INTRODUCTION

THIS MANUAL IS INTENDED AS A COMPANION PIECE TO H.B.V.'S MANUAL ON SEEBURG AMPLIFIERS. THE SAME APPROACH (NO SCHEMATICS) HAS BEEN USED IN ORDER TO ENABLE AS MANY PEOPLE AS POSSIBLE TO REPAIR THESE UNITS.

DUE TO THE FACT THAT THE CONTROL CENTRES ARE INVOLVED IN ALMOST ALL THE FUNCTIONS OF A SEEBURG PHONOGRAPH, THE FAULT DESCRIPTIONS FOR THE VARIOUS MODELS DISCUSSED OVERLAP TO SOME DEGREE WITH THE TROUBLE SHOOTING PROCEDURES IN THE TROUBLE SHOOTING GUIDES. IT IS NOT THE INTENTION OF THIS MANUAL TO BE A COMPLETE TROUBLE SHOOTING GUIDE (AFTER ALL, THEY EXIST ALREADY) BUT TO SERVE AS ADDITIONAL INFORMATION. IT IS ONLY WHEN A CONTROL CENTRE IS COMMITTED "TO THE BENCH" THAT THIS MANUAL IS MOST USEFUL.

THE BASIC STRUCTURE OF THIS MANUAL FOLLOWS THE ORDER IN WHICH THE VARIOUS MODELS OF CONTROL CENTRES APPEARED ON THE MARKET. THE FIRST SECTION GIVES WHAT MAY BE CALLED THE HISTORY AND OVERALL CHANGES AS TIME WENT ON. THIS SECTION COMES UNDER THE HEADING "GENERAL INFORMATION". NEXT, THE MAIN BODY OF THIS MANUAL IS DIVIDED INTO THREE SOMEWHAT INTERBLENDING PARTS. THE FIRST PART CONCERNS ITSELF WITH THE TCC1 CONTROL CENTRE; THE NEXT PART COVERS CONTROL CENTRES SCC4 TO SCC9; AND FINALLY THE ENTIRE RANGE OF DIGITAL CONTROL CENTRES IS DESCRIBED AS TO THEIR MOST PROBABLE FAULTS. ADDITIONALLY, THERE ARE A NUMBER OF ILLUSTRATIONS TO HELP LOCATE THE VARIOUS COMPONENTS MENTIONED IN THE TEXT.

IT IS HOPED THAT THIS MANUAL WILL CONTRIBUTE TO ELIMINATING PHONOGRAPH "DOWN-TIME". FEEL FREE TO MAKE ANY COMMENTS REGARDING THE STRUCTURE AND CONTENT OF THIS MANUAL BY COMMUNICATING WITH ME.

AND NOW, GOOD LUCK!

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SEEBURG PHONOGRAPH

CONTROL CENTRES

GENERAL INFORMATION

IN THE SCHEME OF SEEBURG COIN-OPERATED PHONOGRAPHS (AS WELL AS THE HOME UNITS WHICH WERE MARKETING SOME YEARS BACK), THE CONTROL CENTRE IS, AS THE NAME IMPLIES, THE GOVERNOR OF MOST OF THE FUNCTIONS OF THESE PHONOGRAPHS (EXCEPT THE AMPLIFIER). IN THE TIME PERIOD WITH WHICH WE WILL CONCERN OURSELVES IN THIS MANUAL (FROM 1963 TO 1977) THERE HAVE BEEN FOUR OPERATIONALLY SIMILAR BUT ELECTRONICALLY DIFFERENT DESIGNS WHICH WERE NOT INTERCHANGEABLE.

THE DESIGN WHICH WILL BE FOUND IN LPC1 AND LPC480 MODEL PHONOGRAPHS (1963/64) WAS A HYBRID DESIGN EMPLOYING BOTH SOLID STATE DEVICES AND VACUUM TUBES. IN ADDITION, THESE PHONOGRAPHS WERE DESIGNED TO PLAY PRIMARILY "ALBUMS":33-1/3 RPM 7"("MINI-LP") RECORDS (THIS LATTER FEATURE DID NOT DIE OUT UNTIL 1967). THIS NECESSITATED THE INTRODUCTION OF A PLAYBACK SEQUENCE WHICH ALLOWED THE PLAYING OF BOTH LEFT AND RIGHT SIDES OF ANY PARTICULAR RECORD "BACK TO BACK" BEFORE SCANNING ONTO THE NEXT SELECTION. AS A RESULT, THESE UNITS INCORPORATE SEVERAL ADDITIONAL COMPONENTS (RELAYS, TIMING AND SENSING CIRCUITS) WHICH MAKE THE WHOLE DESIGN RATHER CUMBERSOME AND PRONE TO RELAY CONTACT PROBLEMS (THESE WERE THE DAYS BEFORE THE PRESENT HIGHLY SOPHISTICATED DIGITAL ELECTRONICS WERE GENERALLY AVAILABLE). IN ADDITION, PLAYING 45 RPM RECORDS REQUIRED A UNIT TO PRODUCE THIS SPEED, CALLED "AUTOSPEED UNIT" (NOT DISCUSSED IN THIS MANUAL).

THE NEXT IMPROVEMENT IN DESIGN CAME WITH THE INTRODUCTION (IN 1965) OF COMPLETELY SOLID STATE CONTROL CENTRES. AT THE SAME TIME, OPERATORS HAD THE OPTION OF BUYING EITHER AN "ALBUM" OR "SINGLE PLAY" MODEL PHONOGRAPH WHICH GAVE RISE TO TWO VERSIONS OF THESE. ONE HAD THE SAME ARRANGEMENT (FROM A FUNCTIONAL POINT) AS THE LPC CONTROL CENTRES. THE OTHER WAS MUCH SIMPLIFIED (SEE FIG. 6) AND REVERTED BACK TO THE PLAYBACK OF THE PRE-LPC "SINGLE PLAY" PHONOGRAPHS, MEANING THE NON SEQUENTIAL PLAYING OF LEFT SIDES AND RIGHT SIDES.

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THIS ALLOWS THE MECHANISM TO PICK UP SELECTIONS AS IT GETS TO THEM; SIMPLIFIES MATTERS APPRECIABLY AND IS THE SYSTEM WITH WHICH ALL PHONOGRAPHS HAVE BEEN WORKING SINCE. THE USE OF THE 45RPM AUTOSPEED FOR 45RPM RECORDS CONTINUED UNTIL THE END OF 1966. STARTING IN 1967, SEEBURG WENT BACK TO CONSIDER 45RPM RECORDS AS THE STANDARD, ELIMINATING THE NEED FOR AN AUTOSPEED FOR THESE RECORDS. HOWEVER, NOW 33-1/3RPM RECORDS NEEDED AN "AUTOSPEED". THIS WAS INCORPORATED AS A SUBASSEMBLY INTO THE CONTROL CENTRE (UP TO NOW, THE AUTOSPEED UNITS HAD BEEN MOUNTED ON A SEPARATE CHASSES), BUT HAD NO DIRECT INFLUENCE ON THE CONTROL CENTRE ELECTRONICS. THIS AUTOSPEED HAS BEEN USED EVER SINCE, EXCEPT THAT IT LATELY HAS BECOME AN OPTION (SEE FIG. 12 WHERE IT IS MISSING AND REPLACED BY A DUMMY PLUG).

THE CONTROL CENTRES WHICH WERE USED IN 1965/66 ARE INTERCHANGEABLE AS ARE THE ONES USED IN 1967/68. THE DIFFERENCE IN 1968 OPPOSED TO 1967 WAS THE USE OF PRINTED CIRCUIT BOARDS (THIS ALSO OCCURRED IN THE AMPLIFIERS); STILL, OUTSIDE PLUG ARRANGEMENTS IN THOSE TWO YEARS WERE THE SAME MAKING FOR THE INTERCHANGEABILITY. ELECTRONICALLY, THE MODELS '65 TO '68 WERE ALMOST IDENTICAL.

THE BIG CHANGE OCCURRED IN 1969 WITH THE INTRODUCTION OF THE FIRST TRULY "DIGITAL" PHONOGRAPH IN THE INDUSTRY. THIS REQUIRED A COMPLETE REDESIGN OF THE "WRITE-IN" SECTION OF THE CONTROL CENTRE. THIS SYSTEM WAS AT THE LEADING EDGE OF THE STATE OF ELECTRONIC ART AT THE TIME AND WAS USED FOR THE NEXT 10 YEARS. INTERCHANGEABILITY BETWEEN ANY MODELS FROM 1969 TO 1978 IS ONE OF THE BENEFITS OF THIS INNOVATION (THIS IS TRUE ALSO WITH SOME QUALIFICATION FOR THE AMPLIFIERS - REFER TO H.B.V.'S MANUAL ON SEEBURG AMPLIFIERS). ANY CHANGES THAT TOOK PLACE WERE OF A MINOR ELECTRONIC NATURE SO THAT EVEN INDIVIDUAL PRINTED CIRCUIT BOARDS ARE INTERCHANGEABLE ALL ALONG THE LINE.

IN 1979, WITH THE INTRODUCTION OF MICROPROCESSORS, THE SEEBURG "TORMAT" SYSTEM WAS ABANDONED (IT HAD STARTED IN 1957). THIS HAS MEANT THE END OF CONTROL CENTRES OF THE TYPE DESCRIBED HERE.

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HERE IS A LIST OF CONTROL CENTRES AS THEY ARE FOUND IN THE VARIOUS SEEBURG PHONOGRAPHS STARTING IN 1963.

CONTROL CENTRE	PHONOGRAPH MODEL	YEAR	REMARKS
TCC1	LPC 1	1963	INTERCHANGEABLE, MACHINES ON 33-1/3 RPM STANDARD
	LPC480	1964	
SCC4	APFEA1	1965	(ALBUM VERSION)
SCC3	PFEA1	1965	INTERCHANGEABLE
	SS160	1966	
SCC7	LS1	1967	INTERCHANGEABLE, MACHINES ON 45 RPM STANDARD
SCC8	LS2	1968	
SCC9	SE-100 (100 SEL)	1969	INTERCHANGEABLE, MACHINES ON 45 RPM STANDARD
	SX 100 (100 SEL)	1972	
DCC 1	LS3	1969	
	USC1	1970	
DCC2	USC2	1971	
DCC3	SPS160	1972	
DCC32	FC1	1972	
DCC4	SPS2	1973	"
	STD160	1974	
DCC42	STD2	1975	
	STD3	1976/77	
PPC1-56	100-77D(100 SEL)	1976/77	

THE CONTROL CENTRES FOR 100 SEL. MODELS ARE NOT INTERCHANGEABLE WITH THOSE OF 160 SEL. MODELS, EVEN THOUGH THEIR OPERATING PRINCIPLES ARE VERY SIMILAR.

THE FOREGOING LIST SERVES AS A CONVENIENT GUIDE TO THE DISCUSSIONS IN THIS MANUAL. THE SEQUENCE WILL BE FOLLOWED AS WE MENTION THE IMPORTANT POINTS IN EACH CONTROL CENTRE.

TCC1

THIS CONTROL CENTRE (FIG. 1) IS THE LAST UNIT INCORPORATING TUBES FOR MOST OF ITS FUNCTIONS. FROM AN OPERATIONAL POINT OF VIEW, IT WAS ORGANIZED AS SHOWN IN FIG. 3. AS CAN BE SEEN, MANY OF ITS FUNCTIONS ARE DUPLICATED AND GROUPED ACCORDING TO LEFT OR RIGHT SIDE; IN ADDITION, THE VARIOUS TUBES NEEDED A NUMBER OF DIFFERENT VOLTAGES TO BE OPERATIONAL. THIS CREATED THE NEED FOR A VERY COMPLEX AND EXPENSIVE

POWER TRANSFORMER. THIS TRANSFORMER IS THE MOST INVOLVED TRANSFORMER TO BE FOUND IN ANY OF SEEBURG'S EQUIPMENT.

WHAT CAN GO WRONG WITH THIS CONTROL CENTRE? WELL, THE FIRST THING TO CONSIDER WHEN WORKING ON AN APPARENTLY FAULTY TCC1 CONTROL CENTRE IS: ARE ALL THE NECESSARY VOLTAGES PRESENT? THIS SEEMS TO IMPLY THE AVAILABILITY OF A METER FOR MEASUREMENT. HOWEVER, A LOT OF INFORMATION CAN BE GLEANED BY JUST "EYEBALLING" THE UNIT.

THE FOLLOWING TEST SEQUENCE MAY BE OF USE WHEN CONFRONTED WITH AN APPARENTLY FAULTY CONTROL CENTRE. (THIS WILL LIKELY HAPPEN ON LOCATION, WHEN THE CONTROL CENTRE IS STILL LOCATED INSIDE A PHONOGRAPH):

1. OPERATE THE PHONOGRAPH MECHANISM BY MEANS OF THE SERVICE SWITCH AND OBSERVE THE FOLLOWING:
   a) DOES THE MECHANISM START SCANNING?
   b) DOES IT REVERSE AT THE END OF THE TRACK? (THESE FUNCTIONS NEED THE 24V SUPPLIED BY THE TCC1 TRANSFORMER. IF THE ABOVE FUNCTIONS ARE NOT OPERATIONAL, CHECK THE 15A FUSE IN THE TCC1).

2. OBSERVE THE OA2 VOLTAGE REGULATOR TUBES. THEY SHOULD SHOW A PURPLE GLOW INSIDE. THIS PURPLE GLOW WILL VARY ("FLICKER") IN INTENSITY AS THE MECHANISM SCANS FROM LEFT TO RIGHT AND STAY STEADY AS THE MECHANISM SCANS FROM RIGHT TO LEFT. THE FLICKERING IS CAUSED BY THE CLOSING AND OPENING OF THE "DETENT" (R.O.) SWITCH AS IT READS OUT <u>BOTH SIDES</u> OF EACH RECORD (ON THE LEFT TO RIGHT SCAN). THE READ-OUT (R.O.) IS DISABLED ON THE RIGHT TO LEFT SCAN. THEREFORE, THE GLOW INSIDE THE OA2 TUBES REMAINS STEADY. IF NO GLOW CAN BE DETECTED INSIDE THE OA2'S AT ALL, CHECK THE 6X4 HIGH VOLTAGE RECTIFIER TUBE. YOU ARE LOOKING FOR THE RED GLOWING FILAMENT AT THE CENTRE OF THIS TUBE. IT IS ADVANTAGEOUS TO REPLACE THIS TUBE WHEN THE OA2'S ARE NOT SHOWING THE PURPLE GLOW, WHETHER THE GX4 FILAMENT IS LIT OR NOT.

3. CHECK THE 2050 "TRIP" TUBES. THERE IS ONE FOR THE "LEFT" AND ONE FOR A "RIGHT" SIDE SELECTION. THESE TUBES SHOULD ALSO HAVE A GLOWING FILAMENT LIKE THE 6X4 TUBE. IN ADDITION, IN ORDER TO TEST THE PROPER FUNCTION OF THESE TUBES, YOU MUST MAKE A "DOUBLE-SIDED" SELECTION; THAT IS, YOU SHOULD SELECT SAY "A8 AND B8",

ONE AFTER THE OTHER. AS THE MACHINE SCANS TO THE SELECTED RECORD, AND ONLY WHEN IT GETS THERE, SHOULD YOU OBSERVE A MOMENTARY "FLASH" AROUND THE GLOWING FILAMENT OF BOTH 2050 TUBES. THIS INDICATES THAT BOTH THE "LEFT SIDE" AND "RIGHT SIDE" SELECTIONS HAVE BEEN "READ OUT". THE MACHINE SHOULD NOW INITIATE "LEFT SIDE" PLAY. AFTER THE RECORD ENDS (OR IF YOU OPERATE THE REJECT SWITCH) THE MACHINE SHOULD IMMEDIATELY COMMENCE "RIGHT SIDE" PLAY.

IT MAY BE POSSIBLE THAT ONLY ONE SIDE (SAY THE RIGHT SIDE) OF A RECORD IS PLAYED, EVEN THOUGH BOTH SIDES HAVE BEEN SELECTED. IT WILL HELP HERE TO INTERCHANGE THE TWO 2050 TUBES AND THEN TO TRY AGAIN. IF THE SAME SELECTION (AS ABOVE) IS PLAYED (SAY THE RIGHT SIDE ONLY), THE INTERCHANGE HAD NO EFFECT AND THE FAULT LIES ELSEWHERE. IN THIS CASE, OBSERVE THE TWO 12AX7 TUBES (CHECK FOR THE RED GLOW OF THEIR FILAMENTS). THESE ARE THE SENSING TUBES WHICH HANDLE THE SIGNAL GENERATED BY THE TORMAT UNIT WHEN A "SELECTED" TOROID IS READ OUT. SWITCH THESE TUBES AROUND AS WELL TO SEE IF YOU TRANSFER THE PROBLEM (IN THIS CASE, SEE IF YOU NOW GET ONLY "LEFT SIDE" PLAY). IT IS EXTREMELY UNLIKELY THAT BOTH TUBES OF EACH SET (2050'S AND 12AX7'S) ARE FAULTY AT THE SAME TIME, SO THAT TUBE TROUBLES CAN USUALLY BE DETECTED BY THIS INTERCHANGE TECHNIQUE.

4. SHOULD THE ABOVE TESTS NOT ALTER THE TROUBLE SYMPTONS, OBSERVE THE ACTION OF THE LEFT AND RIGHT SIDE TRIP RELAYS (FIG. 2). AS THE MACHINE REACHES THE SELECTED RECORD, A8 AND B8 IN OUR EXAMPLE, THEY SHOULD BOTH SIMULTANEOUSLY ACTIVATE. THE LEFT SIDE RELAY WILL RELEASE AS SOON AS THE MECHANISM STARTS RECORD TRANSFER (LEFT SIDE). NOTE THAT THE RIGHT SIDE TRIP RELAY MUST STAY ACTIVATED DURING THE ENTIRE DURATION OF LEFT SIDE PLAY, IF BOTH SIDES OF THE SELECTION WERE SELECTED AT THE SAME TIME. IF THE RIGHT SIDE RELAY SHOULD FAIL TO DO SO, YOU CAN TEST IT BY MAKING THE LEFT SIDE SELECTION ONLY (A8 ONLY) AND LETTING THE MACHINE PLAY IT AND THEN MAKING THE RIGHT SIDE SELECTION (B8 ONLY) TO SEE IF IT WILL PLAY THE RIGHT SIDE. IF THIS SEQUENCE WORKS OK (AND IN MOST CASES IT WILL), THE PROBLEM IS VERY LIKELY IN THE HOLDING CONTACTS OF EITHER THE LEFT SIDE RELAY OR THE PLAYING MECHANISM.

AT THIS TIME, IT WILL BE ADVANTAGEOUS TO CLEAN ALL RELAY AND PLAYING MECHANISM CONTACTS BY MEANS OF A BURNISHING TOOL (PULL THE CONTROL CENTRE 117V PLUG SO THAT NO POWER IS APPLIED). CONTACT PROBLEMS ARE, NEXT TO THE TUBE TROUBLES, THE MOST COMMON CAUSE OF PROBLEMS IN THIS TYPE OF CONTROL CENTRE.

5. IF THE ABOVE PROCEDURES PRODUCE NO CONSISTENT RESULTS, TRY THE BATTERY TEST. THIS INVOLVES REMOVING THE SENSING PLUGS FROM THE SENSING AMPLIFIER SOCKETS (LEFT SIDE AND RIGHT SIDE). THESE CABLES ARE COLORED RED AND BLUE. HOLD THE BATTERY (FLASHLIGHT TYPE) SO THAT THE BATTERY CASE TOUCHES AN UNPAINTED PART OF THE CONTROL CENTRE CHASSIS. MOMENTARILY CONNECT THE CENTRE OF EACH SENSING CABLE PLUG TO THE POSITIVE POST IN THE CENTRE OF THE BATTERY TOP. NOW PLUG THE SENSING CABLES BACK INTO THEIR RESPECTIVE SOCKETS (TAKE CARE NOT TO MIX UP THE LEFT AND RIGHT SIDE CABLES; THIS WILL RESULT IN THE WRONG RECORD SIDES BEING PLAYED WHEN SELECTIONS ARE MADE BY MEANS OF THE SELECTION BUTTONS OR WALLBOXES). NOW USE THE SERVICE SWITCH TO START THE MACHINE SCANNING. AS SOON AS THE MACHINE REVERSES AT THE LEFT SIDE OF THE TRACK, IT WILL HIT SELECTION "A1". IT WILL PLAY THIS SELECTION (EVERYTHING BEING OK). AT THE TIME OF RECORD REJECT, THE MACHINE WILL PUT THE RECORD BACK INTO THE MAGAZINE AND THEN PICK IT RIGHT UP AGAIN TO PLAY SELECTION "B1". AFTER THIS, IT WILL GO TO SELECTION "C1", PLAY IT, THEN "D1", ETC.... UNTIL ALL SELECTIONS HAVE BEEN PLAYED. THIS PROCEDURE IS VERY LONG AND NEED NOT BE CARRIED OUT COMPLETELY. WHAT YOU HAVE DONE IS TO ACTUALLY TEST THE COMPLETE READ-OUT AND "TRIP ON"*) SYSTEM OF THIS PHONOGRAPH. IN EFFECT, YOU HAVE SUBSTITUTED A DIFFERENT

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*) "TRIP ON" IS A FUNCTION OF THE 2050 TUBES AND TRIP RELAYS. "TRIP OFF" AT THE END OF RECORD PLAY OR WHEN A REJECT BUTTON IS PUSHED IS A FUNCTION OF THE MUTE RELAY IN THE AMPLIFIER AND HAS NOTHING TO DO WITH THE CONTROL CENTRE. THIS HOLDS TRUE FOR ANY SUBSEQUENT MODEL SEEBURG PHONOGRAPHS.

WAY OF SELECTING RECORDS. IT IS CLEAR THAT THE READ-OUT SYSTEM HAS TO WORK BEFORE THE WRITE-IN CIRCUITS (= THE SELECTION CIRCUITS) CAN BE TESTED. NO AMOUNT OF WRITING-IN WILL DO ANY GOOD IF YOU CANNOT READ OUT THIS INFORMATION. IF THE ABOVE BATTERY TEST RESULTS IN CORRECT OPERATION, SELECTION PROBLEMS CAN BE MORE LIKELY FOUND IN THE CREDIT UNIT AND/OR SELECTION BUTTON ASSEMBLIES (CHECK THE "K" CONTACT IN THE CREDIT UNIT). TO ERASE THE SELECTIONS MADE "BY BATTERY" CONNECT THE BATTERY AS DESCRIBED, BUT WITH POSITIVE TO CHASSIS.

6. EVERY TEST DESCRIBED ABOVE CAN BE DONE ON LOCATION. IF THESE TESTS DO NOT CORRECT THE PROBLEM, CONTROL CENTRE SUBSTITUTION IS CALLED FOR IN THE PHONOGRAPH. IF THIS PRODUCES NO CORRECTION OF THE PROBLEM, YOUR TROUBLES ARE OBVIOUSLY NOT PART OF THE CONTROL CENTRE. HOWEVER, IF THE PHONOGRAPH NOW WORKS CORRECTLY, YOUR CONTROL CENTRE JUST REMOVED IS FAULTY AND WILL NEED BENCH WORK.

AT THIS POINT, IT MAY BE ADVANTAGEOUS TO DETAIL THE COMPONENTS WHICH HAVE GONE CONSISTENTLY FAULTY OVER THE YEARS. THIS WILL LIKELY SOLVE ABOUT 90% OF THE PROBLEMS THAT THIS UNIT COULD DEVELOP. BEAR IN MIND THAT THESE UNITS ARE AT LEAST 15 YEARS OLD (AT THE TIME THIS IS BEING WRITTEN, JANUARY 1979) AND COULD CONCEIVABLY SHOW AGEING PROBLEMS WHICH HAVE NOT BEEN APPARENT BEFORE. BE SURE THAT ALL PLUGS AND SOCKET PINS ARE IN GOOD SHAPE BEFORE DECIDING THAT YOU HAVE PROBLEMS IN THE ELECTRONICS OF THIS UNIT.

WE ARE NOW GETTING INTO AN AREA WHERE FAMILIARITY WITH SCHEMATICS CAN BE OF GREAT HELP. HOWEVER, A LOT OF PROBLEMS CAN BE SPOTTED BY VISUAL INSPECTION. SUCH ITEMS AS BURNED RESISTORS AND LEAKING CAPACITORS CAN EASILY BE SEEN. THESE TESTS ARE DONE WITH NO POWER CONNECTED TO THE CONTROL CENTRE. REFER TO FIG. 2 FOR THE FOLLOWING ITEMS:

A) CAPACITORS C514 AND C515 HAVE FAILED AT A CONSISTENT RATE. USUALLY THEY SHORT OUT. THIS MEANS THAT THE 6X4 RECTIFIER TUBE WILL USUALLY BE AFFECTED ESPECIALLY IF C514 SHORTS OUT. THE RESULTING CURRENT IS MANY TIMES THE DESIGN RATING OF THIS TUBE AND RESULTS IN INTERNAL SHORTS IN IT. IF C515 SHORTS OUT THE 3300 (3.3K) OHM RESISTOR R518 BURNS OUT. THIS IS A FUSE RESISTOR OF 5W RATING AND SHOWS NO CHANGE IN ITS APPEARANCE WHEN BURNED OUT. THE ONLY WAY TO ASCERTAIN

WHETHER IT IS GOOD OR NOT IS BY USE OF AN OHMMETER.

B) RESISTORS R519 HAS ALSO OCCASIONALLY BURNED OUT (IT SHOWS VISIBLE DAMAGE). R519 HAS A VALUE OF 2700 OHMS AT A 2W RATING. THE CAUSE MAY BE SHORTED OA2 TUBES (THIS IS RARE).

C) RESISTORS R514 AND R516 ARE PART OF THE READ-OUT CIRCUITRY AND MAY BE SUBJECT TO CHANGE OF RESISTANCE IF THE MECHANISM IS STATIONARY FOR A LONG TIME WITH THE DETENT SWITCH (R.O.) CLOSED. THIS CAN AGAIN ONLY BE TESTED BY MEANS OF AN OHMMETER. R516 HAS A VALUE OF 36 OHMS, 1/2 WATT AND R514 IS A 56000 OHM RESISTOR OF 2 WATT RATING. THE VALUES FOR ALL THE RESISTORS MENTIONED ABOVE CAN VARY $\pm$ 10% AND STILL BE GOOD.

D) DUE TO THE COMPLEXITY OF THE "LEFT-SIDE, RIGHT-SIDE" PLAY SEQUENCE, THIS SYSTEM RELIES MORE HEAVILY ON RELAYS AND HOLDING CONTACTS. AS A RESULT, DIRTY CONTACT PROBLEMS ARE PREVALENT. IT IS GOOD PRACTICE, WHEN RUNNING INTO SELECTION PROBLEMS, TO CLEAN NOT ONLY ALL TRIP RELAY CONTACTS IN THE TCC1, BUT ALSO ALL CONTACTS ON THE PLAY MECHANISM (INCLUDING THE REVERSING RELAY). REMOVE THE POWER PLUG THAT SUPPLIES THE TCC1 FROM THE POWER SOCKET INSIDE THE PHONOGRAPH WHEN CLEANING THESE CONTACTS.

THE FOREGOING DISCUSSION HAS BEEN RATHER LENGTHY AND MAY SEEM SOMEWHAT INVOLVED. THIS IS A REFLECTION OF THE COMPLEXITY OF THIS PARTICULAR CONTROL CENTRE. WITH A BIT OF PRACTICE, THINGS WILL BECOME EASIER. YOU'LL BE GLAD TO KNOW THAT THE CONTROL CENTRE MODELS TO BE TALKED ABOUT FROM NOW ON ARE FAR SIMPLER (MAINLY DUE TO THE FACT THAT THEY ARE COMPLETELY SOLID STATE) AND THAT A LOT OF THE ABOVE MENTIONED PROCEDURES ARE USEFUL IN THESE "NEWER" UNITS SO WELL.

THE SCC4 CONTROL CENTRE (FOUND IN MODEL APFEA1 PHONOGRAPH)

LET US START WITH THE SCC4. THIS UNIT EXHIBITED GREAT ELECTRONIC DIFFERENCES WITH RESPECT TO ITS PREDECESSOR (THE TCC1). THERE ARE NO VACUUM TUBES OF ANY KIND. THE FUNCTIONS OF THE 6X4 IS TAKEN OVER BY A SIMPLE DIODE RECTIFIER; THE 12 AX7 AND 2050 TUBES ARE REPLACED BY "SILICON-CONTROLLED SWITCHES" (SCS). EACH ONE OF THESE COMBINED THE

"SENSING" AND "TRIP ON" FUNCTIONS OF A 12 AX7 AND A 2050 OF THE PREVIOUS MODEL. THIS RESULTED IN A VAST SIMPLIFICATION OF CIRCUITRY AND MADE POSSIBLE THE USE OF A MUCH LESS COMPLEX POWER TRANSFORMER. THE OA2'S WERE REPLACED BY ONE ZENER DIODE.. THE SCC4 RETAINED THE "LEFT SIDE , RIGHT SIDE" SELECTION SEQUENCE OF THE LPC MODEL PHONOGRAPHS. THEREFORE, TWO SCS CIRCUITS WERE NEEDED AS WELL AS A LEFT SIDE TRIP RELAY AND A RIGHT SIDE TRIP RELAY. FOR TROUBLE SHOOTING, PARAGRAPH (1) IN THE TCC1 SECTION IS APPLICABLE AS WELL AS PARAGRAPH 4, 5 - WITH THE EXCEPTION THAT THE POSITIVE (CENTRE) ELECTRODE OF THE BATTERY SHOULD NOW BE TOUCHING THE CHASSIS AND THE CENTRE PIN OF EACH SENSING PLUG TO BE MOMENTARILY CONNECTED TO THE CASE OF THE BATTERY (THIS IS DUE TO THE CHANGE IN ELECTRONICS) AND PARAGRAPH 6.

A FURTHER SIMPLIFICATION APPEARS WITH THE USE OF THE:

SCC 3 CONTROL CENTRE (FOUND IN PFEA1 AND SS160 PHONOGRAPHS).

THIS UNIT DOES AWAY WITH THE "LEFT SIDE, RIGHT SIDE" FEATURE. THEREFORE ONLY ONE SINGLE SCS DOES THE WORK WHICH WAS DONE BY FOUR TUBES IN THE TCC1. (ALSO THE REVERSING RELAY AND OTHER CONTACTS ARE ELIMINATED ON THE PLAY MECHANISM). IN ADDITION, CONVENIENT TEST POINTS WERE MADE AVAILABLE ON THE FRONT OF THE SCC3 (AND SCC4) CONTROL CENTRES FOR READING VOLTAGES AND ISOLATING PULSE CIRCUITS.

CONTROL CENTRE PROBLEMS DIMINISHED DRAMATICALLY AS A RESULT. THIS SIMPLICITY OF DESIGN COMPARED TO EARLIER MODELS BECOMES APPARENT WHEN LOOKING AT FIG. 4. NOTE ESPECIALLY THE FAR FEWER VOLTAGES REQUIRED AND THE CONSEQUENTLY MUCH SIMPLER POWER TRANSFORMER.

THESE CHANGES ELIMINATED MANY OF THE PROBLEMS OF THE TUBE TYPE CONTROL CENTRES. BUT, INTRODUCED ONE OR TWO NEW ONES. A DESIRABLE ADDITION WAS THE FUSING OF EACH OF THE DIFFERENT CIRCUITS WITH THEIR OWN FUSE. THESE CIRCUITS SUPPLIED POWER TO MOST EXTERNAL UNITS (I.E. STEPPER OR CREDIT PLAY MECHANISM) SO THAT MALFUNCTIONS IN THESE COULD CAUSE THE FUSES TO BLOW IN THE CONTROL CENTRE. CONVERSELY, SOME MALFUNCTIONS IN THE CONTROL CENTRE COULD DISABLE SOME APPARENTLY UNRELATED FUNCTION IN AN EXTERNAL UNIT JUST BECAUSE IT HAPPENED TO "BLOW" A PARTICULAR FUSE. FOR THIS REASON, A FUSE CHECK IS PROBABLY THE FIRST ITEM OF BUSINESS

WHEN CONFRONTED WITH A FAULTY CONTROL CENTRE (OR PHONOGRAPH, FOR THAT MATTER).

THE COMMON PROBLEMS ENCOUNTERED WITH THESE "NEWER UNITS" CAN BE FOUND ALL THE WAY UP TO THE SCC9. FOR THIS REASON, THE FOLLOWING LIST OF "REGULAR" FAULTS APPLIES TO ALL MODEL CONTROL CENTRES UP TO AND INCLUDING THOSE FOUND IN THE MODEL LS2 PHONOGRAPH.

A) FUSES (REFER TO FIG. 6)

(F3101) 15A PROTECTS THE 24VAC CIRCUITS WHICH SUPPLY THE SOLENOIDS THROUGHOUT THE PHONOGRAPH. THIS HAS OCCASIONALLY BEEN BLOWN DUE TO A FAULTY TRIP COIL IN THE PLAY MECHANISM. THEREFORE, IT IS NOT REALLY A CONTROL CENTRE PROBLEM, EXCEPT THAT THIS FUSE IS LOCATED THERE. SERIOUS OVERFUSING OF THE CREDIT UNIT CAN ALSO CAUSE THIS FUSE TO FAIL.

(F3102) 1/8 A FUSES THE WRITE-IN AND READ-OUT CIRCUITS (ALSO A TRANSISTOR IN THE STEPPER UNIT OF ALL PLACES!). THIS IS A "PIGTAIL" FUSE SOLDERED INTO PLACE IN MOST OF THESE CONTROL CENTRES. (THIS FUSE APPEARS FIRST IN THE SCC3 AND IS PRESENT THROUGH THE ENTIRE RANGE OF SUBSEQUENT CONTROL CENTRES, INCLUDING ALL "DIGITAL" MODELS. IN PHONOGRAPHS UP TO AND INCLUDING THE LS2, IT BLOWS FOR ONE MAIN REASON: THE FAILURE OF RESISTORS R3107 (56000 OHMS) AND R3109 (36 OHM) SHOWN IN FIG. 6 (IN FIG. 6 AND 7 THEY HAVE BEEN REPLACED BY 50000 AND 39 OHM RESISTORS, RESPECTIVELY. THIS IS BARELY WITHIN THE LIMITS OF DESIGN TOLERANCE). THE REASON FOR FAILURE IS DUE TO A DESIGN PROBLEM AND IS THIS: WHEN THE PLAYING MECHANISM COASTS TO A STOP AFTER HAVING FINISHED WITH THE LAST SELECTION, IT IS EQUALLY POSSIBLE FOR THE DETENT SWITCH (R.O. SWITCH) TO BE IN ITS CLOSED OR OPEN POSITION. IN THE CLOSED POSITION, A CONSTANT CURRENT FLOWS THROUGH BOTH RESISTORS R3107 AND R3109. THIS CURRENT IS LARGE ENOUGH TO CAUSE R3107 TO HEAT UP TO ITS FULL 2 WATT RATING. IN TIME, THIS CAUSES A CHANGE (DOWNWARD) IN ITS INTERNAL RESISTANCE, INCREASING THE CURRENT EVEN MORE. MORE HEAT IS DISSAPATED STILL, RESISTANCE DECREASES SOME MORE, ETC. EVENTUALLY R3109 OVERHEATS TOO. THE CURRENT INCREASES FROM ABOUT 7 MILLIAMPS TO WELL IN EXCESS OF THE 125 MILLIAMPS OF FUSE F3102, WHICH MUST OBVIOUSLY BLOW. FOR ALL THIS THE OUTWARD APPEARANCE OF R3107

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HARDLY CHANGES (IT MAY LOOK A LITTLE "PUFFED UP"), BUT IT'S READING WILL SHOW A RESISTANCE OF ONLY A FEW HUNDRED OHMS. THE FUSE WILL HAVE BLOWN SEVERAL TIMES DURING THE TIME IT TAKES FOR ALL THIS TO HAPPEN. SINCE THERE IS NO "OBVIOUS" CAUSE FOR THE FUSE FAILURE, PEOPLE HAVE A TENDENCY TO REPLACE IT WITH A HIGHER RATED ONE (I HAVE SEEN 15A FUSES USED). THIS ACCELERATES THE "AGEING" PROCESS OF THE ABOVE RESISTORS AND DOES NOT CURE ANYTHING; IT WILL HOWEVER RESULT IN THE SHORTING OF THE RECTIFIER DIODES AND/OR BURN-OUT OF THE MAIN POWER TRANSFORMER. THE REAL CURE IS TO REPLACE RESISTOR R3107 WITH ONE THAT IS RATED AT 56000 OHMS, 5 WATTS OR HIGHER. (THE 50000 OHM, 12 WATT RESISTOR IN FIG. 7 IS A BARELY ACCEPTABLE SUBSTITUTE). R3109 (36OHM 1/2 WATT) CAN BE REPLACED WITH EITHER A 39 OHM OR 33 OHM RESISTOR (EACH 1/2 WATT). CHECK RESISTOR R3107 WITH AN OHMMETER IF YOU FIND THE FUSE (F3102) BLOWN.

F3101 1.5A FUSES THE 40VDC CIRCUIT WHICH SUPPLIES NOT ONLY THE CONTROL CENTRE BUT ALSO THE CREDIT AND STEPPER UNITS. THEREFORE, FAILURE OUTSIDE OF THE CONTROL CENTRE CAN CAUSE THIS FUSE TO BLOW ALSO (LIKE F3101, MENTIONED ABOVE). THIS CIRCUIT SUPPLIES THE "TRIP ON" RELAY(S) IN THE CONTROL CENTRE AS WELL. THIS FUSE HAS NOT BEEN A CONSISTENT PROBLEM. A SYMPTOM NOT REALLY CONNECTED WITH THE CONTROL CENTRE IS THE BLOWING OF THE 1.6A FUSE IN THE CREDIT UNIT WHEN THE ABOVE MENTIONED FUSE F3103 IN THE CONTROL CENTRE IS BLOWN. THIS IS DUE TO THE TIMING RELAY IN THE CREDIT UNIT BEING WITHOUT POWER (IT IS PART OF THE 40V CIRCUIT). WHEN THE TIMING RELAY DOES NOT INTERRUPT THE POWER TO THE CREDIT UNIT SUBTRACT SOLENOID AS A SELECTION IS BEING MADE BY MEANS OF THE PUSHBUTTONS, THE SUBTRACT SOLENOID STAYS ACTIVATED. IT WOULD BURN OUT IN SHORT ORDER IF IT WAS NOT FUSED BY THE 1.6A CREDIT UNIT FUSE. HERE IS ONE EXAMPLE OF SOME APPARENTLY UNRELATED PROBLEM CAUSING TROUBLE ELSEWHERE.

B) OCCASSIONAL FAILURES OF ZENER DIODES CR3105 (150V, 10W) AND CR3104 (27V, 10W) WILL CAUSE THE OPENING OF RESISTOR R3106 (7500 OHMS, 10 W) AND R3110 (100 OHMS, 7W). THESE COMPONENTS WILL NOT SHOW ANY VISIBLE DAMAGE AND MUST THEREFORE AGAIN BE TESTED

BY MEANS OF AN OHMMETER (THIS ENTIRE DISCUSSION SHOWS THE IMPORTANCE OF BEING FAMILIAR WITH THIS MOST IMPORTANT DIAGNOSTIC TOOL). FOR THE ZENER DIODES, CONNECT ONE OF THE TWO METER LEADS TO THE CONTROL CENTRE CHASSIS (SET THE OHMMETER ON THE OHMX10 RANGE) AND THE OTHER TO THE CENTRE CONNECTION OF THE ZENER DIODE UNDER TEST, THEN REVERSE THE CONNECTIONS. A LOW RESISTANCE READING MUST BE HAD WITH ONLY ONE COMBINATION OF CONNECTIONS. IF YOU GET A LOW RESISTANCE READING IN BOTH DIRECTIONS (I.E. IRRESPECTIVE OF HOW THE LEADS ARE CONNECTED), THE ZENER DIODE IS FAULTY AND MUST BE REPLACED. YOU MAY ALSO FIND A ZENER DIODE SHOWING NO READINGS IN EITHER DIRECTION (THIS IS VERY RARE). IN THIS CASE, THERE WILL BE NO FAULTY RESISTORS AND THE ONLY PROBLEM WITH A PHONOGRAPH MAY BE THE SELECTION AND PLAYING OF MORE THAN ONE RECORD WHEN ONLY ONE SELECTION HAS BEEN PUNCHED (THIS APPLIES WHEN ZENER DIODE CR3105 IS "OPEN"). AS AN EXAMPLE, YOU MAY HAVE SELECTED SAY "A1", BUT MAY ALSO GET "A2", "A3", "A4", "A5" ETC.... ZENER DIODES ARE REGULATING DEVICES TO CONTROL SUCH EFFECTS.

IN ANY CASE, THE TESTING OF ZENER DIODES BY MEANS OF AN OHMMETER IS NO DIFFERENT FROM TESTING ANY OTHER DIODE. YOU ARE REFERRED TO H.B.V.'S MANUAL ON SEEBURG AMPLIFIERS, WHERE THE TESTING PROCEDURE IS DESCRIBED TO SOME EXTENT. FAILURE OF THE 27V ZENER DIODE CR3104 WILL RESULT IN NO TRIP RELAY OPERATION IF THE DIODE IS SHORTED (MOST COMMONLY) ALONG WITH THE POSSIBILITY OF BURNING OUT RESISTOR R3110 MENTIONED ABOVE. AN OPEN ZENER DIODE CR3104 WILL, IN TIME, AFFECT THE SILICON CONTROLLED SWITCH (SCS 3100) WHICH IS THE MAIN COMPONENT OF THE SENSING AND TRIP CIRCUITRY IN THESE CONTROL CENTRES. THE SCS WILL SHORT OR OPEN (UNPREDICTABLE). IN CASE OF AN SCS SHORT, THE TRIP RELAY IS ON ALL THE TIME, RESULTING IN THE PHONOGRAPH PLAYING THE SAME RECORD OVER AND OVER (THIS SYMPTOM IS MORE OFTEN CAUSED BY DIRTY TRIP RELAY AND PLAY MECHANISM CONTACTS - CLEAN THEM BEFORE YOU ACCUSE THE CONTROL CENTRE ELECTRONICS OF BEING FAULTY). IF THE SCS IS OPEN, NO RECORDS WILL BE SELECTED.

C) AN OBSCURE AND VERY SELDOM OCCURRING PROBLEM IS THE OPENING OF INDUCTORS (CHOKES) L3101 AND L3100 WHICH ARE INVOLVED IN SHAPING

THE "WRITE-IN" PULSE. AGAIN, NO VISIBLE DAMAGE IS APPARENT (UNLESS IT IS PHYSICAL DAMAGE). A GOOD INDUCTOR SHOULD SHOW A READING OF APPROXIMATELY 3 OHMS. IN A PINCH, IF NO REPLACEMENT IS AVAILABLE, JUMPERING A SHORT WIRE ACROSS THESE CHOKES FROM ONE END OF THE CHOKE TO THE OTHER, NOT TO CHASSIS GROUND, WILL PUT THE MACHINE BACK INTO OPERATION. BE CAUTIONED THOUGH THAT SHORTING OF COMPONENTS IS NORMALLY A DANGEROUS PRACTICE; IT WORKS HERE ONLY BECAUSE OF THE WAY THE CIRCUIT IS ARRANGED.

THE SCS CAN BE TESTED BY SIMPLY REMOVING THE TORMAT SENSING PLUG (FIG. 5, 8) FROM THE CONTROL CENTRE AND INSERTING ONE OR THE OTHER OF YOUR OHMMETER LEADS INTO THE CENTRE OF THE FEMALE SENSING PLUG ON THE CONTROL CENTRE CHASSIS. SET YOUR OHMMETER ON THE X10 OR X100 SCALE. FOR THIS TEST, POWER HAS TO BE APPLIED TO THE CONTROL CENTRE. CONNECT THE OTHER LEAD OF THE OHMMETER TO CHASSIS. THE SCS WILL "FIRE", PULL IN THE TRIP RELAY AND IF THE CONTROL CENTRE IS CONNECTED TO THE PLAY MECHANISM, CAUSE THE TRIP SOLENOID IN THIS MECHANISM TO PUT THE MACHINE INTO THE TRANSFER MODE (RECORD TO BE TAKEN OUT OF THE RECORD MAGAZINE AND TO BE TRANSFERRED TO THE TURNTABLE).

A WORD OF CAUTION HERE: BEFORE YOU MAKE THIS TEST, PUT THE MACHINE INTO SCAN SO THAT THE MOTOR TURNS. IF THIS IS NOT THE CASE, THERE IS NO WAY TO DISCONTINUE THE POWER APPLIED TO THE TRIP SOLENOID OTHER THAN TO REMOVE THE CONTROL CENTRE POWER. THE RESULT WILL BE A BURNED OUT TRIP SOLENOID SINCE THIS SOLENOID IS DESIGNED TO DO INTERMITTENT DUTY ONLY. THIS CAN ALSO RESULT IN A BLOWN 15A FUSE (F3101) IN THE CONTROL CENTRE.

IF THIS OHMMETER TEST RESULTS IN THE JUST DESCRIBED TRIP ACTION, THE SCS IS LIKELY OK AND YOUR SELECTION TROUBLES (FOR THIS IS WHAT WE ARE TALKING ABOUT HERE) ARE ELSEWHERE.

ASIDE FROM THE ABOVE MENTIONED PROBLEMS, PINS IN THE INTERCONNECTING CABLE PLUGS CAN ALSO BE A SOURCE OF PROBLEMS (POOR SEATING OR MISALIGNMENT). IT IS SELF-EXPLANATORY THAT CHECKING FOR LOOSE AND MISMATCHED PLUG CONNECTIONS SHOULD BE AN AUTOMATIC PROCEDURE BEFORE ANYTHING ELSE IS UNDERTAKEN IN THE WAY OF TROUBLE SHOOTING. AS A MATTER OF FACT, THIS IS A USEFUL CHECK EVEN WHEN NO TROUBLES

ARE APPARENT, SINCE IT MAY PREVENT A FUTURE SERVICE CALL. THIS APPLIES TO ANY AND ALL VENDING MACHINES (AT LEAST THOSE WHICH ARE OF AN ELECTRICAL OR ELECTRONIC NATURE).

THIS MORE OR LESS CONCLUDES THE SECTION ON THE "NON DIGITAL" CONTROL CENTRES. THE INTRODUCTION OF THE DCC1 "DIGITAL CONTROL CENTRE" BROUGHT WITH IT A DRASTIC CHANGE IN THE WRITE-IN PART OF THE CONTROL CENTRE (THE READ-OUT SECTION HARDLY CHANGED EXCEPT FOR BEING INTEGRATED INTO ONE OF THE PRINTED CIRCUIT BOARDS). THE REASON FOR AND RESULT OF THIS CHANGE WAS THE REDUCED NEED FOR MOVING ELECTROMECHANICAL PARTS (THERE WAS A REDUCTION BY ABOUT FIVE HUNDRED MOVING PARTS). ON THE OTHER HAND, THIS CHANGE MEANT THAT A LOT OF THE MECHANICAL FUNCTIONS WERE TAKEN OVER BY ELECTRONIC COMPONENTS, A FAIR NUMBER OF WHICH WERE LOCATED IN THIS CONTROL CENTRE, ESPECIALLY POWER SUPPLY CIRCUITS. (AGAIN, THE DESIRABILITY OF HAVING TECHNICIANS WITH ELECTRONIC EXPERIENCE IS APPARENT). THE ATTEMPT HERE WILL BE, AS BEFORE, TO DESCRIBE AND PINPOINT COMMON AND RECURRING TROUBLES AND TO DETAIL THEIR CORRECTION WITHOUT REFERENCE TO SCHEMATICS. THIS IS NOT TO DISCOURAGE ANYBODY FROM BECOMING THOROUGHLY FAMILIAR WITH THE THEORY OF OPERATION OF THESE PHONOGRAPHS, BUT PRIMARILY TO HELP THOSE PEOPLE WHO HAVE NOT HAD A CHANCE TO PARTAKE OF THE TRAINING SEMINARS HUDSON'S BAY VENDING CONDUCTS AND WHICH INCLUDE, AMONG OTHER THINGS, DISCUSSIONS ON THESE SUBJECTS.

DCC1 TO DCC42 (FOUND IN ALL PHONOGRAPHS FROM 1969 TO 1978)

THE TROUBLES WHICH APPEAR IN THE DIGITAL PHONOGRAPHS CAN BROADLY BE DIVIDED INTO (A) CREDIT PROBLEMS (B) SELECTION PROBLEMS AND (C) MECHANICAL PROBLEMS (THIS IS NO DIFFERENT FROM ANY OTHER PHONOGRAPH). A AND B WILL IN MOST CASES BE OF AN ELECTRONIC NATURE.

IT IS ASSUMED HERE THAT THE TROUBLE SHOOTING GUIDE WHICH WAS ISSUED FOR THE DIGITAL PHONOGRAPHS BY SEEBURG (PART OF THE INSTALLATION AND OPERATIONS MANUAL) HAS BEEN FOLLOWED AND THE PROCEDURE LAYED OUT THEREIN RESULTED IN PINPOINTING THE TROUBLE TO THIS CONTROL CENTRE.

THE FIRST ORDER OF BUSINESS IS TO INSPECT THE FUSES ON THE POWER SUPPLY BOARD. THERE ARE TWO 8/10 (=0.8) AMP FUSES AND ONE 1/8 (=0.125)

AMP FUSE. ONE OF THE 8/10 AMP FUSES (FIG. 13A, 16) PROTECTS THE +27 VOLT SUPPLY, THE OTHER PROTECTS THE -27 VOLT SUPPLY. THE 1/8A FUSE PROTECTS THE WRITE-IN READ-OUT SUPPLY. IN ADDITION, THERE IS THE 15A FUSE LOCATED RIGHT NEXT TO THE MAIN POWER TRANSFORMER WHICH PROTECTS THE 25 VOLT AC CIRCUIT (PLAY CONTROL AND TRIP SOLENOIDS). ON SOME CONTROL CENTRES THERE EXISTS AN ADDITIONAL RED HEADED FUSE OF 3.2A RATING, LOCATED ON THE "OUTSIDE" OF THE CONTROL CENTRE NEAR THE MAIN POWER TRANSFORMER. THIS FUSE IS MEANT FOR A DOLLAR BILL VALIDATOR (ONLY IN U.S. MODELS) AND IS NON-FUNCTIONAL IN ALL OUR MACHINES. THIS FUSE IS A HANDY "SPARE" FOR THOSE MACHINES EQUIPPED WITH AN SHP TYPE AUDIO AMPLIFIER WHICH HAS AN IDENTICAL FUSE. ON LATER MODELS THE FUSEHOLDER WAS EMPTY AND "CAPPED". THE FAILURE OF FUSE F3102 (-27V) RESULTS IN LOSS OF POWER FOR THE BLACK AND GREY BOXES AND WHAT WOULD OBVIOUSLY BE A CREDIT PROBLEM (I.E. THE BLACK BOX IS RESPONSIBLE FOR CREDIT FUNCTIONS, AMONG OTHER THINGS). THE MAIN REASON FOR BLOWING THIS FUSE IS FOUND TO BE A FAULTY PREREGULATOR CIRCUIT (AN EVEN MORE COMMON CAUSE IS A FAULTY BLACK OR GREY BOX, OBVIOUSLY NOT A CONTROL CENTRE PROBLEM). THE COMPONENTS TO CHECK HERE ARE TRANSISTOR Q3120, RESISTORS R3111, R3112, R3113 AND DIODES CR3112 AND CR3110. THIS DIODE (CR3110) IS THE -13 VOLT ZENER REGULATOR DIODE WHICH IS IMPORTANT FOR THE OPERATION OF BOTH BLACK AND GREY BOXES. INSPECT THE RESISTORS FOR ANY EVIDENCE OF OVERHEATING (REFER TO FIG. 16). TRANSISTOR Q3120 CAN BE CHECKED AS POINTED OUT IN HUDSON'S BAY VENDING MANUAL ON SEEBURG AMPLIFIERS. RESISTORS R3189 AND R3190 ARE CLOSE TOLERANCE (1%) WIRE WOUND RESISTORS WHICH WILL SHOW A DEFINITE "BROWNING" EFFECT WHEN SOMETHING HAS GONE WRONG WITH SOME OF THE OTHER ABOVE MENTIONED COMPONENTS. CHECK THEM WITH AN OHMMETER. THEY DO NOT NORMALLY BURN OUT. IN ADDITION, THE RESET CIRCUIT, OF WHICH TRANSISTOR Q3100 (FIG. 16) IS THE MAIN COMPONENT, CAN FAIL CAUSING THE PHONOGRAPH TO GIVE FREE CREDITS WHENEVER THE MAIN POWER SWITCH IS TURNED ON. THE MOST COMMON BREAKDOWNS IN THE ABOVE MENTIONED COMPONENTS ARE TRANSISTOR Q3120, R3113, R3111, TRANSISTOR Q3100, R3113 WHEN BURNED INDICATES THAT Q3120 IS TO BE REPLACED.

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THE VALUES FOR THE ABOVE MENTIONED RESISTORS ARE:

CR 3110		-13V Zener Diode Part #309613	
R 3111		5.6 OHMS	2W
R 3112		560 OHMS	1/2W
R 3113 →	THIS CAN BE REPLACED BY ANY VALUE UP TO 820 OHM, 1 W	390 OHMS	1/2W
R 3189		634 OHMS (1%)	1/2W
R 3190		750 OHMS (1%)	1/2W

Q3100 Transistor	#309684	) SEEBURG PARTS NUMBERS
Q3120 Transistor	309685	

MAKE ANY RESISTANCE TYPE CHECKS ON THE BOARD WHEN IT IS REMOVED FROM THE CONTROL CENTRE IN THE ABOVE CIRCUITS. OCCASIONALLY, THE +27 VOLT FUSE F3101 WILL BE FOUND BLOWN. THIS IS QUITE RATE AND IS USUALLY CAUSED BY OVERLOADING THE +27 VOLT CIRCUIT (IE. ADDING TOO MANY OPTIONAL COMPONENTS, SUCH AS SWITCHING RELAYS AND USING THE +27 VOLT TEST TERMINAL ON THE CONTROL CENTRE AS A POWER SOURCE FOR THESE RELAYS - THIS IS OK WITHIN LIMITS). JUST IN CASE, INSPECT AND CHECK R3108 (5.6 OHM 2W), ZENER DIODES CR3104, CR3105, CR3107 AND DIODE CR3106. (ZENER DIODES, AND ANY OTHERS ARE CHECKED WITH THE OHMMETER ON THE X10 OR X100 SCALE. A LOW RESISTANCE READING, ROUGHLY 1/3 FULL SCALE, SHOULD BE HAD ONLY WITH ONE SET OF CONNECTIONS. IF THE DIODE UNDER TEST SHOWS READINGS IRRESPECTIVE OF HOW THE METER LEADS ARE CONNECTED, IT IS FAULTY, SIMILARLY WHEN NO READINGS CAN BE OBTAINED IN ANY FASHION). RESISTORS R3109 AND R3110 (1800 OHMS AND 910 OHMS) MAY ALSO MERIT ATTENTION. A BLOWN FUSE (F3101) DISABLES THE COIN SWITCHES AND TRIP RELAY WITH THE ATTENDANT SYMPTONS BEING (AGAIN) NO CREDIT, OR, IF THE PHONOGRAPH IS IN THE MIDDLE OF A PLAY CYCLE IT WILL QUIT PICKING UP ANY MORE SELECTIONS.

THE WRITE-IN/READ-OUT SUPPLY FUSE F3100 HAS GIVEN VERY LITTLE TROUBLE IN THIS CONTROL CENTRE BUT SHOULD BE INSPECTED AND REPLACED IF NECESSARY. BEING OF A 1/8A RATING, THE COMPONENTS IT PROTECTS WILL LIKELY NOT BE BURNED OUT, OR FAULTY, WITH THE POSSIBLE EXCEPTION OF CAPACITOR C3100 WHICH COULD PERHAPS SHORT OUT WITH AGE (IT FILTERS THE 120 VOLT SUPPLY). IN THIS CONNECTION (BAD WORD HERE) IT IS GOOD PRACTICE TO

INSPECT ALL ELECTROLYTIC FILTER CAPACITORS ON THIS BOARD FOR LEAKAGE OR POOR SOLDER CONNECTIONS. SHORTED FILTER CAPACITORS CAN CAUSE ANY OF THE POWER SUPPLY BOARD FUSES TO BLOW. THESE CAPACITORS ARE: C3109, C3107, C3105, AND C3106. POOR SOLDER CONNECTIONS CAN CAUSE AN UNPREDICTABLE PHONOGRAPH BEHAVIOR, SUCH AS SUBTRACTING TOO MANY CREDITS , OR WRONG SELECTIONS AMONG OTHERS.

WHILE WE ARE ON THE SUBJECT OF WRONG OR MISSING SELECTIONS, IT IS WORTHWHILE TO POINT OUT THAT THE CONTROL CENTRE OFTEN GETS BLAMED WHEN IN ACTUALITY OTHER COMPONENTS CAUSE THIS PROBLEM. THE MOST COMMON CAUSE OF SELECTION PROBLEMS IS THE DETENT SWITCH (R.O. SWITCH) ON THE PLAYING MECHANISM. WHEN THIS SWITCH IS DIRTY, READ-OUT IS IMPAIRED AND SELECTIONS ARE PICKED UP WILLY-NILLY. ANOTHER MORE OBSCURE POSSIBILITY IS A MISADJUSTED PLAY CONTROL SUBTRACT SWITCH, ALSO ON THE MECHANISM, WHICH MAY CAUSE ONLY A SINGLE SCAN, RATHER THAN THE DESIGNED-FOR DOUBLE SCAN OF THE PLAY MECHANISM. THIS MAY CAUSE THE MECHANISM TO NOT PLAY CERTAIN SELECTIONS WHEN THEY ARE SELECTED, BUT RATHER AT A LATER TIME WHEN SELECTIONS ARE AGAIN MADE BY SOMEBODY ELSE. THIS CAN BE THE REASON FOR A COMPLAINT REGARDING NOT GETTING ENOUGH SELECTIONS FOR MONEY(CONTROL CENTRE WORKS WITH ERRONEOUS INFORMATION, BUT IS NOT FAULTY ITSELF). REFER TO SEEBURG MANUAL ON ADJUSTMENTS FOR FURTHER INFORMATION.

THE NEXT AREA OF CONCERN IS THE BUFFER BOARD (FIG. 15). THIS BOARD CONTAINS TWELVE TRANSISTORS WHICH IN ONE WAY OR ANOTHER ARE INVOLVED WITH THE SELECTION INFORMATION TRANSMITTED BY THE BLACK BOX AND THE COIN SWITCH CIRCUITS IN THE PHONOGRAPH. IF ANY PROBLEMS EXIST IN THIS AREA AT ALL, THEY USUALLY INVOLVE EITHER THE TRANSISTORS OR THE CIRCUIT BOARD CONNECTING PLUG. THE TRANSISTORS ARE SUSCEPTIBLE TO MECHANICAL DISTURBANCES SUCH AS LEADS SHORTED TOGETHER DUE TO EXCESSIVE BENDING (THIS CAN CAUSE TRANSISTOR FAILURE). UNFORTUNATELY, THE PHYSICAL LAYOUT OF THIS CONTROL CENTRE MAKES IT VERY EASY TO BEND THE TRANSISTORS OUT OF PLACE. USUALLY "STRAIGHTENING" THE TRANSISTOR RESULTS IN A CURE OF PROBLEMS. NORMALLY, FAULTS SUCH AS MISSING THE SAME SELECTIONS ALL THE TIME OR NO CREDIT FOR A PARTICULAR DENOMINATION COIN (SAY DIMES) ARE ATTRIBUTABLE TO THE BUFFER BOARD.

ANOTHER FUNCTION OF THE BUFFER BOARD IS THE ISOLATION OF WALL BOXES (REMOTE SELECTORS, IE. STEREO CONSOLETTES) FROM THE BLACK AND GREY BOXES IN THE PHONOGRAPH. AS YOU WELL KNOW, PEOPLE WILL TRY ANYTHING, INCLUDING STICKING PINS INTO ACCESSIBLE WALLBOX WIRING IN ORDER TO GET FREE PLAYS. THE BUFFER BOARD SEES TO IT THAT SUCH OCCURENCES DO NOT DAMAGE THE ELECTRONICS IN THE PHONOGRAPH AND THAT THE PHONOGRAPH, AT LEAST, IS STILL OPERATIONAL. OCCASIONALLY, CERTAIN FAULTS IN THIS BUFFER BOARD MAY THEREFORE AFFECT WALLBOX OPERATION, BUT LEAVE THE PHONOGRAPH ITSELF WORKING PROPERLY. ON THE WHOLE, BUFFER BOARD PROBLEMS DO NOT OCCUR TOO OFTEN. CHECK THE CONNECTING PLUG PINS FOR GOOD CONNECTION AND MECHANICAL ALIGNMENT (REFER TO H.B.V.'S AMPLIFIER MANUAL). THE PROPER OPERATION OF THIS BUFFER BOARD IS DEPENDENT ON THE -27 VOLT CIRCUIT AND +8.2 VOLTS DERIVED FROM THE +27 VOLT CIRCUIT WHICH ARE GENERATED ON THE POWER SUPPLY BOARD (SEE ABOVE).

THE LAST MAJOR ELECTRONIC SUBASSEMBLY IS THE "SCAN BOARD". FOR A BOARD WHICH HAS REALLY ONLY ONE FUNCTION (THE AMPLIFICATION OF THE SCAN SIGNAL FROM THE GREY BOX SO THAT IT CAN BE USED TO OPERATE THE PLAY CONTROL "ADD" SOLENOID AND THE TOTAL PLAY COUNTER), IT IS SURPRISINGLY COMPLEX (REFER TO FIG. 17). THERE IS NO DOUBT THAT NOWADAYS IT WOULD BE REPLACED BY A SINGLE INTEGRATED CIRCUIT TUCKED AWAY IN SOME CORNER OF THE POWER SUPPLY BOARD. THE SCAN BOARD IS JUST AS "EXPOSED" AS THE BUFFER BOARD AND THE MOST COMMON PROBLEM IS THAT THE TRIAC, Q3115, IS BENT AGAINST THE SCAN BOARD MOUNTING POST CAUSING THE PLAY CONTROL ADD SOLENOID TO BE ACTIVATED ALL THE TIME SO THAT THE PHONOGRAPH PLAYING MECHANISM SCANS CONTINUOUSLY (SELECTIONS MADE WILL BE PICKED UP. A FAULTY SUBTRACT SWITCH MENTIONED ABOVE COULD ALSO CAUSE THIS CONDITION). ON THE OTHER HAND, A FAULT IN ONE OF THE OTHER COMPONENTS COMPRISING THE SCAN BOARD CAN RESULT IN THE SCAN SIGNAL FROM THE GREY BOX NOT BEING PASSED ALONG TO THE PLAY CONTROL ASSEMBLY. THE PHONOGRAPH WILL NOT START A SCAN (AND THEREFORE WILL NOT PLAY A RECORD) WHEN A SELECTION IS BEING MADE BY A CUSTOMER. WHEN THE SERVICE TECHNICIAN ARRIVES ON LOCATION AND OPERATES "MANUAL SCAN START", ON THE SERVICE SWITCH ASSEMBLY IN THE PHONOGRAPH, ALL PREVIOUSLY SELECTED RECORDS WILL BE PICKED UP. USUALLY THE FAULT IS IN ONE OF THE

TRANSISTORS (OPEN OR SHORTED); OCCASIONALLY THE TRIAC Q3115 IS FAULTY ITSELF AND MUST BE REPLACED. IN THE ABSENCE OF THE PROPER DIAGNOSTIC TOOL (AN OSCILLOSCOPE), THIS IS A TRIAL AND ERROR PROCEDURE, IE. TRY ANOTHER TRIAC. LET IT BE SAID HERE THAT SCAN BOARD PROBLEMS ARE NOT TOO NUMEROUS, OR COMMON.

ASIDE FROM THE VARIOUS PRINTED CIRCUIT BOARDS JUST MENTIONED, SOME SELECTION PROBLEMS CAN BE ATTRIBUTED TO THE TRIP RELAY WHICH CAN DEVELOP DIRTY CONTACTS. REPLACEMENT OF THE RELAY IS PROBABLY THE EASIEST WAY TO CHECK ITS OPERATION. ON PHONOGRAPHS WITH THE SEEBURG SHP TYPE AMPLIFIER IT IS POSSIBLE TO INTERCHANGE IT WITH THE MUTE RELAY ON THIS AMPLIFIER. IF THE RELAY IS FAULTY, A CHANGE IN PROBLEMS (OR THEIR DISAPPEARANCE) WILL BE EVIDENT WHEN THIS EXCHANGE IS MADE.

ALSO CHECK THE SWITCH CONTACT IN THE PLAY CONTROL ASSEMBLY. ITS FUNCTION IS THE CONTROL OF THE PLAY MECHANISM MOTOR. A DIRTY CONTACT CAN CAUSE PROBLEMS IDENTICAL TO THE ONES MENTIONED REGARDING THE PLAY CONTROL SUBTRACT SWITCH. IT MAY ALSO MEAN THAT THE MOTOR NEVER STARTS (YOU MIGHT TEND TO BLAME THE SCAN BOARD).

THE CONTROL CENTRE IS EQUIPPED WITH A TERMINAL BOARD WHICH ALLOWS FOR THE TESTING OF THE IMPORTANT VOLTAGES GENERATED BY THE POWER SUPPLY BOARD (SEE FIG. 12). IT IS IMPERATIVE THAT THE VOLTAGES DEVIATE NO MORE THAN 3% FROM THE VALUES MARKED ON THE CHASSIS. FOR THIS REASON, ANY CONTROL CENTRE MUST BE CHECKED BY READING THESE VOLTAGES WITH A VOLTMETER. REFER TO FIG. 16 FOR THE VOLTAGES TO BE READ IN THIS MANNER. VOLTAGES WHICH DEVIATE FROM THE NORM BY MORE THAN THE ABOVE MARGIN INDICATE TROUBLE WHICH EXISTS ON THE POWER BOARD AND/OR BLACK OR GREY BOXES (IF THE CONTROL CENTRE IS HOOKED INTO A PHONOGRAPH). THE FUNCTIONS OF THE CONTROL CENTRE ARE SHOWN IN FIGURE 18 AS PART OF THE ENTIRE PHONOGRAPH CYCLE. THE ONLY UNIT NOT DEPENDENT ON THE CONTROL CENTRE IS THE AMPLIFIER. IT HAS ITS OWN INTERNAL POWER SUPPLY.

THE PPC1 - 56 CONTROL CENTRE

THIS UNIT IS USED WITH THE 100 - 77D 100 SELECTION PHONOGRAPHS. ITS DESIGN DEPARTS SIGNIFICANTLY FROM THAT OF THE 160 SELECTION CONTROL CENTRES SINCE THERE ARE NO GREY OR BLACK BOXES USED IN THE PHONOGRAPH.

INSTEAD YOU WILL FIND A "RED" BOX. THE ONLY TROUBLE WHICH HAS OCCURRED SO FAR IS IN SOME OF THE C-MOS CHIPS IN THE RED BOX. THIS IS THEREFORE NOT A CONTROL CENTRE PROBLEM. BECAUSE THIS UNIT IS RELATIVELY NEW, CONSISTENTLY RECURRING PROBLEMS ARE NOT YET EVIDENT. FROM AN ELECTRONIC POINT OF VIEW, THIS CONTROL CENTRE IS FAR SIMPLER THAN ITS DIGITAL "BROTHERS". IT IS REMINISCENT OF THE SCC-SERIES CONTROL CENTRES.

ASIDE FROM CHECKING FUSES, PLUGS AND RELAYS (NONE OF WHICH ARE INTERCHANGEABLE WITH OTHER UNITS), AND MAKING THE "BATTERY TEST" (REFER TO SCC-SERIES DISCUSSION) WHEN THE CONTROL CENTRE IS INSIDE A PHONOGRAPH AND THE READING OF VOLTAGES ON THE TEST TERMINALS, CHECKS INSIDE CAN ONLY BE MADE BY QUALIFIED PEOPLE WITH A DIGITAL BACKGROUND. FOR THIS REASON, AND SINCE H.B.V. OWNS ONLY A FEW OF THE 100-77D PHONOGRAPHS, THIS UNIT IS MENTIONED ONLY IN PASSING.

THIS SEEMS TO BE AN APPROPRIATE POINT TO CONCLUDE THE DISCUSSIONS. PLEASE DO NOT HESITATE TO MAKE COMMENTS OR ASK QUESTIONS ON THE MATERIAL IN THIS MANUAL.

REGARDS,

KARL

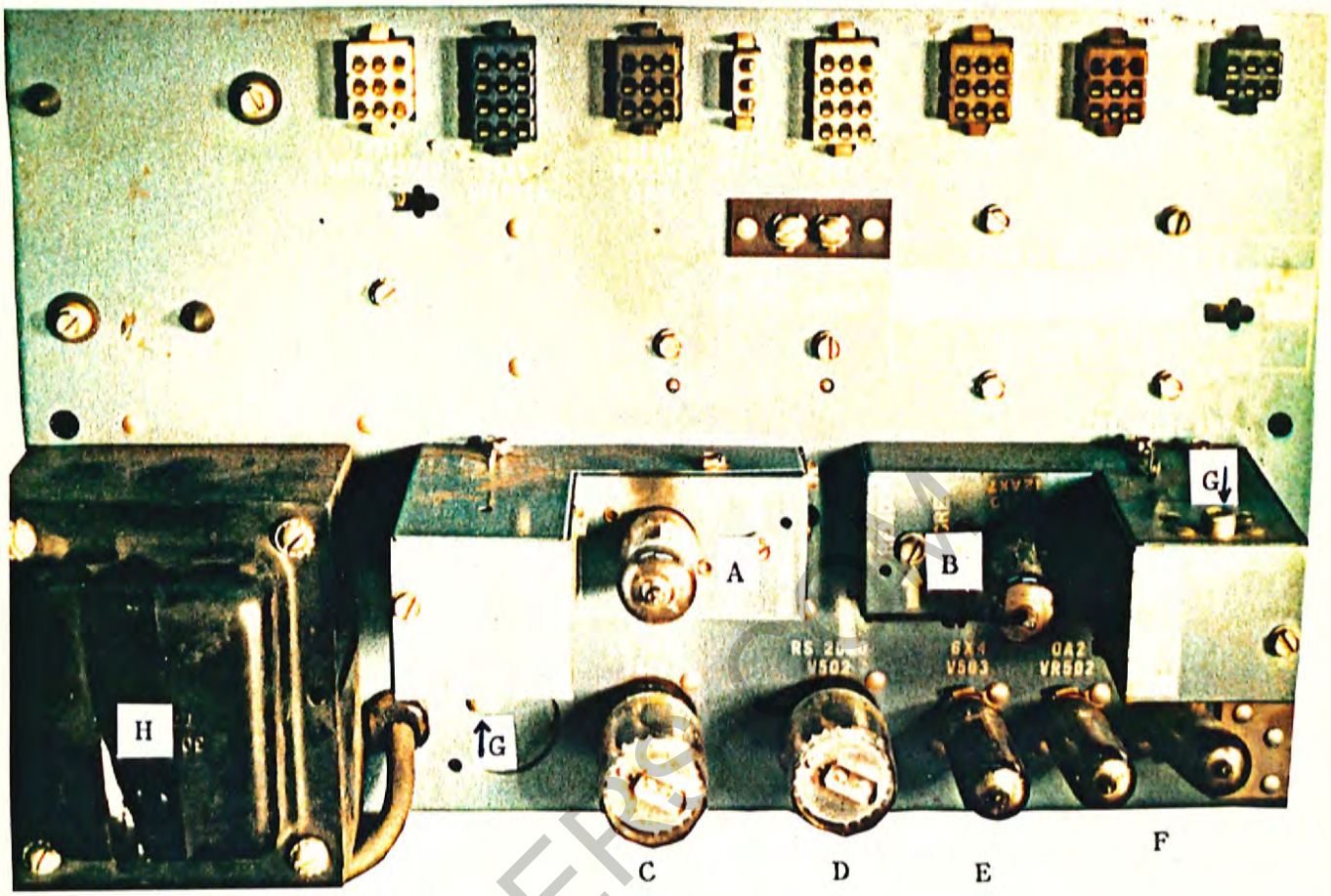


FIG 1 TCC1 CONTROL CENTRE

A. LEFT SIDE SENSING AMPLIFIER (12 AX7 TUBE)
B. RIGHT SIDE SENSING AMPLIFIER (12 AX7 TUBE)
C. LEFT SIDE TRIP TUBE (2050)
D. RIGHT SIDE TRIP TUBE (2050)
E. HIGH VOLTAGE RECTIFIER (6X4 TUBE)
F. HIGH VOLTAGE REGULATOR (TWO 0A2 TUBES)
G. SENSING AMPLIFIER SOCKETS:
SENCING PLUGS INSERT HERE
H. MAIN POWER TRANSFORMER
LEFT AND RIGHT SIDE TUBES (2050's AND 12 AX7s) CAN BE INTERCHANGED FOR CHECKING FAULTY TUBES

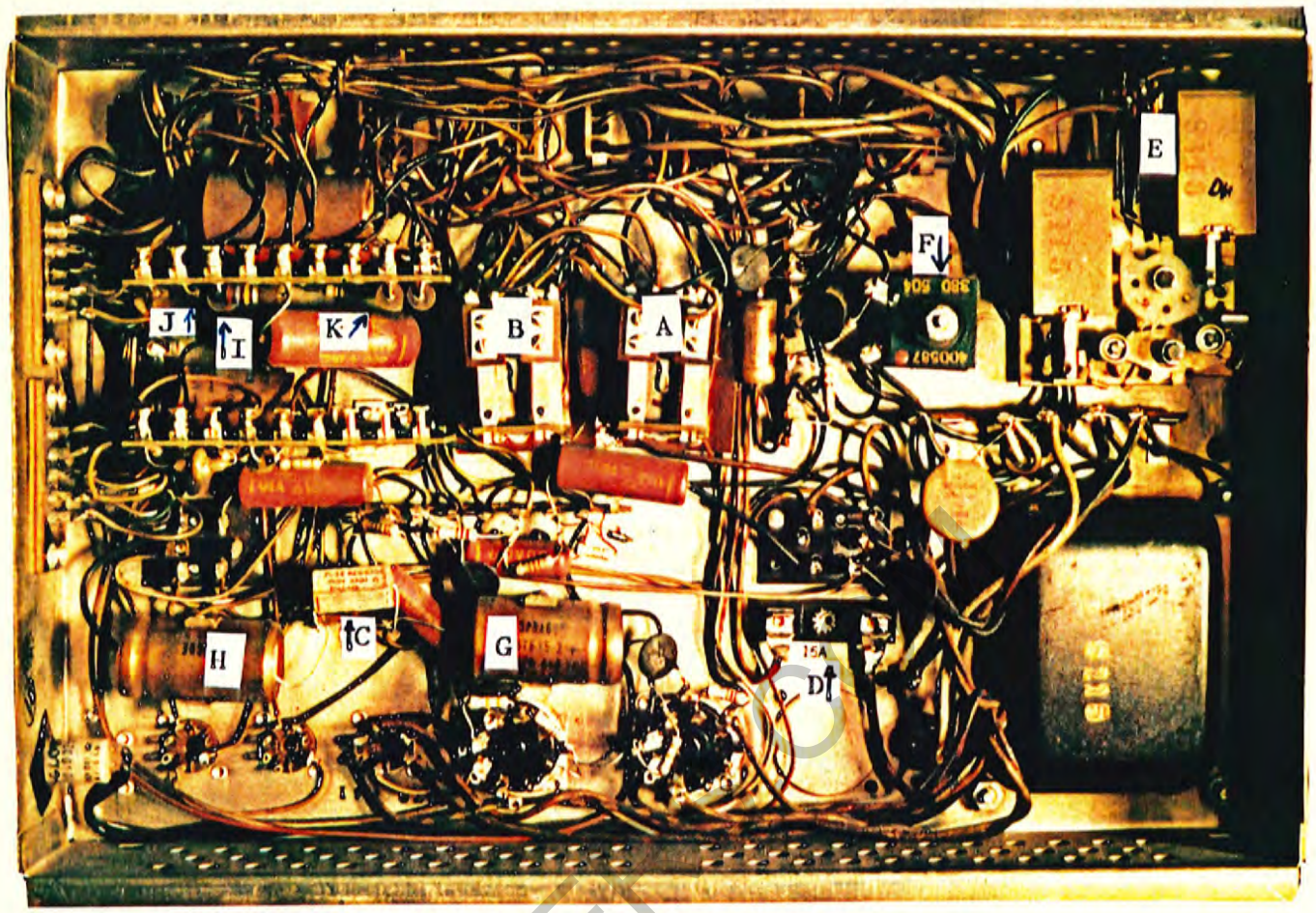


FIG 2 TCC1 ELECTRONICS

A. LEFT SIDE TRIP RELAY
B. RIGHT SIDE TRIP RELAY
C. 3300 OHM FUSE RESISTOR (R518)
D. CLIP FOR 15 A FUSE (24VAC CIRCUIT)
E. PLAY CONTROL ASSEMBLY
F. 40 V BRIDGE RECTIFIER
G. CAPACITOR C 514
H. CAPACITOR C 515
I. R 514 (HIDDEN)
J. R 516 (HIDDEN)
K. 2700 OHMS 2W (R 519)

TCC1 CONTROL CENTRE

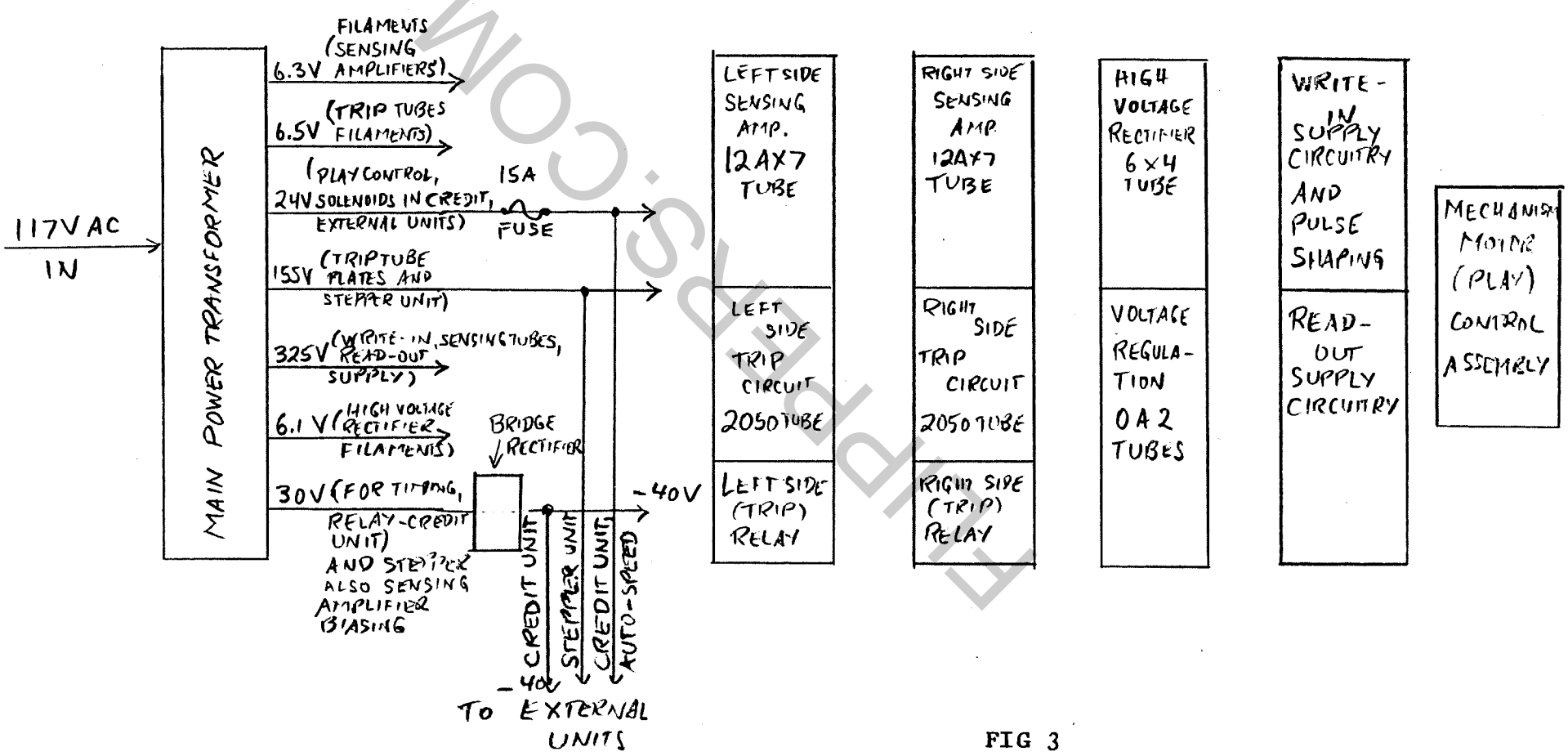


FIG 3

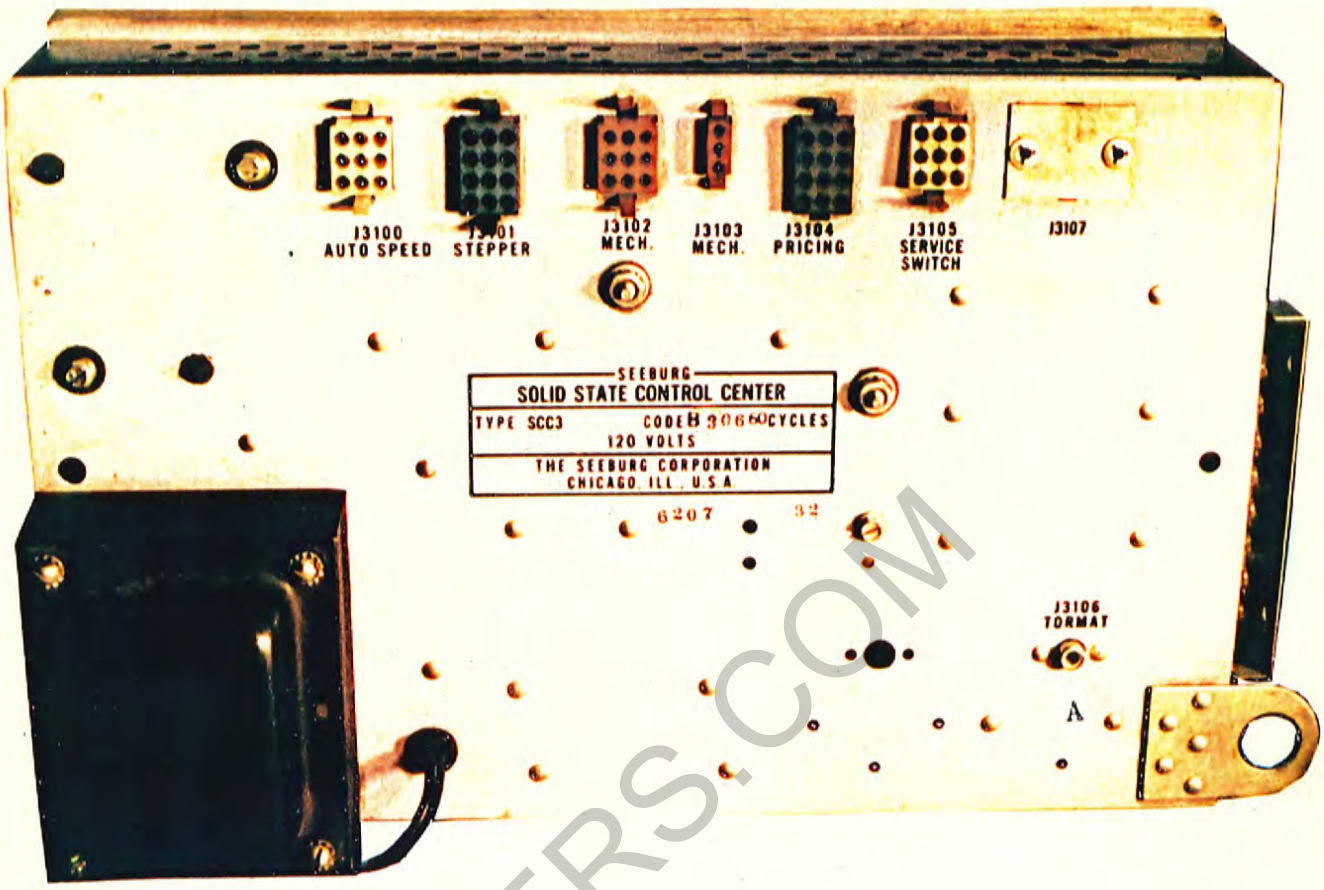


FIG 5
THE MUCH SIMPLIFIED SCC3 CONTROL CENTRE. (COMPARE WITH FIG. 1)

A. TORMAT SENSING PLUG FITS HERE

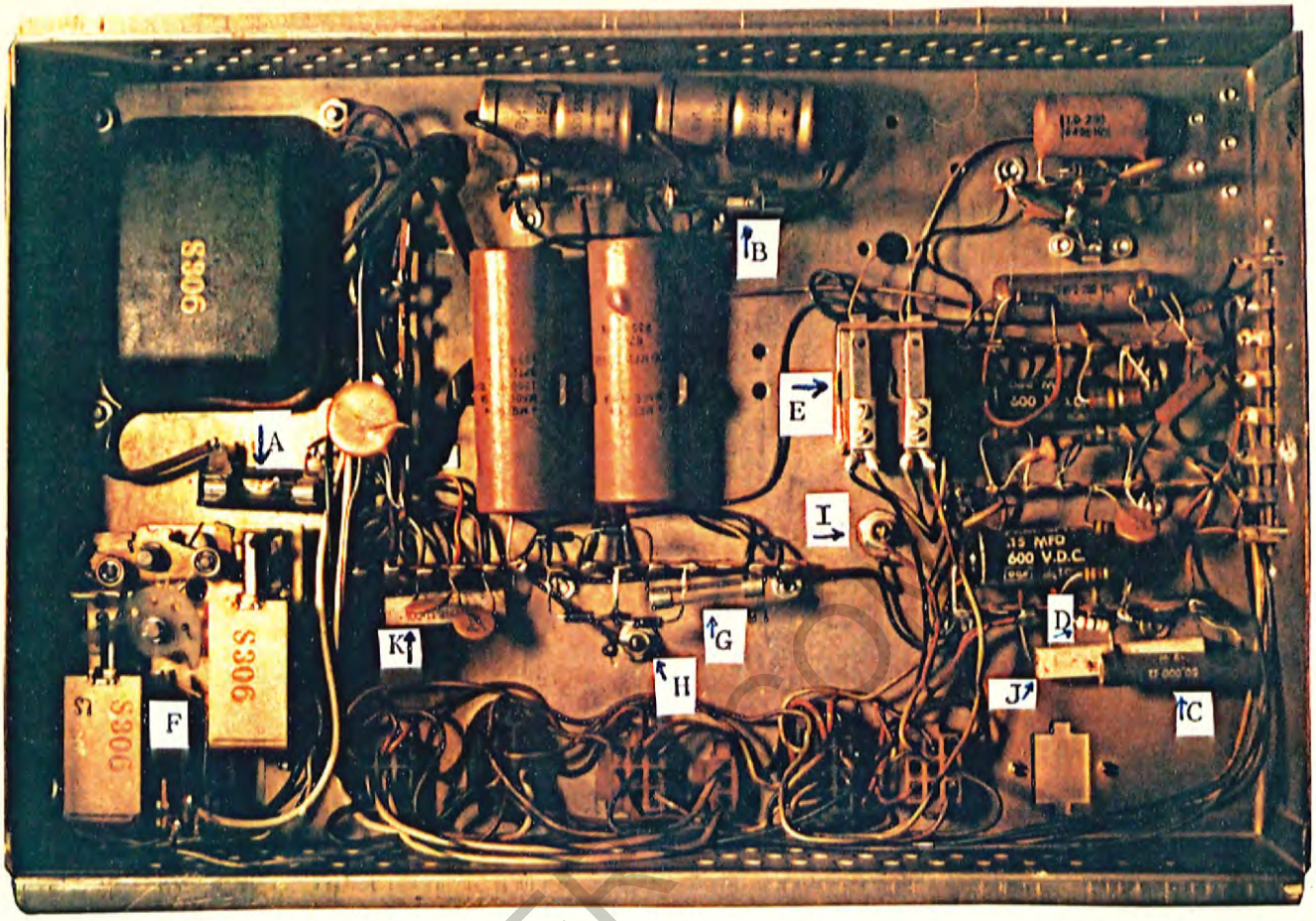


FIG 6

A. F 3101 15 A FUSE
B. F 3102 1/8 A FUSE
C. R 3107 RESISTOR 56000 OHMS } DIFFERENT VALUES SUBSTITUTED HERE
D. R 3109 RESISTOR 36 OHMS }
E. TRIP RELAY
F. PLAY CONTROL ASSEMBLY. THIS UNIT IS FOUND IN ALL SEEBURG CONTROL CENTRES.
G. F 3103 1.5 ($1\frac{1}{2}$) A FUSE
H. ZENER DIODE, CR 3104 27V, 10W
I. ZENER DIODE, CR 3105 150V, 10W
J. R 3106 RESISTOR, 7500 OHM, 10W
K. R 3110 RESISTOR, 100 OHM 7W

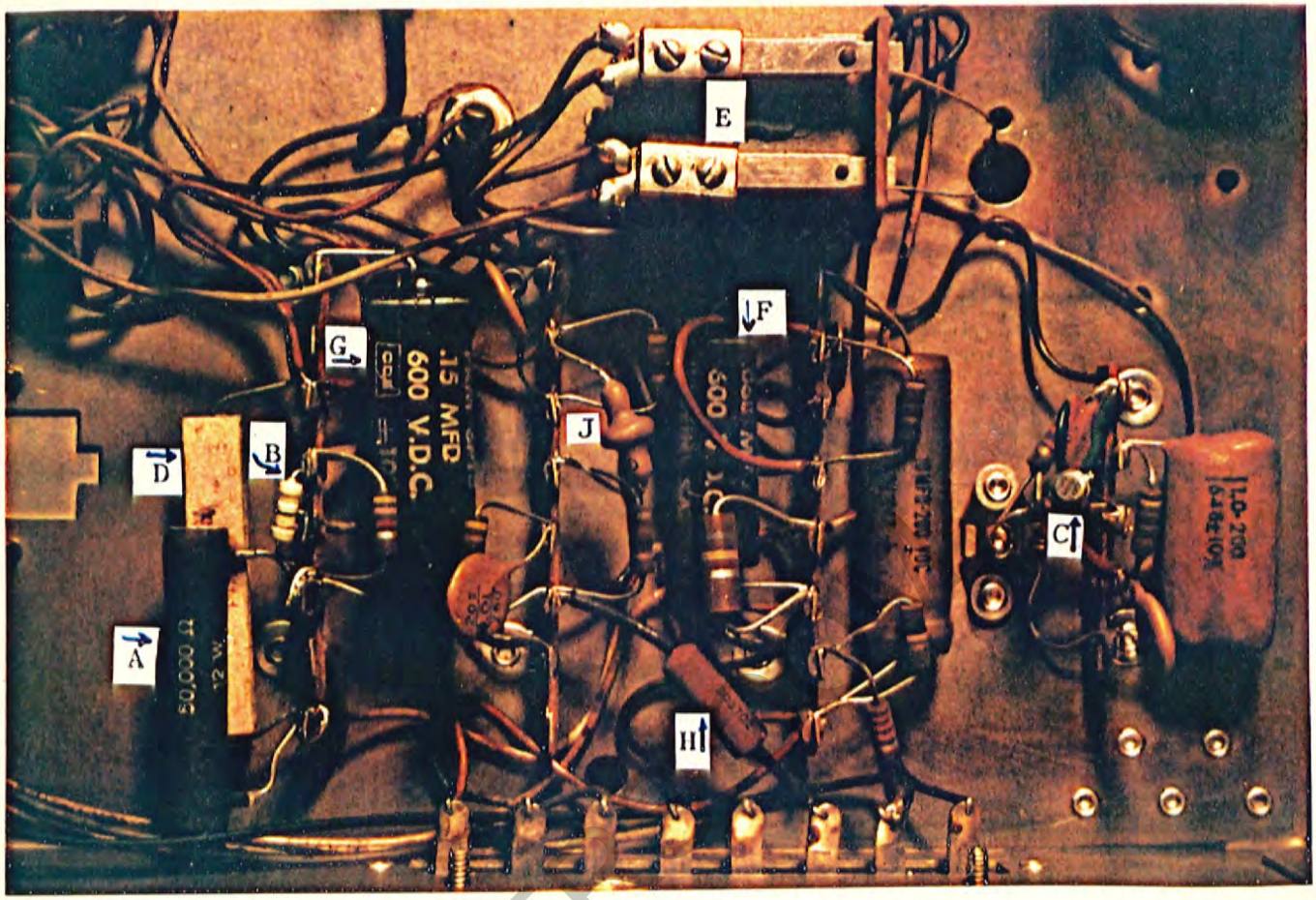


FIG 7 CLOSE-UP OF WRITE-IN/READ-OUT COMPONENTS

A. NOTICE 50000 OHM, 12W REPLACEMENT FOR R 3107. THIS IS AT THE LOWER LIMIT OF DESIGN TOLERANCE, BUT WORKS OK.

B. 39 OHM REPLACEMENT FOR R 3109
C. SILICON CONTROLLED SWITCH (SCS 3100) WHICH ACTIVATES THE TRIP RELAY (E)
D. R 3106, RESISTOR 7500 OHMS, 10W
E. TRIP RELAY
F. WRITE-IN CAPACITOR: THIS STORES THE ENERGY NECESSARY TO PUT A TOROID IN THE TORMAT ASSEMBLY INTO ITS "SELECTED" STATE (TORMAT IS NOT PART OF THE CONTROL CENTRE)
G. READ-OUT CAPACITOR: STORES ENERGY FOR PUTTING A TOROID INTO ITS "UNSELECTED" STATE.
H. CHOKE, L 3101
J. CHOKE, L 3100

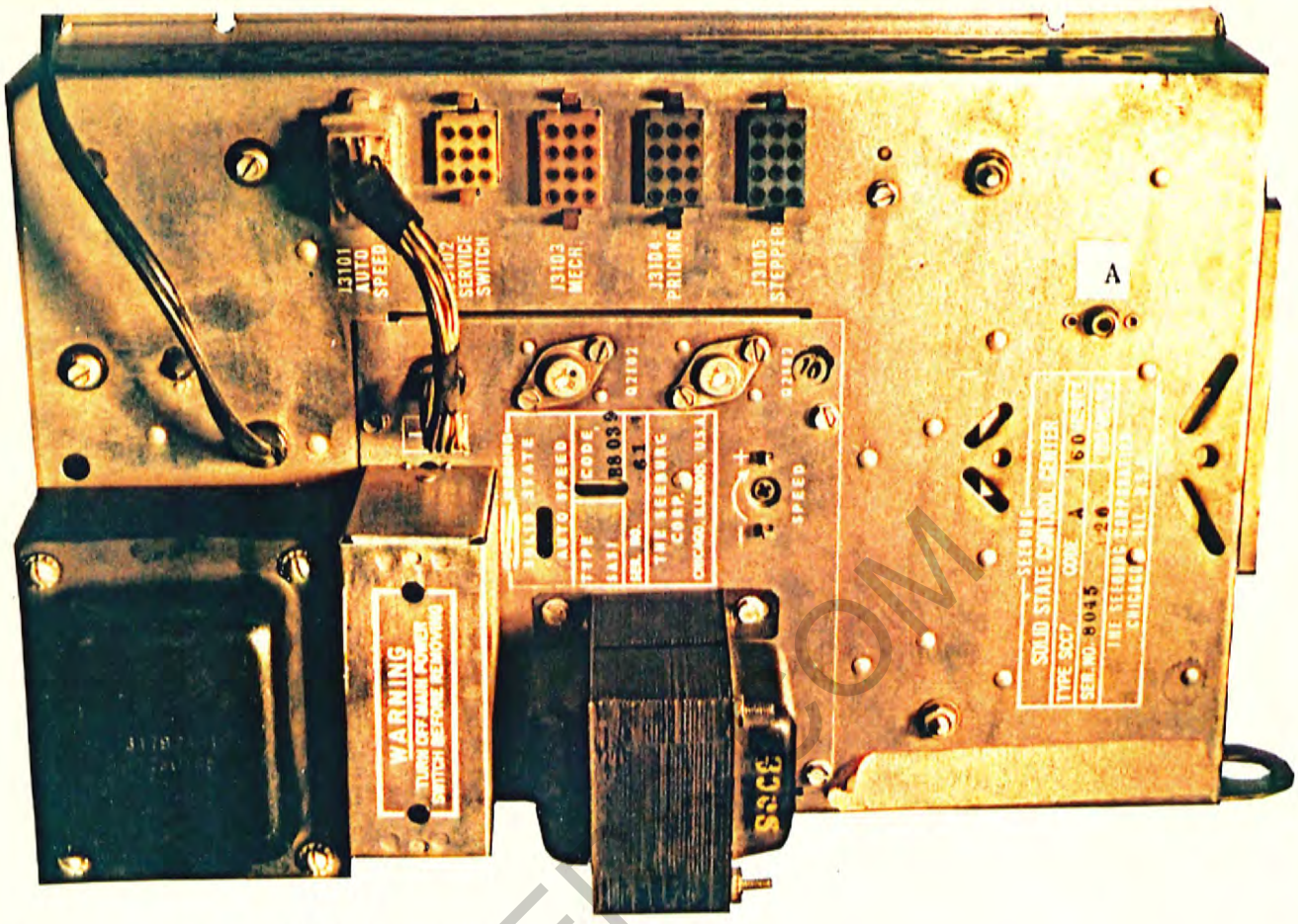


FIG 8 SCC7 CONTROL CENTRE

NOTICE THE "AUTO SPEED" UNIT IS NOW INTEGRATED INTO THE CONTROL CENTRE.

A. TORMAT SENSING PLUG FITS HERE

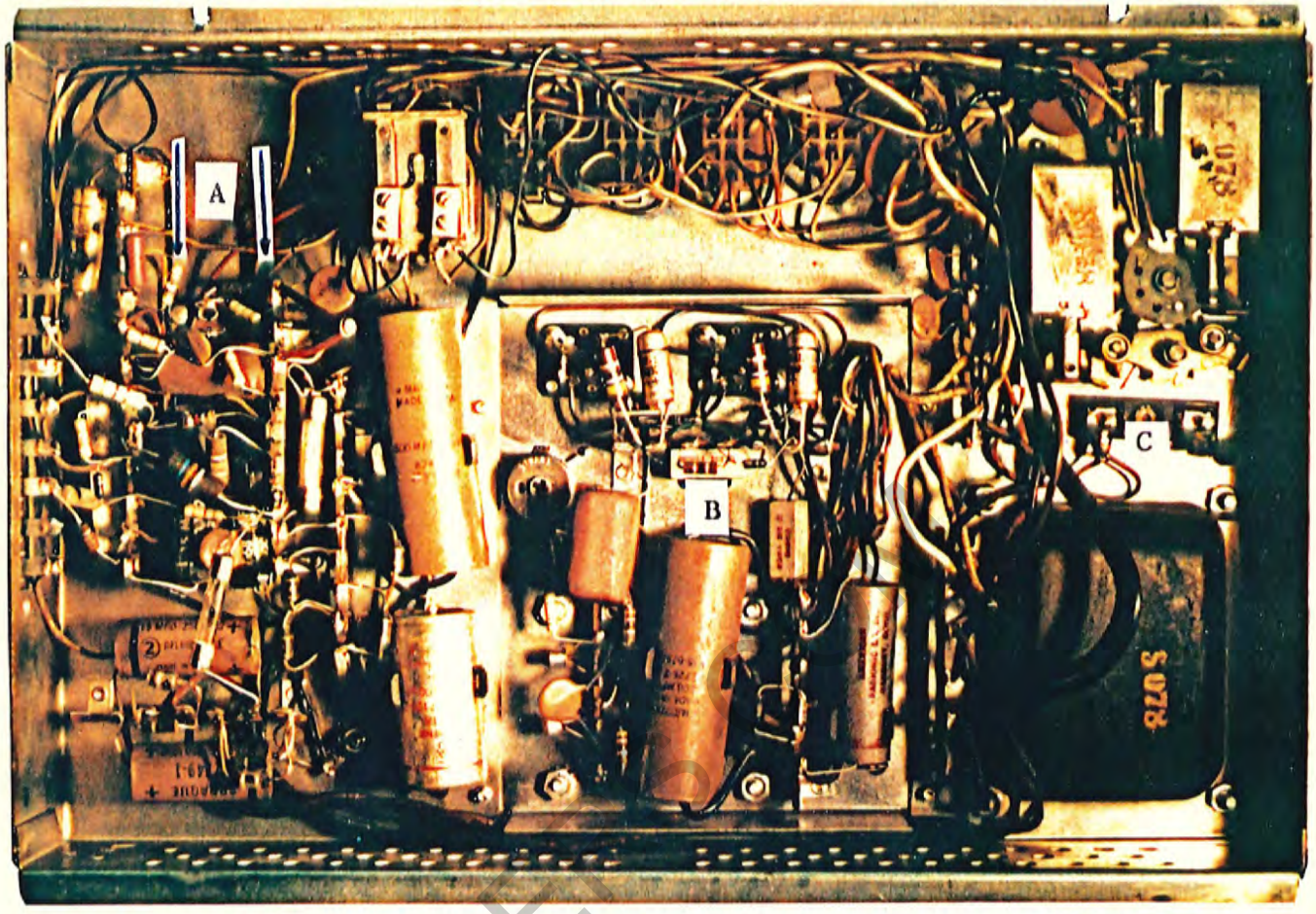


FIG 9 SCC 7 ELECTRONICS

A. THIS AREA IS A DUPLICATE (ELECTRONICALLY SPEAKING) OF FIG 7, SHOWN CLOSE-UP IN FIG 10
THIS AREA CONTAINS
B. THE AUTO SPEED ELECTRONICS. THEY HAVE NO FUNCTION IN CONTROL CENTRE OPERATION.
C. SOCKET FOR 15 A FUSE

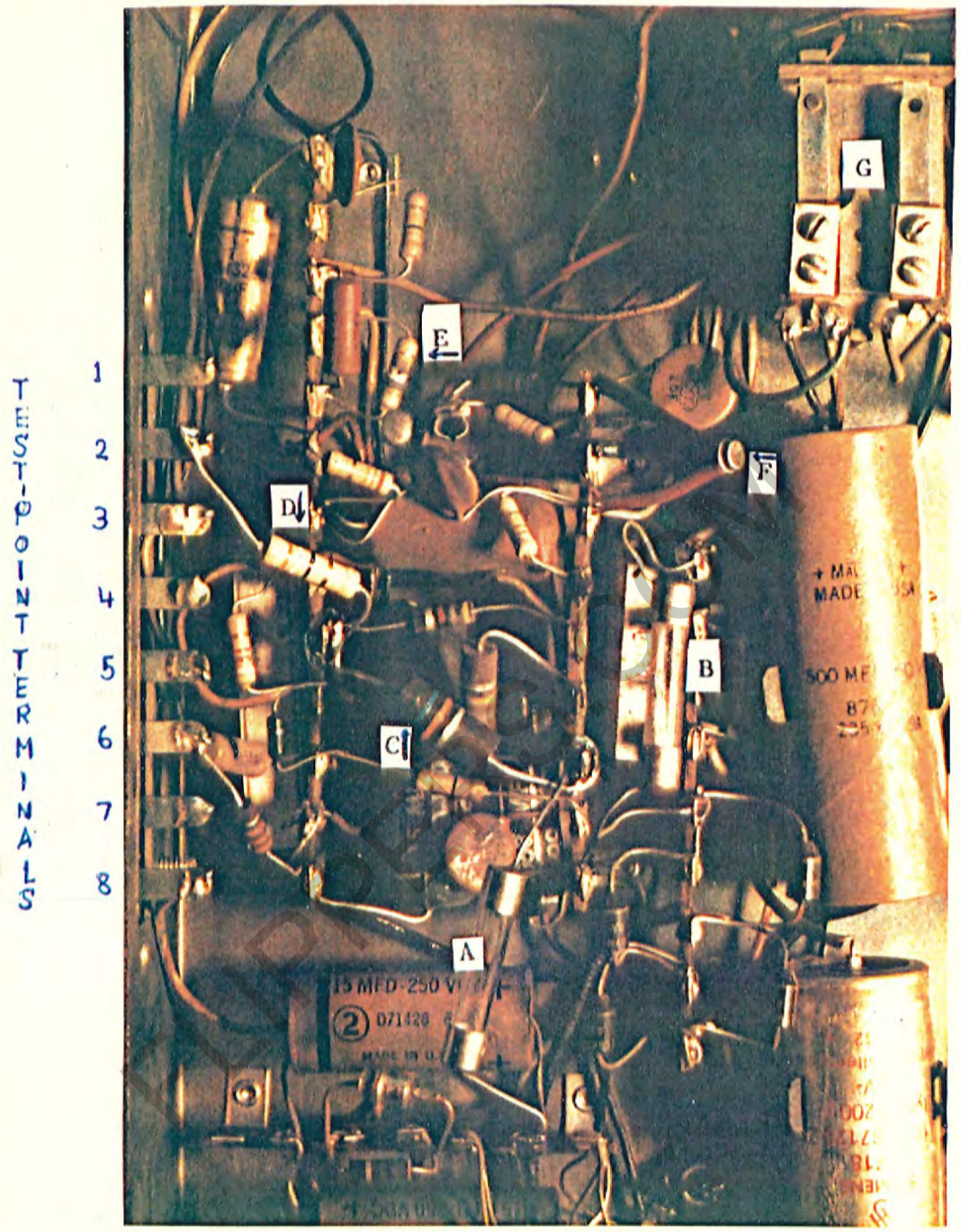


FIG 10 CLOSE UP OF WRITE-IN/READ-OUT SECTION, SCC7 CONTROL CENTRE

A. 1/8 A FUSE
B. $1\frac{1}{2}$ A FUSE
C. 56000 OHM RESISTOR, 2W (ORIGINAL EQUIPMENT PART. THIS ONE FAILS OFTEN. REPLACE WITH HIGHER WATTAGE RATING)
D. 39 OHM, 1W (REPLACEMENT FOR 36 OHM RESISTOR)
E. NOTICE BURNED OUT RESISTOR, R 3114, 47 OHM, $\frac{1}{2}$W. PROBABLY CAUSED BY ACCIDENTALLY SHORTING TEST POINT 1 ON TEST TERMINAL TO CHASSIS.
F. SCS
G. TRIP RELAY

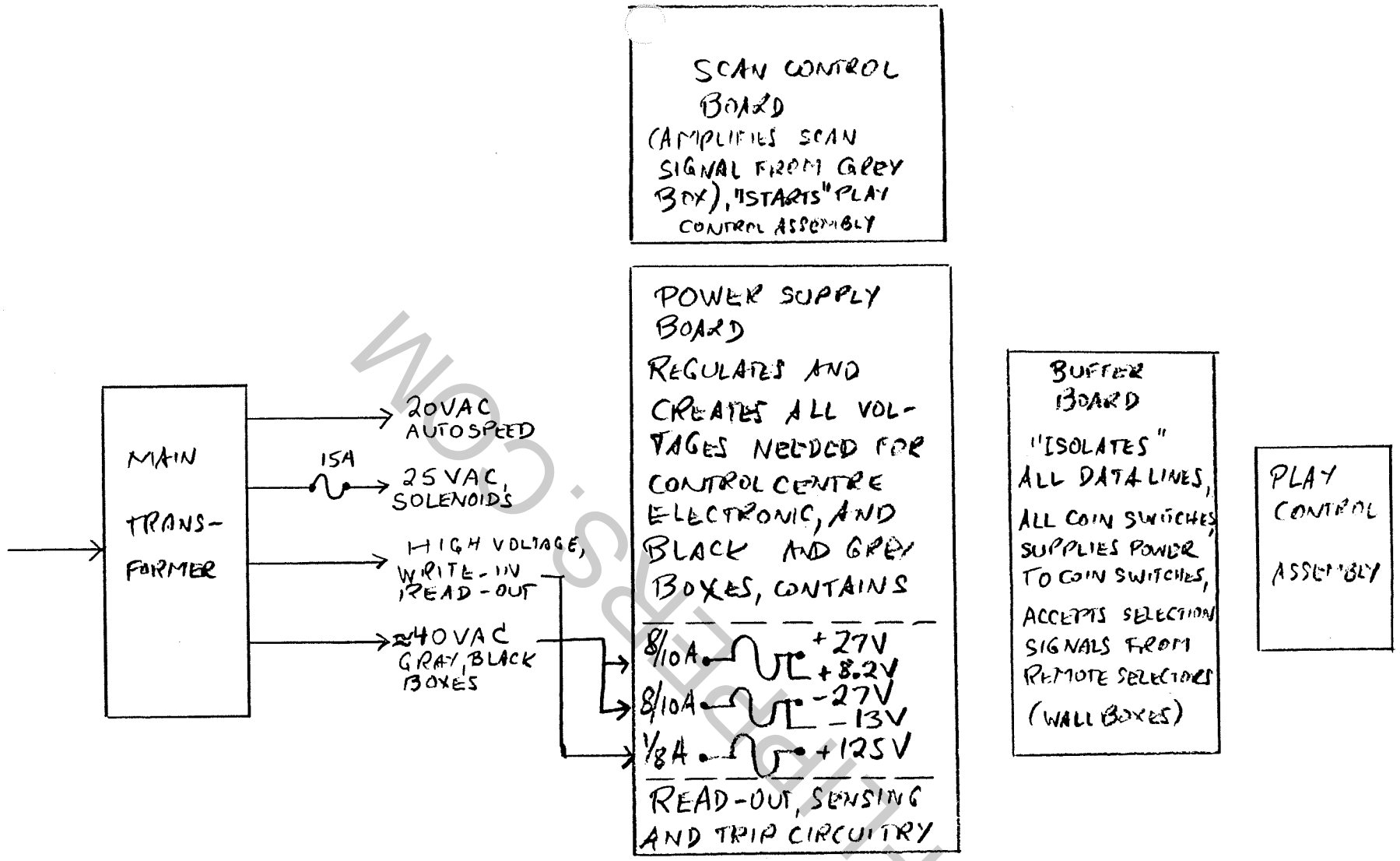


FIG 11 DCC-1 → DCC-42 BASIC ARRANGEMENT

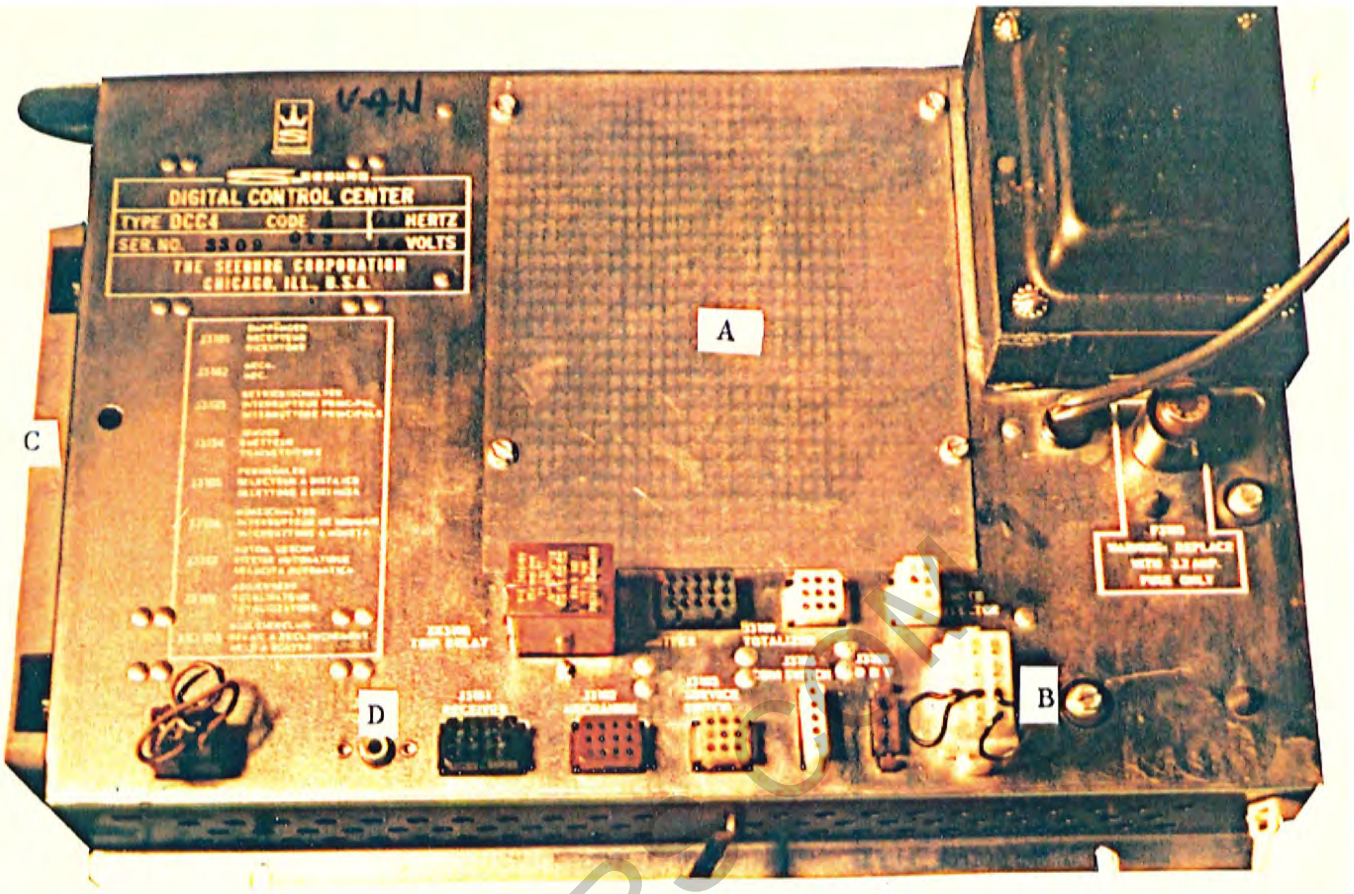
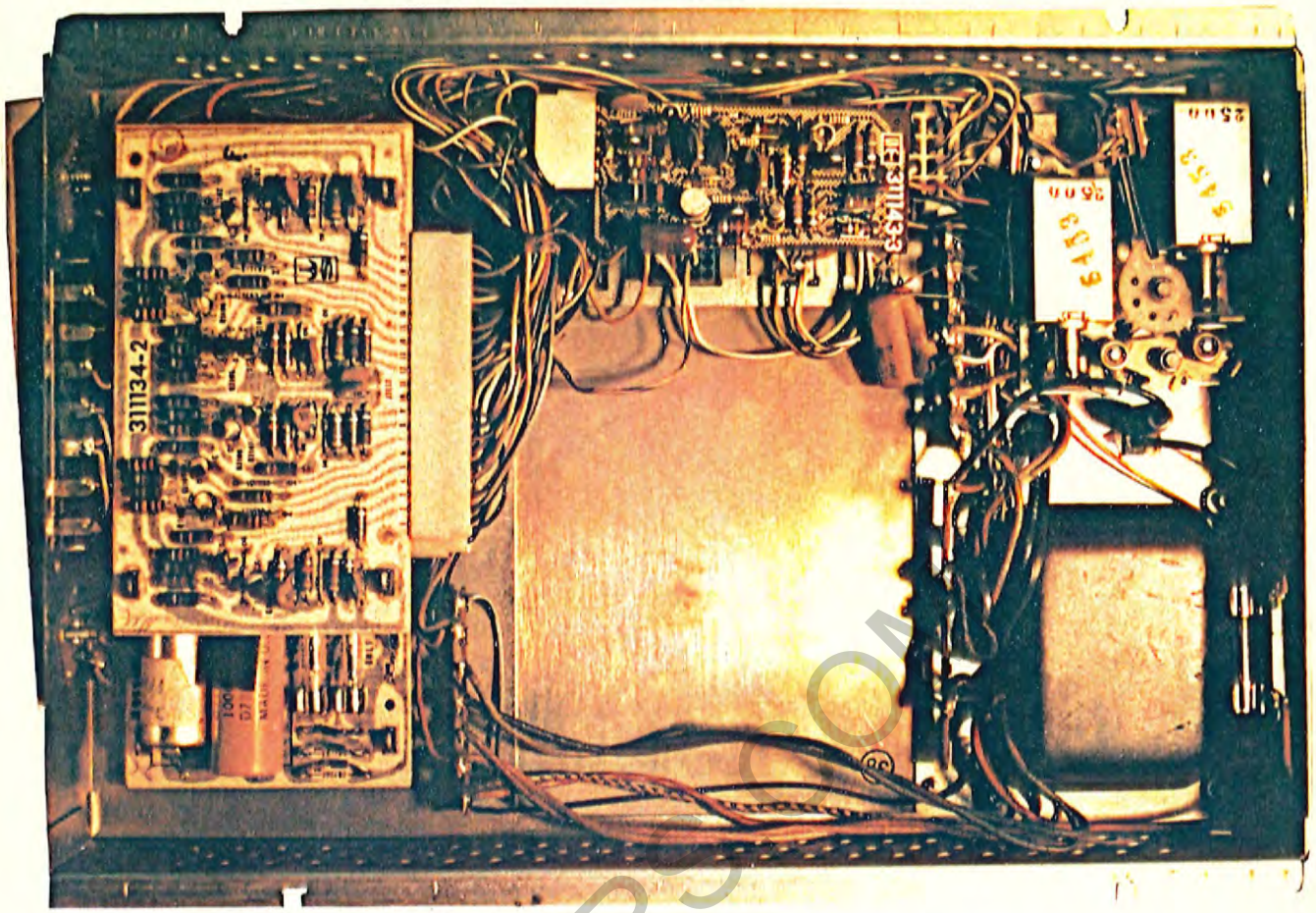


FIG 12 DCC 4 DIGITAL CONTROL CENTRE
THIS UNIT IS REPRESENTATIVE OF ALL DIGITAL CONTROL CENTRES.

A. NOTICE AUTO SPEED MISSING,
B. AUTO SPEED DUMMY PLUG
C. TEST POINT TERMINALS PLASTIC COVER
D. TORMAT SENSING PLUG FITS HERE

FIG 13 DCC ELECTRONICS



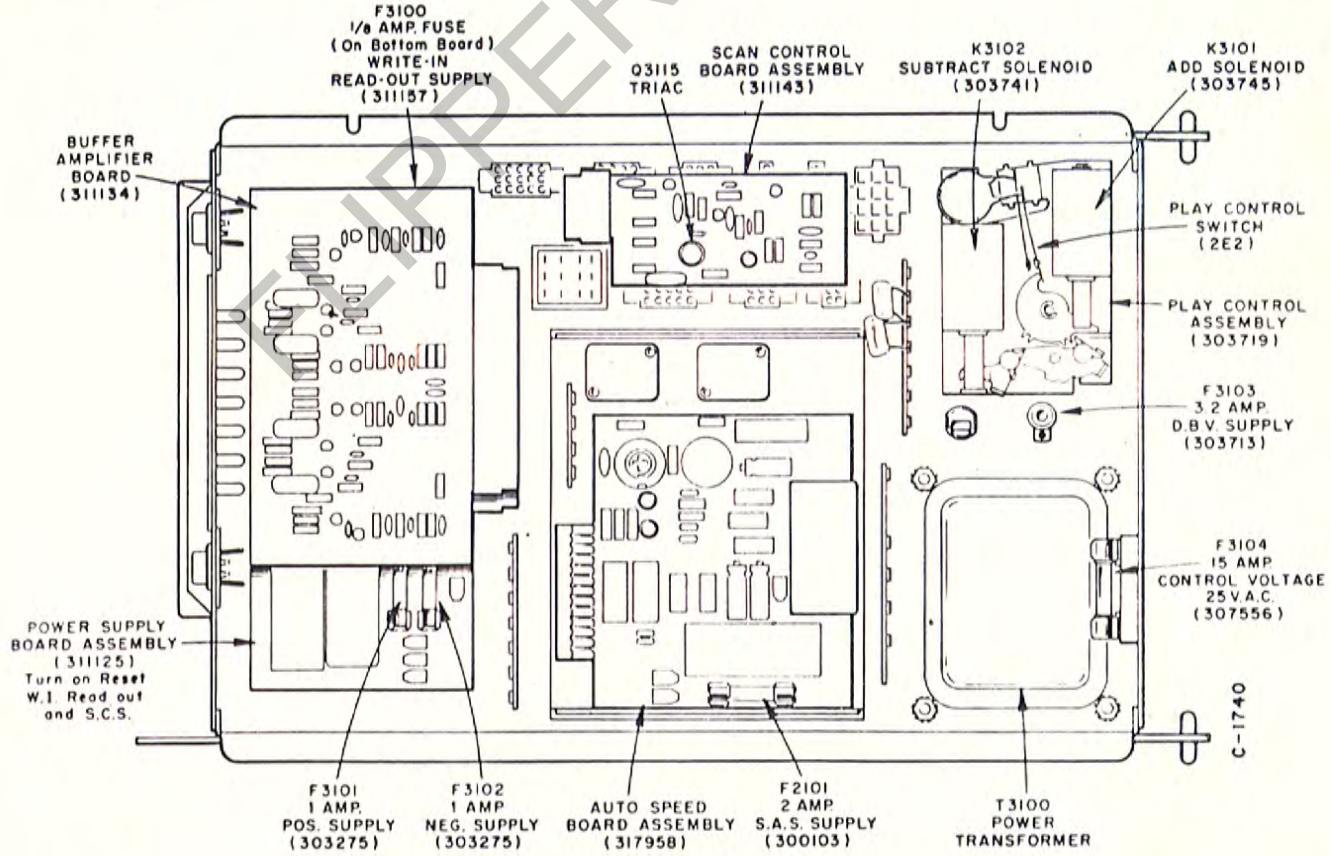


FIG 13A (FUSES F 3101 AND F 3102 VARY FROM 6/10 TO 1 AMP OVER THE VARIOUS DIGITAL CONTROL CENTRES)

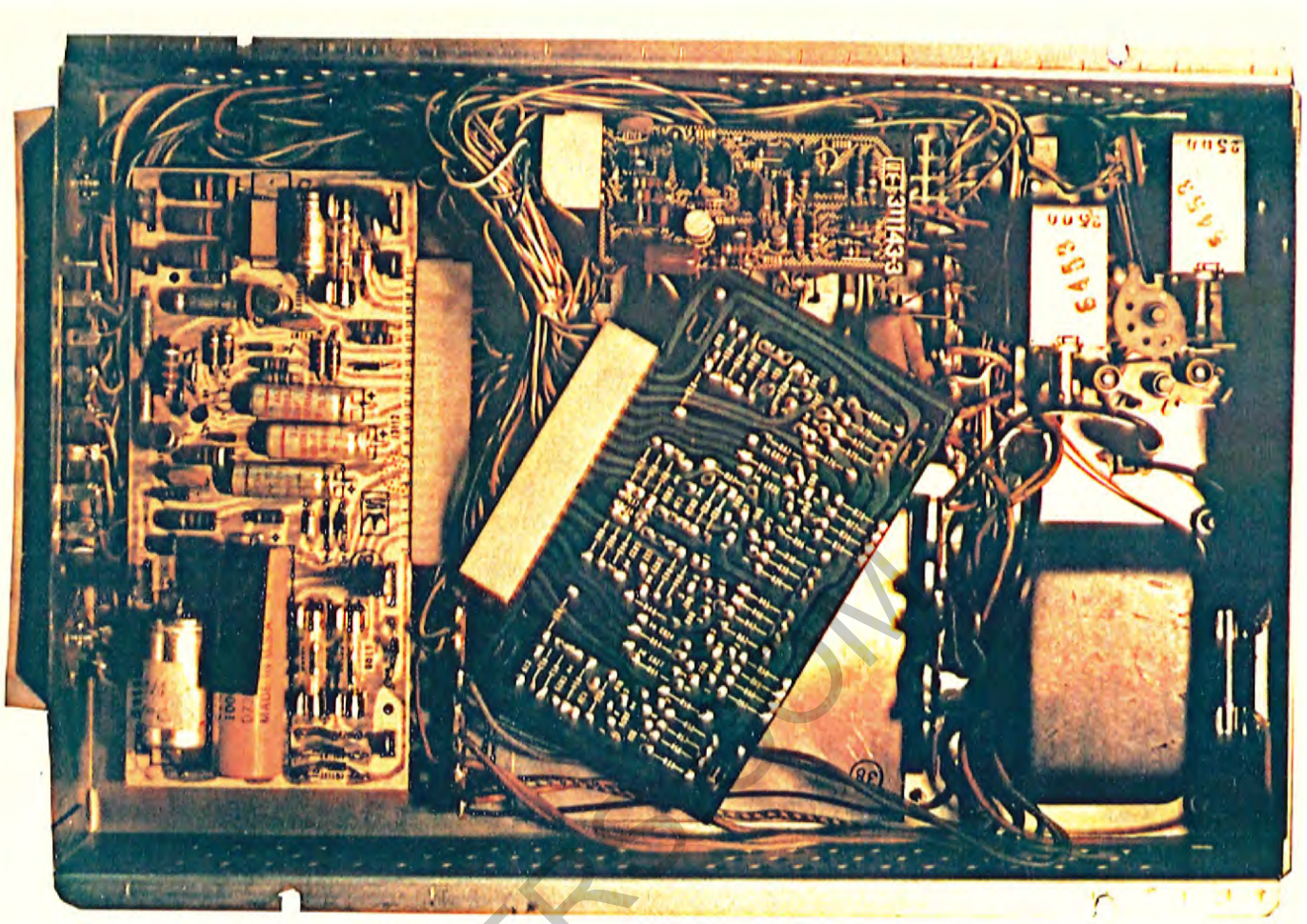


FIG 14 BUFFER BOARD REMOVED FROM ITS SUPPORT FOR BETTER ACCESS TO THE FUSES.

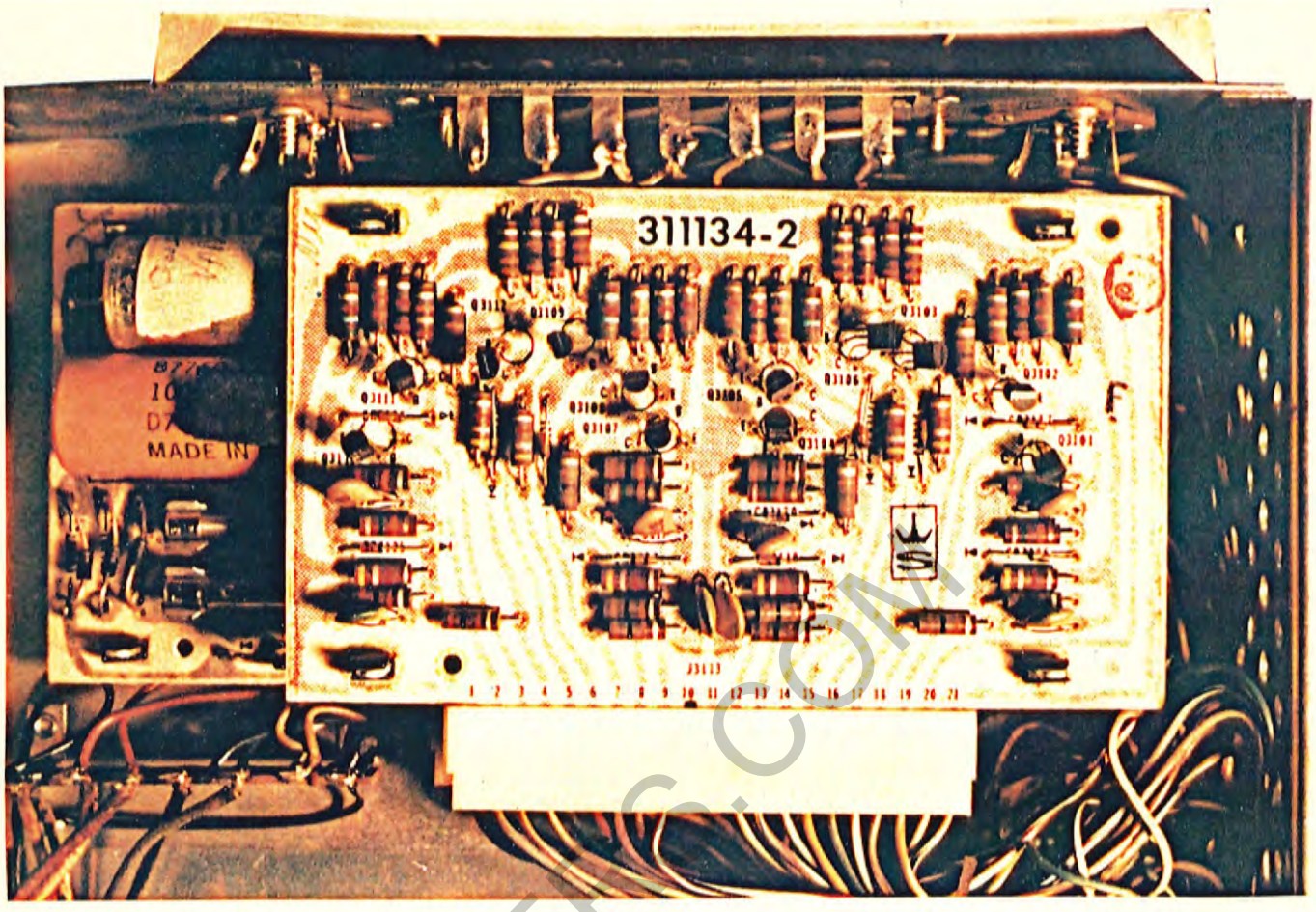


FIG 15 CLOSE-UP OF BUFFER BOARD

MAKE SURE TRANSISTORS ARE NOT "SQUASHED DOWN", BUT APPEAR AS SHOWN HERE.

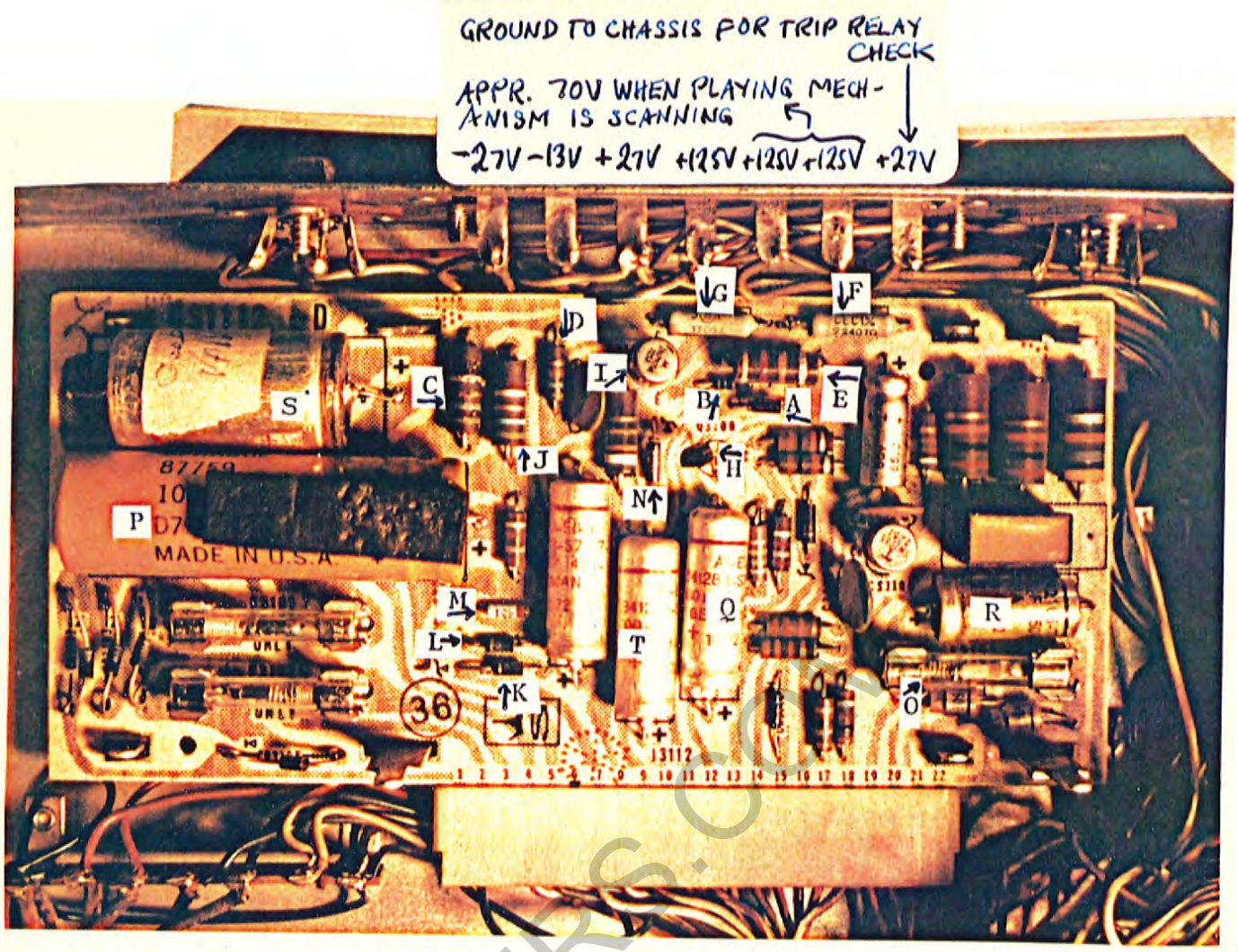


FIG 16 CLOSE-UP OF POWER SUPPLY BOARD. REFER TO TEXT FOR COMPONENT VALUES.

A. CR 3110
B. CR 3112
C. R 3111 -THIS ONE LOOKS LIKE IT HAS BEEN SUBJECT TO OVERHEATING
D. R 3112
E. R 3113
F. R 3189
G. R 3190
H. Q 3100
I. Q 3120
J. R 3108
K. CR 3104
L. CR 3105
M. CR 3106
N. CR 3107
O. 1/8 A FUSE, WI/RO SUPPLY
P. C 3109
Q. C 3107
R. C 3100
S. C 3105
T. C 3106

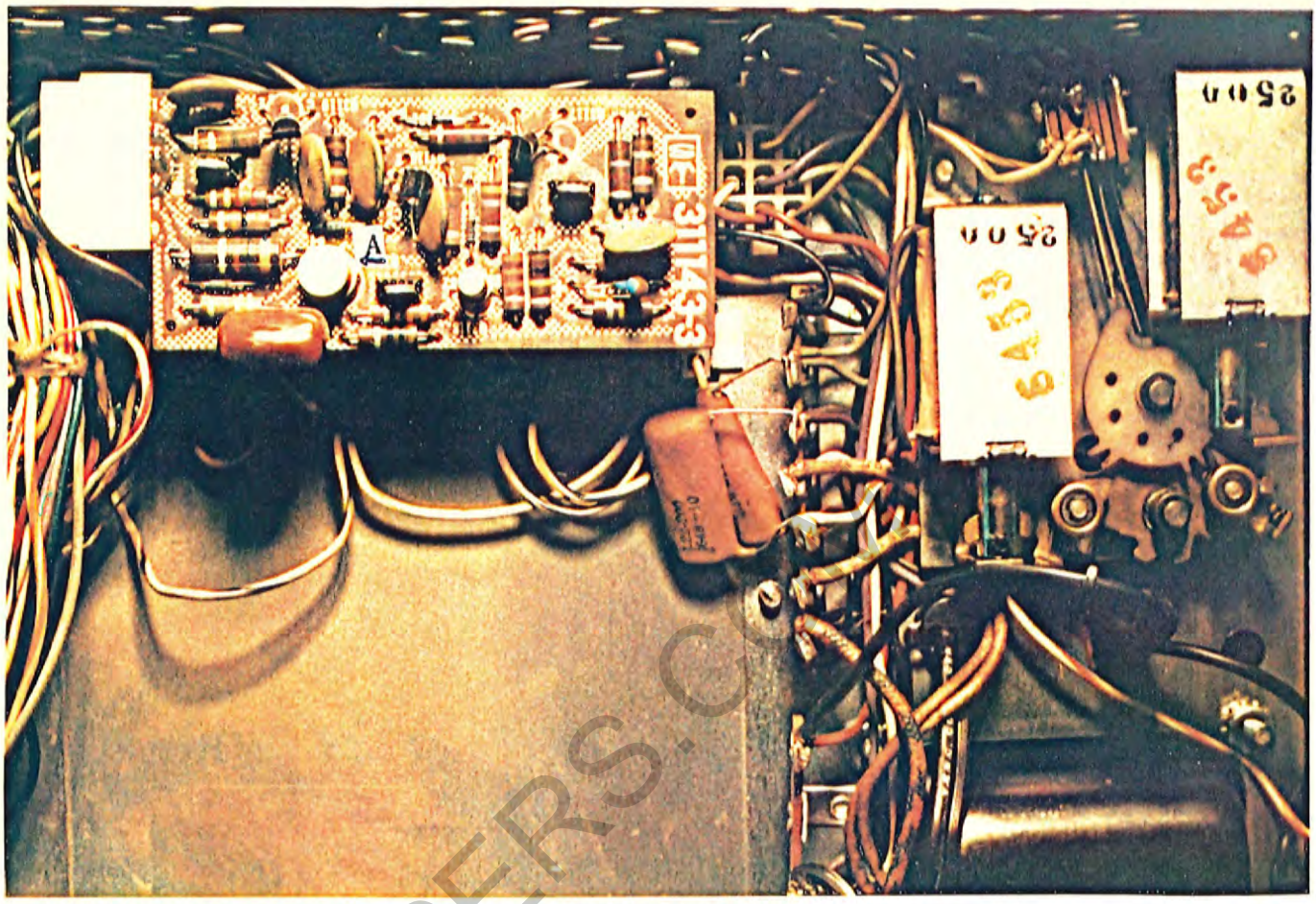


FIG 17 SCAN BOARD

A. Q 3115 TRIAC

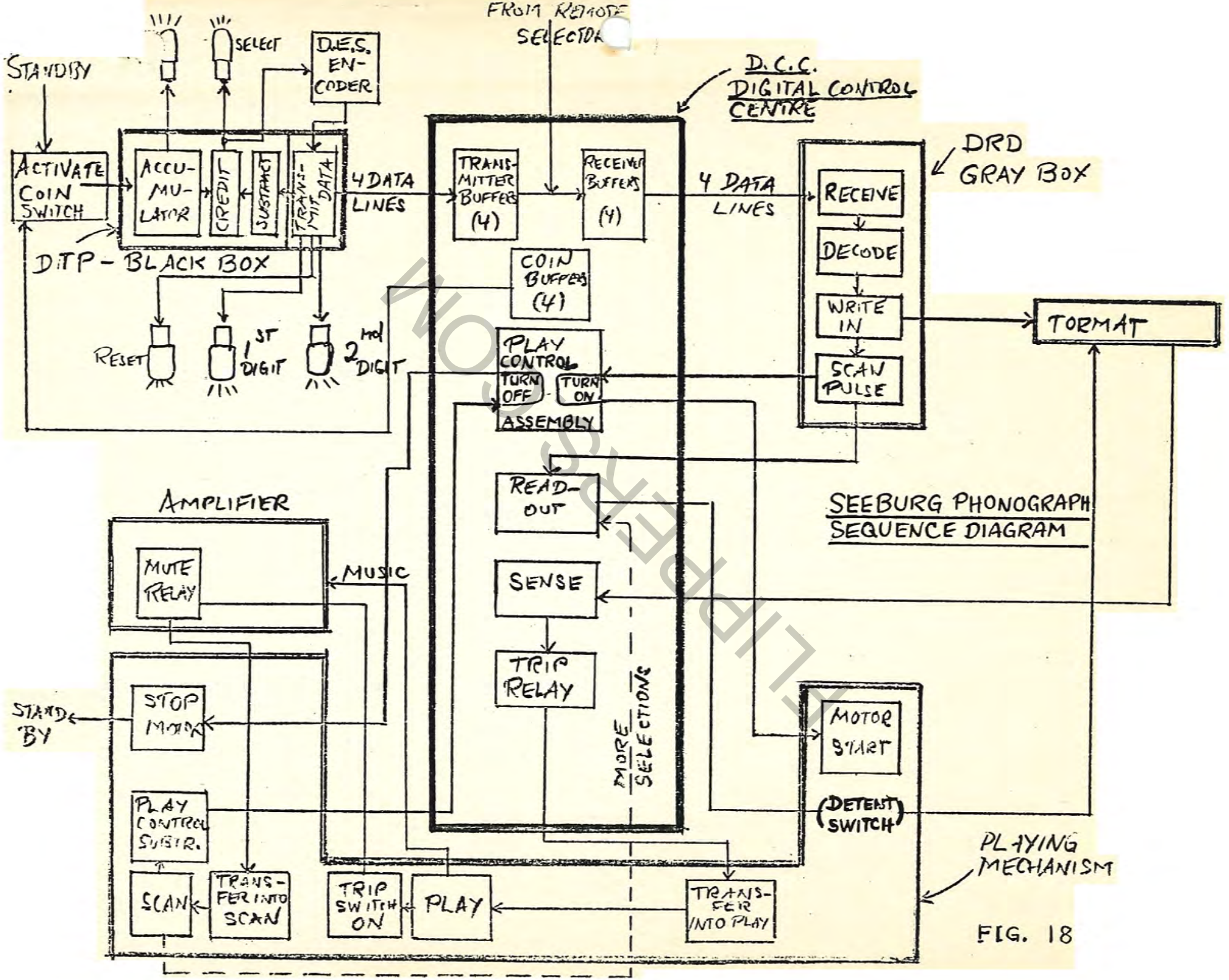

FROM REMOTE SELECTOR
D.C.C. DIGITAL CONTROL CENTRE
DRD GRAY BOX
STANDBY
SELECT
D.E.S. ENCODER
ACTIVATE COIN SWITCH
ACCUMULATOR
CREDIT
SUBTRACT
TRANSMIT DATA
4 DATA LINES
DTP - BLACK BOX
TRANSMITTER BUFFERS (4)
RECEIVER BUFFERS (4)
4 DATA LINES
RECEIVE
DECODE
WRITE IN
SCAN PULSE
TORMAT
COIN BUFFERS (4)
RESET
1ST DIGIT
2nd DIGIT
PLAY CONTROL
TURN OFF
TURN ON
ASSEMBLY
READ-OUT
SEEBURG PHONOGRAPH SEQUENCE DIAGRAM
AMPLIFIER
MUTE RELAY
MUSIC
SENSE
TRIP RELAY
MORE SELECTIONS
STAND BY
STOP MOTOR
MOTOR START
(DETENT SWITCH)
PLAY CONTROL SWITCH
SCAN
TRANSFER INTO SCAN
TRIP SWITCH ON
PLAY
TRANSFER INTO PLAY
PLAYING MECHANISM

FIG. 18