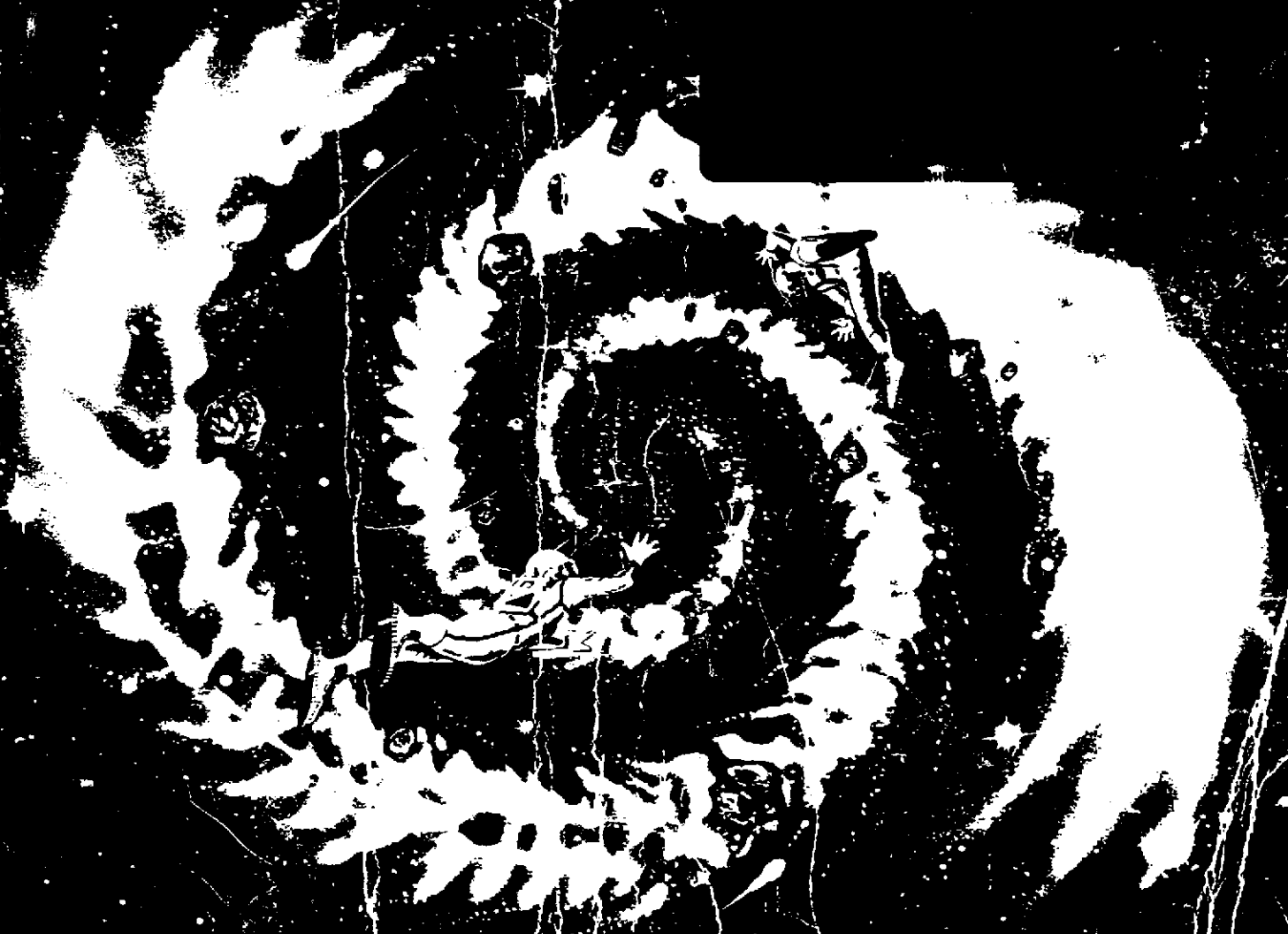


BLACK HOLE

INSTRUCTION MANUAL



Gottlieb
AMUSEMENT GAMES

165 W. Lake Street, Northlake, IL 60164
(312) 582-7400 Telex 72-8463

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FINAL EDITION
APPLICABLE TO ALL GAMES
NOT HAVING THE LETTER "S"
IN THEIR SERIAL NUMBER

BLACK HOLE (GAME #668)
INSTRUCTION MANUAL

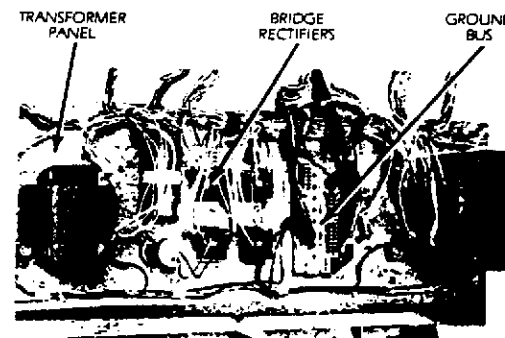
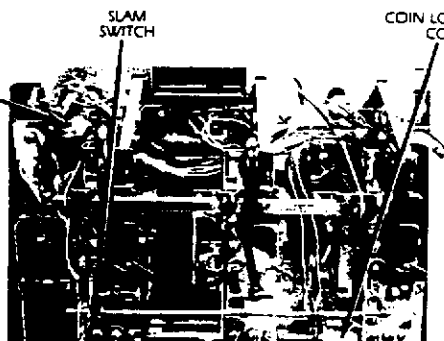
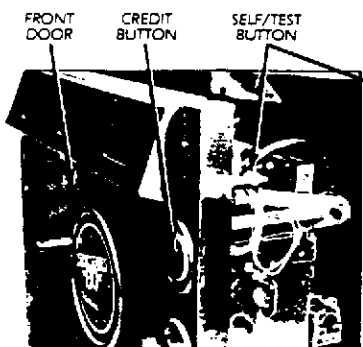
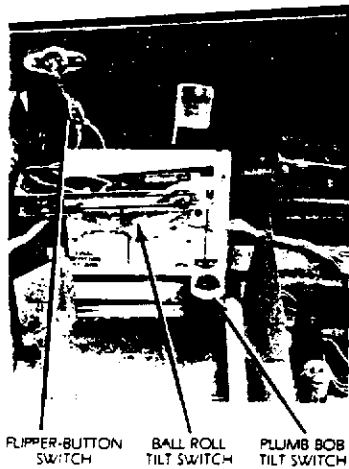
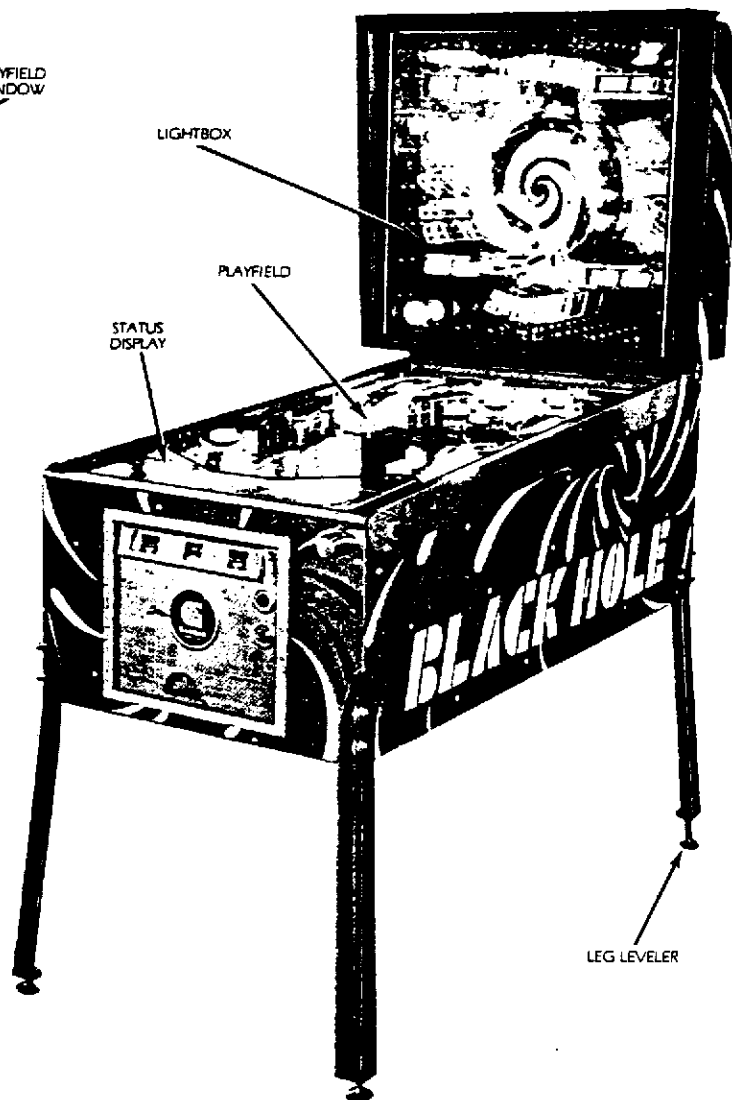
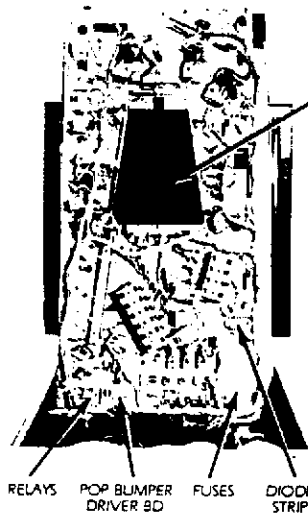
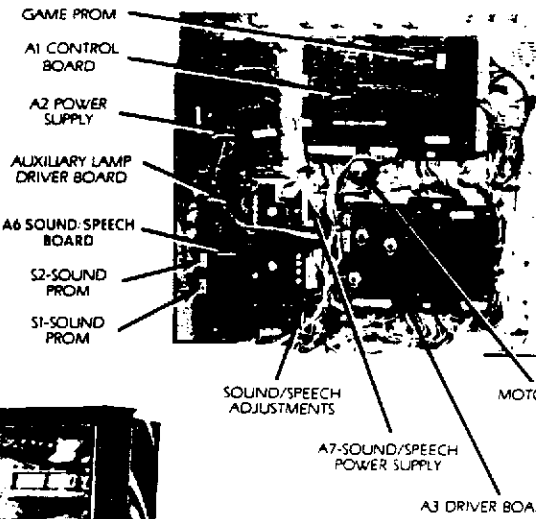
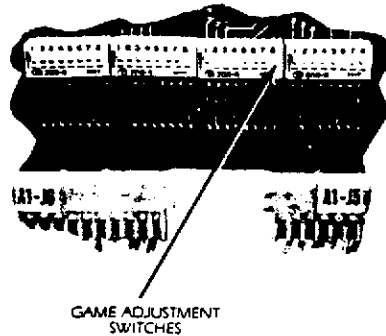
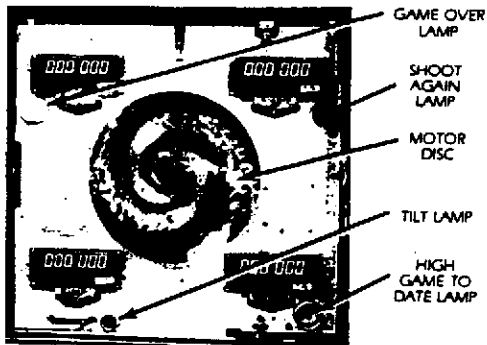
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BLACK HOLE PROMS

GAME PROM (GAMES WITH SOUND SPEECH) 668/2
GAME PROM (GAMES WITH SOUND ONLY) 668A/2
SOUND SPEECH PROMS 668/S1, 668/S2
SOUND PROM 668A/S

I. INSTALLATION



I. INSTALLATION

A. SET-UP

1. Bolt the legs to the cabinet.
2. From the inside of the cabinet, remove the binding strap from the power cord. Feed the cord to the outside of the cabinet through the black plastic line cord housing.
3. Place the lightbox atop the pedestal and engage the holding bracket.

LIGHTBOX HOLDING BRACKET



4. Insert the key and unlock the lightbox door. Swing the backglass door out.
5. Loosen and lower the shipping bracket at the top center of the lightbox insert panel.
6. Lift the insert; then swing it out.
7. Secure lightbox to cabinet with bolts and washers provided.
8. Connect all cables in the lightbox.
9. Open the cabinet door and loosen the front moulding locking arm.
10. Remove the moulding from the playfield.
11. Slide glass forward and let all 3 balls drain to the outhole.

B. CHECK-OUT

1. Check that all cables are clear of moving parts.
2. Check for any loose wires.
3. Check switches for loose solder or other foreign matter.

4. Be certain all fuses are firmly seated.
5. Check transformers for any foreign matter across terminals.
6. Be sure transformer wiring corresponds to the supply voltage.
7. Check the setting of the normally open tilt switch on the underside of the playfield. One blade should be free-floating with a weight on the end.
8. Check that the surface of the plexiglass panel has been properly aligned with the surface of the upper playfield.

The specifications are as follows:

- A. At the top, the plexiglass must be $1/64$ of an inch below the surface of the playfield.
- B. At the bottom the plexiglass must be $1/64$ of an inch above the surface of the playfield.
- C. Along the sides, flush.

CAUTION: Clean the plexiglass with glass cleaner and a soft cloth only. Never use abrasive materials.

NOTE: The allen screws used are 6-32 x 5/8" flatheads, requiring a 5/64 allen wrench.

9. Check that a sponge rubber washer has been inserted underneath the plexiglass at each attachment point.
10. Level the machine.
11. The plumb-bob tilt can be adjusted by loosening the wing nut and raising the plumb-bob to increase its sensitivity, or lowering it to decrease its sensitivity.

The ball-roll tilt can be adjusted by loosening the front screw or raising the tilt bracket to increase sensitivity, or lowering it to decrease its sensitivity.

12. With the line cord unplugged, drop

I. INSTALLATION

a coin into one of the chutes. It should be rejected.

13. Plug game into a properly grounded 3-wire receptacle **ONLY!**

14. Refer to Section VI to make all necessary game adjustments.

NOTE: If used, Switches #31 and #32 are special adjustments to make the game liberal or conservative.

PLAYFIELD REMOVAL

The following procedure must be carefully followed in order to avoid damaging the upper playfield drop target assemblies (coils and targets) and the lower playfield guides as shown in figure one.



FIGURE 1

UPPER PLAYFIELD

1. Pivot the front end of the upper playfield up until it is at least 12 inches above the front of the cabinet as shown in figure two.

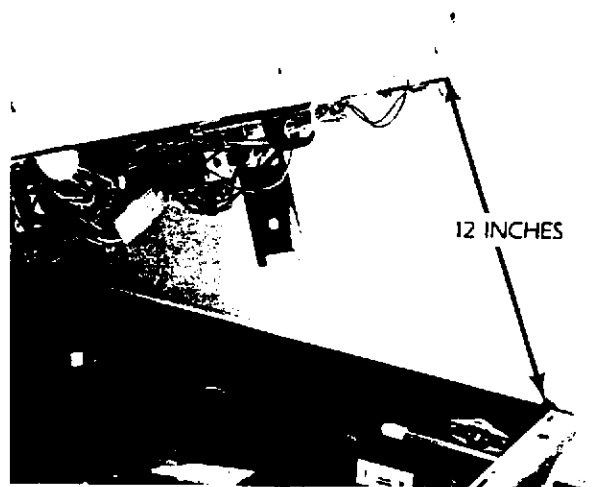


FIGURE 2

I. INSTALLATION

2. Pull the playfield toward you until its back end is 1 to 2 inches from the front end of the playfield support assemblies as shown in figure three.

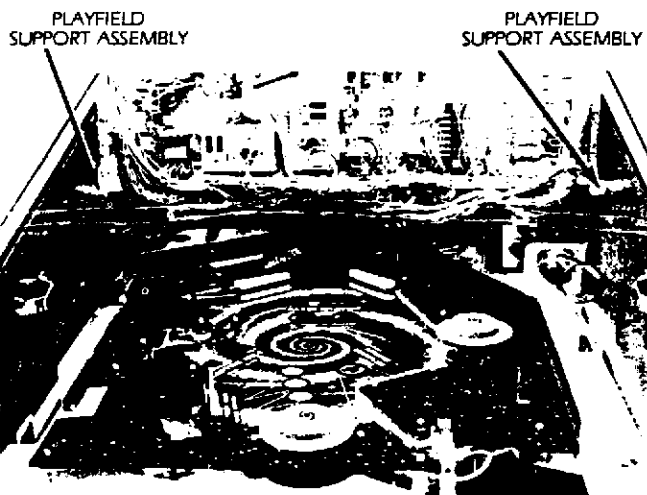


FIGURE 3

CAUTION: While completing step two, check that the upper playfield wiring harness, shown in figure four, is clearing the lower playfield.

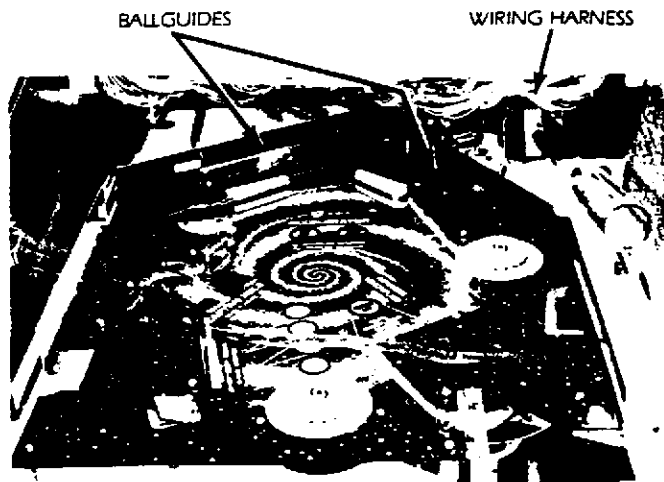


FIGURE 4

3. The upper playfield can now be pivoted back until it rests on the lightbox, or after disconnecting its wiring harness, it can be totally removed.

LOWER PLAYFIELD

1. Remove shipping bolts from both sides of the playboard as shown in figure five.
2. Pull the playboard straight back to the position shown in figure six.

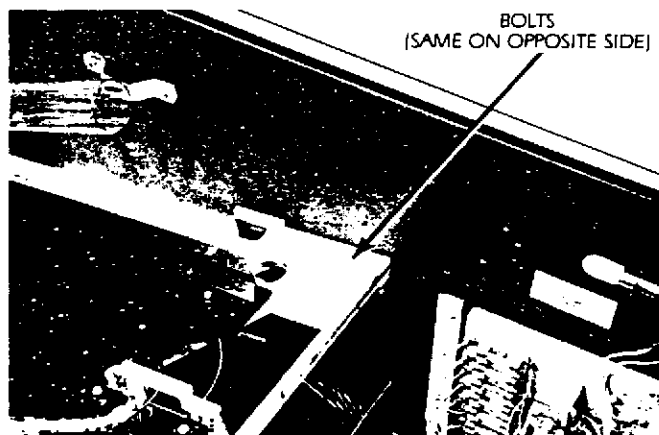


FIGURE 5

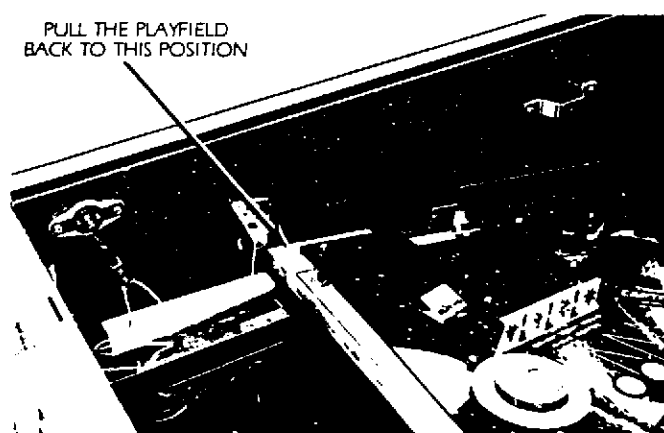
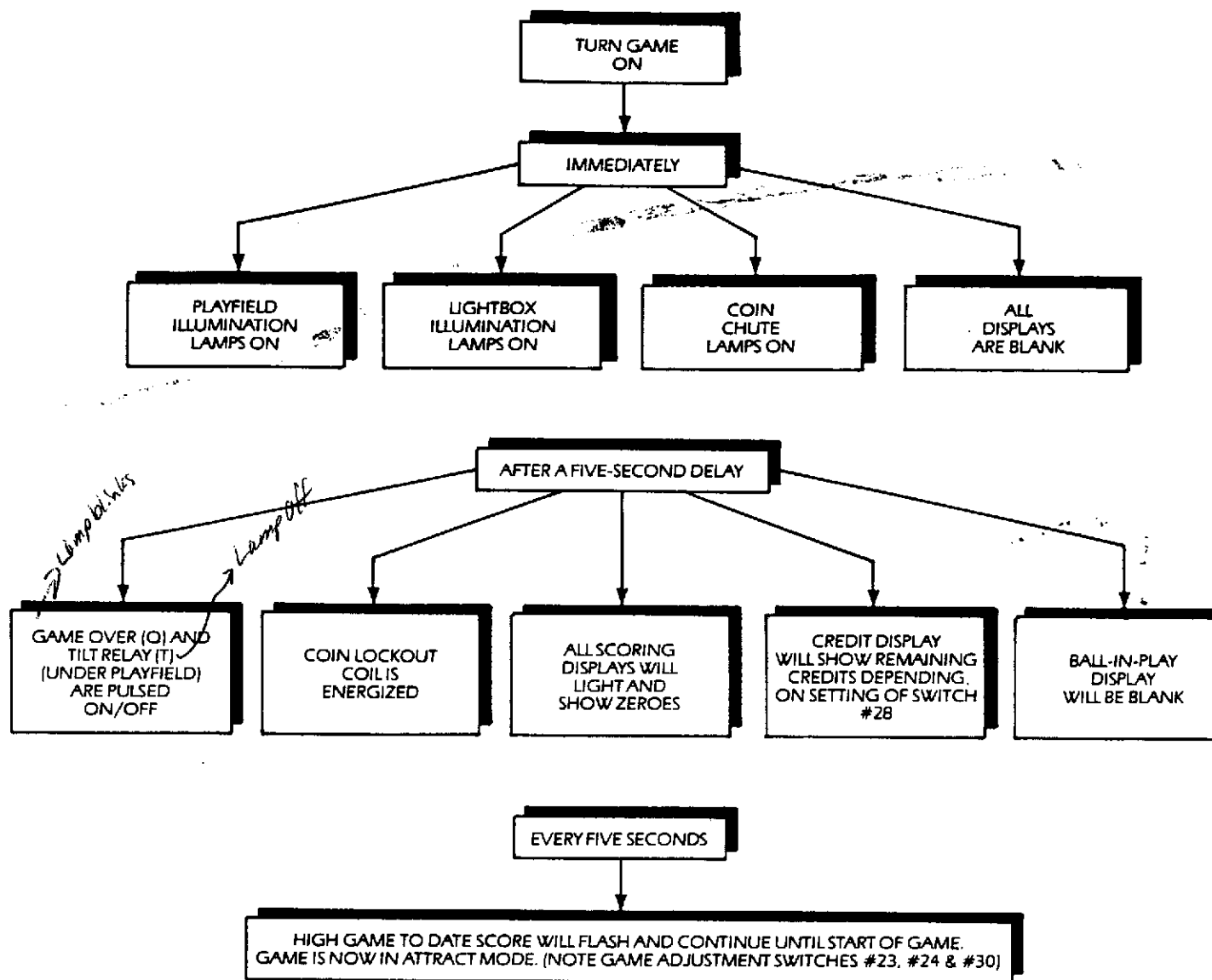


FIGURE 6

3. Pivot the playboard back until it rests against the upper playfield or after disconnecting its wiring harness, it can be totally removed.

II. INITIALIZATION



III. GAME OPERATION

A. GAME START

All three balls must be in the ball return trough to start a game.

1. Insert coins into coin chute.
 - a. Coin chute tune is played (dependent on Switch #27).
 - b. Total credits are displayed in status display (dependent on Switch #28).
2. Press Credit Button to start game.
 - a. Credit tune or voice is played.
 - b. Total credits displayed decrease by one.
3. All playfield features reset.
4. The first player score display flashes a single zero.
5. When the ball is released to the shooter:
 - a. Playfield-controlled lamps flash.
 - b. High Game to Date is briefly displayed in all 4 players' score displays and the lower playfield display.

III. GAME OPERATION

B. FIRST PLAYER

1. First player's score display flashes zero.
2. The other players' displays are now blank.
3. A "1" appears on the ball-in-play display.
4. When the ball enters the outhole, any bonus earned on the lower playfield is scored.

C. ADDITIONAL PLAYERS

1. Additional players are indicated by a zero (not flashing) in each corresponding player's display.
2. After the maximum number of players are added, or no more credits remain, the Credit Button has no effect.
3. Additional players can be added anytime the first player's ball is still in play. If the Credit Button is pressed after the first player's first ball has entered the outhole, all players' scores will be erased with the first player's score display showing a flashing zero, indicating a new game only for the first player.

D. EXTRA BALLS

1. When the SHOOT AGAIN lamp is lit, neither the player-up nor the ball-in-play display changes when the ball enters the outhole.
2. Only one extra ball per ball-in-play is given.

E. TILT MODE

1. Tilting the game results in a loss of ball in play.
2. When the game is tilted, all the

playfield lamps go off except the pop bumper lights.

3. All accumulated bonus and bonus multipliers are lost.
4. Upper playfield captured ball is released; the lower is not.

F. SLAM MODE

1. If the normally closed slam switch (located inside front door) is opened, the entire game is ended for all players.
2. The GAME OVER lamp comes on.
3. The entire switch matrix is inactive for three seconds.
4. All coins will be rejected if dropped into any coin chute during the three-second delay.
5. If the match feature exists (dependent on Switch #18), a replay can be won even if the game is slammed.
6. Game returns to the attract mode.

G. GAME OVER

1. When the last ball enters the outhole, the GAME OVER lamp continually flashes.
2. A random number appears in the ball-in-play display. If this number matches the last two digits in any player's score, a replay (dependent on Switch #18) is awarded.
3. HGTD is periodically flashed in all players' displays. When a score higher than this is achieved, an award (dependent on Switches #23 and #24) is given.
4. All captive balls will be ejected and returned to the outhole.
5. All of the target banks will reset.

IV. GAME PLAY AND SCORING

BALL-CAPTURE

- Completing the yellow spot target sequence enables the upper playfield capture hole. Once enabled, the blue capture hole lamp will flash until a ball is captured.
- The lower playfield capture hole is always active. The 3 blue captive hole arrows will flash until a ball is captured.
- A ball captured on the lower playfield will be remembered from ball-to-ball unless used by any of the players during 3-ball play.
- When the upper playfield capture lamp is lit by a player, it will be remembered for that player.
- Ball captured on upper playfield will be ejected at the end of player's turn.

MULTI-BALL PLAY

- Begins when a ball is shot down to the lower playfield while both capture holes are occupied.
- The lower playfield ball is released first, resulting in 2-ball play.
- Once both balls have been lost (lower playfield), the third ball will be released (upper playfield), resulting in 3-ball play.
- If the reentry gate is not open when the two balls are returned to the upper playfield, they will both be lost, and 1-ball play will resume.
- During 3-ball play the gate is always open.

BONUS MULTIPLIERS

- Completing the top rollover sequence (upper playfield) advances the "BONUS MULTIPLIER".
- Actuating the rollover on the

lower playfield will also advance the "BONUS MULTIPLIER".

- The rollovers actuated by a player will be remembered for that player.

BONUS

(Lower Playfield Only)

- "BONUS" can only be earned on the lower playfield.

During play, the "BONUS" will accumulate on the lower playfield display.

- Completing either drop target lamp sequence (B-L-A-C-K or H-O-L-E), in order, will light a "g force" accelerator (lower playfield) lamp for double scoring.
- Completing both lamp sequences, (B-L-A-C-K and H-O-L-E), in order, will light both "g force" for triple scoring.
- At the end of a player's turn, the bonus multiplier will be applied to the lower playfield "BONUS" score and added to the player-up's score in the lightbox.
- B-L-A-C-K or H-O-L-E sequences completed will be remembered unless both have been completed, which results in neither being remembered.
- "g force" double scoring will be remembered from ball-to-ball.
- Drop target banks on the lower playfield will not reset until completed for each player.

SPECIAL

- Completing the B-L-A-C-K H-O-L-E lamp sequence lights the white 3-drop target bank on the lower playfield for the "SPECIAL". Completing the bank will award the "SPECIAL".

IV. GAME PLAY AND SCORING

- Each time the white 3-drop target bank on the lower playfield is completed, the value for the rollunder on the upper playfield advances. Passing the rollunder leading to the upper playfield rollover sequence when its red "SPECIAL" lamp is lit will award the "SPECIAL".

EXTRA BALL

- Completing the lower playfield left drop target bank (4-Bank), when all the targets are lit, will light the "EXTRA BALL" lamp on the left side of the upper playfield. Capturing the ball on the upper playfield, or if ball has already been captured, will award the "EXTRA BALL".
- Each time the white right drop target bank on the lower playfield (3-Bank) is completed, the rollunder value on the upper playfield will advance. Passing the rollunder when its purple lamp is lit will award the "EXTRA BALL".

ADDITIONAL FEATURES

- A captive ball in the upper playfield hole will be kicked out each time a player loses the ball-in-play.
A tilt will not be recognized during the end-of-ball bonus countdown or during initialization.
- The reentry gate will open and direct the ball onto the upper playfield if either of the two lower playfield drop target banks have been completed or if the ball passes over the right return rollover when its arrow is flashing green.

UPPER PLAYFIELD

RIGHT SIDE ROLLOVER

- Score 500 points when unlit.
- Score 10,000 points when lit.

ROLLUNDER

- Score 5,000 points when unlit.
- Score 10,000 points when lit (white).
- Awards extra ball when purple lamp is lit.
- Awards special when red lamp is lit.

"CAPTIVE HOLE"

- Score 5,000 points.
- Awards extra ball when purple lamp is lit.
- Captures ball when blue lamp is flashing.

DROP TARGETS

- Score 500 points when unlit.
- Score 5,000 points (3-ball) when lit or flashing.
- Score 3,000 points (5-ball) when lit or flashing.
- Hitting drop target with flashing lamp will advance lamp sequence.
- Completing drop target lamp sequence resets bank and lights spinner (5-bank) or lights right side rollover (4-bank).
Completing either lamp sequence (B-L-A-C-K or H-O-L-E) gives 2X scoring on lower playfield. Lights "g force" accelerator lamp.
- Completing both lamp sequences (B-L-A-C-K and H-O-L-E) lights 3-bank (lower playfield) for special and gives 3X scoring on lower playfield.

RIGHT RETURN ROLLOVER

- Score 500 points when unlit.
- Score 5,000 points and opens gate when flashing.

IV. GAME PLAY AND SCORING

TOP ROLLOVERS

- Score 500 points when unlit.
- Score 3,000 points when lit.
- Completing sequence advances bonus multiplier and resets sequence.

RIGHT SIDE SPOT TARGETS

- Score 500 points when unlit.
- Score 3,000 points when lit.
- Corresponding lamp for 4-yellow drop target bank (lower playfield, 4-bank) will illuminate.
- Completing sequence lights right return rollover and blue hole, which enables captive hole.

POP BUMPERS

- Score 1,000 points (3-ball).
- Score 100 points (5-ball).
- Closes gate except during multi-ball.

SPIN TARGET

- Score 100 points when unlit.
- Score 1,000 points when lit.

TEN-POINT SWITCHES

- Score 10 points.
- Closes gate except during multi-ball.

LOWER PLAYFIELD

LEFT DROP TARGET BANK (4-Bank)

- Score 3,000 points when lit (3-ball).
- Score 1,000 points when lit (5-ball).
- Score 300 points when unlit (3-ball).
- Score 100 points when unlit (5-ball).

- Completing sequence resets bank and opens gate.
- Completing sequence with all targets lit lights hole (upper playfield) for extra ball.

RIGHT DROP TARGET (3-BANK)

- Score 500 points.
- Completing sequence resets bank, opens gate, advances rollunder (upper playfield) value and awards special when lit.

"CAPTIVE HOLE"

- Score 3,000 points.
- Captures ball when flashing.

ROLLUNDER

- Score 100 points.
- Advances multiplier.

POP BUMPERS

- Score 100 points.

LEFT RETURN ROLLOVER

- Score 100 points.

TEN-POINT SWITCHES

- Score 10 points.
Kicking Target
Kicking Rubbers

HIGH GAME TO DATE

If the high game to date is 980,000 or greater at the start of a new game, the high game to date will automatically reset to 770,000.

V. GAME SPEECH

ATTRACT MODE OCCURRENCE

"DO YOU DARE TO ENTER THE BLACK HOLE" Random

"NO ONE ESCAPES THE BLACK HOLE" Random

GAME MODE OCCURRENCE

"SHOOT CAPTIVE HOLE"
(Ball on upper playfield) Random; after captive hole lamp is flashing.

"SHOOT CAPTIVE HOLE"
(Ball on lower playfield) Random

"COMPLETE BANK FOR RE-ENTRY" Random; while ball is on lower playfield and only until either bank has been completed.

"SHOOT FOR SPECIAL" Random; after "SPECIAL" lamp is lit.

"EXTRA BALL LIT" Random; after extra ball lamp is lit.

"ENTER GRAVITY TUNNEL" Random; after 2 balls are captive.

"RE-ENTRY ACCOMPLISHED" Each time ball passes from lower playfield to upper playfield (gate must be open).

"RE-ENTRY ATTEMPT HAS FAILED" Each time ball travels from lower playfield and is lost (gate closed).

"G-FORCE ACCELERATED" Each time a drop target bank lamp sequence has been completed in order (B-L-A-C-K or H-O-L-E).

VI. GAME ADJUSTMENTS

A. CONTROL BOARD SWITCH ADJUSTMENTS

There are 32 switches on the control board which permit adjustment of the game parameters. These switches are contained in four packages of eight switches each, as shown below:

S1-S8 S9-S16 S17-S24 S25-S32

Switch settings are recognized only during normal power-up and when starting the first player of a new game (not when additional players are added).

SWITCHES				COIN CHUTE ADJUSTMENTS
S1	S2	S3	S4	Left Chute
S5	S6	S7	S8	Right Chute
S9	S10	S11	S12	Center Chute

NOTE: FOR GERMAN GAMES ONLY, switches S5-S8 adjust the center chute and switches S9-S12 adjust the right chute.

				COINS/CREDITS
OFF	OFF	OFF	OFF	1/1
OFF	OFF	OFF	ON	1/2
OFF	OFF	ON	OFF	1/3
OFF	OFF	ON	ON	1/4
OFF	ON	OFF	OFF	1/5
OFF	ON	OFF	ON	1/6
OFF	ON	ON	OFF	1/7
OFF	ON	ON	ON	1/8
ON	OFF	OFF	OFF	1/9
ON	OFF	OFF	ON	2/1*
ON	OFF	ON	OFF	2/2*
ON	OFF	ON	ON	2/3*
ON	ON	OFF	OFF	2/4*
ON	ON	OFF	ON	2/5*
ON	ON	ON	OFF	1/1 AND 2/3
ON	ON	ON	ON	3/1

*NO CREDITS UNTIL LAST COIN IS INSERTED.

SWITCH 13	EXTRA CREDITS
ON	Adds 9 credits to center coin chute setting
OFF	No effect

NOTE: FOR GERMAN GAMES ONLY, Switch 13 adds 9 credits to the RIGHT coin chute setting, when ON.

SWITCH 14	COIN CHUTE CONTROL
ON	Left and Right Chutes Same
OFF	Left and Right Chutes Separate

NOTE: FOR GERMAN GAMES ONLY, Switch 14 controls the left and CENTER coin chutes.

SWITCHES		MAXIMUM CREDITS
15	16	
OFF	OFF	8
OFF	ON	10
ON	OFF	15
ON	ON	25

SWITCH 17	BALLS PER GAME
ON	3
OFF	5

SWITCH 18	MATCH FEATURE
ON	ON
OFF	OFF

SWITCH 19	REPLAY LIMIT
ON	Limits each player to one replay per game
OFF	No replay limit

SWITCH 20	NOVELTY MODE
ON	Playfield SPECIAL and EXTRA BALL features award 50,000 points and 5 knocks. High score, high game to date, and match features disabled
OFF	Normal game mode

NOTE: SWITCH 20 overrides SWITCH 21.

SWITCH 21	GAME MODE
ON	Extra Ball
OFF	Replay

NOTE: If SWITCH 21 is ON, the high game to date and match awards are disabled.

SWITCH 22	PLAYFIELD SPECIAL
ON	Awards Extra Ball
OFF	Awards Special

SWITCHES		
23	24	HIGH GAME TO DATE
OFF	OFF	Not displayed-no award
OFF	ON	Displayed-no award
ON	OFF	Displayed-awards 2 replays
ON	ON	Displayed-awards 3 replays

SWITCH 25	MUST REMAIN ON
------------------	-----------------------

SWITCH 26	MUST REMAIN ON
------------------	-----------------------

SWITCH 27	COIN SWITCH TUNE?
ON	Yes
OFF	No

SWITCH 28	CREDITS DISPLAYED?
ON	Yes
OFF	No

SWITCH 29	OFF
------------------	------------

SWITCH 30	ATTRACT FEATURES
ON	ON
OFF	OFF

SWITCH 31	MUST REMAIN OFF
------------------	------------------------

SWITCH 32	BACKGROUND TONE FOR GAMES WITH SOUND BOARD ONLY.
------------------	---

NOTE: If game is equipped with Sound/Speech board this switch must remain off.

ON	ON
OFF	OFF

(SEE SECTION VI, B)

VI. GAME ADJUSTMENTS

B. POST ADJUSTMENTS

There is one post adjustment that provides liberal or conservative game play. See Playboard Information (page 31) for post positioning.

THE SOUND/SPEECH BOARD (A6) USED IN BLACK HOLE GAME #668 IS NOT INTER-CHANGEABLE WITH SOUND BOARDS (A6) USED IN GAMES PREVIOUS TO MARS (#666).

C. SOUND/SPEECH ADJUSTMENTS

The Volume potentiometer for adjusting the speaker output is located on the Fuse/Knocker panel. Which is accessible through the front door.

IMPORTANT: All potentiometers (pot) on the sound/speech board are factory adjusted for maximum voltage. Damage to board components may result if settings are changed, unless an oscilloscope and calibration procedure is followed.

SWITCH BANK (SB1) SETTINGS:

SBI-1	USED IN SELF-TEST ONLY.
SBI-2	NOT USED.
SBI-3	SBI-4 Attract Mode Speech
OFF	OFF Disabled.
ON	OFF Every 10 Seconds.
OFF	ON Every 2 Minutes.
ON	ON Every 4 Minutes.
SBI-5	ON Background sound enabled.
	OFF Background sound disabled.
SBI-6	ON All Speech enabled.
	OFF All Speech disabled.
SBI-7	NOT USED
SBI-8	NOT USED

SOUND/SPEECH BOARD (A6) TEST SEE SECTION IX, E PAGE 14.

VII. BOOKKEEPING AND SELF TEST

The circuitry in this game helps the operator perform many bookkeeping and game test functions. The information is shown one step at a time in the first player's score display, while the step number is shown in the credit display (refer to flow chart Section VII, C for order and function).

A. BOOKKEEPING

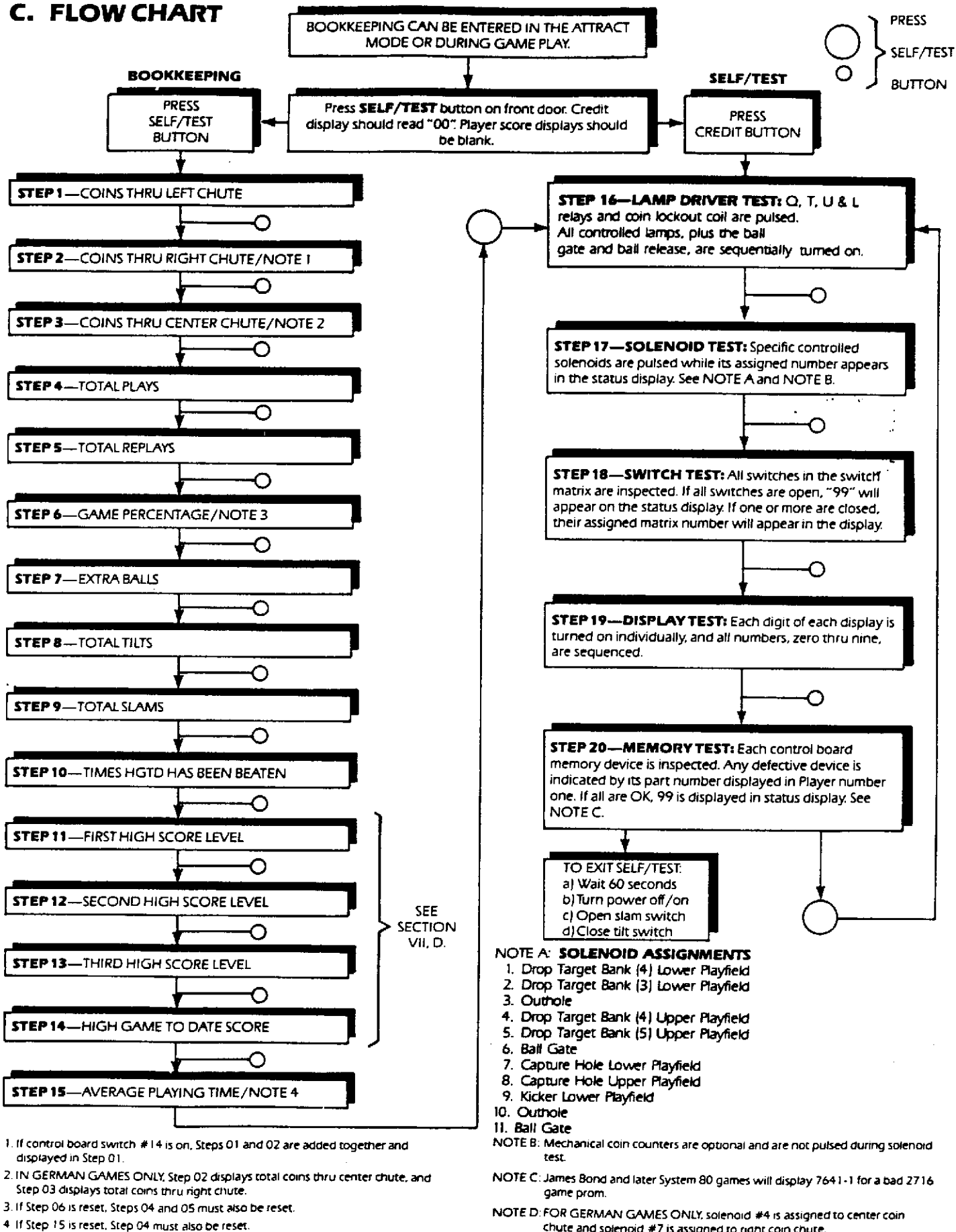
- Pressing the SELF-TEST button inside the front door begins the bookkeeping which are steps 01 through 15.
- The data in any of these steps may be reset to zero while it is displayed by pressing the replay button on the front door.
- THE SELF-TEST BUTTON MUST THEN BE PRESSED TO ENTER ZERO INTO MEMORY.

- All bookkeeping information is checked against itself to insure that it is correct. If any data is invalid or bad, that information will flash while it is displayed.
- If the SELF-TEST button is not pressed within 60 seconds of each step, the game will return to the attract mode.

B. SELF-TEST

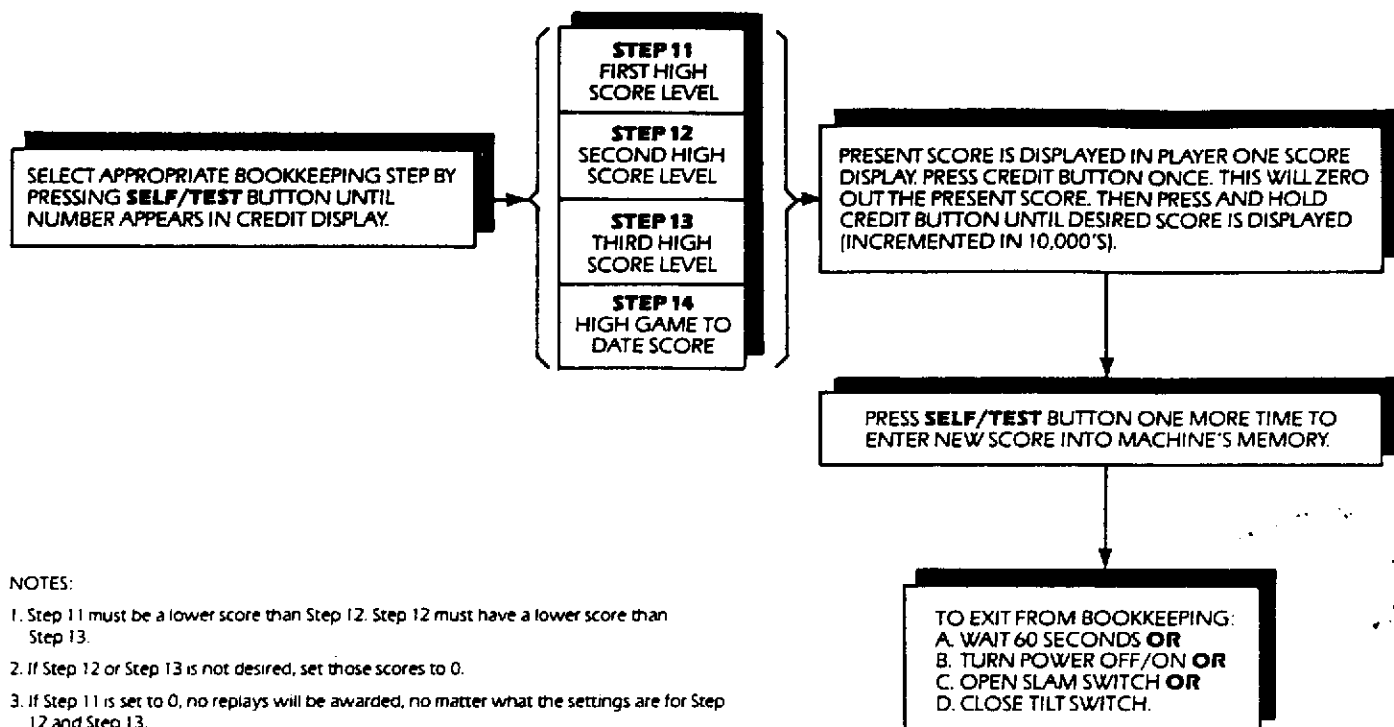
- Steps 16 through 20 are SELF-TEST or game tests the operator can use for quick troubleshooting.
- All the tests are explained in the flow chart (Section VII, D).
- Each test can be repeated by pressing the replay button on the front door. This starts the test for another 60 seconds.
- If the SELF-TEST button or the replay button is not pressed within 60 seconds, the game will return to the attract mode.

C. FLOW CHART



VII. BOOKKEEPING AND SELF TEST

D. HOW TO RESET HIGH SCORE LEVELS OR HIGH GAME TO DATE SCORES



VIII. OPTIONS

A. ELECTRO-MECHANICAL COIN COUNTERS

Electro-mechanical coin counters may be installed on the fuse panel, located inside the cabinet below right-hand flipper switches. Solder lugs are provided which will connect the counters to the electronic circuitry.

1. Position the counter and secure it to the Fuse Panel. Mounting holes are spotted for most standard 24-volt counters.

2. CAUTION: A IN4004 diode must be connected across each counter with the cathode lead connected to the solder lug with the RED-BLACK-BLACK wire.
3. Connect one counter lead to each of the two solder lugs provided for each counter.
4. The counter should increment once when the respective coin chute switch is closed.

IX. GENERAL INFORMATION

A. PRINTED CIRCUIT BOARDS ARE DESIGNATED AS FOLLOWS:

- A1 ___ Control Board
- A2 ___ Power Supply
- A3 ___ Driver Board
- A4 ___ Score Displays (5)
- A5 ___ Status Display
- A6 ___ Sound/Speech Board
- A7 ___ Sound/Speech Power Supply
- A8 ___ Pop Bumper Driver Boards (6)
- A11 ___ Auxiliary Lamp Driver Board —
Lightbox

Printed circuit board connectors will be labeled AX-JX. For example, A3-J4 is the connector J4 on the driver board (A3).

B. WIRE COLORS ARE SHOWN AS NUMBERS:

- 0 Black
- 1 Brown
- 2 Red
- 3 Orange
- 4 Yellow
- 5 Green
- 6 Blue
- 7 Purple
- 8 Slate
- 9 White

For example, 688 is a BLUE-SLATE-SLATE striped wire.

C. FUSES

FUSE PANEL

F1	Sound/Speech Power Supply 12VAC	½ Amp SLO-BLO
F2	Power Supply 10VAC	5 Amp SLO-BLO
F3	Displays 60VAC	¼ Amp SLO-BLO
F4	Solenoids 25VAC	8 Amp SLO-BLO
F5	Controlled Lamps 8VAC	10 Amp
F6	Playboard Illumination 6.3VAC	10 Amp SLO-BLO
F7	Lightbox 6.3VAC	15 Amp SLO-BLO
F8	Sound/Speech Power Supply 24VDC	1 Amp SLO-BLO

NOTE: F8 is not used in foreign games

IX. GENERAL INFORMATION

C. FUSES (cont.)

UPPER PLAYFIELD FUSES

F10	Right Pop Bumper 38VDC	2½ Amp SLO-BLO
F11	Bottom Left Pop Bumper 38VDC	2½ Amp SLO-BLO
F12	Upper Center Pop Bumper 38VDC	2½ Amp SLO-BLO
F13	Lower Center Pop Bumper 38VDC	2½ Amp SLO-BLO
F14	Five Drop Target Bank 24VDC Four Drop Target Bank 24VDC	2 Amp SLO-BLO
F15	Outhole, Hole Kicker 24VDC	1 Amp SLO-BLO
F16	Trough Ball Gate 24VDC	1 Amp SLO-BLO

LOWER PLAYFIELD FUSES

F17	Kicker (to upper playfield) 24VDC	6¼ Amp SLO-BLO
F18	Four Drop Target Bank 24VDC	2 Amp SLO-BLO
F19	Ball Return Gate 24VDC	1 Amp SLO-BLO
F20	3-Position Drop Target Bank, 24VDC Bank, Hole Kicker	1 Amp SLO-BLO
F21	Right Pop Bumper 24VDC	2 Amp SLO-BLO
F22	Center Pop Bumper 24VDC	2 Amp SLO-BLO

IX. GENERAL INFORMATION

D. COIL CHART

SOLENOID COILS

PART NUMBER	GENERAL USAGE*	RESISTANCE (ohms)	NUMBER OF TURNS	WIRE GAUGE	WRAPPER COLOR
A-1496	KICKING RUBBERS POP BUMPERS	2.95	635	#23	Yellow
A-4893	POP BUMPERS BALL KICKER	2.1	535	#22	Red
A-5194	GONG	4.5	780	#24	Blue
A-5195	KNOCKER, HOLE KICKER	12.3	1305	#26	White
A-16570	HOLE KICKER, OUTHOLE	15.5	1450	#27	Green
A-17875	FLIPPERS	2.8/40.0	560/1100	#24/31	Yellow
A-17891	5 BANK RESET	3.35	850	#22	White
A-18102	3 BANK RESET, 7 BANK RESET USES 2	9.0	1430	#24	Red
A-18318	4 BANK RESET	6.7	1130	#24	Orange
A-19300	BALL KICKER	7.8	1075	#25	Orange
A-20095	SUPER FLIPPER	1.55/35.5	450/900	#22/31	Red

RELAY COILS

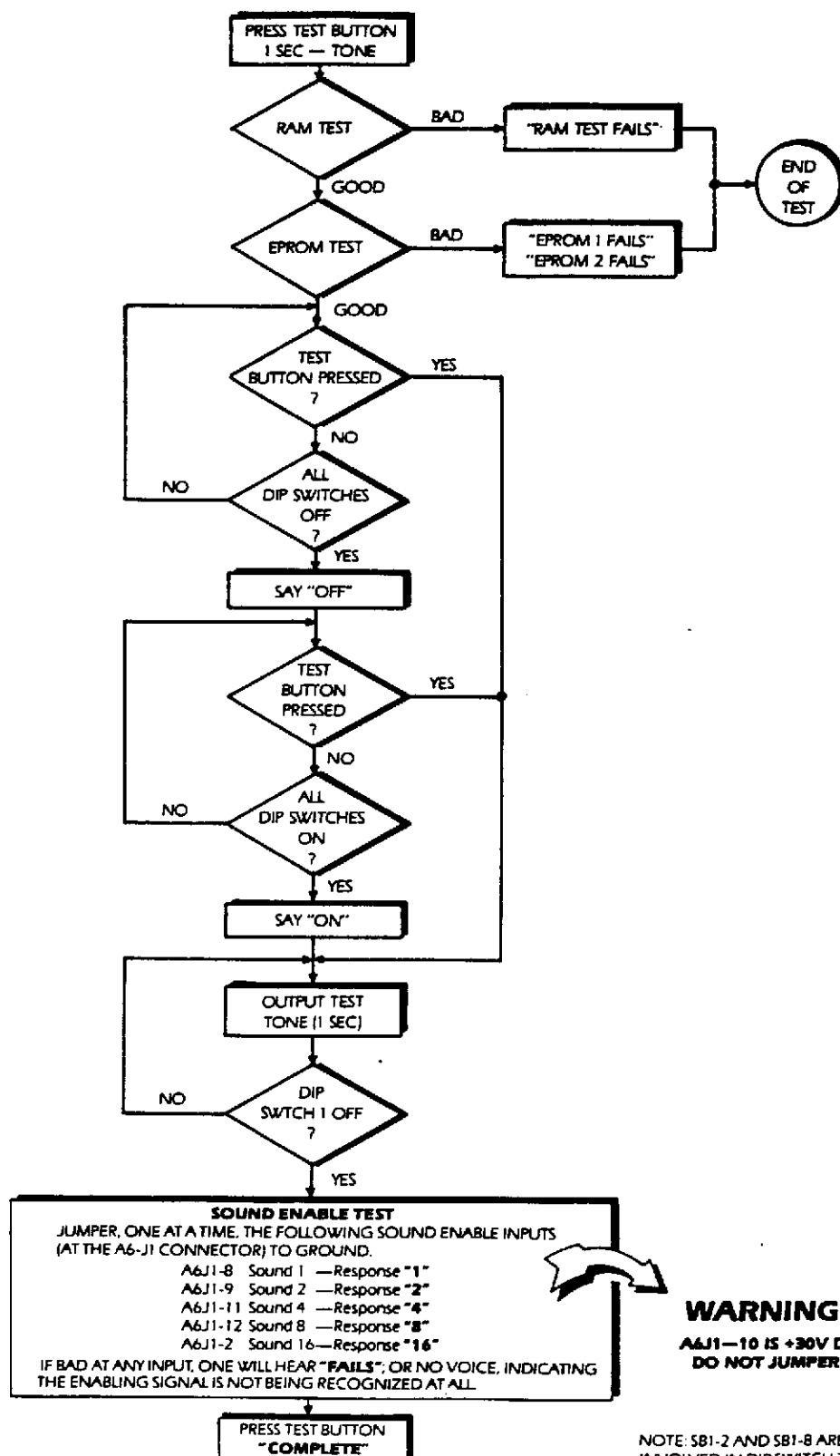
A-16890	O, T, AND COIN LOCKOUT RELAYS	231.0	4000	#35	Orange
A-17564 A-20558	GATE RELAY	156.0	3400	#34	White
A-18642	MEMORY/ DROP TARGETS	58.0	1590	#33	White

*Coils may vary from game to game. Check game manual for exact coil usage.

IX. GENERAL INFORMATION

E. SOUND/SPEECH BOARD (A6) TEST

1. Game must be in game over mode to initiate test.
2. Pressing the test button on the sound board will initiate the test.
3. The test must be completed to enable the sound board or game power must be turned on/off.
4. Words in bold print with quotation marks are the voice responses the sound board issues at specific points in the test.



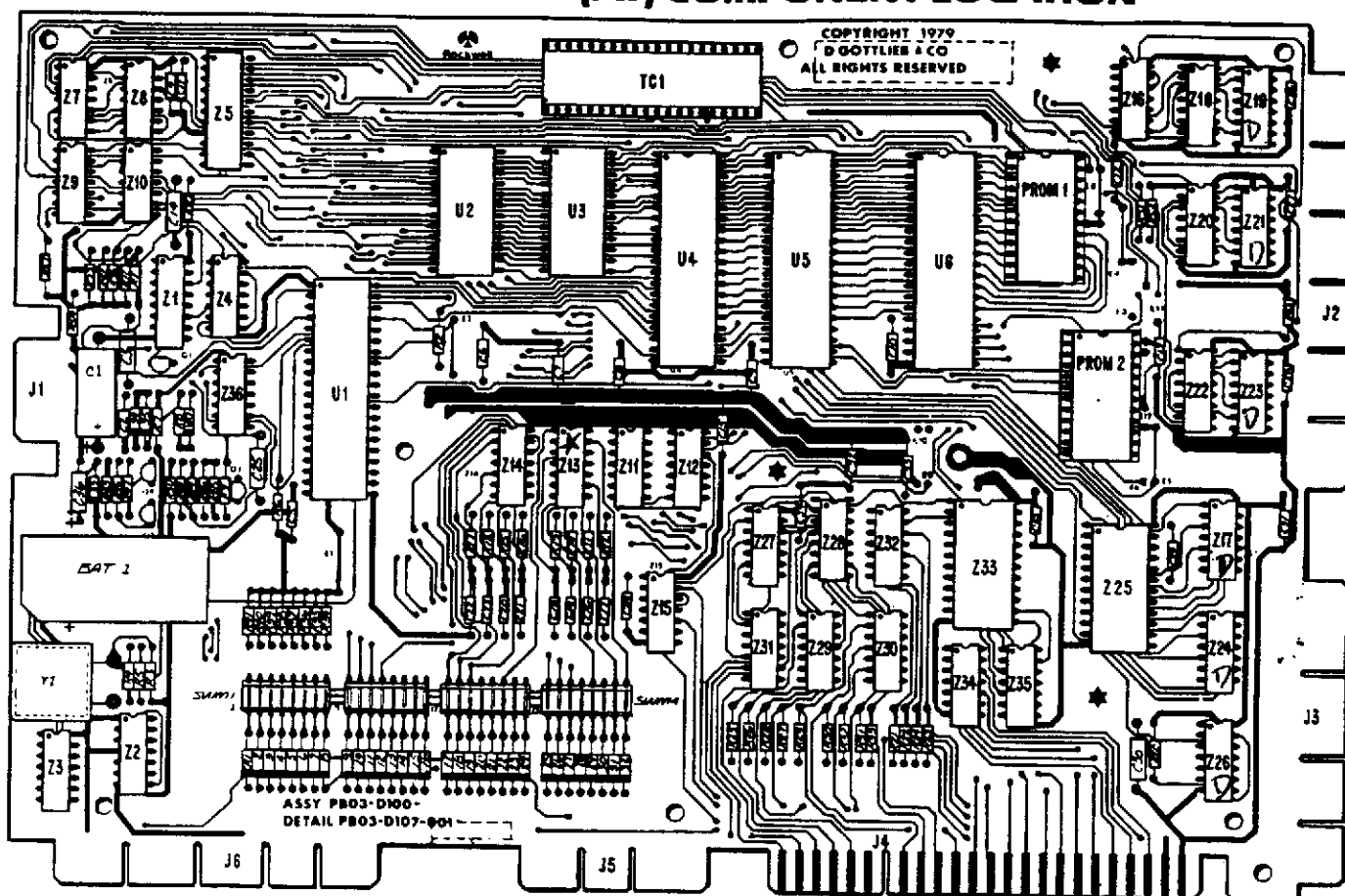
X. WIRING AND SCHEMATIC DIAGRAMS, PARTS LISTS

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X. WIRING AND SCHEMATIC DIAGRAMS, PARTS LISTS

CONTROL BOARD (A1) COMPONENT LOCATION

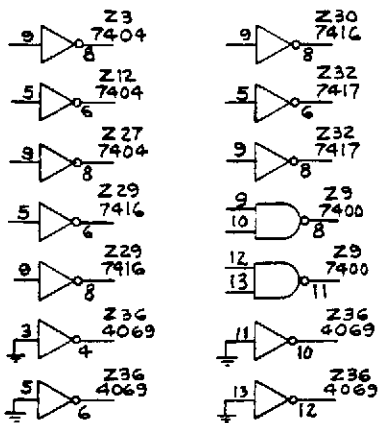


CONTROL BOARD (A1) PARTS LIST

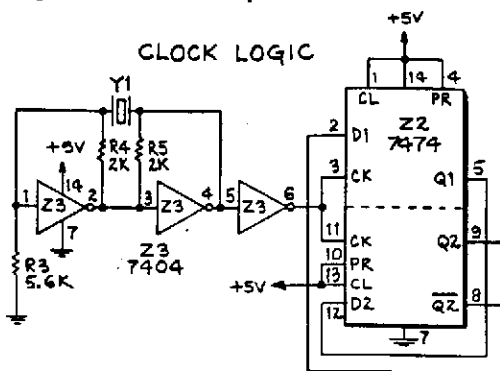
REFERENCE	DESCRIPTION	PART NUMBER	REFERENCE	DESCRIPTION	PART NUMBER
BAT.1	Battery—3.6V	326R10-002	U3	ROM	R3272-12
C1	Capacitor, 100 mfd., 10V.		U4, U5, U6	RIOT	R6532-18
C2,	Capacitor, .01 mfd., 50V		VR1	Zener Diode—3.0V, 5%	1N5225B or 1N5987B
C4-C13,					333R08-001
C15-C24,			Y1	Crystal, 3.579545 MHZ	SCL4528B
C26-C29,			Z1	IC—CMOS—Dual 1 Shot	SN7474N
C31-C35			Z2	IC—Dual Flip Flop	SN7404N
C3, C14,	Capacitor, .1 mfd., 50V		Z3, Z11,	IC—Hex Inverter	
C25, C30			Z12, Z16,		
CR1-CR35	Diode, GP	1N4148	Z17, Z24,		
Q1, Q4	Transistor—PNP	MPS-A70	Z26, Z27,		
Q2, Q3	Transistor, NPN (Motorola)	2N440	Z34, Z35		
R1, R6,	Resistor, 3.0K ohm, 5%, 1/4W		Z4	IC—CMOS—Quad 2 Input "AND"	SCL4081B
R11-R24,			Z5	IC—RAM/CMOS	P5101-L
R42, R45,			Z7	IC—Hex Inverter	SN74LS04N
R46, R48,			Z8	IC—2 Input "NOR"	SX7402N
R51-R57			Z9, Z13,	IC—2 Input "NAND"	SN7400N
R2,	Resistor, 4.7K ohm, 5%, 1/4W		Z14		
R34-R41			Z10	IC—Open Collector Inverter	SN74LS05N
R3, R43,	Resistor, 5.6K ohm, 5%, 1/4W		Z15	IC—2 Input—"OR"	SN7432N
R49			Z18, Z20	IC—"D" Flip Flop	SN74175N
R4, R5,	Resistor, 2.0K ohm, 5%, 1/4W		Z22		
R44			Z19, Z21,	IC—4 to 7 Decoder	SN7448N
R7	Resistor, 62 ohm, 5%, 1/4W		Z23		
R8, R50	Resistor, 180 ohm, 5%, 1/4W		Z25, Z33	IC—4 to 16 Decoder	SN74154N
R9	Resistor, 1K ohm, 5%, 1/4W		Z28	IC—2-to-4 Decoder	SN74LS139N
R10	Resistor, 2.8M ohm, 5%, 1/4W		Z29, Z30	IC—Hex Inverter—OC/T-V	SN7416N
R25-R33	Resistor, 620 ohm, 5%, 1/4W		Z31	IC—2 Input "AND"	SN7408N
R47	Resistor, 24K ohm, 5%, 1/4W		Z32	IC—Hex Buffer—OC	SN7417N
SW1-SW4	Dip Switch Pak—8 Position	341R31-005	Z36	IC—CMOS	MM74C04 or SCL4069B
TC1	Socket, 40 Pin	640379-3		Socket—DIL, 24 PIN	640361-3
U1	CPU	R6502-13		Spacer, Cork	131R06-001
U2	ROM	R3273-12			

NOTE: UNLESS OTHERWISE INDICATED;
 1. RESISTORS ARE $\pm 5\%$, 1/4W.
 2. CAPACITORS ARE .01UF, 50V.
 3. DIODES ARE TYPE 1N4148.
 4. REF. DESIGNATION Z6 NOT USED.

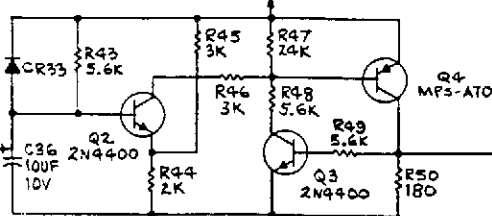
SPARE GATES



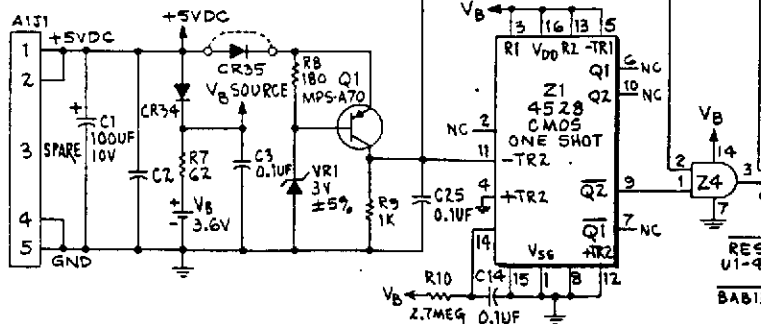
CLOCK LOGIC



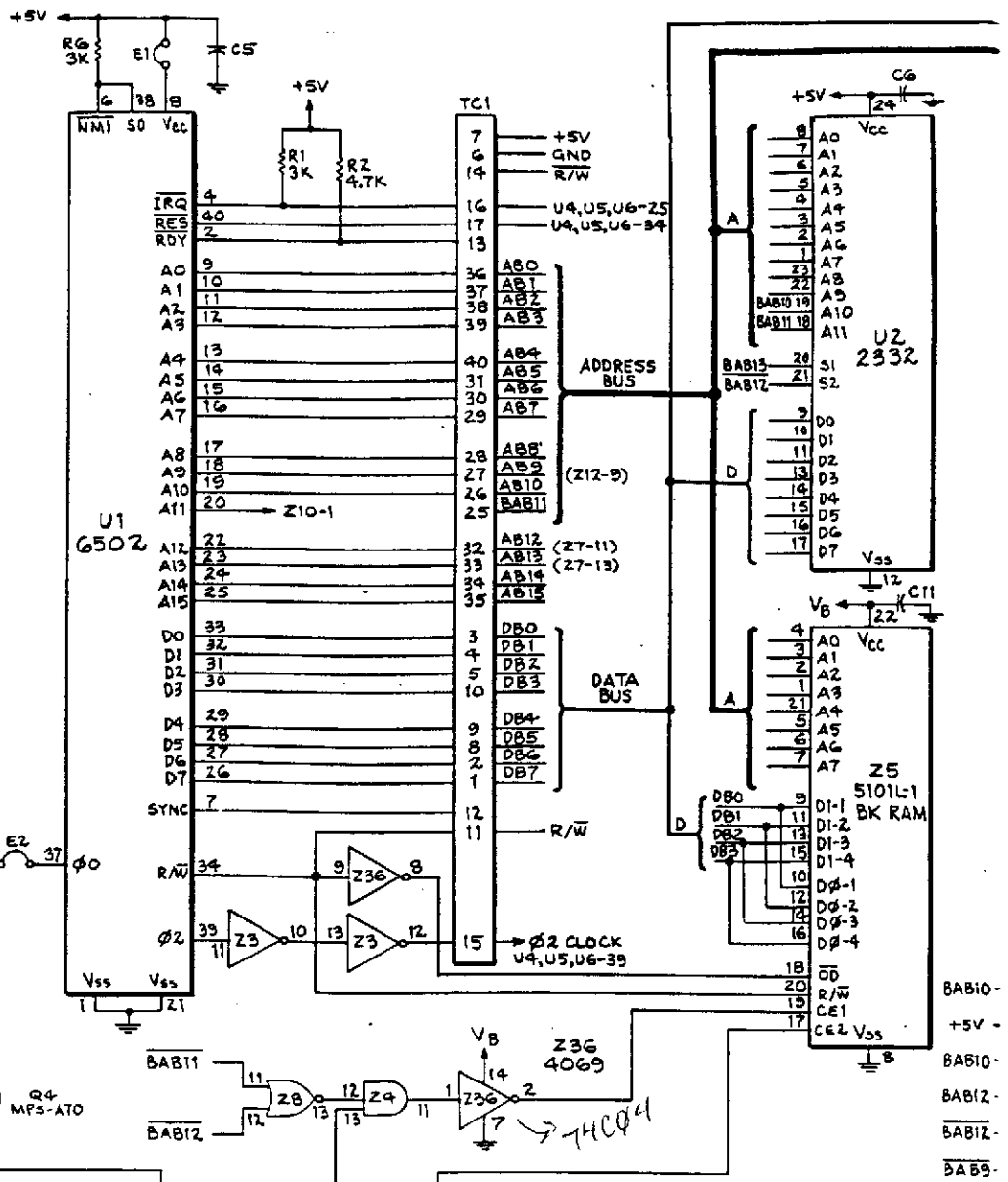
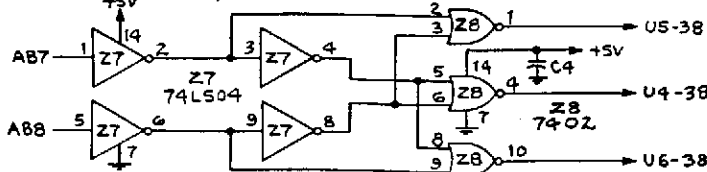
DELAY CIRCUIT



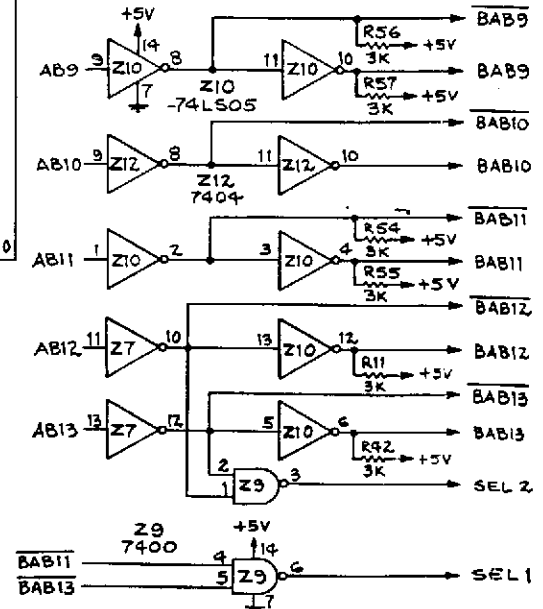
UP/DOWN MEMORY PROTECT LOGIC



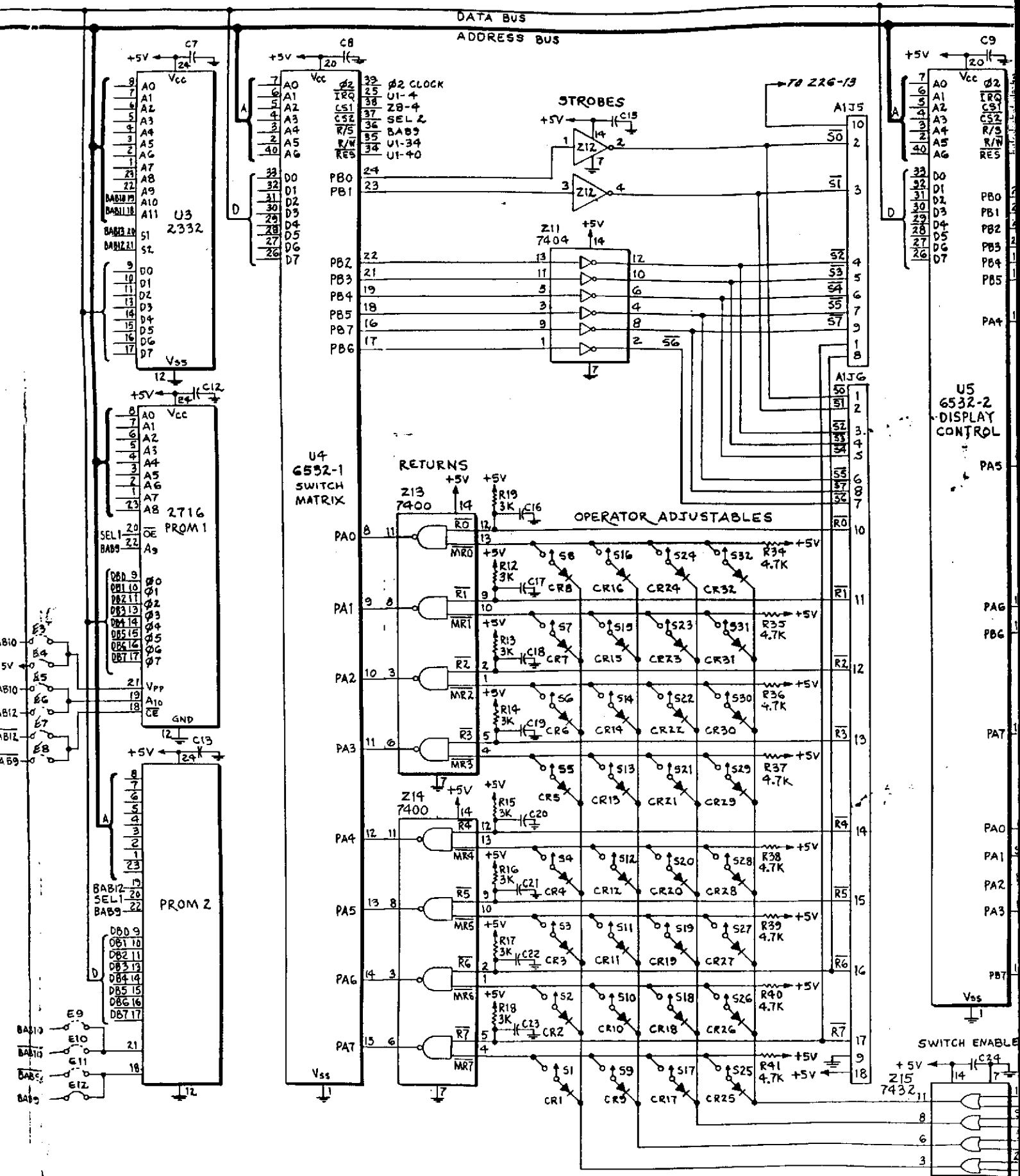
INPUT/OUTPUT DEVICE SELECTION

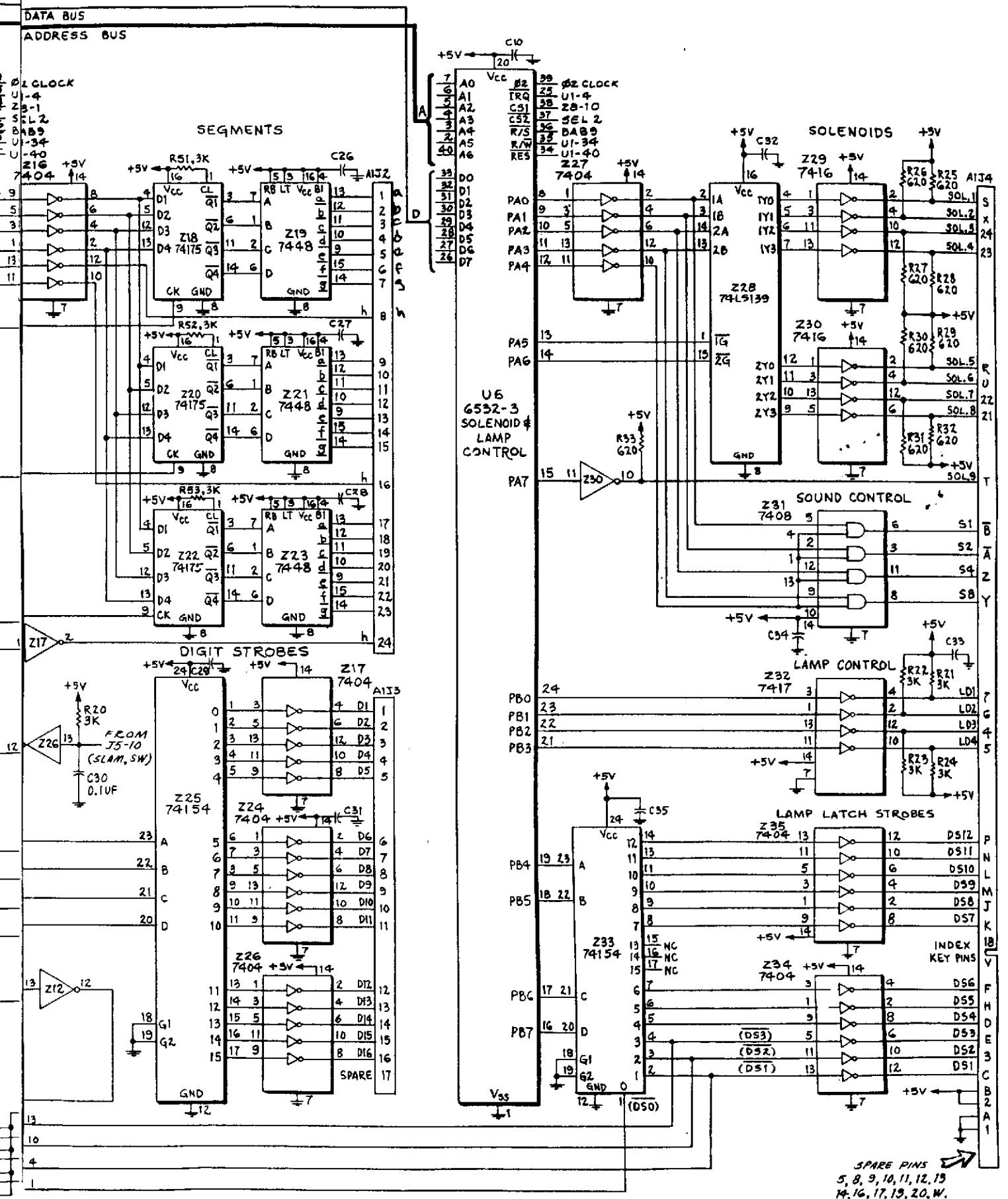


PROM SELECTION

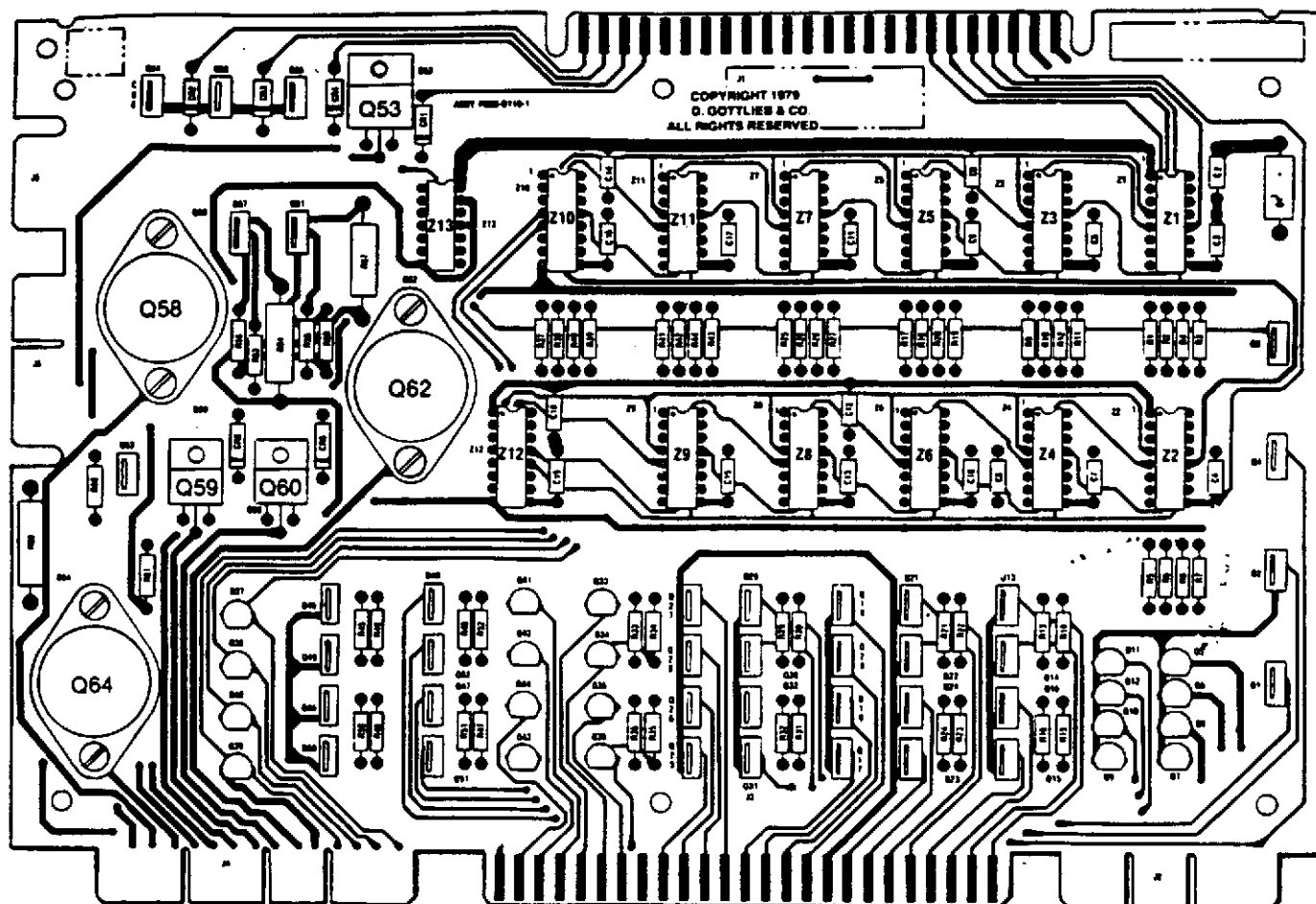


X. WIRING AND SCHEMATIC DIAGRAMS, PARTS LISTS





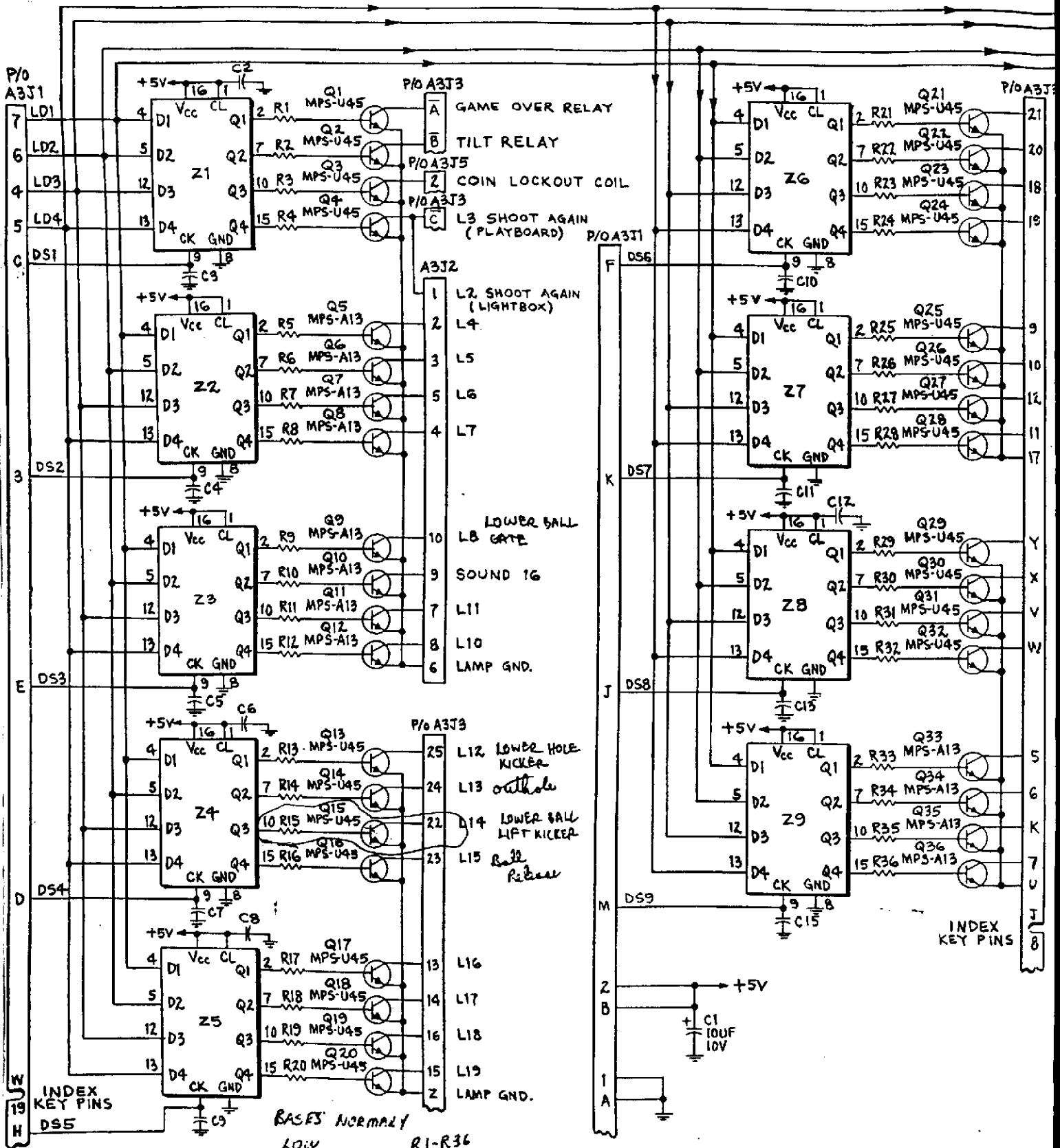
DRIVER BOARD (A3) COMPONENT LOCATION



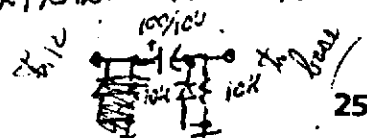
DRIVER BOARD (A3) PARTS LIST

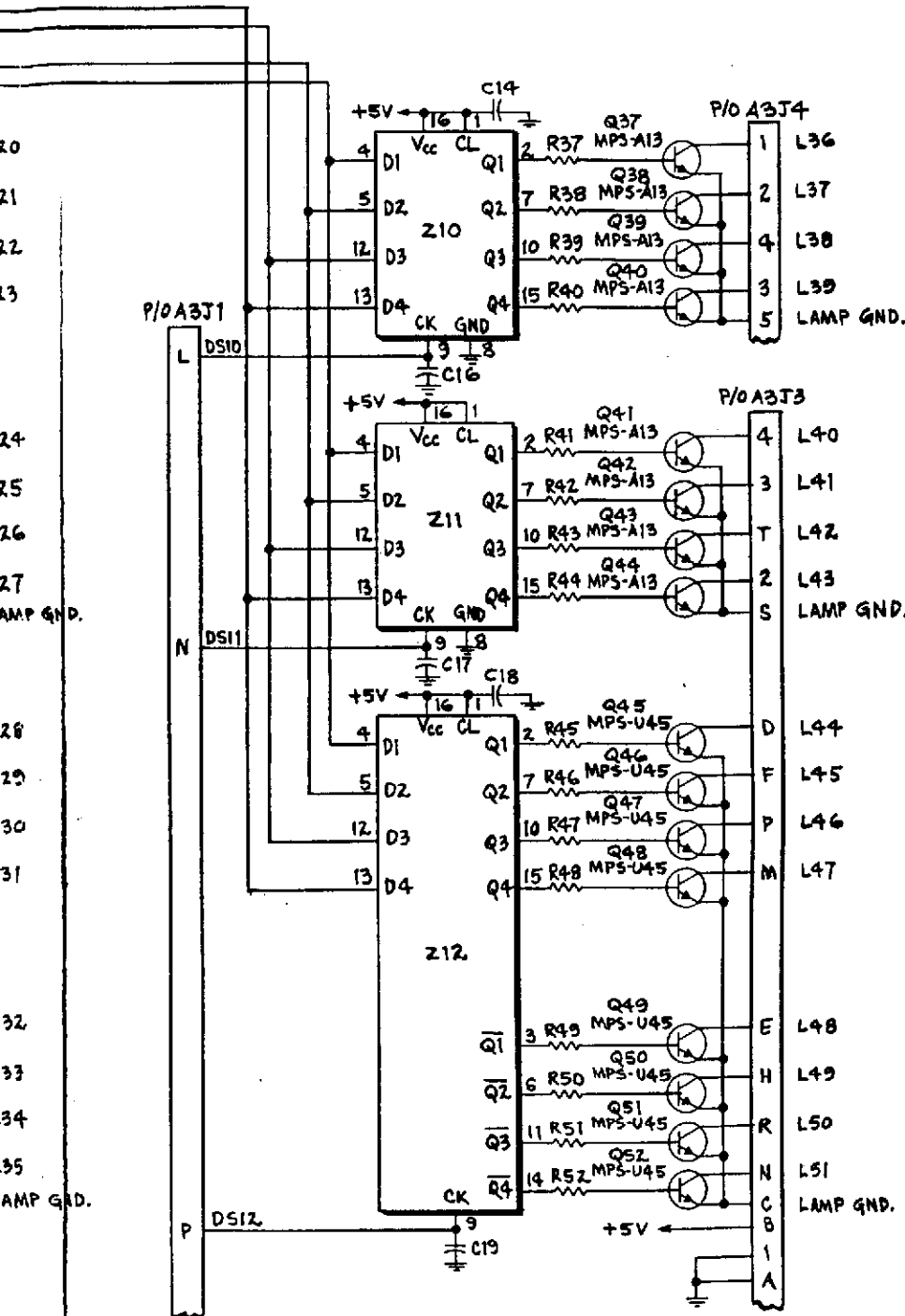
REFERENCE	DESCRIPTION	PART NUMBER
C1	Capacitor, 10 mfd., 10V— Tantalum	
C2-C19	Capacitor, .01 mfd., 50V	
CR1-CR6	Diode—Silicon	1N4148
R1-R53, R61, R55, R56, R58, R59	Resistor, 1000 ohm, 5%, 1/4W	
R54, R57, R60	Resistor, 9.1 ohm, 5%, 1W	
Q1-Q4, Q13-Q32, Q45-Q52, Q54-Q57, Q63	Transistor, NPN, Darlington	MPS-L45
Q5-Q12, Q33-Q44	Transistor, NPN, Darlington	MPS-A13
Q53, Q59, Q60	Transistor, NPN, Darlington	2N6043
Q58, Q62, Q64	Transistor, NPN	2N3055
Z1-Z12	I.C. Quad "D" Latch Flip Flop	SN74175N
Z13	I.C. Hex Inverter	SN7404N
	Insulator—Thermalloy	43-03-4

X. WIRING AND SCHEM

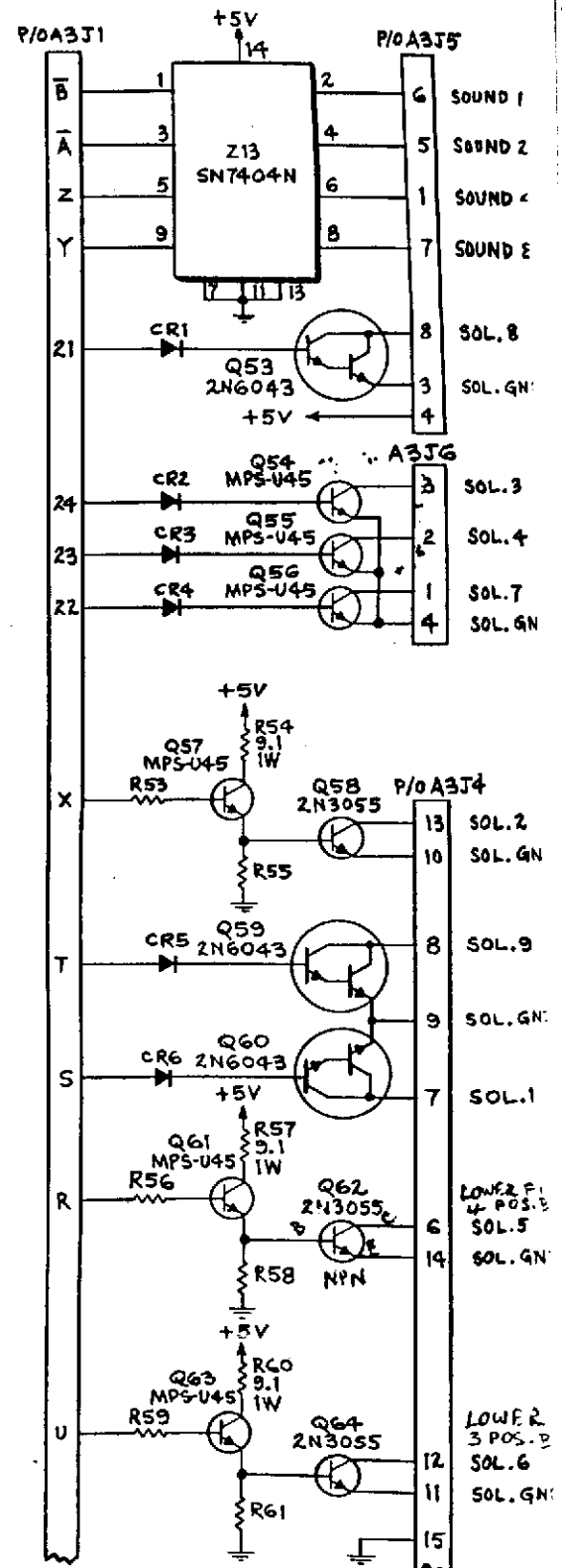


REPLACE R1-R36 (IF SOLID STATE COOK)



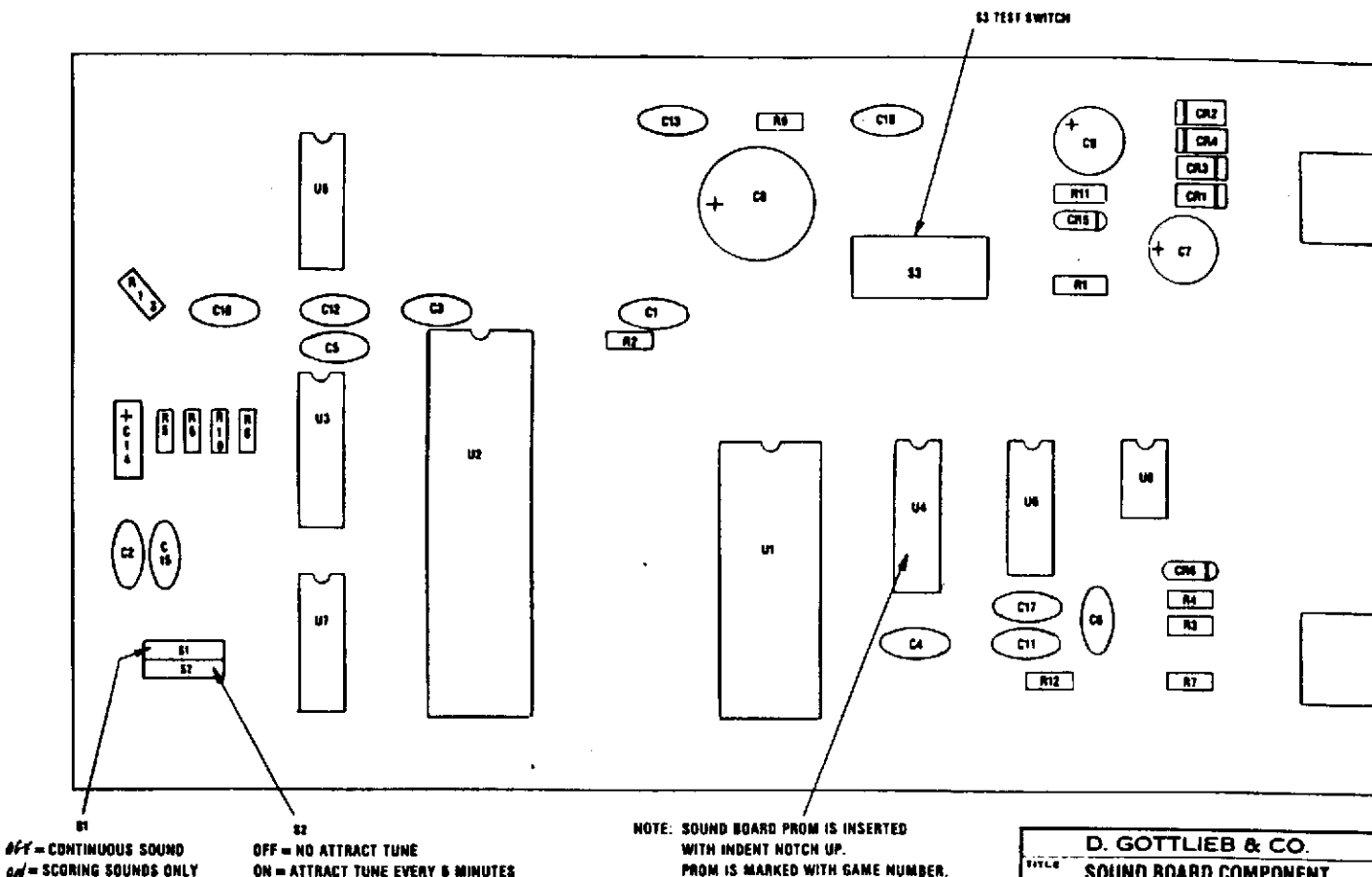


NOTE: UNLESS OTHERWISE SPECIFIED;
 1. RESISTORS ARE 1.0K, $\pm 5\%$, 1/4W.
 2. CAPACITORS ARE .01UF, 20%, 50V.
 3. DIODES ARE TYPE IN414B.
 4. INTEGRATED CIRCUITS ARE SN74175N.
 5. TRANSISTOR TYPES MPS-A13 AND MPS-U45 ARE NPN DARLINGTONS.



D. GOTTLIEB & CO.			
TITLE			
DRIVER BOARD (A3)			
SYSTEM 80			
USED ON	DATE	APPROVED	DATE
16-82	RAM	12-12-80	E-20915

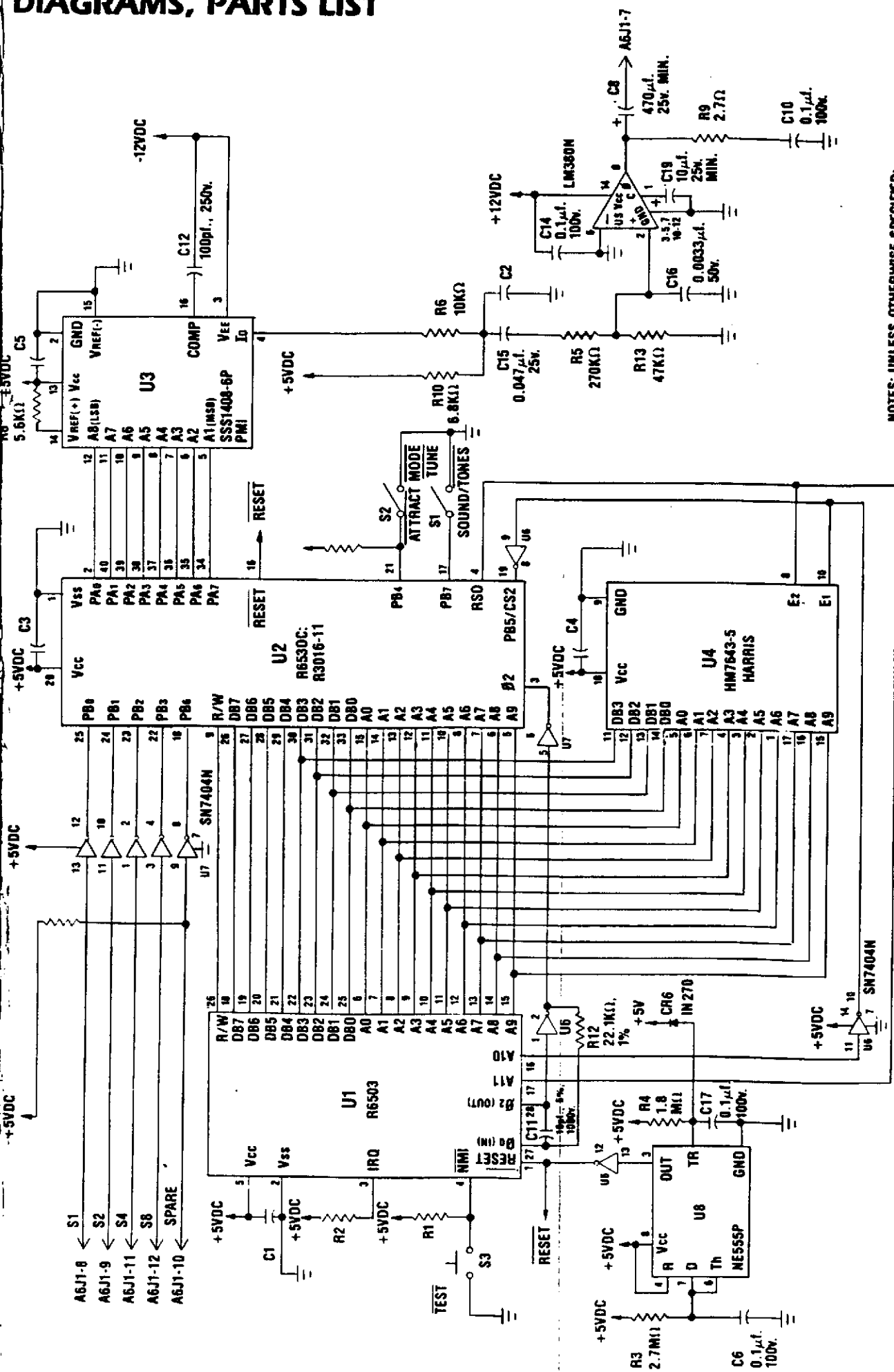
SOUND BOARD (A6) COMPONENT LOCATION



SOUND BOARD (A6) PARTS LIST

REFERENCE	DESCRIPTION	PART NUMBER	REFERENCE	DESCRIPTION	PART NUMBER
A1, R2, R7	RESISTOR—2.7K Ω , 1/4W, 5%		C15	CAPACITOR—0.047 MICROFARAD, 25V, 20%	
R9	RESISTOR—2.7 Ω , 1/4W, 5%		C16	CAPACITOR—0.0033 MICROFARAD, 50V, 20%	
A10	RESISTOR—6.8K Ω , 1/4W, 5%		C14	CAPACITOR—10 MICROFARAD, 25V	
R11	RESISTOR—430 Ω , 1/2W, 5%		U1	IC—CPU	R6503
R3	RESISTOR—2.7M Ω , 1/4W, 5%		U2	IC—ROM/RAM/I/O	R6530C:R3016-11
R4	RESISTOR—1.8M Ω , 1/4W, 5%		U3	IC—DAC	SSS1408-6P
A12	RESISTOR—22.1K Ω , 1/4W, 1%		U4	IC—PROM	HM7643-5
R6	RESISTOR—10K Ω , 1/4W, 5%		U8	IC—TIMER	NE555P
A8	RESISTOR—5.6K Ω , 1/4W, 5%		U6, U7	IC—INVERTER	SN7404N
R5	RESISTOR—270K Ω , 1/4W, 5%		U5	IC—AMPLIFIER	LM380N
A13	RESISTOR—47K Ω , 1/4W, 5%		CR1, CR4	DIODE	1N4004
C1, C5	CAPACITOR—0.01 MICROFARAD, 100V, 20%—KEMET		CR5	ZENER DIODE—12V, 1W, 5%	1N4742A
C1, C9	CAPACITOR—47 MICROFARAD, 25V		CR6	DIODE	1N270
C8	CAPACITOR—470 MICROFARAD, 25V		S1, S2	2 POSITION DIP SWITCH	765802
C6, C10, C13, C17	CAPACITOR—0.1 MICROFARAD, 100V, 20%—KEMET		S3	PUSH BUTTON SWITCH	EVO-PAR-11K
C11	CAPACITOR—10 PICOFARAD, 1000V, 5%		PROM SOCKET	SOCKET, 18 PIN	640359-1
C12	CAPACITOR—100 PICOFARAD, 250V, 20%				

DIAGRAMS, PARTS LIST



NOTES: UNLESS OTHERWISE SPECIFIED:

- 1. ALL RESISTORS ARE 2.7KΩ, ± 5%, 1/4W.
- 2. ALL CAPACITORS ARE 0.01μf., 20%, 100V.
- 3. ALL DIODES ARE 1N4004

D. GOTTlieb & CO.		
TITLE	SOUND BOARD	
USED ON	SCHEMATIC	
DRAWN	APPROVED	DATE
		C-19691

SYSTEM 80 SOUND CIRCUITRY

When the System 80 Sound/Speech Board is to be replaced by the Sound Board, the System 80's circuitry must be altered in the following manner:

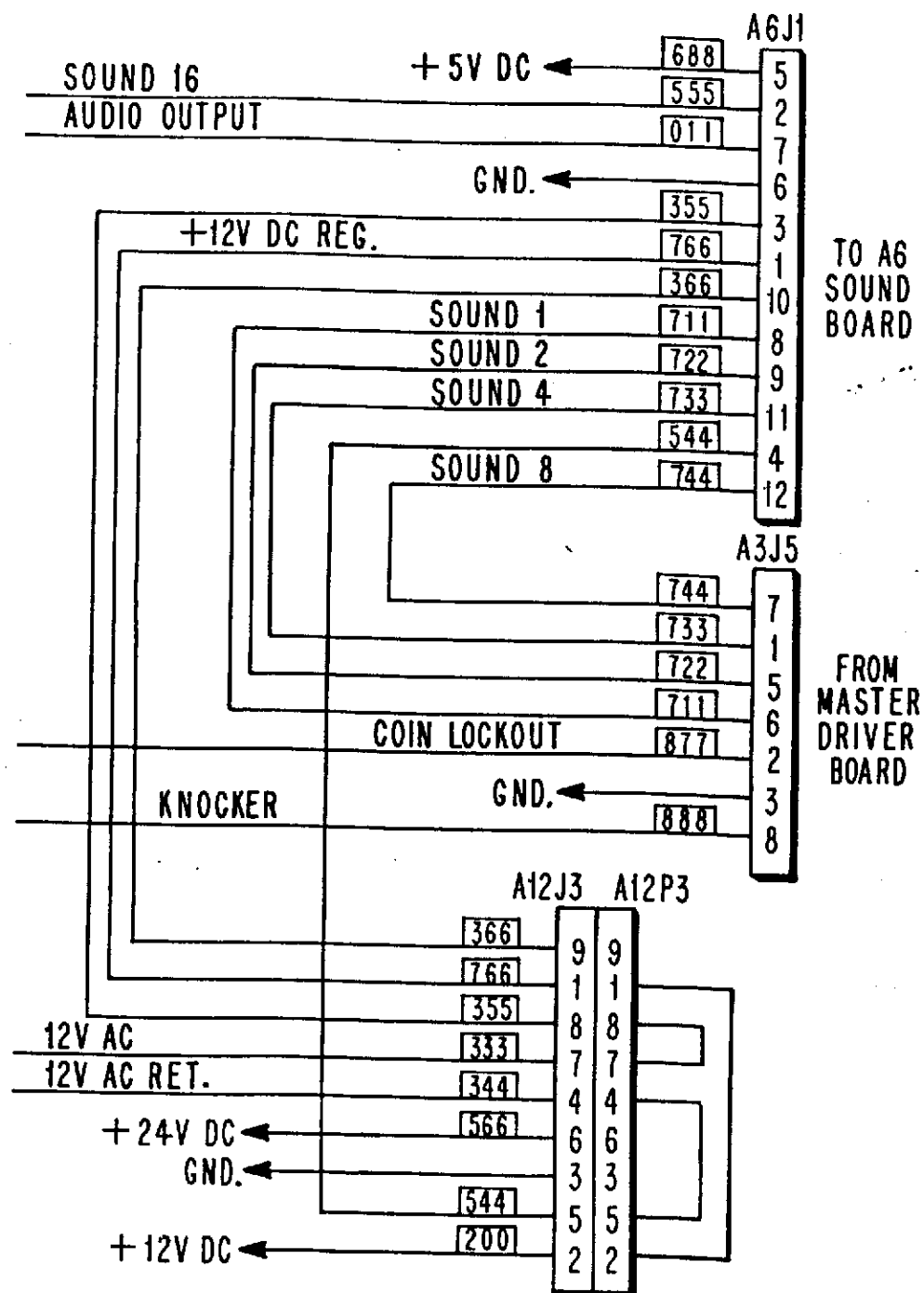
1. The Sound Speech Board is removed from its connector A6J1.
2. The Sound Board (A6) is then installed in the same connector (A6J1) vacated by the sound/speech board in step one.
3. The Sound/Speech Power Supply Board, A7, is removed from its connector, A12J3.
4. The female connector A12J3, and its male connector A12P3, are then connected.

In doing so 12VDC, 12VAC and a return for the 12VAC return will be available for use by the Sound Board.

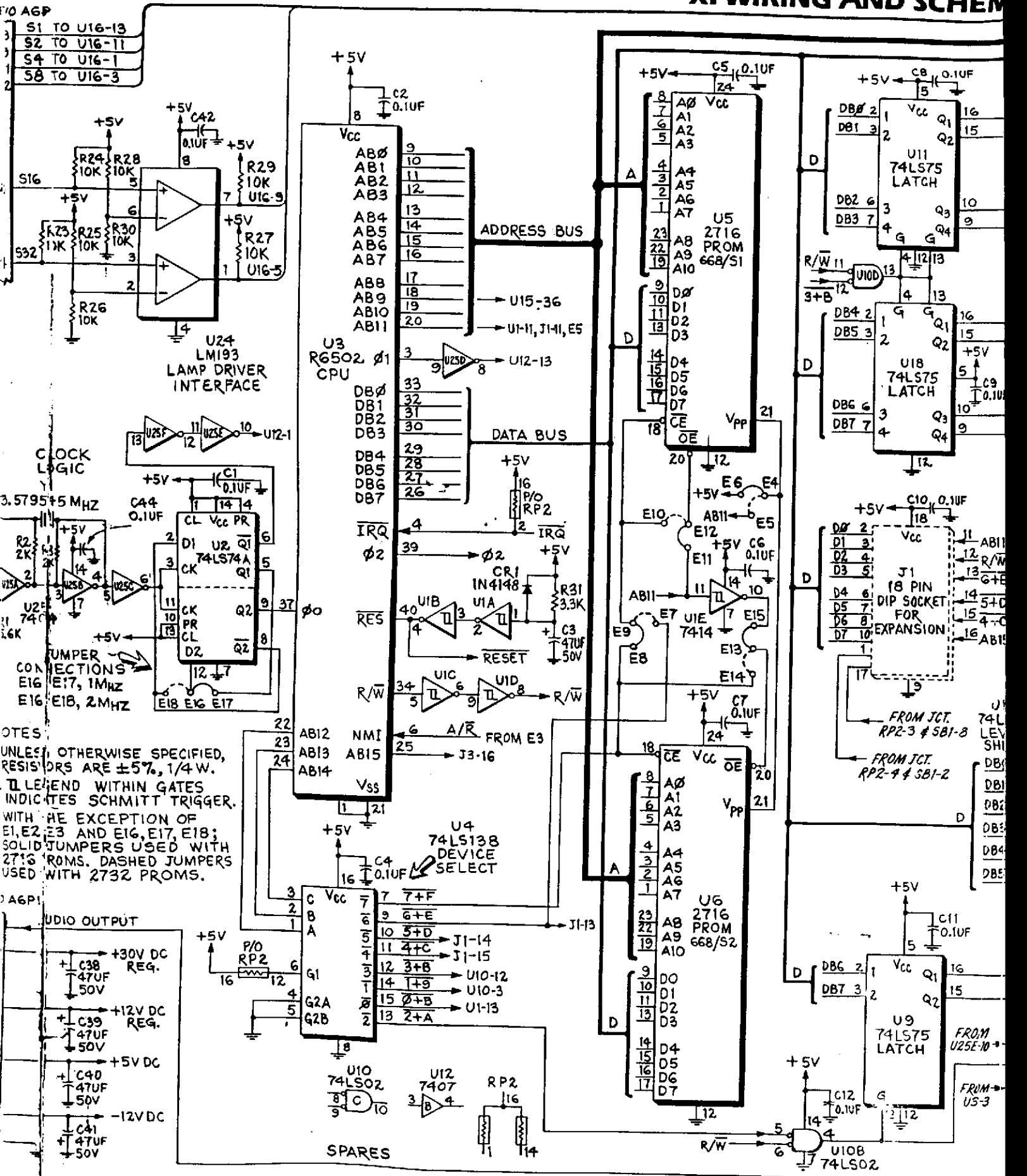
5. Once this procedure has been completed power can be safely applied to the game and the Sound Board.

WARNING:

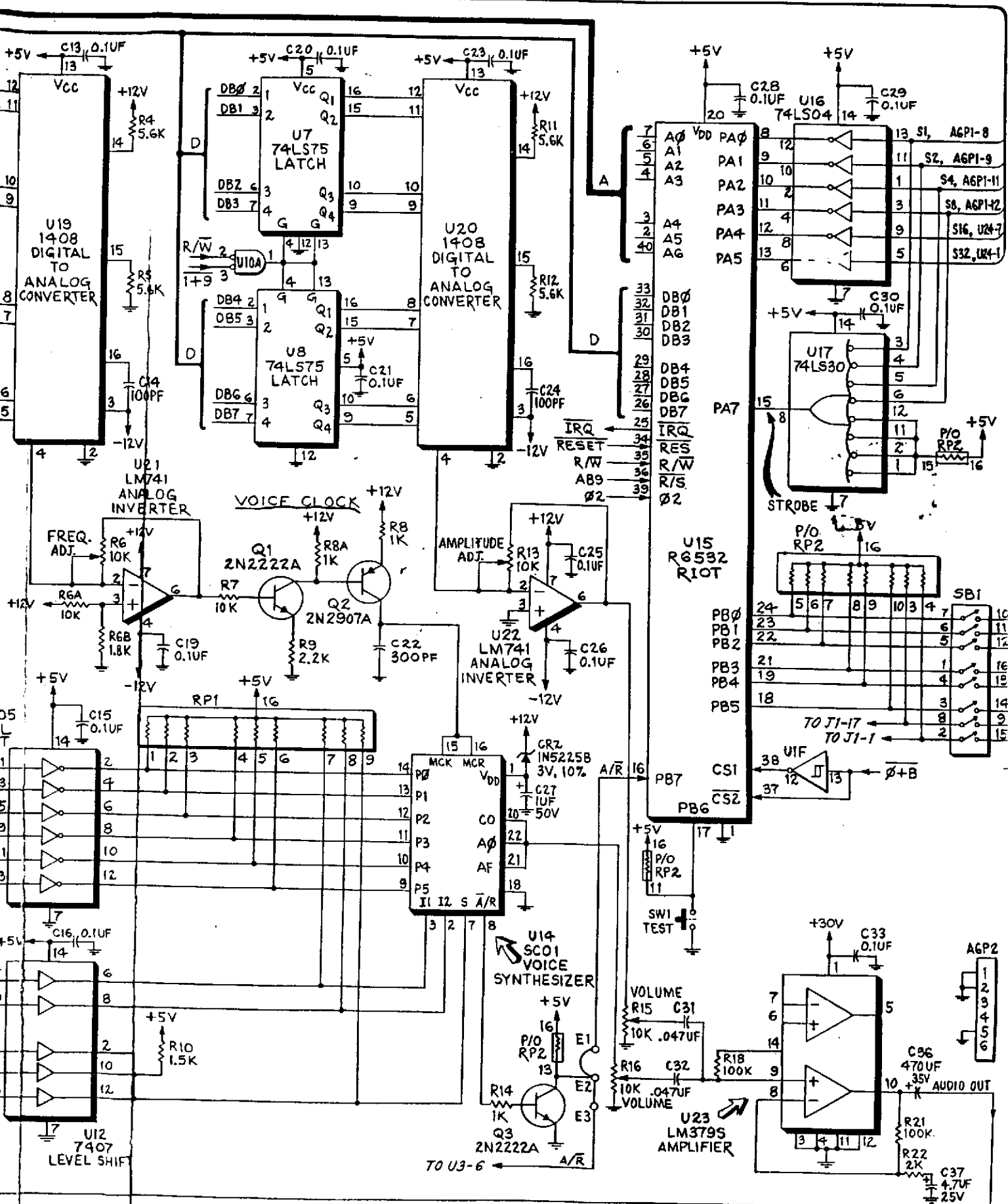
THESE BOARDS ARE NOT INTERCHANGEABLE. INSTALLING ONE OF THESE BOARDS IN A GAME WHICH DOES NOT HAVE THE PROPER CIRCUITRY WILL SEVERELY DAMAGE THAT BOARD.



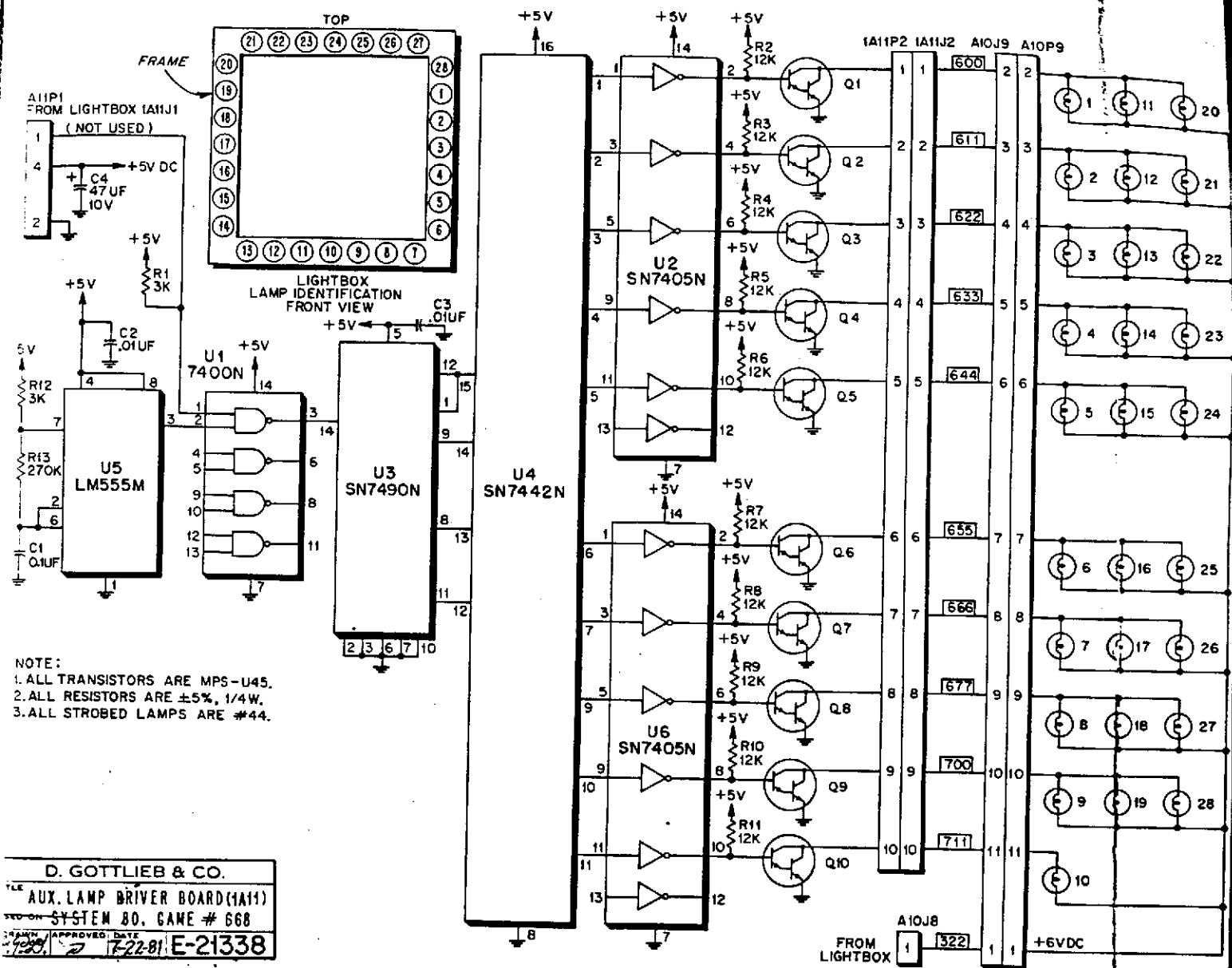
X. WIRING AND SCHEM



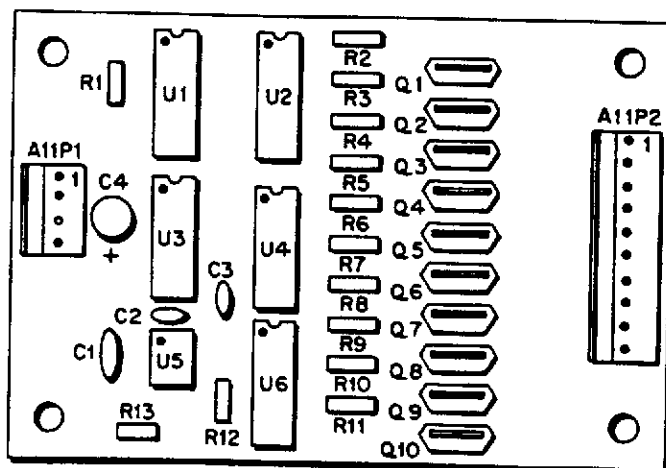
ATIC DIAGRAMS, PARTS LISTS



X. WIRING AND SCHEMATIC DIAGRAMS, PARTS LISTS



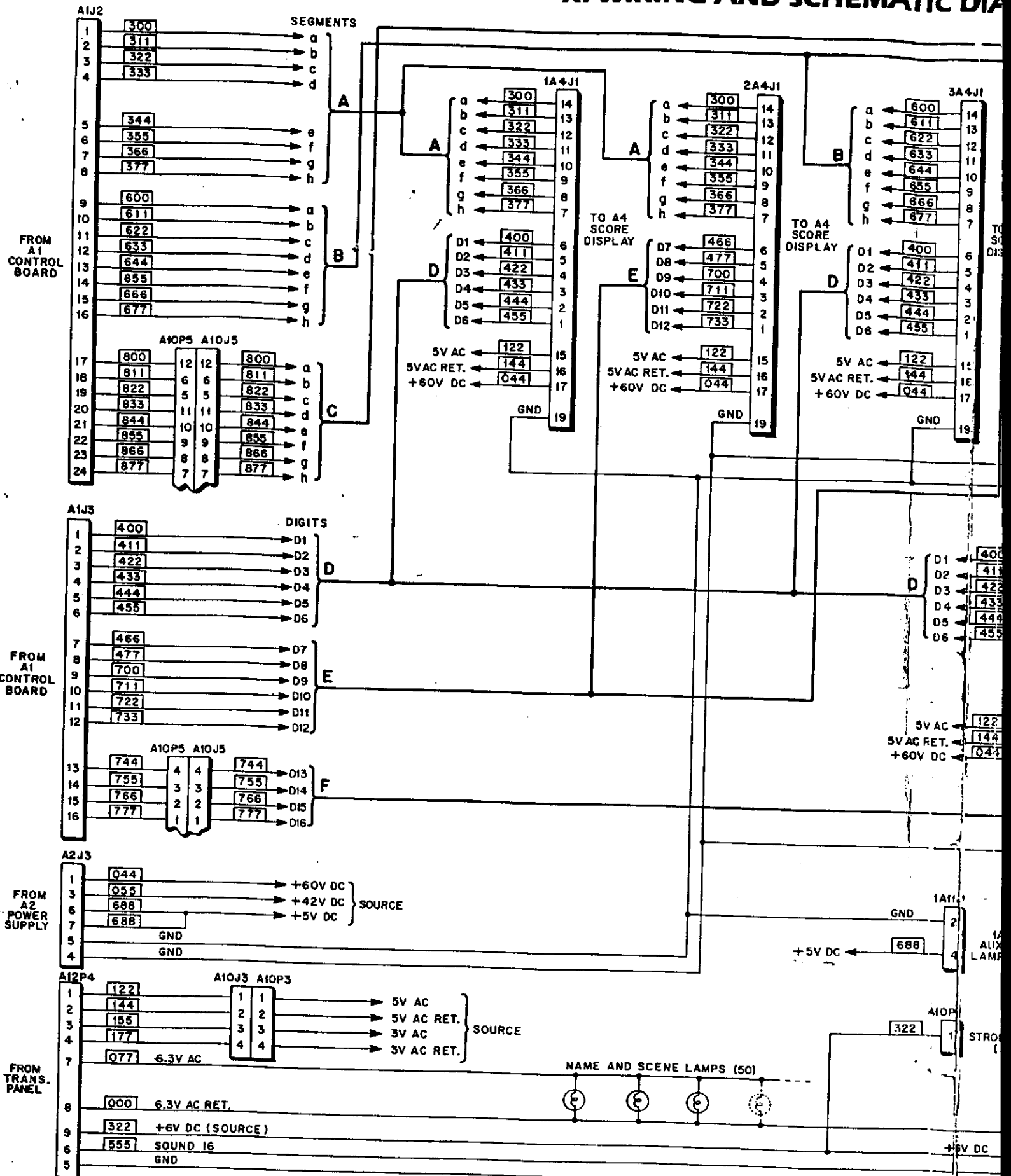
AUXILIARY LAMP DRIVER BOARD (A11) COMPONENT LOCATION



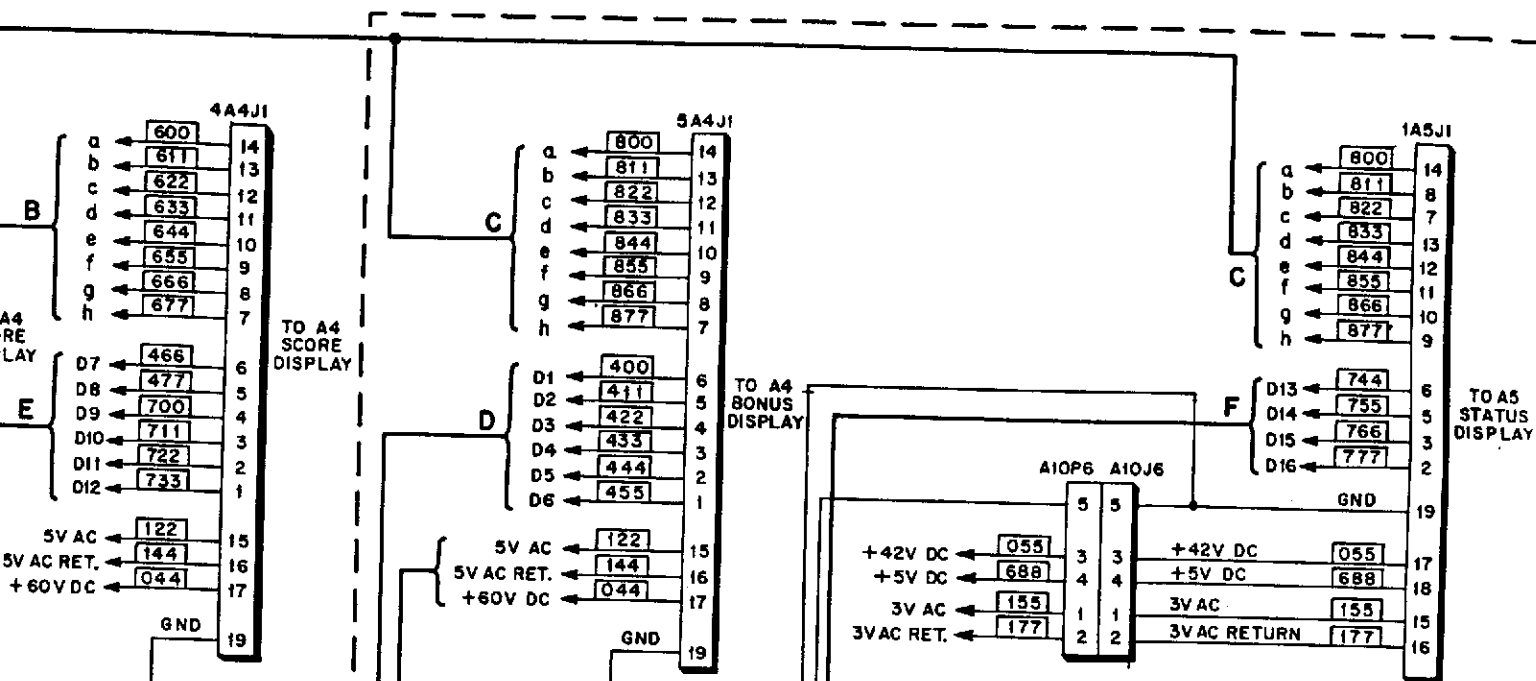
AUXILIARY LAMP DRIVER BOARD (A11) PARTS LIST

REFERENCE	DESCRIPTION	PART NUMBER
C1	CAPACITOR, .1 MFD, 100V	
C2-C3	CERAMIC RADIAL LEAD CAPACITOR, .01 MFD, 100V	
C4	RADIAL LEAD CAPACITOR, 47 MFD, 10V	
Q1-Q10	ELECTROLYTIC RADIAL LEAD TRANSISTOR, NPN DARLINGTON	MPS-U45
R1, R12	RESISTOR, 3K OHM, 5%, 1/4 W	
R2-R11	RESISTOR, 12K OHM, 5%, 1/4 W	
R13	RESISTOR, 270K OHM, 5%, 1/4 W	
U1	I.C. 2-INPUT NAND	SN7400N
U2, U6	I.C. INVERTER	SN7405N
U3	I.C. DECADE COUNTER	SN7490N
U4	I.C. DECODER	SN7442N
U5	I.C. TIMER	LM555N
P2	10 POS. SQUARE WIRE FRICTION LOCK CONNECTOR	
P1	4 POS. SQUARE WIRE FRICTION LOCK CONNECTOR	

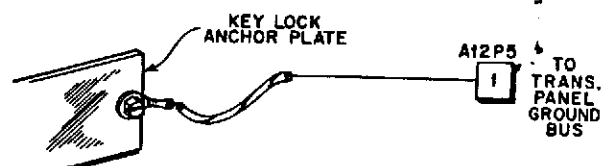
X. WIRING AND SCHEMATIC DIA



GRAMS, PARTS LISTS

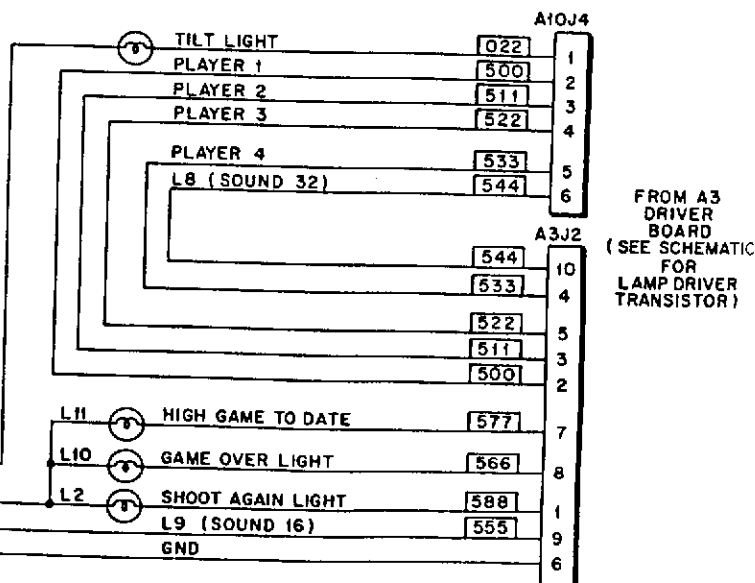
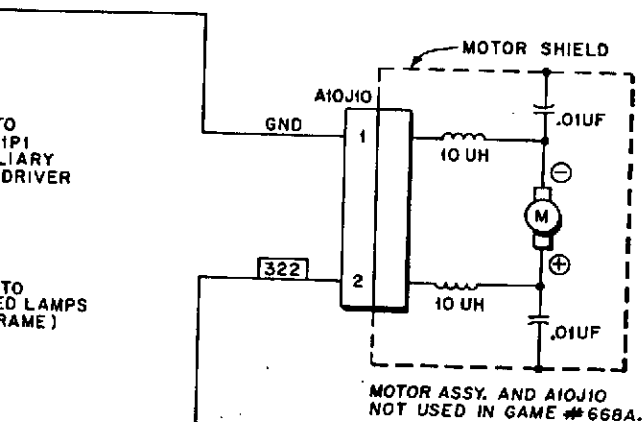
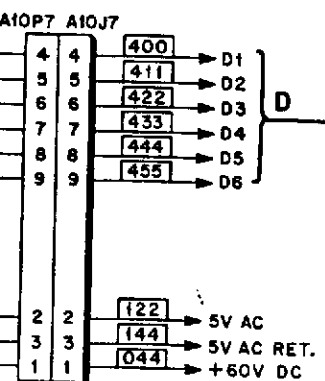


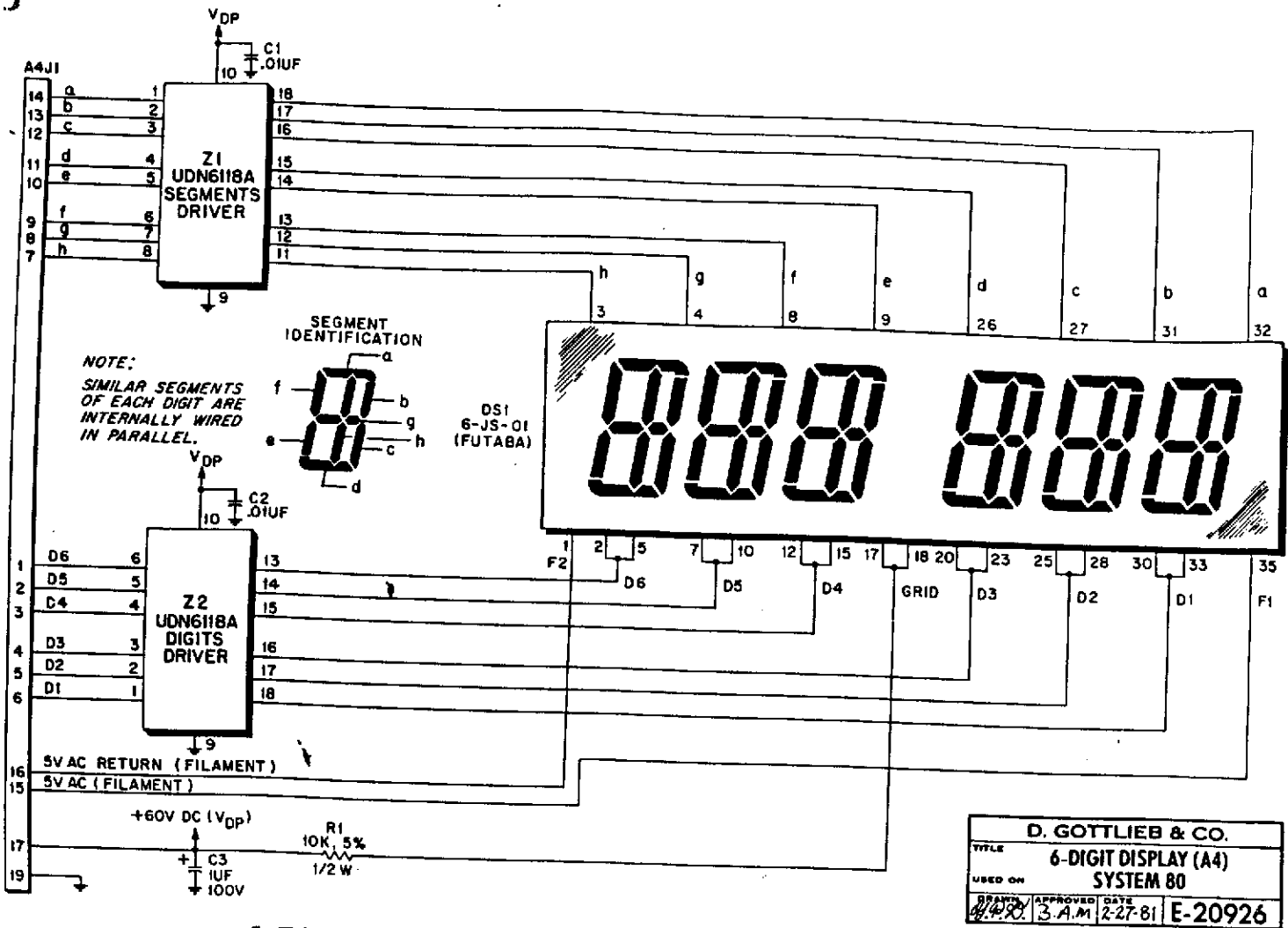
LOCATED ON UPPER PLAYFIELD



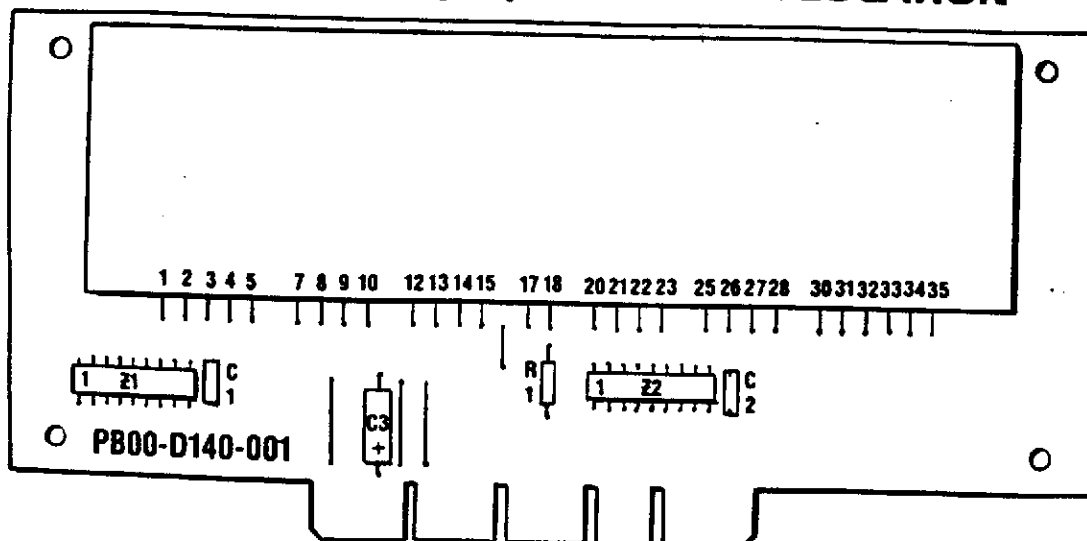
COLOR CODE			
0	BLACK	5	GREEN
1	BROWN	6	BLUE
2	RED	7	PURPLE
3	ORANGE	8	SLATE
4	YELLOW	9	WHITE

- NOTE:
1. NAME AND SCENE LAMPS ARE #44 OR #455 FLASHING.
 2. [XXX] INDICATES WIRE COLOR.
 3. GROUND WIRE COLOR IS 54, 18 GA.





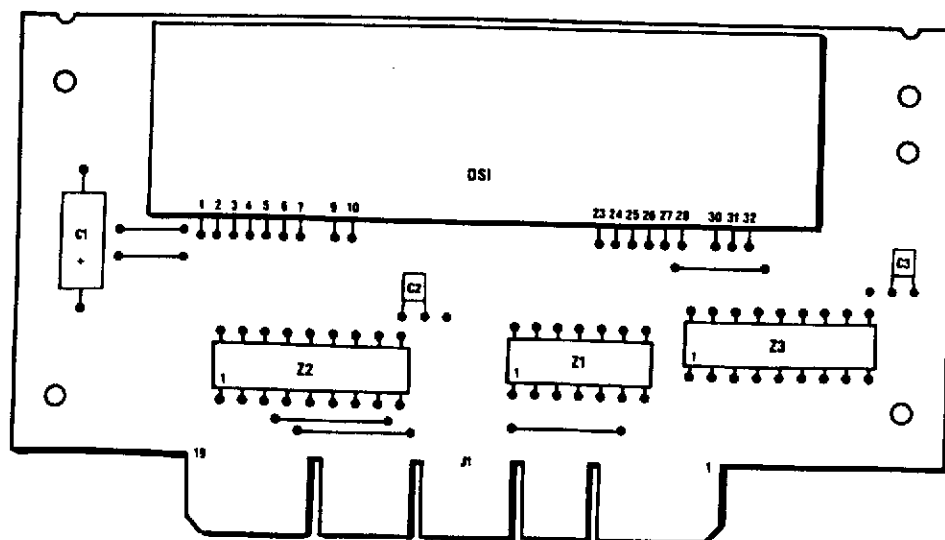
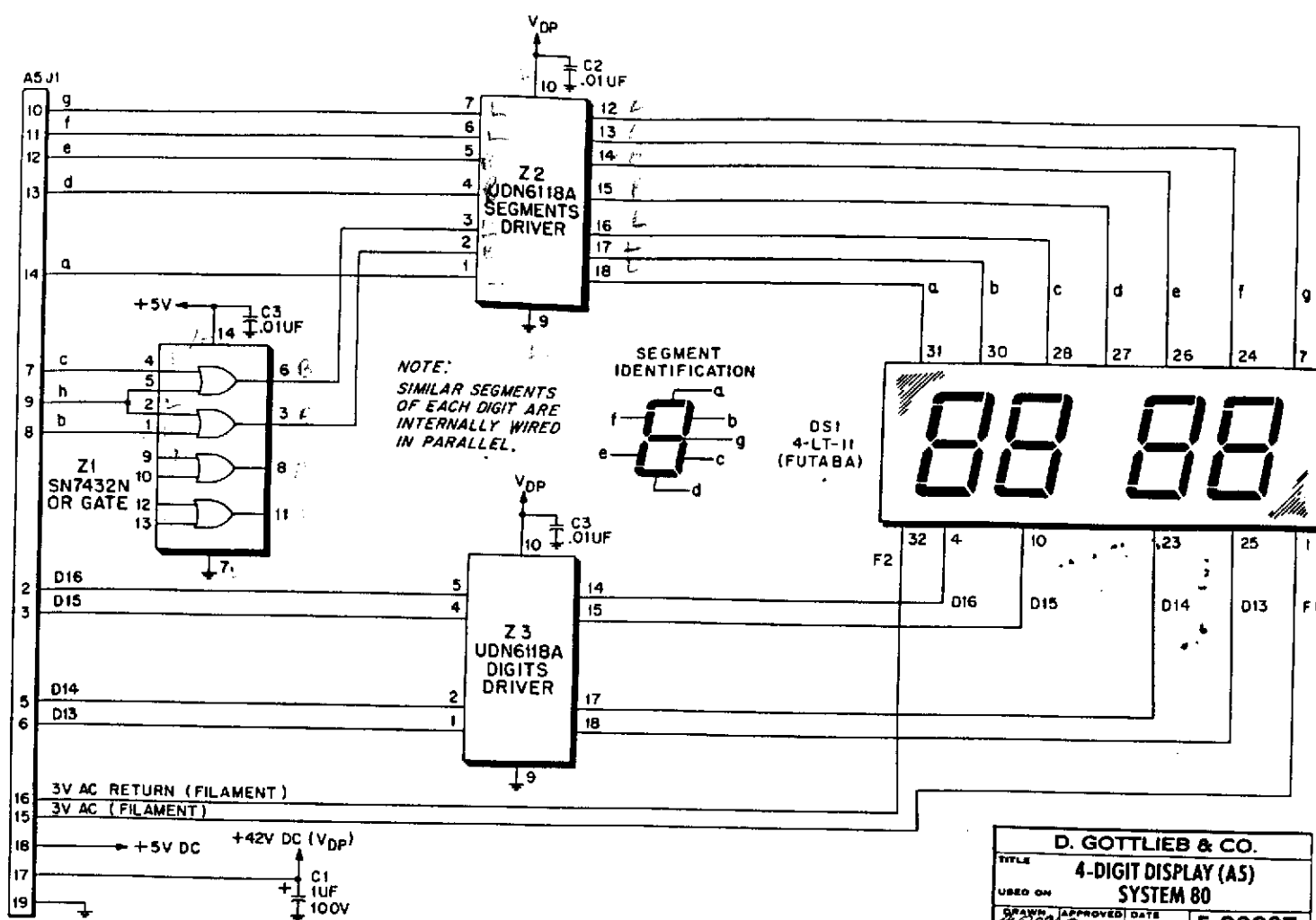
6-DIGIT DISPLAY (A4) COMPONENT LOCATION



6-DIGIT DISPLAY (A4) PARTS LIST

REFERENCE	DESCRIPTION	PART NUMBER
C1, C2	Capacitor, .01 mfd., 100V Kemet	C320C103MIR5CA
C3	Capacitor, 1 mfd., 100V Sprague	TE1400
DS1	6-Digit Display Tube—FUTABA	6-JS-01
R1	Resistor, 10K ohm, 5%, 1/2W	RC20GF103
Z1, Z2	IC—Fluorescent Display Driver—Sprague	UDN6118A

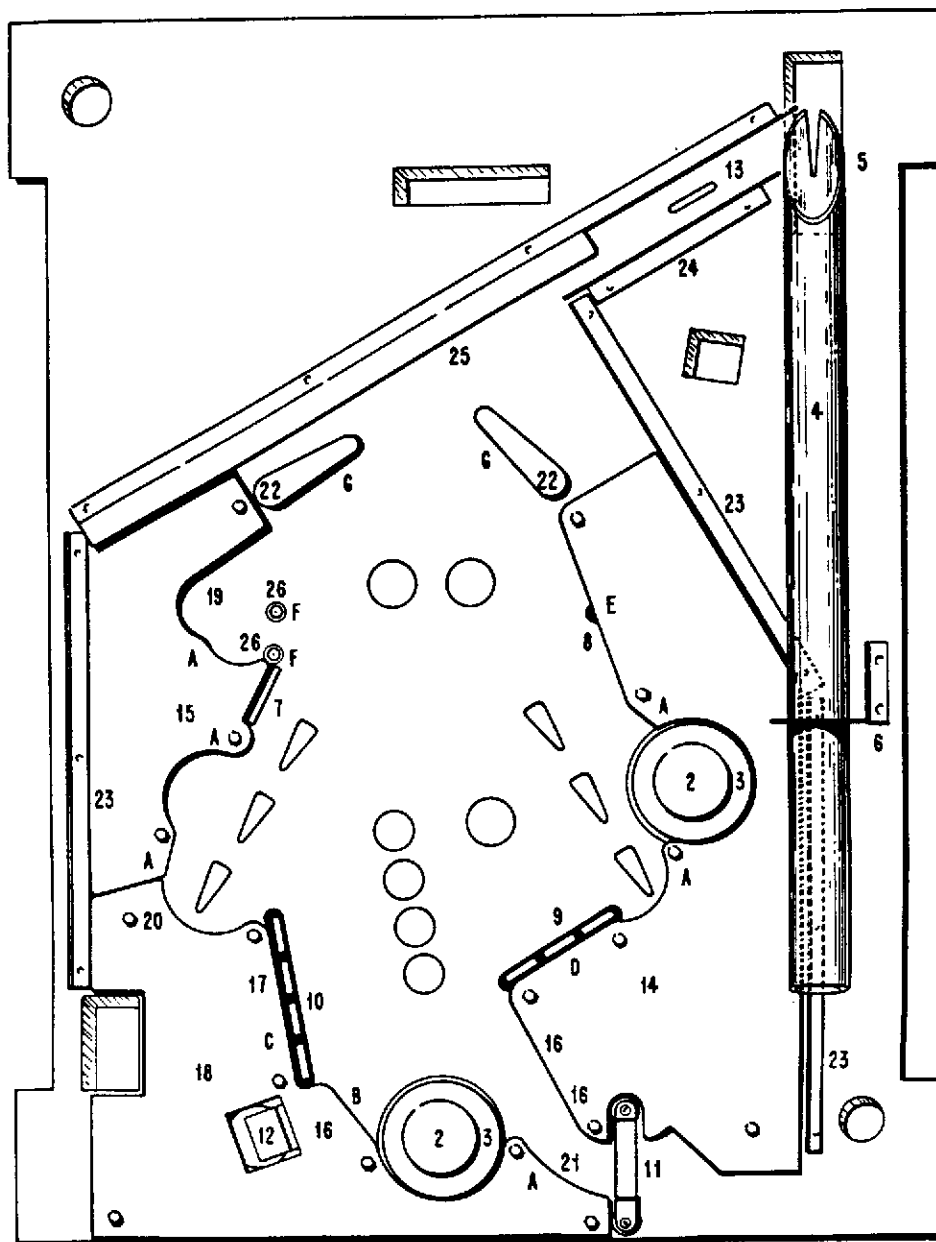
WTC DIAGRAMS, PARTS LIST



4-DIGIT DISPLAY (A5) PARTS LIST

REFERENCE	DESCRIPTION	PART NUMBER
C1	Capacitor, 1 mfd., 100V Sprague	TE1400
C2, C3	Capacitor, .01 mfd., 100V Kemet	C320C103MIR5CA
DS1	4-Digit Display Tube—FUTABA	4-LT-11
Z1	IC—Quad or Gate—T.I.	SN7432N
Z2, Z3	IC—Fluorescent Display Driver— Sprague	UDN6118A

X. WIRING AND SCHEMATIC DIAGRAMS, PARTS LIST



PLAYBOARD INFORMATION

BOTTOM PLAYBOARD

RUBBER RINGS

A	A-10217	(6)
B	A-10220	(1)
C	A-10221	(1)
D	A-10223	(1)
E	A-10224	(1)
F	A-15705	(2)
G	A-13151	(2)

PART LIST

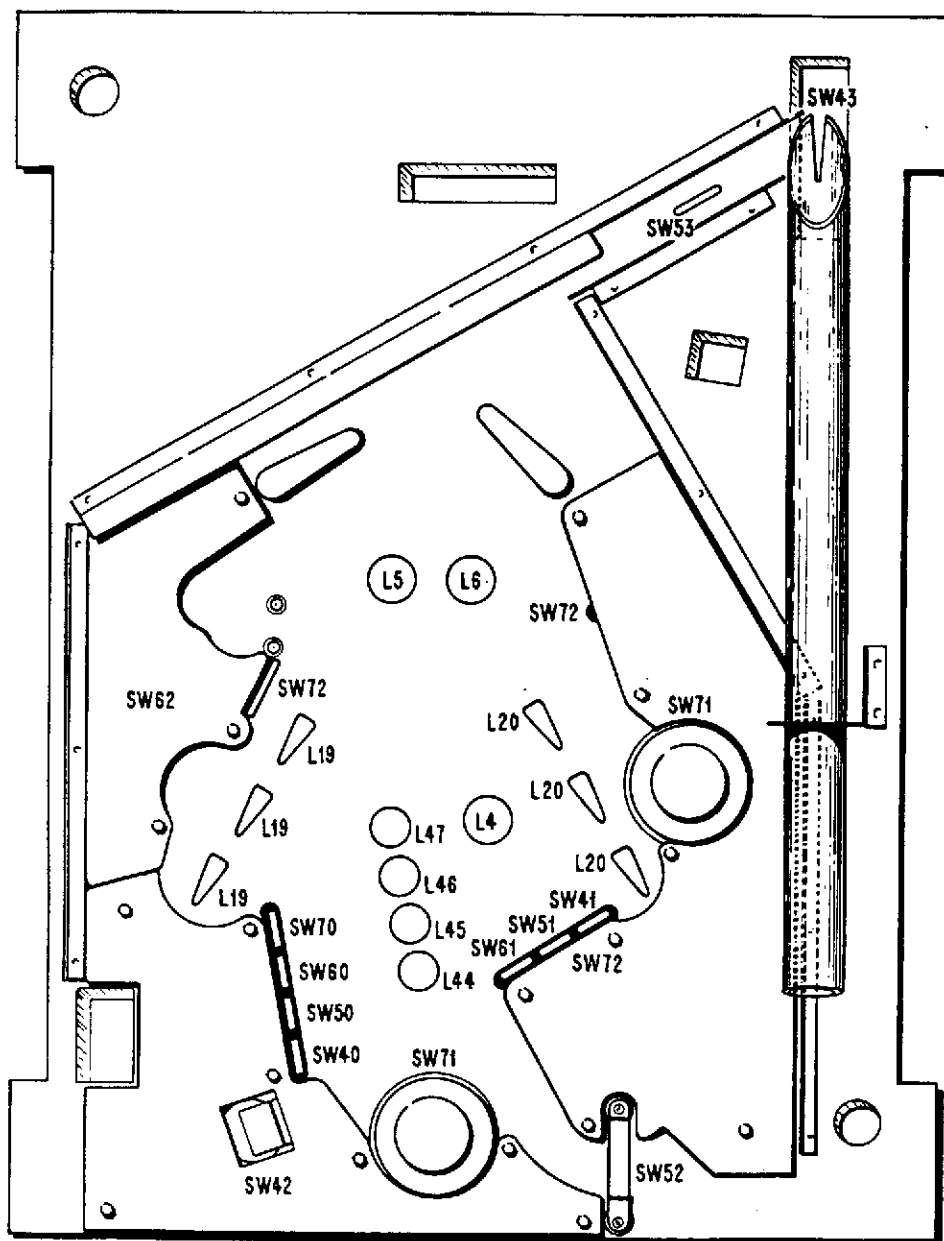
1. D-21304 Plastic Set
 2. Blue Pop Bumper D-10435 & A-21298 in Black (2)
 3. C-10433 Blue Pop Bumper Skirt (2)
 4. B-21179 Tube
 5. B-21178 Kicker Unit
 6. C-21180 Tube Support Bracket
 7. A-21039 Kicking Target
 8. A-15836 Kicking Rubber
 9. A-13179 White Drop Target in Gold
 10. A-13179 Yellow Drop Target in Gold
 11. A-9869 Gate Shield
(USE A-4706 WIREFORM)
 12. A-21159 Ball Snubber
 13. C-21222 Ball Return Unit
 14. B-21163 Ball Guide Rail
 15. A-21162 Ball Guide Rail
 16. A-18070 Ball Guide Rail (3)
 17. A-17106 Ball Guide Rail
 18. A-8514 Ball Guide Rail
 19. B-21153 Metal Flat Rail
 20. B-21152 Metal Flat Rail
 21. B-21154 Metal Flat Rail
 22. C-13150 White Jumbo Flipper
 23. B-21155 Guard Rail (3)
 24. B-21156 Guard Rail
 25. D-21157 Guard Rail
 26. A-14792 Mini Post Screw (2)
- C-11561 1" High Post (23)
C-11562 1 3/16" High Post (3)

PLAYBOARD SWITCH AND LAMP ASSIGNMENTS

BOTTOM PLAYBOARD

SWITCH MATRIX NUMBER	SWITCH ASSIGNMENT
40	Left #1 Drop Target
41	Right #1 Drop Target
42	Hole Kicker Switch
43	Ball Tube Kicker Switch
50	Left #2 Drop Target
51	Right #2 Drop Target
52	Rollunder Gate
53	Track Switch
60	Left #3 Drop Target
61	Right #3 Drop Target
62	Return Rollover
70	Left #4 Drop Target
71	Lower Level Pop Bumpers
72	10 Point Switches and Kicking Targets

LAMP NUMBER	LAMP ASSIGNMENT
L4	3 Pos. Bank Special Lower Playfield
L5	"+ 1X" Scoring (L) Lower Playfield
L6	"+ 1X" Scoring (R) Lower Playfield
L19	Hole Lights (Arrows) Lower Playfield
L20	Loop Lights (Arrows)
L44	#1 Drop Target Light Lower Playfield
L45	#2 Drop Target Light Lower Playfield
L46	#3 Drop Target Light Lower Playfield
L47	#4 Drop Target Light Lower Playfield



PLAYBOARD INFORMATION

TOP PLAYFIELD

RUBBER RINGS

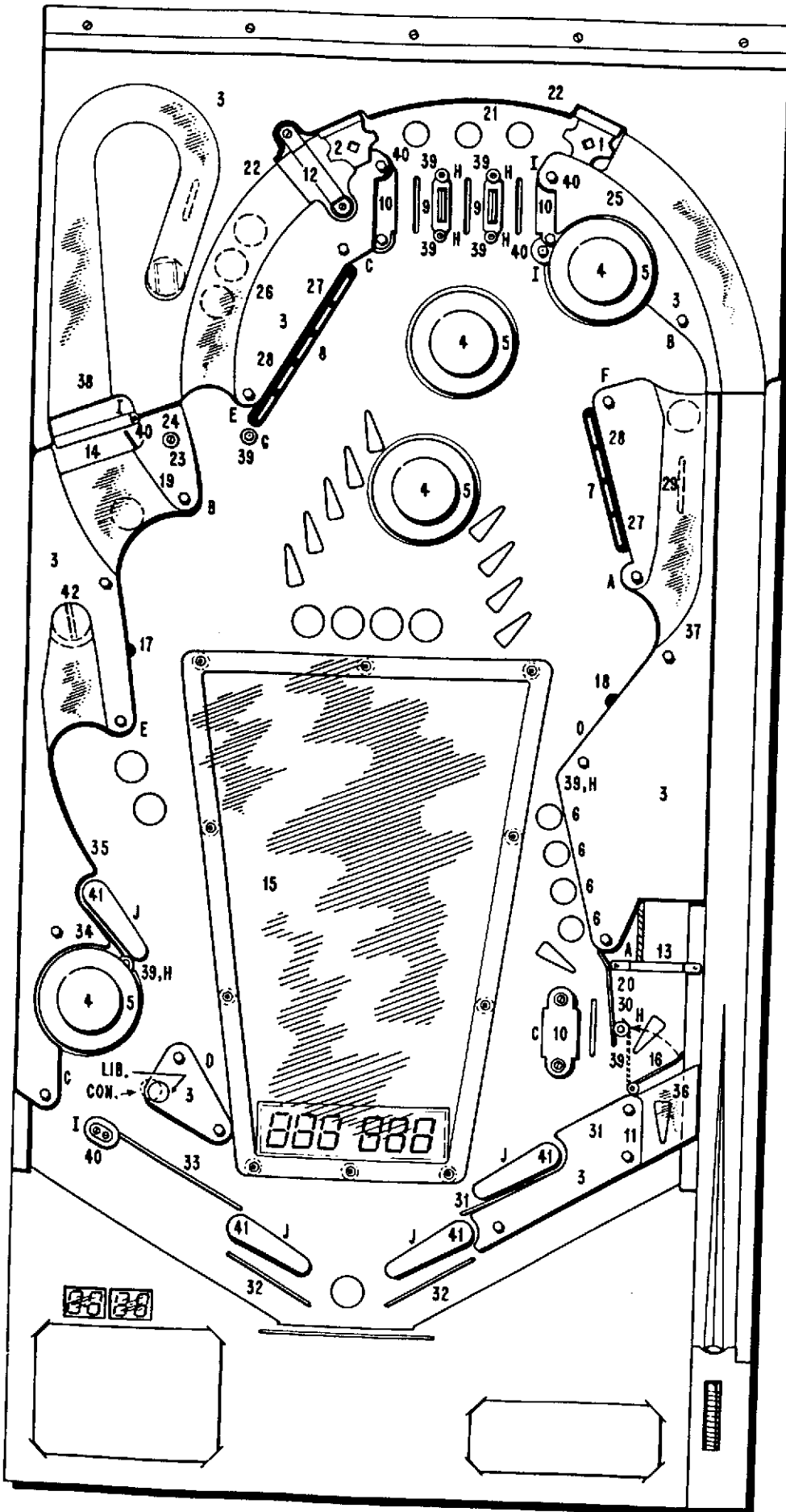
A	A-10217	(2)
B	A-10218	(2)
C	A-10219	(3)
D	A-10221	(2)
E	A-10222	(2)
F	A-10223	(1)
G	A-14793	(1)
H	A-15704	(7)
I	A-17493	(4)
J	A-1351	(4)

PARTS LIST

1. A-19645 Ball Gate Right
2. A-19646 Ball Gate Left
3. E-21229 Plastic Set
4. Blue Pop Bumper D-10435 and A-21298 Cap in Black (4)
5. C-10433 Blue Pop Bumper Skirt (4)
6. A-9374 Yellow Plastic Target (4)
7. Black Drop Target Bank - "Hole"
8. Black Drop Target Bank - "Black"
9. C-15647 Rollover Guide (2)
10. A-9395 2 1/8" Guide Rail (3)
11. A-9393 1 1/8" Guide Rail
12. A-4869 Rollunder Gate Shield (USE A-4706 WIREFORM)
13. A-17300 Gate Shield (USE A-17299 WIREFORM)
14. A-20388 Swinging Target
15. D-21140 Window
16. A-21160 Ball Return Gate
17. A-21366 Kicking Rubber
18. A-15836 Kicking Rubber
19. A-21158 Ball Deflector
20. A-20645 Plastic Tubing
21. D-21166 Top Arch Rod
22. B-19875 Arm Rod Support Post (2)
23. B-19873 Top Arch End Post
24. B-19874 Top Arch End Cap
25. B-21165 Ball Guide Rail
26. B-21164 Ball Guide Rail
27. A-18070 Ball Guide Rail (2)
28. A-17650 Ball Guide Rail (2)
29. A-4832 Ball Guide Rail
30. A-14686 Ball Guide Rail
31. A-17106 Ball Guide Rail (2)
32. A-13798 Ball Snubber (2)
33. A-18563 Ball Guide Rail
34. A-6612 Ball Guide Rail
35. C-21149 Metal Flat Rail
36. A-8688 Metal Flat Rail
37. B-21150 Metal Flat Rail
38. C-21151 Metal Flat Rail
39. A-14792 Mini-Post (8)
40. C-13150 White Flipper Jumbo (4)
41. A-16038 Ball Snubber

TOP

- C-11561 1" High Post (29)
- C-11562 1 3/16" High Post (4)
- A-14487 Split Post Base (3)
- A-14488 Split Post Cap (3)



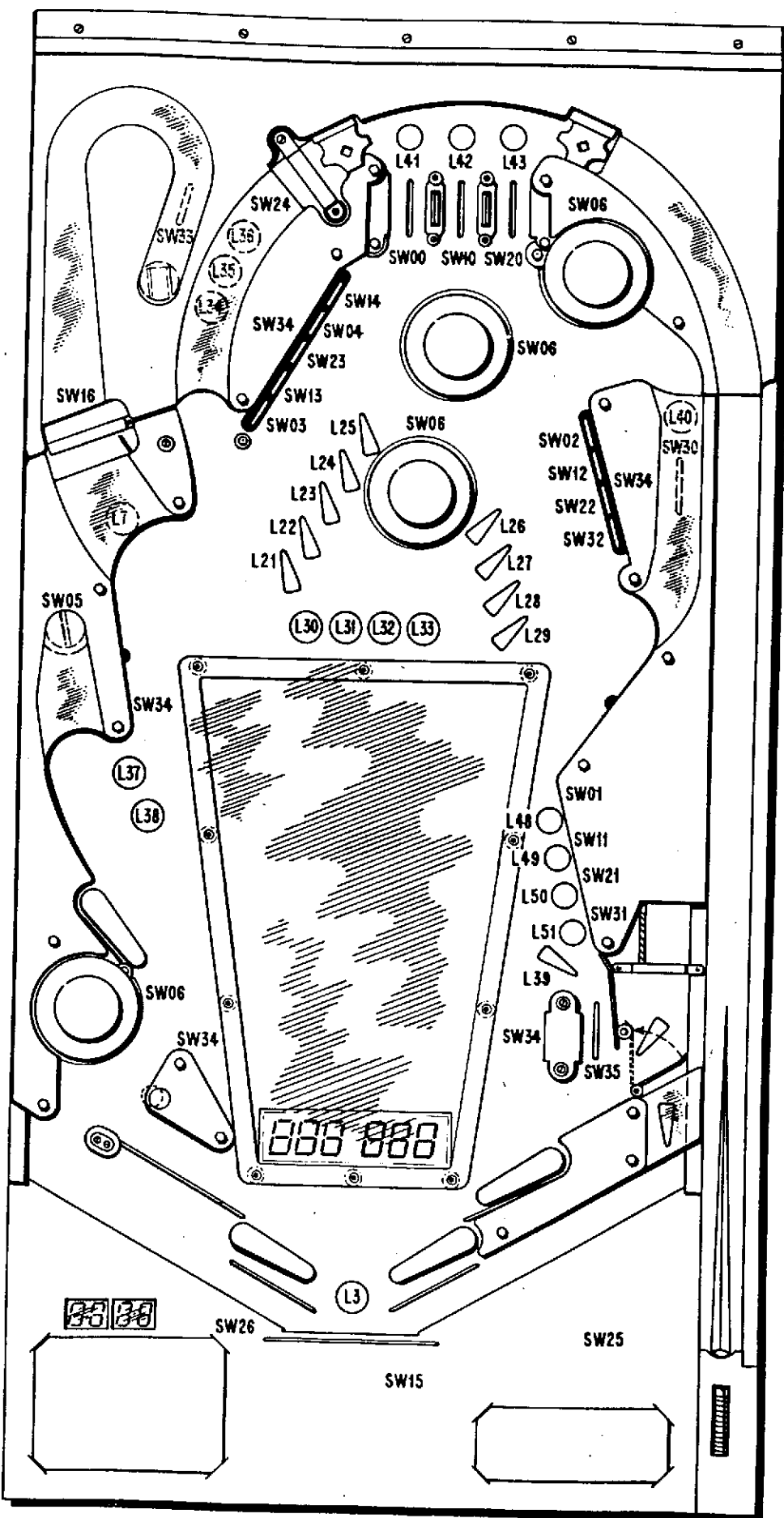
PLAYBOARD SWITCH AND LAMP ASSIGNMENTS

TOP PLAYFIELD

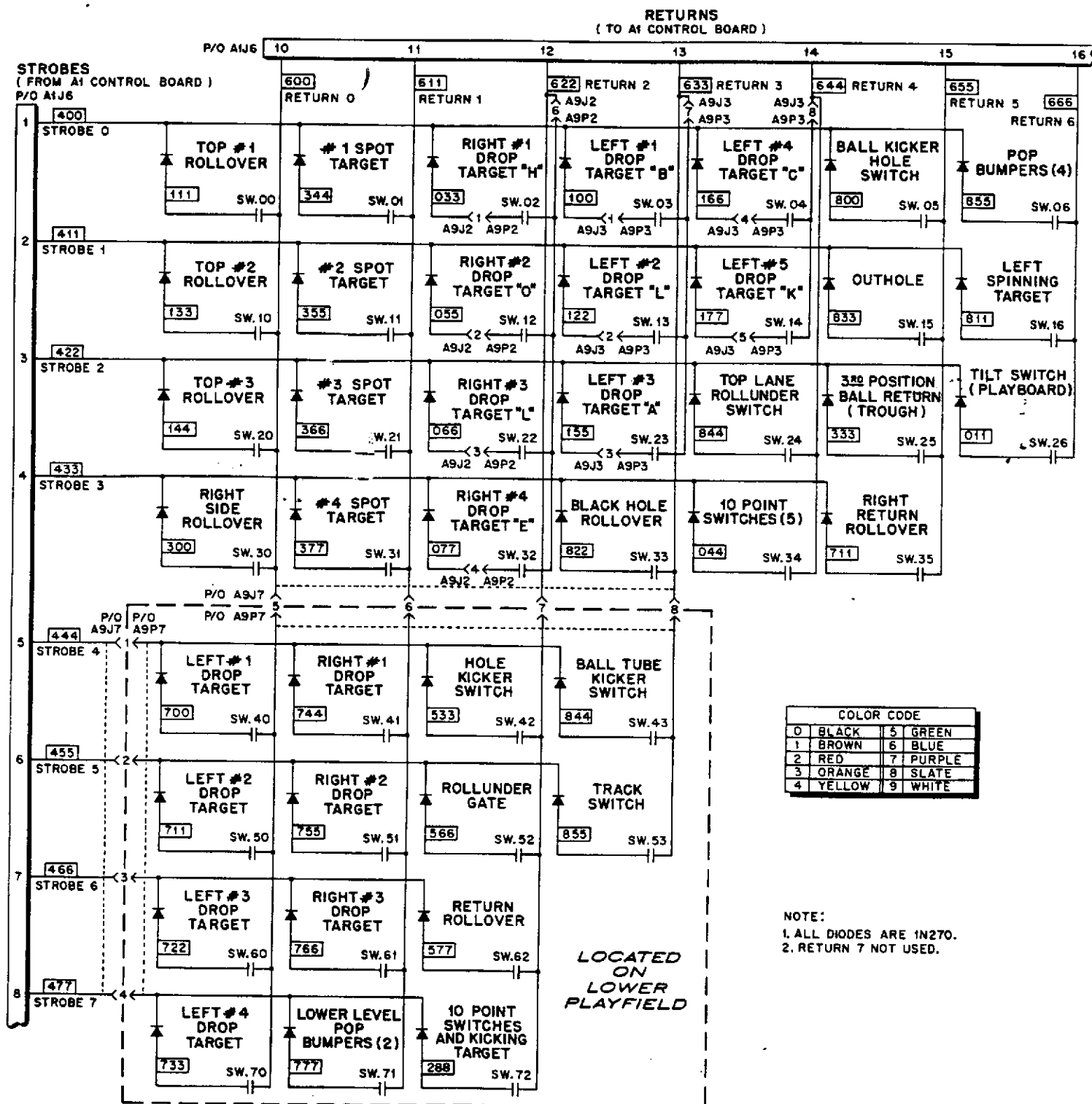
SWITCH MATRIX NUMBER	SWITCH ASSIGNMENT
00	Top #1 Rollover
01	#1 Spot Target
02	Right #1 Drop Target "H"
03	Left #1 Drop Target "B"
04	Left #4 Drop Target "C"
05	Ball Kicker Hole Switch
06	Pop Bumpers 4
10	Top #2 Rollover
11	#2 Spot Target
12	Right #2 Drop Target "O"
13	Left #2 Drop Target "L"
14	Left #5 Drop Target "K"
15	Outhole
16	Left Spinning Target
20	Top #3 Rollover
21	#3 Spot Target
22	Right #3 Drop Target "L"
23	Left #3 Drop Target "A"
24	Top Lane Rollunder Switch
25	3rd Position Ball Return (Trough)
26	Tilt Switch Playboard
30	Right Side Rollover
31	#4 Spot Target
32	Right #4 Drop Target "E"
33	Black Hole Rollover
34	10 Point Switches (S)
35	Right Return Rollover

LAMP NUMBER LAMP ASSIGNMENT

L3	Shoot Again
L7	Left Spinning Target
L21	"B" Drop Target Light
L22	"L" Drop Target Light
L23	"A" Drop Target Light
L24	"C" Drop Target Light
L25	"K" Drop Target Light
L26	"H" Drop Target Light
L27	"O" Drop Target Light
L28	"L" Drop Target Light
L29	"E" Drop Target Light
L30	2X Multiplier
L31	3X Multiplier
L32	4X Multiplier
L33	5X Multiplier
L34	Top Lane Top Lane XI (10,000)
L35	Top Lane #2 (Extra Ball)
L36	Top Lane #3 (Special)
L37	Top Hole #1 (Captive)
L38	Top Hole #2 (Extra Ball)
L39	Right Return Rollover
L40	Right Side Rollover
L41	#1 Top Rollover
L42	#2 Top Rollover
L43	#3 Top Rollover
L48	#1 Spot Target Light
L49	#2 Spot Target Light
L50	#3 Spot Target Light
L51	#4 Spot Target Light



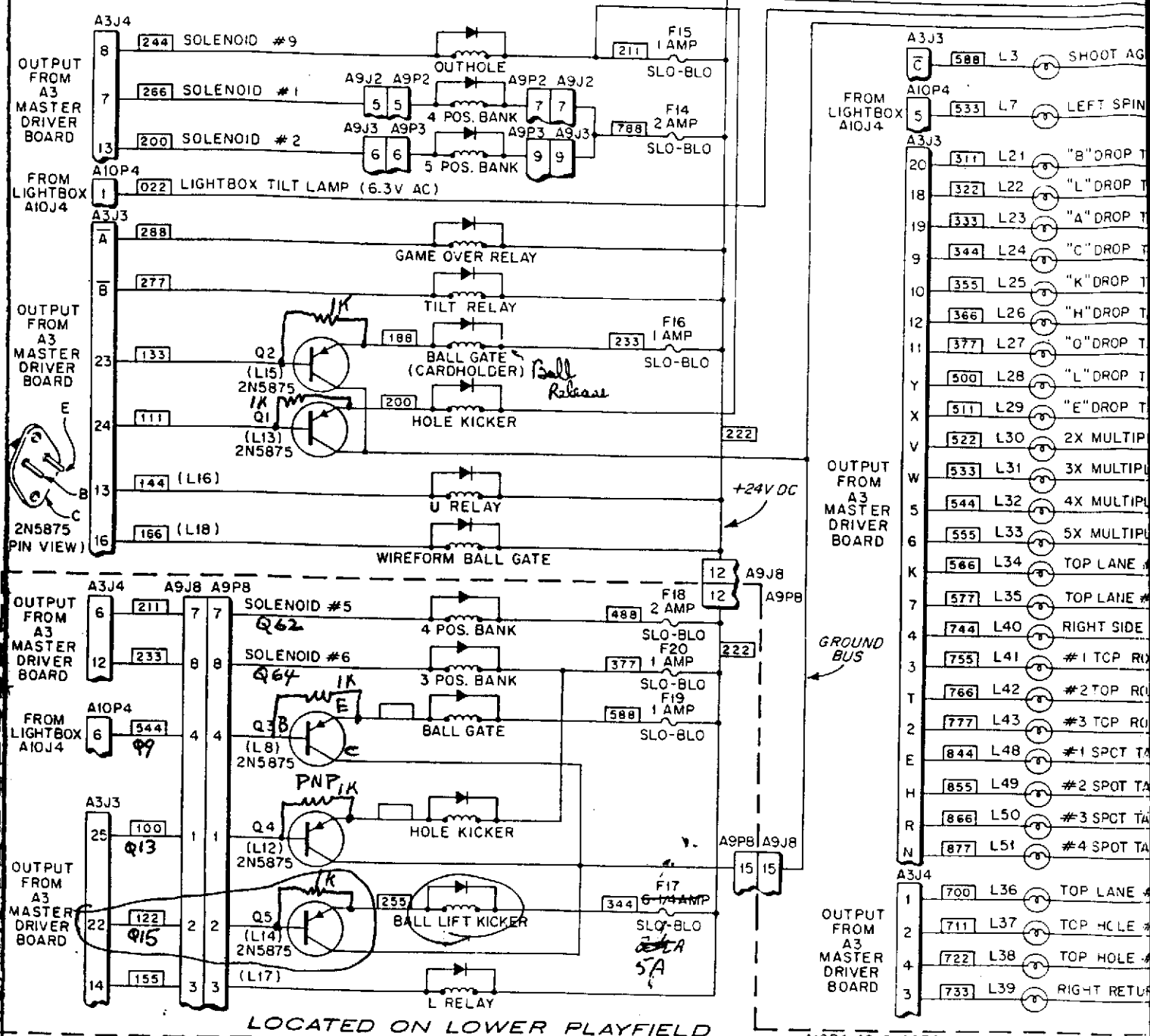
X. WIRING AND SCHEMATIC DIAGRAMS, PARTS LISTS



D. GOTTLIEB & CO.	
TITLE	UPPER AND LOWER PLAYFIELD SWITCH MATRIX
USED ON	SYSTEM 80, GAME #668
APPROVED DATE	24 JUNE 1981
REV	E-21340

X. WIRING AND SCHEM

PLAYFIELDS "CONTROLLED" SOLENOIDS AND ILLUMINATION

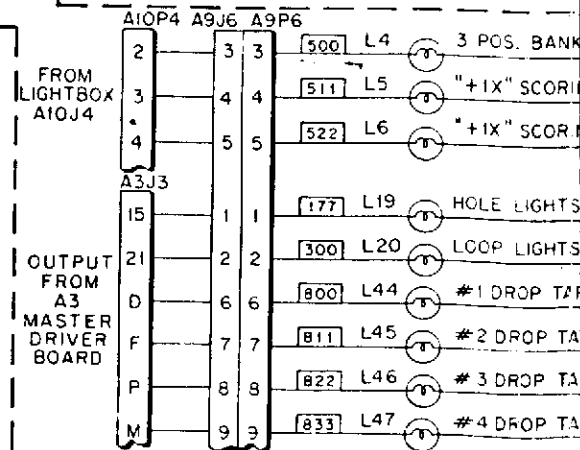


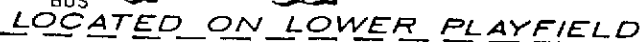
NOTE:
ALL DIODES ARE IN4004.
LAMPS L32 THRU L43 ARE DRIVEN BY MPS-A13'S; ALL OTHER LAMPS ARE DRIVEN BY MPS-U45'S.

3. UNLESS OTHERWISE SPECIFIED;
ALL LAMPS ARE #44.
GROUND WIRE COLOR IS 54, 18GA.
4. [XXX] INDICATES WIRE COLOR.

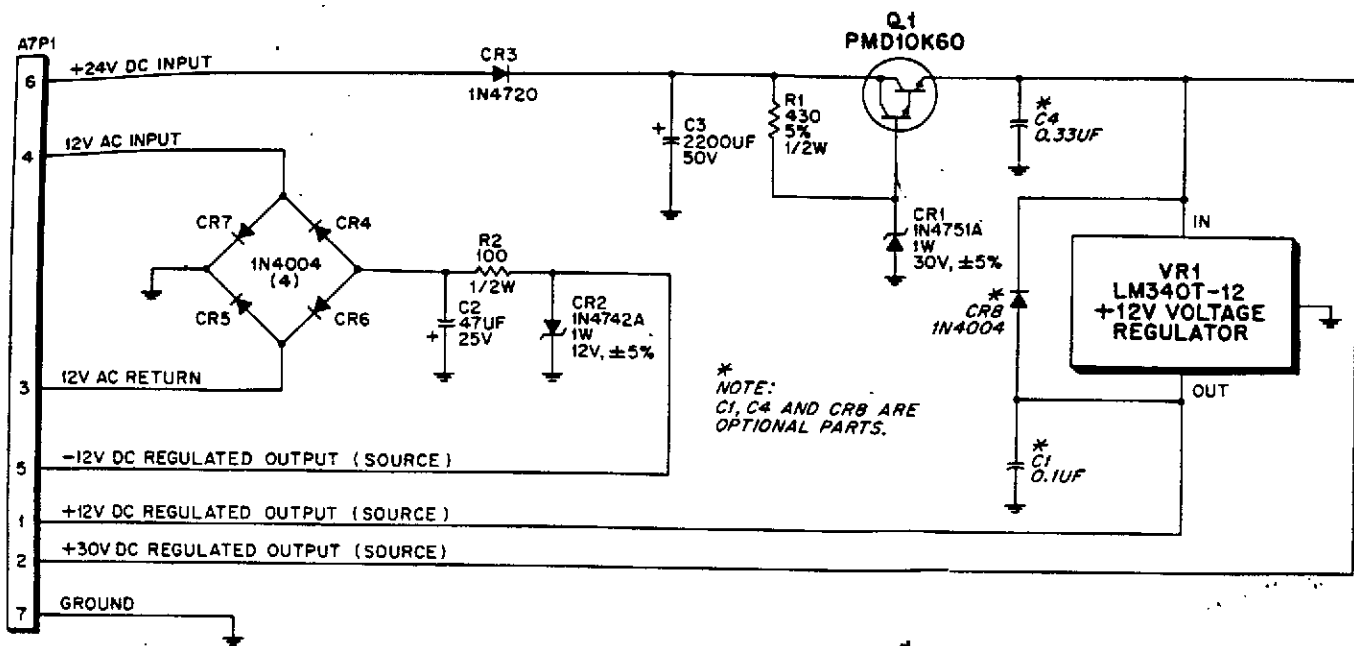
COILS USED			
PART NO.	DESCRIPTION	PART NO.	DESCRIPTION
-16570	OUTHOLE	A-18102	3 POS. BANK (L)
-18318	4 POS. BANK (U)	A-16570	BALL GATE (L)
-17891	5 POS. BANK (U)	A-16570	HOLE KICKER (L)
-16890	GAME OVER RELAY	A-4893	BALL LIFT KICKER (L)
-16890	TILT RELAY	A-16890	LOWER RELAY (L)
-16570	BALL GATE	A-1496	KICKING RUBBER (6)
-16570	HOLE KICKER (U)	A-17875	FLIPPERS (6)
-16890	UPPER RELAY (U)	A-5194	KICKING TARGET
-17564	WIREFORM BALL GATE	A-1496	POP BUMPERS (6)
-18318	4 POS. BANK (L)		

COLOR CODE	
0	BLACK
1	BROWN
2	RED
3	ORANGE
4	YELLOW
5	GREEN
6	BLUE
7	PURPLE
8	SLATE
9	WHITE



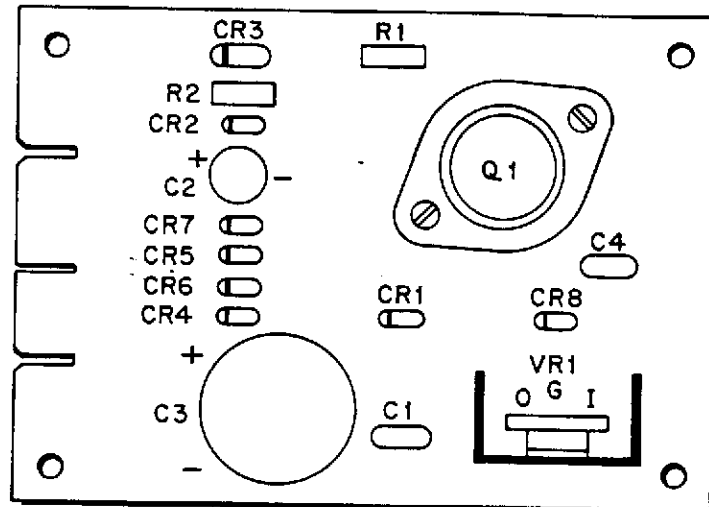


X. WIRING AND SCHEMATIC DIAGRAMS, PARTS LISTS



D. GOTTLIEB & CO.		
TITLE	SOUND/SPEECH BOARD POWER SUPPLY A7	
USED ON	SYSTEM 80, GAME # 668	
DRAWN	APPROVED	DATE
6/1/80	2	10-5-81
D-21343		

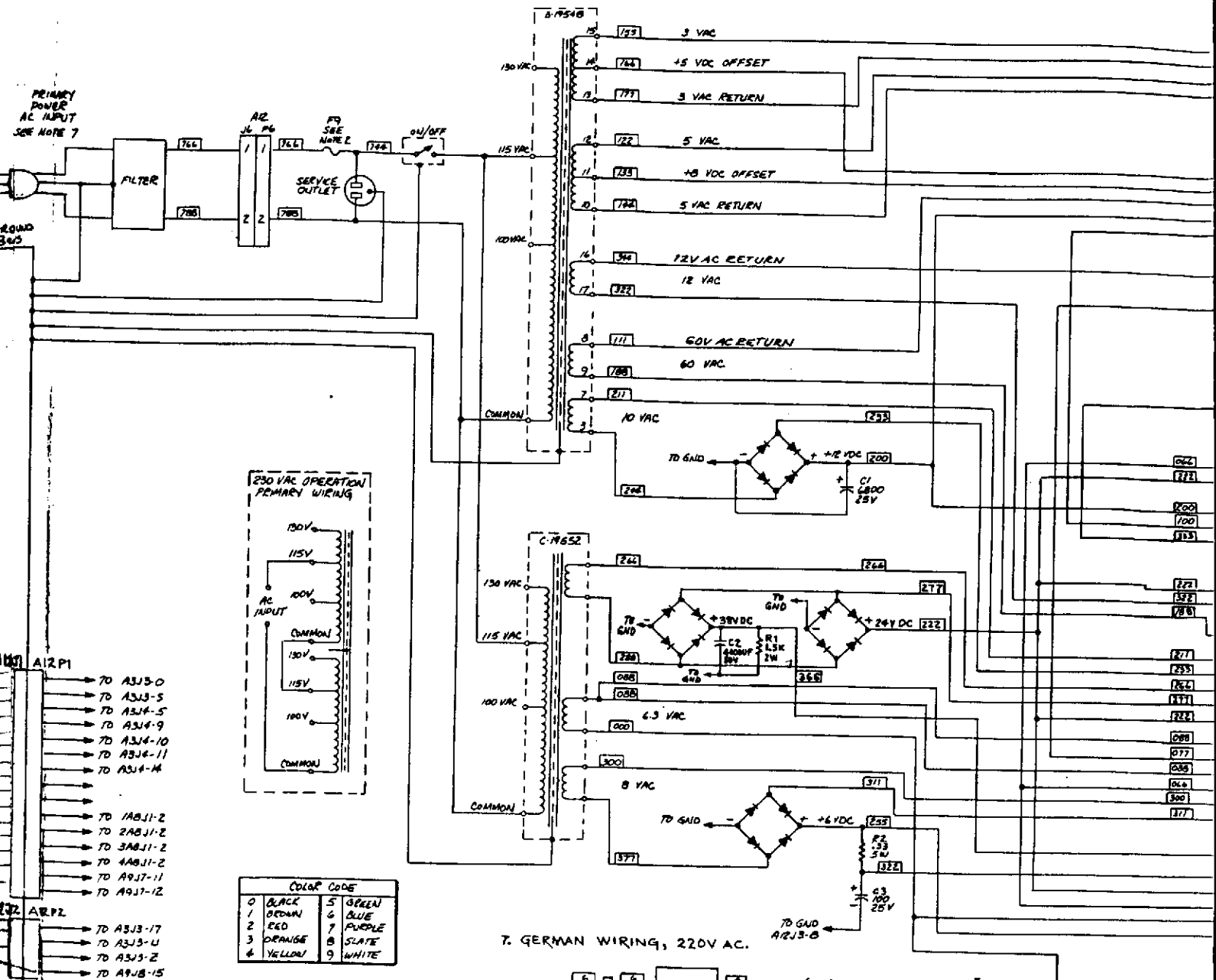
SOUND/SPEECH POWER SUPPLY (A7) COMPONENT LOCATION



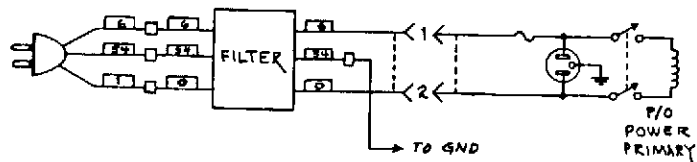
SOUND/SPEECH POWER SUPPLY (A7) PARTS LIST

REFERENCE	DESCRIPTION	PART NUMBER
C1	Capacitor 0.1UF	
C2	47UF, 25 Volt	
C3	2200 UF, 50 Volt	
C4	0.33 UF	
CR1	Diode, Zener 3-V, $\pm 5\%$, 1W	1N4751A
CR2	Diode, Zener 12V, $\pm 5\%$, 1W	1N4742A
CR3	Diode	1N4720
CR4, CR5, CR6 CR7, CR8	Diode	1N4004
R1	Resistor 430 OHM, 50%, 1/2 Watt	
R2	Resistor 100 OHM, 1/2 Watt	
Q1	Transistor, Darlington Pair	PMD10K60
VR1	+ Volt Voltage Regulator	LM 340T-12

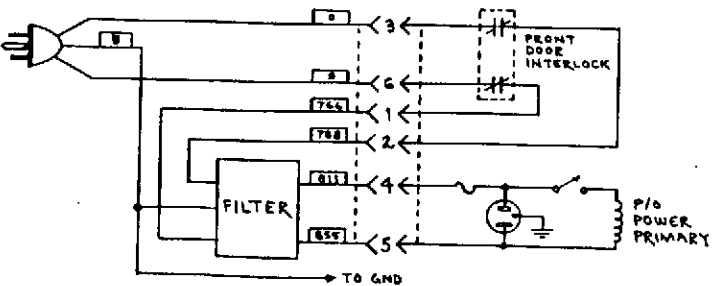
X. WIRING AND SCHEM



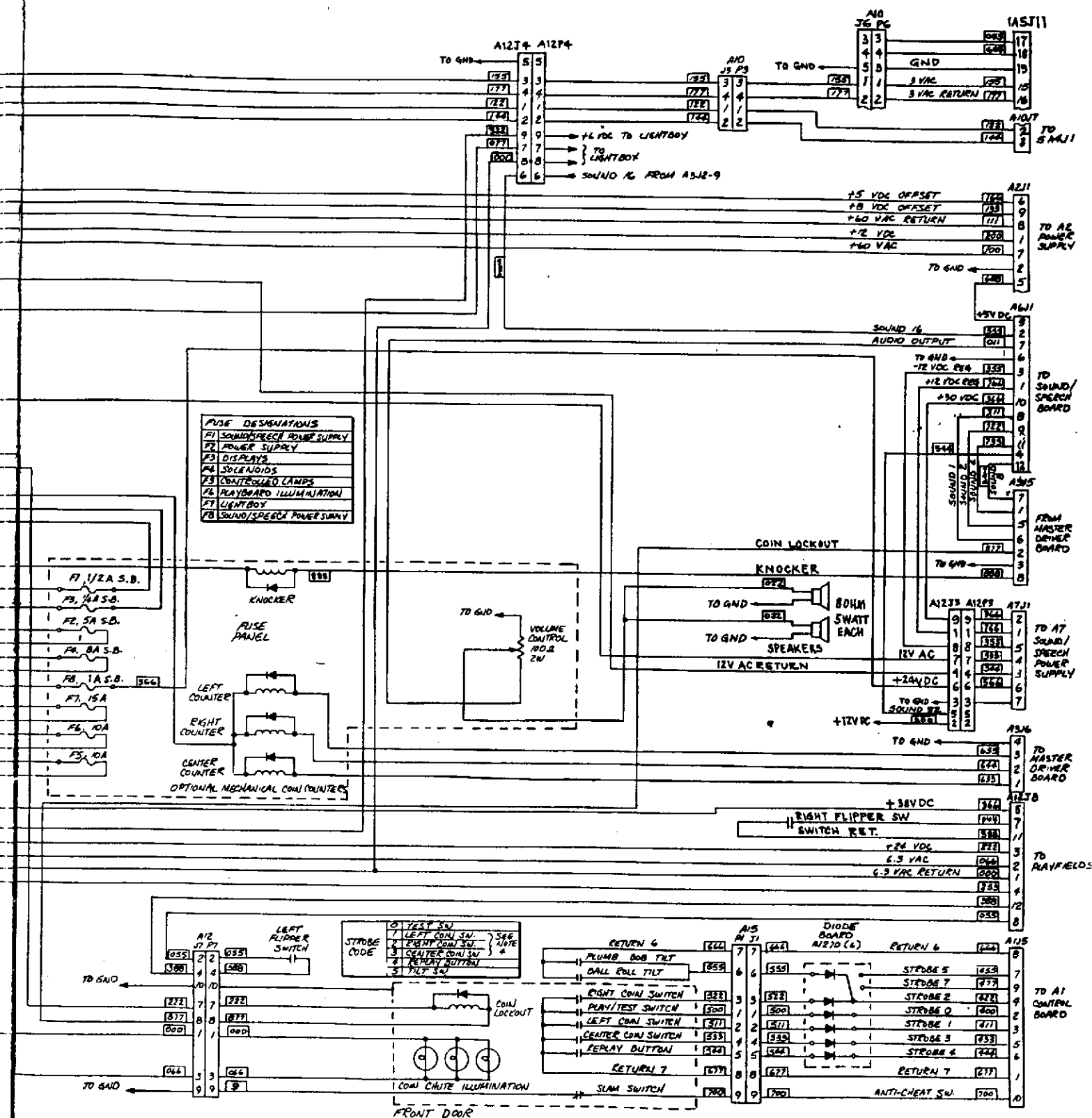
- NOTES
1. OPTIONAL CHINA COUNTER, REFER TO SAME MANUAL FOR INSTRUCTIONS.
 2. PRIMARY FUSE VALUES:
115 VAC USE 5 AMP SLO-BLO
230 VAC USE 2.5 AMP SLO-BLO
 3. 230 VAC TRANSFORMERS:
B-19550 & C-19554
GERMAN TRANSFORMERS:
B-19549 & C-19553
 4. REFER TO INSTRUCTION MANUAL FOR GERMAN GAME VARIATIONS.
 5. UNLESS OTHERWISE SPECIFIED, GROUND WIRE COLOR IS S^t, B^l GA.
 6. X^W INDICATES WIRE COLOR



8. JAPANESE WIRING, 100V AC



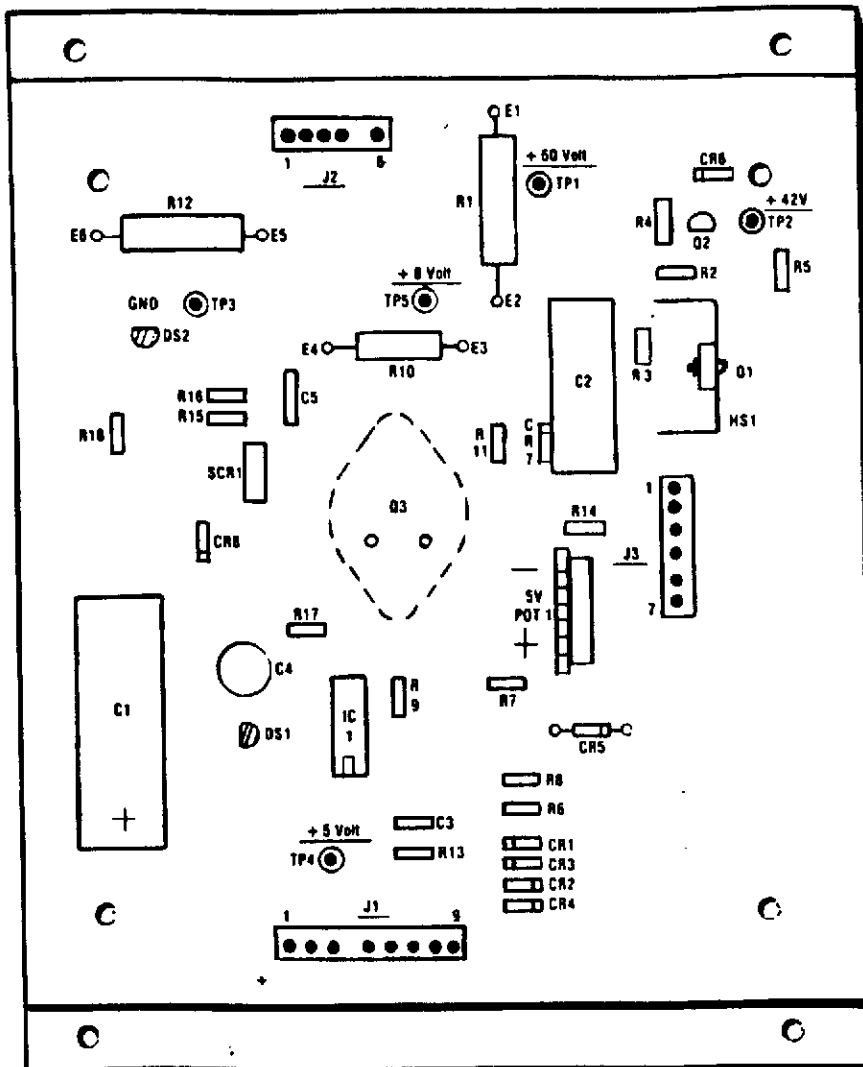
ATIC DIAGRAMS, PARTS LISTS



D. GOTTLIEB & CO.

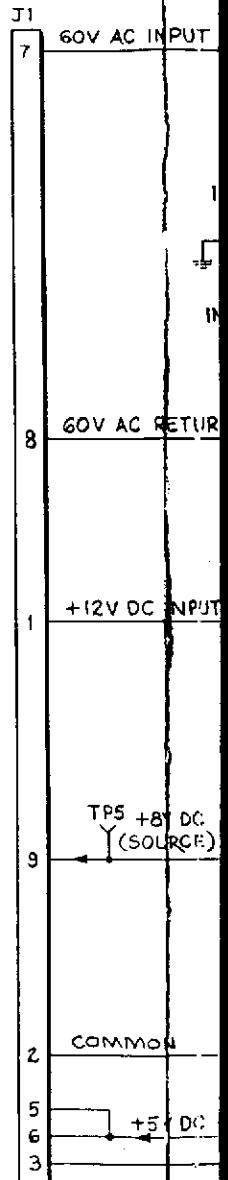
TITLE BOTTOM BOARD AND CABINET
USED ON SYSTEM 80

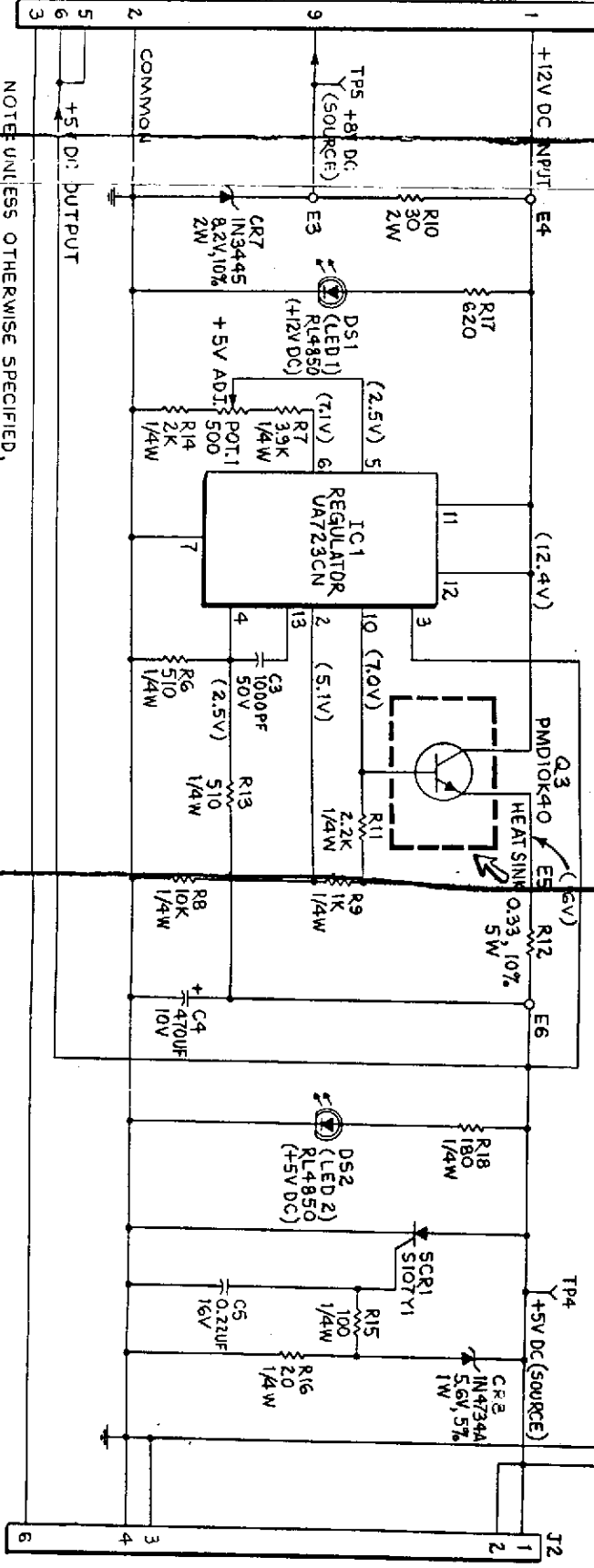
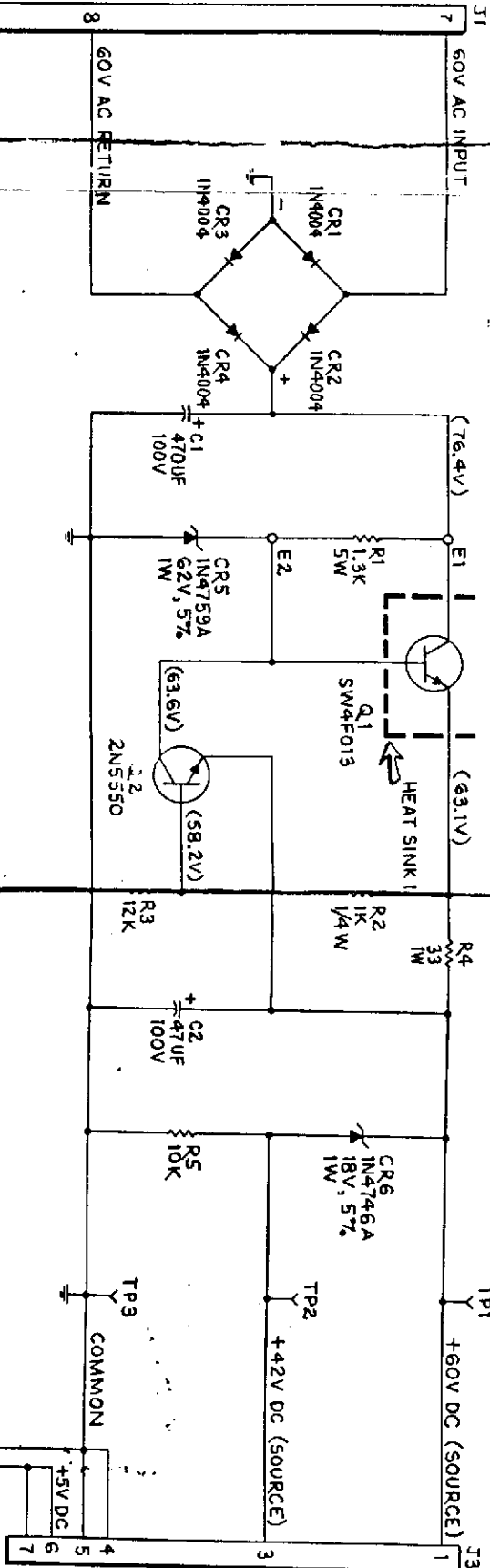
POWER SUPPLY (A2) COMPONENT LOCATION



POWER SUPPLY (A2) PARTS LIST

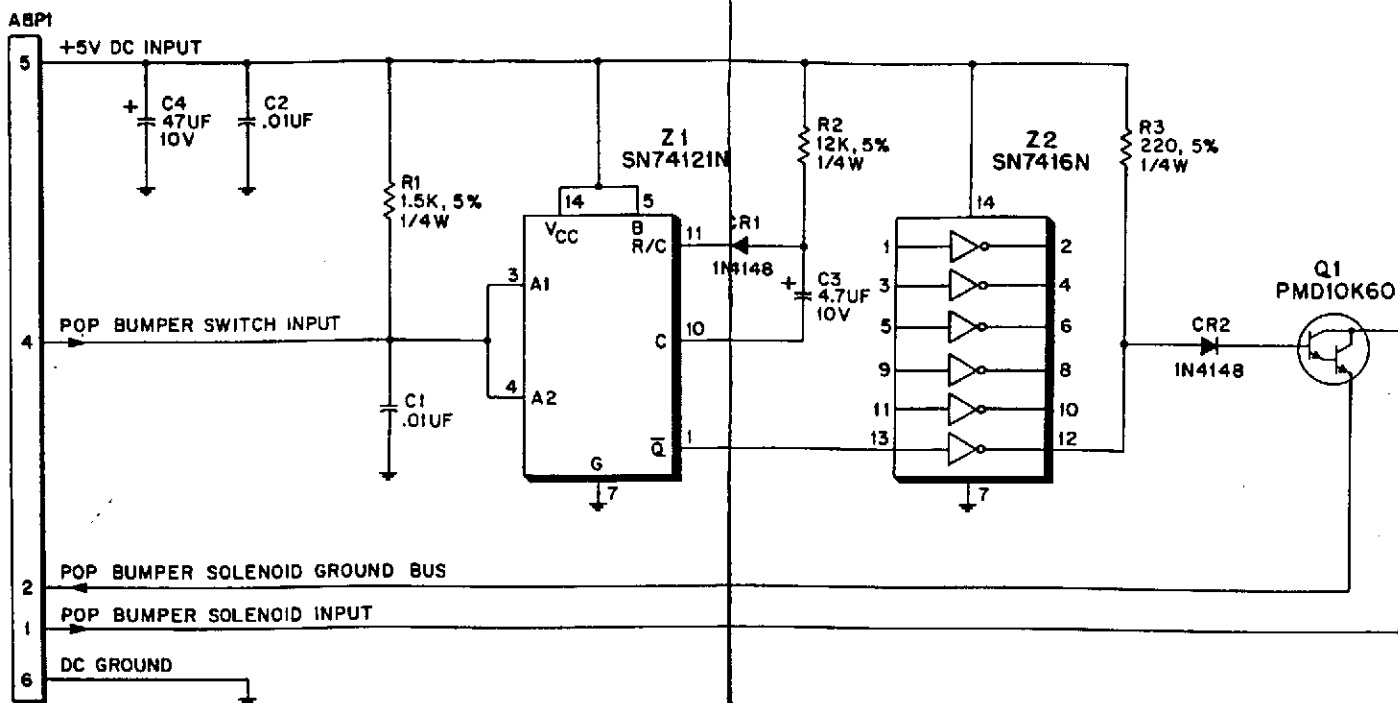
REFERENCE	DESCRIPTION	PART NUMBER	REFERENCE	DESCRIPTION	PART NUMBER
C1	Capacitor, 470 mfd., 100V		R4	Resistor, 33 ohm, 5%, 1W	
C2	Capacitor, 47 mfd., 100V		R5	Resistor, 10K ohm, 5%, 1/2W	
C3	Capacitor, 1000 PicoFarad, 50V		R6, R13	Resistor, 510 ohm, 5%, 1/4W	
C4	Capacitor, 470 mfd., 10V		R7	Resistor, 3.9K ohm, 5%, 1/4W	
C5	Capacitor, 2 mfd., +80%, -20%, 16V		R8	Resistor, 10K ohm, 5%, 1/4W	
CR1-CR4	Diode	1N4004	R10	Resistor, 30 ohm, 5%, 2W	
CR5	Diode, Zener, 62V, 5%, 1W	1N4759A	R11	Resistor, 2.2K ohm, 5%, 1/4W	
CR6	Diode, Zener, 18V, 5%, 1W	1N4746A	R12	Resistor, .33 ohm, 10%, 5W (Wirewound)	
CR7	Diode, Zener, 8.2V, 10%, 2W	1N3445	R14	Resistor, 2K ohm, 5%, 1/4W	
CR8	Diode, Zener, 5.6V, 5%, 1W	1N4734A	R15	Resistor, 100 ohm, 5%, 1/4W	
DS1, DS2	Diode, Light Emitting	CM4-22	R16	Resistor, 20 ohm, 5%, 1/4W	
E1-E6	Turret Terminal		R17	Resistor, 620 ohm, 5%, 1/2W	
IC1	I.C.—14 Pin Dip	UA723CN	R18	Resistor, 180 ohm, 5%, 1/4W	
J1	Connector, 9 Pin, Molex		SCR1	Silicon Controlled Rectifier	S107Y1
J2	Connector, 6 Pin, Molex		TP1-TP5,	Turret Terminal	
J3	Connector, 7 Pin, Molex			Eyelet	GS2-3
POT1	Potentiometer, 500 ohm, CTS	115R501A		Heat Sink Mounting Plate	
Q1	Transistor, NPN, National	SW4F013		Heat Sink, Thermalloy	
Q2	Transistor, NPN	2N5550		Insulator	INS-3
Q3	Transistor, Darlington, LAMBDA	PMD10K40		Insulator	DM111
R1	Resistor, 1.3K ohm, 10%, 5W			Spacer—6-32 Thread x 5/32	
R2, R9	Resistor, 1K ohm, 5%, 1/4W			Spacer—6-32 Thread x 1/8	
R3	Resistor, 12K ohm, 5%, 1/2W				





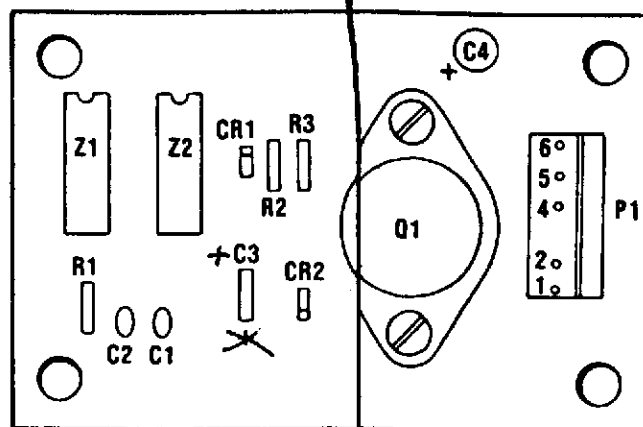
NOTE: UNLESS OTHERWISE SPECIFIED,
1. RESISTORS ARE $\pm 5\%$, $1/2W$.
2. VOLTAGES ARE DC WITH RESPECT TO CIRCUIT GROUND.
3. ALL VOLTAGES ARE AT NOMINAL LINE VOLTAGE (115V AC)

X. WIRING AND SCHEMATIC DIAGRAMS, PARTS LISTS



D. GOTTLIEB & CO.			
TITLE POP BUMPER DRIVER BOARD (A8)			
SYSTEM 80			
DRAWN BY	APPROVED BY	DATE	D-20923
ABP1	BAM	2-9-81	

POP BUMPER DRIVER BOARD (A8) COMPONENT LOCATION



POP BUMPER DRIVER BOARD (A8) PARTS LIST

REFERENCE	DESCRIPTION	PART NUMBER
C1, C2	Capacitor, .01 mfd., 100V	
C3	Capacitor, 4.7 mfd., 10V	
C4	Capacitor, 47 mfd., 10V	
CR1, CR2	Diode	1N4148
P1	Connector	09-65-1061
R1	Resistor, 1.5K ohm, 1/4W	
R2	Resistor, 12K ohm, 1/4W	
R3	Resistor, 220 ohm, 1/4W, 5%	
Q1	Transistor—LAMBDA	PMD10K60
Z1	IC	SN74121N
Z2	IC	SN7416N