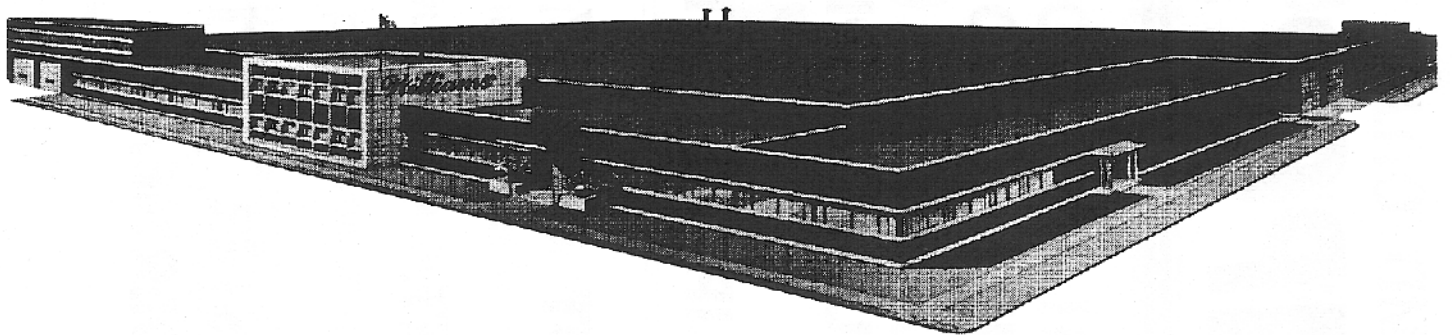


Instruction Manual

for

STUDENT PRINCE



Williams[®] ELECTRONICS, INC.
SUBSIDIARY OF THE SEEBURG CORPORATION

3401 N. California Ave.
Phone 267-2240

Chicago, Ill. 60618, U.S.A.
Cable Address: Wilcoin

IMPORTANT NOTICE

**KINDLY INFORM LOCATIONS THAT THEY
CAN TURN DISPLAY LIGHTS ON BY PRESSING
LEFT FLIPPER BUTTON. MACHINE CAN STILL
BE SHUT OFF BY TAPPING BOTTOM OF
CABINET.**

**MASTER SWITCH (ON-OFF) IS LOCATED
UNDERNEATH FRONT PART OF CABINET.**

CAUTION!

The playboard on this machine has an improved finish with excellent wearing properties. Do not under any circumstances clean the board with water, water soap solutions or harsh abrasives. Avoid such things as steel wool, kitchen cleansers or abrasive hand soap. Water will weaken the adhering of the paint to the board and abrasives shorten the board life by many thousand plays. A wax base cleaner with negligible abrasive qualities used lightly, but frequently, will extend the board life to its full capabilities.

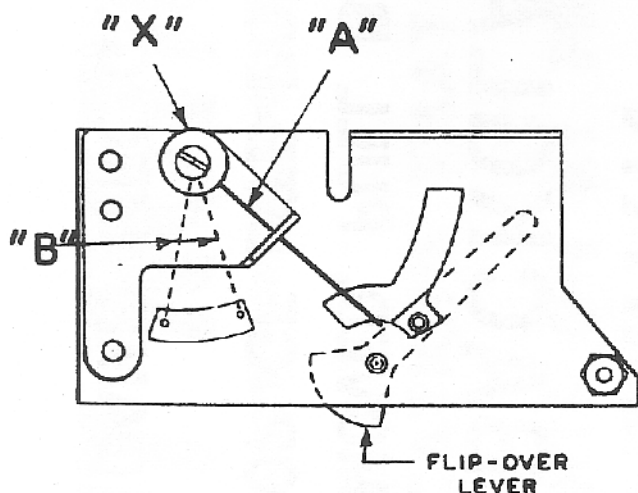
SERVICEMAN TO REMOVE BACKGLASS:

- **WITH BACK DOOR REMOVED, PULL BACK ON BRACKETS AT INSIDE TOP OF LITE BOX.**
- **FROM THE FRONT OF GAME, LIFT GLASS UP AND OUT.**

INSTRUCTIONS FOR ALTERING COIN CHUTES EQUIPPED WITH A FLIP-OVER DEVICE.

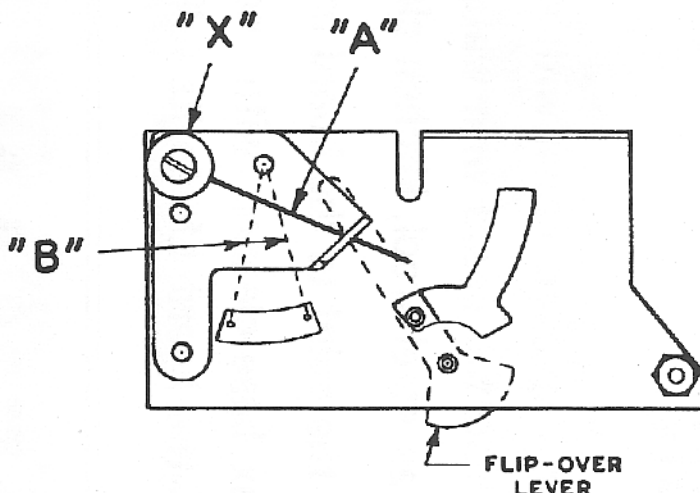
FOR 1 COIN - FOR 1 PLAY

FIGURE 1



OR 2 COINS - FOR 1 PLAY

FIGURE 2



1 COIN - FOR 1 PLAY (FIGURE 1):

Wire form "A" should be in position as shown in Figure 1. Flip-over lever should rebound from wire form "A" and return to position shown in Figure 1 everytime a coin is inserted. All coins pass over the coin trip switch wire "B".

2 COINS - FOR 1 PLAY (FIGURE 2):

Wire form "A" should be in position as shown in Figure 2 (see note). Flip-over lever should alternate from side to side. 1st coin should go to cash box without actuating coin trip switch wire "B", 2nd coin should pass the coin trip switch wire "B" and returns flip-over to position as shown in Figure 2.

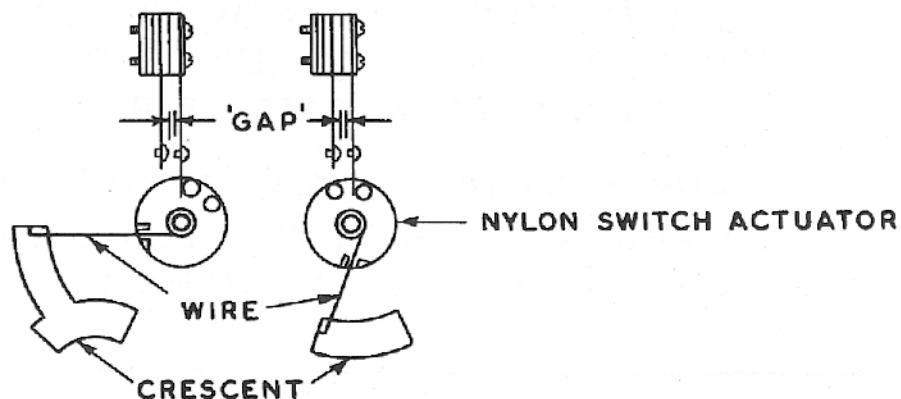
NOTE:

To change from 1 coin play to 2 coin play or vice versa - loosen screw "X" and move screw, bushing & wire form "A" to position as required - shown in Figure 1 position as required - shown in Figure 1 or Figure 2.

When using 1 coin for 1 play, wire form "A" should not under any circumstances be allowed to enter the "Banana" slot and cause binding of flip-over lever.

INSTRUCTIONS FOR COIN TRIP SWITCH ADJUSTMENT

WIRE SHOULD BE IN CONTACT WITH END OF CRESCENT OPENING WHEN BLADE ADJUSTMENT IS MADE.



Long blade should be in contact with nylon switch actuator and have a maximum overtravel of $1/32$.

or

Using a gram gauge, tension of long blade should not exceed 10 grams.

SWITCH ADJUSTMENT

1. For small coins, such as dimes, adjust short blade so that the 'gap' between the silver contacts is .045 to .055.
2. For larger & heavier coins the 'gap' should be .045 to .060.
3. Do not adjust 'gap' closer than .040.

WARRANTY

THE MOTORS IN ALL NEW WILLIAMS PRODUCTS ARE UN-CONDITIONALLY GUARANTEED FOR 6 MONTHS FROM DATE OF PURCHASE.

ANY DEFECTIVE MOTORS RETURNED DURING THE WARRANTY PERIOD WILL BE REPLACED FREE OF CHARGE BY YOUR WILLIAMS DISTRIBUTOR.

IMPORTANT NOTICE

WHEN ORDERING PARTS ALWAYS SPECIFY NAME OF UNIT, GAME AND SERIAL NUMBER, IN ADDITION TO A CLEAR DESCRIPTION OF THE PART AND PART NUMBER IF POSSIBLE.

UNIT PARTS LIST FOR "STUDENT PRINCE"

UNIT NAME	CONTACT DISC	WIPER ASS'Y.	RATCHET GEAR ASSEMBLY	MOTORS
REPLAY	----	----	A-6400	
BALL COUNT	C-6932	C-6520	A-6402-5	
MATCH	C-6879	C-6520	A-6401	14A-7805
PLAYER	C-6417	C-6521	A-6405-3	(60 CYCLE)
COIN	C-6896	C-6520	A-6402-3	
0-9	B-6297	A-6294	3C-7128	
TENS	----	----	3C-7128	14A-7806
HUNDREDS	B-6297	A-6294	3C-7128	(50 CYCLE)
THOUSANDS	B-6297	A-6294	3C-7128	
TARGET	B-6297	A-6294	3C-7128	

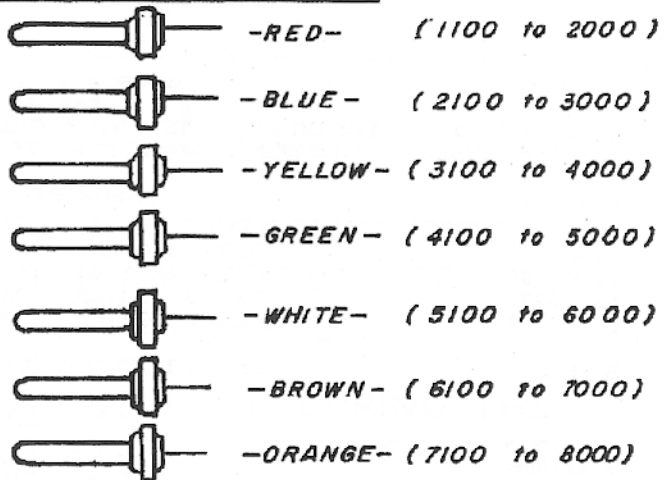
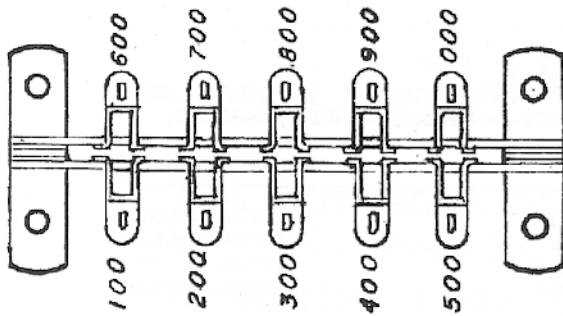
"STUDENT PRINCE" COIL CHART

NOTICE:

THIS GAME OPERATES ON 24 VOLTS. WHEN ORDERING REPLACEMENT TRANSFORMERS, MOTORS, COILS OR METERS ... MAKE SURE TO SPECIFY CORRECT PART NUMBERS.

NUMBER	DESCRIPTION	LOCATION
14 A 7805	SCORE MOTOR - 60 CYCLE	MECH. PANEL
14 A 7806	SCORE MOTOR - 50 CYCLE	MECH. PANEL
15 A 6771	TRANSFORMER - 60 CYCLE	MECH. PANEL
15 A 6773	TRANSFORMER - 50 CYCLE	MECH. PANEL
B 6396	24 VOLT METER (Coil #XM 27-675)	MECH. PANEL
<u>SOLENOID COILS</u>		
A 22-550	FLIPPER UNIT LATCH BALL RELEASE COIL PLAYER UNIT STEP UP MATCH UNIT STEP UP COIN UNIT STEP UP	PLAYFIELD PLAYFIELD INSERT INSERT MECH. PANEL
A 23-600	BALL COUNT UNIT STEP UP REPLAY UNIT STEP UP	MECH. PANEL INSERT
A2-23-750	LARGE BELL KNOCKER	CABINET CABINET
B 26-800	COIN UNIT RESET REPLAY UNIT RESET PLAYER UNIT RESET BALL COUNT UNIT RESET SCORE DRUM UNIT ... (16 REQ'D.) TARGET DRUM UNIT	MECH. PANEL INSERT INSERT MECH. PANEL INSERT PLAYFIELD
D 24-1400	BANK RESET	PLAYFIELD
FL 21-375/ 28-400	FLIPPER COILS ... (2 REQ'D.)	PLAYFIELD
G 22-550	JET BUMPER COILS ... (4 REQ'D.)	PLAYFIELD
G 23-750	KICKER COILS ... (2 REQ'D.)	PLAYFIELD
<u>RELAY COILS</u>		
M 29-1000	1st & 2nd RESET RELAY 3rd & 4th RESET RELAY	INSERT INSERT
M 29-1100	1 PT. RELAY 10 PT. RELAY 100 PT. RELAY CENTER TARGET RELAY NO. 1 BUMPER RELAY NO. 2 BUMPER RELAY TARGET RELAY 10¢ RELAY 25¢ RELAY	INSERT INSERT INSERT PLAYFIELD PLAYFIELD PLAYFIELD PLAYFIELD MECH. PANEL MECH. PANEL
M 30-1300	GATE RELAY	PLAYFIELD
Z 27-1000	REPLAY RELAY COIN RELAY RESET RELAY OUTHOLE RELAY PLAYER RESET RELAY 300 RELAY	MECH. PANEL MECH. PANEL MECH. PANEL MECH. PANEL MECH. PANEL MECH. PANEL
Z 28-1150	LOCK RELAY EXTRA BALL	MECH. PANEL MECH. PANEL
Z 28-1200	BALL INDEX RELAY	MECH. PANEL
M1-31-1500	COIN LOCKOUT	DOOR
S 27-500	RELAY BANK. (7 REQ'D.)	PLAYFIELD
M1-25-400	FLIPPER UNIT TRIP	PLAYFIELD

ADJUSTMENTS IN BACKBOX

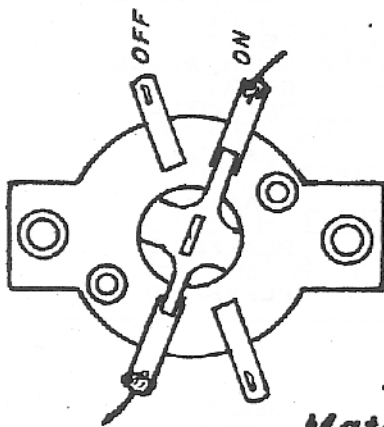


Hi-Score Adjustment

Insert plugs into 10 Point Female at desired positions.

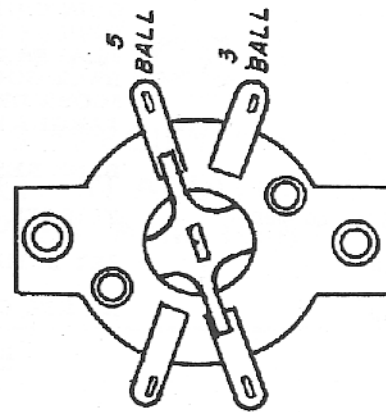
Examples:

Yellow wire into 300 position scores at 3300,
Yellow wire into 000 position scores at 4000.



Number
Match Adjustment

In 'ON' position, a number match lite will appear when game is over. To award replays, when number is matched, Extra Ball Adjustment Jack must be in 'Replay' position. In 'Off' position, Number Match is inoperative.

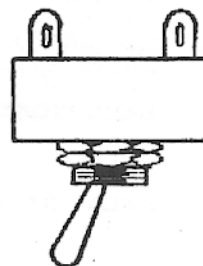


No. of Balls Adjustment

This switch changes 3 Ball to 5 Ball play, or vice versa.

*(Located under front of
Cabinet)*

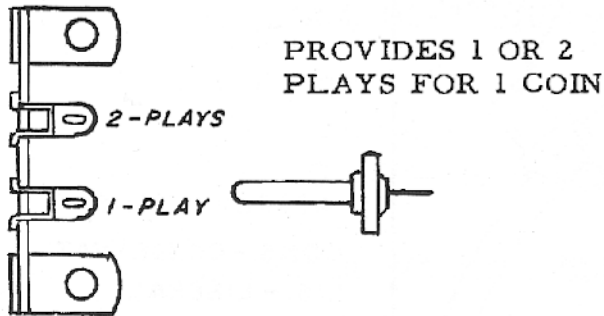
Master On-Off Switch



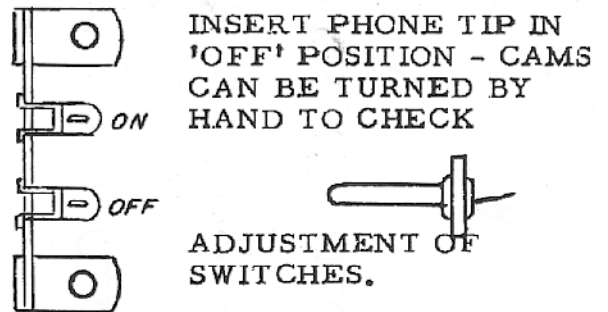
CONTROLS POWER TO
TRANSFORMER

ADJUSTMENTS ON MECHANISM PANEL

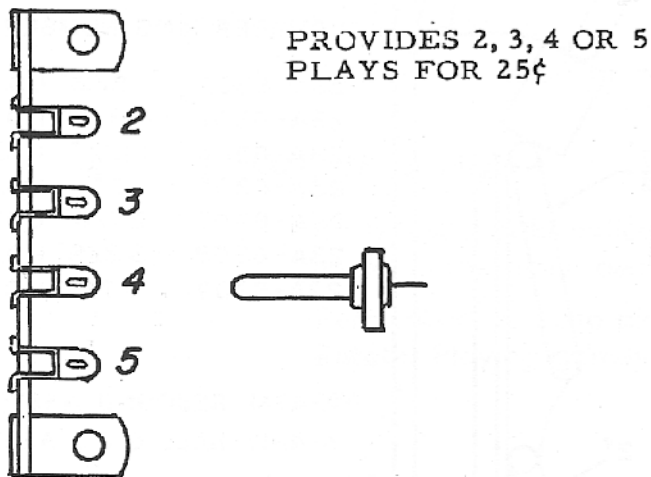
10¢ Adjustment



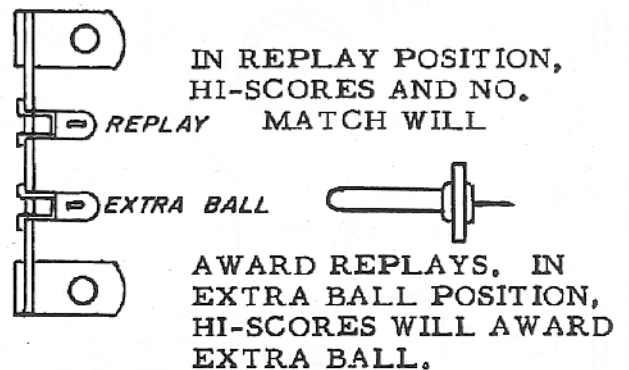
Motor Service Jack



25¢ Adjustment



Extra Ball Jack Adj.



THE POWER TRANSFORMER.

LOCATED ON PANEL, IS EQUIPPED WITH A SECONDARY TAP. IF YOUR GAME IS ON LOCATION WITH EXTREMELY LOW LINE VOLTAGE, REMOVE LEAD FROM LUG MARKED 24 VOLT AND SOLDER TO ALTERNATE LUG MARKED "HIGH". THIS WILL BOOST SECONDARY VOLTAGE BY APPROXIMATELY 2-3 VOLTS.

LEG LEVELERS.

ARE PROVIDED FOR TWO PURPOSES - 1ST TO LEVEL GAME ON LOCATION, 2ND TO INCREASE PITCH FOR GAME PERCENTAGING. IF IT IS DESIRED TO SPEED UP PLAY OR DECREASE SCORES, RAISE REAR LEG LEVELERS TO INCREASE PITCH.

SUGGESTED SCORE CARDS.

FOR REGULAR PLAY:

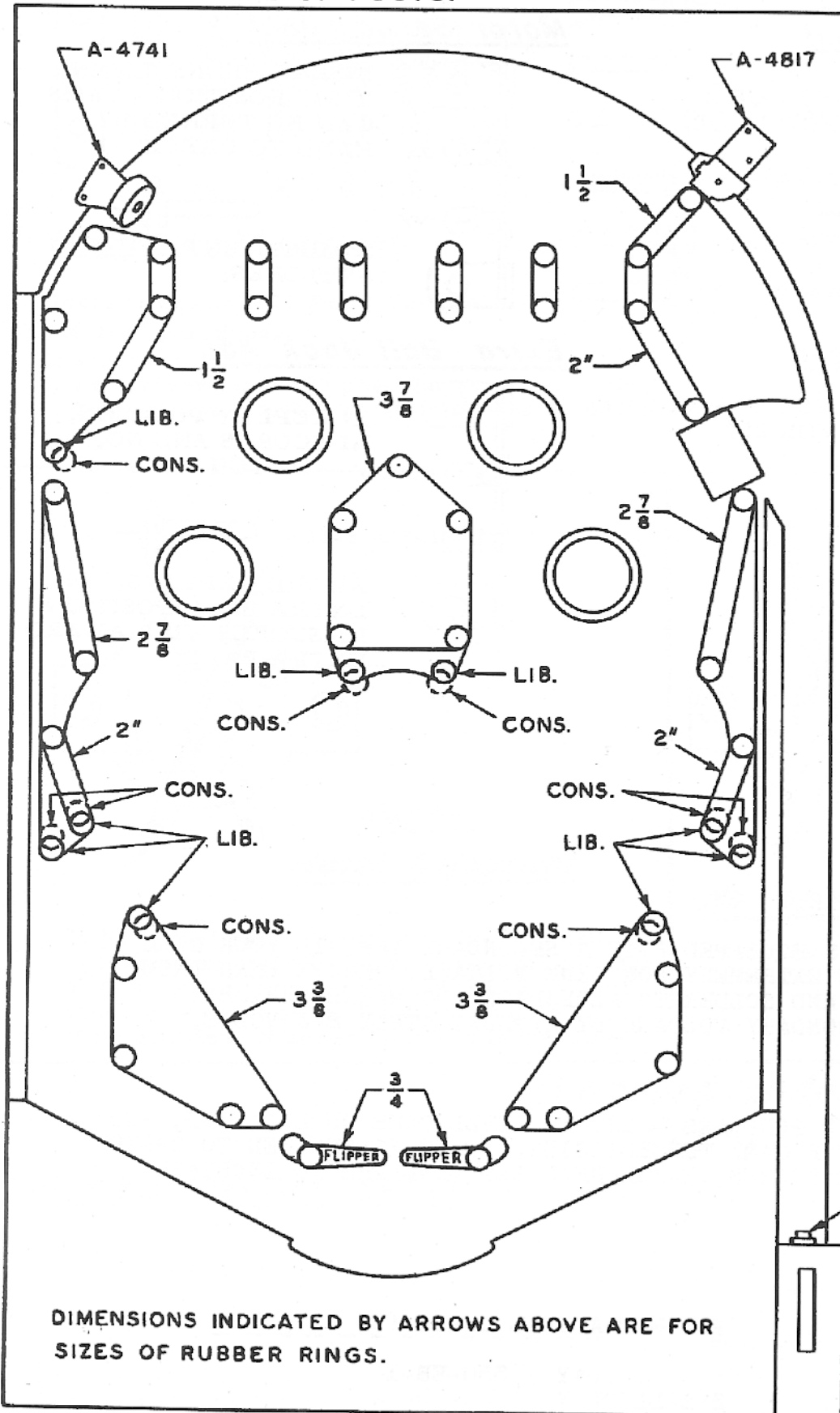
5 BALL PLAY - 350-5
3 BALL PLAY - 350-13

FOR EXTRA BALL ONLY: (NO REPLAYS)

5 BALL PLAY - 350-EB-1
3 BALL PLAY - 350-EB-1A

"STUDENT PRINCE" — POST ADJUSTMENT SHEET

TO MAKE GAME MORE "CONSERVATIVE" OR "LIBERAL"—MOVE POSTS $\frac{3}{16}$ " AS SHOWN IN SKETCH BELOW. SPOTTING HOLES ARE PROVIDED AND CAN BE SEEN ON REMOVAL OF POSTS.



ABBREVIATIONS:

CONS.—CONSERVATIVE
LIB.—LIBERAL

RUBBER RING NUMBERS:

23A-6300	5/16" I.D.
23A-6301	3/4" I.D.
23A-6304	1 1/2" I.D.
23A-6305	2" I.D.
23A-6307	2 7/8" I.D.
23A-6308	3 3/8" I.D.
23A-6309	3 7/8" I.D.

A-4741 REBOUND ASS'Y.
A-4817 BALL GATE ASS'Y.

23A-6327-BALL SHOOTER
RUBBER TIP

DIMENSIONS INDICATED BY ARROWS ABOVE ARE FOR SIZES OF RUBBER RINGS.

SUGGESTED TIPS FOR PEAK COLLECTIONS

1. CLEAN, NEAT EQUIPMENT:

- a. Playfields — clean semi-monthly or sooner if necessary.
- b. Cabinet — same as above.
- c. Glass — ask location to cooperate, clean daily.

2. PROPER WORKING EQUIPMENT:

- a. Replace lite bulbs if blown.
- b. Bring game into shop for periodical adjustment and thorough check-up.
- c. Rubbers — clean or replace often, keeps playfield live.

3. ROTATE GAMES:

- a. Cash box should indicate time for change, however eight weeks is the usual peak player interest.

Remember: to keep player interest high - **Rotate, Rotate Rotate**. Playing games is a habit. Don't let your players lose it.

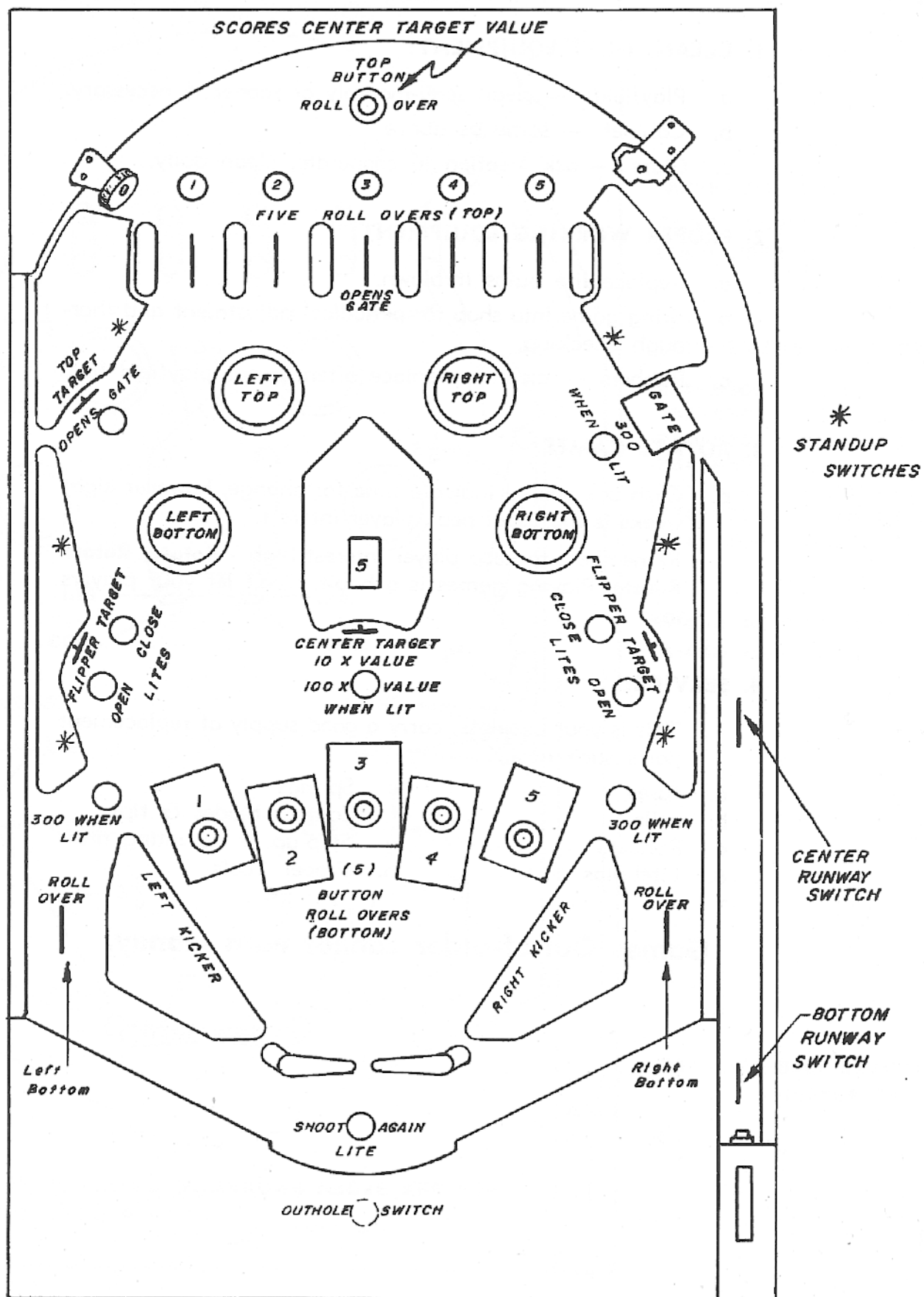
4. SERVICE:

This is your business; carry a good supply of replacement parts such as:

- | | |
|--------------|------------------------------|
| a. fuses | e. Springs |
| b. coils | f. Contact blades & tips |
| c. Rubbers | g. Step-up or actuating arms |
| d. Litebulbs | h. Proper Tools |

Games Out-of-order cannot earn money.

PLAYFIELD LAYOUT SHOWING LOCATION OF TARGETS, ROLL OVERS, AND JET BUMPERS.



"STUDENT PRINCE"

"STUDENT PRINCE" OPERATES AS FOLLOWS:

BALL GOING THRU ANY OF THE FIVE TOP ROLLOVER LANES WILL TRIP THE NUMBERED RELAY AS INDICATED. THESE FIVE RELAYS ARE LOCATED ON THE RELAY BANK. MAKING THE TOP ROLLOVER BUTTON OR HITTING THE CENTER TARGET WILL TRIP THE NUMBERED RELAY INDICATED ON THE TARGET DRUM. ANY OF THE FIVE RELAYS, WHEN TRIPPED, WILL LITE THE CORRESPONDING BOTTOM ROLLOVER BUTTON.

TRIPPING ALL FIVE RELAYS (NO.1 TO NO.5) ENERGIZES EXTRA BALL RELAY WHICH COMPLETES CIRCUIT TO "SHOOT AGAIN" LITE.

MAKING HI-SCORES, AS INDICATED ON SCORE CARD, REGISTERS A REPLAY OR EXTRA BALL, DEPENDING ON WHAT POSITION THE "REPLAY-EXTRA BALL ADJUSTMENT" IS SET.

MATCHING THE LAST NUMBER IN SCORE, ON GAME-OVER, ALSO AWARDS A REPLAY THRU THE ABOVE ADJUSTMENT JACK. REFER TO PAGES 6 AND 7 FOR EXPLANATION OF ADJUSTMENT JACKS.

WITH FLIPPERS IN OPEN POSITION, HITTING LEFT OR RIGHT TARGET WILL CLOSE FLIPPERS. WHEN FLIPPERS CLOSE, CENTER TARGET SCORES "100 TIMES VALUE" OF NUMBER ON DRUM UNIT.

WITH FLIPPERS IN CLOSED POSITION, THE FOLLOWING WILL OPEN FLIPPERS:

- 1.) HITTING LEFT, RIGHT OR CENTER TARGETS.
- 2.) BALL GOING THRU OPEN GATE AND MAKING THE CENTER RUNWAY SWITCH.
- 3.) BALL LEAVING PLAYFIELD (MAKING THE OUTHOLE SWITCH).
- 4.) STARTING A NEW GAME (ENERGIZES THE COIN RELAY).

FOR THE VARIOUS SCORING VALUES OF JET BUMPERS, TARGETS, ROLLOVERS ETC., REFER TO EXPLANATIONS OF 1 POINT RELAY, 10 POINT RELAY AND 100 POINT RELAY. THESE ARE FOUND IN THE A.C. RELAYS SECTION.

1. GENERAL

NEVER EXPERIMENT with any of the mechanism. Locate any trouble with the aid of Wiring Diagrams or Operating & Servicing Information supplied with the machine, then check for proper adjustment of the units involved before making any changes. Improper adjustment or make-shift repair will only cause serious damage to other parts of the machine or repeated failure of the part.

NOTE: Always look for a possible loose wire, bad connection at a plug and socket, broken or unhooked springs on step-up units, relays, etc., before adjustments are made or wires reconnected.

2. FUSES

IMPORTANT: Never replace fuses with any rating other than specified on the fuse block; this block is located adjacent to the transformer.

3. LUBRICATION

Over-lubrication causes far more trouble in coin operated equipment than under-lubrication. Practically all cases of poor contact on switches and wiper discs are due to oil or grease, or oil vapor, which forms a film or residue on the contacts and will not allow current to pass through. Excess lubricant may also seep into clutches causing them to slip.

IMPORTANT: NEVER USE VASELINE FOR LUBRICATION OF ANY PART OF THE MACHINE. Vaseline is not a true lubricant. It leaves a dirty and gummy residue and it becomes very thick when cold. A special Coin Machine Lubricant is supplied with each machine.

STEP-UP Levers, Ratchets, Cams, Shafts and other sliding or oscillating parts should be very lightly greased with special Coin Machine Lubricant (supplied with machine) not oftener than every six months. The bakelite discs (biscuits) on the Motor Units and Step-up Units will require lubrication with the special Coin Machine Lubricant only after the grease is completely evaporated (3 to 12 months, depending on climate) or when the film of grease becomes dirty. In either event, clean the parts thoroughly with a solvent, then apply an extremely thin coat of the special grease.

Solenoid Plungers should not have a lubricant of any kind. Should there be a sluggish tendency or if plungers are sticking, the parts should be cleaned with a solvent and flaked graphite applied on reassembly.

4. RELAY and SWITCH ADJUSTMENT

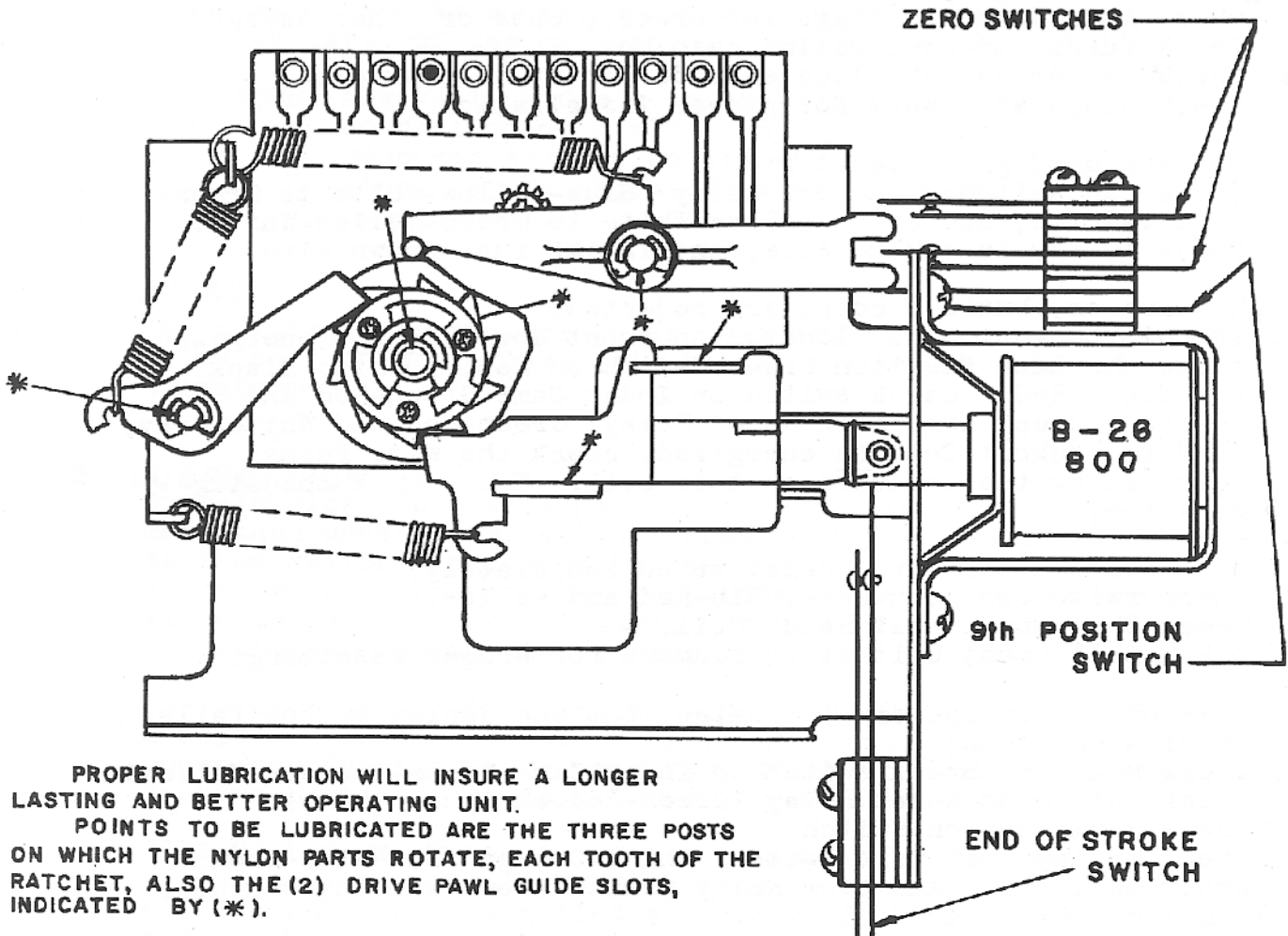
Where relay adjustments are called for, before bending blades, in all cases, on any machine, make certain that the screws holding the switch stacks are down very tightly. This is suggested because the plastic spacers in the switch stacks have occasionally shrunk by drying out, causing a poor adjustment.

WHAT TO DO IF:

1. Lights are out, game is inoperative:
 - a. Check A.C. cord and plugs for breaks, cuts or other damage.
 - b. Check fuses, located behind cash box.
 - c. Check master switch, located under front of cabinet.
 - d. Check plugs and jacks for proper installation.
2. Lights are out, game operates:
 - a. Check two switches on Lock Relay: Blue-Yellow-White to Green-Yellow-White, and Brown-Yellow-White to Green-Yellow-White.
 - b. Check 10 AMP fuse-Blue wire, and 15 AMP fuse-Brown wire.
3. Lights are on, but all coins are rejected:
 - a. If Coin Lockout Coil (located on front door) is not energized, check the Last Position Break Switch on Replay Unit: Black and Black-Red. Check switch on Index Cam; Green-Red and Yellow. Check switch on Reset Relay; Green-Red and White-Gray.
 - b. If Coin Lockout Coil is energized, check the wire forms actuated by the armature on this coil. Then check the slug rejector.
4. Game resets but Game Over Relay trips immediately:
 - a. Check switch on Lock Relay Blu-Red and Yellow.
 - b. Check Ball Count Unit Reset Coil.
 - c. Check Ball Count Unit wiper fingers for proper resetting.
5. Game is over, replays are indicated, but the Replay Button fails to start a new game:
 - a. Check Make and Break Switch on Index Cam (Green-Red and Yellow).
 - b. Check switch on Reset Relay (Green-Red and White-Gray).
 - c. Check Reply Button Switch.
 - d. Check Replay Unit Zero Switch, White-Orange and White-Brown.
 - e. Check switch on Game Over Relay (White-Brown and White-Blue).
 - f. Check Replay Relay Coil.
6. 300 Relay fails to energize when ball goes thru open Gate:
 - a. Check switch on Gate Relay, White-Gray and Black-Orange.
 - b. Check Center Runway switch, Black-Orange and Yellow.
7. Flipper Unit does not close (Latch), when hitting Left or Right Target:
 - a. Left or Right Target switch should energize Target Relay, thru Flipper Unit E.O.S. and Limit switches.
 - b. Two Switches on Target Relay (Red-Brown and Orange-Green - & Orange-Green and Yellow) should energize Flipper Unit Latch Coil.
 - c. Target Relay should remain energized until Cam switch 2C opens, Blu-Black and Yellow.
8. Flipper Unit does not open (trip) when hitting Left or Right Target:
 - a. Check Flipper Unit End-Of-Stroke switch Blu-White and Blu-Brown.
 - b. Check Flipper Unit Trip Coil.

SCORE DRUM UNIT

WITH PRINTED CIRCUIT AND CONTACT RING



PROPER LUBRICATION WILL INSURE A LONGER LASTING AND BETTER OPERATING UNIT.

POINTS TO BE LUBRICATED ARE THE THREE POSTS ON WHICH THE NYLON PARTS ROTATE, EACH TOOTH OF THE RATCHET, ALSO THE (2) DRIVE PAWL GUIDE SLOTS, INDICATED BY (*).

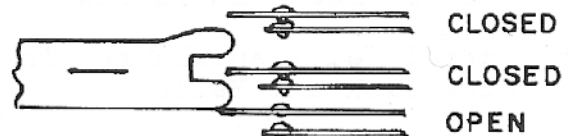
LUBRICATION: DO NOT PUT LUBRICANT ON DRIVE ARMATURE

SWITCH ADJUSTMENT

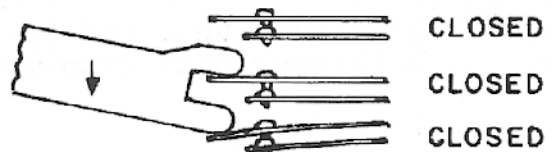
AT "0" OR INDEX POSITION ALL SWITCHES ARE OPEN AS SHOWN.



AT 1st. TO 8th. POSITION TOP SWITCHES ARE CLOSED—BOTTOM SWITCH REMAINS OPEN.



AT 9th POSITION ALL SWITCHES ARE CLOSED AS SHOWN

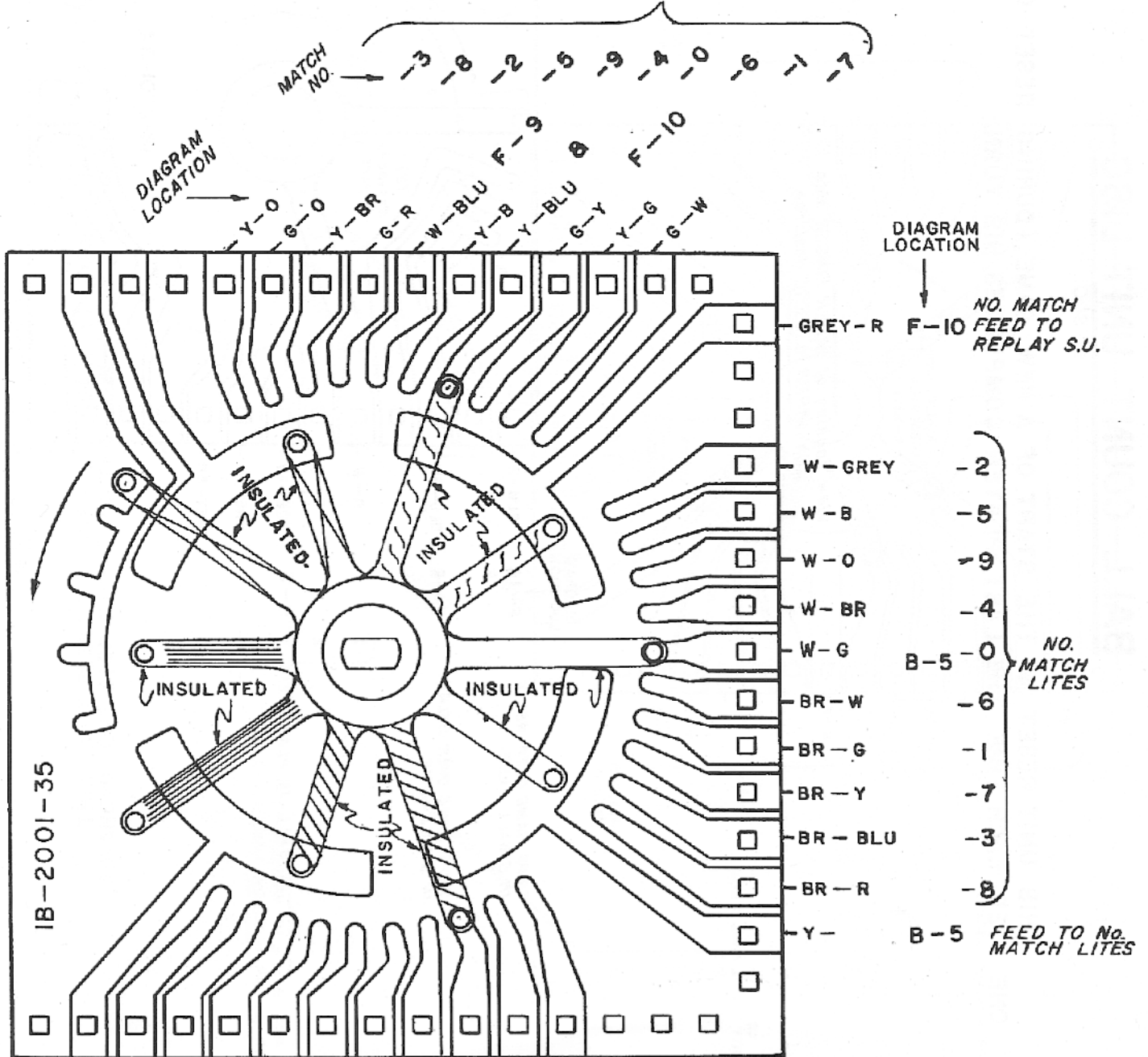


No. MATCH UNIT

THIS UNIT ADVANCES ONE STEP EACH TIME THE ONE POINT RELAY IS PULSED.

View looking at
WIPER FINGER side

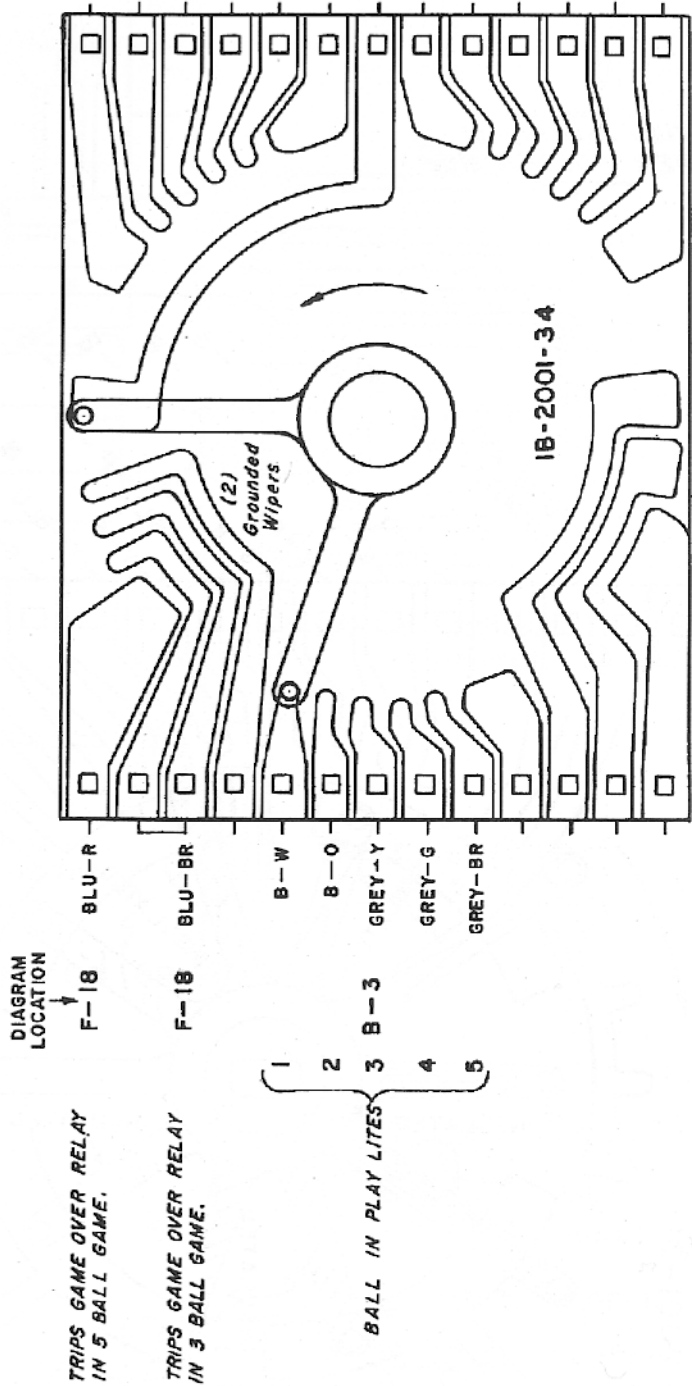
IN No. MATCH CIRCUIT.
THESE WIRES COME FROM
THE 1-PT. D.U. DISC OF
ALL FOUR PLAYERS.



BALL COUNT UNIT DISC

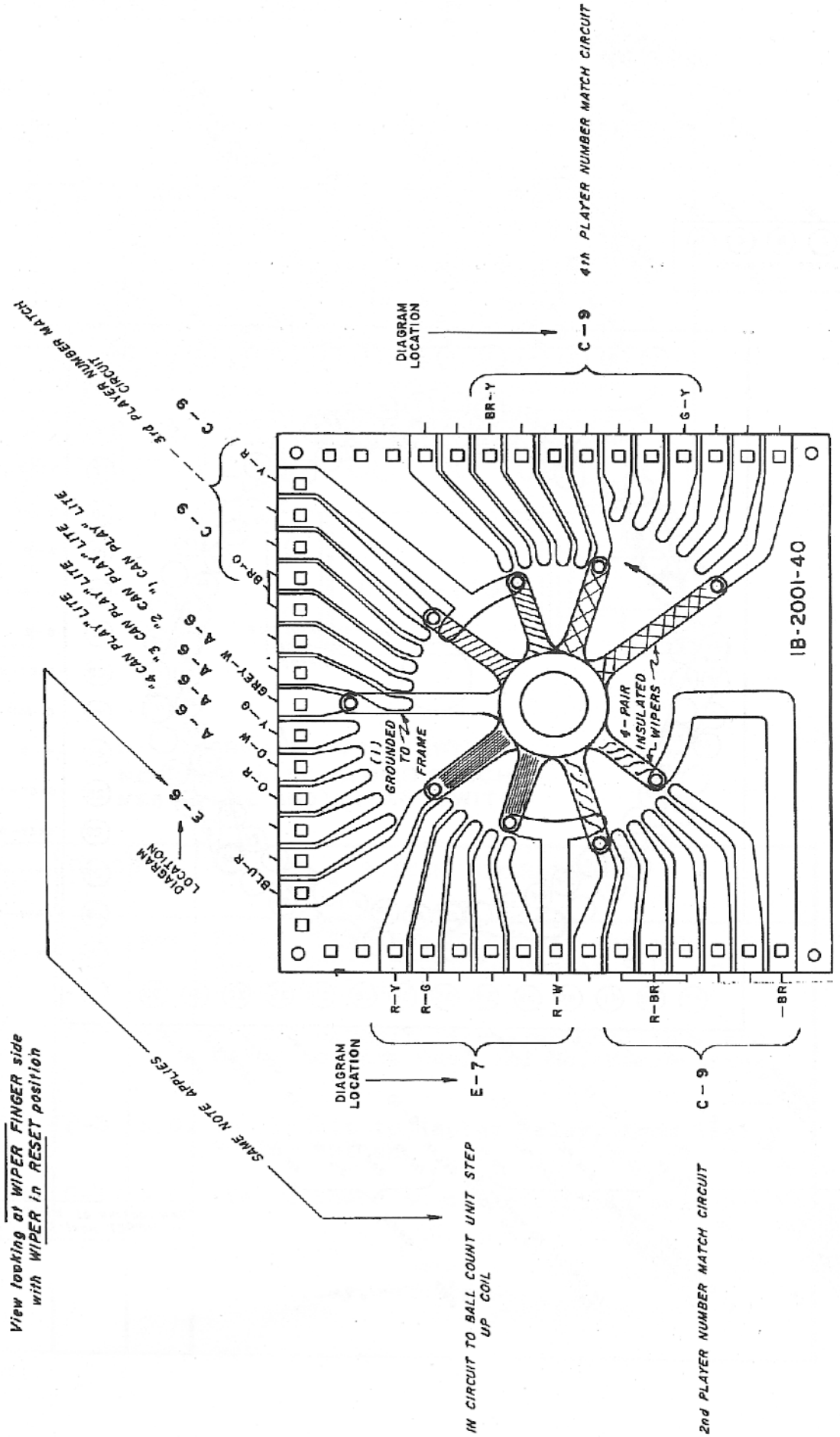
THIS UNIT RESET AT THE START OF A NEW GAME, (DURING RESET CYCLE). IT ADVANCES ONE STEP EACH TIME THE LAST PLAYER COMPLETES HIS TURN.

*View looking at WIPER FINGER side
with WIPER in ZERO position.*

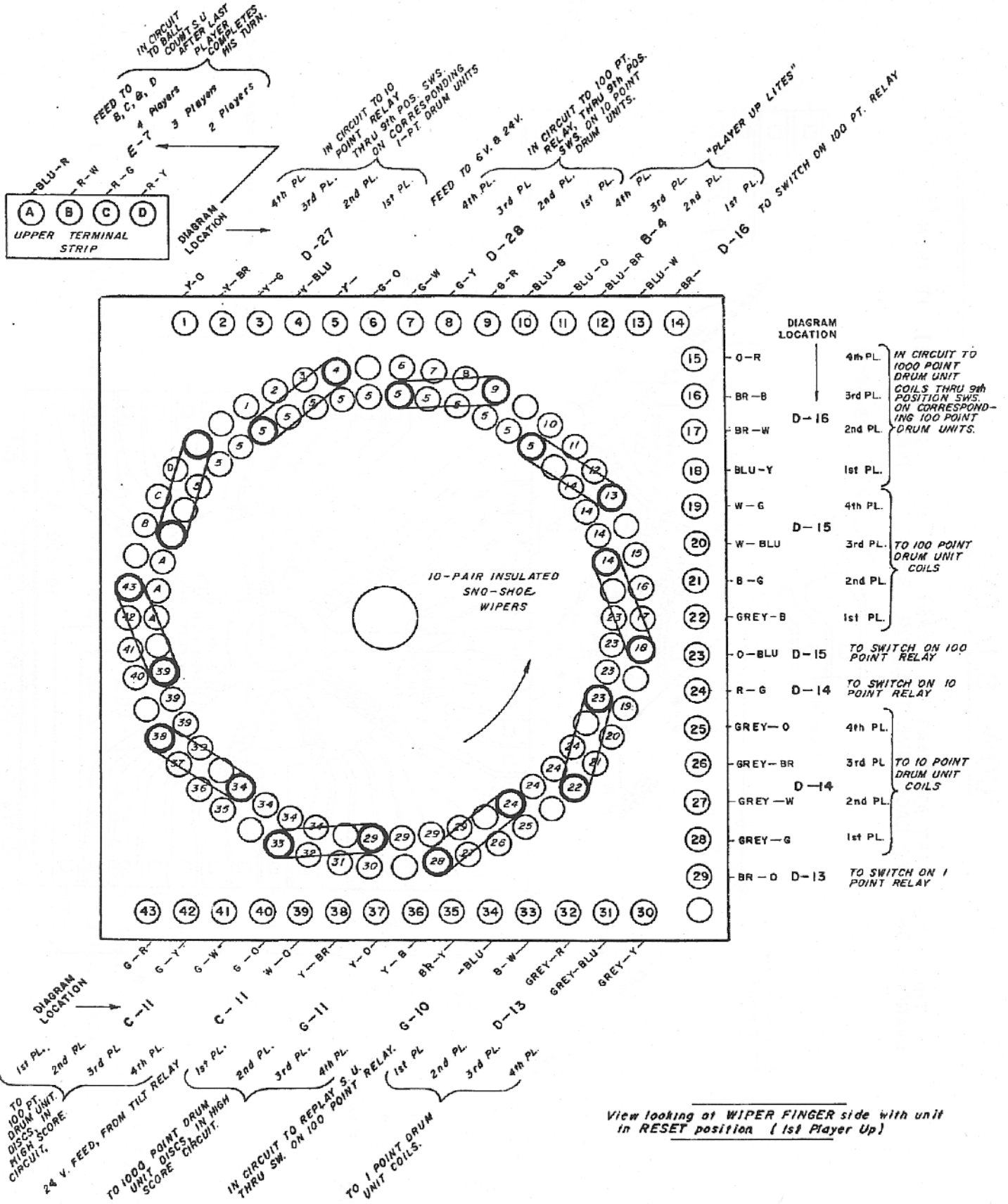


COIN S. U. DISC

THIS UNIT RESET AT START OF A GAME (DURING RESET CYCLE). IT THEN ADVANCES ONE STEP EACH TIME THE COIN RELAY IS PULSED.

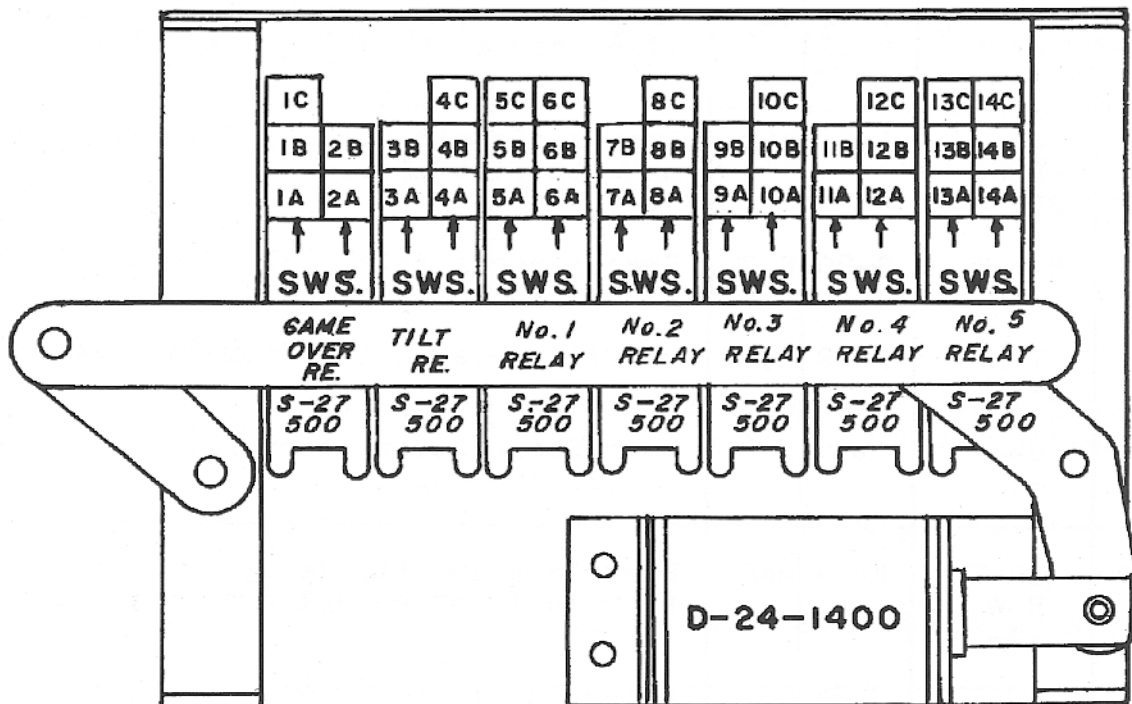


PLAYER UNIT DISC



View looking at WIPER FINGER side with unit in RESET position (1st Player Up)

RELAY BANK SWS.



N.O. — NORMALLY OPEN SWITCH
 N.C. — NORMALLY CLOSED SWITCH
 M&B — MAKE AND BREAK SWITCH

RELAY	SW.	WIRE COLORS	DIAG LOC.	TYPE	SWITCH OPERATION
GAME- OVER RELAY	1C	B-W GREY-BR GREY-G	F-9	M&B	Breaks High Score Circuit and makes in No. Match circuit to Replay S.U. or Extra Ball Relay.
	1B	BLU-Y -BR- GREY-O	A-4	M&B	Breaks circuit to Player Up lites, and makes to Game Over and No. Match lites.
	1A	W-BLU W-BR	F-3	N.O.	In circuit to Replay Relay, from Replay Button switch.
	2B	BLU-Y-W -B-	G-17	N.C.	Breaks power to all playfield switches.
	2A	O-R BLU-W	E-6	N.O.	Energizes Reset Relay, from switch on Coin Relay.

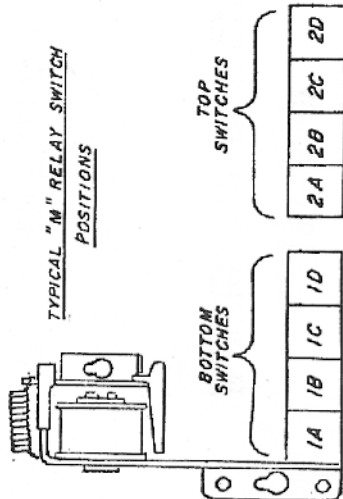
RELAY	SW.	WIRE COLORS	DIAGRAM LOCATION	TYPE	SWITCH OPERATION
TILT RELAY	3C	BLU-O R-G	C-21	N.O.	Energizes Flipper Unit (Trip Coil), from Cam Switch 3B.
	3B	W-O -Y- W-B	C-10 D-19	M&B	In Hi-Score circuit to Replay S.U.--- Also energizes Ball Index Relay.
	3A	-W- -BLU- BLU-B	A-7	M&B	Breaks circuit to Playfield lites and make to Tilt lite.
	4C	R-Y-W -R-	G-20	N.C.	Breaks power to all playfield switches except Outhole Switch.
	4B	Y-R -J-	F-18	N.C.	To Tilt Relay Coil, from Tilt Switches.
	4A	G-O -Y-	C-5	N.O.	Runs Score Motor, thru Flipper Unit E.O.S. Switch.
NO.1 RELAY	5C	BR-Y R-W -J-	F-24	M&B	Energizes 100 Pt. Relay or 300 Relay, from left Bottom Rollover switch.
	5B	-J- R-O W-R	E-24	M&B	Pulses 1 Pt. or 10 Pt. Relay, from No.1 Rollover Button.
	5A	GREY-R -J- GREY-BLU	A-8	M&B	To No.1 lites---also to 300 lite at Left Bottom R.O.
	6C	R-BLU G-R -J-	E-23	M&B	Trips No.1 Relay and pulses 100 Point Relay, from No.1 Rollover Switch.
	6B	R-BLU -J-	F-23	N.C.	Safety switch to this relay.
	6A	-J- -Y-	D-20	N.O.	In series with switch 8A on No.2 Relay.
NO.2 RELAY	7B	-J- -BLU- -J-	E-25	M&B	Pulses 1 Pt. or 10 Pt. Relay, from No.2 Rollover Button.
	7A	GREY-Y -J- GREY-G	A-8	M&B	To No.2 lites---also to Red Bumper lites.
	8C	R-Y BR-BLU -J-	E-23	M&B	Trips No.2 Relay and pulses 100 Point Relay, from No.2 Rollover Switch.

RELAY	SW.	WIRE COLORS	DIAG LOC.	TYPE	SWITCH OPERATION
NO.2 RELAY (CONT)	8B	R-Y -J-	F-23	N.C.	Safety switch to this relay.
	8A	-J- -J-	D-20	N.O.	In series with switch 10A on No.3 Relay.
NO.3 RELAY	9B	-J- BLU-R -J-	E-25	M&B	Pulses 1 Pt. or 10 Pt. Relay, from No.3 Rollover Button.
	9A	GREY-BR -J- GREY-O	A-9	M&B	To No.3 lites.
	10C	BR-O O-W -J-	E-23	M&B	Trips No.3 Relay and pulses 100 Point Relay, from No.3 Rollover Switch.
	10B	BR-O -J-	F-23	N.C.	Safety switch to this relay.
	10A	-J- -J-	E-20	N.O.	In series with switch 12A on No.4 Relay.
NO.4 RELAY	11B	-J- Y-B -J-	E-25	M&B	Pulses 1 Pt. or 10 Pt. Relay, from No.4 Rollover Button.
	11A	GREY-B -J- R-BLU	A-9	M&B	To No.4 lites---also to Yellow Bumper lites.
	12C	R-W O-BLU -J-	E-23	M&B	Trips No.4 Relay and pulses 100 Point Relay, from No.4 Rollover Switch.
	12B	R-W -J-	F-23	N.C.	Safety switch to this relay.
	12A	-J- -J-	E-20	N.O.	In series with switch 14A on No.5 Relay.
NO.5 RELAY	13C	-J- O-B W-GREY	F-24	M&B	Energizes 100 Point Relay or 300 Relay, from Right Bottom Rollover switch.
	13B	G-B B-R -J-	E-25	M&B	Pulses 1 Pt. or 10 Pt. Relay, from No.5 Rollover Button.

RELAY	SW.	WIRE COLORS	DIAG LOC.	TYPE	SWITCH OPERATION
NO.5 RELAY (CONT)	13A	R-G -J- R-Y	A-10	M&B	To No.5 lites---also to 300 lite at Right Bottom Rollover.
	14C	BR-W O-G -J-	E-23	M&B	Trips No.5 Relay and pulses 100 Point Relay, from No.5 Rollover Switch.
	14B	BR-W -J-	F-23	N.C.	Safety switch to this relay.
	14A	R-B -J-	F-20	N.O.	Energizes Extra Ball Relay, when Nos.1, 2,3 and 4 Relays are tripped.

A. C. RELAYS & SWITCHES

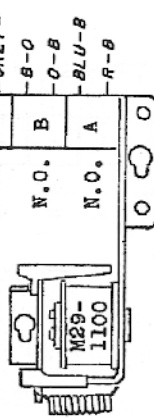
On Mechanism Panel



10¢ RELAY

IS ENERGIZED BY 10¢ COIN SWITCH, IF 10¢ ADJUSTMENT JACK IS IN "2 PLAYS" POSITION.

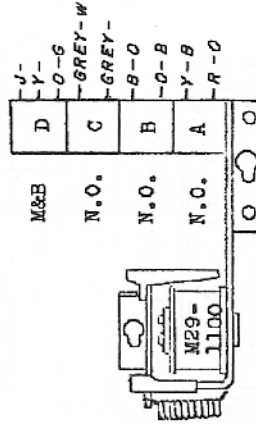
SWITCH TYPE	DIAGRAM LOCATION	OPERATION
D M&B O-R O-G	D-5	IN CIRCUIT TO KNOCKER COIL---ALSO RUNS SCORE MOTOR.
C N.O. GREY-W B-O	D-8	PULSES REPLAY S.U. FROM IMPULSE CAM SWITCH B.
B N.O. O-B	E-17	ENERGIZES LOCK RELAY.
A N.O. BLU-B R-B	E-1	IN HOLD CIRCUIT TO THIS RELAY.



25¢ RELAY

IS ENERGIZED BY 25¢ COIN SWITCH.

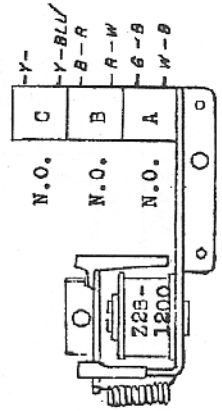
D M&B Y- O-G	D-5	IN CIRCUIT TO KNOCKER COIL---ALSO RUNS SCORE MOTOR.
C N.O. GREY-W B-O	D-8	PULSES REPLAY S.U. FROM IMPULSE CAM SWITCH B.
B N.O. O-B	E-17	ENERGIZES LOCK RELAY.
A N.O. Y-B R-O	E-2	IN HOLD CIRCUIT TO THIS RELAY.



BALL INDEX RELAY

IS ENERGIZED WHEN GAME IS TILTED, OR BY 100 PT. RELAY.

D N.O. Y- Y-BLU	D-20	PROVIDES A HOLD CIRCUIT FOR EXTRA BALL RELAY WHILE BALL IS ON PLAYFIELD.
B N.O. R-R	E-7	IN CIRCUIT TO PLAYER UP UNIT STEP-UP AND RESET COILS.
A N.O. R-W G-B W-B	F-19	IN HOLD CIRCUIT TO THIS RELAY.

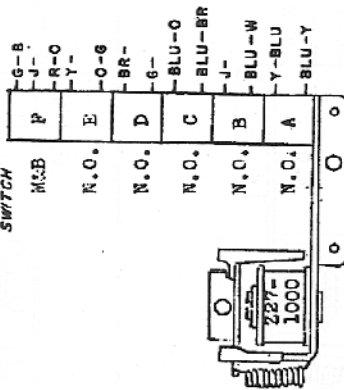


ON MECHANISM PANEL

OUTHOLE RELAY

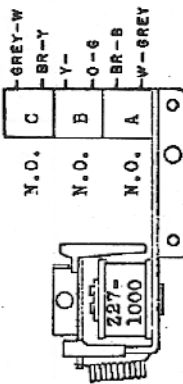
IS ENERGIZED, DURING PLAY, BY OUTHOLE SWITCH WHEN SCORE MOTOR IS AT INDEX POSITION.

TYPE SWITCH



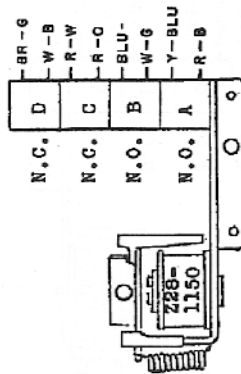
300 POINT RELAY

IS ENERGIZED BY LEFT OR RIGHT BOTTOM ROLLOVER, WHEN LIT. ALSO BY BALL GOING THRU OPEN GATE.



EXTRA BALL RELAY

IS ENERGIZED WHEN NO. 1, 2, 3, 4, AND 5 RELAYS ARE TRIPPED. ALSO BY HI-SCORE CIRCUIT IF REPLAY-EXTRA BALL ADJUSTMENT JACK IS IN EXTRA BALL POSITION.



LOCK RELAY

IS ENERGIZED BY 10¢, 25¢, OR COIN RELAYS. ALSO BY LEFT FLIPPER BUTTON.

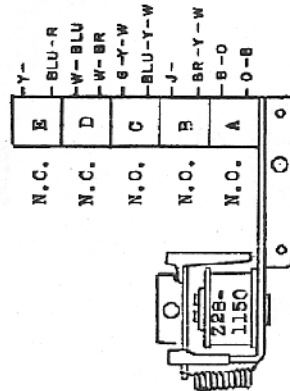


DIAGRAM LOCATION

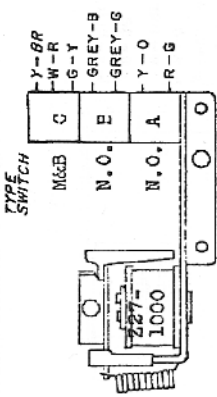
OPERATION

- D-7 IN SERIES WITH SWITCH A ON BALL INDEX RELAY OR---IN SERIES WITH SWITCH B ON BALL INDEX RELAY.
- D-19 RUNS SCORE MOTOR.
- D-5 PULSES RELAY BANK RESET COIL, FROM CAM SWITCH 1D.
- D-1 ENERGIZES FLIPPER UNIT (TRIP COIL), FROM CAM SWITCH 3C.
- E-20 ENERGIZES BALL RELEASE COIL, FROM CAM SWITCH 3C.
- F-19 IN HOLD CIRCUIT TO THIS RELAY.
- F-19 PULSES 100 PT. RELAY, FROM IMPULSE CAM SWITCH B.
- D-5 RUNS SCORE MOTOR.
- F-24 IN HOLD CIRCUIT TO THIS RELAY.
- E-19 INSURES EXTRA BALL RELAY WILL DROP OUT BEFORE BALL INDEX RELAY PULLS IN.
- D-7 BREAKS CIRCUIT TO PLAYER UNIT AND BALL COUNT UNIT STEP-UP COILS.
- A-7 TO "SHOOT AGAIN" LITES.
- F-20 IN HOLD CIRCUIT TO THIS RELAY.
- D-17 TRIPS GAME-OVER RELAY.
- E-3 IN CIRCUIT TO REPLAY RELAY, FROM REPLAY BUTTON.
- A-1 6 VOLTS TO LITES, FROM TRANSFORMER.
- A-1 6 VOLTS TO LITES, FROM TRANSFORMER.
- E-17 IN HOLD CIRCUIT TO THIS RELAY, THRU KICK-OFF SWITCH.

ON MECHANISM PANEL

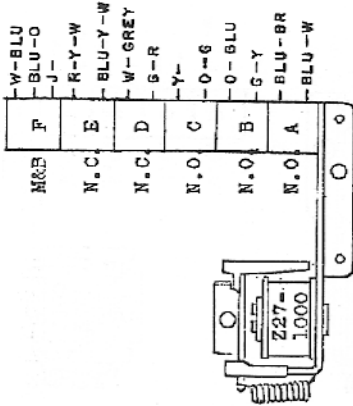
PLAYER RESET RELAY

IS ENERGIZED BY BALL COUNT UNIT END-OF-STROKE SWITCH.



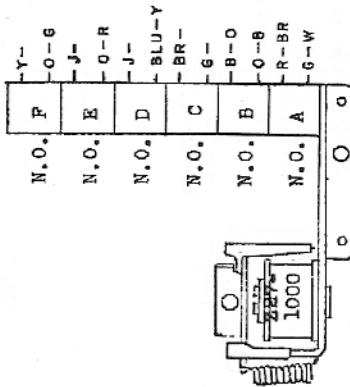
RESET RELAY

IS ENERGIZED BY THE COIN RELAY, WHEN GAME-OVER RELAY IS TRIPPED.



COIN RELAY

IS ENERGIZED BY COIN SWITCH OR BY REPLAY RELAY.



REPLAY RELAY

IS ENERGIZED BY THE REPLAY BUTTON, WHEN ONE OR MORE CREDITS ARE ACCUMULATED, UNTIL 4 PLAYERS ARE SET UP.

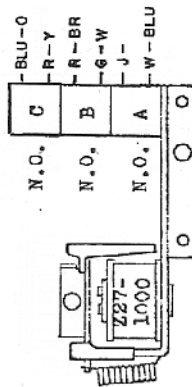


DIAGRAM LOCATION

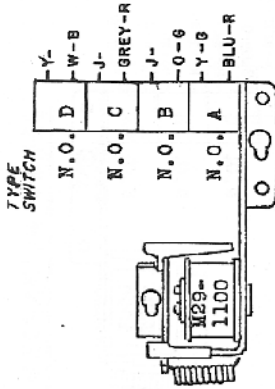
OPERATION

- F-7 IN SERIES WITH SWITCH B ON BALL INDEX RELAY.
- G-9 TO REPLAY S.U. COIL, IN NO. MATCH CIRCUIT, WHEN GAME-OVER RELAY TRIPS.
- E-8 IN HOLD CIRCUIT TO THIS RELAY.
- F-6 IN CIRCUIT TO BALL COUNT, COIN, AND PLAYER UNIT RESET COILS (DURING RESET CYCLE).
- G-17 BREAKS POWER TO COILS OPERATED BY SWITCHES ON PLAYFIELD.
- D-3 DOES NOT ALLOW REPLAY RELAY TO ENERGIZE AGAIN, AFTER IT HAS DROPPED OUT (DURING RESET CYCLE).
- D-6 RUNS SCORE MOTOR.
- F-7 IN CIRCUIT TO PLAYER UNIT RESET COIL (DURING RESET CYCLE).
- E-6 IN HOLD CIRCUIT TO THIS RELAY, THRU (16) DRUM UNIT ZERO POSITION BREAK SWITCHES.
- D-5 RUNS SCORE MOTOR.
- D-6 ENERGIZES RESET RELAY, THRU SWITCH ON GAME-OVER RELAY.
- D-18 TRIPS GAME-OVER RELAY, THRU PLAYER UNIT OR BALL COUNT UNIT ZERO BREAK SWITCHES.
- D-1 ENERGIZES RELAY BANK RESET COIL, FROM CAM SWITCH 1D (110V).
- E-17 ENERGIZES LOCK RELAY.
- D-3 IN HOLD CIRCUIT TO THIS RELAY.
- F-6 PULSES REPLAY UNIT RESET COIL, FROM CAM SWITCH 1B.
- D-3 ENERGIZES COIN RELAY.
- D-3 IN HOLD CIRCUIT TO THIS RELAY.

LOCATED ON PLAYFIELD

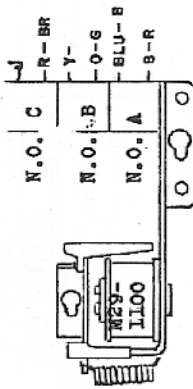
CENTER TARGET RELAY

IS ENERGIZED BY THE TOP ROLLOVER BOTTOM, OR BY HITTING THE CENTER TARGET.



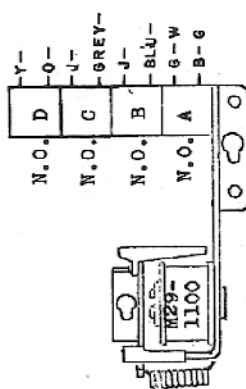
TARGET RELAY

IS ENERGIZED BY LEFT OR RIGHT TARGETS, THRU FLIPPER UNIT END-OF-STROKE AND LIMIT SWITCHES.



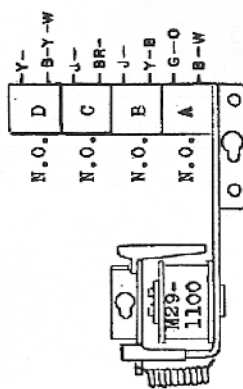
No. 1 BUMPER RELAY

IS PULSED BY LEFT TOP OR RIGHT BOTTOM JET BUMPER SWITCH.



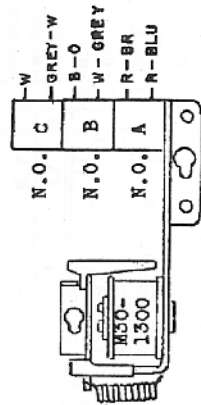
No. 2 BUMPER RELAY

IS PULSED BY RIGHT TOP OR LEFT BOTTOM JET BUMPER SWITCH.



GATE RELAY

IS ENERGIZED BY TOP CENTER (NO.3) ROLLOVER OR BY LEFT TOP TARGET.



OPERATION

- | | |
|--|---|
| <p>DIAGRAM LOCATION</p> <p>D-22</p> <p>D-24</p> <p>D-5</p> <p>F-21</p> <p>E-21</p> <p>C-5</p> <p>E-20</p> <p>D-4</p> <p>D-4</p> <p>D-25</p> <p>F-29</p> <p>D-5</p> <p>D-4</p> <p>D-26</p> <p>F-29</p> <p>A-9</p> <p>E-26</p> <p>E-20</p> | <p>TRIPS RELAY INDICATED BY TARGET DRUM UNIT.</p> <p>IN CIRCUIT TO 10 PT. OR 100 PT. RELAY, THRU FLIPPER UNIT SWITCH.</p> <p>RUNS SCORE MOTOR.</p> <p>IN HOLD CIRCUIT TO THIS RELAY, FROM TARGET DRUM UNIT E.O.S. SWITCH.</p> <p>ENERGIZES FLIPPER UNIT LATCH COIL.</p> <p>RUNS SCORE MOTOR.
(ALSO IN SERIES WITH SW. C ON THIS RELAY)</p> <p>IN HOLD CIRCUIT TO THIS RELAY.</p> <p>PULSES RIGHT BOTTOM JET BUMPER.</p> <p>PULSES LEFT TOP JET BUMPER.</p> <p>PULSES 1 PT. OR 10 PT. RELAY, THRU SWITCH ON NO.2 RELAY.</p> <p>IN HOLD CIRCUIT TO THIS RELAY.</p> <p>PULSES LEFT BOTTOM JET BUMPER.</p> <p>PULSES RIGHT TOP JET BUMPER.</p> <p>PULSES 1 PT. OR 10 PT. RELAY, THRU SWITCH ON NO.4 RELAY.</p> <p>IN HOLD CIRCUIT TO THIS RELAY.</p> <p>TO "300" GATE LITE.</p> <p>ENERGIZES 300 RELAY, FROM CENTER RUNWAY SWITCH.</p> <p>IN HOLD CIRCUIT TO THIS RELAY, FROM BOTTOM RUNWAY SWITCH.</p> |
|--|---|

LOCATED IN BACK-BOX

1-POINT RELAY

IS PULSED BY (5) BOTTOM ROLLOVER BUTTONS, WHEN NOT LIT, ALSO BY STANDUP AND KICKER SWITCHES.

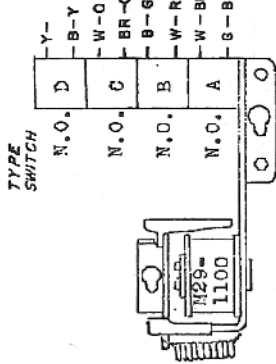
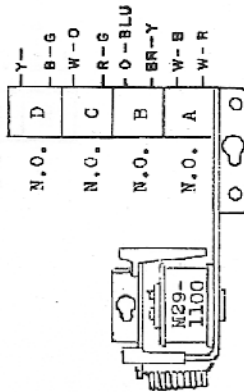


DIAGRAM LOCATION

- D-28 ENERGIZES NO. MATCH S.U. COIL.
- D-13 PULSES 1 PT. DRUM UNITS, THRU PLAYER UNIT DISC.
- F-27 PULSES 10 PT. RELAY, THRU 9TH POSITION SWITCHES ON 1 PT. DRUM UNITS.
- F-26 HOLD CIRCUIT TO THIS RELAY, THRU E.O.S. SWITCHES ON 1 PT. DRUM UNITS.

10' POINT RELAY

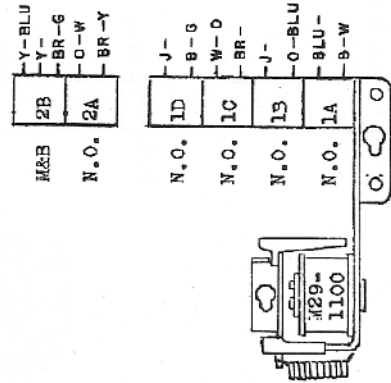
IS PULSED BY (5) BOTTOM ROLLOVER BUTTONS WHEN LIT, BY LEFT AND RIGHT TARGETS, AND WHEN COLLECTING 10 TIMES VALUE OF TARGET DRUM.



- D-28 PULSES LARGE BELL COIL.
- D-14 PULSES 10 PT. DRUM UNITS, THRU PLAYER UNIT DISC.
- F-28 PULSES 100 PT. RELAY, THRU 9TH POSITION SWITCHES ON 10 PT. DRUM UNITS.
- F-26 HOLD CIRCUIT TO THIS RELAY, THRU E.O.S. SWITCHES ON 10 PT. DRUM UNITS.

100 POINT RELAY

IS PULSED BY (5) TOP ROLLOVERS, LEFT AND RIGHT BOTTOM ROLLOVERS WHEN NOT LIT, LEFT TOP TARGET, AND BY THE 300 RELAY, ALSO WHEN COLLECTING 100 TIMES VALUE OF TARGET DRUM.



- D-19 ENERGIZES BALL INDEX RELAY---ALSO BREAKS A HOLD CIRCUIT TO EXTRA BALL RELAY.
- F-27 HOLD CIRCUIT TO THIS RELAY, THRU E.O.S. SWITCHES ON 100 PT. DRUM UNITS.
- D-28 PULSES LARGE BELL COIL.
- D-16 PULSES 1000 PT. DRUM UNITS, THRU 9TH POSITION SWITCHES ON 100 PT. DRUM UNITS.
- D-15 PULSES 100 PT. DRUM UNITS, THRU PLAYER UNIT DISC.
- G-10 ENERGIZES REPLAY S.U. OR EXTRA BALL RELAY (IN HI-SCORE CIRCUIT).

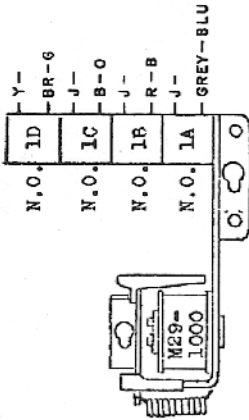
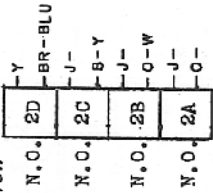
LOCATED IN BACK-BOX

**1st & 2nd PLAYER
SCORE RESET RELAY**

IS PULSED, DURING RESET CYCLE, BY IMPULSE CAM SWITCH D, AND SWITCH A OF RESET RELAY.

DIAGRAM LOCATION

TYPE SWITCH



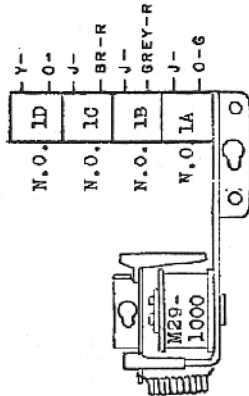
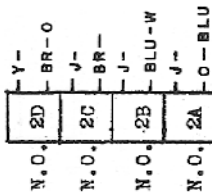
OPERATION

- E-16 1ST PLAYER 1000 PT. DRUM UNIT.
- E-15 1ST PLAYER 100 PT. DRUM UNIT.
- E-14 1ST PLAYER 10 PT. DRUM UNIT.
- E-13 1ST PLAYER 1 PT. DRUM UNIT.
- E-16 2ND PLAYER 1000 PT. DRUM UNIT.
- E-15 2ND PLAYER 100 PT. DRUM UNIT.
- E-14 2ND PLAYER 10 PT. DRUM UNIT.
- E-13 2ND PLAYER 1 PT. DRUM UNIT.

THESE DRUM UNITS ARE PULSED, IN THE RESET CYCLE, THRU ZERO SWITCHES ON THE CORRESPONDING DRUM UNITS.

**3rd & 4th PLAYER
SCORE RESET RELAY**

IS PULSED, DURING RESET CYCLE, BY IMPULSE CAM SWITCH A, AND SWITCH A OF RESET RELAY.



- E-16 3RD PLAYER 1000 PT. DRUM UNIT.
- E-15 3RD PLAYER 100 PT. DRUM UNIT.
- E-14 3RD PLAYER 10 PT. DRUM UNIT.
- E-13 3RD PLAYER 1 PT. DRUM UNIT.
- E-16 4TH PLAYER 1000 PT. DRUM UNIT.
- E-15 4TH PLAYER 100 PT. DRUM UNIT.
- E-14 4TH PLAYER 10 PT. DRUM UNIT.
- E-13 4TH PLAYER 1 PT. DRUM UNIT.

THESE DRUM UNITS ARE PULSED, IN THE RESET CYCLE, THRU ZERO SWITCHES ON THE CORRESPONDING DRUM UNITS.

NOTES