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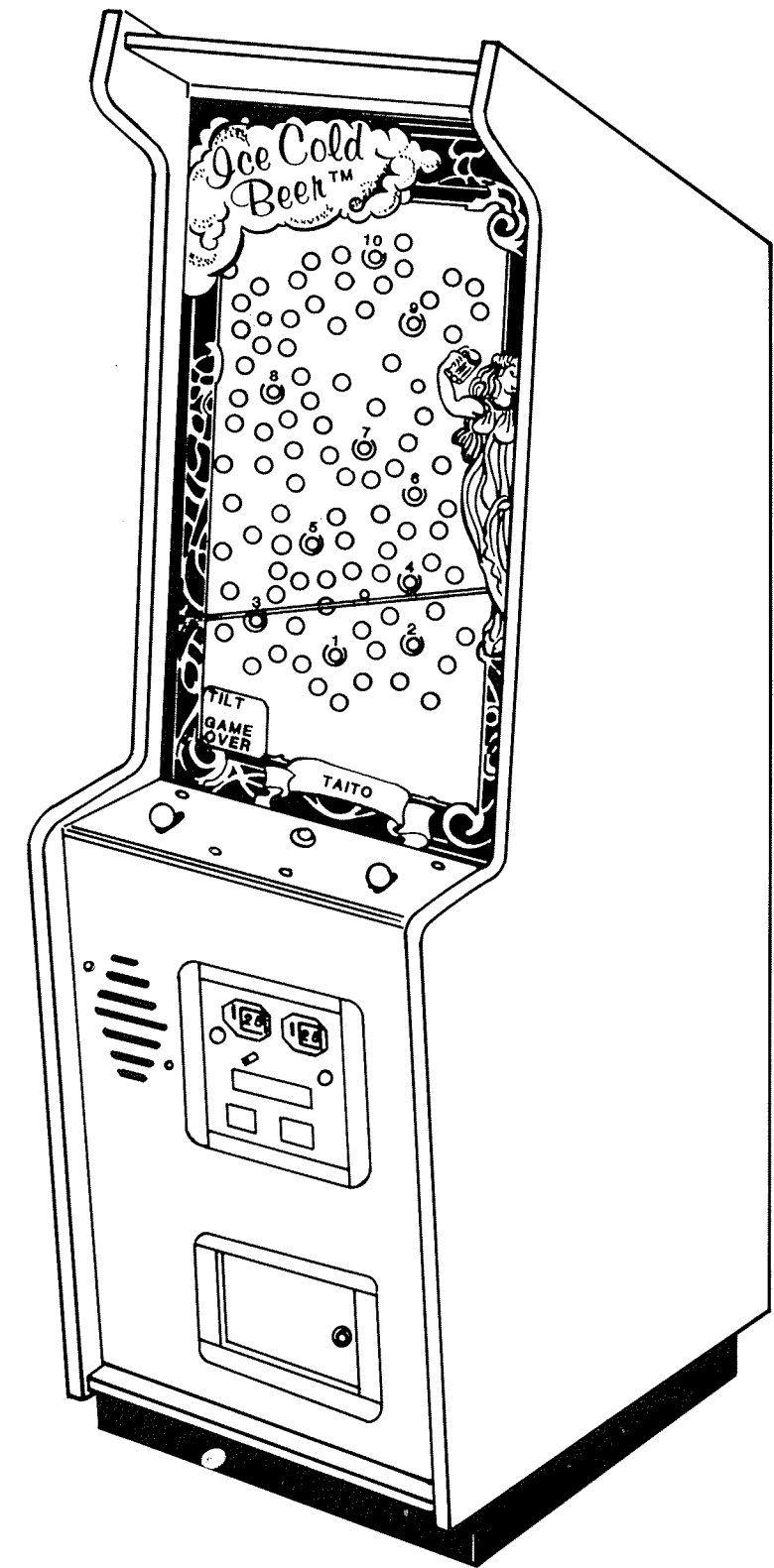
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ICE COLD BEER



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ICE COLD BEER™

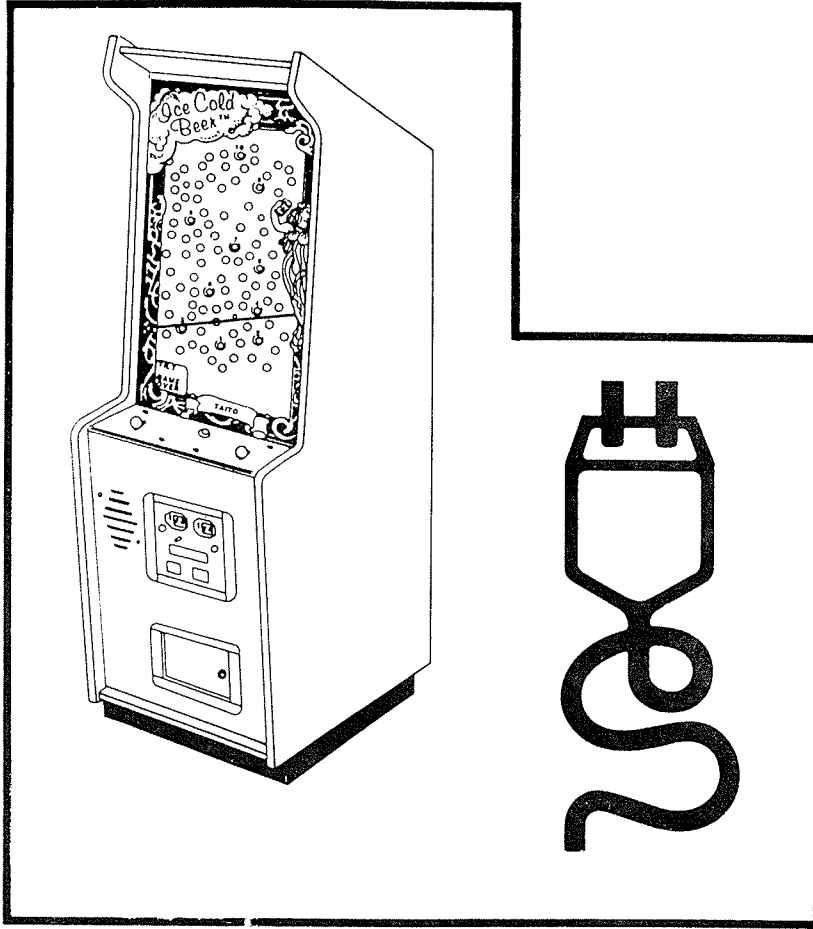
OPERATION, MAINTENANCE AND SERVICE MANUAL
Complete with Illustrated Parts Catalog

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Game Set-Up

1

1. GAME SET-UP

1.1 GAME FEATURES

TAITO AMERICA CORPORATION'S "ICE COLD BEER"™ game operates on a simple electro-mechanical mechanism, which makes it reliable and easy to service.

A larger security designed cash box has been incorporated into the design of this cabinet.

The Control Panel has a polycarbonate overlay, so cigarette marks and marks can easily be wiped clean. This overlay can be replaced if necessary.

The Coverglass is made of fully Tempered Glass to minimize breakage.

The Back Service Door is fully removeable making servicing of the game easier.

Leg levelers are installed on the game.

An Optional Ticket Dispenser is available. For further information contact Taito America Corporation's Customer Service Department in Elk Grove Village, Illinois.

1.2 INTRODUCTION

TAITO AMERICA CORPORATION is pleased to introduce "ICE COLD BEER"™ the most challenging game to hit the market in years.

The object of the game is for the player to maneuver the ball with the joysticks that moves the bar to position the ball in the lit hole. Each side of the bar can be moved independently to position the ball.

The vertical playfield is filled with non lit holes so you must use all your skills to position the ball to go in the right lit hole. The easier lit holes are at the bottom of the playfield so you have to have steady concentration to reach the top hole.

"ICE COLD BEER"™ has several features like our self prompt feature. If you take too long to move the bar it will begin on its own. It also has a tilt feature and a Bonus feature. If the game is tilted in any way the ball in play will be lost. The Bonus feature allows you to start out with bonus points and the quicker your ball goes in the lit hole the more bonus points you receive.

1.3 GAME INSPECTION

TAITO AMERICA CORPORATION'S "ICE COLD BEER"™ game is shipped ready for operation, but a last visual check should be made to insure the game is in good condition. Please verify the following before turning the game on.

- * Check the exterior of the game for shipping damage, chips, dents or broken parts.
- * Open the Rear Service Door and check for any interior damage.
- * Make sure there isn't any damage to the wiring.
- * Check the printed circuit board, making sure there is no damage to the components.
- * Check fuses making sure they are firmly in their holders.
- * Check for loose foreign objects, especially metal objects which may cause electrical problems.
- * Check Plug-in Connectors making sure they are firmly in their sockets.
- * Check the Coin Door for any possible damage, especially the switches.

1.4 PRE GAME INSTALLATION

"ICE COLD BEER"™ has leg levelers which should be adjusted before your game is ready to play. Be sure you readjust the leg levelers whenever you move the game from one location to another.

Since the ball is shipped separately, you will have to take the ball out of the shipping package and place the ball into the hole at the upper right hand corner of the playfield background.

1.5 POWER REQUIREMENTS

TAITO AMERICA CORPORATION'S "ICE COLD BEER"™ game is shipped ready for operation at 120VAC, 60 Hz with a power consumption of approximately 100 Watts.

1.6 POWER ON/OFF SWITCH

To minimize the hazard of electrical shock while servicing the game, a Power ON/OFF Switch has been provided. This switch is located in the lower right front of the cabinet. Refer to Figure 1.

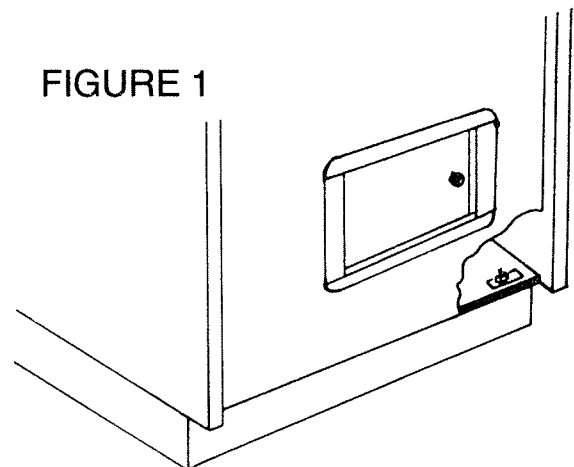


FIGURE 1

1.7 COIN METERS

This game is equipped with one coin meter inside the cash box.

1.8 TEST AND ALIGNMENT PROCEDURE ELECTRICAL TEST

The hole test is to test the lit holes to make sure they light in the right sequence. The bar test is to insure the bar will travel the entire playfield without binding. The Errant Ball test is to test the errant ball switch and solenoid to make sure they function properly. Follow the instructions below before performing each of these tests.

1. Open the Coin Door and unlatch the Control Panel, tilt the Control Panel forward and remove the playfield glass. Refer to Section 2.6.
2. Turn the game on and credit the game. Push play button.

1.8.1 HOLE TEST

Wait until the music and bar stops at the starting position and then place the ball in the lit hole. Make sure that the points tally properly if not the display will say "OOPS". Repeat until all ten holes have been tested. If the "OOPS" is displayed adjust the appropriate switch.

1.8.2 BAR TEST

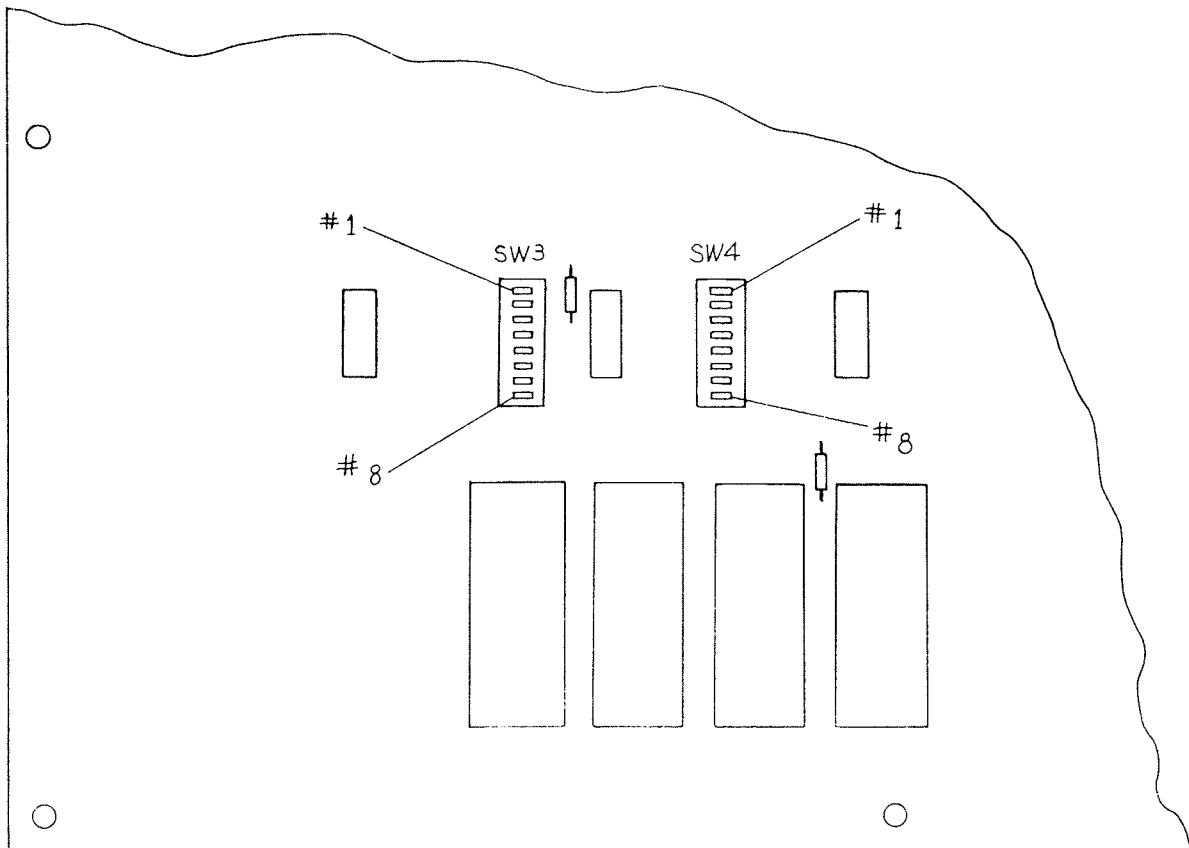
With the ball off the bar run the bar up and down the playfield using the appropriate joystick to insure that the upper and lower limit switches engage properly.

1.8.3 ERRANT BALL TEST

Drop the ball in the bottom most hole making sure that "OOPS" is displayed and the ball returns to the ball gate.

1.9 DIP SWITCH SETTINGS

FIGURE 2



SW3

C = "CLOSED" or "ON"
O = "OPEN" or "OFF"

1	
2	
3	
4	
5	
6	
7	
8	

DIFFICULTY (PROMPT TIME) (SEC.)

7	8	Dif.	(SEC.)
C	C	EASY	(5, 4, 2, 1)
O	C	FACTORY	(4, 2, 1, 1)
C	O	HARD	(2, 2, 1, 1)
O	O	X-HARD	(1, 1, 1, 1)

MANUAL ATTRACT MODE DELAY (MIN.)

5	6	(MIN.)
C	C	0
O	C	2
C	O	5
O	O	10

AUTOMATIC ATTRACT MODE DELAY (MIN.)

3	4	(MIN.)
C	C	1
O	C	5
C	O	10
O	O	15

ROUNDS TO COMPLETE TO LIGHT STAR

CLOSED = 1 FRAME
OPEN = 2 FRAMES

AUTOMATIC ATTRACT MODE ENABLE

CLOSED = DISABLED
OPEN = ENABLED

SW4

C = "CLOSED"
O = "OPEN"

1	
2	
3	
4	
5	
6	
7	
8	

BONUS COUNTDOWN SPEED

7	8	SPEED
C	C	SLOW
O	C	FACTORY
C	O	FAST
O	O	X-FAST

SCORE FOR EXTRA BALL

5	6	OPTION
C	C	NO EXTRA BALL
O	C	2000
C	O	4000
O	O	8000

COINS PER CREDIT
C = 2 O = 1

SW3 DISPENSE OPTION

1	2	3	OPTION
C	C	C	DISABLED
O	C	C	5 TICKETS AFTER HOLE 5
C	O	C	1 TICKET AFTER HOLES 5 - 10
O	O	C	5 TICKETS AFTER HOLE 10
C	C	O	2 TICKETS AFTER HOLE 6
C	O	O	3 TICKETS AFTER HOLE 10
O	C	O	NO TICKETS DISPENSED
C	O	O	NO TICKETS DISPENSED
O	O	O	NO TICKETS DISPENSED

Switch 3

1 2 3 4 5 6 7 8

C = Closed or On
O = Open or Off

Difficulty (Prompt Time)(Sec)

7	8	Diff.
C	C	Easy
O	C	Factory
C	O	Hard
O	O	X-Hard

Scoring:
Closed = Reset score to 0 on loss of ball
Open = Normal

Target Hole

Closed = Restart player at hole 1 on loss of ball
Open = Continue from last hole completed

Balls/Game

3	4	Balls
C	C	2
O	C	3
C	O	4
O	O	5

Rounds to complete Game/Light Star
Closed = 1 Frame
Open = 2 Frames

Automatic Attract Mode Enable
Closed = Disabled
Open = Enabled

Switch 4

1 2 3 4 5 6 7 8

C = Closed
O = Open

Bonus Countdown Speed

7	8	Speed
C	C	Slow
O	C	Factory
C	O	Fast
O	O	X-Fast

X 2500

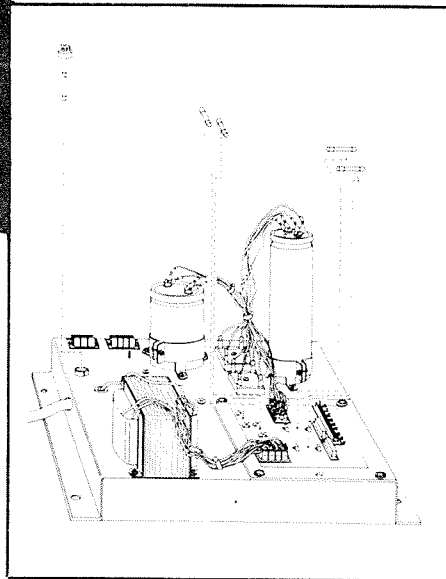
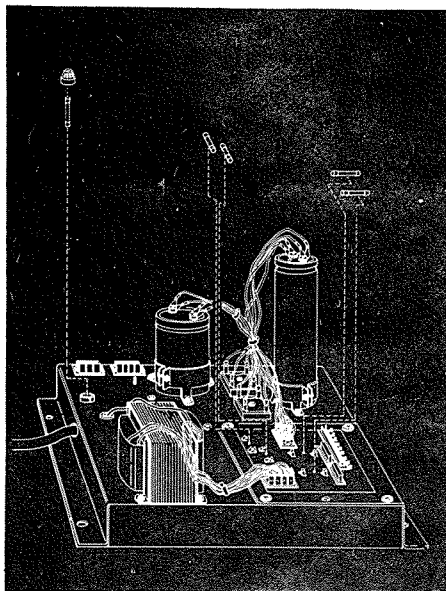
Coins per Credit
C = 2 O = 1

Payout Option

Bonus Payout
1 at 3,000
1 at 5,000
1 at 8,000

Ticket Vend

1	2	3	Option
C	C	C	Disabled
O	C	C	1 at Hole 10, 1 at Hole 20
C	O	C	2 at Hole 6, 3 at Hole 10
O	O	C	1 at Hole 10, 2 at Hole 20
C	C	O	1 at Hole 20
O	C	O	2 at Hole 10, 3 at Hole 20
C	O	O	3 at Hole 10, 5 at Hole 20
O	O	O	5 at Hole 10, 10 at Hole 20



Maintenance

ALL GAMES REQUIRE A CERTAIN AMOUNT OF MAINTENANCE TO KEEP IT IN GOOD WORKING ORDER. A PERIODIC CHECK OF THE MECHANICAL CONTROLS WOULD BE BENEFICIAL TO THE SUCCESS OF YOUR GAME.

2

2. MAINTENANCE

2.1 CLEANING

The exterior of the game, all metal parts and all plastic parts can be cleaned with a non-abrasive cleanser. Caution should be used when cleaning the glass, a dry cloth can cause scratches and result in a foggy appearance.

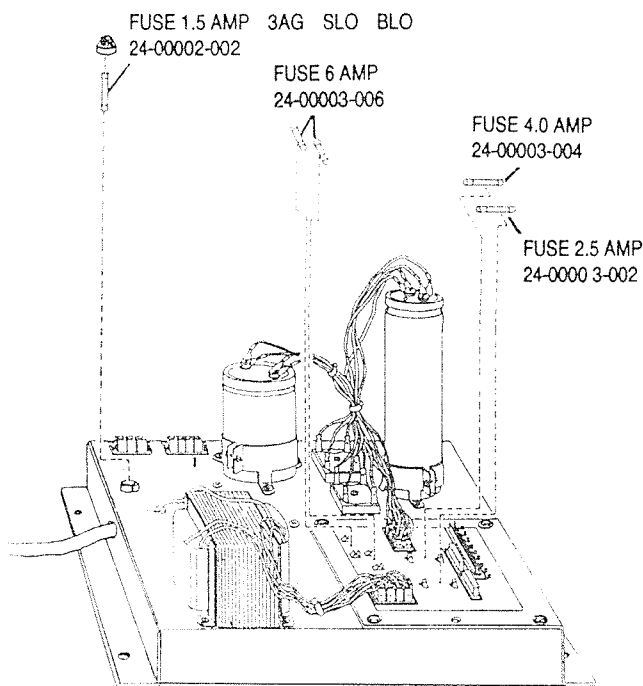
2.2 COIN DOOR

The Coin Door in "ICE COLD BEER"™ game needs little or no maintenance. If desired, a special coin mechanism cleanser that leaves no residue, can be obtained from your distributor.

2.3 FUSE REPLACEMENT

This game contains (5) fuses. All five of these fuses can be found on the Power Supply Assembly. Refer to Figure 3 for the location of these fuses.

FIGURE 3



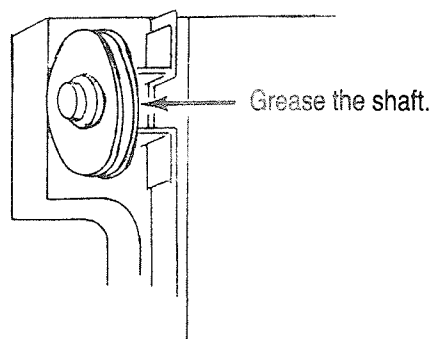
2.4 LUBRICATION OF MECHANICAL PARTS

To insure a minimum of maintenance on this game a periodic lubricating of the mechanical parts is required.

PULLEY LUBRICATION

Lubricate the upper pulleys every 60 days using a multi- service lithium grease. See Figure 4.

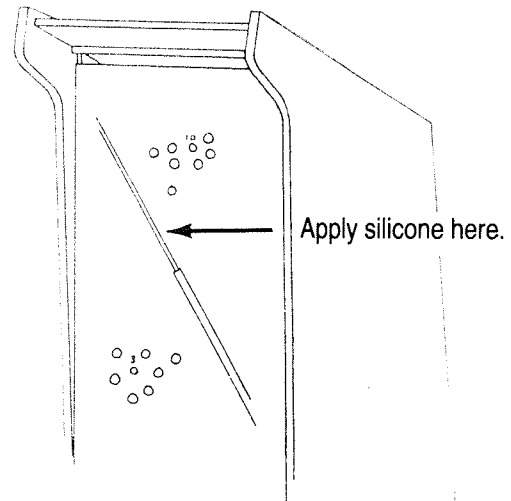
FIGURE 4



BALL ROD LUBRICATION

Lubricate the ball rods every 60 days using silicone.

FIGURE 5



Ball Rod Lubrication

1. Remove the coverglass. Refer to coverglass removal section 2.6.
2. Extend rods diagonally as shown in Figure 5.
3. Put the silicone on a clean cloth and then rub the cloth over the ball rods.

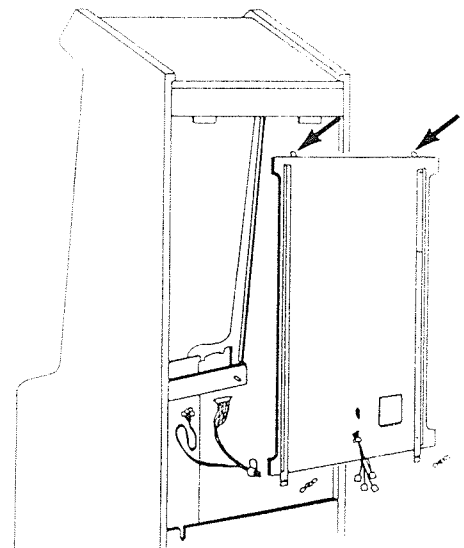
Note: It is important not to get the silicone on the playfield. This may be accomplished by shielding the playfield with a non absorbant material such as waxed paper.

2.5 PLAYFIELD REMOVAL (Refer to Figure 6.)

To remove the playfield follow the instructions listed.

1. Remove the playfield by removing the four harness connectors and the playfield readout connector.
2. Unscrew the two wing nuts on the bottom of the playfield.
3. Slide the playfield out by lifting the bottom out and down.
4. Slide the playfield out until the upper retaining brackets are free and then remove it from the cabinet.

FIGURE 6

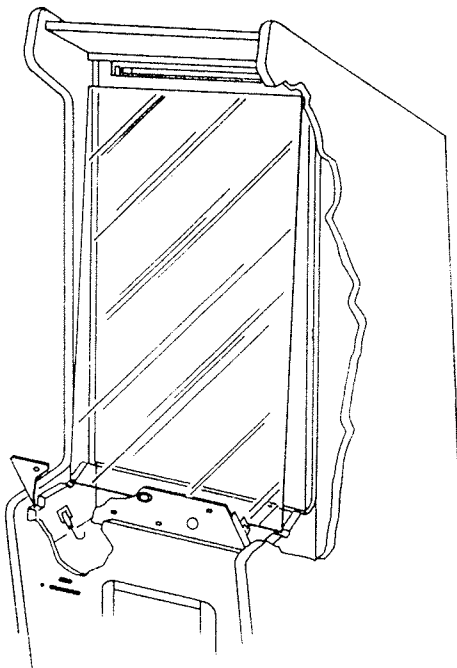


2.6 COVERGLASS REMOVAL Refer to Figure 7.

To remove the coverglass follow the directions listed.

1. Open the Coin Door.
2. Unlock the Control Panel by releasing the two latches.
3. Lift the Control Panel up and place vertically in front notches below the control panel.
4. Place hands under the coverglass and lift up and out until glass come to rest in the rear notches under the control panel.
5. Tilt the coverglass out from the top and lift out.

FIGURE 7

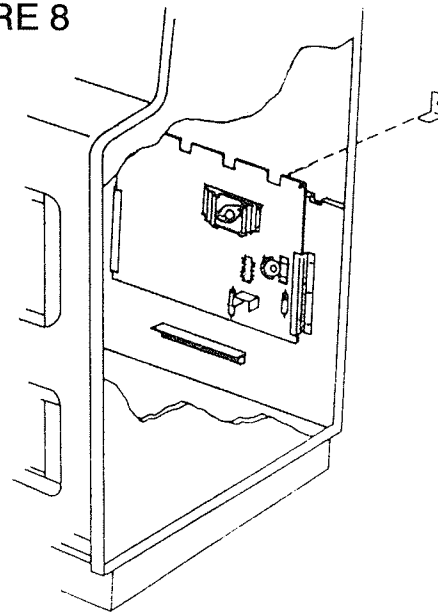


2.7 PRINTED CIRCUIT BOARD REMOVAL

To remove the printed circuit board simply follow the instructions listed.

1. Turn power off.
2. Remove the rear service door.
3. Disconnect the connectors from the boards.
4. Loosen and turn the stop bracket and lift the boards out of the board guides.

FIGURE 8



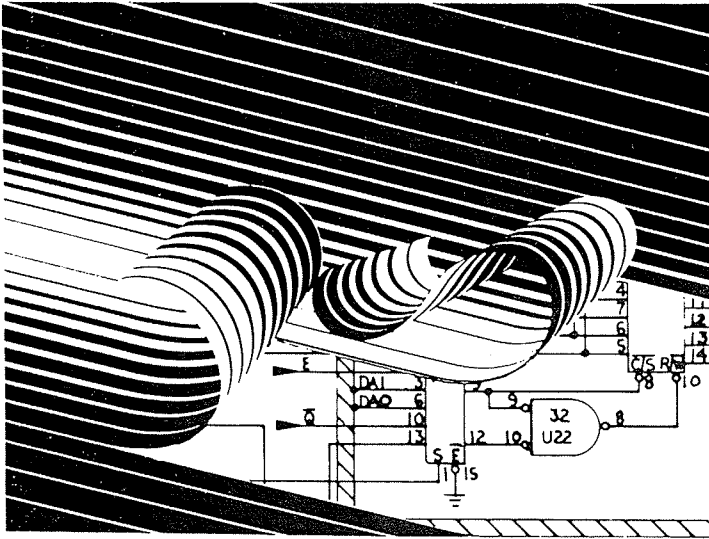
2.8 POWER SUPPLY VOLTAGE TEST POINTS

These voltages are measured across the test points, on the power supply board indicated, not to the chassis. Voltages are taken in the attract mode with the motors stationary.

TP1 - TP2	11VDC
TP3 - TP4	14VDC
TP5 - TP6	6VDC*
TP7 - TP8	32VDC* *

These voltages are unfiltered DC. The response characteristic of the meter will effect the reading.





Theory Of Operation

3

THIS SECTION PROVIDES A TECHNICAL DESCRIPTION
OF ICE COLD BEER™ GAME.

3. THEORY OF OPERATION

3.1 ICE COLD BEER™ GAME OPERATION

The game objective is to move the ball up the playfield using the motorized bar and roll it into the illuminated target hole. There are ten numbered target holes amongst many trap holes. The target is advanced as the player successfully reaches the illuminated hole. The star on the score board is illuminated when the player finishes the tenth hole.

The start button flashes after the game is coined. When the START button is pushed the bar descends, opening the gate, and releasing the ball. The bar then rises to the "Start" position on the playfield. During this time the joysticks are disabled.

The bonus for the target appears on the scoreboard. The bonus begins decrementing when a joystick is moved or after 10 seconds if no action is taken. A "heart beat" sound is heard during countdown followed by a "straight-line" sound if the bonus reaches the minimum. When the target is reached the remaining bonus points are added to the player's score. The countdown rate is adjustable via the dip switch.

Should the joysticks be inactive for a while the bar will automatically begin stepping upward. The stepping rate is adjustable via the dip switch.

After playing through the first frame (all 10 target holes) the scoreboard star is lit and play continues at HOLE 1. Game difficulty is increased by shortening the time from the last joystick command and the onset of automatic bar stepping. The difficulty increases with each frame.

If the ball is not at the gate (BALL GATE SWITCH open) when the game starts the search program will be initiated. The bar will sweep the playfield and the ERRANT BALL SOLENOID will be pulsed. The search ends when the ball closes the ball gate switch. The search program will terminate and the "OUT OF ORDR" message will be issued if the ball is not found.

When the ball falls below the bar (usually by bouncing out of a trap hole on it's way down) it is funneled to a hole at the bottom of the playfield. Upon entering the hole the ball activates the ERRANT BALL SWITCH and comes to rest over the ERRANT BALL SOLENOID. The solenoid then kicks the ball up to the gate closing the BALL GATE SWITCH.

Each target hole is monitored by a switch. These switches are part of a scanned switch matrix including the tilt/slam, coin, start, ball gate, errant ball, ticket vend, hopper cycle, hopper empty, and free play switches. Each switch must be closed for at least 20ms to be recognized. When a switch is replaced it must be adjusted to meet this requirement. See Figure .

The ticket vendor (optional) dispenses at user selectable target levels. Tickets are loaded and the vendor adjusted using the TICKET VEND switch inside the coin door. When the ticket hopper is empty the game issues the "OUT OF TICS" message, a warning sound, and disables the attract mode. The game will continue to accept coins and play. At the ticket vend points the warning sound will be heard.

3.2 CIRCUIT DESCRIPTION

The electrical portion of the game consists of a Logic and Regulator circuit board and an unregulated power supply.

3.2.1 POWER SUPPLY

The unregulated power supply is located on the floor of the cabinet. This assembly contains the line filter, power transformer, fuses, rectifiers and filter capacitors.

The power supply provides the following:

12V @ 2.5 Amps unregulated, for motors, sound and display.

9V @ 2.0 Amps unregulated, to supply the 5V regulator.

6V @ 2.0 Amps unregulated, unfiltered for lamps.

25V @ 2.0 Amps unregulated, unfiltered for the solenoid.

The four supply sections have no common ground on the supply chassis. THE COMMON GROUND IS ESTABLISHED ON THE LOGIC AND REGULATOR BOARD.

3.2.2 LOGIC AND REGULATOR BOARD

The game is controlled by a 68A09E microprocessor unit (MPU) and associated support logic. All logic and the 5 volt supply regulator reside on a single printed circuit board located on the lower rear cabinet panel.

The power supply return lines (9RTN, 12RTN, 6RTN, 25RTN) are commoned at connector J3 pins 3, 4, 5, and 6.

The MPU operates on a 1.5 MHz 2-phase clock. The 6 MHz crystal oscillator output is divided by U5 to generate the E and Q clock signals.

The power-on RESET signal is generated by voltage comparator U1 (pins 2, 4, 5). When power is first applied the 2.5V REF is established quickly while C110 charges slowly through R37. During this period U1-2 (RESET) is high and U22-8 (RESET/) is low. After 50ms the voltage across C110 exceeds 2.5V driving U1-2 low and U22-8 high. C110 is discharged quickly through D1 when power is removed.

The game program is contained in 2764 EPROMS U23 and U24. U25 is not currently used. The EPROMS are permanently chip selected. The output enables are selected by address decoder U16.

The 2128 RAM U13 is permanently chip selected. The output and write enables are driven by address decoder U14.

The "TEST" switch SW1 and U1 (pins 1, 6 and 7) toggle the NMI/ line to enter the system diagnostics program. R35 provides positive feedback to debounce SW1.

The PIA U27 and J4 are currently unused.

The PIA U26 is an input port for the JOYSTICK and LIMIT switches from J1 and the configuration DIP switch SW3. U26 also provides an output signal, LPFON/, and an interrupt input for the SWIRQ signal. These will be discussed later.

The audio power amplifier U38 drives the speaker. U38 is mounted on a heat sink.

The 9V power supply is regulated to 5V by U11. The regulator is mounted on a heatsink. The heatsink and regulator case are at ground potential.

The PIA U28 is the MPU interface to the sound generators U9 and U10. The bi-directional data lines of the sound bus (SDO-SD7) are connected to the "A" port of U28. The "B" port drives the sound bus control lines CON0-CON5.

U28 also provides an interrupt input for the "SINT" signal. This will be discussed later.

The sound generator IC's, U9 and U10, each provide three square wave analog audio outputs and two 8-bit TTL bi-directional I/O ports.

The audio outputs of U9 are summed across R69 to generate SOUND1. The two I/O ports are buffered by U2, U7 and U15 to drive various lamps and counters. The output buffer IC's are open collector types capable of sinking 500mA. The COINLOCK/and EBSOL/outputs require greater current and are buffered by Q1 and Q2. Bit 7 of I/O port A is the source for TIMERST/which controls the WATCHDOG TIMER (described later). During reset all I/O port lines are set high. The output of port "B" is disabled after reset by U8 until MOTENBL/is driven low. This prevents spurious coin counts during power-up.

The CH-A and CH-B audio outputs of U10 are summed across R68 to generate SOUND0. The CH-C output is translated to TTL levels by Q3 and becomes HZ30. The edges of HZ30 are sharpened at U17-8 to insure the proper rise time for the clock input U17-3. HZ30 is divided by two at U17-5 to form SINT which is applied to U28-40. SINT is a 15Hz signal used to generate 67mS interrupts (FIRQ/) for software timekeeping. The "A" I/O port reads the configuration switch SW4. The "B" I/O port is buffered by U3 and U4 to drive various lamps. Bit 7 of this port generates the MOTENBL/ signal which inhibits the motors and coin counters during power-up.

U33 is a four-section Norton amplifier used to filter and combine the audio signals SOUND0 and SOUND1. SOUND1 is applied to two sections of U33. One of these (U33 pins 1,5,6) is a 2-pole, unity-gain, 500Hz low-pass filter. The other section (U33 pins 2,3,4) is a flat unity-gain amplifier. The outputs of these two stages are combined at the junction of R97 and R98. Each stage is active when the bias voltage (BUFBIAS or FILBIAS) is approximately 2.7V. Stages are similarly inactive when the bias is 12V driving the amplifier into saturation. The bias sources are controlled by LPFON/ from U26. When LPFON/ is low, U21-12 is pulled to ground setting FILBIAS to 2.7V while U22-2 is open circuit setting BUFBIAS to 12V. SOUND1 is then passed through the filter. The converse is true when LPFON/ is high. SOUND1 is then unfiltered.

SOUND0 is passed through a 6KHz, 2-pole, low-pass filter (U33 pins 10,11,12) and added to SOUND1 through R104. The sum is buffered by U33 (pins 8,9,13) to form the AUDIO signal applied to the power amplifier.

Each motor is driven by a bridge amplifier made up of NPN and PNP darlington power transistors driven by open-collector drivers. Logic circuits insure that the two transistors of a bridge-half can never be energized simultaneously.

For example, to drive the left motor in one direction LDRIVE1/ and LDRIVE2/ are set low, LDRIVE0/ AND LDRIVE3/ set high. Q8 and Q17 are then turned on and Q9 and Q16 turned off driving LMOTOR to 12V and LMOTOR/ to ground. To reverse the motor LDRIVE0/ and LDRIVE3/ are set low, LDRIVE1/ and LDRIVE2/ are set high driving LMOTOR to ground and LMOTOR/ to 12V.

If LDRIVE0/ and LDRIVE2/ are set low U36-1 will go high forcing both U32-3 and U32-6 high thus preventing Q8 and Q16 from turning on.

Motor control signals are latched by U35. The latch command comes from the output of address decoder U34-8. The motor port output is disabled (motor off) when MOTENBL/ is high (during reset).

The keyboard/display IC, U29, drives the eight digit display and reads all switches apart from the joysticks and limits. Three scan lines from U29-32,33,34 are decoded by U19 to activate the digit drivers Q4-Q7 and Q12-Q15. The same three scan lines are decoded by U20 to drive the switch matrix drivers SCAN0/-SCAN2/ and STROBE0/.

IOR/ and IOW/ signals for U29 are generated by U30-3 and U30-11. The chip select is generated by U35-6.

The returns from most of the scanned switches are connected to SENSE0/-SENSE6/. These switches cannot close simultaneously. Several switches may close at the same time as these and are therefore isolated by diodes D3-D7, D11 and D12. The HOPSTOP/ switch closes to ground and cannot be scanned directly. The STROBE0/ signal is used with U31 (pins 1,2,3) to gate HOPSTOP/ into U29.

The scanned switches are not recognized unless they are closed longer than 20mS. Tilt switch closures are lengthened to 50mS by the pulse stretcher U1 (pins 10,11 and 13). The output is gated into U29 by STROBE0/ and U31 (pins 4,5, and 6).

U39 is a WATCHDOG TIMER which will restart the game should the MPU be upset by power line noise or static discharge. Under normal operation a 5uS TIMERST/ pulse will be generated by software during each SINT interval (67mS). This pulse is output at U9-14 and triggers section 1 of dual timer U39. The pulse is stretched to 8mS at U39-5 and keeps C166 discharged through Q20. Section 2 of U39 is a 1.1Hz square wave oscillator whose output U39-9 will remain high as long as C166 is discharged. Should the MPU lose control the TIMERST pulses will cease allowing C166 to charge. Approximately 450mS later a RESET/ signal will be generated at U39-2. When RESET/ goes high the system must begin issuing TIMERST/ pulses within 380mS or another RESET/ pulse will be generated. The cycle will continue until the system restarts successfully.

3.3 SELF DIAGNOSTIC

IMPORTANT: BEFORE USING THE DIAGNOSTIC PROGRAM THE WATCHDOG TIMER MUST BE DISABLED. This is done by connecting a jumper from TP17 to GROUND. REMOVE THE JUMPER WHEN FINISHED.

The diagnostic depends on a minimum degree of functioning hardware to perform. If clock, control lines, or the address and data busses are faulted then no self diagnostic will run. The diagnostic is intended for the use of a service technician having some knowledge of microprocessor circuits and access to an oscilloscope with trigger. The diagnostic provides a constant software environment in which to debug individual circuits.

The diagnostic is located entirely in the \$E000-\$FFFF EPROM (U23) along with its vector such that only that EPROM is required to be present for diagnosing hardware faults. The other EPROMS are not necessary but may be present unless they are continuously enabled or otherwise faulting the busses.

The diagnostic consists of 12 tests. It is entered and then stepped from test to test by use of the test switch which asserts the CPU non-maskable interrupt line. This line will interrupt execution of the CPU program at any point and begin execution of the diagnostics.

The possibility exists that a faulted instruction space could cause the CPU to lose control and execute an illegal op-code. In the 6809, one or more of these will cause the processor to enter a faulted state in which the test switch will not be recognized. In such cases, it is recommended that the memory selects be disabled and the data bus checked for electrical faults before attempting to use the self diagnostic.

Normally, entering the diagnostic will turn off all outputs and begin with test 0, the display test. Each subsequent depression of the test switch will step to the next diagnostic test in sequence. The display will be used to show the test number in the bonus display and pass/fail indications and other data unique to each test in the score and balls remaining displays. To return to the game mode, power can be turned on and off at any time or the diagnostic can be stepped past test 12, which will also return the logic game mode.

Each of the 12 tests is self sufficient and makes no assumption that faults found in previous tests have been corrected. For example, subroutine and interrupt linkages are not used during the diagnostic, so functioning RAM memory is unnecessary except to pass the RAM test. Fault in display should be corrected first since the display is used during diagnostic to communicate with the operator.

3.3.1 TEST 0: 8279 DISPLAY TEST (U29)

This test exercises the display of the 8279 keyboard display controller. Write cycles to the 8279's display register place it in 8 x 8 character display mode and prepare it to write data into its internal display RAM. This is followed by eight writes of identical segment data to the 8279's data register. This should result in a display of eight "0" digits on the display when the test switch is first pressed.

The second test switch closure writes segments for the digit "1", and so forth to "9". After the display of 9's, the next test switch closure will advance to test 1, the EPROM checksum test.

DISPLAY TROUBLESHOOTING

If the desired displays are not obtained, the display should be corrected before proceeding with the diagnostic. Although the remaining test will run without the display, it will be difficult to tell what is going on.

Because all 8 displays should be showing the same digit, the segment data between the 8279 and the displays will be the easiest to recognize and should be checked first. The 8279 display clock is driven from the CPU clock and should appear as a 1.5MHz square wave. This should result in a digit display time of 600uS for each of the 8 digits.

During display test, the sequence of write cycles from the CPU to the 8279 is repeated over and over with the same segment data to allow oscilloscope tracing of the interface. Because the only write cycles being performed are to the 8279, it is possible to trigger a scope on R/W and observe the data as it is being written. The write cycles are interspersed with fetch and execution cycles and should occur repeatedly in the following sequence:

ADDRESS	DATA
\$4081	\$04
\$4081	\$2F
\$4081	\$C2
\$4081	\$90
\$4080	SEGMENT DATA (WRITTEN 8 TIMES)
"	"
"	"
"	"
\$4080	SEGMENT DATA

The segment data written represents A-F in data bits D0 through D7 respectively with logic 1 corresponding to an illuminated segment.

DISPLAY	BUS DATA
0	\$3F
1	\$06
2	\$5B
3	\$4F
4	\$66
5	\$6D
6	\$7D
7	\$07
8	\$FF
9	\$67

TEST 1: EPROM CHECKSUM

Test 1 computes a checksum for each EPROM. The data content of each EPROM has been arranged to produce a specific result for this test. There are two EPROMs on the logic board, U23 and U24. When it completes the test, the diagnostic displays an "F" for each failing EPROM or a "P" for each passing EPROM in the SCORE display. The left most digit represents the U24 EPROM and the right most the U23. The BONUS display will show the test number, in this case a "1". After completion, this test continues to repeat until the test switch is pressed.

TEST 2: RAM EXERCISE

The RAM test writes an incrementing data value into each RAM location from its origin (\$0) to its end (\$7FF). It then goes back and rereads the RAM comparing the data read with what was written at that address previously. Each pass begins by writing different data at \$0, thus 256 passes are used to completely exercise the RAM. If 256 successful passes are completed, a "P" and the final address 0800 is displayed and the exercise stops until a power on reset or another test switch closure. If during the test, the data read back does not match the data previously written, an "F", the hexadecimal address at which the failure was detected, and the EXCLUSIVE-OR of the written and read data is displayed. Diagnostic then loops on alternate reads and writes to the failed address until released by reset or another test switch closure.

Test 2 requires about 10 seconds to complete during which the pass number is displayed. It may be interrupted at any time without damage by depressing the test button for the next test.

TEST 3: JOYSTICK/LIMIT SWITCH INPUTS

Test 3 displays its test number in the bonus display and repeatedly reads the joystick and limit switch inputs on the PIA addressed at \$4010. The data is complemented and displayed as hex in the lower two digits of the score display. The hex value displayed for a single switch closure is as follows:

SWITCH	BIT POSITION	DISPLAY
Right Down Limit	00000001	0001
Right Joystick Down	00000010	0002
Left Down Limit	00000100	0004
Left Joystick Down	00001000	0008
Right Up Limit	00010000	0010
Right Joystick Up	00100000	0020
Left Limit Up	01000000	0040
Left Joystick Up	10000000	0080

TEST 4: 8279 SWITCH INPUTS SCAN 0

Test 4 displays its test number in the bonus display then reads the switches from the 8279 in its sensor matrix mode. During this time, The 8279 will scan all three rows of switches continuously and report to CPU the data returned to its sense inputs during the scan 0 time. The scanned row number (0) will be displayed in the two low digits of the score display and the sensed input data will be displayed in hex in the two high digits. The switches, bit position, and displayed values for a single switch closure are as follows:

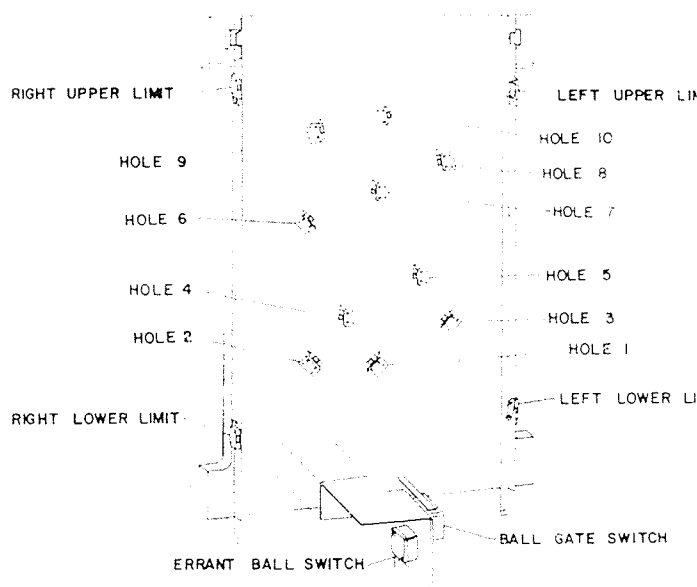
SWITCHES	BIT POSITION	DISPLAY
Start switch	00000001	0100
Coin switch	00000010	0200
Ball Gate switch	00000100	0400
Tilt switch	00001000	0800
Free Play Service	00010000	1000
Hopper cycle sensor	00100000	2000
Hopper empty (optional)	01000000	4000

TEST 5: SWITCH INPUTS SCAN 1

Test 5 displays its test number in the bonus display then reads the switches from the 8279 in its sensor matrix mode. During this time, the 8279 will scan all three rows of switches continuously and report to the CPU the data returned to its sense inputs during the scan 1 time. The scanned row number (1) will be displayed in the two low digits of the score display and the sensed input data will be displayed in hex in the two high digits. The switches, bit positions, and displayed values for a single switch closure are as follows:

SWITCH	BIT POSITION	DISPLAY
Hole 1	00000001	0101
Hole 2	00000010	0201
Hole 3	00000100	0401
Hole 4	00001000	0801
Hole 5	00010000	1001
Hole 6	00100000	2001
Hole 7	01000000	4001

FIGURE 9



TEST 6: 8279 SWITCH INPUTS SCAN 2

Test 6 displays its test number in the bonus display then reads the switches from the 8279 in its sensor matrix mode. During this time, the 8279 will scan all three rows of switches continuously and report to the CPU the data returned to its sense inputs during the scan 2 time. The scanned row number (2) will be displayed in the two low digits of the score display and the sensed input data will be displayed in hex in the two high digits. The switches, bit positions, and displayed values for a single closure are as follows:

SWITCH	BIT POSITION	DISPLAY
Hole 8	00000001	0102
Hole 9	00000010	0202
Hole 10	00000100	0402
Ticket Feed	00001000	0802
Errant Ball	00010000	1002

TEST 7: MOTOR CONTROL PORT

A square wave signature is generated on the motor control port. If the waveforms are observed at the motor latch outputs, the signature should appear as a square wave of approximately 0.66mS period at the least significant bit, a square wave of 1.32mS period at the next most significant, and square waves on all remaining bits with periods increasing down to 86mS on the most significant bit. The test number is displayed continuously throughout the test. The right motor will oscillate slightly.

If the wave forms are observed at the output of the motor drive gates U32, U37 they will be altered by the gates which prevent simultaneous turn on of opposing drives. Observing wave forms at the motor drive outputs will require test loads there. Debugging of the motor drive outputs is recommended using simulated play.

TEST 8 AND 9: CONTROL AND DATA PORTS:

The 8910 programmable sound generators are interfaced to the CPU via a 68A21 peripheral interface addressed at \$4020-\$4023. Six lines of the port at \$4020 are used to drive the control inputs of the 8910's while eight lines of the port are used to drive the 8910 data inputs.

Test 8 and 9 provide a means of testing the PIA portion of the circuit by generating square wave signatures on the PIA outputs. The signature should appear as a square wave of approximately 13uS period at PA0 or PBO, a square wave of 26uS period at PA1 and PB1, with periods increasing down to 1.7mS on PA7 or PB7. The test number is displayed continuously throughout the test.

Test 8 produces the signature at the control outputs (PBO-PB7 and BC1-BC3) with the data port cleared. Test 10 produces the signature at the data outputs (PA0-PA7 and DA0-DA7) with the control port cleared. These signals will have no discernable effect on the 8910s because their sequence does not match the 8910 protocols; however, the square wave signature is easily recognizable on an oscilloscope. Both PIA outputs must be operating properly for proper operation of the 8910s during test 11 and during play.

TEST 10: 8910 OUTPUT PORT TEST

The output ports of the 8910 PROGRAMMABLE SOUND GENERATORS (U9, U10) are written with alternating bit patterns and an "off" pattern. Channel C of U10 (pin 38) is programmed for a 30Hz square wave and bit 7 of I/O port B (U10-6), MOTENBL/, is programmed continuous LOW. The remaining bits of the A and B I/O ports of U9 and U10 are HIGH for 130mS and LOW for 1.87 seconds. The low duty cycle is required to keep the solenoid from overheating.

NOTE: This test will cycle the counters and drive the ticket vendor. The counters must be disconnected if changes to the readings are not allowable. To prevent accidental operation this test will not start until a joystick is moved.

TEST 11: U10 SOUND TEST

SOUND0 (U10-3,4) is programmed for a 3KHz square wave output. This signal permits testing of the 6KHz low-pass filter, (U33 pins 10,11, 12), the mixer (U33 pins 8,9,13), the power amplifier (U38). and the speaker.

TEST 12: U9 SOUND TEST

SOUND1 (U9 pins 3,4, 38) is programmed for a 1.5KHz square wave output. This signal permits testing of the switchable 500Hz low- pass filter. The filter is switched in and out at a 0.5Hz rate with SOUND1 constant. The filter attenuates and rounds the 1.5KHz square wave causing the output at U33-9 to alternate between a 1 volt square wave and a 0.2 volt sine wave. Refer to Figures 12 & 13.

SOUNDS AND SOURCES

SOUND	SOUND	GENERATOR
	U10	U9
TARGET HOLE		X
NON TARGET HOLE		X
BELL ON BAR		X
BONUS		X
CREDIT		X
GAME OVER		X
TILT		X
GOOD GAME		X
EXTRA BALL		X
BONUS COUNTDOWN (HEARTBEAT)		X
BONUS MINIMUM VALUE		X
(STRAIGHT LINE)		X
EMPTY HOPPER (OUT OF TICKETS)		X
LEFT MOTOR "UP"	X	
"DOWN"	X	
RIGHT MOTOR "UP"	X	
"DOWN"	X	

3.4 ADJUSTMENTS

Tools required:

Quantity	Description
1	#1 Offset phillips screwdriver
2	50" long jumpers with minature clips
1	6" clip lead
1	¼ watt resistor any value from 1K to 47K ohm
1	Triggered oscilloscope

3.4.1 Playfield Hole Switches (Refer to Figure)

These switches MUST close for 20mS MINIMUM to be recognized. Closure time is measured and adjusted as follows:

1. Remove the playfield coverglass. Refer to Section 2.6.
2. Disconnect the four playfield harness connectors, A-D
3. Disconnect the 14 pin connector at power supply.
4. Connect a jumper wire from TP2 (9V RTN) of the power supply to the NORMALLY OPEN terminal of the hole switch.
5. Connect a current limiting resistor (1K-47K ohms) to TP1 (+ 9V).
6. Connect the other end of the resistor to the COMMON terminal of the hole switch.
7. Connect triggerable oscilloscope across the same COMMON and NORMALLY OPEN switch terminals.
8. Turn the power on.
9. Drop the ball in the target hole. The scope trace will show 0 Volts during the closure time and 9 volts while the switch is open.
10. Adjust the switch for a MINIMUM closure time of 20ms. Test the switch at least 10 times. Properly set switches typically close for 40 to 70mS. Closure times greater than 120mS are unnecessary and may cause the ball to stop on the switch.
11. TURN POWER OFF AND REMOVE JUMPERS BEFORE RE-CONNECTING THE HARNESS.

3.4.2 BALL GATE SWITCH

1. Loosen the switch.
2. Close the switch lever all the way and position the switch so the lever just touches the inside of the hole.
3. Tighten the switch mounts.
4. Verify that the ball closes the switch and rests on the bottom of the hole behind the ball gate.

3.4.3 ERRANT BALL SWITCH

1. Loosen the switch.
2. Close the lever all the way and position the switch so the lever just touches the inside of the ball channel.
3. Tighten the switch mounts.
4. Verify that the ball does not hang up on the switch.

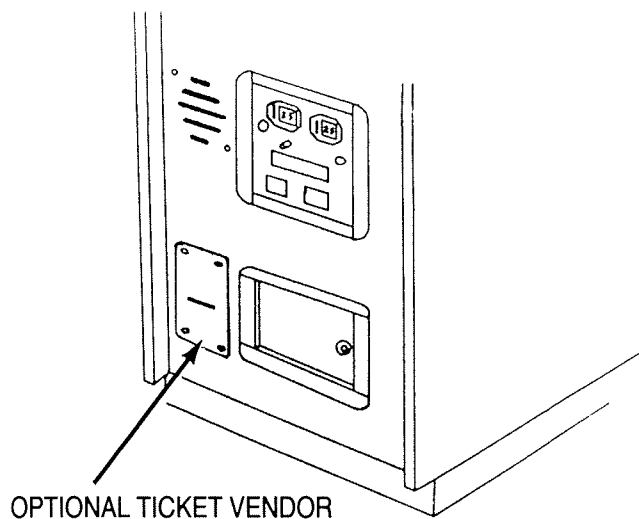
3.4.4 MOTOR LIMIT SWITCHES

Adjust the switches to close just before the end of bar travel. Verify that each switch closes with some overtravel to insure operation.

3.4.5 TICKET VENDOR (OPTIONAL)

The tear off point may be adjusted by loosening two screws holding the printed circuit board on the vendor and moving it forward or backward. One ticket will vend each time the ticket switch inside the coin door is pressed. The ticket switch is also used when loading the vendor.

FIGURE 10



3.4.6 VOLUME CONTROL

The volume control is located on the Logic and Regulator board and is adjustable from the front of the game. The control is located near the lower right side of the board as viewed through the coin door opening.

FIGURE 11

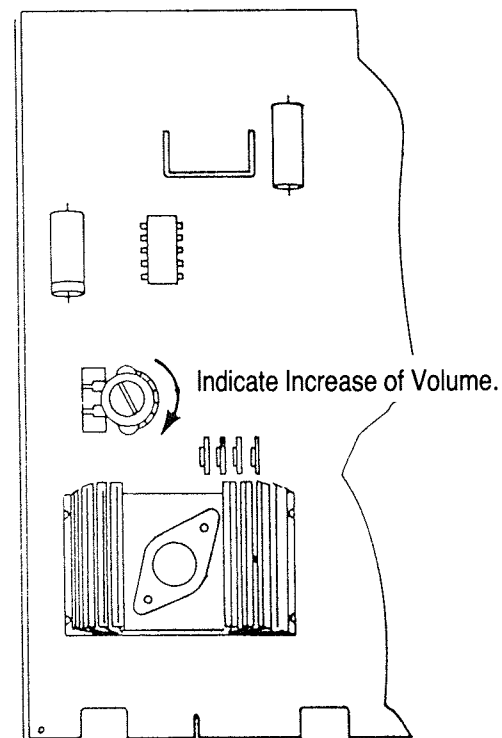
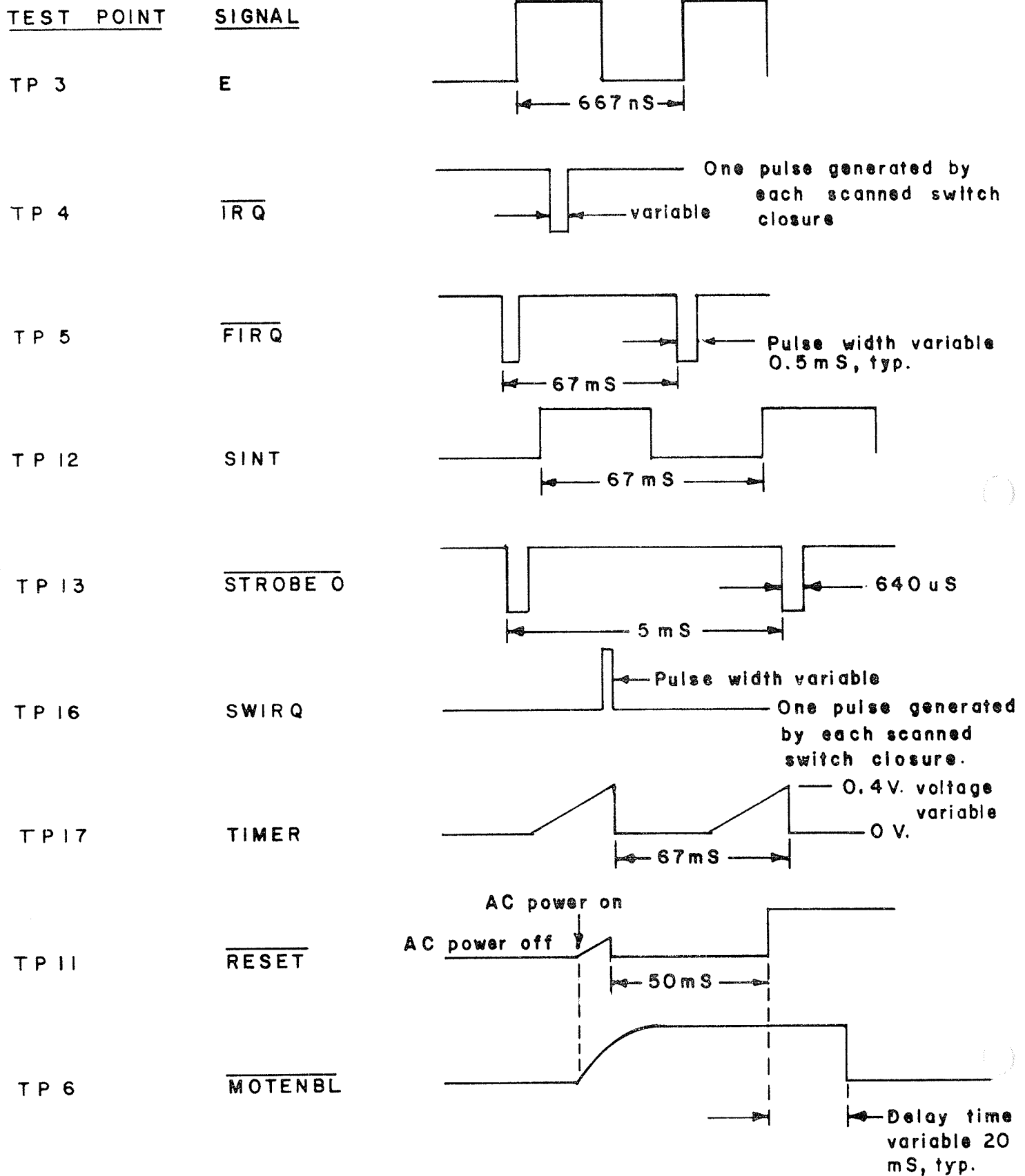


FIGURE 12 TEST POINT WAVE FORMS

ALL WAVEFORMS TAKEN IN ATTRACT MODE WITH NO CREDITS UNLESS OTHERWISE SPECIFIED. ALL SIGNALS AT TTL LEVELS UNLESS OTHERWISE SPECIFIED.

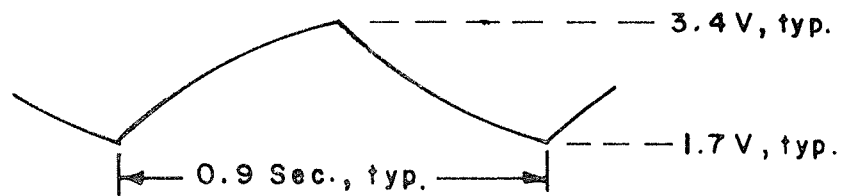


TEST POINT WAVEFORMS

CONTINUED

TEST POINT SIGNAL

TP 17
TIMER
Wave form shown with Q 20
base grounded.



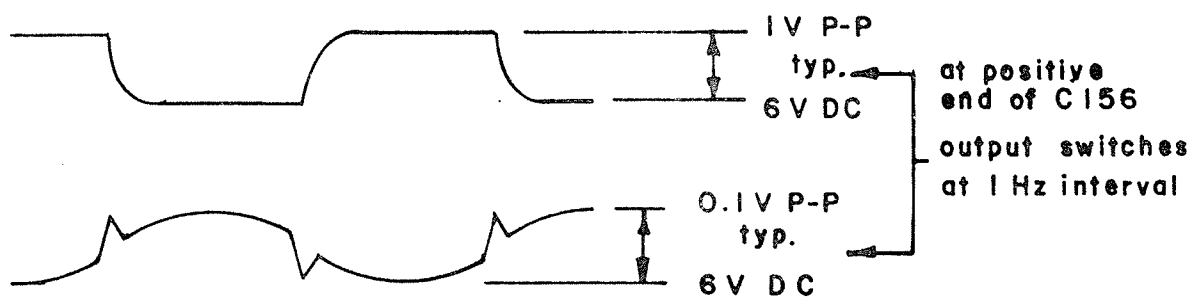
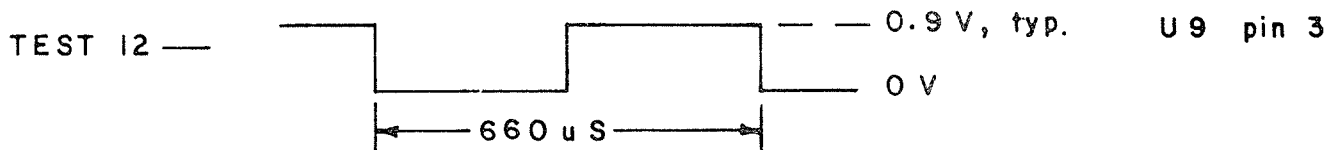
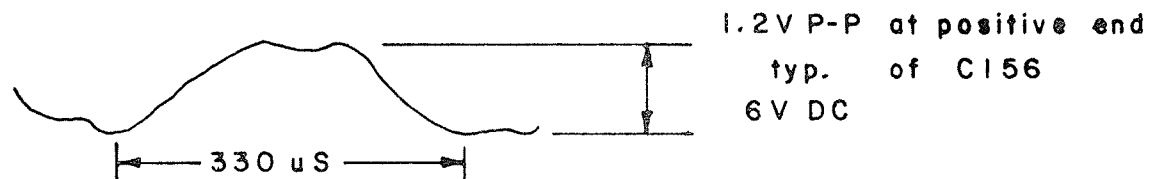
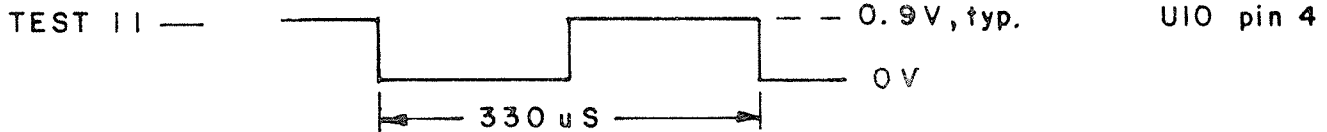
TP 11
RESET
Wave form shown with Q 20
base grounded.



FIGURE 13

DIAGNOSTIC TEST WAVEFORMS

TEST NUMBER WAVE FORM MEASUREMENT POINT





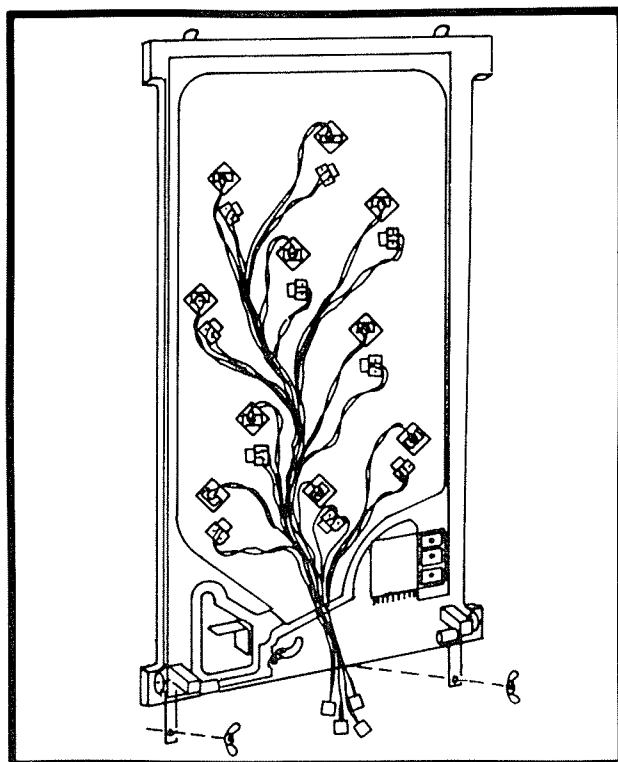


Illustration & Parts Lists

4

FIGURE 14
FLUORESCENT PANEL

ITEM	PART NUMBER	DESCRIPTION
1	59-00015-001	WIRE NUT
2	27-00001-001	LAMP, FLUORESCENT 15W
3	26-00004-001	LAMP SOCKET, FLUORESCENT
4	42-00152-001	PANEL, FLUORESCENT LAMP
5	26-00005-001	STARTER SOCKET
6	29-00003-001	STARTER SWITCH
7	18-00002-001	BALLAST TRANSFORMER 120V
8	09-00295-001	FLUORECENT LAMP CABLE

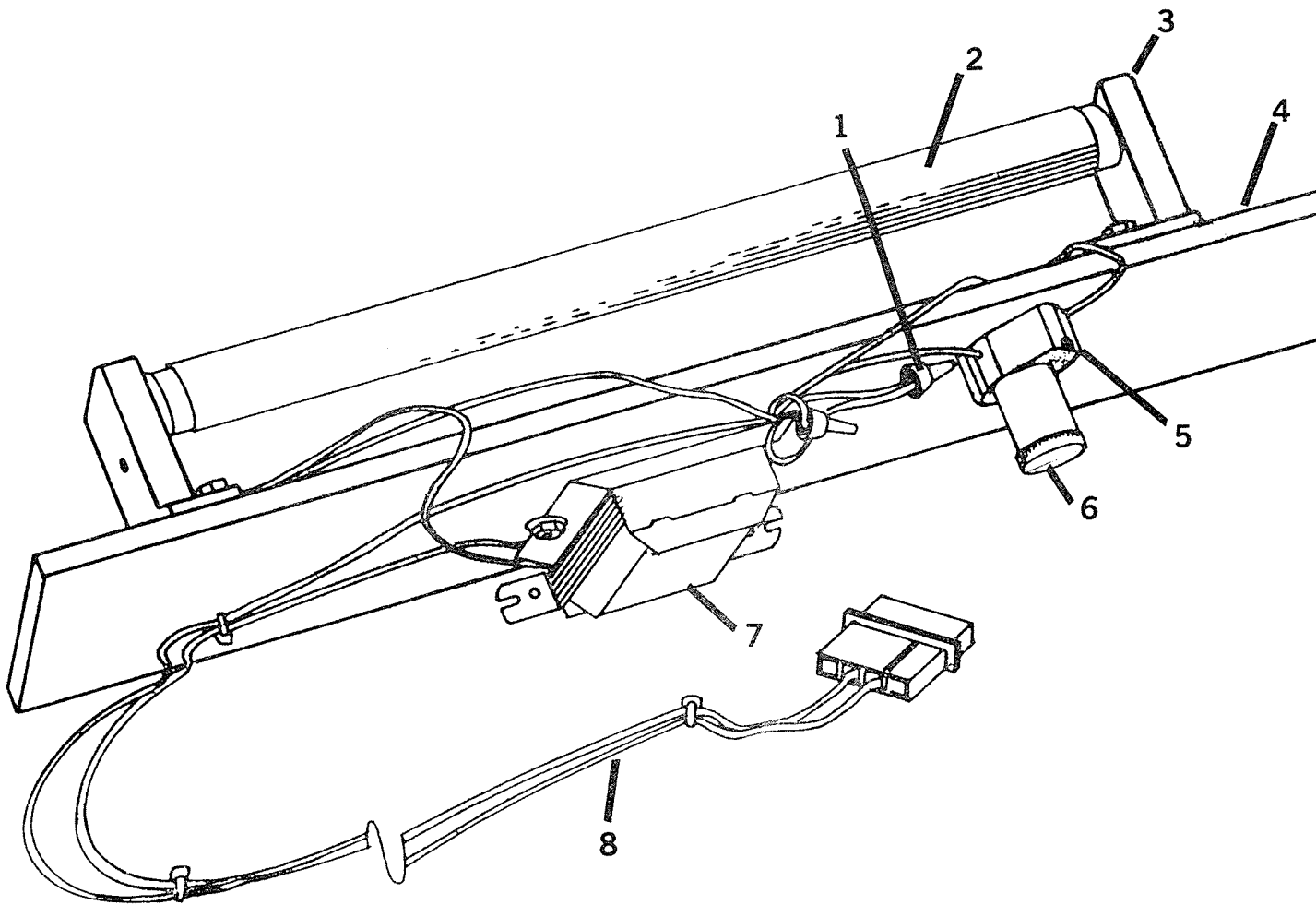
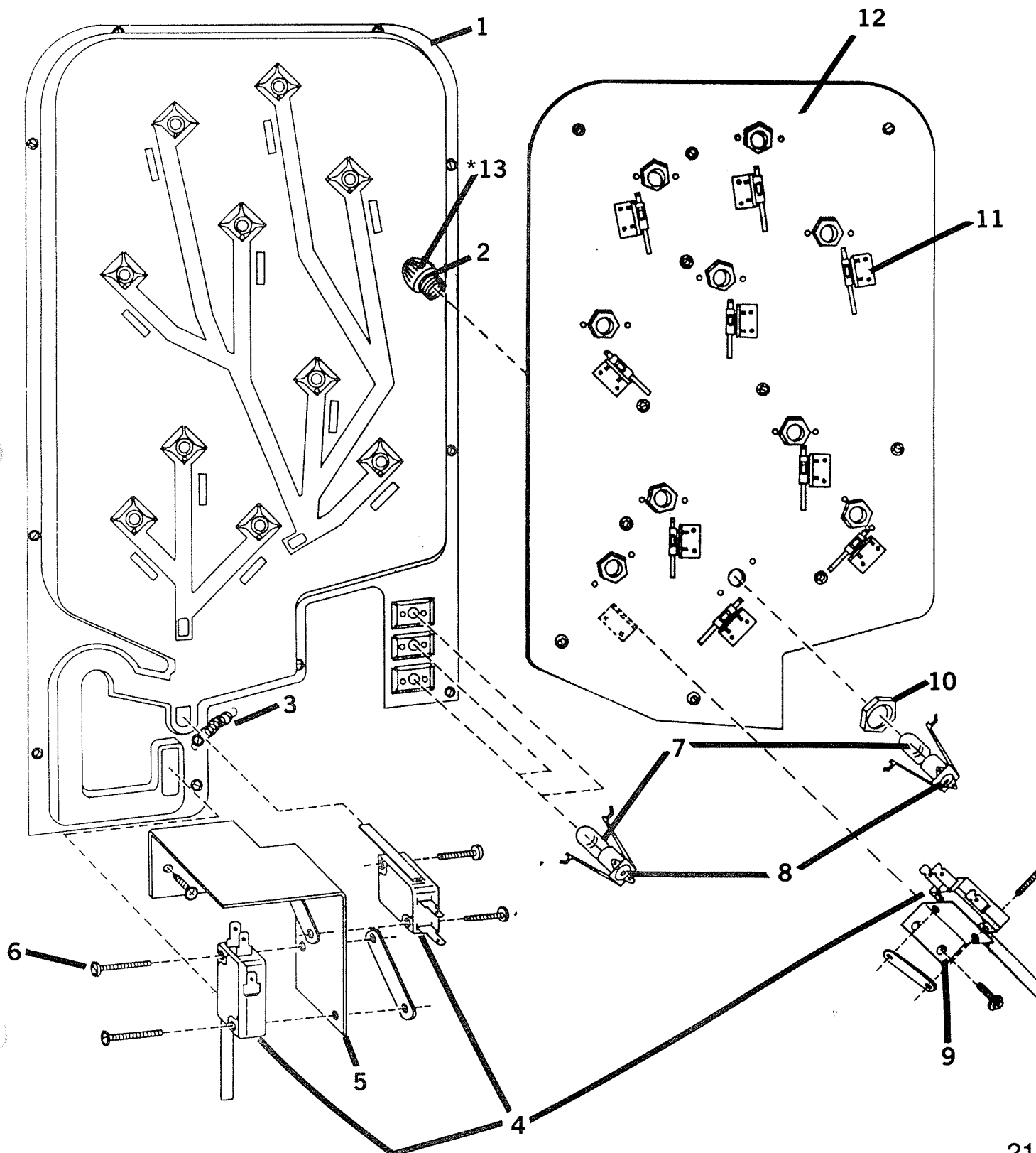


FIGURE 15
PLAYFIELD REAR VIEW

ITEM	PART NUMBER	DESCRIPTION
1	63-00169-001	PLAYFIELD BACKGROUND
2	63-00171-002	LENS, AMBER
3	58-00009-001	EXTENSION SPRING
4	29-00042-001	MICRO SWITCH
5	61-00328-001	RETURN SWITCH BRACKET
6	51-02011-009	SCREW #4-40 X 3/4
7	27-00004-001	LAMP #44
8	26-00021-001	LAMP SOCKET
9	61-00335-001	SWITCH MOUNTING BRACKET, LEFT
10	54-00005-001	NUT HEX 9/16-#27
11	61-00335-002	SWITCH MOUNTING BRACKET, RIGHT
12	63-00170-001	SWITCH PLATE PLAYFIELD
*13	63-00171-001	LENS, RED

* Item not shown on drawing.

FIGURE 15
PLAYFIELD REAR VIEW



* ITEM NOT SHOWN ON DRAWING

FIGURE 16
CABINET REAR VIEW

ITEM	PART NUMBER	DESCRIPTION
1	41-00026-001	CABINET FINISHED
2	07-00311-001	PLAYFIELD ASSEMBLY
3	45-00002-005	NUT 5/16-24
4	45-00002-003	CAM LOCK
5	45-00002-009	NUT 3/4-24
6	42-00155-001	BACK DOOR
7	45-00002-001	LOCK & KEY
8	45-00002-006	WASHER 5/16
9	61-00333-001	HANGER BRACKET
10	59-00066-001	WIRE HOOK
11	59-00067-001	PLUMB BOB
12	54-04003-001	WING NUT
13	08-00129-001	P.C.B. ASSEMBLY GAME
14	09-00291-001	CABLE MAIN HARNESS
15	59-00004-013	CABLE CLAMP
16	21-00003-001	SPEAKER 6" 4 OHM 3 OZ.
17	07-00278-001	POWER SUPPLY ASSEMBLY

FIGURE 16
CABINET ASSEMBLY REAR VIEW

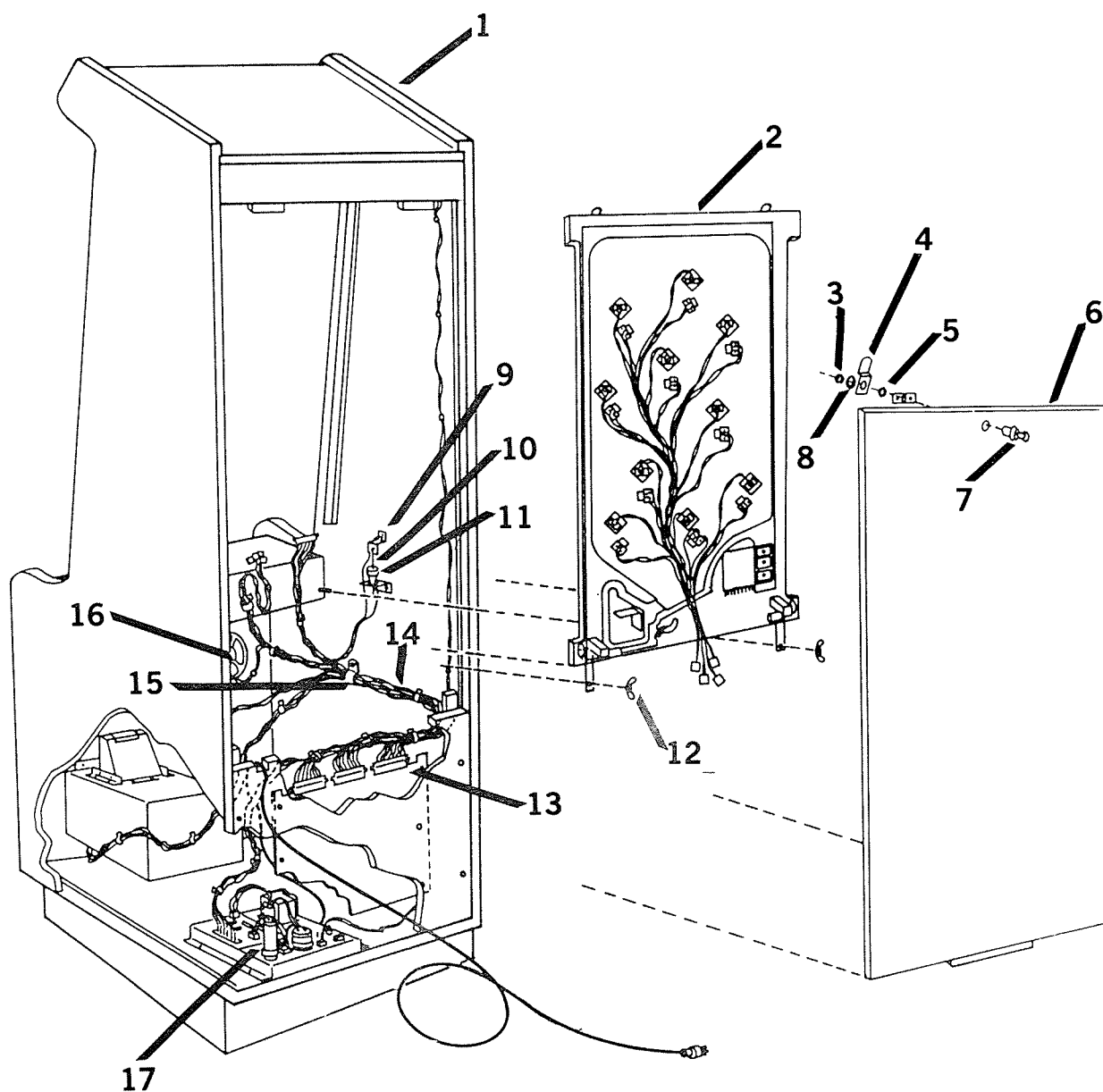


FIGURE 17
POWER SUPPLY ASSEMBLY

ITEM	PART NUMBER	DESCRIPTION
1	61-00313-001	CHASSIS POWER SUPPLY
2	18-00005-001	TRANSFORMER
3	08-00128-001	PCB ASSEMBLY UNREG
4	59-00062-001	CAPACITOR CLAMP
5	12-20003-209	CAPACITOR, 20,000uf
6	12-20003-509	CAPACITOR, 50,000uf
7	59-00062-002	CAPACITOR CLAMP
8	29-00004-001	FUSE HOLDER 3AG
9	09-00063-001	LINE CORD

FIGURE 17
POWER SUPPLY

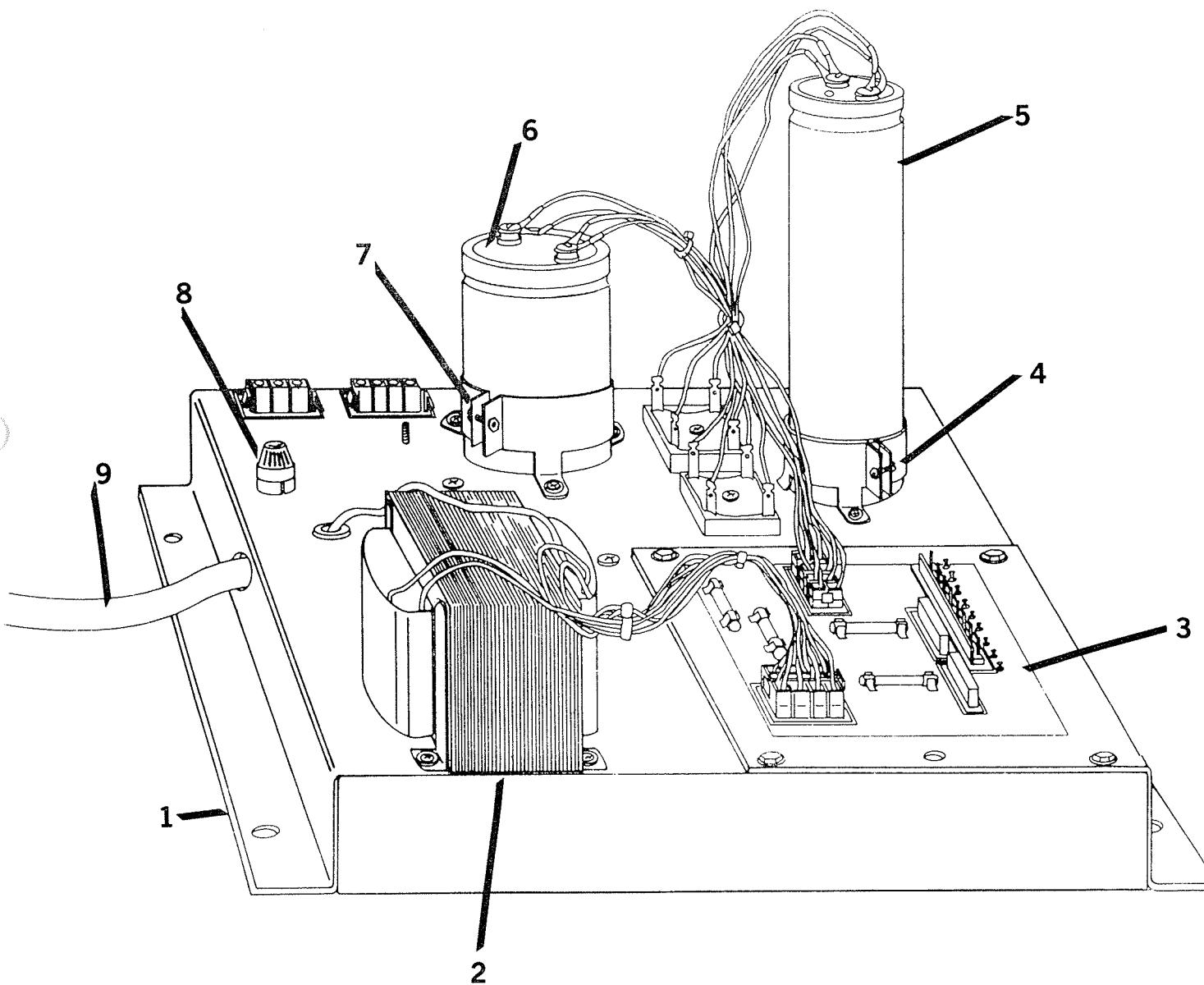
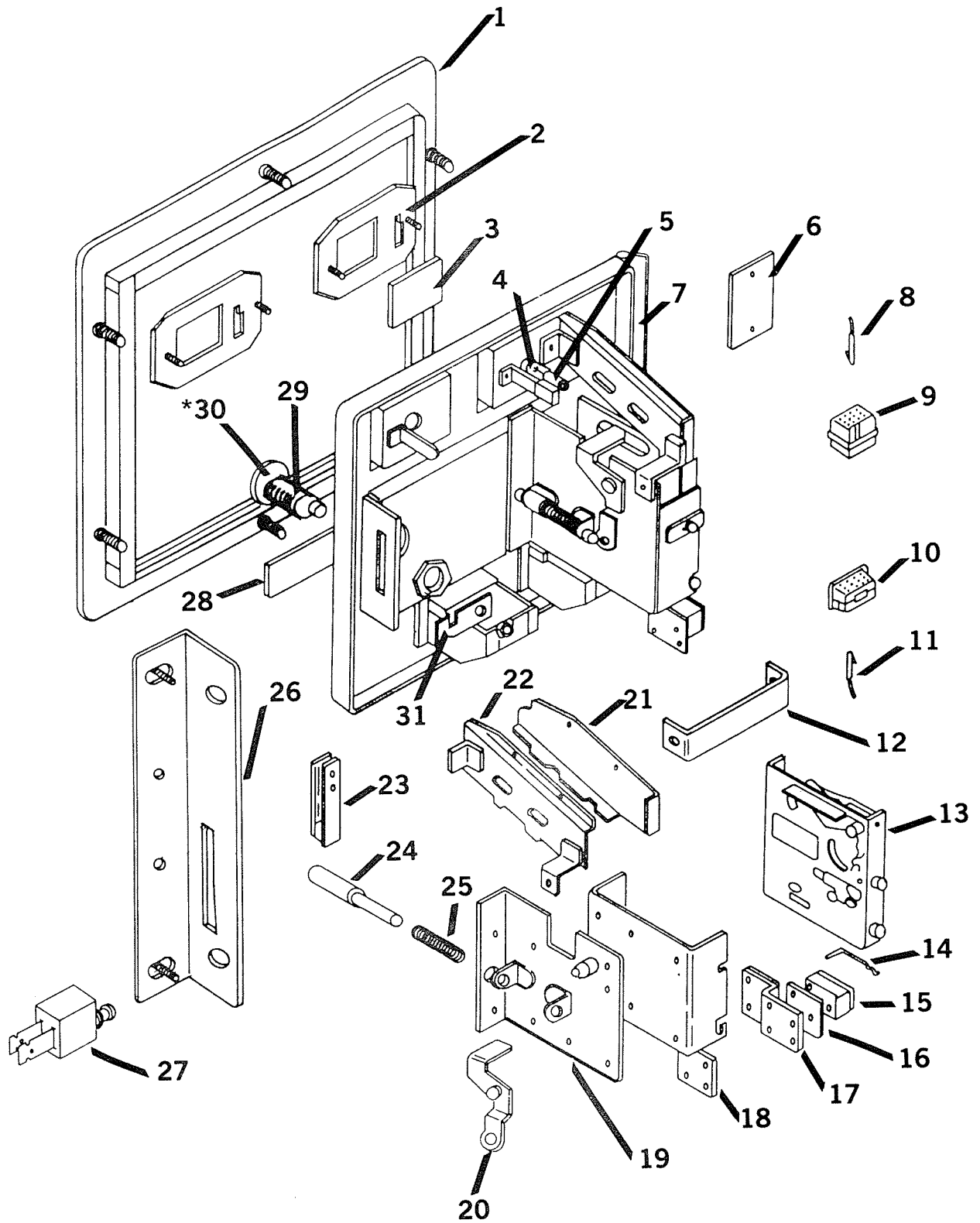


FIGURE 18
COIN DOOR

ITEM	PART NUMBER	DESCRIPTION
1	500010	DOOR FRAME
2	61-00051-001	COIN ENTRY PLACE .25
3	79-50005-001	PRICE CARD U.S. .25
4	27-00002-001	PILOT LAMP 12V 150ma
5	113001	VINYL SOCKET
6	500021-E	COVER PLATE
7	500009	COIN DOOR
8	25-00007-001	MATE-N-LOC PIN A
9	103007	MATE-N-LOC 9 PIN
10	103008	MATE-N-LOC 9 PIN
11	100024	MATE-N-LOC 1B
12	500021-R	REJECTOR LEVER CONNECTOR
13	59-00035-001	COIN ACCEPTOR
14	370002	ACTUATOR
15	020502	MICRO SWITCH
16	199005	INSULATOR
17	500054	COIN GUIDE
18	500021-P	REJECTOR HOLDER
19	500021-N	REJECTOR BRACKET
20	500021-M	CANCEL LEVER
21	500021-G	COIN GUIDE (B)
22	500021-H	COIN GUIDE(A)
23	500021-J	TILT SWITCH
24	500021-K	REJECTOR BUTTON
25	500021-L	SPRING CANCEL HOLDER
26	61-00041-001	LOCK GUARD
27	29-00029-001	SWITCH
28	79-00016-001	TAITO NAME TAG
29	600002	SERVICE LOCK
*30	600004	KEY
31	500021-I	LOCK CAM

*Item not shown on drawing.

FIGURE 18
COIN DOOR



* ITEM NOT SHOWN ON DRAWING

FIGURE 19
CONTROL PANEL & JOYSTICK

ITEM	PART NUMBER	DESCRIPTION
1	63-00172-001	PUSH BUTTON RED-LONG
2	63-00168-002	BALL & SHAFT
3	63-00168-003	MASK
4	63-00168-001	CONTROL 2-WAY
5	63-00168-004	WASHER
6	59-00020-017	"E" RING
7	020503	MICRO SWITCH
8	500083	LEAF
9	54-07001-008	NUT STAMPED 5/8-11
10	020501	MICRO SWITCH
11	35-00007-001	INSULATOR
12	500018	SWITCH BRACKET
13	26-00020-001	SOCKET LAMP
14	27-00004-001	LAMP #44
15	61-00015-001	STRIKE HOOK
16	42-00153-001	CONTROL PANEL STIFFNER
17	61-00329-001	CONTROL PANEL METAL
18	66-00006-001	LEXAN OVERLAY

FIGURE 19
CONTROL PANEL & 2 WAY JOYSTICK

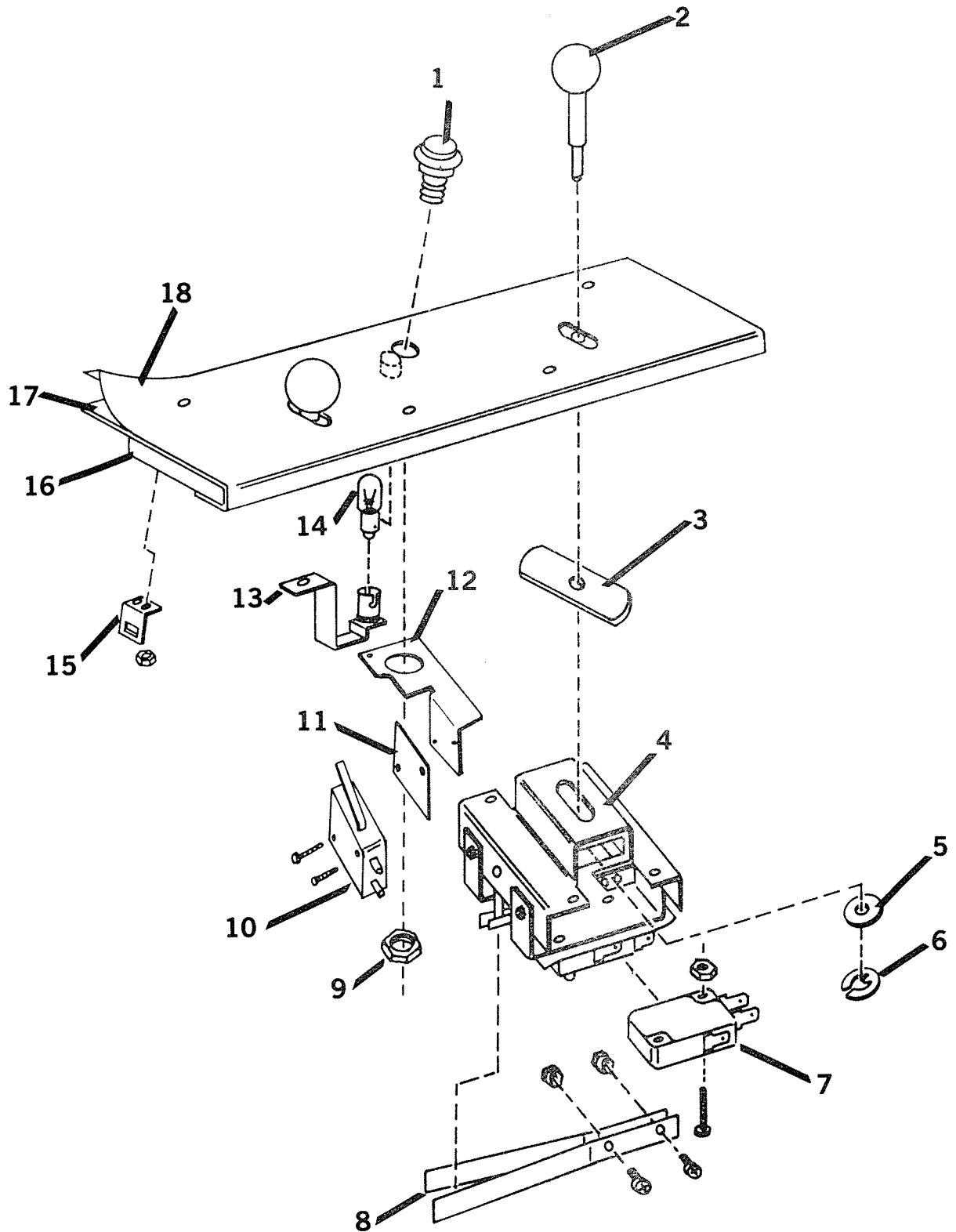
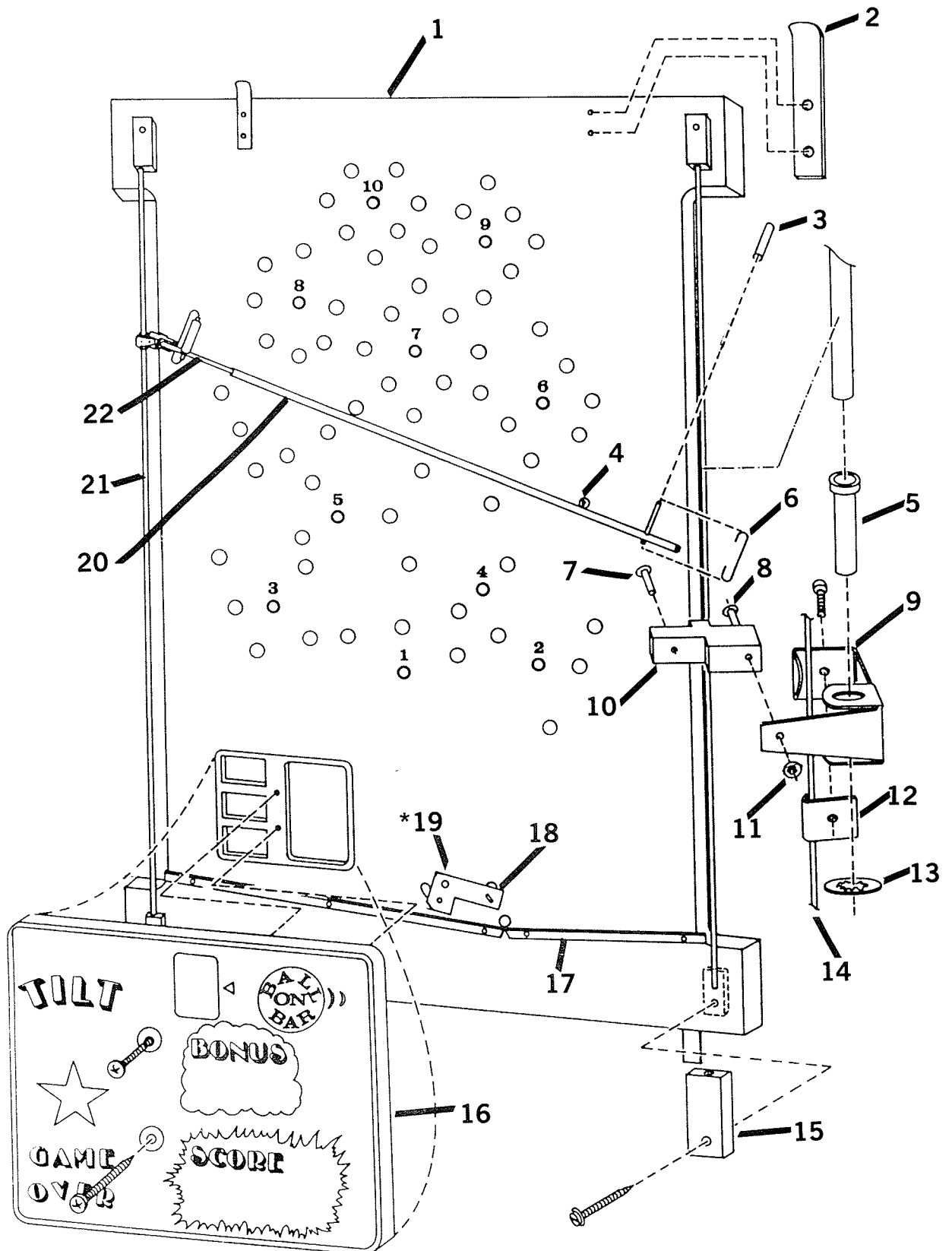


FIGURE 20
PLAYFIELD FRONT VIEW

ITEM	PART NUMBER	DESCRIPTION
1	47-00027-001	PLAYFIELD, SCREENED
2	61-00319-001	RETAINER, TOP
3	63-00158-001	BUMPER
4	59-00069-001	BALL, METAL
5	63-00167-001	SLIDER BUSHING
6	59-00065-001	BALL CHECK
7	56-00005-001	RIVET POP 1/8" X 1/2"
8	56-00004-001	POP RIVET
9	61-00318-001	SLIDER FRAME
10	63-00159-001	BALL ROD PIVET
11	59-00068-001	SHAFT RETAINER 1/8"
12	61-00327-001	BELT CLAMP
13	59-00068-002	SHAFT RETAINER 3/8"
14	63-00165-001	BELT DRIVE 3/16" DIA
15	63-00161-001	SLIDER ROD MOUNT
16	63-00157-002	PLAYFIELD INSERT
17	61-00316-001	BALL CATCH
18	61-00322-001	RETURN GATE
*19	63-00166-001	RETURN GATE BUSHING
20	61-00324-001	RIGHT HAND BALL ROD
21	61-00331-001	GUIDE ROD
22	61-00325-001	LEFT HAND BALL ROD

* ITEM NOT SHOWN ON DRAWING.

FIGURE 20
PLAYFIELD FRONT VIEW



* ITEM NOT SHOWN ON DRAWING

FIGURE 21
CABINET FRONT VIEW

ITEM	PART NUMBER	DESCRIPTION
1	47-00026-001	COVERGLASS
2	41-00026-001	CABINET FINISHED
3	63-00157-002	PLAYFIELD INSERT
4	07-00312-001	CONTROL PANEL ASSY
*5	59-00008-001	LATCH CLAMP
6	07-00304-001	COIN DOOR ASSY
7	07-00029-001	COIN FUNNEL
8	500088	CASH BOX
9	500087	"L" BRACKET BOTTOM
10	500091	BRACKET, COUNTER
11	130000	COUNTER
12	400050	CASH TRAY
13	600007	CAM
14	500089	CASH BOX DOOR
15	600006	LOCK & KEY
16	500086	"L" BRACKET TOP

* Item not shown on drawing.

FIGURE 21
CABINET ASSEMBLY FRONT VIEW

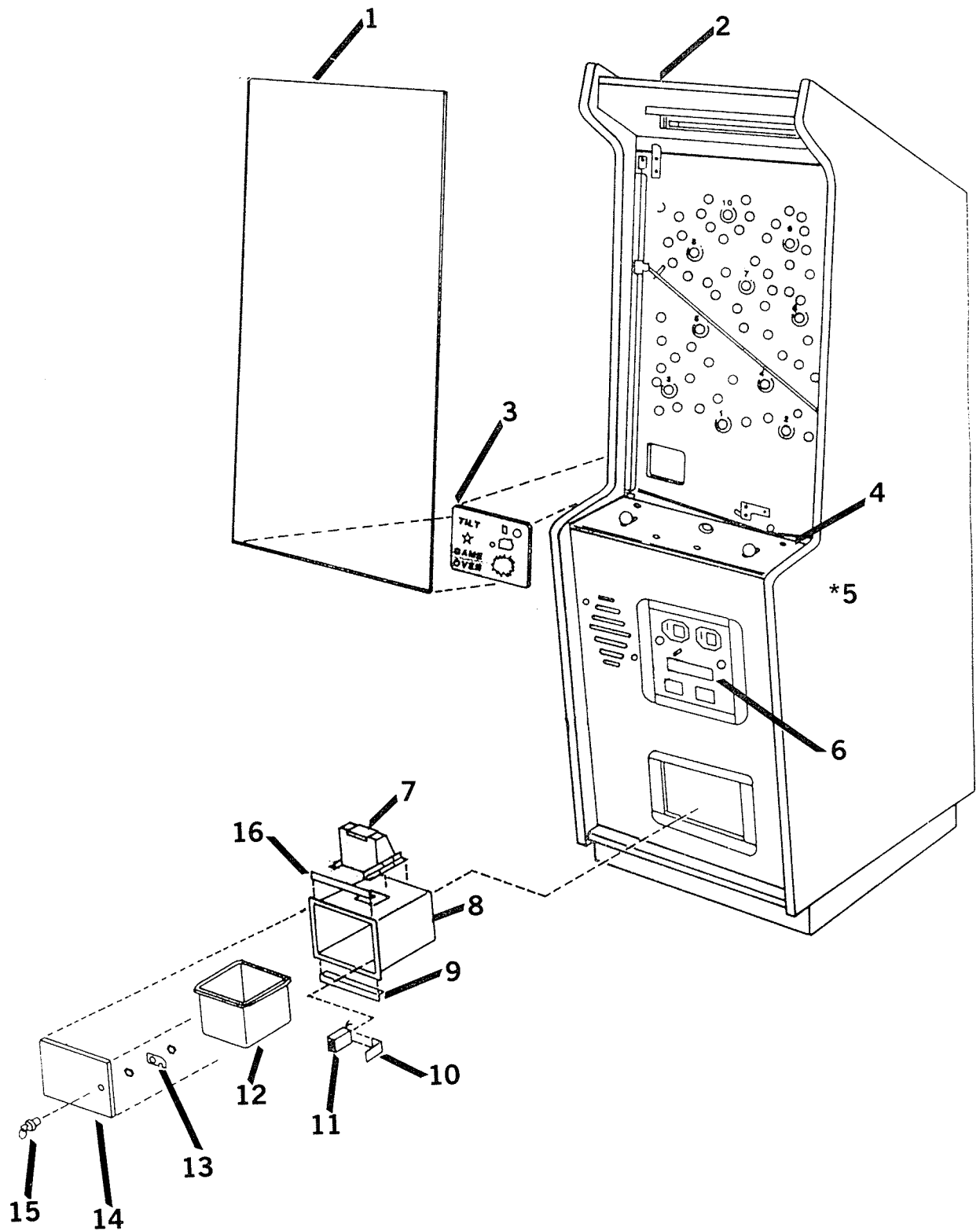


FIGURE 22
UNREGULATED POWER SUPPLY

ITEM	PART NUMBER	DESCRIPTION
BR1	13-00100-002	DIODE BRIDGE 2A
BR2	13-00100-002	DIODE BRIDGE 2A
J1	25-00022-010	CONN., 10 PIN
J2	25-00022-008	CONN., 8 PIN
J3	25-00002-014	CONN., 14 PIN
TP1-TP8	59-00021-001	TEST POINT, TURRET TYPE
F1,F2	24-00003-006	FUSE, 6 AMP 3AG 250V
F3	24-00003-004	FUSE, 4 AMP
F4	24-00003-002	FUSE, 2 AMP 3AG
*	24-10001-001	FUSE CLIP, PC MOUNT

* Item not shown on drawing.

FIGURE 22
PC BOARD UNREGULATED SUPPLY

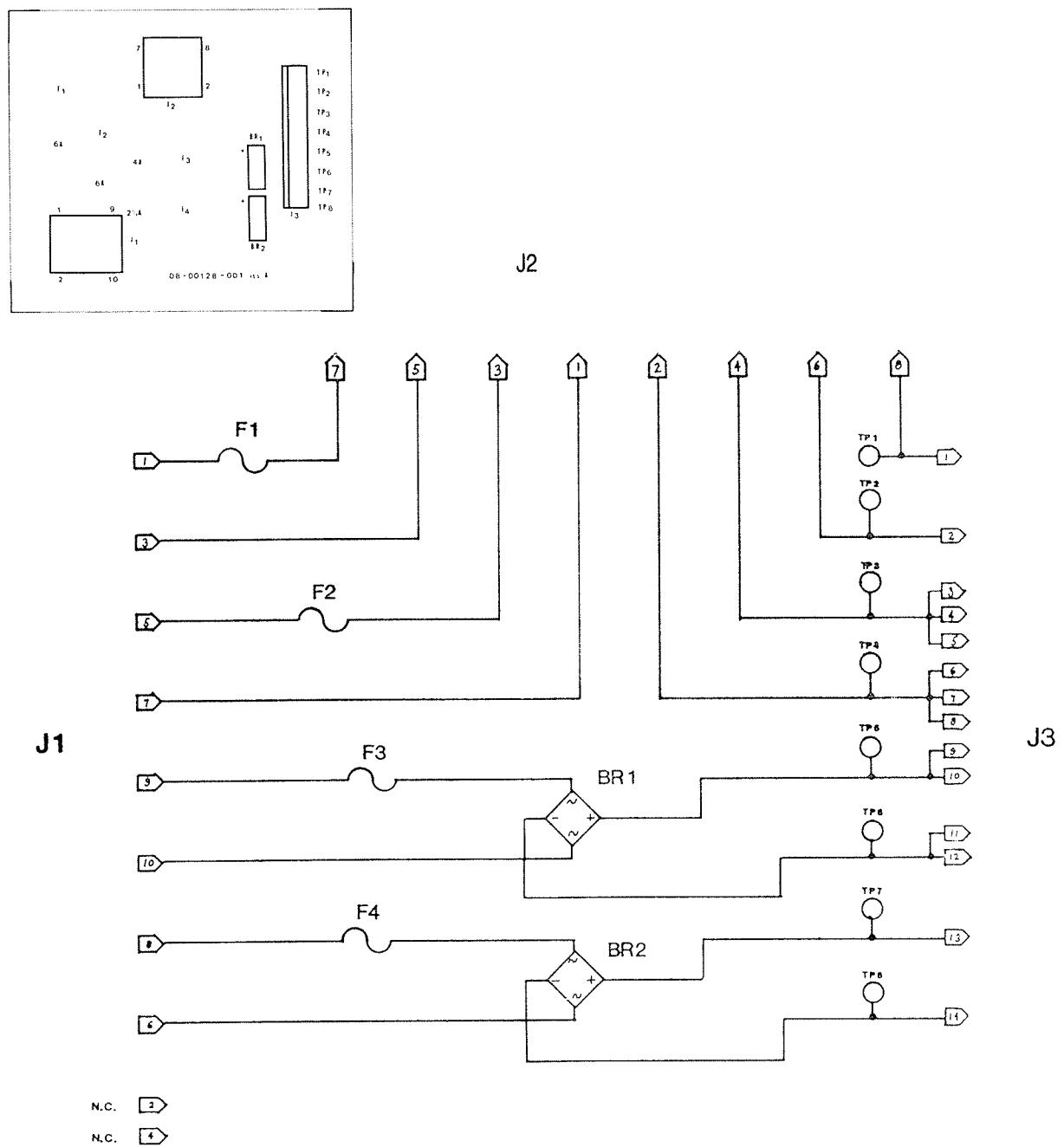


FIGURE 23
MOTOR PULLEY ASSEMBLY

ITEM	PART NUMBER	DESCRIPTION
1	52-00015-001	SHOULDER BOLT
2	55-00003-001	NYLON WASHER
3	63-00163-001	PULLEY
4	54-00004-001	NYLOC NUT
5	61-00323-001	RIGHT STIFFNER
6	51-02011-009	SCREW 4-40 X3/4
7	29-00040-001	MICRO SWITCH
8	59-00064-001	SPEED NUT TWIN TYPE
9	59-00020-017	"E" RING
10	08-00131-001	PCB ASSEMBLY 7-SEG DISPLAY (PLAYFIELD READOUT BOARD)
11	59-00063-001	GEAR MOTOR ASSEMBLY
12	61-00320-001	LEFT STIFFNER
13	63-00165-001	BELT DRIVE 3/16" DIA

FIGURE 23
MOTOR PULLEY ASSEMBLY

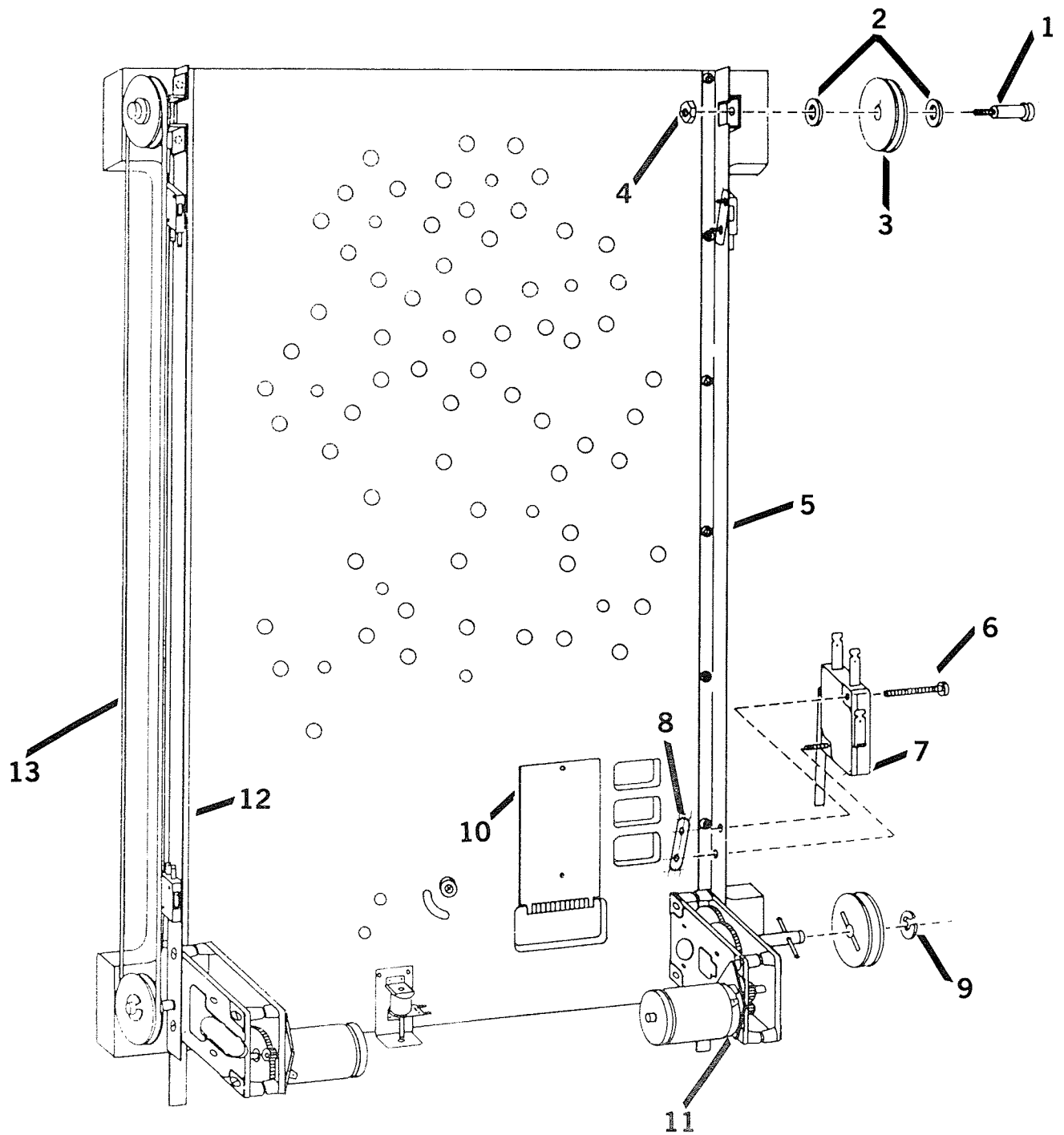


FIGURE 24
SOLENOID ASSEMBLY

ITEM	PART NUMBER	DESCRIPTION
1	23-00004-001	SOLENOID
2	61-00317-001	SOLENOID PLUNGER
3	61-00321-001	SOLENOID BRACKET
4	61-00332-001	COIL MOUNTING BRACKET
5	62-00008-001	RUBBER BUMPER
6	59-00020-020	"E" RING $\frac{7}{16}$ DIA
7	62-00010-001	"O" RING
8	51-01012-004	#6 x $\frac{3}{8}$ SCREW
9	63-00164-001	RETURN COIL SLEEVE

FIGURE 24
SOLENOID ASSEMBLY

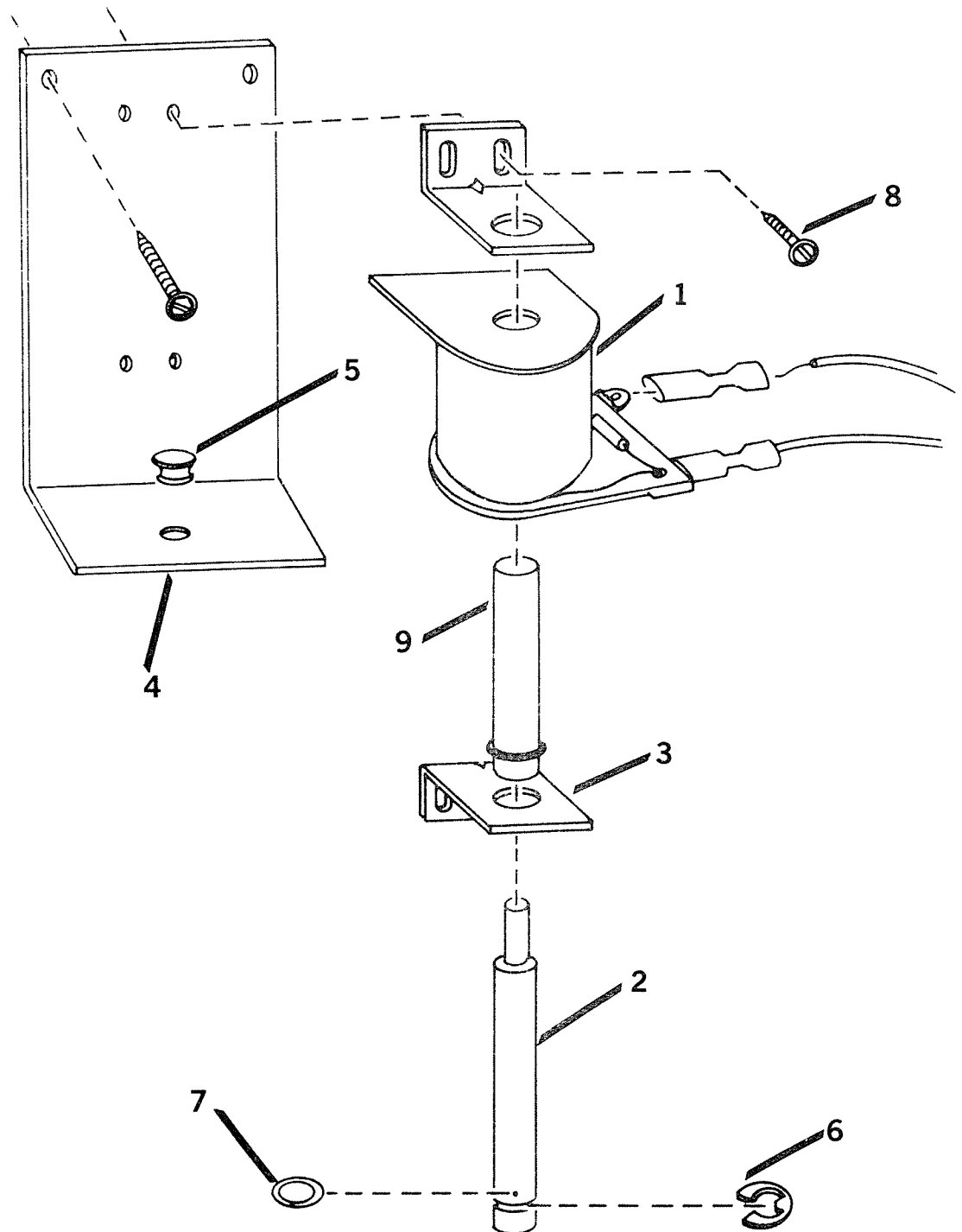


FIGURE 25
LOGIC AND REGULATOR BOARD

ITEM	PART NUMBER	DESCRIPTION
U1	15-53302-001	LM3302
U2-U4	15-62003-001	ULN2003A
U5	15-20076-001	74LS76
U6	15-20004-001	74LS04
U7	15-62003-001	ULN2003A
U8	15-20244-001	74LS244
U9,U10	15-60006-001	G1 AY-3-8910
U11	15-50323-001	LM323K
U12	15-00002-001	MC68A09E
U13	15-10013-001	2128-20 SRAM
U14	15-20020-001	74LS20
U15	15-62003-001	ULN2003A
U16	15-20138-001	74LS138
U17	15-20074-001	74LS74
U18	15-62003-001	ULN2003A
U19	15-30145-001	74145
U20	15-20138-001	74LS138
U21	15-30007-001	7407
U22	15-30006-001	7406
U23	16-00033-023	EPROM ICB 23
U24	16-00033-024	EPROM ICB 24
U26-U28	15-00004-001	MC68A21
U29	15-00016-001	8279-5
U30-U32	15-20032-001	74LS32
U33	15-50004-001	LM3900
U34	15-20020-001	74LS20
U35	15-20374-001	74LS374
U36	15-20002-001	74LS02
U37	15-20032-001	74LS32
U38	15-50002-001	TDA2002
U39	15-50556-001	556 TIMER
C1-C69	12-10001-471	CAP, 470pf 50V
C70	12-20001-107	CAP, 100uf 16V ELE
C71-C105	12-10001-471	CAP, 470pf 50V
C106	12-10002-104	CAP, .1uf 50V
C107,C108	12-10001-471	CAP, 470pf 50V
C109	12-10002-104	CAP, .1uf 50V
C110	12-30001-225	CAP, 2.2uf TANT
C111	12-10004-103	CAP, .01uf 50V
C112	12-10003-221	CAP, 220pf 50V
C113	12-30001-225	CAP, 2.2uf TANT
C114-C116	12-10004-103	CAP, .01uf 50V
C117	12-10003-221	CAP, 220pf 50V
C118-C121	12-10004-103	CAP, .01uf 50V

ITEM	PART NUMBER	DESCRIPTION
C122	12-10002-104	CAP, .1uf 50V
C123-C129	12-10004-103	CAP, .01uf 50V
C130	12-30001-225	CAP, 2.2uf TANT
C131	12-30001-225	CAP, 2.2uf TANT
C132-C139	12-10004-103	CAP, .01uf 50V
C140	12-10002-104	CAP, .1uf 50V
C141	12-10004-103	CAP, .01uf 50V
C142	12-10002-104	CAP, .1uf 50V
C142	12-10002-104	CAP, .1uf 50V
C143	12-10002-104	CAP, .1uf 50V
C144	12-10001-103	CAP, .01uf 50V 10%
C145	12-10002-104	CAP, .1uf 50V
C146	12-10003-122	CAP, 1200pf 50V 10%
C147	12-10003-151	CAP, 150pf 50V 10%
C148	12-10002-104	CAP, .1uf 50V
C149	12-10003-122	CAP, 1200pf 50V 10%
C150-C153	12-10004-103	CAP, .01uf 50V
C154	12-20001-477	CAP, 470uf 16V ELE
C155	12-20001-105	CAP, 1uf 50V ELE
C156	12-20001-475	CAP, 4.7uf 50V ELE
C159	12-20001-807	CAP, 800uf 16V ELE
C160	12-10002-104	CAP, .1uf 50V
C161	12-10002-104	CAP, .1uf 50V
C162	12-10004-103	CAP, .01uf 50V
C163	12-10002-104	CAP, .1uf 50V
C164	12-10004-103	CAP, .01uf 50V
C165	12-10004-103	CAP, .01uf 50V
C166	12-30001-225	CAP, 2.2uf TANT
C167	12-10003-150	CAP, 15pf 50V 10%
C168	12-10003-150	CAP, 15pf 50V 10%
R1	11-00001-001	RES, 1000HM 1/4W 5%
R2-R9	11-00001-151	RES, 150 OHM 1/4W 5%
R11-R19	11-00001-221	RES, 220 OHM 1/4W 5%
R20-R26	11-10001-121	RES, 120 OHM 1/2W 5%
R27-R34	11-00001-221	RES, 220 OHM 1/4W 5
R35	11-00001-473	RES, 47K OHM 1/4W 5%
R36	11-00001-103	RES, 10K OHM 1/4W 5%
R37-R39	11-00001-273	RES, 27K OHM 1/4W 5%
R40	11-00001-105	RES, 1M OHM 1/4W 5%
R41	11-00001-103	RES, 10K OHM 1/4W 5%
R42	11-00001-273	RES, 27K OHM 1/4W 5%
R43,R44	11-00001-101	RES, 100 OHM 1/4W 5%
R45	11-00001-102	RES, 1K OHM 1/4W 5%
R46	11-00001-181	RES, 180 OHM 1/4W 5%

FIGURE 25
LOGIC AND REGULATOR BOARD

ITEM	PART NUMBER	DESCRIPTION
R47	11-00001-221	RES, 220 OHM 1/4W 5%
R48	11-00001-222	RES, 2.2K OHM 1/4W 5%
R50	11-00001-681	RES, 680 OHM 1/4W 5%
R49	11-00001-472	RES, 4.7K OHM 1/4W 5%
R51	11-00001-222	RES, 2.2K OHM 1/4W 5%
R52-R55	11-00001-472	RES, 4.7K 1/4W 5%
R56-R67	11-00001-222	RES, 2.2K OHM 1/4W 5%
R68-R77	11-00001-102	RES, 1K OHM 1/4W 5%
R78-R85	11-10001-681	RES, 680 OHM 1/2W 5%
R86,R87	11-00001-472	RES, 4.7K OHM 1/4W 5%
R88	11-00001-272	RES, 2.7K OHM 1/4W 5%
R89	11-00001-912	RES, 9.1K OHM 1/4W 5%
R90	11-00001-274	RES, 270K OHM 1/4W 5%
R91	11-00001-124	RES, 120K OHM 1/4W 5%
R92	11-00001-912	RES, 9.1K OHM 1/4W 5%
R93	11-00001-272	RES, 2.7K OHM 1/4W 5%
R94-R96	11-00001-472	RES, 4.7K OHM 1/4W 5%
R97-R100	11-00001-684	RES, 680K OHM 1/4W 5%
R101	11-00001-274	RES, 270K OHM 1/4W 5%
R102	11-00001-912	RES, 9.1 OHM 1/4W 5%
R103	11-00001-563	RES, 56K OHM 1/4W 5%
R104	11-00001-684	RES, 680K OHM 1/4W 5%
R105	11-00001-104	RES, 100K OHM 1/4W 5%
R106,R107	11-00001-274	RES, 270K OHM 1/4W 5%
R108	11-00001-333	RES, 33K OHM 1/4W 5%
R109	11-00001-272	RES, 2.7K OHM 1/4W 5%
R110	11-00001-513	RES, 51K OHM 1/4W 5%
R111	11-00001-104	RES, 100K OHM 1/4W 5%

ITEM	PART NUMBER	DESCRIPTION
R112	11-00001-684	RES, 680K OHM 1/4W 5%
R113	11-00001-221	RES, 220 OHM 1/4W 5%
R114	11-00001-020	RES, 2.2 OHM 1/4W 5%
R115	11-10001-010	RES, 1 OHM 1/2W 5%
R116	11-00001-104	RES, 100K OHM 1/4W 5%
R117	11-00001-472	RES, 4.7K OHM 1/4W 5%
R118	11-00001-102	RES, 1K OHM 1/4W 5%
R119	11-00001-334	RES, 330K OHM 1/4W 5%
R120	11-00001-471	RES, 470 OHM 1/4W 5%
RP1	11-50001-102	RES, SIP 1K
RP2	11-50001-102	RES, SIP 1K
VR1	11-60001-502	POT, 5K PC MOUNT
Y1	19-00009-001	CRYSTAL, 6MHz
Q1,Q2	14-00001-001	TRNSTR, NPN TIP120
Q3	14-23904-001	TRNSTR, NPN 2N3904
Q4-Q15	14-00002-001	TRNSTR, PNP TIP125
Q16-Q19	14-00001-001	TRNSTR, NPN TIP120
Q20	14-23904-001	TRNSTR, NPN 2N3904
D1,D2	13-14001-001	DIODE, 1N4001
D3-D7	13-10914-001	DIODE, 1N914
D8,D9	13-14001-001	DIODE, 1N4001
D10-D12	13-10914-001	DIODE, 1N914
FB1-FB36	17-00001-001	FERRITE BEAD
SW1	29-30000-001	PUSH BUTTON SWITCH
SW3,SW4	29-00001-008	DIP SWITCH 8 POS
HS1	30-00006-001	HEATSINK TO-3, W/PAD
HS2	30-00004-001	HEATSINK TO-220, VERT
TP1-TP16	59-00021-001	TEST POINT, TURRET TYPE

FIGURE 25
LOGIC & REGULATOR BOARD
COMPONENT LAYOUT

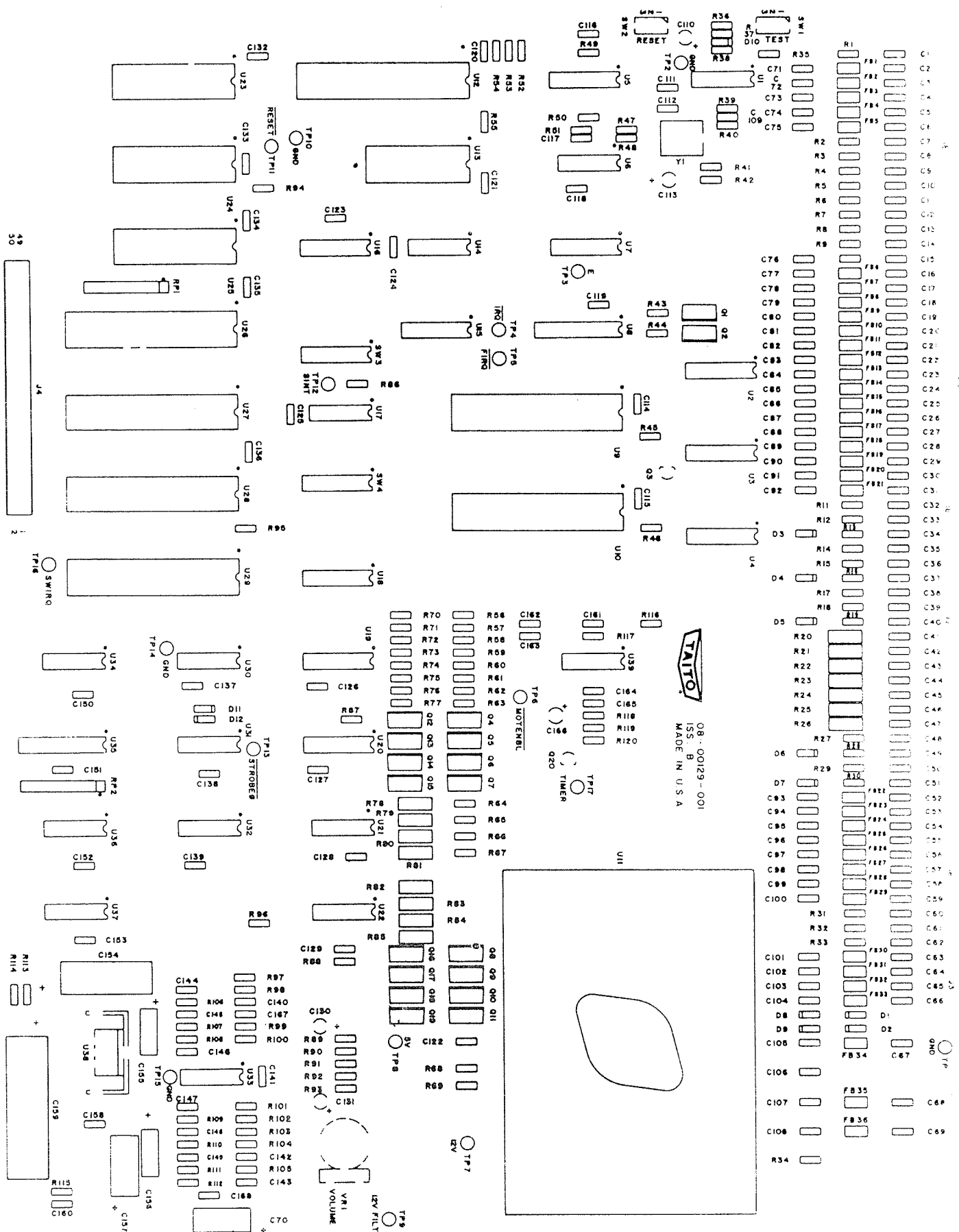


FIGURE 26
ICE COLD BEER
PLAYFIELD READOUT BOARD

ITEM	PART NUMBER	DESCRIPTION
DO-D7	13-20001-002	LED DISPLAY

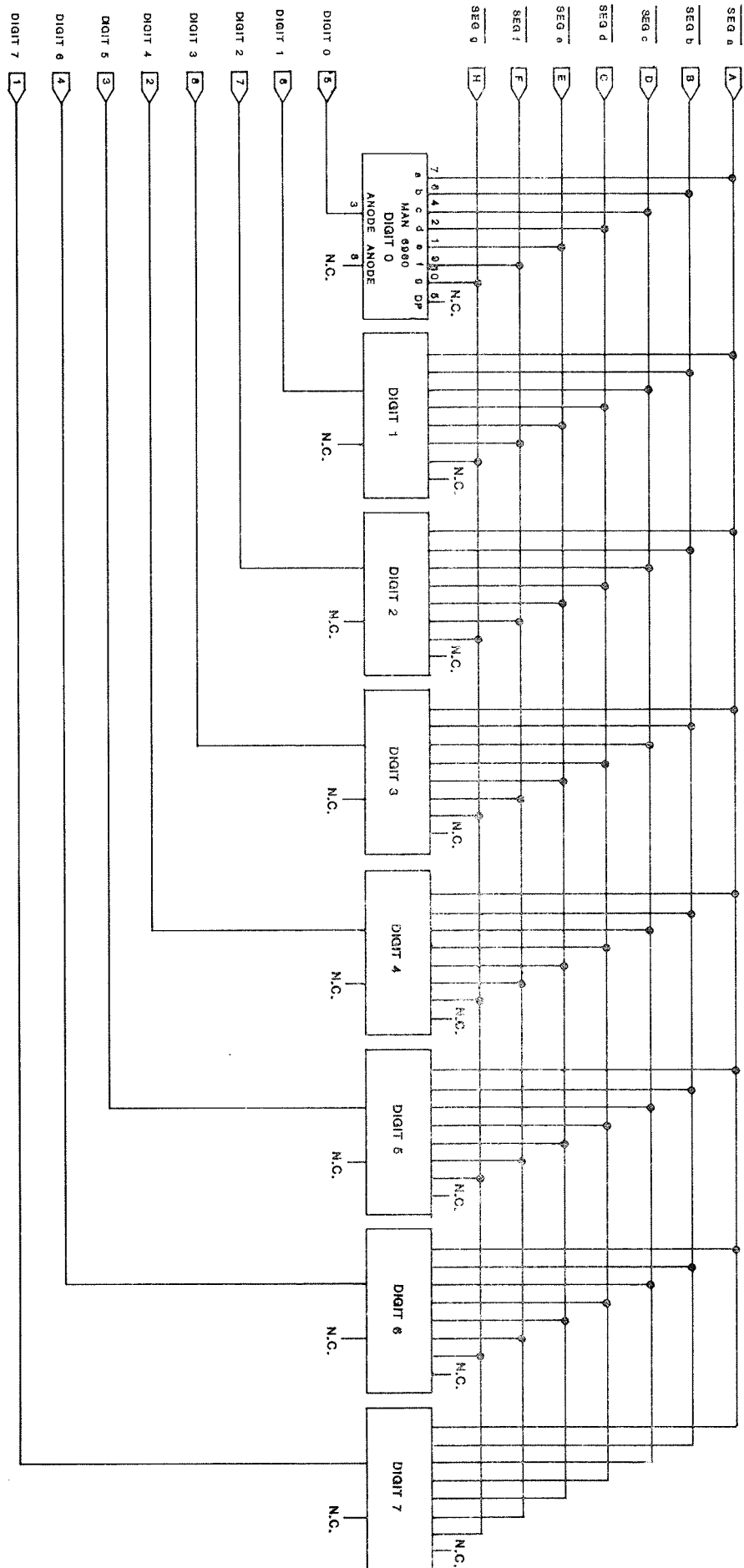
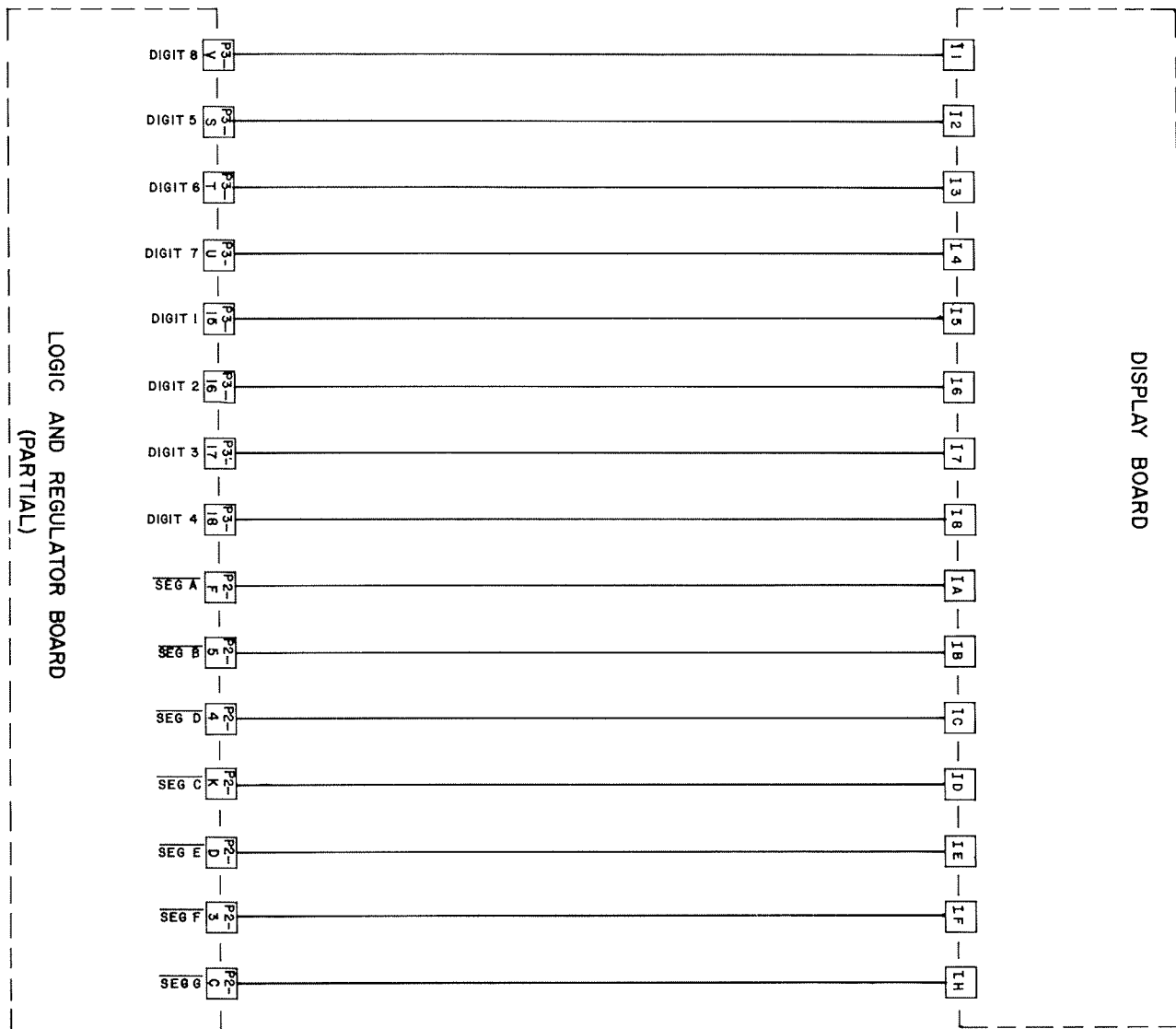


FIGURE 27
WIRING DIAGRAM SCHEMATIC 3 of 3



TAITO		TAITO AMERICA CORPORATION 1256 Estes Avenue, Elk Grove Village, IL 60007 Telephone (312) 981-1000 Telex 25-3200	
UNLESS OTHERWISE SPECIFIED		INCHES	SCALE
DIM. TOL.	INCHES	mm	
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4			
5			
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ICE COLD BEER-WIRING DIAG.

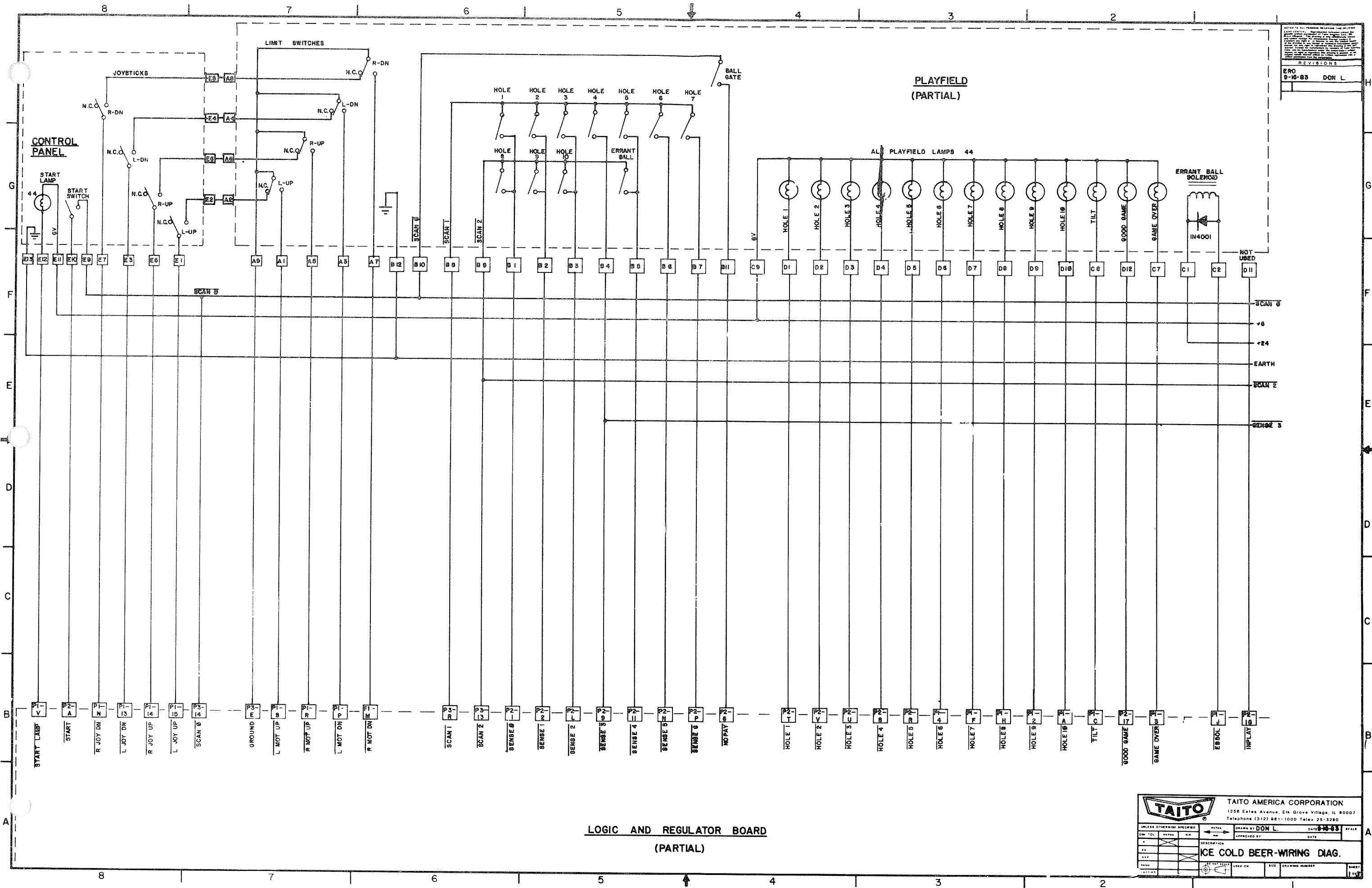
DRAWN BY: DON L. DATE: 9-16-83
APPROVED BY: DATE:

SHEET 3 OF 3

REVISIONS

NO.	DESCRIPTION	DATE
1	Initial Design	9-16-83
2	Revised Design	9-16-83
3	Final Design	9-16-83

FIGURE 28

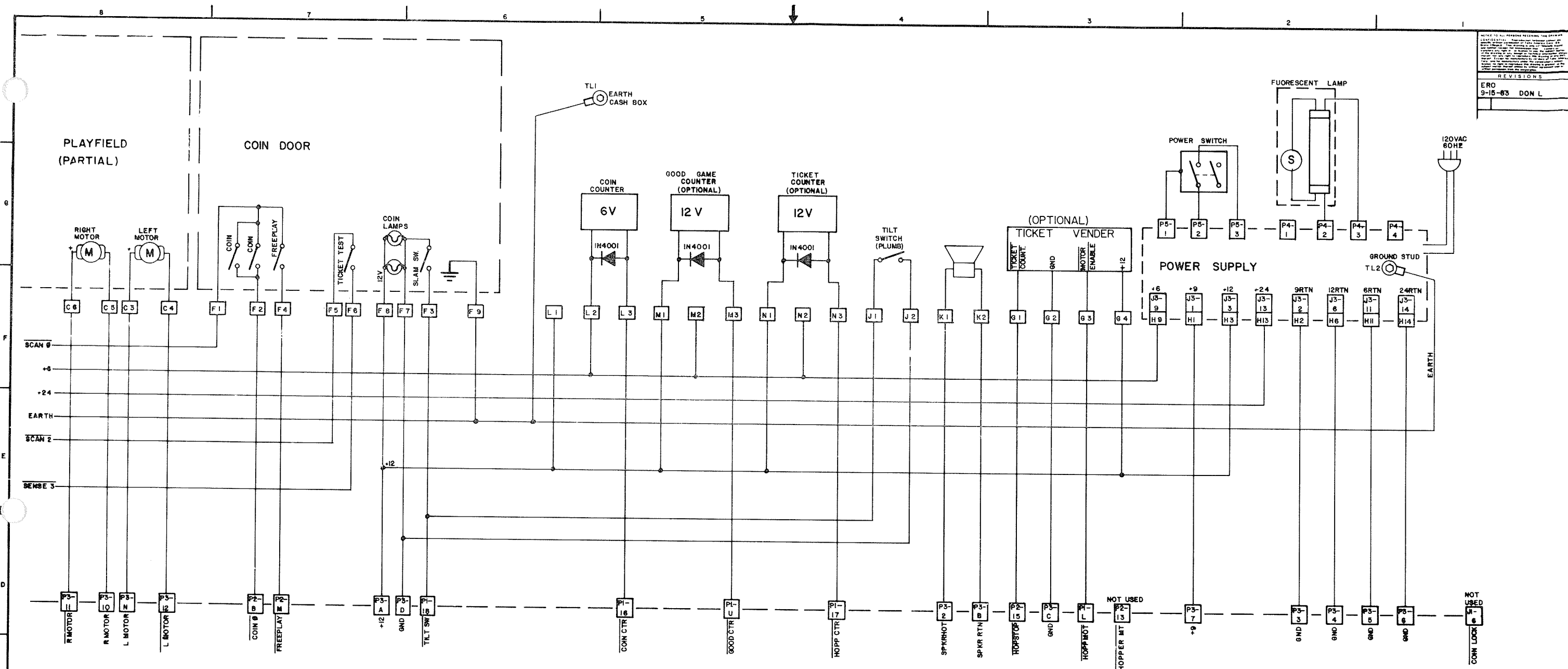


NOTES TO THE READER RELATIVE TO THIS SHEET

REVISIONS	
ERO	9-16-83
9-16-83	DON L.

TAITO		TAITO AMERICA CORPORATION	
1258 Estes Avenue, Elk Grove Village, IL 60007		Telephone (312) 981-1000 Telex 25-3280	
UNLESS OTHERWISE SPECIFIED	DATE	DATE	SCALE
CM TO	INCH	APPROVED BY	DATE
1	2	3	4
DESCRIPTION			
ICE COLD BEER-WIRING DIAG.			
DATE	BY	USED ON	SIZE
9-16-83	DON L.		1/8"

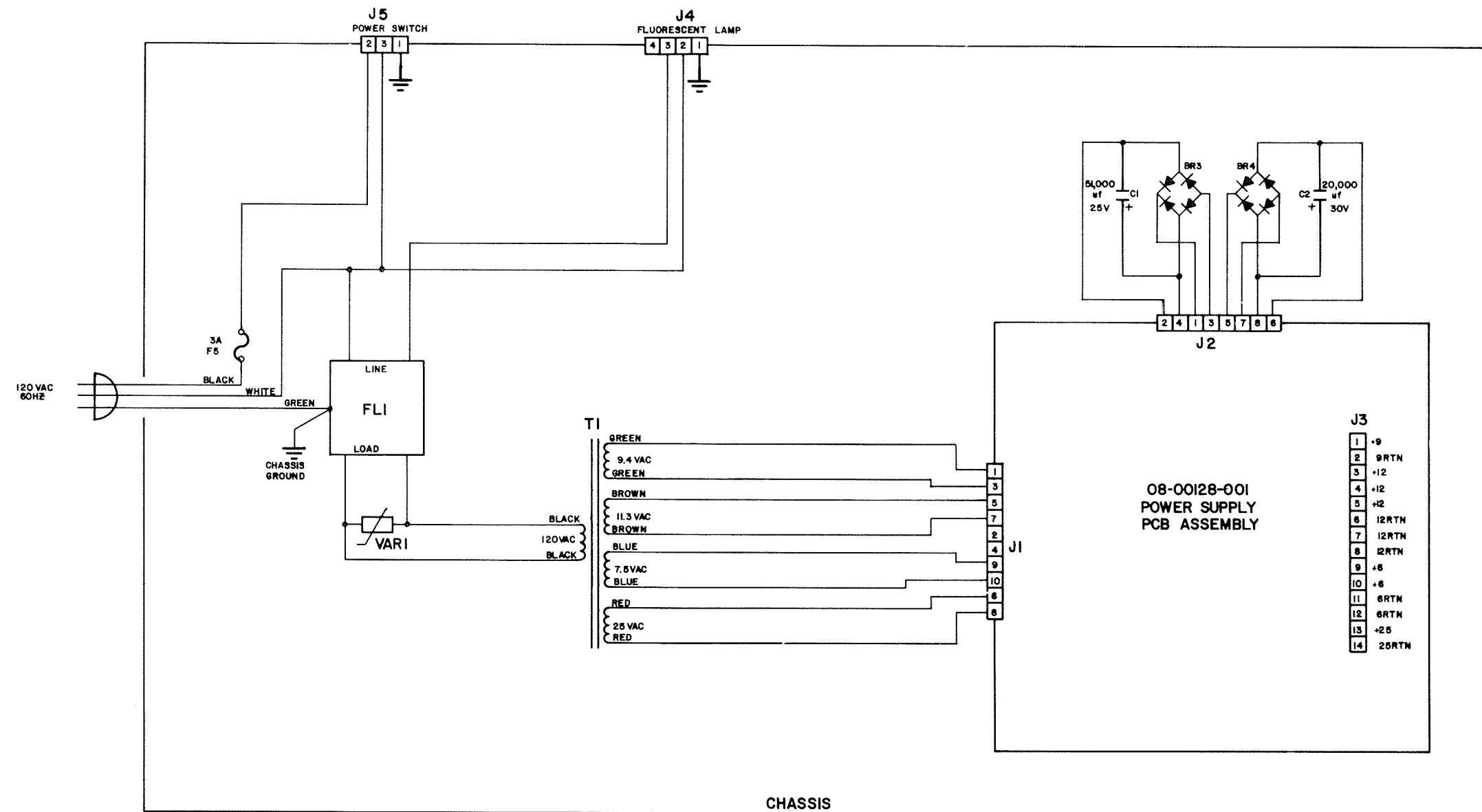
FIGURE 29



LOGIC AND REGULATOR BOARD
(PARTIAL)

TAITO		TAITO AMERICA CORPORATION	
1256 Estes Avenue, Elk Grove Village, IL 60007		Telephone (312) 981-1000 Telex 25-3280	
UNLESS OTHERWISE SPECIFIED	DATE	DRAWN BY	DATE
1. 1/2" = 1"	9-16-83	DON L.	9-16-83
2. 1/4" = 1"		APPROVED BY	
3. 1/8" = 1"			
4. 1/16" = 1"			
ICE COLD BEER-WIRING DIAG.			
1. 1/2" = 1"	2. 1/4" = 1"	3. 1/8" = 1"	4. 1/16" = 1"

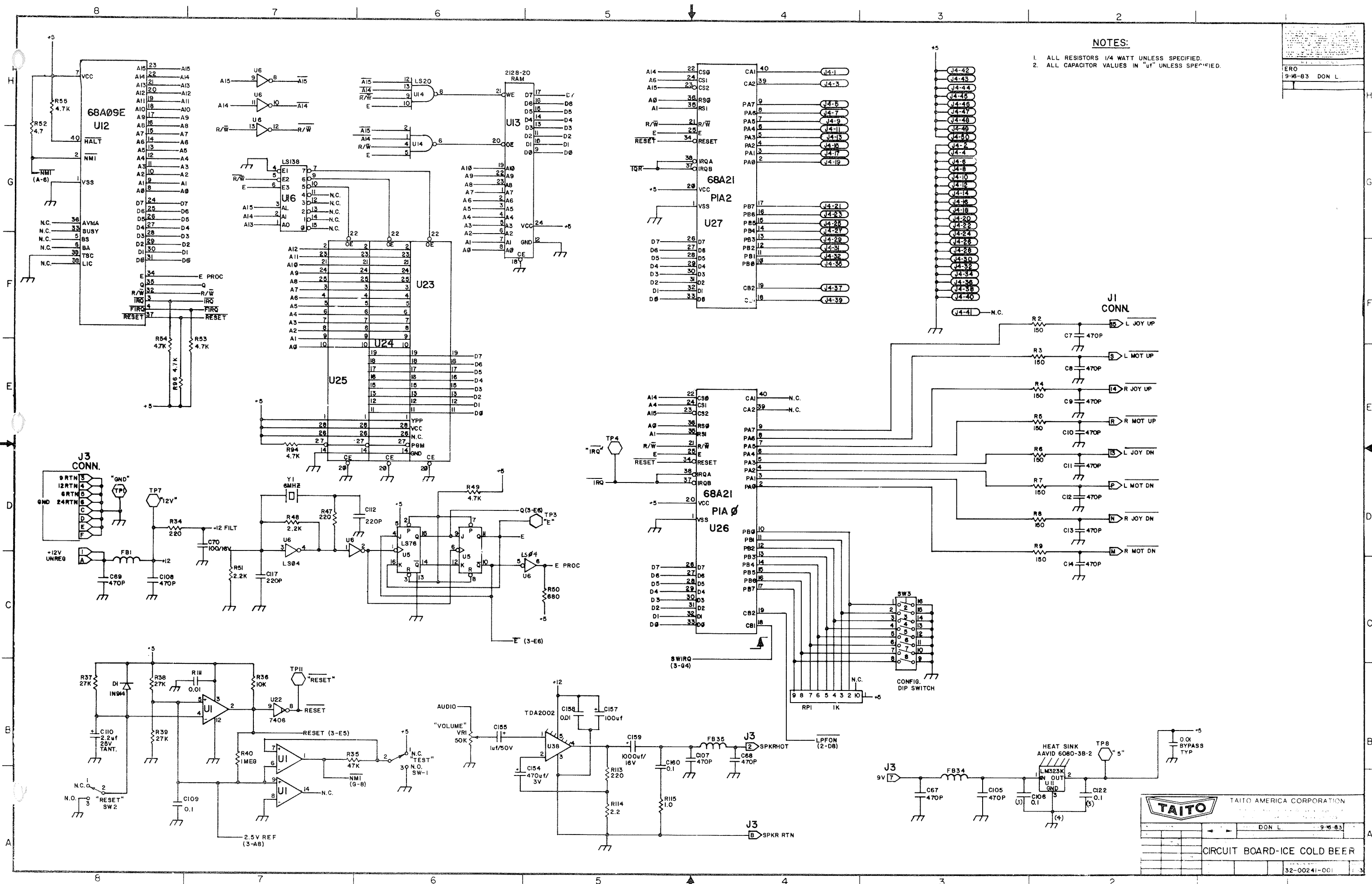
FIGURE 30



REVISIONS	
ERO	9-14-83

TAITO TAITO AMERICA CORPORATION 1256 Estes Avenue, Elk Grove Village, IL 60007 Telephone (312) 981-1000 Telex 25-3290	
UNLESS OTHERWISE SPECIFIED DIM. TOL. INCHES MM 1/16 .0015 1/32 .0010 1/64 .0005 3/32 .0010 1/2 .0015 1 .0020	DRAWN BY: DON L. DATE: 9-14-83 APPROVED BY: _____ DATE: _____ POWER SUPPLY-ICE COLD BEER SHEET 1 OF 1

FIGURE 31



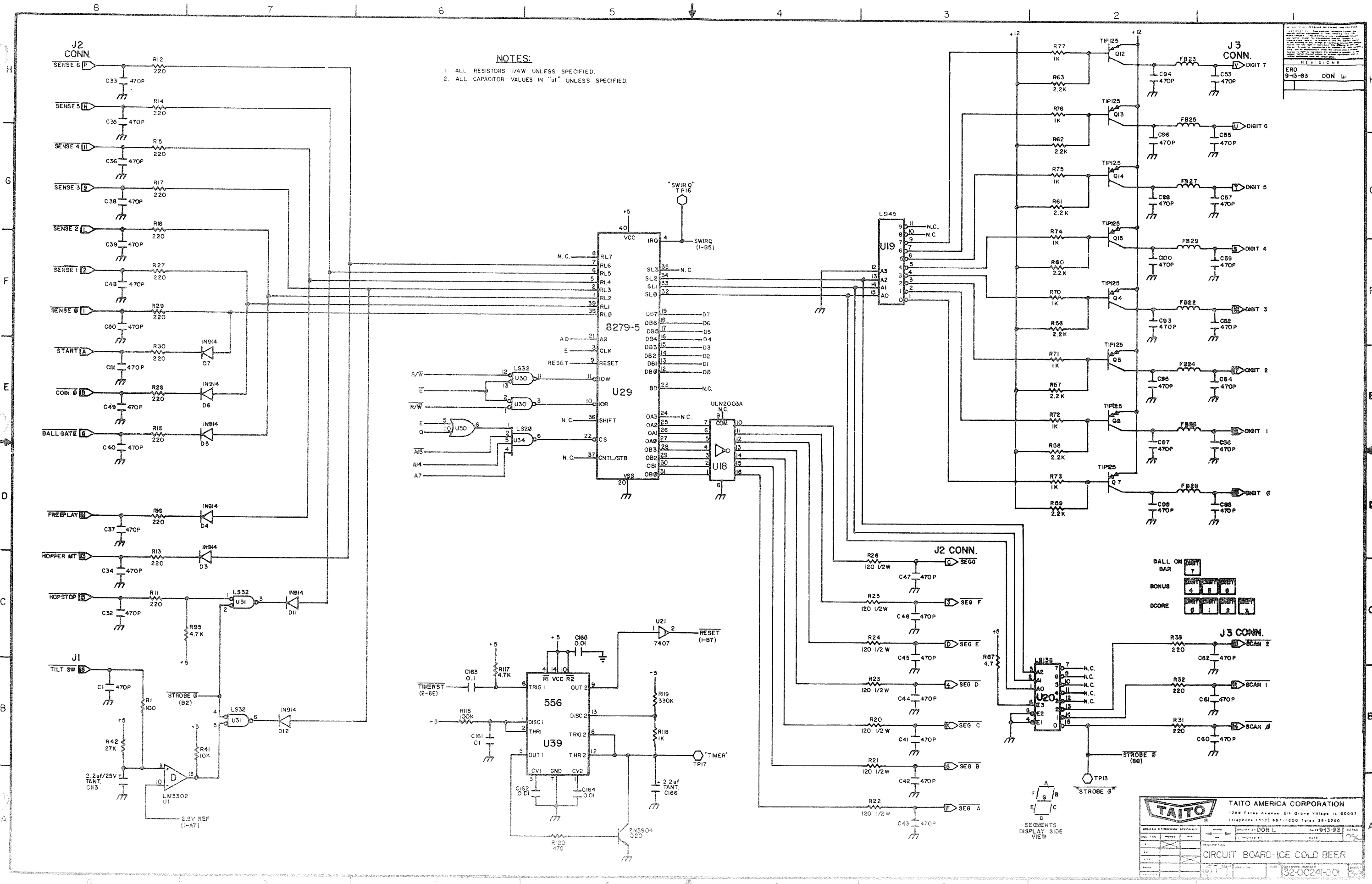
NOTES:

1. ALL RESISTORS 1/4 WATT UNLESS SPECIFIED.
2. ALL CAPACITOR VALUES IN "u" UNLESS SPECIFIED.

ERO
9-16-83 DON L

TAITO AMERICA CORPORATION
DON L 9-16-83
CIRCUIT BOARD-ICE COLD BEER
32-00241-001

FIGURE 33



ICE COLD BEER

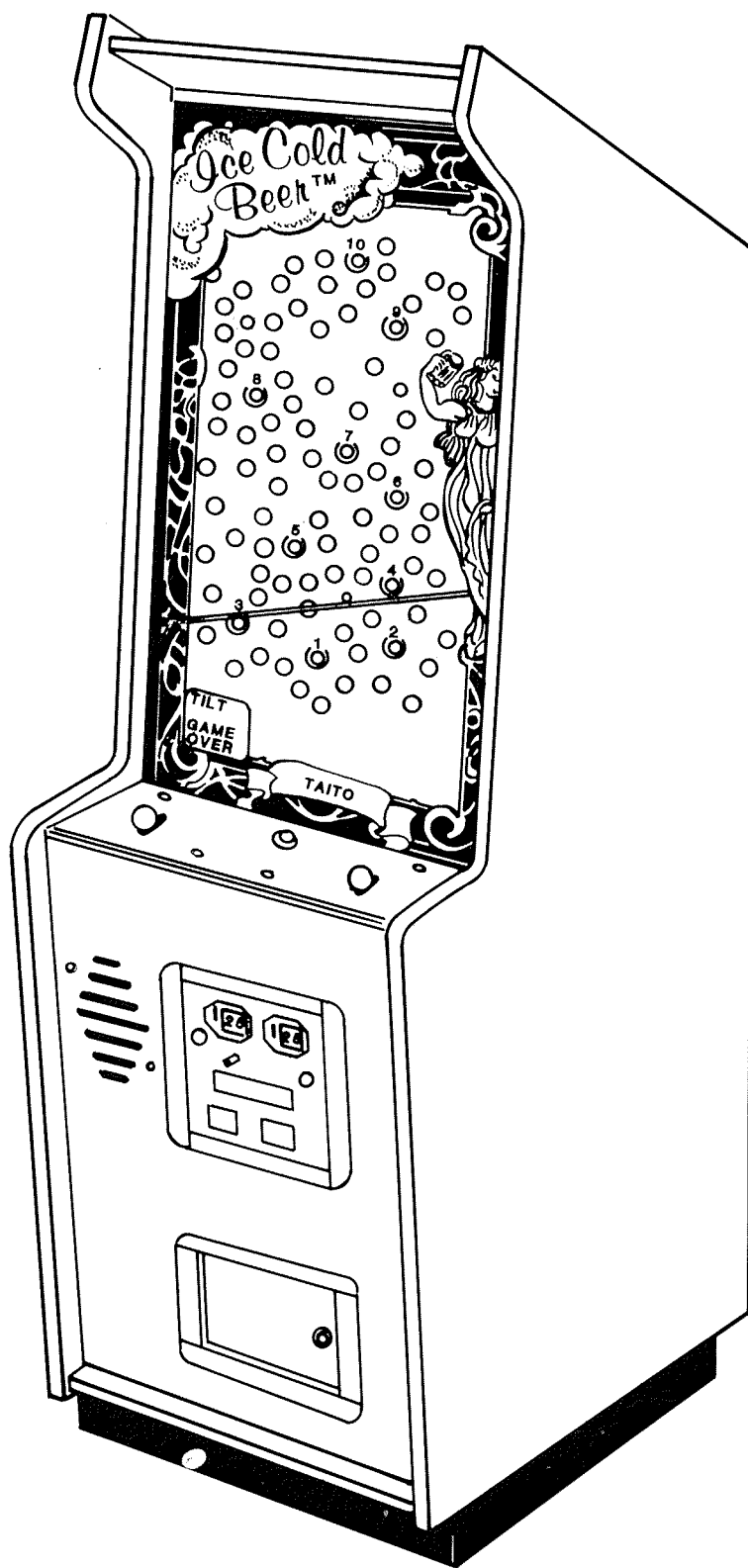
T.M.

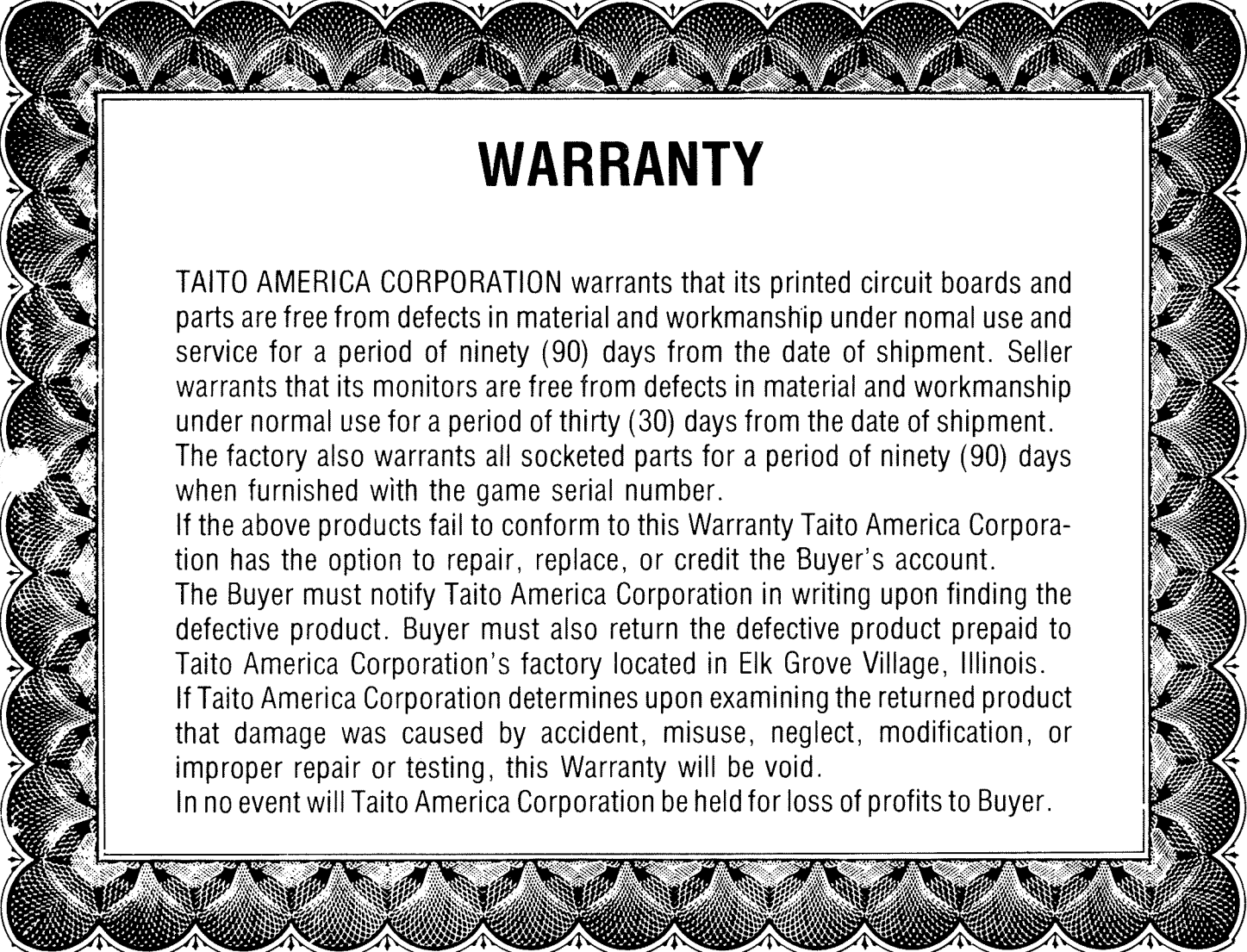


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72-00041-001





WARRANTY

TAITO AMERICA CORPORATION warrants that its printed circuit boards and parts are free from defects in material and workmanship under normal use and service for a period of ninety (90) days from the date of shipment. Seller warrants that its monitors are free from defects in material and workmanship under normal use for a period of thirty (30) days from the date of shipment. The factory also warrants all socketed parts for a period of ninety (90) days when furnished with the game serial number.

If the above products fail to conform to this Warranty Taito America Corporation has the option to repair, replace, or credit the Buyer's account.

The Buyer must notify Taito America Corporation in writing upon finding the defective product. Buyer must also return the defective product prepaid to Taito America Corporation's factory located in Elk Grove Village, Illinois.

If Taito America Corporation determines upon examining the returned product that damage was caused by accident, misuse, neglect, modification, or improper repair or testing, this Warranty will be void.

In no event will Taito America Corporation be held for loss of profits to Buyer.



TAITO AMERICA CORPORATION
1256 Estes Avenue, Elk Grove Village, IL 60007
Telephone (312) 981-1000 Telex 25-3290