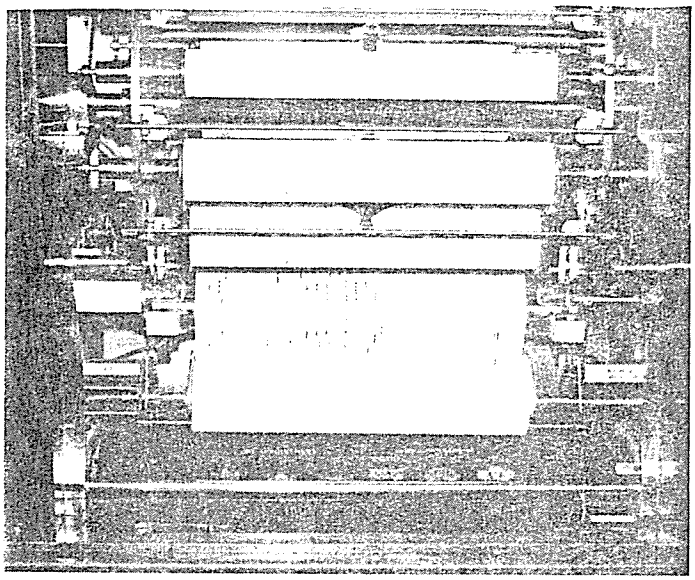
THE UPPER HALF OF THE PIANO

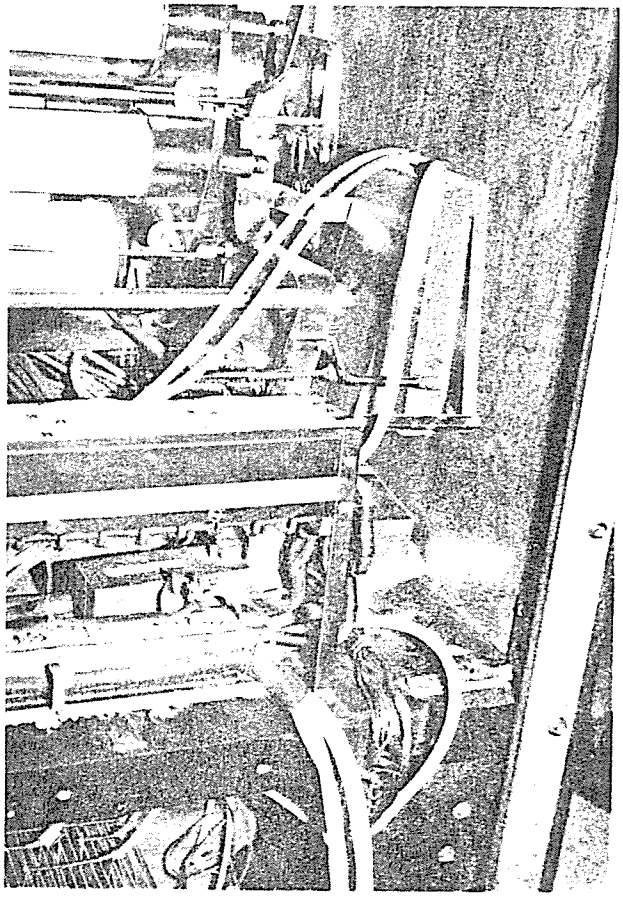
3 DECK PNEUMATIC STACK
COVERED WITH GLASS PANELS.
THE SEAL BETWEEN GLASS PANEL
AND THE STACK IS SOFT LEATHER.

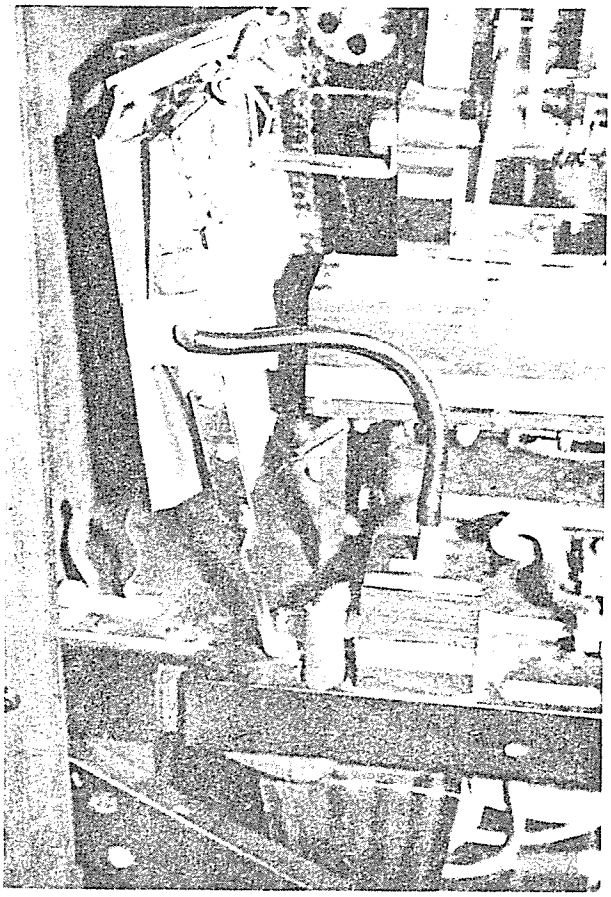
DUO-ART CONCERTOLA MECHANISM

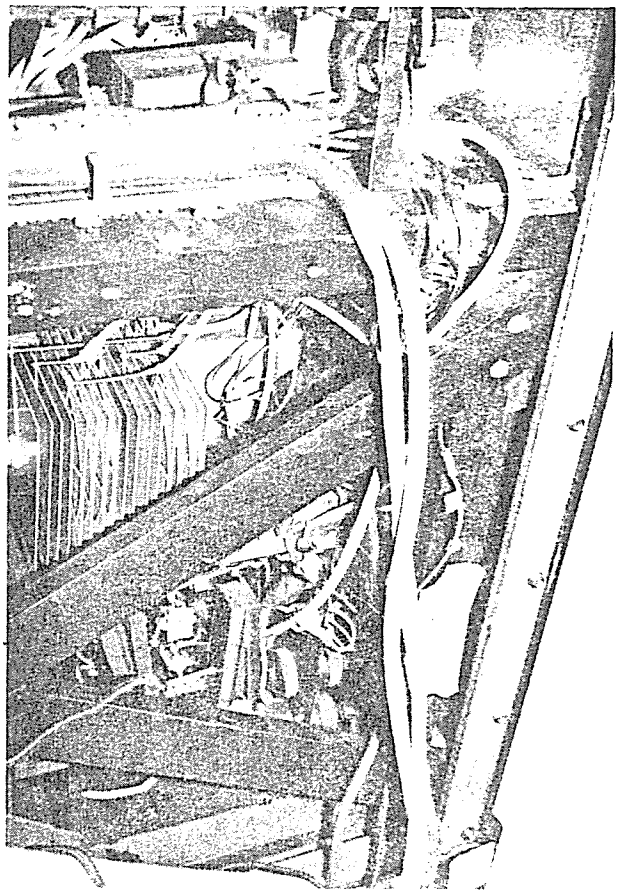
from the collection of Dr. James Heyworth.

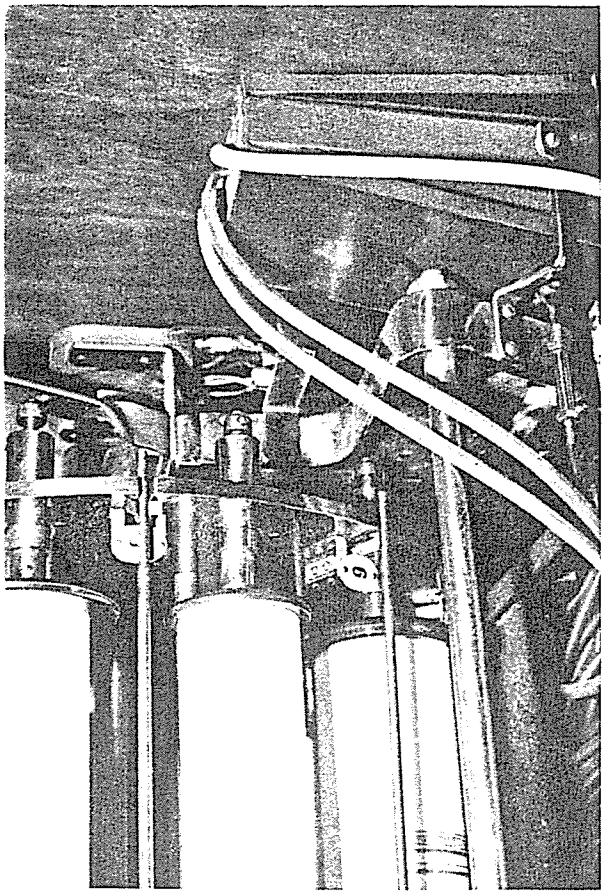
Also see ad on inside of front cover.

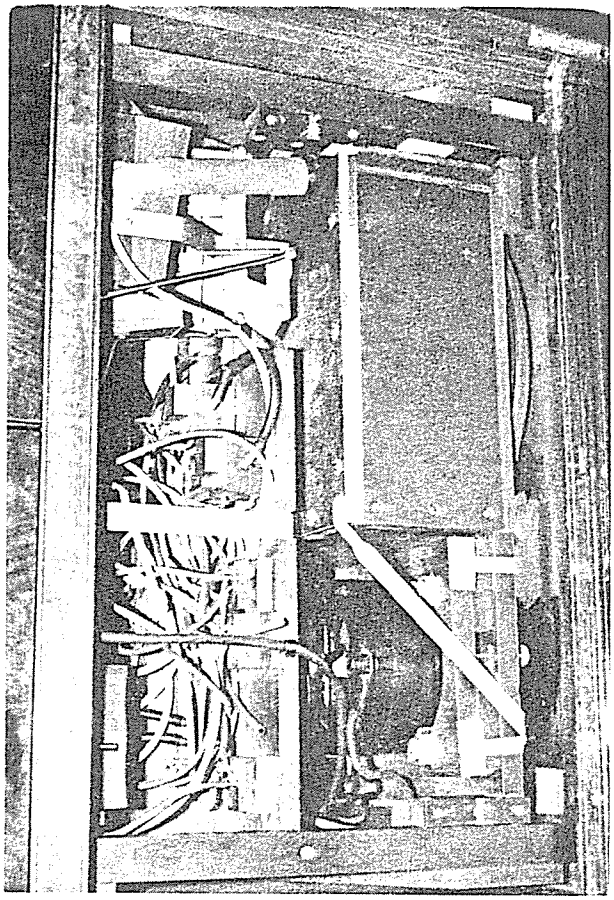


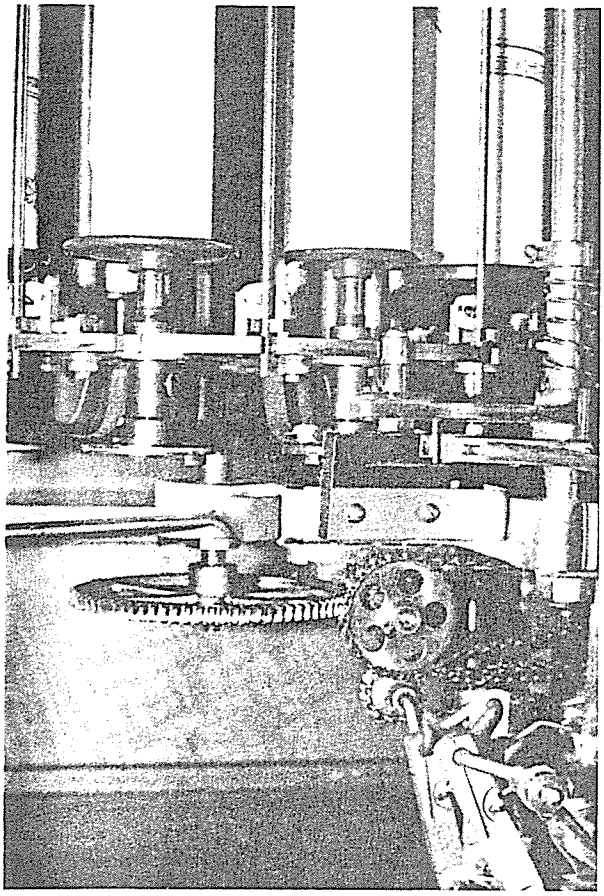


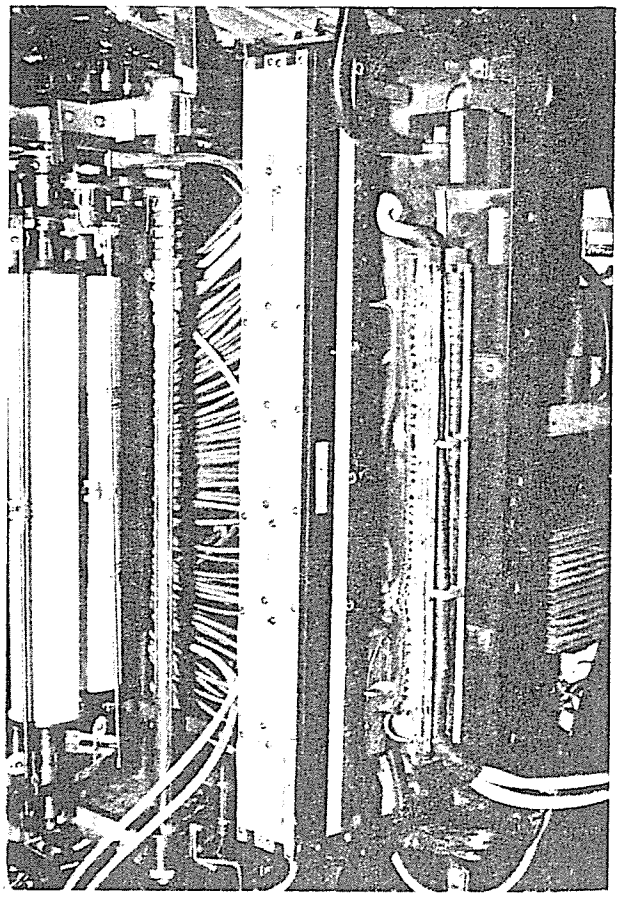


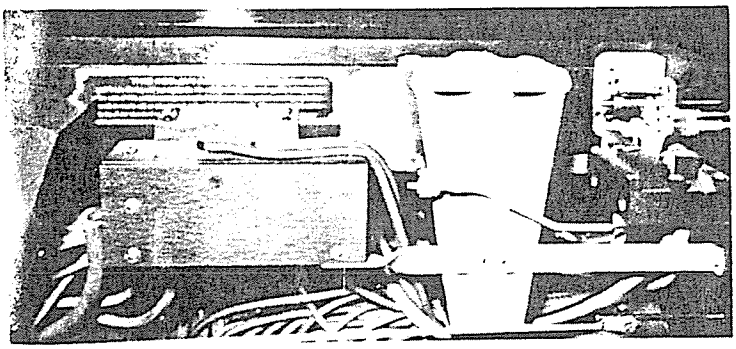




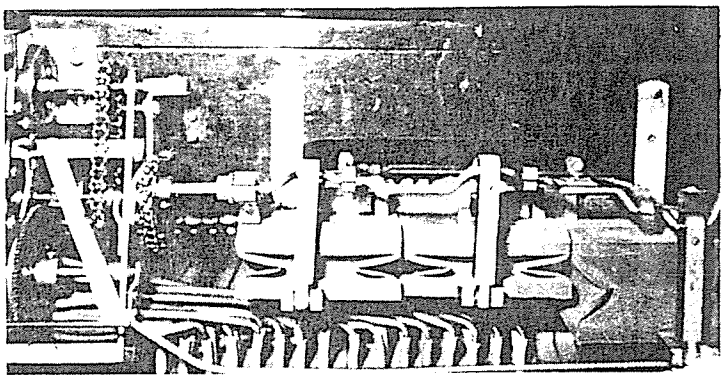






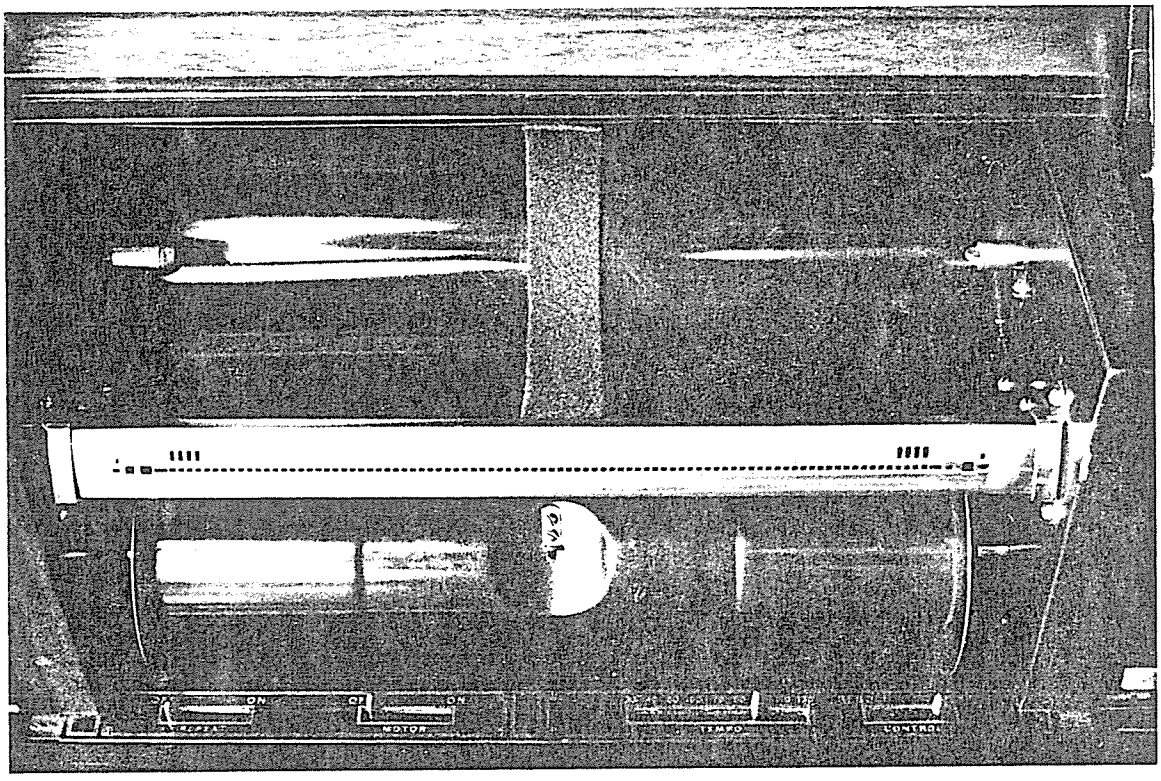


Left of spool box early 1932 Steinway Duo-Art



Right of spool box early 1932 Steinway Duo-Art

Note the difference in the mechanism between this and the slightly later model, as shown on the inside of the back cover.



Spool box, 1932–33 Steinway Duo-Art. See inside of back cover for two other photos showing to the left and right of this spool box.

TUBING DIAGRAM FOR DUO-ART GRAND REPRODUCING ACTION - 1925 MODEL - TOP VIEW - ABOVE KEY BED

NOTES

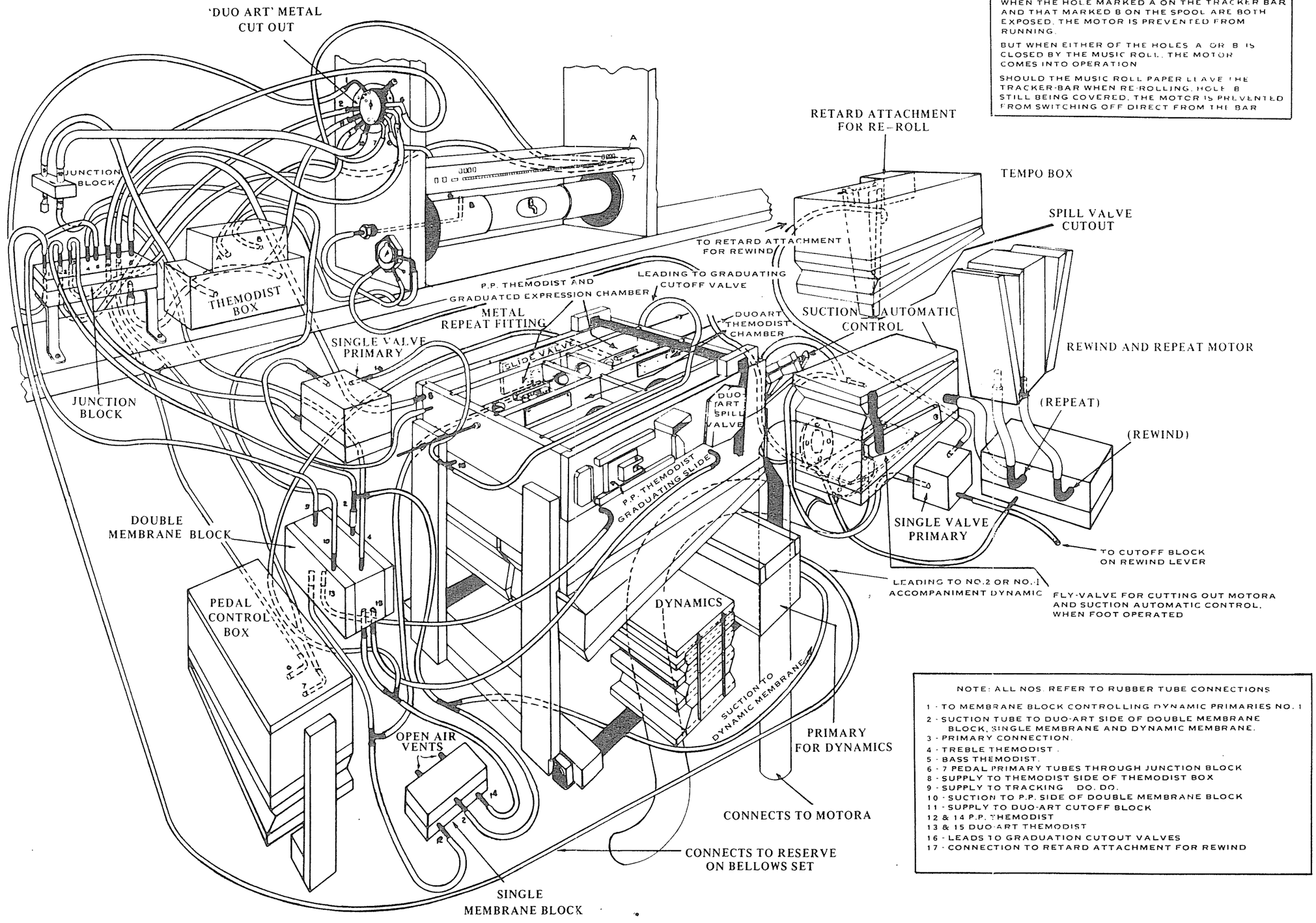
① ON MODELS 1924 & EARLIER, A SECOND CUT-OFF VALVE BLOCK SIMILAR TO UNIT "X" IS USED TO CUT OFF NOTES 1-2-3-4 & 85-86-87-88 WHEN DUO-ART IS IN "ON" POSITION (UNIT "W") THE CONTROL LINE OF THIS UNIT TEES INTO LINE (123)

② ON MODELS 1925 TO END OF PRODUCTION THE ABOVE NOTES ARE NOT USED AS SHOW ON THIS DRAWING.

DIAGRAM SHOWING OPERATIONS OF PEDAL ELECTRIC DUO ART CONTROLS.

REDRAWN BY
SCOTT ECKHART FOR
AMP PUBLISHING CO.
1984

AEOLIAN CO. Ltd.
Hayes, Middlesex



NOTES
ON THE ACTION OF THE DECOY BOX

WHEN THE HOLE MARKED A ON THE TRACKER BAR AND THAT MARKED B ON THE SPOOL ARE BOTH EXPOSED, THE MOTOR IS PREVENTED FROM RUNNING.

BUT WHEN EITHER OF THE HOLES A OR B IS CLOSED BY THE MUSIC ROLL, THE MOTOR COMES INTO OPERATION

SHOULD THE MUSIC ROLL PAPER LEAVE THE TRACKER-BAR WHEN RE-ROLLING, HOLE B STILL BEING COVERED, THE MOTOR IS PREVENTED FROM SWITCHING OFF DIRECT FROM THE BAR

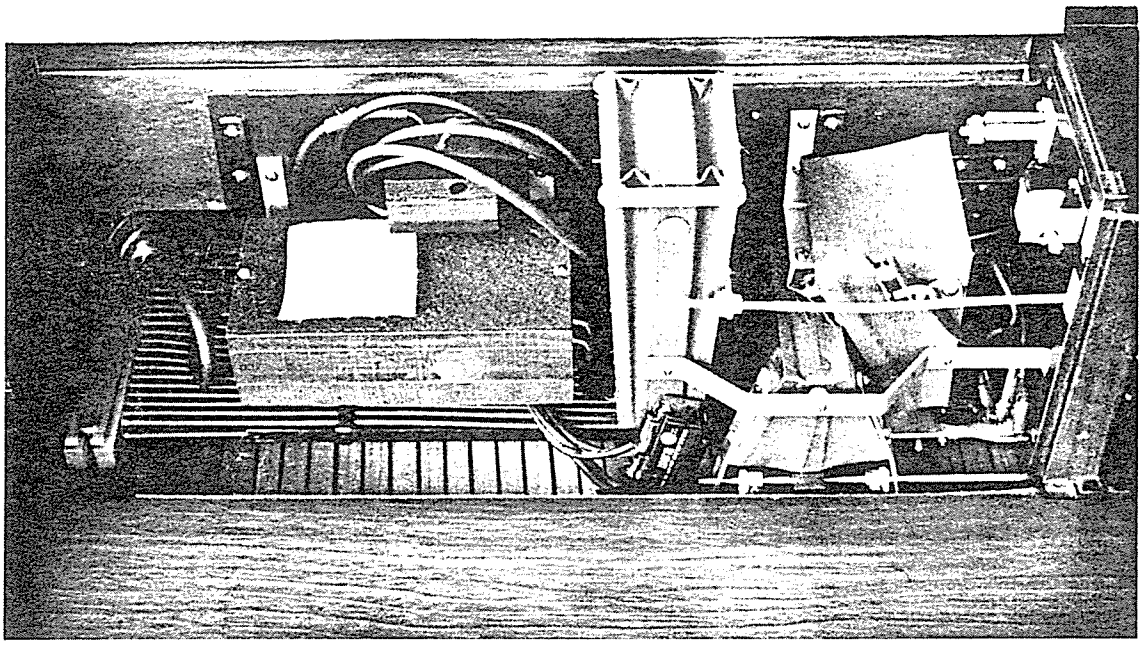
NOTE: ALL NOS. REFER TO RUBBER TUBE CONNECTIONS

1 - TO MEMBRANE BLOCK CONTROLLING DYNAMIC PRIMARIES NO. 1
2 - SUCTION TUBE TO DUO-ART SIDE OF DOUBLE MEMBRANE BLOCK, SINGLE MEMBRANE AND DYNAMIC MEMBRANE.
3 - PRIMARY CONNECTION.
4 - TREBLE THEMODIST.
5 - BASS THEMODIST.
6 - 7 PEDAL PRIMARY TUBES THROUGH JUNCTION BLOCK
8 - SUPPLY TO THEMODIST SIDE OF THEMODIST BOX
9 - SUPPLY TO TRACKING DO. DO.
10 - SUCTION TO P.P. SIDE OF DOUBLE MEMBRANE BLOCK
11 - SUPPLY TO DUO-ART CUTOFF BLOCK
12 & 14 P.P. THEMODIST
13 & 15 DUO-ART THEMODIST
16 - LEADS TO GRADUATION CUTOUT VALVES
17 - CONNECTION TO RETARD ATTACHMENT FOR REWIND

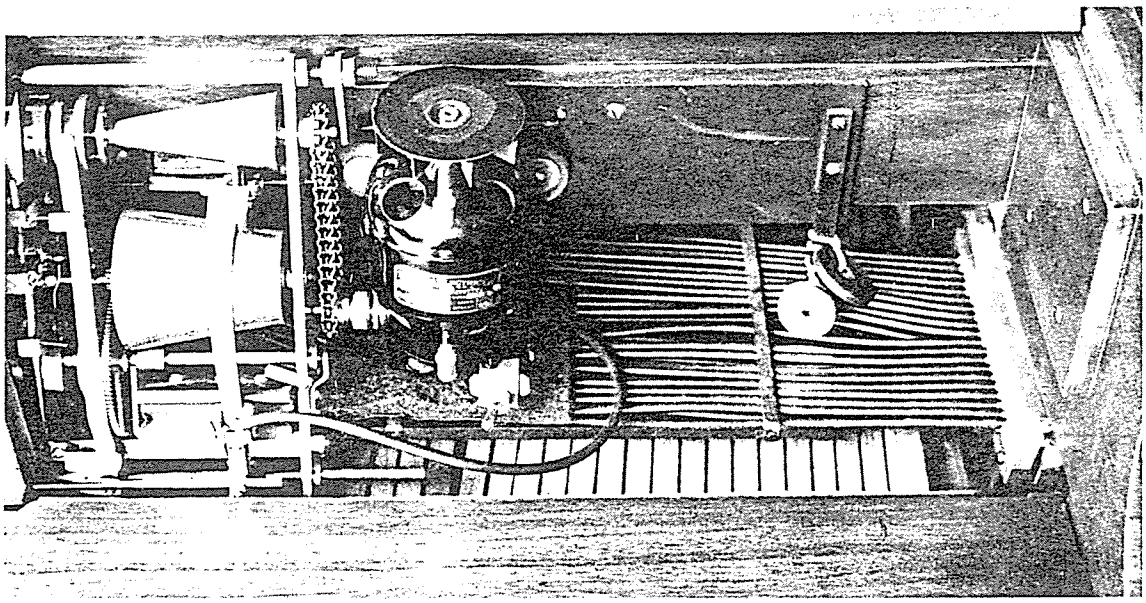
NOTES

MEMO

MEMO



Left side of spool box, 1932 Steinway Duo-Art. Note the tracking pneumatic connects directly to the tracker bar.



Right side of spool box, 1932 Steinway Duo-Art. Electric roll drive, with reversible cone drive tempo device.

The

DUO-ART

ADAM

Design No. 3077, Duo-Art Grand Piano

by

THE AEOLIAN COMPANY

EXQUISITE Adam design, light and graceful. Made in mahogany and Thuya wood burr. The carving is very delicate and flowing in character; following the classic forms of the Adam brothers. The propstick is of noteworthy detail being carved as an arrow with ribbon enrichment.