

SKYHAWK II

fischer

SERVICE MANUAL



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A DIVISION OF
QUESTOR

SKYHAWK II

PINBALL

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SKYHAWK II

Home Style Pinball Game

MODEL NO.: 3019

INTRODUCTION:

The following information was compiled to assist you in becoming more familiar with the component parts and their functions.

The second half of this manual is devoted to solving malfunctions that may occur after the game has been played several hours. The two most important steps in solving malfunctions with this game are; one, to have a step-by-step check procedure and two, to understand the flow of action.

NOTE: There is always a possibility that two or more malfunctions may occur simultaneously, compounding the problem-solving procedure.

VERY IMPORTANT: Be aware of the terms of the "Limited 90-Day Warranty" which in on page 3 of the owner's manual. Unless proof of purchase is presented to the field technician before repairs are made, reimbursement cannot be made to the service company.

LIMITED 90-DAY WARRANTY

The Fischer Sky Hawk Pinball is warranted to the original retail purchaser for a period of 90 days from date of purchase against defects in material and workmanship which are not the result of abuse, misuse, alteration, accident, improper assembly or installation, damage in transit or failure to maintain properly the unit as stated below, provided the enclosed warranty registration card has been completed and returned within 15 days of purchase. As a condition to this warranty, the consumer must have performed all normal maintenance on the unit as outlined in the owner's service manual. Call 800-325-8012 to obtain the name and address of the Fischer service center nearest your home. Free in-home warranty service will be provided if the defect has occurred within 30 days of purchase. After 30 days, a mileage charge for service must be paid by you or you have the responsibility to transport the unit to and from the dealer's place of business at your expense and risk. For further information concerning this warranty, please write Fischer Manufacturing Company, P.O. Box 50, California, Missouri 65018. This warranty does not cover bulbs, rubber bands, or damage to the plastic playfield or score unit covers. Damage that occurs in transit must be claimed against the shipper. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

Playfield Layout Top View (Visual No. 1)

The following are components which are positioned on the playing side of playfield:

1. Bumper Post (02-62-036)

There are thirty-one posts responsible for holding rubber rings and ball gate bracket.

- 2. Rubber Rings (5-16" - 02-62-037)**
- Rubber Rings (1" - 02-62-038)**
- Rubber Rings (4" - 02-62-039)**

These rings help provide the recoil action which the ball receives during play.

3. Ball Gate and Bracket (02-22-060)

After the ball has been put into play, the gate prevents the ball from returning to the ball ramp.

4. Wire Guide with Nuts (08-22-059)

The wire guide sets up a free-ball channel and out-of-play channel. The free-ball channel returns the ball to the shooter ramp for an additional play. The out-of-play channel returns the ball to the ball storage area until next game.

(Visual No. 1)

Top View of Playfield

(Visual No. 2)

Bumper Post

(Visual No. 3)

Rubber Rings

(Visual No. 4)

Ball Gate and Bracket

(Visual No. 5)

Wire Guide with Nuts

5. Thumper Bumper Assembly (02-64-072)

Only the upper portion of the thumper bumper is seen on the top side of the playfield, but the upper and lower halves have to work together in order for the assembly to fulfill its functions.

When the ball makes contact with the thumper skirt (02-64-032), this will activate the spoon switch (02-64-028), causing the thumper coil solenoid (02-64-030) to pull the plunger completely closed.

Simultaneously, this will pull the thumper ring and rod (02-64-031) down, deflecting the ball back into play.

NOTE: The coil resistance is approximately 3.6 ohms.

6. Flipper Arm Assembly (02-64-015)

Flipper, Right Solenoid Assembly (02-64-013)

Flipper, Left Solenoid Assembly (02-64-014)

Flipper Button Assembly (02-64-041)

There are two flipper arm assemblies (02-64-015) located near the bottom of the playfield. The right flipper is connected to the right flipper solenoid assembly (02-64-013) and the left flipper is connected to the left flipper solenoid assembly (02-64-014). The flipper button assemblies (02-64-041), located on the sides of the lower cabinet, are connected to their respective flipper solenoid assemblies.

NOTE: The coil resistance is approximately 1.8 ohms.

(Visual No. 6)

Thumper Bumper Assembly

(Visual No. 7)

Thumper Bumper Spoon Switch

(Visual No. 8)

Flipper Arm Assembly

(Visual No. 9)

Flipper Solenoid Assembly

(Visual No. 10)

Flipper Button Assembly

7. Plastic Disk Inserts (02-64-041)

Four plastic disk inserts (02-64-041) are positioned on the top side of playfield to provide covers for lights which are located on the under side of playfield.

Playfield Layout Bottom View (Visual No. 11)

1. Roll Over Bracket and Wire (02-64-025)

Roll Over Leaf Switch (02-64-026)

When the ball rolls through any one of three lanes located near the top of playfield, the weight of the ball will depress the wire (02-64-025), causing the roll over switch (02-64-022) to close.

NOTE: As long as the switch stays closed, the player will receive points.

2. Kicker or Vertical Leaf Switch (02-64-029)

Positioned behind the four inch rubber rings, these switches are primarily responsible for scoring. In addition to scoring, the lower two switches, near the bottom of playfield, are also connected to the kicker solenoid assembly (02-64-017), causing it to react when either of these two switches are closed.

3. Vertical Mount Light Socket (02-64-055)

Primary function - to light playfield.

(Visual No. 11)

Bottom View of Playfield

(Visual No. 12)

Roll Over Bracket and Wire

(Visual No. 13)

Roll Over Leaf Switch

(Visual No. 14)

Kicker or Vertical Leaf Switch

(Visual No. 15)

Vertical Mount Light Socket

4. Horizontal Mount Light Socket (02-64-056)

Primary function - lights up when bonus scoring is in effect.

5. Kickout Switch (02-64-024)

When the ball lands in bonus hole, the kickout switch (02-64-024) is closed, sending an electrical impulse to the lower printed circuit board (02-64-008). Whether or not the bonus is in effect will decide how long the ball will remain in bonus hole.

6. Kickout Solenoid Assembly (02-64-022)

Kickout Plunger Assembly (02-64-023)

The kickout solenoid and plunger are responsible for moving the ball out of bonus hole, back into play.

NOTE: The coil resistance is approximately 3.6 ohms.

(Visual No. 16)

Horizontal Mount Light Socket

(Visual No. 17)

Kickout Switch

(Visual No. 18)

**Kickout Solenoid
Kickout Plunger**

7. Lower Printed Circuit Board (02-64-008)

The lower P.C. Board performs the following functions:

- (A) Roll over switch memory - after all three switches have made contact and lights are flashing, this will activate the bonus scoring.**

- (B) Bonus time delay - when the bonus scoring is in effect, the bonus kicker will be delayed approximately five seconds. After the time delay has elapsed, the bonus kicker solenoid will react, putting the ball back into play.**

- (C) Conversion of current - both the 7 and 28 volt systems are directed through this panel where conversion of alternating current (A.C.) to direct current (D.C.) is made.**

- (D) Solid state switching - there are two solid state switches designed into this board. The first switch works in conjunction with the bonus time delay. If the bonus is not in effect, the switch stays closed; but, when the bonus is activated, this solid state switch in the P.C. Board opens and will not close until after the time delay has elapsed.**

The connection between the lower kicker switch and solenoid is made through the second solid state switch. The switch provides a one-tenth of one second time delay after the circuit is closed. This is to guard against the switch being closed by the recoil of the rubber ring, resulting in a continuous opening and closing of the circuit switch.

(Visual No. 19)

Lower Printed Circuit Board

8. Lower Kicker Solenoid Assembly (02-64-017)

Lower Kicker Arm Assembly (02-64-016)

The kicker arm and solenoid assemblies are positioned on the lower half of the playfield. When the kicker switches are closed, the solenoid is activated, causing the kicker arms to react, kicking the ball away from the switch.

NOTE: The coil resistance is approximately 3.6 ohms.

9. Resistor (02-64-021)
Asbestos (02-64-058)
Connectors (02-64-047)

The purpose of the resistor burning (see note below) is to prevent the coil from overloading, burning itself out. The asbestos must be placed between the bottom of the playfield and the resistor. If the asbestos is eliminated, smoke and possible fire may result from the heat given off from the resistor. There are two connectors with each resistor (see note below), which are used to connect the resistor to the flipper assembly.

NOTE: Due to engineering changes, the following should be observed:

- (A) If the flipper assembly has two resistors with the number 20 stamped on them, the resistance will be correct.
- (B) If the flipper assembly has one resistor with the number 13 stamped on it, the resistance will be correct.
- (C) If the flipper assembly has one resistor with the number 20 stamped on it, the resistance will not be correct. Add either one-13 or one-20 resistor to the resistor already on the playfield to correct the resistance.

IMPORTANT - When two resistors are used, they must be parallel, not in line with each other, to be able to achieve the proper resistance.

(Visual No. 20)

Lower Kicker Solenoid

(Visual No. 21)

**Resistor
Asbestos
Connectors**

Upper Cabinet Components

1. Speaker - 40 ohms (02-64-007)

This speaker is located in the upper cabinet and is connected to the upper P.C. Board for audio output.

2. Upper Printed Circuit Board (02-64-003)

The upper P.C. Board performs the following functions:

- (A) Audio - The upper panel controls the thirty-two tones which are transmitted through the 40 ohms speaker.**
- (B) Scoring - The upper P.C. Board received electrical impulses from the lower P.C. Board and directs these scoring impulses to the display panel in proper sequence.**
- (C) Scoring display panel (L.E.D.) - is controlled by the upper P.C. Board and is responsible for displaying the player's score.**
- (D) Ignition Light - is controlled by the upper P.C. Board and indicates by flashing when a new game starts. This light will remain on as long as game is left on.
NOTE: Scoring will not start until after the ignition light stops flashing.**
- (E) Tilt - When game is jarred too aggressively the ignition light will start flashing and game will be over.**

(Visual No. 22)

Speaker - 40 ohms

(Visual No. 23)

Upper Printed Circuit Board

Outside Cabinet Components

1. Pull Rod (02-64-037)

The player must pull the pull rod to the maximum allowed before the ignition light is activated. Score is reset to zero and the game balls roll into position.

Push Rod (02-64-038)

The only function of the push rod is to push the game ball into position after the preceding ball has gone out of play.

NOTE: If more than one ball is in play at a time, a power overload may result, causing the circuit breakers to be thrown.

2. Ball Stop Bracket (08-22-076)

Shooter Assembly (02-64-039)

The ball stop bracket positions and holds the ball in place until the shooter is pulled back and released, sending the ball up the ramp into play.

(Visual No. 24)

**Pull Rod (Reset Knob)
Push Rod**

(Visual No. 25)

Ball Stop Bracket

(Visual No. 26)

Shooter Assembly

Inside Cabinet Components

1. Transformer (02-64-011)

The transformer is located on the bottom of the main cabinet. Its function is to reduce the voltage which powers the unit. The input voltage is 110-volt and is divided into a 28-volt and 7-volt system. The 28-volt powers, the solenoids and the 7-volt system powers the lights and switches.

2. Tilt Bracket (08-22-057)

Circuit Breaker Bracket (08-22-058)

The tilt and circuit breaker brackets work in conjunction with each other. If the game is jarred too aggressively, a circuit will be broken and the game will stop.

3. Circuit Breaker Switch (02-64-010)

There are two circuit breakers designed into the wiring layout. The first breaker is responsible for the 28-volt system and the second breaker is responsible for the 7-volt system. If for any reason a short or power overload should occur, one or both breakers will "open".

Wiring Harnesses

1. Cabinet Wiring Harness (02-64-006)

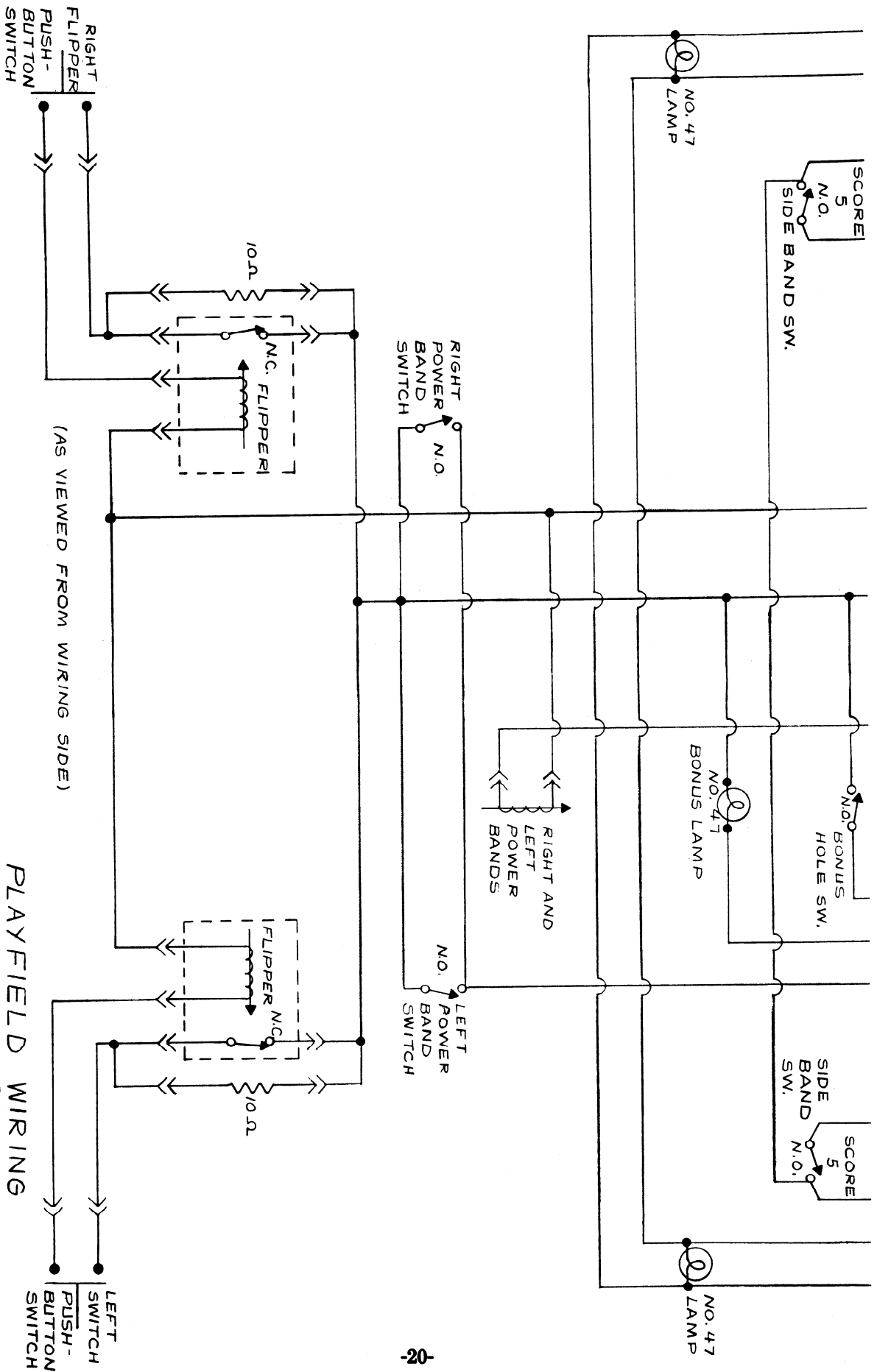
The cabinet harness connects the power source to the upper and lower P.C. Boards and is responsible for the relay of information between these two boards.

2. Playfield Wiring Harness (02-64-012)

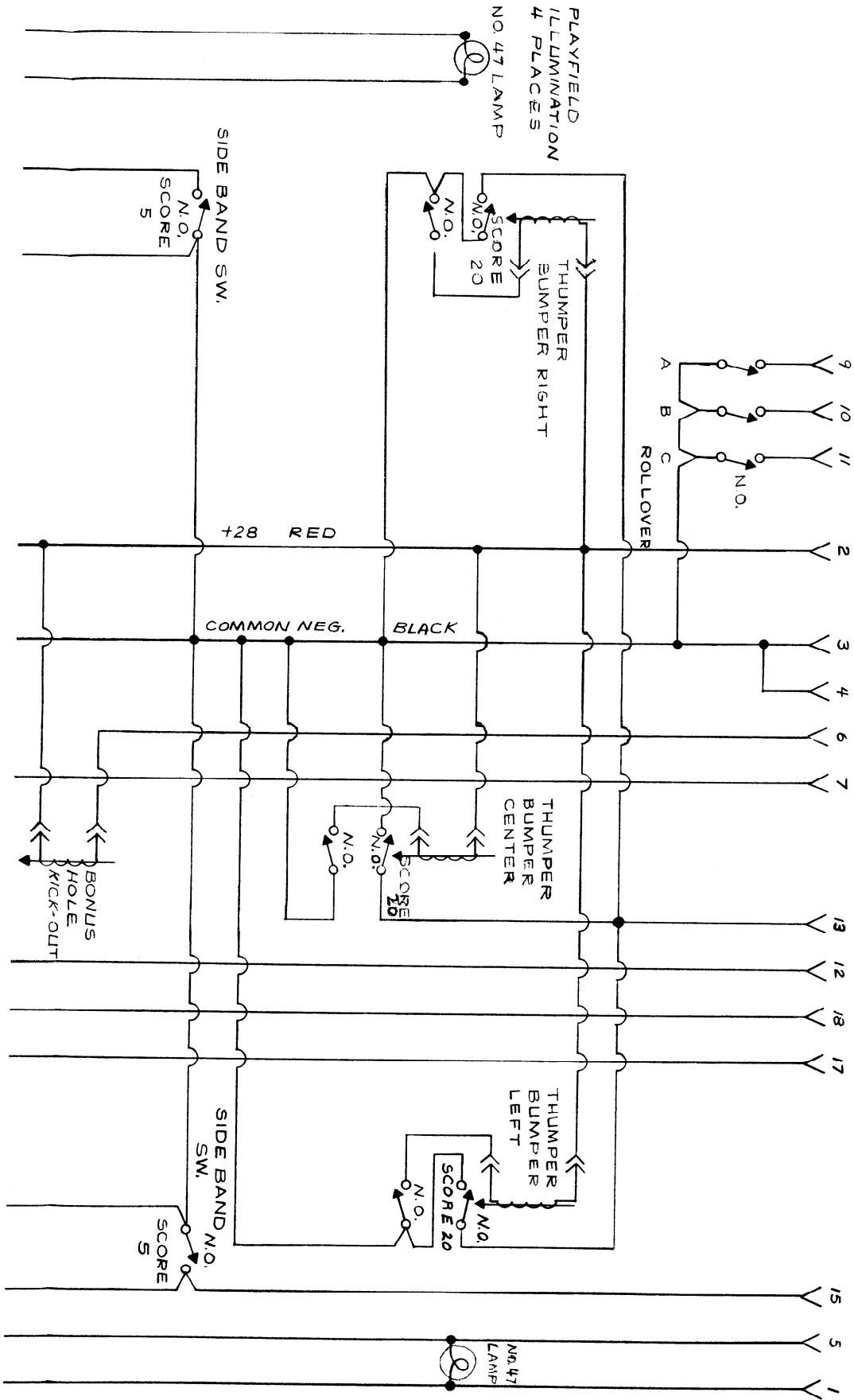
The playfield harness connects all component parts located on bottom side of playfield to the lower P.C. Board.

(Visual No. 27)

Transformer
Tilt Bracket
Circuit Breaker Bracket
Circuit Breaker Switch



PLAYFIELD WIRING
SKYHAWK II PINBALL
27 OCTOBER 1977



NOTES

PROBLEM SOLVING

This half of the Service Manual is to assist the service technician in finding and correcting the malfunctions which have occurred. The solutions to the following malfunctions are based on the theory that there is only one malfunction causing the problem. Remember, it is always possible for more than one malfunction to occur at the same time compounding the service problem.

IMPORTANT: Disconnect power cord from electrical outlet.

How to Remove Playfield:

1. Remove Plexiglas playfield cover by inserting a knife blade or screw driver between edge of plexiglas and metal trim and lift upward. This will disengage the match mate parts located in the corners. (To reseal the match mate, just press the two parts together.)
2. Remove six (6) screws which attach the playfield to the support tray. This will enable the technician to lift the lower portion of the playfield slowly, making sure that all wires are clear.

NOTE: Do not lift the lower portion of playfield more than eight inches (8") from cabinet until the flipper button lead wires have been disconnected. Fischer recommends that the service technician disconnect either one or the other flipper button leads. After the disconnection, the playfield can be propped up from the side, allowing the technician to work on the bottom side of playfield while still connected to main unit.

CAUSES OF MALFUNCTIONS

1. All Lights “OFF” - Nothing Works

Cause of Problem:

- A. In-Line switch in “OFF” position**
- B. No power from A.C. outlet**
- C. Circuit breaker “open”**
- D. Faulty electrical connection**
- E. Faulty transformer**

2. All Playfield Lights “OFF”, Upper Cabinet Lights “ON”

Cause of Problem:

Faulty electrical connection.

3. All Playfield Lights “ON”, Upper Lights “OFF”

Cause of Problem:

- A. Faulty electrical connection**
- B. Burned out light bulb**
- C. Faulty upper P.C. Board**

SOLUTIONS TO PROBLEMS

1. All Lights "OFF" - Nothing Works

Solutions to Problem:

- (A) Check to see if in-line switch is "ON" position.**
- (B) Test A.C. outlet with a current tester or an appliance that you know works.**
- (C) Reset circuit breakers by depressing the two red stems. Listen for a clicking sound, if a click is not heard, breakers must be replaced. (Breakers are located on bottom side of main cabinet.)**
- (D) Check for loose connections or broken wires.**
- (E) Check transformer for power output (110-volt input, 7 and 28-volt output)**

2. All Playfield Lights "OFF", Upper Cabinet Lights "ON"

Solutions to Problem:

Carefully check all wires and terminals for loose or broken connections.

3. All Playfield Lights "ON", Upper Lights "OFF"

Solution to Problem:

- (A) Carefully check all wires and terminals for loose or broken connections.**
- (B) Replace light bulb.**
- (C) Replace upper P.C. Board.**

CAUSES OF MALFUNCTIONS

4. No Action on Playfield - All Lights "ON"

Cause of Problem:

- A. Game has been "tilted".**
- B. Circuit breaker "open".**
- C. Faulty electrical connection.**

5. Audio Holds Steady Tone While Score Continues When Plugged In

Cause of Problem:

- A. Scoring switch closed somewhere on playfield.**
- B. Harness incorrectly installed into P.C. Board.**

6. Reset Knob (Pull Rod) Releases Balls But Does Not Reset Score

Cause of Problem:

- A. Switch adjustment**
- B. Faulty electrical connection.**
- C. Faulty P.C. Board.**

SOLUTIONS TO PROBLEMS

4. No Action on Playfield - All Lights "ON"

Solution to Problem:

- (A) Game has been "tilted". Pull rod (reset knob) for new game.**
- (B) Reset circuit breakers by depressing the two red stems. Listen for a clicking sound, if a click is not heard, breakers must be replaced. (Breakers are located on bottom side of main cabinet.)**
- (C) Carefully check all wires and terminals for loose or broken connections.**

5. Audio Holds Steady Tone While Score Continues When Plugged In

Solution to Problem:

- (A) Check all playfield switches and readjust any switch out of adjustment.**
- (B) Harness installed correctly into P.C. Board, making sure that terminal points make firm contact with P.C. Board contacts.**

6. Reset Knob (Pull Rod) Releases Balls But Does Not Reset Score

Solution to Problem:

- (A) Readjust leaf switch so that a quarter inch ($\frac{1}{4}$ "') gap exists between points.**
- (B) Carefully check all wires and terminals for loose or broken connections.**
- (C) Replace with new P.C. Board.**

CAUSES OF MALFUNCTIONS

7. Circuit Breaker Trips Repeatedly

Cause of Problem:

- A. Faulty electrical connection**
- B. Flipper switch open**
- C. Thumper bumper switch closed**
- D. Faulty lamp socket**
- E. Faulty circuit breaker**

8. Roll Over Fails to Score or Prevents Ball from Rolling Through Lane

Cause of Problem:

- A. Switch adjustment**
- B. Points of contact are dirty**

9. Thumper Bumper Does Not Work

Cause of Problem

- A. Circuit breaker tripped**
- B. Switch adjustment**
- C. Faulty electrical connection**
- D. Faulty solenoid**
- E. Mechanical failure**

SOLUTIONS TO PROBLEMS

7. Circuit Breaker Trips Repeatedly

Solutions to Problem:

- (A) Carefully check all wires and terminals for loose or broken connections.
- (B) The flipper switch must remain closed. It should only open when the flipper button is pushed and will close immediately thereafter.
- (C) The thumper bumper switch should be adjusted so there is no more than one-sixteenth (1-16") of an inch gap between contact points.
- (D) Check all lamp sockets carefully so that a short does not exist, causing an overload.
- (E) Reset circuit breakers by depressing the two red stems. Listen for a clicking sound. If a click is not heard, breakers must be replaced. (Breakers are located on bottom side of main cabinet.)

8. Roll Over Fails to Score or Prevents Ball from Rolling Through Lane

Solutions to Problem:

- (A) Adjust roll over switch so it closes when the wire form is approximately $\frac{1}{4}$ " above playfield.
- (B) Clean contact points with emery paper.

9. Thumper Bumper Does Not Work

Solutions to Problem:

- (A) Reset circuit breakers by depressing the two red stems. Listen for a clicking sound. If a click is not heard, breakers must be replaced. (Breakers are located on bottom side of main cabinet.)
- (B) Readjust thumper switches so that a one-sixteenth (1-16") of an inch gap exists between points. Also check spoon switch alignment.
- (C) Carefully check all wires and terminals for loose or broken connections.
- (D) Check solenoid for a coil resistance of approximately 3.6 ohms. If the coil does not meet this specification, replace solenoid.
- (E) Inspect for mechanical damage or failure.

CAUSES OF MALFUNCTIONS

10. Thumper Bumper Reaction Slow, Inconsistent or Not Scoring Every Time

Cause of Problem.

- A. Switch adjustment**
- B. Faulty electrical connection**
- C. Dirty contact points**
- D. Mechanical failure**

11. Flipper “Chatters” When Operated

Cause of Problem:

- A. Switch adjustment - flipper solenoid**
- B. Switch adjustment - flipper button**
- C. Faulty electrical connection**
- D. Insufficient resistance of resistor**
- E. Points of contact are dirty**

SOLUTIONS TO PROBLEMS

10. Thumper Bumper Reaction Slow, Inconsistent or Not Scoring Every Time

Solutions to Problem:

- (A) Readjust thumper switches so that a one-sixteenth (1-16") of an inch gap exists between points. Also check spoon switch alignment.
- (B) Carefully check all wires and terminals for loose or broken connections.
- (C) Clean contact points with emery paper.
- (D) Inspect for mechanical damage or failure.

11. Flipper "Chatters" When Operated

Solutions to Problem:

- (A) The flipper switch must remain closed. It should only open when the flipper button is pushed and will close immediately thereafter.
- (B) Readjust flipper button switch so that no more than one-sixteenth (1-16") of an inch gap exists between points.
- (C) Carefully check all wires and terminals for loose or broken connections.
- (D) If the flipper assembly has two resistors with the number 20 stamped on them, the resistance will be correct.

If the flipper assembly has one resistor with the number 13 stamped on it, the resistance will be correct.

If the flipper assembly has one resistor with the number 20 stamped on it, the resistance will **not** be correct. Add either one-13 or one-20 resistor to the resistor already on the playfield to correct the resistance.

IMPORTANT - When two resistors are used, they must be parallel, not in line with each other, to be able to achieve the proper resistance.

- (E) Clean contact points with emery paper.

CAUSES OF MALFUNCTIONS

12. Flipper Button Fails to Operate Flipper

Cause of Problem:

- A. Points of contact are dirty**
- B. Switch adjustment**
- C. Faulty electrical connection**
- D. Mechanical problem**

13. Ball is Not Ejected from Bonus Hole

Cause of Problem:

- A. Switch adjustment**
- B. Mechanical failure**
- C. Faulty lower P.C. Board**
- D. Faulty electrical connections**

14. Ball Keeps Returning to Ramp

Cause of Problem:

- A. Mechanical failure**
- B. Component failure**

SOLUTIONS TO PROBLEMS

12. Flipper Button Fails to Operate Flipper

Solutions to Problem:

- (A) Clean contact points with emery paper.**
- (B) Readjust flipper button switch so that no more than one-sixteenth (1-16") of an inch gap exists between points.**
- (C) Carefully check all wires and terminals for loose or broken connections.**
- (D) Check and tighten set-screws on flipper solenoid and check the spring in flipper button assembly.**

13. Ball is Not Ejected from Bonus Hole

Solutions to Problem:

- (A) Readjust kickout switch whereby a one-sixteenth (1-16") of an inch gap exists between contact points.**
- (B) Check kickout plunger and kickout solenoid for possible misalignment.**
- (C) The lower P.C. Board may cause this problem if circuit is blown.**
- (D) Carefully check all wires and terminals for loose or broken connections.**

14. Ball Keeps Returning to Ramp

Solutions to Problem:

- (A) The wire in the ball gate may either be in a bind or broken.**
- (B) The shooter assembly could have a spring which has lost its compression or maybe rubbing against the ball stop bracket.**

CAUSES OF MALFUNCTIONS

15. Lower Kicker Hangs Up

Cause of Problem:

- A. Mechanical failure.**
- B. Faulty lower P.C. Board.**

SOLUTIONS TO PROBLEMS

15. Lower Kicker Hangs Up

Cause of Problem:

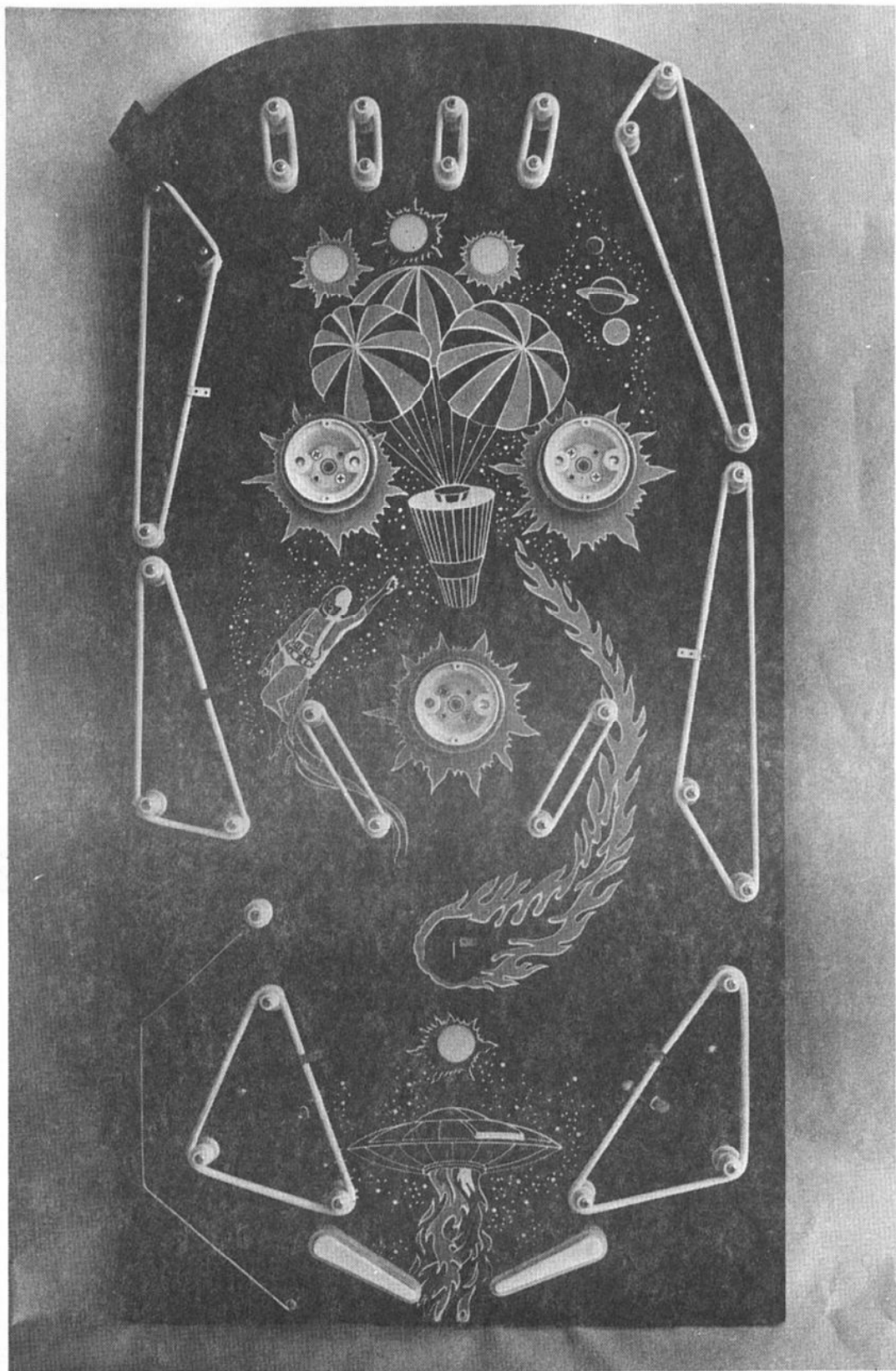
(A) Check kicker plunger and kicker solenoid for possible misalignment.

Check kicker arm assembly and kicker plunger for possible misalignment.

(B) The lower P.C. Board may cause this problem if a circuit is blown.

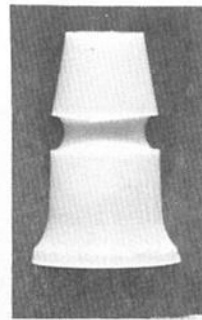
If the service technician, after checking all the possible causes and solutions, is still unable to find or solve the malfunction, please call **TOLL FREE 800-325-8012** for service assistance.

NOTES

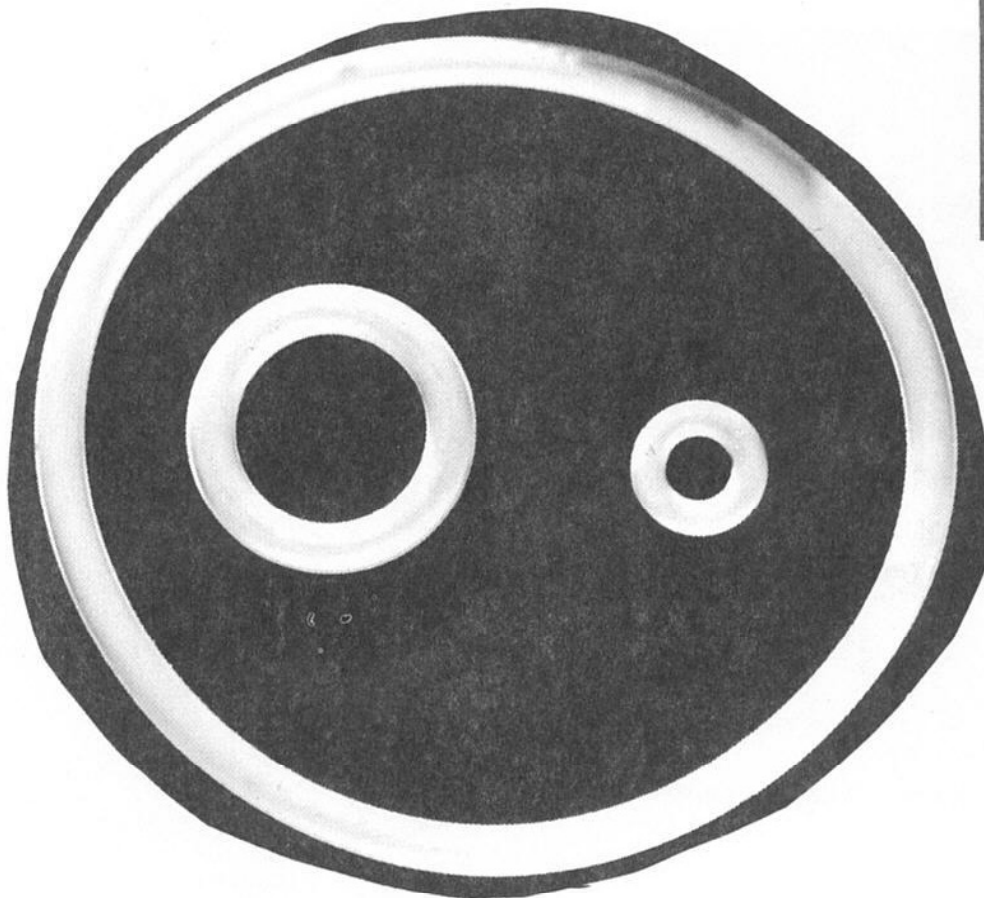


Visual No. 1

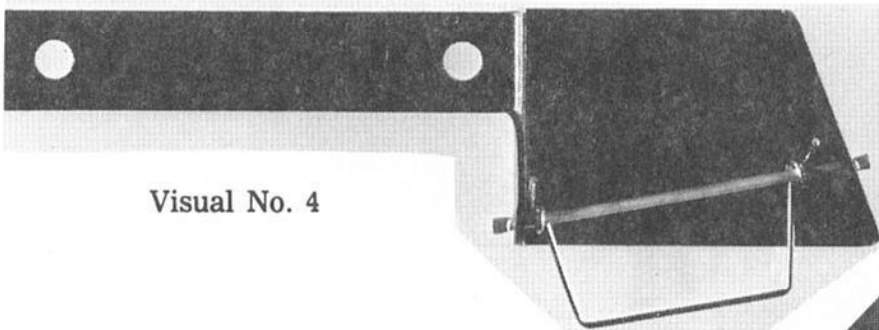
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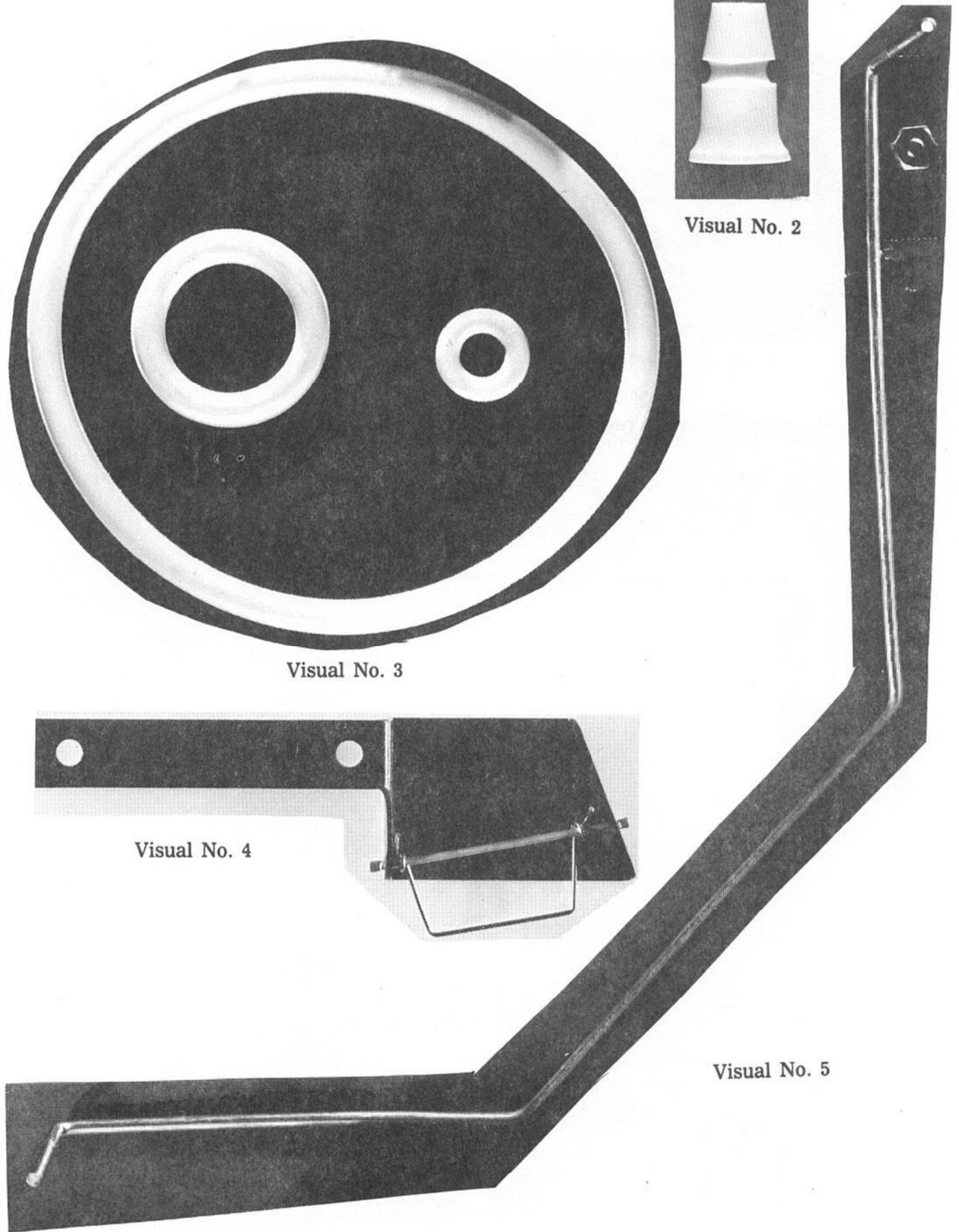
Visual No. 2



Visual No. 3

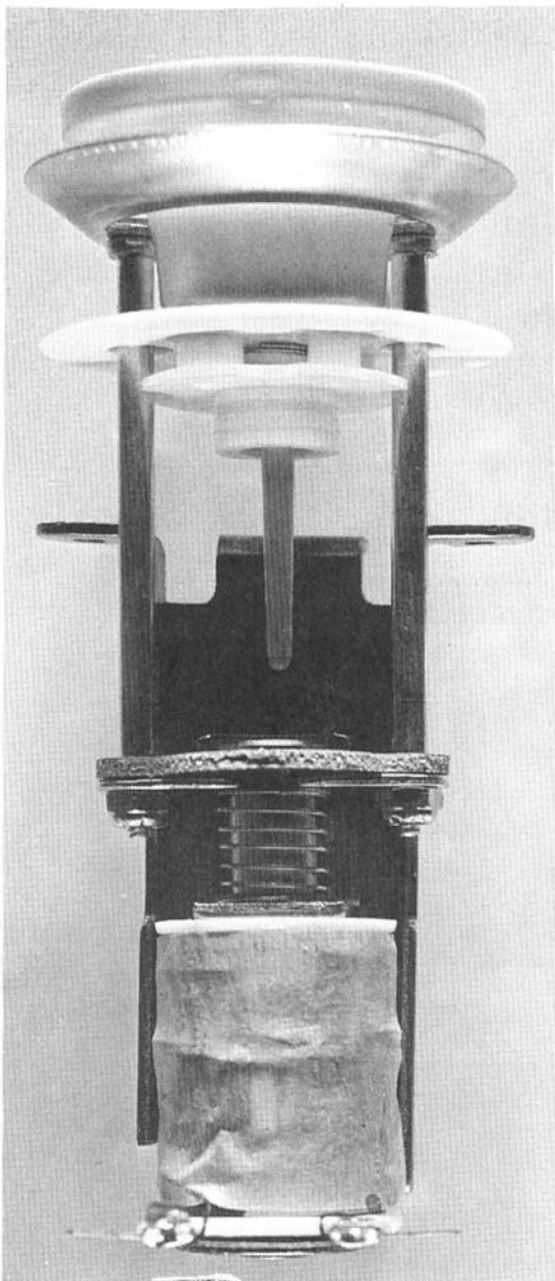


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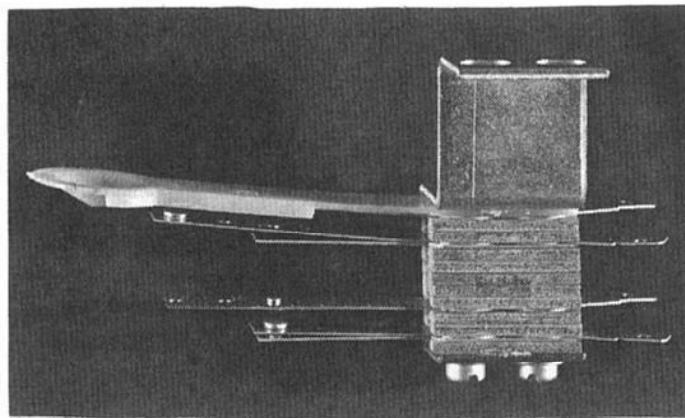


Visual No. 5

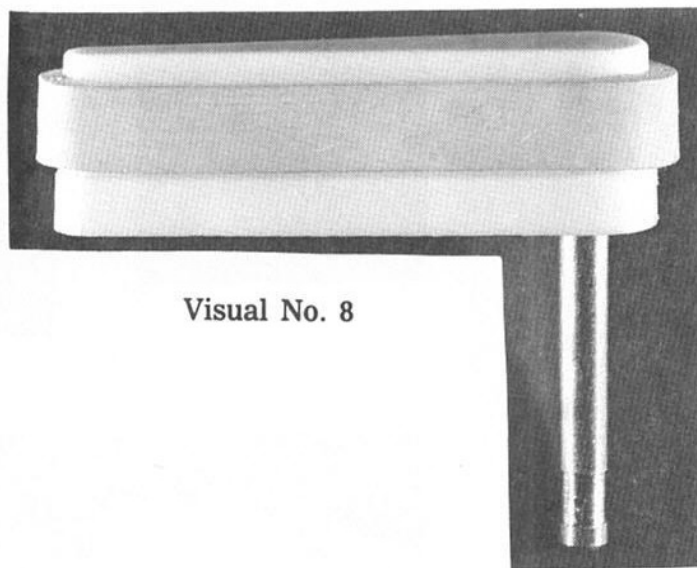
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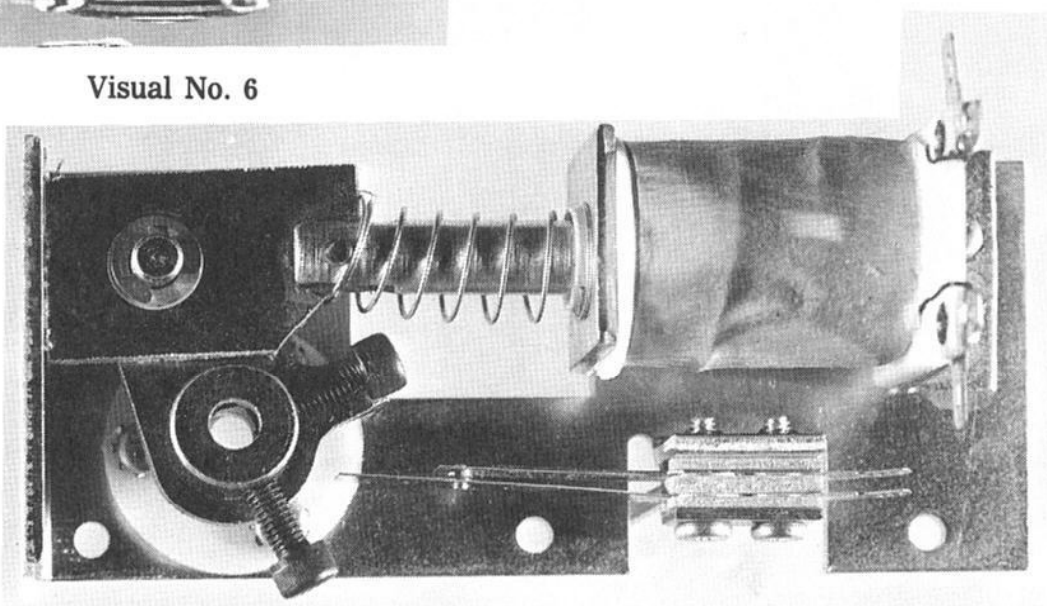
Visual No. 6



Visual No. 7

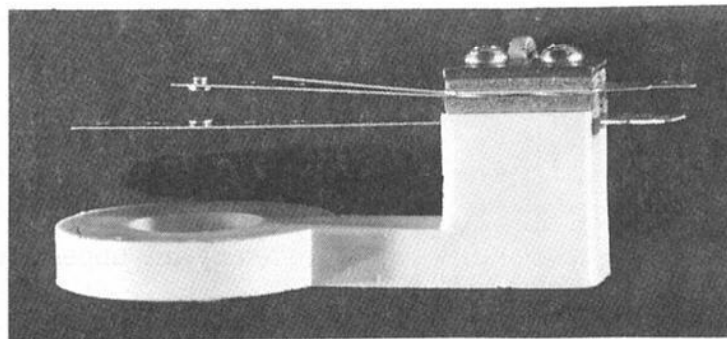
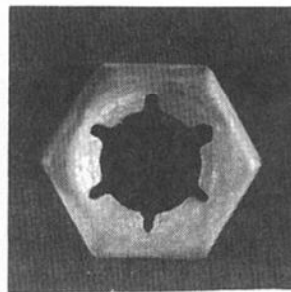


Visual No. 8



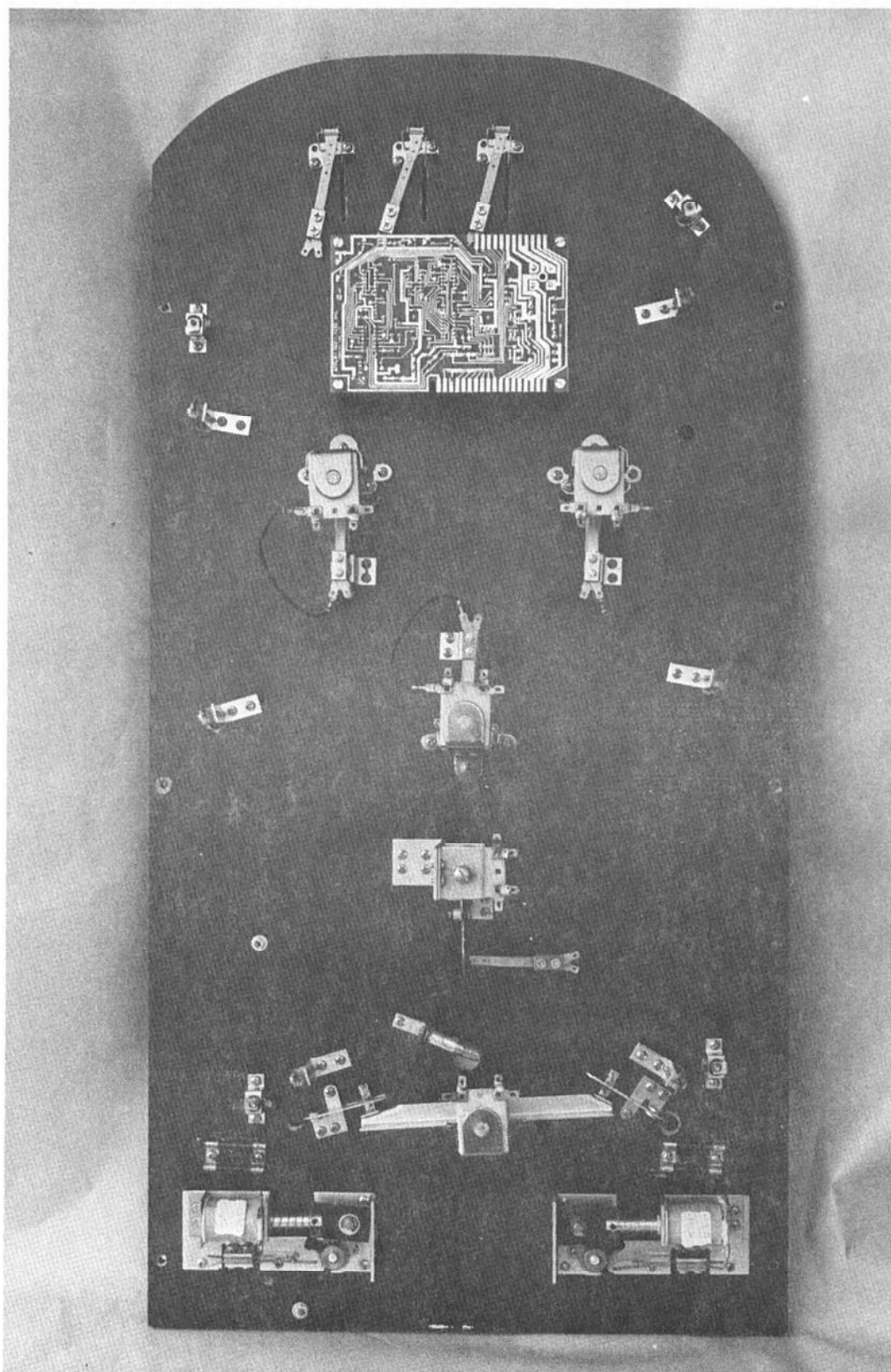
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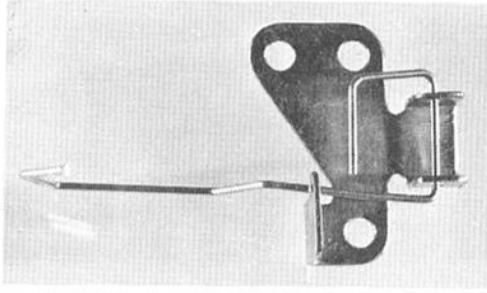
Visual No. 10

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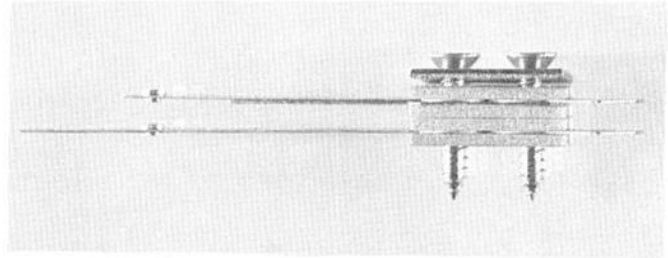


Visual No. 11

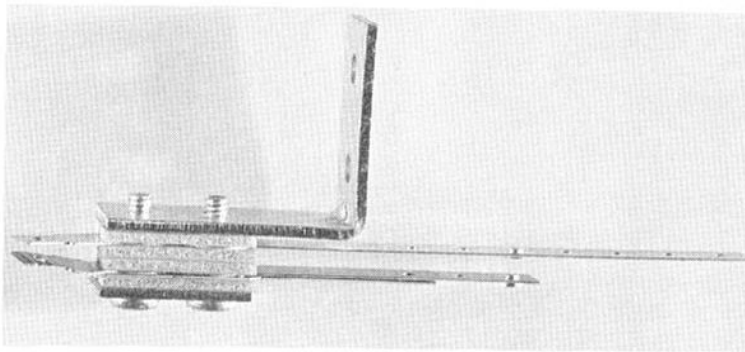
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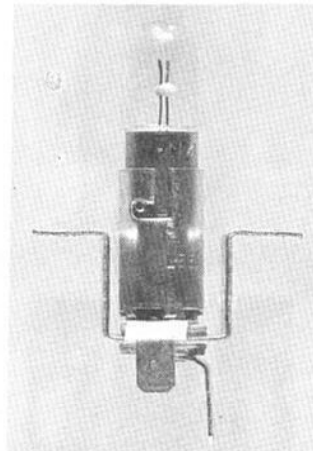
Visual No. 12



Visual No. 13

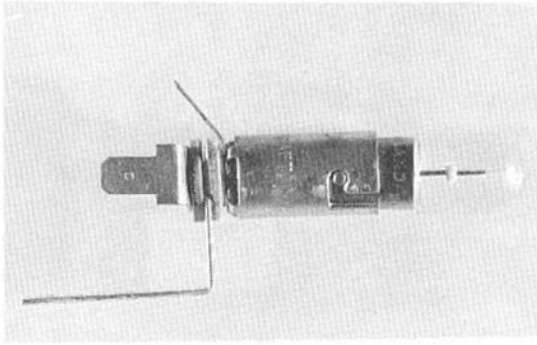


Visual No. 14

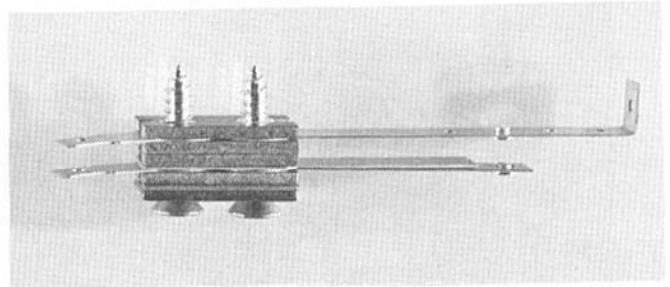


Visual No. 15

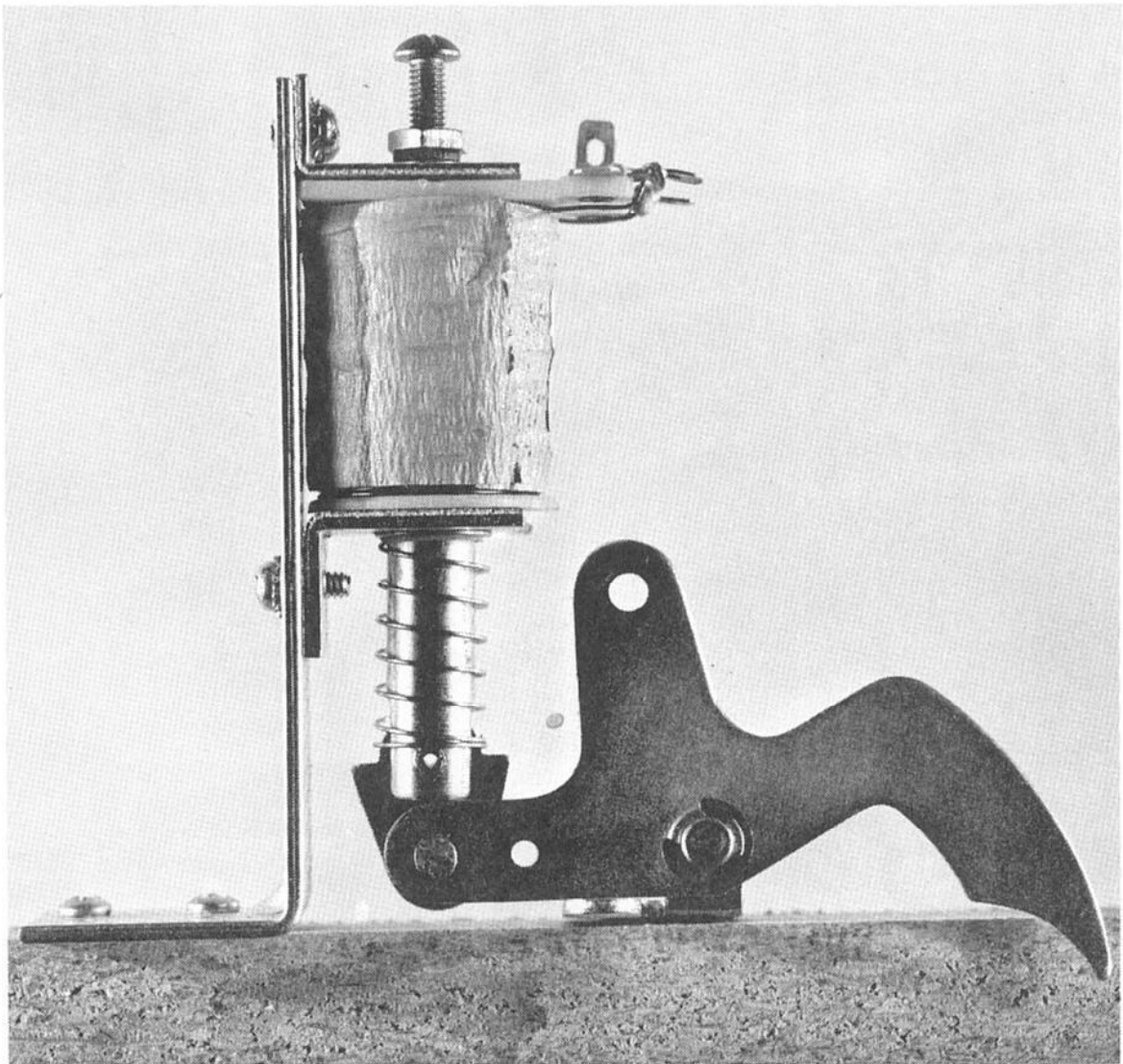
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Visual No. 16

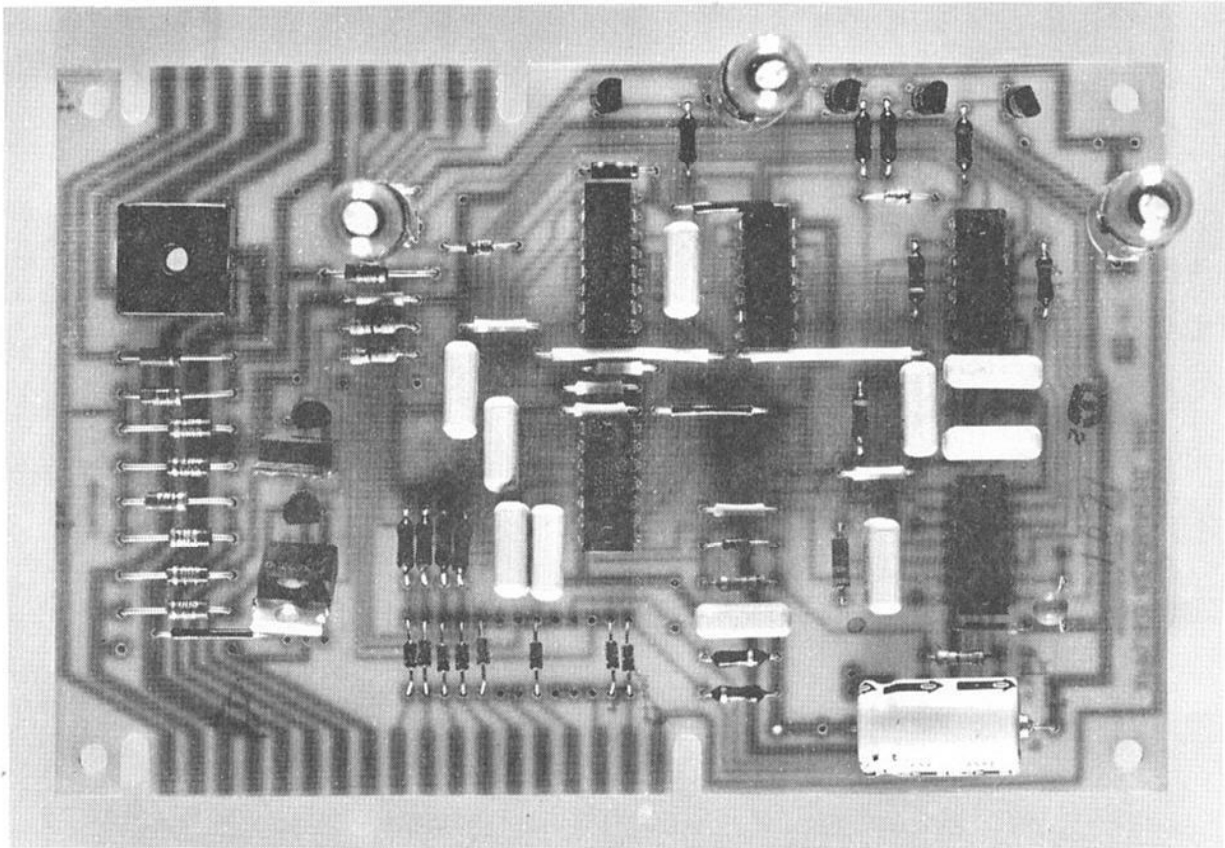


Visual No. 17

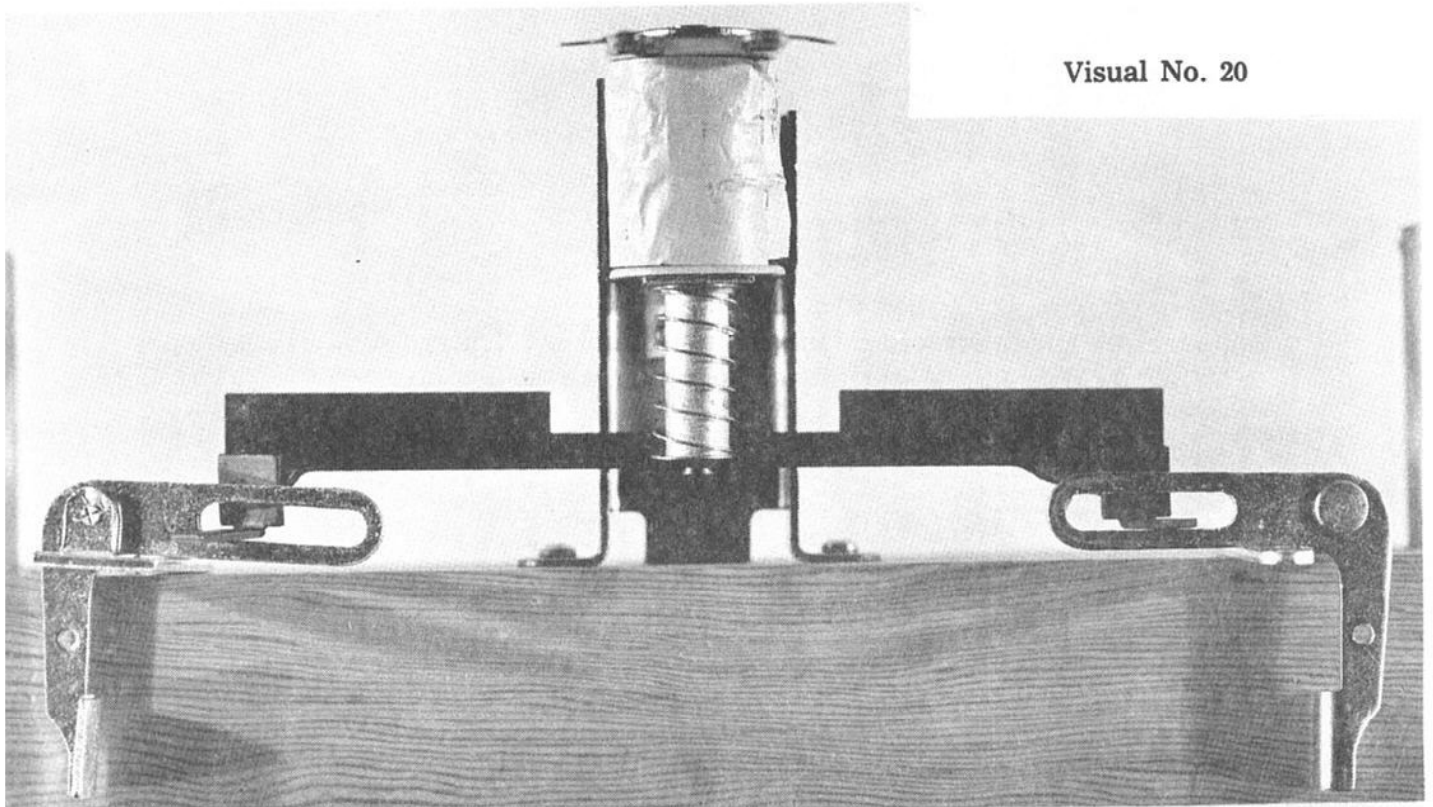


Visual No. 18

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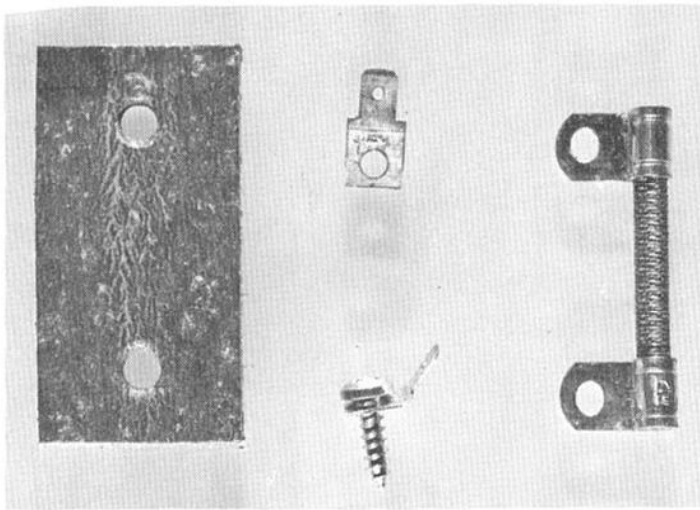


Visual No. 19



Visual No. 20

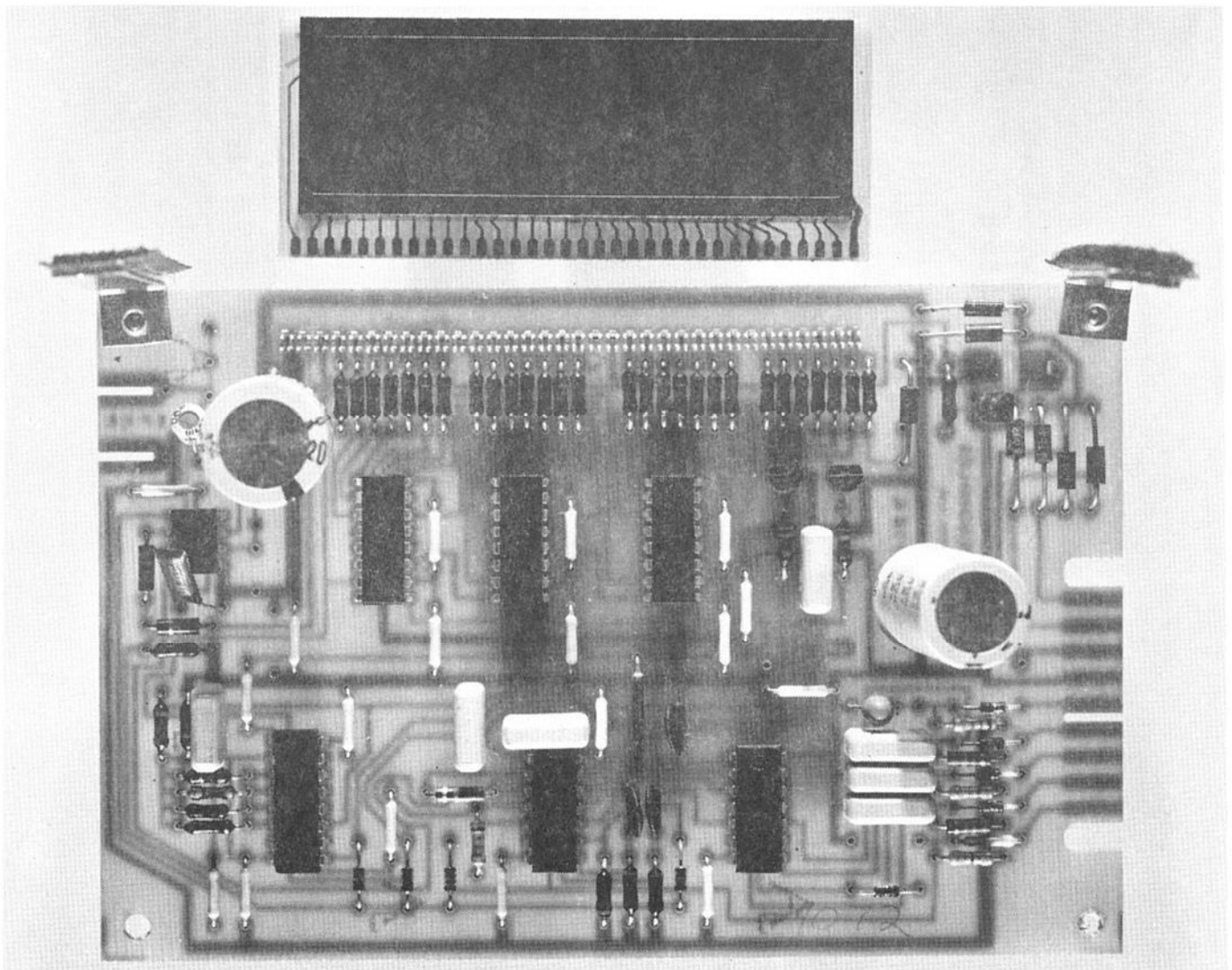
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Visual No. 21

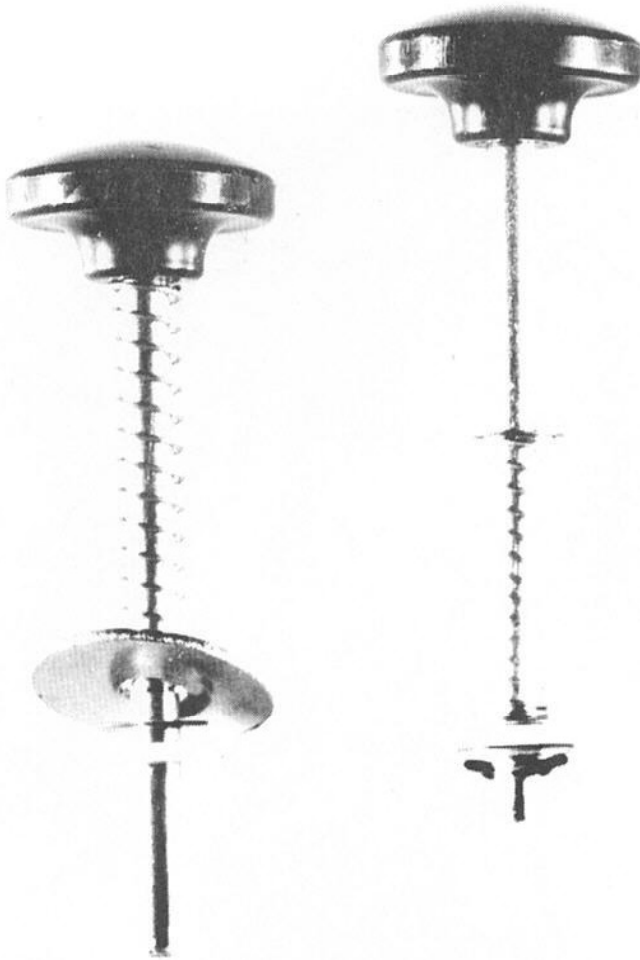


Visual No. 22

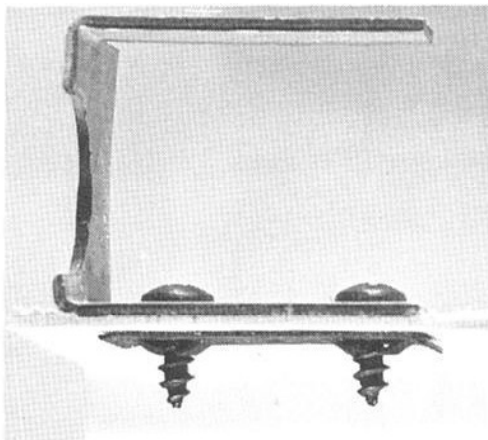


Visual No. 23

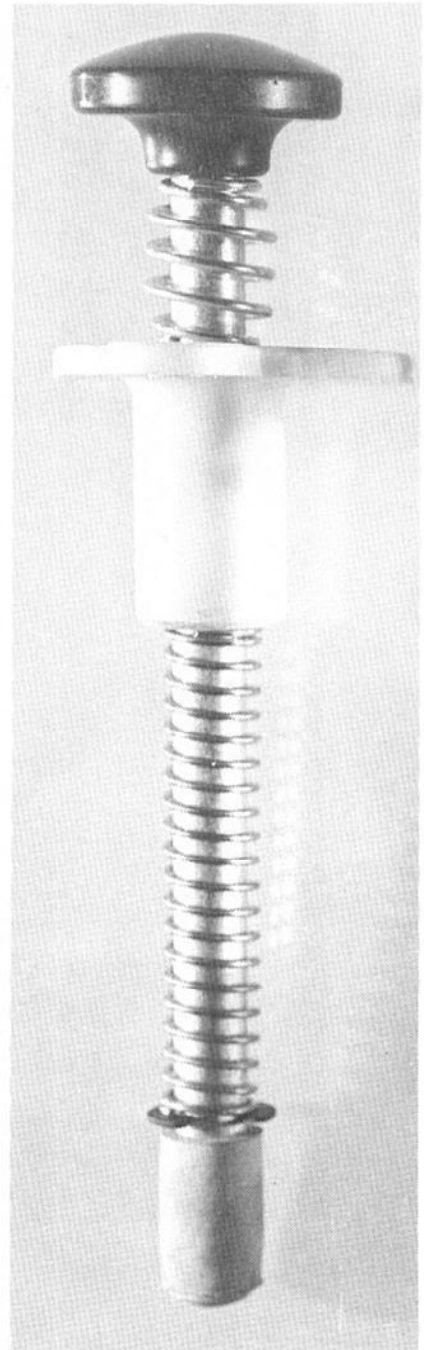
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Visual No. 24

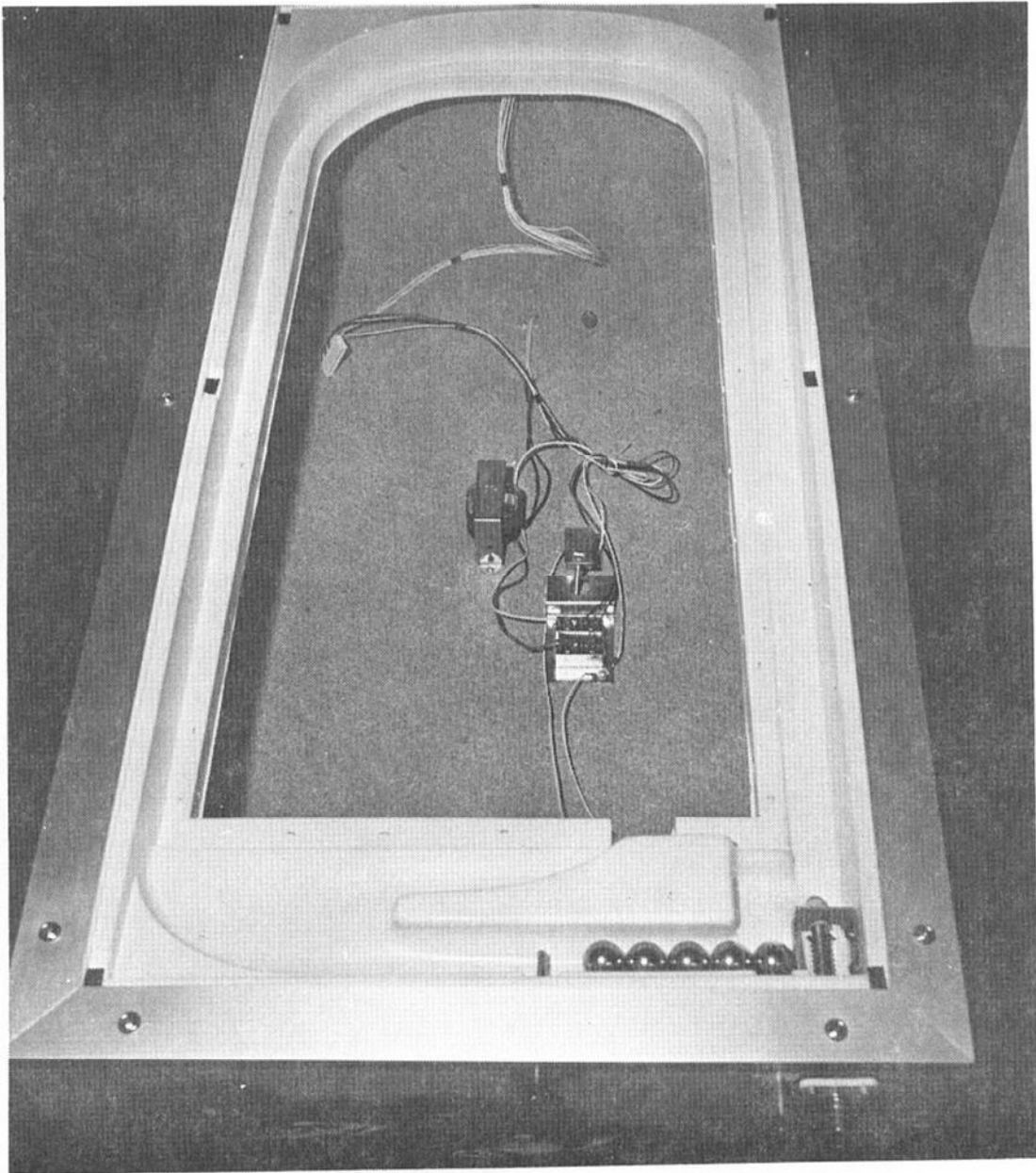


Visual No. 25



Visual No. 26

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Visual No. 27



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