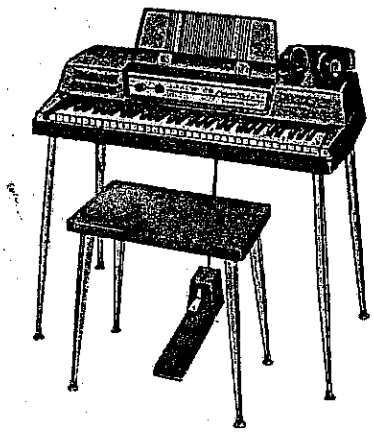
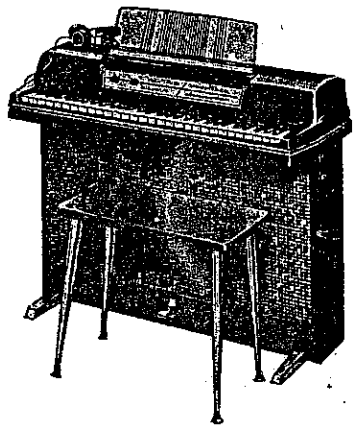
WURLITZER® ELECTRONIC PIANOS

Service Manual

SERIES 200 AND 200A

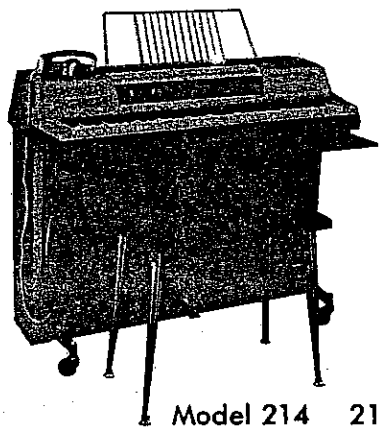


Model 200 200A & 200B

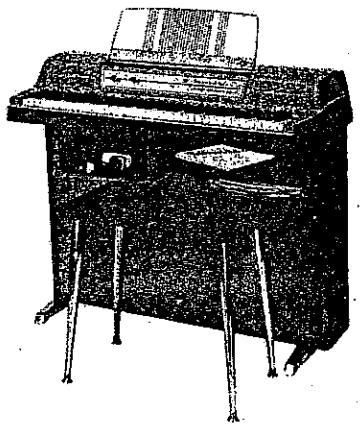


Model 203 & 210A

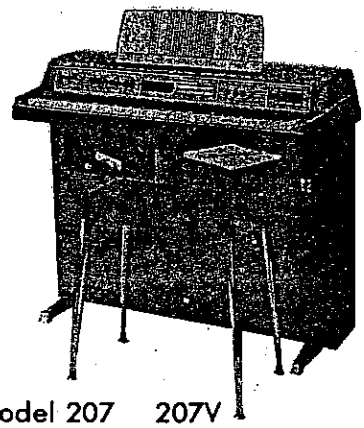
Model 203W



Model 214 214V
214A 214VA & 215VA



Model 206 & 206A



Model 207 207V
207VA & 205VA

Model 270

THE WURLITZER COMPANY - DEKALB, ILLINOIS 60115

P1R-1000-816

PART NO. 800011

SERIES 200 AND 200A

SECTION I

WURLITZER ELECTRONIC PIANOS

MODELS 200, 203, 203W, 205V, 206, 207, 207V, 214, 214V & 215V

SPECIFICATIONS AND DESCRIPTION

MODEL 200, 200A (PROFESSIONAL PORTABLE)

Keyboard Range:	64 Notes, A-13 thru C-76
Height (From Floor to Top of Keys With Legs):	28 5/8"
Height of Case (Less Legs):	7 1/8"
Height (From Floor to Top of Case, Not Including Music Panel):	33"
Overall Width:	40"
Overall Depth:	18 9/16"
Weight: (Less Legs and Pedal)	56 lbs.

Legs: Removable chrome plated steel legs, two of which have leveling glides.

MODELS 203, 203W, 206, 205V, 206, 207, 207V, 214, 214V, 215V & 270

The Models 203 and 203W are home consoles. For Group Piano Instruction, the Model 206 is the student console and the Models 205V, 207 and 207V are teacher's consoles. The Models 214, 214V and 215V are classroom consoles. The Models 207V and 214V have the switches, wiring and plugs installed for use with the Model 208 Key/Note Visualizer. The Models 205V and 215V are similarly equipped to operate the V-500 Key/Note Visualizer. The Model 270 is a butterfly grand using similar internal assemblies as the Model 200.

Keyboard Range:	64 Notes, A-13 thru C-76
Height (From Floor to Top of Keys):	28 5/8"
Height (From Floor to Top of Keys) Model 270:	27 1/4"
Overall Height (Not Including Music Panel or Casters):	32 7/8"
Overall Height (Not Including Music Panel) Model 270:	34"
Overall Width:	40"
Overall Width Model 270:	41"
Overall Depth:	18 9/16"
Overall Depth Model 270:	37 1/2"
Weight Model 270:	Approx. 150 lbs.
Weight (With Legs & Lyre) Model 270:	160 lbs.

NOTE: The Following Information Applies to All Models Except as Noted.

BENCH:
Wood bench with removable chrome plated steel legs, two of which have leveling glides.

KEYBOARD:
Sugar Pine keyboard, naturals are covered with white Implex plastic, sharp tops are black molded plastic.

ACTION:
Wurlitzer manufactured action, employing conventional action parts such as whips, butts, flys (jacks), dampers, etc. **Regulates Like a Conventional Piano Action.**

HAMMERS:
Three ply maple covered with mothproofed felt.

TONE SOURCE:
Hammers strike steel tone producing elements, causing them to vibrate in a polarized electrostatic field.

SPEAKERS:
Following is listed the various models showing the description and number of speakers used in these instruments:

Model 200 - Two 4" x 8" oval.

Model 203 - Two 4" x 8" oval plus two 8" round **or** four 8" round.

Model 203W - Four 8" round.

Model 205V - Two 8" round.

Model 206 - Two 4" x 8" oval or two 8" round.

Model 207 - One 6" x 9" oval **or** one 8" round **or** two 8" round.

Model 207V - Two 8" round.

Model 214, 214V & 215V - Four 8" round.

Model 270 - Two 8" round.

(Refer to schematic diagram for matching output impedance to speaker impedance).

POWER REQUIREMENTS:
ALL MODELS - 40 watts; operated from 117-volt 60 Hertz A.C. Three wire center grounded A.C. cord standard.

TOP (ALL FOUR MODELS):
ABS (Acrylontrile-Butadiene-Styrene) molded plastic top, hinged at the back. Secured to the keybed with three (3) screws thru the keyslip.

Model 270 has a finished all wood case (walnut).

PEDAL SUSTAIN:
Lifts dampers, permitting tone to sustain as in a conventional piano. (Detachable on Model 200 portable, built in on console models).

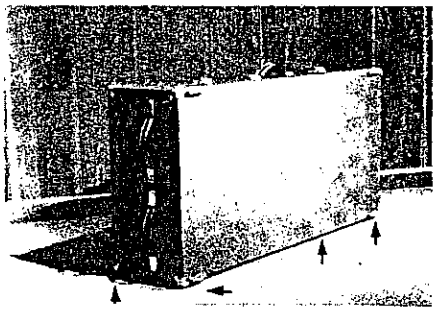
OPTIONAL EQUIPMENT:
Model 206 - Bench is optional, as well as the special A.C. cable, Model 8315, permitting a 206 to be taken out of lab installation and used as a separate or individual piano.

Models 200 and 203 - Bench and headphones are optional.

CARRYING CASE (FOR MODEL 200 PORTABLE): A heavy duty carrying case, Model 233A is available thru the Sales Department. See pages 6A and 6B for photos and instructions for use.

CARRYING CASE - MODEL 233A for WURLITZER ELECTRONIC PIANO - MODEL 200

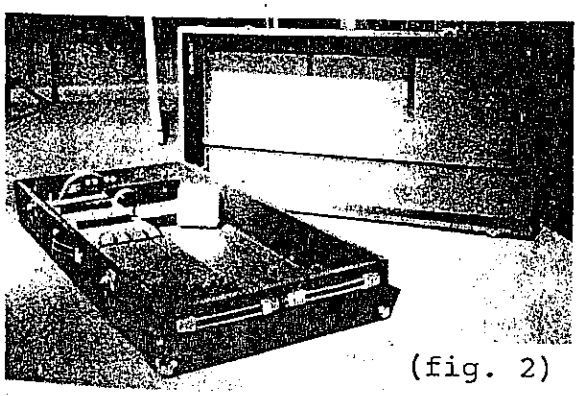
A. Remove the case from the shipping carton (fig. 1). To open, lay case flat on floor and unlatch the four locks. (Note: the locks are placed in different positions on each side of the case to avoid improper closing.)



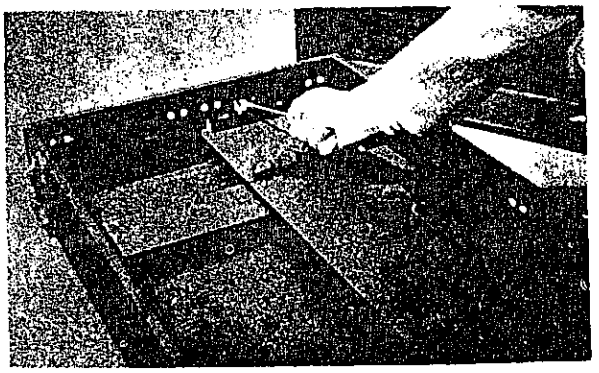
(fig. 1) caster placement

B. Inside the case is a box containing four 1½" chrome casters to be attached on the bottom or end of the case, as you see fit. These casters are designed primarily for use indoors on floors or carpet; if the case is to be moved on sidewalks or on any rough ground, it is suggested that you purchase 2" (or larger) rubber casters.

C. Inside the case you will find a covered board with elastic straps designed to hold the piano legs and the expression pedal (fig. 2). During initial shipment of the empty case, this board is secured by two metal clamps located at each end. Using a Phillips screwdriver, remove these clamps (fig. 3) and dispose of them. Now take the board out of the case.

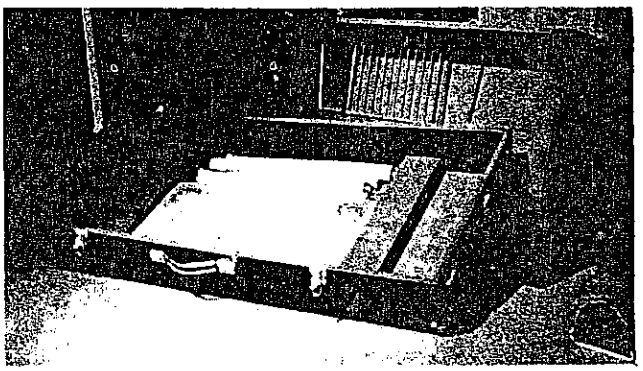


(fig. 2)



(fig. 3)

D. Place the piano bench in the bottom of the case (fig. 4) with the bench legs alternated alongside. Slip the music panel under the elastic straps in the top as shown . . . be sure the rack lies in flat with screw arms facing you.

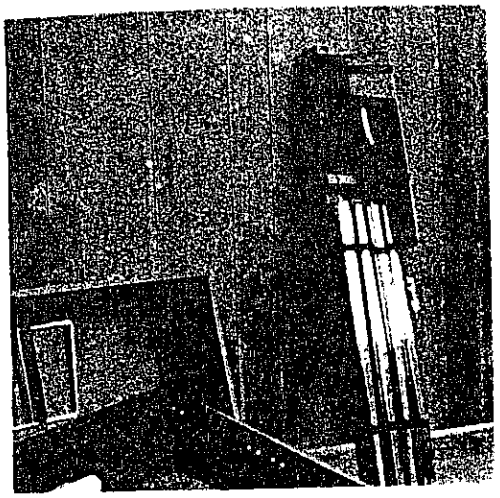


(fig. 4)

E. Place the Electronic Piano over the bench parts in the carrying case with keybed toward the front handle (fig. 5).

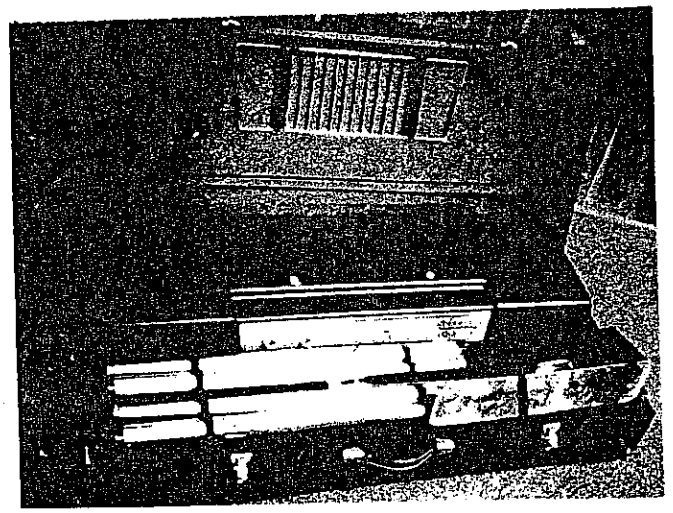
(fig. 5)

F. Alternate the piano legs through the elastic straps on the board (fig. 6). Then, place the expression pedal into position through the straps provided.



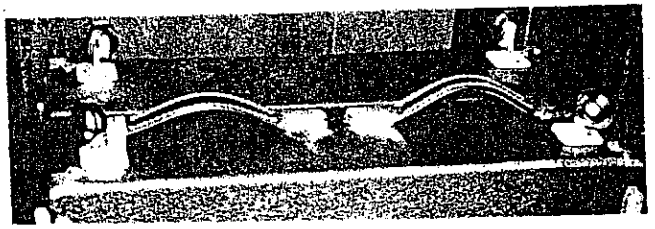
(fig. 6)

G. Finally, place the assembly with the piano legs and pedal over the keyboard of the E.P. (fig. 7). The board will rest on the piano arm, not on the keys. Close the case.

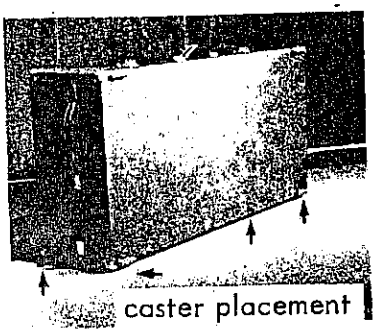


(fig. 7)

H. Fig. 8 shows ways to install the casters on the end of the case for upright mobility or on the bottom.



(fig. 8)



PREPARATION OF THE PIANO FOR SERVICING (SEE FIG. 1 & 2 Page 4)

Unplug the piano from AC outlet. To remove the top assembly, remove the three (3) Phillips head screws that hold the keyslip down to the keybed, take out the two (2) screws that hold the music panel in place, remove the control knobs. (It may be necessary to pull the front of the top slightly forward to clear the shafts which hold the control knobs). Unplug the plastic speaker plug, located at the left hand corner on the top of the chassis assembly. Lift the keyslip portion until nearly vertical and unhook the three hinges at the back side of the top.

If the service needed is to correct a problem with the amplifier, the printed circuit board can now be removed and turned over for checking without unsoldering the leads at each end.

If the service required is regarding the keys or action, the entire chassis assembly should be removed as follows:

NOTE: If any of the four models have a screw that fastens the heat sink on the printed circuit board to the reed bar, remove the screw and discard it.

MODEL 200 AND 200A (PORTABLE): (SEE FIG. 1 & 2 Page 4)

1. Unplug the input cable at the bass end of the printed circuit board. (SEE FIG. 2 Page 4.)
2. Loosen the six screws that hold the shield to the reed bars and remove the shield by lifting straight up.
3. Unplug the white plastic plug behind the speaker plug, located on the left side of the chassis assembly. (SEE FIG. 2 Page 4.)
4. Remove the two screws at each end of the chassis that secure it to the mounting blocks. (Note: The screw located on the left hand side and toward the action bracket is larger than the other screws and has a washer located under the chassis.)
5. Remove the Pre Amp Board located at the top center of the reed bar, by loosening the two (2) 1/4" hex head screws. (200A only)
6. Lift up the entire chassis assembly, being careful not to damage the two phone jacks mounted on a bracket at the bass end.
7. Replace the front mounting screw and washer in bass action bracket. The keys and action are now exposed for any necessary regulation.

MODELS 203, 203W and 214 (HOME CONSOLES):

Follow the same procedure as for the Model 200 for steps (1) thru (7).

If there is a square white plastic nine-pin plug and socket located above the printed circuit board, unplug and remove the chassis assembly.

If there is no plug at this location, remove the three screws that hold the round mounting plates for the headphone sockets at each end of the keybed. Also remove all cable clamps used to dress the wires leading to these jacks.

Remove the lower front panel by removing the four wood screws across the top of the panel. Unplug or unsolder all cables going to the lower front panel.

MODEL 206 (STUDENT CONSOLE):

Follow steps (1) thru (7) as described for the Model 200. If there is a square white plastic nine-pin plug and socket located above the printed circuit board, unplug it and remove the entire chassis assembly. **If there is no plug at this location,** remove the three screws that hold the round mounting plate for the auxiliary headphone socket at the bass end of the keybed and the cable clamp that dresses the wires leading to this socket. The chassis assembly can then be removed.

MODEL 207 (TEACHER'S CONSOLE):

Follow steps **one, three** and **four** as described for the Model 200. Disconnect the thirty-six pin plug and socket located near the treble end of the chassis. Disconnect all the nine-pin plugs and sockets on the chassis assembly. The entire chassis assembly can now be removed.

The five or six screws on the shield over the reed bars can now be loosened and the shield removed.

REGULATING PROCEDURE

In the keys and action of the Wurlitzer electronic piano there are approximately 3,200 parts made mostly of wood, metal and felt. These materials are specially selected and manufactured for use in piano keys and actions, but the normal wear from playing the piano, packing of the felts, and changing atmospheric conditions will probably necessitate some periodic re-regulation of the instrument.

The following pages outline the procedure for complete regulation of the Wurlitzer electronic piano. Before proceeding with a complete regulation, however, the instrument should be analyzed to determine the extent of regulation required.

1. **KEYBOARD INSPECTION (SEE FIG. 2, Page 8):** First, check the felt punchings on both the balance and front pin lines and the felt on the keybed at the back of the keys. Replace these felts if they are moth-eaten or packed excessively.

   Next, inspect the entire keyboard for free movement of each key at both the balance and front pin lines. Check both natural and sharp keys by lifting them about 1/4" and dropping. If the keys do not drop back, they are tight in either the balance rail bushing or the balance rail hole.

   Check the balance rail bushing first by moving the key from side to side. There should be a slight movement of the key at that point. Check the balance rail hole by moving the key forward and backward. There should be a slight chug (movement). Check the front rail bushing by pushing the key all the way down and moving it from side to side. There should be a slight movement.

2. **EASE KEYS**

   When a piano keyboard is found to be sticking or sluggish, the cause is often due to the felt swelling either at the balance key bushing or at the front key bushing, or both. Even if just one or two keys are sticking, it is advisable to check the entire keyboard. Key easing is done by using a pair of key **easing pliers** which can be obtained from any reputable tuners supply house. (SEE FIG. A) Easing is executed by inserting one lip of the pliers into the opening in the key and positioning the other lip of the pliers on the outside of the key, and squeezing firmly but carefully. Wood and felt are thereby compressed to obtain a proper clearance at the pin.

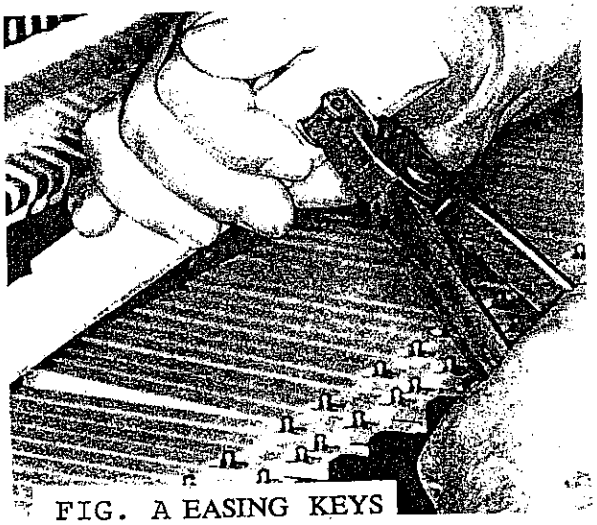
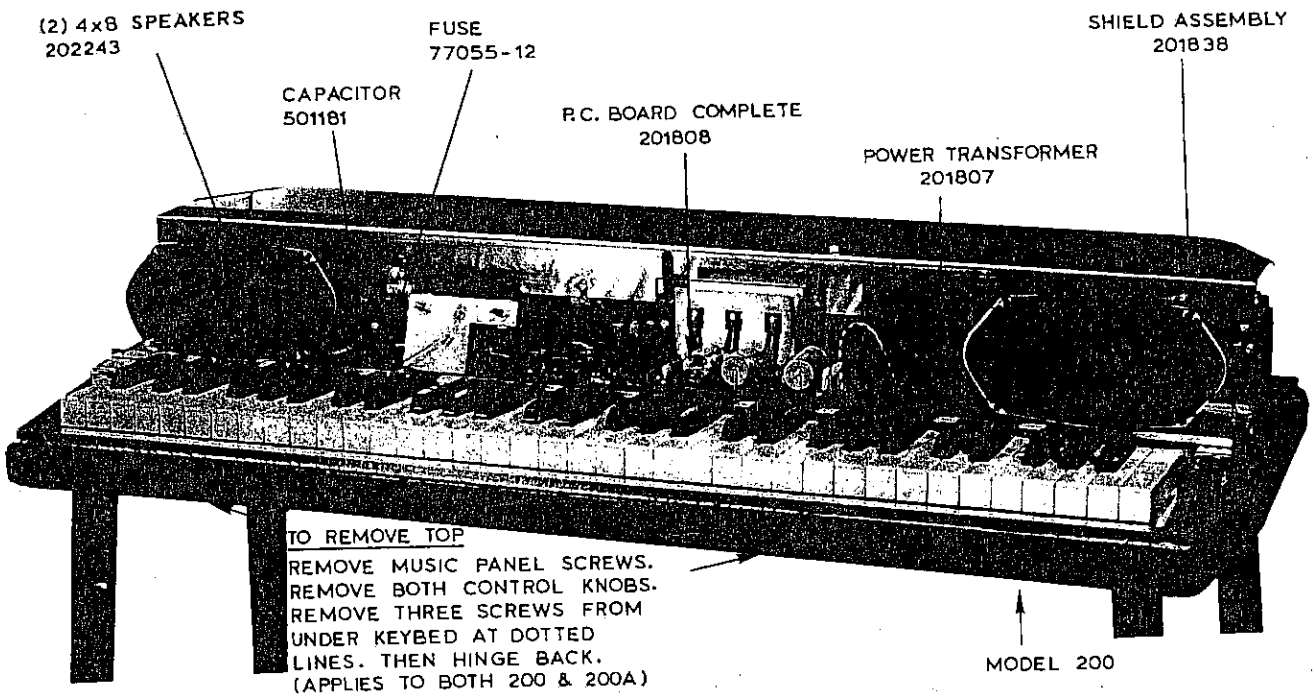
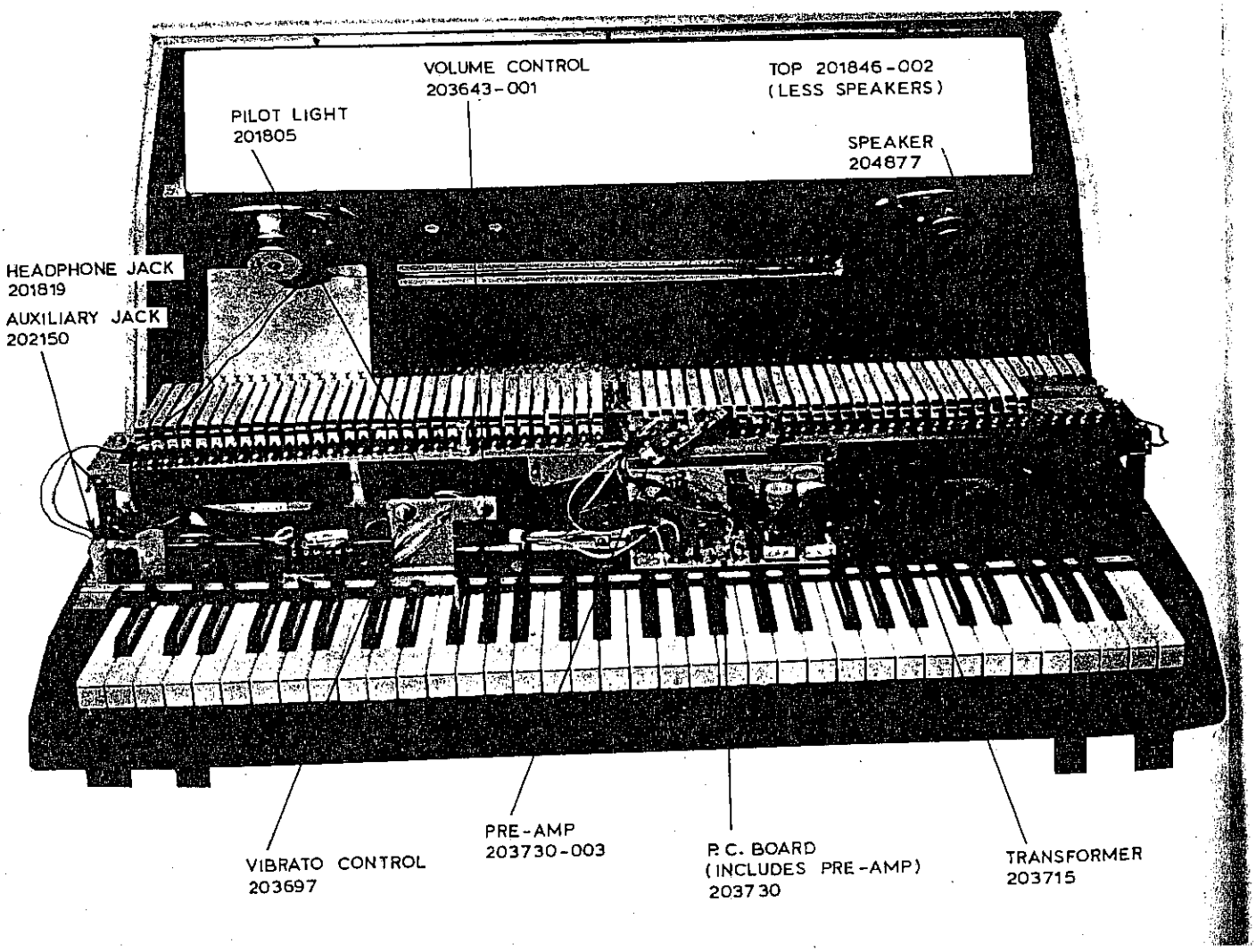


FIG. A EASING KEYS

When easing keys, caution should be exercised so keys are not over-eased. Over-eased balance pin bushings will cause the keys to tip, and over-eased front pin bushings will cause excessive side play, and in extreme cases, adjacent keys touching at the fronts. Over-eased keys will become noisy and will not stay properly spaced.

Sometimes sticking keys may be due to the hole at the bottom of the key (at balance point) swelling and tightening around the balance pin. The clearance should not be excessive but the key should drop freely over the pin. If the balance rail hole is tight it can be enlarged by inserting the smooth shank, not the cutting edge, of a #21 drill (.159" dia.) into the hole. This will give you the ideal size hole with less danger of making the hole too large.


(2) 4x8 SPEAKERS
202243
FUSE
77055-12
SHIELD ASSEMBLY
201838
CAPACITOR
501181
P.C. BOARD COMPLETE
201808
POWER TRANSFORMER
201807
TO REMOVE TOP
REMOVE MUSIC PANEL SCREWS.
REMOVE BOTH CONTROL KNOBS.
REMOVE THREE SCREWS FROM
UNDER KEYBED AT DOTTED
LINES. THEN HINGE BACK.
(APPLIES TO BOTH 200 & 200A)
MODEL 200


VOLUME CONTROL
203643-001
TOP 201846-002
(LESS SPEAKERS)
PILOT LIGHT
201805
SPEAKER
204877
HEADPHONE JACK
201819
AUXILIARY JACK
202150
VIBRATO CONTROL
203697
PRE-AMP
203730-003
P.C. BOARD
(INCLUDES PRE-AMP)
203730
TRANSFORMER
203715

Noisy or loose keys can be tightened with a **key bushing tightener.** Insert the tool into the key bushing and tap lightly with a small hammer. This tool may be used on the balance rail key bushing or the front rail key bushing. A key bushing tightener can be obtained from any reputable tuners' supply house. (SEE FIG. B)

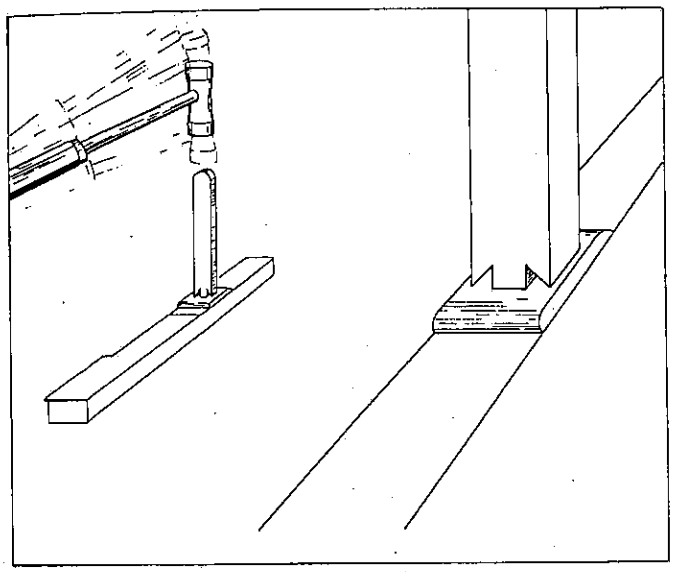


FIG. B
KEY BUSHING TIGHTENER

3. **INSPECT ACTION FOR FREE CENTERS**
First, check the butt centers by raising the butts from the hammer regulating rail and allowing them to fall abruptly, observing the movement of the butts. If the butt centers are free, the butts will fall back to the rail without any hesitation.

Whip centers are checked by depressing the full sustaining pedal to remove all damper spring tension from the whip assembly. Fully depress each key and release it slowly. If the key does not completely return, or if it returns very slowly, the whip centers are probably sluggish. Keys must, course, be properly eased before this inspection is performed.

If the action centers are sluggish, treat the action centers according to the procedure which follows.

4. **TREATING ACTION CENTERS**
If the action centers become sluggish they must be treated to restore the proper amount of freedom. If treatment is necessary, all action centers should be treated.

The treating solution consists of eight (8) parts of V. M. & P Naphtha and one (1) part of silicone liquid. V. M. & P Naphtha can be purchased at most paint stores. **Damper flange** centers, **hammer butt** centers, **fly** centers, **whip** centers and **damper sticker** centers are possible points of sluggishness and all should be treated.

Apply silicone solution freely at these points, making sure the action centers are completely wet. Application of the silicone solution can be made with a small plastic squeeze bottle with nozzle. (SEE FIG. C).

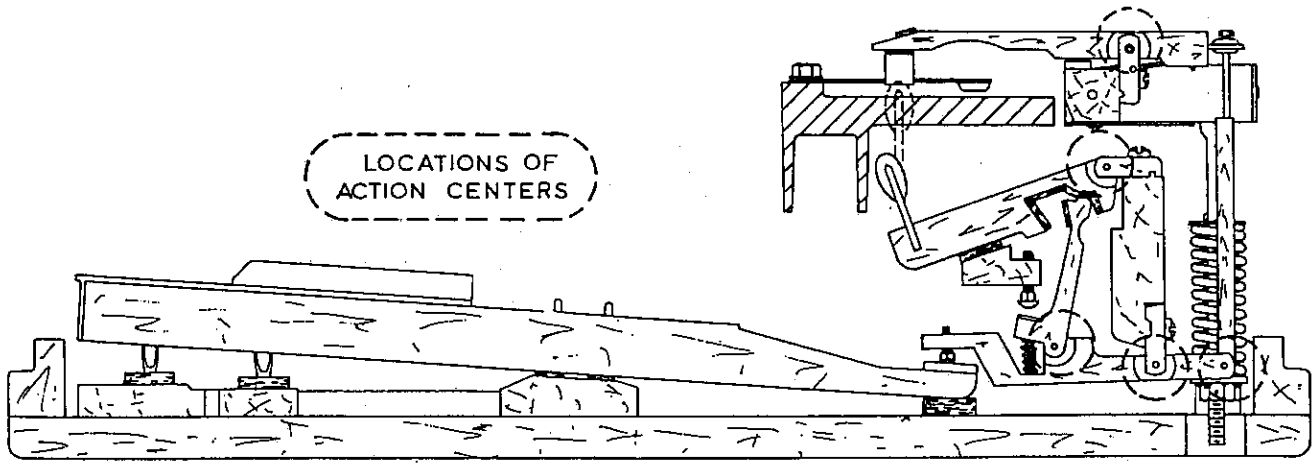


FIG. C
TREATING ACTION CENTERS

The response to the silicone solution treatment should be immediately apparent. CAUTION should be used when applying. Key covers can be damaged or reeds may go out of tune if spilled on. The silicone solution should be applied before regulation for best results, if needed. Silicone and applicator kit is available from DeKalb, Illinois Service Department.

Never re-pin a sluggish or tight action with a center pin that is smaller in diameter than the original center pin. The pin will be tight in the felt bushings and become loose in the wood. The wood will become the action center. This type of repair will not last long and will create a "rubbery" feel to the keyboard.

5. **INSPECT ACTION**
   A. Tighten all screws. (Does not include Regulating Screws).

   B. Check the damper levers for squeaks. Use a soft lead pencil to apply graphite to the teflon groove located under the damper lever spring to eliminate any squeak. (SEE FIG. D).

   C. Check the action completely for any broken parts, loose flanges, moth-eaten or loose felts, etc., and repair or replace as necessary.

   D. With a sand paper file, reface the hammers if necessary. Also, the hammer felt may be softened to remove a "clicking" sound by applying a solution of 75% methol alcohol (methanol) and 25% water. Apply the solution to the crown of the hammers using a plastic squeeze bottle with nozzle, until the solution soaks into the felt. Allow forty-five minutes drying time. This will "puff" up the felt fibers of the hammers and will help restore hammer crown. (SEE FIG. D). Reed bars must be removed to perform the above service.

6. **SET KEY HEIGHT**
   The proper key height is 2" measured from the keybed to the underside of the projecting lip on the front of the natural keys. The key height is adjusted by adding or removing hard paper shims between the balance rail of the key frame and the keybed. (SEE FIG. D).

7. **SQUARE AND LEVEL**
   After the keys have been set to the proper height, the keys are then squared to a straightedge by lightly tapping the tops of the balance rail pins toward the bass or treble as required. This may be done by using a screw driver or a small hammer.

   The natural keys are leveled to the proper height above the keybed. The sharp keys are then leveled to the natural keys so the wood surface just in back of the sharp cap is even with the wood surface of the natural key. (SEE FIG. E).

8. **SPACE KEYS**
   Keys are spaced with a forked key spacing tool by bending the front rail pin toward the bass or treble as necessary. (SEE FIG. F). The natural keys are adjusted so the spaces between the keys are uniform. The sharp keys are then spaced so they are centered between the adjacent natural keys.

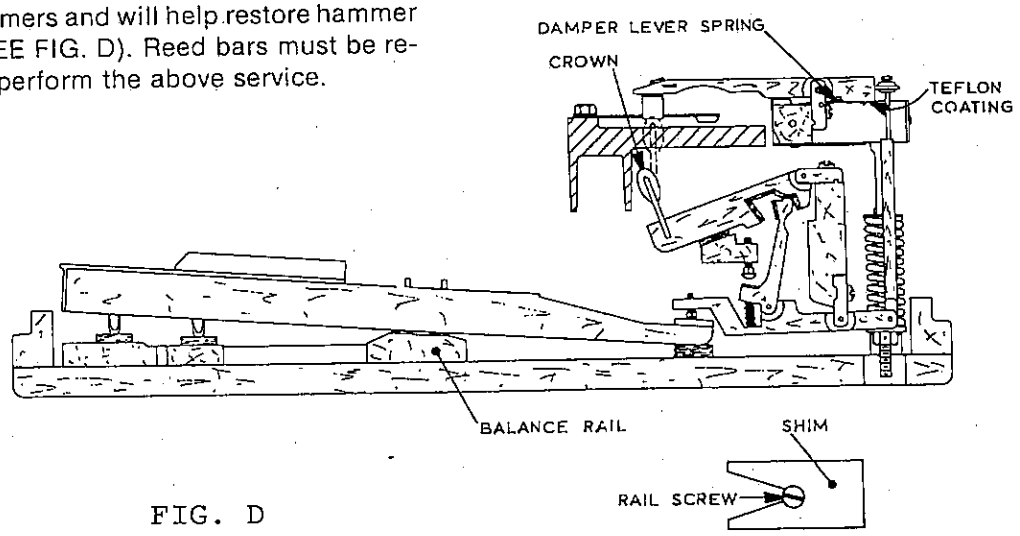


FIG. D

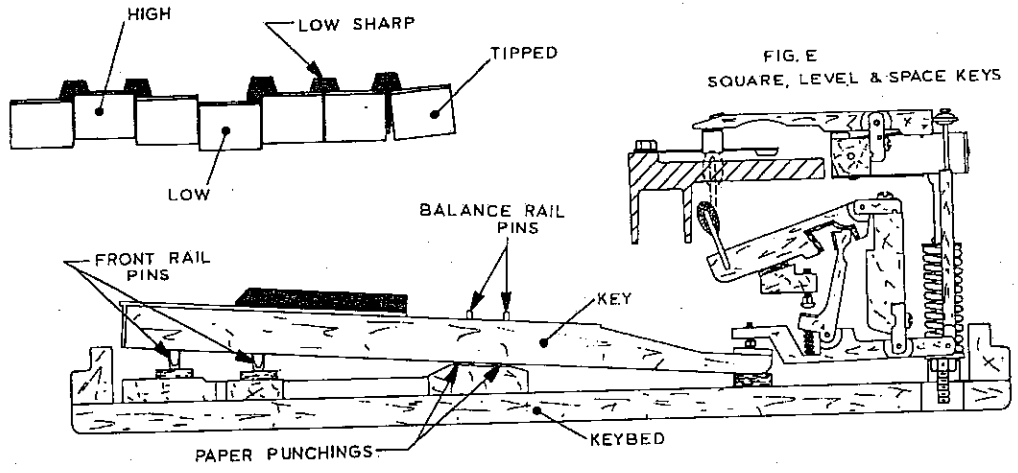

HIGH
LOW SHARP
TIPPED
LOW
FIG. E
SQUARE, LEVEL & SPACE KEYS
BALANCE RAIL PINS
FRONT RAIL PINS
KEY
KEYBED
PAPER PUNCHINGS

FIG. E

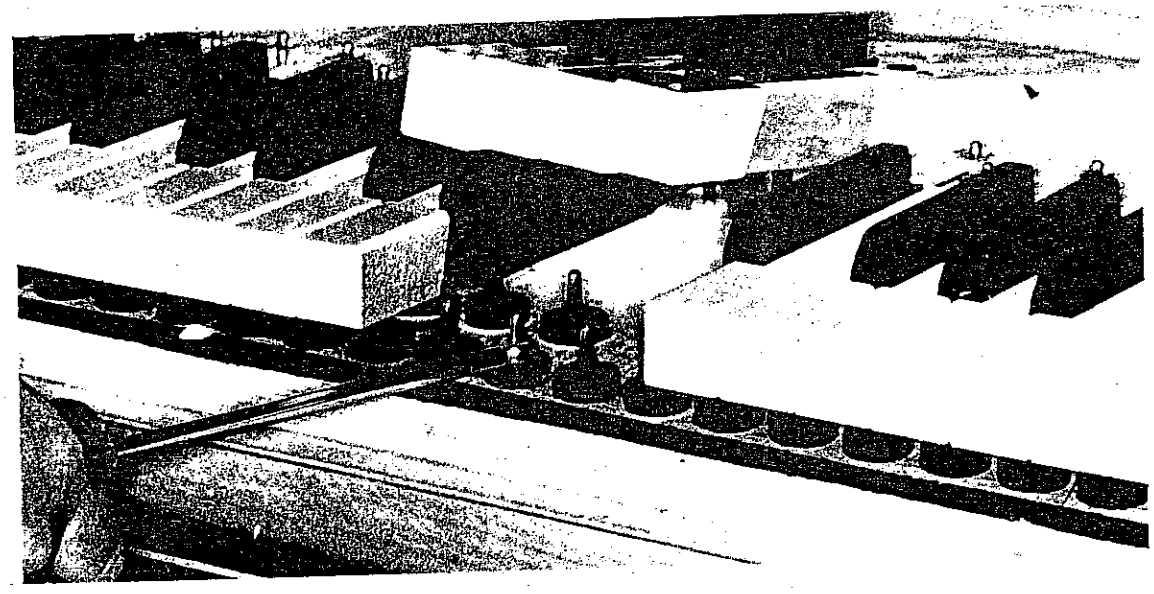


FIG. F

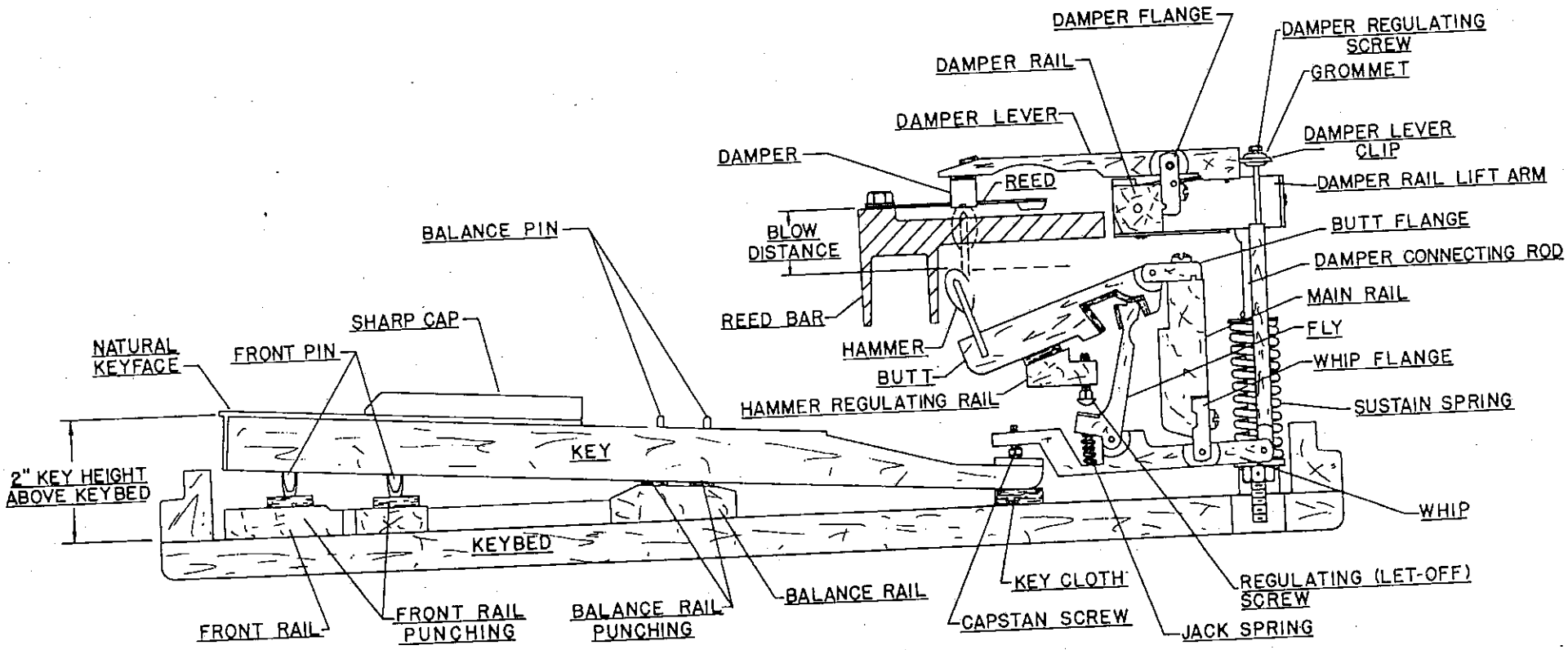

DAMPER FLANGE
DAMPER REGULATING SCREW
DAMPER RAIL
GROMMET
DAMPER LEVER
DAMPER LEVER CLIP
DAMPER
REED
DAMPER RAIL LIFT ARM
BLOW DISTANCE
BUTT FLANGE
BALANCE PIN
DAMPER CONNECTING ROD
MAIN RAIL
SHARP CAP
REED BAR
FLY
NATURAL KEYFACE
FRONT PIN
HAMMER
WHIP FLANGE
BUTT
HAMMER REGULATING RAIL
SUSTAIN SPRING
KEY
2" KEY HEIGHT ABOVE KEYBED
WHIP
KEYBED
REGULATING (LET-OFF) SCREW
BALANCE RAIL
KEY CLOTH
FRONT RAIL
FRONT RAIL PUNCHING
BALANCE RAIL PUNCHING
CAPSTAN SCREW
JACK SPRING

FIG. 2

As the keys are spaced, "brush" forward on the keys with the palm of the hand so the keys fall in their natural position. (SEE FIG. G.) **A Word of Caution:** After the keys are spaced, check the backs of the keys to make certain adjacent keys are not touching each other. It may be necessary to sand some keys slightly to insure the proper clearance between them.

FIG. G

9 **STRIKING POINT**

The striking point is properly set at the factory and should require little or no adjustment in the field. If it is necessary to put in a new hammer or to reset a strike point, heating the glue line with a soldering iron will soften the glue to the point where it can be either moved for a new strike point or taken out to replace the hammer. (SEE FIG. H.)

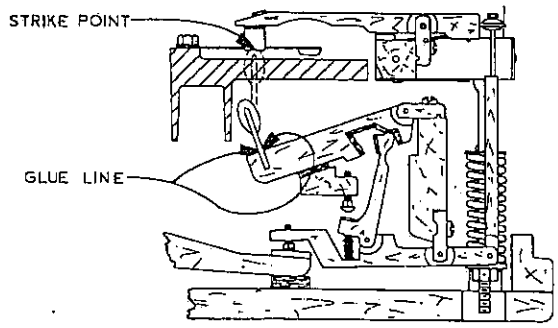


FIG. H

10. **HAMMER BLOW DISTANCE**

The hammer blow distance is factory-set and normally will not require adjustment, providing the hammers are down on the hammer regulating rail.

The correct blow distance is 1 5/64" measured from the tip of the hammer to the under surface of the reed. (SEE PAGE 10, FIG. 2.)

11. **ADJUST LOST MOTION**

A SMALL AMOUNT OF LOST MOTION should be put into the key and action of the electronic piano to make sure the jack will always return under the hammer butt on a slow return of the key. The lost motion is a 1/32" gap between the tip of the fly and the hammer butt covering. To adjust the lost motion, turn the capstan screw, with a capstan wrench. (SEE FIG. I). Counter clockwise adds lost motion. Clockwise to decrease lost motion.

As you depress the key, watch the front of the whip and front of hammer butt to see movement of whip before hammer butt moves. (SEE FIG. I).

ADJUST LOST MOTION

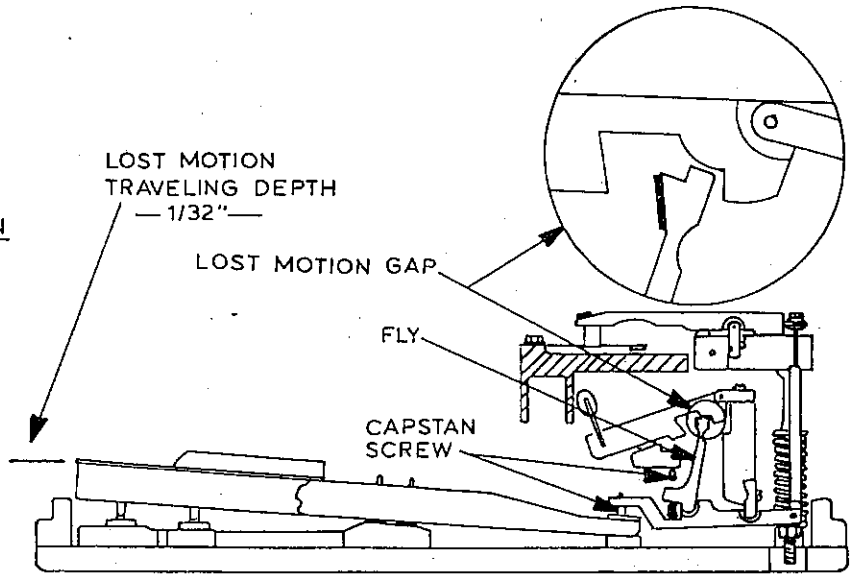


FIG. I

12. ADJUST LET-OFF

LET-OFF refers to the distance between the top of the hammer and the bottom of the reed at the point where the fly will escape the hammer butt. The present specifications for the let-off distance is 1/8" (plus or minus 1/32").

Setting the let-off is, perhaps, the most critical operation in regulating the Electronic Piano Action. Insuring that the let-off is consistent throughout an entire keyboard helps to avoid problems like loud-and-soft notes (uneven scale) and an uneven touch from note to note.

Generally, adjusting let-off requires one tool - a capstan screw wrench, which can be obtained from any reputable tuners' supply house.

To sight and measure the let-off distance, depress a piano key slowly and firmly. (SEE FIG. J). From the point where the hammer peaks-out (before falling) to the bottom of the reeds measures the Let-Off.

To adjust let-off, turn the regulating (let-off) screw with the capstan wrench. Raise the screw (counter clock-wise turns) to decrease the amount of let-off; thus allowing the hammer to get closer to the reed. Lower the screw (clock-wise turns) to increase the amount of let-off. (SEE FIG. J).

SPECIAL NOTE:

Electronic pianos that receive hard use and/or abuse are often subject to a greater degree of reed breakage (very often by professional and/or rock band musicians). It is possible to decrease the number of breaking reeds by increasing the Let-Off distance from 1/8" to 1/4". If this is done, be sure to inform the customer that the instrument will play softer than before and that it would be necessary for them to slightly increase their amplification. (SEE FIG. J).

13. KEY DIP AND BACK CHECKING

Before doing this operation be sure lost motion and let-off operations have been completed.

The blow distance on all electronic pianos is pre-set at the factory and is not adjustable. (SEE FIG. K).

The back check (see insert) is also a fixed dimension but can be set to the proper position by adjusting the key dip.

If the key dip is shallow, the fly or jack which also acts as a catcher will not make contact with the back check and the hammer will bobble. This can be adjusted by shimming up the balance rail. (SEE FIG. K).

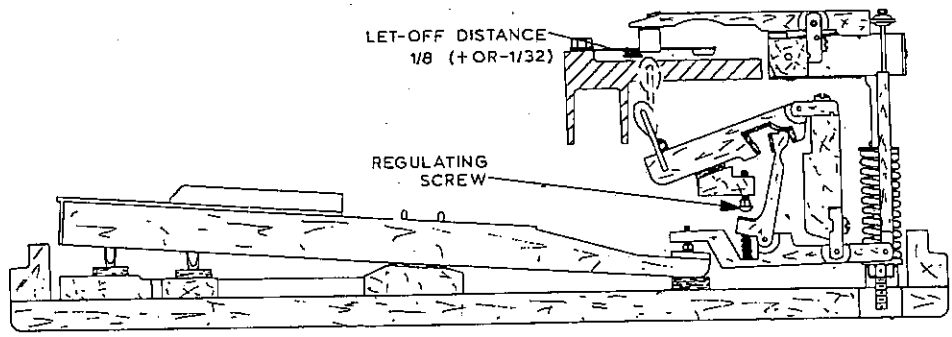


FIG. J

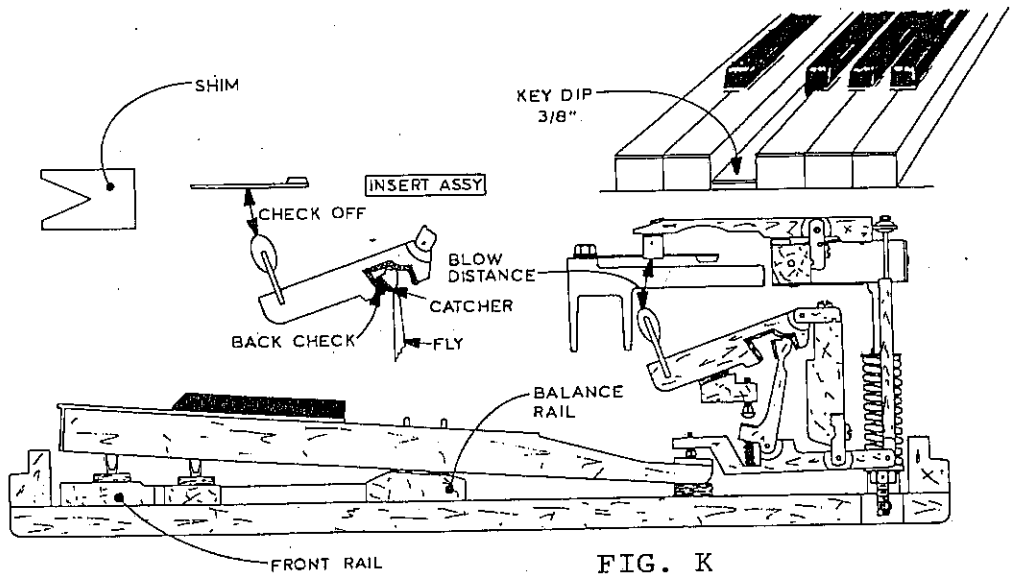


FIG. K

KEY DIP is the total travel measured at the front of the key.

If the key dip is too deep, the catcher will make contact with the back check too soon and the hammer will either block or check off too close to the reed. The hammer should check off between 3/8" and 1/2" from the reed.

If a few individual naturals or sharps are checking off too close to the reed a paper punching can be added under the felts at the front rail to obtain proper back checking.

14. DAMPER SUSTAIN ADJUSTMENT

The 7/16" nut on the bottom of the damper connecting rod, shown in FIG. L, is a step to limit the upward movement of the damper connecting rod. This nut should be adjusted so that a space no more than **1/32"** exists between the bottom of the damper levers and the felt on the damper rail. (SEE FIG. L). This will insure proper damping of the reeds.

The following conditions are characteristic of an improperly adjusted **damper connecting rod nut:** (SEE FIG. L).

A. **Nut Too Low**
If the nut is set too low a greater space remains between the damper rail and damper lever, and as the sustaining pedal is depressed to rotate the damper rail, all of the dampers may not lift off the reeds. This results in a "dull" tone of extremely short duration.

B. **Nut Too High**
When the nut is adjusted too high there will be sufficient space between the damper rail and the damper levers, and some of the dampers may be held off the reeds. This results in failure to dampen some reeds.

The adjustment of the damper connecting rod nut must be performed before proceeding with the regulation of the individual dampers.

15. DAMPER LEVELING

When the damper connecting rod nut has been properly adjusted, the dampers themselves should be inspected for uniform lift.

Depress the full sustaining pedal and observe the lift of the dampers. If some of the dampers are "slow", that is, they lift off the reeds somewhat later than the majority of the dampers, they must be adjusted by **gluing a thin paper shim** on the bottom surface of the damper lever where it contacts the felt on the top of the damper rail. (SEE FIG. L).

The shim compensates for uneven wear or packing of the damper rail felt and provides a uniform damper lift.

16. DAMPER REGULATION

The dampers are adjusted by turning the **damper regulating screws** which pass through the neoprene grommets at the back of the damper levers. (SEE FIG. L). The dampers are properly regulated when a gap of approximately .035" exists between the top of the grommet and the bottom of the screw head. The damper regulating screw has a slotted hexagonal head, and either a screwdriver or a 7/32" (nut driver) may be used to adjust this screw.

17. PEDAL INSTRUCTIONS

To attach the sustain pedal to the Model 200 portable piano, thread the knurled cable nut inside the aluminum housing onto the damper connecting rod through the hole in the bottom of the instrument. Turn until it bottoms against the nut on the rod. There should be a very small amount (about 1/32" to 1/16") lost motion in the pedal before it starts pushing harder and lifting the dampers. This assures that the pedal is not holding some dampers off the reeds. To adjust

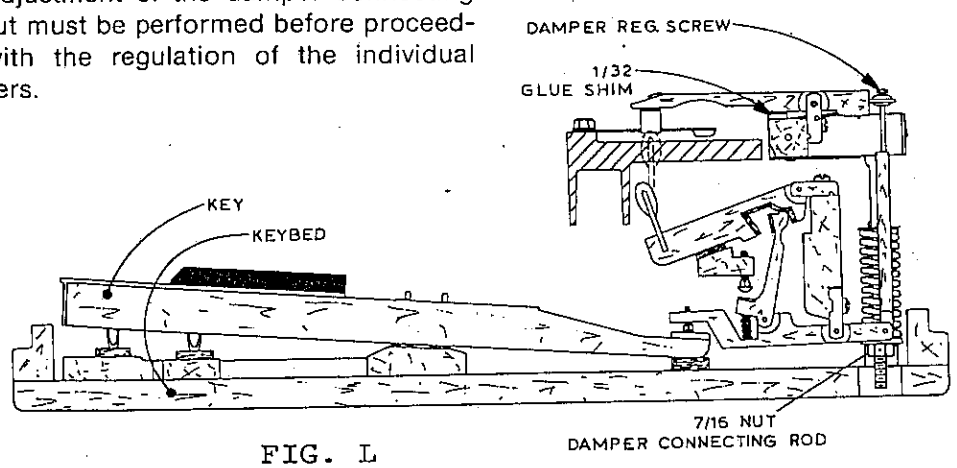


FIG. L

the pedal, loosen the two round head Phillips head screws that secure the top of the cable to the aluminum housing. Pull down on the cable to remove lost motion or push up to get more lost motion. The pedals are set at the factory and generally will not need adjustment unless the cable has slipped through the clamp. Some pedals have two (2) Allen head set screws that clamp the cable as it enters the bottom of the housing. However, the adjustment is the same.

On all console model electronic pianos, the pedal is built in, but the adjustment is the same as covered on the 200 portable. A cable clamp is located about eight (8) inches below the knurled nut. (SEE FIG. M).

18. **VOICING**

This is the most important aspect of the entire action regulation procedure. This insures the tonality, volume, and ring time of the individual notes are uniform and consistent. Loud notes, soft notes, and notes that have a piercing tone, will be eliminated.

Voicing is accomplished by adjusting the pickup (SEE FIG. N) so the flat surface of the steel reed and the face of the pickup are in the same plane. The same procedure is used in the bass with the lead down and the treble with the lead up. **Positioning** of the reed in this manner is very important especially on the smaller reeds.

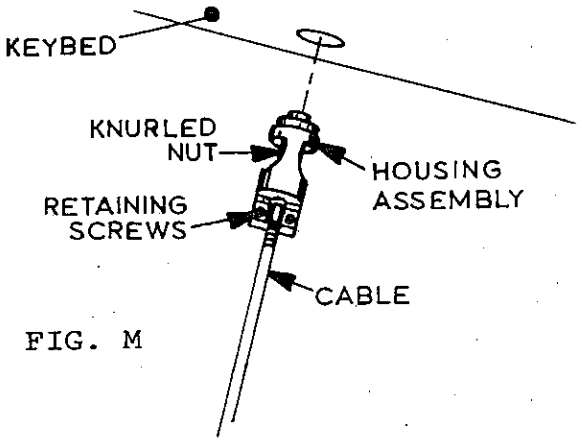
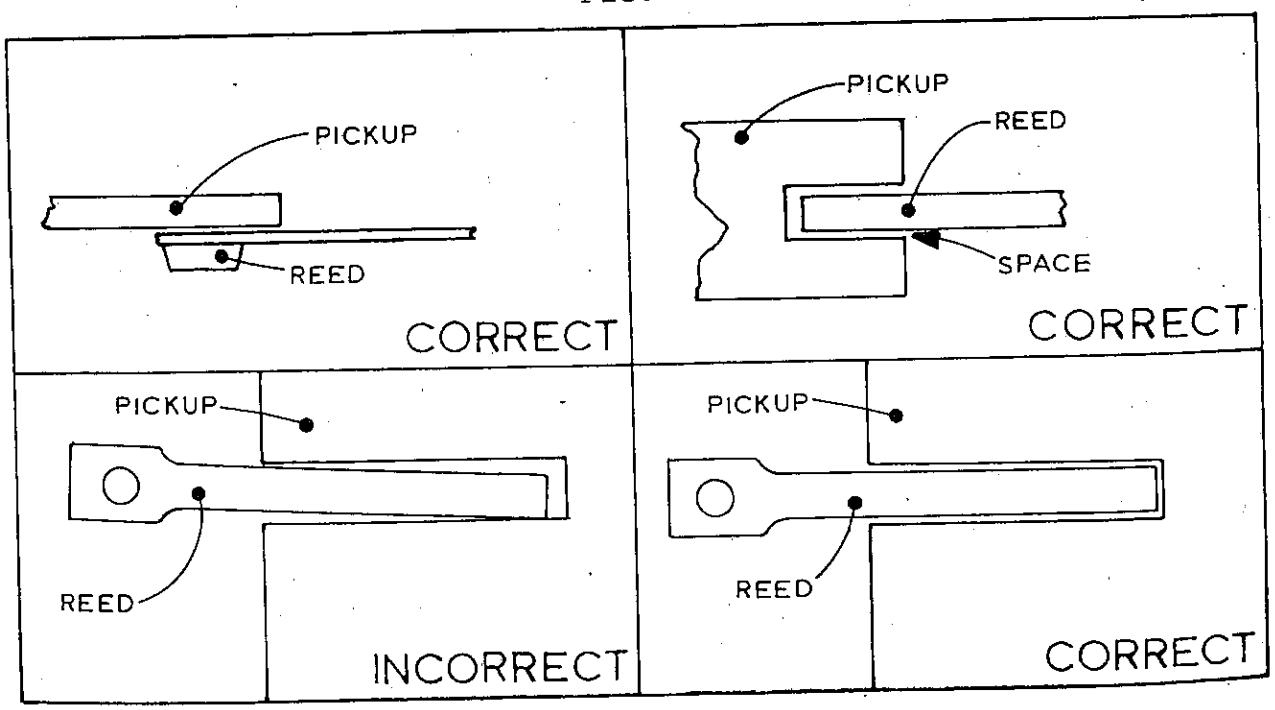


FIG. M

NOTE: PEDAL SHOULD BE ADJUSTED TO LIFT THE DAMPERS TO THE SAME HEIGHT. THE DAMPERS ARE LIFTED WHEN A SINGLE NOTE IS STRUCK.

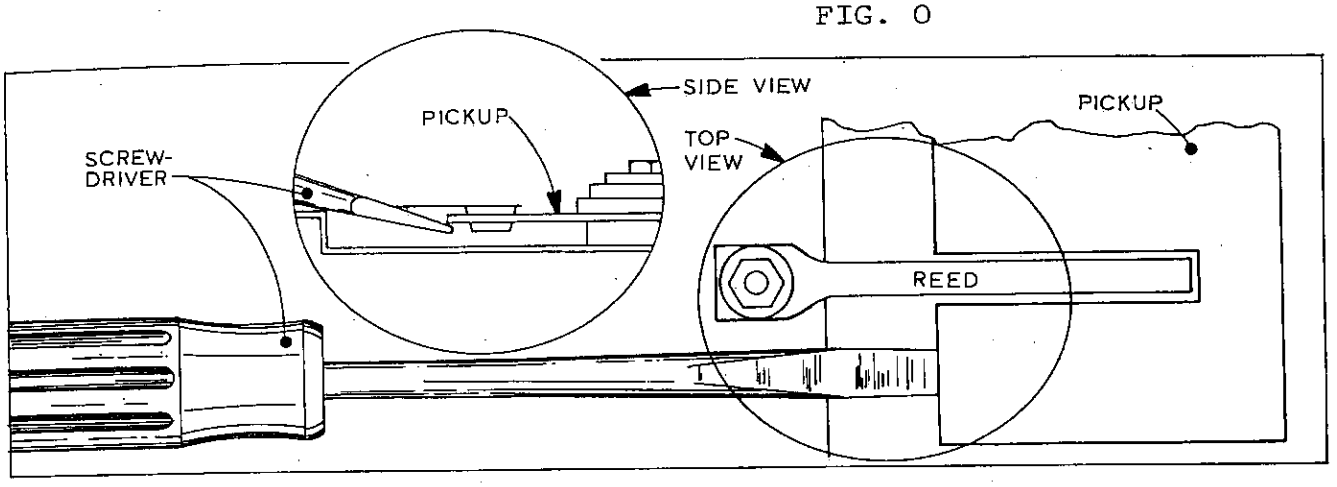
FIG. N



When a reed at rest is positioned inside the pickup, a very strong undesirable harmonic will be generated. Reeds should be positioned as close to the center as possible (SEE FIG. N). An automotive feeler gauge makes a good tool for checking the clearance on each side of the reed to be sure it is centered in the pickup. Unequal **spacing** makes a reed too close to one side of the pickup and will give an undesirable loud tone.

Voicing can be accomplished, in part, by changing the relative position of the pickup to the reed (SEE FIG. O). Moving the pickup up or down adjacent to the reed will change tone characteristics of each note. Be careful not to bend the pickups up or down excessively or frequently since this will weaken it.

FIG. O



For notes that have a **short ring time.** Remove the reed (SEE FIG. P) to check a note with a **short ring time.** The base of the reed or the part under the reed screw should be inspected on both sides of the reed for any foreign material. The reed can be cleaned by holding a very fine grit emory paper on a flat surface and polishing both sides of the head until metal shows through. This is also an electrical ground. If you lose the ground, you will lose the volume. Any foreign material on the head of the reed will dampen the oscillation. If this does not cure the ring time, the reed should be replaced.

Changing the strike point of the hammer to get a better sound should only be attempted after the preceding steps have been undertaken. It is possible to improve the tone and sustain of a reed by being certain that the strike point is correct. First, loosen the reed bar screws. This will allow the reed bar to be moved backward and forward. From this you can determine which way the hammer needs to be moved. To move the hammer, take a soldering iron and heat at the base of the hammer stem where it meets the butt assembly. (SEE FIG. Q). Thermal glue is used here. After glue is soft, the hammer stem can be moved forward or backward to the appropriate location.

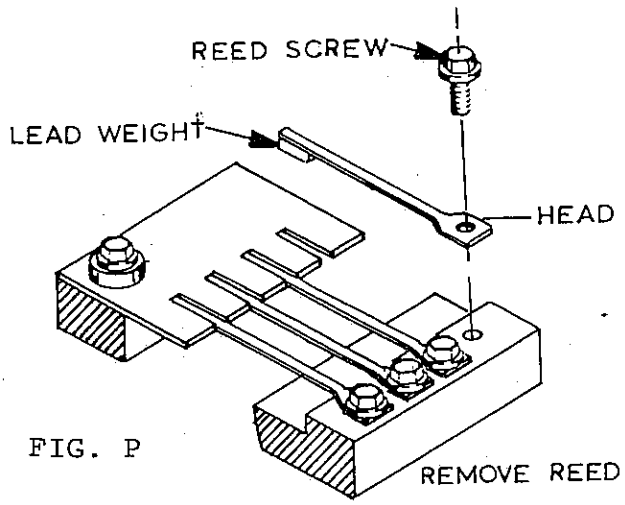


FIG. P

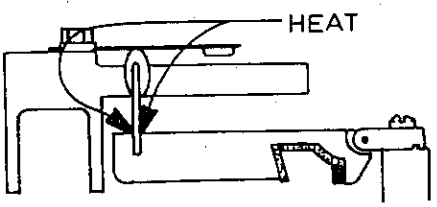


FIG. Q

19. TUNING THE ELECTRONIC PIANO REED

The REED is the tone element of the Wurlitzer Electronic Piano. Its tuning position in the instrument and how this position relates to the pick-ups are essential to the tonal quality of the piano.

INSTALLING NEW REEDS — The reed's retaining hole is slightly larger than the diameter of the reed screw. When putting a new reed in place for tuning, be sure that the reed is as far "BACK" as it will go. (SEE FIG. R). Additionally, before beginning to tune, insure that the reed screw is tight. NOTE: the reed screw washer is dish shaped. This washer should **not** be flattened. Tightening the screw after the reed has been brought up to pitch will cause it to go sharp (and lead will need to be added to the tip and the reed retuned).

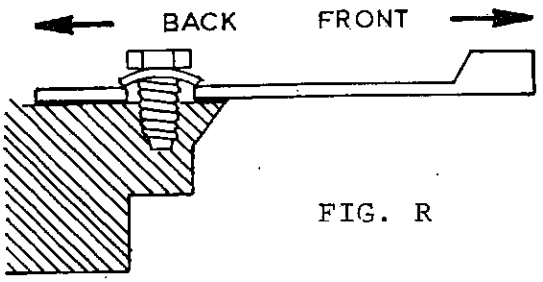


FIG. R

Tuning is accomplished by removing the lead from the reed tip (by filing or scraping a small amount at a time). Continue to remove the excess lead until arriving at the proper pitch. If the reed is flat, the pitch can be raised by removing lead from the tip. If the reed is sharp, the pitch can be lowered by adding lead to the tip or moving the reed as far forward as possible.

While removing the excess lead, it is very important to maintain the PYRAMID shape of the tip. (SEE FIG. S.) Remove lead from the tip by filing or scraping a small amount at a time. Try to remove the lead evenly so the weight remaining on the tip will be evenly distributed. (SEE FIG. S.) A lop-sided tip can affect the motion of the reed as it vibrates.

When tuning a new reed, removing too much lead will cause the pitch to be sharp (too high). Moving the reed to the "FRONT" will drop the pitch (from 2 to 5 cents) and permit fine tuning without having to add additional lead to the tip.

If moving the reed to the "FRONT" does not sufficiently lower the pitch, remove the reed, add lead to the tip by using a soldering iron and rosin core solder. A low heat is best, so a small drop of solder can be added without melting the lead to make it flat, and then fine tune the reed by filing it to remove the excess.

When tuning new reeds, pitch tolerances should be kept to within 5 cents (−2 to +3). The tuning process is often made easier with the use of a strobe-type tuner.

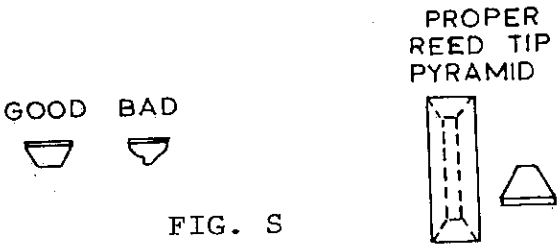


FIG. S

20. REMOVING ACTION PARTS

It is not necessary to remove the action from the piano to replace a **butt assembly** or a **damper lever.**

It is necessary to remove the action to replace a **whip assembly.**

A. **Butt Assembly** (SEE FIG. 2, PAGE 8)
Disconnect the damper regulating screw from the related damper lever and one on each side of it by pulling the grommets out of the wire clips. Remove the butt flange screw with a slim screwdriver between the backs of the damper levers (or remove the related damper lever for better accessibility), rotate the back side of the butt between the main rail and the damper rail and pull out.

B. **Damper Assembly** (SEE FIG. 2, PAGE 8)
Disconnect the damper regulating screw from the damper lever by pulling the grommet out of the wire clip. Remove the damper flange screw and lift the damper lever up and out of the action.

C. **Action Removal**

1. Unplug the 2 or 3 wire A.C. plug located at the bass end.
2. Remove the metal shield over the reed bars.
3. Remove the four screws that secure the extreme bass and treble ends of the entire metal amplifier chassis assembly to the mounting blocks.
4. Remove ground screws on chassis.
5. Unplug the input cable from the printed circuit board on 200 only. For 200A, use a 1/4" nut driver and two screws that hold the Pre Amp assembly board located between the reed bars.
6. Lift the chassis and pull it forward approximately one inch and remove.

7. Remove the shoulder bolt that connects the damper connecting rod to the damper rail lift arm, noting the location of the felt washer and the spring washer.
8. Remove the two screws behind the damper rod sustain spring that secures the main rail support bracket to the main rail.
9. Remove the three screws (one in front and two in back) that fasten the end action brackets to the mounting blocks. If there are cable clamps fastened to the front of the reed bars, remove them.
10. The action is still being held down in the center. Take a long 10" blade, 3/16" diameter Phillips head screw driver and remove the screw that secures the bottom right side of the center action bracket to the whip stop and keybed. (see photo, page 16). The screw driver must be inserted at the back left or bass corner of the treble reed bar just in front of the treble damper rail.
11. At this point, the whole action reed bar assembly should be free to be lifted out of the piano. Also, you can see the tip of the screw driver going into the screw head by looking at the space located between the middle support bracket and the 33 whippen.

D. **REMOVE THE WHIP ASSEMBLY**

Turn the action upside down so it rests on the damper levers. Remove the screw at each end of the whip stop and turn it approximately 90°. Slide the damper regulating screw and grommet out of the clip in the damper lever. Remove the whip flange screw and the entire whip assembly will come out.

IMPORTANT: When installing the new whip, be sure the tip of the jack (or fly) is placed properly in the butt before screwing the whip stop back in place.

E. **Installing Action Assembly**

Place action assembly back in place - start mounting screws, but do not tighten. Be sure all jacks are placed properly by depressing each key. If a key is jammed, the jack is not installed correctly and must be adjusted or "tripped". After the keys are operating, tighten mounting screws.

Connecting External Amplifiers for Model 200 only

The most satisfactory point to obtain a signal for driving any external amplifier is at the external output jack. As the piano is wired, this signal is taken from point 7 (signal) and point 1 (ground).

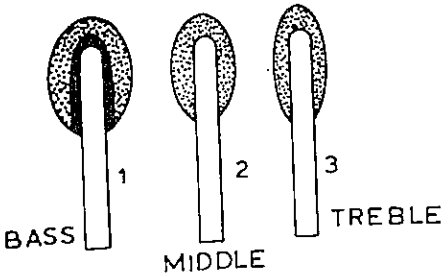
In early production amplifiers, the resistor between points 6 and 7 (R 75) should be changed to a 6.8K, the resistor between points 1 and 7 (R 76) should be changed to a 2.2K, and the 5 mfd. capacitor between points 5 and 6 should be removed and replaced with a jumper wire. The signal output level will now be approximately 0.5 volts.

Should the external amplifier require more output signal to drive it, the position of the 6.8K resistor and the 2.2K resistor may be reversed.

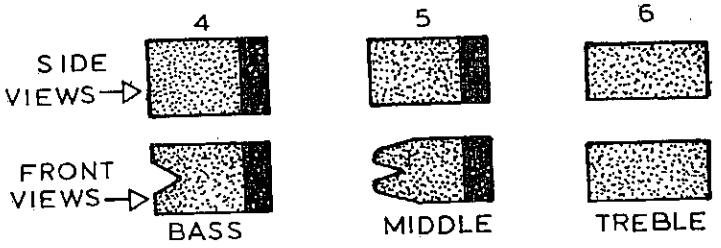
Refer to "amplifier-piano-P.C. board assembly" drawing #201808-S-1 E-1 in the back of the service manual.

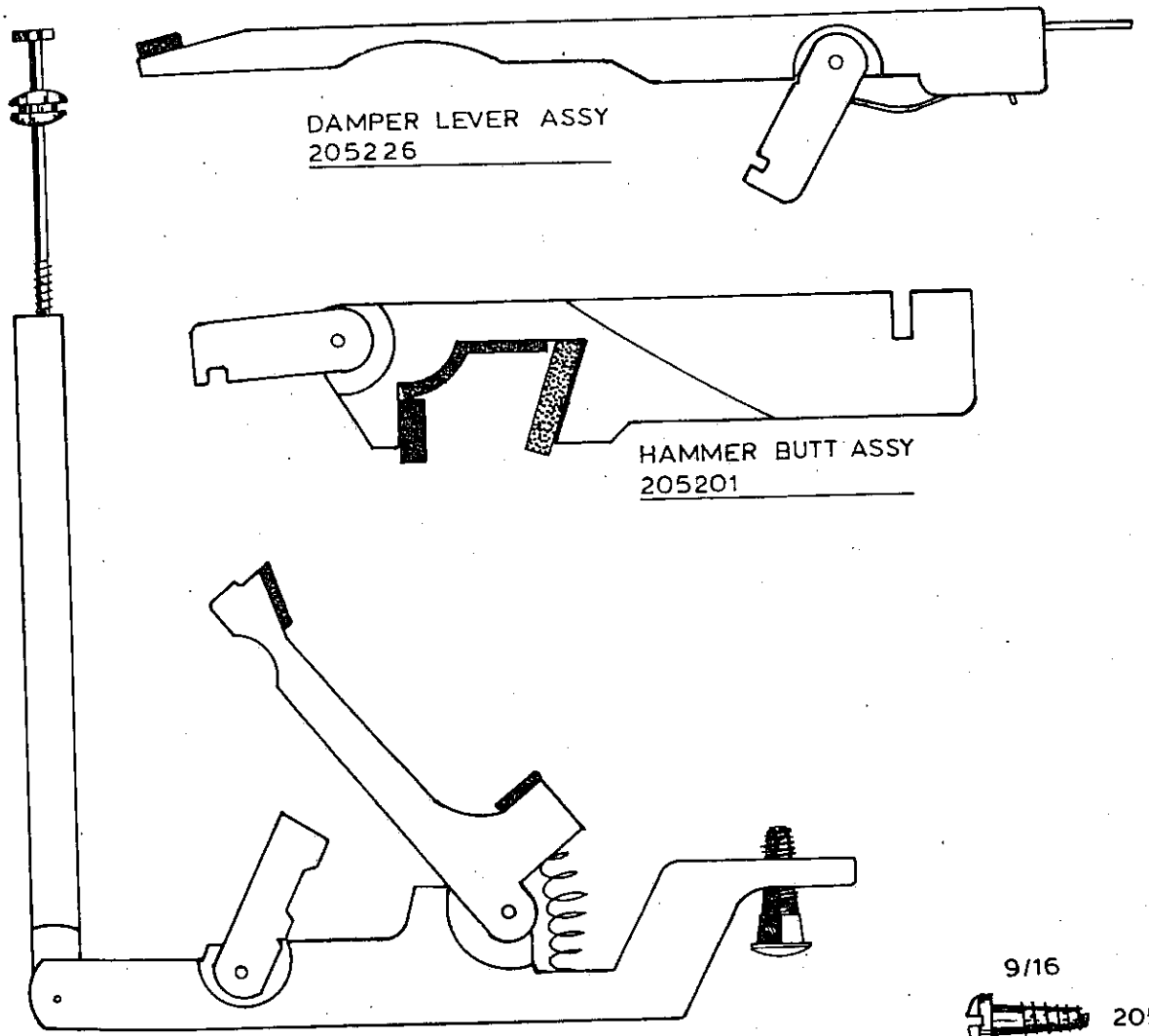
ACTION PARTS

HAMMERS



DAMPER FELTS





DAMPER LEVER ASSY
205226

HAMMER BUTT ASSY
205201

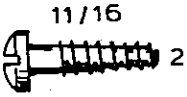
WHIPPEN ASSY
205339

9/16

205172

WHIPPEN & DAMPER SCREW

11/16



205171

HAMMER BUTT SCREW

PARTS FOR HAMMERS & DAMPER FELTS	
1. 201775	4. 201792
2. 201785	5. 201793
3. 201782	6. 201794

MODELS 206 AND 207

TROUBLE SHOOTING CHART

Following is a complete check out procedure with trouble shooting hints.

NOTE: Useful service tools for making these checks are:

1. A 2000 ohm headphone with a 5 MFD, 35 volt (or greater) capacitor in series for D.C. blocking.

2. A small tape recorder with programmed music or a small transistor radio. These should have an appropriate patch cord to connect the tape recorder or radio in a phone jack or phono jack.

   The headphone assembly will be used as a signal tracer. The tape recorder or radio will be a second "helper" providing an audio signal from a second piano. The signal from the sound source will be inserted into the microphone input. This will simulate a person playing the piano for signal tracing purposes.

   For trouble shooting of 207 teacher's lab console and 206 student pianos, see 207 check out procedures starting on Page 26.

NOTE: The following complaints could happen on all six models. These are followed by a section strictly applicable to 206's and a 207 in a lab installation.

Complaint: Piano Dead - No Sound.
Make sure AC power is available at wall outlet.

Cause: 1. No AC power (Pilot light will not light).
Correction: 1.1 Check wall outlet for 120 V.A.C.
1.2 Check the line fuse in the piano.
1.3 Defective line cord and/or connectors.

Cause: 2. Defective transistor.
Correction: 2.1 Check all transistor voltages (collector-base-emitter).

Cause: 3. Shorted filter or open diodes in power supply.
Correction: 3.1 Check for low voltage and high voltage and replace shorted filter.
3.2 Check diode for resistive front to back ratio.

Cause: 4. Cracked printed circuit.
Correction: 4.1 Solder cracks in printed circuit.

Cause: 5. Defective transformer.
Correction: 5.1 Replace transformer.

Cause: 6. Reed shorted against pickup.
Correction: 6.1 With volume turned down, strike all keys several times with palm of hand. This will shake loose any foreign matter between the reed and the pick-up. Check to be sure reeds are centered in pick-up slots.

Cause: 7. Input Transistor (shorted or open).
Correction: 7.1 Replace TR-1.

Complaint: Distorted Tone.

Symptom: Raspy or harsh tone.
Cause: 1. Blown fuse on printed cirucit board.
Correction: 1.1 Replace only the blown fuse on the circuit board with a short piece of wire. (Fuse has been eliminated on later models).

Cause: 2. Voltage regulation bad (higher or lower than 15.5 volts ± 10%)
Correction: 2.1 Replace TR-5 and/or TR-6 (voltage regulator transistors).

Cause: 3. Final transistors (#11-0772, 11-0773) (202056, 202057) and driver transistor (#11-0770) (202055) defective.
Correction: 3.1 Replace all three transistors and check D-4 and R-10. Replace if defective.
Note: After removing all three transistors from the P.C. board and heat sink, follow procedure found on Pages 27 and 28.

Cause: 4. Weak input transistor TR-1 (#11-0778, green or yellow dot only) (202051)
Correction: 4.1 Replace TR-1.

Complaint: Excessive "Hiss" in Amplifier.

Cause: 1. Voltage regulator oscillating.
Correction: 1.1 Place a .01 MFD. capacitor from the collector of TR-5 to ground.

Cause: 2. Transistor TR-2 and TR-3 noisy.
Correction: 2.1 Change capacitor #18 which is a .1 MFD.

Cause: 3. Transistor TR-1 noisy.
Correction: 3.1 Place a 470 PF capacitor from the base to the collector of TR-1.

Complaint: R. F. Interference (Radio, T.V., Etc.)

Correction:
1. Place a 750 PFD capacitor from the base of TR-1 to ground.
2. Place a 750 PFD capacitor from the base of TR-2 to ground.
3. Place a 750 PFD capacitor from the base of TR-3 to ground.
4. Make sure all grounds and shielded cables are properly connected.

Complaint: Excessive Hum or Buzz.

Cause: 1. Reed bar input cable not fully inseted into socket on P.C. board.
Correction: 1.1 Insert plug fully.

Cause: 2. A.C. power wires too close to amplifier input.
Correction: 2.1 Redress A.C. cabling for minimum A.C. hum.

Cause: 3. Filter capacitor in both low voltage and polarizing voltage power supplies broken loose from printed circuit board through vibration.
Correction: 3.1 Resolder joints and/or cracked printed circuit.

Cause: 4. Neon pilot light wires dressed too close to input of amplifier or volume control wires.
Correction: 4.1 Redress all cables or wires away from pilot light assembly.

Cause: 5. Light dimmer control in a room can cause noise in A.C. power lines.
Correction: 5.1 Turn lights to full brightness. Put a .01 MFD. bypass capacitor rated at 3,000 volts between the ground post of the A.C. line and either one of the two 'hot' leads. One side will increase the hum, the other will remove it.

Complaint: Excessive Hum That Normal Grounding Does Not Eliminate.

Cause: 1. Some water pipe and electrical grounds are located so far from the actual grounding point, they end up being above ground electrically, and lose their effectiveness.
Correction: 1.1 Find a suitable ground as near the installation as possible and connect the lab ground system to it.

Complaint: Vibrato "On" All the Time When Piano is Turned On.

Symptom:
1. Vibrato on a Model 206 or 207 (no vibrato normally on these two models).
2. On all models, if vibrato cannot be turned off.

Cause: 1. Shorting wire from pin #1 and #12 on printed circuit board improperly soldered or missing (206 and 207 only).
Correction: 1.1 Properly solder or add a jumper wire from pin #1 to pin #12 on the printed circuit board.

Cause: 2. Voltage regulator oscillating and going out of regulation in time with the vibrato oscillator.
Correction: 2.1 Add a .01 MFD. capacitor from the collector of TR-5 to ground.

Complaint: Keys "Clicking".

Cause: 1. Back of the sharp caps hitting the aluminum strip behind them.
Correction: 1.1 Remove the top and unscrew the two hex headed bolts that receive the music panel screws one or two turns. Be sure to tighten lock nuts after adjusting.

Complaint: "Cross Talk" in Lab.

Cause: 1. This can be caused by improper or no audio ground anywhere in the system.
Correction: 1.1 Correct faulty audio ground.

Complaint: A Squeak When the Sustain Pedal is Used.

Correction: Place a small amount of thin grease or "Lubriplate" at the point where the bottom of the damper connecting rod passes through the felt washer and rubber grommet.

Complaint: A "Click" or Noticeable "Snap" When the Sustain Pedal is Depressed.

Correction: Squeeze the equivalent of four or five drops of an adhesive sealer such as Dow Corning's Clear Seal, or a white bathtub calking compound into the hole on top of the sustain pedal where the cable enters. (Allow three (3) hours to dry before using.) This material never hardens but gets rubbery and acts as a cushion or gasket for the steel ball on the end of the cable. The material is available at most hardware stores.

Complaint: Sticky Keys or Sluggish Action.

Correction: Refer to page 2, "Preparation of the Piano for Servicing" for information on how to dismantle the piano, and following this, it describes **easing keys and shrinking action centers.**

Complaint: One or More Notes That Are Extra Loud or Harsh.

Correction: Check to see if the reed involved is slightly off center in the pickup or electrode. If so, loosen the reed mounting screw, center reed, and retighten screw.

If the reed is centered and still too loud, bend the ends of the pickup up slightly (1/32" to 1/16"). (Do not bend the reeds, this makes them go flat in pitch).

Complaint: "Duds" or Reeds that Ring A Very Short Time and "Die Out".

Correction: This can generally be corrected, or at least helped, by loosening (one at a time) the four screws that mount the reed bar to the action brackets. If it can be determined which screw, when loosened, helped the most, remove the screw and place a paper front rail punching .010" to .025" thick under the reed bar at that hole and put the screw back in and tighten. It is generally a very slight twist to the reed bar when fully tightened down that causes "short ringers" or "duds".

AMPLIFIER — DESCRIPTION OF MODELS 200, 203, 206, 207 AND 270

The 200 Series Amplifier consists of six basic sections which are as follows: low voltage power supply, low voltage regulator, high voltage polarizing supply, pre-amp, vibrato modulator, vibrato oscillator, and power output stage. (Refer to Schematic Drawing #11-0783) (201904-S-1-E-1).

The low voltage power supply is a conventional full wave rectifier design consisting of power transformer, rectifier D-2 and D-3, and a filter capacitor C-6. The supply delivers 42 volts positive in respect to ground to both the output stage and the input of the low voltage regulator.

The voltage regulator consists of a pass transistor TR-6, a voltage sensing transistor TR-5, and associated stage resistors and capacitors. This regulator maintains a 15.5 (±20%) positive voltage output with a minimum amount of voltage fluctuation and AC ripple.

The reed pickups, mounted on the reed bar are 160 to 170 volts DC above ground. This is a polarizing voltage used to develop a capacitive type input signal pickup. A power transformer step-up winding, D-1, R-2, R-3 and R-5, C-3 and C-4, form this high voltage polarizing supply. It is a half wave rectifier followed by a filter network and bleeder resistor. Because R-56, is in series with the output, the supply can deliver only a very small amount of current to the reed bar, minimizing shock hazard.

INPUT AMPLIFIER

TR-1, TR-2 and TR-3 is a high impedance low level AC amplifier with a low frequency modulator input.

TR-1 is an emitter follower, matching the high impedance of the reed bar to the lower impedance of the voltage amplifier of TR-2 and TR-3. The gain of TR-2 and TR-3 is controlled via R-36 and R-40.

With an input of 60 millivolts at 1 KHz, adjust R-48 for an AC voltage of 4.75 volts at the output of the amplifier with an 8 ohm, 10 watt load and with the volume control on maximum.

MODULATOR

TR-4 and associated components form a twin T oscillator, with R-32 selected for a vibrato frequency of 5.75 Hertz. The output of the low frequency oscillator is coupled to the AC feedback of TR-2 and TR-3 of the input amplifier via R-54, C-53, R-42 and C-46. The AC feedback is in effect shorted to ground at the tremolo rate, and thus the signal from the reed bar is amplitude modulated.

The percent modulation should be approximately 50%. This is measured with an oscilloscope; recording the maximum peak to peak voltage and the minimum peak to peak voltage; and use the following equation:

$$\% \text{ Mod} = \frac{\text{Emax} - \text{Emin}}{\text{Emax} + \text{Emin}} = 50\%$$

OUTPUT AMPLIFIER

The output amplifier stage comprises transistors TR-7, TR-8, TR-9 and TR-10. These transistors are directly coupled together, however, the speaker is capacitor coupled (C-9) to the output load.

The output circuit of this amplifier is a complementary pair of output transistors (TR-9 - NPN, TR-10 - PNP). TR-8 represents a Class A driver stage. The voltage drop across R-10 and D-4 provides the small amount of forward bias required for Class AB operation of the complementary pair of output transistors. The diode D-4 is to maintain the quiescent bias current at a reasonable value with variations in temperature and is thermally connected to the output transistors heatsink; and thus will track with the base emitter voltage of the output transistors. Because of the simple design, the output power is limited to approximately 10 - 15 watts. At higher power levels, TR-8 (the Class A driver) would dissipate considerable heat and the power supply would have to be upgraded.

Capacitor C-9 performs two functions. First, it blocks the positive 26 volts present at the emitters of TR-9 and TR-10 from the 8 ohm speaker load. Second, it acts as a bootstrap capacitor to provide the drive necessary to pull TR-10 into saturation. This function results from the fact that the stored DC voltage of the capacitor with reference to the emitter junctions of TR-9 and TR-10 provides a higher negative voltage than the normal collector-supply voltage to drive transistor TR-10. This higher voltage is necessary during the signal conditions that exist when TR-10 is being turned on, and its emitter voltage is approaching ground. An increase in the base voltage to a point below this level is required to drive TR-10 into saturation.

TR-7 is a voltage amplifier to drive TR-8.

Resistor R-14 provides the necessary AC and DC feedback to maintain the emitter junctions of TR-9 and TR-10 at approximately one half the supply voltage, to reduce distortion and to improve low-frequency performance.

Selectable resistor R-23 is choosen for initially setting the DC voltage at the emitter of TR-9 and TR-10 to +26 ±3 volts.

MODELS 200A, 205VA, 206A, 207VA, 214A, 214VA & 215VA

Schematic: 203720

ELECTRONIC PIANO AUDIO AMPLIFIER

1. General Description

The basic Electronic Piano Amplifier pc. board assembly contains a 20 watt power amplifier, vibrato circuit, low level amplifier for microphone or magnetic phonograph cartridge, voltage amplifier capable of driving external auxiliary amplifiers such as used by performers, high impedance preamp for reed voltage pick-up, and all necessary power supply circuitry. It requires a power transformer, and volume, vibrato and auxiliary volume controls as auxiliary equipment.

Three assemblies are provided for, which add or delete circuit features according to the requirements of the end product. These are as follows:

203721 — Used in 214A, 214VA, and 215VA models and contain vibrato, microphone amplifier, and auxiliary output circuitry.

203722 — Used in 205VA, 206A and 207A models, and is the same as 203721 except without vibrato and auxiliary output circuitry.

203730 — Used in 200A model, and is the same as 203721 except without the microphone amplifier circuitry.

There are four d.c. voltages supplied. A bridge rectifier circuit supplies + and −24 volts for the power output stage. A 14 lead integrated circuit package provides +14.5 volts regulated for all low voltage requirements. A separate transformer winding is required for a half-wave rectifier circuit which provides 147 volts required as polarizing voltage for the reed bar pick-up.

The high impedance preamp, which is connected to the reed pick-up consists of two direct coupled small signal NPN transistors, TR-1 and TR-2. The input impedance is controlled principally by R3 in parallel with the input impedance of the transistor. A small signal diode, D1, is connected from base to ground in reverse polarity as protection against voltage transients if the pick-up is shorted to ground. Protection against radio frequency interference is provided by shunt capacitor C-1, and collector-base feedback capacitors C-3 and C-4.

The reed bar signal is modulated by inserting the vibrato voltage into the feedback loop of the high impedance preamp. A divider is formed by the feedback resistor R-10, and the light dependent resistor of LG-1. The L.D.R., in conjunction with the light emitting diode in the same package, creates a variable leg in the feedback divider and makes possible amplitude modulation of the reed bar voltage. On models not requiring vibrato a 12K resistor, R57, is connected across terminal 1 and 2 on the preamp board.

The vibrato circuit consists of two direct-coupled transistors TR-3 and TR-4, with a band-pass feedback circuit. The circuit will oscillate at approximately 6 Hz. An adjustable control, R-17, is provided for adjusting the depth of vibrato modulation.

A low level preamp is provided for applications requiring a microphone, magnetic phonograph pick-up or similar equipment. It consists of two direct-coupled transistors, TR-5 and TR-6. A shunt disc capacitor, C20, is used to protect against direct pick-up of radio signals, and high frequency rolloff is provided with the capacitor, C21. Because the amplifier is intended to provide for general application of inputs, no particular frequency compensation is provided.

On models that require a signal to drive an auxiliary amplifier, a two transistor direct-coupled stage with feedback consisting of TR-15 and TR-16 is provided.

The signal input is coupled to TR-7 (one-half of the differential amplifier stage) via C-8. The other half of this stage, TR-8, monitors the final output level via R-31. Since the emitters are wired in common, the conduction of TR-8 will affect the conduction of TR-7 (positive feedback); the collector of TR-7 feeds the base of TR-11, the predriver stage.

The predriver stage signal is fed to the bases of the complimentary drivers: TR-12 driver and TR-10 driver (via TR-9 bias control). The bias circuit controls the driver and output stages so that as one of the sets of transistors begins to turn off, the other begins to turn on; eliminating crossover distortion in the final output signal (keeping the final output transistors slightly turned on, class AB).

The bias control circuit, TR-9, is a constant current source; its base emitter diode junction is used as a reference voltage. If too much current passes through resistor R-35 and exceeds the threshold of the base emitter junction of TR-9 (.7V), the transistor will turn on more, reducing the excessive current through R-35, establishing the stable bias current in the driver and output stage transistors. R-38 should be tailored for approximately 10 MA output bias or 4.7 millivolts across R-37 or R-38 with the speaker disconnected. The driver stages TR-12 and TR-10 feed the final power output transistors, TR-13 and TR-11, respectively, which are wired in push-pull. The signal from the collector of TR-13, via R-38 and fuse F-2 and the signal from the collector of TR-11, via R-37 and fuse F-1, are both wired in common to form the output stage. A portion of the output is fed back to TR-8 via R-31, to provide negative feedback which increases frequency response, lowers distortion, minimizes DC offset voltage.

The audio output amplifier is of a quasi complementary design. The driver transistors provide the necessary phase inversion for the output transistors. The collector current of the driver transistor becomes

the base current of the output transistor. The output transistors which are operated as on emitter-followers, provide additional current gain. If the emitter of the output transistor is considered as the collector of this two-transistor circuit, then this circuit is equivalent to a high gain high power transistor.

Capacitor C-12 performs two functions: 1) it acts as a bypass to decouple any power supply ripple from the driver stages, and 2) it is connected as a "boot-strap" capacitor to provide the drive necessary to pull TR-10 and TR-11 into saturation. The stored voltage of the capacitor (with reference to the output) provides a higher voltage than the normal collector-supply voltage to drive TR-10 and TR-11. This higher voltage is necessary during the signal conditions that exist when TR-10 and TR-11 are being turned on, because the emitter voltage of TR-10 now approaches the normal +22 supply voltage. It is then necessary to increase the base voltage to a point above this level in order to drive TR-10 and TR-11 into saturation.

MODELS 200A, 205VA, 206A, 207VA, 214A, 214VA & 215VA

Schematic: 203720

ELECTRONIC PIANO AUDIO AMPLIFIER

1. General Description

The basic Electronic Piano Amplifier pc. board assembly contains a 20 watt power amplifier, vibrato circuit, low level amplifier for microphone or magnetic phonograph cartridge, voltage amplifier capable of driving external auxiliary amplifiers such as used by performers, high impedance preamp for reed voltage pick-up, and all necessary power supply circuitry. It requires a power transformer, and volume, vibrato and auxiliary volume controls as auxiliary equipment.

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203722 — Used in 205VA, 206A and 207A models, and is the same as 203721 except without vibrato and auxiliary output circuitry.

203730 — Used in 200A model, and is the same as 203721 except without the microphone amplifier circuitry.

There are four d.c. voltages supplied. A bridge rectifier circuit supplies + and −24 volts for the power output stage. A 14 lead integrated circuit package provides +14.5 volts regulated for all low voltage requirements. A separate transformer winding is required for a half-wave rectifier circuit which provides 147 volts required as polarizing voltage for the reed bar pick-up.

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The reed bar signal is modulated by inserting the vibrato voltage into the feedback loop of the high impedance preamp. A divider is formed by the feedback resistor R-10, and the light dependent resistor of LG-1. The L.D.R., in conjunction with the light emitting diode in the same package, creates a variable leg in the feedback divider and makes possible amplitude modulation of the reed bar voltage. On models not requiring vibrato a 12K resistor, R57, is connected across terminal 1 and 2 on the preamp board.

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A low level preamp is provided for applications requiring a microphone, magnetic phonograph pick-up or similar equipment. It consists of two direct-coupled transistors, TR-5 and TR-6. A shunt disc capacitor, C20, is used to protect against direct pick-up of radio signals, and high frequency rolloff is provided with the capacitor, C21. Because the amplifier is intended to provide for general application of inputs, no particular frequency compensation is provided.

On models that require a signal to drive an auxiliary amplifier, a two transistor direct-coupled stage with feedback consisting of TR-15 and TR-16 is provided.

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The bias control circuit, TR-9, is a constant current source; its base emitter diode junction is used as a reference voltage. If too much current passes through resistor R-35 and exceeds the threshold of the base emitter junction of TR-9 (.7V), the transistor will turn on more, reducing the excessive current through R-35, establishing the stable bias current in the driver and output stage transistors. R-38 should be tailored for approximately 10 MA output bias or 4.7 millivolts across R-37 or R-38 with the speaker disconnected. The driver stages TR-12 and TR-10 feed the final power output transistors, TR-13 and TR-11, respectively, which are wired in push-pull. The signal from the collector of TR-13, via R-38 and fuse F-2 and the signal from the collector of TR-11, via R-37 and fuse F-1, are both wired in common to form the output stage. A portion of the output is fed back to TR-8 via R-31, to provide negative feedback which increases frequency response, lowers distortion, minimizes DC offset voltage.

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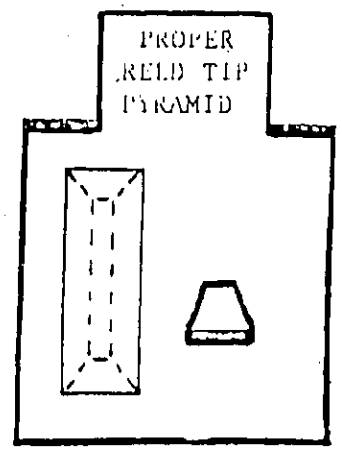
TUNING
THE ELECTRONIC PIANO REED

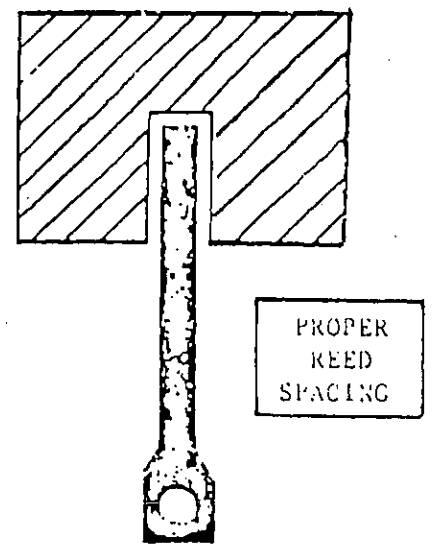
The REED is the tone element of the Wurlitzer Electronic Piano. Its tuning, position in the instrument and how this position relates to the pick-ups are essential to the tonal quality of the piano.

INSTALLING NEW REEDS - The reed's retaining hole is slightly larger that the diameter of the reed screw. When putting a new reed in place for tuning, be sure that the reed is as far "BACK" as it will go. Additionally, before beginning to tune, insure that the reed screw is tight (not just snug). Tightening the screw after the reed has been brought up to pitch will cause it to go sharp (and lead will need to be added to the tip and the reed retuned).

Tuning is accomplished by removing lead from the reed tip (by filing or scraping a small amount at a time). Continue to remove the excess lead until arriving at the proper pitch.

While removing the excess lead, it is very important to maintain the PYRAMID shape of the tip.

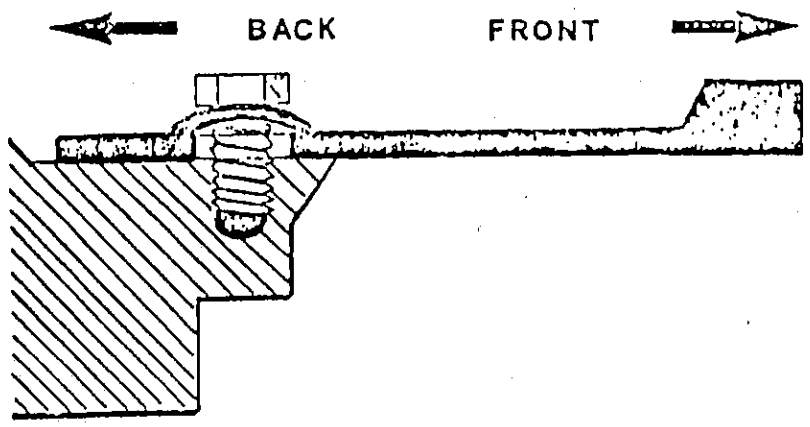




When tuning a new reed, removing too much lead will cause the pitch to be sharp (too high). Moving the reed to the "FRONT" will drop the pitch (from 2 to 5 cents) and permit fine tuning without having to add additional lead to the tip.

If moving the reed to the "FRONT" does not sufficiently lower the pitch, remove the reed, add lead to the tip and begin the tuning process again.

When tuning new reeds, pitch tolerances should be kept to within 5 cents (-2 to +3). The tuning process is often made easier with the use of a strobe-type tuner.



VOICING - This is the most important aspect of the entire action regulation procedure. This insures the tonality, volume, and ring time of the individual notes that are uniform and consistent and loud notes, soft notes, and notes that have a piercing tone, will be eliminated.

Voicing is accomplished by adjusting the pickup - (Figure 1) - so the steel reed and the face of the pickup are in the same plane. The same procedure is used in the bass with the lead down and the treble with the lead up. Positioning of the reed to the pickup in this manner is very important especially on the smaller reeds. When a reed at rest, and positioned inside the pickup, a very strong undesirable harmonic will be generated.

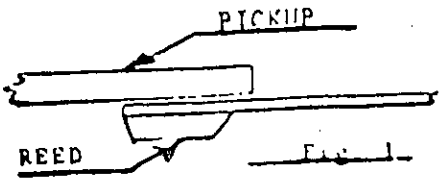


Fig. 1

Reeds side to side should be positioned as close to center as possible. This can be accomplished by using a .007" feeler gauge on the lower 2/3 of the scale and .004" feeler gauge on the treble notes. (See Figure 2). Unequal spacing makes a reed too close to one side of the pickup and will give an undesirable loud tone.

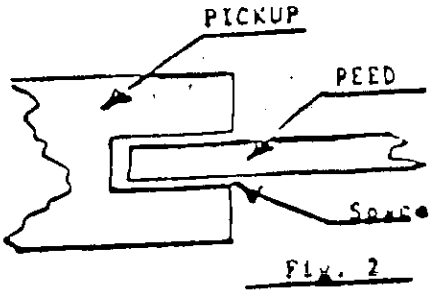


Fig. 2

For notes that have a short ring time. The reed can be removed (Figure 3) and the head of the reed or the part under the reed screw should be inspected on both sides of the reed for any foreign material. The reed can be cleaned by holding a very fine grit emory paper down on a flat surface and polishing both sides of the head until the metal shows through. This is also an electrical ground and if you lose the ground, you will lose the volume. Any foreign material on the head of the reed will dampen the oscillation. If this does not cure the ring time, the reed should be replaced.

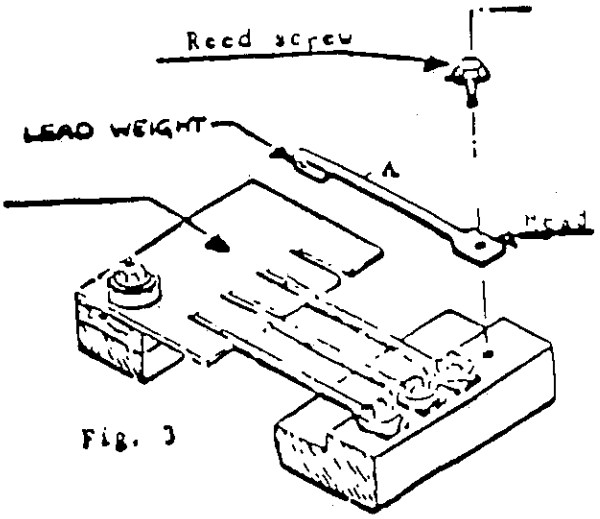
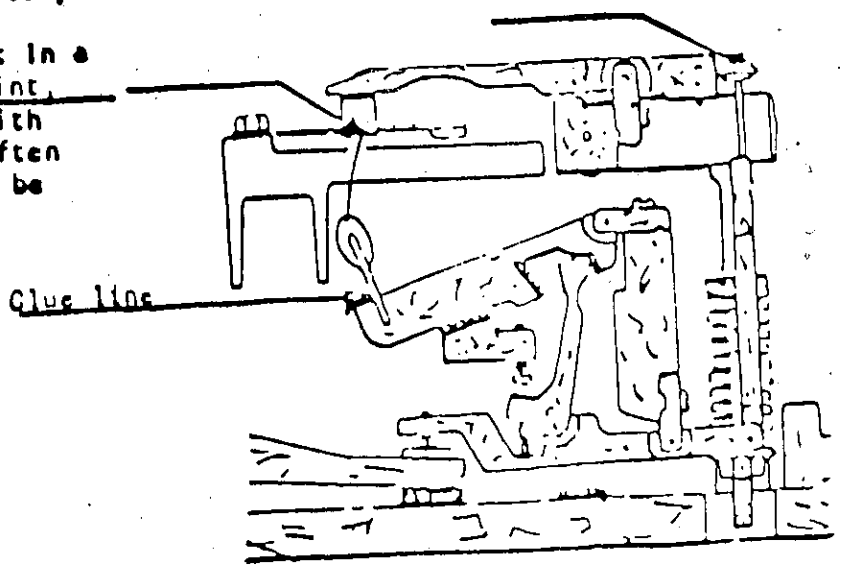


Fig. 3

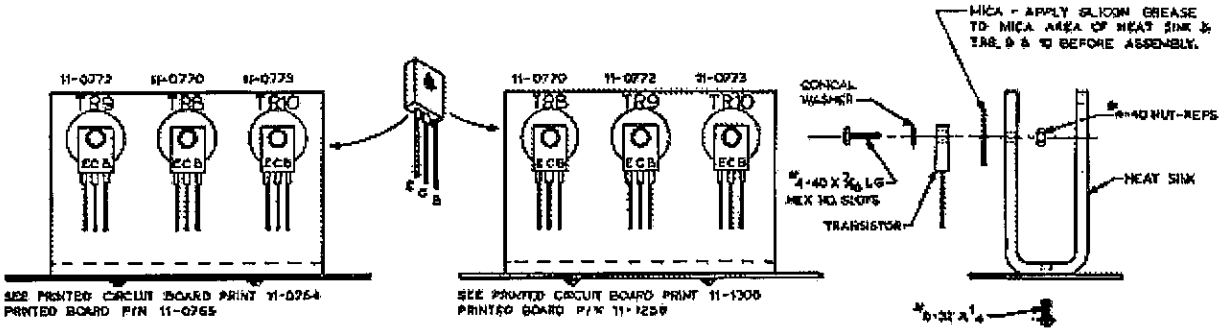
Strike Point (Figure 4) is also factory set and will probably never have to be changed. If it is necessary to put in a new hammer or to reset a strike point, heating (Figure 1) the glue line with a soldering iron or a heat will soften the glue to the point where it can be either moved for a strike point or taken out to replace the hammer.

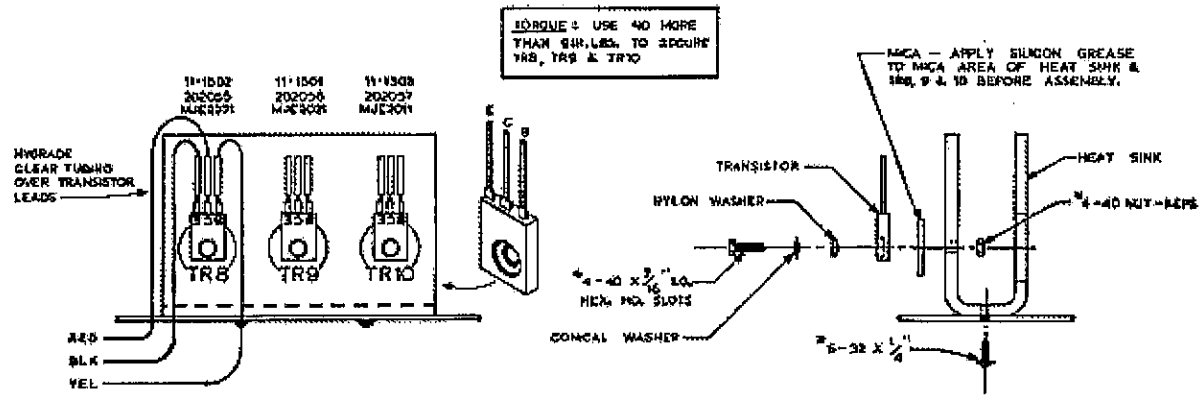


YOU WILL NOTE THERE HAS BEEN A CHANGE OF PART NUMBERS AND TRANSISTORS WHICH MAY TEND TO BE CONFUSING UPON REPLACEMENT. BELOW IS A LISTING OF PARTS, PART NUMBERS AND THEIR REPLACEMENTS. IN ADDITION, PLEASE NOTE LOCATION OF TRANSISTORS BEFORE REPLACEMENT.

NEW PART NUMBERS MODEL & STARTING SERIAL NUMBERS		"OLD" PART NUMBER MODEL & STARTING SERIAL NUMBERS	MANUFACTURER'S EQUIVALENT	"OLD PART NUMBERS MODELS AND APPROX. STARTING SERIAL NO.	MANUFACTURER'S EQUIVALENT
	200-73257	200-58050		200-55900	
	203-79414	203-56403		203-55256	
	214-73397	203W-56491		206-56501	
		206-57144		207-54029	
		207-55921		214-57777	
		214-57776			
TR-1	202051	11-0778	2N2926	11-1667*	2N6008
TR-2	202052	11-0779	2N2926	11-1668*	2N5998
TR-3	202073	11-0778	2N2926	11-0778	2N2924
TR-4	202053	11-0775	2N5306	11-0775	2N5306
TR-5	202073	11-0778	2N2926	11-0778	2N2924
TR-6	202073	11-0778	2N2926	11-0778	2N2924
TR-7	202054	11-0774	2N3859A	11-0774	2N3859A
TR-8	202055	11-0770	2N4919	11-1502*	MJE2371
TR-9	202066	11-0772	2N5191	11-1501*	MJE2021
TR-10	202067	11-0773	2N5194	11-1503* (*CHANGED)	MJE2011
ITEM		NEW PART NUMBERS			
D-1, D-2, D-3, D-4	202050	11-0769 11-0771	GE-A13, 1N4005 GE-A13, 1N4005	11-1500 (11-0769)	
D-5, D-6	202049	11-0781	1N4148	11-0781	

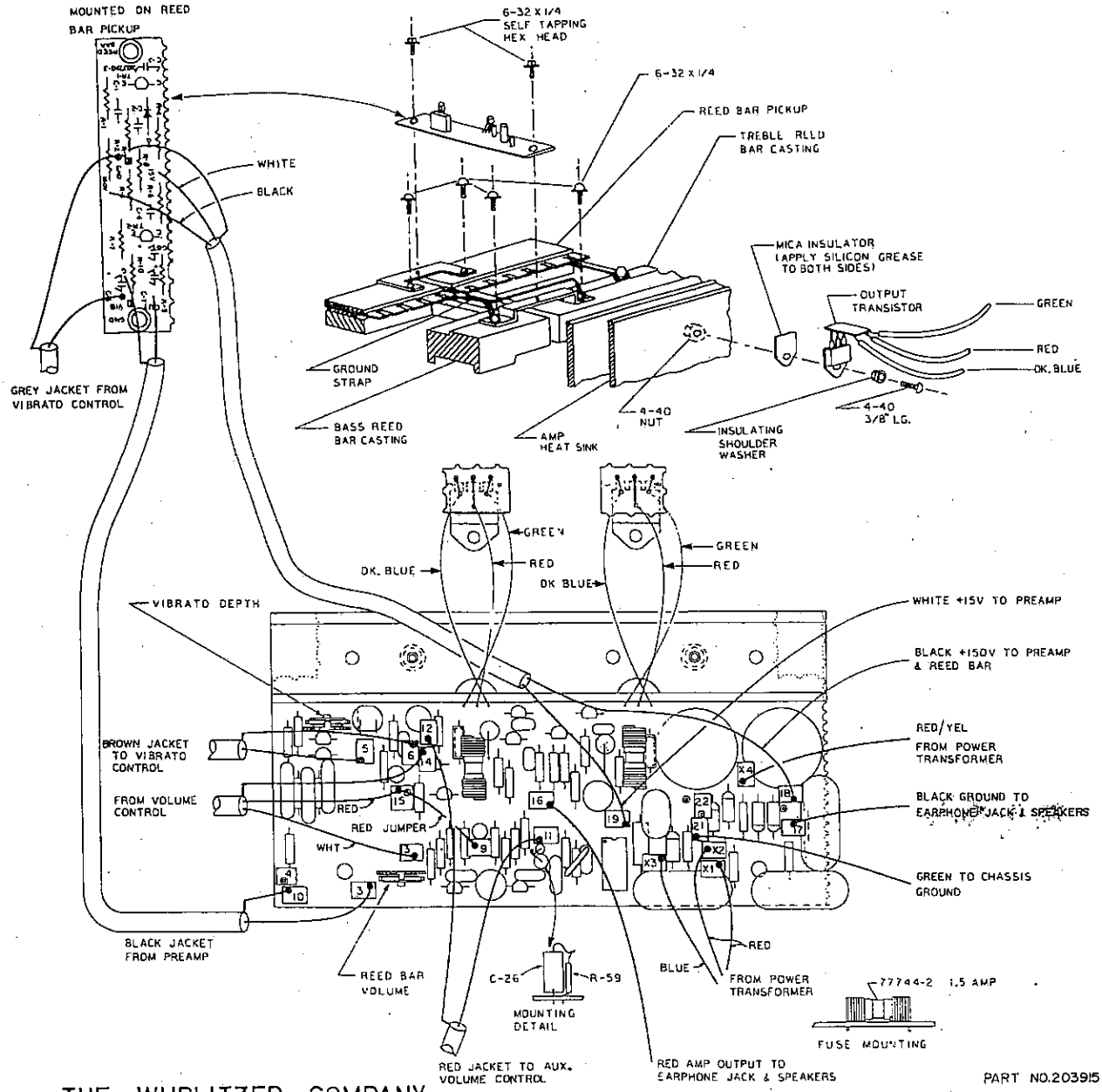
SEE PAGE 37 FOR TRANSISTOR LEAD CONFIGURATION.





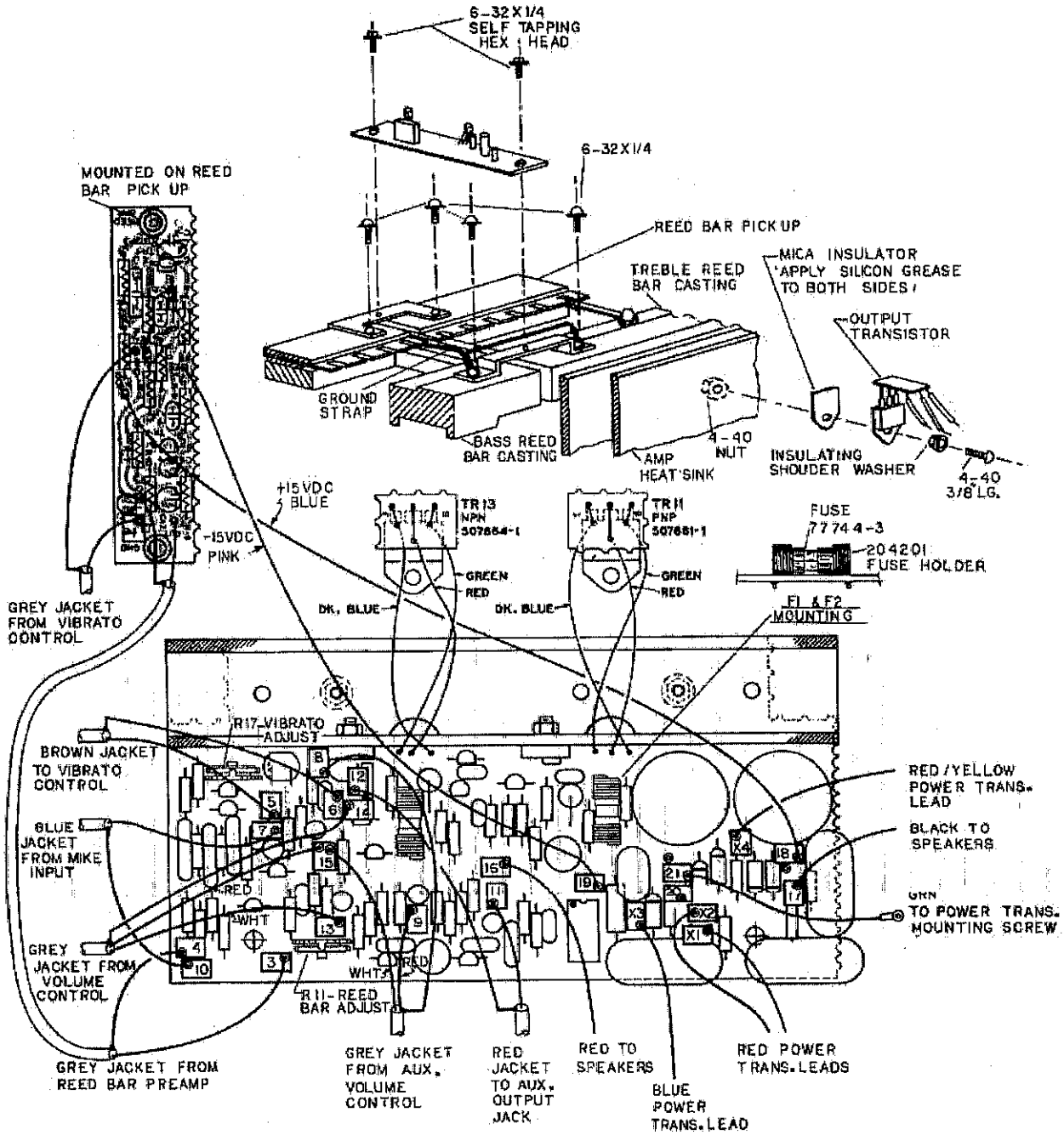
MODEL 200A

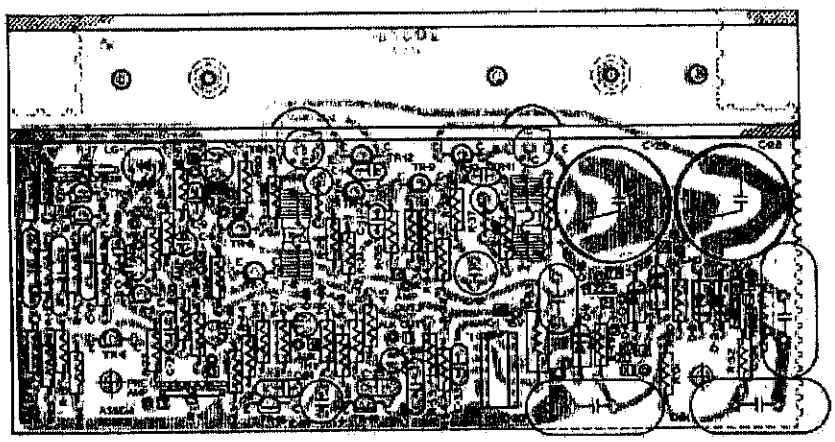
STARTING SERIAL NO. 102905
ASS'Y. NO. 203730-3



THE WURLITZER COMPANY

PART NO. 203915
ISSUE #2





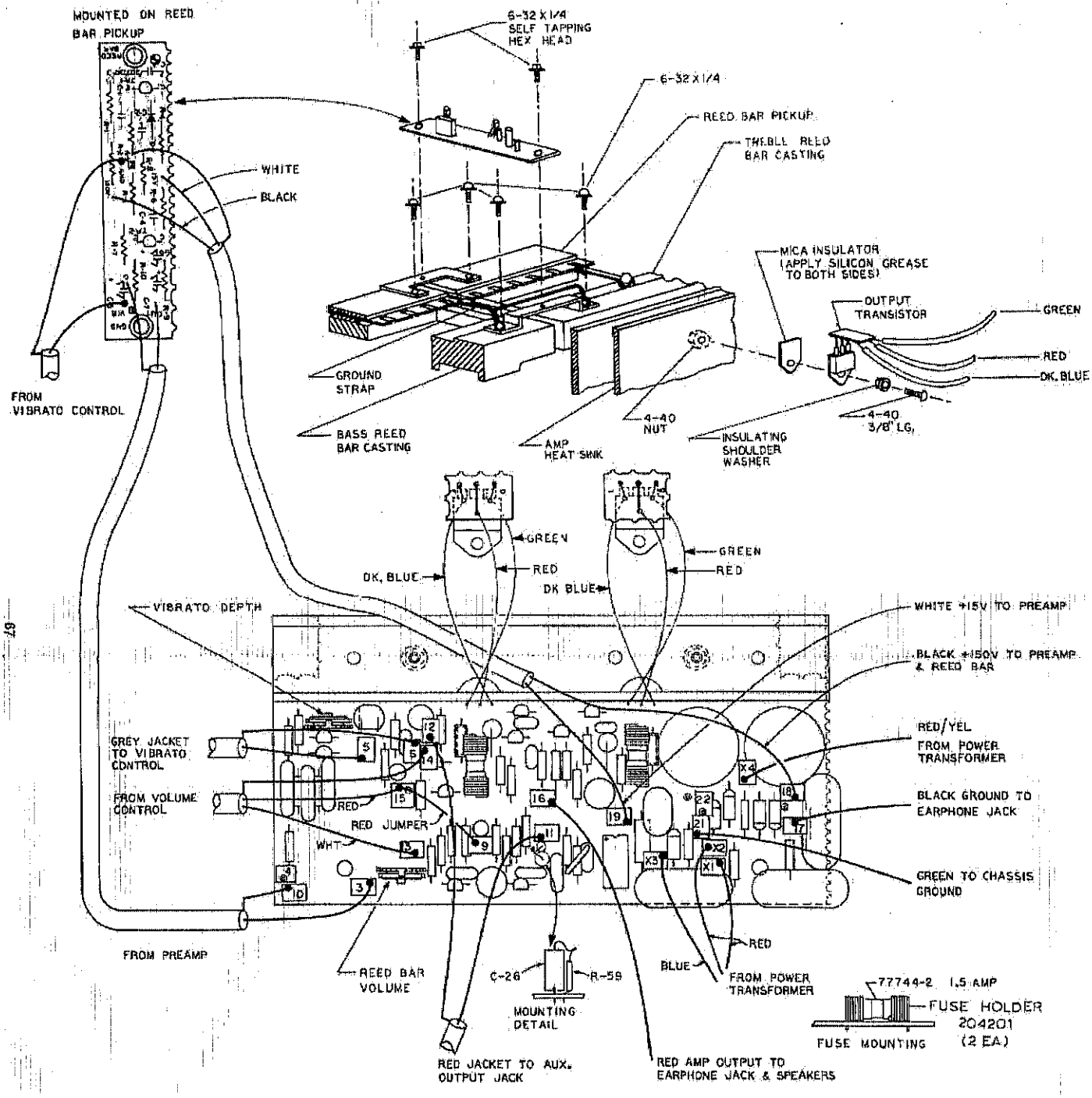
MODEL 214A & 214VA ELECTRONIC PIANO

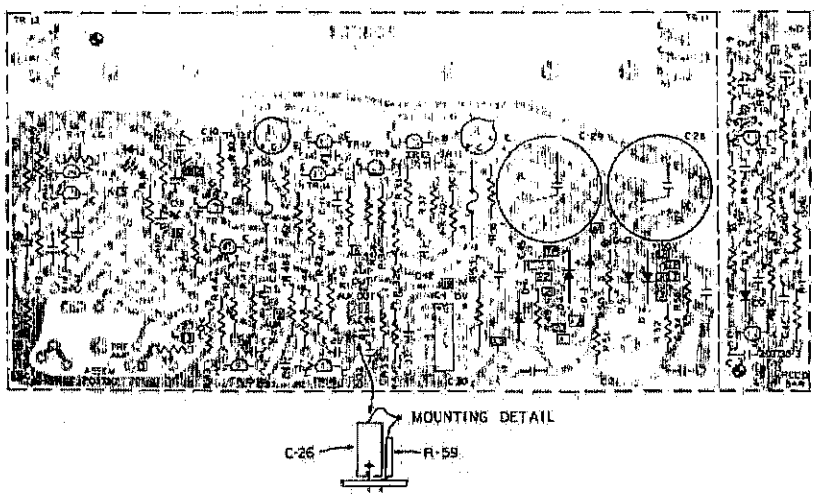
AMPLIFIER P.C. BOARD ASSEMBLY

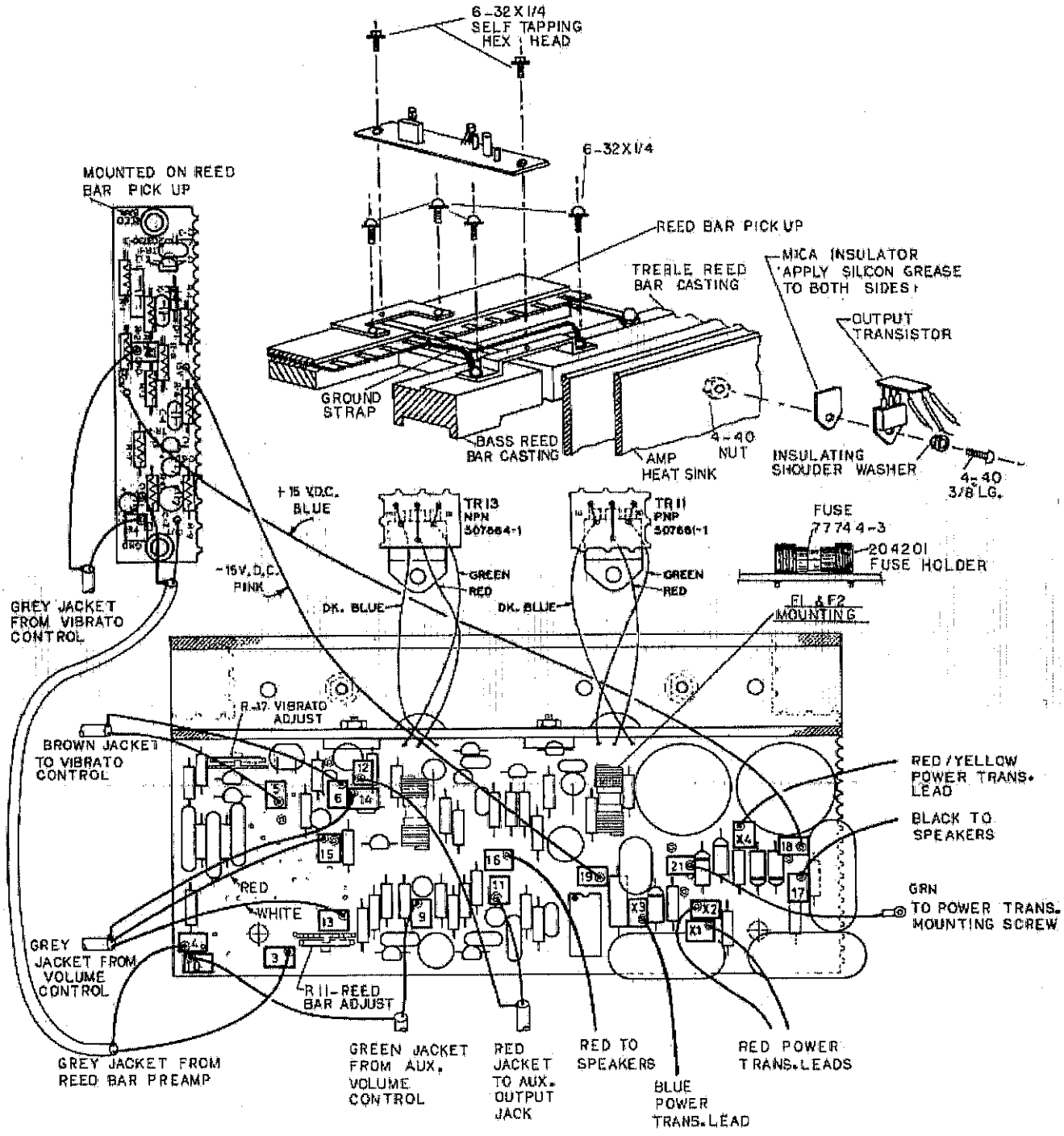
PART NO. 203721-S1 -E6

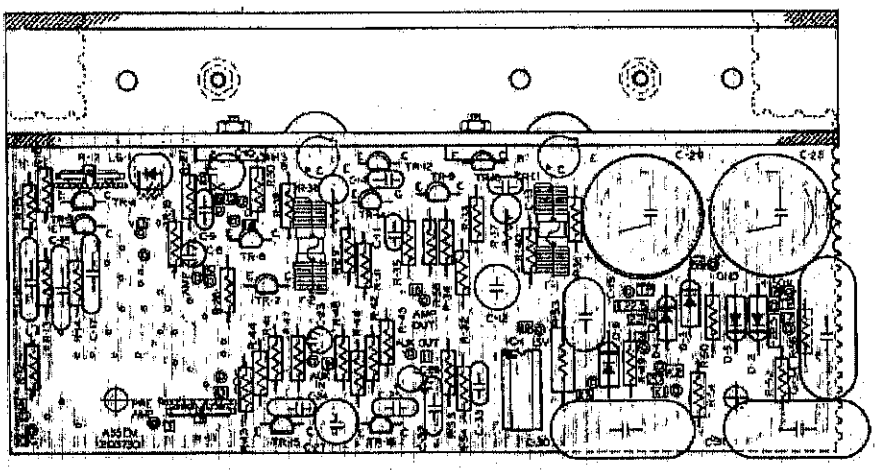
MODEL 200A

STARTING SERIAL NO. 102905
ASS'Y. NO. 203730-3





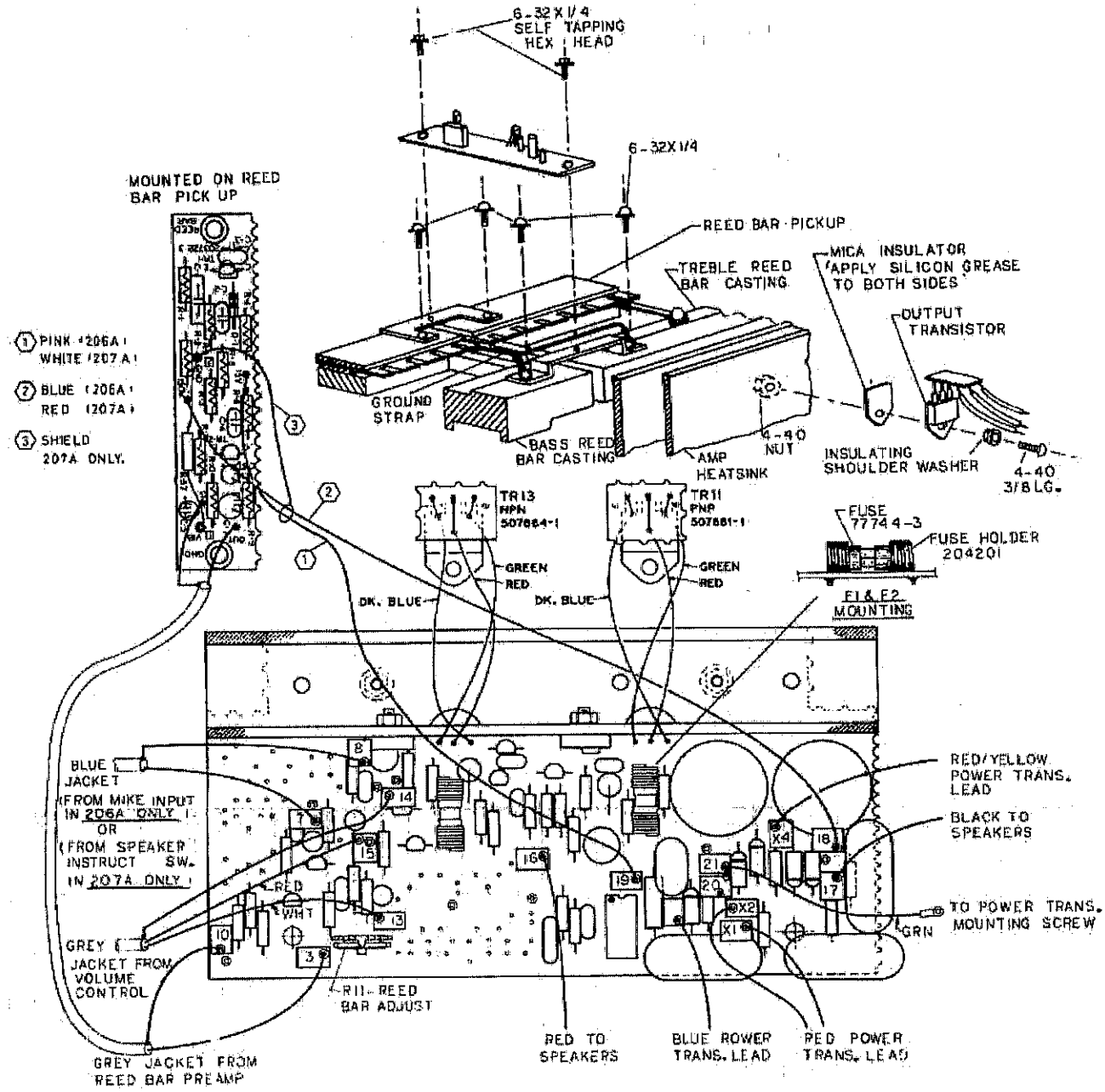


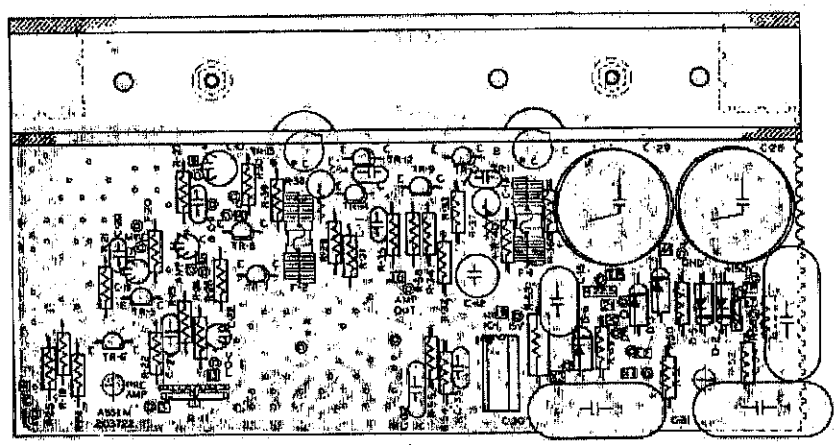


MODEL 200A ELECTRONIC PIANO

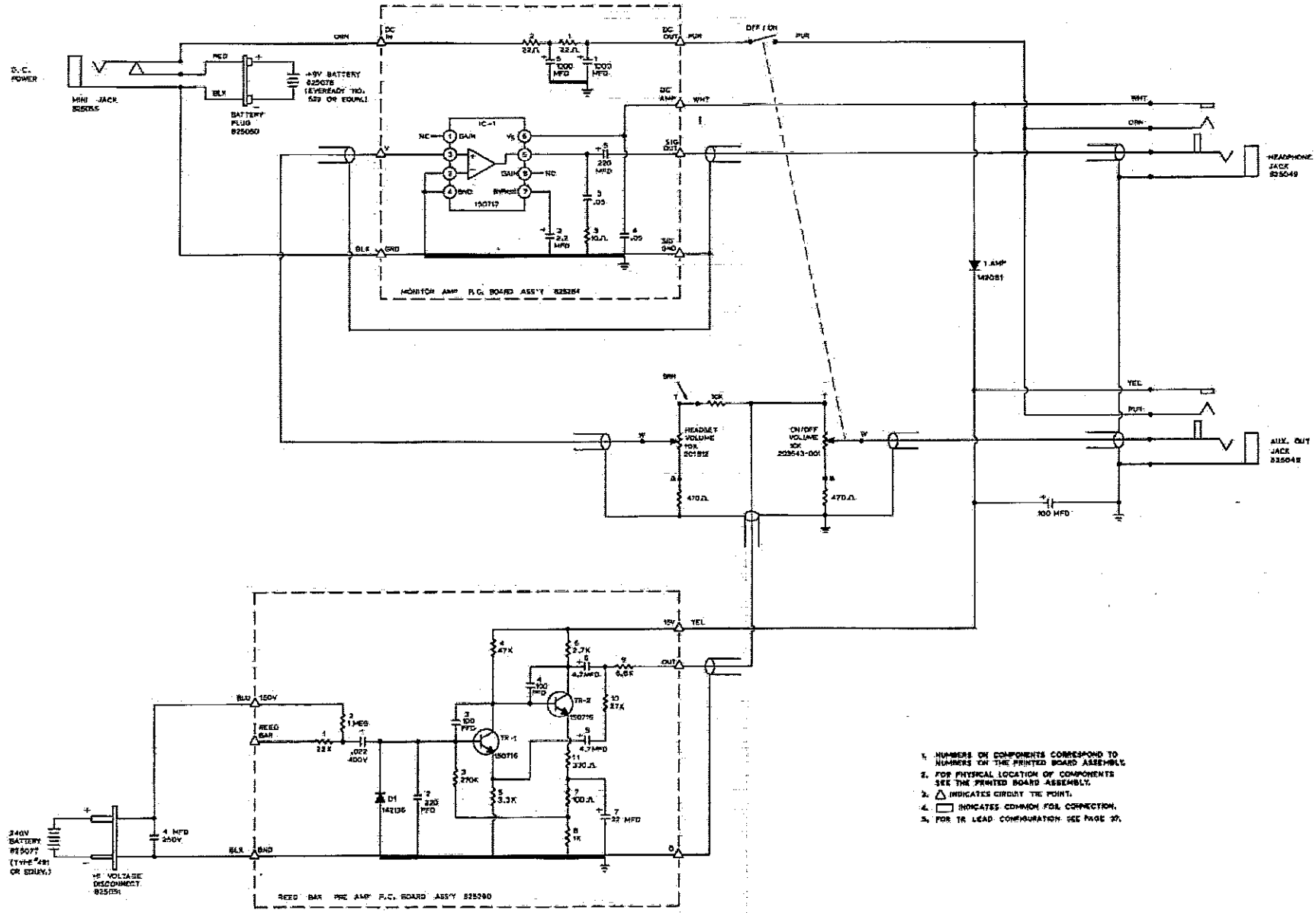
AMPLIFIER P.C. BOARD ASSEMBLY

PART NO. 203730-S1-E6





MODEL 206A , 207A ,207VA
ELECTRONIC PIANO
AMPLIFIER P.C.BOARD ASSEMBLY
PART NO. 203722-S1-E6

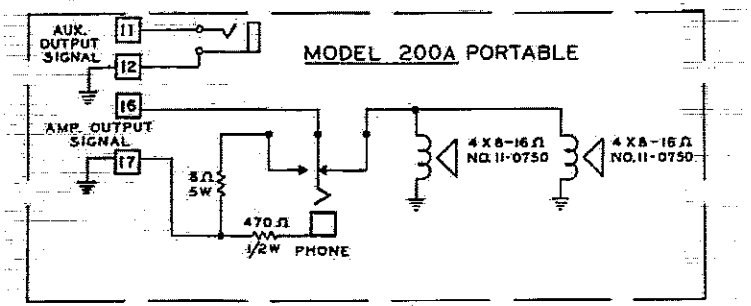


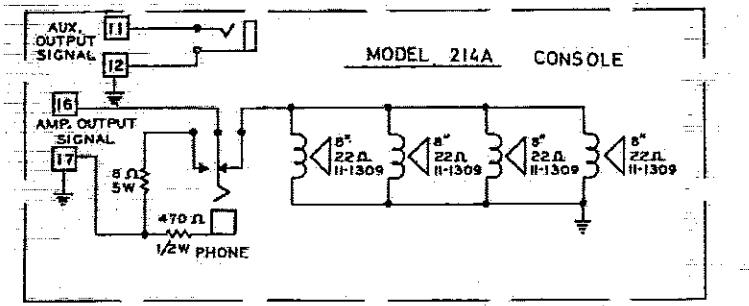
1. NUMBERS ON COMPONENTS CORRESPOND TO NUMBERS ON THE PRINTED BOARD ASSEMBLY.
2. FOR PHYSICAL LOCATION OF COMPONENTS SEE THE PRINTED BOARD ASSEMBLY.
3. △ INDICATES CIRCUIT TIE POINT.
4. ▭ INDICATES COMMON FOIL CONNECTION.
5. FOR TR LEAD CONFIGURATION SEE PAGE 37.

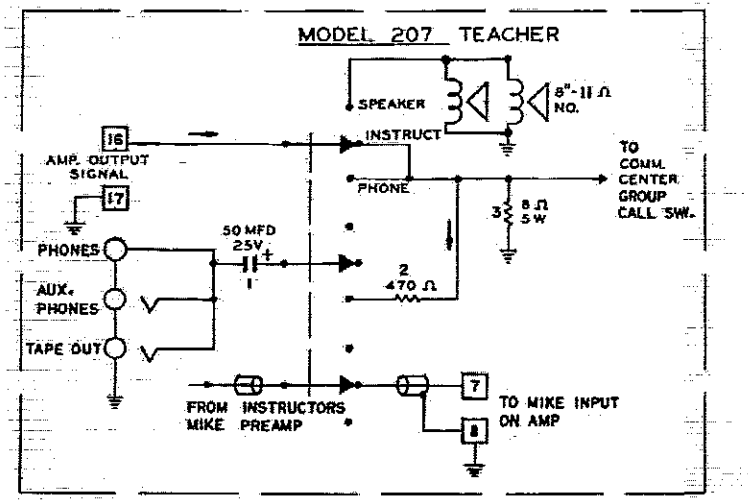
200B	6-1-81
MONITOR & PRE AMP SCH.	825298
THE WURLITZER COMPANY - De Kalb Illinois 60115	

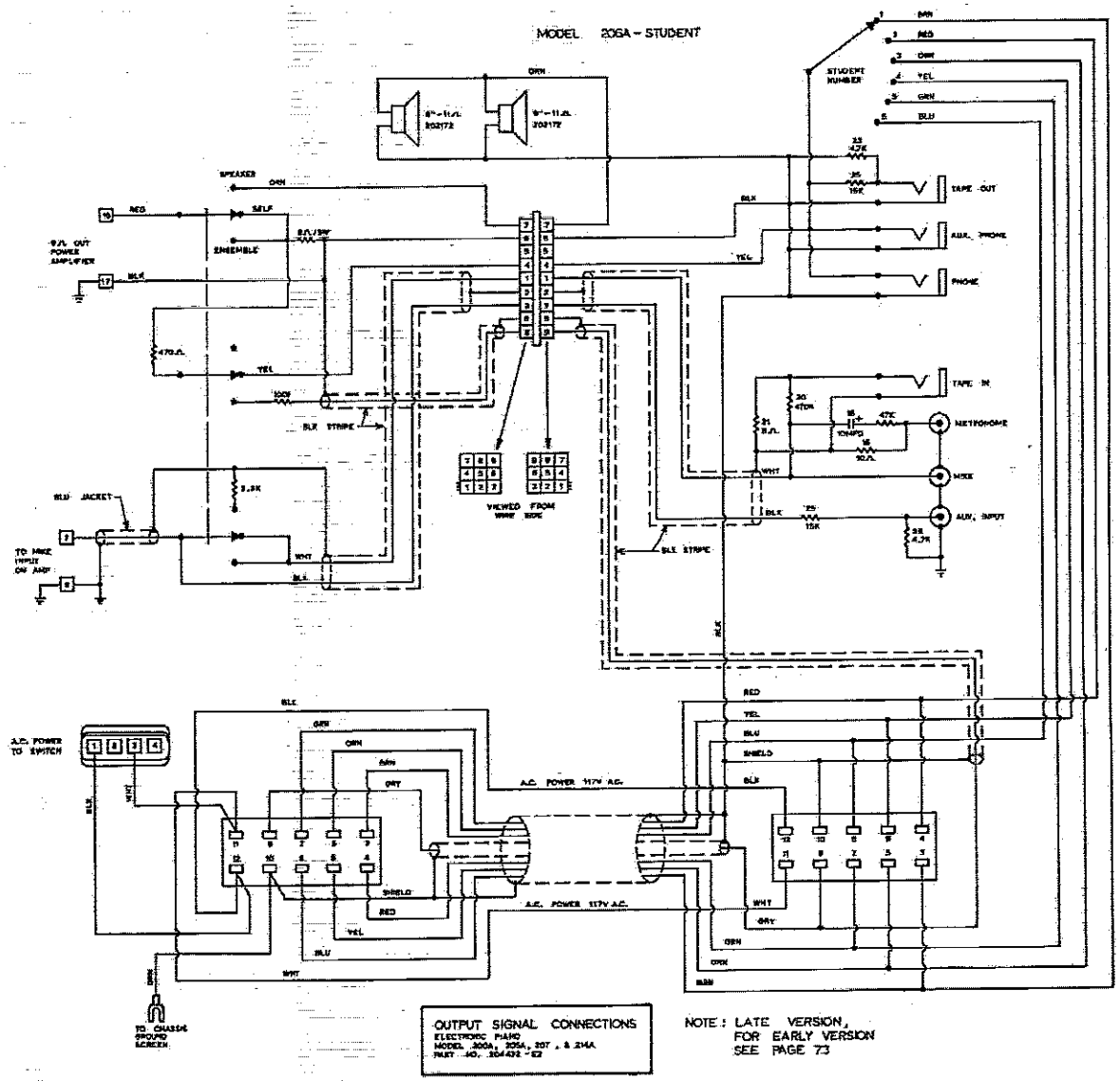
81

REVISION	ISSUE	C/N	DATE	DRN	INS
DRAWN	2	L-2134	080881	EB	EB



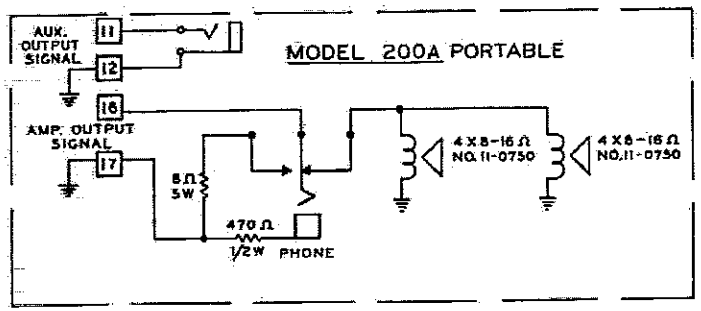


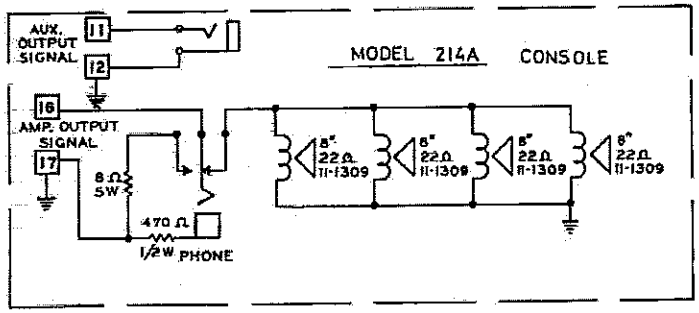


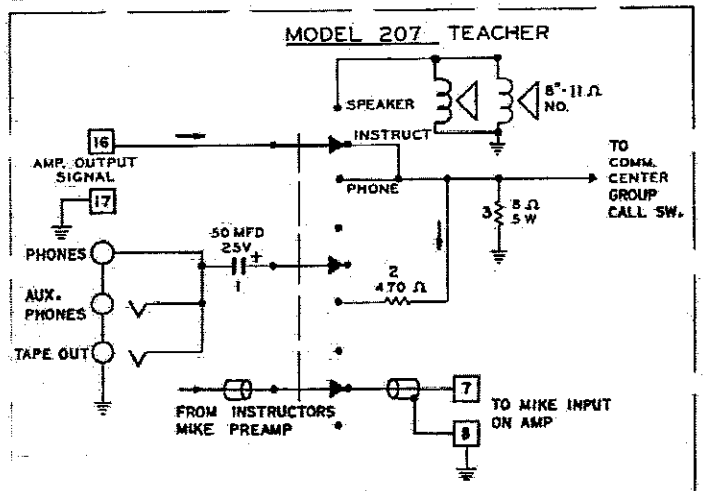


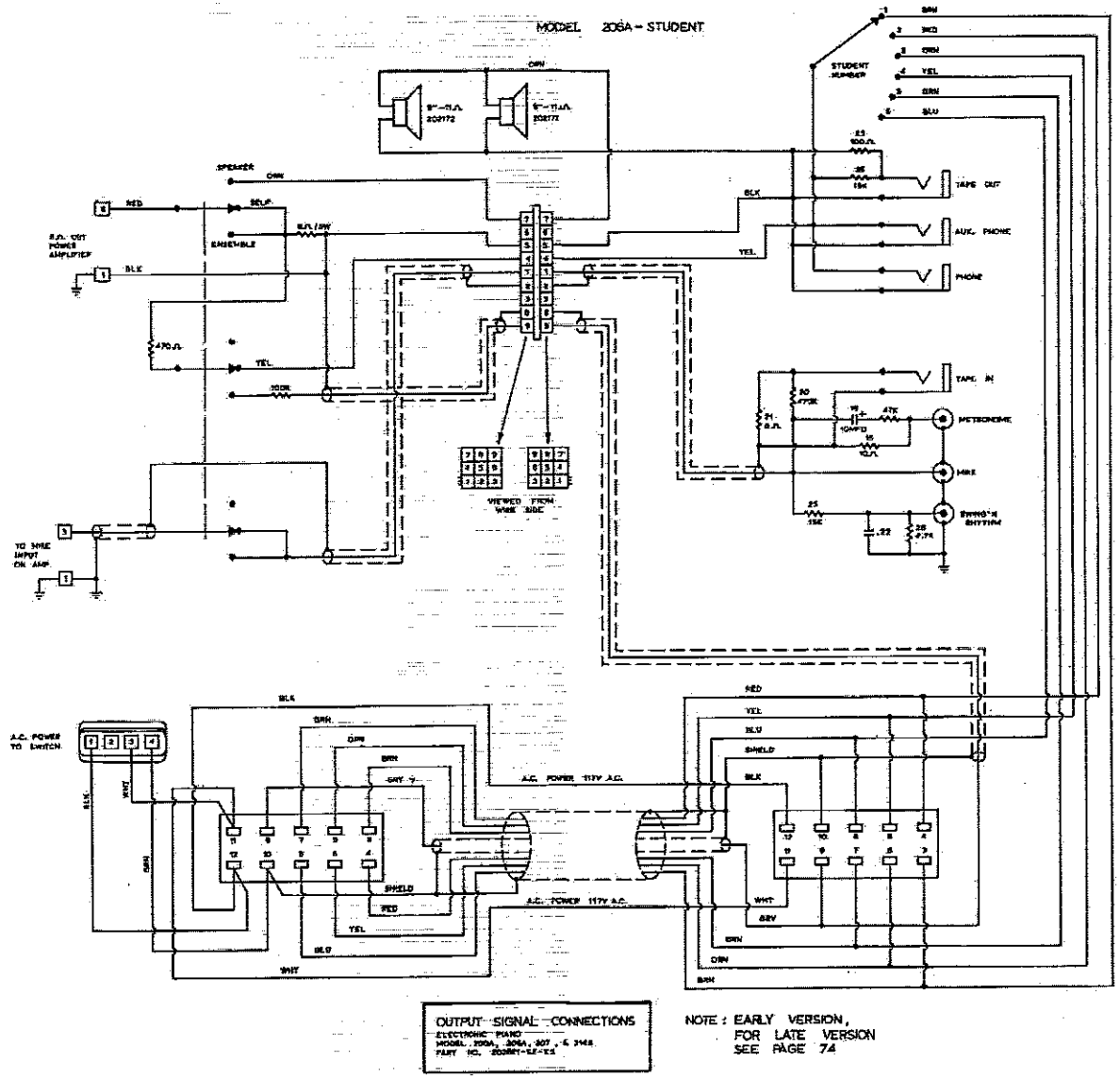
OUTPUT SIGNAL CONNECTIONS
ELECTRONIC PIANO
MODEL 200A, 205A, 207, & 214A
PART NO. 304422-62

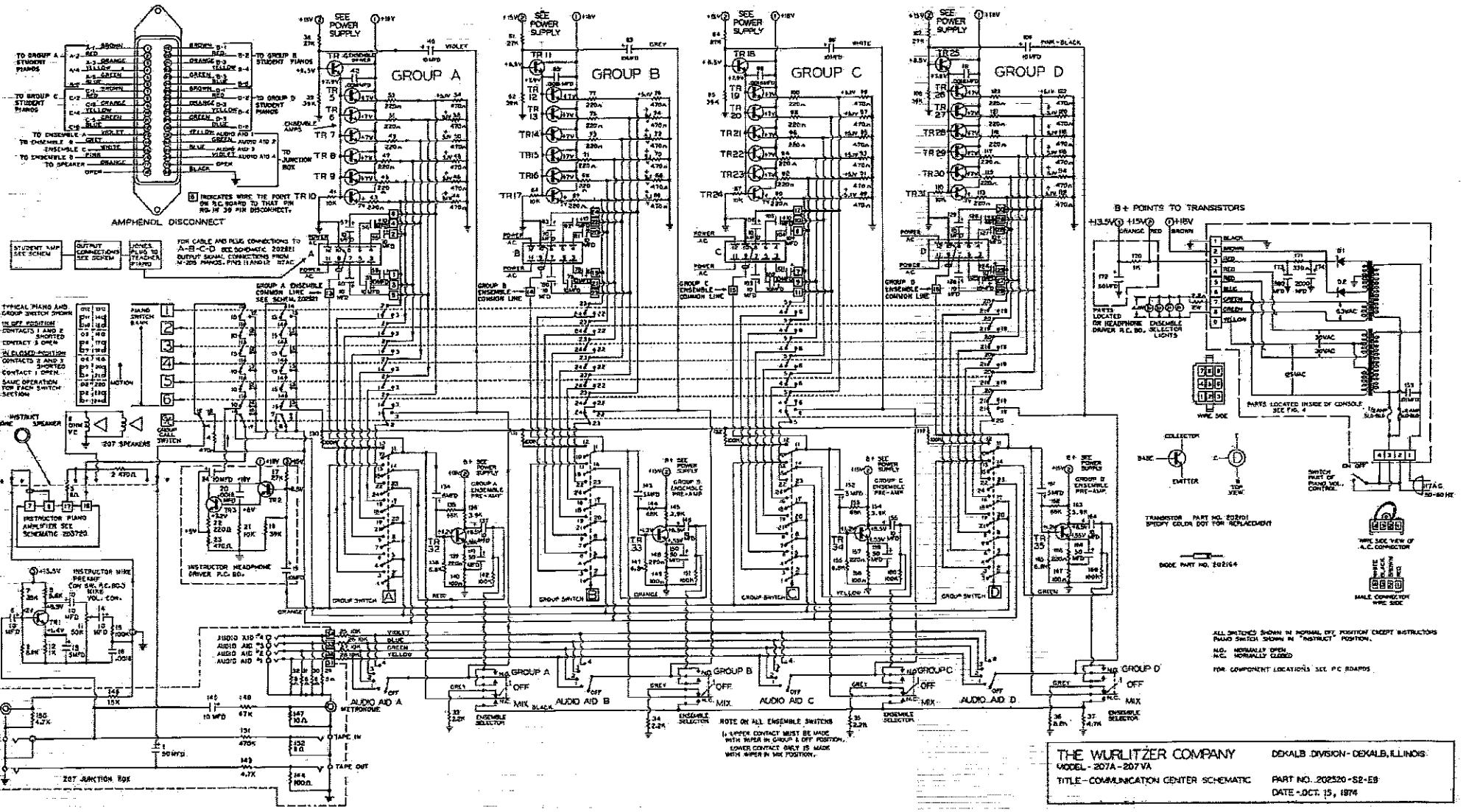
NOTE: LATE VERSION, FOR EARLY VERSION SEE PAGE 73


MODEL 200A PORTABLE
AUX. OUTPUT SIGNAL
11
12
AMP. OUTPUT SIGNAL
16
17
8Ω 5W
470Ω 1/2W PHONE
4 X 8-16Ω NO. 11-0750
4 X 8-16Ω NO.11-0750


MODEL 214A CONSOLE
AUX. OUTPUT SIGNAL
11
12
AMP. OUTPUT SIGNAL
16
17
8Ω 5W
470Ω 1/2W PHONE
8" 22Ω 11-1309
8" 22Ω 11-1309
8" 22Ω 11-1309
8" 22Ω 11-1309


MODEL 207 TEACHER
SPEAKER
INSTRUCT
8"-11Ω NO.
16
AMP. OUTPUT SIGNAL
17
PHONE
TO COMM. CENTER GROUP CALL SW.
3
8Ω 5W
PHONES
50 MFD 25V
1
2
470Ω
AUX. PHONES
TAPE OUT
FROM INSTRUCTORS MIKE PREAMP
7
8
TO MIKE INPUT ON AMP


MODEL 206A - STUDENT
STUDENT NUMBER
SPEAKER
ORN
RED
BLU
ENSEMBLE
BLK
YEL
470Ω
100Ω
TAPE OUT
AUX. PHONE
PHONE
TAPE IN
METRONOME
MIKE
RHYTHM
VIEWED FROM WIRE SIDE
TO MIKE INPUT ON AMP
A.C. POWER TO SWITCH
A.C. POWER 117V A.C.
SHIELD
WHT
GRY
BRN
OUTPUT SIGNAL CONNECTIONS
ELECTRONIC PIANO
NOTE : EARLY VERSION,
FOR LATE VERSION
SEE PAGE 74



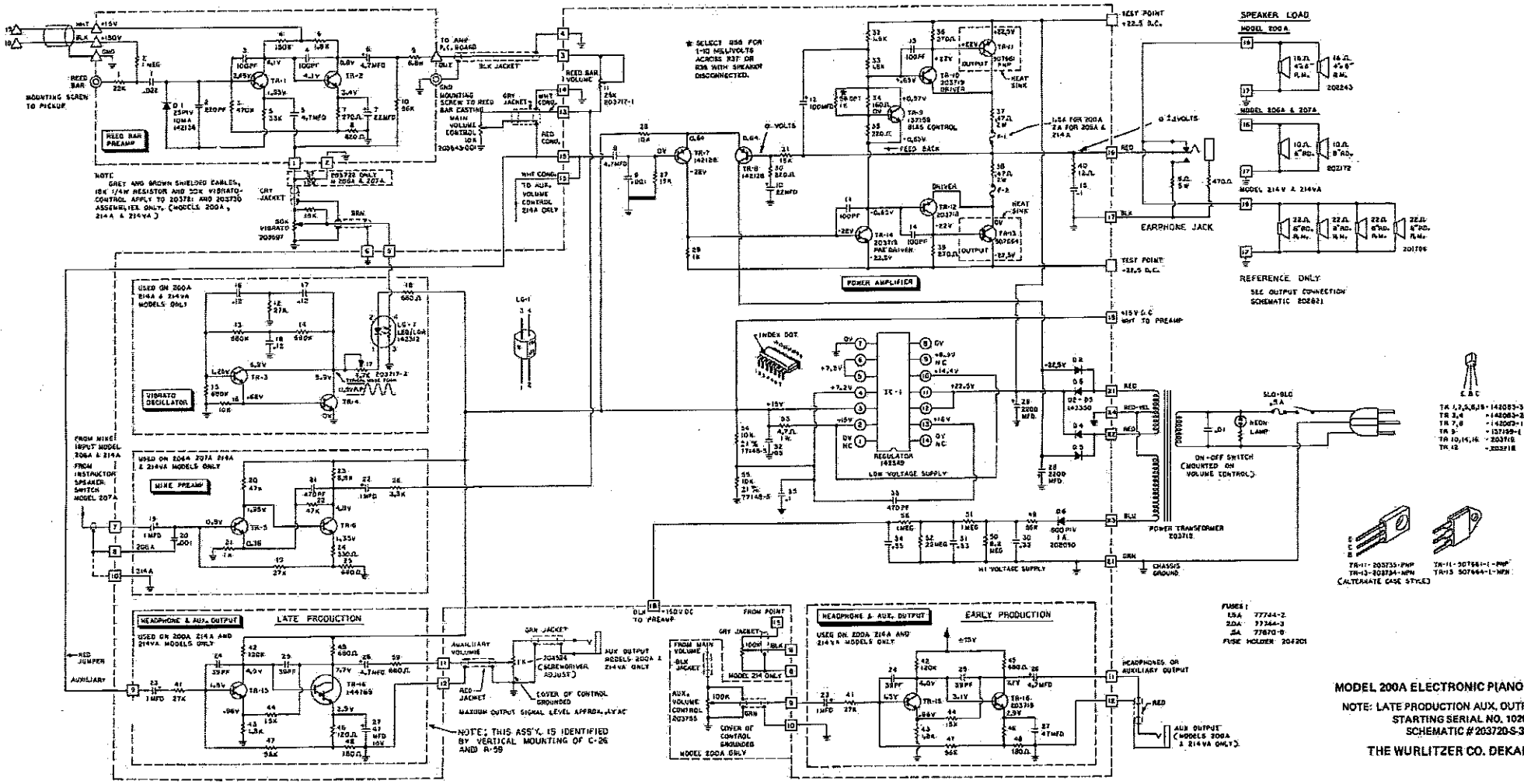
THE WURLITZER COMPANY — DEKALB DIVISION - DEKALB, ILLINOIS

MODEL - 207A - 207VA

TITLE - COMMUNICATION CENTER SCHEMATIC

PART NO. 202520-S2-E8

DATE - OCT. 15, 1974



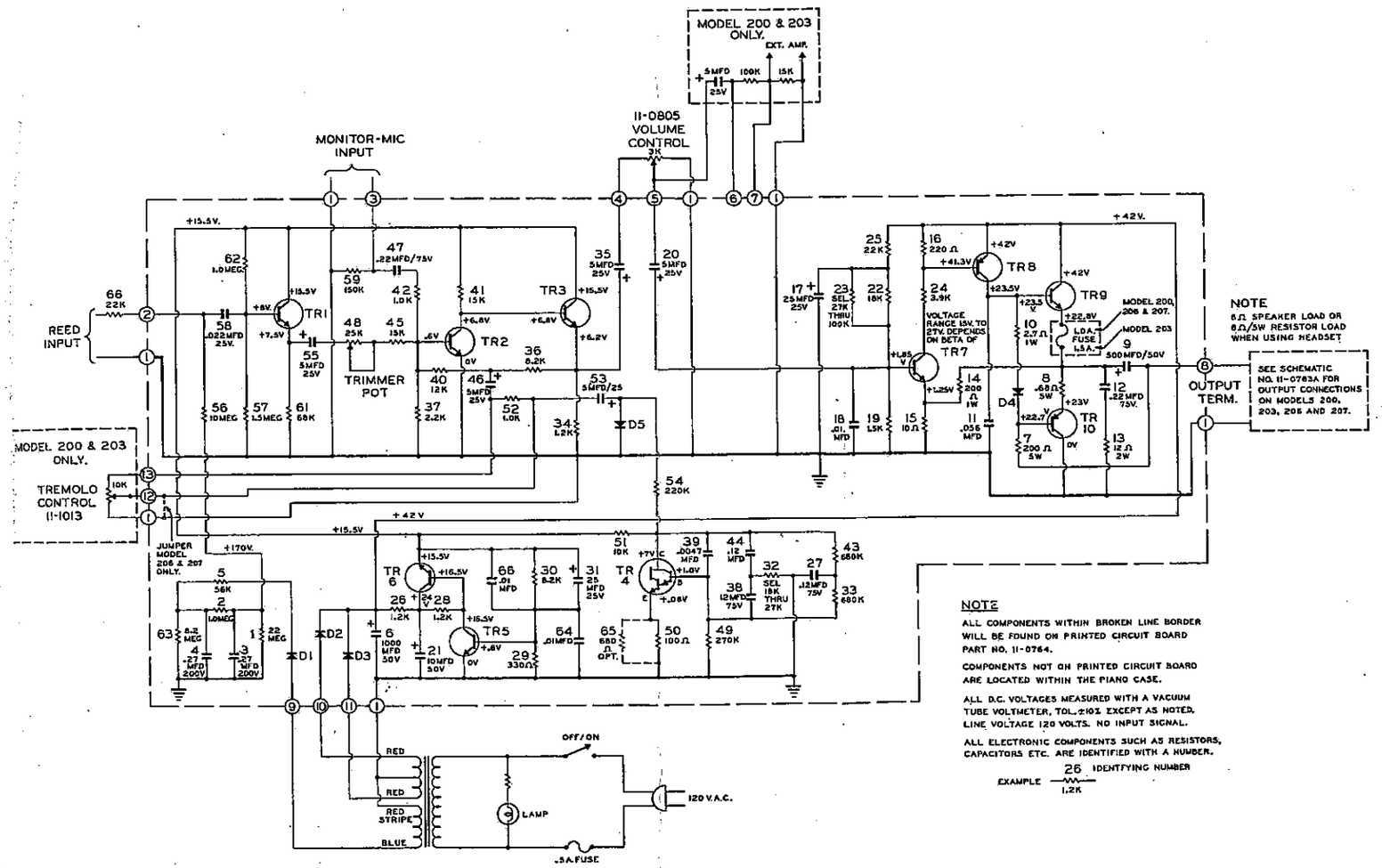
MODEL 200A ELECTRONIC PIANO SCHEMATIC

NOTE: LATE PRODUCTION AUX. OUTPUT CIRCUIT STARTING SERIAL NO. 102906

SCHEMATIC # 203720-S-3

THE WURLITZER CO. DEKALB ILL.

SCHEMATIC - ELECTRONIC PIANO AMPLIFIER
MODELS 200-203-206 & 207



PART	NUMBER	WURLITZER PART NUMBER
TRANSISTOR	TR 1	202051
	TR2	202052
SPECIFY DOT	TR3	202073
COLOR CODE	TR4	202053
FOR SERVICE	TR5	202073
REPLACEMENT	TR6	202073
	TR7	202054
	TR8	202055
	TR9	202056
	TR10	202057
DIODE	D1	202050
	D2	202050
	D3	202050
	D4	202050
	D5	202049

NOTE

ALL COMPONENTS WITHIN BROKEN LINE BORDER WILL BE FOUND ON PRINTED CIRCUIT BOARD PART NO. 11-0764.

COMPONENTS NOT ON PRINTED CIRCUIT BOARD ARE LOCATED WITHIN THE PIANO CASE.

ALL D.C. VOLTAGES MEASURED WITH A VACUUM TUBE VOLTMETER, TOL. ±10% EXCEPT AS NOTED. LINE VOLTAGE 120 VOLTS. NO INPUT SIGNAL.

ALL ELECTRONIC COMPONENTS SUCH AS RESISTORS, CAPACITORS ETC. ARE IDENTIFIED WITH A NUMBER.

EXAMPLE 26 IDENTFYING NUMBER — 1.2K

FUSES

1A	SLO BLO PIGTAIL	77055-17
1.5A	SLO BLO PIGTAIL	77055-20
.5A	SLO BLO PIGTAIL	77670-8

SEE PRINTED CIRCUIT BOARD PAGE 41

TRANSISTOR PART NUMBERS AND MANUFACTURERS EQUIVALENTS PAGE 28.

EXAMPLES OF TRANSISTOR LEAD CONFIGURATION PAGE 37.

THE WURLITZER COMPANY - DEKALB DIVISION - DEKALB, ILLINOIS

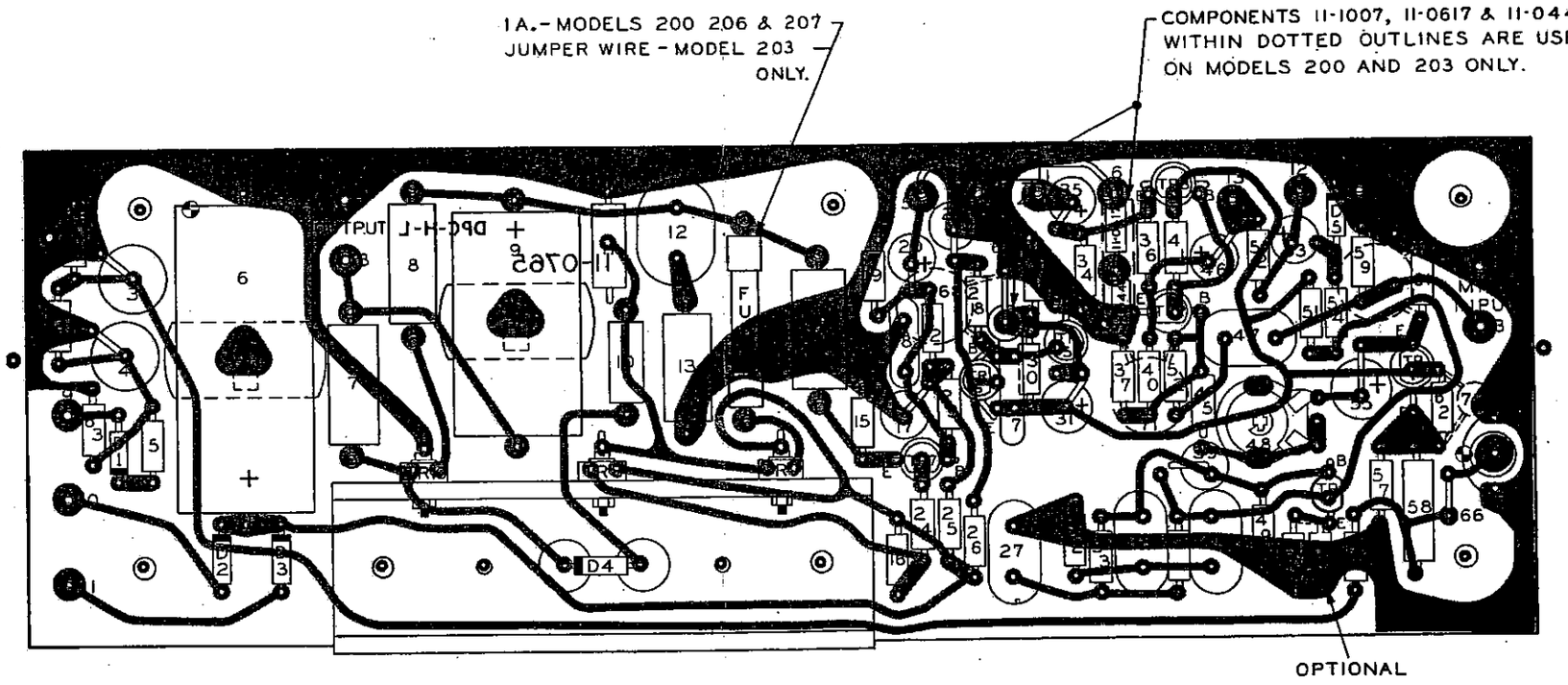
MODEL - 200 - 203 - 206 - 207

TITLE - SCHEMATIC - AMPLIFIER

PART NO. 11-0783-S-1-E-2

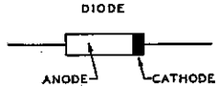
DATE - SEPT. 1, 1968.

ELECTRONIC PIANO AMPLIFIER P.C. BOARD
MODELS 200-203-206 AND 207



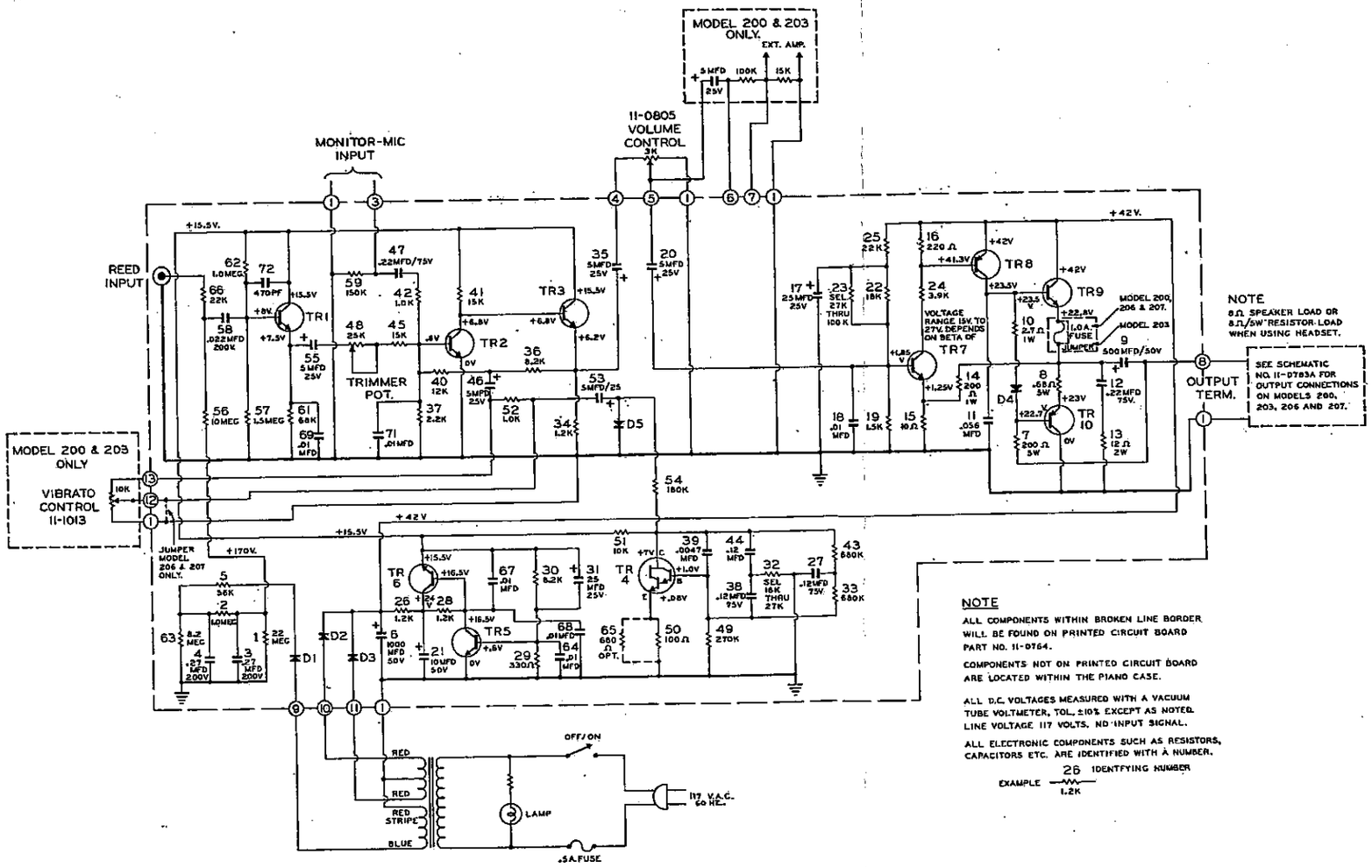
NOTE

SEE SCHEMATIC PART NO. 11-0783 FOR CONNECTIONS AND COMPLETE CIRCUIT.
NUMBERS ON COMPONENTS CORRESPOND TO NUMBERS ON SCHEMATIC 11-0783.



THE WURLITZER COMPANY-DEKALB DIVISION, DEKALB, ILL.
MODEL - 200-203-206-207
TITLE - P.C. BOARD-AMPLIFIER
PART NO. 11-0764-S2E-9
DATE - SEPT. 1, 1969.

SCHEMATIC - ELECTRONIC PIANO AMPLIFIER
MODELS 200-203-206 & 207



NOTE

8Ω SPEAKER LOAD OR 8Ω/5W RESISTOR LOAD WHEN USING HEADSET.

SEE SCHEMATIC NO. 11-0783A FOR OUTPUT CONNECTIONS ON MODELS 200, 203, 206 AND 207.

NOTE

ALL COMPONENTS WITHIN BROKEN LINE BORDER WILL BE FOUND ON PRINTED CIRCUIT BOARD PART NO. 11-0764.

COMPONENTS NOT ON PRINTED CIRCUIT BOARD ARE LOCATED WITHIN THE PIANO CASE.

ALL D.C. VOLTAGES MEASURED WITH A VACUUM TUBE VOLTMETER, TOL. ±10% EXCEPT AS NOTED. LINE VOLTAGE 117 VOLTS, NO INPUT SIGNAL.

ALL ELECTRONIC COMPONENTS SUCH AS RESISTORS, CAPACITORS ETC. ARE IDENTIFIED WITH A NUMBER.

EXAMPLE 26 IDENTFYING NUMBER — 1.2K

PART	NUMBER	WURLITZER PART NUMBER
TRANSISTOR	TR1	202051
	TR2	202052
SPECIFY DOT COLOR CODE FOR SERVICE REPLACEMENT	TR3	202073
	TR4	202053
	TR5	202073
	TR6	202073
	TR7	202054
	TR8	202055
	TR9	202056
	TR10	202057
DIODE	D1	202050
	D2	202050
	D3	202050
	D4	202050
	D5	202049

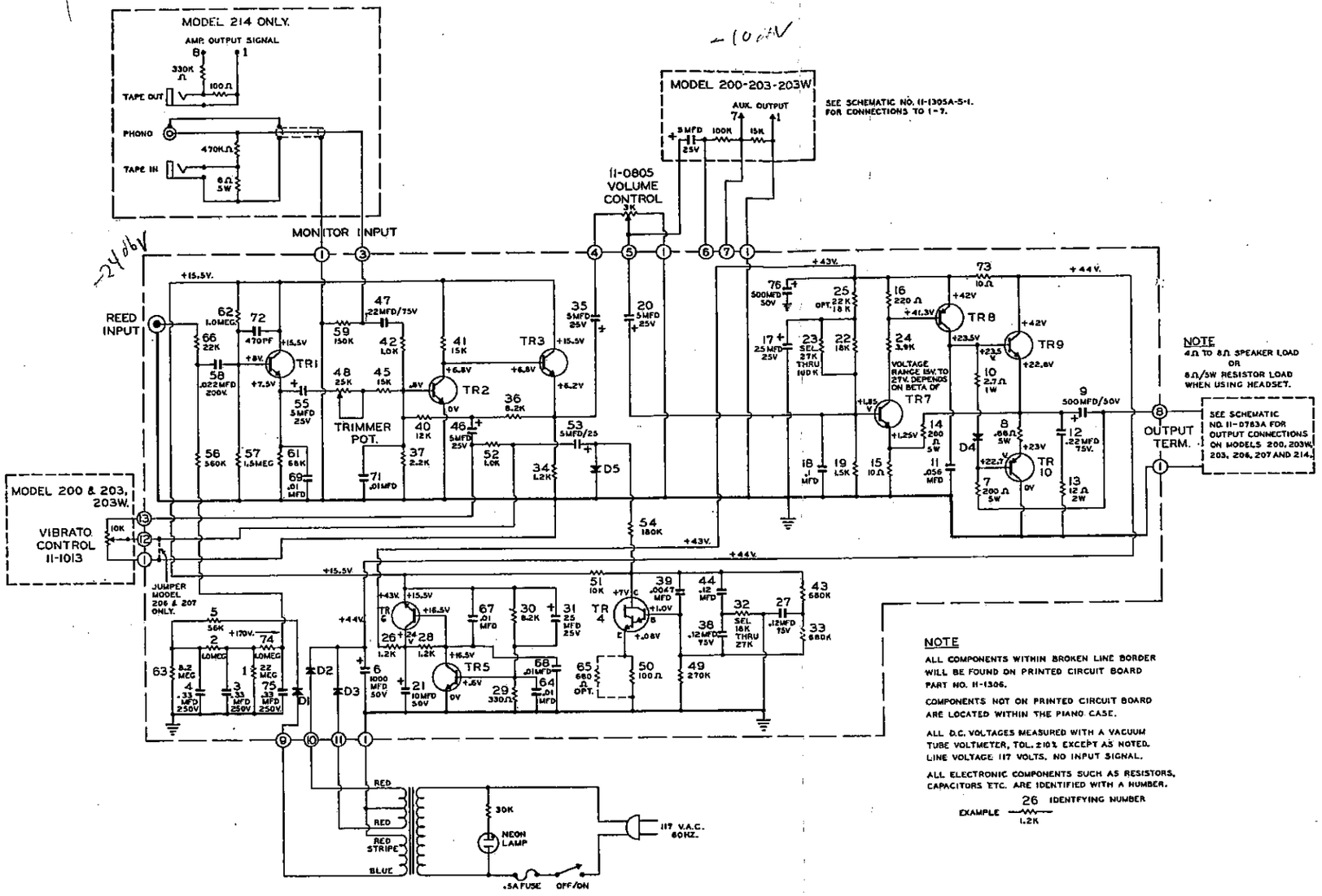
FUSES
1A SLO BLO PIGTAIL 77055-17
.5A SLO BLO PIGTAIL 77670-8

SEE PRINTED CIRCUIT BOARD PAGE 41.

TRANSISTOR PART NUMBERS AND MANUFACTURERS EQUIVALENTS PAGE 28.

EXAMPLES OF TRANSISTOR LEAD CONFIGURATION PAGE 37.

THE WURLITZER COMPANY - DEKALB DIVISION - DEKALB, ILLINOIS.
MODEL - 200 - 203 - 206 - 207.
TITLE - SCHEMATIC - AMPLIFIER
PART NO. 11-0783-S-2-E-10
DATE - SEPT. 1, 1969.



PART	NUMBER	WURLITZER PART NUMBER
TRANSISTOR	TR1	II-0776
	TR2	II-0776
SPECIFY DOT	TR3	II-0776
COLOR CODE	TR4	II-0775
FOR SERVICE	TR5	II-0778
REPLACEMENT	TR6	II-0776
	TR7	II-0774
	TR8	H-0770
	TR9	II-0772
	TR10	II-0773
DIODE	D1	H-0769
	D2	II-0771
	D3	H-0771
	D4	II-0771
	D5	H-0761

NOTE

ALL COMPONENTS WITHIN BROKEN LINE BORDER WILL BE FOUND ON PRINTED CIRCUIT BOARD PART NO. II-1306.

COMPONENTS NOT ON PRINTED CIRCUIT BOARD ARE LOCATED WITHIN THE PIANO CASE.

ALL D.C. VOLTAGES MEASURED WITH A VACUUM TUBE VOLTMETER, TOL. ±10% EXCEPT AS NOTED. LINE VOLTAGE 117 VOLTS. NO INPUT SIGNAL.

ALL ELECTRONIC COMPONENTS SUCH AS RESISTORS, CAPACITORS ETC. ARE IDENTIFIED WITH A NUMBER.

EXAMPLE 26 (IDENTIFYING NUMBER) — 1.2K

FUSE
.5A SLO BLO PIGTAIL 77670-8

SEE PRINTED CIRCUIT BOARD PAGE 43

TRANSISTOR PART NUMBERS AND MANUFACTURERS EQUIVALENTS PAGE 28

EXAMPLES OF TRANSISTOR LEAD CONFIGURATION PAGE 37

THE WURLITZER COMPANY - DEKALB DIVISION - DEKALB, ILLINOIS.

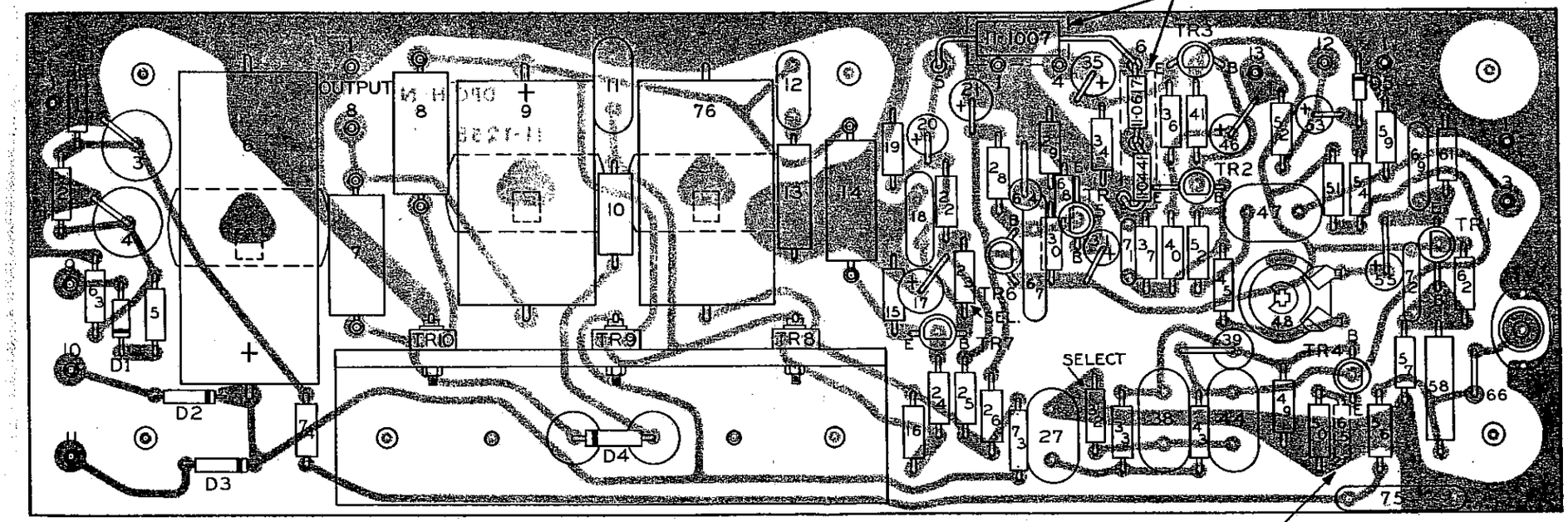
MODEL - 200 - 203 - 203W - 206 - 207 - 214

TITLE - SCHEMATIC - AMPLIFIER

PART NO. II-1305-S-I-E-3

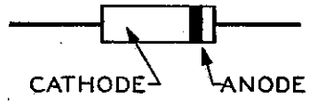
DATE - JUNE 1, 1971.

COMPONENTS 11-1007, 11-0617 & 11-0441 WITHIN DOTTED LINES ARE USED ON MODELS 200 AND 203 ONLY.

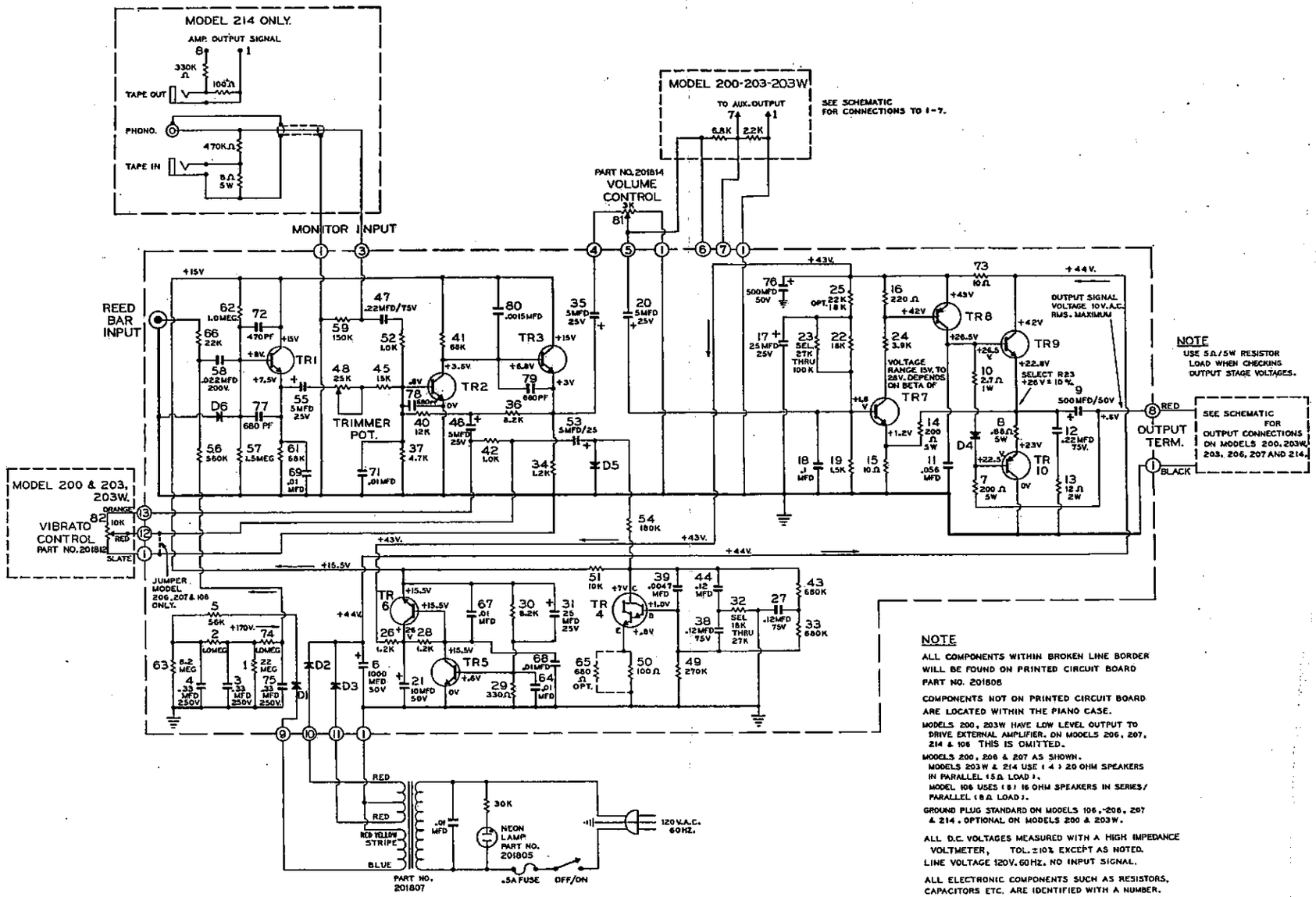


NOTE.
SEE SCHEMATIC PART NO. 11-1305 FOR CONNECTIONS AND COMPLETE CIRCUITS.
NUMBERS ON COMPONENTS CORRESPOND TO NUMBERS ON SCHEMATIC 11-1305.

DIODE



TITLE – P.C. BOARD - E.P. AMPLIFIER.
MODEL – 200 203 203W 206 207 214 PART NO. 11-1306-S-1-E-1
DATE JUNE 1, 1971
THE WURLITZER COMPANY - DEKALB DIVISION - DEKALB, ILL.



NOTE

ALL COMPONENTS WITHIN BROKEN LINE BORDER WILL BE FOUND ON PRINTED CIRCUIT BOARD PART NO. 201808

COMPONENTS NOT ON PRINTED CIRCUIT BOARD ARE LOCATED WITHIN THE PIANO CASE.

MODELS 200, 203W HAVE LOW LEVEL OUTPUT TO DRIVE EXTERNAL AMPLIFIER. ON MODELS 206, 207, 214 & 106 THIS IS OMITTED.

MODELS 200, 206 & 207 AS SHOWN. MODELS 203W & 214 USE (4) 20 OHM SPEAKERS IN PARALLEL (5Ω LOAD). MODEL 106 USES (8) 16 OHM SPEAKERS IN SERIES/PARALLEL (8Ω LOAD).

GROUND PLUG STANDARD ON MODELS 106, 206, 207 & 214. OPTIONAL ON MODELS 200 & 203W.

ALL D.C. VOLTAGES MEASURED WITH A HIGH IMPEDANCE VOLTMETER, TOL. ±10% EXCEPT AS NOTED.

LINE VOLTAGE 120V. 60Hz. NO INPUT SIGNAL.

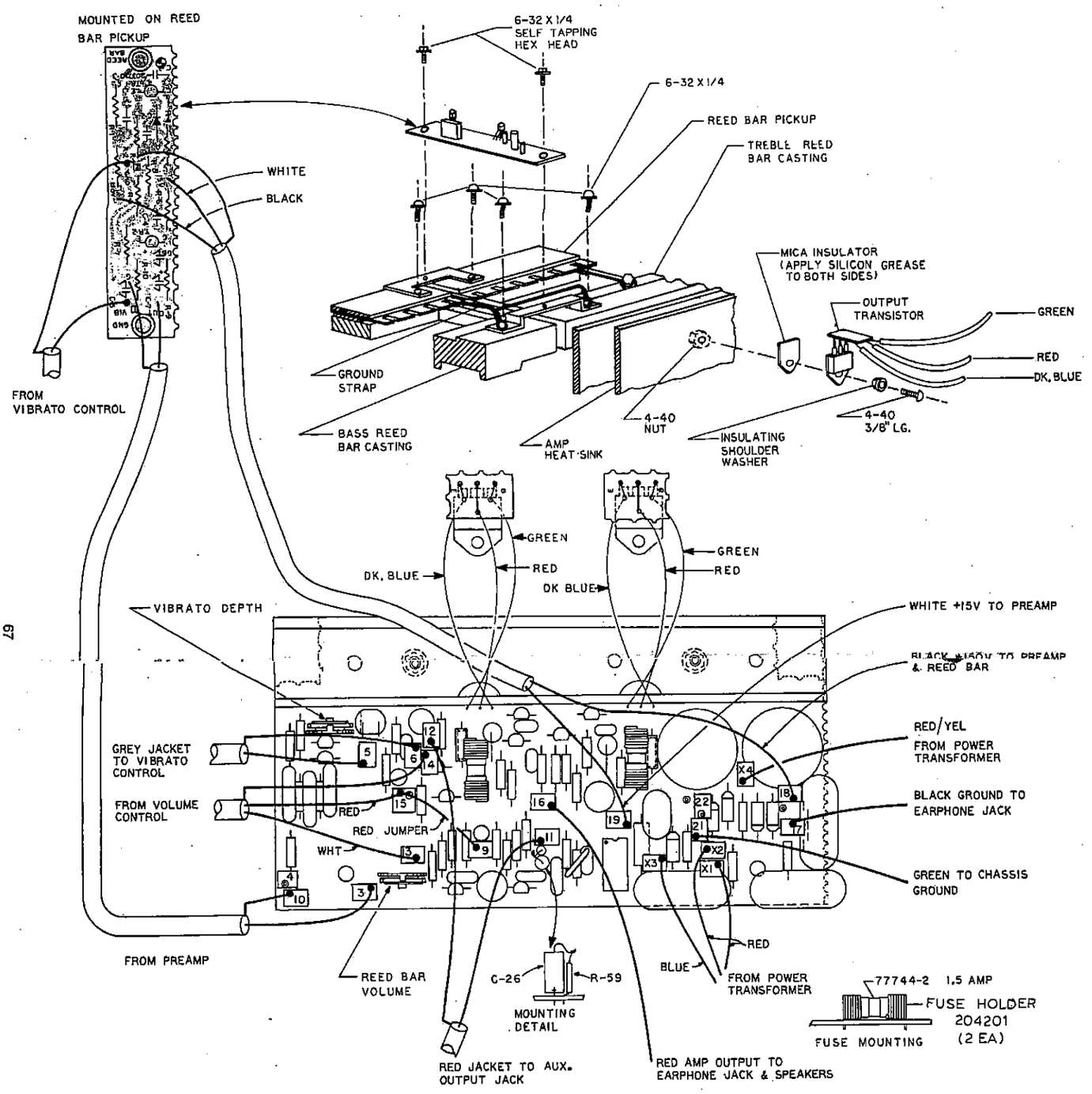
ALL ELECTRONIC COMPONENTS SUCH AS RESISTORS, CAPACITORS ETC. ARE IDENTIFIED WITH A NUMBER.

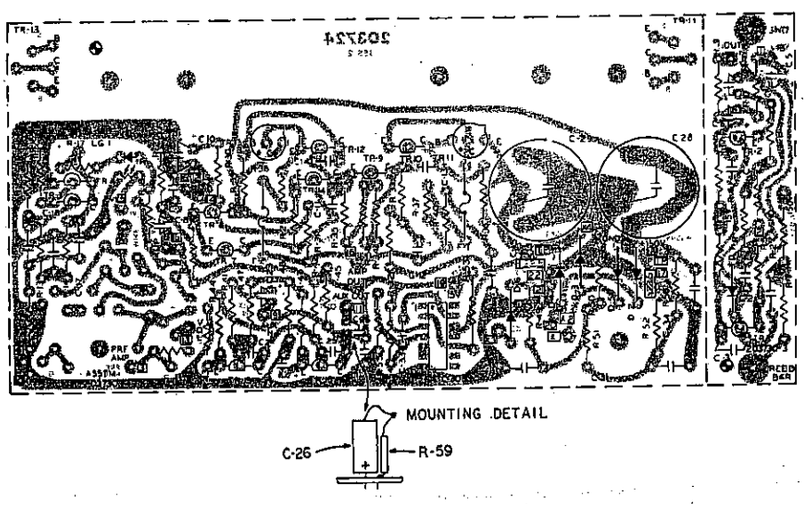
EXAMPLE 26 IDENTFYING NUMBER 1.2K

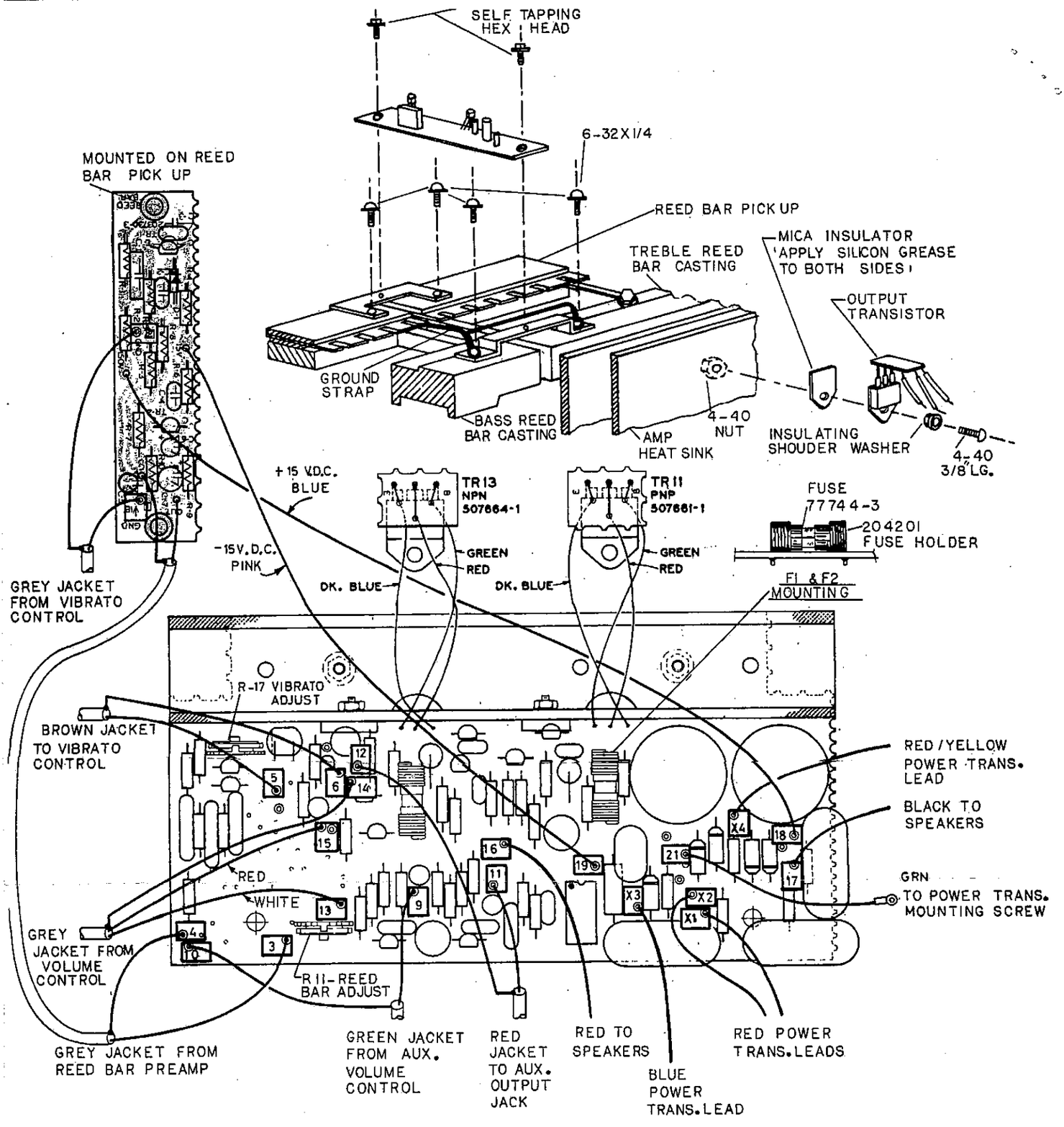
MODEL- 200 SERIES PART NO.- 201904-S-1-E-1
TITLE- ELECTRONIC PIANO AMPLIFIER SCHEMATIC
200 203 214 DATE- 8-1-73
THE WURLITZER COMPANY - DEKALB DIVISION - DEKALB, ILL.

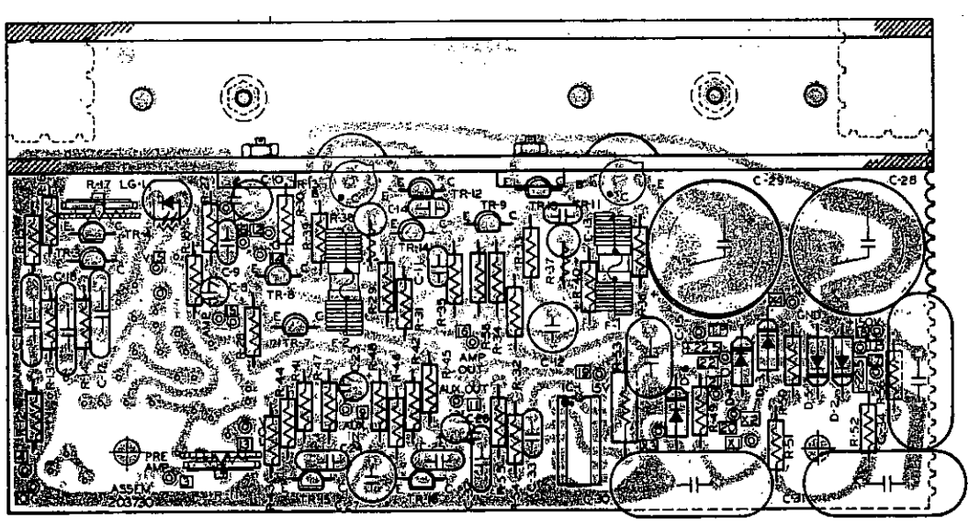
MODEL 200A

STARTING SERIAL NO. 102905
ASS'Y. NO. 203730-3









MODEL 200A ELECTRONIC PIANO

AMPLIFIER P.C. BOARD ASSEMBLY

PART NO. 203730-S1-E6

EARLY PRODUCTION