

Williams[®]

Game No. 489
September, 1979

TIME WARP



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800-621-4765
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Williams[®] 
ELECTRONICS, INC.

An Xcor International Inc., Company
3401 N. California Ave., Chicago, IL 60618
Cable Address: WILCOIN, CHICAGO
(312) 267-2240

FOREWORD

This is a basic instruction manual that provides information unique to TIME WARP. For detailed troubleshooting and interconnection information refer to the Williams Solid State Flipper Maintenance Manual.

SPECIAL CONSIDERATIONS WHEN REPLACING CIRCUIT BOARDS

CPU BOARD

1. For memory protection feature, revision level 6 CPU Boards (batteries located on lower right corner of board) must be used. Revision level 4 CPU Boards equipped with IC14 and IC26 sockets may be used but the memory protection feature is lost.
2. Must be equipped with green-labeled TIME WARP PROMs or game ROM and green-labeled flipper ROMs. Revision 2 PROMs provided with this game cannot be intermixed with Revision 1 PROMs provided with prototype games.
3. With Game ROM, jumper J3 must be connected and jumper J4 removed.

Sound Board

1. **Must** be equipped with two fuse clips.
2. Must be jumpered for ROM operation and be equipped with Sound ROM 1.

Power Supply Board

1. Fuse F4 (10A SB) for flipper solenoids must be installed.

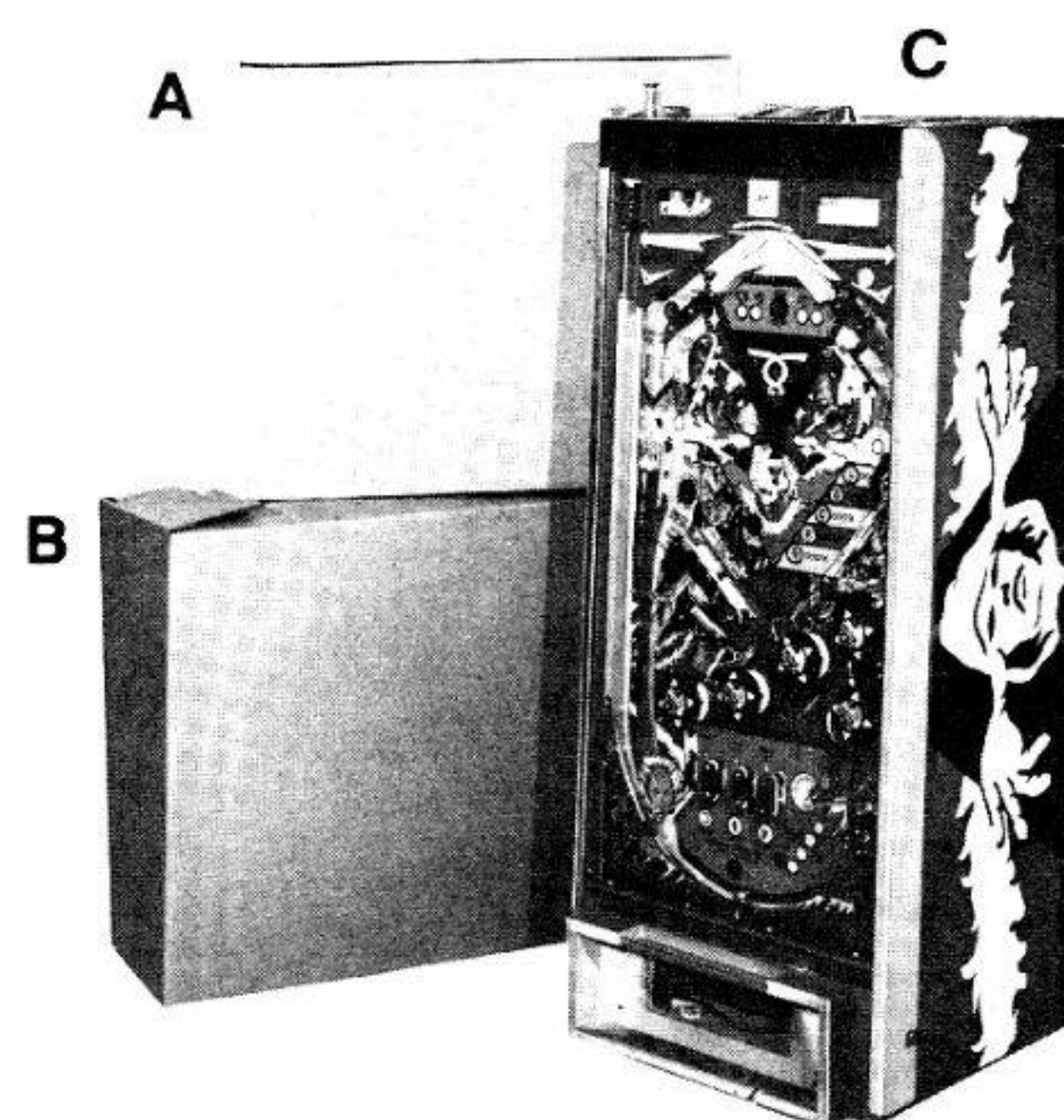
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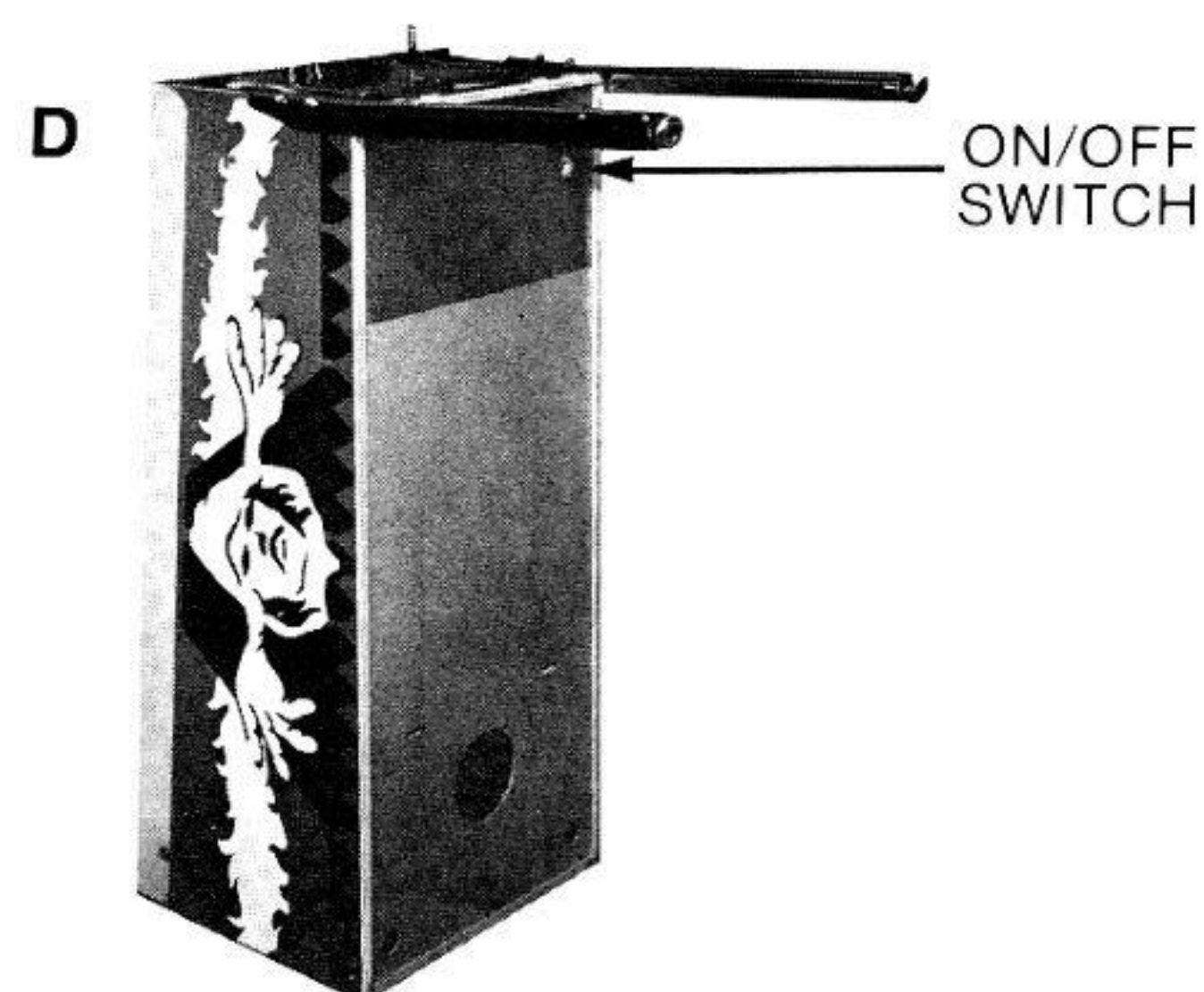
SECTION 1 INSTALLATION

Assembly and Interconnection

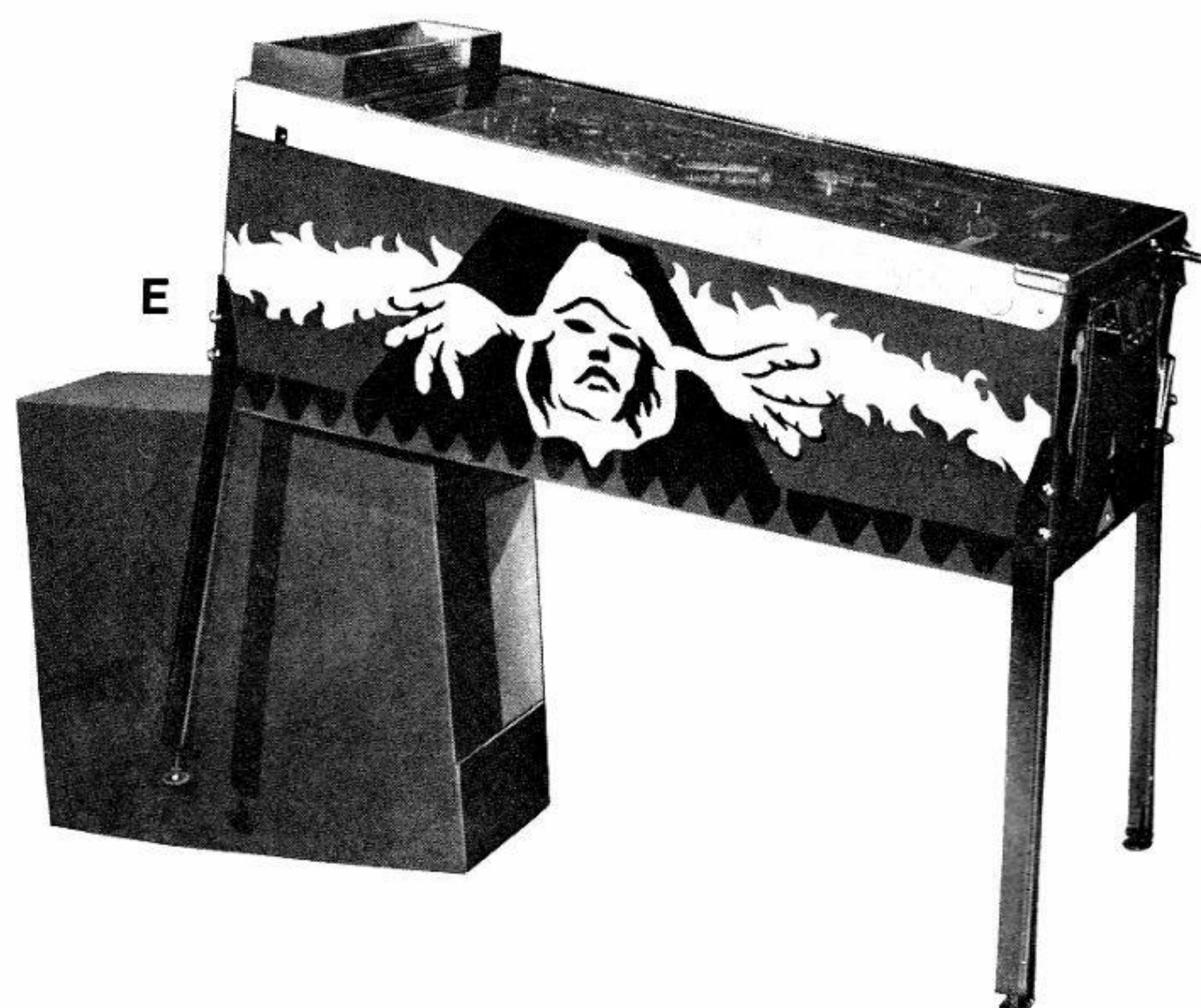
- A Carton with backglass, coin box, legs, and mounting hardware.
- B Backbox
- C Cabinet



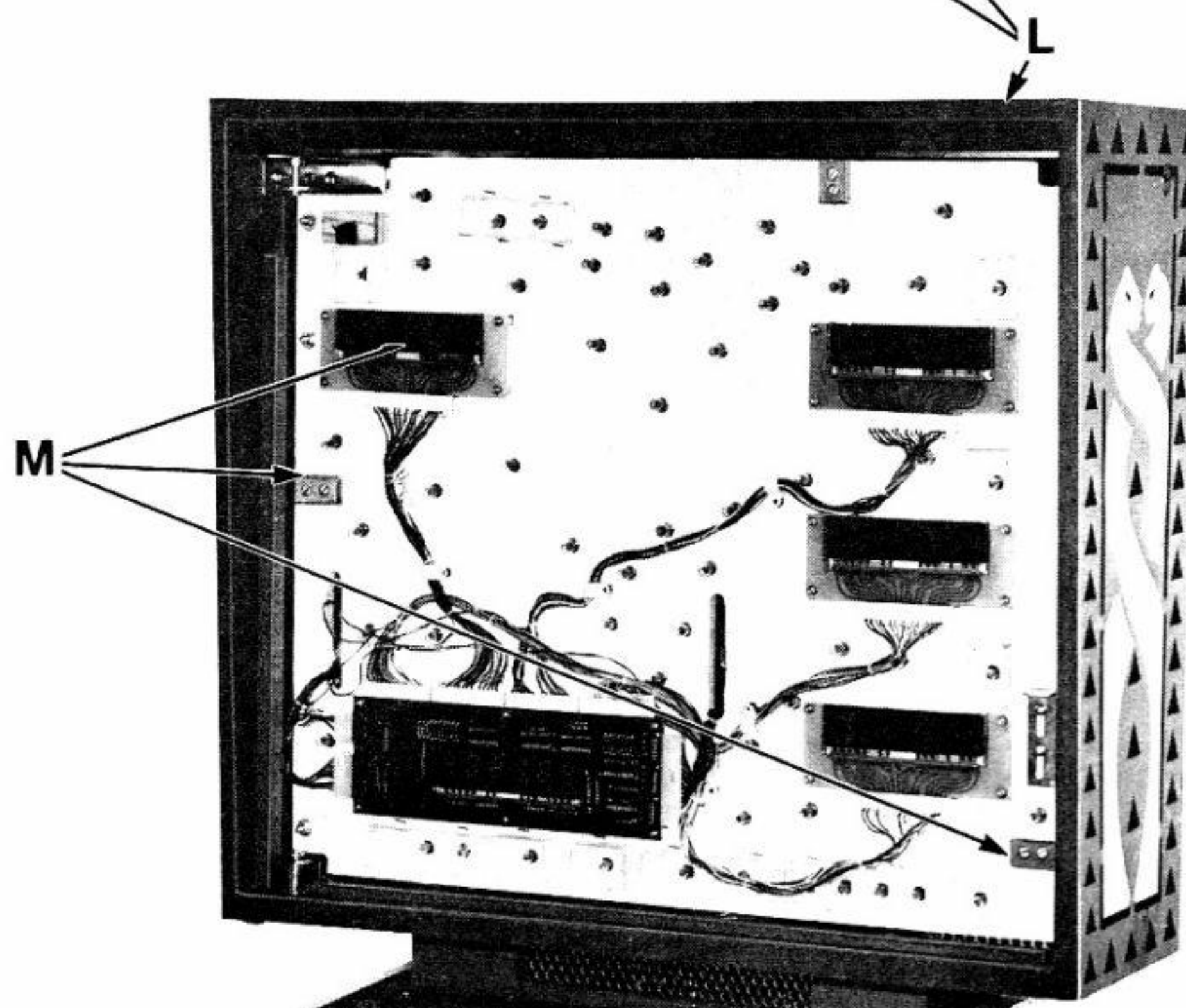
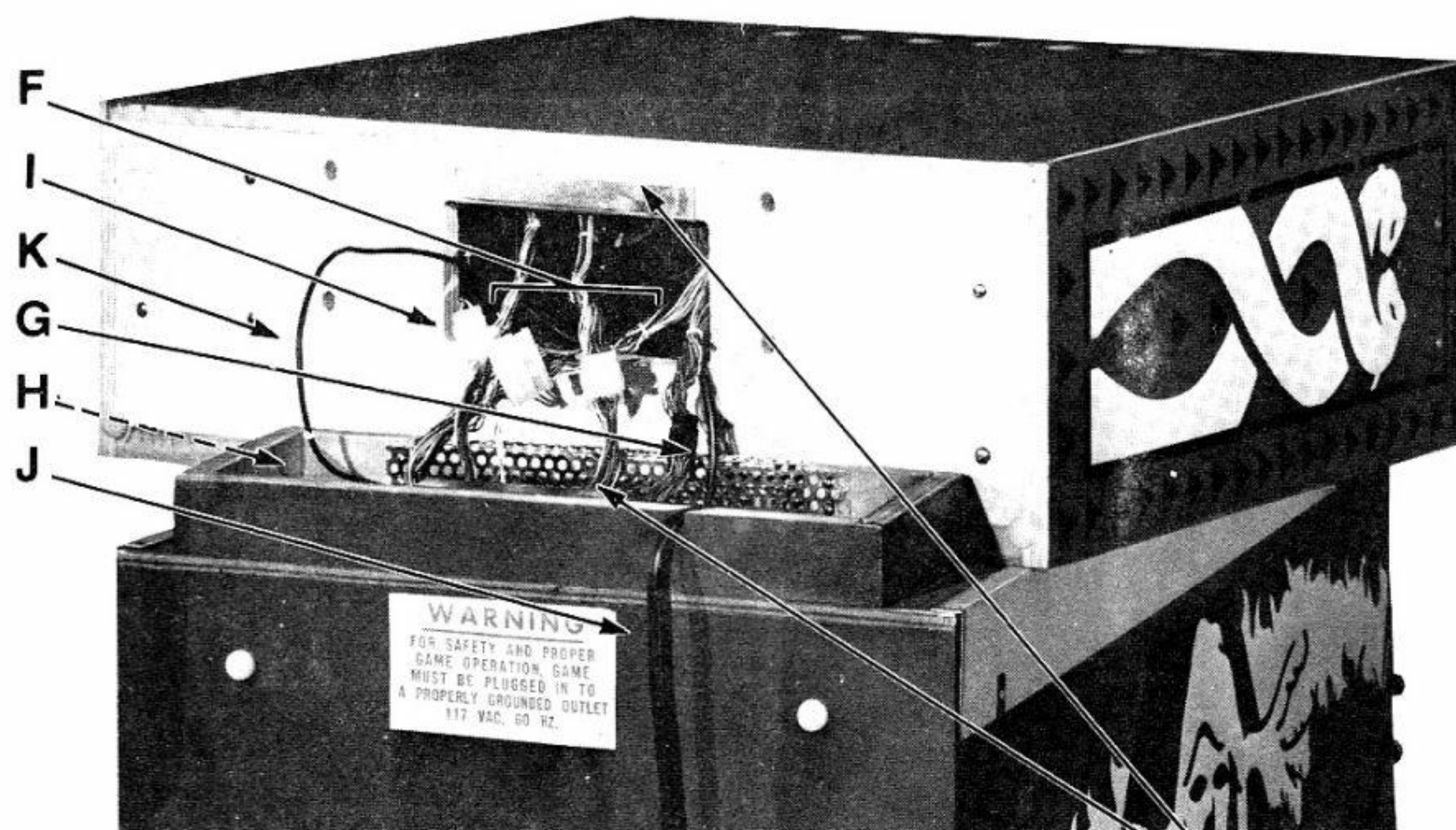
- D Attach front legs using four acorn bolts.



- E Lay backbox on side to support rear of cabinet. Attach rear legs using four acorn bolts.

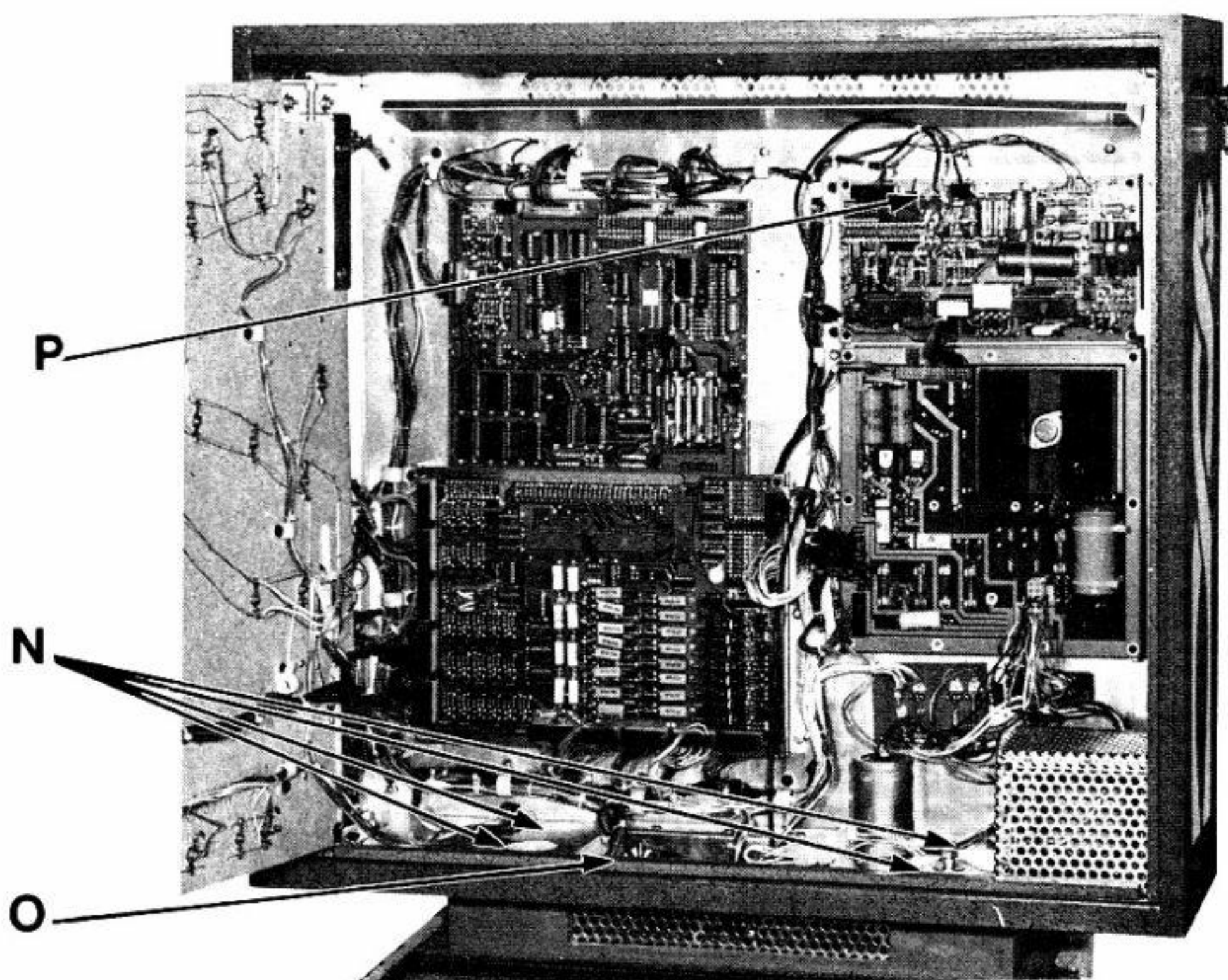


- F** Pull five cables from backbox.
- G** Reach into right side of pedestal hole, pull up ground strap, and push it into backbox.
- H** Remove the tie securing cabinet and playfield cables to cabinet and pull up these cables.
- I** Interconnect five cables. They are size and color coded except for power connector where wire colors do not match.
- J** Insert line cord into notch in cabinet. **DO NOT PLUG IN AT THIS TIME.**
- K** Push remote volume control cable into backbox.
- L** Lift up backbox and position on cabinet pedestal, engaging brackets for support.



- M** Remove shipping blocks.

- N** Secure backbox to cabinet using four bolts and washers.
- O** Connect ground braid under wing nut and washer.
- P** Loosely position remote volume control cable in harness and plug connector into 10J4 on Sound Board.



Inspection

A Check all connectors in backbox for loose wire terminations. Reseat any loose wires by pushing in on the termination.

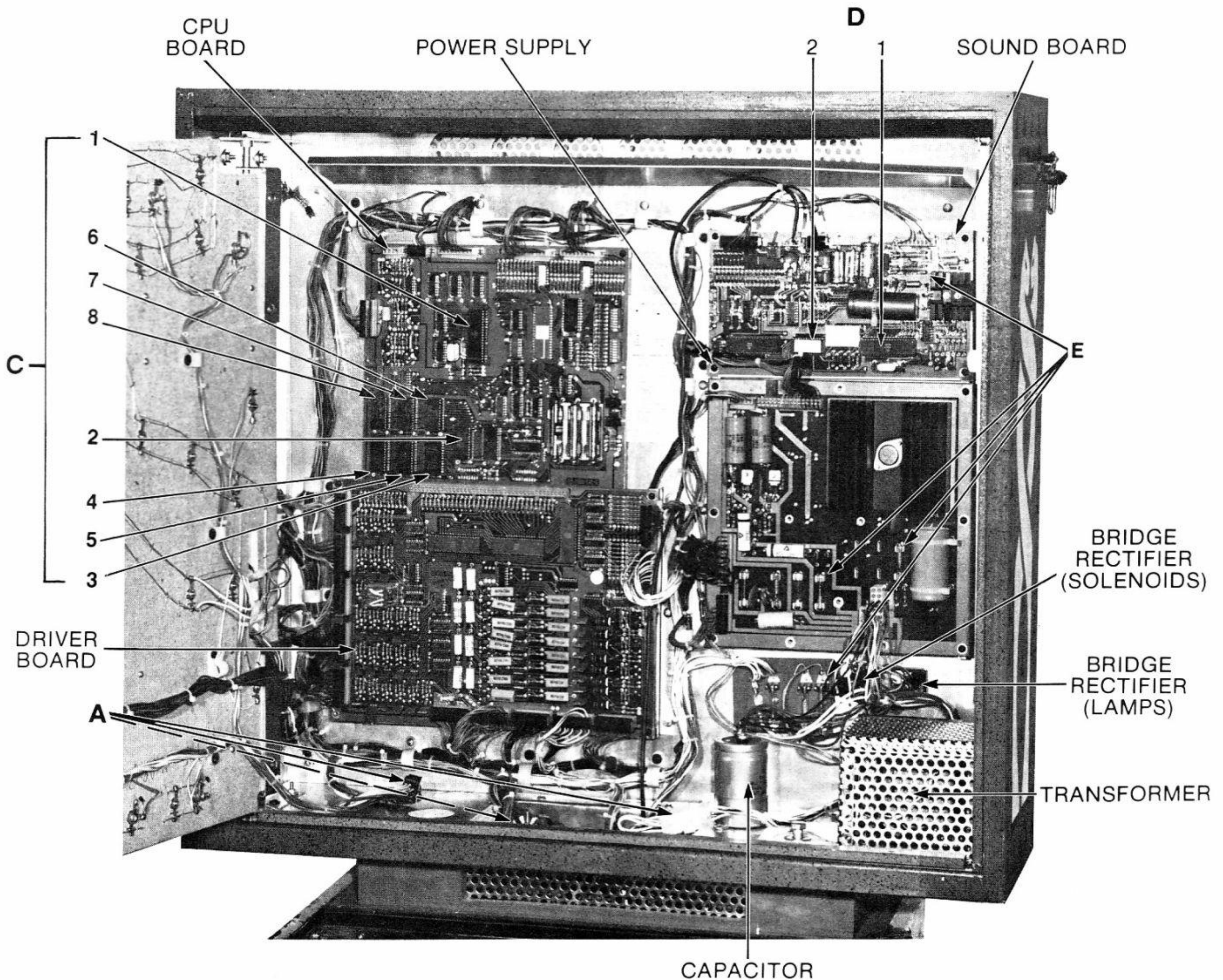
B (Not called out) Push on all connectors attached to the CPU, Driver, Sound, and Power Supply Boards and check terminations on capacitor and bridge rectifiers.

C Gently press on the socketed IC packages on CPU

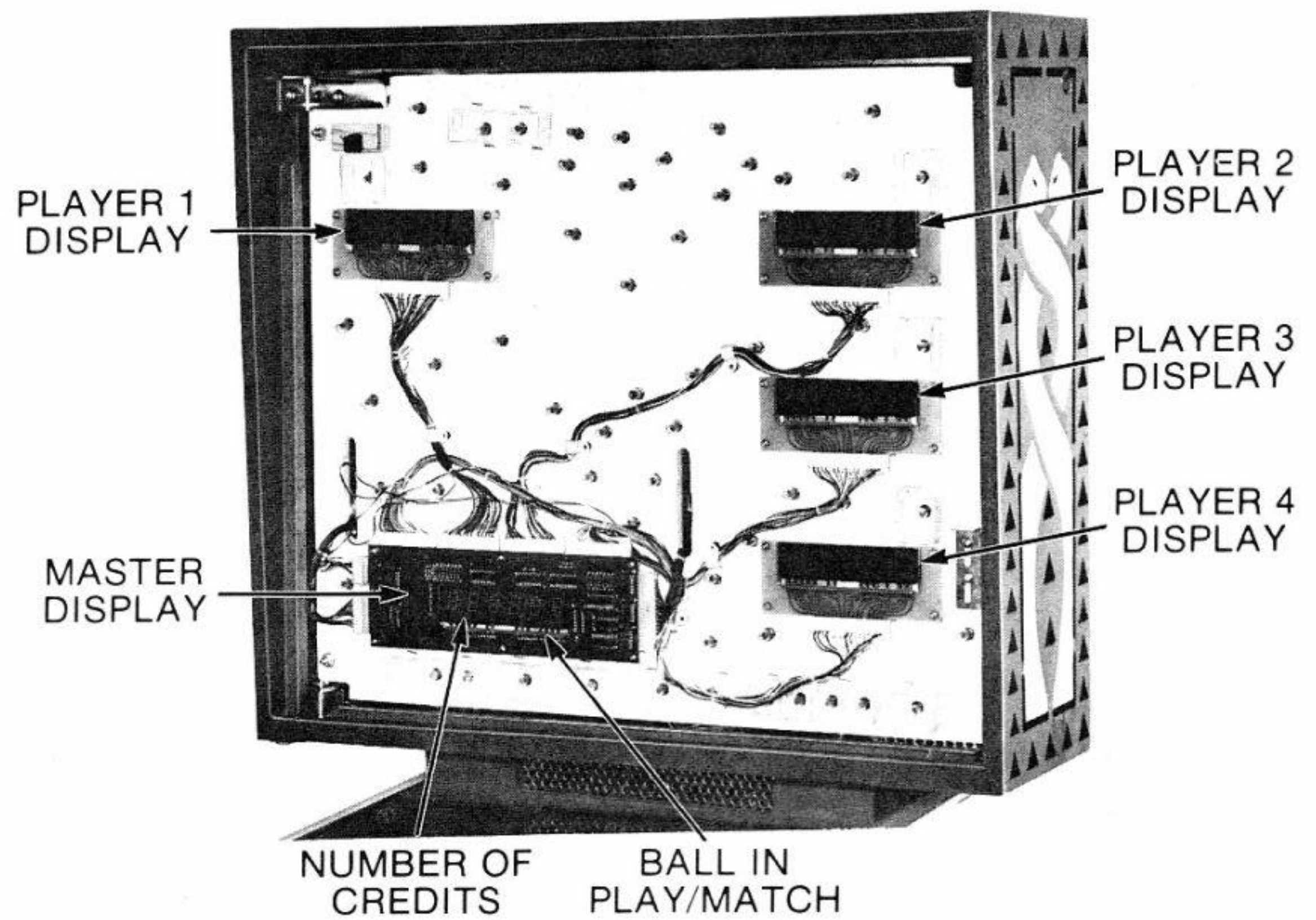
Board: 1 MPU, 2 RAM, 3 Game ROM (or 6, 7, and 8 PROMs), and 4 and 5 ROMs.

D Gently press on the socketed IC packages on Sound Board: 1 MPU, 2 Sound ROM.

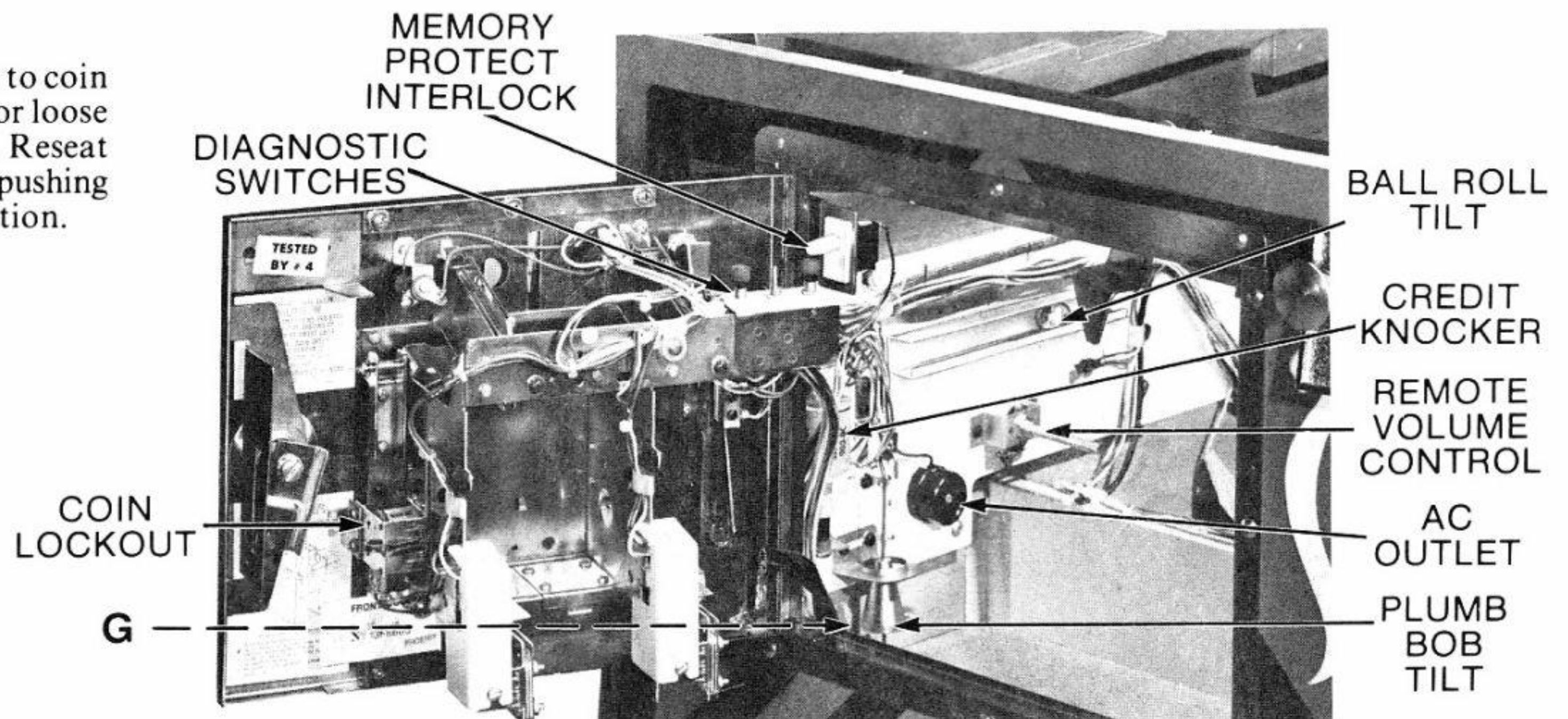
E Check that two fuses on Sound Board, five fuses on Power Supply, and three fuses on fuse card are secure.



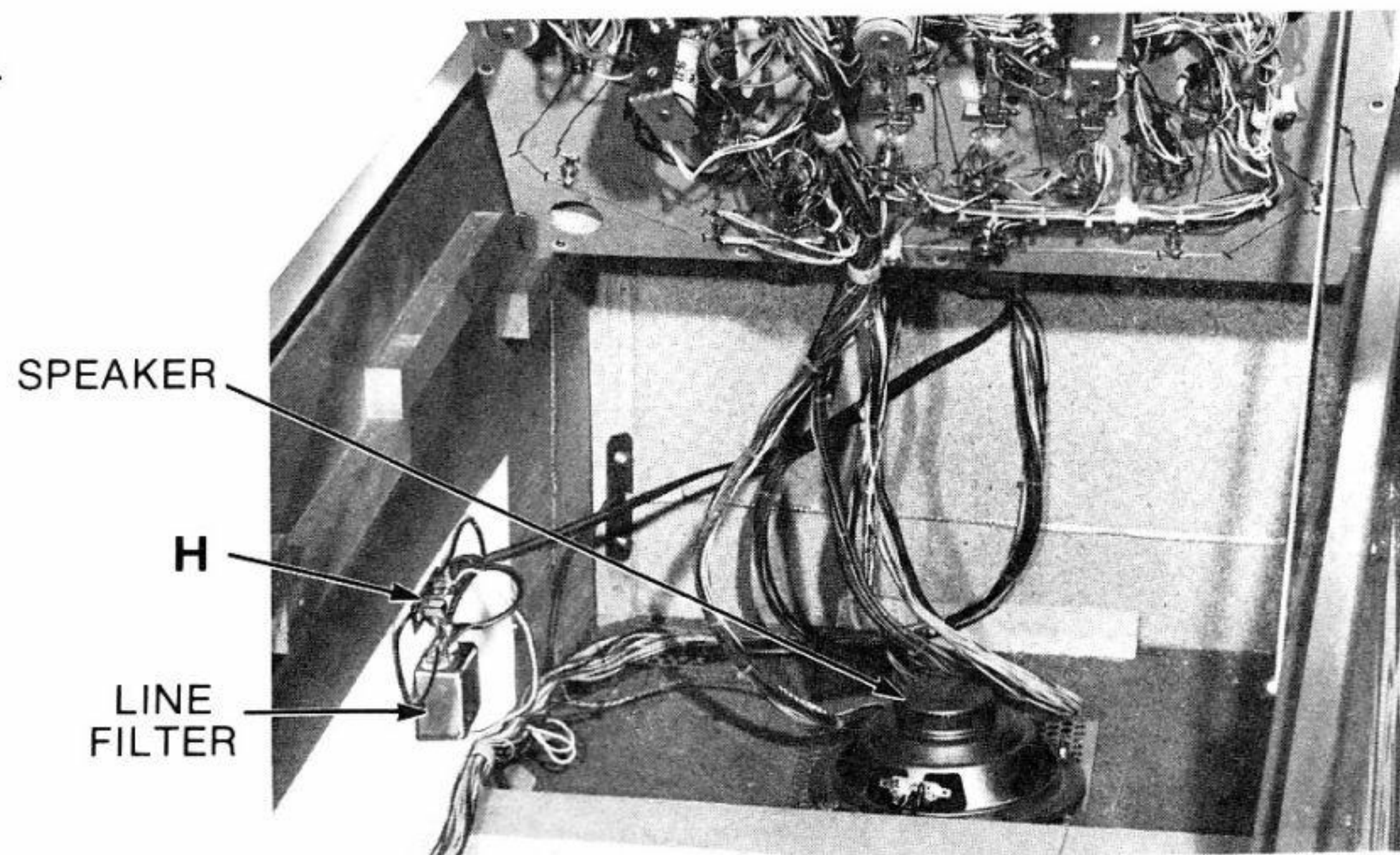
F (Not called out) Push on all connectors attached to Master and Player Display Boards.



G Check the cabinet to coin door connectors for loose wire terminations. Reseat any loose wires by pushing in on the termination.



H Check that the line fuse is secure.



Power Turn-On

This machine **MUST BE PLUGGED INTO A PROPERLY GROUNDED OUTLET** to **PREVENT SHOCK HAZARD** and to ensure **PROPER GAME OPERATION**. **DO NOT** use a "cheater" plug to defeat the ground pin on the line cord, and **DO NOT** cut off the ground pin. The line voltage **MUST** agree with that specified on the back of the cabinet or serious damage to the machine could occur. For low-line applications (105 or 210V ac), refer to the power wiring diagram in the drawing set.

1. **With the coin door closed**, plug the game in and turn it ON. The game should come on in the game over mode as indicated by the player scores reading zero, player 1 up light flashing, game over lights lit, and the high score to date alternating with the player 1 score.
2. If the game comes on in the diagnostic mode (number of credits display showing 04, ball in play display showing 00, and player 1 display showing game identification) turn the game OFF and ON again.
 - a. If the game now comes on in the game over mode the bookkeeping and game evaluation totals have been reset to zero.
 - b. If the game still comes on in the diagnostic mode, open the coin door and turn the game OFF and ON **twice**. This is an indication of the batteries being removed with the power OFF or coming loose during shipment. This has also resulted in features reverting to factory settings. Any changes from factory settings must be reentered using procedures provided in Section 3 of this manual.
3. If the game still comes on in the diagnostic mode, refer to troubleshooting procedures in the maintenance manual.
4. Perform diagnostic tests (Section 5) and make any desired changes to features (Section 3).

SECTION 2 GAME OPERATION

This Section provides an explanation of game operation.

Place the ball onto the playfield by the outhole. When the game is turned on it will come up in the game over mode. All player scores will be zero, high score to date* will alternate with the player 1 score, the player 1 up light will flash, and the game over lights will light. All playfield lights except for the credit lamp cycle in an attract mode.

When coins are inserted, credits will be posted. The knocker will sound for each credit. When the credit button on the front of the cabinet is pressed, the ball release solenoid serves the ball, the credit display will be reduced by one, the ball in play will show 1, the startup tune will be played, and the player 1 up light will flash until the first switch is made. Pressing the credit button at any time before the ball in play display indicates 2 will allow additional players, change the

number of player lights, and reduce the number of credits by one for each additional player.

The Player 1 up light will flash and the top eject lamps will sequence until the first switch is made. The top eject hole lamps then sequence each time it or any drop target is made. The bonus is advanced each time the 3-bank of drop targets is made and as indicated on the playfield. The top eject hole scores 500 when the Advance "X" Value or Lites Bull's-Eye for 30,000 lamps are lit. It scores 5000 and one bonus advance when one of the other lamps is lit. Spotting "A", "B", and "C" causes those lamps to flash and spotting them a second time with the same ball lights the Bull's-Eye target for a possible Special.

Each 3-bank target scores 1000. Making the 3-bank the first time scores 5000 and lights "1" and "2"*. Each additional time the 3-bank is made the highest lit value is scored and lighting of "1" through "5" is advanced. Lighting "5" lights the top eject hole for a possible extra ball.

Making each 5-bank drop target scores 1000 and lights a jet bumper to score 1000. Making all targets in the 5-bank advances the bonus multiplier, scores an additional 5,000, and turns off all jet bumpers. Making the 5-bank the first time lights the left outlane rollover for 30,000 and 3 bonus advances; making them a second time lights the right outlane and flashes the 5-bank Special lamp*. Making the 5-bank when the Special lamp is flashing awards a Special.

The right side eject hole collects the bonus. If the 10X lamp is lit, the "X" value resets to 5X. The top right and left standups and the kickers each score 10. The 3-bank and 5-bank standups each score 500. The lower left and right standups each score 1000. All other scoring is as previously described or as indicated on the playfield. The Bull's-Eye target Special lamp and top eject hole Extra Ball when lit lamps are restored for subsequent balls if the feature was not collected. In addition, the lit "1"-"5" lamps are restored* until an Extra Ball is won.

If a player's score exceeds the current high score to date, three* credits will be awarded, the game will play a high score to date tune, and the highest score to date lights will remain lit.

The Plumb Bob Tilt tilts the ball in play on the third* closure. The Playfield Shake and Ball Roll tilt switches tilt the ball in play immediately. The slam tilt switch on the coin door sets all player scores to zero and returns the game to game over.

If coins are inserted or credits won and the maximum* number of credits is exceeded, the credits will be posted correctly but the coin lockout coil will be de-energized until the number of remaining credits is below the maximum. While the coil is de-energized, no credits may be won and any coins inserted will be rejected.

*These features are adjustable and the procedure is outlined in Section 3.

SECTION 3 GAME ADJUSTMENTS

This section provides information for making game adjustments and reviewing game status. There are four switches, all accessible from the coin door (Figure 1) or the front of the cabinet, which are used to display and change game features:

1. AUTO-UP/MANUAL-DOWN toggle switch (inside coin door)
2. ADVANCE pushbutton (inside coin door)
3. HIGH SCORE RESET pushbutton (inside coin door)
4. Credit button (front of cabinet)

Procedure (Refer to Table 1 and [for pricing] Table 2 for Function 13-35 adjustment values).

Coin door must remain open to change settings

1. In game over mode, set toggle switch to AUTO-UP and depress ADVANCE pushbutton. Test 04 is indicated in number of credits display, Function 00 in ball in play display, and game identification in player 1 display.
2. To raise Function number in ball in play display, operate ADVANCE pushbutton with switch set to AUTO-UP; to lower Function number operate ADVANCE with it set to MANUAL-DOWN.
3. With desired Function number indicated in ball in play display, raise value in player 1 display by operating credit button with switch set to AUTO-UP; lower value by operating credit button with it set to MANUAL-DOWN. Value left on player 1 display is new setting.
4. Repeat steps 2 and 3 until all desired adjustments have been made.

5. Turn game OFF and back ON to return to game over mode.

Restoring Factory Settings (Functions 01-35)

Coin door must remain open to restore factory settings

Factory settings are restored using the coin door switches and two switches on the CPU Board. On the right side of the CPU Board (Figure 2) there are two 8-position miniature slide switches and two pushbutton switches. The lower 8-position switch is not used and the lower (DIAGNOSTIC) pushbutton switch is used only for trouble-shooting. The game is first placed in a blanking mode from the coin door and then switch number 7 on the MASTER COMMAND (upper) slide switch is set to ON (moved to left) and all other switches are set to OFF (moved to the right). Finally, the MASTER COMMAND ENTER pushbutton is depressed. To reset Functions 12 through 35 to factory settings and to zero audit totals (Functions 01-11), proceed as follows:

1. With the game in the game over mode, set the AUTO-UP/MANUAL-DOWN switch to MANUAL-DOWN AND momentarily depress the ADVANCE pushbutton. All displays should go blank.
2. Remove the backglass and unlatch and open the insert door.
3. Set all switches on the MASTER COMMAND switch to OFF (move to the right).
4. Set switch 7 on the MASTER COMMAND switch to ON (move to the left).
5. Momentarily depress MASTER COMMAND ENTER pushbutton. The LEDs should blink once.
6. Turn the game OFF and ON twice to return to the game over mode.

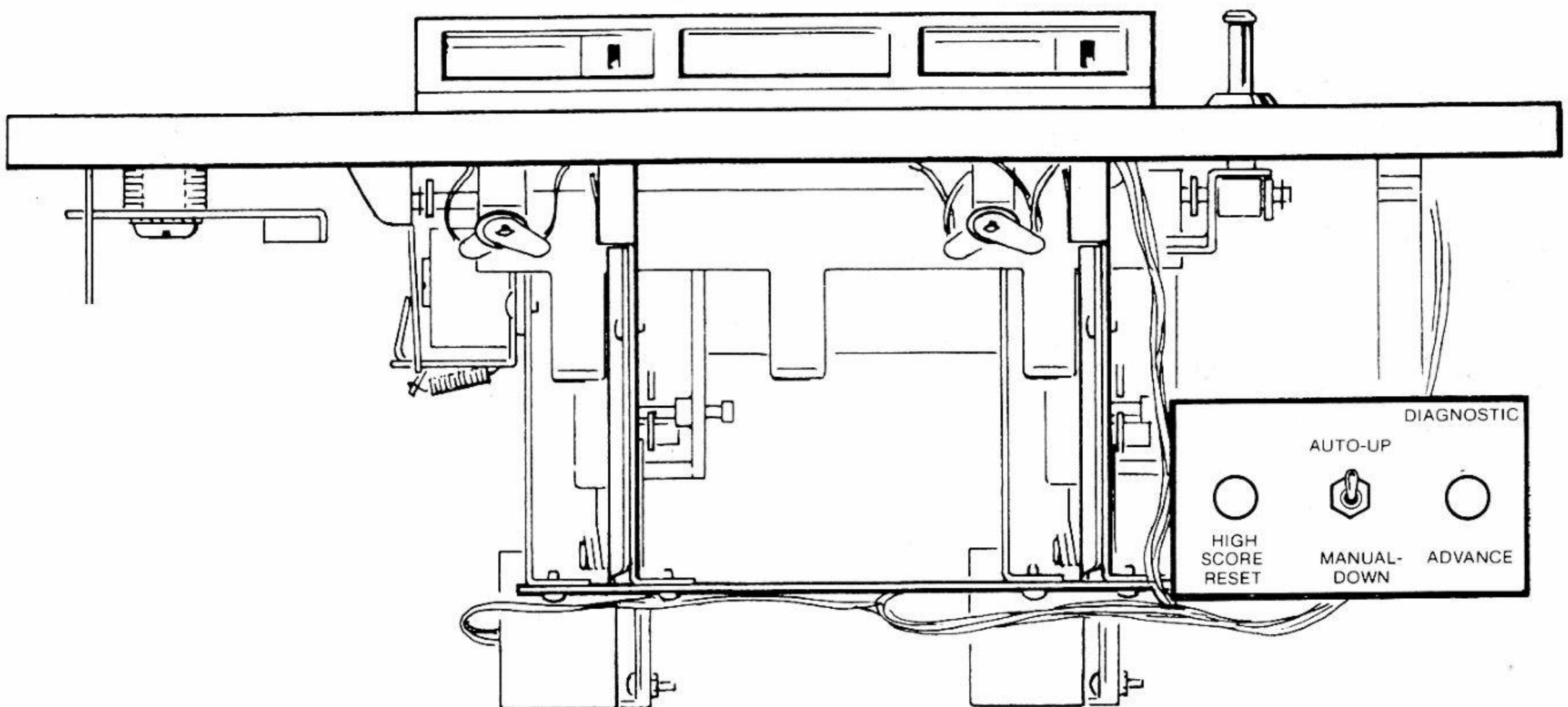


Figure 1. Coin Door Switches

Table 1. Game Adjustments

FUNCTION	DESCRIPTION	NOTES	FACTORY SETTING	Notes:
00	Game Identification		1489 2	1. Functions 00-11 cannot be changed from the coin door; however, Functions 01-11 can be set to zero as described in Section 4.
01	Coins, Left Chute (Closest to coin door hinge)	1	—	
02	Coins, Center Chute	1	—	
03	Coins, Right Chute	1	—	2. Total Credits (Function 08) is the sum of Function 04 and as applicable, Functions 05, 06, and 07.
04	Total Paid Credits	1	—	
05	Total Specials	1	—	
06	Total Replay (Extra Ball) Scores	1	—	3. Total Extra Balls (Function 09) is the sum of the game extra ball feature and Functions 05 and 06, as applicable.
07	Match and High Score to Date Credits	1	—	
08	Total Credits	1,2	—	
09	Total Extra Balls	1,3	—	
10	Total Ball Time in Minutes	1	—	
11	Total Number of Balls Played	1	—	4. Current High Score to Date (Function 12) can be changed to the value of the Backup High Score to Date (Function 13) by operating the HIGH SCORE RESET switch while in the game over mode.
12	Current High Score to Date	4	450,000	
13	Backup High Score to Date	5	450,000	
14	Replay 1 Score	6	290,000	
15	Replay 2 Score	6	490,000	
16	Replay 3 Score	6	600,000	5. Function 13 may be set to any multiple of 10,000 points. Setting Function 25 to zero with Function 13 set to any score but zero permits the High Score to Date feature to operate but no credits are awarded.
17	Replay 4 Score	6	0	
18	Maximum Credits	7	20	
19	Standard and Custom Pricing Control (00-07)	8	05	
20	Left Coin Slot Multiplier	8	01	6. Functions 14-17 (Replay Scores) may be set to any multiple of 10,000 points. Setting a function to zero disables the replay score point. Always disable the Replay 4 level first, the Replay 3 level second, etc. The replay levels must be set with ascending values.
21	Center Coin Slot Multiplier	8	04	
22	Right Coin Slot Multiplier	8	01	
23	Coin Units Required for Credit	8	01	
24	Coin Units Bonus Point	8	04	
25	High Score Credits	8	03	
26	Match (00=ON, 01=OFF)	5	00	7. Setting Maximum Credits (Function 18) to zero places the game in a free play mode.
27	Bull's-Eye Target Special	—	00	
	00 = Awards Credit	—	00	
	01 = Awards Extra Ball	—	00	
	02 = Awards 50,000 Points	—	00	
28	Scoring Awards	—	00	
	00 = Credits at Replay Score	—	00	
	01 = Extra Ball at Replay Score	—	00	8. With Function 19 set to 00, Functions 20-24 must be set manually. Refer to Table 2 for seven standard pricing schemes (selected by values of 01-07 for Function 19) and custom pricing values.
29	Maximum Plumb Bob Tilts (1-9)	—	03	
30	Number of balls (03 or 05)	—	03	
31	Play	—	02	9. Setting Function 35 to 00 turns the background sound off. Alternate settings of 12, 14, or 16 are also suggested.
	01 = Liberal, Stars 1 & 2 and Stars 3 & 4 lit together	—	00	
	02 = Moderate, Stars 1 & 2 lit together	—	00	
	03 = Conservative, All Stars lit separately	—	00	
32	5-Bank Target Awards	—	00	
	00 = Moderate, Right Outlane 30,000 and 5-Bank Target Special lit separately	—	00	
	01 = Liberal, Right Outlane 30,000 and 5-Bank Target Special lit together	—	00	
33	Extra Ball Control	—	00	
	00 = Extra Ball Allowed	—	00	
	01 = No Extra Ball	—	00	
34	5-Bank Target Special Awards, "1"-5" Restore	—	00	
	00 = Awards Credit, lamps restored	—	00	
	01 = Awards Extra Balls, lamps restored	—	00	
	02 = Awards 50,000 points, lamps restored	—	00	
	10 = Awards Credit, lamps not restored	—	00	
	11 = Awards Extra Ball, lamps not restored	—	00	
	12 = Awards 50,000 points, lamps not restored	—	00	
35	Background Sound Option (00-31)	9	18	

RECOMMENDED SCORE LEVELS

Levels	Score Card
CREDIT GAMES	
3-Ball:	
*290,000; 490,000; 600,000	489-16
or 280,000; 430,000	489-30
5-Ball:	
490,000; 670,000	489-46
EXTRA BALL	
3-Ball:	
160,000	489-57
5-Ball:	
220,000	489-59
*Factory setting	

Table 2. Standard and Custom Price Settings

COIN DOOR MECHANISM	CREDITS	FUNCTION					
		19	20	21	22	23	24
Quarter, Twin-Quarter,	•1/25c, 3/50c	01	01	01	01	01	02
	•1/25c	02	01	04	01	01	00
	2/25c, 5/50c	00	02	02	02	01	04
	2/25c	00	02	02	02	01	00
	1/25c, 5/\$1	00	01	01	01	04	00
	1/50c	00	01	01	01	02	00
	1/50c, 3/\$1	00	01	01	01	02	04
*Quarter, Dollar, Quarter	•1/25c, 5/\$1	05	01	04	01	01	04
	•1/25c, 4/\$1	02	01	04	01	01	00
IDM, 5DM, 2 DM	•2/1DM, 5/2DM, 14/5DM	03	13	65	26	05	65
20-Cent, 50-Cent	1/20c, 3/50c	00	06	00	15	05	00
1 Franc, 5 Frank	•1/1F, 6/5F	04	01	00	05	01	05
	1/1F, 7/5F	00	06	00	30	05	30
25 Cent, 1 Guilder,	•1/25c, 4/1G	06	01	00	04	01	00
	1/25c, 5/1G	00	01	00	04	01	04
50 Yen, 100 Yen	•1/50Y, 2/100Y	07	01	00	02	01	00
1 Franc or Twin-1 Franc	•1/1F, 3/2F	01	01	01	01	01	02
	•1/1F	02	01	01	01	01	00
5 Franc, 10 Franc	•1/5F, 2/10F	07	01	00	02	01	00
	1/10F	00	01	00	02	02	00
Twin-2 Franc	•1/2F	02	01	01	01	01	00
10, 20 Franc	•1/10F, 2/20F	07	01	00	02	01	00
Twin-1 Sucre	1/3S, 2/5S	00	02	00	02	05	00

•Indicates standard price settings by adjusting **only** Function 19. For other price settings, set Function 19 to 00 and set Functions 20 through 24 to the values indicated in the chart.

*or Quarter, Dollar, — .

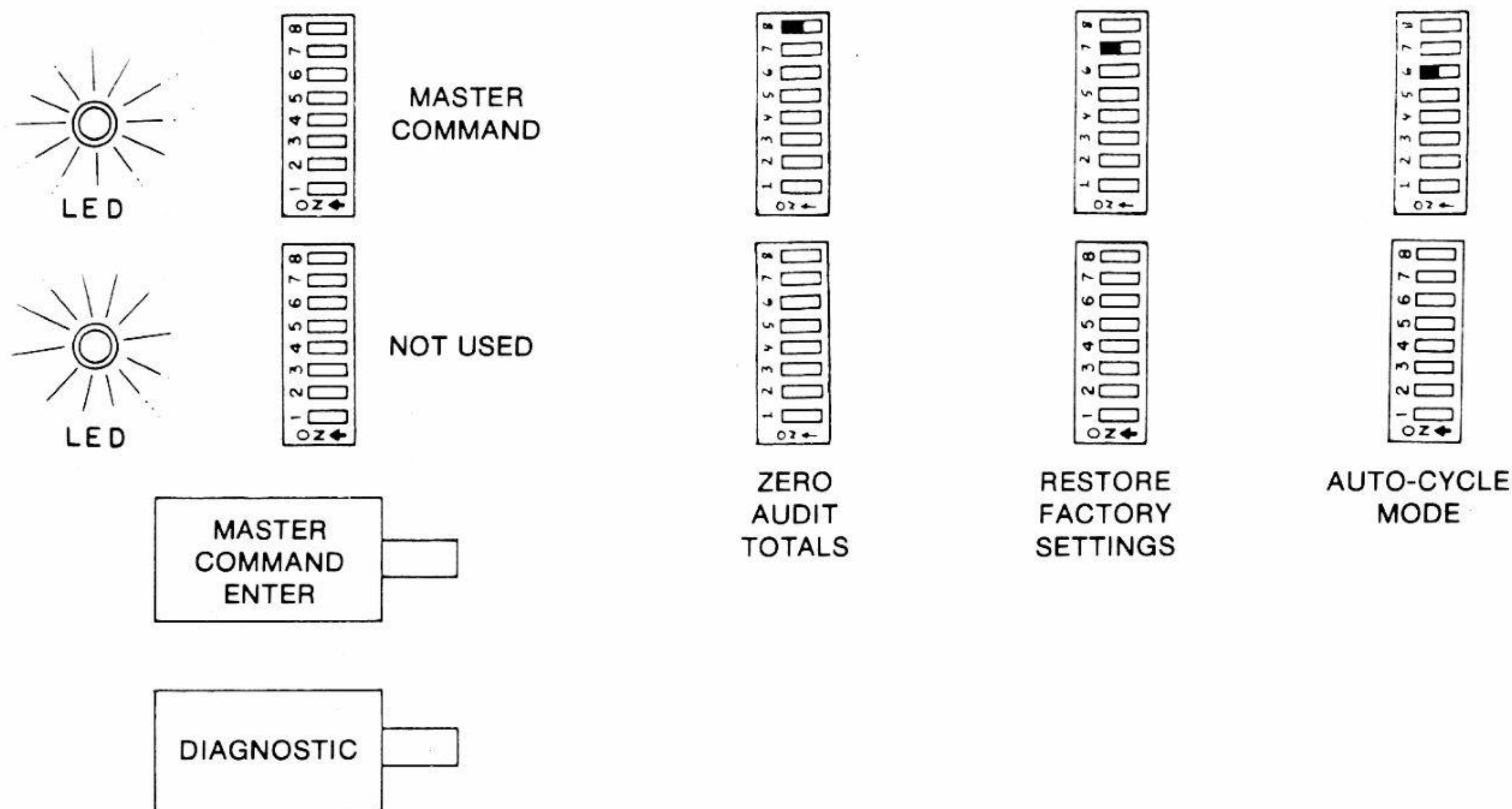


Figure 2. Master Command Switch Settings

SECTION 4 BOOKKEEPING AND GAME EVALUATION

Procedure (Functions 01-12, see Table 1)

1. In game over mode, set toggle switch to AUTO-UP and depress ADVANCE pushbutton. Test 04 is indicated in number of credits display, Function 00 in ball in play display, and game identification in player 1 display.
2. Operate the ADVANCE pushbutton to display each Function on the ball in play display and record each total from the player 1 display. (To review a total that has been advanced past, set toggle switch to MANUAL-DOWN and operate ADVANCE pushbutton).
3. Calculate percentage of paid credits as follows:

$$\% \text{ Paid Credits} = \text{Function 04} \div \text{Function 08}$$
4. Turn game OFF and back ON to return to game over mode.

High Score Reset

The current High Score to Date (Function 12) may be reset to the backup High Score to Date (Function 13) from the coin door. To adjust the backup High Score to Date, see Section 3. With the game in the game over mode, momentarily depress the HIGH SCORE RESET pushbutton.

Resetting Audit Totals (Functions 01-11)

Audit totals may be reset to zero using the coin door switches and two switches on the CPU Board described in Section 3. To reset Functions 01 through 11 to zero, refer to Figure 2 and proceed as follows:

1. With the game in the game over mode, set the AUTO-UP/MANUAL-DOWN switch to MANUAL-DOWN and momentarily depress the ADVANCE pushbutton. All displays should go blank.
2. Remove the backglass and unlatch and open the insert door.
3. Set all switches on the MASTER COMMAND slide switch to OFF (move to the right).
4. Set switch 8 on the MASTER COMMAND switch to ON (move to the left).
5. Momentarily depress MASTER COMMAND ENTER pushbutton. The LEDs should blink once.
6. Turn the game OFF and ON to the game over mode.

SECTION 5 BUILT-IN DIAGNOSTICS

Procedure (Display Digits, Lamp, Solenoid, and Switch Tests; see Table 3 and Figure 3)

1. In game over mode, set toggle switch to MANUAL-DOWN and depress ADVANCE. All displays should go blank.
2. Momentarily depress ADVANCE and set toggle switch to AUTO-UP. Display Digits test is performed.
3. Momentarily depress ADVANCE. Test 01 is indicated on number of credits display and lamp test is performed. (All multiplexed lamps blink).
4. Set toggle switch to MANUAL-DOWN and momentarily depress ADVANCE. Test 02 is indicated on number of credits display and solenoid 01 on ball in play display; solenoid 01 is pulsed by Driver Board.
5. Operate ADVANCE to pulse each solenoid.

6. Set toggle switch to AUTO-UP and momentarily depress ADVANCE. Test 03 is indicated on number of credits display and stuck switches on ball in play display.
7. Operate switches; switch number is indicated on ball in play display.
8. Turn game OFF and ON to return to game over mode.

Table 3. Solenoids

SOL. NO.	FUNCTION
01	Ball Release
02	Top Eject Hole
03	Side Eject Hole
04	3-Bank Drop Targets Reset
05	5-Bank, Top Drop Targets Reset
06	5-Bank, Bottom Drop Targets
07	Right Kicker
08	Left Kicker
09	Sound
10	Sound
11	Sound
12	Sound
13	Sound
14	Credit Knocker
15	Not Used
16	Coin Lockout
17	Left Top Jet Bumper
18	Left Center Jet Bumper
19	Left Bottom Jet Bumper
20	Right Center Jet Bumper
21	Right Jet Bumper
22	Not Used

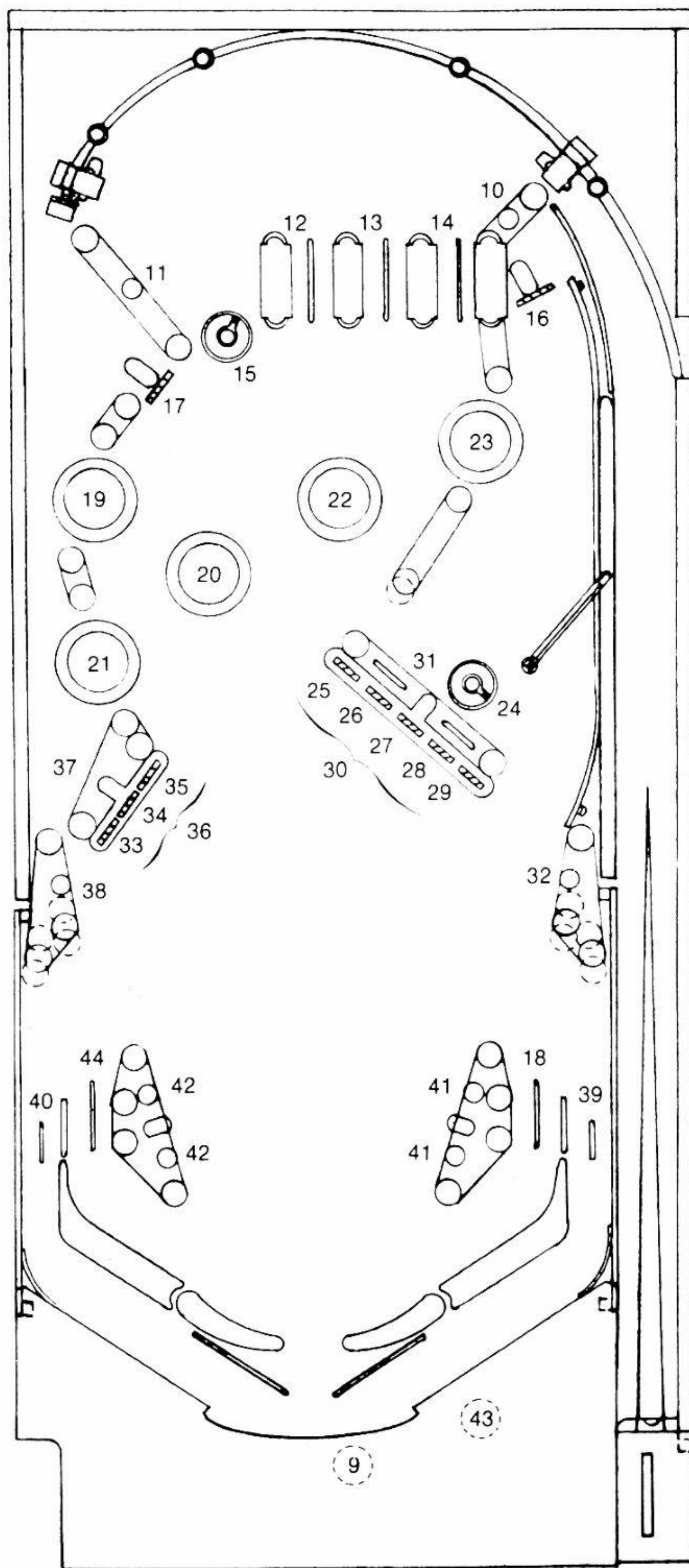
Auto-Cycle Mode

This mode is provided to help diagnose intermittent problems by continuously performing the Display Digits, Lamp, and Solenoid Tests. Each cycle of this mode sequences through the display tests, flashes the lamps 64 times, and pulses each solenoid. This mode is initiated using the coin door switches and two switches on the CPU Board described in Section 3. To initiate the Auto-Cycle mode refer to Figure 2 and proceed as follows:

1. With the game in the game over mode, set the AUTO-UP/MANUAL-DOWN switch to MANUAL-DOWN and momentarily depress the ADVANCE pushbutton. All displays should go blank.
2. Remove the backglass and unlatch and open the insert door.
3. Set all switches on the MASTER COMMAND slide switch to OFF (move to the right).
4. Set switch 6 to ON (move to the left).
5. Momentarily depress the MASTER COMMAND ENTER pushbutton. The LEDs should blink once.
6. Set the toggle switch to AUTO-UP and momentarily depress the ADVANCE pushbutton.
7. To terminate the Auto-Cycle mode and go to game over, turn the game OFF and ON.

SECTION 6 MATRIX CHARTS AND PLAYFIELD SPARE PARTS

This section provides matrix charts for lamps and switches (Figures 4 and 5), solenoid identification and connections (Table 4), and playfield spare parts identification (Figure 6).



**Switch
No. Function**

- 1 Plumb Bob Tilt
- 2 Ball Roll Tilt
- 3 Credit Button
- 4 Right Open Switch
- 5 Center Coin Switch
- 6 Left Coin Switch
- 7 Slam Tilt
- 8 High Score Reset
- 9 Outhole
- 10 Upper Right Standup
- 11 Upper Left Standup
- 12 "A" Rollover
- 13 "B" Rollover
- 14 "C" Rollover
- 15 Top Eject Hole
- 16 Bulls'-Eye Target
- 17 Left Target
- 18 Right Inside Rollover
- 19 Left Top Jet Bumper
- 20 Left Center Jet Bumper
- 21 Left Bottom Jet Bumper
- 22 Right Center Jet Bumper
- 23 Right Jet Bumper
- 24 Right Eject
- 25 5-Bank Drop Target #1 (Top)
- 26 5-Bank Drop Target #2
- 27 5-Bank Drop Target #3
- 28 5-Bank Drop Target #4
- 29 5-Bank Drop Target #5 (Bottom)
- 30 5-Bank Drop Target Series
- 31 5-Bank Standup
- 32 Right Standup
- 33 3-Bank Drop Target Left
- 34 3-Bank Drop Target Center
- 35 3-Bank Drop Target Right
- 36 3-Bank Drop Target Series
- 37 3-Bank Standup
- 38 Left Standup
- 39 Right Outside Rollover
- 40 Left Outside Rollover
- 41 Right Kicker
- 42 Left Kicker
- 43 Playfield Tilt
- 44 Left Inside Rollover

Figure 3. Playfield Switch Locations and Switch Chart

COLUMN ROW	1 YEL-BRN	2 YEL-RED	3 YEL-ORN	4 YEL-BLK	5 YEL-GRN	6 YEL-BLU	7 YEL-VIO	8 YEL-GRY
1 RED-BRN	NOT USED	"8" BONUS	EJECT HOLE 5000	"A-B-C" LITES BULL'S-EYE SPECIAL	3-BANK "1"	LEFT BOTTOM JET BUMPER	INSIDE ROLLOVERS (2)	#1 PLAYER UP
2 RED-BLK	"1" BONUS	"9" BONUS	EJECT HOLE BULL'S-EYE	BULL'S-EYE #1 (BOTTOM)	3-BANK "2"	RIGHT CENTER JET BUMPER	1 CAN PLAY	#2 PLAYER UP
3 RED-ORN	"2" BONUS	"10" BONUS	EJECT HOLE ADVANCE "X"	BULL'S-EYE #2	3-BANK "3"	RIGHT JET BUMPER	2 CAN PLAY	#3 PLAYER UP
4 RED-YEL	"3" BONUS	"11" BONUS	EJECT HOLE LITES INSIDE ROLLOVERS	BULL'S-EYE "3"	3-BANK "4"	EXTRA BALL WHEN LIT #1 (BOTTOM)	3 CAN PLAY	#4 PLAYER UP
5 RED-GRN	"4" BONUS	"12" BONUS	"X2"	BULL'S-EYE #4 (TOP)	3-BANK "5"	EXTRA BALL WHEN LIT #2	4 CAN PLAY	TILT
6 RED-BLU	"5" BONUS	"A"	"X3"	BULL'S-EYE SPECIAL	SHOOT AGAIN	EXTRA WHEN LIT #3	MATCH	GAME OVER
7 RED-VIO	"6" BONUS	"B"	"X5"	LEFT 30,000 WHEN LIT	LEFT TOP JET BUMPER	EXTRA BALL WHEN LIT #4 (TOP)	BALL IN PLAY	SAME PLAYER SHOOTS AGAIN (BACKBOX)
8 RED-GRY	"7" BONUS	"C"	"X10"	RIGHT 30,000 WHEN LIT	LEFT CENTER JET BUMPER	5-BANK SPECIAL WHEN LIT	CREDITS (PLAYFIELD)	HIGH SCORE TO DATE

Figure 4. Lamp Matrix

COLUMN ROW	1 GRN-BRN	2 GRN-RED	3 GRN-ORN	4 GRN-YEL	5 GRN-BLK	6 GRN-BLU	7 GRN-VIO	8 GRN-GRY
1 WHT-BRN	PLUMB BOB TILT 1	OUTHOLE 9	LEFT TARGET 17	5-BANK DROP TARGET #1 (TOP) 25	3-BANK DROP TARGET LEFT 33	RIGHT KICKER 41	NOT USED 49	NOT USED 57
2 WHT-RED	BALL ROLL TILT 2	UPPER RIGHT STANDUP 10	RIGHT INSIDE ROLLOVER 18	5-BANK DROP TARGET #2 26	3-BANK DROP TARGET CENTER 34	LEFT KICKER 42	NOT USED 50	NOT USED 58
3 WHT-ORN	CREDIT BUTTON 3	UPPER LEFT STANDUP 11	LEFT TOP JET BUMPER 19	5-BANK DROP TARGET #3 27	3-BANK DROP TARGET RIGHT 35	PLAYFIELD TILT 43	NOT USED 51	NOT USED 59
4 WHT-YEL	RIGHT COIN SWITCH 4	"A" ROLLOVER 12	LEFT CENTER JET BUMPER 20	5-BANK DROP TARGET #4 28	3-BANK DROP TARGET SERIES 36	LEFT INSIDE ROLLOVER 44	NOT USED 52	NOT USED 60
5 WHT-GRN	CENTER COIN SWITCH 5	"B" ROLLOVER 13	LEFT BOTTOM JET BUMPER 21	5-BANK DROP TARGET #5 (BOTTOM) 29	3-BANK STANDUP 37	NOT USED 45	NOT USED 53	NOT USED 61
6 WHT-BLU	LEFT COIN SWITCH 6	"C" ROLLOVER 14	RIGHT CENTER JET BUMPER 22	5-BANK DROP TARGET SERIES 30	LEFT STANDUP 38	NOT USED 46	NOT USED 54	NOT USED 62
7 WHT-VIO	SLAM TILT 7	TOP EJECT HOLE 15	RIGHT JET BUMPER 23	5-BANK STANDUP 31	RIGHT OUTSIDE ROLLOVER 39	NOT USED 47	NOT USED 55	NOT USED 63
8 WHT-GRY	HIGH SCORE RESET 8	BULL'S-EYE TARGET 16	RIGHT EJECT 24	RIGHT STANDUP 32	LEFT OUTSIDE ROLLOVER 40	NOT USED 48	NOT USED 56	NOT USED 64

Figure 5.  Matrix

Table 4. Solenoid Connections

SOL. NO.	FUNCTION	WIRE COLOR	CONNECTIONS	DRIVER TRANS.	SOLENOID PART NO.
01	Ball Release	GRY-BRN	2P11-4, 8P3-17	Q15	SA-23-850-DC
02	Top Eject Hole	GRY-RED	2P11-5, 8P3-18	Q17	SA3-23-850-DC
03	Side Eject Hole	GRY-ORN	2P11-7, 8P3-19	Q19	SA3-23-850-DC
04	3-Bank Drop Targets Reset	GRY-YEL	2P11-8, 8P3-20	Q21	SA3-23-850-DC
05	5-Bank, Top Drop Targets Reset	GRY-GRN	2P11-9, 8P3-21	Q23	SA3-23-850-DC
06	5-Bank, Bottom Drop Targets Reset	GRY-BLU	2P11-3, 8P3-22	Q25	SA3-23-850-DC
07	Right Kicker	GRY-VIO	2P11-2, 8P3-23	Q27	SA3-23-850-DC
08	Left Kicker	GRY-BLK	2P11-1, 8P3-24	Q29	SA3-23-850-DC
09	Sound	BRN-BLK	2P9-9, 10P3-3	Q31	--
10	Sound	BRN-RED	2P9-7, 10P3-2	Q33	--
11	Sound	BRN-ORN	2P9-1, 10P3-5	Q35	--
12	Sound	BRN-YEL	2P9-2, 10P3-4	Q37	--
13	Sound	BRN-GRN	2P9-3, 10P3-7	Q39	--
14	Credit Knocker	BRN-BLU	2P9-4, 7P1-16	Q41	SA2-23-850-DC
15	Not Used	BRN-VIO	2P9-5, 7P1-17	Q43	--
16	Coin Lockout	BRN-GRY	2P9-6, 7P1-18, 7P2-4	Q45	SM-35-4000-DC
*17	Left Top Jet Bumper	BLU-BRN	2P12-7, 8P3-11	Q2	SG-23-850-DC
*18	Left Center Jet Bumper	BLU-RED	2P12-4, 8P3-12	Q4	SG-23-850-DC
*19	Left Bottom Jet Bumper	BLU-ORN	2P12-3, 8P3-13	Q6	SG-23-850-DC
*20	Right Center Jet Bumper	BLU-YEL	2P12-6, 8P3-14	Q8	SG-23-850-DC
*21	Right Jet Bumper	BLU-GRN	2P12-8, 8P3-15	Q10	SG-23-850-DC
*22	Not Used	BLU-BLK	2P12-9, 8P3-16	Q12	--
*	Right Flipper	BLU-VIO	7P1-8, 8P3-3	--	SFL-20-300/ 30-800-DC
*	Left Flipper	BLU-GRY	7P1-10, 8P3-4	--	SFL-20-300/ 30-800-DC

***NOTES:**

1. Special switch connections for solenoids 17 through 22 are as follows:

17 -- ORN-BRN -- 2P13-5, 8P3-5
 18 -- ORN-RED -- 2P13-3, 8P3-6
 19 -- ORN-BLK -- 2P13-2, 8P3-7
 20 -- ORN-YEL -- 2P13-4, 8P3-8
 21 -- ORN-GRN -- 2P13-8, 8P3-9
 22 -- ORN-BLU -- 2P13-9, 8P3-10

2. Flipper button connections are as follows:

Right -- ORN-VIO -- 2P12-1, 7P1-7
 Left -- ORN-GRY -- 2P12-2, 7P1-9

3. Typical wiring for solenoids and special switches:

