Rhodes®

Keyboard Instruments U.S.A.

SERVICE MANUAL

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There has been a growing need for a comprehensive manual describing the Piano as it has progressed through the years in its various stages of development.

Fundamentally, there has been no deviation from the original design principle, though the actual configuration of the parts has changed.

THE ACTION

The original Hammer Assembly appeared as shown in Figure 1.

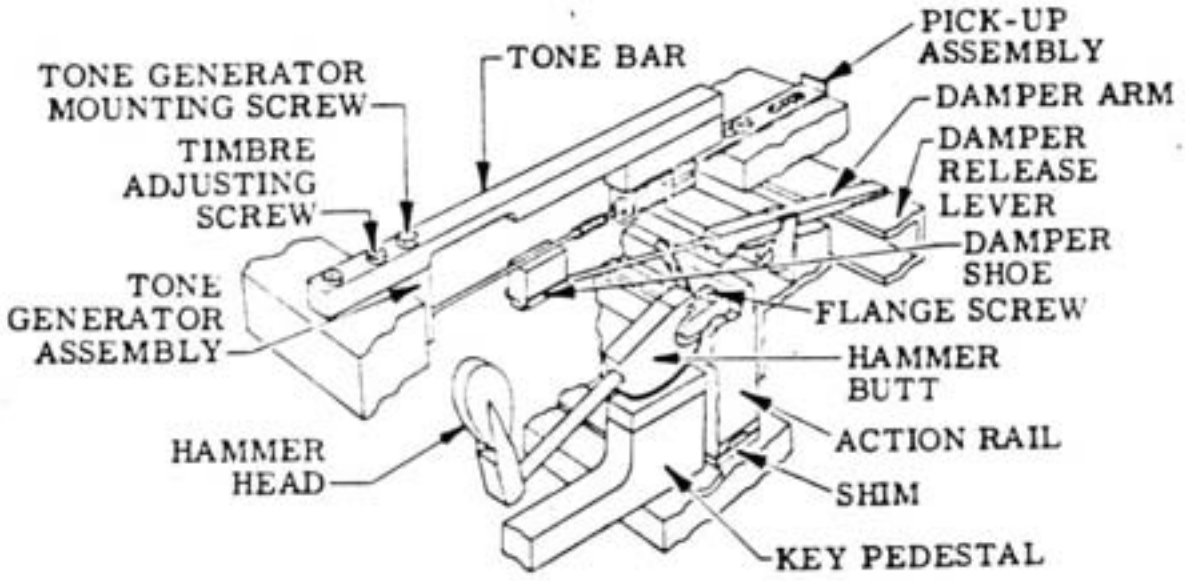


Figure 1

The Hammer Head was of the conventional "tear drop" design. The Hammer Shank and Hammer Butt were formed from wood and therefore tended to suffer the weaknesses of wooden parts, such as off-center holes, drifting holes, warping, etc.

An interim change involved the insertion of an aluminum clip (A, Figure 2) on top of the Key Pedestal. This was done to increase the acceleration of the old Hammer design.

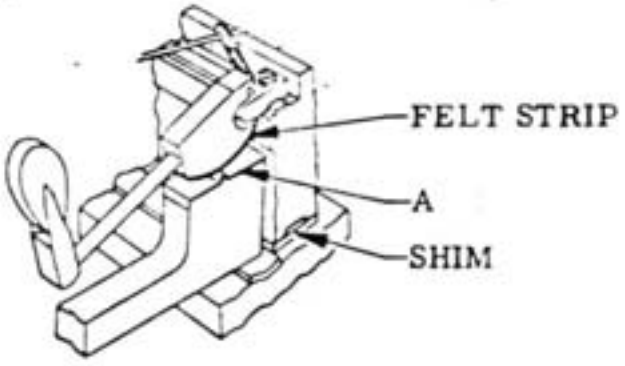


Figure 2

The next generation of Hammers featured a molded Shank and a molded Flange (Figure 3). These parts were made of CYCOLAC, a material which has withstood the test of time and has proved to be dimensionally far superior to its predecessor, besides being practically impervious to variations in temperature and weather. At this same time the Felt Strip originally attached to the cam curve of the Hammer was instead placed on the newly designed Pedestal surface of the Key.

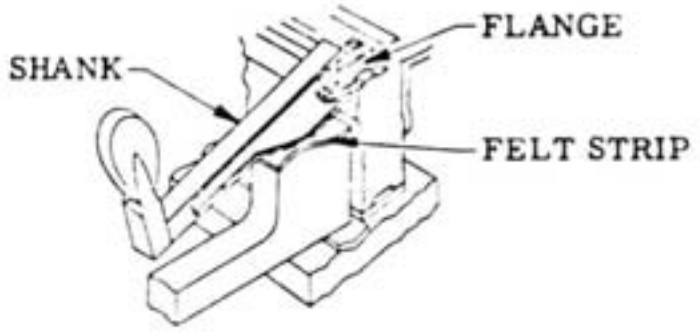


Figure 3

The "tear drop" Hammer Head was excellent for standard pianos, however, it tended to wear a groove, and as the groove deepened, the quality of sound deteriorated. Replacement was cumbersome and costly.

While this type of Head was retained for awhile, another innovation followed soon (Figure 4). It consisted of a wooden Head with a Felt Tip, which was easily removed for replacement. This was a major step forward in that replacement could be done inexpensively by the musician.

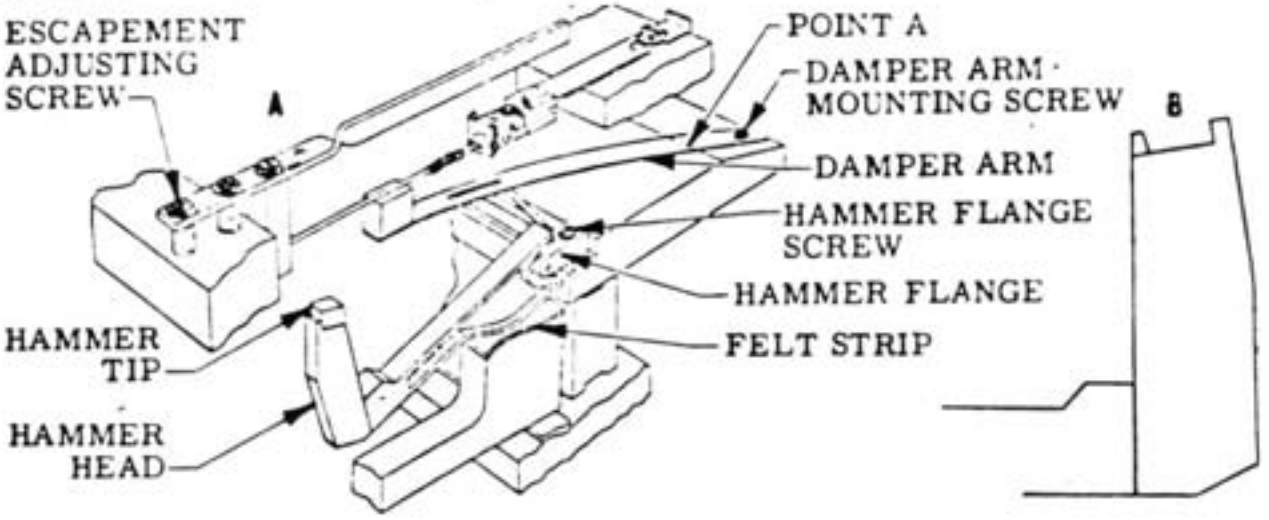


Figure 4

At the same time, research was going on with a type of Neoprene which would be a usable substitute for the felt Tips. Felt - being what it is - was still subject to grooving. The formation of a groove is costly in tone production, since the walls of the groove act as dampers. It was hoped that a material could be found which would end the problem of grooving. The Neoprene Tips proved superior in every way and were introduced into the line early in 1971, following extensive testing.

THE TONE SOURCE

In the broad claim of our original patent, No. 2,972,922, the tone source is described as a "tuning fork of unequal legs". In other words, we deviate from the traditional concept of a tuning fork in that, while both legs of the fork vibrate at the same frequency, the lower leg is more resilient and, as a consequence, responds more positively to the blow of a Hammer. It is to our advantage to construct this lower leg in such a way as to render it as resistant to wear and fatigue as possible. In pursuit of this, the Tone Bar Assembly has gone through three major changes through the years.

1. In the original Piano, the Tone Bar Assembly (tuning fork) was a single piece of cast iron which was suspended in a metal channel. The bottom leg was a length of piano wire of a diameter of .075". (See Figure 5).

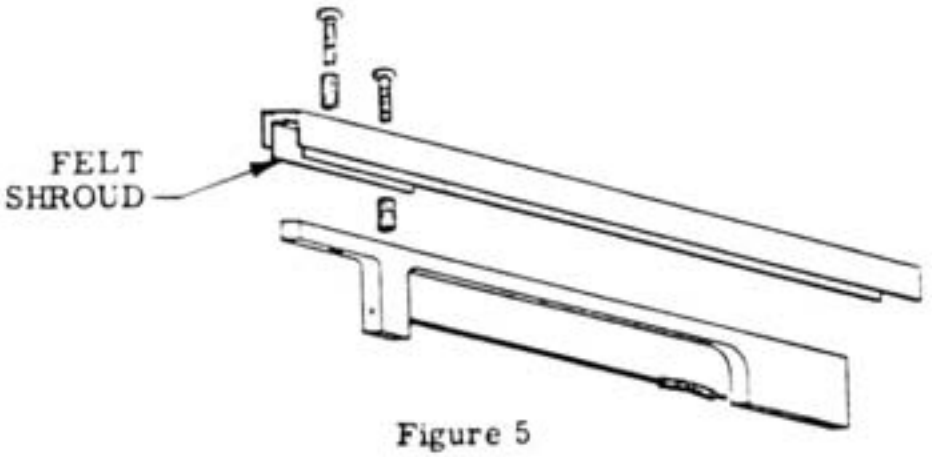


Figure 5

2. In the next stage the Assembly was constructed as shown in Figure 6. Several improvements were accomplished by this change.

   a. The Tone Generator Assembly (Figure 6) was now removeable for easy replacement.

   b. Timbre adjustment was more easily accomplished.

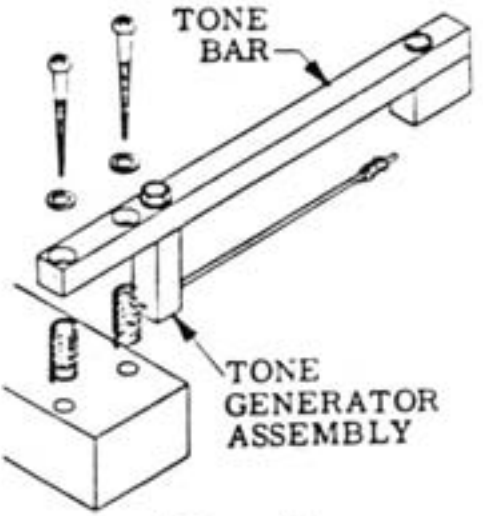


Figure 6

c. Escapement distance was more easily adjusted.

3. In an attempt to further improve the tone quality and at the same time to reduce weight, we came up with the current Tone Bar design, which we call the "twisted steel bar" (See Figure 7). (Patent No. 3,644,656)

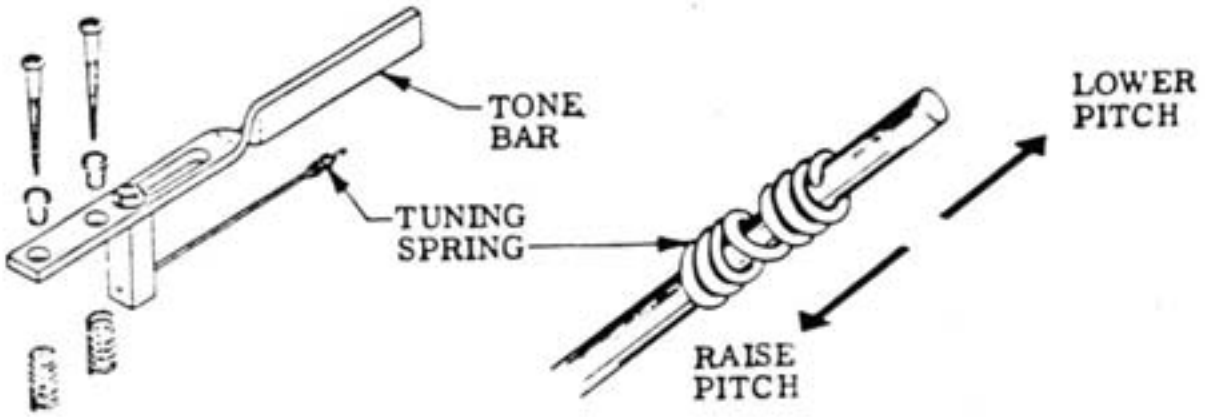


Figure 7

THE TINE

In our original design, the "Tine" (bottom leg of the tuning fork) consisted of a length of piano wire .075 in diameter (Figure 8). Fine tuning was accomplished by means of a slideable length of coil spring which was crimped to produce a friction fit (Figure 7).

Figure 8

Later, in an attempt to distribute the vibrational shock created by a heavy Hammer blow, the wire was tapered as shown in Figure 9.

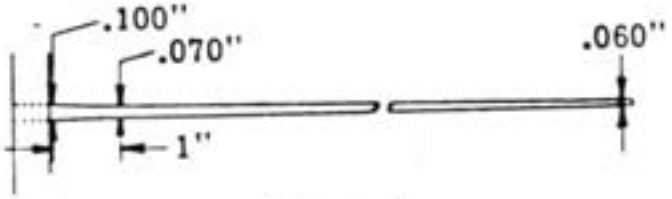


Figure 9

This taper was accomplished by the "centerless grinding process". This new configuration added considerable life expectancy to the Tine.

As a result of some six years of developmental procedure, a major breakthrough was accomplished in the processing of these new tapered Tines. Instead of the centerless grinding process, and through the cooperation of the Torrington Needle Bearing Co., we introduced the current Tine, which we call the "Torrington Tine" (Figure 10). In this new innovation the Tine is formed by the swaging process, a process which by its very nature adds strength to the part by compacting the outer surface (skin) of the Tine.

Figure 10

In a comparative shock test, Tine No. 1 withstood 40,000 heavy Hammer blows; Tine No. 2 withstood 1,500,000 blows; Tine No. 3 was still going after 6,000,000 blows.

While it is the nature of even the finest steel to deteriorate when shocked by stresses beyond its elastic limit and thus finally to crystalize and break, we feel that in this new process we now have reached the ultimate in providing a part capable of withstanding indefinitely all but the most withering treatment.

MAINTENANCE AND REJUVENATION

The remaining pages of this manual will be devoted to maintenance procedure and to description of the ways in which the various vintage models can be adapted to newer standards.

1. Suppose you have a Piano of the vintage depicted in Figure 1 and wish to bring it up to current sound standards. Proceed as follows:
    a. Examine the condition of the Hammer Heads. If the grooves are not more than 3/16" deep, they can be reshaped by sanding off the outer surface. To accomplish this, construct a shaping tool from a 6" length of yard stick to which has been cemented a piece of very rough sand paper. Beginning at Points A and A^1 work upward toward the crown - taking off enough of the outer layer of felt to remove all trace of the groove (see Figure 11).

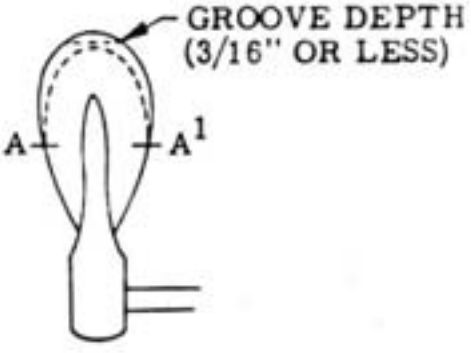


FIGURE 11

It should be noted that by the method chosen in this shaping process, you have a measure of control over the "striking line". (The point of Hammer contact along the length of the Tine).

Suppose Point A (Figure 12) is the optimum point for best tone and volume response. You can shape the Hammer so that the peak of the felt is left or right of center in order to accomodate to Point A.

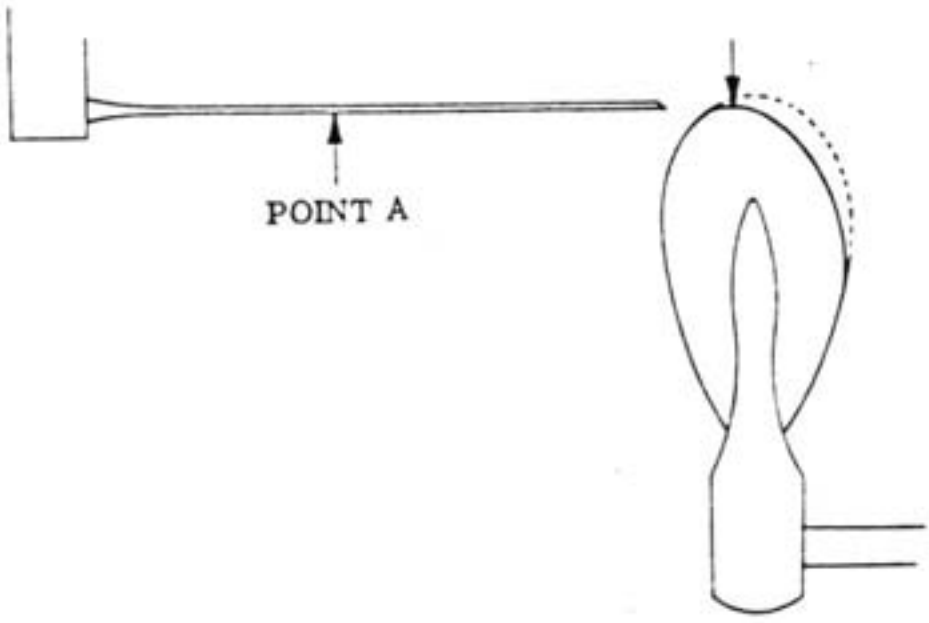


FIGURE 12

You can determine the exact location of Point A by removing all the Mounting Screws from the Harp so that it can be slid back or forward on the Support Blocks. With the Harp free to move, slide it back or forward as you strike the Key until you locate the point of maximum power response. Next, mark this point on the Tine with a felt pen, slide the Harp to original position, with Hammer raised, mark a spot on the Hammer Tip where the Felt Tip should be shaped. This procedure should be repeated about every 6th Hammer throughout the scale. The intervening Hammers can be shaped to the "curve" thus developed.

b. Next, test Felt hardness by playing the Piano through the mid-range. If the tone quality is harsh, indicating excessive hardness of Hammers, the Felts can be softened by the "Voicing" process. This is accomplished through the use of a Voicing tool, available in any piano supply house. Failing this, embed a common sewing needle in a hand drill, then "drill" the needle directly into the Felt at several points in the striking area.

c. If the Hammer Heads are too badly worn for salvage, remove all Hammer Assemblies and replace with the new Hammers. The new Hammer Assembly will come complete with Flange and Bridle Strap mounted. It will appear as shown in Figure 4A, without Tip.

Proceed as follows:

1. Remove all Damper Shoes by sliding forward (Figure 1).

2. Unscrew Flange Screw and remove Hammer by sliding Bridle Strap out over Damper Arm.

3. Mount the new Hammer Assembly by sliding the new Bridle Strap over the Damper Arm then by securing the Assembly with the Flange Screw.

4. Slide all Damper Shoes back into place.

5. Create a 1/8" x 3/8" x 3/8" shim and glue into place on the Hammer Head as shown in Figure 13. This is necessary in order to bring the Hammer Tip up to the full height of the one replaced.

   Your best bet is to purchase a 2' length of balsa wood, dimension stock 1/8" x 3/8" at your local model shop. Cut into squares with a sharp knife and cement to the Hammer Head with Elmer's glue.

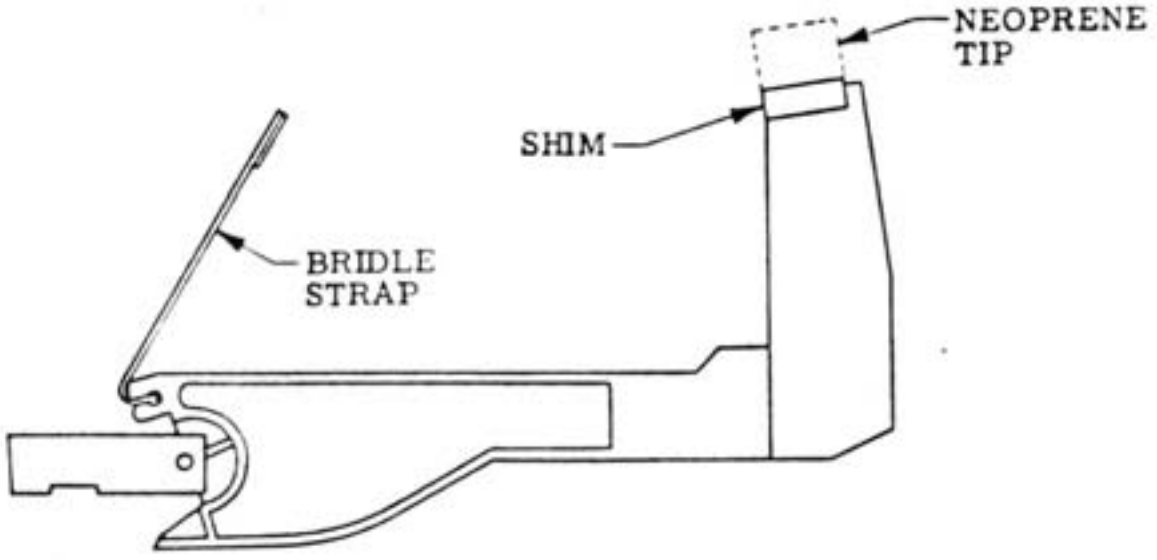


FIGURE 13

6. Secure all Neoprene Tips following the instructions given in the Kit.

7. The new Bridle Straps are slightly shorter than the old, resulting in a lower rest position of the Damper Felts. Adjust these upward to suit by bending the Maleable Wire Damper Arm (Figure 14).

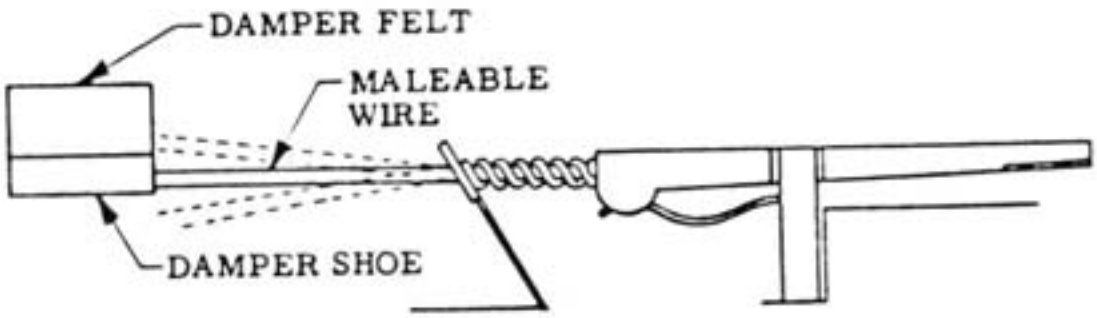


FIGURE 14

8. Carefully peel off the red woven Felt from the cam curve of the old Hammers, exercising care to leave a smooth, clean surface, and cement to the top of the Key Pedestal. This applies whether the Key is as shown in Figure 1 or Figure 2.

2. Suppose you have a Piano of the vintage depicted in Figure 4 but with the type Tone Bars shown in Figure 6, and you wish to restore it. Proceed as follows:

   a. Remove all Felt Hammer Tips with a jack knife. Make certain that the maple Hammer Head surface is clean of all Felt and old glue. If the Hammer Head is of the variety shown in inset Figure 4B, remove the back shoulder with a pair of end cutters in order to provide ample surface for the new Neoprene Tips. See Figure 15.

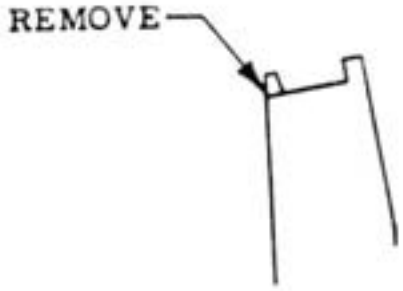


FIGURE 15

   b. Using 3M Weatherstripping Cement No. 8001 or a similar bonding agent, cement the new Neoprene Tips following instructions given in the Kit.

      1. Remove all Tone Generator Assemblies by removing all Tone Generator Mounting Screws (Figure 1).

      2. Mount all new Tone Generator Assemblies following instructions given in the Kit.

3. Adjust Timbre Adjusting Screw (Figure 1) until working edge of Tine rests on a plane slightly above dead center with the Pick-Up as shown in Figure 16. Let your ear guide you in this.

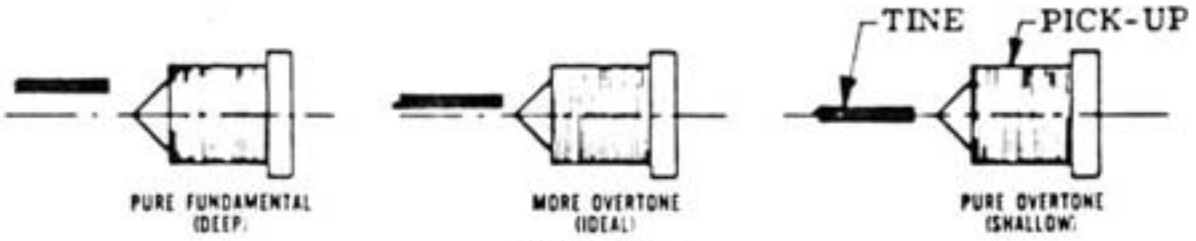


FIGURE 16

4. Slide all Pick-Up Arms in or out to establish a gap between Pick-Up and Tine of between 1/16" and 1/8" as shown in Figure 17.

   It should be noted that the smaller the gap between Tine and Pick-Up the greater the volume of sound and, more importantly - the more pronounced the DYNAMIC RESPONSE.

   By Dynamic Response is meant "percentage of volume increase in response to increased weight of touch". In Pianos built since March 1972, a gap of .020" can be accomodated in the middle and upper range.)

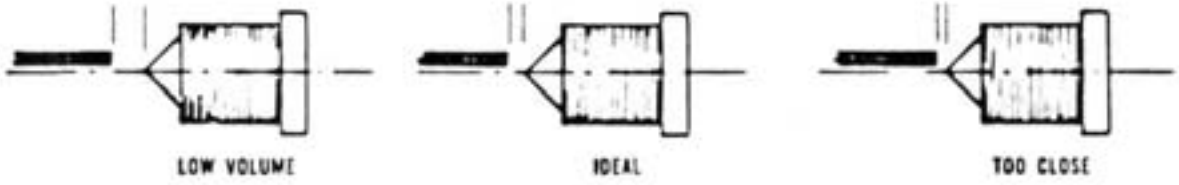
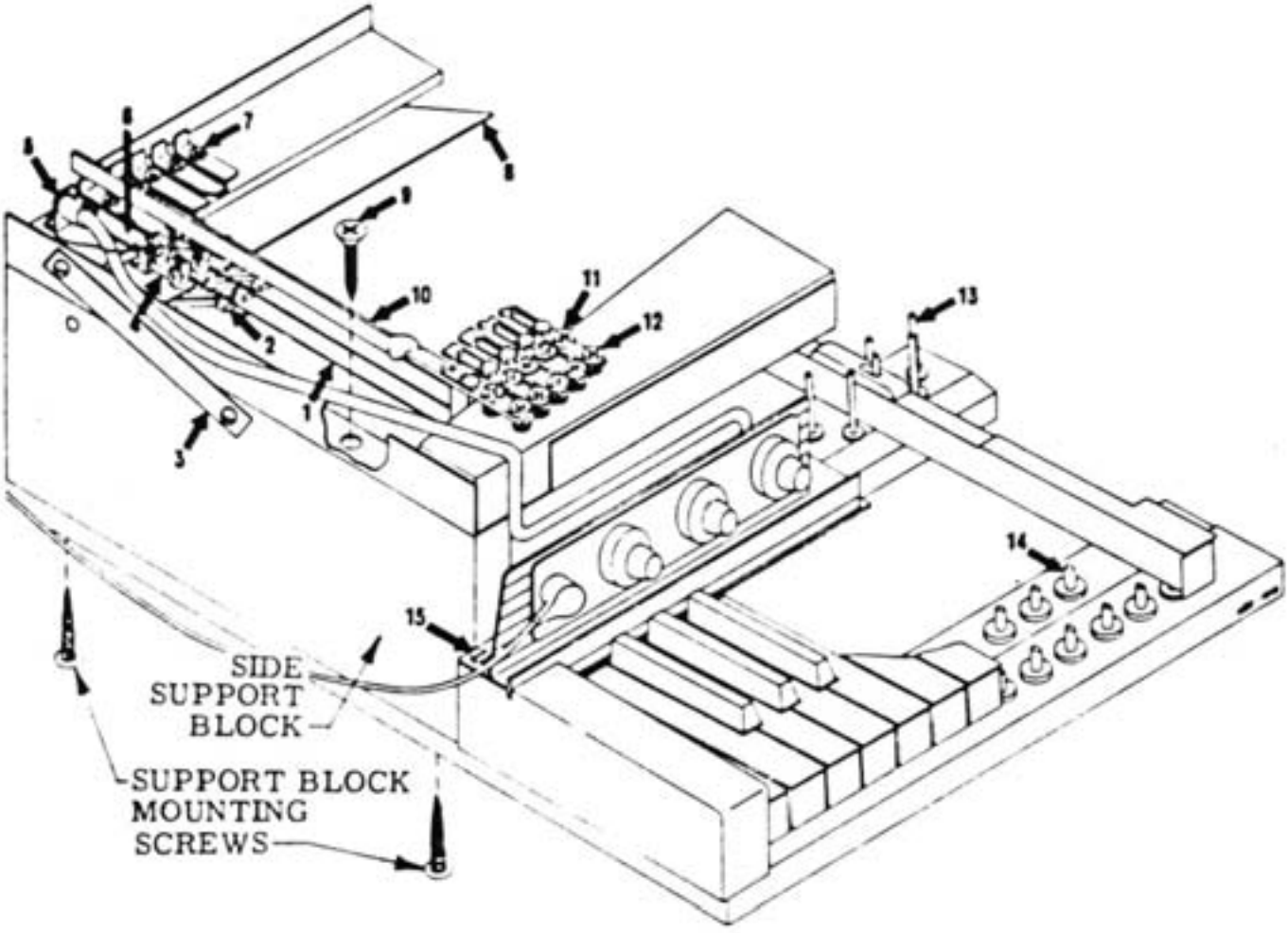


FIGURE 17

5. Remove the Mounting Screws (including the hinge screw) on the left (bass) side of the Harp, Figure 18. While striking Middle C, slide the left side of the Harp away from you approximately 1/4". This should result in a noticeable increase in volume response of the tone being struck. The reason for this is to re-establish a new striking line as dictated by the changes just described.

6. When you have located this new Harp position to your satisfaction, sink two new holes in the maple Side Support Blocks (Use a No. 10 drill), then secure the Harp by re-mounting the Screws. Next, re-mount the Hinge by drilling a new hole (No. 10) in the side of the Harp Frame. Exercise extreme care in guiding your drill through the steel so as to avoid plunging the drill into the Pick-Up.



1. Tines
2. Dampers
3. Harp Hinge
4. Pick-ups
5. Preamp-jack
6. Pick-up Arms
7. Pick-up Mounting Screws
8. Damper Release Bar
9. Harp Mounting Screws
10. Typical Tone Bar
11 & 12. Tone Bar Adjustment Screws
13. Action Rail Guide Pins
14. Front Rail Guide Pins
15. Nameboard Mounting Screws

FIGURE 18

GENERAL INFORMATION ON MAINTENANCE AND ADJUSTMENT

1. Key Dip. Key dip and Hammer travel are controlled by the height of the Action Rail (Figure 19). Key dip is the term used to describe the downward limit of travel of the Key when depressed. 3/8" is ideal. This is controlled by means of shims placed between the Action Rail and the Key Frame. To adjust, remove the entire Action from the box. Along the back of the Key Frame under the Action Rail will be five wood screws. Remove these, then either remove shims or add shims depending upon whether you wish to reduce or increase the Key dip.

2. Damper Control. The Damper ideally clears the Tine by at least 3/8" to 1/2" when the Key is depressed. Conversely, when the Key is at rest, the Damper should bear firmly on the Tine in order to effectively damp the sound. (See Figure 19).

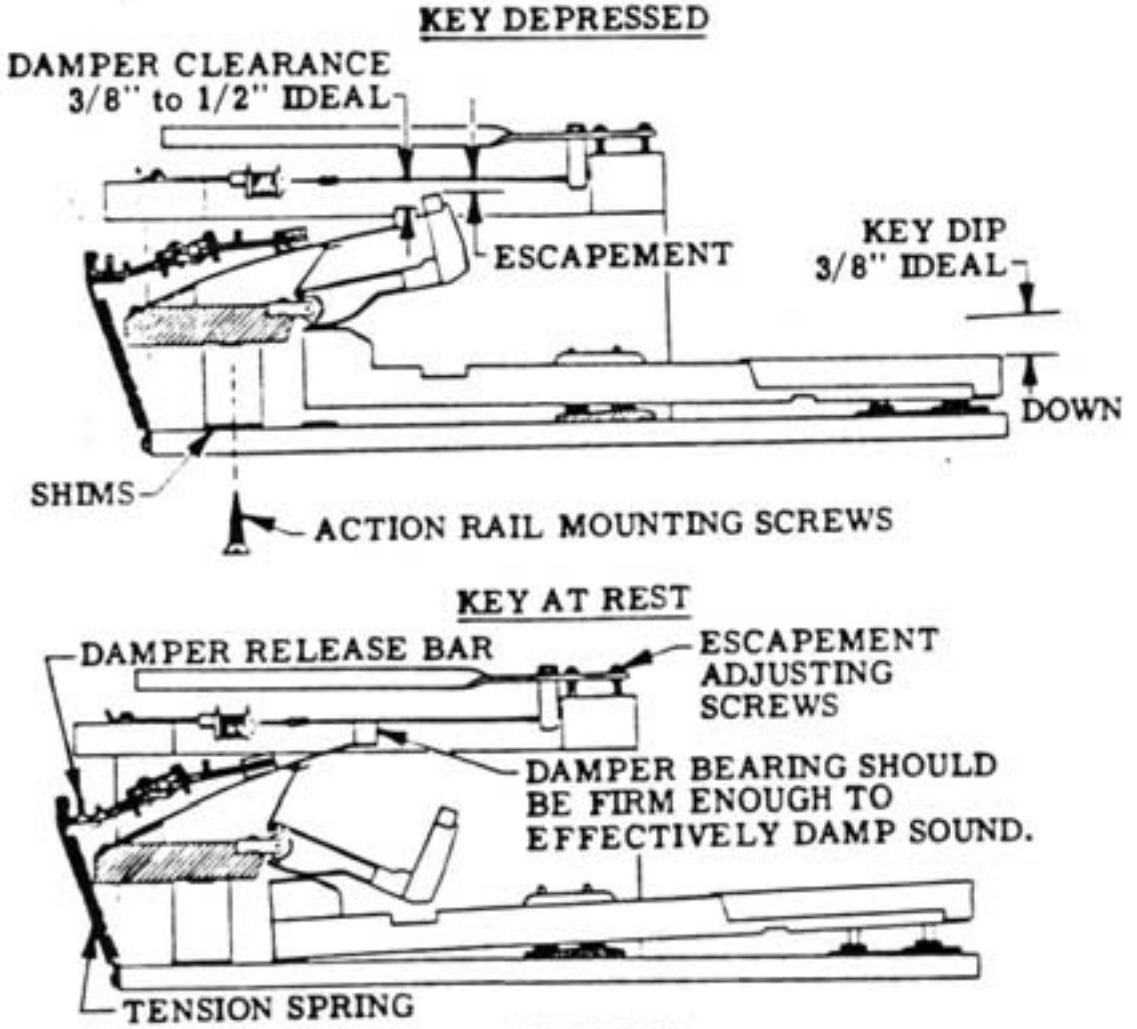


FIGURE 19

To maintain this relationship, there are two adjustments possible.

a. Tension. The Damper Arm is actually a leaf spring. (See Figure 4). Tension can be increased by "ironing" a slight reverse curve in the part with your two fingers. Another way is to pull upward on the Arm at Point "A" (Figure 20). The added tension thus imparted will result in improved Damper response.

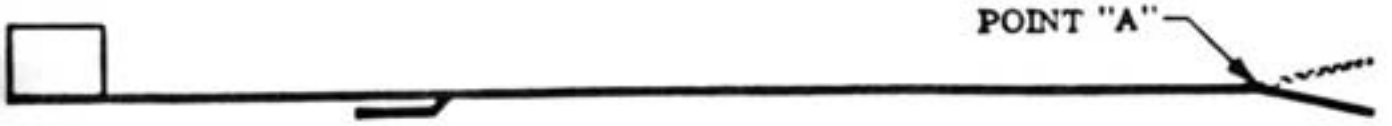


FIGURE 20

b. Alignment. With tension thus established, proper Damper coordination is achieved by bending the forward portion of the Damper Arm up or down as shown in Figure 21.

FIGURE 21

3. Escapement. Escapement is the word used to describe the distance between the striking edge of the Hammer Tip and the Tine when the Key is fully depressed. This distance varies from between 3/16" and 1/4" in the bass section to between 1/16" and 1/8" in the mid section and between 1/32" and 1/16" in the treble section. The shorter the escapement distance, the more sensitive the touch.

The escapement distance could be called the "free throw" area. In other words this is the area of Hammer travel after the energy imparted by the touch is no longer effective. In order to understand the philosophy, suppose the escapement distance were 1/2". Under this condition, it would require an extremely sharp blow to impart enough acceleration to the Hammer to enable it to reach the Tines. Now reverse the situation, suppose that we reduce the escapement to zero. The lightest feather touch will produce a sound. However, sustained finger pressure on the Key will cause the Hammer to smother the sound. Now back off a bit. Raise the escapement to the point where the Hammer can no longer smother the sound. This becomes the ideal setting.

To achieve the ideal escapement setting, there are several adjustments possible depending upon the vintage Piano involved.

1. To decrease the escapement distance, compress both Escapement Adjusting Springs (Figure 4). This will lower the entire Tone Bar Assembly thus reducing the gap. Once this is accomplished re-establishment of timbre and volume setting is done in the usual way.
2. If the escapement is excessive through out the entire Piano, proceed as follows:
    a. Remove the two Side Support Blocks.
    b. Using a table saw, shave off the desired amount from the top surface of each Block. (1/16" to 1/8") (Figure 18).
    c. Replace the Assembly, then reset the Dampers for maximum performance.
3. An alternate method of accomplishing the same thing is to remove all Hammer Tips, add a Shim, then replace the Tips, as outlined on page 7. This proceedure, while perhaps a bit more tedious, requires no equipment nor re-adjustment of Dampers.

As also is the case in string pianos, the escapement distance in the bass section should be greater than in the middle and upper sections. This requirement is even more pronounced in our instrument due to the wide arc of Tine movement encountered. Escapement distance on Tone Bar 1 could be 3/8". Insufficient escapement in this area invites "double stroking" with an accompanying disturbing sound.

Signal Strength:

Originally the 73 Pick Up Coils were joined in a series parallel arrangement as shown in Figure 22.

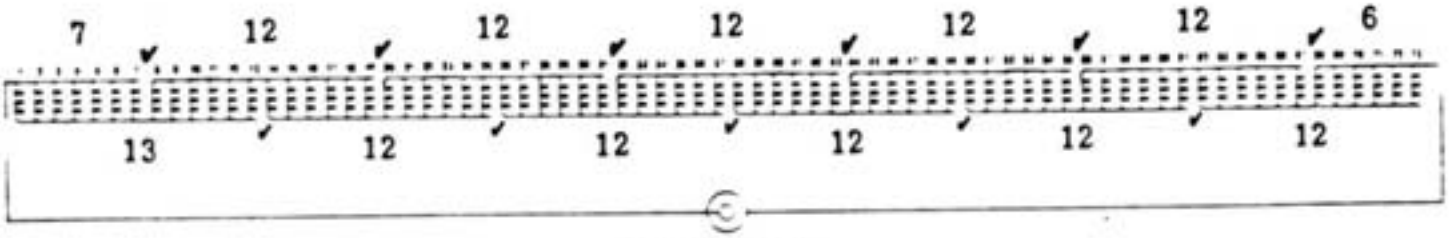


FIGURE 22

Later, basic voltage output was quadrupled by changing the series parallel arrangement as shown in Figure 23.

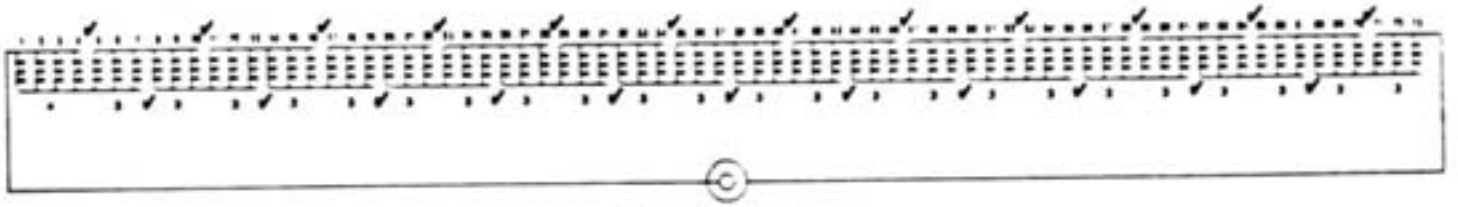


FIGURE 23

This change can be made on any of the older Pianos simply by re-routing the bus wires as shown in Figure 24. The output impedance then becomes approximately 2500 ohms.

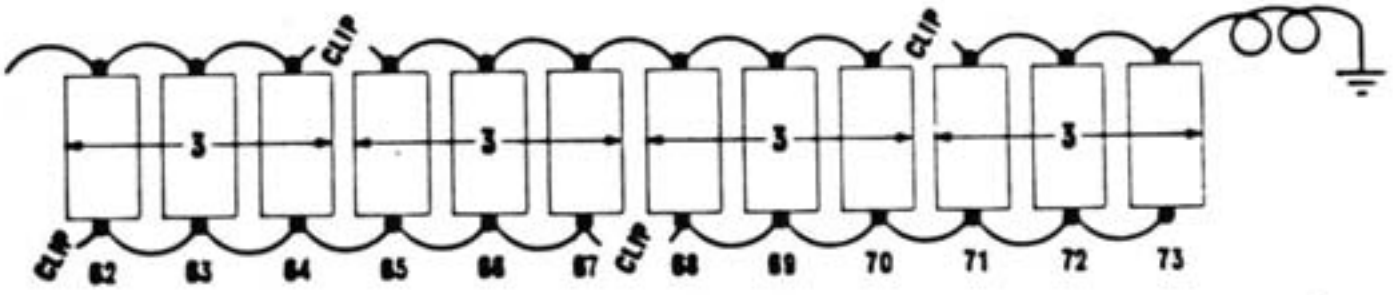


FIGURE 24

Where a Mark I Stage Piano is connected to an outside amp which has a high input impedance (one megohm) an impedance matching transformer is recommended.

Choose a transformer with the following specification:

1. Primary = 5,000 to 10,000 ohms
2. Secondary = 100,000 to 500,000 ohms

Under the conditions described, this will step up signal strength by a factor of 5 to 10.

To avoid the possibility of any loss of "highs", it is recommended that the transformer be mounted near the auxiliary amp. The length of cable from Piano to primary is not important.

In cases such as this, many dealers have mounted inexpensive battery operated pre amps behind the Nameboard of the Piano. These often have the advantage of providing tone controls.

TUNING (GENERAL)

Generally speaking it can be said that the Piano will not "go out of tune". Certainly it does not go generally out of tune over the entire keyboard as does the traditional string piano.

What may happen is that one or more notes may go out of tune because of a loose Tuning Spring or as a result of Tine fatigue under the stress of constant heavy blows. Under these conditions tuning simply requires pitch comparison with the tone an octave below and shifting of the Tuning Spring until pitch alignment is achieved. In the case of extreme Tine fatigue, the tine should be replaced.

An extremely helpful feature is the easy removal of the Tine portion (Tone Generator Assembly) (Figure 25), from the tuning fork by simply unscrewing the Tone Generator Mounting Screw; thus, should a Tine become damaged for any reason, replacement will be easy and inexpensive. Replacement Tone Generator Assemblies are available in Kit form, with the Tine 4 3/8 inches in length. This length Tine will accommodate the "Heavy Traffic" area where the highest incidence of fatigue and breakage is likely to occur. These can be cut to desired length with a pair of side-cutters.

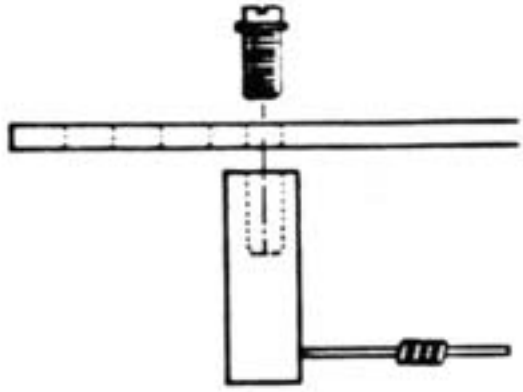


FIGURE 25

Complete Tuning 1:

If you are a piano tuner by profession, and if you prefer not to use one of the available tuning devices such as the Strobotuner, proceed as follows:

1. Remove the Mounting Screws from the Harp Frame (13 - Figure 18).
2. Raise the Harp to a vertical position. (See Figure 26).

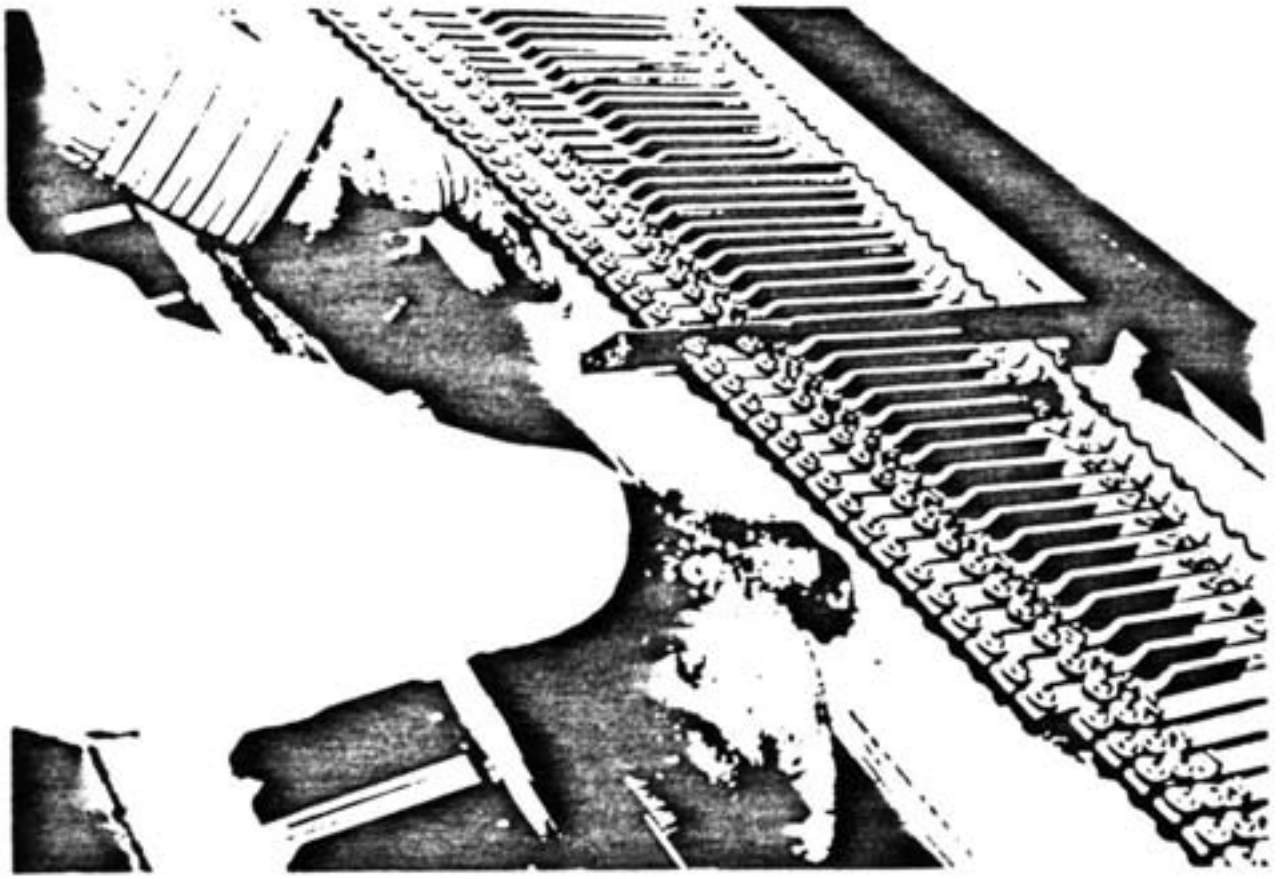


FIGURE 26

3. Mark the letter names of the 73 Tines on the Tone Bar Rail.
4. Turn up the volume and pluck the Tines with the fingers. Set the desired pitches by manipulating the little Tuning Springs (Figure 27). Set your temperament in the same manner employed with a string piano.

Proceed up and down the keyboard precisely as you would with a string piano. The job will be much easier in this case since there will be no need to tune unisons.

Stretched octave tuning is recommended where the musician is an accomplished soloist.

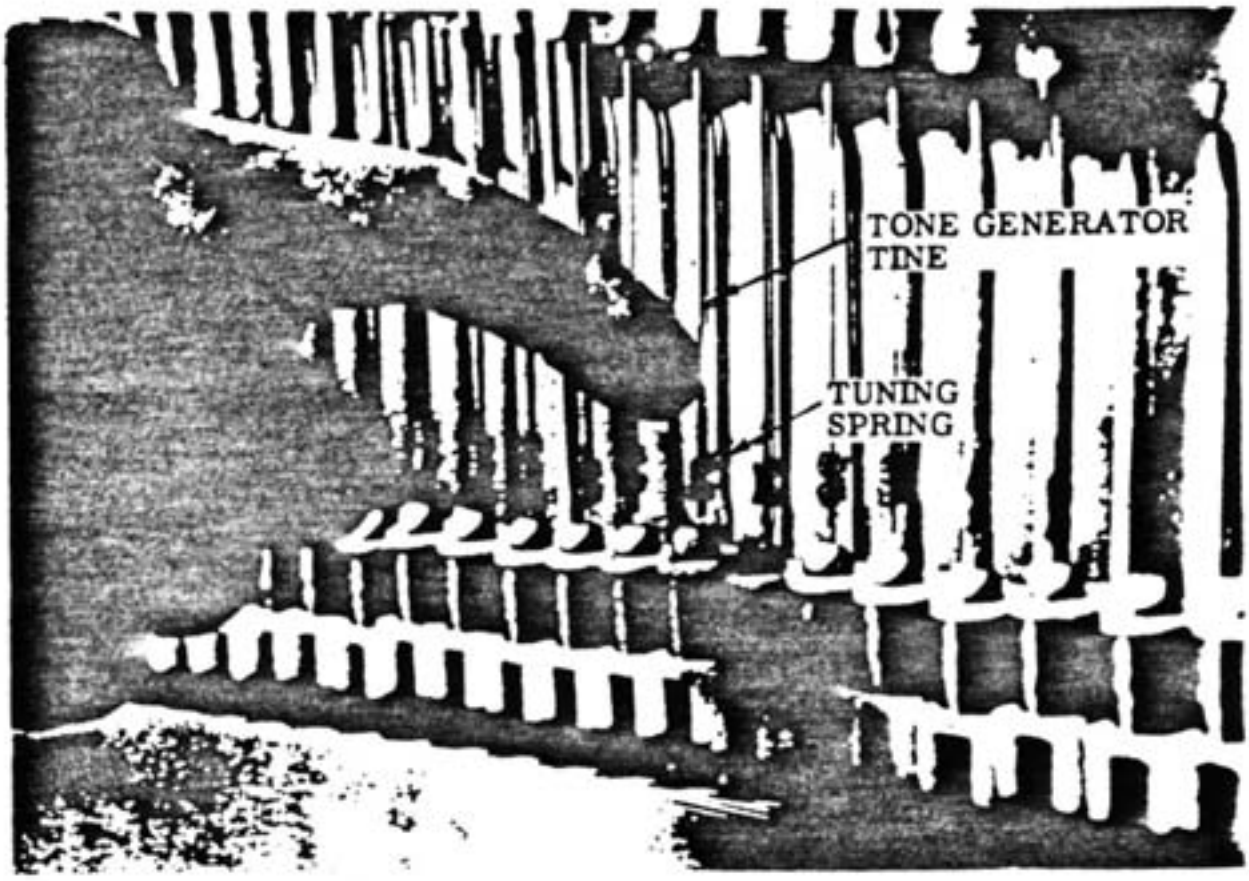


FIGURE 27

Complete Tuning 2:

If you have a Strobotuner, start at C below Middle C. Set the Strobotuner on C and manipulate the Tuning Spring until the strobe disc seems to stop. Move on to C♯, etc. Continue to High C above Middle C. For stretched octave tuning, continue as follows. For the next half octave, (C♯, D, D♯, E, F, F♯ and G) set the Strobotuner one cent sharp. (On the Strobotuner, each marked calibration represents five one hundredths of a semitone or 5 cents. On the more sophisticated StroboConn, each marked calibration represents one one hundredth of a semitone or 1 cent.)

For G♯, A, A♯, B and C set the Strobotuner another cent sharp. Continue raising the Strobotuner one cent for each half octave until you reach the top of the Piano. Next, start with B below Low C.

Set the Strobotuner 1 cent flat. Tune B, B♭, A, A♭ and G. Set Tuner another cent flat and tune G♭, F, E, E♭, D, D♭ and C. Continue to bottom of Piano.

GENERAL INSTRUCTION FOR DISASSEMBLY

1. Harp Cover Removal

   The Cover is formed of A. B. S. material and is practically impervious to damage. To remove, lift up on the two back corners of the molded top. With this done, simply pull the front edge free.

2. Piano Harp Removal

The Harp is secured to two maple blocks called Harp Support Blocks. (Figure 28). In later models, the Harp is also secured by Hinge Rods.

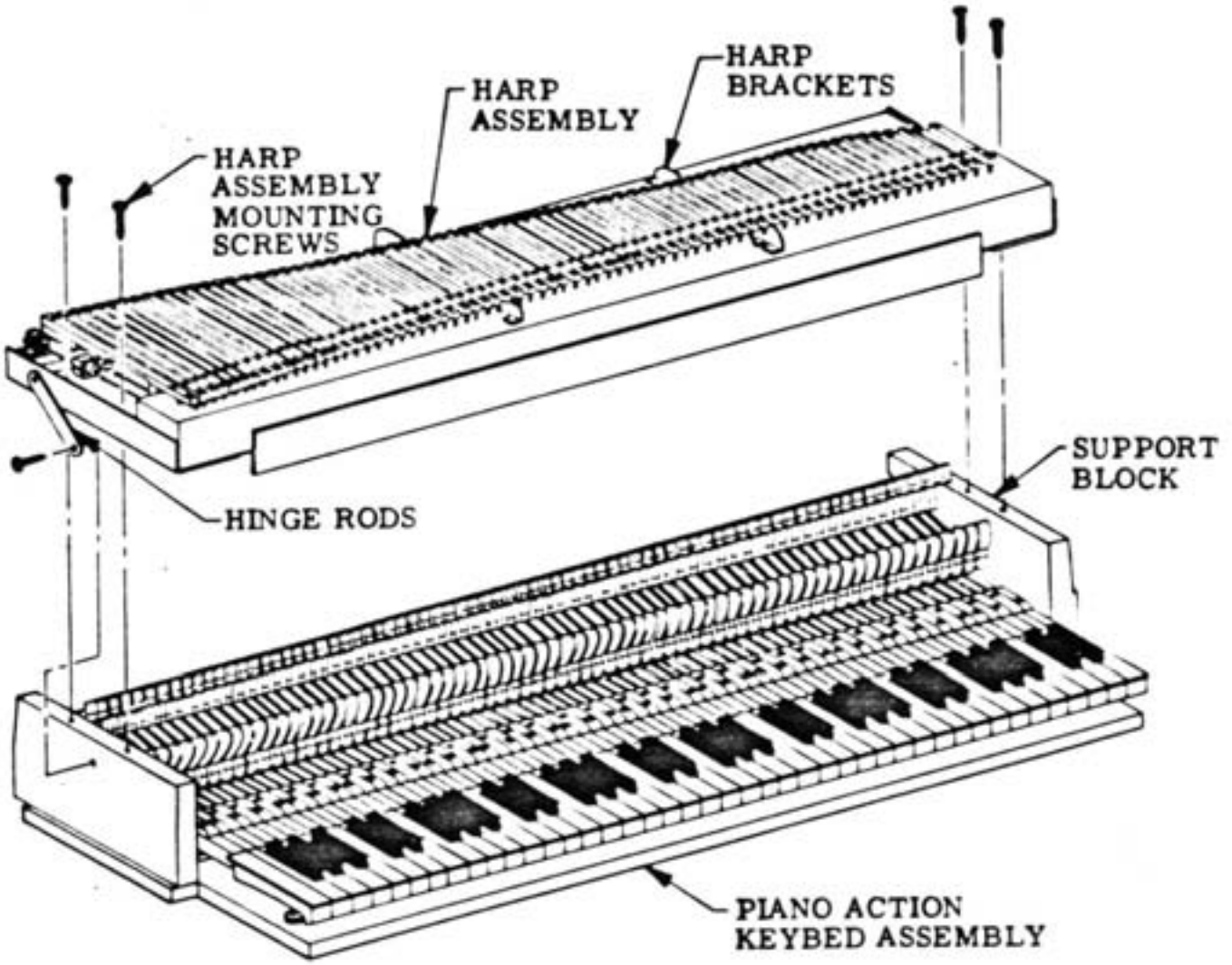


FIGURE 28

Complete removal of the Harp, then, is accomplished by removing the four Mounting Screws as well as the two bolts which secure the Hinge Rods.

The Harp consists of three major assemblies, the Frame, the Tone Bar Rail and the Pick-Up Rail. The Tone Bar Rail and the Pick-Up Rail are joined by two metal brackets called Harp Brackets.

Disassembly begins with removal of these two Brackets. Next, turn the Harp over and remove the wood screws which hold the Tone Bar Rail in place. With removal of these screws the Tone Bar Rail, complete with Tone Bars, simply lifts off.

Finally, removal of the Pick-Up Rail is accomplished in the same way.

The only practical reason for such activity might be for the purpose of reaching the Pick-Ups and thus to make easy the change of series-parallel alignment of the Pick-Ups as outlined on pages 13 and 14.

3. Damper Release Bar Removal

The Damper Release Bar is secured to the Harp Support Blocks by means of two removable Rods. (See Figure 29).

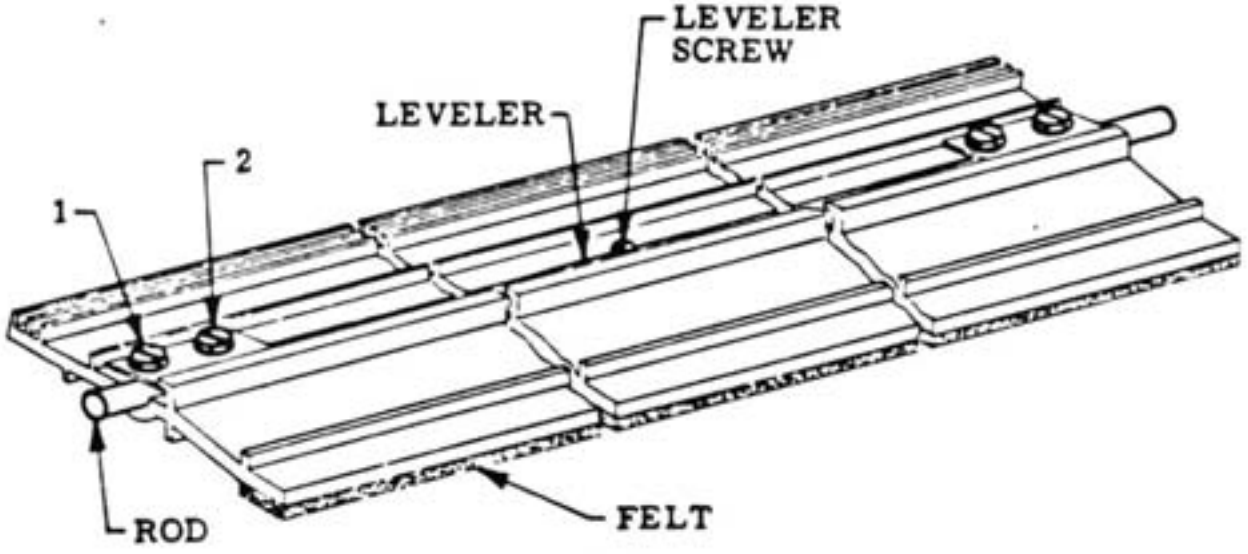


FIGURE 29

a. Loosen, but do not remove, the two Screws (1 and 2, Figure 29).

b. With a pair of needle-nose pliars, pull the Rod loose from the nylon bushing in the Support Block.

c. Remove the Leveler Screw located in the center of the Damper Release Bar (Figure 29).

d. With the same needle-nose pliars, drop the Tension Spring (Figure 19).

e. Slide the entire Damper Release Bar loose from the bushing in the other Support Block.

Of course removal of the Damper Release Bar is required in order to reach the Damper Arms for the adjustments described on Pages 12 and 13.

4. Damper Removal

a. Remove Damper Arm Mounting Screw (Figure 4).

b. With a knife or screw driver, pull the secured end of the Damper Arm loose from the semi non-hardening cement. You will notice that, besides the Mounting Screw, the Damper Arms have been held in place by a layer of semi non-hardening cement.

c. Holding the Bridle Strap with one hand, carefully pull the Damper Arm back so as to break the glue bond between the strap and the formed tongue in the Damper Arm without damaging the tongue.

5. Hammer Removal

Once the Damper has been removed, the Hammer Assembly is removed by removing the Hammer Flange Screw (Figure 4). Hammer removal does not require prior removal of the Damper Arm nor of the Damper Release Bar.

With care, the screw driver can be guided between Damper Arms. Once the Flange Screw is removed, pull forward on the Hammer. Again, exercise care not to damage the Damper Arm tongue. Replacement Hammers are available as complete assemblies consisting of Hammer, Hammer Flange and Bridle Strap, without the Neoprene Tip.

6. Key Removal

a. Remove the Nameboard Assembly by removing the Mounting Screws (Figure 18).

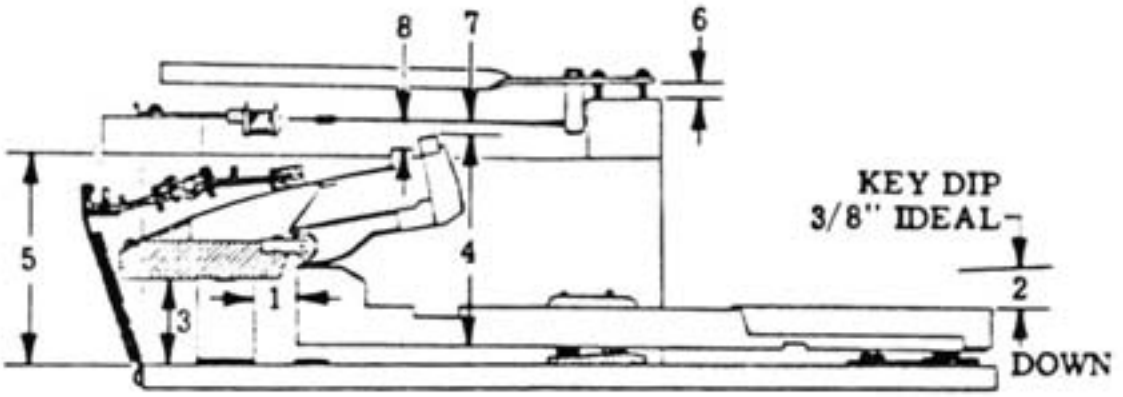
Key leveling is accomplished by adding or removing shims from the center rail pin. Sticking Keys are eased by compressing the wood around the Guide Pin slot with a pair of needle-nose pliars.

CAUTION

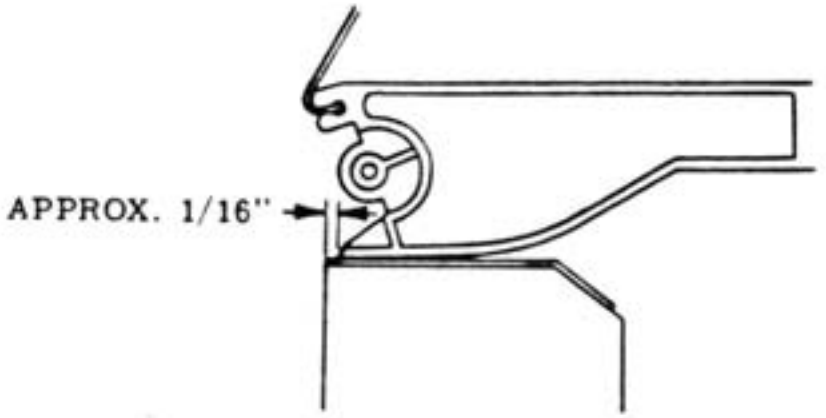
Before turning the Piano up-side-down, be sure the Nameboard is secured in place as a precaution against losing the Keys and the paper key-leveling shims.

DIMENSIONAL STANDARDS FOR THE RHODES PIANOS

The following are the important dimensional standards for maximum performance of your Rhodes Piano.



1. The distance (1) from back of Key to front of Action Support Rail with Key depressed should be 15/16". This dimension should be checked at Hammer Number 1 and at Hammer Number 73. Observance of this dimension will insure proper relationship between Hammer Cam Curve and Key surface. The objective is to insure a full platform for the Hammer as it rotates through its full swing. When the Hammer is at the top of its swing, the extreme rear surface of its Cam Curve should be approximately 1/16" from the rear edge of the felt pad of the Key. (See Figure below.)



To insure free action, the felt pad should be saturated with graphite, teflon or silicone.

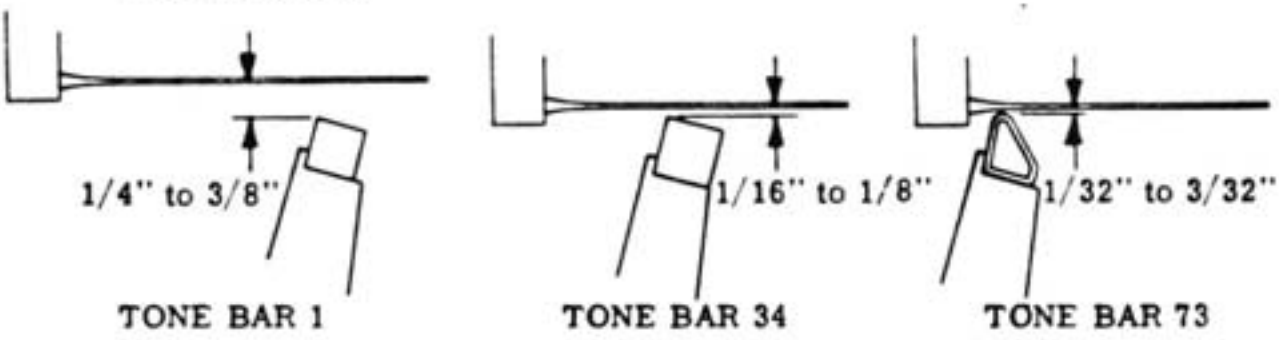
2. The distance of downward travel of the Key front (2) is called "Key Dip." Ideally, this is 3/8". Some pianists may prefer a deeper dip. This is accomplished by increasing the height of the Action Support Rail (3). This is done by removing the Action Support Rail Screws and fitting cardboard or fiber shims of the desired thickness between the Action Support Rail and the Key Frame. Factory standard for dimension (3) is 1-15/16".

3. Hammer rise (4) should be 4-29/32" from top of Key Frame to top of Hammer Tip. This measurement should be taken at Hammer Number 1. A serious deviation from this dimension would indicate misalignment of dimensions (1) and (3).

4. The height of both left and right Maple Harp Support Blocks (5) should be 4-1/2".

5. The initial dimensional setting of all Tone Bar Assemblies (6) is 3/8" above the Rail. With this accomplished, rotate the Timbre Adjustment Screw until the end of the Tine is slightly above an imaginary center line running through the Pick-up. The ideal Timbre setting is determined by ear. See Timbre Setting, Page 9 in the Service Manual.

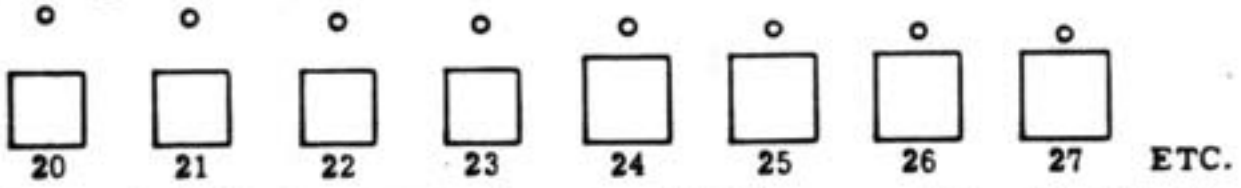
6. The gap (7) remaining between the Hammer Tip and the Tine with the Key depressed is called the Escapement distance. This should vary from 1/4" to 3/8" at Tone Bar 1 to a distance of 1/16" to 1/8" at Tone Bar 34, finally to a distance of 1/32" to 3/32" at Tone Bar 73. (See Figure below.)



The philosophy behind this variation is that, while the ideal Escapement for the most responsive touch is 1/32", the whipping action of the Tine in response to the Hammer blow increases as it becomes longer toward the Bass end of the Keyboard, making this ideal setting impossible.

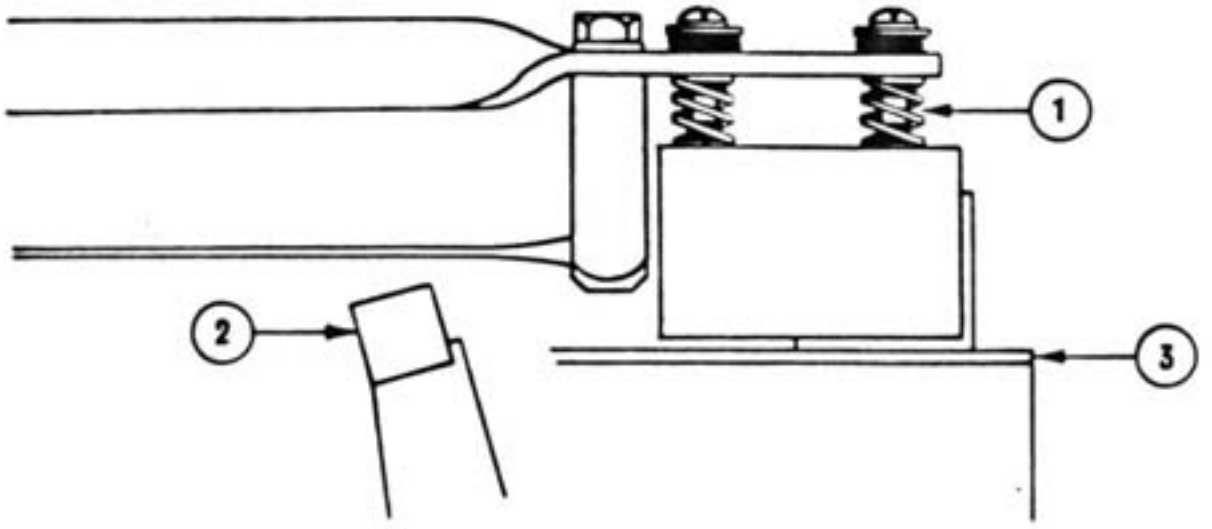
In older model Pianos, an approximation of the ideal was achieved by raising the entire Harp Frame on the left hand (Bass) side. This was done by adding a number of black fiber shims to the top of the left hand Harp Support Block. See Figure 28, Page 17 in the Service Manual.

Recently, in order to develop more touch sensitivity in the Mid-range, an added step was taken, The Neoprene Tips were increased in size starting with Hammer Number 24 and extending upward to the extreme right side. (See Figure below.)

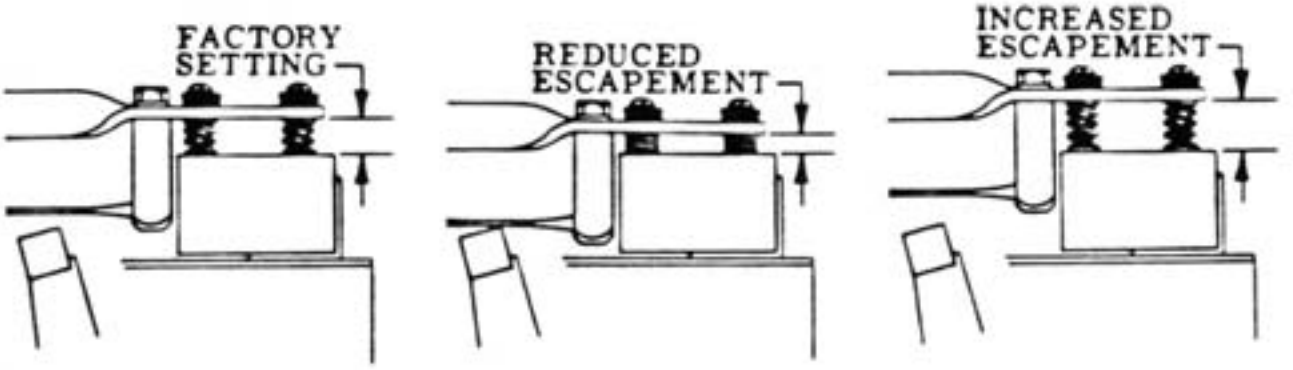


The result of this then, is that there is a 1/16" step-up at Tone Bar 24 with a welcome 1/16" reduction in the Escapement distance as shown in the above Figure.

A quick glance at the following Figure will reveal that there are three ways of achieving a fine, custom adjustment of the Escapement distances.

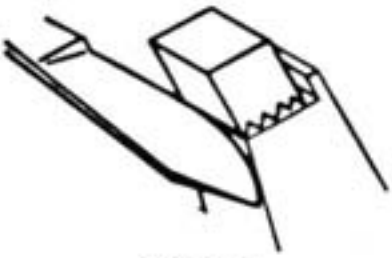


Adjustment Number 1: Each of the Tone Bar Assemblies is separated from the Rail by two adjustable coil Springs. By means of these, the height of the Tone Bar Assembly can be raised to 1/2" or lowered to 3/16" (factory setting is 3/8"). From the Figure below, it can be observed that this adjustment directly affects the Escapement distance and thus provides for a fine degree of custom adjustment.

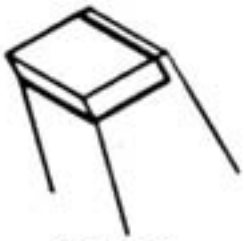


It should be noted that any major change of adjustment by this means requires re-alignment of Timbre setting, Volume setting and Damper setting.

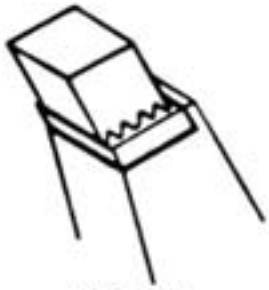
Adjustment Number 2: The height (thickness) of the Hammer Tip can be altered with relative ease. To reduce the Escapement, increase the height of the Tip. This is accomplished by removing the Tip by wedging the blade of a jack knife on the rear edge of the cement bond and flipping the blade upward. The cement is a semi-non-hardening type designed for easy removal. Next, insert and cement in place a 3/8" x 3/8" shim of desired thickness. Balsa wood is available in strips of 1/16" x 3/8" x 2' and 1/8" x 3/8" x 2' at most model shops. Note the steps illustrated in the following Figure.



STEP 1



STEP 2



STEP 3

Tedious as this method of adjustment may seem, it should be noted that none of the other sensitive settings are disturbed by it.

Adjustment Number 3: Adding or subtracting shims from the Harp Support Blocks should be resorted to only for the purpose of establishing the desired Escapement at Tone Bar 1 (1/4" to 3/8") and Tone Bar 73 (1/32" to 3/32").

Having now been introduced to the various adjustments available to you in achieving the best Escapement settings for optimum touch response, you should strive to tailor the Escapement settings in accordance with the particular style of play employed by the person who plays the Instrument. A sensitive musician will be looking for extremely close settings in the Mid- and Upper - range. A musician who plays heavy, strong octaves in the Bass area will require even greater Escapement distances in the left hand area. Thus, you now have the tools by which to customize the action to the individual tastes and needs of the musician.

7. "Striking Line" is the term used to describe the best place along the length of each Tine to aim the striking edge of the Hammer. Like the "sweet spot" of a baseball bat, there is a point of maximum response. This was determined by a painful trial process and resulted in the precise curve given to the Tone Bar Rail.

   Proper striking line is assured by setting the Harp in such a way as to arrive at a dimension of 2-1/4" between leading edge of the Hammer Tip and the leading edge of the Tone Generator (7). This dimension should be taken at Tone Bar 1. At Tone Bar 73, this dimension is approximately 1/8".

   If a deviation from this setting occurs, then relocate the Harp on its Support Blocks and drill fresh mounting holes in the Blocks. As a test of the validity of the Harp setting for best striking line, remove all restrictions from the Harp, then as you strike Middle C, rotate the left side of the Harp forward and back until the maximum tonal response occurs. Next, repeat this procedure at C below Middle C, etc. Continue until you are satisfied with the setting. Next, secure the Harp to the Support Blocks at this new setting.

Voicing Your Piano:

There are presently five gradations of hardness in the Hammer Tips. Tips 0 through 23 are of a hardness of approximately 30 as read on a "Durometer".

Tips 24 through 33 are of a hardness of 50. Tips 34 through 43 are of a hardness of 70. Tips 44 through 57 are of a hardness of 90. Tips 58 through 81 are wrapped.

The change-points from one hardness specification to another could be a matter of choice. For instance, Tone 33 would respond with more brilliance with a Tip of the hardness used in the range of 34 through 43. On the other hand, Tone 34 would be more mellow if a Tip of the hardness used in the range of 24 through 33 were used.

From this it is apparent that it is possible to establish greater brilliance throughout by moving to the harder Tips at for instance, Tones 20, 30, 40 and 54. Conversely, it is possible to achieve more mellowness by making the changes at Tones 28, 38, 48 and 62.

Any technician who has worked on the voicing of a standard piano is well aware of the fact that the ultimate tonal characteristic of a given piano depends heavily on the Hammer Head hardness. Brilliance or mellowness on a standard piano is achieved by ironing or pricking the felt Hammers - a procedure to be attempted only by a qualified technician since the Hammers could be permanently ruined in the hands of a novice. Not so in our case, where complete replacement sets of Tips are available at a nominal price.

The Damper System:

The Damper mechanism is the epitome of simplicity. It consists of a length of tempered aluminum, one end of which is secured to the back of the Action Rail at such an angle as to create some spring tension when joined to the Bridle Strap. At the other end is a felt Damper Pad so positioned as to bear against the Tine and thus to damp the sound.

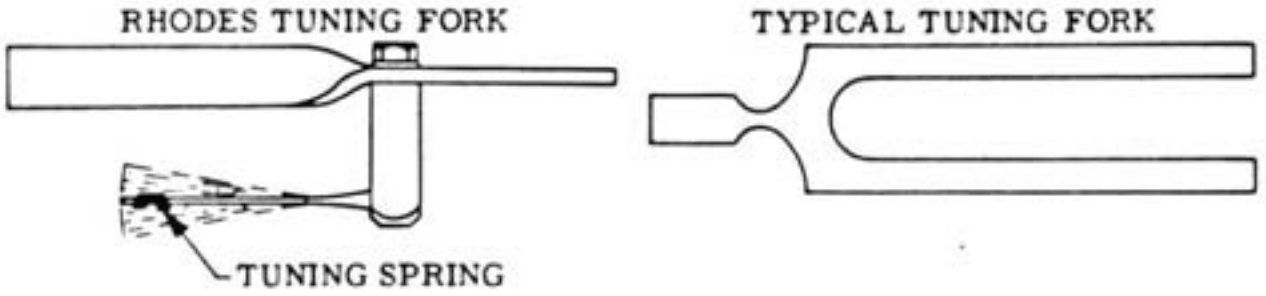
The Bridle Strap is a part of the Hammer Assembly. It is designed to engage a "hook" which is formed into the Damper Assembly at approximately its midpoint. As the Hammer swings upward, the Bridle Strap pulls the Damper Arm downward, thus disengaging the Damper felt from the Tine. As the Hammer strikes the Tine, the Damper is at the point of maximum clearance (8), thus allowing the Tine to vibrate unimpeded. As the Hammer drops back into its position of rest, the Damper re-engages the Tine, thus dampening the sound.

The Damper Release Bar provides a foot-activated mechanical means of disengaging all Dampers, thus allowing all Tines to vibrate freely.

The Damper Arm is subject to two easy adjustments. Both are described in detail on Page 11.

TINE REPLACEMENT PROCEDURE

The unique tone of your Rhodes Piano derives from the principle of the tuning fork. While the common tuning fork has two legs (tines) of equal length and mass, the tuning forks in your Rhodes Piano differ from these in one very important way. The two prongs (tines or legs) of our tuning fork are not of the same mass, shape or size. They are alike only in pitch. The lower, more resiliant leg responds visibly to the blow of a Hammer by vibrating in a wide arc at a certain frequency.



The upper leg, while not so visibly, does vibrate at the same frequency. The importance of this upper leg can easily be demonstrated by the following simple experiments.

1. Strike any note, preferably in the mid-range of the Piano. With the Sustain Pedal down, squeeze the upper leg with the fingers. The tone will die immediately.
2. Perform tne same experiment, but this time touch the upper leg very lightly. The vibration will be distinctly felt under the fingers.

This patented concept of the tuning fork offers many advantages. One of these is that the upper leg supports the pitch variations in the lower leg (Tine). In other words, assuming G to be the target pitch, the lower leg could be deliberately tuned to F, F♯, G, G♯ or A without any appreciable loss of support from the upper leg. This opens up a world of possibilities as will be shown.

You will note a small coil Spring on the lower leg so designed as to be a tight fit. This coil Spring acts as a counter-weight and therefore as a pitch control. Moving this Spring will result in a change of pitch. By this means, then, it is possible to arrive at a fine tuning merely by sliding the Spring to the desired spot on the Tine. See Tuning Your Rhodes Piano, Page 28.

The Tines in your Rhodes Piano, like the strings of a guitar, are subject to breakage under stress. We here at the factory are constantly on the alert for ways to achieve the longest possible life in these as well as in all other component parts of your Piano. In actual tests, Tines picked at random have withstood in excess of 6,000,000 blows in a test machine. This machine is so constructed as to simulate actual playing conditions. Despite this, steel wire of even the finest quality, invariably has flaws along its surface. If these microscopically small flaws occur on a node point, they can become the point of eventual fracture. This is offered to explain the fact that, while one person's Piano may play for three years under constant use with no more than a couple or three broken Tines. Another musician may experience a similar breakage within a few weeks.

For reasons just described, the Tines cannot be covered in the general warranty of the Piano.

In anticipation of this, we have devised a simple procedure for replacement - one which the musician can perform in about the time it takes to replace a guitar string.

Since all Tines throughout the pitch range are of the same configuration and vary only in length, and since the Tines can easily be cut to size by means of a pair of side cutter pliers, it follows that all the musician needs is a set of replacement Tines.

To aid the musician, replacement Tines are packaged in Kits of six. In each Kit is an assortment of Tuning Springs and a complete cutting chart.

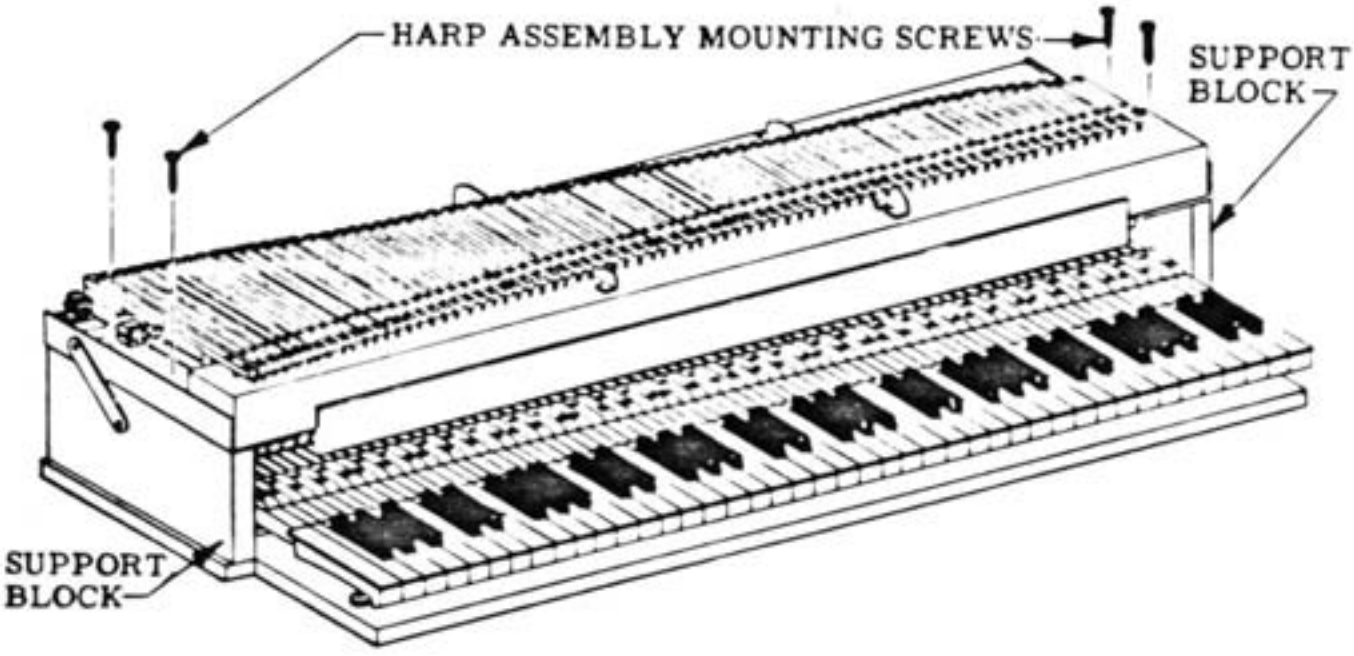
Each of the six Tines comes already pressed into the little cross-piece called the Tone Generator. Thus, the two parts when joined together become the "Tone Generator Assembly". The Kit then is known as the Tone Generator Assembly Replacement Kit.

To perform the replacement procedure, you will need the following tools:

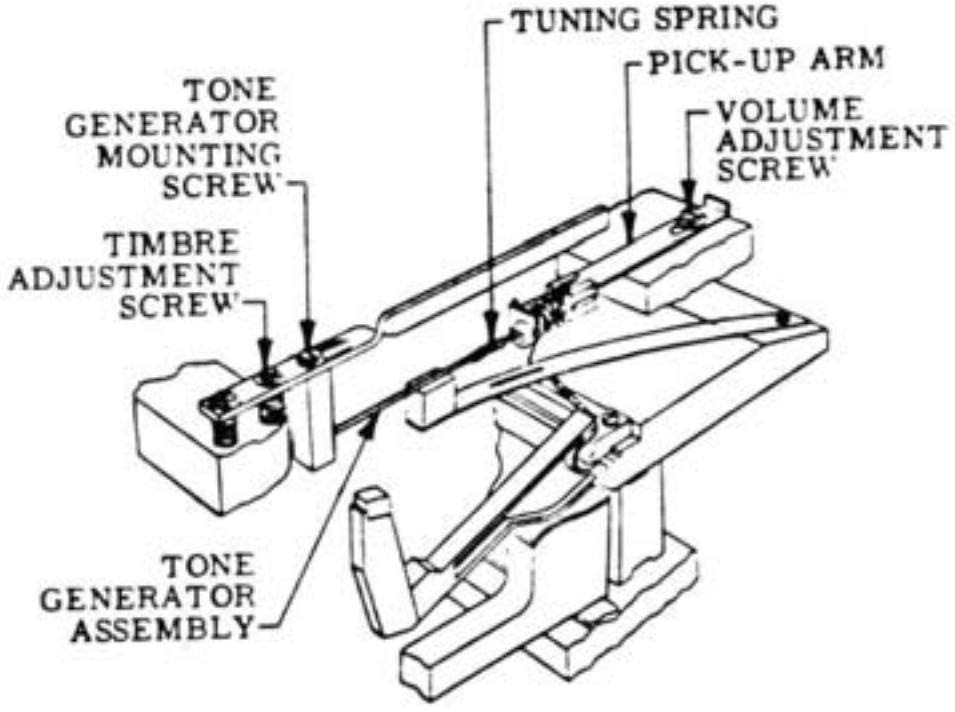
1. A Phillips Screw Driver (No. 2)
2. A pair of Side Cutters
3. A 1/4" and a 5/16" Wrench

Complete replacement requires only the following simple steps.

1. Remove the Harp Cover.
2. Remove the Tone Generator Mounting Screw.
3. Remove the four Screws which secure the Piano Harp Frame to the Harp Support Blocks and stand the Harp vertically on its Hinge.

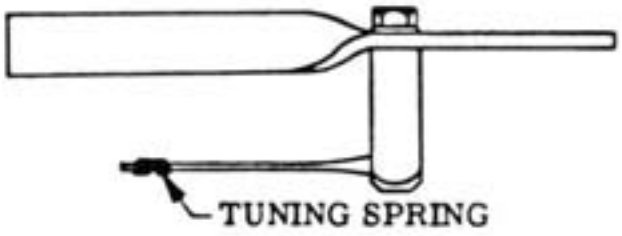


4. Consult the cutting chart in the Tone Generator Assembly Replacement Kit and cut the Tine to length with a pair of sharp side cutters.
5. Mount the Tuning Spring.
6. Secure the new replacement by tightening the Tone Generator Mounting Screw shown in the drawing below.
7. Turn on the Amp with the Volume at maximum setting.
8. Re-set Volume by loosening the Volume Adjustment Screw and sliding the Pick-up Arm in or out as you play.
9. Re-set Timbre (tone color) by rotating the Timbre Adjustment Screw as you play.
10. With your left hand, pluck the Tine an octave below the Replacement Assembly. With your right hand, pluck the Replacement Tine and slide the Tuning Spring until pitch alignment is accomplished.
11. Check for pitch once more.
12. Secure Harp and replace Harp Cover.



TUNING THE RHODES PIANO

On each Tine there is a crimped coil Spring (see Figure below) so fitted that it can be moved by hand with some effort. By design it fits tightly enough to resist normal stresses. Ideally, it remains fixed firmly in place unless deliberately moved.



This Spring acts as a counter-weight and thus provides a vernier control of pitch. Moving it outward, away from the fixed end of the Tine, will cause a drop in pitch. Conversely, moving it inward, toward the fixed end of the Tine, will cause a rise in pitch. The total range thus achieved could be as much as 1-1/2 steps above or below optimum.

Theoretically and ideally, once set, the pitch remains unchanged until deliberately altered by purposed relocation of the Tuning Spring (counter-weight).

Pitch control by this means is not as difficult a task as with a standard piano. The novice is invited to test his skill by taking the following steps.

1. Remove the Harp Mounting Screws and rotate the Harp to a vertical position as shown in the photo below.

2. With the amplifier and speaker on and volume up, pluck the Tine at Middle C with the finger of the right hand. At the same time, pluck C an octave below Middle C with the left hand.
3. Move the Tuning Spring at Middle C slightly upward so as to cause a slight rise in pitch.
4. As you continue to pluck both Middle C and C an octave below, slowly slide the Spring back.

5. As you do this, you will observe the following phenomenon. As the upper C approaches synchronization with the low C you will notice a beat. As the Middle C approaches maximum synchronization the speed of the beat will reduce.

6. Continue this process until there is no longer a discernable beat. Repeat this entire procedure several times until you become familiar with the technique. With some practice you should be able to restore pitch synchronization within five seconds.

There are several brands of electronic tuning devices on the market. Most of these operate roughly on the principle of the strobe light. There is a spinning disk, the speed of which is accurately calibrated. A control knob allows for scale tone changes. Assuming you set the control dial at C, there is a microphone which "hears" the pitch of the Bar you are tuning. Its vibrations are interpreted as flashes of light. These in turn are superimposed on the spinning disk. If the two are in synchronization, the wheel will appear to be stopped. If the Tone Bar is high in pitch, the wheel will appear to rotate clockwise, etc. Moving the Tuning Spring downward will slow the speed of the Tine. This will cause the strobe wheel to slow its movement until finally, when your adjustment is correct, the wheel will stop, indicating that the Bar is "in tune".

The various electronic devices have another feature - some are more sophisticated than others. It is a deliberate and controllable means of calibrating the entire mechanism with reference to the 60 cycle signal coming from the electrical outlet. With calibration thus achieved and with the control dial set at zero, the machine supposedly is now set at A440. This is a standard arbitrarily determined as an international standard and means merely that A above Middle C will vibrate at precisely 440 vibrations per second. Because of such a standard, it is possible to tune an instrument in California with reasonable assurance that it will be "in tune" with a piano in New York. Or, that 24 pianos delivered to a school as a "lab" will all arrive tuned alike.

Certain musicians will demand a more sensitive tuning than what would be the result if the tuning machine were set at A440 for the duration of the entire tuning procedure. This brings up a term known as "Stretch Tuning".

Stretch tuning is a procedure widely followed by the piano tuning profession. It recognizes a phenomenon of the human ear whereby tones in the upper range of a keyboard will sound "flat" even though they are calibrated with extreme precision. Fortunately for all, a consensus has long since been agreed upon as to the exact amount of stretching. A piano so tuned creates the impression of great tonal brilliance. Preliminary to a description of stretch tuning, a bit more basic information is in order.

For the purpose of standardization, the word "semitone" is used to describe the difference in pitch between any tone and the tone 1/2 step above. One one-hundredth part of a semitone is called a "cent". Thus, to raise a certain tone "one cent" is to raise it from its original A440 setting by one one-hundredth of a semitone.

All electronic tuning devices make use of this standard and have a dial by which the technician can deliberately change the basic setting of a given tone

by as many "cents" above or below a given optimum as he chooses, merely by altering the setting on the dial of his tuning device. See Figure below.

Armed with this standard, it now becomes possible for the technician to plot with precision the exact degree of stretch and to achieve exact synchronization of tuning between two instruments even though one may be tuned in New York and the other in California.

"Stretch Tuning" as described here means the deliberate and precise raising or lowering in pitch of a given range of tones along the scale by one or more "cents" according to a pre-determined standard.

NOTE: Rhodes Pianos are not stretch tuned at the factory. Instead, they are tuned to equal temperament.

The schedule offered here is a carefully determined approximation which is the result of the consensus of the tuning of a great number of qualified concert tuners.

Since this is an approximation, deviation from this in qualified hands is certainly allowable. However, with the tools just described, it is also possible to plot with equal precision the exact degree of deviation decided upon. The end result then, will be that two pianos so tuned will synchronize with such precision as to play together as one.

To ease your work in following this schedule, it is suggested that you mark with a pencil on the Tone Bar Rail (see photo Page 28) the exact place where the basic setting changes and the number of "cents" change dictated by the chart on the next page.

How To Follow The Chart

Typical procedure might be as follows:

First, calibrate your tuning machine in accordance with Manufacturer's instructions, making sure that the arrow is set on Zero. Next, tune A above

Middle C. Follow with A#, B, C, C# and D. Observing your Chart, you will notice that the next tone, D#, is supposed to be tuned 1 Cent sharp. So, turn the dial on the tuning machine one one-hundredth of a Semitone (1 Cent) sharp. Now continue thuning D#, E, F, F# and G. Again, observing your Chart, notice that the next tone, G#, is supposed to be tuned 2 Cents sharp. So, again, re-set the dial on your tuning device. This time set the dial two Cents sharp. Continue this procedure until you reach the highest note on the Piano.

Now, go back to your starting point at A above Middle C. Move the dial back again to Zero. Observe G# to the left of A. The Chart shows this to be 1 Cent flat. Therefore, following the procedure which by now is familiar to you, turn the dial to the left of Zero a distance of 1 Cent and tune G#. Continue downward, tuning G, F#, F and E.

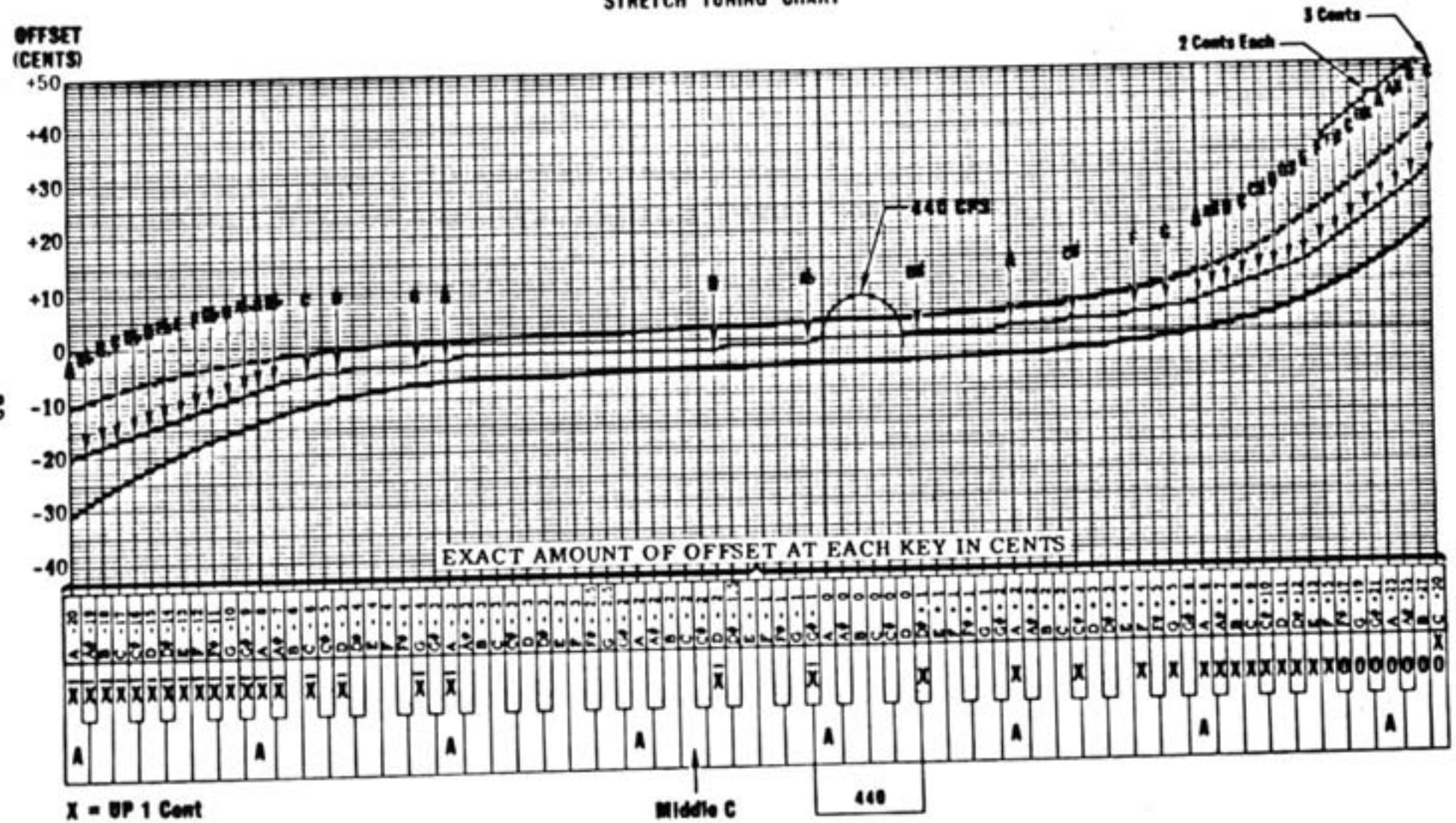
The next note, D#, is one and one-half Cents flat. D, C#, C, B, A and G# are all two Cents flat, etc. Continue observing the schedule shown on the Chart until you reach the lowest note on the Piano.

Upon completion of this, you will have Stretch Tuned the Piano in accordance with the best tuning tradition. Now, treat yourself to a performance and enjoy the rare brilliance that only Stretch Tuning can achieve.

Should you ever wish to revert to standard, equal temperament tuning, simply set your dial to Zero and leave it there as you proceed throughout the entire keyboard. This may be necessary where you feel the need to synchronize with an organ, for instance, where it is impossible to Stretch Tune.

It should be noted also that with all instruments where any option can be realized, the musician will automatically follow the concept of Stretch Tuning. This may explain why an instrument tuned to equal temperament may sound dull and flat.

STRETCH TUNING CHART



A. DAMPER RELEASE BAR

The Damper Release Bar (I-22) is locked in place by two Pivot Pins (I-23) which slide into two bushed holes provided in the new aluminum Harp Supports. These pins are held in place by two locking screws (I-24). Removal is accomplished by loosening these screws and then by sliding the two pins either out or in along the shaft provided.

B. DAMPER PUSH ROD ASSEMBLY

The Damper Push Rod Assembly is a short length of wooden dowel (I-33) capped on each end with felt (I-32 & 35) and held in place by a sleeve built into the back structure of the Piano housing. Forced upward by the thrust of the Sustain Rod, it, in turn, pushes upward on the back surface of the Damper Release Bar (I-22) causing its leading edge to bear downward on all of the Dampers (I-17) thus disengaging them from the Tines (I-13). With the Dampers thus released, all tines are now free to vibrate sympathetically with the struck tones as is the case with an acoustic piano. The difference becomes apparent when a comparison is made between the resultant sound of a chord where only those Dampers involved with a particular chord are released and then the sound of the same chord when all Dampers are released.

1. The Damper Push Rod, in its rest position, should bear solidly against the back surface of the Damper Release Bar (I-22). An ideal setting would be that where all play between the Damper Release Bar and the Damper Arms (I-17) is removed. This can be accomplished by adding felt either to the top of the Push Rod or to the mating surface of the Damper Release Bar. Extreme care should be exercised to avoid possible disengagement of the Dampers. Conversely, it can be seen that excessive play or lag in the linkage will result in a loss of touch sensitivity by the foot.

2. SUITCASE PIANO ONLY:

   In its rest position, the bottom surface of the Push Rod should be reasonably flush with the outer surface of the bottom of the Piano. There is a slot on the top surface of the Sustain Rod providing screw-driver adjustment on the top of the Amplifier Enclosure.

C. DAMPER MODULE

The Damper Arms (I-17) are now provided in fixed multiples of twelve - Damper Modules. This change was made to preclude the possibility of side shift in shipping. Removal is accomplished by removing the four screws of each module, then by sliding the entire twelve arms forward 1/16", thus disengaging them from the detent

lip provided in the Action Rail (I-29). Next, pull lightly back while disengaging one by one the Bridle Straps with the fingers of one hand.

D. ACTION RAIL

With the Damper Release Bar and the Damper Modules removed, the new Action Rail is revealed to be a sturdy extremely dimensionally accurate aluminum extrusion. Also, it will be noted that its removal can easily be accomplished from the top by the removal of the Action Rail Mounting Screws (I-28).

NOTE

The Action Rail also is securely locked to both Harp supports by means of the Harp Support-To-Action Rail Mounting Screw (I-30). While this can be removed easily, it is suggested that instead, the two Harp Supports be removed, thus maintaining the three pieces as an assembly.

E. HARP SUPPORTS

The new Harp Supports (I-6) are fabricated from heavy aluminum extrusions sturdy enough to hold the assembly in place undamaged by a direct six-foot drop. Removal is accomplished by removing lock nuts on each side and by removing one bolt on either side. The head of this bolt is found on the outer surface of the bottom of the Piano housing.

F. HAMMER COMBS

The new Hammer Combs (I-26) are molded in multiples of twelve. These also were redesigned in this manner to preclude the possibility of side shift in shipping. Removal requires merely the removal of the five mounting screws in each section.

It should be noted that the Hammer Comb is molded of a hard A. B. S. material with a 15% teflon content, thus providing lifetime lubrication.

G. ADJUSTMENTS

While this unit is practically free of the need for adjustment, nevertheless, the ease with which adjustments or replacements can be made should be noted.

1. Hammer Removal - It is not necessary to unscrew or to displace any of the supporting structures to remove a Hammer (I-15). Proceed as follows: Hold the Hammer head with the index finger and thumb, then rotate either left or right while at the same time twisting on the

vertical axis until the protruding ear (pin) pops out of the Hammer Comb. Then, simply lift out, exercising care to ease the Bridle Strap (I-16) off the Damper Arm tongue.

2. Hammer Replacement - Replacement is accomplished merely by forcing the two ears of the Hammer against the leading edge of the Comb, thus forcing it to spread until the two ears are nested in their slots. Your job is made easier if you slide the Bridle Strap back on to the Damper tongue first.

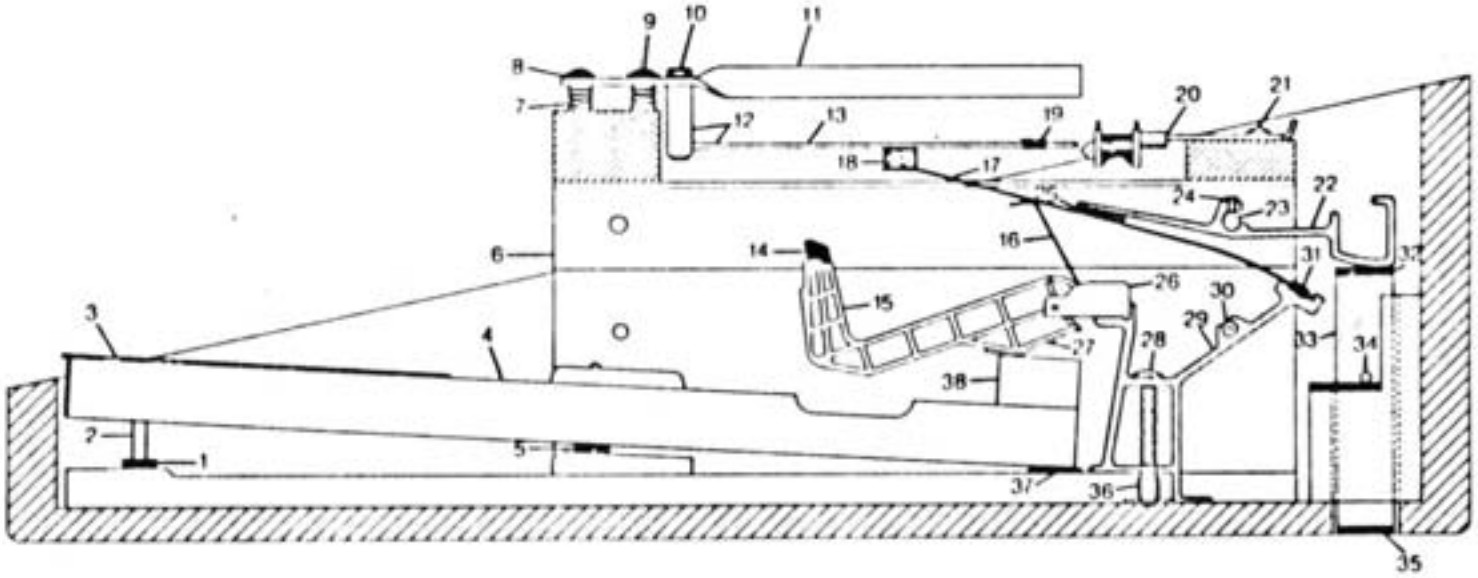
3. Damper Arm Adjustment - With the Hammer in its rest position, the Damper Felt (I-18) should bear against the Tine sufficiently firm so that the sound will be Damped immediately following the Hammer blow. There are four possible conditions which could result in malfunction:

   a. The Tine is out of adjustment. Solution: The factory setting places the Tines slightly above dead center of the Pick-up. See Page 9, Figure 16.

   b. The Damper Release Bar is bearing down excessively, thus disengaging or partially disengaging the Damper Arm. Solution: See: G. ADJUSTMENTS, Page 34.

   c. The Damper Arm has sustained damage sufficient that it no longer bears firmly against Tine. Solution: Remove Damper Release Bar and disengage Bridle Strap. With Damper Arm thus free, note whether it assumes a position similar to the neighboring Arms. If not, bend upward slightly on the surface nearest the point where it is mounted to Action Rail. The aluminum is of an alloy purposely chosen to invite this type of adjustment. Caution should be exercised to avoid excessive correction which would result in some loss of touch control due to the strong resistance thus introduced in opposition to the upward travel of the Hammer.

   d. The leading edge of the Damper has been bent downward. (The leading edge referred to is that portion of the Damper Arm which extends forward from the Bridle Strap tongue and thus actually provides adjustment possibilities in terms of higher or lower setting of the Damper Felt.) Solution: With Bridle Strap in place and having determined that none of the first three conditions exist, notice whether the particular damper felt is in approximate vertical alignment with the neighboring Felts. If not, with the fingers of two hands, bend this portion of the Damper Arm upward while exercising care that in doing so, you do not disturb the configuration of the back portion of the Damper Arm, and thus inadvertantly introducing condition c.



RHODES MODULAR ACTION ASSEMBLY - SINGLE KEY VIEW

Figure I

REFERENCE DESIGNATION - FIGURE I

1. Front Guide Pin Felt
2. Front Guide Pin
3. Key Cap
4. Key
5. Balance Rail Felt
6. Harp Support
7. Tone Bar Assembly Mounting Spring
8. Tone Bar Assembly Mounting Grommet
9. Tone Bar Assembly Adjustment Screw
10. Tone Generator Mounting Screw
11. Tone Bar
12. Tone Generator Assembly
13. Tine
14. Hammer Tip
15. Hammer
16. Bridle Strap
17. Damper Module
18. Damper Felt
19. Tuning Spring
20. Pickup Assembly
21. Pickup Adjustment Screw
22. Damper Release Bar
23. Damper Release Bar Pivot Pin
24. Damper Release Bar Pivot Pin Locking Screw
25. Damper Release Bar Felt
26. Hammer Comb
27. Hammer Butt Felt
28. Action Rail Mounting Screw
29. Action Rail
30. Harp Support-To-Action Rail Mounting Screw
31. Damper Module Mounting Screw
32. Push Rod Assembly Top Felt
33. Push Rod Assembly
34. Push Rod Assembly Balance Pivot
35. Push Rod Assembly Bottom Felt
36. Action Rail Mounting T-Nut
37. Keybed Felt
38. Key Pedestal

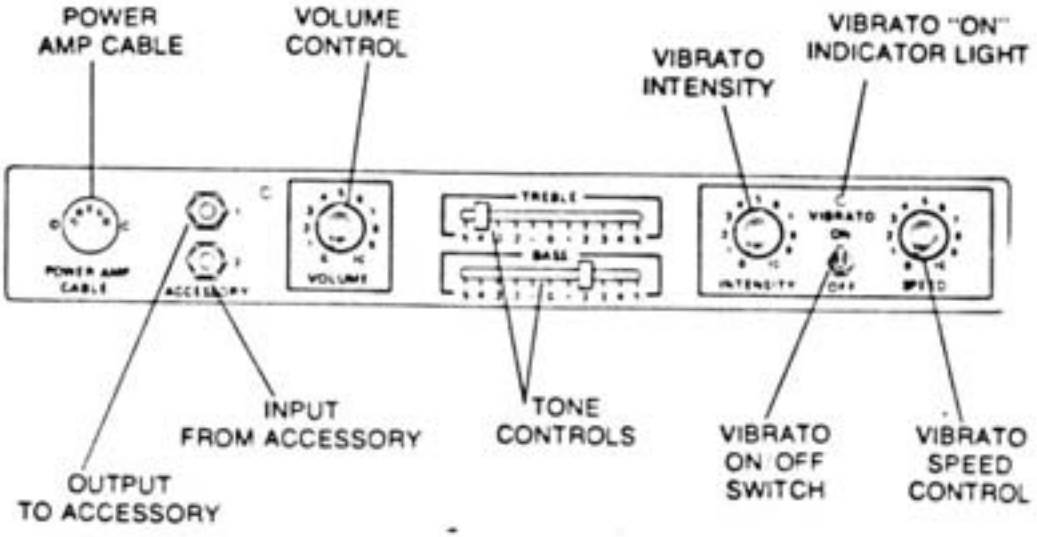
RHODES 100 WATT SUITCASE PIANO

Attention is called to this Model because of the changes in both the Piano Control Panel (See Page 38) and the Speaker Enclosure Panel (See Page 39). Schematics for the Pre Amplifier and Power Amplifier have been included (Pages 42 and 43, respectively).

The Action itself remains the same as the previous model Modular Action, details of which are covered beginning on Page 33.

PIANO CONTROL PANEL

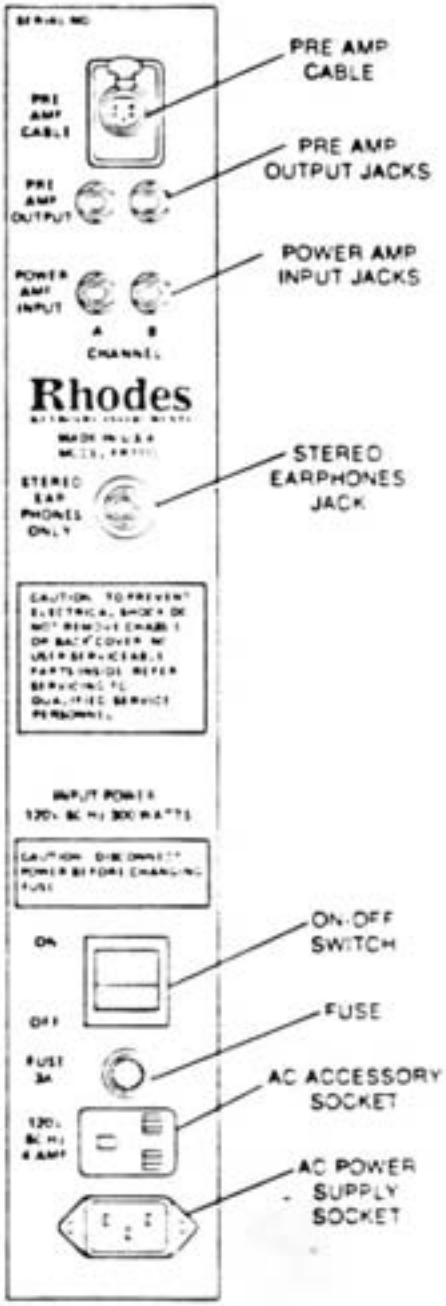
Located above Keyboard to Left



- **POWER AMP CABLE**
  Accepts female end of interconnecting cable.
- **ACCESSORY JACKS**
  Accept a non-stereo special effects accessory. (phase shifter, fuzz, etc.). Input of special effects accessory plugs into Jack 1, Output plugs into Jack 2.
- **VOLUME KNOB**
  Controls the volume.
- **TONE CONTROLS**
  (Bass & Treble) When the knobs are set at "0" position (center) the response is normal. Moving the knobs to the right increases the response, to the left reduces the response.
- **VIBRATO**
  The on-off switch activates the vibrato effect and the vibrato indicator light which flashes on and off at the same speed as the vibrato. The intensity knob controls the intensity of vibrato and the speed knob controls the speed.

SPEAKER ENCLOSURE PANEL

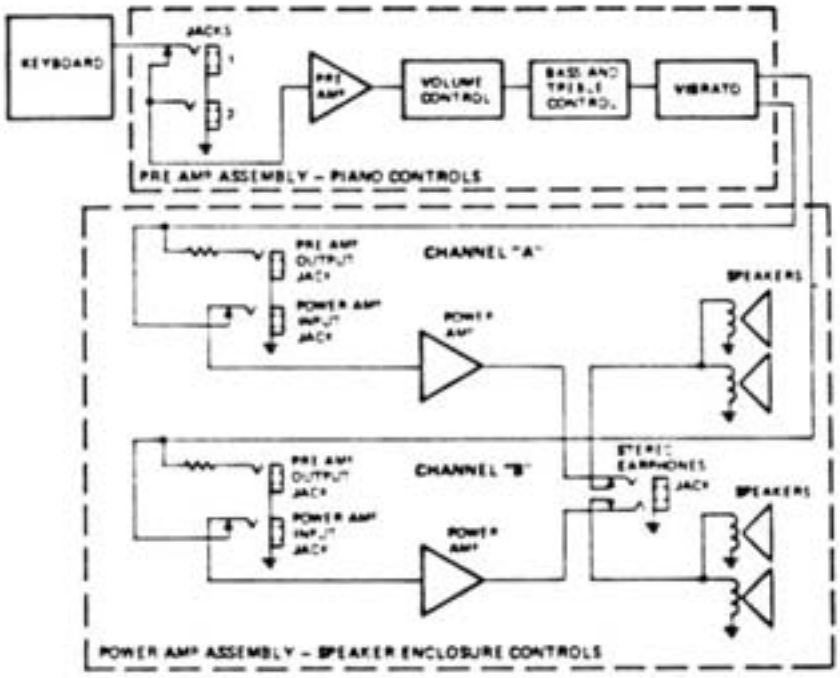
Located on left side of speaker enclosure



- **PRE AMP CABLE**
  Accepts male end of interconnecting cable.
- **PRE AMP OUTPUT JACKS**
- **POWER AMP INPUT JACKS**
  Accept stereo special effects accessories (phaser), etc. Special effect accessory inputs are plugged into Pre Amp Output Jacks, outputs are plugged into Power Amp Input Jacks.
- **STEREO EARPHONES JACK**
  Accepts stereo earphones, 600 ohm impedance. The attachment of earphones to this connection will automatically channel the sound exclusively into the earphones.
- **ON-OFF SWITCH**
  Turns AC power on and off.
- **FUSE-3 AMP**
  Replace only with similar type.
- **AC ACCESSORY SOCKET**
  Accepts any 120 volt, 60 Hz AC Accessory which draws not more than 450 watts.
- **POWER SOCKET**
  Accepts female end of AC power cord.

SPECIAL EFFECTS DEVICES

The power amp input jacks are provided to allow use of various special effects devices. When these jacks are used, the signal from the Keyboard is disconnected internally from the power amplifier. The power amplifier input must now come from whatever you plug into this jack. To help you understand this feature, a block diagram of the system is shown.



For example, a Stereo Phaser would be connected as follows: