Operation & Service Manual

GS-SERIES PINSETTER

47-902728-000
2/97

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GS-Series Pinsetter Operation and Service Manual

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Brunswick Indoor Recreation Group
525 West Laketon Avenue
Post Office Box 329
Muskegon, MI 49443-0329
U.S.A.

616-725-3300

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Preface

The GS-Series of pinsetters consists of several models of pinsetters that have changed to meet the needs of the proprietor, mechanic and bowler.

The original model was the GS-10 which was principally designed by Augusti Schmid in Scherzenbach, Switzerland to promote the sport of bowling throughout Europe. In 1984, Brunswick Bowling & Billiards Corporation acquired the rights to manufacture and sell the GS-10 Pinsetter. Since that time, Brunswick has used its many years of bowling experience to modify this machine to improve its durability and functionality. The mechanical portion of the pinsetter is manufactured in the Brunswick plant located in Stockach, Germany. The electronic control system and the ball accelerator are manufactured in the Brunswick plant located in Muskegon, Michigan.

In 1991, Brunswick introduced the GS-92 Pinsetter which incorporated many changes to the pinsetter to make it quicker to install and easier to service.

In 1995, Brunswick introduced the GS-96 Pinsetter which involved several changes in the software and hardware to speed up loading time of the pinsetter. These changes ensure that the pinsetter is always ready for the bowler's next ball.

In 1997, Brunswick introduced the GS-98 Pinsetter. It is controlled and operated by a new consolidated electronic system which uses a two control box system to reduce the number of printed circuit boards needed to operate the pinsetter. Also, software and hardware improvements have made the GS-98 pinsetter more efficient and user friendly.

Overview

This manual is designed to help you prepare for the service, repair and preventive maintenance of the GS-Series Pinsetters in a safe and efficient manner. Prior to working on one of these pinsetters, you should read the *Safety Guidelines* Brunswick has prepared for all persons working on or near these pinsetters. You will find these guidelines in the beginning of the Servicing section and the Adjustments section of this manual.

This manual also provides troubleshooting guidelines that will help reduce downtime and can be used to provide years of reliable operation of your pinsetters.

The GS-Series Pinsetters have been designed to operate within the ten pin system of bowling based on ABC FIQ standards and specifications. This primary concept is that the bowler has two chances to roll a bowling ball down the lane and knock down the ten pins standing at the end of the lane. These pinsetters are also capable of operating under several other formats in which the bowler may vary the number of pins and balls being used in the game.

Pinsetter Orientation

Whenever any position or motion is described in the text of this manual such as clockwise (CW), counterclockwise (CCW), right, left, forward or rearward, the description is as if viewed from the left side of the pinsetter. Refer to *Figure 1-1*. The left side is determined by taking the bowler's view when standing at the foul line - the bowler is looking at the front of the pinsetter.

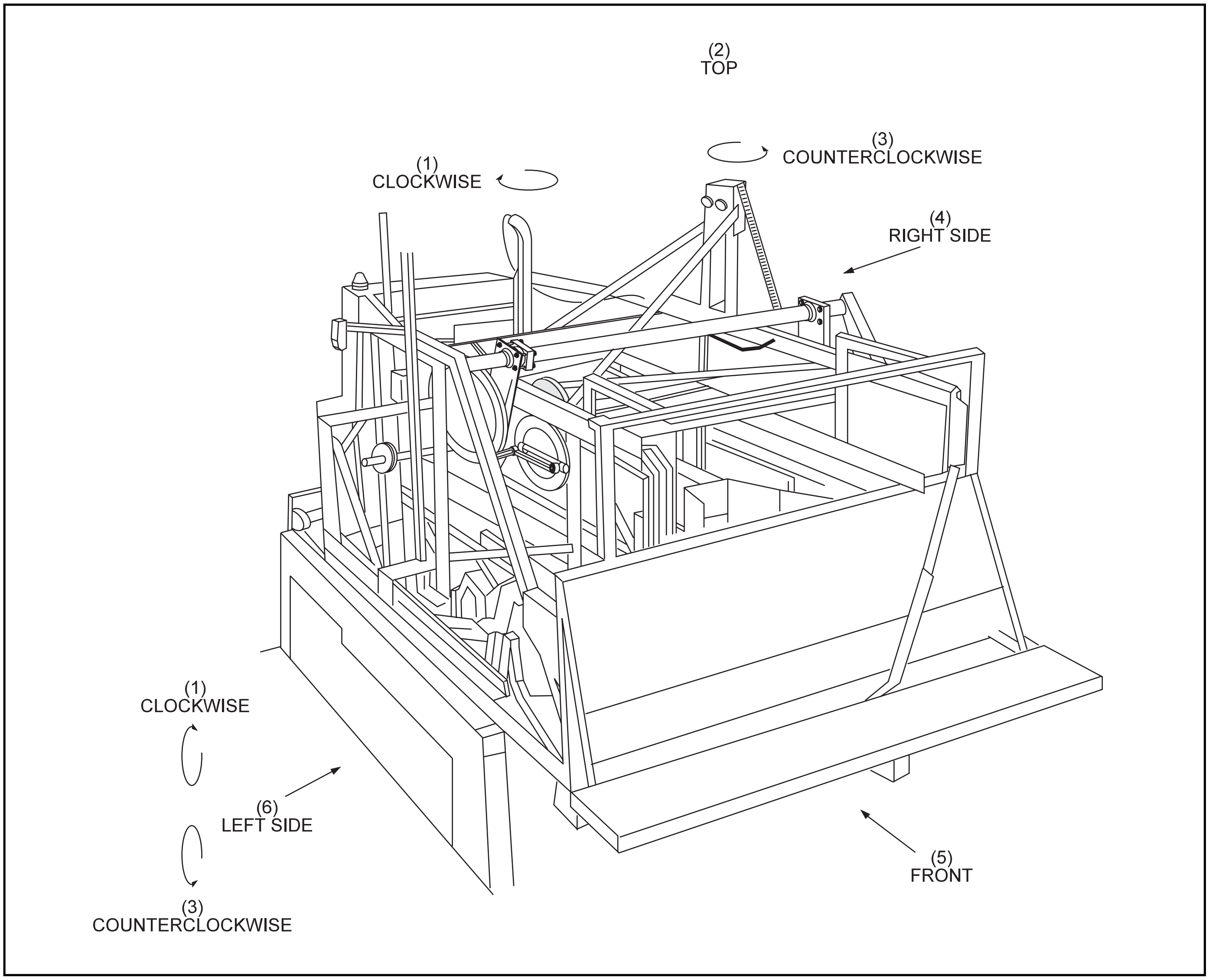

Figure 1-1. Orientation.

(1) CLOCKWISE	(2) TOP	(3) COUNTERCLOCKWISE
(4) RIGHT SIDE	(5) FRONT	(6) LEFT SIDE

Pinsetter Dimensions

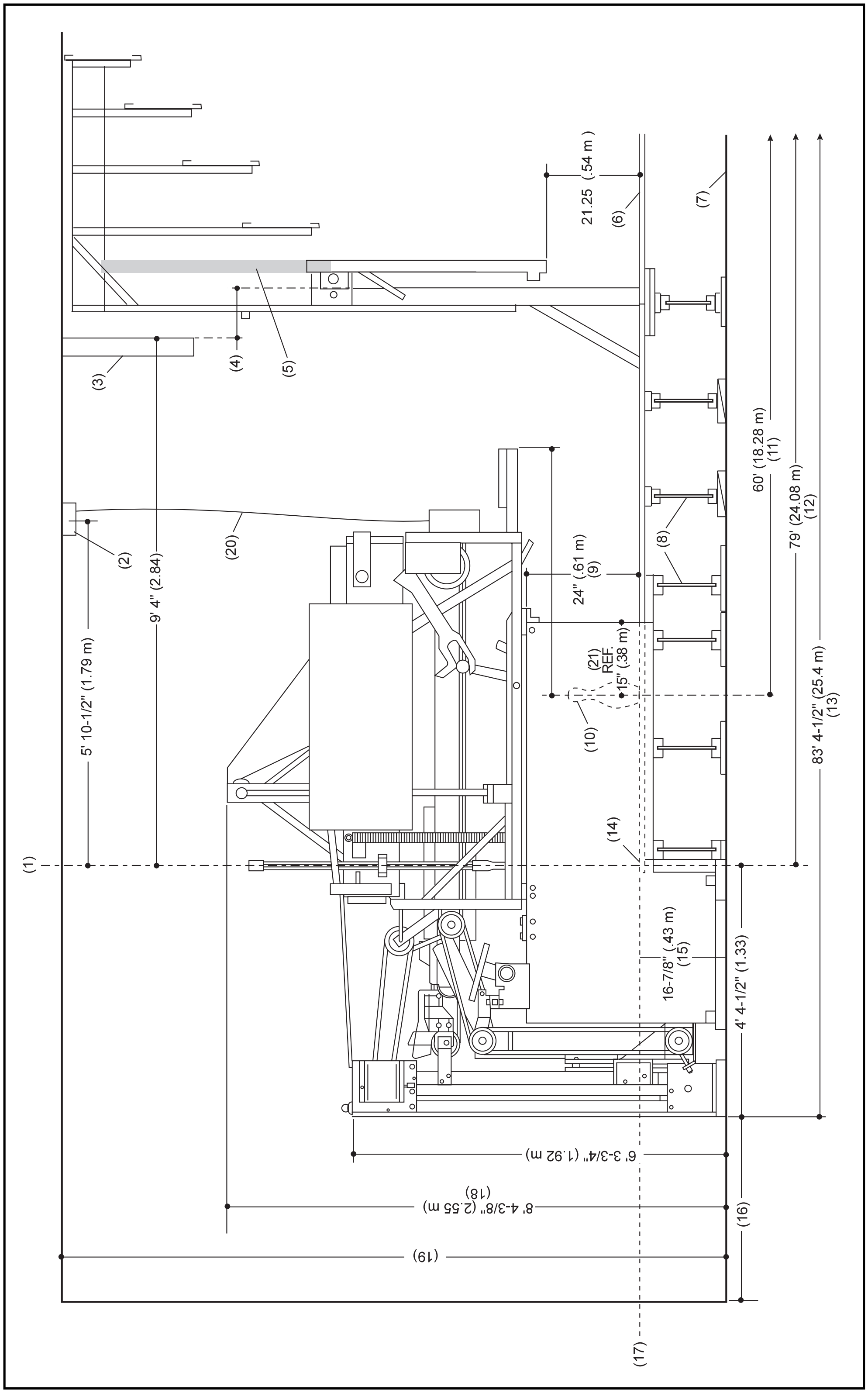

Figure 1-2. Pinsetter Dimensions.

(1) ZERO LINE
(2) ELECTRICAL JUNCTION BOX (BY CUSTOMER)
(3) CURTAIN WALL (BY CUSTOMER)
(4) 10" (.25 m) FROM CURTAIN WALL
(5) MASKING UNIT IN RAISED POSITION
(6) LANE SURFACE
(7) CONCRETE FLOOR
(8) FOUNDATION I-JOISTS
(9) TOP OF KICKBACK TO LANE SURFACE
(10) HEADPIN
(11) HEAD PIN TO FOUL LINE
(12) ZERO LINE TO EDGE OF APPROACH
(13) TOTAL LENGTH OF BOWLING INSTALLATION (BACK OF PINSETTER TO EDGE OF APPROACH)
(14) PINDECK
(15) HIGH SPOT OF CONCRETE FLOOR TO LANE SURFACE
(16) SERVICE AISLE 5' (1.52 m) PREFERRED 3' (.91 m) MINIMUM
(17) ZERO POINT (LANE SURFACE)
(18) EXTREME PINSETTER HEIGHT
(19) 12' (3.66 m) PREFERRED CEILING HEIGHT 9'10" (3 m) MINIMUM CEILING HEIGHT 10' (3.05 m)
(20) DROP CORD (BY CUSTOMER) TYPE "S" SERVICE CORD, RUBBER SHEATHED, 4-CONDUCTOR, 12 GAUGE
(21) DIMENSION IS FOR REFERENCE ONLY

Pinsetter Description

The GS-Series Pinsetters consist of seven mechanical subassemblies and a few electronic subassemblies.

The mechanical subassemblies will be discussed in this section of the manual. A separate section has been dedicated to the electrical and electronic components of this pinsetter.

The seven mechanical subassemblies are:

Ball Pit
Ball Accelerator
Pin Elevator
Distributor
Setting Table
Sweep Wagon
Drive Frame

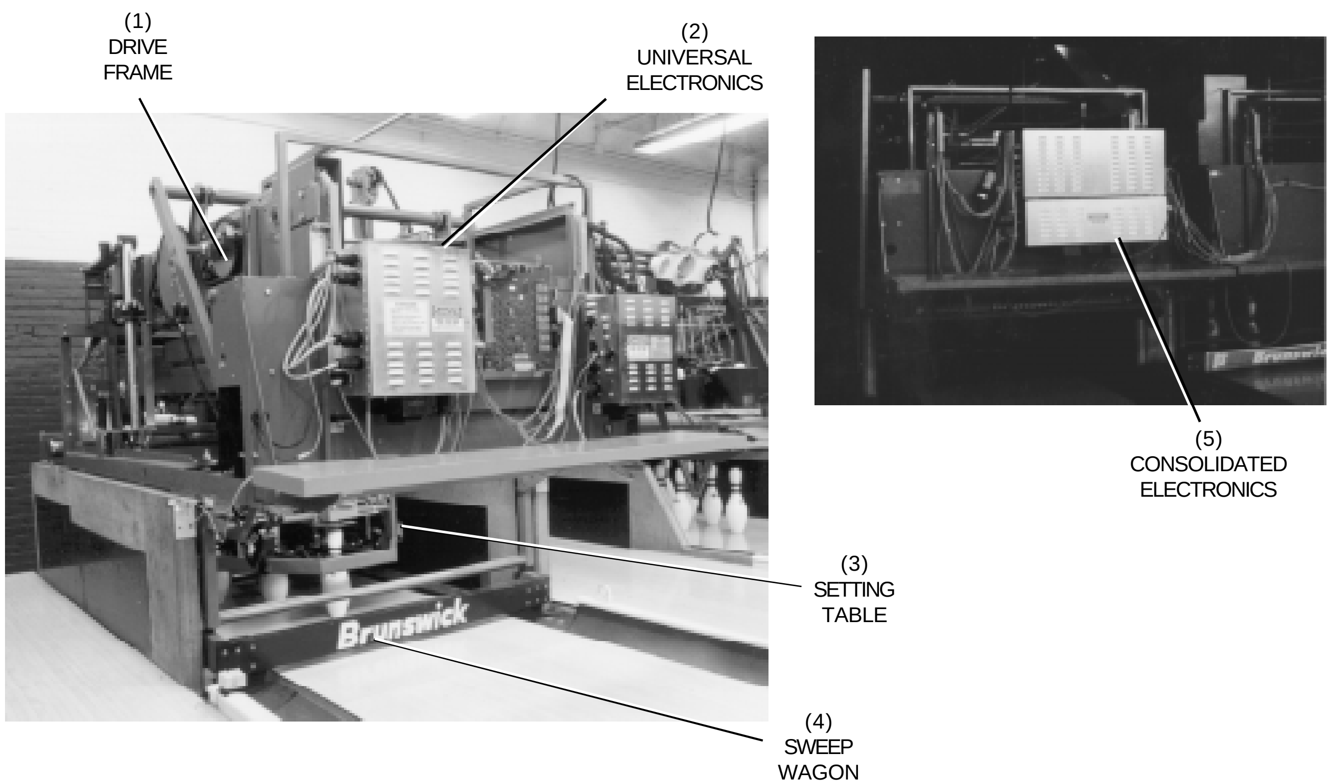

Figure 1-3. Front View

(1) DRIVE FRAME	(2) UNIVERSAL ELECTRONICS	(3) SETTING TABLE
(4) SWEEP WAGON	(5) CONSOLIDATED ELECTRONICS	

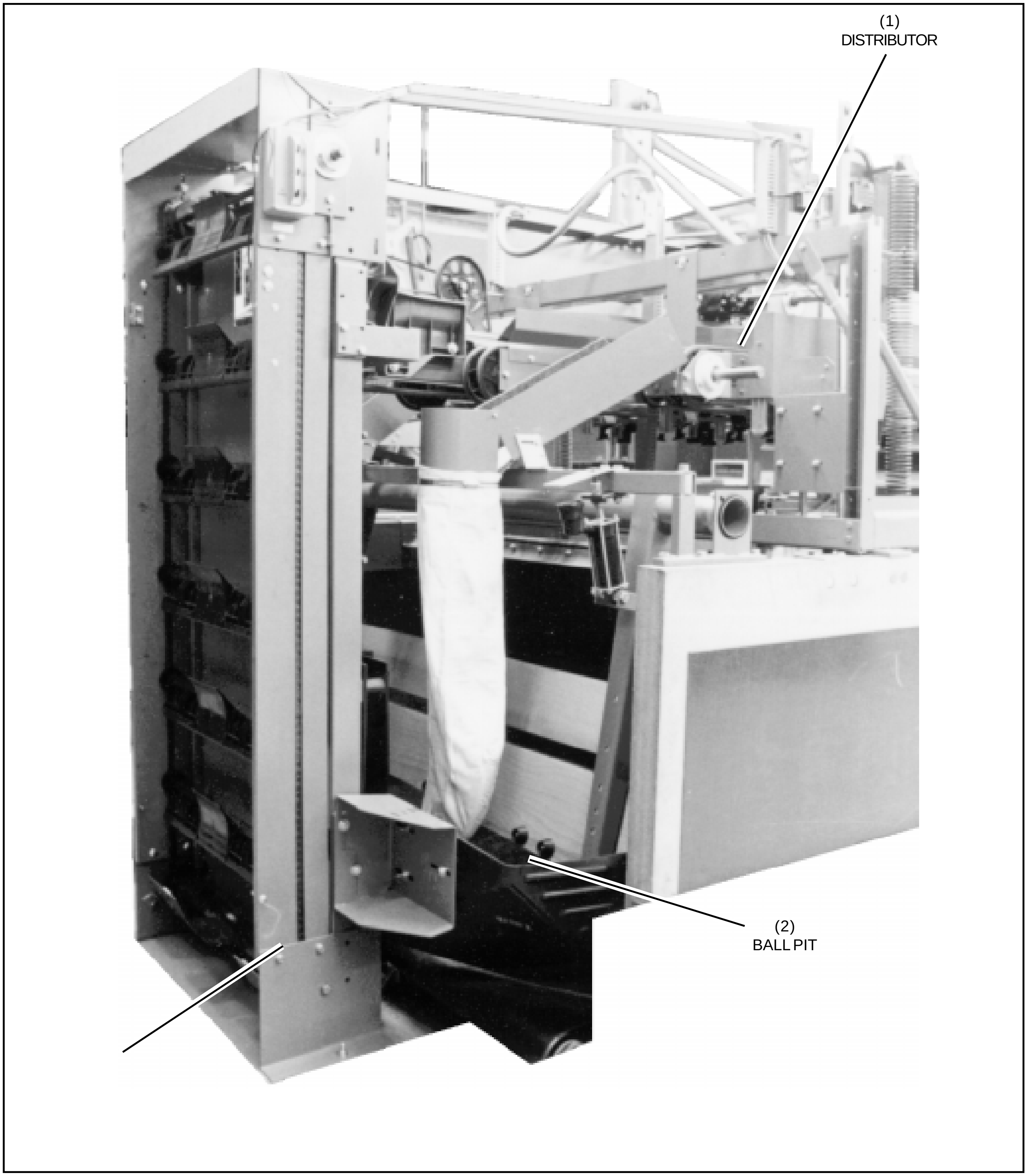

Figure 1-4. Rear View.

(1) DISTRIBUTOR (2) BALL PIT (3) PIN ELEVATOR

Ball Pit

The ball pit area contains a ball cushion assembly, a pit curtain and a transport band assembly. The primary purpose of this area is to handle the initial impact of the pins and ball and to cycle them through the machine to get ready for the next ball.

The ball cushion pivots rearward when struck by a bowling ball. It consists of a metal frame with a laminated board that is covered with a thick rubber facing that helps absorb the ball impact. A hydraulic shock absorber mounted to the frame assists the cushion in stopping the ball and pins. After impact, the cushion returns to its fully forward position which allows it to guide the ball into the ball accelerator. An adjustment bolt and rubber stop mounted on the cushion frame determine the foremost position of the cushion. Refer to *Figure 1-5*.

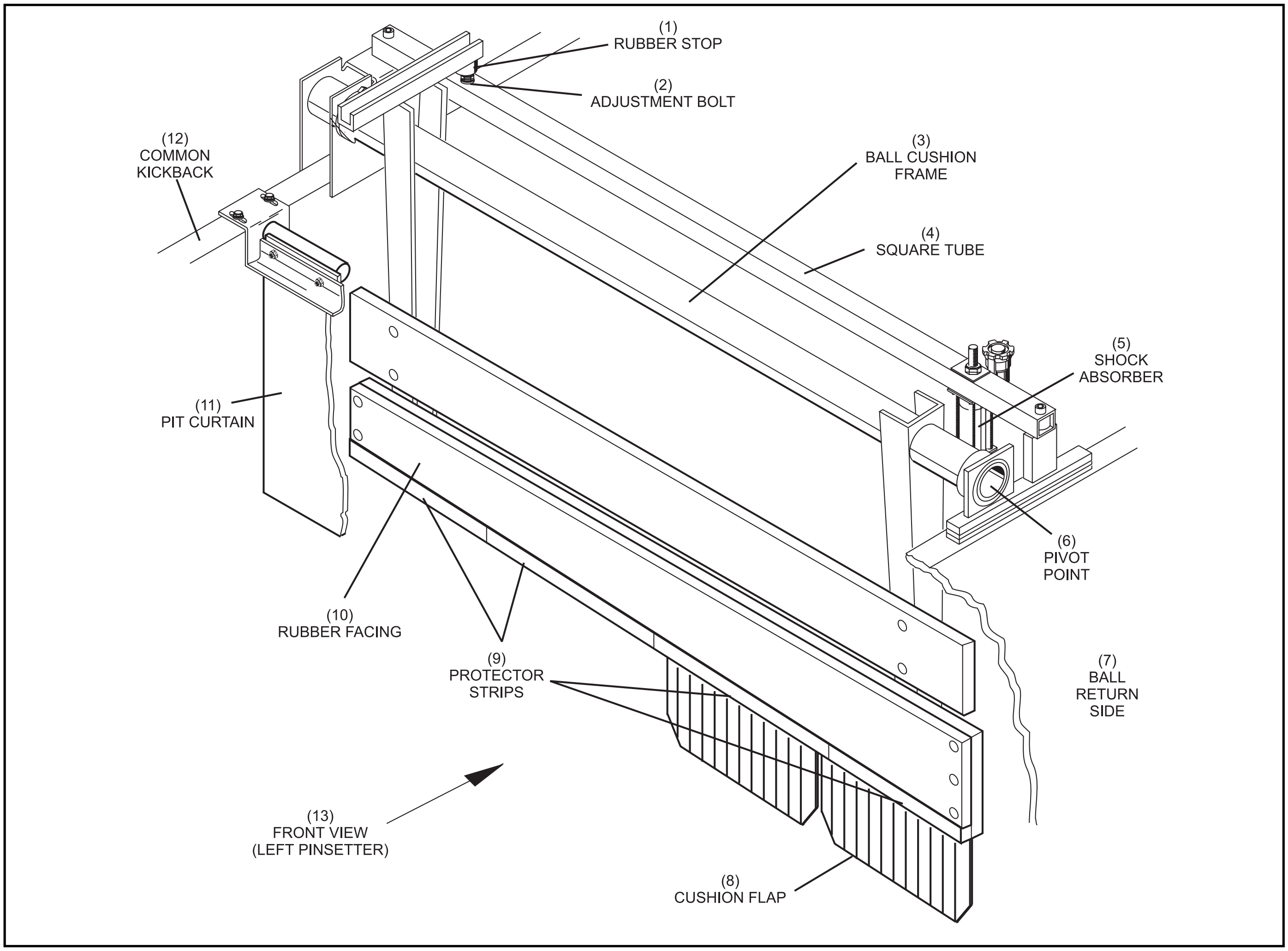

Figure 1-5. Ball Cushion.

(1) RUBBER STOP	(2) ADJUSTMENT BOLT	(3) BALL CUSHION FRAME
(4) SQUARE TUBE	(5) SHOCK ABSORBER	(6) PIVOT POINT
(7) BALL RETURN SIDE	(8) CUSHION FLAP	(9) PROTECTOR STRIPS
(10) RUBBER FACING	(11) PIT CURTAIN	(12) COMMON KICKBACK
(13) FRONT VIEW (LEFT PINSETTER)		

The pit curtain hangs free in front of the cushion. It is made of heavy rubber that stops bowling pins rearward movement after ball impact and allows them to fall onto the transport band.

The transport band consists of a large band moving on two rollers that pulls the pins and ball rearward. A framework mounted onto the ball accelerator and the common kickback tilts the band slightly to the rear and toward the ball door to assist in the clearing of the pins and ball from the pit area. The band is powered by the distributor motor via a series of belts leading to the "V" belt drive pulley on the rear transport band roller. The rear roller has two adjustment screws that are used to put proper tension on the band and to keep it centered on the front and rear rollers. Two boards are mounted on the frame which support the band as it carries the pins and ball out of the pit. The rear support board is tapered at the ball door to allow ball entry into the ball accelerator.

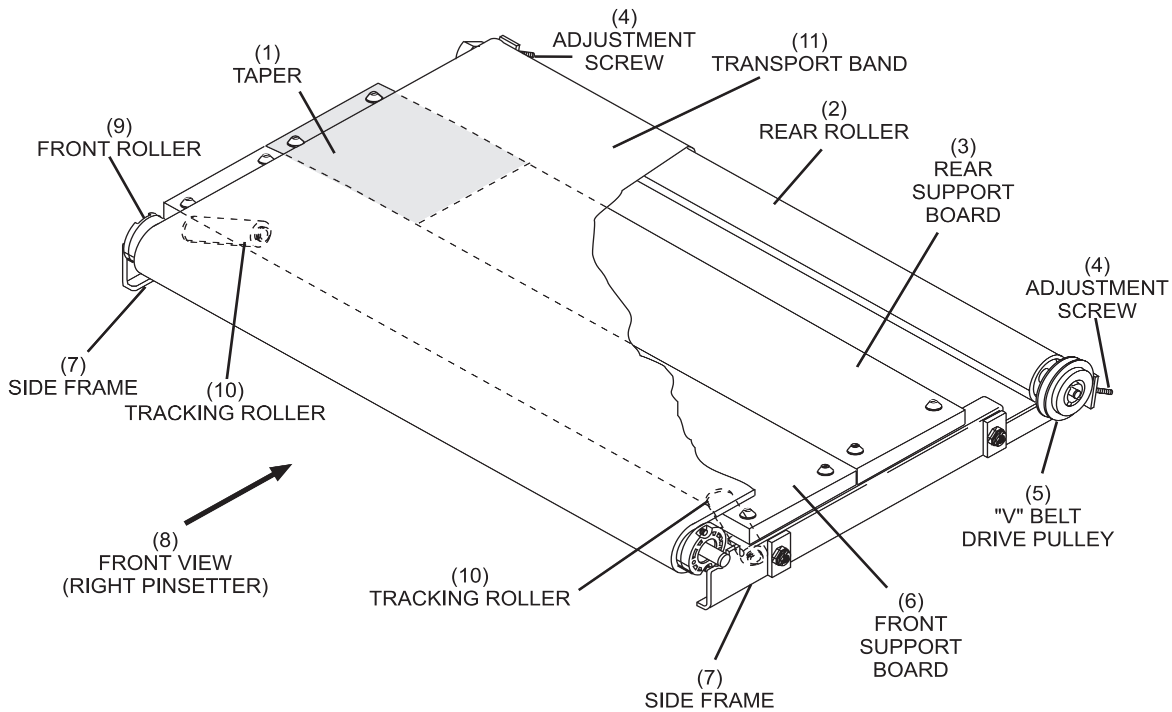

Figure 1-6. Transport Band.

(1)	TAPER	(2)	REAR ROLLER	(3)	REAR SUPPORT BOARD
(4)	ADJUSTMENT SCREW	(5)	"V" BELT DRIVE PULLEY	(6)	FRONT SUPPORT BOARD
(7)	SIDE FRAME	(8)	FRONT VIEW (RIGHT PINSETTER)	(9)	FRONT ROLLER
(10)	TRACKING ROLLER	(11)	TRANSPORT BAND		

Ball Accelerator

Mounted between the two pinsetters is a ball accelerator that returns balls to the bowler from either lane. The ball enters from the transport band through a ball door and onto a track. At this point, a large flat belt mounted on two driving drums grips the ball and propels it forward to the ball lift. The power to run this belt is furnished by a three phase motor turning the rear driving drum. The motor receives its power from either the universal Common box or the consolidated High Voltage box and runs continuously whenever one or both pinsetters are turned on. The tension bar and spring apply pressure to the flat belt via the pivoting lever which supports the front driving drum.

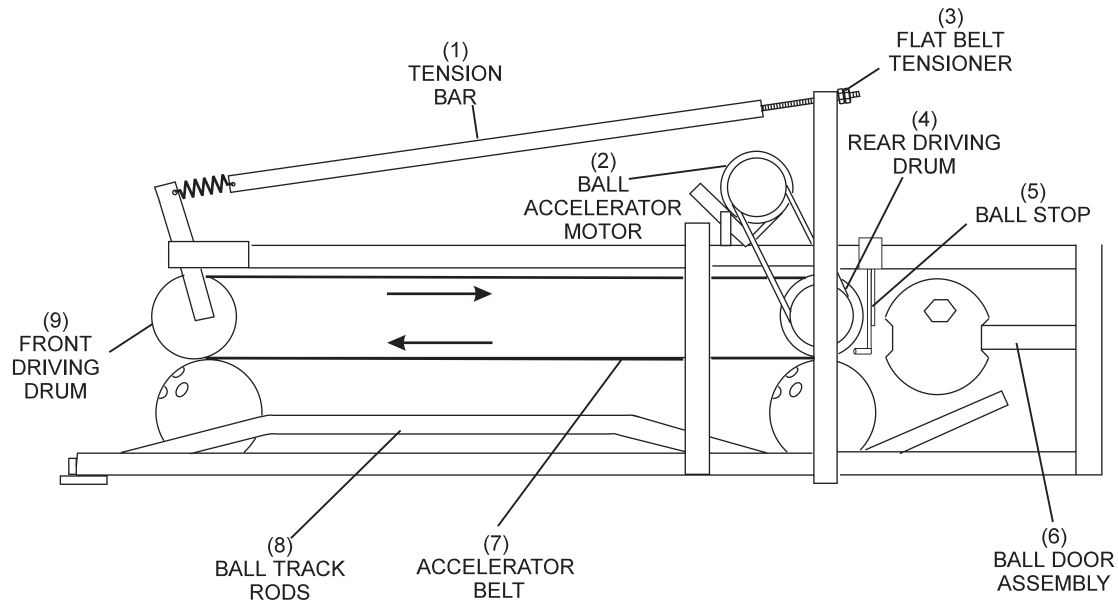

Figure 1-7. Ball Accelerator.

(1) TENSION BAR	(2) BALL ACCELERATOR MOTOR	(3) FLAT BELT TENSIONER
(4) REAR DRIVING DRUM	(5) BALL STOP	(6) BALL DOOR ASSEMBLY
(7) ACCELERATOR BELT	(8) BALL TRACK RODS	(9) FRONT DRIVING DRUM

To prevent two balls from entering the accelerator at the same time, the ball accelerator has two ball doors and two ball door locking assemblies. The ball doors are designed to block the opposite door when one door is opened by a ball entering the accelerator. When the ball passes through, a spring closes the door and allows the other door to open when a ball pushes against the door. The ball door has a button that must be pressed to allow the door to open. This prevents a pin from entering the accelerator as it is being carried rearward by the transport band. For additional protection against pins opening the ball door, a ball door locking assembly is energized for three seconds after the pinsetter has detected a ball entering the pit area. A solenoid energizes and forces a locking bolt downward to prevent the ball door button from opening the door at this time to keep flying pins from entering the ball accelerator. After the three seconds have lapsed, the door can be opened by the ball pushing against it.

(1) BALL DOOR LOCKING SOLENOID
(2) LOCKING BOLT
(3) BALL DOOR CLOSING SPRING
(4) BUTTON
(5) BALL DOOR LEVER

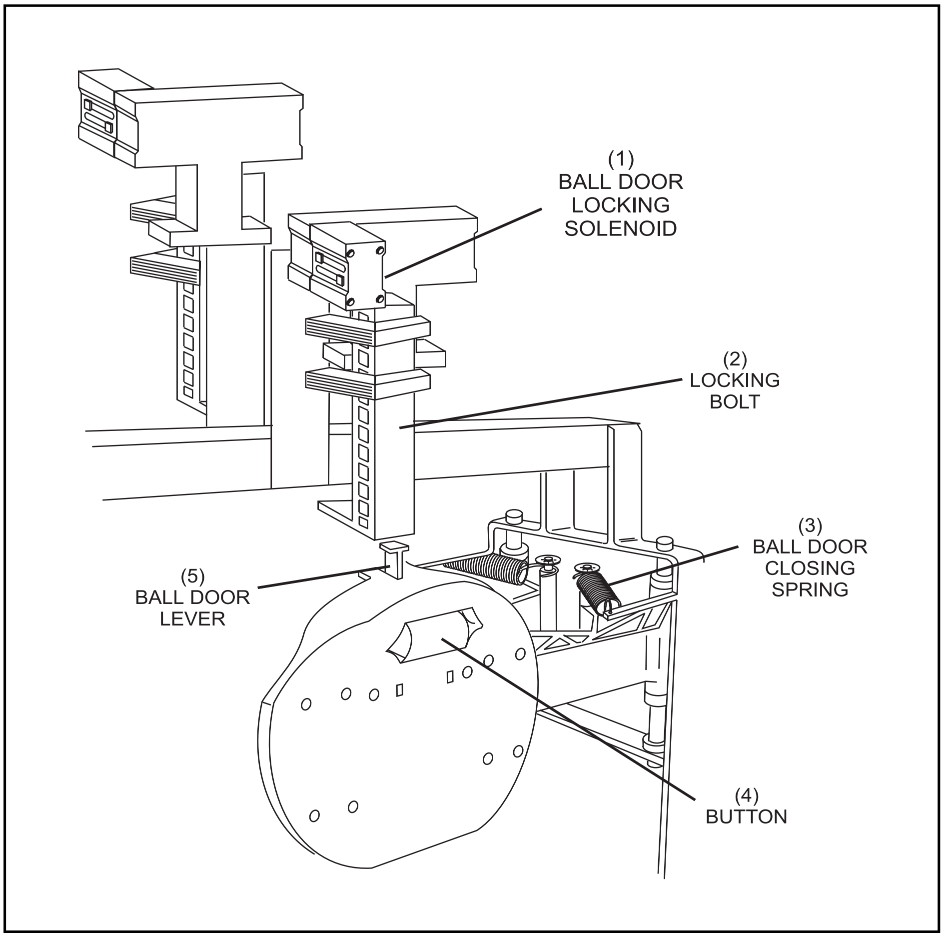

Figure 1-8. Ball Door.

Pin Elevator

The pin elevator receives the pins from the transport band and raises them up to the distributor in preparation for setting the pins on the lane again. The elevator has 14 shovels that lift the pins, one per shovel. The shovels are moved by two parallel chains that are belt driven by the distributor motor. At the bottom of the elevator are two pin feed deflectors that help the transport band guide the pins into the elevator. As the shovels lift the pins, two sets of pin deflectors position the pins in the middle of the shovel. If more than one pin is on the shovel, this deflecting action will knock one of the pins off the shovel as the pin turn system handles each pin individually. Also mounted halfway up the right side of the elevator frame is an ejector. This will gently wiggle each shovel to knock off the top pin if two pins are stacked on the same shovel.

The pins continue to rise, and a pair of pin centering wedges position the pin to the center of the shovel. This allows proper pin alignment when entering the shark switch assembly.

As the shovel nears the top of the elevator, a shovel guide on the right side tips the shovel to allow the pin to roll out onto the pin guide wedges and into the distributor.

(1) ELEVATOR DRIVE SHAFT
(2) PIN COUNT SWITCH
(3) WEDGE GUIDE
(4) SHOVEL GUIDE
(5) CHAIN
(6) 1 OF 14 PIN SHOVELS
(7) EJECTOR
(8) RIGHT PIN DEFLECTOR
(9) RIGHT PIN FEED DEFLECTOR
(10) DAMPER PLATE
(11) LOWER PAN GUIDE
(12) LEFT PIN FEED DEFLECTOR
(13) LEFT PIN DEFLECTOR
(14) PIN CENTERING WEDGES
(15) EC SWITCH
(16) CHAIN TENSIONER
(17) REAR CONTROL BOX
(18) TROUBLE LIGHT

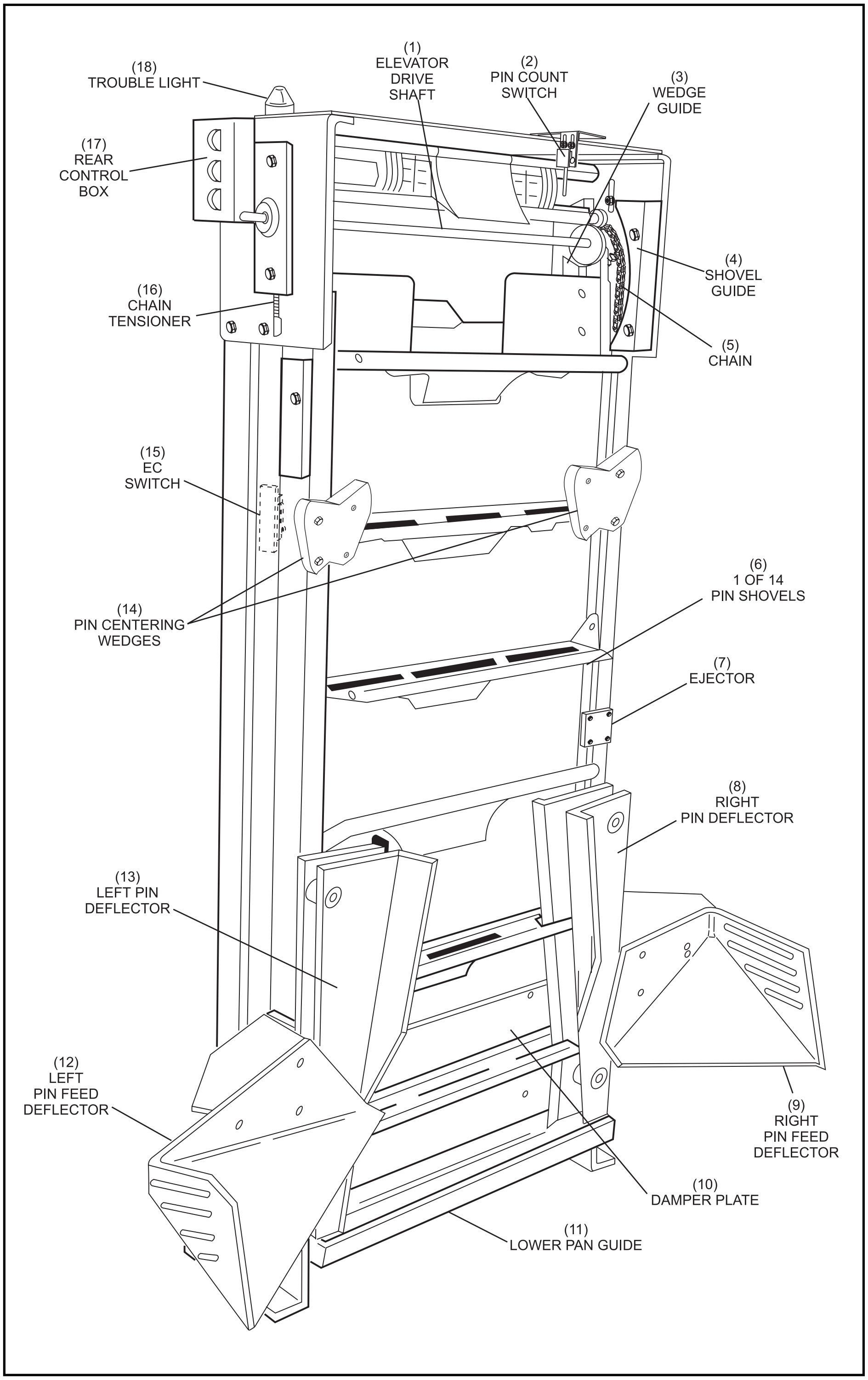

Figure 1-9. Elevator.

Distributor

The distributor moves the pins from the elevator and places them in position so the setting table can receive them at the appropriate time. The distributor consists of a shark switch assembly, four lanes of parallel round belts, two crossover lanes and ten pin station assemblies.

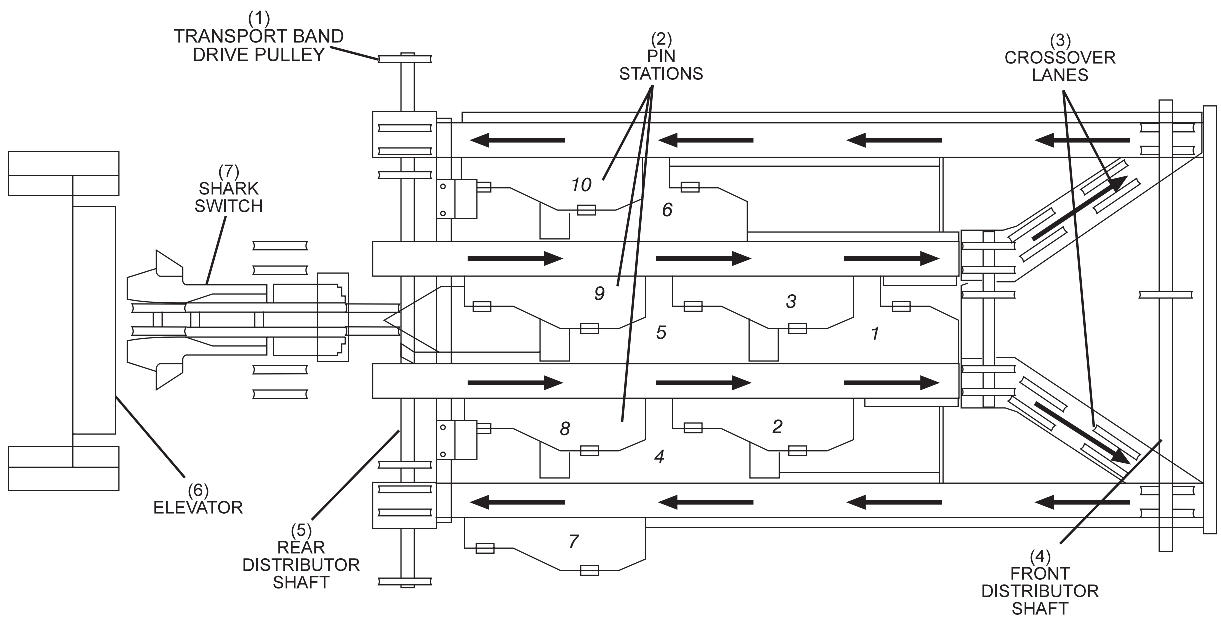

Figure 1-10. Distributor.

(1) TRANSPORT BAND DRIVE PULLEY	(2) PIN STATIONS	(3) CROSSOVER LANES
(4) FRONT DISTRIBUTOR SHAFT	(5) REAR DISTRIBUTOR SHAFT	(6) ELEVATOR

The shark switch assembly has two pin guide wedges that turn the pin so that it will be positioned onto the distributor round belts bottom first. On GS-92s the two round belts in the shark switch assembly carry the pin forward and over a pin guide wire and onto the left center or right center lane. The weight of the pin pushes down on the pin guide wire and switches the pin guide over so the next pin will go into the opposite center lane. This allows for even distribution of the pins to all ten pin stations. Refer to *Figure 1-11*.

(1) PIN GUIDE
(2) ROUND BELTS
(3) PIN GUIDE WEDGES
(4) PIN GUIDE WIRE

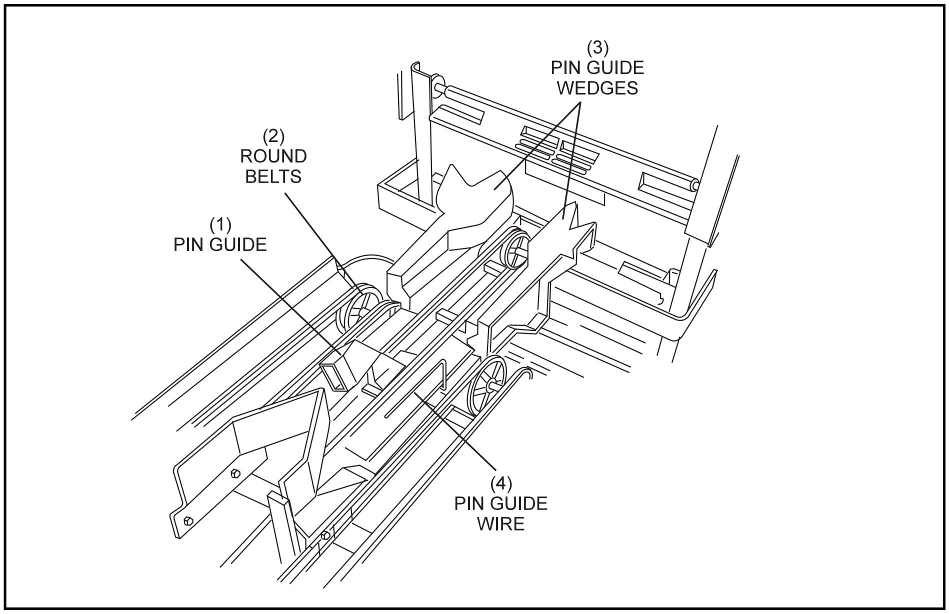

Figure 1-11. Shark Switch Assembly (GS-92s)

On GS-96 and later pinsetters, a pincount switch on the top of the elevator monitors pins leaving the pin shovels. The electronics then sends a signal to the shark solenoid to control the direction of the pin guide while feeding pins to the distributor pin stations. Refer to *Figure 1-12*.

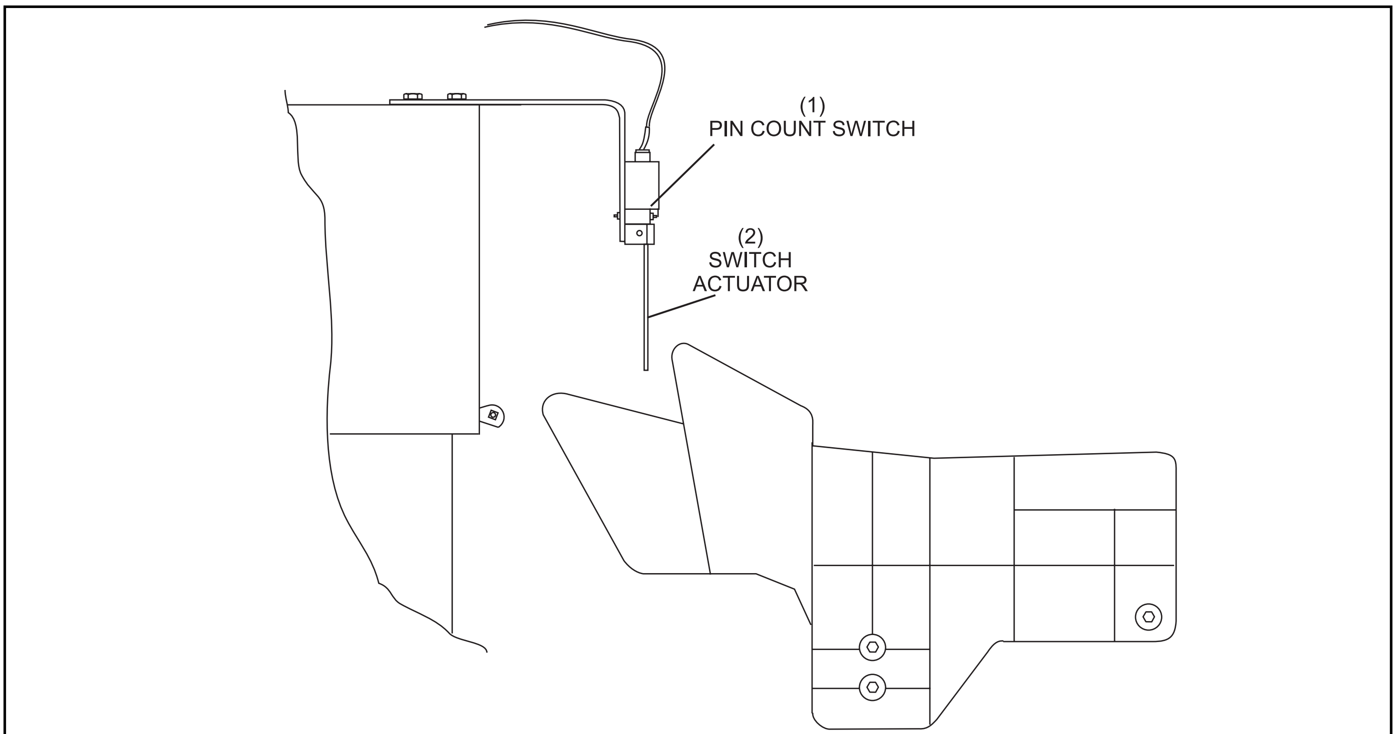

Figure 1-12. Pin Count Switch and Shark Solenoid (GS-96s and Later)

(1) PIN COUNT SWITCH
(2) SWITCH ACTUATOR

The pins will move down the distributor lanes until an empty pin station is found. An ejector flap will be sticking up from the pin station between the two round belts. The pin will fall onto the pin station's retaining bow. This will unlock the ejector flap and allow any other pins to move onto the next available pin station. The pin will remain in the pin station until the setting table is ready to receive that pin. The retaining bow will drop the pin when the pin holder's gripper engages the pin release lever.

(1) EJECTOR FLAP
(2) PIN RELEASE LEVER
(3) RETAINING BOW
(4) ORIGINAL PIN STATION
(5) UNIVERSAL PIN STATION

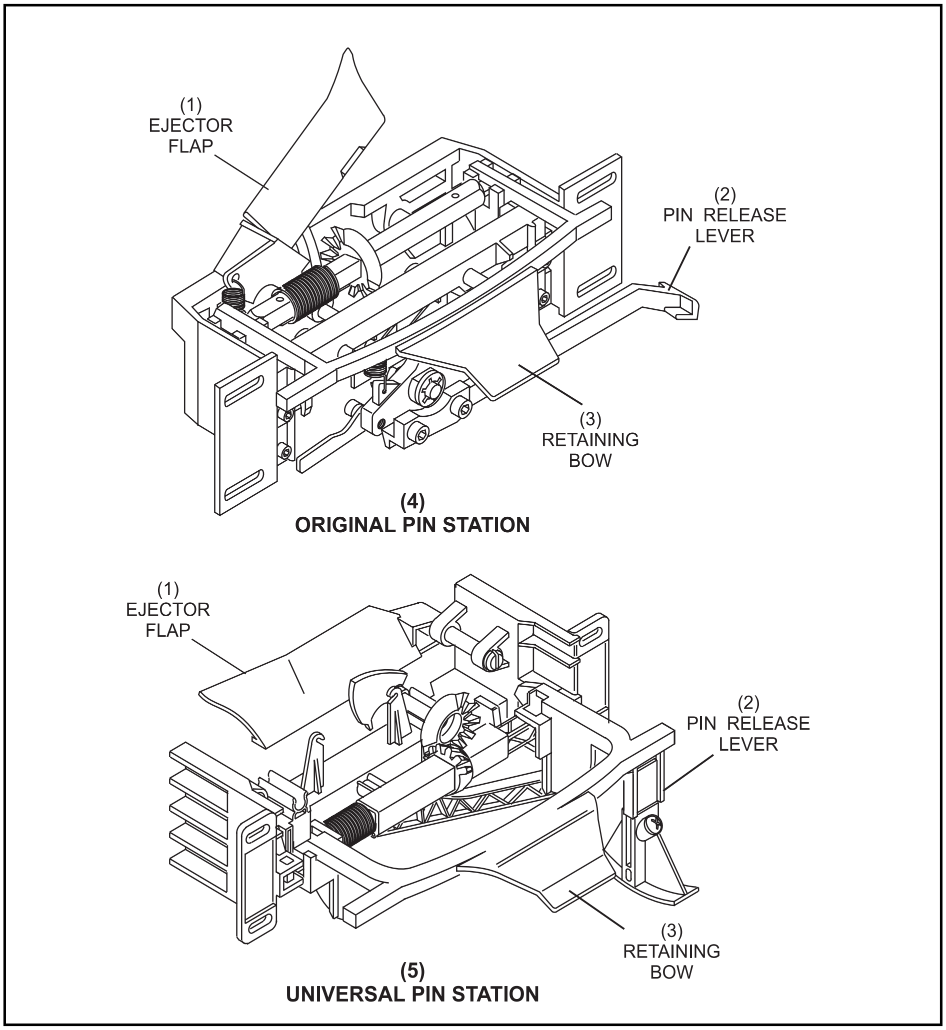

Figure 1-13. Pin Station.

Any pins that do not find an empty pin station are returned to the transport band through the overflow chute at the end of each outside distributor lane. They will then be recycled through the elevator, shark switch and distributor until an empty pin station has been located. If no bowler activity occurs within 45 seconds, the distributor motor will shut off to save energy and reduce wear and tear on the pins and pinsetter. Shutting off the distributor motor stops the transport band, elevator and the distributor only.

(1) OVERFLOW CHUTE
(2) PIN IMPACT AREA BETWEEN REAR BOARD AND REAR ROLLER
(3) OVERFLOW SOCK

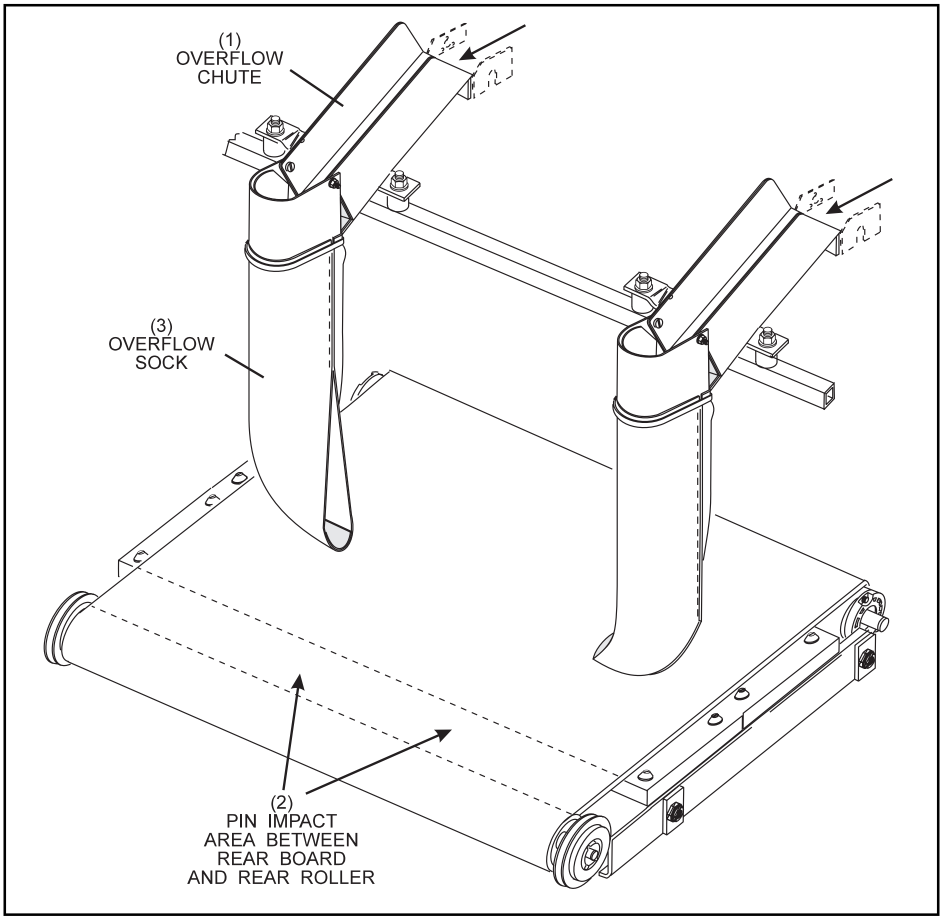

Figure 1-14. Pin Overflow Area.

Setting Table

The setting table is a multipurpose assembly.

1. It must detect for standing pins after a ball has been rolled.
2. It must close the spotting tongs and pick up the pins standing on the lane if another ball is to be rolled.
3. It must load pins from the distributor and set them on the lane for a new frame.

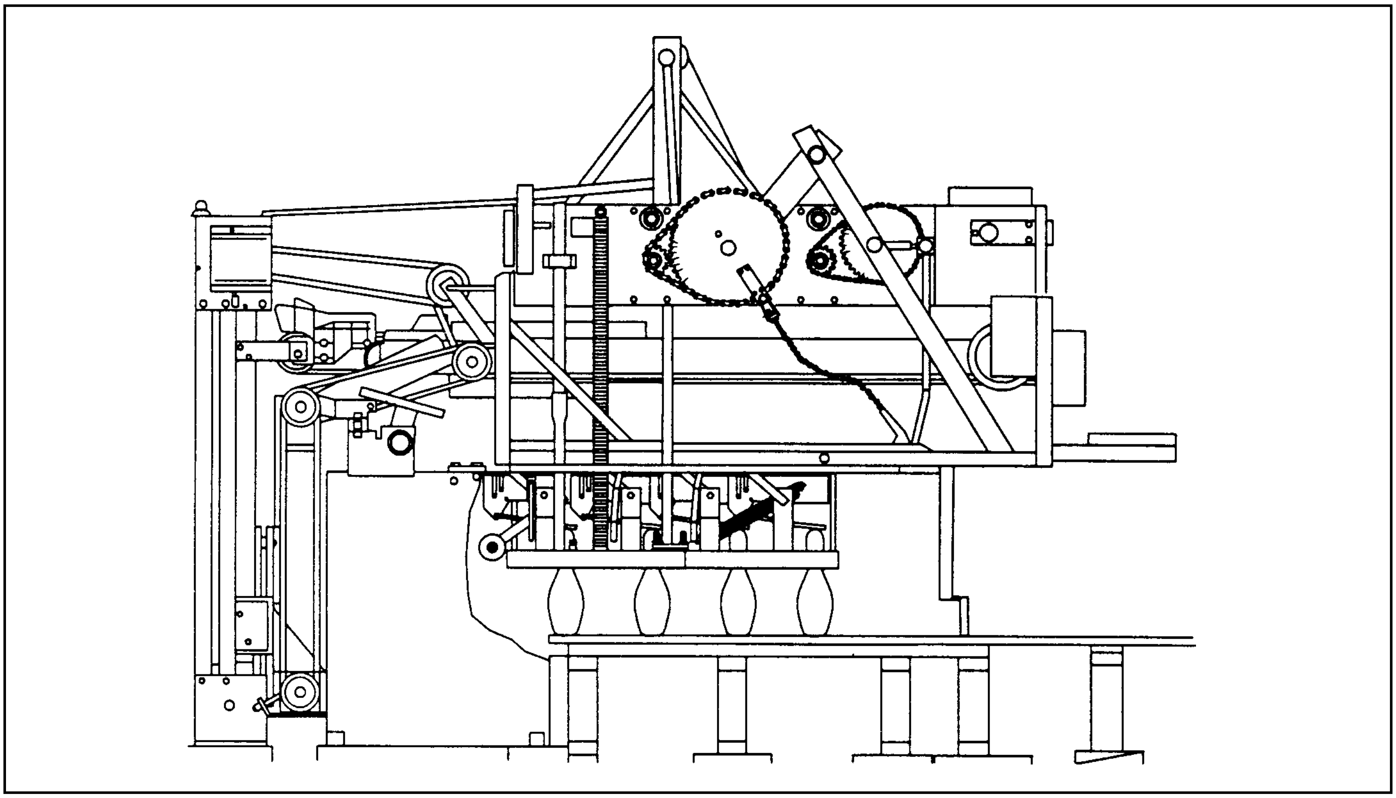

Figure 1-15. Detecting Pins.

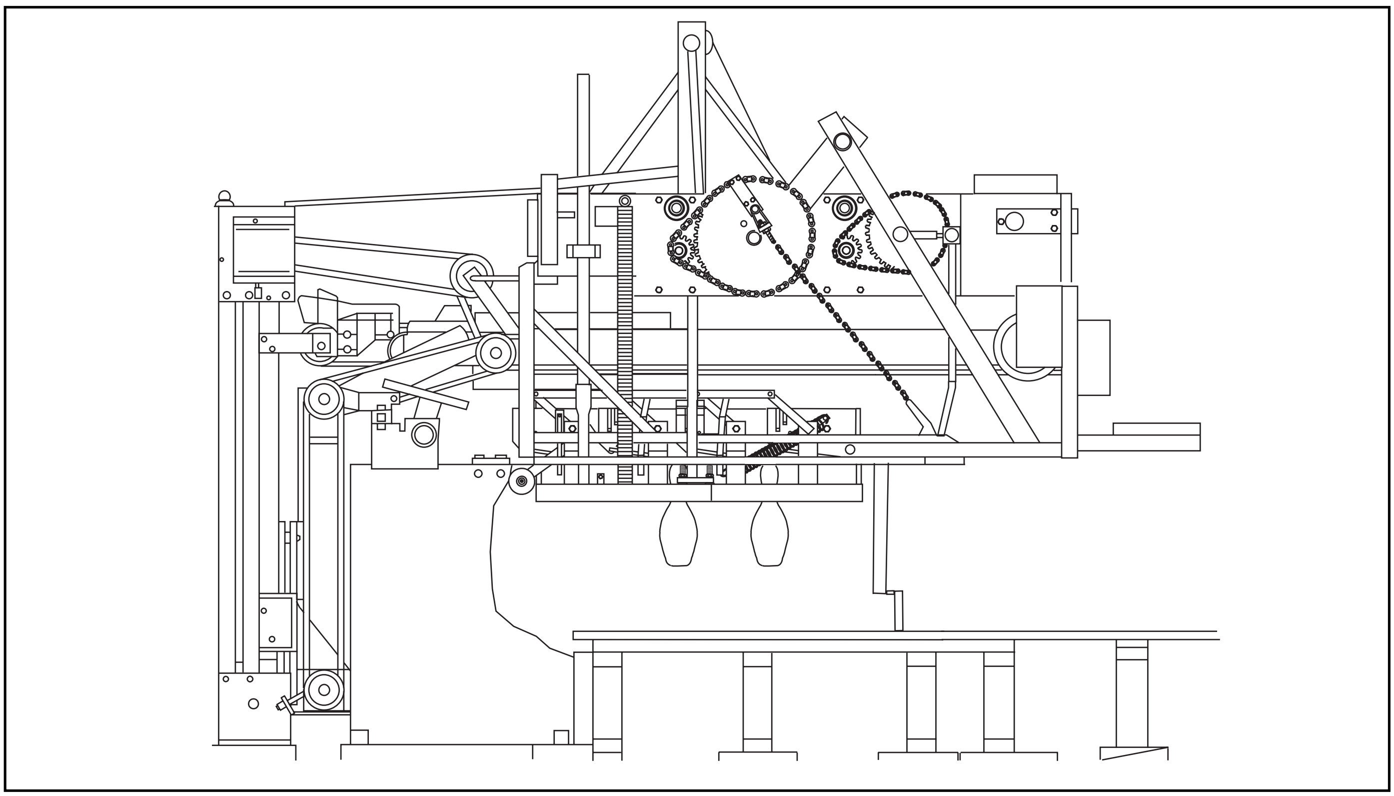

Figure 1-16. Spotting Tongs Closed - Picking Up Pins.

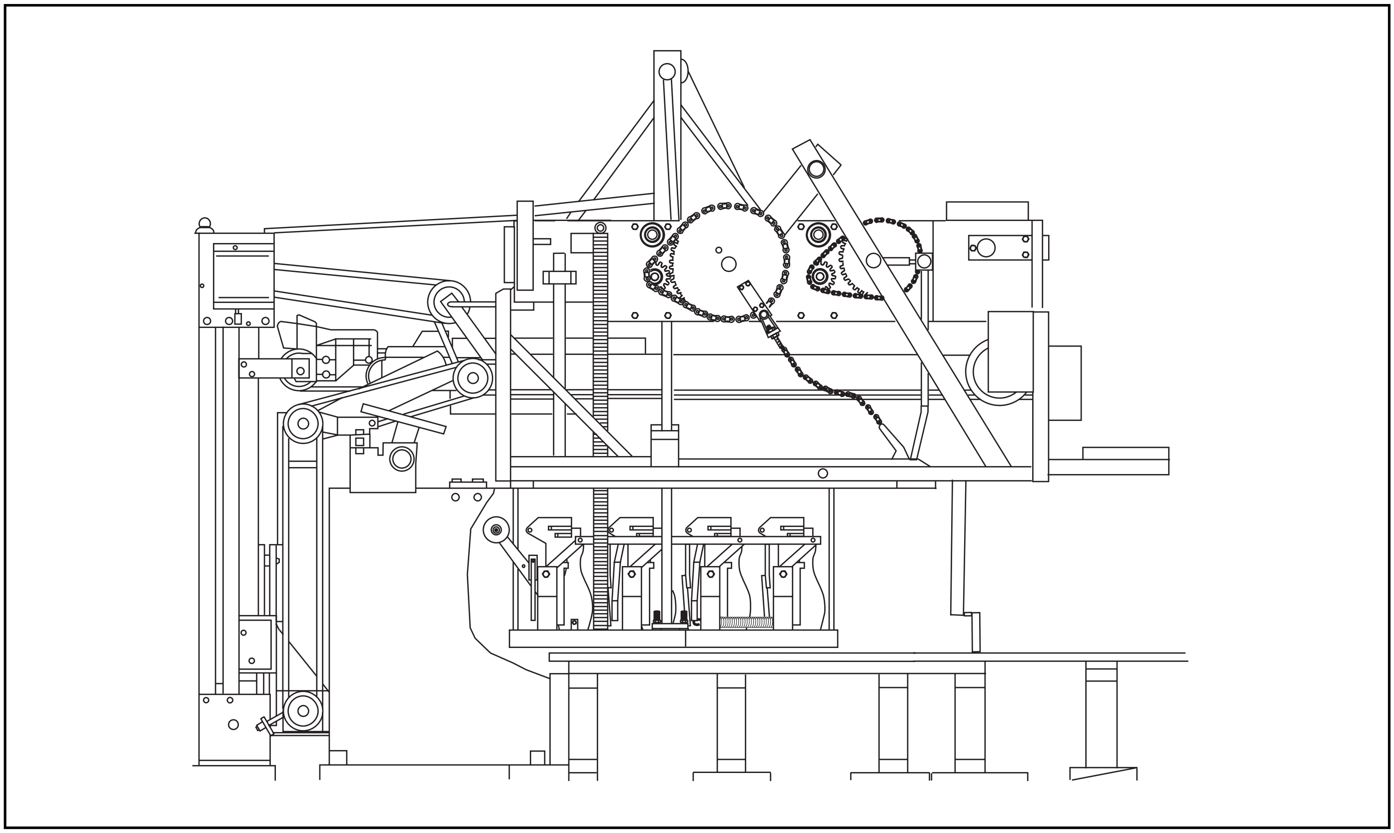

Figure 1-17. Setting New Pins.

The setting table contains ten pin holders that are mounted on four swing shafts. The pin holders are held in the horizontal position when they are loading pins (up) or waiting for a ball, and when the table is detecting pins (down) or closing the spotting tongs. All ten pin holders are rotated to a vertical position when the table lowers all the way down to set new pins onto the lane surface.

GS-92 and earlier pin holders have one switch when serves two purposes. First, it is used to detect pins when the pin detector plate on the bottom is pushed upward by the top of a pin when the table is down during a detection. The second purpose is to inform the pinsetter electronics that a pin has been loaded into the pin holder. Refer to *Figures 1-18* and *1-19*.

NOTE: *On this style pin holder (one switch), the pinsetter will not make a detection when pins are loaded in the pin holders.*

GS-96 and some GS-98 pinsetters have two switch pin holders which are wired parallel with each other but operate separately. One switch is for detecting, the other for pin loading. This style pin holder allows the pinsetter to make a detection with pins loaded into the pin holder. Refer to *Figure 1-19*.

(1) CLOSED PIN GRIPPER
(2) PIN RELEASE LEVER
(3) PIN HOLDER
(4) PIN DETECT SWITCH
(5) PIN DETECTOR PLATE
(6) PIN STATION

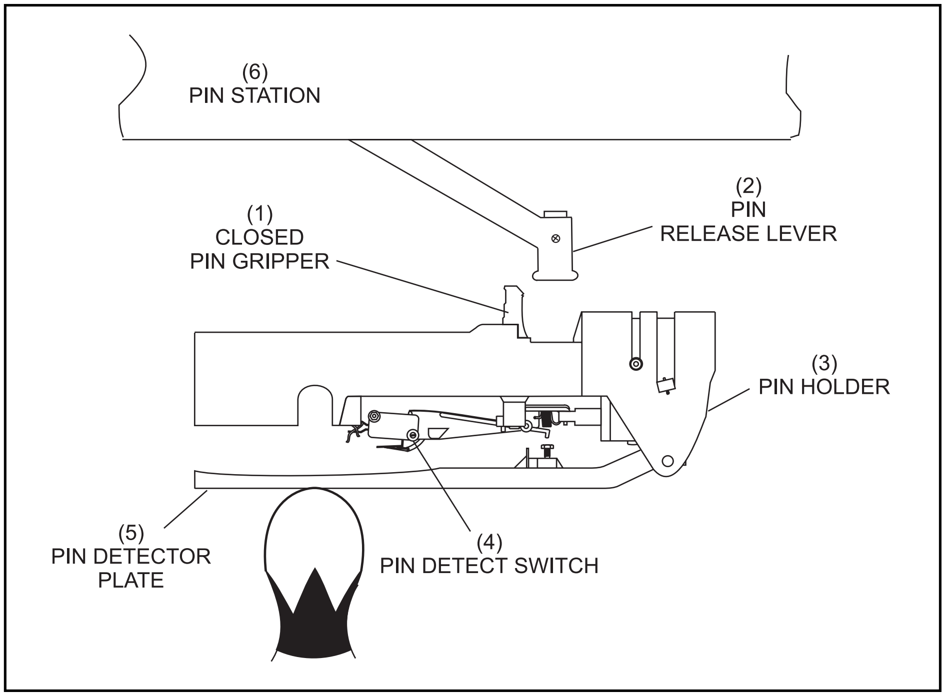

Figure 1-18. Detecting Pins.

(1) PIN RELEASE LEVER
(2) OPEN PIN GRIPPER
(3) PIN HOLDER
(4) SOLENOID ENERGIZED
(5) PIN LOAD SWITCH
(6) PIN DETECT SWITCH
(7) PIN STATION

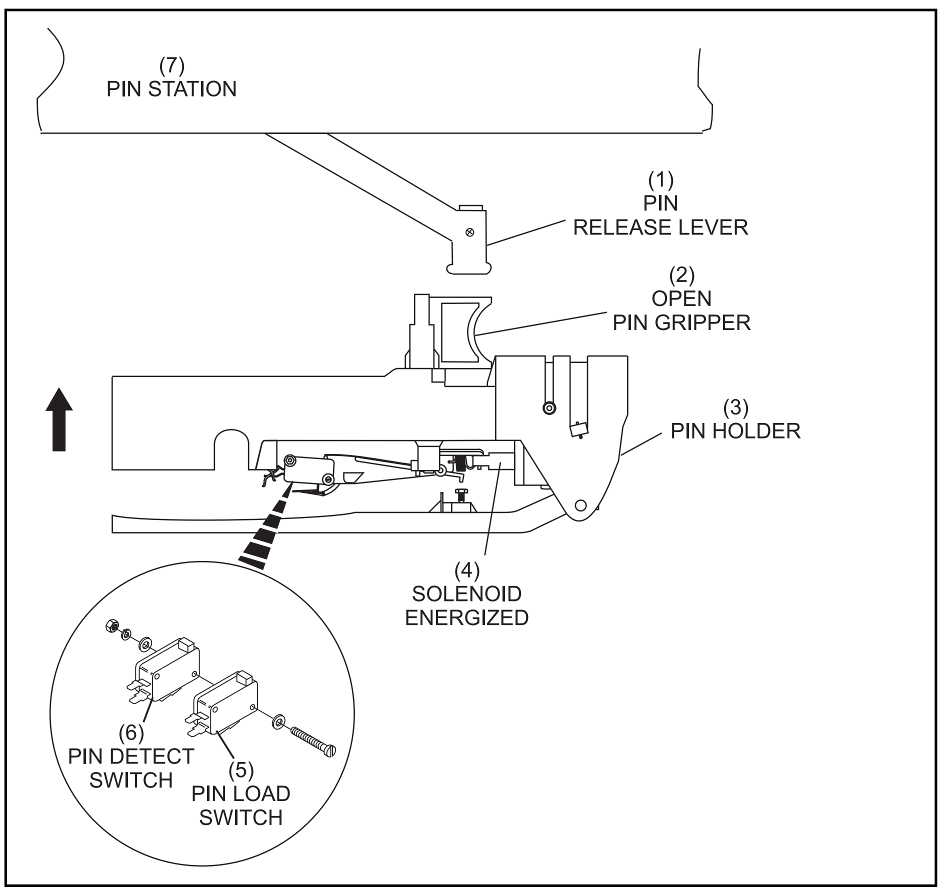

Figure 1-19. Loading Pins.

On the left side of the table is a square shaft and latch assembly. The latch is used to keep the pin holders in the horizontal position when the table is not up in the home position. Refer to *Figure 1-20*. When the table must go all the way down to set new pins, the square shaft is rotated by a stroke limiter solenoid and a large spring mounted on the front swing shaft pulls the pin holders into the vertical position. Refer to *Figure 1-21*. After the pins have been set, a roller on the rear shaft will press against a Table Jam Switch Actuator Arm to overpower the spring on the front swing shaft and rotate the pin holders back to the horizontal position. Refer to *Figure 1-22*. The latch will keep them in this position until the stroke limiter solenoid is energized again.

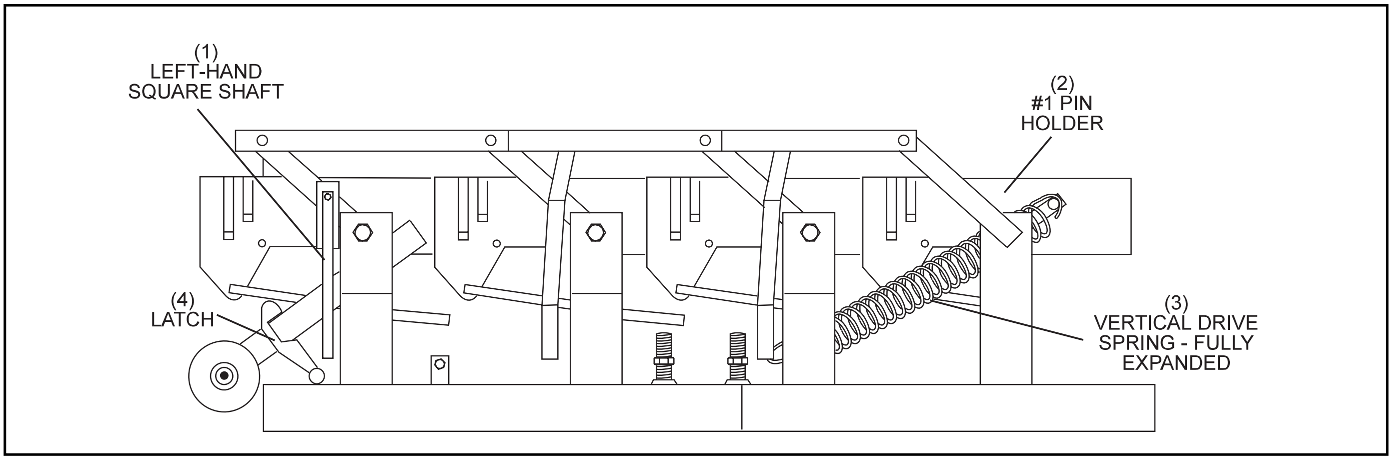

Figure 1-20. Table Up in Loading Pins Position.

(1) LEFT-HAND SQUARE SHAFT (2) #1 PIN HOLDER (3) VERTICAL DRIVE SPRING - FULLY EXPANDED

(4) LATCH

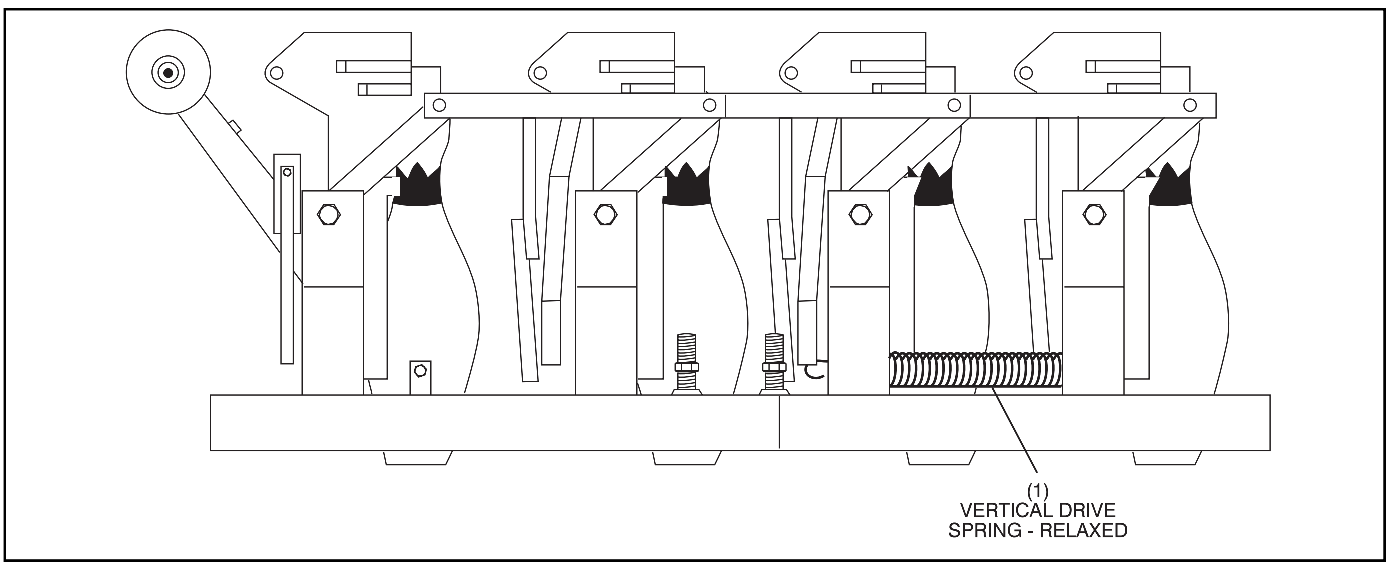

Figure 1-21. Setting New Pins Position.

(1) VERTICAL DRIVE SPRING - RELAXED

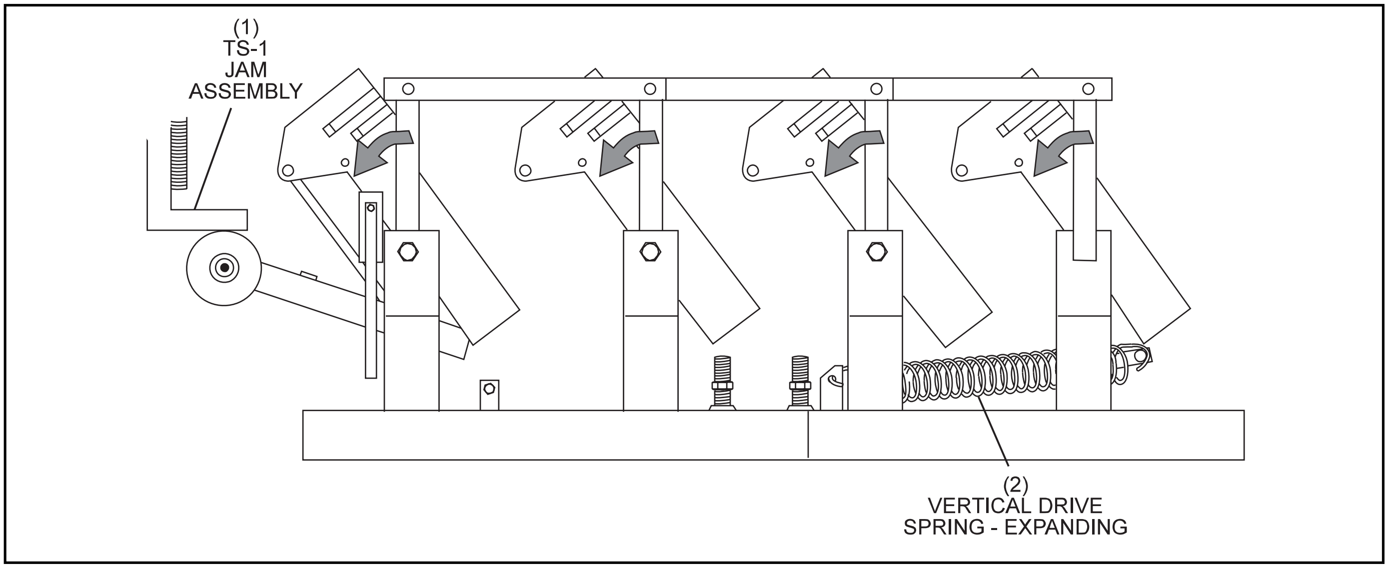

Figure 1-22. Table Raising - Pin Holders Returning to Horizontal Position.

(1) TS-1 JAM ASSEMBLY (2) VERTICAL DRIVE SPRING - EXPANDING

On the right hand side of the table is another square shaft. This square shaft uses a series of gears and toothed racks to drive all ten sets of spotting tongs closed when pins are to be raised for clearing deadwood from the lane. The shaft then turns the opposite direction to reopen the tongs and leave the pins on the lane surface for the next ball. Refer to *Figure 1-23.*

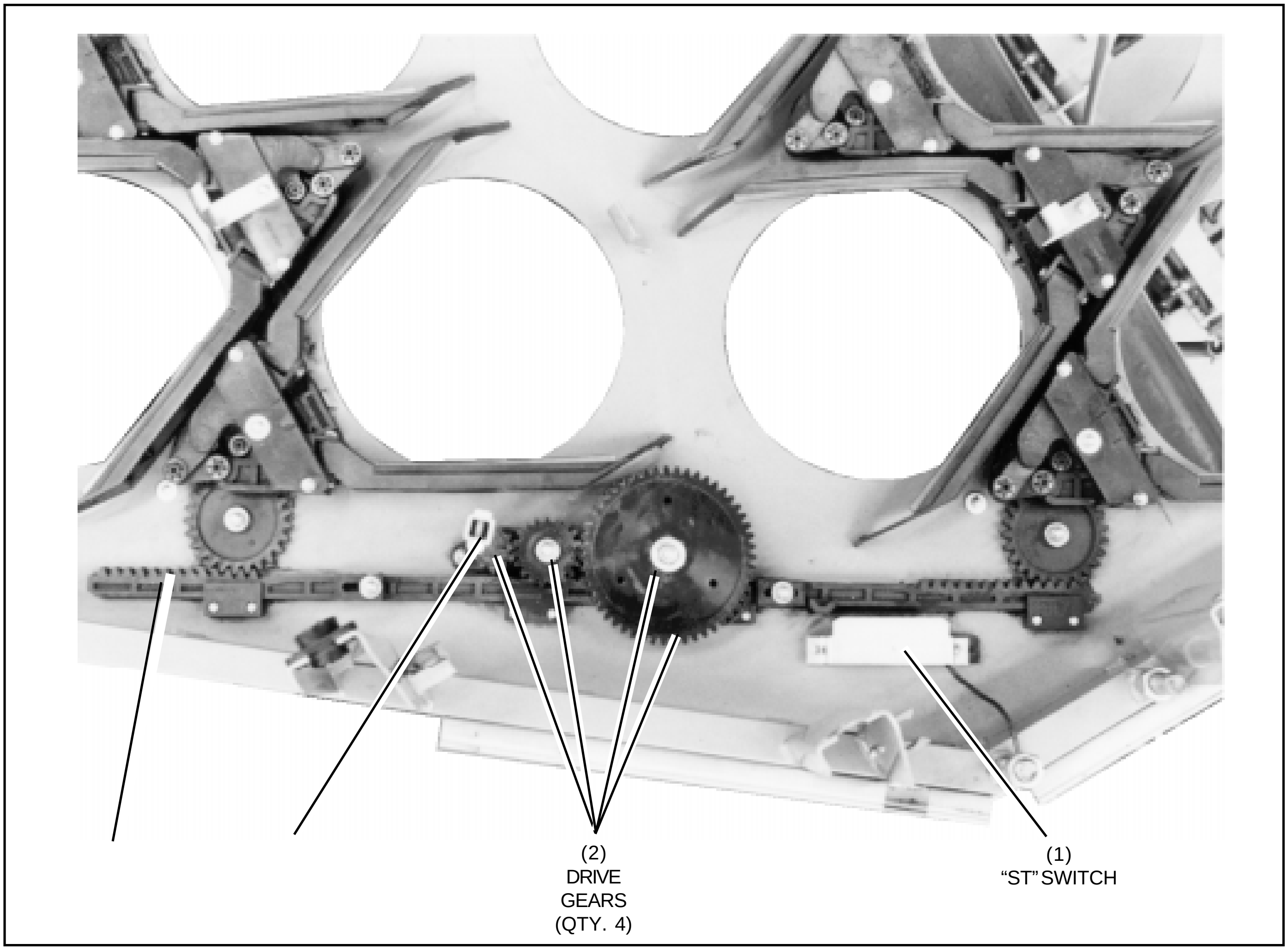

Figure 1-23. Spotting Tong Drive.

(1) "ST" SWITCH
(2) DRIVE GEARS (QUANTITY OF 4)
(3) RIGHT-HAND SQUARE SHAFT
(4) SPOTTING TONG GEAR RACK

The bottom of the setting table has a 9" (229 mm) circular cutout for each pin location. During bowling the pin may be moved off spot but still within the cutout when the table lowers during detection. The spotting tongs are designed to allow them to close on the pin regardless of the current location of the pin. Refer to *Figure 1-24*. When the tongs are closed, the connecting links are driven over center to lock the tongs closed and prevent pins from dropping from the table when raised for clearing deadwood. Refer to *Figure 1-25*.

(1) REAR SPOTTING TONG GEAR RACK
(2) “ST” SWITCH
(3) TONG CLOSED AT RIGHT SIDE
(4) FRONT SPOTTING TONG GEAR RACK
(5) TONGS CLOSED IN CENTER POSITION
(6) SPOTTING TONG GEAR RACK (USED TO CLOSE TONGS)
(7) TONGS CLOSED AT LEFT SIDE

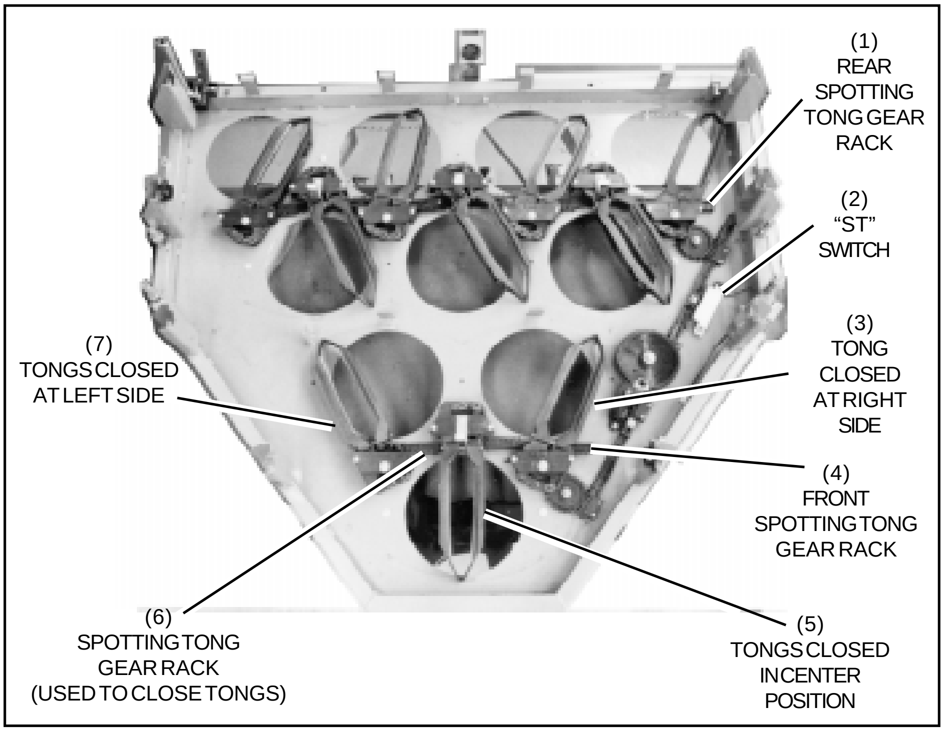

Figure 1-24. Spotting Tong Closing Position.

(1) CONNECTING LINKS IN LOCKED POSITION
(2) SPOTTING TONGS - CLOSED
(3) DAMPER
(4) SPOTTING TONGS - FULLY OPEN
(5) DRIVE GEAR

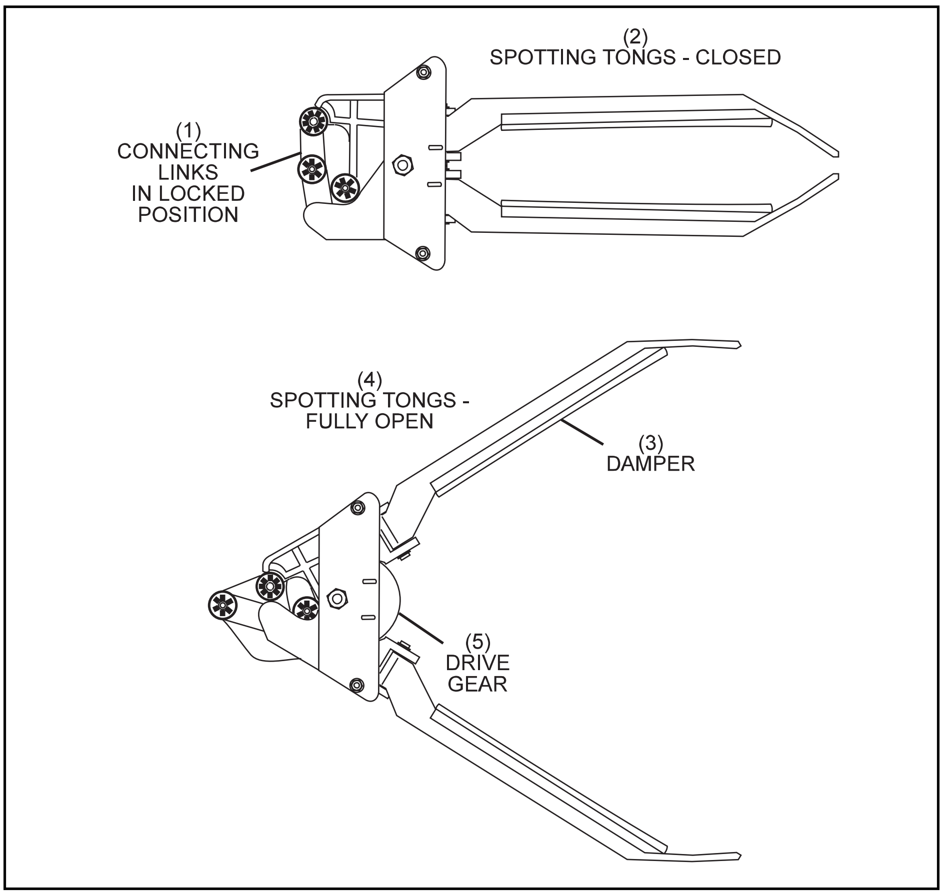

Figure 1-25. Spotting Tongs.

On each side of the setting table is a table rack tube. These are used for guiding the table as it raises and lowers. The right-hand tube has a chain mounted inside attached to it that goes up and over a sprocket mounted on the guide tower and connects to a crank arm mounted onto the main table shaft that is driven by the table motor. Refer to *Figure 1-26*.

The left-hand table rack tube has a “T” stop on the top of it. It stops the lowering of the setting table when it comes in contact with the stroke limiter plate. The table will be lowered only part of the way. This is used for detecting pins and respotting pins. The plate is pulled out of the path of the “T” stop by the stroke limiter solenoid when the table is to be lowered all the way down to the new pin setting height. Refer to *Figure 1-27*.

(1) SPROCKET
(2) TS-2 SWITCH
(3) “OOR” SWITCH
(4) RIGHT-HAND TABLE RACK
(5) TOOTHED RACK
(6) TABLE SHAFT
(7) CRANK ARM
(8) CRANK ARM ADJUSTING SCREWS
(9) CHAIN ADJUSTMENT SCREW
(10) TABLE LIFT CHAIN

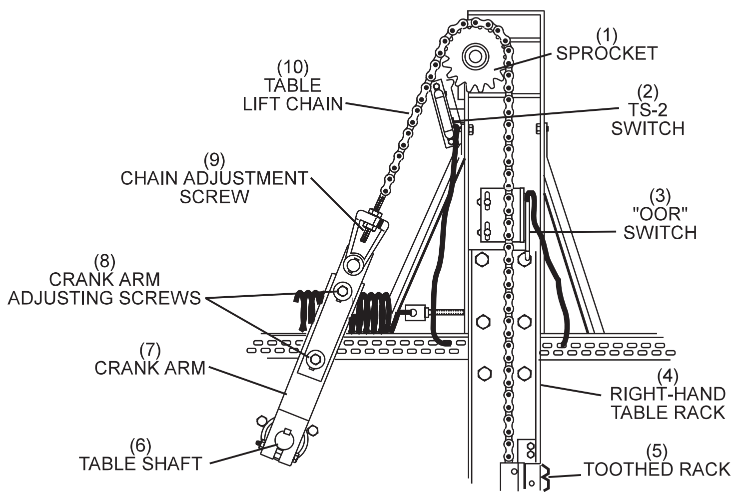

Figure 1-26. Right-Hand Table Rack.

(1) LEFT-HAND SQUARE SHAFT
(2) STROKE LIMITER PLATE
(3) T-STOP
(4) LEFT-HAND TABLE RACK
(5) STROKE LIMITER SOLENOID
(6) STROKE LIMITER SHOCK ABSORBER

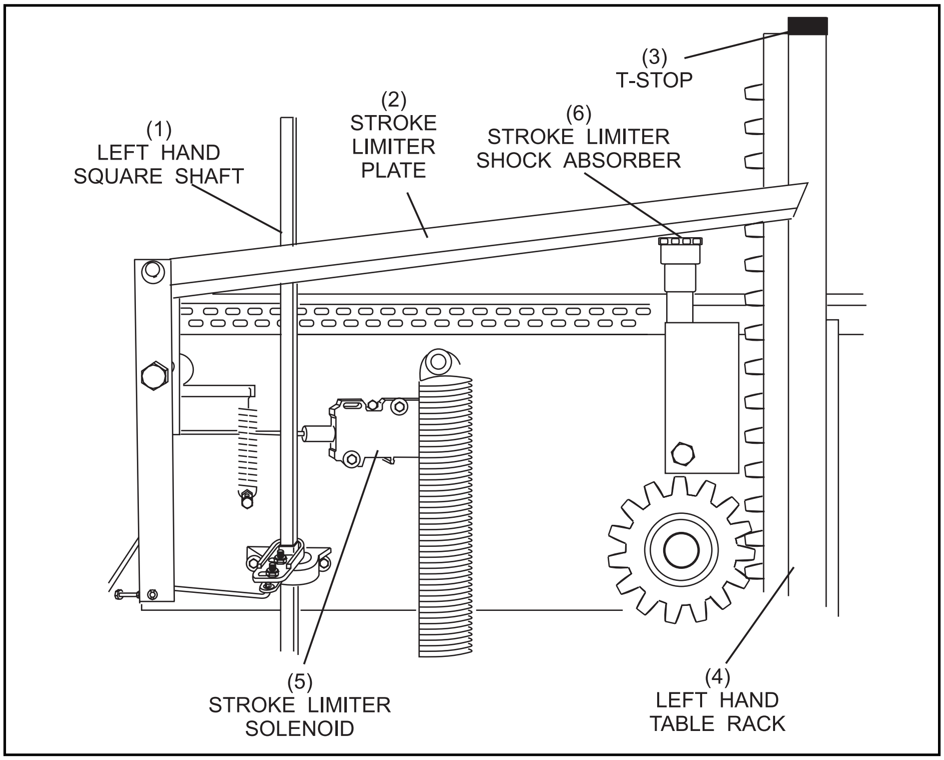

Figure 1-27. Left-Hand Table Rack with "T" Stop.

Sweep Wagon

The sweep wagon assembly has two functions. First, upon ball detect or manual triggering (SET or RESET), the sweep is lowered immediately to prevent pins from rolling forward on the lane and to guard the table as it lowers to detect and set new pins. The second purpose is to sweep any pins that are no longer wanted on the lane.

The sweep wagon is held up by the sweep release assembly. To lower the sweep wagon, the sweep release assembly's solenoid forces the swing lever rearward away from the sweep release arm. A roller bearing on the bottom of the swing lever is pulled away from the tipper which allows the tipper to rotate and let the sweep wagon drop. To control the dropping of the sweep, a sweep attenuator, along with its hydraulic shock absorber, slows the dropping motion until it stops all the way down in the guarding position. Function switch "G" is made by the attenuator when the sweep has lowered completely. Refer to *Figures 1-28* and *1-29.*

(1) SHOCK ABSORBER
(2) "G" SWITCH
(3) TIPPER
(4) SWEEP RELEASE LEVER
(5) SWING LEVER
(6) SWEEP RELEASE SOLENOID
(7) ATTENUATOR

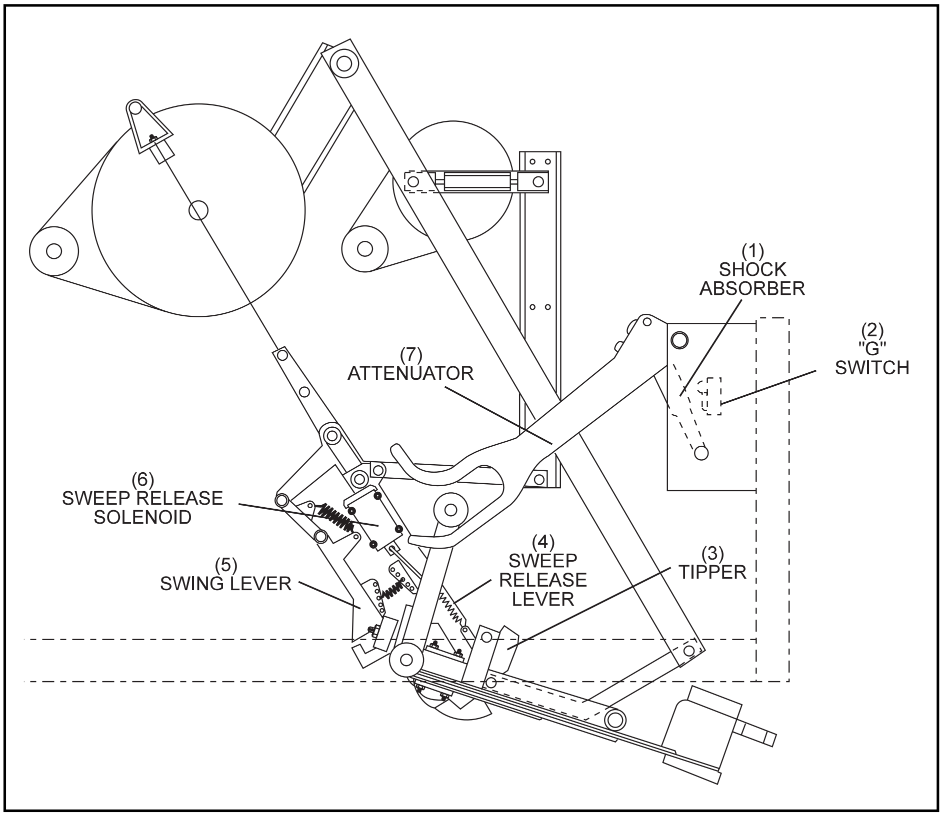

Figure 1-28. Sweep Release - Raised Position.

Once the sweep is down in the guarding position and the setting table is back up after detecting, it is time to sweep the unwanted pins off the lane. To do this, the sweep motor turns the sweep shaft clockwise. This rotates the sweep crank arms and turnbuckles and drives the sweep shaft and arms rearward and then forward. Six guide rollers are mounted on the sweep wagon, four vertically and two horizontally. These rollers assure that the wagon rolls smoothly and squarely rearward and forward in its sweep path. When the cam on the right side crank arm closes the Sweep Motor switch, the sweep motor shuts off and an internal brake prevents the motor from coasting. This allows the sweep to be stopped at the fully forward position. Refer to *Figure 1-30.*

(1) PIVOT POINT
(2) SWEEP SHAFT
(3) SWEEP CRANK
(4) “G” SWITCH
(5) SWEEP ATTENUATOR
(6) VERTICAL GUIDE ROLLERS
(7) PUSHER ROD
(8) FORWARD POSITION
(9) REARWARD POSITION
(10) HORIZONTAL GUIDE ROLLERS

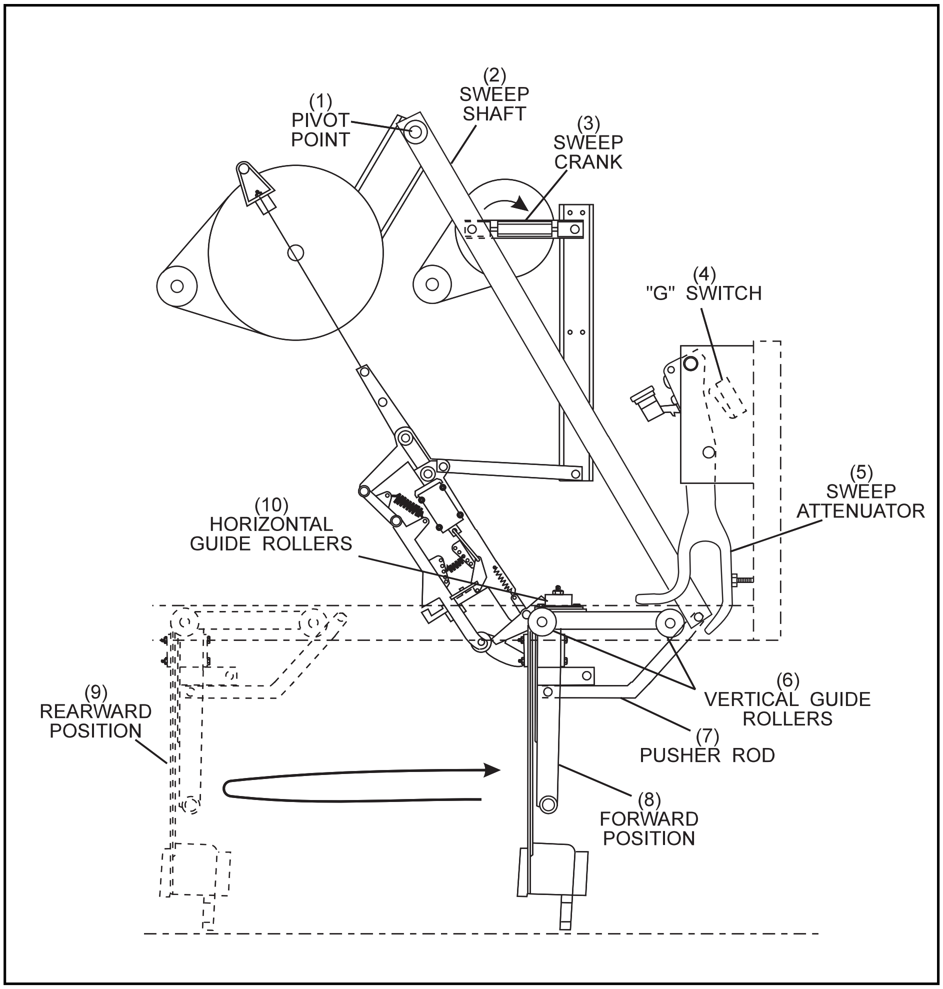

Figure 1-29. Sweep Motion.

(1) TURNBUCKLE
(2) SWEEP SHAFT
(3) CAM
(4) “SM” SWITCH

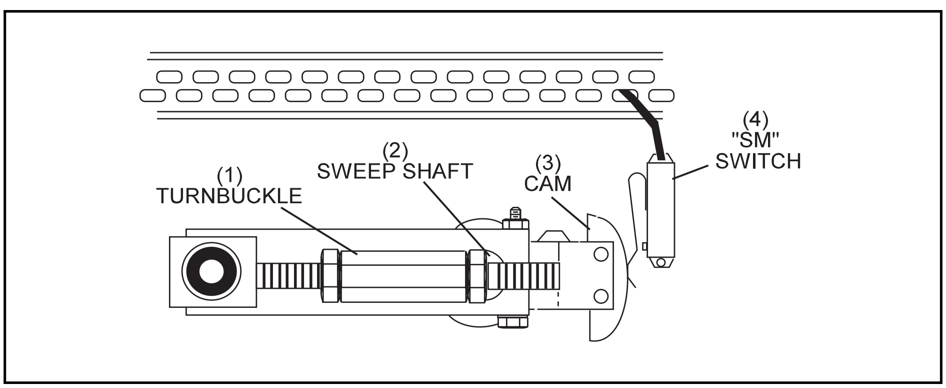

Figure 1-30. SM Switch Closed - Sweep Forward.

Near the end of the cycle, the table motor and sweep release assembly work together with a sweep guide lever to raise the sweep. The table motor runs twice per pinsetter cycle. The first time it runs counterclockwise during the detection stroke. During this time it will be unable to raise the sweep. During the second half of the cycle, the table motor will run clockwise. This will cause it to position the tipper of the sweep release arm under the tipper roller on the sweep wagon and raise the sweep along with the table.

The tipper can only come in contact with the roller when the table motor is turning clockwise. This is because the clevice mounted on the table shaft is positioned on the right side of the shaft when the table is raising on a detection stroke (CCW) but the clevice is on the left hand side during the clockwise rotation. This forces the sweep release arm and tipper under the tipper roller as the table motor is raising the setting table. Refer to *Figures 1-31* and *1-32*.

(1) CLEVICE
(2) PIVOT LINK
(3) TIPPER ROLLER
(4) TIPPER (REARWARD)
(5) TABLE SHAFT

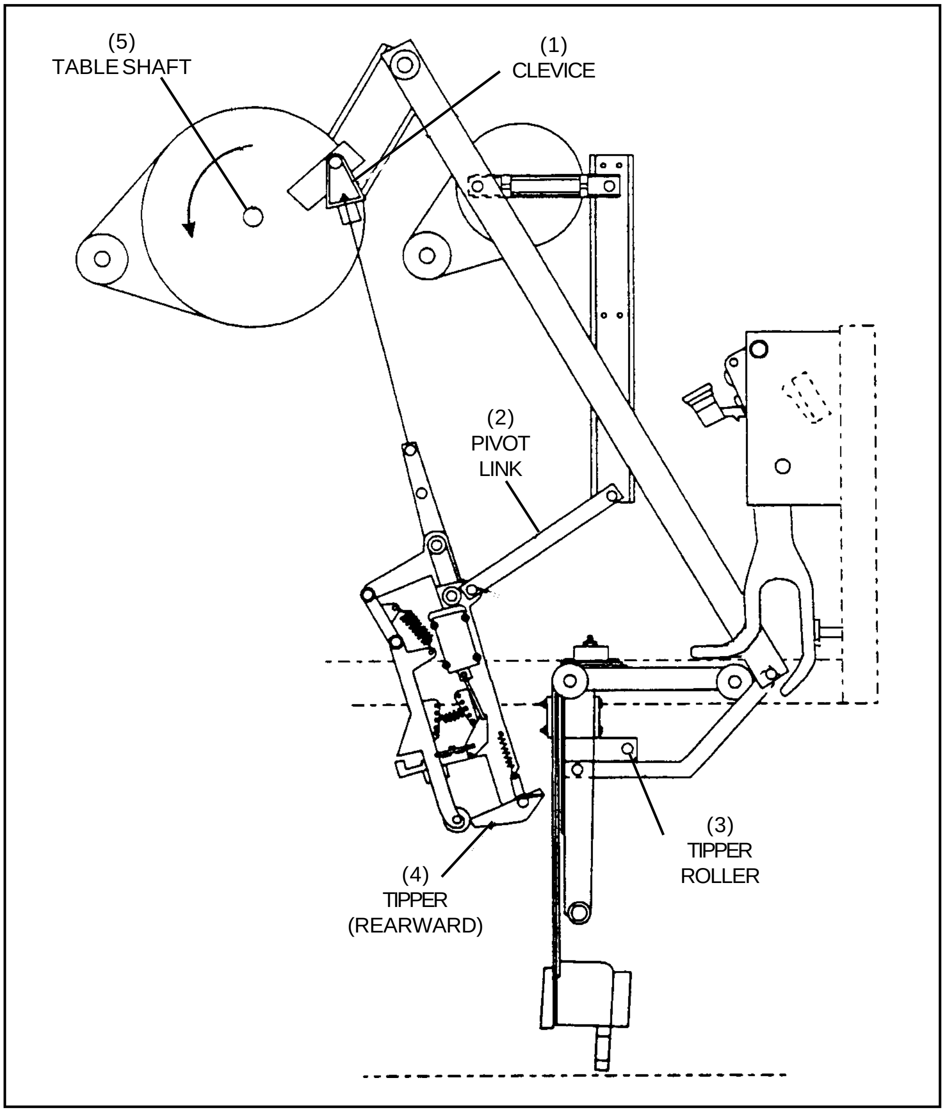

Figure 1-31. Bypassing the Sweep (CCW).

(1) TABLE SHAFT
(2) CLEVICE
(3) PIVOT LINK
(4) PIVOT POINT
(5) TIPPER ROLLER
(6) TIPPER (FORWARD)

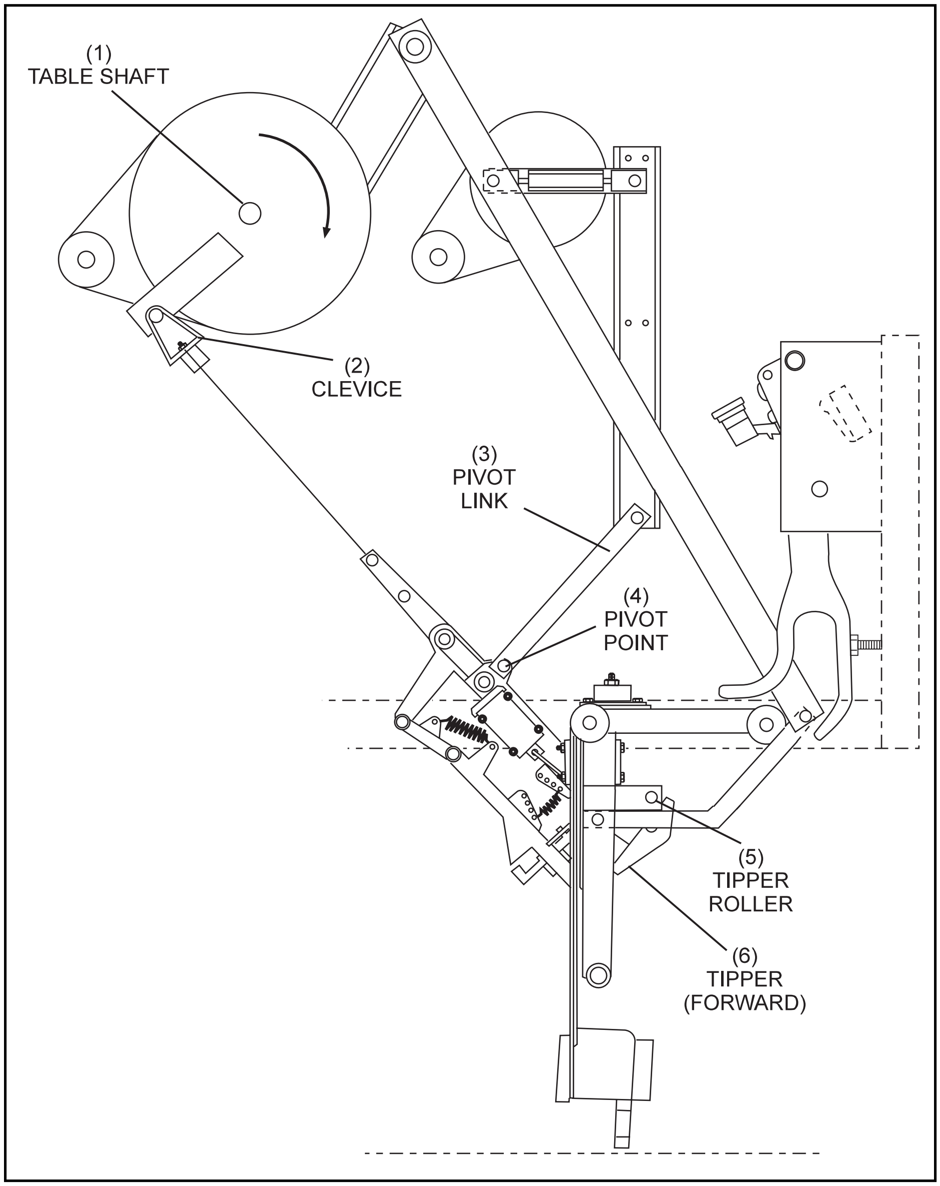

Figure 1-32. Raising the Sweep (CW).

Drive Frame

The left drive frame assembly consists basically of the three pinsetter motors along with their drive systems and the stroke limiter assembly.

The front motor is the distributor motor. It uses a double pulley system to drive the front distributor shaft. This, in turn, drives all the distributor belts, the shark switch assembly, the elevator and the transport band. It will run continuously while handling pins until bowling stops. If no ball is detected within 45 seconds of the last ball detect, the motor will stop and wait. This is to save energy and reduce wear on the pinsetter.

The center motor is the sweep motor. Its only function is to drive the sweep rearward and forward. This motor has a brake that stops the sweep in the forward position and prevents coasting when power is turned off.

The rear motor is the table motor. It raises and lowers the setting table as needed. It also drives counterclockwise and clockwise to close and reopen the spotting tongs and to raise the sweep wagon at the end of a cycle. The motor has an internal brake that locks the motor shaft when the motor is turned off. This holds the table in that position until the motor is turned on again. Normally this will be in the raised position while waiting for a ball.

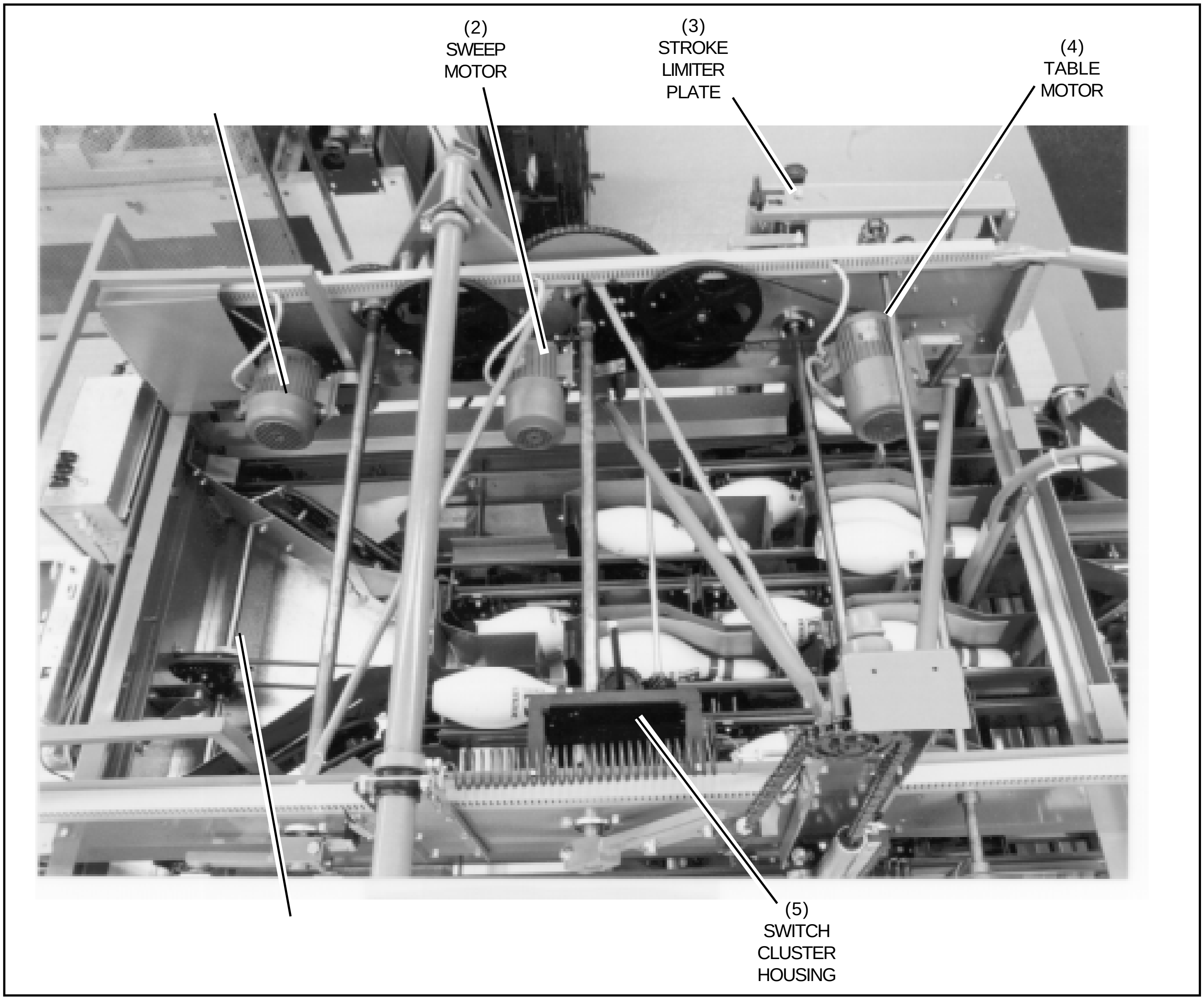

Figure 1-33. Drive Frame Assemblies.

(1) ELEVATOR, TRANSPORT BAND AND DISTRIBUTOR MOTOR
(2) SWEEP MOTOR
(3) STROKE LIMITER PLATE
(4) TABLE MOTOR
(5) SWITCH CLUSTER HOUSING
(6) FRONT DISTRIBUTOR SHAFT

The stroke limiter assembly is used to control whether the table lowers to the detecting height or the new pin setting height. It consists of a stroke limiter plate, a hydraulic shock absorber, a solenoid and a square shaft. The plate and shock absorber are used to control and slow the table's lowering action when it lowers for a short stroke to detect or respot pins for a second ball. The solenoid pulls the stroke limiter plate back out of the path of the "T" stop on the left-hand table rack so the table can lower fully to the new pin setting height. It also rotates the left-hand square shaft to unlatch the swing shafts to allow the pin holders to go vertical and set the pins on the lane.

(1) LEFT-HAND SQUARE SHAFT
(2) STROKE LIMITER PLATE
(3) T-STOP
(4) LEFT-HAND TABLE RACK
(5) STROKE LIMITER SOLENOID
(6) STROKE LIMITER SHOCK ABSORBER

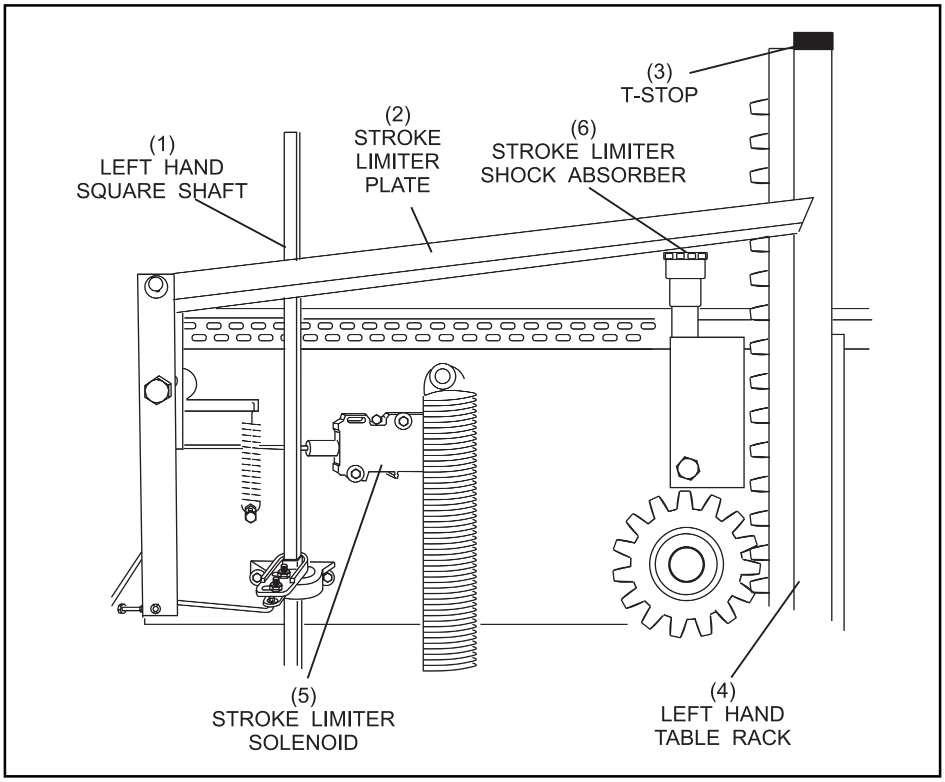

Figure 1-34. Stroke Limiter Assembly.

The right drive frame assembly contains a switch cluster housing and the guide tower assembly.

The switch cluster assembly contains four switches labeled "A","B","C" and "D" that inform the Pinsetter CPU of the setting table height and direction the table motor is turning by monitoring the rotation of the main table shaft.

(1) SWITCH “C”
(2) SWITCH “B”
(3) CAM
(4) SWITCH “A”
(5) TABLE SHAFT
(6) SWITCH “D”

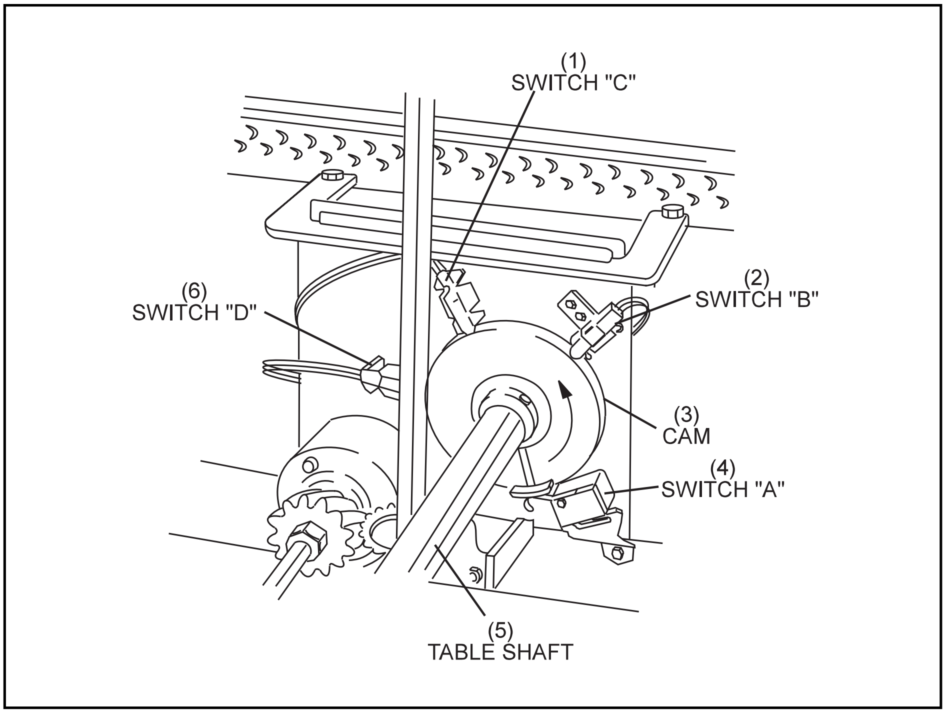

Figure 1-35. Switch Cluster Assembly.

The right-hand guide tower is bolted onto the drive frame. At the top is a sprocket on which the table chain rides as the table is raised and lowered.

(1) SPROCKET
(2) TS-2 SWITCH
(3) “OOR” SWITCH
(4) RIGHT-HAND TABLE RACK
(5) TABLE SHAFT
(6) CRANK ARM
(7) CRANK ARM ADJUSTING SCREWS
(8) TABLE LIFT CHAIN

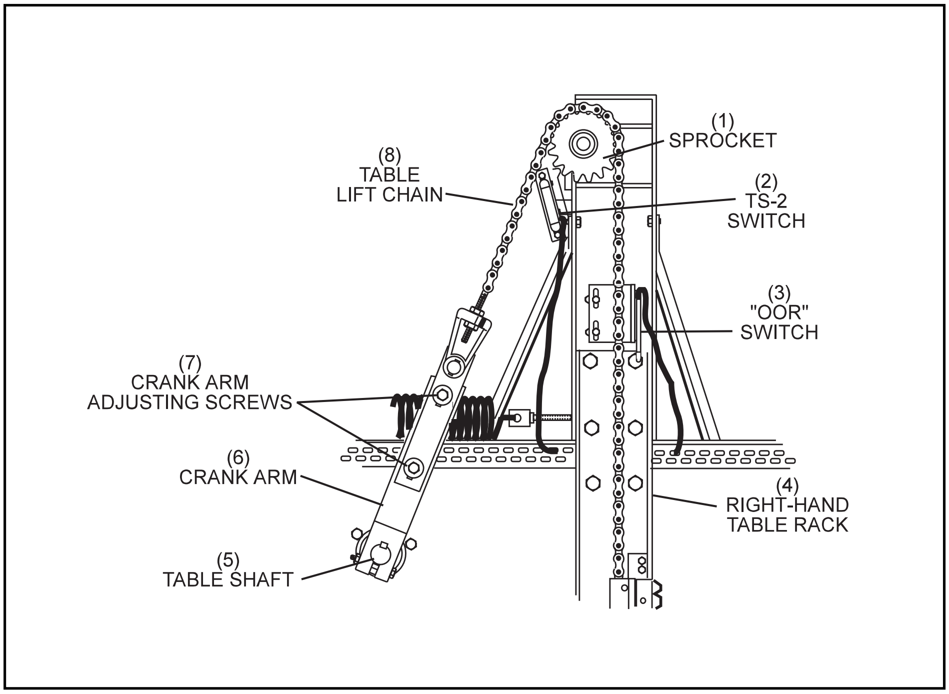

Figure 1-36. Right-Hand Guide Tower Assembly.

Table of Contents

Switches, Solenoids and Motors

The electrical portion on GS-Series pinsetters consists of switches, solenoids and motors.

Switches

The GS-92 contains 24 switches which monitor, protect and help control the pinsetter. Eleven additonal switches were added to the GS-96 and later model pinsetters. Ten were added to the pin holders to allow a standing pin detection while the pin holder has a pin loaded in the top position. Also, a pin count switch was added to monitor pins leaving the elevator assembly.

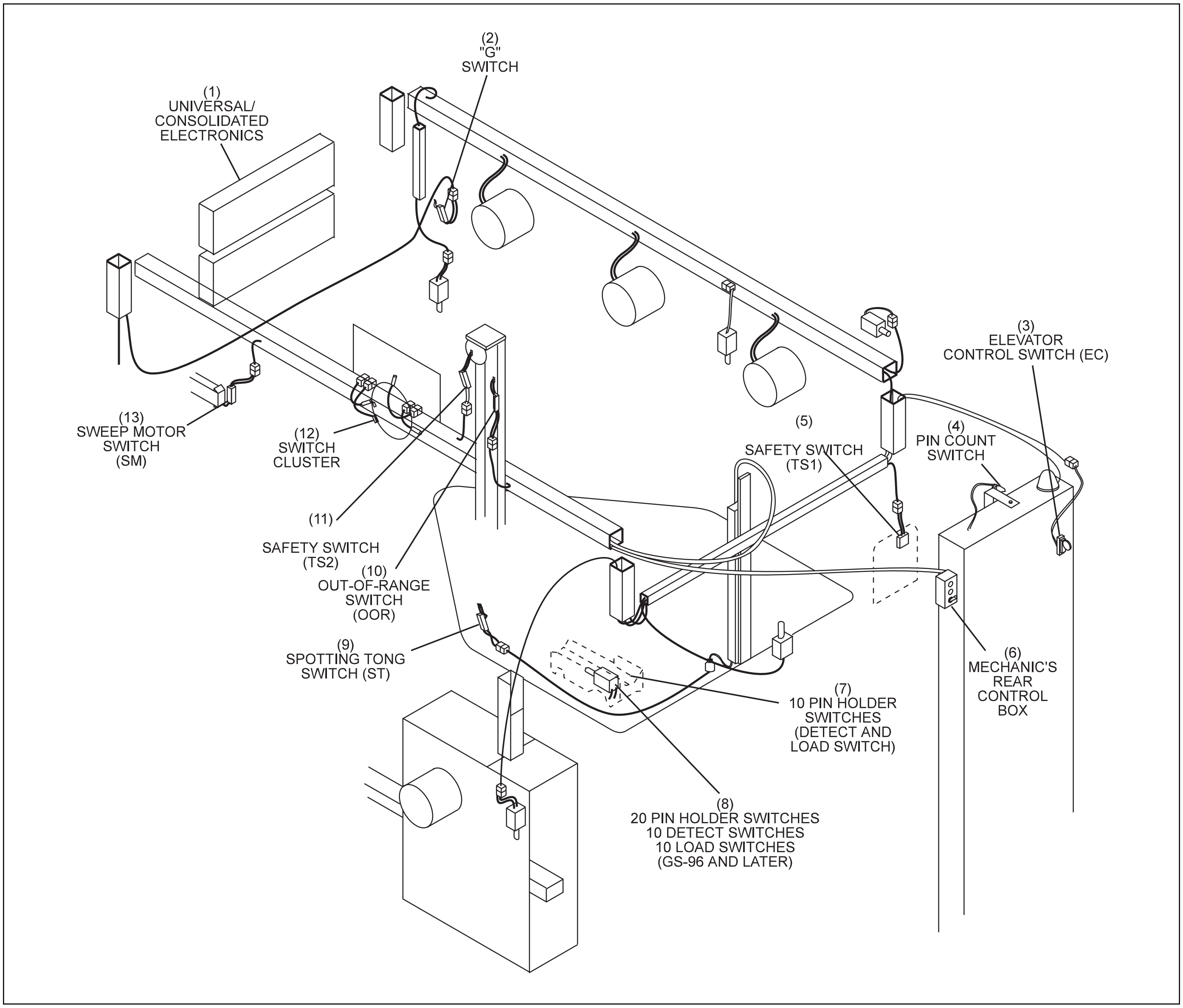

Figure 2-1. Switches.

(1) UNIVERSAL/CONSOLIDATED ELECTRONICS
(2) "G" SWITCH
(3) ELEVATOR CONTROL SWITCH (EC)
(4) PIN COUNT SWITCH
(5) SAFETY SWITCH (TS1)
(6) MECHANIC'S REAR CONTROL BOX
(7) 10 PIN HOLDER SWITCHES (DETECT AND LOAD SWITCH)
(8) 20 PINHOLDER SWITCHES
10 DETECT SWITCHES
10 LOAD SWITCHES
(GS-96 AND LATER)
(9) SPOTTING TONG SWITCH (ST)
(10) OUT-OF-RANGE SWITCH (OOR)
(11) SAFETY SWITCH (TS2)
(12) SWITCH CLUSTER
(13) SWEEP MOTOR (SM)

Switches "A", "B", "C" and "D"

These switches are mounted on a switch cluster housing located on the right frame of the pinsetter. The primary function of the switch cluster is to inform the Pinsetter CPU of the position of the setting table. The "A" switch is a microswitch that is held closed by an actuator when the table is up in the home position. A cam mounted on the main table shaft contains the actuator and a small magnet that will close the contacts in the "B," "C" and "D" switches as the table is being lowered and raised. The cam and actuator are designed to activate these switches from either direction the table motor may be turning (CW or CCW).

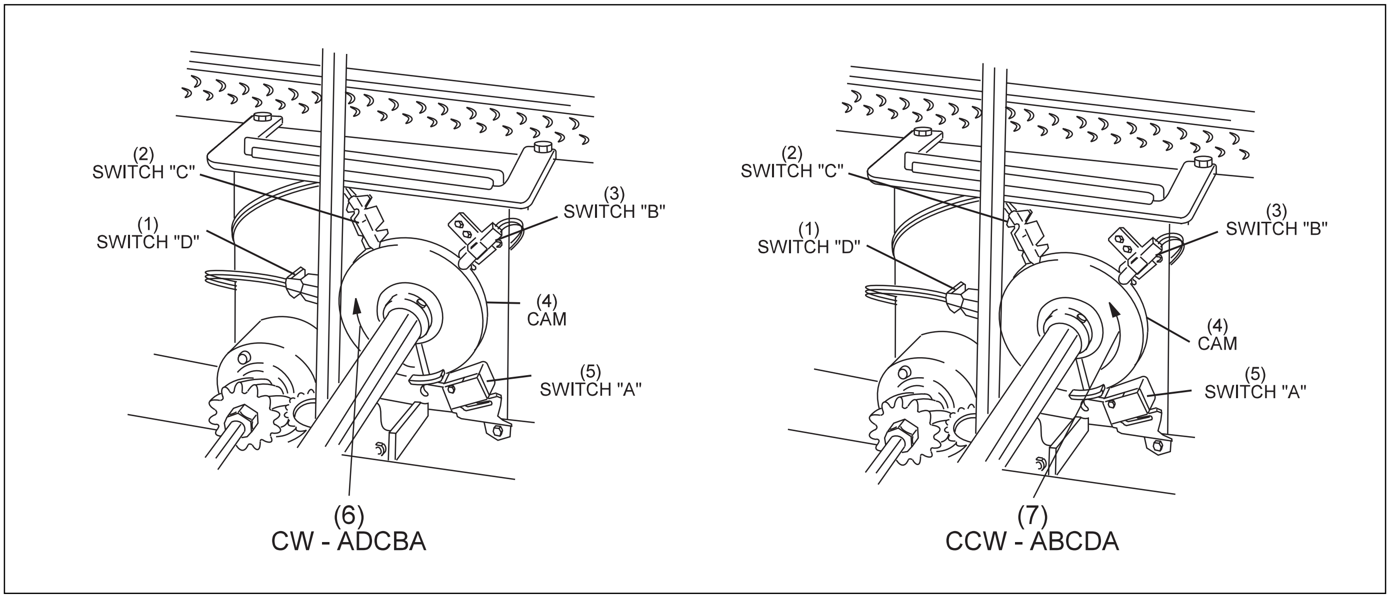

Figure 2-2. Switch Cluster.

(1) SWITCH "D"
(2) SWITCH "C"
(3) SWITCH "B"
(4) CAM
(5) SWITCH "A"
(6) CLOCKWISE - ADCBA
(7) COUNTERCLOCKWISE - ABCDA

Error Code "A" Switch

60	SWITCH A NOT EXPECTED BUT FOUND
70	SWITCH A EXPECTED BUT NOT FOUND
90-95	**INVALID MACHINE STATE**

Error Code "B" Switch

61	SWITCH B NOT EXPECTED BUT FOUND
71	SWITCH B EXPECTED BUT NOT FOUND

Error Code “C” Switch

62	SWITCH C NOT EXPECTED BUT FOUND
72	SWITCH C IS EXPECTED BUT NOT FOUND

Error Code “D” Switch

63	SWITCH D NOT EXPECTED BUT FOUND
73	SWITCH D EXPECTED BUT NOT FOUND

Elevator Control Switch (EC)

This switch is located on the left rear frame of the elevator. It is pulsed by rollers on the pin shovel shaft that pass by the switch as the shovels are moving. This switch must be pulsed at least once every six seconds to keep the pinsetter running. If it is not pulsed in that time frame, the Pinsetter CPU determines that the elevator is either jammed or a drive belt is slipping or some other defect is preventing the switch from being pulsed properly.

(1) SHOVEL DRIVE CHAIN
(2) EC SWITCH
(3) SHOVEL ROLLER

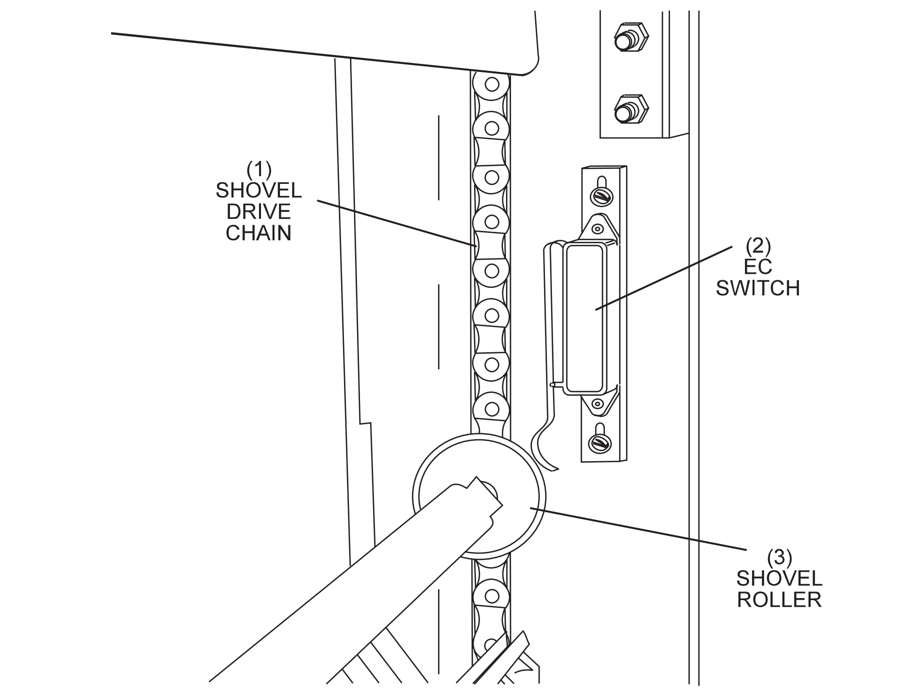

Figure 2-3. Shovel Roller Pulsing EC Switch.

Error Code "EC" Switch

EJ	ELEVATOR JAM

***NOTE:** The masking unit switch in the off position can also create the "EJ" Error Code.*

Switch "G"

This switch is located under the attenuator on the front left side of the pinsetter. This switch is closed by the attenuator when the sweep is all the way down in the guarding position. This switch must be actuated before the table can be lowered.

(1) FREE PLAY WITH SWITCH CLOSED
(2) SWITCH "G"
(3) ADJUSTABLE
(4) SWEEP ATTENUATOR

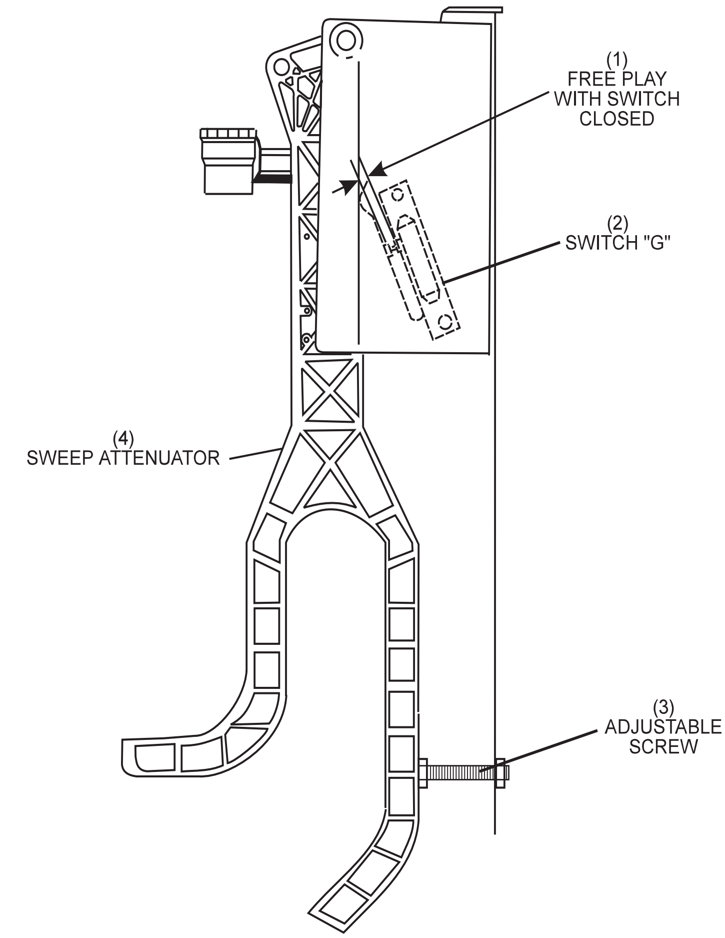

Figure 2-4. Attenuator Down, Closing "G" Switch.

Error Code "G" Switch

65	SWITCH G IS NOT EXPECTED BUT FOUND
75	SWITCH G EXPECTED BUT NOT FOUND
90-95	**INVALID MACHINE STATE**

Mechanic’s Rear Control Switches

A mechanic’s rear control box mounted on the side of the elevator gives the mechanic operational control of the pinsetter. Three switches are located on this box. The first is the “set” switch. Pushing this switch causes the table to lowers on top of the pins, detect those standing and then sweep and set an identical combination of pins. This is useful in troubleshooting and clearing certain conditions where the pin combination must be saved.

The next switch is called the “reset” switch. Pushing this switch will cause the pinsetter to cycle to the next ball.

NOTE: *The reset switch will act like the set switch in league or tournament mode when the pinsetter is connected to Brunswick Frameworx scoring. This is done to keep the pinsetter in sync with the automatic scorer.*

The bottom switch is an on/off toggle switch called the “high voltage stop” switch. This switch gives the mechanic the capability to turn off the machine from the back before entering the machine for service.

These three switches are identical in function to the switches mounted on the top of the universal high voltage or consolidated low voltage box located on the front of the pinsetter.

(1) ON/OFF TOGGLE SWITCH
(2) UNIVERSAL - PLUGS INTO P8 OF HIGH VOLTAGE BOX
(3) CONSOLIDATED - PLUGS INTO P11/P27 OF LOW VOLTAGE BOX

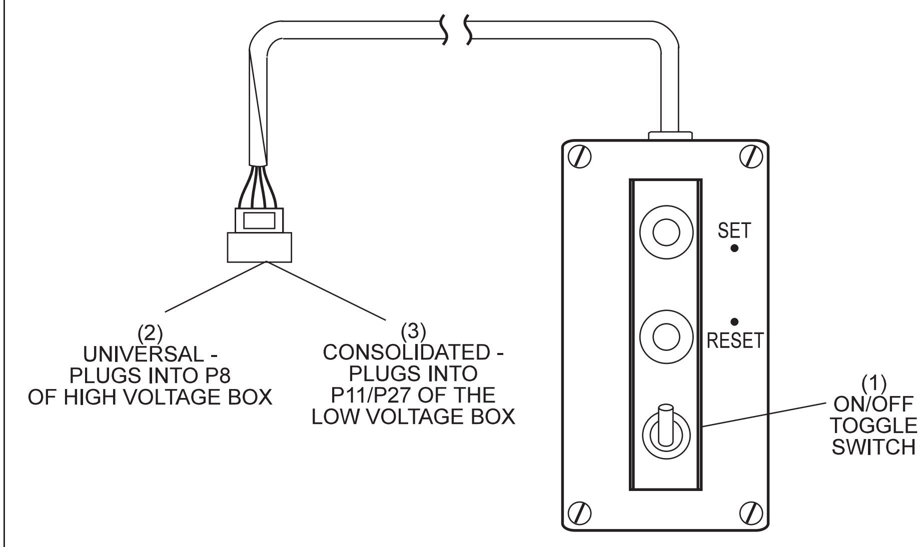

Figure 2-5. Mechanic's Rear Control Box.

Out-Of-Range Switch

This switch is located on the right hand guide tower. The purpose of this switch is to inform the Pinsetter CPU if the table was able to lower to the normal detecting height. If a pin is moved out of range, the table will land on top of the pin and not allow this switch to be closed. The table will complete its detection stroke and the pinsetter will stop. The pinsetter will then have to be turned off, the pin deck area cleared of any deadwood and then the pinsetter will have to be turned on again to resume operation.

NOTE: This switch will be ignored if the pinsetter is connected to Brunswick Frameworx scoring and in an open play mode.

(1) OUT-OF-RANGE CAM
(2) OUT-OF-RANGE SWITCH
(3) RIGHT HAND TOWER ASSEMBLY
(4) RIGHT HAND TABLE RACK & TUBE
(5) TABLE LIFT CHAIN

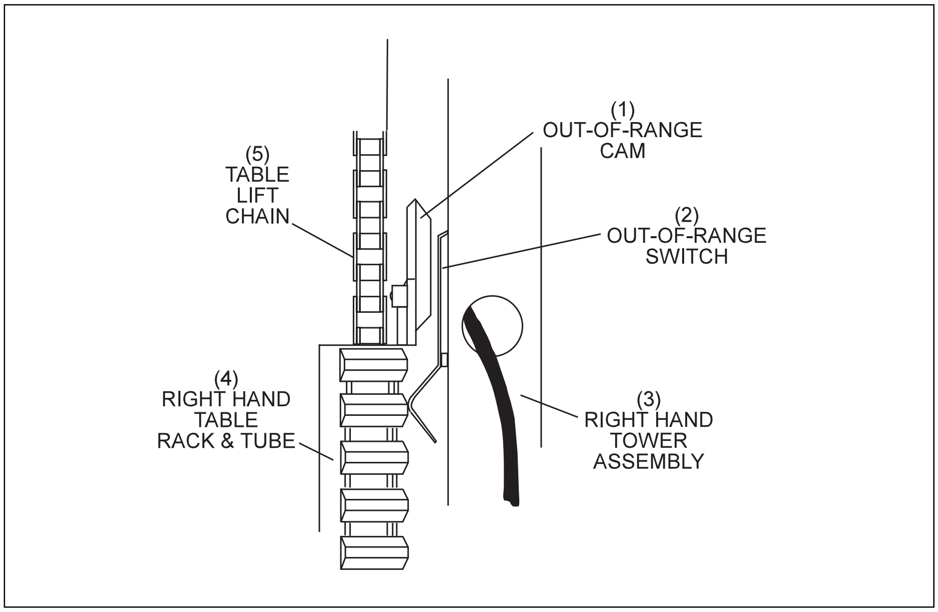

Figure 2-6. Out-Of-Range Switch.

Error Code "OOR" Switch

67	SW. OOR IS NOT EXPECTED BUT FOUND
PO	OUT OF RANGE PIN DETECTED

Pin Holder Switches

GS-92 Pinsetters

The setting table has ten pin holders. Each pin holder has its individual switch that is used for two purposes. First, the switch will be activated by the pin detector plate being pushed up on the lower switch finger by a pin during detection. Refer to *Figure 2-7*. Second, the switch will be activated when a pin is dropped onto the upper switch finger in the pin holder from the pin station. Refer to *Figure 2-8*.

(1) SOLENOID
(2) PIN DETECT AND LOAD SWITCH
(3) PIN DETECTOR PLATE
(4) LOWER SWITCH FINGER

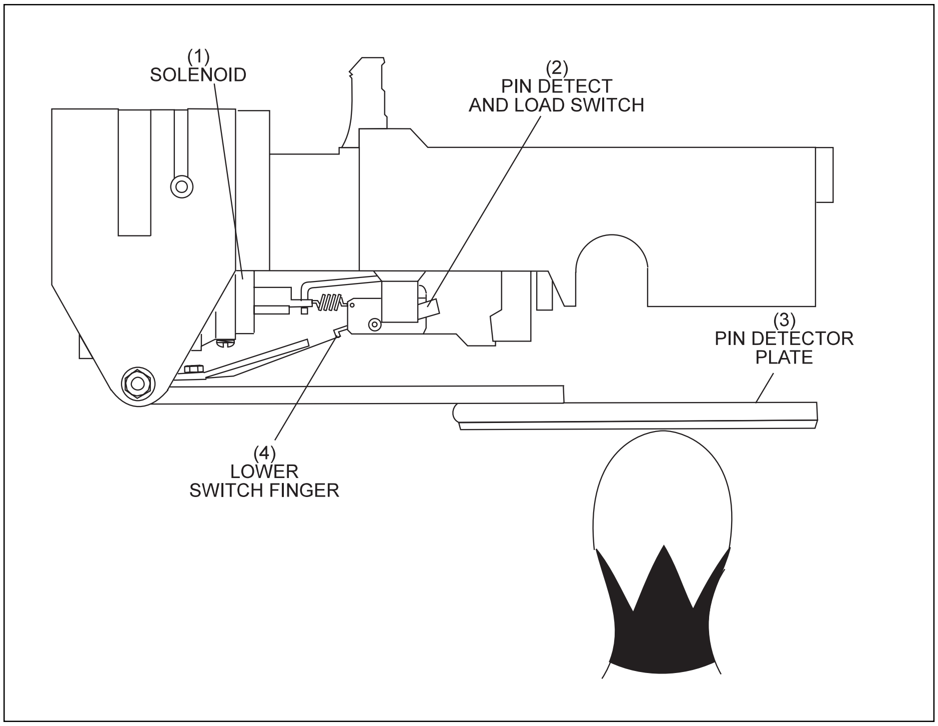

Figure 2-7. Pin Holder Detecting (GS-92)

(1) UPPER SWITCH FINGER
(2) SOLENOID
(3) PIN DETECT AND LOAD SWITCH

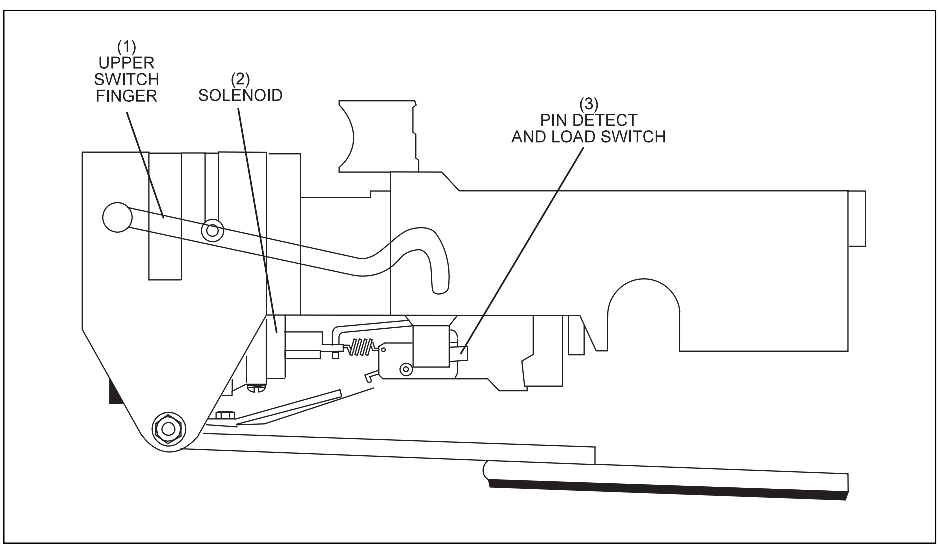

Figure 2-8. Pin Holder Loading (GS-92)

GS-96 and Early GS-98 Pinsetters

Each pin holder has two switches to determine if a pin is loaded or detected.

The load switch is activated from the top by the neck of the bowling pin when it is dropped from the distributor. The bowling pin presses down on the upper switch finger and causes it to activate the load switch's contacts. Refer to *Figures 2-8* and *2-9*.

The detect switch is actuated when a bowling pin, standing on the lane, pushes up on the pin detect plate while the setting table is down and resting on the stroke limiter. A spring loaded bolt from the plate pushes up on the lower switch finger and activates the detect switch. Refer to *Figure 2-10*.

(1) LOAD SWITCH
(2) DETECT SWITCH
(3) LOWER SWITCH FINGER
(4) REAR VIEW OF PIN HOLDER

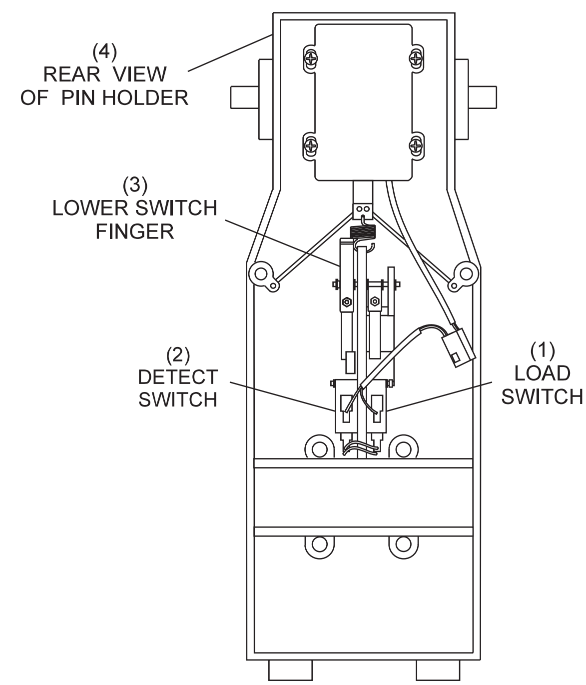

Figure 2-9 Pin Holder Switches (GS-96 and Early GS-98).

The two pinholder switches are wired in a parallel configuration with the commons wired to terminals 1 and 2 of the pin holder connector. The normally closed (NC) and normally open (NO) contacts are cross-wired to the opposite side of the other switch. This allows the Pinsetter CPU to monitor the switches to determine if one, both or none of these switches are closed at predetermined times. Refer to *Figures 2-9* and *2-11*.

When the pinsetter is in a preload or double load condition, the Pinsetter CPU will memorize the pin holder switches' positions as the table starts to lower. As the table reaches the "B" switch position of the detect portion of the cycle, the Pinsetter CPU will look at the pin holder switches again. Any changes that take place will allow the Pinsetter CPU to determine which pins, if any, are standing on the lane surface. The Pinsetter CPU uses this switch information to decide how to finish the cycle and also processes this information to the automatic scorer and player control station.

(1) LOWER SWITCH FINGER
(2) SPRING LOADED BOLT
(3) PIN DETECT SWITCH

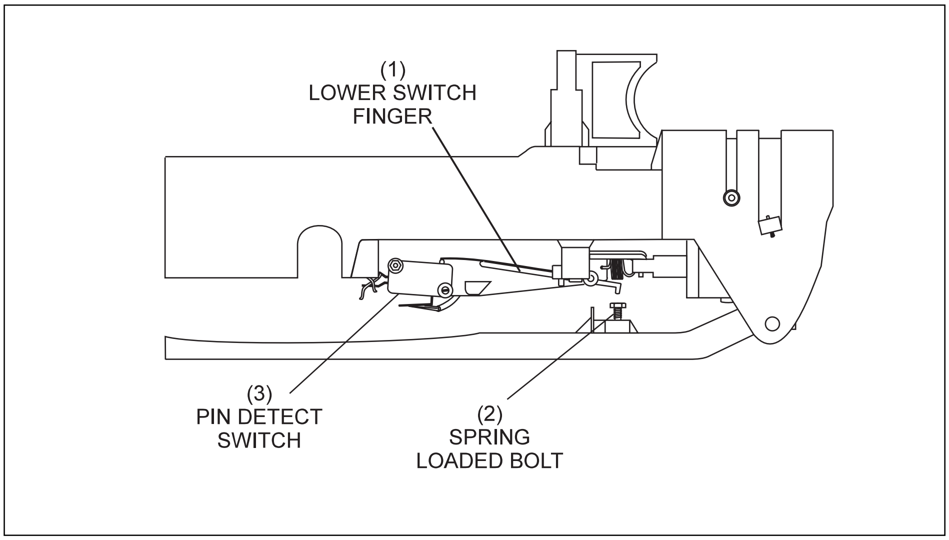

Figure 2-10. Pin Holder Detecting (GS-96 and Early GS-98)

(1) RED SOLENOID COIL
(2) LOAD SWITCH
(3) DETECT SWITCH

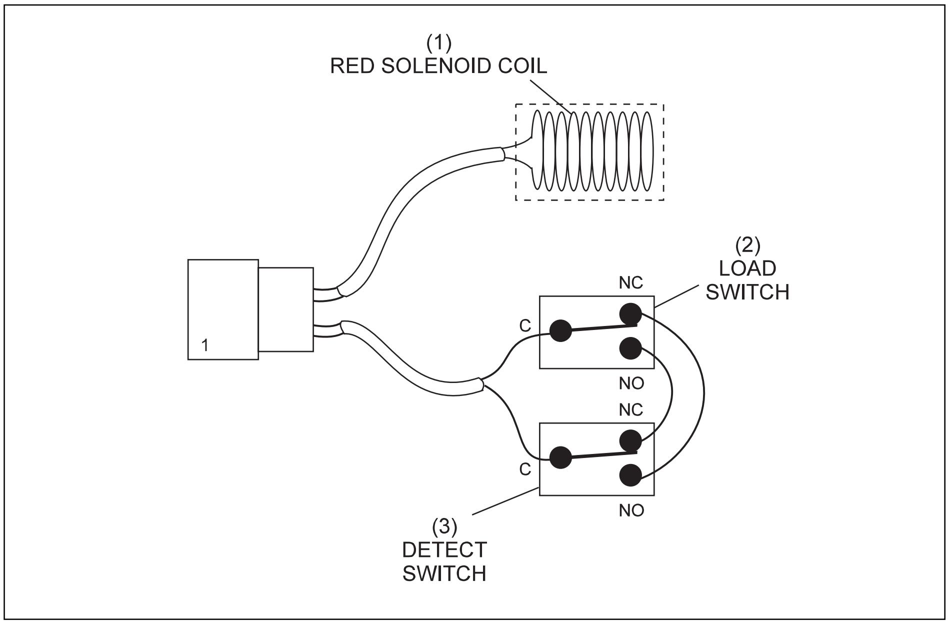

Figure 2-11. Pin Holder Wiring

Error Codes - Pin Loading and Detecting

01-10	PIN LOADING TIME-OUT
50-59	PIN NOT DETECTED IN DIAGNOSTICS

Spotting Tong Switch (ST)

This switch is located on the right side of the setting table. It lets the Pinsetter CPU know if the tongs are open or closed. A small cam on the toothed rack will close this switch when the spotting tongs are open.

(1) RIGHT HAND SQUARE SHAFT
(2) CAM
(3) SPOTTING TONG SWITCH
(4) TOOTHED RACK

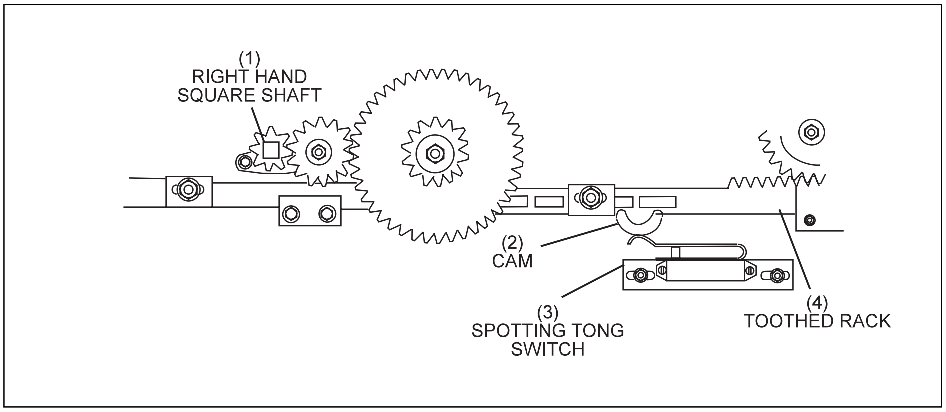

Figure 2-12. ST Switch with Tongs Open.

Error Codes "ST" Switch

66	SWITCH ST NOT EXPECTED BUT FOUND
76	SWITCH ST EXPECTED BUT NOT FOUND
90-95	**INVALID MACHINE STATE**

Sweep Motor Switch (SM)

This switch is mounted on the right side of the pinsetter. A cam mounted on the sweep crank arm will close this switch when the sweep wagon is all the way forward. Activating this switch will turn the sweep motor off and allow the brake to stop the sweep before the table can be lowered.

(1) RIGHT HAND SWEEP CRANK ARM
(2) SWEEP SHAFT
(3) CAM
(4) SM SWITCH

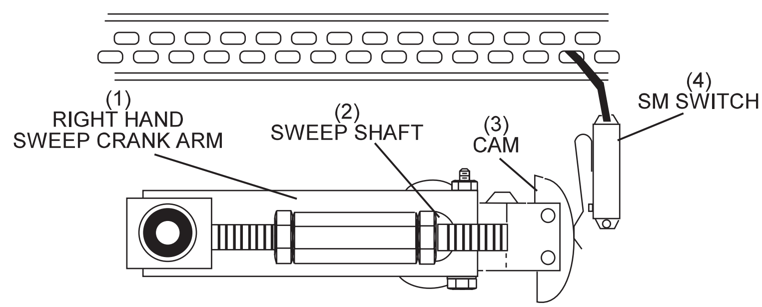

Figure 2-13. SM Switch.

Error Codes "SM" Switch

64	SWITCH SM NOT EXPECTED BUT FOUND
74	SWITCH SM EXPECTED BUT NOT FOUND
90-95	**INVALID MACHINE STATE**

TS-1 Switch

This table safety switch is mounted on the back left side of the pinsetter frame. It is a jam switch that is activated only when the pin holders are unable to return to the horizontal position after setting new pins. A roller on the rear swing shaft of the setting table must overpower a spring tensioned table jam switch actuator arm to close this switch. Any time this switch is closed, the pinsetter will stop immediately. It will not restart until the problem has been corrected and the switch reopened.

CAUTION: On pinsetters with upgraded software, the table motor will reverse the table for 1.5 seconds or until the "C" switch is closed. An error code "J1" will appear on the LED display on top of the Gamesetter or Consolidated Low Voltage box. The trouble light will continue to flash.

Once the jam has been cleared, turn the on/off switch on the High Voltage box or on the Consolidated Low Voltage box off and then back on again.

(1) TS-1 SWITCH
(2) PIN HOLDER
(3) REAR SWING SHAFT
(4) ROLLER
(5) ACTUATOR ARM

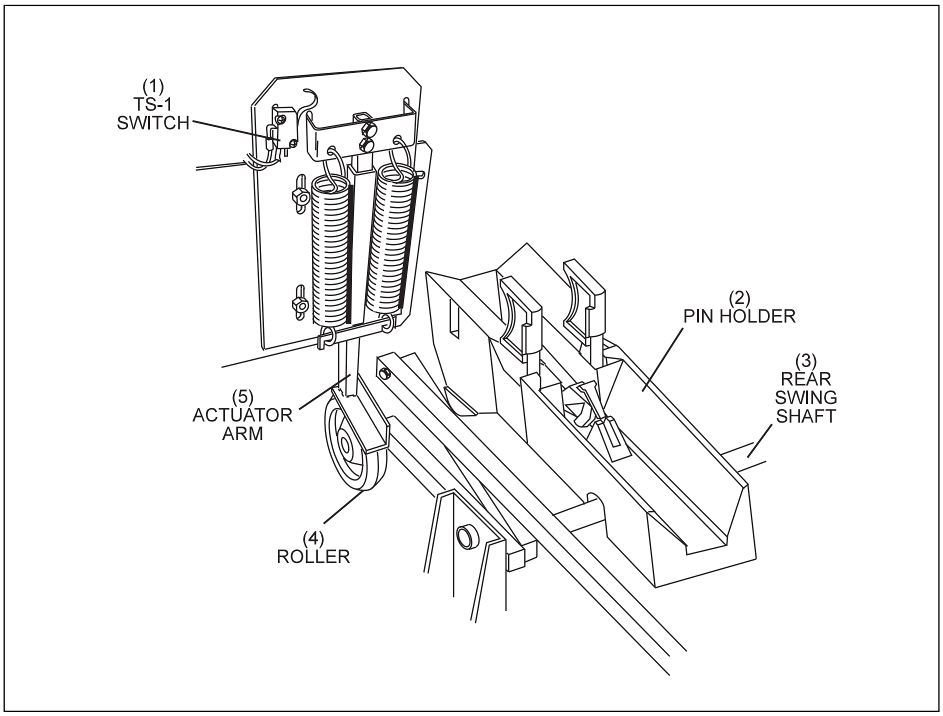

Figure 2-14. TS-1 Switch.

TS-2 Switch

This table safety switch is mounted on the top of the table guide tower. This is a jam switch that is activated only when the table is not able to return to its up home position. When a pin or broken part becomes wedged between the top of the setting table and the bottom of the distributor, the table stops rising. The table motor is still trying to raise the table until switch "A" is actuated. At this point, the chain applies pressure to the sprocket and sprocket shaft which overpowers the large tension spring and closes the contacts on the TS-2 switch. The pinsetter shuts off immediately to prevent any damage to the pinsetter. The problem must be taken care of before the switch will reopen and allow the pinsetter to restart.

CAUTION: On pinsetters with upgraded software, the table motor will reverse the table for 1.5 seconds or until the "C" switch is closed. An error code "J2" will appear on the LED display on top of the Gamesetter or Consolidated Low Voltage box. The trouble light will continue to flash.

Once the jam has been cleared, turn the on/off switch on the High Voltage box or on the Consolidated Low Voltage box off and then back on again.

(1) SPROCKET
(2) TABLE LIFT CHAIN
(3) COUNTERWEIGHT INSIDE TABLE RACK TUBE
(4) TENSION SPRING
(5) TS2 SWITCH

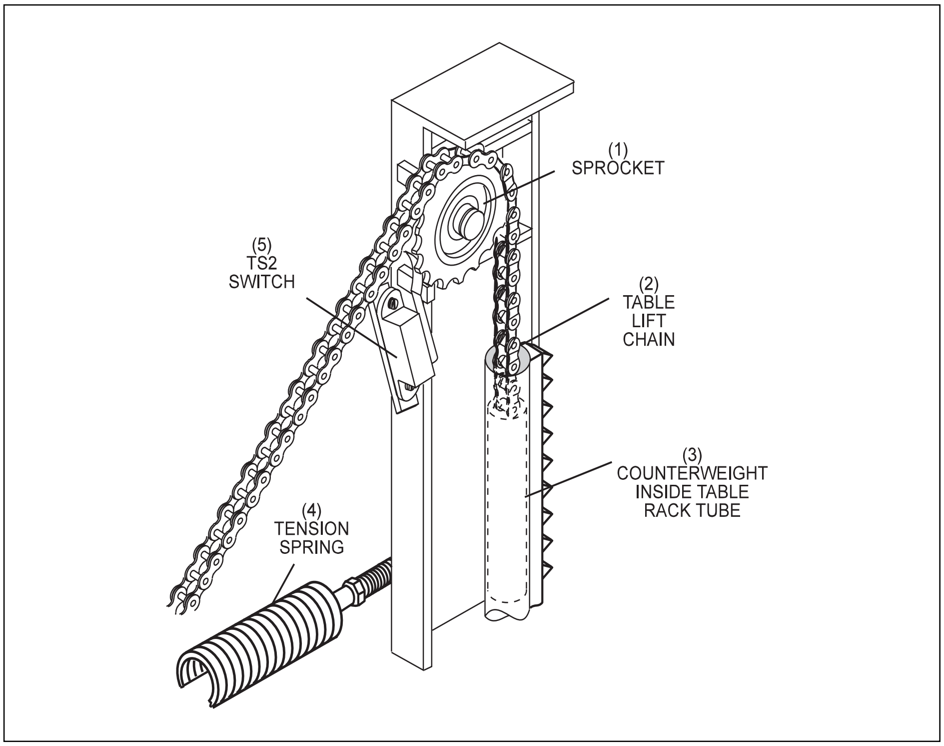

Figure 2-15. TS-2 Switch.

Error Code

J2	JAM SWITCH TS2 (TOWER)

Pin Count Switch

GS-96 and Later Pinsetters

This switch is mounted on the top of the Elevator. The switch is actuated to count each pin as the bowling pin leaves the pin shovel and lands onto the pin guide wedges of the shark switch assembly. This switch information is used to determine which distributor lane the pin should enter to find an empty pin station.

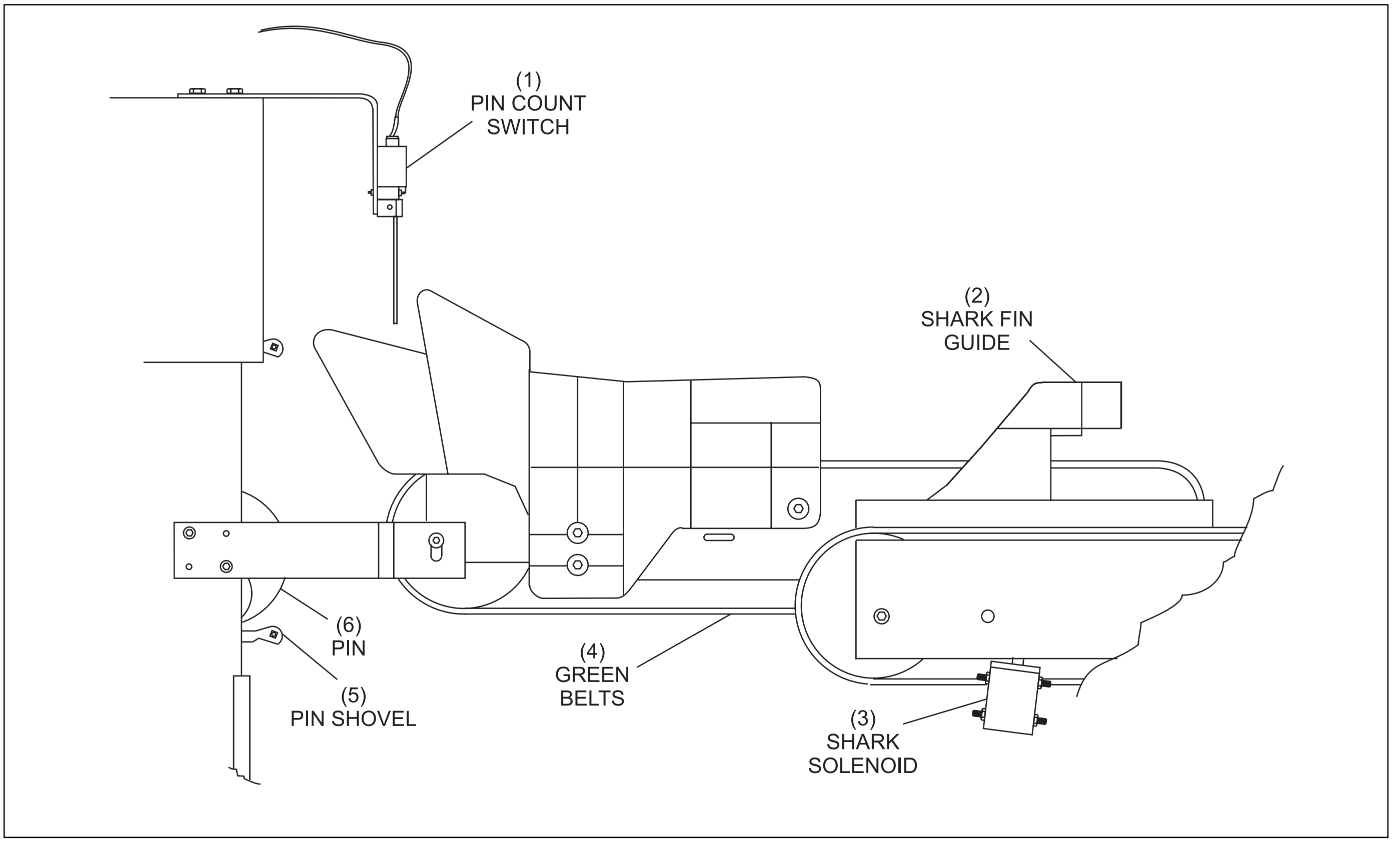

Figure 2-16. Pin Count Switch and Shark Solenoid (GS-96s and Later)

(1) PIN COUNT SWITCH	(2) SHARK FIN GUIDE	(3) SHARK SOLENOID
(4) GREEN BELTS	(5) PIN SHOVEL	(6) PIN

Error Code

EL	PIN COUNT SWITCH SHORTED FOR AT LEAST 5 SECONDS

Solenoids

There are two types of solenoids used on the GS-Series pinsetter. There are four function solenoids that are black in color and are intermittent duty type solenoids. This type of solenoid is pulsed only for a brief amount of time. There are ten pin holder solenoids and one shark solenoid that are red in color and are continuous duty type solenoids. This type of solenoid can be energized for 90 seconds at a time when waiting for a pin, if necessary.

NOTE: *When working properly, the black function solenoid coils will have 12 ohms of resistance while the red solenoid coils will have 26 ohms of resistance.*

When troubleshooting solenoids, a reading on the multi-meter of 0 ohms indicates that the solenoid has shorted out and is defective. A reading of infinity (no reading) indicates that the coil is opened and defective.

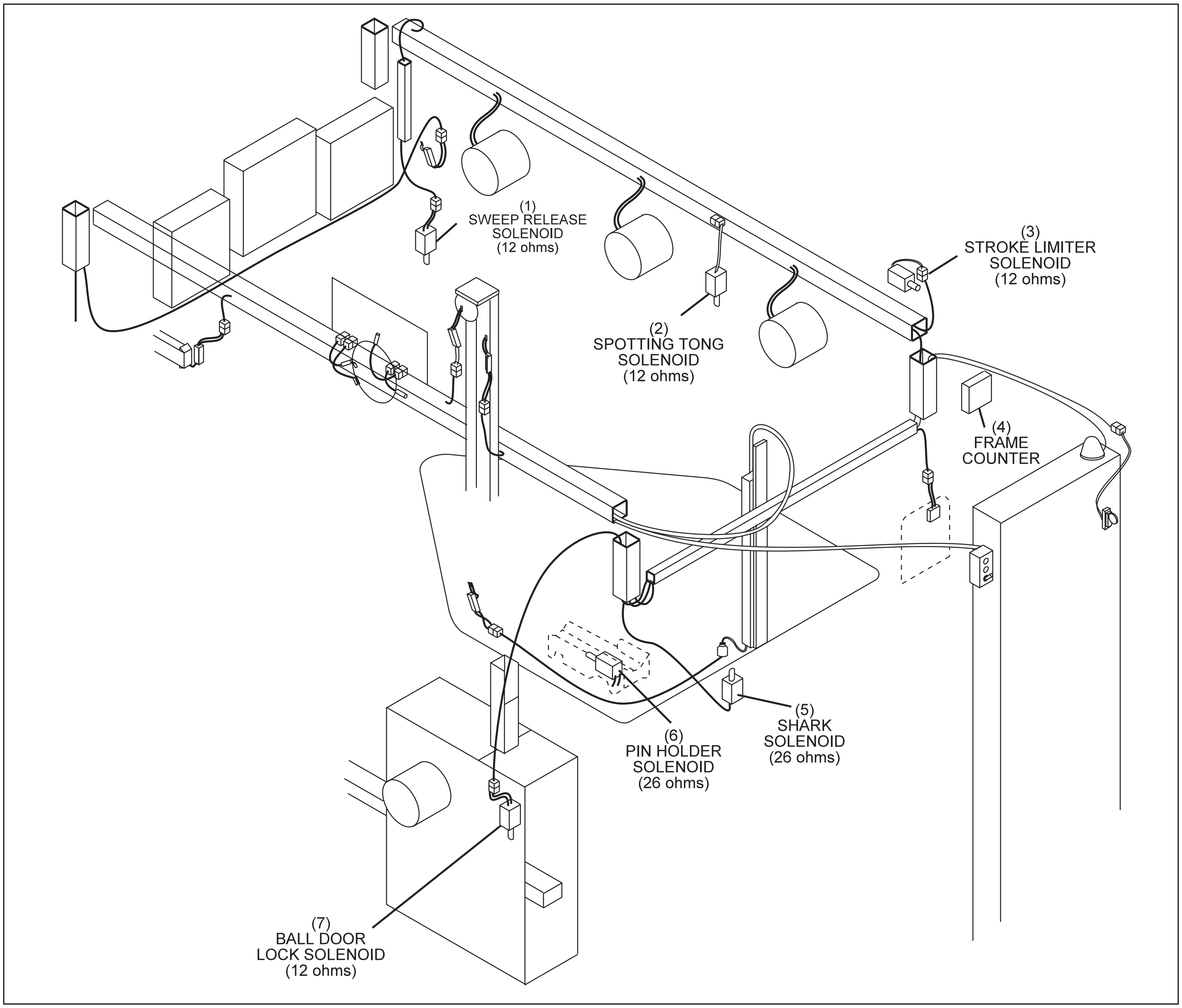

Figure 2-17. Solenoids.

(1) SWEEP RELEASE SOLENOID (12 ohms)	(2) SPOTTING TONG SOLENOID (12 ohms)	(3) STROKE LIMITER SOLENOID (12 ohms)
(4) FRAME COUNTER	(5) SHARK SOLENOID (26 ohms)	(6) PIN HOLDER SOLENOID (26 ohms)
(7) BALL DOOR LOCK SOLENOID (12 ohms)		

Ball Door Solenoid

The ball door solenoid locks the ball door for three seconds upon ball detect. This is to prevent pins from entering the ball accelerator during the ball impact by forcing the locking bolt down to block the door button lever.

(1) BALL DOOR LOCKING SOLENOIDS
(2) LOCKING BOLT
(3) DOOR CLOSING SPRING
(4) BUTTON
(5) LEVER

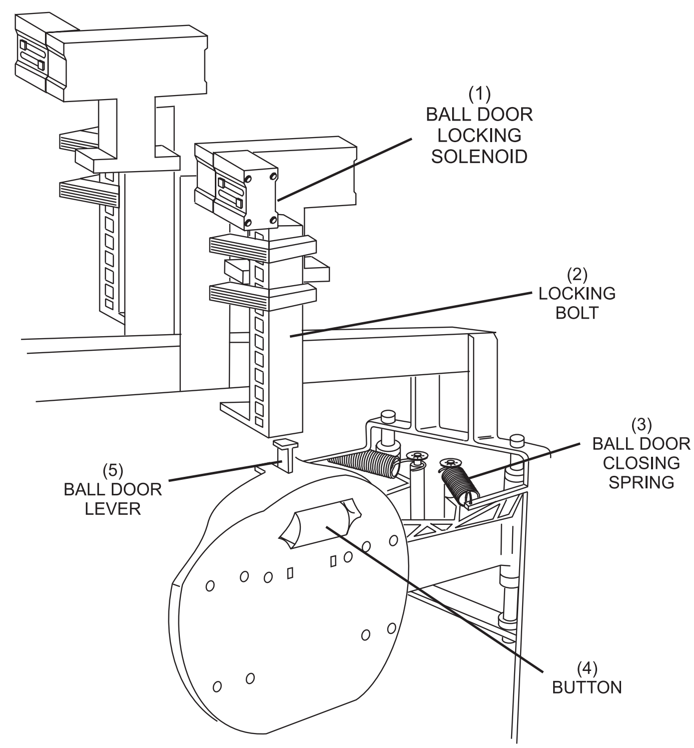

Figure 2-18. Ball Door Solenoid.

Sweep Release Solenoid

The purpose of the sweep release solenoid is to actuate the sweep release mechanism. This allows the sweep wagon to lower from its up home position to the guarding position. It is energized immediately when a ball passes through the ball detector's beam or someone presses a "set" or "reset" button.

(1) ATTENUATOR
(2) "G" SWITCH
(3) SWEEP WAGON
(4) SWEEP RELEASE SOLENOID

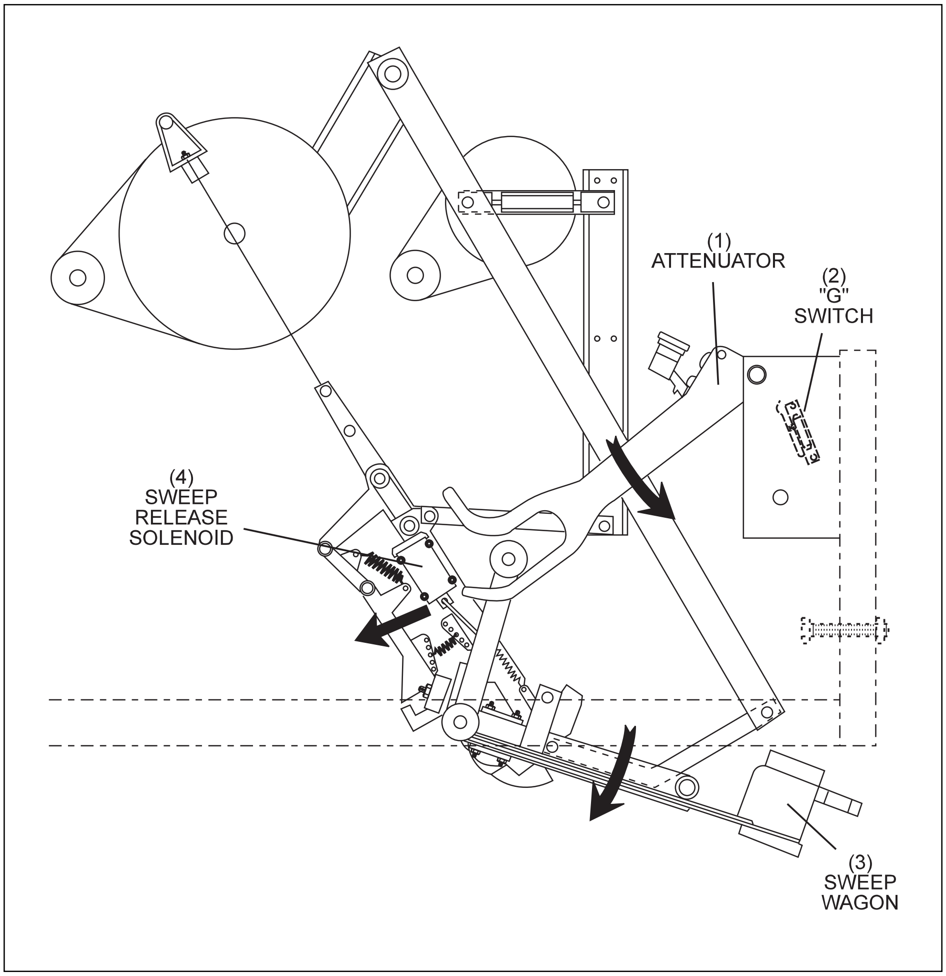

Figure 2-19. Sweep Release Solenoid.

Stroke Limiter Solenoid

The purpose of the stroke limiter solenoid is to briefly pull the stroke limiter plate rearward allowing the T-stop to clear the stroke limiter plate which allows the table to lower fully to its lowest position. It also releases the pin holder's swing shaft latch to allow the pin holders to go vertical while the table is lowering.

(1) LEFT-HAND SQUARE SHAFT
(2) STROKE LIMITER PLATE
(3) T-STOP
(4) STROKE LIMITER SOLENOID

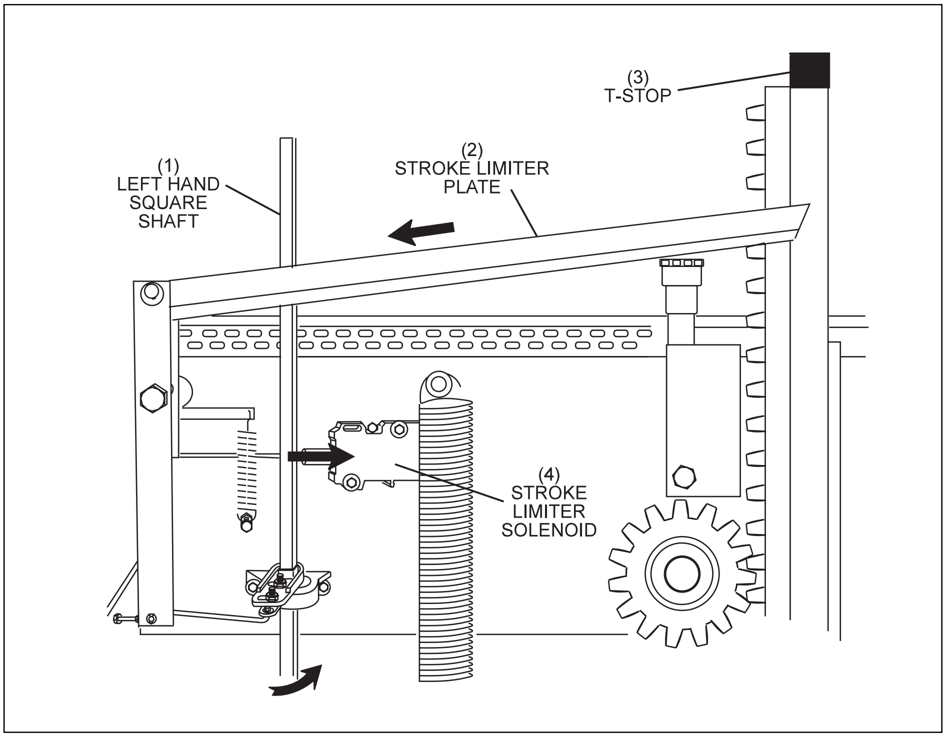

Figure 2-20. Stroke Limiter Solenoid.

Spotting Tong Solenoid

The spotting tong solenoid engages a gear clutch assembly with the table drive gear to close or reopen the spotting tongs depending on which direction the motor is turning. The gear clutch assembly rotates a spindle shaft, turning a helical gear driving the right hand square shaft. When the main table drive shaft and right hand square shaft are turning counterclockwise, the spotting tongs close. When they are turning clockwise, the spotting tongs open.

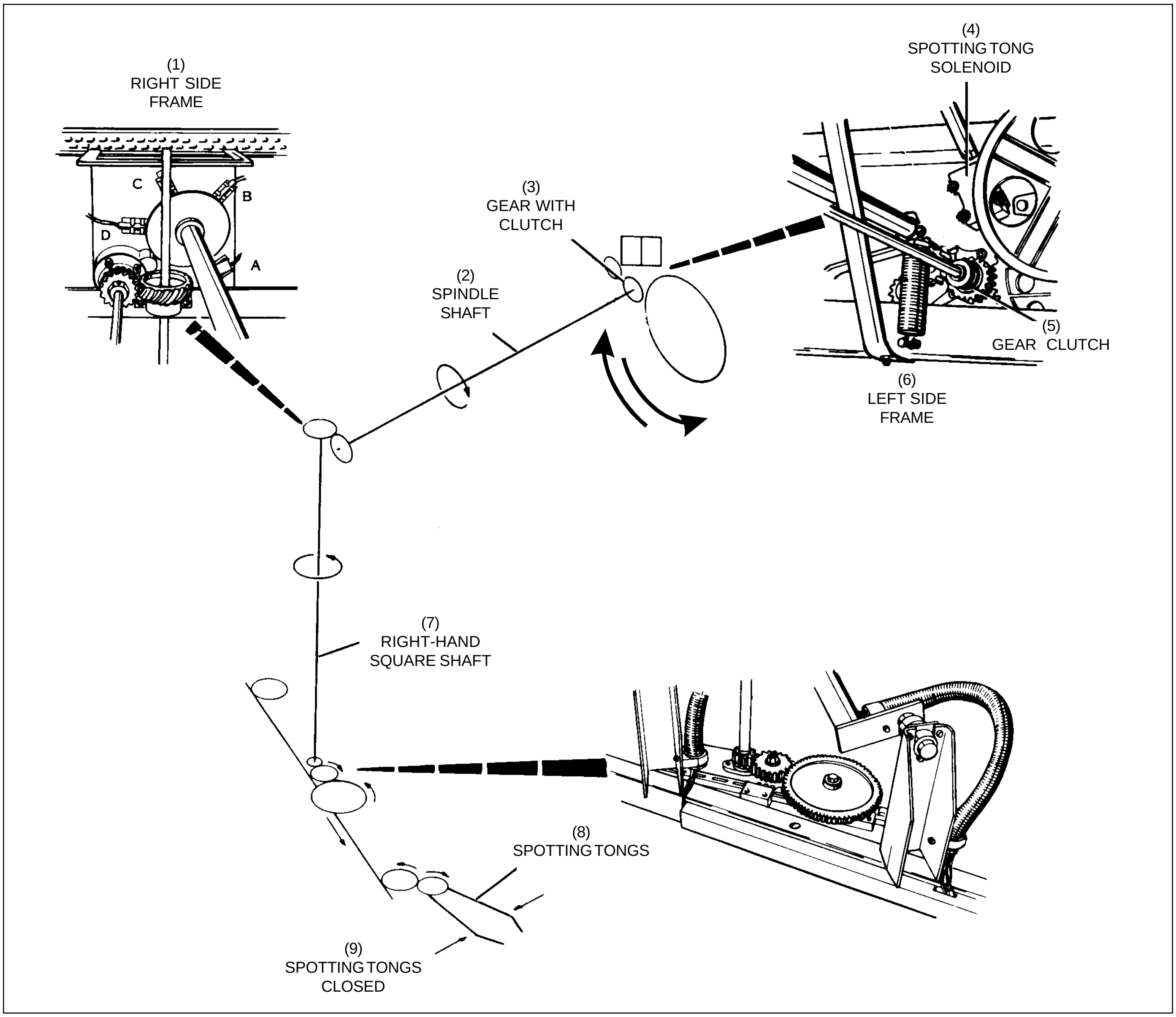

Figure 2-21. Spotting Tong Drive.

(1) RIGHT SIDE FRAME	(2) SPINDLE SHAFT	(3) GEAR WITH CLUTCH
(4) SPOTTING TONG SOLENOID	(5) GEAR CLUTCH	(6) LEFT SIDE FRAME
(7) RIGHT-HAND SQUARE SHAFT	(8) SPOTTING TONGS	(9) SPOTTING TONGS CLOSED

Pin Holder Solenoids

The red pin holder solenoid opens the grippers on the pin holder. When the solenoid is energized, it is holding the grippers open to load pins when the table is on its way up to the home position or when the table is down releasing a new set of pins onto the lane.

(1) SOLENOID
(2) GRIPPER
(3) SWITCH

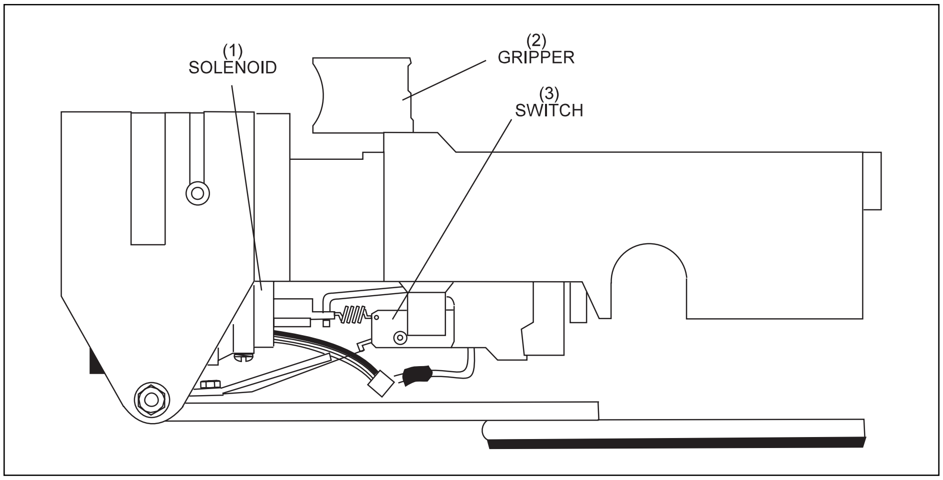

Figure 2-22. Pin Holder Horizontal - Up for Loading Pins.

(1) SOLENOID
(2) GRIPPER
(3) SWITCH

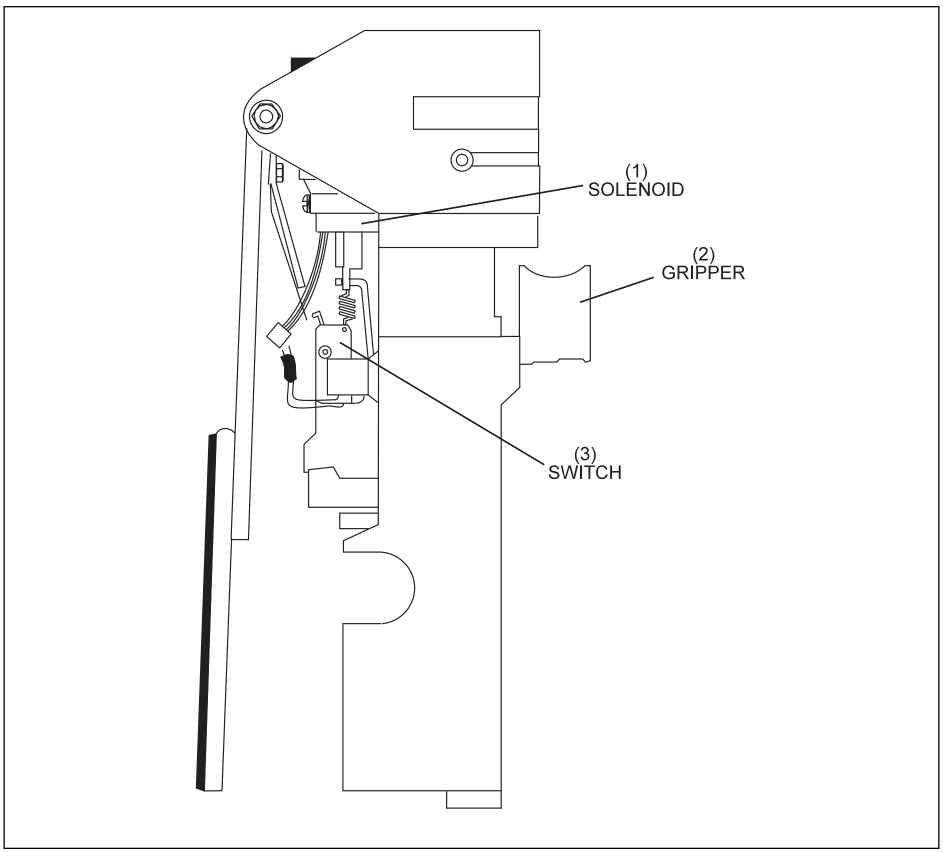

Figure 2-23. Pin Holder Vertical - Setting Pin on Lane.

Shark Solenoid

GS-96 and Later Pinsetters

This red solenoid is used to control the Shark Fin guide. The solenoid will cause the pin guide to flip right or left to direct the pin onto the left or right side of the distributor. When the solenoid is energized, the pin guide will direct the pin to the right distributor lanes. When the solenoid is deenergized, a return spring pulls the pin guide back and deflects the pin to the left distributor lanes. The pins are loaded in a (R-L-L-R-L-R-L-L-R-L) configuration. The "R" designation is for the 10 pin or right hand side of the pinsetter. The "L" designation is for the "7" pn or the left side of the pinsetter. The left side holds 6 pins while the right side holds 4 pins.

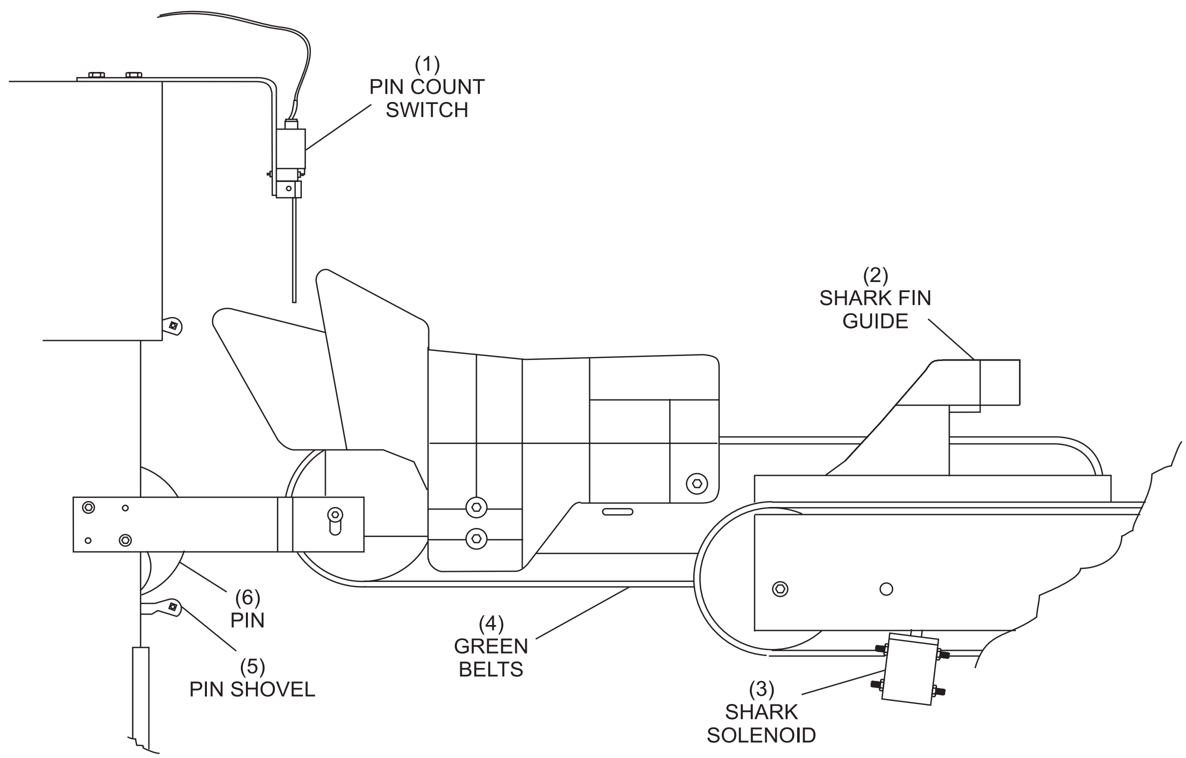

Figure 2-24. Shark Solenoid (GS-96s and Later)

(1) PIN COUNT SWITCH	(2) SHARK FIN GUIDE	(3) SHARK SOLENOID
(4) GREEN BELTS	(5) PIN SHOVEL	(6) PIN

Motors

All motors used on the GS-Series Pinsetters are three phase motors capable of working at several voltages and with either 50 or 60 hertz. The high voltage position is typically 380 - 415 volts AC. The low voltage position is 200 - 240 volts AC. For proper wiring and pulley installation information when replacing a motor, see the “Service” section of this manual.

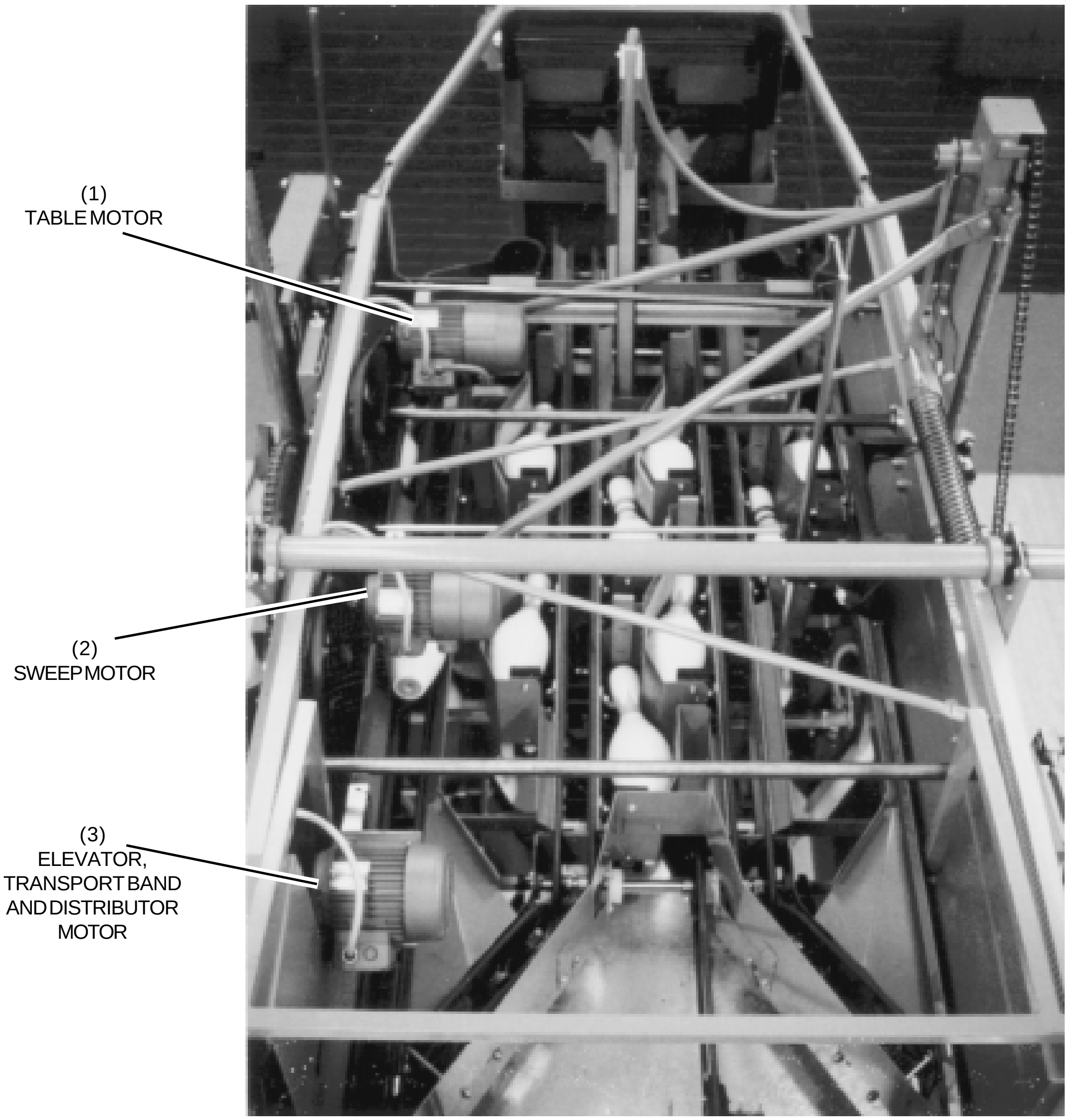

Figure 2-25. Pinsetter Motors.

(1) TABLE MOTOR (2) SWEEP MOTOR (3) ELEVATOR, TRANSPORT BAND AND DISTRIBUTOR MOTOR

Distributor Motor

The distributor motor is a 1/2 horsepower (hp) motor at the front left corner of the pinsetter. It drives the pin handling round belts of the distributor, the shovels in the elevator and the transport band in the pit area. This motor will run for 45 seconds to handle pins. If no ball detect or reset occurs within that time frame, it will stop and wait until a ball is detected. If the table is waiting for one or more pins, the motor will run for 90 seconds. If the pins are not received in that time, the entire machine stops as it assumes a pin jam has occurred and service is required. Refer to *Figure 2-25*.

Sweep Motor

The sweep motor is a 1/4 hp motor at the center left-hand side of the pinsetter. It drives the sweep rearward and forward to clear pins off the lane surface. This motor has an electric brake attached to it that locks onto the shaft preventing coasting when power is turned off to the motor. Refer to *Figure 2-25*.

Table Motor

The table motor is a 1/2 hp motor at the rear left-hand side of the pinsetter. Its functions are to raise and lower the table, close and open the spotting tongs and raise the sweep at the end of a cycle. This motor runs both clockwise and counterclockwise to operate the tongs and raise the sweep when appropriate. This motor has an electrical brake that locks onto the shaft when the motor is turned off. The brake holds the table up in the raised position when waiting for a ball or if the pinsetter has been turned off. Refer to *Figure 2-25*.

Ball Accelerator Motor

The ball accelerator motor is a shared motor. Its 3 phase power comes from either the common box in a universal electronics system or the high voltage box in the consolidated electronics system. It is a 1/2 hp motor that does not have a brake. It runs continuously at full speed when either one or both pinsetters is in operation.

Table of Contents

Universal Electronics

The GS-Series Pinsetters are controlled and operated by a universal electronic control system. This system consists of several control boxes mounted on the front of the pinsetter and several other items that monitor and help the pinsetter operate. These boxes are referred to as “Universal” control boxes that are capable of working with all voltage systems throughout the world. The earlier model GS-10 Pinsetter used a Red Box system or a Silver Box system to operate the pinsetters. These systems are not compatible with the GS-92 and later model pinsetters.

In *Figure 3-1* below is a representation of the control boxes mounted on the front of a pair of pinsetters. Each pinsetter will have its own High Voltage box for operating its motors and solenoids. The left pinsetter will have a Gamesetter and a Common box. The Gamesetter can best be described as being the brains of both pinsetters. It gathers switch information and sends out operating instructions to each pinsetter. The Common box is the entry point for the 3 phase power needed to run both pinsetters.

If the GS-Series Pinsetters are installed along with the Brunswick BowlerVision Automatic Scoring system, the right lane pinsetter will have a Gamemaker box and a Video Switcher box mounted on the front. These items will not be discussed in this manual as there is a separate manual for the BowlerVision System. These two positions will be empty if no scoring system is installed. The AS-90, ASK or Frameworx Automatic Scoring systems do not require any equipment to be installed in these positions.

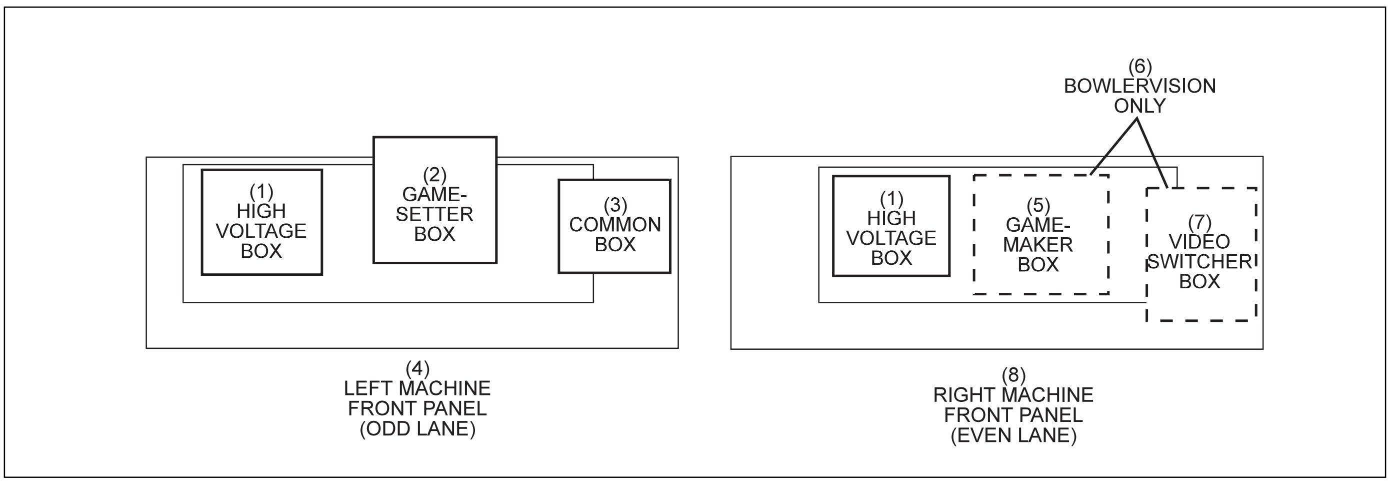

Figure 3-1. Electronic Control Box Layout.

(1) HIGH VOLTAGE BOX	(2) GAMESETTER BOX	(3) COMMON BOX
(4) LEFT MACHINE FRONT PANEL (ODD LANE)	(5) GAMEMAKER BOX	(6) BOWLERVISION ONLY
(7) VIDEO SWITCHER BOX	(8) RIGHT MACHINE FRONT PANEL (EVEN LANE)	

Figure 3-2 is a block diagram which shows the flow of information and power paths between the pinsetters, several external devices and the electronic boxes.

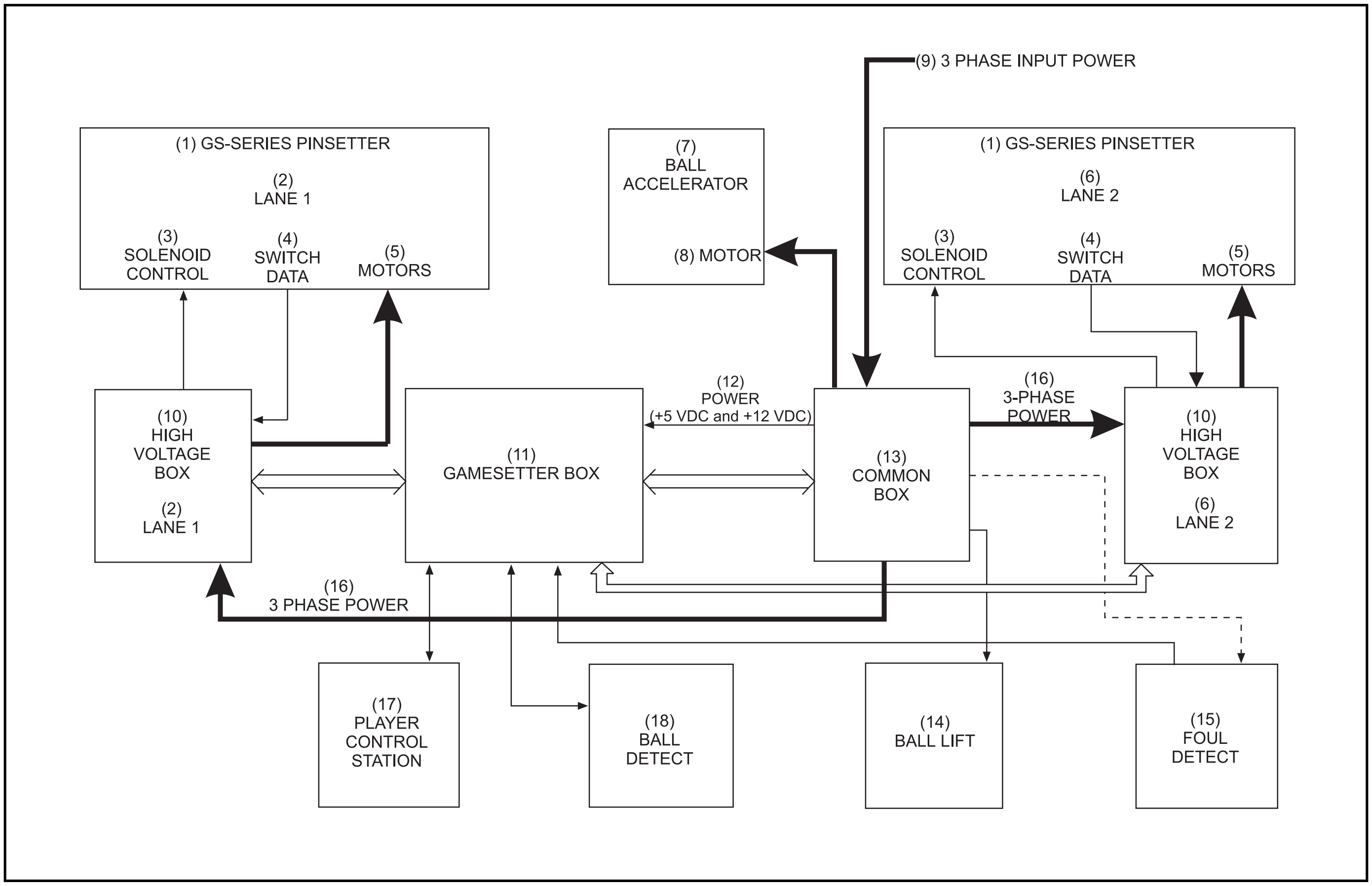

Figure 3-2. Electronic Block Diagram.

(1) GS-SERIES PINSETTER	(2) LANE 1	(3) SOLENOID CONTROL
(4) SWITCH DATA	(5) MOTORS	(6) LANE 2
(7) BALL ACCELERATOR	(8) MOTOR	(9) 3 PHASE INPUT POWER
(10) HIGH VOLTAGE BOX	(11) GAMESETTER BOX	(12) POWER (+5 VDC AND +12 VDC)
(13) COMMON BOX	(14) BALL LIFT	(15) FOUL DETECT
(16) 3-PHASE POWER	(17) PLAYER CONTROL STATION	(18) BALL DETECT

Universal Common Box

The Common box receives the incoming 3-phase AC power and distributes it to both High Voltage boxes for operating the pinsetter motors. It supplies the 3-phase power to the ball accelerator motor. One phase is attached to a step down transformer inside the Common box. This transformer supplies 28, 24, 13.6 and 8.2 volts AC to the printed circuit board. The 28 volts is used to turn on the ball lift when needed. The 24, 13.6 and 8.2 are converted into DC voltages that are used by the Gamesetter and High Voltage boxes.

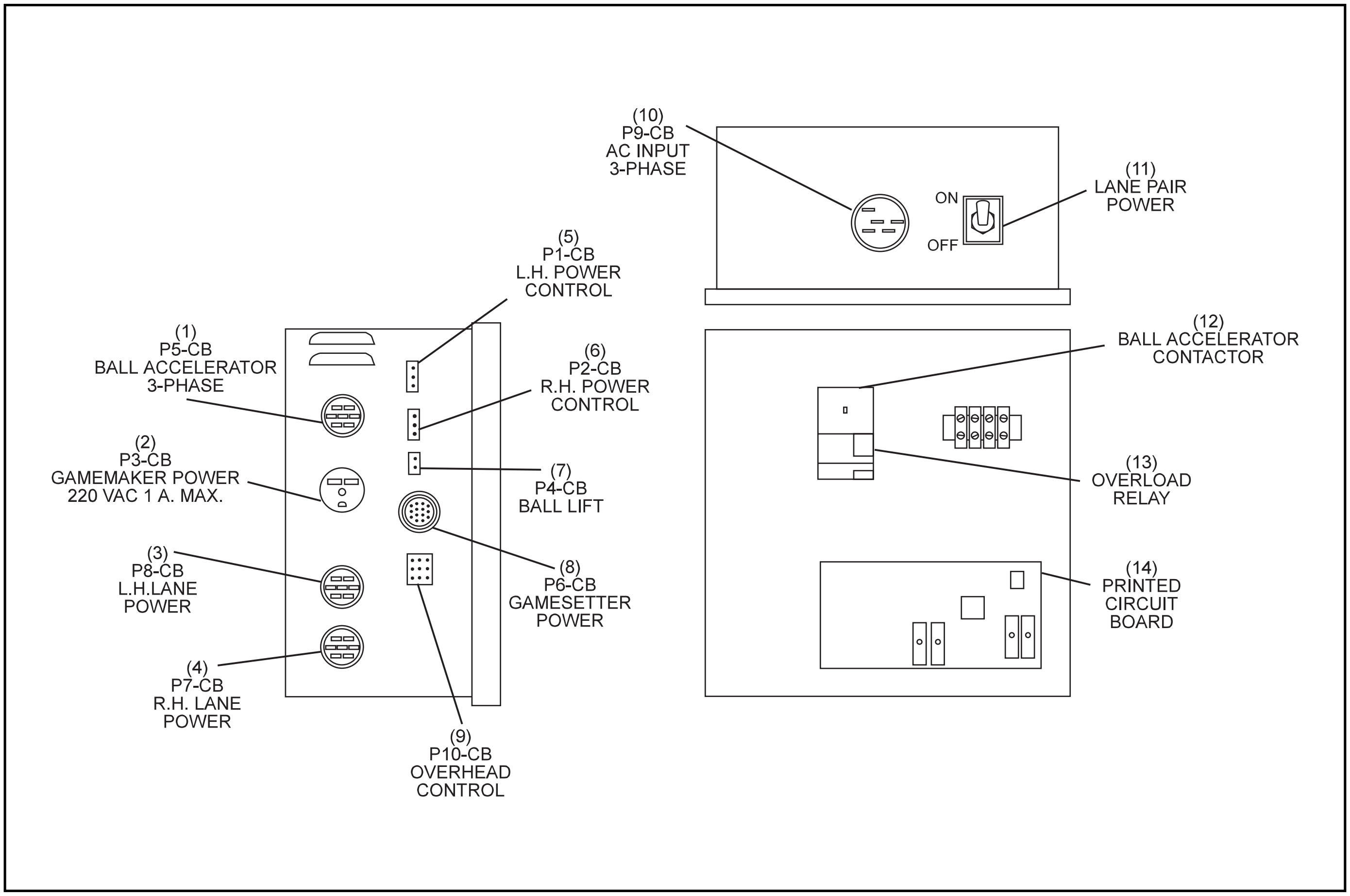

Figure 3-3. Universal Common Box.

(1)	P5-CB BALL ACCELERATOR 3-PHASE	(2)	P3-CB GAMEMAKER POWER 220 VAC 1 A. MAX	(3)	P8-CB L.H. LANE POWER
(4)	P7-CB R.H. LANE POWER	(5)	P1-CB L.H. POWER CONTROL	(6)	P2-CB R.H. POWER CONTROL
(7)	P4-CB BALL LIFT	(8)	P6-CB GAMESETTER POWER	(9)	P10-CB OVERHEAD CONTROL
(10)	P9-CB AC INPUT 3 PHASE	(11)	LANE PAIR POWER	(12)	BALL ACCELERATOR CONTACTOR
(13)	OVERLOAD RELAY	(14)	PRINTED CIRCUIT BOARD		

Top Side of Common Box

P9-CB - Incoming 3-phase AC power connector. This connector receives the AC power used to run both pinsetters.

Lane Pair Power Switch - This switch controls the AC power upon its entry into the Common box. Turning this switch off disables both pinsetters.

Left Side of Common Box

P1-CB (L.H. Power Control) - Provides two way communication between the left lane High Voltage box and the Common box for the system to power up in a stand-alone environment.

P2-CB (R.H. Power Control) - Same as P1-CB but for the right lane.

P3-CB (Gamemaker Power) - Provides access for 220-240 VAC single phase power to the Gamemaker in a BowlerVision environment.

P4-CB (Ball Lift) - Provides 28 VAC to the ball lift control box relay.

P5-CB (Ball Accelerator) - Provides 3-phase power to the ball accelerator motor.

P6-CB (Gamesetter Power) - Provides +5 VDC and +12 VDC to the Gamesetter. This connection also receives control signals from the Gamesetter for foul, service light, overhead, ball accelerator and ball lift.

P7-CB (R.H. Lane Power) - Provides 3-phase power to the right lane High Voltage box.

P8-CB (L.H. Lane Power) - Provides 3-phase power to the left lane High Voltage box.

P10-CB (Overhead Control) - This connection is used only in a BowlerVision center for Scoreboard, BowlerTrack and service light functions.

Internal Common Box

Ball Accelerator Contactor and Overload Relay - This contactor controls the 3-phase power to the motor when either the left, right or both pinsetters are turned on. The overload relay protects both the motor and the Common box when the input voltage is improper or the overload motor is defective.

Universal Common Box PCB

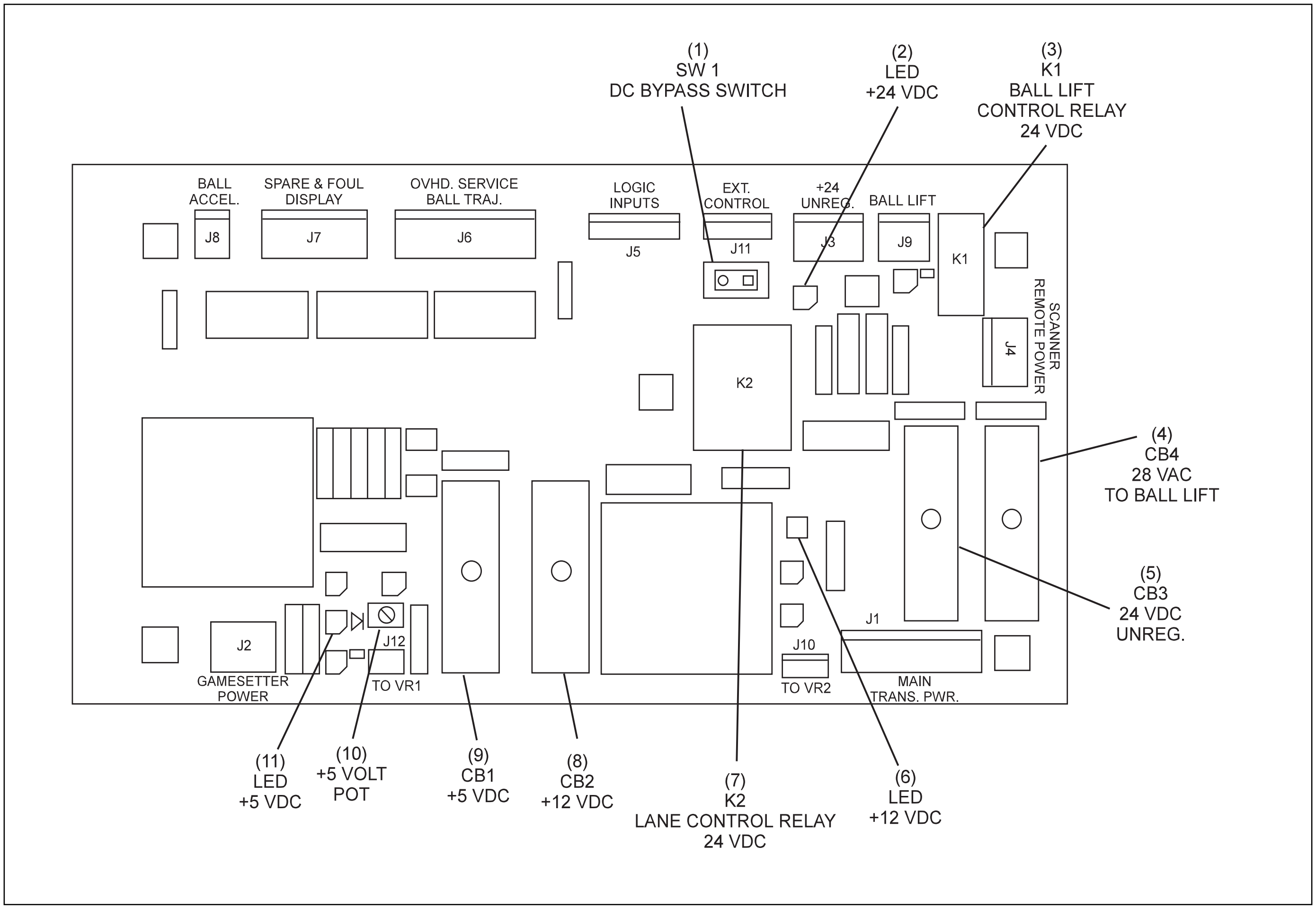

Figure 3-4. Universal Common Box PCB.

(1) SW 1 DC BYPASS SWITCH	(2) LED +24 VDC	(3) K1 BALL LIFT CONTROL RELAY 24 VDC
(4) CB4 28 VAC TO BALL LIFT	(5) CB3 24 VDC UNREG.	(6) LED +12 VDC
(7) K2 LANE CONTROL RELAY 24 VDC	(8) CB2 +12 VDC	(9) CB1 +5 VDC
(10) +5 VOLT POT	(11) LED +5 VDC	

J1-J12 - These connections on the PCB serve as inputs and outputs between the PCB and external connections of the Common box and the other components inside the Common box.

K1 (Ball Lift Relay) - This relay sends the 28 VAC signal to the ball lift control relay located at the ball lift.

K2 (DC Power Relay) - Energizing this relay sends DC voltages to the Pinsetter CPU, the High Voltage box and the ball lift relay on the Common box PCB for powering up the pinsetters.

LED1 (+5 VDC Light Emitting Diode) - Lights up when PCB is producing +5 VDC.

LED 2 (+12 VDC Light Emitting Diode)

LED 3 (+24 VDC Light Emitting Diode)

CB 1 (+5 VDC Circuit Breaker)

CB 2 (+12 VDC Circuit Breaker)

CB 3 (+24 VDC Circuit Breaker)

CB 4 (28 VAC Circuit Breaker)

R 7 (+5 VDC Potentiometer) - This “pot” is an adjustable resister used to set the +5 VDC as close to +5.14 VDC as possible. This voltage is measured at the input to the Gamesetter on connector J5-GS, pins 1 & 3 with the Gamesetter “on.”

SW 1 (DC Bypass Switch) - This switch allows the mechanic to turn on the DC power to the Gamesetter without the Manager's Control Unit.

Universal High Voltage Box

Each pinsetter has its own High Voltage box. It takes the 3-phase power from the Common box to operate the distributor, sweep and table motors at the appropriate time. It also takes one phase power to operate the pin light and another phase to operate the transformer that supplies the operating voltages for the pinsetter solenoids and masking unit lamps.

All switch information from the pinsetter passes through the High Voltage box on its way to the Gamesetter. The Gamesetter then acts on this information and directs the High Voltage box in its preparation for the next ball.

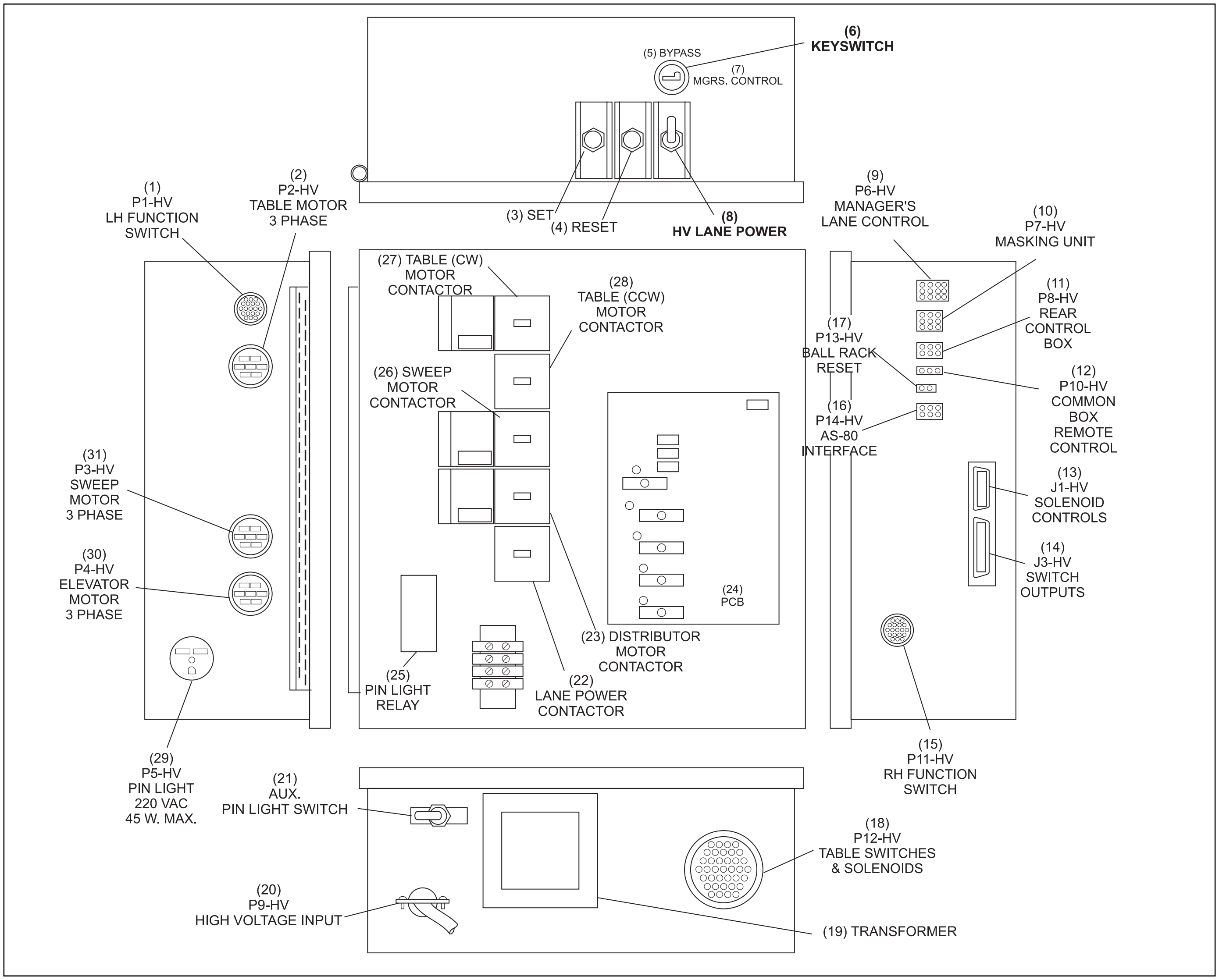

Figure 3-5. Universal High Voltage Box.

(1) P1-HV LEFT-HAND FUNCTION SWITCH	(2) P2-HV TABLE MOTOR 3 PHASE	(3) SET
(4) RESET	(5) BYPASS	(6) KEYSWITCH
(7) MANAGER'S CONTROL	(8) HIGH VOLTAGE LANE POWER	(9) P6-HV MANAGER'S LANE CONTROL
(10) P7-HV MASKING UNIT	(11) P8-HV REAR CONTROL BOX	(12) P10-HV COMMON BOX REMOTE CONTROL
(13) J1-HV SOLENOID CONTROLS	(14) J3-HV SWITCH OUTPUTS	(15) P11-HV RIGHT-HAND FUNCTION SWITCH
(16) P14-HV AS-80 INTERFACE	(17) P13-HV BALL RACK RESET	(18) P12-HV TABLE SWITCHES AND SOLENOIDS
(19) TRANSFORMER	(20) P9-HV HIGH VOLTAGE INPUT	(21) AUXILIARY PIN LIGHT SWITCH
(22) LANE POWER CONTACTOR	(23) DISTRIBUTOR MOTOR CONTACTOR	(24) PRINTED CIRCUIT BOARD
(25) PIN LIGHT RELAY	(26) SWEEP MOTOR CONTACTOR	(27) TABLE (CLOCKWISE) MOTOR CONTACTOR
(28) TABLE (COUNTERCLOCKWISE) MOTOR CONTACTOR	(29) P5-HV PIN LIGHT 220 VAC 45 W. MAXIMUM	(30) P4-HV ELEVATOR MOTOR 3 PHASE
(31) P3-HV SWEEP MOTOR 3 PHASE		

Switches

High Voltage Lane Power Switch - This toggle switch is used to manually stop or start the pinsetter. Turning this switch off de-energizes the lane power contactor in the High Voltage box.

Reset Switch - This push-button switch is used to cycle the pinsetter to the next ball. Identical switches are mounted on the ball rack for the bowlers' use and the rear control box mounted on the side of the elevator for the mechanics' use from the back of the pinsetter.

Set Switch - This push-button switch causes the last combination of pins to be set. This switch is duplicated on the player control station PCB and on the rear control box mounted on the elevator.

Keyswitch - This switch allows for a manual turn on and off of the pinsetter in a stand-alone environment. Positioning this switch in the "Bypass" position allows the pinsetter to be operated regardless of the Manager's Control unit. In the "Manager's Control" position, the turn on and off capability is turned over to the Manager's Control unit at the Control Desk. In a BowlerVision or Frame-worx environment, this keyswitch must be left in the "Manager's Control" position. Putting it in the "Bypass" position forces the pinsetter to turn off.

Pin Light - This toggle switch permits you to manually turn on the pin light for maintenance and troubleshooting. This switch is located on the bottom of the High Voltage box.

CAUTION: When using the pin light switch during bowling activity, the bowler must be made aware the pinsetter is not usable even though the pin light is on.

Cable Connections

Left Side

P1-HV (Left Hand Function Cable) - This connection provides the input for the "TS1," "G," "EC," and pin count (GS-96 and later) switches. It provides the output signals to the sweep release, spotting tong, stroke limiter, and shark (GS-96 and later) solenoids on the left side of the pinsetter.

P2-HV (Table Motor) - This connection provides 3-phase power to the table motor.

P3-HV (Sweep Motor) - This connection provides 3-phase power to the sweep motor.

P4-HV (Elevator Motor) - This connection provides 3-phase power to the distributor, transport band and elevator motor.

P5-HV (Pin Light) - This connection provides single phase power to the pin light when the pinsetter is turned on.

Bottom

P9-HV (High Voltage Input Cable) - This cable is routed to and connects to P7 or P8 on the Common box. This is the supply route for the 3-phase power to run the pinsetter motors, solenoids, etc.

P12-HV (Table Switches and Solenoids Cable) - This cable is routed along the right hand side of the pinsetter and down to the back of the setting table. Pinsensing information from the pin holders and spotting tong switch is sent to the High Voltage box through this cable. The pin holder solenoids are energized and deenergized via the voltages sent from the High Voltage box.

Right Side

P6-HV (Manager's Lane Control) - This connection is used to provide remote control of the pinsetter from the Control Desk.

P7-HV (Masking Unit) - This connection provides first ball, second ball and strike light signals to the masking unit. It also connects to the toggle switch on the masking unit which can be used to turn off the pinsetter.

P8-HV (Rear Control Box) - This connection provides input from the “Set”, “Reset” and “On/Off” switches mounted on the ball return side of the elevator.

P10-HV (Common Box Remote Control) - Allows the High Voltage box to remotely turn on the Common box when a Manager’s Control unit is in use. This connection is not used in a BowlerVision or Frameworx center.

P11-HV (Right-Hand Function Cable) - This connection is the input for all the switches on the right side of the pinsetter. These switches are “A, B, C, D, SM, TS2 and OOR.” The cable also provides the output signals for the trouble light and the ball door solenoid.

P13-HV (Ball Rack Reset) - Provides the input for the bowlers' reset switch on the ball rack.

P14-HV (AS-80 Interface Connection) - Provides the third ball/tenth frame signal, second ball light power and a remote turn on for the AS-80, AS-90 or AS-K Scorer console.

J1-HV (Solenoid Controls) - This ribbon cable connection receives input signals from the Gamesetter. These signals direct the High Voltage box to energize the solenoids and turn on the masking unit lights, pin light, trouble light and the distributor, sweep and table motors.

J3-HV (Switch Outputs) - This ribbon cable connection sends all the switch information gathered by the High Voltage box to the Gamesetter.

Contactors

The Universal High Voltage box contains five contactors for controlling power to the motors and the solenoids. The contactors are three pole contactors; a pole for each phase. Refer to *Figures 3-5* and *3-6*.

Lane Power Contactor - This contactor applies high voltage to all the motor contactors and to the transformer used to generate voltages for energizing the solenoids. The Gamesetter turns this contactor on and off.

Table Motor Contactor (CW) - This contactor turns the table motor clockwise when the setting table must perform a respotting or new pin setting stroke.

Table Motor Contactor (CCW) - This contactor turns the table motor counter-clockwise when the setting table must perform a detection stroke.

Sweep Motor Contactor - This contactor runs the sweep motor.

Distributor Motor Contactor - This contactor runs the distributor, elevator and transport band motor.

(1) OVERLOAD RELAY
(2) CONTACTOR
(3) INPUTS
(4) CURRENT ADJUSTMENT
(5) AUTOMATIC/MANUAL RESET
(6) MANUAL RESET
(7) OUTPUTS

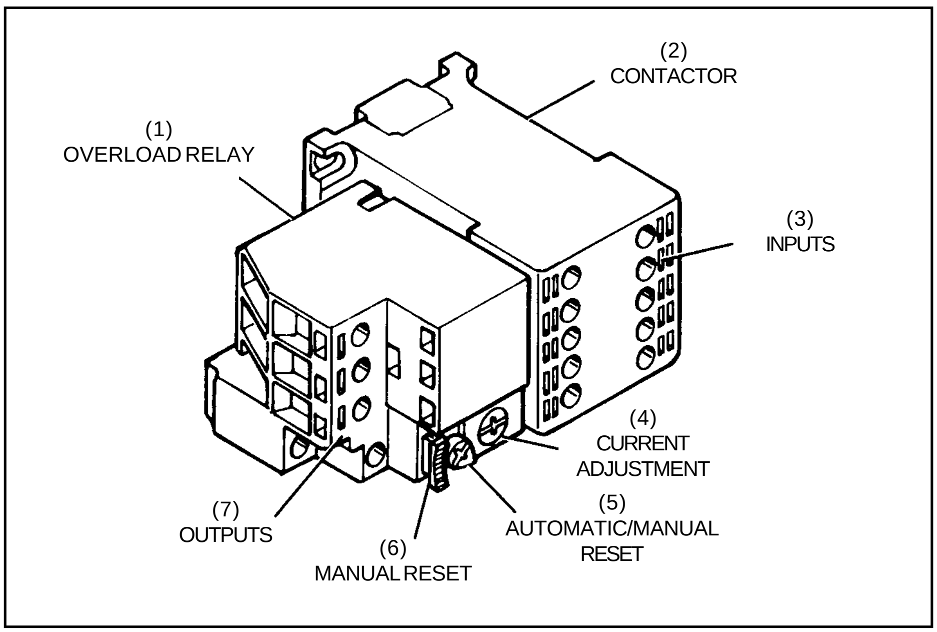

Figure 3-6. Motor Contactor and Relay.

Overload Relays

Each motor has an overload relay that monitors the current at each pole of its contactor. When an overload is detected, the overload relay will open the coil control line to turn off the contactor. This relay can be set to automatic or manual reset. Refer to *Figure 3-6*. In this application, the blue reset button must be "up" in the manual position. The red button on the relay must be pushed to manually reset the relay and re-energize the motor contactor. Check the motor and pinsetter for a possible cause of the tripping of the relay before resetting the relay.

CAUTION: Continuous tripping of the relay indicates a problem exists within the pinsetter. Damage to the electronic assemblies, the motor and/or the pinsetter may occur.

Pin Light Relay

The pin light is turned on and off by this relay when the lane power contactor is turned on. The pin light switch bypasses this relay to turn on the pin light for maintenance or troubleshooting.

High Voltage Box PCB

Figure 3-7 shows the printed circuit board. Following this drawing is a description of the key items on this board.

(1) STRIKE MASKING UNIT RELAY
(2) 2ND BALL MASKING UNIT RELAY
(3) 1ST BALL MASKING UNIT RELAY
(4) EXTERNAL CONTROL RELAY
(5) POWER LED 6
(6) LANE POWER LED 9
(7) FRAME COUNT CONNECTION
(8) BALL COUNT CONNECTION
(9) DECK FULL LED 8
(10) SWITCH "A" LED 7
(11) HIGH VOLTAGE CONTROL PRINTED CIRCUIT BOARD
(12) LED 2
(13) LED 3
(14) LED 4
(15) LED 5
(16) LED 1

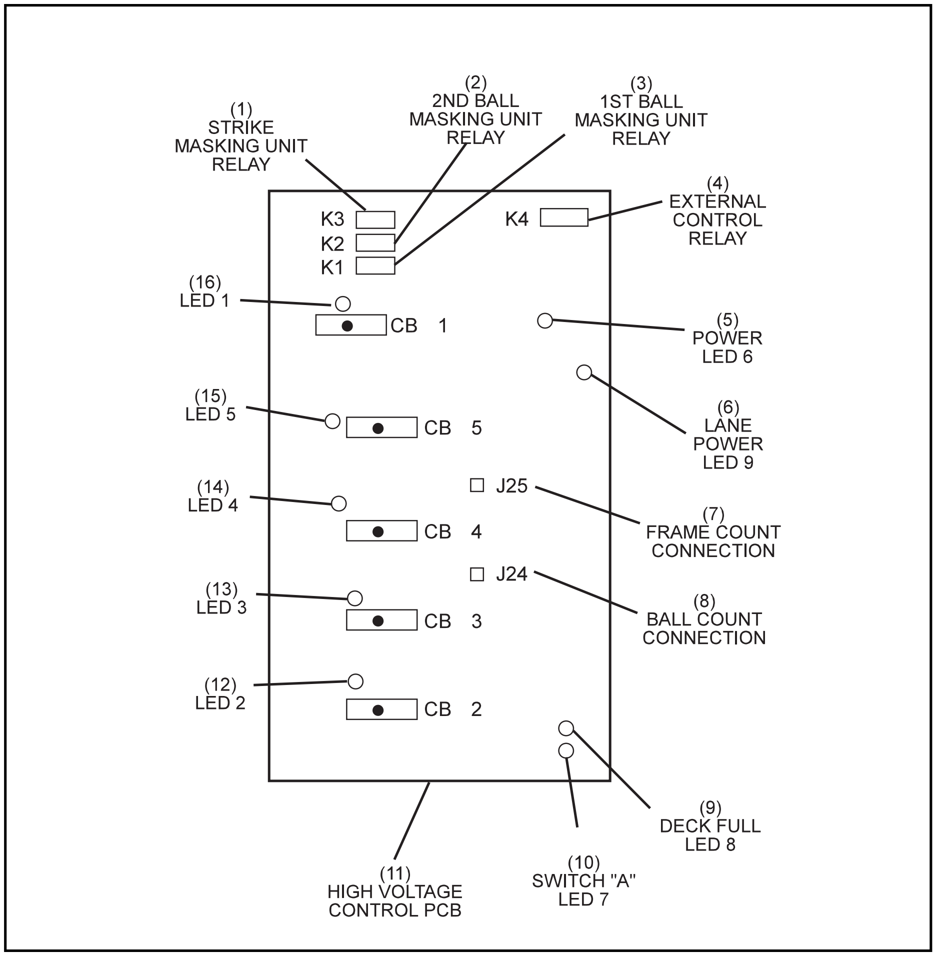

Figure 3-7. Universal High Voltage Control PCB.

PCB Relays

K1 - Energizes to turn on the first ball lamp in the masking unit.

K2 - Energizes to turn on the second ball lamp in the masking unit.

K3 - Energizes to turn on the strike lamps in the masking unit.

K4 - Energizes to complete a path to the Common box that allows it to activate the Gamesetter for pinsetter turn on and operation. This relay is used only in a stand-alone environment and is controlled by the on/off switch at the Manager's Control unit.

Printed Circuit Board Circuit Breakers (3.2 Amps)

CB1 - Protects and monitors the controlling voltages for the motor contactors, the pin light relay and the masking unit lamp relays.

CB2 - Protects and monitors the #1, #2 and #3 pin holder solenoids and the spotting tong solenoid.

CB3 - Protects and monitors the #4, #5 and #6 pin holder solenoids and the sweep release solenoid.

CB4 - Protects and monitors the #7, #8 and #9 pin holder solenoids and the stroke limiter solenoid.

CB5 - Protects and monitors the #10 pin holder solenoid,the ball door locking solenoid, and the shark solenoid (GS-96 and later).

Printed Circuit Board Light Emitting Diodes (LEDs)

There are a total of nine LEDs on this PCB. LEDs 1-5 monitor the five circuit breakers on the PCB and are lit when the circuit breakers are in their normal “untripped” state. The functions of the other four LEDs are as follows:

LED 6 -Indicates “lane power” is on. The lane power contactor is energized when this LED is lit.

LED 7 - Indicates switch “A” is closed. This means the setting table is all the way up in the “home” position.

LED 8 - Indicates all ten switches in all ten pin holders have been made by bowling pins either sitting in the pin holders or the pin holders have detected ten pins standing on the lane during a detection stroke.

LED 9 - Indicates power to turn on the lane power contactor is present in the form of a +12 VDC signal from the Gamesetter box. This LED will stay lit as long as the Gamesetter signals for the pinsetter to stay operating.

Printed Circuit Board Cable Connections J24 & J25

These two connections are used by the Manager's Control unit (stand-alone only) to count the number of frames bowled or the number of balls rolled. A two wire cable from P6-HV inside the High Voltage box is labeled J24 and is connected as follows:

J24 - Counts the number of balls rolled. This connection monitors the energizing of the sweep release solenoid.

J25 - Counts the number of frames bowled. This connection monitors the energizing of the stroke limiter solenoid.

Gamesetter

The Gamesetter is the central control unit or the "brains" for a pair of GS-Series Pinsetters with universal electronics. This box accepts and reads all incoming information from the switches, ball detects, foul units and the player control station for each pinsetter. Refer to *Figure 3-8*. It then reacts to this information by directing the motors, solenoids, and relays to perform certain functions at precise times, making the pinsetters set, reset, sweep and reload pins as needed.

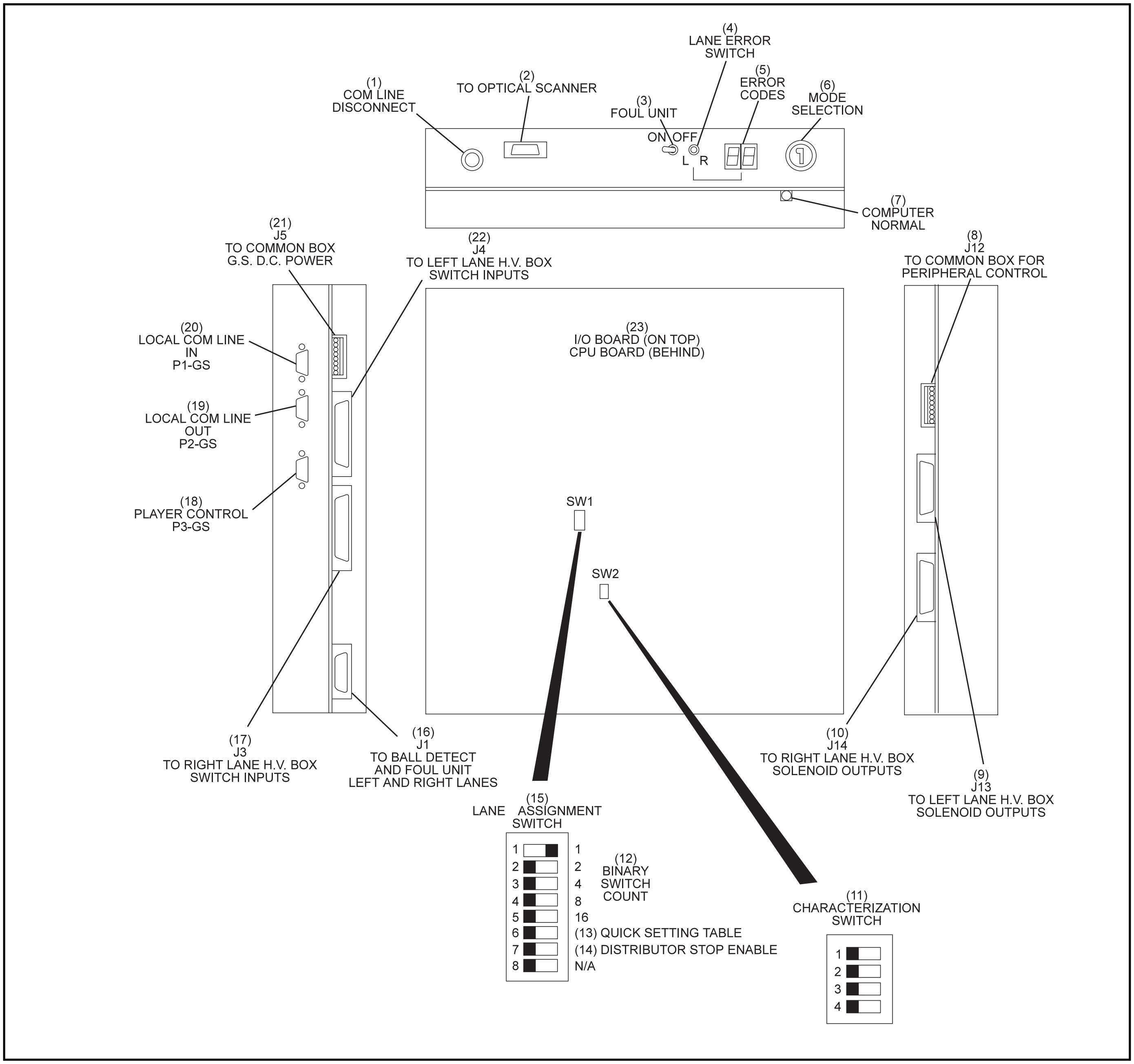

Figure 3-8. Gamesetter.

(1)	COMLINE DISCONNECT	(2)	TO OPTICAL SCANNER	(3)	FOUL UNIT
(4)	LANE ERROR SWITCH	(5)	ERROR CODES	(6)	MODE SELECTION
(7)	COMPUTER NORMAL	(8)	J12 TO COMMON BOX FOR PERIPHERAL CONTROL	(9)	J13 TO LEFT LANE H.V. BOX SOLENOID OUTPUTS
(10)	J14 TO RIGHT LANE H.V. BOX SOLENOID OUTPUTS	(11)	CHARACTERIZATION SWITCH	(12)	BINARY SWITCH COUNT
(13)	QUICK SETTING TABLE	(14)	DISTRIBUTOR STOP ENABLE	(15)	LANE ASSIGNMENT
(16)	J1 TO BALL DETECT AND FOUL UNIT LEFT AND RIGHT LANES	(17)	J3 TO RIGHT LANE H.V. BOX SWITCH INPUTS	(18)	PLAYER CONTROL P3-GS
(19)	LOCAL COMLINE OUT P2-GS	(20)	LOCAL COMLINE IN P1-GS	(21)	J5 TO COMMON BOX G.S. D.C. POWER
(22)	J4 TO LEFT LANE H.V. BOX SWITCH INPUTS	(23)	I/O BOARD (ON TOP) CPU BOARD (BEHIND)		

I/O Board

The Gamesetter consists of two printed circuit boards; an Input/Output (I/O) PCB and a Central Processing Unit (CPU) PCB. The I/O is mounted in front. Its purpose is to receive all the incoming switch information and signals from other peripheral assemblies such as the ball detect, foul unit and player control station. This is the passed onto the CPU which then makes the appropriate decision and forwards this information back to the I/O and out to the pinsetter for action.

SW1

The I/O board contains two sets of DIP switches. The largest is SW 1 and is an 8-position switch which is called the Lane Assignment switch. This switch is designed to stagger the power-up time to prevent simultaneous start up of several pinsetters. Refer to *Figure 3-8*.

NOTE: *This is beneficial in containing power costs. If a Brunswick scoring system such as BowlerVision, Frameworx, or Command Network is used, this switch should always be set to a 1 as these scoring systems incorporate the same staggered start-up system. This is explained also in the Service section of this manual.*

Position #1 through #5 - Represents the lane assignment. Set it binarily for half of the even lane pinsetter. Right = ON.

Position	Binary Value
#1	(1)
#2	(2)
#3	(4)
#4	(8)
#5	(16)

Position #6 - Controls the delay of the setting table operation after the sweep drops to a guarded position.

OFF (left) - Quick setting table - No delay after sweep drop
ON (right) - Delayed setting table - ABC, FIQ..., compliant delay.

Position #7 - Determines if the distributor will stop after all 10 pins have been delivered to the pin holders while waiting for a 2nd ball cycle.

OFF (left) - Stop enable - Distributor stops after ten pins have loaded while waiting for 2nd ball.
ON (right) - Stop disabled - Continuous distributor operation while loading pin.

Position #8 - Not used at this time.

SW2

The second switch is a 4-position unit labeled SW 2. This switch is called the Characterization switch. Its purpose is to define the pinsetter's operating environment.

Position #1 - Labeled SCN. Gives the pinsetter the choice of detecting pin activity on second ball. If a scoring system is present that has the capability of interfacing with the CPU, it can use the pin holder switch information to determine the bowler's pinfall. If no scoring system is available, or the scoring system uses a scanner or camera for determining pinfall, turning this switch on disables the detection stroke of the setting table during the second ball.

OFF (left) - Double Detect - Set if a scanner or CCD Camera are not used.
ON (right) - Single Detect - Set if a scanner or CCD Camera are used.

Position #2 - Labeled GM. Gives the CPU the capability of communicating with the BowlerVision's Gamemaker or Frameworx Scoring.

OFF (left) - Non-BowlerVision or Frameworx Scoring System - including stand alone.
ON (right) - BowlerVision or Frameworx Scoring System

Position #3 - This position allows pinfall detection to be monitored or ignored during machine cycle diagnostics.

OFF (left) - Diagnostic Codes 50-59 not activated.
ON (right) - Diagnostic Codes activated.

Position 4 - The fourth switch is a disabling switch for the out-of-range cycle. Placing this switch to the right will cause the pinsetter to ignore an out-of-range pin. ABC, the FIQ and many other bowling organizations require that the pinsetter stop and any deadwood (pins that have been knocked over but are still in the field of play) must be removed before the next ball can be rolled. In many countries, this is not a requirement and it interferes with the bowler's flow of bowling. If your center has sanctioned leagues that require deadwood be removed before a second ball is rolled, this switch should be in the left position.

OFF (left) - Pinsetter stops for an out-of-range pin.
ON (right) - Ignores an out-of-range pin.

Figure 3-9 shows three typical switch arrangements. Pick the one that matches your environment.

(1) DOUBLE DETECT (BOWLERVISION AND FRAMEWORX)
(2) SINGLE DETECT (STAND-ALONE) AUTOMATIC SCORERS WITH SCANNERS OR CCD
(3) DOUBLE DETECT AUTOMATIC SCORERS WITHOUT SCANNERS OR CCD

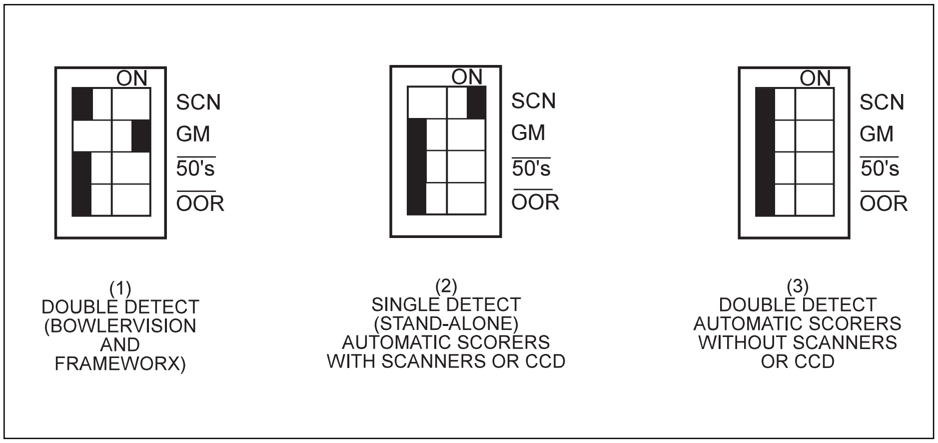

Figure 3-9. Typical Switch Arrangements.

CPU Board

The rear board is the Central Processing Unit. As stated in the I/O section, the CPU accepts the data from the I/O and processes it to determine the next actions of the pinsetter. The CPU contains pre-programmed circuitry that dictates what should happen at specific times.

The CPU has a memory that retains the status of each pinsetter. It is backed up by a 3.6 volt battery for when the power is turned off during servicing or a power failure. This allows resumption of bowling in the format that was occurring prior to any interruption to the incoming power.

Gamesetter External Switches

Mode Switch - This switch is a key operated switch that is set into one of five positions.

Diagnostics - This mode allows the pinsetter(s) to be self-tested by the Gamesetter.

Normal - This position is used when Brunswick's BowlerVision or Frameworx scoring is used.

10 Pin - This mode allows the pinsetter to set ten pins and up to two balls to knock them down.

Figures Clearing - This mode allows the bowler to select any combination of pins at the player control station and will allow the bowler to roll balls until all the pins have been knocked down. Then the pinsetter will set the selected combination again.

Figures - This mode is similar to Figures Clearing mode except the bowler only gets to roll one ball at selected combinations of pins. The pinsetter will sweep any remaining pins and set the selected combination again.

Lane Error Switch - This switch is used to start and stop the Contact Closure diagnostics that will be discussed later in this section. The switch is also used to display a detected error code LED by toggling the switch to either the left or right depending on the lane desired.

Foul Enable Switch - This switch controls the Gamesetter's ability to accept any incoming foul signals.

Com Line Disconnect Switch - This switch is only used in the BowlerVision and Frameworx modes. In order for the GS-Series Pinsetter to communicate with the BowlerVision or Frameworx electronics, this switch must be down in the closed position.

Gamesetter External Connections

J1 (Optical Scanner) - This connection is used to provide scoring communication between the Gamesetter and a Brunswick automatic scorer system other than BowlerVision or Frameworx. The cable connected here is routed directly to the scorer console and passes pinfall information, pinsetter position, foul signals and third ball-tenth frame information between the two systems.

P1-GS (Local Com Line In) - This connection is used only in a BowlerVision or Frameworx system. It provides two way communication between the Gamesetter and the BowlerVision Gamemaker or Frameworx Pinsetter Interface.

P2-GS (Local Com Line Out) - This connection is used only in a BowlerVision or Frameworx system. It routes communication signals through the Gamesetter to the BowlerVision console in the bowlers' area or Frameworx lane devices.

P3-GS (Player Control) - This connection routes information between the Gamesetter and the player control station.

CPU External Connections

J1 (Ball Detect and Foul) - This connection provides the power to the ball detect units. It also receives input signals from the ball detect unit and the foul unit.

J3 (Right Lane Switch Input) - This connection receives the switch data from the right lane pinsetter via the High Voltage box.

J4 (Left Lane Switch Input) - This connection receives the switch data from the left lane pinsetter via the High Voltage box.

J5 (DC Power) - This connection receives +5 VDC and +12 VDC from the Common box to power the Gamesetter.

J12 (Peripheral Control) - This connection sends control signals from the Gamesetter to the Common box which enable the ball lift and ball accelerator.

J13 (Left Lane Solenoid Outputs) - This connection provides control signals for the motors, lamps and solenoids to the left High Voltage box.

J14 (Right Lane Solenoid Outputs) - This connection provides control signals for the motors, lamps and solenoids to the right High Voltage box.

Diagnostic Modes

Trouble Diagnostics

The Gamesetter also contains a means of diagnosing pinsetter problems and will shut down a pinsetter if a fault is detected. When a problem occurs, the pinsetter will shut down and the trouble light on top of the elevator will start to flash. The Lane Error display on top of the Gamesetter can be used to diagnose the problem.

Contact Closure Diagnostics

In addition to Trouble Diagnostics, the Gamesetter is capable of performing two diagnostic modes for testing pinsetter operations. One mode, the Contact Closure diagnostics checks the switches on the pinsetter and displays which switches are used during the time the check is being made. This mode can be used to verify that switches are working properly and the wiring between the Gamesetter, High Voltage box and the individual switches is correct.

Machine Cycle Diagnostics

The other mode, Machine Cycle diagnostics, puts the pinsetter into a continuous operating cycle in which the pinsetter operates as if it was in a ten pin bowling mode, with the following exceptions. Instead of waiting for a ball detect, a five second time signal from the Gamesetter starts the pinsetter cycle. The pinsetter will continue to set, reset, sweep and reload pins as long as it is still switched into the diagnostic mode. Fouls will be ignored during the diagnostics, and, in BowlerVision and Frameworx systems, pinsetter cycles will not be counted at the Manager's Control location. Diagnostic faults (failures) are active during diagnostics and can stop the pinsetter if a jam or some form of failure is detected.

This mode can be used when an intermittent jam or failure has been reported and the proper corrective action is being sought. It can also be used to test and verify if a repair or adjustment has been successful in solving a problem.

Contact Closure Diagnostics

1. The Contact Closure diagnostics operates only on one pinsetter at a time. The pinsetter is selected by having the following conditions available.

    a. The trouble light cannot be lit.

    b. The rear mechanic switch and masking unit switch must be on.

    c. The power key on the universal High Voltage box must be set to the “bypass.”

    d. The High Voltage box power switch must be off.

    e. The mode selection key switch needs to be in the “diagnostics” mode before supplying power to the Gamesetter. Refer to *Figure 3-10*.

    f. Turn the power switch located on the top of the universal Common box off and then on again to guarantee that the CPU will initialize to the “diagnostics” mode.

    g. Allow the Pinsetter CPU to go through a cold startup (approximately 30 seconds) before continuing with the procedure.

2. To start the Contact Closure diagnostics, follow the steps below.

    a. Hold the lane error switch (refer to *Figure 3-10*) toward the pinsetter on which the diagnostics is to be run (left or right).

    b. While holding the lane error switch, turn on the High Voltage box power switch.

        1. The error code LEDs will sequentially display the seven segments of each LED to verify proper performance. Refer to *Figure 3-11*.

    c. Release the lane error switch to begin diagnostics.

        1. The codes of the switches that are closed at that time will be displayed sequentially.

        2. Refer to Table 1 to identify the switches displayed to determine if they are in their proper positions.

NOTE: *In order for the code to be displayed, the switch will need to be closed while the code "88" flashes.*

3. This diagnostic cycle will run continuously until manually stopped.

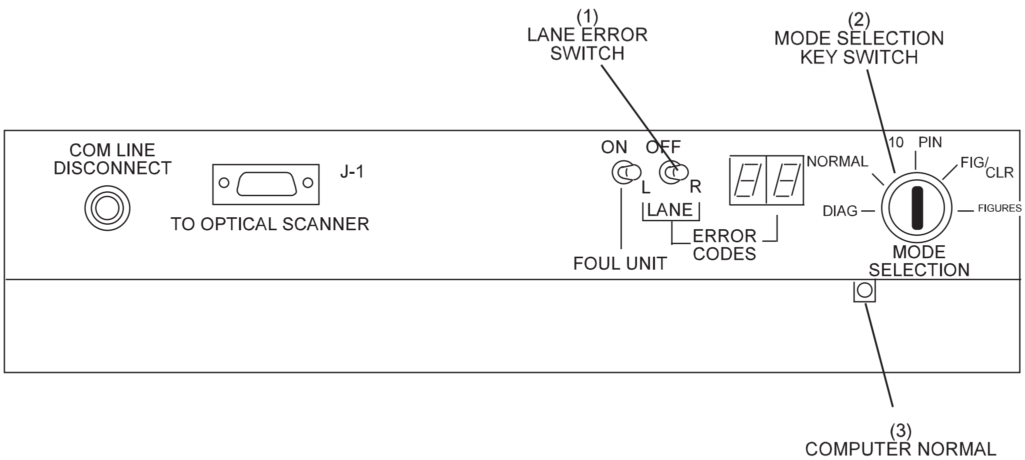

Figure 3-10. Universal Electronics Diagnostics.

(1) TOP OF GAMESETTER (2) LANE ERROR SWITCH (3) MODE SELECTION KEY SWITCH
(4) COMPUTER NORMAL

3. To stop the Contact Closure diagnostics, follow the steps below.

   a. Toggle lane error switch.

      1. If the mode selection switch is turned to "Diagnostics," the pinsetter will go into "Machine Cycle Diagnostics."

      2. If the mode selection switch is in "10 Pin," "Normal" or either "Figures" mode, the pinsetter will do a cold start power up which will put the pinsetter into a ready to bowl state.

Left or Right Lane	∟ or ┌
Lane Number	? ?
Pin Switch 1	01
Pin Switch 2	02
Pin Switch 3	03
Pin Switch 4	04
Pin Switch 5	05
Pin Switch 6	06
Pin Switch 7	07
Pin Switch 8	08
Pin Switch 9	09
Pin Switch 10	10
Switch A	A
Switch B	b
Switch C	C
Switch D	d
Table Switch 1 (TS1)	U1
Table Switch 2 (Tower) (TS2)	U2
Sweep Motor Switch (SM)	E
Switch G	21
Spotting Tong Switch (ST)	22
Out-of-Range (OOR)	23
Elevator Control Switch (See Note) (EC)	24
Rear Mechanic's Stop Switch	31
RESET Switch	32
SET Switch	33
Switch 2 Position 1 (SCN)	41
Switch 2 Position 2 (GM)	42
Switch 2 Position 3	43
Switch 2 Position 4	44
Fouls Enabled (Switch on Pinsetter CPU)	45
Foul Signal from Foul Unit	51
Ball Detect	52
POWER Key Switch on High Voltage Box	53
FIG/CLR Mode	61
10-Pin Mode	62
NORMAL Mode	63
Pin Count Switch	64
FIGURES Mode	60
End of Cycle - Read for New Cycle	88

Table 1. Contact Display Codes.

NOTE: *For #24 to be displayed, Elevator Switch must be manually pulsed during the "88" display which indicates the End of Cycle - Read for New Cycle.*

Machine Cycle Diagnostics

1. To enter into this mode, complete the following.

   a. Power must be supplied to the High Voltage box(es).

   b. The trouble light cannot be on.

   c. The rear mechanic's stop switch and the masking unit switch must be turned on.

   d. The power key on the High Voltage box(es) must be set to “By-pass.”

   e. The High Voltage box(es) power switch(es) must be off.

   f. Turn the mode selection key switch to “Diagnostics.”

   g. Turn the High Voltage box(es) power switch(es) back on.

2. The pinsetter will cycle until an error is detected or the mode selection switch is turned to a non-diagnostic mode and the High Voltage box(es) power switch is turned off and then back on again.

3. If the pinsetter stops and the trouble light is on, check the LED display on top of the Gamesetter. The LEDs will display the error detected and a decimal point on the right of each LED indicates a right or left hand pinsetter. Refer to Figure 3-11.

(1) DECIMAL POINT DESIGNATING LEFT LANE
(2) DECIMAL POINT DESIGNATING RIGHT LANE

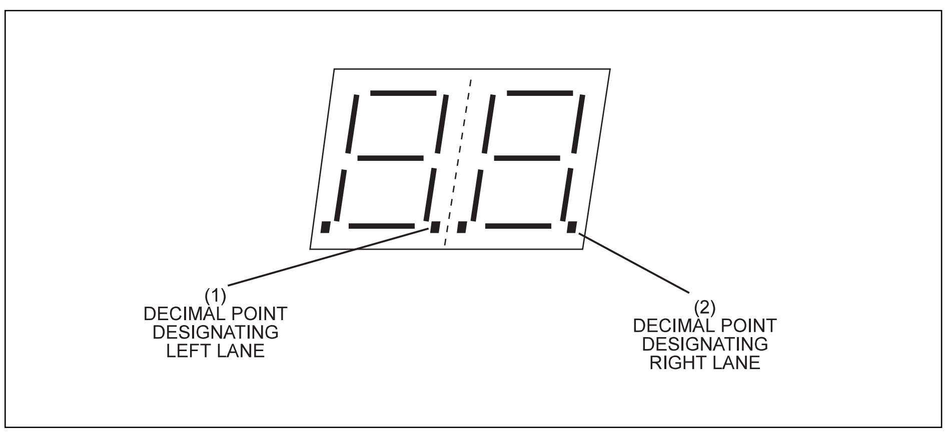

Figure 3-11. LED Display.

NOTE: If more than one error exists, the codes will flash alternately until the power has been restored to the pinsetter.

NOTE: *Error codes A0, A1 and 80 indicate conditions which will not stop the machine. Error codes A0 and A1 require prompt correction. Error code 80 should only be a concern if noticed on several consecutive days which would indicate a problem with the memory back-up battery.*

4. Tables 2 and 3 will give an indication of the failure and where to start looking for the problem. The displayed code will not pinpoint the problem in all cases. For further explanation of the codes, refer to the Troubleshooting section of this manual.

Invalid Machine State	**Spotting Tongs Switch**	**Table**		**Sweep Assembly**			
		Position	"A" Switch	"G" Switch		"SM" Switch	
0 (90)	Closed	Home	Closed	Open	Sweep Up	Open	Not Forward
1 (91)	Closed	Not Home	Open	Open	Sweep Up	Open	Not Forward
2 (92)	Closed	Not Home	Open	Closed	Sweep Down	Open	Not Forward
3 (93)	Open	Home	Closed	Open	Sweep Up	Open	Not Forward
4 (94)	Open	Not Home	Open	Open	Sweep Up	Open	Not Forward
5 (95)	Open	Not Home	Open	Closed	Sweep Down	Open	Not Forward

Table 2. Invalid Machine States.

NOTE: *Invalid machine states usually indicate a problem exists with one of the following:*
1. *Faulty table or sweep motor brake.*
2. *Spotting tong clutch malfunctioning.*
3. *Defective A, G, SM, or ST switch.*

I--I	Power Up in Progress
-II-	No Errors
None	The Lane Initialized
A0	PCS Not Communicating
A1	PCS Not Sending Correct Response
F0	External RAM Testing Failure
F1	Prom Check Sum Failure
FF	CPU Lost
80	Battery Back-up RAM Failure
P0	Can't Pick up These Pins
P0	Out-of-Range
01	Pin Loading Time Out Pin 1
02	Pin Loading Time Out Pin 2
03	Pin Loading Time Out Pin 3
04	Pin Loading Time Out Pin 4
05	Pin Loading Time Out Pin 5
06	Pin Loading Time Out Pin 6
07	Pin Loading Time Out Pin 7
08	Pin Loading Time Out Pin 8
09	Pin Loading Time Out Pin 9
10	Pin Loading Time Out Pin 10
50	#10 Pin Not Detected in Diagnostics
51	#1 Pin Not Detected in Diagnostics
52	#2 Pin Not Detected in Diagnostics
53	#3 Pin Not Detected in Diagnostics
54	#4 Pin Not Detected in Diagnostics
55	#5 Pin Not Detected in Diagnostics
56	#6 Pin Not Detected In Diagnostics
57	#7 Pin Not Detected in Diagnostics
58	#8 Pin Not Detected in Diagnostics
59	#9 Pin Not Detected in Diagnostics
60	Switch A is Not Expected But Found
61	Switch B is Not Expected But Found
62	Switch C is Not Expected But Found
63	Switch D is Not Expected But Found
64	Switch SM is Not Expected But Found
65	Switch G is Not Expected But Found
66	Switch ST Is Not Expected But Found
67	SW. OOR is Not Expected But Found
70	Switch A Expected But Not Found
71	Switch B Expected But Not Found
72	Switch C Expected But Not Found
73	Switch D Expected But Not Found
74	Switch SM Expected But Not Found
75	Switch G Expected But Not Found
76	Switch ST Expected But Not Found
90	Invalid Machine State 0
91	Invalid Machine State 1
92	Invalid Machine State 2
93	Invalid Machine State 3
94	Invalid Machine State 4
95	Invalid Machine State 5
EJ	Elevator Jam
EL	Pin Count Switch Shorted for 5 Seconds
J1	Jam Switch TS1
J2	Jam Switch TS2 (Tower)

Table 3. Error Codes.

Cable Connections

The electronic boxes are interconnected with several external devices that assist in the operation of the pinsetters.

The boxes and cables are labeled for easy identification in the event a box needs to be replaced. However, care must be exercised when making these changes as problems can occur if cables are swapped between the left and right connections.

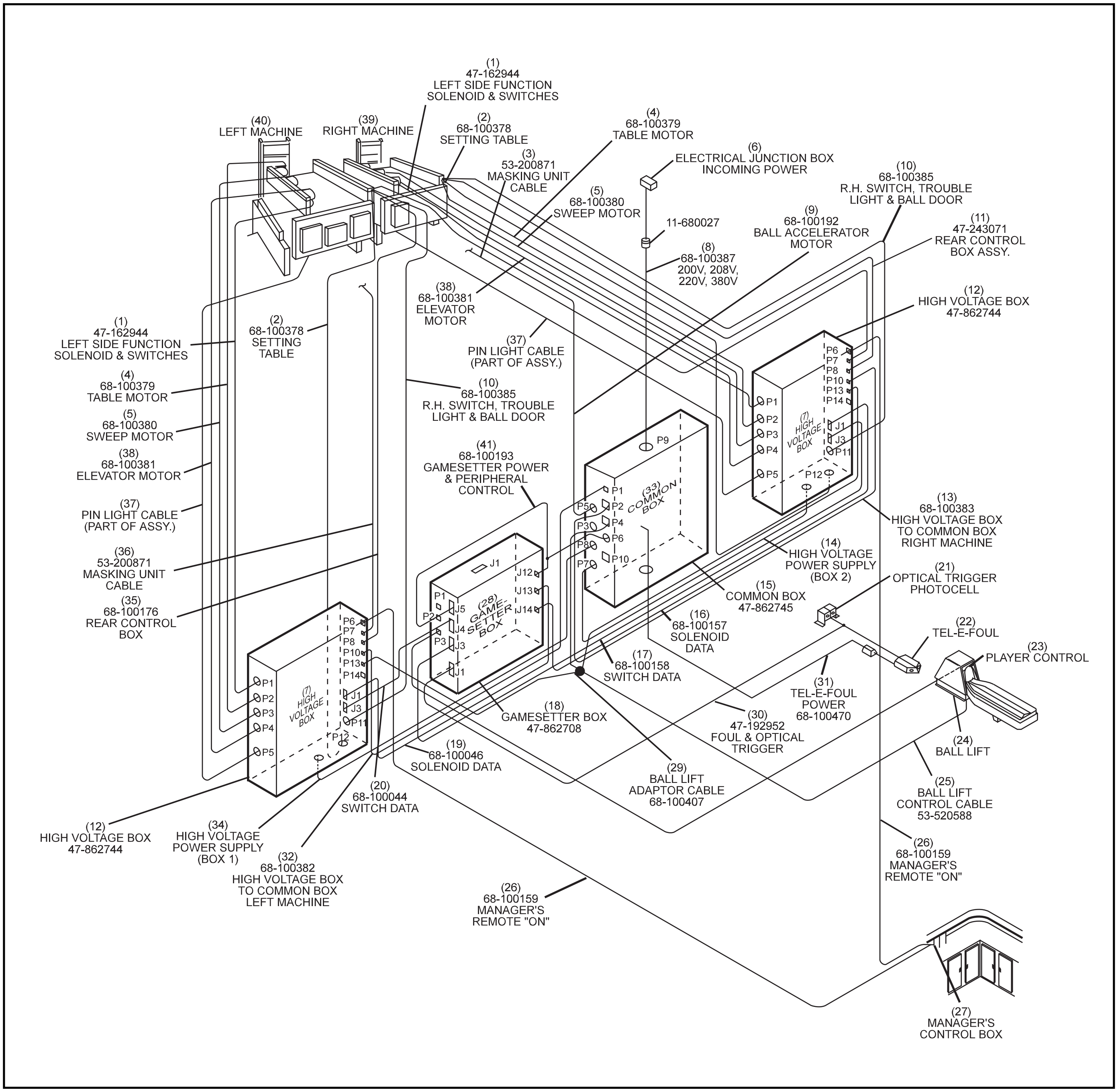

Figure 3-12. GS-Series Pinsetter with Universal Electronics.

Figure 3-12. GS-Series with Universal Electronics.

(1) LEFT SIDE FUNCTION SOLENOID AND SWITCHES (47-162944)
(2) SETTING TABLE (68-100378)
(3) MASKING UNIT CABLE (57-200871)
(4) TABLE MOTOR (68-100379)
(5) SWEEP MOTOR (68-100380)
(6) ELECTRICAL JUNCTION BOX INCOMING POWER
(7) HIGH VOLTAGE BOX
(8) 200 V, 208V, 220V, 380V (68-100387)
(9) BALL ACCELERATOR MOTOR (68-100192)
(10) RIGHT-HAND SWITCH, TROUBLE LIGHT AND BALL DOOR (68-100385)
(11) REAR CONTROL BOX ASSEMBLY (47-243071)
(12) HIGH VOLTAGE BOX (47-862744)
(13) HIGH VOLTAGE BOX TO COMMON BOX RIGHT MACHINE
(14) HIGH VOLTAGE POWER SUPPLY (BOX 2)
(15) COMMON BOX (47-862745)
(16) SOLENOID DATA (68-100157)
(17) SWITCH DATA (68-100158)
(18) GAMESETTER BOX (47-862708)
(19) SOLENOID DATA (68-100046)
(20) SWITCH DATA (68-100044)
(21) OPTICAL TRIGGER PHOTOCELL
(22) TEL-E-FOUL
(23) PLAYER CONTROL
(24) BALL LIFT
(25) BALL LIFT CONTROL CABLE (53-520588)
(26) MANAGER'S REMOTE ON (68-100159)
(27) MANAGER'S CONTROL BOX
(28) GAMESETTER BOX (47-862708)
(29) BALL LIFT ADAPTOR CABLE (68-100407)
(30) FOUL AND OPTICAL TRIGGER (47-192952)
(31) TEL-E-FOUL POWER (68-100470)
(32) HIGH VOLTAGE BOX TO COMMON BOX LEFT MACHINE (68-100382)
(33) COMMON BOX (47-862745)
(34) HIGH VOLTAGE POWER SUPPLY (BOX 1)
(35) REAR CONTROL BOX (68-100176)
(36) MASKING UNIT CABLE (53-200871)
(37) PIN LIGHT CABLE (PART OF ASSEMBLY)
(38) ELEVATOR MOTOR (68-100381)
(39) RIGHT MACHINE
(40) LEFT MACHINE
(41) GAMESETTER POWER AND PERIPHERAL CONTROL (68-100193)

Ball Detect - Photocell Triggering

The photocell is an optical device used to detect a ball rolling down the lane. It consists of a transmitter/receiver device and a retroreflector. The transmitter/receiver device is mounted on the ball return capping and the retroreflector is mounted on the division capping. They are positioned directly across from the each other at 115 mm (4.5") in front of the pinsetter kickbacks. Refer to *Figures 3-13* and *3-14*.

The transmitter sends an infrared beam across the lane to the retroreflector which reflects the beam back to the receiver. When any object cuts this beam, the receiver sends a pulse to the Pinsetter CPU. The Pinsetter CPU then cycles the corresponding pinsetter.

WARNING: A strong light source such as a camera's electronic flash may cause the pinsetter to trigger.

(1) KICKBACK
(2) PHOTOCELL ASSEMBLY

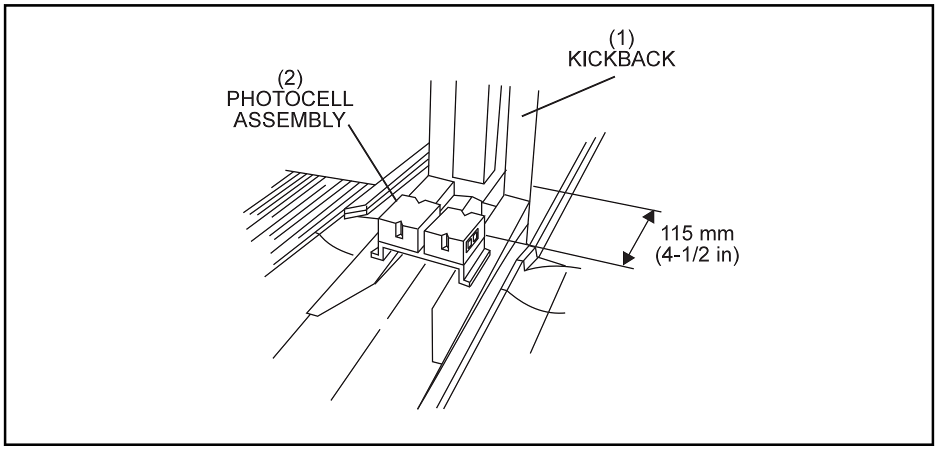

Figure 3-13. Ball Detect.

(1) KICKBACK
(2) RETROREFLECTOR

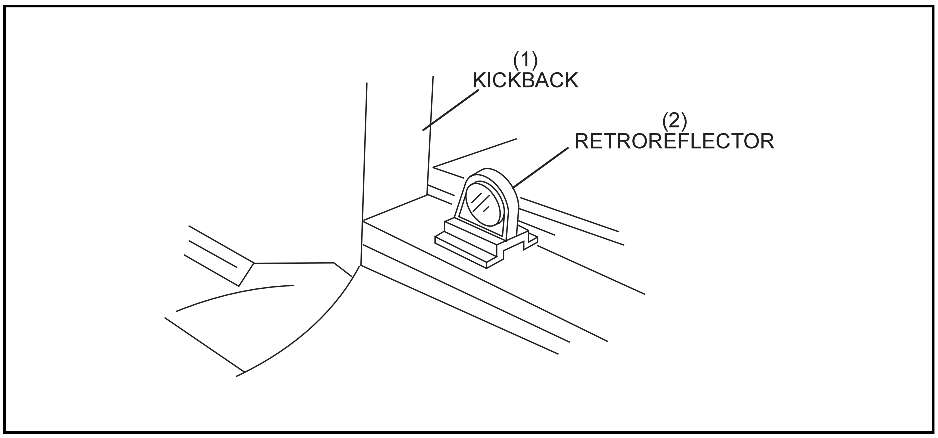

Figure 3-14. Retroreflector.

Foul Detect

The foul detect is located at the foul line and is mounted between the pair of lanes on the ball return capping. Retroreflectors, mounted on divisions, return the beam to the foul detect. A foot or some other object will interrupt this beam and a signal is sent to the Pinsetter CPU to make the pinsetter set ten new pins if the machine is in a first ball foul situation while bowling a ten pin game format. The foul detect will not register a foul when the beam is broken by a bowling ball.

Reset Button

A bowler's reset button is located on the side of the ball rack. This switch parallels the reset switch on the Universal High Voltage boxes and rear Control Boxes on the elevator. Its purpose is to cycle the pinsetter to the next ball.

Masking Unit Switch

The masking unit covers the pinsetter from the bowlers' view. On the bottom of the masking unit is a toggle switch that can be used to turn the pinsetter off.

NOTE: *Leaving this switch off when turning on the pinsetter can result in an EJ error code because the distributor motor cannot run the elevator. Also, error codes 70-74 can be displayed if the pinsetter is turned off at the masking unit when the pinsetter is cycling.*

Manager's Control Unit (Stand-alone Only)

Front Panel

The Manager's Control unit (*Figure 3-14*) is located at the Control Desk of the bowling center. This allows all the pinsetters to be turned on and off and monitored from one vantage point. Each Manager's Control unit controls two pinsetters via two cables connected to the back of the unit. These cables are routed to connection P6 of each High Voltage box in a universal control system or P10/P28 on the low voltage box in a consolidated control system. This unit and the connecting cables are not used when the pinsetters are installed in a BowlerVision or Frameworx center.

Non-Resettable Counter - This counter provides the manager a continuous count of each time the pinsetter sets new pins or a ball is rolled. This can be used by the manager for daily, weekly, monthly, etc. activity reports.

NOTE: *The choice of counting balls or frames is made on the individual universal High Voltage box PCB using connections J24 and J25* ***or*** *connections J8 and J9 on the consolidated Low Voltage box.*

Resettable Counter - This counter allows the Control Desk personnel to monitor the number of frames the bowlers have bowled or the balls they have rolled. The counter should be manually reset each time the lane is assigned to another group of bowlers.

Trouble Light - This small red lamp will flash when the Pinsetter CPU detects an error within the pinsetter. The trouble light will remain flashing until the error has been cleared at the pinsetter.

On/Off Switch - This switch gives the front desk personnel the ability to turn pinsetters on or off from the Control Desk. The push/push switch contains a lamp covered by a green lens that is lit when the pinsetter is turned on.

Lane I.D. Tags - These numbered tags provide lane identification for the Control Desk personnel.

(1) NON-RESETTABLE COUNTER
(2) RESETTABLE COUNTER
(3) TROUBLE LIGHT
(4) ON/OFF SWITCH
(5) LANE I.D. TAGS

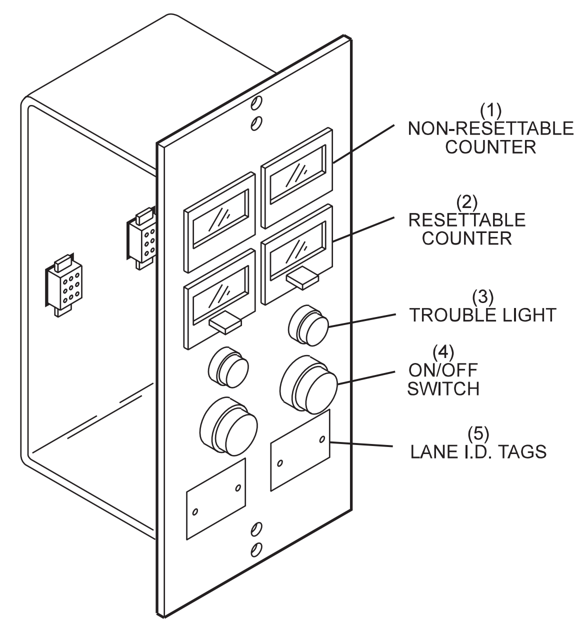

Figure 3-14. Manager's Control Unit.

Player Control Station

The Player Control Station (PCS) is located at the ball rack and is used by the bowler. Two types of the PCS are used; one for stand-alone centers and the other for BowlerVision centers.

The stand-alone PCS has two basic functions; one is the pinfinder display which consists of two arrays of ten LEDs that show the bowler which pins have been left standing after the ball has been delivered. Refer to *Figure 3-14*. The other function is activated when the pinsetter is switched into “Figures” or "Figures Clearing" modes at the Pinsetter CPU. Ten individual switches, one for each bowling pin, are enabled to allow the bowler to select any combination of pins to be set by the pinsetter. Two other switches assist the bowler in making these selections.

Set - Pushing this switch makes the pinsetter set the combination of pins the bowler has selected.

Cancel - Pushing this switch clears any previous selections the bowler has made and allows a new combination to be selected.

(1) RED LIGHT EMITTING DIODE
(2) SWITCH

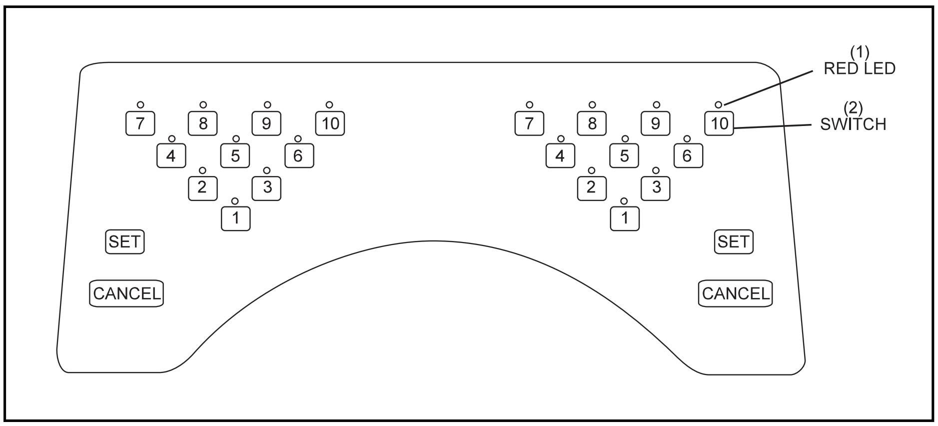

Figure 3-15. Player Control Station (PCS).

The BowlerVision PCS has two arrays of ten LEDs each that show the bowler which pins are standing after a ball has been delivered. The switch capabilities do not exist in this PCS because this function can be performed at the BowlerVision Playpad.

Table of Contents

Consolidated Electronics

The GS-98 Pinsetter is controlled and operated by a consolidated electronic control system. This system consists of two control boxes mounted on the front of the left pinsetter and several other items that monitor and help the pinsetter operate. These boxes are referred to as consolidated control boxes that are capable of working with all voltage systems throughout the world. Model GS-96 and earlier pinsetters use a universal electronics system.

Figure 4-1 is a representation of the control boxes mounted on the front of a pair of pinsetters. Each pinsetter will use a portion of the consolidated High and Low Voltage boxes for the operation of the motors and solenoids. The left pinsetter will have one Low Voltage box and one High Voltage box. The Low Voltage box gathers switch information and sends out operating instructions to each pinsetter. The High Voltage box is the entry point for the 3-phase power needed to run the pinsetters. The High Voltage box also contains all of the transformers and motor contactors used to operate the pinsetter.

If the pinsetters are installed with the Brunswick BowlerVision automatic scoring, an additional box is mounted on the front of the right hand pinsetter. Any other Brunswick automatic scoring system is connected via cabling to the Low Voltage box. Brunswick automatic scoring systems will not be discussed in this manual as information on the operation of these systems is available in its own manual.

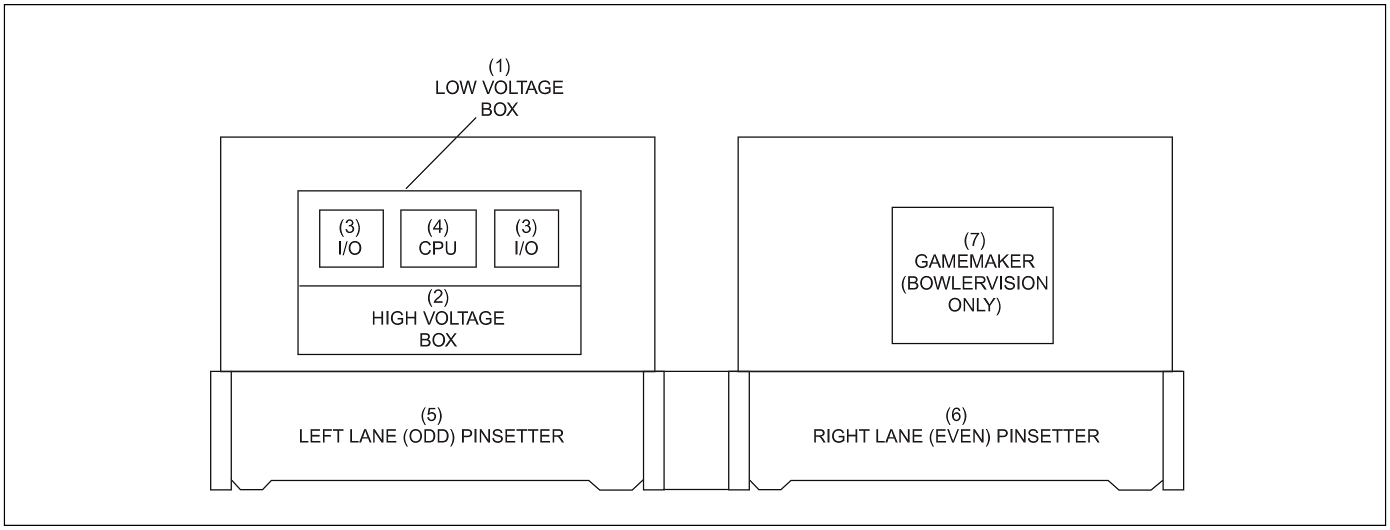

Figure 4-1. Electronic Control Box Layout (Consolidated Control System).

(1) LOW VOLTAGE BOX
(2) HIGH VOLTAGE BOX
(3) INPUT/OUTPUT
(4) CENTRAL PROCESSING UNIT
(5) LEFT LANE (ODD) PINSETTER
(6) RIGHT LANE (EVEN) PINSETTER
(7) GAMEMAKER (BOWLERVISION ONLY)

Figure 4-2 is a block diagram which shows the flow of information and power paths between the pinsetters, several external devices and the electronic boxes.

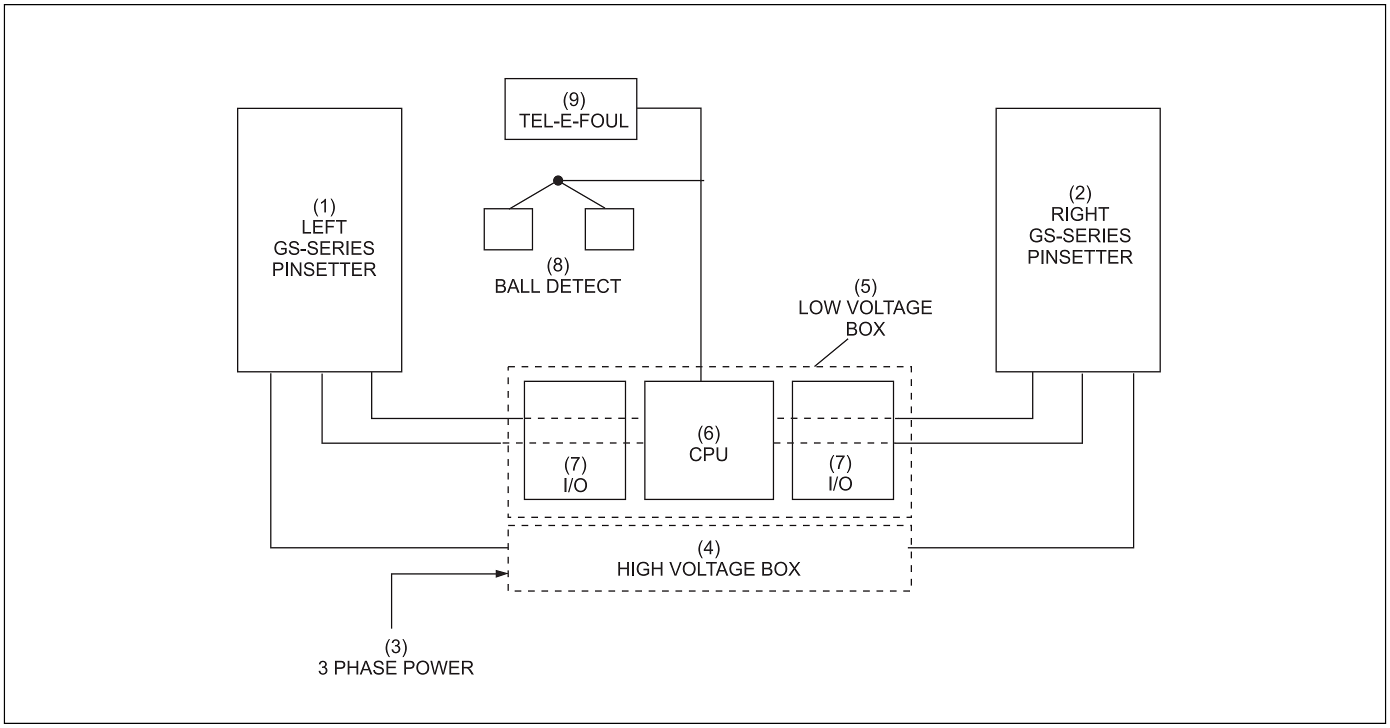

Figure 4-2.

(1)	LEFT GS-SERIES PINSETTER	(2)	RIGHT GS-SERIES PINSETTER	(3)	3 PHASE POWER
(4)	HIGH VOLTAGE BOX	(5)	LOW VOLTAGE BOX	(6)	CENTRAL PROCESSING UNIT
(7)	INPUT/OUTPUT	(8)	BALL DETECT	(9)	TEL-E-FOUL

Consolidated High Voltage Box

The consolidated High Voltage box receives incoming 3-phase power and makes it available for all of the motors, the pin lights and the three transformers used to provide power for the consolidated Low Voltage box. The following is a description of its components and operation.

Left Side

SW9 (Power Switch) - Controls the 3-phase power entering the box. In the off position, this switch will disable both pinsetters and the ball accelerator.

P34 (AC Power-In Cable) - Input power connection for the 3-phase power. This power can be 208, 230 or 380 - 415 VAC.

P21 (Pin Light Power) - Provides 208 or 230 VAC single phase to the left pinsetter's pin light.

SW2 (Pin Light Switch) - Bypasses the pin light relay to provide power to the left pinsetter's pin light during preventive maintenance or troubleshooting.

P15 (Table Motor Power) - Provides full 3-phase power to the left pinsetter's table motor.

P16 (Sweep Motor Power) - Provides full 3-phase power to the left pinsetter's sweep motor.

P17 (Distributor Motor Power) - Provides full 3-phase power to the left pinsetter's distributor motor.

(1) TABLE MOTOR POWER
(2) MAIN POWER SWITCH
(3) ALTERNATING CURRENT POWER
(4) PIN LIGHT SWITCH
(5) PIN LIGHT POWER
(6) DISTRIBUTOR MOTOR POWER
(7) SWEEP MOTOR POWER
(8) TABLE MOTOR POWER

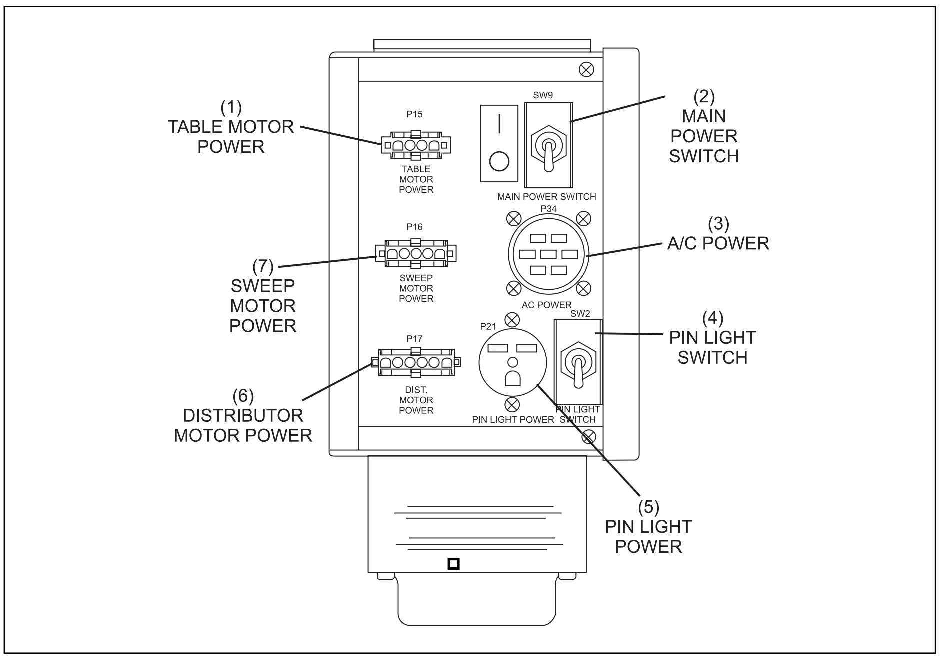

Figure 4-3. Left Side View - Consolidated High Voltage Box.

Right Side

P22 (Ball Accelerator Power) - Provides full 3-phase power to the ball accelerator motor.

P13 (Gamemaker Power) - Provides a single phase power 208 or 230 VAC to the Gamemaker in the BowlerVision automatic scoring system.

P14 (Pin Light Power) - Provides 208 or 230 VAC single phase power to the right pinsetter's pin light.

SW1 (Pin Light Switch) - Bypasses the pin light relay to provide power to the right pinsetter's pin light during preventive maintenance or troubleshooting.

P20 (Distributor Motor Power) - Provides full 3-phase power to the right pinsetter's distributor motor.

P19 (Sweep Motor Power) - Provides full 3-phase power to the right pinsetter's sweep motor.

P18 (Table Motor Power) - Provides full 3-phase power to the right pinsetter's table motor.

(1) DISTRIBUTOR MOTOR POWER
(2) SWEEP MOTOR POWER
(3) TABLE MOTOR POWER
(4) PIN LIGHT POWER
(5) PIN LIGHT SWITCH
(6) GAMEMAKER POWER
(7) BALL ACCELERATOR

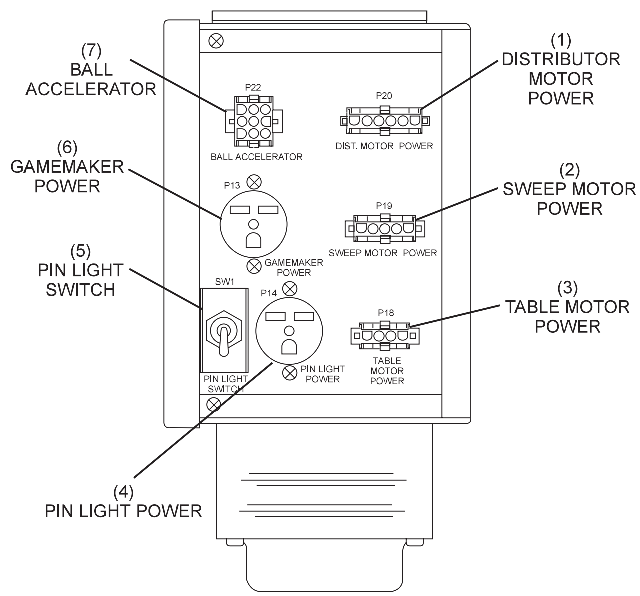

Figure 4-4. Right Side View - Consolidated High Voltage Box.

Bottom

Mounted on the bottom of the High Voltage box are three transformers. These transformers use an incoming 230 Volt single phase of the incoming power and step it down to lower AC voltages. No external cable or switch connections are present on the bottom of this box.

Transformer 1 (Left Pinsetter Power) - Provides 24 VAC and 26 VAC to the I/O PCB in the Low Voltage box. The 24 Volts is converted to 24 VDC to provide power for the coils of the motor contactors, the masking unit relays and pin light relay. The four 26 VAC connections provide power to the function solenoids and the pin holder solenoids. The output wires connect to J11 on the I/O PCB.

Transformer 2 (CPU Power) - Provides 8.2 VAC, 13.6 VAC, 24 VAC and 28 VAC to the CPU PCB for creating the DC voltages for pinsetter operation. The output wires connect to J13 on the CPU PCB.

Transformer 3 (Right Pinsetter Power) - Provides the same functions as Transformer 1, but for the right pinsetter's I/O PCB.

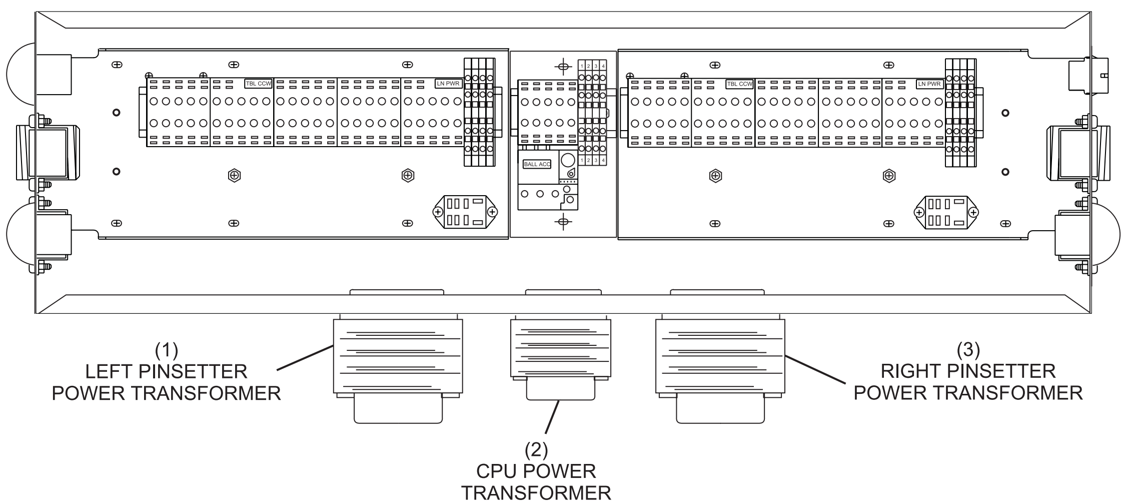

Figure 4-5. Consolidated High Voltage Box Transformers.

(1) LEFT PINSETTER POWER TRANSFORMER (2) CPU POWER TRANSFORMER (3) RIGHT PINSETTER POWER TRANSFORMER

Internal

Inside the High Voltage box are 11 contactors, one overload relay and two pin light relays. Five contactors located on the left side are used to control the motors and high voltage for the left pinsetter. The five on the right do the same for the right pinsetter. The middle contactor controls the ball accelerator motor. The two pin light relays turn on their respective pin lights when the pinsetter is turned on. *Figure 4-6* gives the location of the components located inside of the High Voltage box.

Lane Power Contactors

Each lane power contactor passes the 3-phase power to the motor contactors. Each contactor also passes single phase power to one of the pinsetter power transformers to energize the solenoids as needed. The coil voltage for these contactors is 12 VDC and is connected to A1 and A2. The contactor inputs are connected to the odd number terminals 1, 3, 5 and 13. The outputs are on the even number terminals 2, 4, 6 and 14. When replacing a lane power contactor, verify that the coil is 12 VDC by examining the number at the mounting base of the contactor. Refer to *Figure 4-6*.

Motor Contactors

All of the motor contactors' coils operate on 24 VDC. The coil connections are A1 and A2. The 3-phase power is connected to terminals 1, 3, 5. The outputs are connected directly to the overload relay. Note that the outputs of the table motor contactors are tied in parallel as there is only one overload relay needed to protect the table motor. The coil must be labeled 24 VDC at the mounting base to work properly. Refer to *Figure 4-6*.

Table Motor Contactor (CW) - Runs the table motor clockwise when the setting table is respotting pins or setting new pins.

Table Motor Contactor (CCW) - Runs the table motor counterclockwise when the setting table is detecting for pins.

Sweep Motor Contactor - Runs the sweep motor when clearing unwanted pins (deadwood) from the playing surface.

Distributor Motor Contactor - Runs the distributor, transport band and elevator to prepare the pins for the next ball.

Ball Accelerator Motor Contactor - Runs the accelerator motor when either the left or right pinsetter or both pinsetters are turned on.

Ball Accelerator Overload Relay

The ball accelerator has its own overload relay for self protection. If this relay senses a high current, it will shut off the motor by disabling the motor contactor. The red button is a manual reset that must be pressed to reset the overload relay. If the overcurrent situation is still present or reoccurs, the overload will continue to shut off the motor until the problem has been cleared. Refer to *Figure 4-6*.

The blue reset switch is a 2-position switch that gives you the choice of manual or automatic reset. In this application, the pointer on this switch must be up and pointing to the manual position "H." Leaving this switch down in the automatic "A" position could result in damage to the pinsetter or serious injury to the person servicing this pinsetter.

The grey dial is a sensitivity adjustment for the current being used by the motor. This dial should be set to monitor and protect the motor according to the operating amperage listed on the motor housing.

Pin Light Relays

Each pinsetter has a relay to turn on the pin light during bowling to enable the bowler to see which pins are standing on the lane surface.

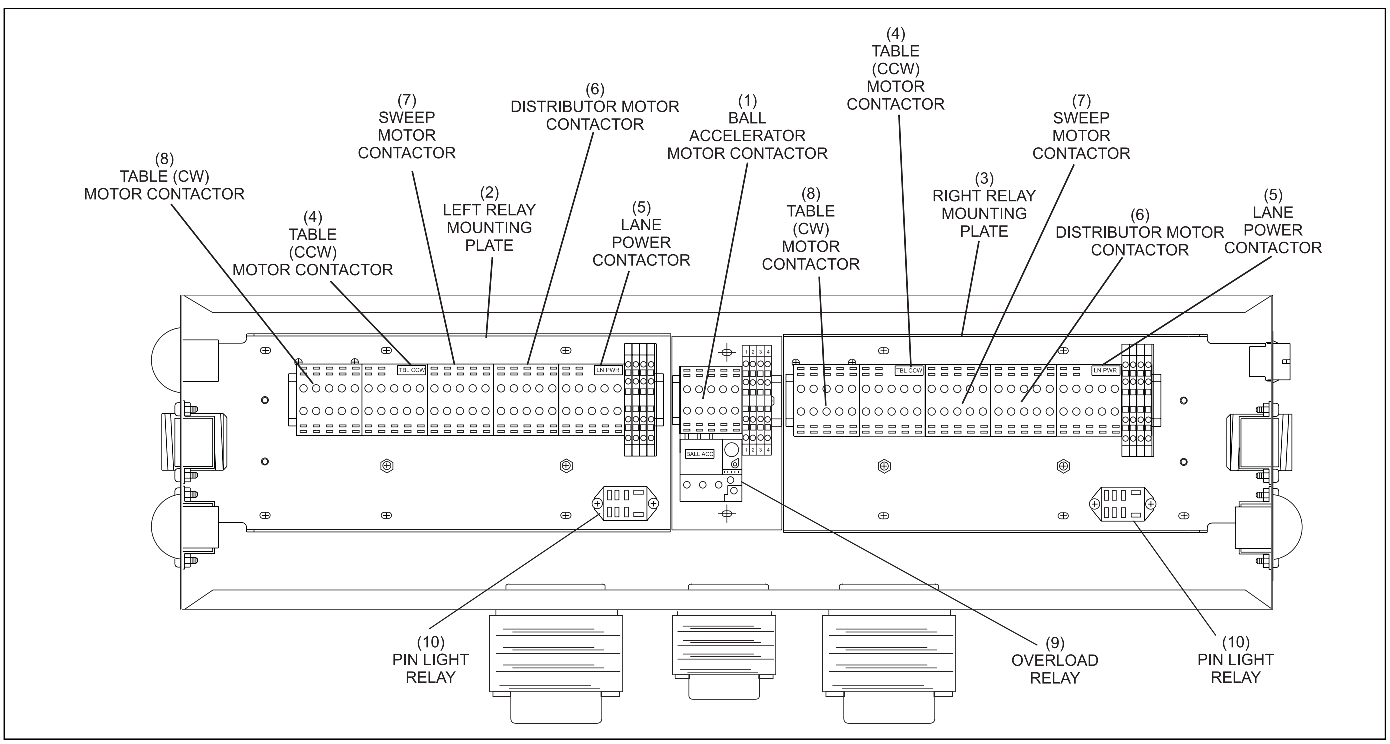

Figure 4-6. Internal View - Consolidated High Voltage Control Box.

(1)	BALL ACCELERATOR MOTOR CONTACTOR	(2)	LEFT RELAY MOUNTING PLATE	(3)	RIGHT RELAY MOUNTING PLATE
(4)	TABLE (COUNTERCLOCKWISE) MOTOR CONTACTOR	(5)	LANE POWER CONTACTOR	(6)	DISTRIBUTOR MOTOR CONTACTOR
(7)	SWEEP MOTOR CONTACTOR	(8)	TABLE (CLOCKWISE) MOTOR CONTACTOR	(9)	OVERLOAD RELAYS
(10)	PIN LIGHT RELAY				

Consolidated Low Voltage Box

The consolidated Low Voltage box consists of three PCBs and many cable and switch connections. This box can be referred to as the brains of a pair of pinsetters. It controls both pinsetters by monitoring the switches and other external devices such as ball detect and foul unit to determine what each pinsetter is doing. This box will then energize solenoids and turn on the motors appropriately to prepare for the next ball. Refer to *Figure 4-7* and *Figure 4-8* for the left and right side connections of the Low Voltage box.

Left Side

P1 (Left Side Function Switches and Solenoids) - This connection provides the input for the “TS1,” “G,” “EC” and pin count switches. It provides output signals to the sweep release, spotting tong, stroke limiter and shark solenoids on the left side of the pinsetter.

P2 (Right Side Function Switches, Trouble Light and Ball Door) - This connection is the input for all the switches on the right side of the pinsetter. These switches are “A,” “B,” “C,” “D,” “SM,” “TS2” and “OOR.” The cable also provides the output signals for the trouble light and the ball door solenoid.

P3 (Table Switches and Solenoids) - This cable is routed along the right side of the pinsetter and down to the back of the setting table. Pinsensing information from the pin holders and spotting tong “ST”switch information is sent to the Low Voltage box through this cable. The pin holder solenoids are energized and denergized via the voltages sent from the Low Voltage box.

P4 (Masking Unit Control) - This connection provides first ball, second ball and strike light signals to the masking unit. It also connects to the toggle switch on the masking unit which can be used to turn off the pinsetter.

P5 (Microprocessor Control) - Provides the third ball/tenth frame signal, second ball light power and a remote turn on for the AS-80, AS-90 or AS-K scorer consoles.

P6 (Comline In) - This connection is used only with BowlerVision or Frameworx Scoring Systems. It provides two-way commuication between the Pinsetter CPU and the BowlerVision's Gamemaker and Frameworx scoring system.

P7 (Overhead Control) - This connection is used only in a BowlerVision center for Scoreboard, BowlerTrack and service light functions.

P8 (Comline Out) - This connection is used with BowlerVision and Frameworx Scoring Systems. It routes communication signals through the Pinsetter CPU to the BowlerVision console in the bowlers' area or Frameworx lane devices.

P9 (Ball Lift) - Provides 28 VAC to the ball lift control box relay.

P10 (Manager's Lane Control) - This connection is used to provide remote control of the pinsetter from the Control Desk.

P11 (Rear Box Control) - This connnection provides input from the set, reset, and on/off switches mounted on the ball return side of the elevator.

P12 (Ball Rack Reset) - Provides the input for the bowlers' reset switch on the ball rack.

(1) P1 - LEFT SIDE FUNCTION SWITCHES AND SOLENOIDS
(2) P2 - RIGHT SIDE FUNCTION SWITCHES TROUBLE LIGHT AND BALL DOOR
(3) P3 - TABLE SWITCH AND SOLENOIDS
(4) P5 - MICROPROCESSOR CONTROL
(5) P7 - OVERHEAD CONTROL
(6) P9 - BALL LIFT
(7) P12 - BALL RACK RESET
(8) P11 - REAR BOX CONTROL
(9) P10 - MANAGER'S LANE CONTROL
(10) P8 - COMLINE "OUT"
(11) P6 - COMLINE "IN"
(12) P4 - MASKING UNIT CONTROL
(13) GROUNDING STRAP

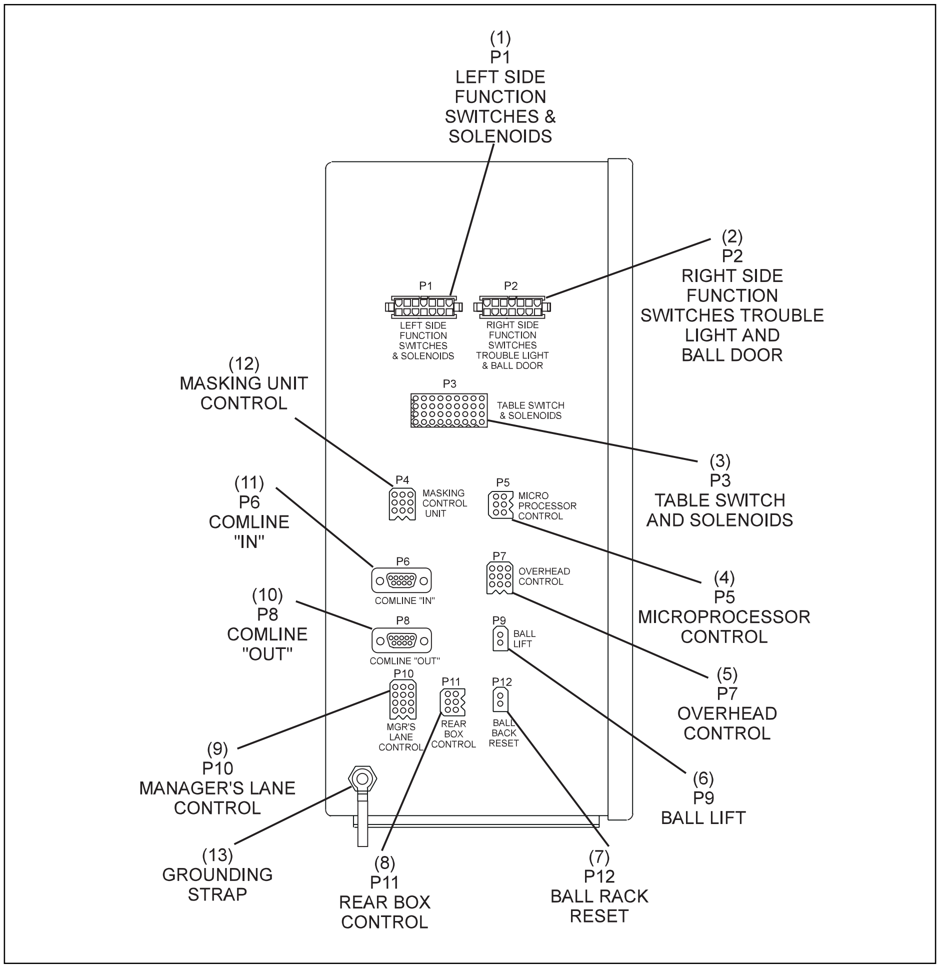

Figure 4-7. Left Side View - Consolidated Low Voltage Control Box.

Right Side

P23 (Right Side Function Switches, Trouble Light and Ball Door) - This connection is the input for all the switches on the right side of the pinsetter. These switches are “A,” “B,” “C,” “D,” “SM,” “TS2” and “OOR.” The cable also provides the output signals for the trouble light and the ball door solenoid.

P24 (Left Side Function Switches and Solenoids) - This connection provides the input for the “TS1,” “G,” “EC” and pin count switches. It provides the output signals to the sweep release, spotting tong, stroke limiter and shark solenoids on the left side of the pinsetter.

P25 (Table Switches and Solenoids) - This cable is routed along the right side of the pinsetter and down to the back of the setting table. Pinsensing information from the pin holders and spotting tong “ST” switch information is sent to the Low Voltage box through this cable. The pin holder solenoids are energized and denergized via the voltages sent from the Low Voltage box.

P26 (Ball Rack Reset) - Provides the input for the bowlers' reset switch on the ball rack.

P27 (Rear Box Control) - This connnection provides input from the set, reset, and on/off switches mounted on the ball return side of the elevator.

P28 (Manager's Lane Control) - This connection is used to provide remote control of the pinsetter from the Control Desk.

P29 (Ball Detect and Foul) - This connection provides the power to the ball detect units. It also receives input signals from the ball detect units and the foul unit.

P30 (Player Control Station [PCS]) - This connection routes information between the Low Voltage box CPU and the player control station.

P31 (Scorer) - This connection is used to provide scoring communication between the Pinsetter CPU and a Brunswick automatic scorer system other than BowlerVision or Frameworx. The cable connected here is routed directly to the scorer console and passes pinfall information, pinsetter position, foul signals and third ball-tenth frame information between the two systems.

P32 (Microprocessor Control) - Provides the third ball/tenth frame signal, second ball light power and a remote turn on for the AS-80, AS-90 or AS-K scorer consoles.

P33 (Masking Unit Control) - This connection provides first ball, second ball and strike light signals to the masking unit. It also connects to the toggle switch on the masking unit which can be used to turn off the pinsetter.

(1) P32 - MICROPROCESSOR CONTROL
(2) P33 - MASKING UNIT CONTROL
(3) P31 - SCORER
(4) P27 - REAR BOX CONTROL
(5) P28 - MANAGER'S LANE CONTROL
(6) P25 - TABLE SWITCH AND SOLENOIDS
(7) P24 - LEFT SIDE FUNCTION SWITCHES AND SOLENOID
(8) P23 - RIGHT SIDE FUNCTION SWITCHES TROUBLE LIGHT AND BALL DOOR
(9) P26 - BALL RACK RESET
(10) P29 - BALL DETECT AND FOUL
(11) P30 - PLAYER CONTROL STATION

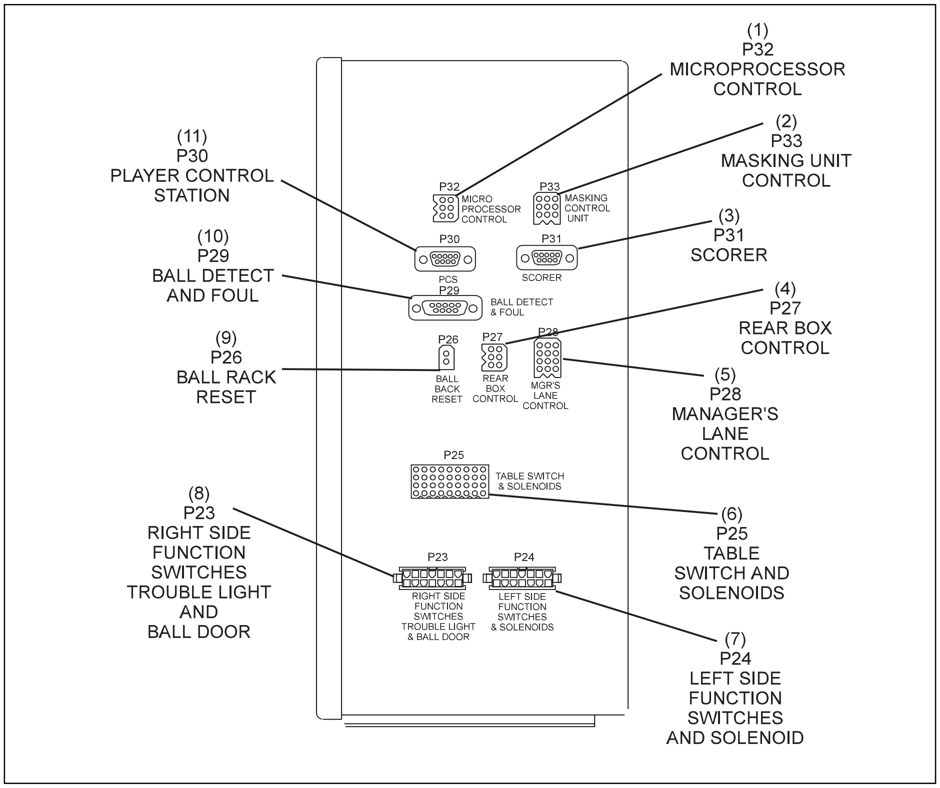

Figure 4-8. Right Side View - Consolidated Low Voltage Box.

Top Side

Figure 4-9 provides the locations of the switches and displays described below.

S12/S13 (Manager's Control/Bypass Switch) - This switch allows for a manual turn on/off of the pinsetter in a stand-alone environment. Positioning this switch in the Bypass position allows the pinsetter to be operated regardless of the Manager's Control unit. In the Manager's Control position, the turn on and off capability is turned over to the Manager's Control unit at the Control Desk. In a BowlerVision or Frameworx Scoring Solutions environment, this switch must be left in the Manager's Control position.

SW3/SW6 (Set Switch) - This push button switch causes the last combination of pins to be set. This switch is duplicated on the player control station PCB and on the rear control box mounted on the elevator.

SW4/SW7 (Reset Switch) - This push button switch is used to cycle the pinsetter to the next ball. Identical switches are mounted on the ball rack for the bowler's use and the rear control box mounted on the side of the elevator for the mechanics' use from the back of the pinsetter.

SW5/SW8 (Stop/Run Switch) - This toggle switch is used to manually stop or start the pinsetter. Turning this switch to the Stop position will deenergize the lane power contactor in the consolidated High Voltage box.

KSW1 (Mode Switch) - This switch is a key operated switch that is set into one of five positions.

> **Diagnostics -** This mode allows the pinsetter(s) to be self tested by the Low Voltage CPU Board.
>
> **Normal -** This position is used only when Brunswick's BowlerVision or Frameworx Scoring Solutions is used for automatic scoring.
>
> **10 Pin -** This mode allows the pinsetter to set ten pins and up to two balls to knock them down. This mode will be used for all other scorers.
>
> **Figures Clearing -** This mode allows the bowler to select any combination of pins at the player control station and will allow the bowler to roll balls until all the pins have been knocked down. Then the pinsetter will set the selected combination again.
>
> **Figures -** This mode is similar to Figures Clearing mode except the bowler only gets to roll one ball at the selected combination of pins and the selected combination will be set again.

NOTE: Figures Clearing and Figures will only be available in a stand alone environment. These features are built into the Frameworx Scoring System and can be initiated from the scoring console.

SW10 (Comline Switch) - This switch is only used in the BowlerVision and Frameworx Scoring Solutions mode. In order for the GS-Series pinsetter to communicate with BowlerVision or Frameworx electronics, this switch must be down in the closed position.

Error Codes LED Display - This LED display will flash a specific code when a malfunction has occured. It is also used to display codes when use the diagnostics.

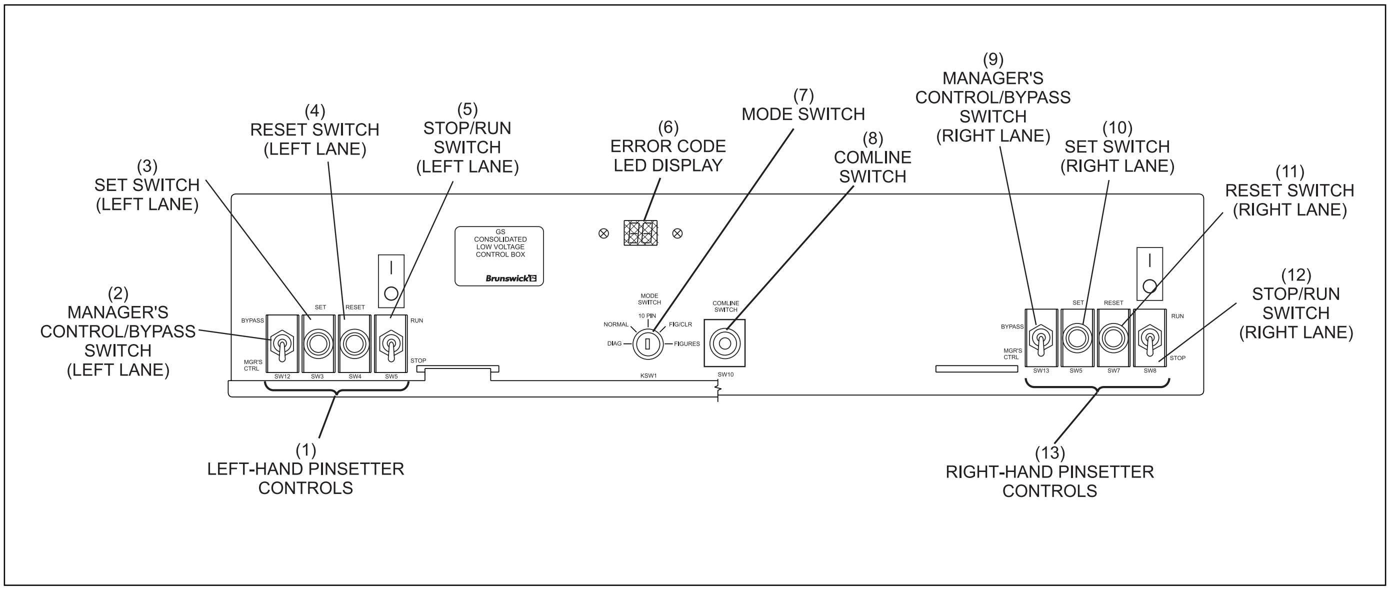

Figure 4-9. Top View - Consolidated Low Voltage Control Box.

(1) LEFT-HAND PINSETTER CONTROLS
(2) MANAGER'S CONTROL/BYPASS SWITCH (LEFT LANE)
(3) SET SWITCH (LEFT LANE)
(4) RESET SWITCH (LEFT LANE)
(5) STOP/RUN SWITCH (LEFT LANE)
(6) ERROR CODE LED DISPLAY
(7) MODE SWITCH
(8) COMLINE SWITCH
(9) MANAGER'S CONTROL/BYPASS SWITCH (RIGHT LANE)
(10) SET SWITCH (RIGHT LANE)
(11) RESET SWITCH (RIGHT LANE)
(12) STOP/RUN SWITCH (RIGHT LANE)
(13) RIGHT-HAND PINSETTER CONTROLS

Internal

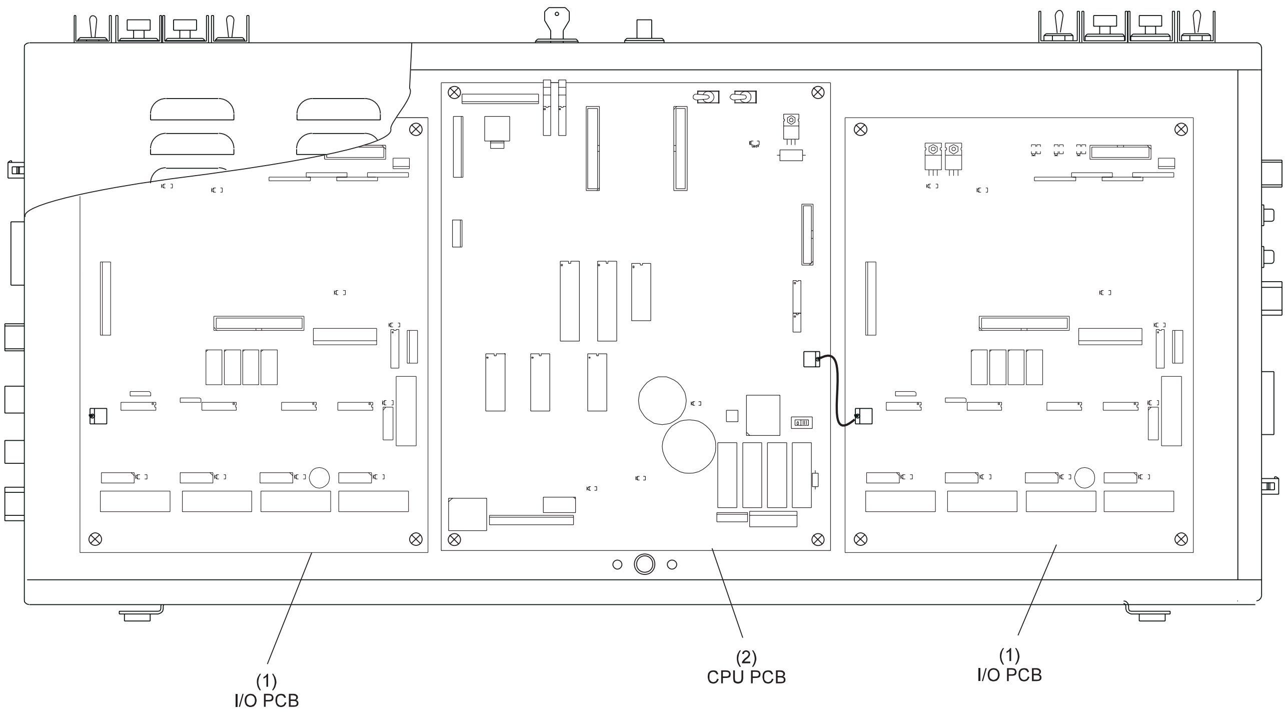

Figure 4-10. Internal View - Consolidated Low Voltage Box.

(1) INPUT/OUTPUT PRINTED CIRCUIT BOARD

(2) CENTRAL PROCESSING UNIT PRINTED CIRCUIT BOARD

I/O PCB

I/O is an acronym for input and output. These printed circuit boards receive the incoming information from the pinsetter and pass it on to the CPU. The CPU then makes an appropriate decision and sends its commands back to the pinsetter through the I/O printed circut board. Refer to *Figure 4-9*.

Circuit Breakers

The I/O PCB has five circuit breakers responsible for protecting the solenoids and relays on the pinsetter. If the current exceeds the 3.2 Amp rating it will disable the circuit. Pushing the red button in the middle of the circuit breaker will reset the contacts inside the breaker. If a problem has not been corrected the circuit breaker may "trip" again and the defect will need to be repaired to get the unit working once again.

CB 1 - Protects the coils of the masking unit relays, the motor contactor coils and the pin light relay coil.

CB 2 - Protects the 1, 2 and 3 pin holder solenoids and the spotting tong solenoid.

CB 3 - Protects the 4, 5, and 6 pin holder solenoids and the sweep release solenoid.

CB 4 - Protects the 7, 8 and 9 pin holder solenoids and the stroke limiter solenoid.

CB 5 - Protects the 10 pin holder solenoid, the smart shark solenoid and the ball door solenoid.

Light Emitting Diodes (LEDs)

The light emitting diode glows red when the voltage it is monitoring flows through it. When a LED is off, it means that the circuit breaker is tripped or the voltage is not present.

LED 1 - Monitors the coils to the motor contactors, masking unit relays and pin light relay.

LED 2 - Monitors the 1, 2, and 3 pin holder solenoids and the spotting tong solenoid.

LED 3 - Monitors the 4, 5, and 6 pin holder solenoids and the sweep release solenoid.

LED 4 - Monitors the 7, 8, and 9 pin holder solenoids and the stroke limiter solenoid.

LED 5 - Monitors the 10 pin holder solenoid, the smart shark solenoid and the ball door solenoid.

LED 6 - Lights when the lane power contactor is energized in the consolidated High Voltage box.

LED 7 - Lights when the switch “A” contacts are closed. This should be when the setting table is in the home position.

LED 8 - Lights when all ten pin holder switches are closed by pins being loaded into the table from the distributor.

LED 9 - Lights when the CPU has enabled the pinsetter to operate.

LED 10 - Lights when the stop/run switch on the top of the Low Voltage box is in the run position and the rear mechanic’s on/off switch is on.

LED 11 - Lights when the bypass/manager’s control switch on this box is in the bypass position. This allows the mechanic to operate the pinsetter independent of the Control Desk during troubleshooting and preventive maintenance.

LED 12 - Lights when the masking unit on/off switch is on.

Relays K1-K4

K1 - Supplies 24 Volt turn on signal when all pinsetter control switches are on or in run position.

K2 - Turns on the first ball lamp in the masking unit.

K3 - Turns on the second ball lamp in the masking unit.

K4 - Turns on the strike lights in the masking unit.

J1 - 5 and 12 volt DC supply from CPU PCB.

J7 - Solenoid Output. Sends output information to motor contactors.

J8 - Sweep Count. When the jumper is set, the frame count will energize when the sweep release solenoid is energized.

J9 - Stroke Count. When the jumper is set, the frame count will energize when the stroke limiter solenoid energizes.

J10 - Pin Solenoids. Sends out information to all solenoids.

J11 - Power In. 24 and 26 volts AC input from transformer in High Voltage box.

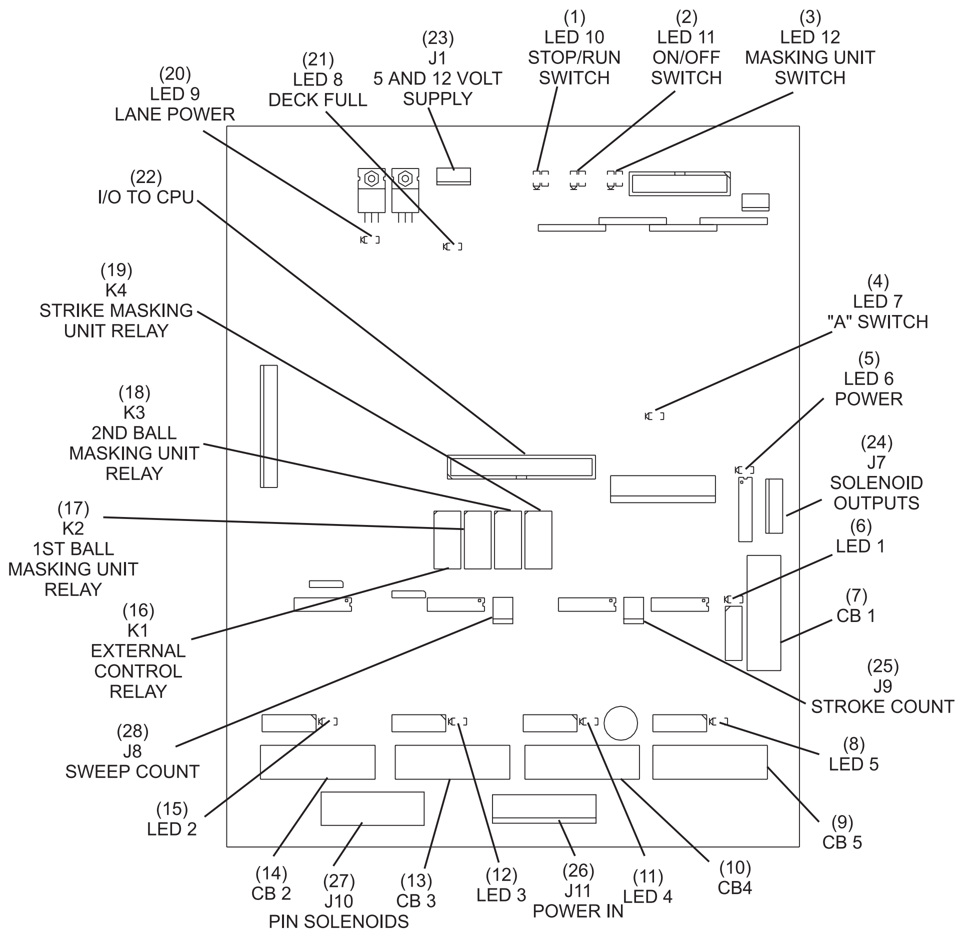

Figure 4-11. I/O PCB - Consolidated Low Voltage Control Box.

(1)	LED 10 STOP/RUN SWITCH	(2)	LED 11 ON/OFF SWITCH	(3)	LED 12 MASKING UNIT SWITCH
(4)	LED 7 “A” SWITCH	(5)	LED 6 POWER	(6)	LED 1
(7)	CIRCUIT BREAKER 1	(8)	LED 5	(9)	CIRCUIT BREAKER 5
(10)	CIRCUIT BREAKER 4	(11)	LED 4	(12)	LED 3
(13)	CIRCUIT BREAKER 3	(14)	CIRCUIT BREAKER 2	(15)	LED 2
(16)	K1 EXTERNAL CONTROL RELAY	(17)	K2 1ST BALL MASKING UNIT RELAY	(18)	K3 2ND BALL MASKING UNIT RELAY
(19)	K4 STRIKE MASKING UNIT RELAY	(20)	LED 9 LANE POWER	(21)	LED 8 DECK FULL
(22)	J5 I/O TO CPU	(23)	J1 5 AND 12 VDC SUPPLY	(24)	J7 SOLENOID OUTPUTS
(25)	J9 STROKE COUNT	(26)	J11 POWER IN	(27)	J10 PIN SOLENOIDS
(28)	J8 SWEEP COUNT				

CPU PCB

CPU is an acronym for Central Processing Unit. This board accepts all the information from both I/O PCBs, and processes it to determine what each pinsetter must do. It then sends this information back to the pinsetters through the I/O PCBs. The CPU contains a microprocessor and an EPROM which determine what should be done to prepare for the next ball. The micorprocessor makes the decisions, but consults the EPROM which contains the program of operating procedures and rules.

The CPU has a memory that retains the status of each pinsetter. It is backed up by a 3.6 Volt battery for when power is turned off during servicing or a power failure. An error code "80" will warn you of a possible battery failure.

CPU Power

Power for the CPU comes from the center transformer mounted on the bottom of the High Voltage box. Four voltages are sent to the board; three are converted to direct current (DC) and protected by individual circuit breakers.

CB 1 Protects the +5 VDC circuitry.

CB 2 Protects the +12 VDC circuitry.

CB 3 Protects the +24 VDC circuitry.

CB 4 Protects the 28 VAC circuit.

LED 1 Labeled “Computer Normal” and lights when the microprocessor is operating properly.

LED 2 Lights when the 5 Volt circuitry is operating.

LED 3 Lights when the 12 Volt circuitry is operating.

LED 4 Lights when the 24 Volt circuitry is operating.

J12 5 and 12 VDC output to each I/O PCB.

J13 Input from center transformer on the bottom of the High Voltage box.

K 1 Sends the 28 VAC to the ball lift control box.

K 2 Initializes the start up sequence when one or both pinsetters are turned on. This enables the lane power contactors, the ball accelerator contactor and ball lift control to prepare the pinsetter for bowling.

R 145 This variable resistor is used to adjust the 5 Volt signal for the CPU's microprocessor.

SW 1 The foul enable switch allows you to accept or ignore the foul signal coming from the foul unit.

SW 2 The lane error switch is used to start "Switch Diagnostics." It is a 3-position switch with the left position being left lane start, right position being right lane start and the center position being the off position. The switch is a spring-loaded toggle switch that returns to the center position when not being held.

SW 3 The lane pair ID switch is an 8-position DIP switch used to delay turning on the CPU during the initial start up and after a power loss. The lane number should be set to one half of the even lane number pinsetter. Consult the Service section of this manual for the proper settings needed to allow a .5 second delay between start up of each lane pair.

NOTE: *This is beneficial in containing power costs. If a Brunswick scoring system such as BowlerVision, Frameworx, or Command Network is used, this switch should always be set to a 1 as these scoring systems incorporate the same staggered start-up system. This is explained also in the Service section of this manual.*

Position #1 through #5 - Represents the lane assignment. Set it binarily for half of the even lane pinsetter. Right = ON.

Position	Binary Value
#1	(1)
#2	(2)
#3	(4)
#4	(8)
#5	(16)

Position #6 - Controls the delay of the setting table operation after the sweep drops to a guarded position.

OFF (left) - Quick setting table - No delay after sweep drop.
ON (right) - Delayed setting table - ABC, FIQ..., compliant delay.

Position #7 - Determines if the distributor will stop after all 10 pins have been delivered to the pin holders while waiting for a 2nd ball cycle.

OFF (left) - Stop enable - Distributor stops after ten pins have loaded while waiting for a 2nd ball.
ON (right) - Stop disabled - Continuous distributor operation while loading pin.

Position #8 - Not used at this time.

SW 4 The characterization switch is a 4-position switch that is used to define the environment the pinsetter is to be operated in.

Position #1 - Labeled SCN. Gives the pinsetter the choice of detecting pin activity on second ball. If a scoring system is present that has the capability of interfacing with the CPU, it can use the pin holder switch information to determine the bowler's pinfall. If no scoring system is available, or the scoring system uses a scanner or camera for determining pinfall, turning this switch on disables the detection stroke of the setting table during the second ball.

OFF (left) - Double Detect - Set if a scanner or CCD Camera are not used.
ON (right) - Single Detect - Set if a scanner or CCD Camera are used.

Position #2 - Labeled GM. Gives the CPU the capability of communicating with the BowlerVision's Gamemaker or Frameworx Scoring system.

OFF (left) - Non-BowlerVision or Frameworx Scoring System - including stand alone.
ON (right) - BowlerVision or Frameworx Scoring System.

Position #3 - Labeled 50's. This position allows pinfall detection to be monitored or ignored during machine cycle diagnostics.

OFF (left) - Diagnostic Codes 50-59 not activated.
ON (right) - Diagnostic Codes activated.

Position #4 - Labeled OOR. The fourth switch is a disabling switch for the out-of- range cycle. Placing this switch to the right will cause the pinsetter to ignore an out-of-range pin. ABC, the FIQ and many other bowling organizations require that the pinsetter stop and any deadwood (pins that have been knocked over but are still in the field of play) must be removed before the next ball can be rolled. In many countries, this is not a requirement and it interferes with the bowler's flow of bowling. If your center has sanctioned leagues that require deadwood be removed before a second ball is rolled, this switch should be in the left position.

OFF (left) - Pinsetter stops for an out-of-range pin.
ON (right) - Ignores an out-of-range pin.

SW 5 The DC bypass switch allows you to turn on the DC power to the CPU without the Manager's Control Unit.

(1) DOUBLE DETECT (BOWLERVISION AND FRAMEWORX)
(2) SINGLE DETECT (STAND-ALONE) AUTOMATIC SCORERS WITH SCANNERS OR CCD
(3) DOUBLE DETECT AUTOMATIC SCORERS WITHOUT SCANNERS OR CCD

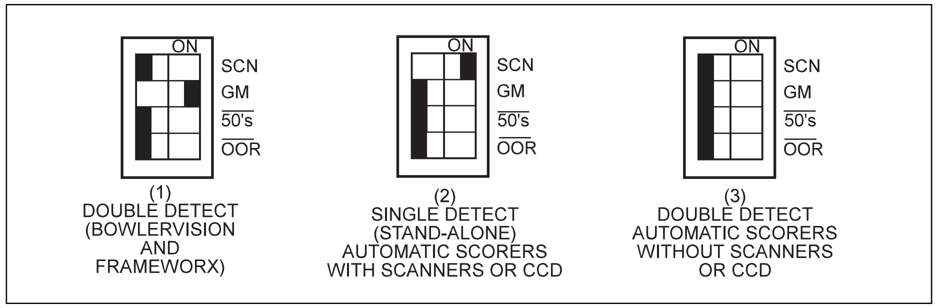

Figure 4-12. Typical Switch Arrangement.

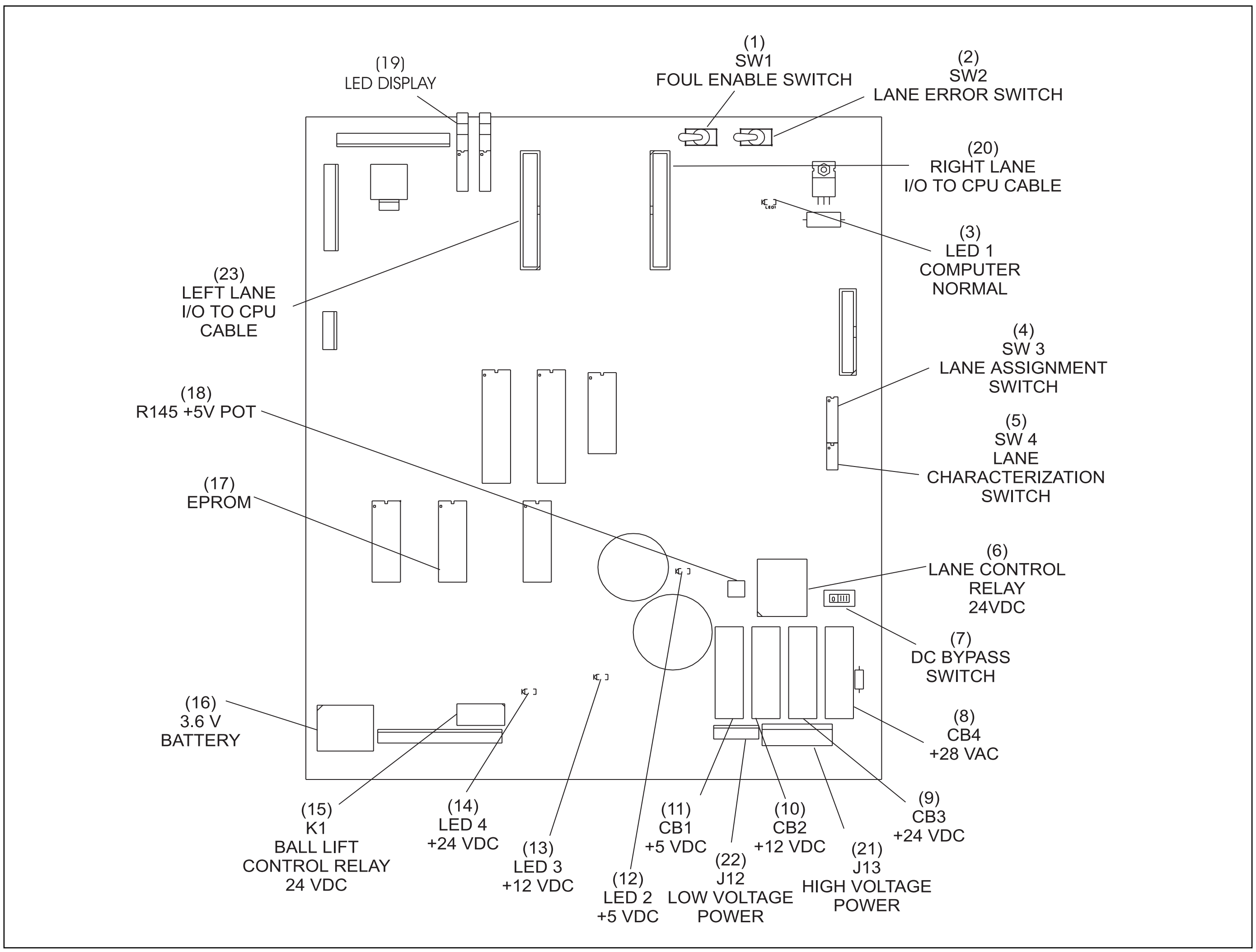

Figure 4-13. CPU PCB - Consolidated Low Voltage Control Box.

(1) SW1 FOUL ENABLE SWITCH
(2) SW2 LANE ERROR SWITCH
(3) LED 1 COMPUTER NORMAL
(4) SW3 LANE ASSIGNMENT SWITCH
(5) SW4 LANE CHARACTERIZATION SWITCH
(6) LANE CONTROL RELAY 24 VDC
(7) DC BYPASS SWITCH
(8) CIRCUIT BREAKER 4 +28 VAC
(9) CIRCUIT BREAKER 3 +24VDC
(10) CIRCUIT BREAKER 2 +12 VDC
(11) CIRCUIT BREAKER 1 +5VDC
(12) LED 2 +5 VDC
(13) LED 3 +12 VDC
(14) LED 4 +24 VDC
(15) K1 BALL LIFT CONTROL RELAY 24 VDC
(16) 3.6 V BATTERY
(17) EPROM
(18) R145 +5 V POT
(19) LED DISPLAY
(20) RIGHT LANE I/O TO CPU CABLE
(21) J13 HIGH VOLTAGE POWER
(22) J12 LOW VOLTAGE POWER
(23) LEFT LANE I/O TO CPU CABLE

Diagnostic Modes

Trouble Diagnostics

The low voltage CPU contains a means of diagnosing pinsetter problems and will shut down a pinsetter if a fault is detected. When a problem occurs, the pinsetter will shut down and the trouble light on the top of the elevator will start to flash. The Lane Error Display on top of the Low Voltage box can be used to diagnose the problem.

Contact Closure Diagnostics

In addition to trouble diagnostics, the Low Voltage box CPU is capable of performing two diagnostic modes for testing pinsetter operations; one mode, contact closure diagnostics, checks the switches on the pinsetter and displays which switches are used during the time the check is being made. This mode can be used to verify that switches are working properly and the wiring between the Low Voltage box, High Voltage box and the individual switches is correct.

Machine Cycle Diagnostics

The other mode, machine cycle diagnostics, puts the pinsetter into a continuous operating cycle in which the pinsetter operates as if it was in a ten pin bowling mode, with the following exceptions. Instead of waiting for a ball detect, a five second time signal from the CPU starts the pinsetter cycle. The pinsetter will continue to set, reset, sweep and reload pins as long as it is switched into the diagnostic mode. Fouls will be ignored during the diagnostics, and in BowlerVision and Frameworx scoring systems, pinsetter cycles will not be counted at the Manager's Control location. Diagnostic faults (failures) are active during diagnostics and can stop the pinsetter if a jam or some form of failure is detected.

Contact Closure Diagnostics

NOTE: *In order to proceed with the contact closure diagnostics, removal of the front cover of the consolidated Low Voltage box is necessary. Also refer to Table 4-1 for switch codes.*

1. The contact closure diagnostics operates only on one pinsetter at a time. The pinsetter is selected by having the following conditions available.

   a. The trouble light cannot be lit.

   b. The rear mechanic switch and masking unit switch must be on.

   c. Either the left or right bypass/manager's control switch on the consolidated Low Voltage box must be set to “Bypass.” This will be dependent on which pinsetter is being tested. Refer to *Figure 4-14*.

   d. Either the left or right stop/run switch on the consolidated low voltage box must be switched to the “stop” position. This will be dependent on which pinsetter is being tested. Refer to *Figure 4-14*.

   e. The mode selection key switch needs to be in the “diagnostics” mode before supplying power to the consolidated low voltage CPU board. Refer to *Figure 4-14*.

   f. Turn the main power switch located on the left side of the consolidated High Voltage box off and then on again to guarantee that the CPU will initialize to the “diagnostics” mode.

2. To start the contact closure diagnostics, follow the steps below.

   a. Hold the lane error switch on the CPU board in the consolidated low voltage box toward the pinsetter on which the diagnostics are to be run (left or right). Refer to *Figure 4-13* for the location of this switch.

   b. Turn either the left or right stop/run switch on the consolidated Low Voltage box to the “run” position. This will be dependent on which pinsetter is being tested.

NOTE: While holding the lane error switch to the left or right, each LED section in the lane error display will light to verify that they are working properly, so that error codes will be displayed correctly. Refer to Figure 4-15.

c. Release the lane error code switch to begin diagnostics.

1. The codes of the switches that are closed at that time will be displayed.

NOTE: *To test individual switches, hold the switch closed while the "88" and the left or right lane code flash on the LED display. The code for the specific switch closed should appear in the next cycle of codes.*

2. Refer to *Table 1* to identify the switches displayed to determine if they are in their proper positions.

3. This diagnostic cycle will run continously until manually stopped.

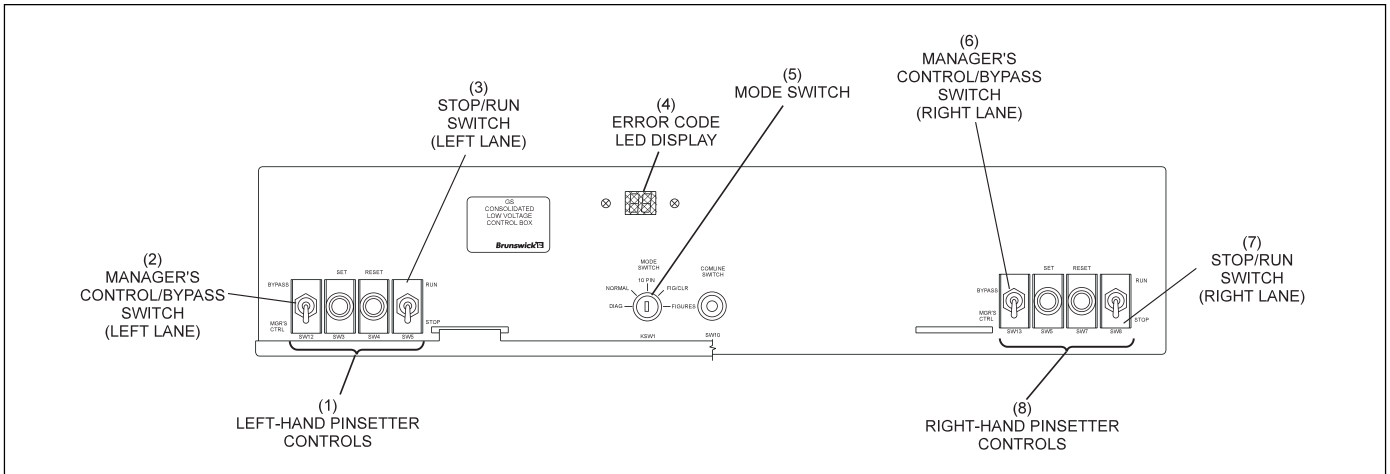

Figure 4-14. Consolidated Electronics Diagnostics.

(1) LEFT-HAND PINSETTER CONTROLS
(2) MANAGER'S CONTROL/BYPASS SWITCH (LEFT LANE)
(3) STOP/RUN SWITCH (LEFT LANE)
(4) ERROR CODE LED DISPLAY
(5) MODE SWITCH
(6) MANAGER'S CONTROL/BYPASS SWITCH (RIGHT LANE)
(7) STOP/RUN SWITCH (RIGHT LANE)
(8) RIGHT-HAND PINSETTER CONTROLS

3. To stop the contact closure diagnostics, follow the steps below:

a. If the mode selection switch is in "Diagnostics," the pinsetter will go into "Machine Cycle Diagnostics."

b. If the mode selection switch is in "10 Pin," "Normal," or "Figures" mode, the pinsetter will go through a cold start power up which will put the pinsetter into a ready-to-bowl state.

Left or Right Lane	└ or ┌
Lane Number	? ?
Pin Switch 1	01
Pin Switch 2	02
Pin Switch 3	03
Pin Switch 4	04
Pin Switch 5	05
Pin Switch 6	06
Pin Switch 7	07
Pin Switch 8	08
Pin Switch 9	09
Pin Switch 10	10
Switch A	A
Switch B	b
Switch C	C
Switch D	d
Table Switch 1 (TS1)	U1
Table Switch 2 (Tower) (TS2)	U2
Sweep Motor Switch (SM)	E
Switch G	21
Spotting Tong Switch (ST)	22
Out-of-Range (OOR)	23
Elevator Control Switch (See Note) (EC)	24
Rear Mechanic's Stop Switch	31
RESET Switch	32
SET Switch	33
Switch 2 Position 1 (SCN)	41
Switch 2 Position 2 (GM)	42
Switch 2 Position 3	43
Switch 2 Position 4	44
Fouls Enabled (Switch on Pinsetter CPU)	45
Foul Signal from Foul Unit	51
Ball Detect	52
POWER Key Switch on High Voltage Box	53
FIGURES Mode	60
FIG/CLR Mode	61
10-Pin Mode	62
NORMAL Mode	63
Pin Count Switch	64
End of Cycle - Read for New Cycle	88

Table 4-1. Contact Display Codes

NOTE: *For #24 to be displayed, Elevator Switch must be manually pulsed during the "88" display which indicated the End of Cycle - Read for New Cycle.*

Machine Cycle Diagnostics

1. To enter into this mode, the following conditions are necessary.

   a. The trouble light cannot be lit.

   b. The rear mechanic switch and masking unit switch must be on.

   c. Either the left or right bypass/manager's control switch on the consolidated Low Voltage box must be set to "Bypass." This will be dependent on which pinsetter is being tested. Refer to *Figure 4-14*.

   d. Either the left or right stop/run switch on the consolidated Low Voltage box must be switched to the "stop" position. This will be dependent on which pinsetter is being tested. Refer to *Figure 4-14*.

   e. The mode selection key switch needs to be in the "diagnostics" mode before supplying power to the consolidated low voltage CPU. Refer to *Figure 4-14*.

   f. Turn the power switch located on the left side of the consolidated High Voltage box off and then on again to guarantee that the CPU will initialize to the "diagnostics" mode.

   g. Turn either the left or right stop/run switch on the consolidated Low Voltage box to the "run" position. This will be dependent on which pinsetter is being tested.

2. The pinsetter(s) will start cycling continuously until an error is detected or the mode selection key switch is moved back to 10-pin or some other mode and the Low Voltage box stop/run switch is moved back to 10-pin or some other mode and the Low Voltage box stop/run switch is toggled from "run" to "stop" and then back.

3. If a pinsetter stops during diagnostics and the trouble light is lit, check the digital display on top of the Low Voltage box. The LEDs will display what type of error was detected with an accompanying decimal point for the lane designation of the problem. Refer to Figure 4-15.

NOTE: *In order to see error codes 50-59 in Machine Diagnostics, position #3 of the lane characterization switch must be to the right (on). See Page 4-20 for an explanation and location of the switch.*

(1) DECIMAL POINT DESIGNATING LEFT LANE
(2) DECIMAL POINT DESIGNATING RIGHT LANE

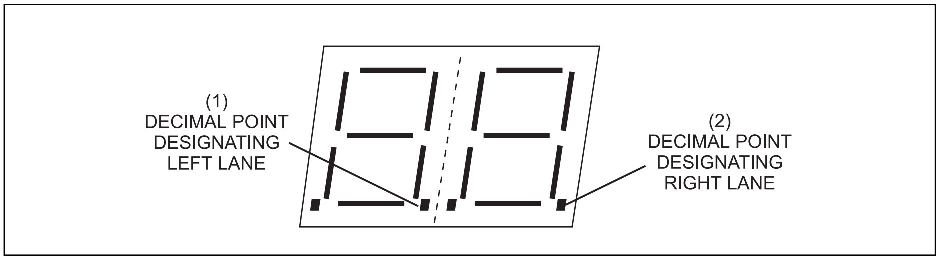

Figure 4-15. LED Display

NOTE: *If other problems on that lane or other lanes occur at the same time, the codes will flash alternately until power has been restored to the pinsetter.*

NOTE: *Error codes A0, A1 and 80 will not shut down a machine. However, they will indicate a problem which needs correction. Error Code 80 should be a concern if noticed on several consecutive days which would indicate a problem with the memory back-up battery.*

4. *Tables 4-2 and 4-3* will give an indication of the failure and where to start looking for the problem. The displayed code will not pinpoint the problem in all cases. For further explanation of the codes, refer to the Troubleshooting section of this manual.

Invalid Machine State	**Spotting Tongs Switch**	**Table**		**Sweep Assembly**			
		Position	"A" Switch	"G" Switch		"SM" Switch	
0 (90)	Closed	Home	Closed	Open	Sweep Up	Open	Not Forward
1 (91)	Closed	Not Home	Open	Open	Sweep Up	Open	Not Forward
2 (92)	Closed	Not Home	Open	Closed	Sweep Down	Open	Not Forward
3 (93)	Open	Home	Closed	Open	Sweep Up	Open	Not Forward
4 (94)	Open	Not Home	Open	Open	Sweep Up	Open	Not Forward
5 (95)	Open	Not Home	Open	Closed	Sweep Down	Open	Not Forward

Table 4-2. Invalid Machine States.

NOTE: *Invalid machine states usually indicate a problem exists with one of the following:*
1. *Faulty table or sweep motor break.*
2. *Spotting tong clutch malfunctioning.*
3. *Defective A, G, SM, or ST switch.*

I--I	Power Up in Progress
-II-	No Errors
None	The Lane Initialized
A0	PCS Not Communicating
A1	PCS Not Sending Correct Response
F0	External RAM Testing Failure
F1	Prom Check Sum Failure
FF	CPU Lost
80	Battery Back-up RAM Failure
P0	Can't Pick up These Pins
P0	Out-of-Range
01	Pin Loading Time Out Pin 1
02	Pin Loading Time Out Pin 2
03	Pin Loading Time Out Pin 3
04	Pin Loading Time Out Pin 4
05	Pin Loading Time Out Pin 5
06	Pin Loading Time Out Pin 6
07	Pin Loading Time Out Pin 7
08	Pin Loading Time Out Pin 8
09	Pin Loading Time Out Pin 9
10	Pin Loading Time Out Pin 10
50	#10 Pin Not Detected in Diagnostics
51	#1 Pin Not Detected in Diagnostics
52	#2 Pin Not Detected in Diagnostics
53	#3 Pin Not Detected in Diagnostics
54	#4 Pin Not Detected in Diagnostics
55	#5 Pin Not Detected in Diagnostics
56	#6 Pin Not Detected In Diagnostics

57	#7 Pin Not Detected in Diagnostics
58	#8 Pin Not Detected in Diagnostics
59	#9 Pin Not Detected in Diagnostics
60	Switch A is Not Expected But Found
61	Switch B is Not Expected But Found
62	Switch C is Not Expected But Found
63	Switch D is Not Expected But Found
64	Switch SM is Not Expected But Found
65	Switch G is Not Expected But Found
66	Switch ST Is Not Expected But Found
67	SW. OOR is Not Expected But Found
70	Switch A Expected But Not Found
71	Switch B Expected But Not Found
72	Switch C Expected But Not Found
73	Switch D Expected But Not Found
74	Switch SM Expected But Not Found
75	Switch G Expected But Not Found
76	Switch ST Expected But Not Found
90	Invalid Machine State 0
91	Invalid Machine State 1
92	Invalid Machine State 2
93	Invalid Machine State 3
94	Invalid Machine State 4
95	Invalid Machine State 5
EJ	Elevator Jam
EL	Pin Count Switch Shorted for 5 Seconds
J1	Jam Switch TS1
J2	Jam Switch TS2 (Tower)

Table 4-3. Error Codes

External Control and Monitor Assemblies

Cable Connections

The electronic boxes are interconnected with several external devices that assist in the operation of the pinsetters.

The boxes and cables are labeled for easy identification in the event a box needs to be replaced. However, care must be exercised when making these changes as problems can occur if cables are swapped between the left and right connections.

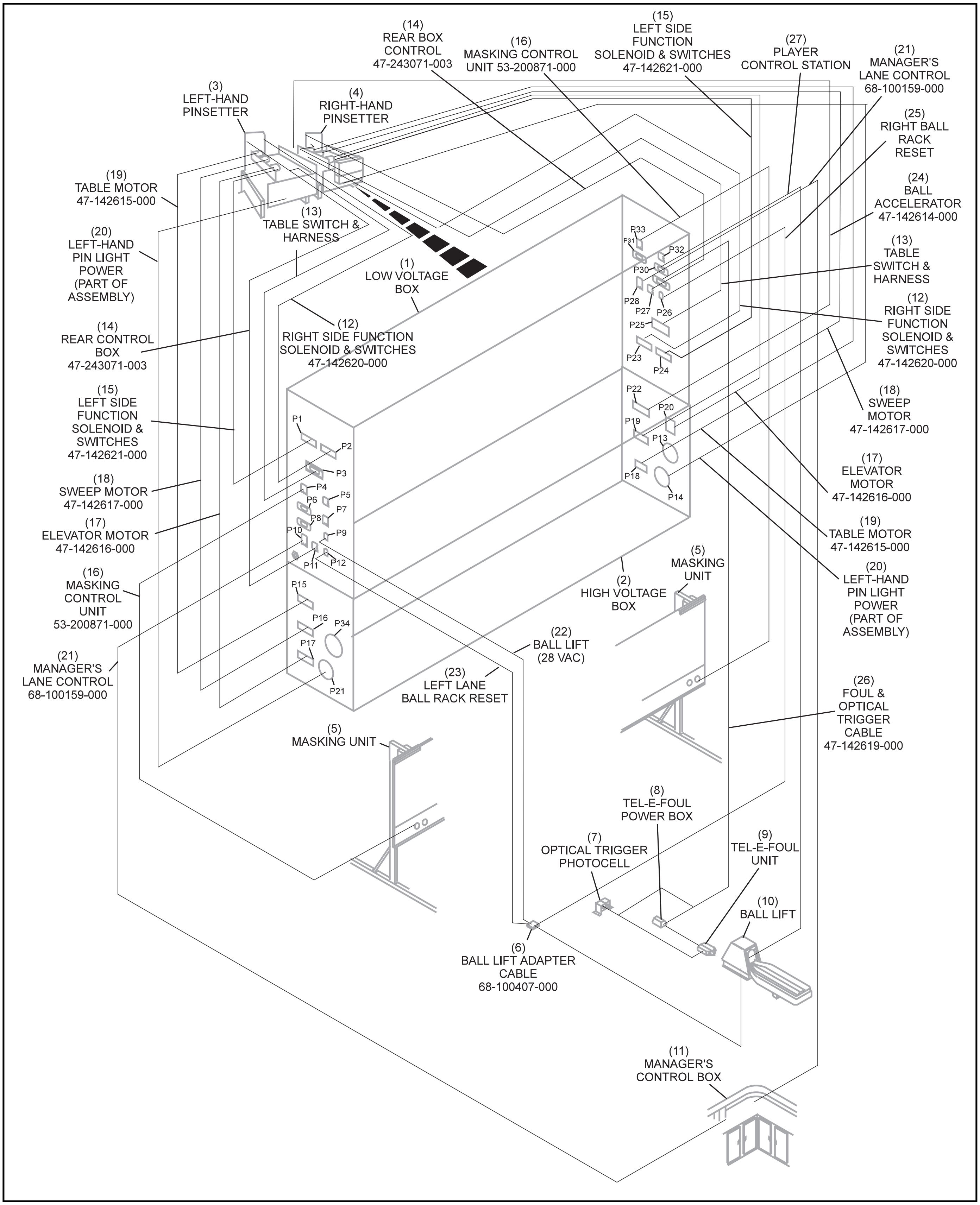

Figure 4-16. GS-Series Pinsetters with Consolidated Electronics.

Figure 4-16. GS-Series Pinsetters with Consolidated Electronics.

(1) LOW VOLTAGE BOX	(2) HIGH VOLTAGE BOX	(3) LEFT-HAND PINSETTER
(4) RIGHT-HAND PINSETTER	(5) MASKING UNIT	(6) BALL LIFT ADAPTER CABLE 68-100407-000
(7) OPTICAL TRIGGER PHOTOCELL	(8) TEL-E-FOUL POWER BOX	(9) TEL-E-FOUL UNIT
(10) BALL LIFT	(11) MANAGER'S CONTROL BOX	(12) RIGHT SIDE FUNCTION SOLENOID & SWITCHES 47-142620-000
(13) TABLE SWITCH AND HARNESS	(14) REAR BOX CONTROL 47-243071-003	(15) LEFT SIDE FUNCTION SOLENOID & SWITCHES 47-142621-000
(16) MASKING CONTROL UNIT 53-200871-000	(17) ELEVATOR MOTOR 47-142616-000	(18) SWEEP MOTOR 47-142617-000
(19) TABLE MOTOR 47-142615-000	(20) LEFT-HAND PIN LIGHT POWER (PART OF ASSEMBLY)	(21) MANAGER'S LANE CONTROL 68-100159-000
(22) BALL LIFT (28 VAC)	(23) LEFT LANE BALL RACK RESET	(24) BALL ACCELERATOR 47-142614-000
(25) RIGHT BALL RACK RESET	(26) FOUL AND OPTICAL TRIGGER CABLE 47-142619-000	(27) PLAYER CONTROL STATION

Ball Detect - Photocell Triggering

The photocell is an optical device used to detect a ball rolling down the lane. It consists of a transmitter/receiver device and a retroreflector. The transmitter/receiver device is mounted on the ball return capping and the retroreflector is mounted on the division capping. They are positioned directly across from the each other at 115 mm (4.5") in front of the pinsetter kickbacks. Refer to *Figures 4-17* and *4-18*.

The transmitter sends an infrared beam across the lane to the retroreflector which reflects the beam back to the receiver. When any object cuts this beam, the receiver sends a pulse to the Pinsetter CPU. The Pinsetter CPU then cycles the corresponding pinsetter.

WARNING: A strong light source such as a camera's electronic flash may cause the pinsetter to trigger.

(1) KICKBACK
(2) PHOTOCELL ASSEMBLY

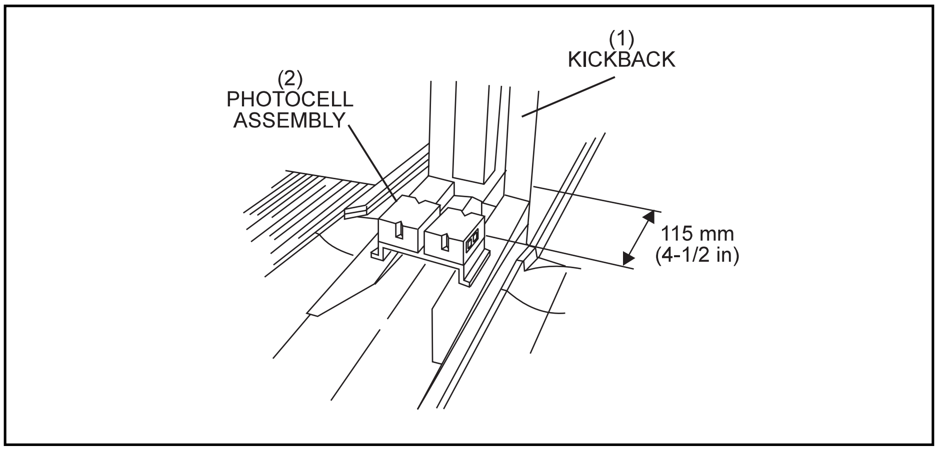

Figure 4-17. Ball Detect.

(1) KICKBACK
(2) RETROREFLECTOR

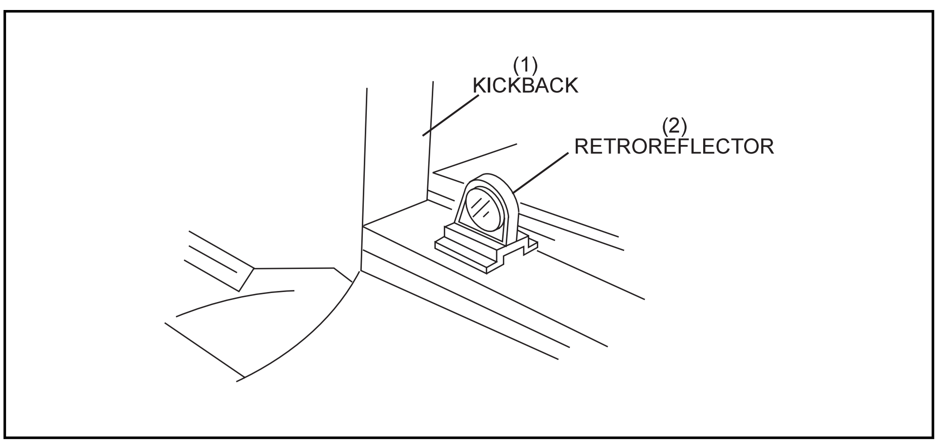

Figure 4-18. Retroreflector.

Foul Detect

The foul detect is located at the foul line and is mounted between the pair of lanes on the ball return capping. Retroreflectors, mounted on divisions, return the beam to the foul detect. A foot or some other object will interrupt this beam and a signal is sent to the Pinsetter CPU to make the pinsetter set ten new pins if the machine is in a first ball foul situation while bowling a ten pin game format. The foul detect will not register a foul when the beam is broken by a bowling ball.

Reset Button

A bowler's reset button is located on the side of the ball rack. This switch parallels the reset switch on the Universal High Voltage boxes and rear Control Boxes on the elevator. Its purpose is to cycle the pinsetter to the next ball.

Masking Unit Switch

The masking unit covers the pinsetter from the bowlers' view. On the bottom of the masking unit is a toggle switch that can be used to turn the pinsetter off.

NOTE: *Leaving this switch off when turning on the pinsetter can result in an EJ error code because the distributor motor cannot run the elevator. Also, error codes 70-74 can be displayed if the pinsetter is turned off at the masking unit when the pinsetter is cycling.*

Manager's Control Unit (Stand-alone Only)

Front Panel

The Manager's Control unit (*Figure 4-19*) is located at the Control Desk of the bowling center. This allows all the pinsetters to be turned on and off and monitored from one vantage point. Each Manager's Control unit controls two pinsetters via two cables connected to the back of the unit. These cables are routed to connection P6 of each High Voltage box in a universal control system or P10/P28 on the low voltage box in a consolidated control system. This unit and the connecting cables are not used when the pinsetters are installed in a BowlerVision or Frameworx center.

Non-Resettable Counter - This counter provides the manager a continuous count of each time the pinsetter sets new pins or a ball is rolled. This can be used by the manager for daily, weekly, monthly, etc. activity reports.

NOTE: *The choice of counting balls or frames is made using connections J8 and J9 on the consolidated Low Voltage box. See* Figure 4-11 *for location.*

Resettable Counter - This counter allows the Control Desk personnel to monitor the number of frames the bowlers have bowled or the balls they have rolled. The counter should be manually reset each time the lane is assigned to another group of bowlers.

Trouble Light - This small red lamp will flash when the Pinsetter CPU detects an error within the pinsetter. The trouble light will remain flashing until the error has been cleared at the pinsetter.

On/Off Switch - This switch gives the front desk personnel the ability to turn pinsetters on or off from the Control Desk. The push/push switch contains a lamp covered by a green lens that is lit when the pinsetter is turned on.

Lane I.D. Tags - These numbered tags provide lane identification for the Control Desk personnel.

(1) NON-RESETTABLE COUNTER
(2) RESETTABLE COUNTER
(3) TROUBLE LIGHT
(4) ON/OFF SWITCH
(5) LANE I.D. TAGS

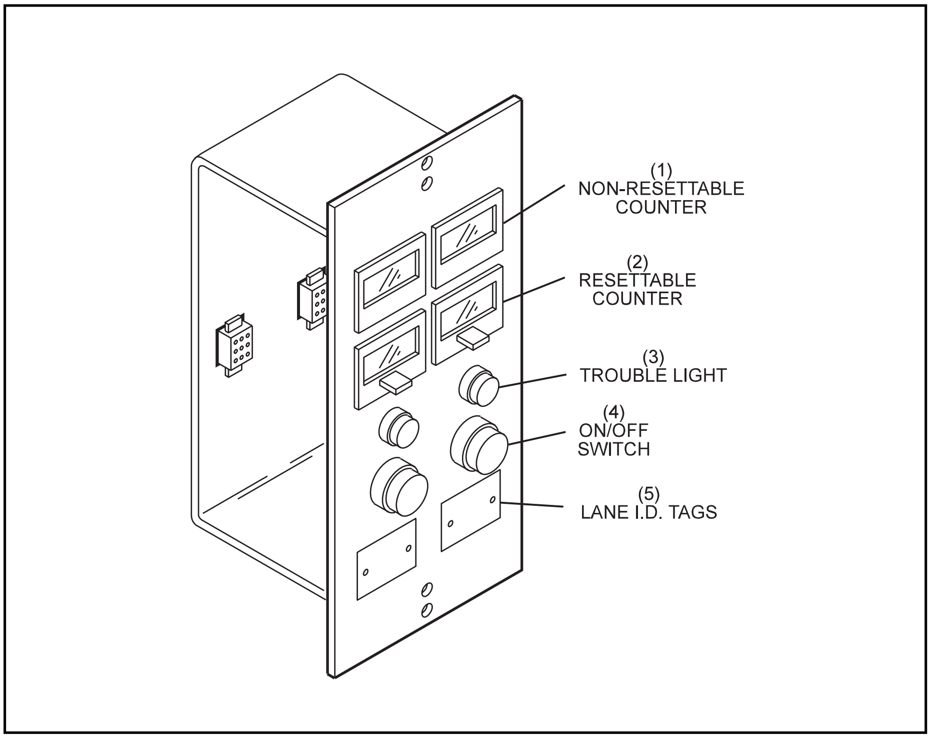

Figure 4-19. Manager's Control Unit.

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Pinsetter Cycles

The GS-Series Pinsetter responds to bowling activity in many prescribed methods that are best described as “cycles.” These cycles are performed because the Pinsetter CPU is programmed to operate in a certain manner when it learns what happens when the ball hits the pins and what it must do to get the pinsetter ready for the next ball.

Before the pinsetter can begin one of these cycles, several basics must be established. The following is a sequence of events that must occur before and after each ball has been rolled.

1. The pinsetter must be turned on and waiting for a ball.

2. The ball detect “sees” a ball and sends a pulse to the Pinsetter CPU.

3. The Pinsetter CPU must have a confirmation that the following conditions are in effect.

    a. Table is up (“A” switch is closed)
    b. Sweep is forward (“SM” switch is closed)
    c. Sweep is up (“G” switch is not closed)
    d. Spotting tongs are fully open (“ST” switch is closed)

4. The ball door solenoid locks the ball door for three seconds.

5. The sweep release solenoid energizes to drop the sweep.

6. The sweep wagon lowers completely to the guarding position and closes the “G” switch.

7. The table motor runs counterclockwise to start the cycle. The “A” switch is no longer closed.

Once the cycle has started, it can be divided into three segments. The first segment is the detection stroke of the cycle. In this segment, the table is lowered to detect or find out the results of the ball hitting the pins. The next segment starts after the table is raised, the sweep clears all the deadwood from the pin deck and flat gutters. The final segment is the response action in which the pinsetter prepares for the next ball. This may be resetting the pins (a short stroke) to allow an additional ball to be rolled or it may be the new pins setting stroke (a long stroke) in preparation for a new frame.

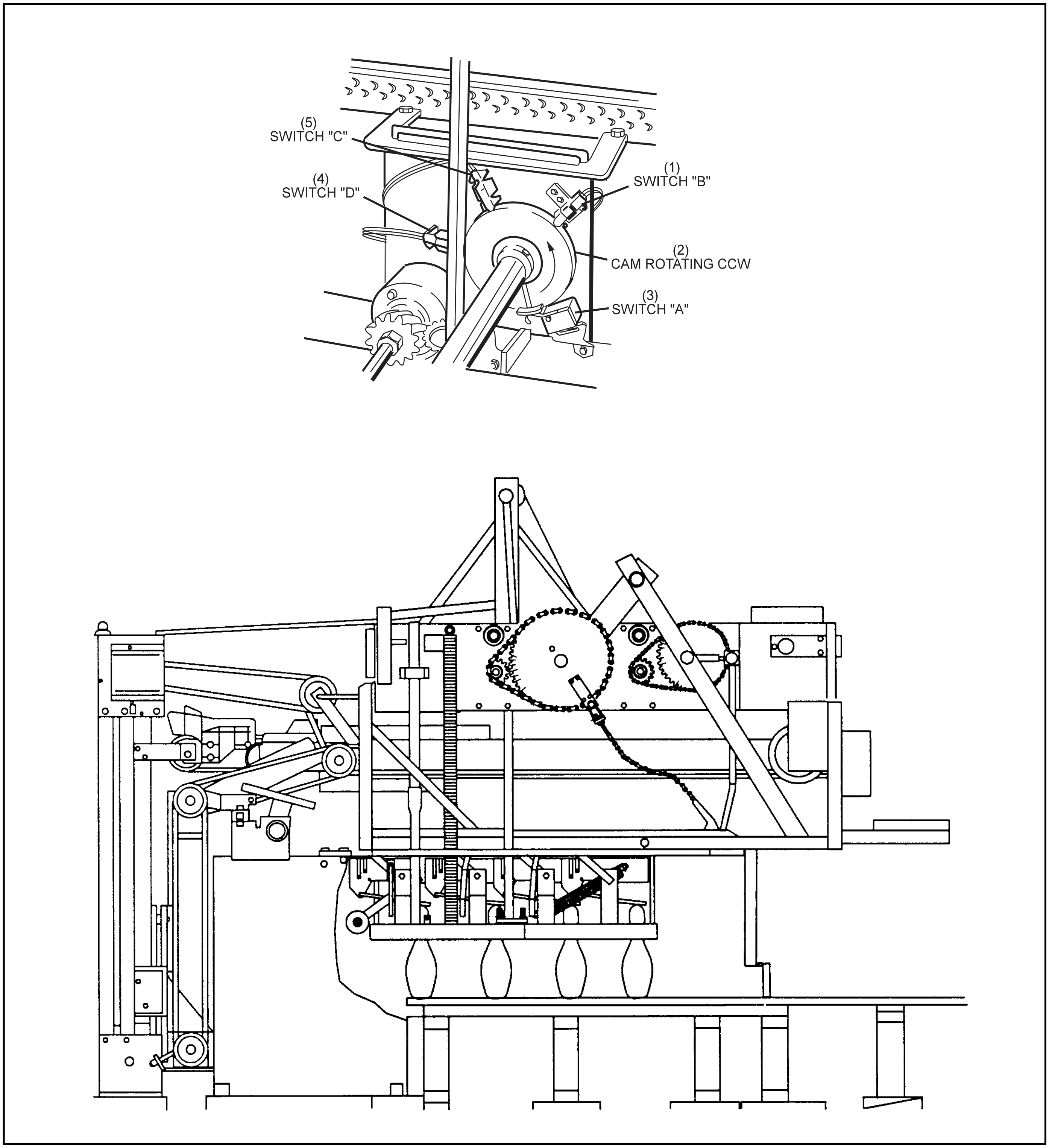

Figure 5-1. Detection Stroke.

(1) SWITCH "B"	(2) CAM ROTATING COUNTERCLOCKWISE	(3) SWITCH "A"
(4) SWITCH "D"	(5) SWITCH "C"	

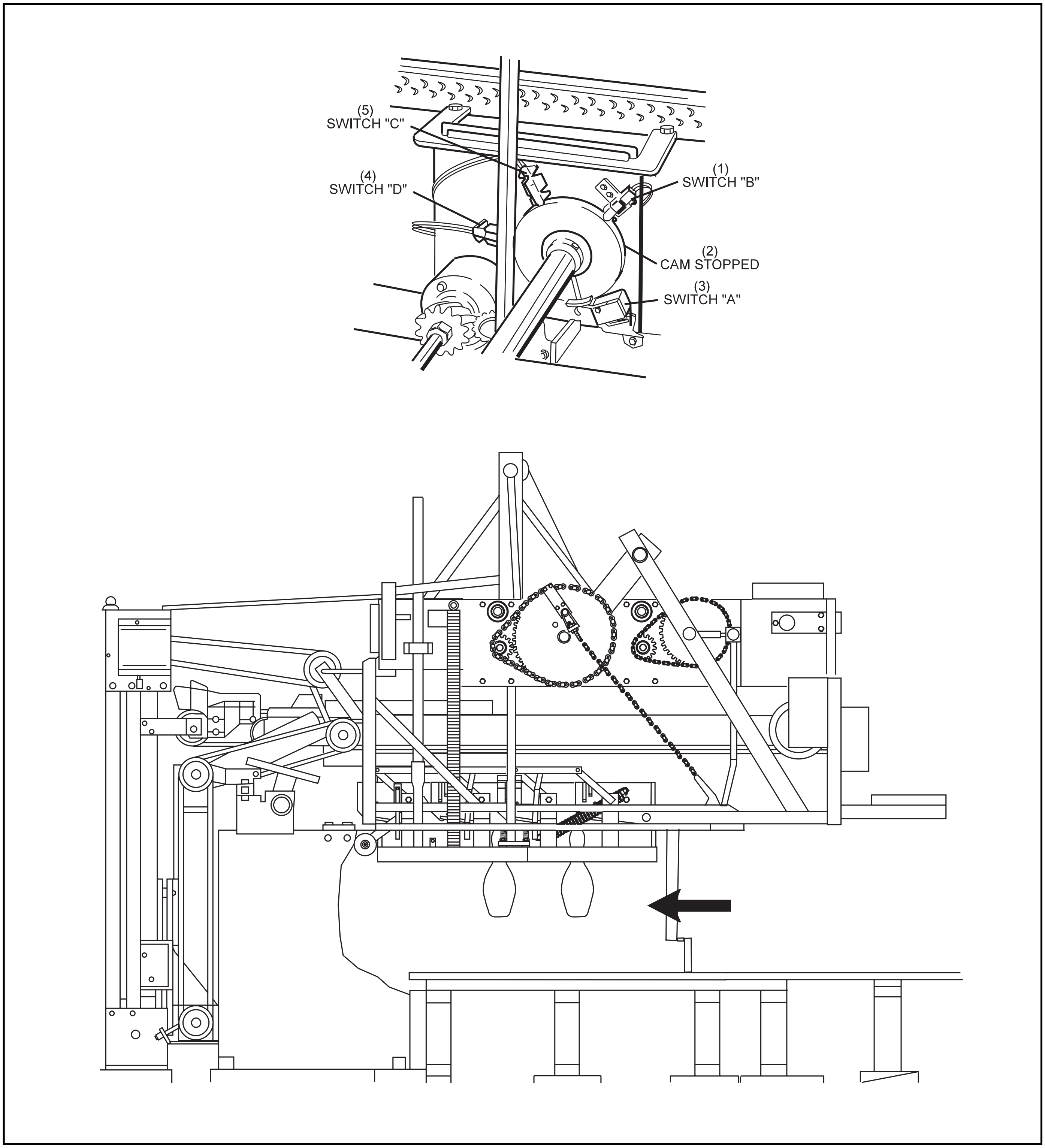

Figure 5-2. Sweeping Deadwood.

(1) SWITCH "B" (2) CAM STOPPED (3) SWITCH "A"
(4) SWITCH "D" (5) SWITCH "C"

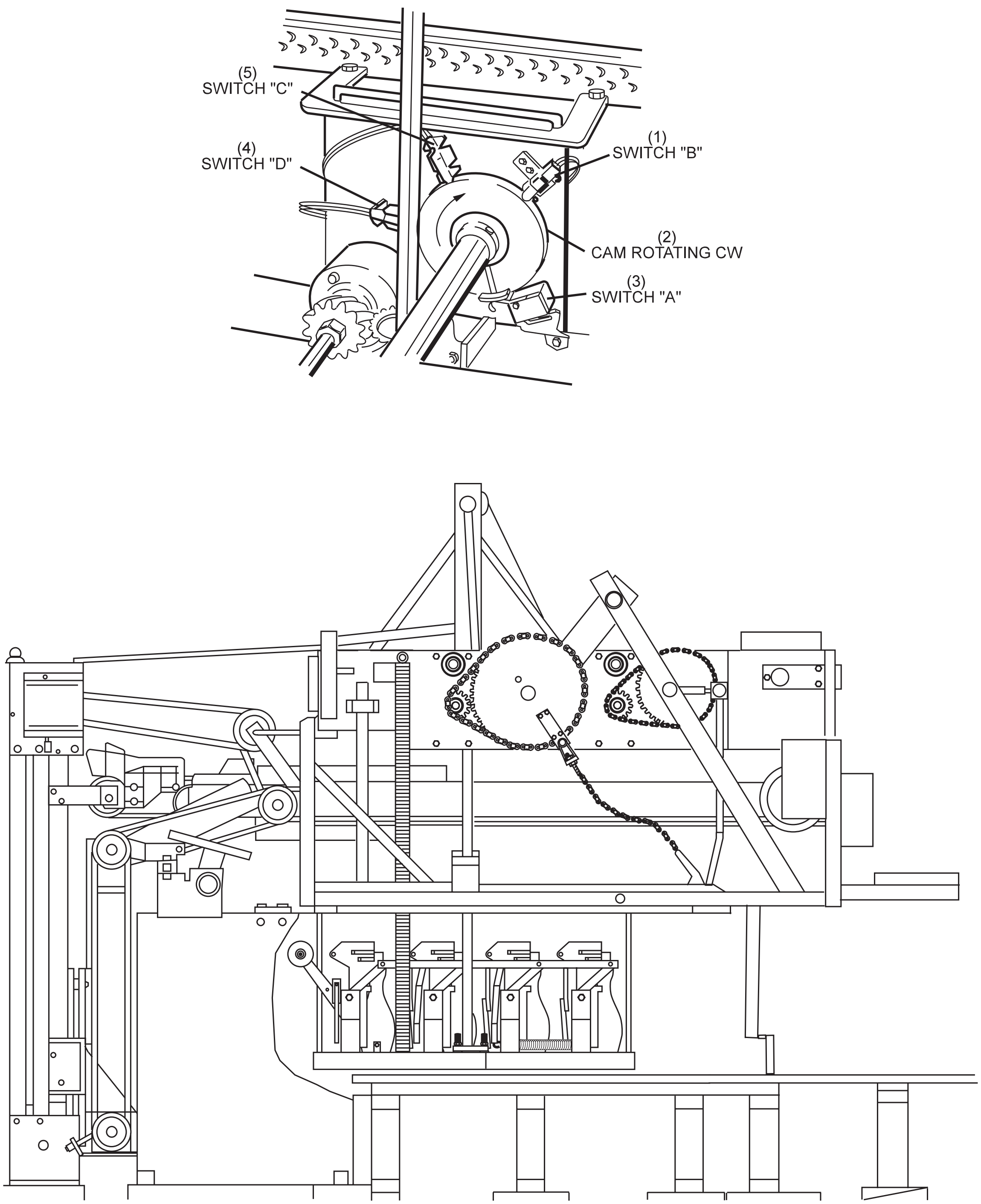

Figure 5-3. New Pins Setting Stroke.

(1) SWITCH "B"
(2) CAM ROTATING CLOCKWISE
(3) SWITCH "A"
(4) SWITCH "D"
(5) SWITCH "C"

Cycles

There are many cycles and combinations of cycles that the pinsetter is capable of performing. There are five first ball cycles and three second ball cycles. These cycles and the numerous combinations are dependent on if and what type of scoring system may be used in conjunction with the pinsetters.

The first ball cycles are:

1. First Ball - Strike
2. First Ball - Standing Pins
3. First Ball - Short Cycle
4. First Ball - Out-Of-Range
5. First Ball - Foul

The second ball cycles are:

1. Second Ball - Single Detect
2. Second Ball - Double Detect
3. Second Ball - Out-Of-Range

Cycle Combinations

The Pinsetter CPU can be switched to one of several combinations to perform a particular task. They are:

1. **Machine Cycle Diagnostics -** This consists of a first ball - standing pins cycle followed by a second ball - double detect cycle. This combination is explained fully in the Electronics section of this manual. It is designed as a continuous operational test for troubleshooting and system checks.

2. **Figures Clearing Mode -** This consists of varied first ball cycles dependent on the bowler's capability of knocking all the pins down. After all of the pins are down, the final cycle will be a second ball - double detect to prepare for the next bowler.

3. **Figures Mode -** This mode consists of only one cycle. Regardless of the bowler's capability to knock down pins, the pinsetter will always sweep and set the selected combination of pins after every ball rolled. The cycle used will be the second ball double detect.

Numerous other cycle combinations are available when Brunswick's BowlerVision is the automatic scoring system installed. These are based on the many games available and will not be discussed in this manual.

First Ball - Strike Cycle

A strike cycle results when a bowler is successful in knocking down all the pins with the first ball. The pinsetter will sweep any deadwood into the pit and set ten new pins onto the pin deck for a new first ball. The following is a complete description of this cycle. Also see *Figure 5-4* that represents what is happening during this cycle.

1. The ball detect occurs.

2. The sweep is lowered into the guard position and the ball door is locked for three seconds.

3. The table motor runs counterclockwise to allow the table to lower. The cam on the table shaft will leave switch “A.”

4. The table rack will lower and close the “OOR” switch denoting a full detection stroke.

5. The table will make a short stroke as it stops on the stroke limiter plate.

6. As the cam passes the “B” switch, the Pinsetter CPU will read the pin holder switches and find that no pins were left standing. At this point, the Pinsetter CPU determines a strike has occurred and sends pinfall information to the automatic scorer.

7. The cam passes switch “C” with no action.

8. As the cam passes the “D” switch, all ten pin holder solenoids will open the grippers.

9. The table will then return to its raised position. The table motor switch will turn off when the “A” switch is closed. As the open grippers push up on the pin release levers, the pins will drop into the pin holders. Once the pin holder’s switch has been closed, the solenoid is deenergized and the grippers close.

10. The sweep motor is turned on and pulls the sweep back and forward to clear the deadwood. When the sweep wagon is fully forward once again, the “SM” switch is closed and the sweep motor is turned off.

11. The table motor runs clockwise and the cam leaves the “A” switch and travels to switch “D.”

12. As the table starts lowering, the stroke limiter solenoid is energized and pulls the stroke limiter plate back. This allows the table to go down for a long stroke to the new pin setting height and releases the swing shafts on the table. This allows them to go into the vertical pinsetting position.

13. The cam passes switch “D” and at switch “C” the grippers are opened and the pins are left on the lane surface. At switch “B” the grippers are closed.

14. As the table continues to rise, the 7 and 10 pin holder grippers will open to preload the 7 and 10 pin if the pins are in the pin station.

15. The table motor raises the table and the sweep until switch “A” is made once again.

16. At “A” switch, the pinsetter is ready for a new first ball cycle.

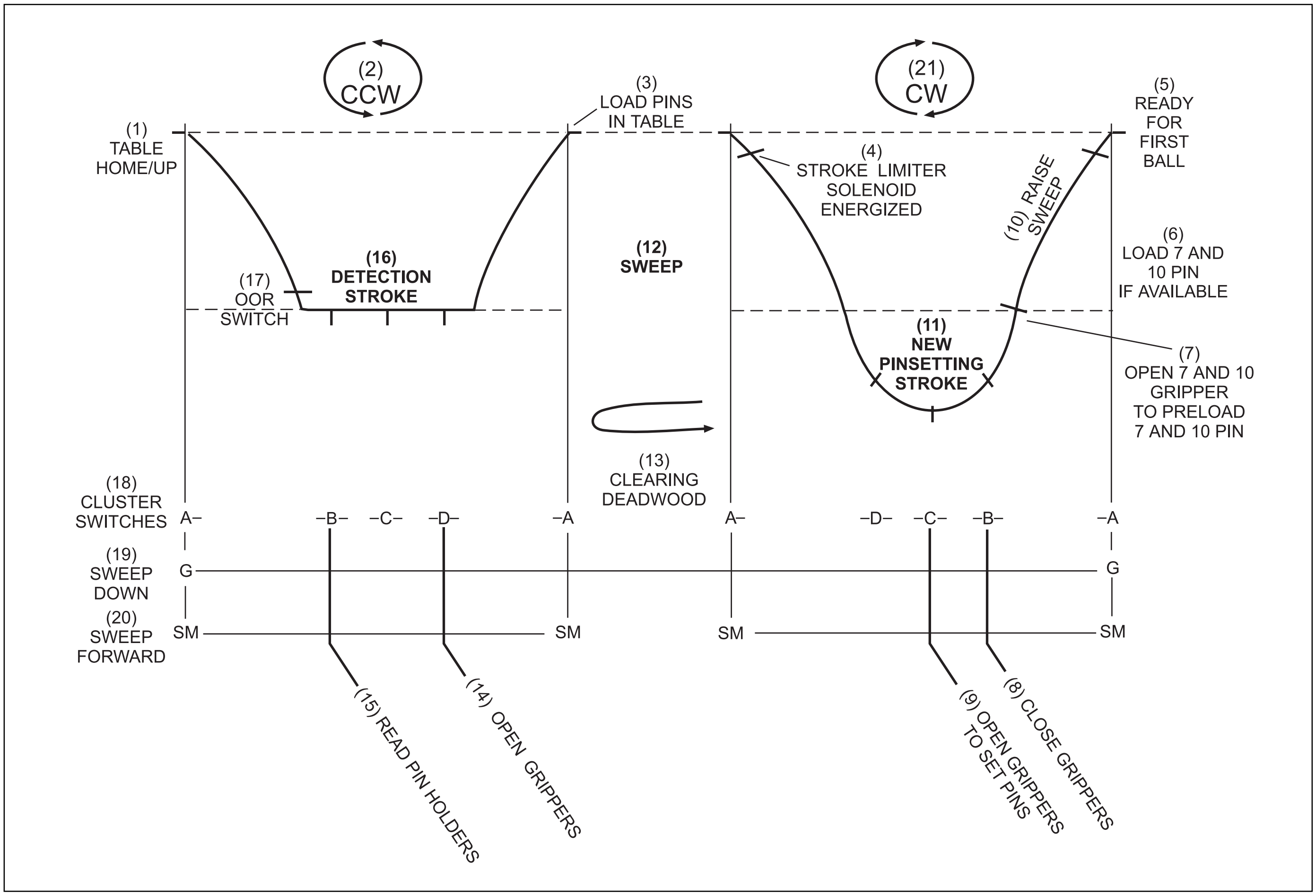

Figure 5-4. First Ball Strike Cycle.

(1)	TABLE HOME/UP	(2)	COUNTERCLOCKWISE	(3)	LOAD PINS IN TABLE
(4)	STROKE LIMITER SOLENOID ENERGIZED	(5)	READY FOR FIRST BALL	(6)	LOAD 7 AND 10 PIN IF AVAILABLE
(7)	OPEN 7 AND 10 GRIPPER TO PRELOAD 7 AND 10 PIN	(8)	CLOSE GRIPPERS	(9)	OPEN GRIPPERS TO SET PINS
(10)	RAISE SWEEP	(11)	NEW PINSETTING STROKE	(12)	SWEEP
(13)	CLEARING DEADWOOD	(14)	OPEN GRIPPERS	(15)	READ PIN HOLDERS
(16)	DETECTION STROKE	(17)	OUT-OF-RANGE SWITCH	(18)	CLUSTER SWITCHES
(19)	SWEEP DOWN	(20)	SWEEP FORWARD	(21)	CLOCKWISE

First Ball - Standing Pins Cycle

This cycle results when the bowler knocks down two to nine pins. The pinsetter must pick up the pins left standing on the lane, the sweep clears the deadwood into the pit and the pins are set back down on the lane to allow the bowler another opportunity to knock down the remaining pins. Refer to *Figure 5-5* and the following for a complete description of the standing pins cycle.

1. The ball detect occurs.

2. The sweep is lowered into the guard position and the ball door is locked for three seconds.

3. The table motor runs counterclockwise to allow the table to lower. The cam on the table shaft will leave switch “A.”

4. The table rack will lower and close the “OOR” switch denoting a full detection stroke.

5. The table will make a short stroke as it stops on the stroke limiter plate.

6. As the cam passes the “B” switch, the Pinsetter CPU will read the pinholder switches and find one or more pins standing. At this point, the CPU determines that there must be a second ball. It also sends the pinfall information to the automatic scorer.

7. The spotting tong solenoid will energize and the tongs will be driven closed.

8. The “C” switch is read by the Pinsetter CPU but no action is taken.

9. When the contacts of the “D” switch are closed, the spotting tong solenoid is deenergized and the tongs stop closing.

10. The table rises with the pins still in the tongs. The table stops when the “A” switch is closed.

11. The sweep motor is turned on and pulls the sweep back and forward to clear the deadwood. When the sweep wagon is fully forward once again, the “SM” switch is closed and the sweep motor is turned off.

12. The table motor runs clockwise and the cam leaves the “A” switch and travels to switch “D” for another short stroke.

13. When switch “D” is closed, the spotting tong solenoid is energized. As the table motor is now turning clockwise, the tongs will reopen and leave the pins on the lane. The tongs stop opening when switch “B” is made.

14. **On GS-92 and earlier pinsetters -** If the pinsetter is programmed for single detect, the pin holder solenoids will open the grippers at switch "B" to allow ten pins to be loaded when the table is back up in the home position.

15. **On GS-96 and later pinsetters -** The pin holder solenoids will open the grippers at switch "B" to allow ten pins to be loaded when the table is back up in the home position. Setting the pinsetter in either single or double detect will not affect this portion of the cycle.

16. The table motor raises the table and the sweep until switch "A" is made once again.

17. The pinsetter is ready for a second ball cycle.

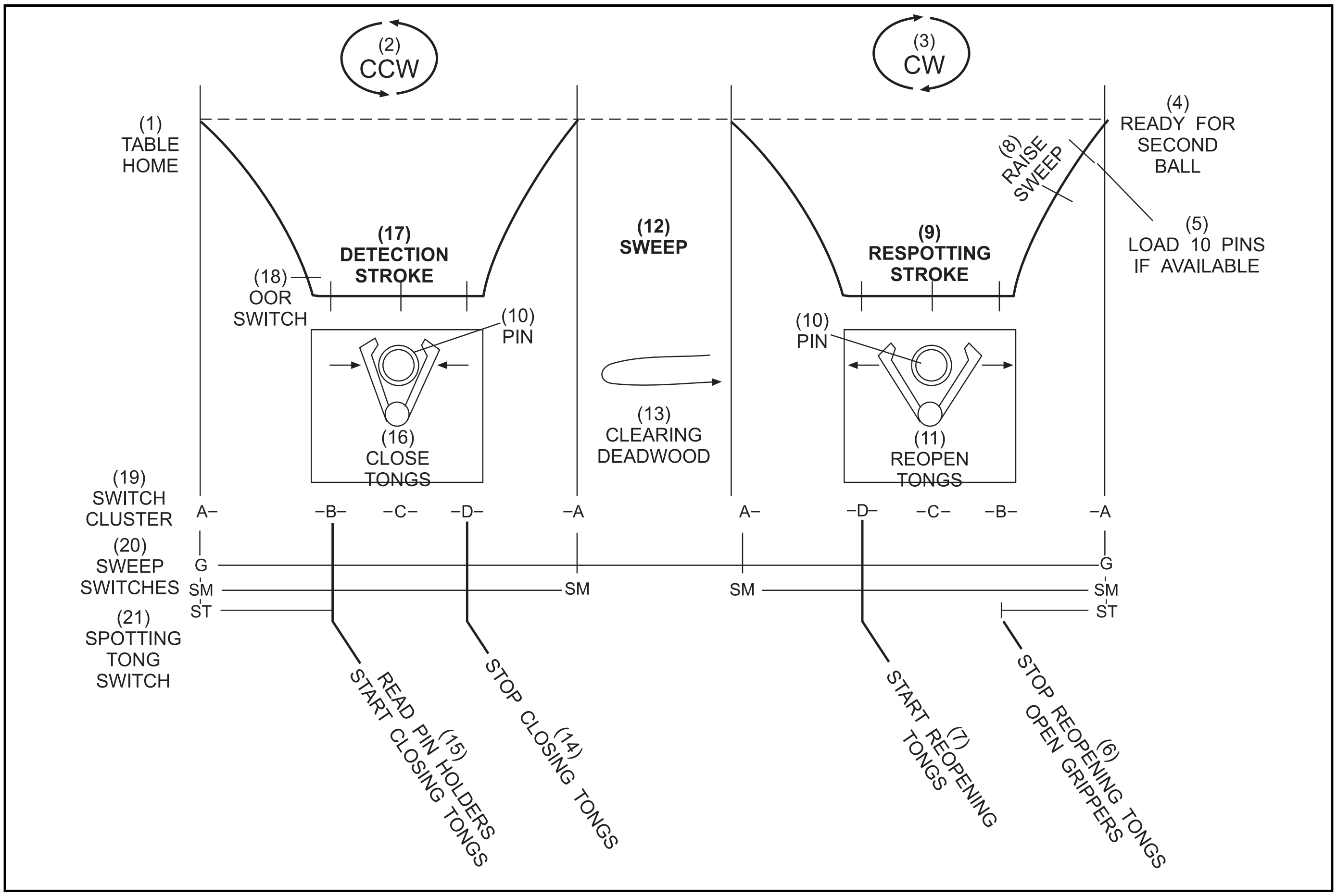

Figure 5-5. First Ball Standing Pins Cycle.

(1)	TABLE HOME	(2)	COUNTERCLOCKWISE	(3)	CLOCKWISE
(4)	READY FOR SECOND BALL	(5)	LOAD 10 PINS IF AVAILABLE	(6)	STOP REOPENING TONGS OPEN GRIPPERS
(7)	START REOPENING TONGS	(8)	RAISE SWEEP	(9)	RESPOTTING STROKE
(10)	PIN	(11)	REOPEN TONGS	(12)	SWEEP
(13)	CLEARING DEADWOOD	(14)	STOP CLOSING TONGS	(15)	READ PIN HOLDERS START CLOSING TONGS
(16)	CLOSE TONGS	(17)	DETECTION STROKE	(18)	OUT-OF-RANGE SWITCH
(19)	SWITCH CLUSTER	(20)	SWEEP SWITCHES	(21)	SPOTTING TONG SWITCH

First Ball - Short Cycle

A short cycle occurs when a bowler has left one of three conditions after rolling the first ball.

A. The number 7 pin was the only pin knocked down by a ball.
B. The number 10 pin was the only pin knocked down by a ball.
C. No pins were knocked down by a ball (gutter ball).

If one of these three conditions occurs, the Pinsetter CPU determines that there is no deadwood and the sweep operation is not necessary. The table lowers on top of the pins and then returns to the home position. This decreases the length of time necessary to complete the first ball cycle. This cycle is not enabled for a second ball. The pinsetter will always sweep and set new pins during any second ball cycle.

1. The ball detect occurs.

2. The sweep is lowered into the guard position and the ball door is locked for three seconds.

3. The table motor runs counterclockwise to allow the table to lower. The cam on the table shaft will leave switch “A.”

4. The table racks will lower and close the “OOR” switch denoting a full detection stroke.

5. The table will make a short stroke as it stops on the stroke limiter plate.

6. As the cam passes the “B” switch, the Pinsetter CPU will read all ten pin holder switches and find one of the three conditions listed above. At this point, the CPU determines that a short cycle is possible. It also sends the pinfall information to the automatic scorer.

7. The table motor will stop briefly when the “C” switch is closed.

8. The CCW (counterclockwise) contactor in the High Voltage box will deenergize and the CW (clockwise) contactor will energize to run the table motor the opposite direction.

9. **GS-92 and earlier pinsetters -** The cam will go back to the “B” switch. If the pinsetter is programmed for single detect, the pin holder solenoids will open the grippers at switch “B” to allow ten pins to be loaded when the table is back up in the home position.

10. The pin holder solenoids will open the grippers at switch "B" to allow ten pins to be loaded when the table is back up in the home position. Setting the pinsetter in either single or double detect will not affect this portion of the cycle.

11. The table motor raises the table and the sweep until switch "A" is made once again. The pinsetter is ready for a second ball cycle.

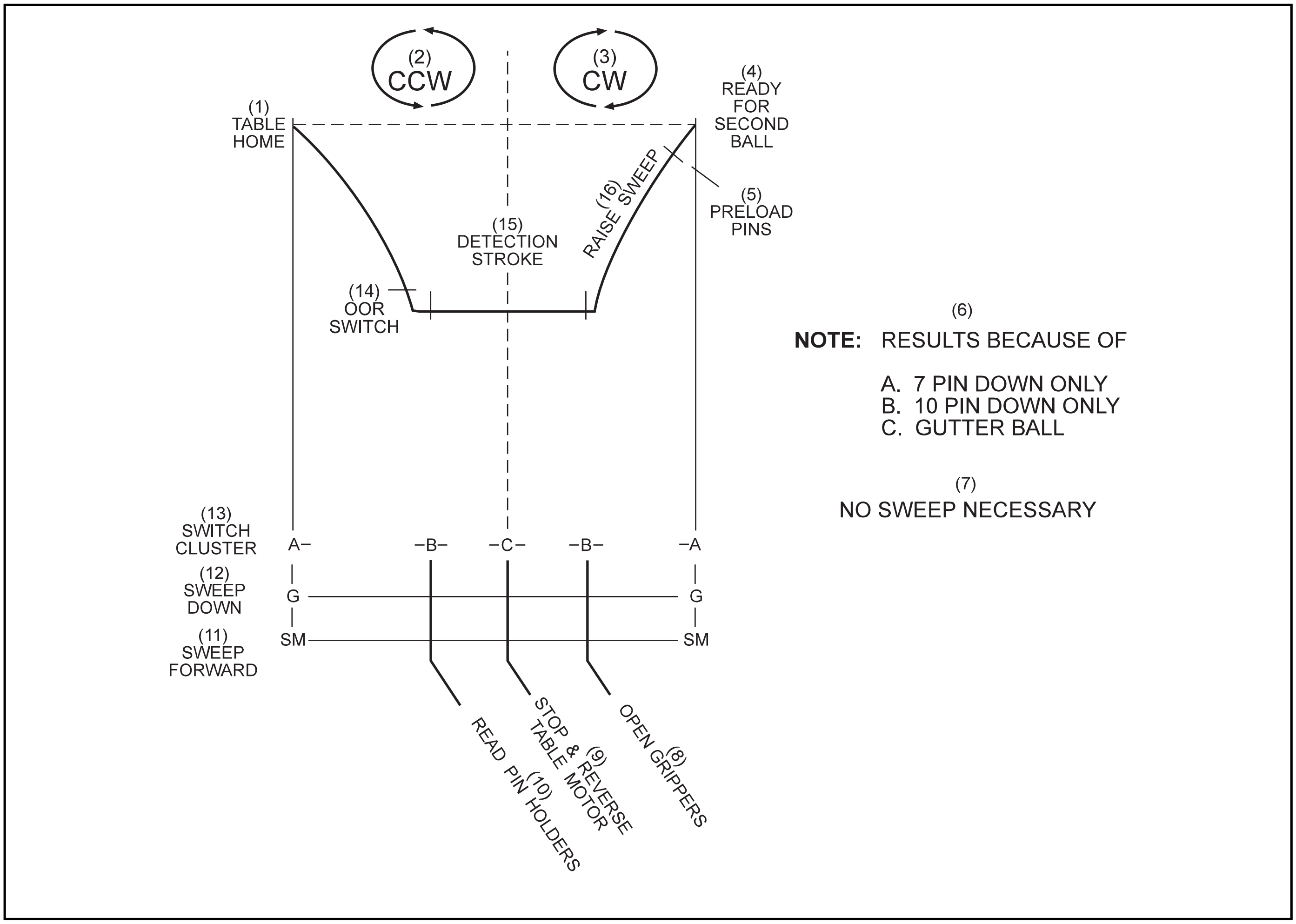

Figure 5-6. First Ball Short Cycle.

(1) TABLE HOME	(2) COUNTERCLOCKWISE	(3) CLOCKWISE
(4) READY FOR SECOND BALL	(5) PRELOAD PINS	(6) NOTE: RESULTS BECAUSE OF A. 7 PIN DOWN ONLY B. 10 PIN DOWN ONLY C. GUTTER BALL
(7) NO SWEEP NECESSARY	(8) OPEN GRIPPERS	(9) STOP AND REVERSE TABLE MOTOR
(10) READ PIN HOLDERS	(11) SWEEP FORWARD	(12) SWEEP DOWN
(13) SWITCH CLUSTER	(14) OUT-OF-RANGE SWITCH	(15) DETECTION STROKE
(16) RAISE SWEEP		

First Ball - Out-of-Range

During the course of bowling, a ball may strike the pins in such a way that a pin slides out of its normal position but does not fall down. If the pin moves far enough, the bottom of the table will lower on top of the pin. This will prevent the table from lowering to the normal detection height and not allow the pin and any other pins left standing to be picked up by the spotting tongs. Bowling Association rules (such as ABC and FIQ) require that any deadwood left on the lane surface be removed before the bowler rolls a second ball. To accomplish this, the Pinsetter CPU will stop the pinsetter after the detection portion of the cycle and signal for the mechanic/technician to remove any deadwood and to restart the pinsetter. The cycle occurs as follows:

1. The ball detect occurs.

2. The sweep is lowered into the guard position and the ball door is locked for three seconds.

3. The table motor runs counterclockwise to allow the table to lower. The cam on the table shaft leaves switch “A” and goes toward switch “B.”

4. The table racks will lower the table on top of the off spot pin (15"/ 381 mm) and be unable to close the “OOR” switch.

5. As the cam passes the “B” switch the Pinsetter CPU will ignore the pin holder switches, which are in a higher than normal detection position, because the “OOR” switch had not been closed before switch “B” was closed. The PCS will be blank and the pinfall will have to scored manually.

6. The table motor will run the cam past the “C” and “D” switches and raise the table until the “A” switch is closed.

7. At this point, the Pinsetter CPU will shut off the pinsetter with the sweep still down in the guarding position. It will also turn on the trouble light and display error code “PO.”

8. If the pinsetters have Universal Electronics, the mechanic must then turn off the HV on/off power switch on either the High Voltage box or the mechanic’s rear control box. If the pinsetters have Consolidated Electronics, the mechanic must turn the stop/run switch on the Low Voltage box to stop or turn off the mechanic’s rear control switch. The deadwood can then be cleared from the rear by lifting the pin curtain and using a pin fork to pull the pins back onto the transport band.

9. The mechanic must then turn the pinsetter back on to allow the pinsetter to resume operation. (If BowlerVision or Frameworx scoring is involved, a score correction must be made at the scorer console before the pinsetter can restart).

10. To prevent the out-of-range pin from being swept, the sweep motor will not be allowed to run. The sweep will stay forward throughout the entire cycle.

11. The table motor will then run the cam clockwise past switches “D” to “C” to “B” and back to “A.” The reason for this action is to raise the sweep from its guarding position.

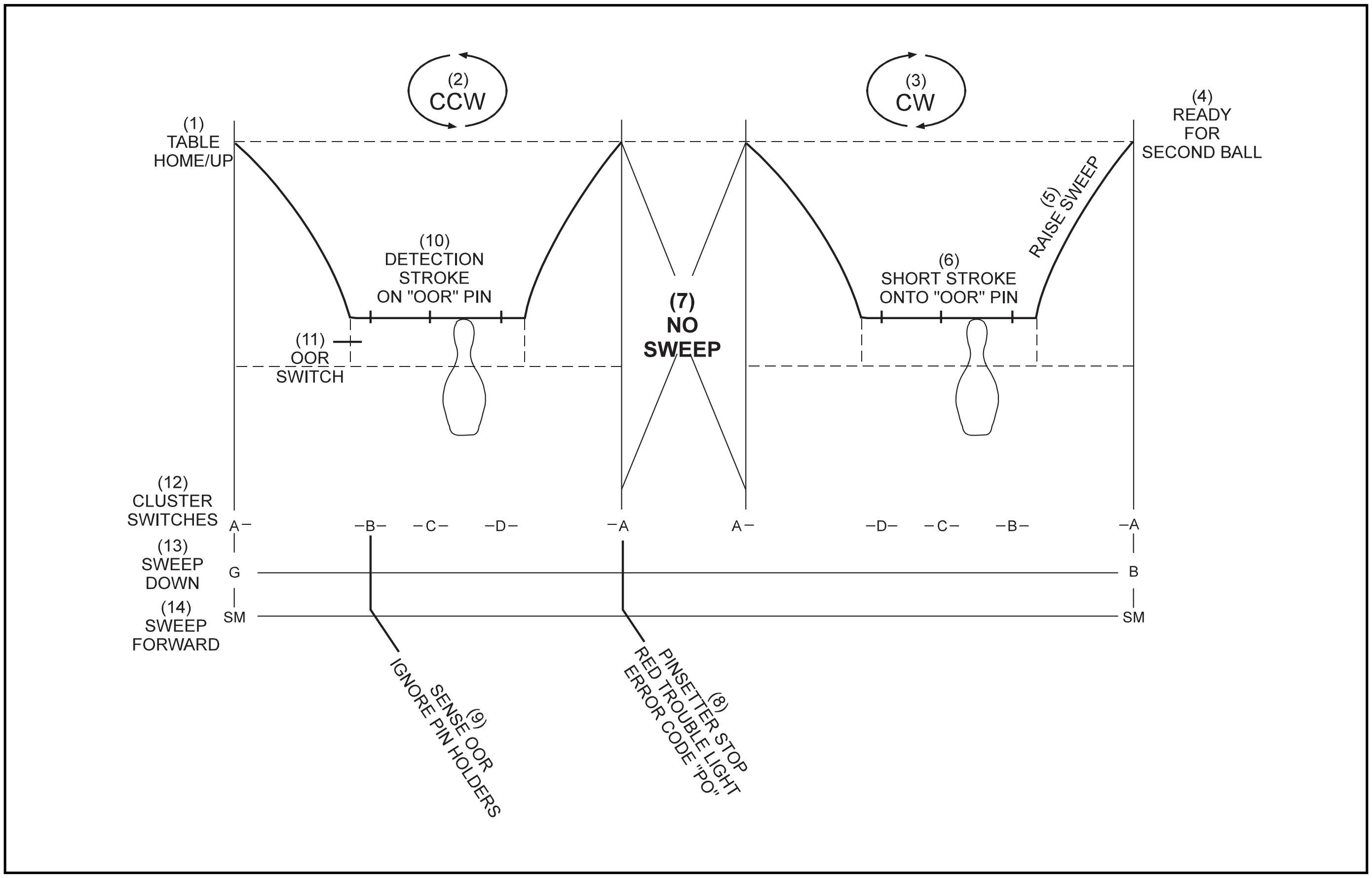

Figure 5-7. First Ball Out-Of-Range Cycle.

(1)	TABLE HOME/UP	(2)	COUNTERCLOCKWISE	(3)	CLOCKWISE
(4)	READY FOR SECOND BALL	(5)	RAISE SWEEP	(6)	SHORT STROKE ONTO OUT-OF-RANGE PIN
(7)	NO SWEEP	(8)	PINSETTER STOP RED TROUBLE LIGHT ERROR CODE “PO”	(9)	SENSE OUT-OF-RANGE IGNORE PIN HOLDERS
(10)	DETECTION STROKE ON OUT-OF-RANGE PIN	(11)	OUT-OF-RANGE PIN	(12)	CLUSTER SWITCHES
(13)	SWEEP DOWN	(14)	SWEEP FORWARD		

First Ball - Foul

When a bowler steps across the foul line, a beam of light over the foul line is interrupted. A signal is then sent to the Pinsetter CPU. The pinfall resulting from this ball is not allowed. The pinsetter must sweep any pins left standing and set ten new pins. The bowler receives zero pins for the first ball and has only one chance to knock down the new pins. On a second ball - foul, the pinsetter performs a regular second ball cycle.

1. A foul signal is sent to the Pinsetter CPU.

2. The ball detect occurs.

3. The sweep is lowered into the guard position and the ball door is locked for three seconds.

4. The table motor runs counterclockwise to allow the table to lower. The cam on the table shaft leaves switch “A” and goes toward switch “B.”

5. The table rack will lower and close the “OOR” switch denoting a full detection stroke.

5. The table will make a short stroke as it stops on the stroke limiter plate.

6. As the cam passes the “B” switch, the Pinsetter CPU will ignore the pin holder switches. The foul signal will be relayed to the automatic scorer instead of the pinfall.

7. The “C” switch is read by the pinsetter CPU but no action is taken.

8. As the cam passes the “D” switch, all ten pin holder solenoids will open the grippers.

9. The table will then return to its raised position and leave any pins on the lane surface. The table motor switch will turn off when the “A” switch is closed. As the open grippers push up on the pin release levers, the pins will drop into the pin holders. Once the pin holder’s switch has been closed, the solenoid is deenergized and the grippers close.

10. The sweep motor is turned on and pulls the sweep back and forward to clear the deadwood and standing pins. When the sweep wagon is fully forward once again, the “SM” switch is closed and the sweep motor is turned off.

11. The table motor runs clockwise and the cam leaves the “A” switch and travels to switch “D.”

12. As the table starts lowering, the stroke limiter solenoid is energized and pulls the stroke limiter plate back. This allows the table to go down for a long stroke to the new pinsetting height and releases the swing shafts on the table which allows them to go into the vertical pinsetting position.

13. The cam passes switch “D” and at switch “C” the grippers are opened and the pins are left on the lane surface. At “B” the grippers are closed.

14. As table continues to rise, all 10 pin holder grippers will open to preload all ten pins if they are in the pin station.

15. The table motor raises the table and the sweep until switch “A” is made once again. The pinsetter is ready for a second ball cycle.

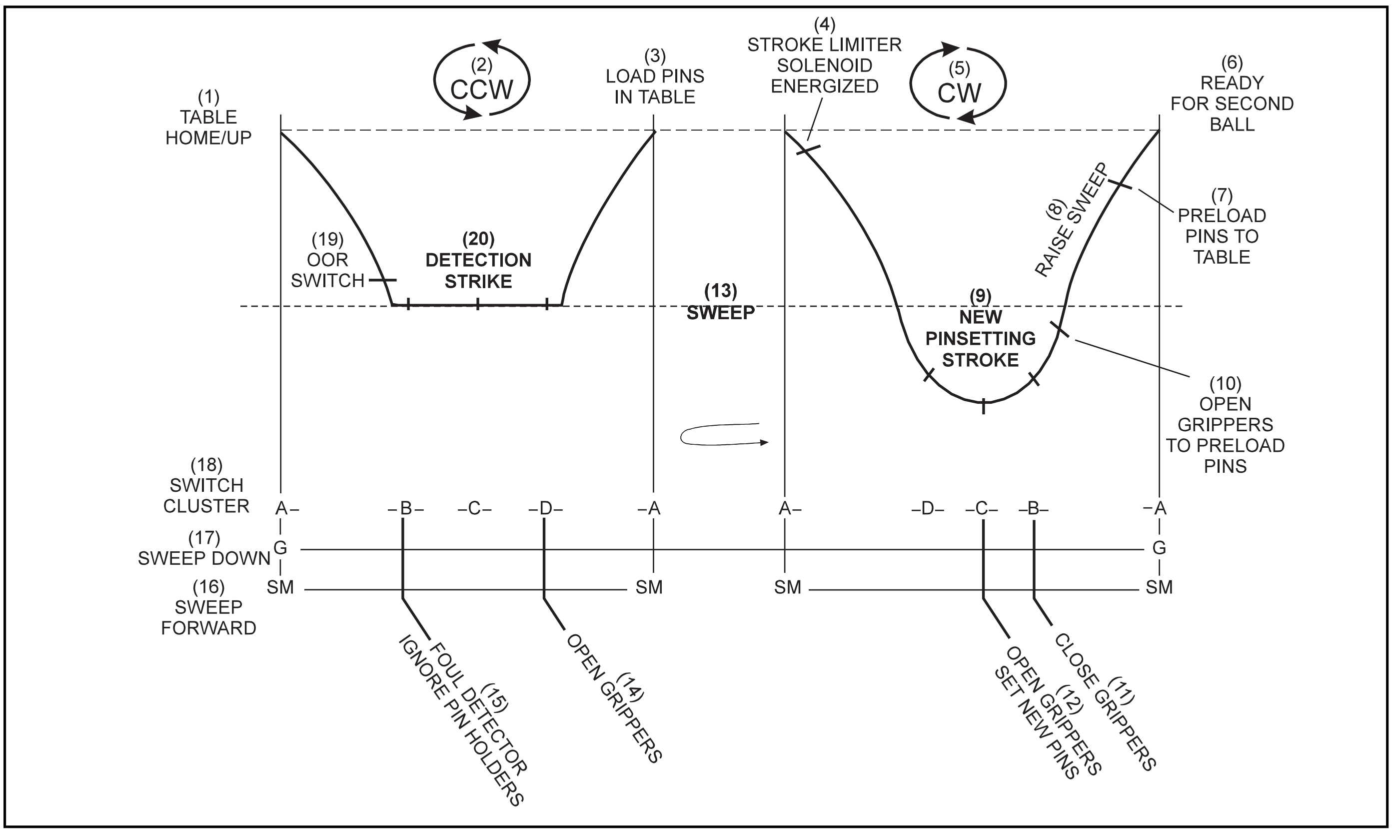

Figure 5-8. First Ball Foul Cycle.

(1)	TABLE HOME/UP	(2)	COUNTERCLOCKWISE	(3)	LOAD PINS IN TABLE
(4)	STROKE LIMITER SOLENOID ENERGIZED	(5)	CLOCKWISE	(6)	READY FOR SECOND BALL
(7)	PRELOAD PINS TO TABLE	(8)	RAISE SWEEP	(9)	NEW PINSETTING STROKE
(10)	OPEN GRIPPERS TO PRELOAD PINS	(11)	CLOSE GRIPPERS	(12)	OPEN GRIPPERS SET NEW PINS
(13)	SWEEP	(14)	OPEN GRIPPERS	(15)	FOUL DETECTOR IGNORE PIN HOLDERS
(16)	SWEEP FORWARD	(17)	SWEEP DOWN	(18)	SWITCH CLUSTER
(19)	OUT-OF-RANGE SWITCH	(20)	DETECTION STRIKE		

Second Ball - Single Detect

Second ball - single detect is a second ball cycle used when the pinsetter is not used to provide pinfall information to an automatic scorer. This cycle would be used when automatic scorers are not present or when a Model 79 or Model 86 scanner or CCD camera is used to provide pinfall to the automatic scoring system.

This cycle has no detection stroke; it simply sweeps away any pins left on the pin deck and sets ten new pins in preparation for a first ball cycle. To accomplish this the grippers must have been opened and pins loaded during the final half of the preceding first ball cycle.

1. The ball detect occurs.

2. The sweep is lowered into the guard position and the ball door is locked for three seconds.

3. The sweep motor is turned on and pulls the sweep back and forward to clear the deadwood. When the sweep wagon is fully forward once again, the “SM” switch is closed and the sweep motor is turned off.

4. When all ten pin holders are full, the table motor runs clockwise and the cam leaves the “A” switch and travels to switch “D.”

5. As the table starts lowering, the stroke limiter solenoid is energized and pulls the stroke limiter plate back. This allows the table to go down for a long stroke to the new pin setting height and releases the swing shafts on the table. This allows them to go into the vertical pinsetting position.

6. The cam passes switch “D” and at switch “C” the grippers are opened and the pins are left on the lane surface. At switch “B” the grippers are closed.

7. As the table continues to rise, the 7 and 10 pin holder grippers will open to preload the 7 and 10 pin if the pins are in the pin station.

8. The table motor raises the table and the sweep until switch “A” is made once again. The pinsetter is ready for a new first ball cycle.

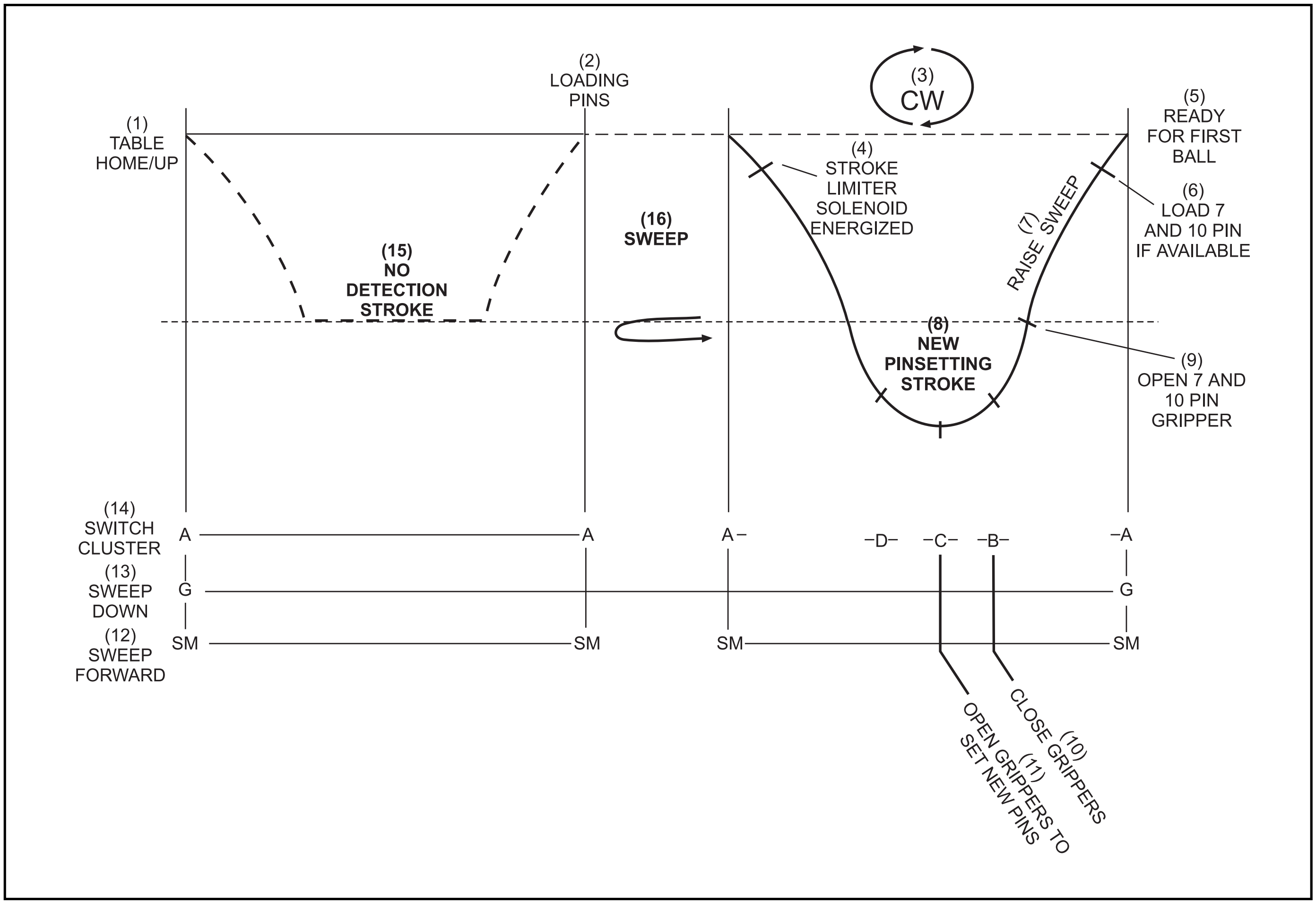

Figure 5-9. Second Ball Single Detect Cycle.

(1)	TABLE HOME/UP	(2)	LOADING PINS	(3)	CLOCKWISE
(4)	STROKE LIMTIER SOLENOID ENERGIZED	(5)	READY FOR FIRST BALL	(6)	LOAD 7 AND 10 PIN IF AVAILABLE
(7)	RAISE SWEEP	(8)	NEW PINSETTING STROKE	(9)	OPEN 7 AND 10 PIN GRIPPER
(10)	CLOSE GRIPPERS	(11)	OPEN GRIPPERS SET NEW PINS	(12)	SWEEP FORWARD
(13)	SWEEP DOWN	(14)	SWITCH CLUSTER	(15)	NO DETECTION STROKE
(16)	SWEEP				

Second Ball - Double Detect

This cycle is used when the GS-Series Pinsetter must provide pinfall activity for scoring on Brunswick BowlerVision, Frameworx, AS-90 and AS-K Automatic Scoring systems. A detection portion of the cycle is used both on first ball and second ball.

1. The ball detect occurs.

2. The sweep is lowered into the guard position and the ball door is locked for three seconds.

3. The table motor runs counterclockwise to allow the table to lower. The cam on the table shaft will leave switch “A.”

4. The table rack will lower and close the “OOR” switch denoting a full detection stroke.

5. The table will make a short stroke as it stops on the stroke limiter plate.

6. As the cam passes the “B” switch, the Pinsetter CPU will read all ten pin holder switches. At this point, the Pinsetter CPU sends the pinfall activity to the scoring system.

7. The table motor raises the table and the sweep until switch “A” is made once again.

8. As the cam passes the “D” switch, all ten pin holder solenoids will open the grippers.

9. The table will then return to its raised position. The table motor switch will turn off when the “A” switch is closed. As the open grippers push up on the pin release levers, the pins will drop into the pin holders. Once the pin holder’s switch has been closed, the solenoid is deenergized and the grippers close.

10. The sweep motor is turned on and pulls the sweep back and forward to clear the deadwood. When the sweep wagon is fully forward once again, the “SM” switch is closed and the sweep motor is turned off.

11. The table motor runs clockwise and the cam leaves the “A” switch and travels to switch “D.”

12. As the table starts lowering, the stroke limiter solenoid is energized and pulls the stroke limiter plate back. This allows the table to go down for a long stroke to the new pin setting height and releases the swing shafts on the table. This allows them to go into the vertical pinsetting position.

13. The cam passes switch “D” and at switch “C” the grippers are opened and the pins are left on the lane surface. At “B” the grippers are closed.

14. As the table continues to rise, the 7 and 10 pin holder grippers will open to load the 7 and 10 pin if the pins are in the pin station. The pinsetter is ready for a new first ball cycle.

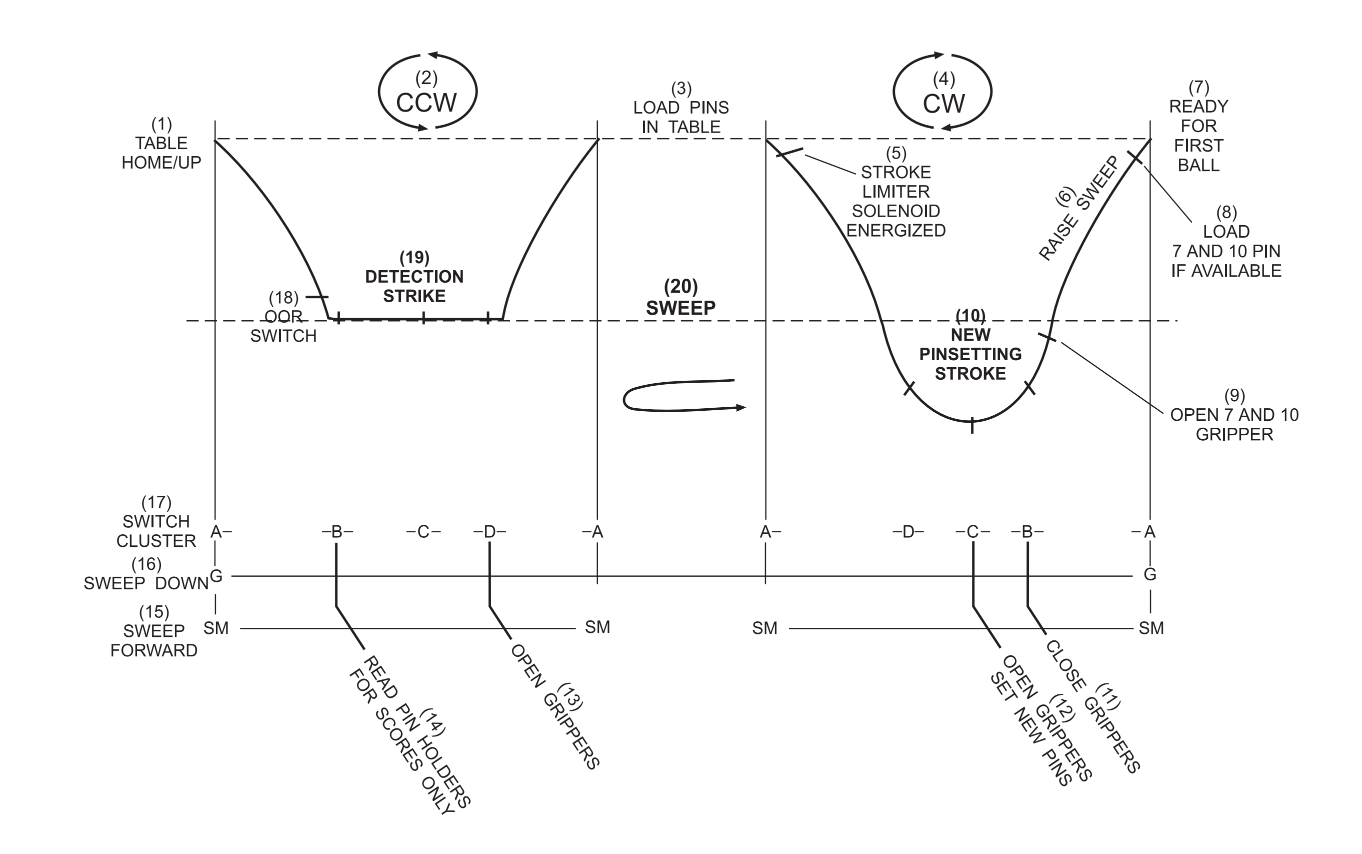

Figure 5-10. Second Ball Double Detect Cycle.

(1) TABLE HOME/UP	(2) COUNTERCLOCKWISE	(3) LOAD PINS IN TABLE
(4) CLOCKWISE	(5) STROKE LIMITER SOLENOID ENERGIZED	(6) RAISE SWEEP
(7) READY FOR FIRST BALL	(8) LOAD 7 AND 10 PIN IF AVAILABLE	(9) OPEN 7 AND 10 GRIPPER (GS-96 AND LATER)
(10) NEW PINSETTING STROKE	(11) CLOSE GRIPPERS	(12) OPEN GRIPPERS SET NEW PINS
(13) OPEN GRIPPERS	(14) READ PIN HOLDERS FOR SCORES ONLY	(15) SWEEP FORWARD
(16) SWEEP DOWN	(17) SWITCH CLUSTER	(18) OUT-OF-RANGE SWITCH
(19) DETECTION STRIKE	(20) SWEEP	

Second Ball - Out-of-Range

A second ball out-of-range occurs only when the Pinsetter CPU is set up for double detection. The table will come down on top of an off spot pin as happens in first ball out-of-range. This causes the pinsetter to stop and requires the mechanic to restart the pinsetter.

1. The ball detect occurs.

2. The sweep is lowered into the guard position and the ball door is locked for three seconds.

3. The table motor runs counterclockwise to allow the table to lower. The cam on the table shaft leaves switch “A” and goes toward switch “B”.

4. The table racks will lower the table on top of the off spot pin (15"/ 381 mm) and be unable to close the “OOR” switch.

5. As the cam passes the “B” switch the Pinsetter CPU will ignore the pin holder switches, which are in a higher than normal detection position, because the “OOR” switch was not closed before “B.”

6. The table motor will run the cam past the “C” and “D” switches and raise the table until the “A” switch is closed.

7. At this point, the Pinsetter CPU will shut off the pinsetter with the sweep still down in the guarding position. It will also turn on the trouble light and display the error code “PO.”

8. If the pinsetters have Universal Electronics, the mechanic must then turn off the HV on/off power switch on either the High Voltage box or the mechanic’s rear control box. If the pinsetters have Consolidated Electronics, the mechanic must turn the stop/run switch on the Low Voltage box to stop or turn off the mechanic’s rear control switch. The deadwood can then be cleared from the rear by lifting the pin curtain and using a pin fork to pull the pins back onto the transport band.

9. The mechanic must then turn the pinsetter back on to allow the pinsetter to resume operation. (If BowlerVision or Frameworx scoring is involved, a score correction must be made at the scorer console before the pinsetter can restart.)

10. The sweep motor will not run. The sweep will stay forward at this time.

11. The table motor will then run the cam clockwise past switches “D” to “C” to “B” and back to “A” to raise the sweep.

12. The Pinsetter CPU will immediately energize the sweep release solenoid to drop the sweep wagon into the guarding position again.

13. The table will go through another detection stroke to open the grippers when switch “D” is closed.

14. The sweep motor is turned on and pulls the sweep back and forward to clear the deadwood. When the sweep wagon is fully forward once again, the “SM” switch is closed and the sweep motor is turned off.

15. When all ten pin holders are full, the table motor runs clockwise and the cam leaves the “A” switch and travels toward switch “D.”

16. As the table starts lowering, the stroke limiter solenoid is energized and pulls the stroke limiter plate back. This allows the table to go down for a long stroke to the new pin setting height and releases the swing shafts on the table. This allows them to go into the vertical pinsetting position.

17. The cam passes switch “D” and at switch “C” the grippers are opened and the pins are left on the lane surface. At switch “B,” the grippers are closed.

18. As the table continues to rise, the 7 and 10 pin holder grippers will open to load the 7 and 10 pin if the pins are in the pin station.

19. The table motor raises the table and the sweep until switch “A” is made once again. The pinsetter is ready for a new first ball cycle.

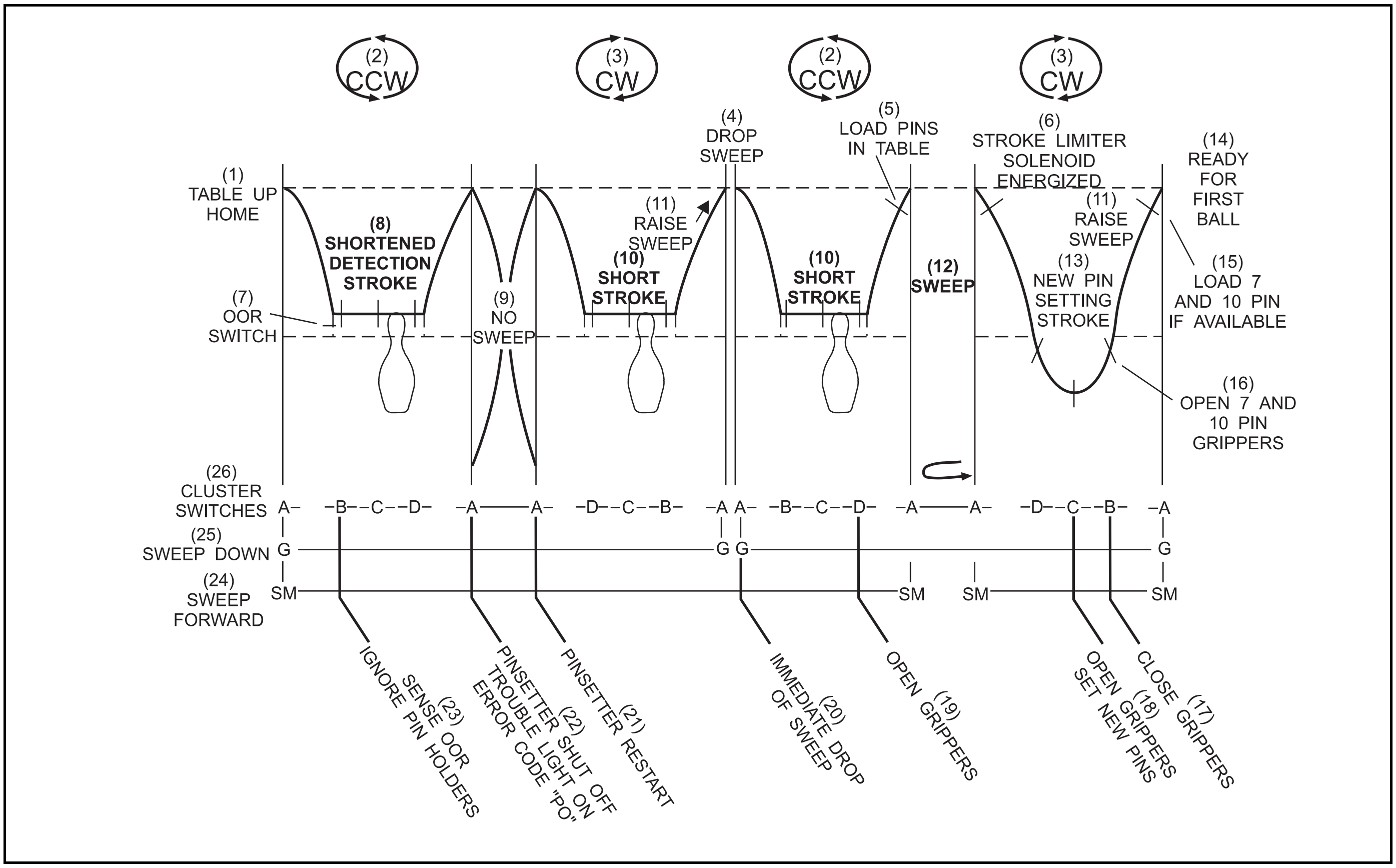

Figure 5-11. Second Ball Out-Of-Range Cycle.

(1) TABLE UP HOME	(2) COUNTERCLOCKWISE	(3) CLOCKWISE
(4) DROP SWEEP	(5) LOAD PINS IN TABLE	(6) STROKE LIMITER SOLENOID ENERGIZED
(7) OUT-OF-RANGE SWITCH	(8) SHORTENED DETECTION STROKE	(9) NO SWEEP
(10) SHORT STROKE	(11) RAISE SWEEP	(12) SWEEP
(13) NEW PINSETTING STROKE	(14) READY FOR FIRST BALL	(15) LOAD 7 AND 10 PIN IF AVAILABLE
(16) OPEN 7 AND 10 PIN GRIPPERS	(17) CLOSE GRIPPERS	(18) OPEN GRIPPERS SET NEW PINS
(19) OPEN GRIPPERS	(20) IMMEDIATE DROP OF SWEEP	(21) PINSETTER RESTART
(22) PINSETTER SHUT OFF TROUBLE LIGHT ON ERROR CODE "PO"	(23) SENSE OUT-OF-RANGE IGNORE PIN HOLDERS	(24) SWEEP FORWARD
(25) SWEEP DOWN	(26) CLUSTER SWITCHES	

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Adjustments

Safety Guidelines for GS-Series Pinsetters

As with all machinery, there is an element of risk in working on the GS-Series Pinsetter if the rules of safety are disregarded. Common sense, a knowledge of the pinsetter, and a knowledge of basic safety procedures will prevent injury to personnel working on the machines.

1. ONLY properly trained people should work on the pinsetter.

2. Always use the correct tools for the job at hand. Remove all tools from the machine before turning it on.

3. Wear the proper clothing when working on the pinsetter. Do not wear neckties or loose clothing that may be caught by the machine. Wear shoes with safety nonslip soles.

4. Avoid using cleaners which may be toxic or poisonous.

5. Fire extinguishers must be on hand and maintained properly. Store oily rags in a fire proof container.

6. Care should be taken while near the front of the machine. If it is turned on, you may accidentally trigger the photocell with your foot or hand which will cycle the pinsetter.

7. When working on one GS-Series Pinsetter, turn off either the High Voltage box toggle switch or the rear mechanic's switch mounted on the pin elevator. If consolidated electronics are used, toggle the stop/run switch on the Low Voltage box to the stop position. If more than one person is working on the machines, turn off both switches to prevent one person from turning on the pinsetter before the other person is clear of the pinsetter.

8. When working on both machines of a lane pair (for example - an electronic control box or the ball accelerator) power must be turned off at the Common box and the input power cable must be removed from the Common box. If Consolidated Electronics are used, turn off power at the Consolidated High Voltage box and remove the input power cable from the High Voltage box.

9. The sweep board should always be lowered when working on the pinsetter or the ball accelerator.

10. When service work is to be performed by entering underneath the setting table, set a jack stand or suitable support under the center of the table.

11. Reinstall all the machine guards and the ladder after any troubleshooting or maintenance work has been done on the pinsetter(s) or ball accelerator.

12. If more than one person is working on a machine, be sure the other person is ***CLEAR*** before restarting the machine.

1. Ball Detect Adjustment

CAUTION: Before adjusting the ball detect on pinsetters with Consolidated Electronics, turn the stop/run switches on the top of the Consolidated Low Voltage box to the stop position. On Universal Electronics, you must turn off the High Voltage box switches on both the left and right lane High Voltage boxes. Failure to do this may result in personal injury caused by a cycling pinsetter when the ball detect's beam is interrupted or the pinsetter is turned on at the Control Desk.

The ball detect assembly is mounted inside a housing with three adjustable spring-loaded screws that are used to adjust the infrared transmitter and receiver so the transmitter's beam can be reflected back from the retroreflector on the opposite side of the lane to the receiver. Refer to *Figure 6-1*.

(1) BALL DETECT
(2) RETROREFLECTOR
(3) LANE

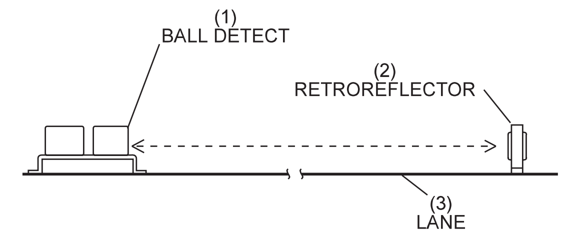


Figure 6-1. Ball Detect and Retroreflector.

The red LED (Light Emitting Diode) mounted on the ball detect is "on" when the beam is not being reflected back to the receiver indicating a ball or some object is in the beam's path or there is an alignment problem. Refer to *Figure 6-2*.

(1) VERTICAL ADJUSTING SCREW
(2) RECEIVER
(3) HORIZONTAL ADJUSTING SCREW
(4) TRANSMITTER
(5) RED LED

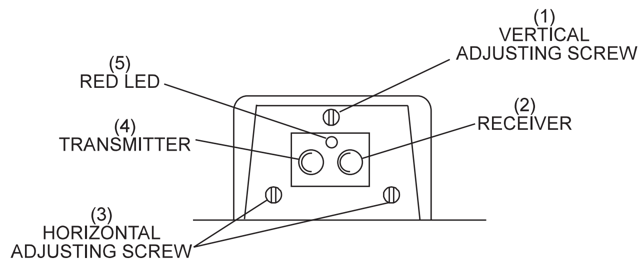


Figure 6-2. Ball Detect Adjusting.

a. Check the face of the ball detect and make sure it is parallel with the face of the ball detect's housing. Check the retroreflector to see if it is mounted securely and parallel to the ball detect. Clean the transmitter, receiver and retroreflector before and after adjusting.

b. Cover the retroreflector with a dark nonreflective object. The red LED should be lit indicating the beam is not reflecting.

c. Hold an unmounted retroreflector in your hand and move it above, below and around the mounted retroreflector until the red LED goes "off." This will indicate the position of the beam and guide you in your adjustment to get the beam centered on the retroreflector.

d. Using the vertical and horizontal adjusting screws (refer to *Figure 6-2*) move the beam until it is aimed exactly on the center of the mounted retroreflector.

e. To verify that the beam is centered, cover one half of the retroreflector with a card. The red LED should not light until more than one half of the retroreflector is covered. Repeat this procedure by covering the top half, the bottom half, the left half and the right half. The beam is centered only when the red LED stays off while covering all four positions.

2. Transport Band Tension Adjustment

There are two areas to concentrate on to make sure the transport band rolls properly. First, it must be set to the proper tension and second, it must roll in the center of the front and rear rollers.

The dimension given below is a starting point that will change slightly when adjusting the transport band to track and center properly.

NOTE: *Before making the tension adjustment, verify that the hardware mounting the transport support frames to the kickback and ball accelerator are tight. Loose hardware will create tracking problems.*

a. A compression spring and two flat washers and two jam nuts are needed. Tighten the inside jam nut until the spread of the compression spring is 20 to 21 mm. Refer to *Figure 6-3*.

(1) INSIDE JAM NUT

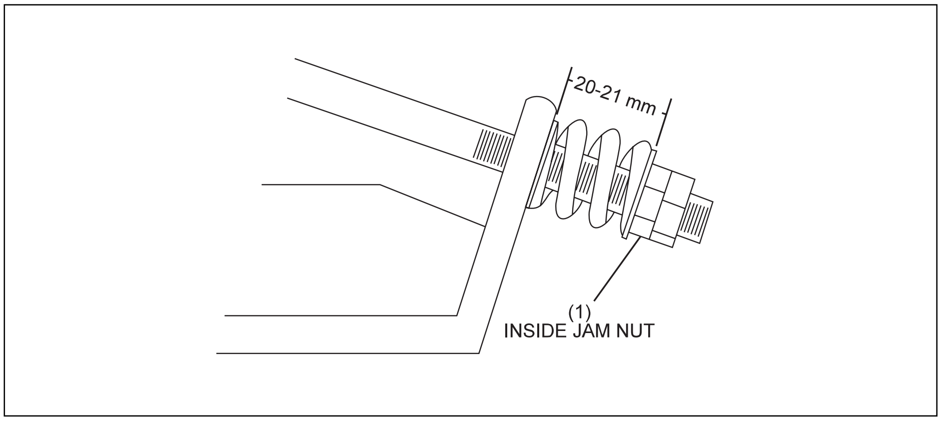


Figure 6-3. Transport Band Tension Using Compression Springs.

Centering the transport band on the front and rear rollers is performed by tightening and/or loosening the same inside jam nuts set in step “a” of this adjustment. Use the following procedure for centering.

b. Cycle the pinsetter and observe any side movement of the band on the rear roller. (Using Diagnostics will allow the band to run continuously which will load the band with ten pins to help in determining if the tension is proper.)

c. If the band is moving to the left, tighten the inside jam nut on the left side a half-turn and loosen the inside jam nut on the right side a half-turn. Refer to *Figure 6-4*.

(1) THREADED BOLT FOR TENSIONING

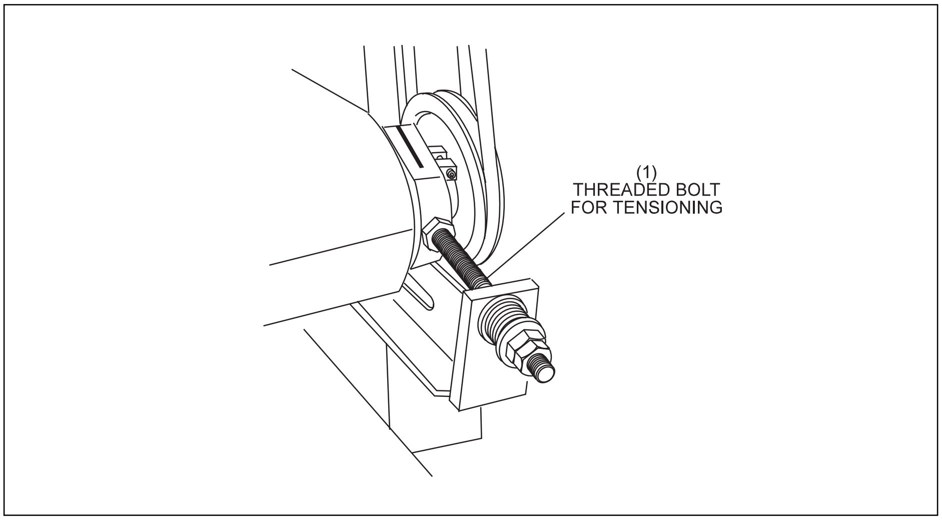


Figure 6-4. Jam Nut for Tensioning the Transport Band.

d. If the band is moving to the right, tighten the inside jam nut on the right a half-turn and loosen the inside jam nut on the left a half-turn.

e. After each adjustment, allow the pinsetter to cycle 3 to 4 minutes as the transport band moves sideways very slowly and needs time to react to the change in tension. Repeat step “c” or “d” as required until the band is centered and has stopped its sideways movement.

f. Lock the outer jam nut against the inside jam nut to keep the transport band tracking properly on the rollers.

3. Transport Band Drive Belt Tension Adjustment

(1) TRANSPORT BAND DRIVE ASSEMBLY
(2) V-BELT
(3) TENSION ADJUSTING SCREW
(4) ROUND BELT
(5) SET SCREW

a. Check the length of the green belt between the rear distributor shaft and the transport band drive assembly. The length should be 1.54 m for 12 mm belts or 1.6 m for 15 mm belts. Shorten the belt by cutting and rewelding per the belt welding instructions found in the "Service" section in this manual.

b. Completely loosen the tension adjusting screw. Refer to *Figure 6-5*.

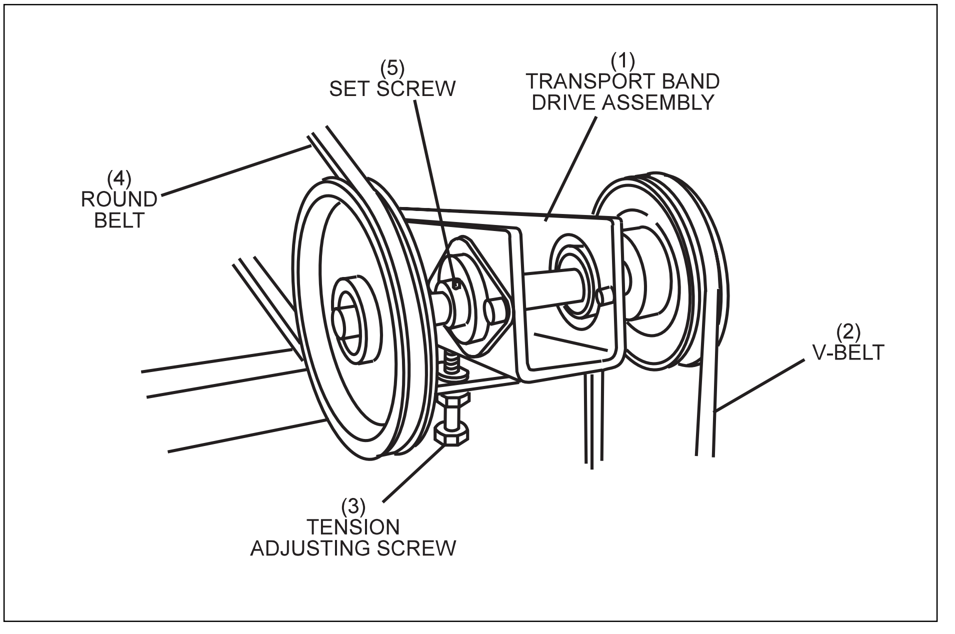


Figure 6-5. Tension Adjustment.

c. Check the green belt and "V" belt to make sure they are seated properly in their pulleys.

d. ***Hand*** tighten the tension adjusting screw as tight as possible.

e. With a 17 mm wrench, tighten the adjusting screw in full turn increments until the belt drives the transport band without slipping.

CAUTION: Do not overtighten the screw as the transport roller may be lifted from the support frame and cause pins to be pushed toward the ball door.

f. Tighten the locknut.

NOTE: *On the left pinsetter, check and tighten the set screws on the shaft bearings. To prevent the set screws from vibrating loose, apply a medium strength threadlocker such as Loctite #242 to the threads.*

4. Ball Cushion Adjustment

The ball cushion's purpose is to absorb the ball impact and to guide the ball to the ball door for return to the bowler.

a. Using the adjusting bolt shown in *Figure 6-6*, adjust the ball cushion so the bottom edge is 10-15 mm in front of the ball protector ring. This will position the ball so it will enter through the ball door without touching the protector ring. Refer to *Figure 6-7*.

(1) RUBBER BUMPER
(2) BEARING BLOCK
(3) ADJUSTING BOLT

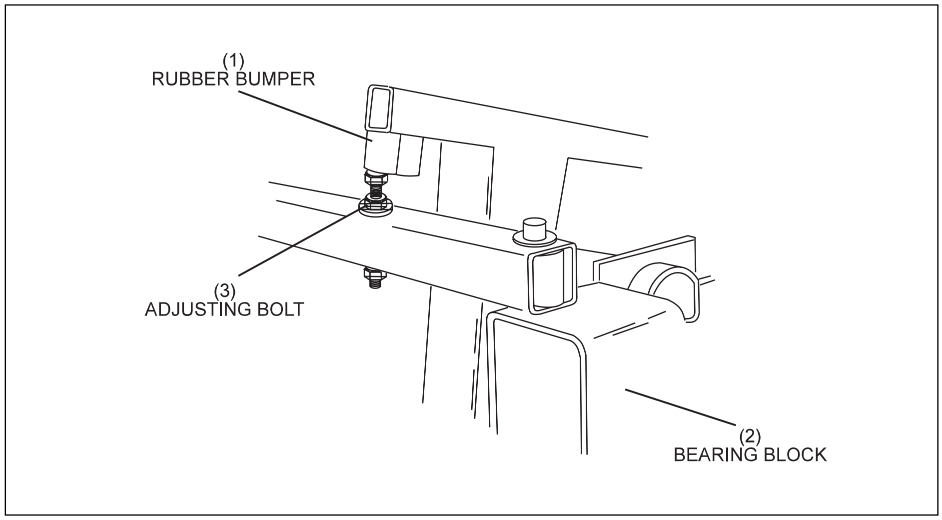


Figure 6-6. Ball Cushion Adjusting Bolt.

(1) BALL DOOR PROTECTOR RING
(2) BALL DOOR
(3) BALL CUSHION

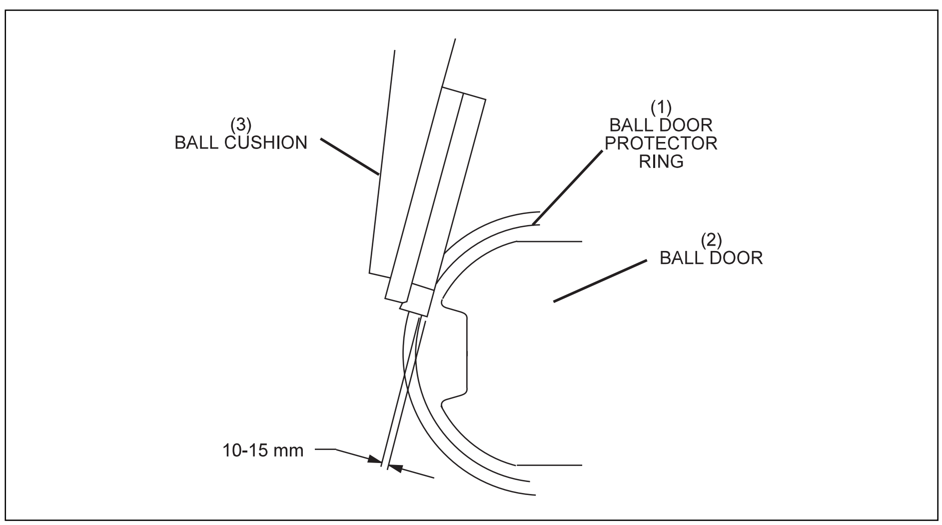


Figure 6-7. Ball Cushion Positioning.

b. Adjust the cushion frame sideways for a proper clearance of 5 mm between the cushion board and the ball protector ring. To adjust, loosen the set screws on the stop collars, reposition the cushion frame, and retighten the set screws. Refer to *Figures 6-8* and *6-9*.

(1) SET SCREW
(2) BALL CUSHION FRAME
(3) BEARING BLOCK
(4) STOP COLLAR

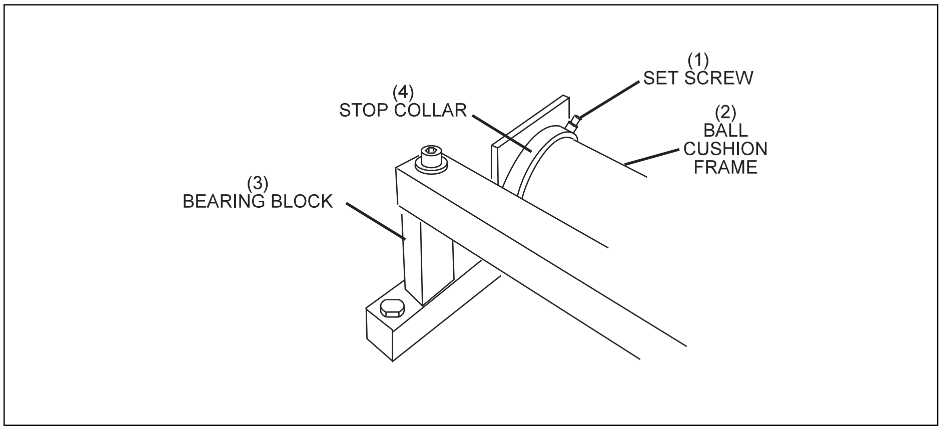


Figure 6-8. Adjust Cushion Frame Sideways.

(1) CLEARANCE OF 5 mm BETWEEN CUSHION BOARD AND BALL PROTECTOR RING

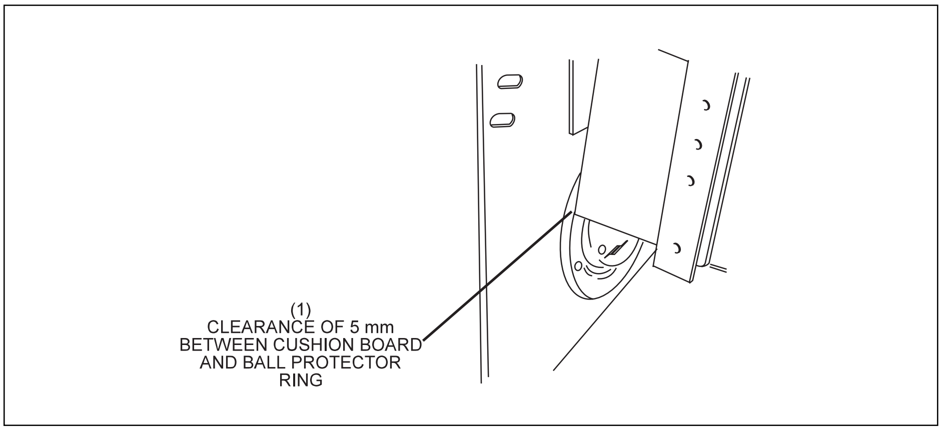


Figure 6-9. 5 mm Clearance Between Cushion Board and Ball Protector Ring.

5. Ball Cushion Shock Absorber Adjustment

The shock absorber must be adjusted properly to help the ball cushion stop the ball ***and*** to prevent damage to the shock absorber.

a. The ball cushion stop is mounted onto the ball accelerator housing. Move the stop as far forward (toward the foul line) in its slots as possible. Pull the cushion back and position the stop flush against the board. Firmly retighten the two bolts and locknuts. Refer to *Figure 6-10*.

(1) CUSHION BOARD
(2) BALL CUSHION STOP BRACKET

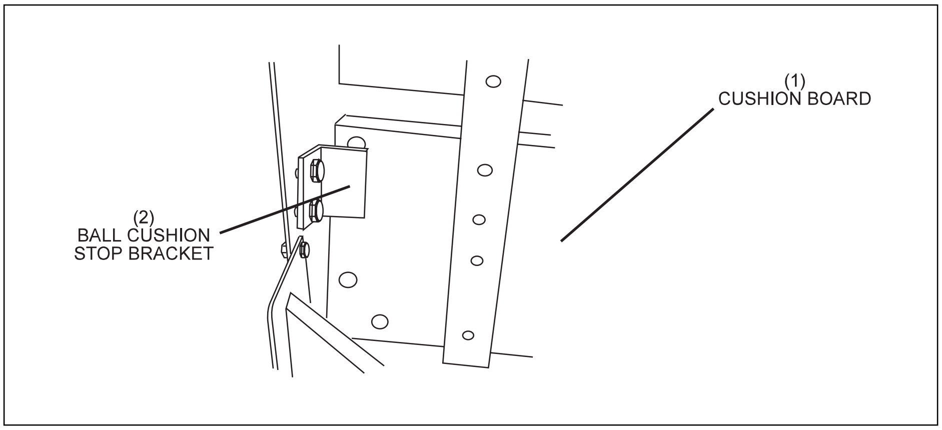


Figure 6-10. Ball Cushion Stop Bracket.

b. Verify that lower locknut and special round nut on shock absorber bracket (*Figure 6-11*) are installed properly. (No threads must be visible below bottom locknut.)

c. With the cushion held against the ball cushion stop, adjust the two upper jam nuts until a gap of 1 mm is obtained between the flat washer and the top of the shock absorber bracket. Refer to *Figure 6-11*.

d. Two check points:

1. With the ball cushion being held against the ball cushion stop, the shaft must not be bottomed in the shock absorber.

2. The ***minimum*** dimension between the top of the shaft and the center of the lower mounting bolt is 223.5 mm. Refer to *Figure 6-11*.

(1) BRACKET
(2) 1 mm GAP
(3) SPECIAL ROUND NUT
(4) LOCKNUT

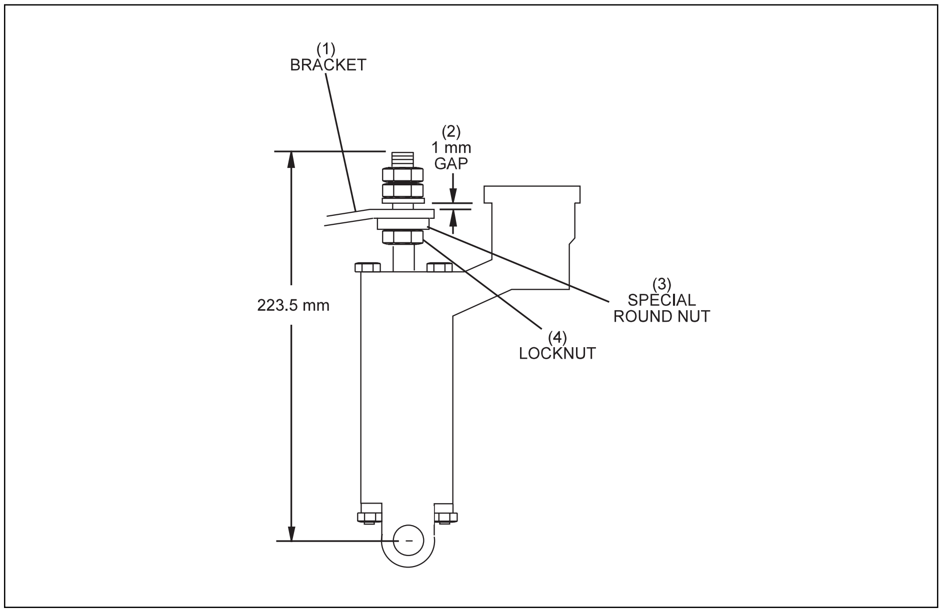


Figure 6-11. Adjust Jam Nuts on Shock Absorber Bracket.

6. Ball Door Adjustment

The ball door must be centered in the ball door protector ring to eliminate any binds. This will allow for complete closing of the ball door and allow light weight balls to exit with minimum interference. Three collars on the ball door shaft are used to provide equal spacing at the top and bottom of the ball door. Refer to *Figure 6-12*. Adjust in the sequence listed below.

Lower Collar: Adjust to provide a 1 mm gap between the shaft's upper retaining pin or hitch pin and the ball accelerator frame.

Middle Collar: This collar centers the ball door in the protector ring. Adjust the collar by loosening the set screw and retightening when the door is centered properly between both "A" points and both "B" points.

Upper Collar: Adjust for a 1 mm gap between the door and the collar. This clearance keeps the door in position without any binding.

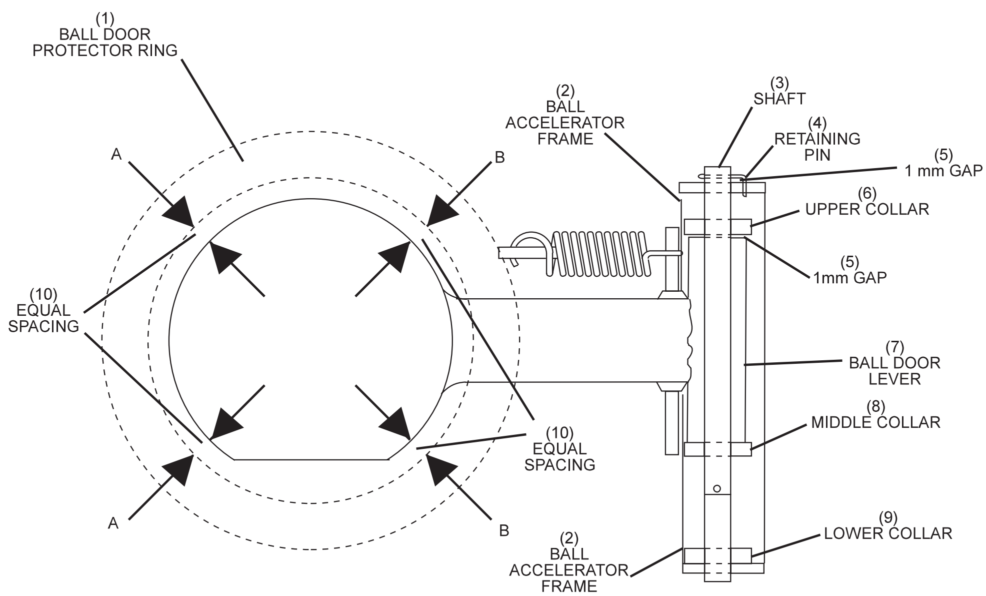


Figure 6-12. Ball Door Centering Adjustment.

(1) BALL DOOR PROTECTOR RING	(2) BALL ACCELERATOR FRAME	(3) SHAFT
(4) RETAINING PIN	(5) 1 mm GAP	(6) UPPER COLLAR
(7) BALL DOOR LEVER	(8) MIDDLE COLLAR	(9) LOWER COLLAR
(10) EQUAL SPACING		

After adjusting or reinstalling a door, check to see if it is level with the other lane's ball door and that both doors can open and close without any binds.

7. Ball Door Locking Adjustment

The ball door is designed to be opened only by a ball when the ball door locking solenoid is ***not*** energized.

a. When a ball presses the ball door key, the key lever should lower and clear the locking bolt by 3-5 mm. Refer to *Figure 6-13*. Adjust by loosening the two hex head screws that mount the locking bolt/solenoid assembly onto the ball accelerator frame. Raise or lower to get to the 3-5 mm clearance and retighten the hex head screws. Refer to *Figure 6-14*.

(1) LOCKING BOLT
(2) 3-5 mm CLEARANCE
(3) KEY LEVER

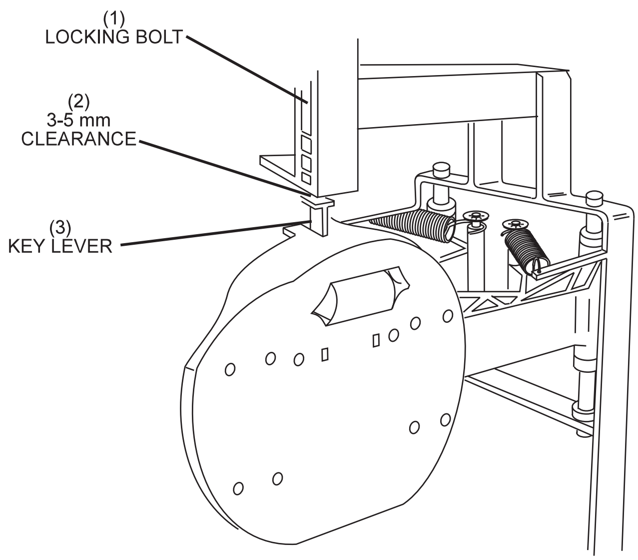


Figure 6-13. Adjusting Locking Bolt.

b. Upon ball detect, the ball door solenoid energizes for three seconds. This causes the locking bolt to lower and prevent the ball door from opening during this time.

To check: Manually push up on the plunger to lower the locking bolt. Also, push in the ball door key to lower the key lever. At this point the locking bolt should prevent the door from opening.

To adjust: Loosen the mounting screws for the solenoid. Raise or lower the solenoid to get the locking bolt to block the key lever when the solenoid is energized and the key lever to clear the locking bolt when the solenoid is de-energized. Refer to *Figure 6-14*.

(1) HEX HEAD SCREWS
(2) BALL DOOR SOLENOID
(3) LOCKING BOLT

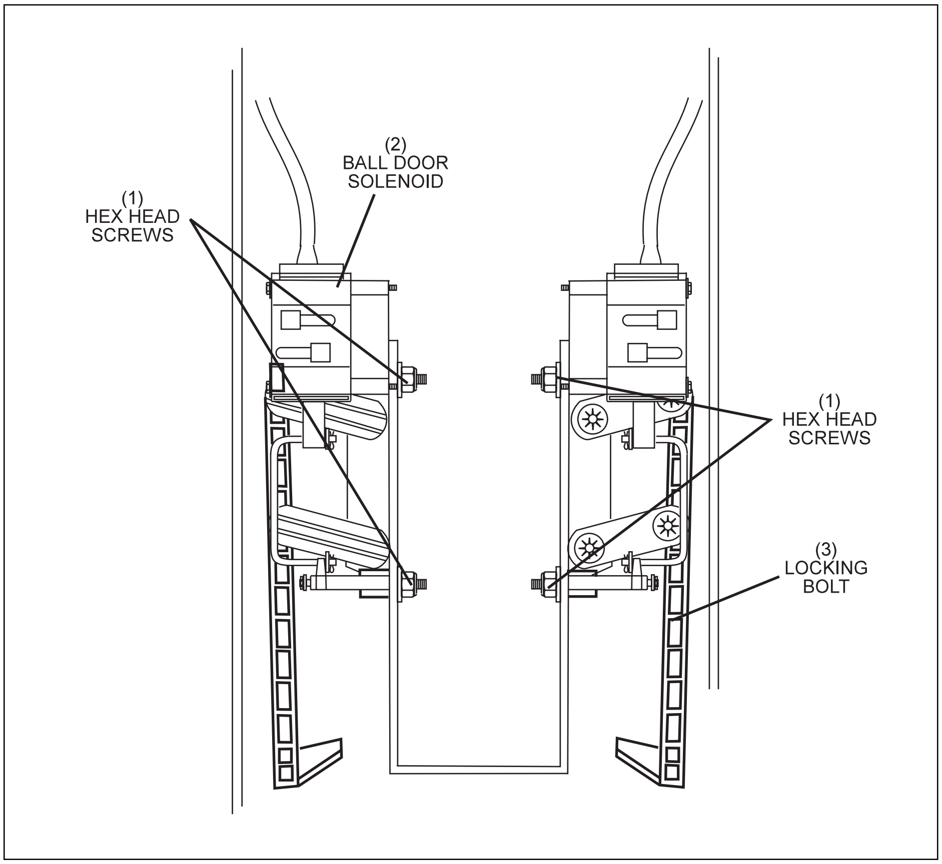


Figure 6-14. Ball Door Solenoid.

8. Ball Accelerator Flat Belt Guard Adjustment

This guard prevents a bowling ball from coming into contact with the accelerator's flat belt when a pin has entered the ball accelerator and has stopped in the path of the ball.

a. Adjust the guard vertically for a distance of 10 mm between the bottom of the guard and a ball riding on the ball track. Refer to *Figure 6-15*.

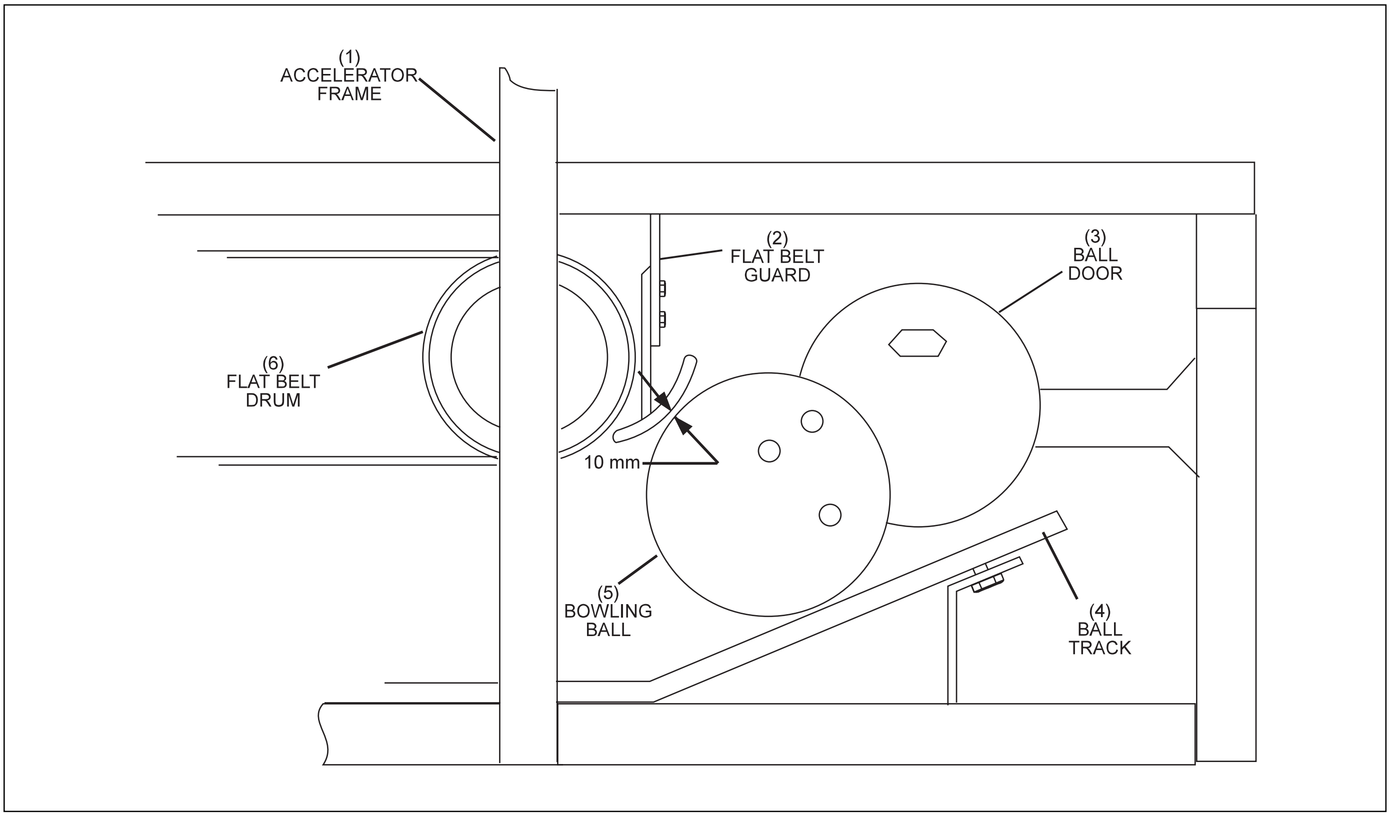


Figure 6-15. Ball Accelerator Flat Belt Guard Adjustment.

(1) ACCELERATOR FRAME	(2) FLAT BELT GUARD	(3) BALL DOOR
(4) BALL TRACK	(5) BOWLING BALL	(6) FLAT BELT DRUM

9. Ball Accelerator Flat Belt Tension and Alignment Adjustment

Flat Belt Tension

A large tension spring at the front of the accelerator provides the tension for the flat belt. When the belt is under proper tension, this spring will be 194 mm from center to center. Refer to *Figure 6-16*. Adjust by tightening or loosening the two tensioning nuts that secure the long tension bar to the rear of the accelerator frame.

NOTE: *As access to the spring is impossible when installed between the pinsetters, a reference measurement should be taken at the tensioning nuts for resetting the tension after reinstalling the ball accelerator.*

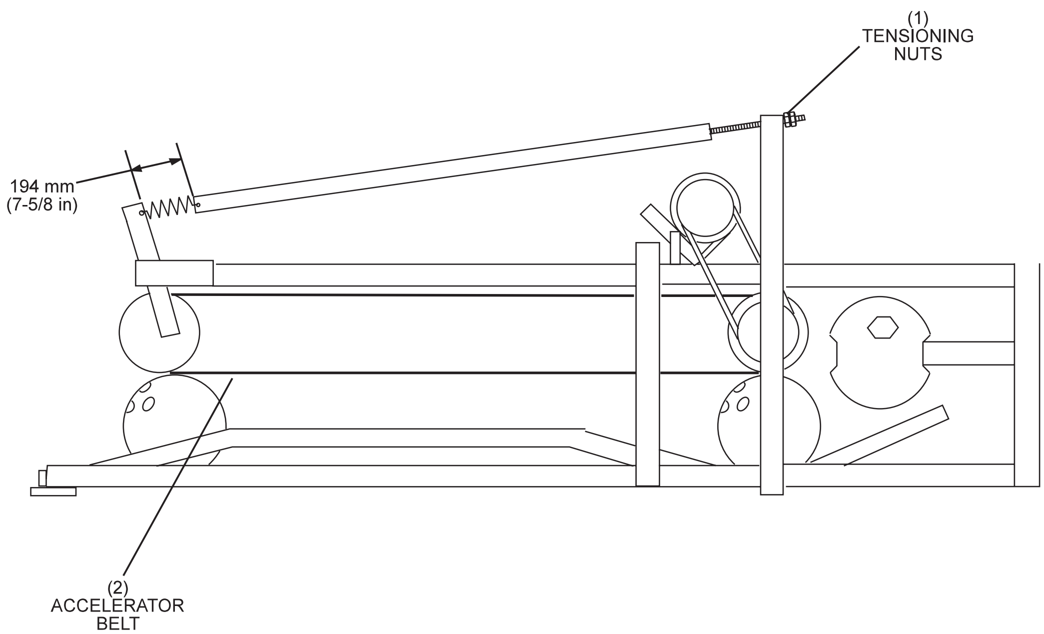


Figure 6-16. Ball Accelerator Flat Belt Tension Adjustment.

(1) TENSIONING NUTS (2) ACCELERATOR BELT

Belt Alignment

NOTE: *It is recommended that two people perform the following procedure; one to control power to the accelerator, and one to perform belt tracking adjustment as needed.*

WARNING: The following procedure involves making adjustments to the accelerator with power on and requires close proximity to moving machine parts. Use extreme caution around moving belt to prevent injury to personnel! DO NOT wear loose fitting clothes which may be caught in moving belt!

1. Plug in accelerator power cord and observe belt tracking on front pulley drum.

2. If belt is not centered on the front pulley drum:

   a. Using a 17 mm socket, ratchet and wrench, loosen the two screws and nuts securing the pivot levers. ONLY loosen screws enough to allow slight adjustment of pivot levers. Refer to *Figure 6-17*.

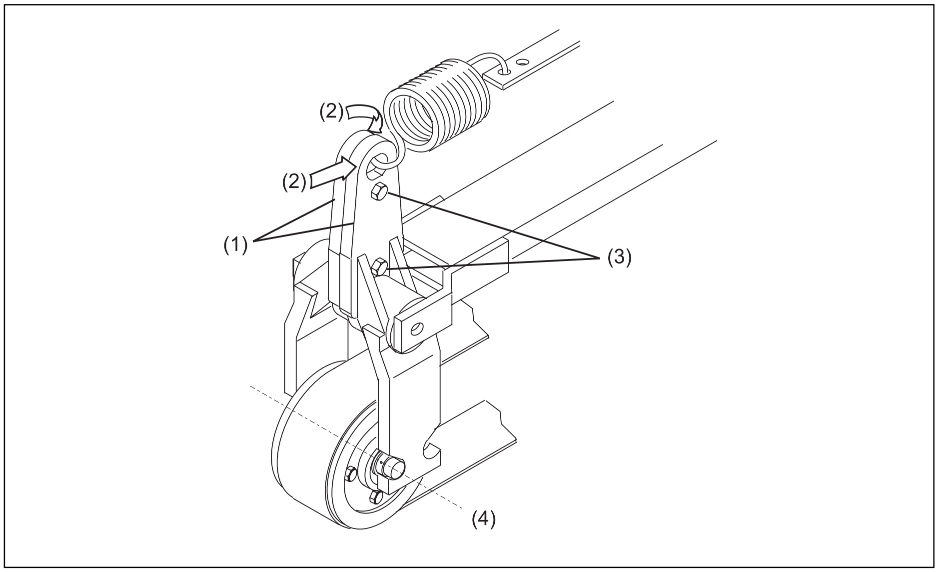


Figure 6-17. Loosen Hardware Securing Pivot Levers

WARNING: When making adjustments, use care to prevent belt from slipping off pulley drum surface. Belt could damage pivot levers and possibly injure personnel!

b. Observe belt tracking and use light, short taps from a soft rubber mallet to reposition left and right pivot levers until belt is tracking on the center of pulley drum. Refer to *Figure 6-17*.

c. Tighten two screws and nuts securing the pivot levers.

3. If belt is still not centered on drum surface:

a. Unplug power to accelerator and loosen two jam nuts on the tension bar threads. Refer to *Figure 6-18* for location.

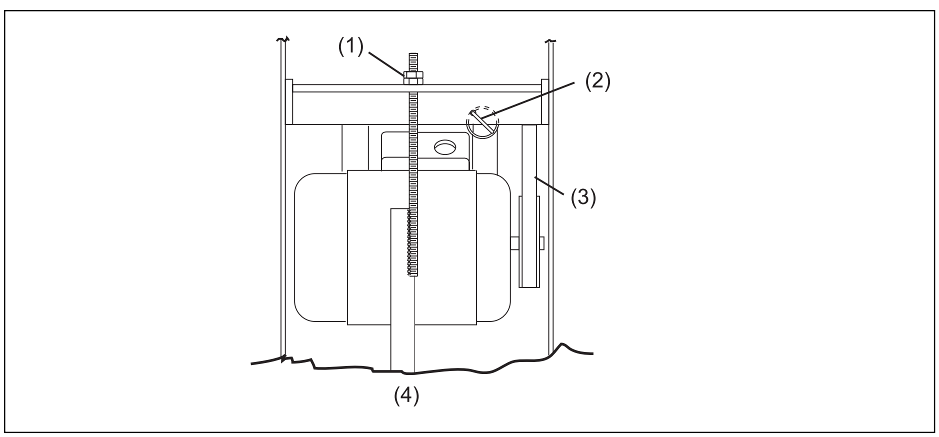


Figure 6-18. Loosen Jam Nuts

b. Using pliers, remove tension spring on V-belt motor pivot point.

c. Lift V-belt out of V-belt pulley and move out of way of pulley drum.

d. Slide the pulley toward accelerator rear and remove shaft ends from shaft holders. Refer to *Figure 6-19.*

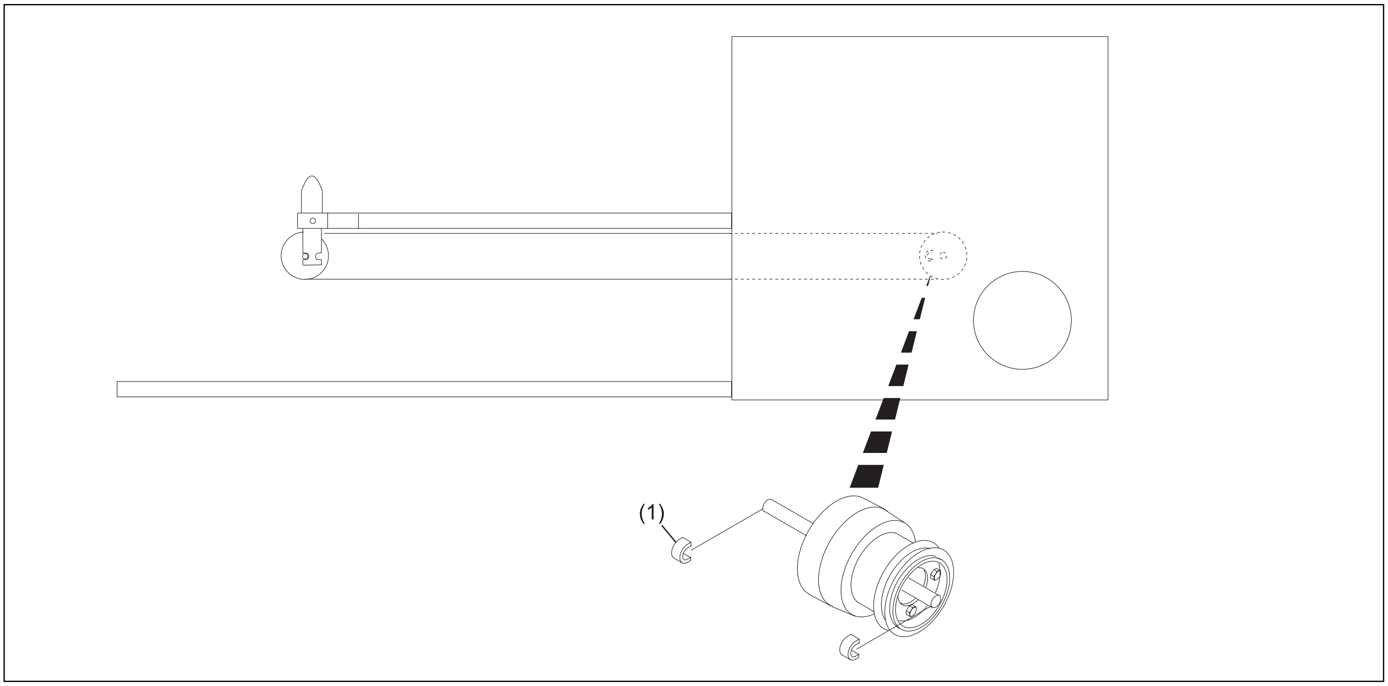


Figure 6-19. Remove Shaft Ends.

(1) SHAFT ENDS

10. Pin Feed Deflector Adjustment

The pin feed deflectors have three adjustment points to be concerned with. The end result of these adjustments is that there should be a clearance of 6 mm ± 1.5 mm between the transport band and the deflectors.

a. The right hand pin feed deflector has an additional mounting hole for positioning the deflector properly on the odd or even lane. The top hole “B” is used when the deflector is installed on the odd lane pinsetter. The bottom hole “C” is used when the deflector is installed on an even lane pinsetter. Refer to *Figure 6-20*.

(1) RIGHT HAND DEFLECTOR

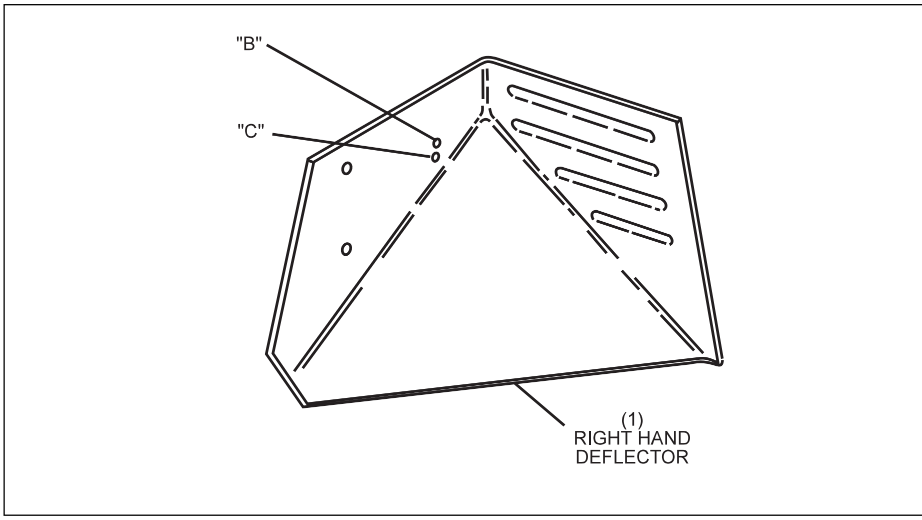


Figure 6-20. Right Hand Deflector Mounting Holes.

b. The remaining holes are used to attach the deflector to the pin deflector mounting plate. The mounting plate has two sets of slotted holes that allow for vertical and horizontal movement of the deflectors. The deflectors should be positioned to firmly touch the kickback or ball accelerator with proper clearance of the transport band as stated above. Refer to *Figure 6-21*.

(1) PIN DEFLECTOR MOUNTING PLATE
(2) MOUNTING HARDWARE
(3) ADJUST FOR 6 mm GAP BETWEEN TRANSPORT BAND AND BOTTOM OF DEFLECTOR
(4) PIN DEFLECTOR

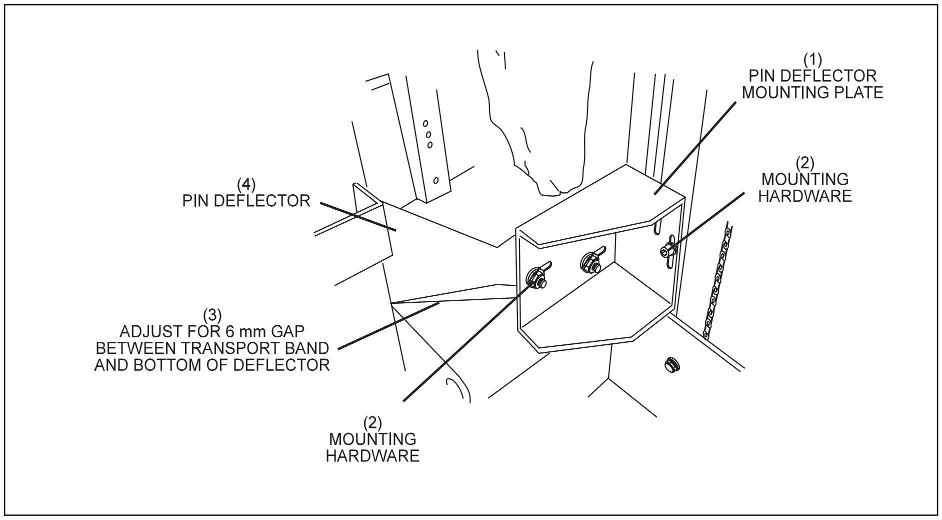


Figure 6-21. Deflector Positioning for Proper Clearance

11. Elevator Shovel Cam Adjustment

NOTE: *Prior to making this adjustment, make sure the shark assembly is level and positioned 135 mm from the back plate of the elevator.*

a. Rotate the elevator's pin shovels so the lower surface of the pin shovel is 22 mm ± 2 mm above the top surface of the pin turn wedges. Refer to *Figure 6-22.*

(1) ATTACHING HARDWARE
(2) CENTER LINE ON SHOVEL CAM
(3) LOWER SHOVEL END
(4) PIN TURN WEDGE
(5) WOOD TEMPLATE
(6) PIN SHOVEL GUIDE ROLLER
(7) SHOVEL CAM

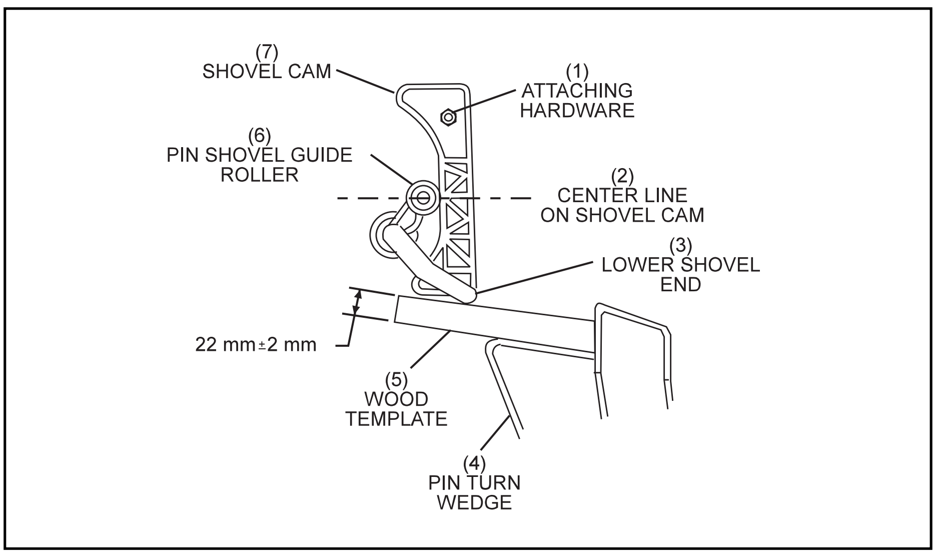


Figure 6-22. Elevator Pin Shovel Cam Adjustment.

b. Loosen the attaching hardware and position the centerline of the shovel cam on the center of the pin shovel's guide roller.

12. Elevator Drive Belt Tension Adjustment

a. Check the length of the green belt between the rear distributor shaft and the elevator drive assembly. This length should be 975 mm. Shorten the belt by cutting and rewelding per the belt welding instructions found in the Service section in this manual.

b. Completely loosen the tension adjusting screw. Refer to *Figure 6-23*.

(1) ELEVATOR DRIVE PULLEY
(2) TENSION ADJUSTING SCREW
(3) GREEN BELT
(4) V-BELT

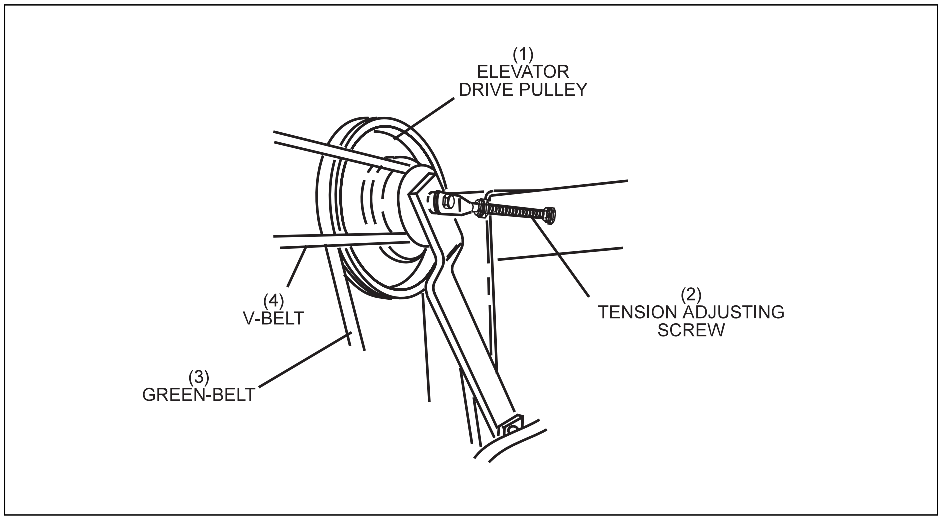


Figure 6-23. Tension Adjustment.

c. Check the green belt and “V” belt to make sure they are seated properly in their pulleys.

d. ***Hand tighten*** the tension adjusting screw and nut as tight as possible.

e. With a 17 mm wrench, tighten the adjusting screw in full turn increments until the belt drives the transport band without slipping.

f. Tighten the jam nut against the rear distributor frame.

13. Pin Count Switch Adjustment (GS-96 & Later)

The pin count switch must be adjusted to make sure that all pins leaving the elevator are counted to insure that the distributor is loaded as efficiently as possible.

NOTE: *Prior to making this adjustment, make sure the shark assembly is level and positioned 135 mm from the back plate of the elevator.*

To set (original) switch assembly, a line must be set 35 mm back from the edge of the deflector wings on the pin guide assembly. The bottom of the switch actuator must be 80 mm +/- 2 mm above the center point between the two pin guides. Refer to *Figure 6-24*.

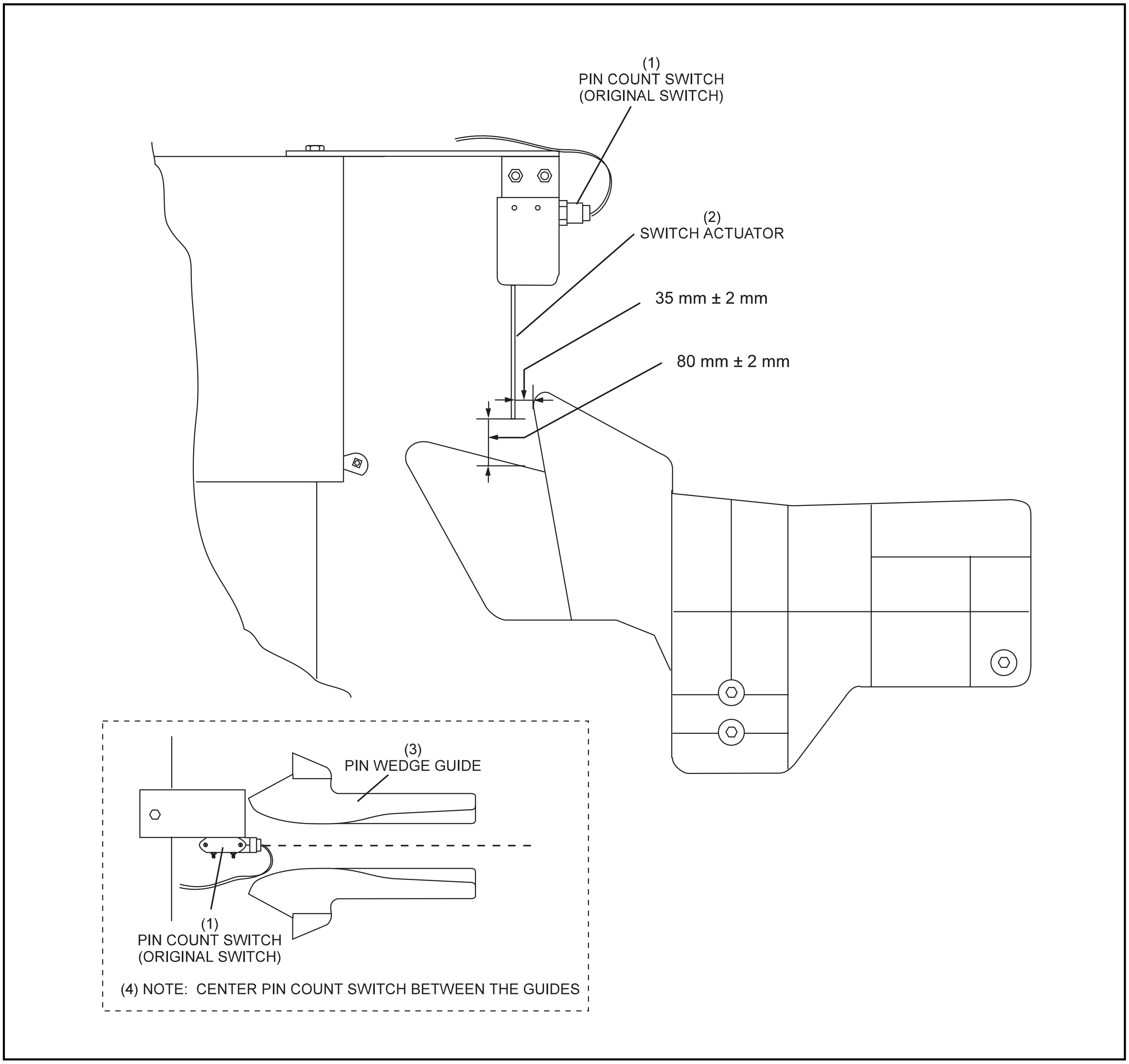


Figure 6-24. Original Style Pin Count Switch

(1) PIN COUNT SWITCH (ORIGINAL SWITCH) (2) SWITCH ACTUATOR (3) PIN WEDGE GUIDE
(4) NOTE: CENTER PIN COUNT SWITCH BETWEEN THE GUIDES

With the updated switch assembly, there is no adjustment necessary to the switch and bracket. With the shark positioned 135 mm from the back plate of the elevator, the switch actuator should be 20 mm from the edge of the deflector wings on the pin guide assembly. The bottom of the switch actuator must be 75-80 mm above the center point between the two pin guides. To adjust, loosen the actuator clamps and position the switch actuator to the proper dimensions. Retighten the clamp. Refer to *Figure 6-25*.

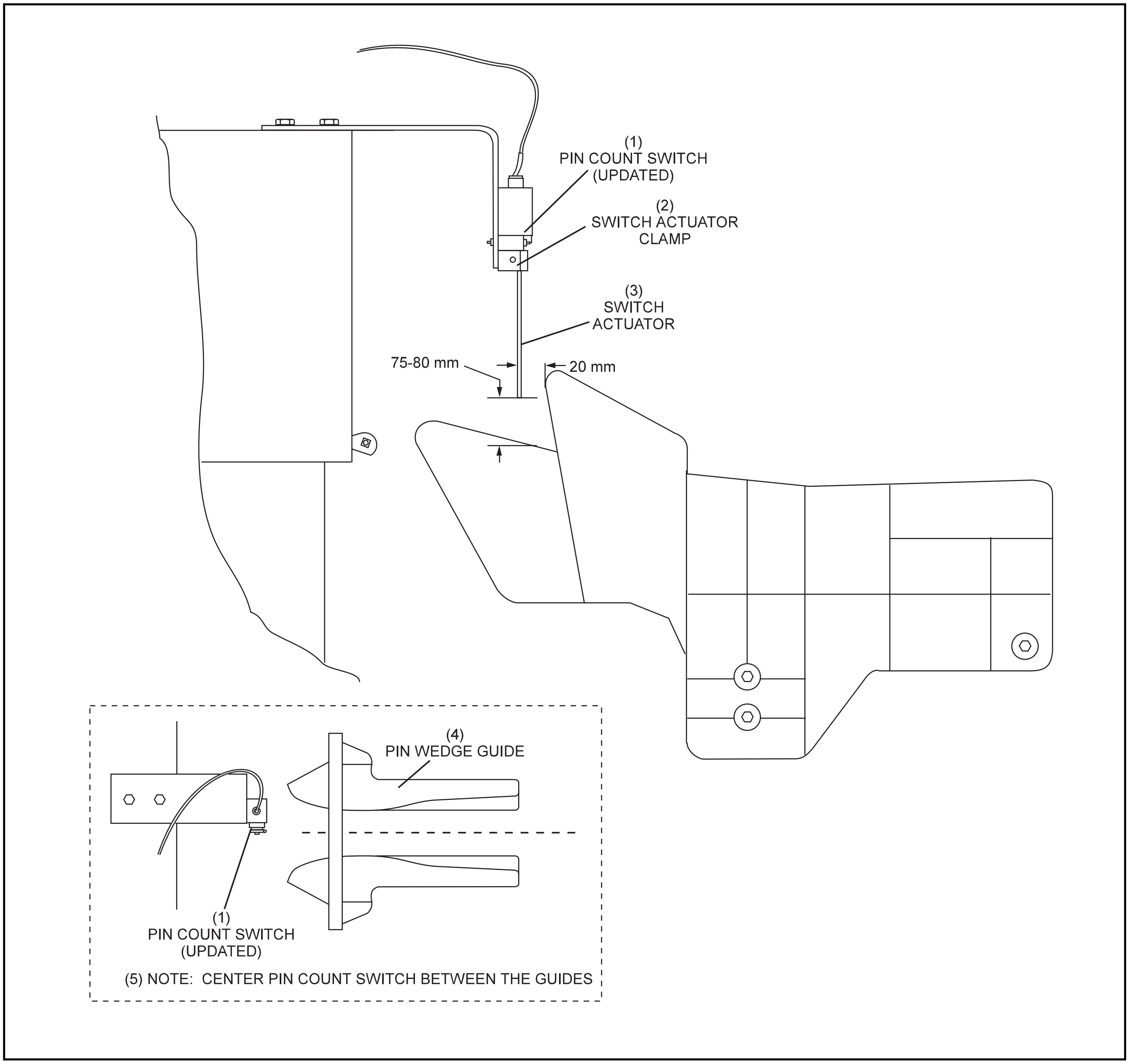


Figure 6-25. Updated Pin Count Switch

(1) PIN COUNT SWITCH (UPDATED)	(2) SWITCH ACTUATOR CLAMP	(3) SWITCH ACTUATOR
(4) PIN WEDGE GUIDE	(5) NOTE: CENTER PIN COUNT SWITCH BETWEEN THE GUIDES	

14. Shark Assembly Drive Gear and Spur Gear Meshing Adjustment

The spur gear on the rear distributor drive shaft drives the shark assembly drive gear to carry the pins from the elevator to the distributor. These two gears must be meshed properly for correct drive and to reduce wear and damage to the gears.

a. The tooth gap clearance between the two gears must be 1-3 mm. Refer to *Figure 6-26*.

(1) REAR DISTRIBUTOR SHAFT
(2) 1-3 mm TOOTH GAP
(3) SHARK SWITCH DRIVE GEAR
(4) SHARK SWITCH MOUNTING PLATE
(5) GREEN PIN HANDLING BELT
(6) MOUNTING HARDWARE

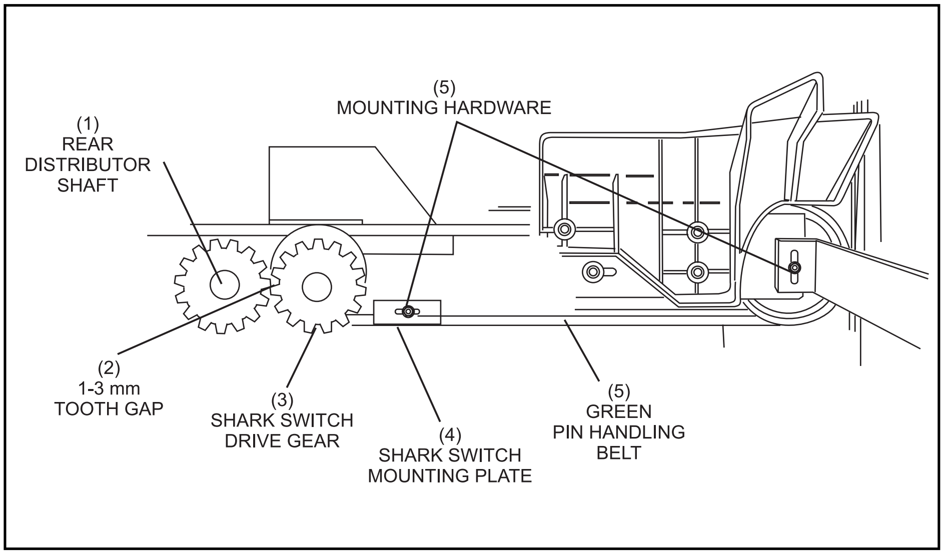


Figure 6-26. Clearance Between Drive Gear and Spur Gear

b. To check for proper gap, pull one of the shark assembly's green pin handling belts rearward and forward. If the shark switch gear will not rotate independently of the distributor's spur gear 1-3 mm, loosen the mounting hardware for the shark switch mounting plate and position the gear to get the proper tooth gap. Retighten the mounting hardware.

15. Shark Switch Adjustment

The upper rear corner of each pin turn wedge must be 135 mm ± 3 mm from the rear plate of the elevator. This will allow for the proper placement of the pins into the shark switch assembly.

a. Loosen the pin turn wedge mounting hardware and position the wedge to 135 mm. Retighten the hardware. Refer to Figure 6-27.

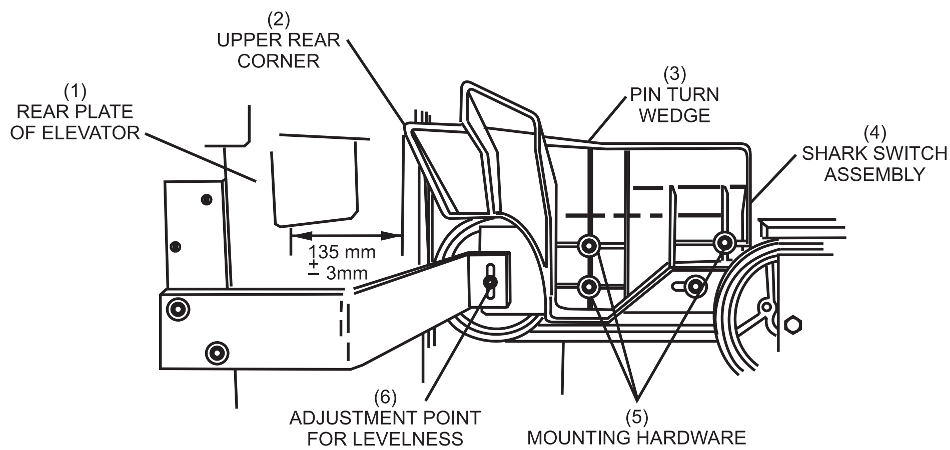


Figure 6-27. Pin Turn Wedge Positioning.

(1) REAR PLATE OF ELEVATOR	(2) UPPER REAR CORNER	(3) PIN TURN WEDGE
(4) SHARK SWITCH ASSEMBLY	(5) MOUNTING HARDWARE	(6) ADJUSTMENT POINT FOR LEVELNESS

b. The shark switch assembly and pin turn wedges must be level from side to side and front to back. Refer to *Figure 6-28* and *Figure 6-29* to properly position the level and *Figure 6-27* for the adjustment location.

(1) PIN GUIDE WEDGES
(2) LEVEL
(3) PIN GUIDE
(4) ROUND BELTS

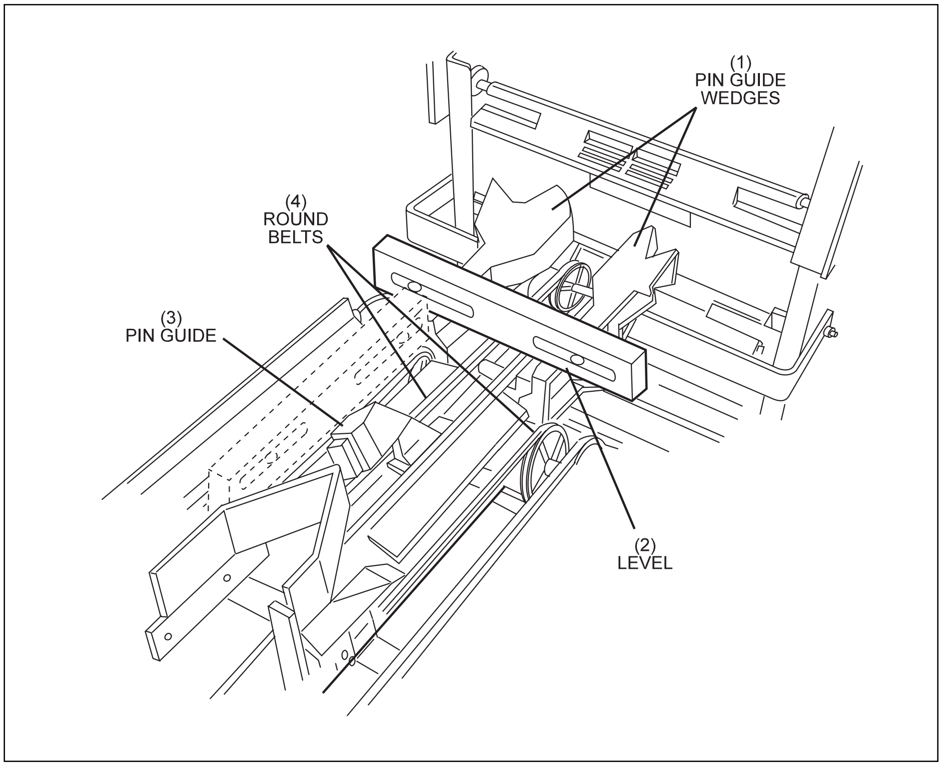


Figure 6-28. Shark Switch Leveling Adjustment - Side to Side.

(1) PIN GUIDE WEDGES
(2) LEVEL
(3) PIN GUIDE
(4) ROUND BELTS

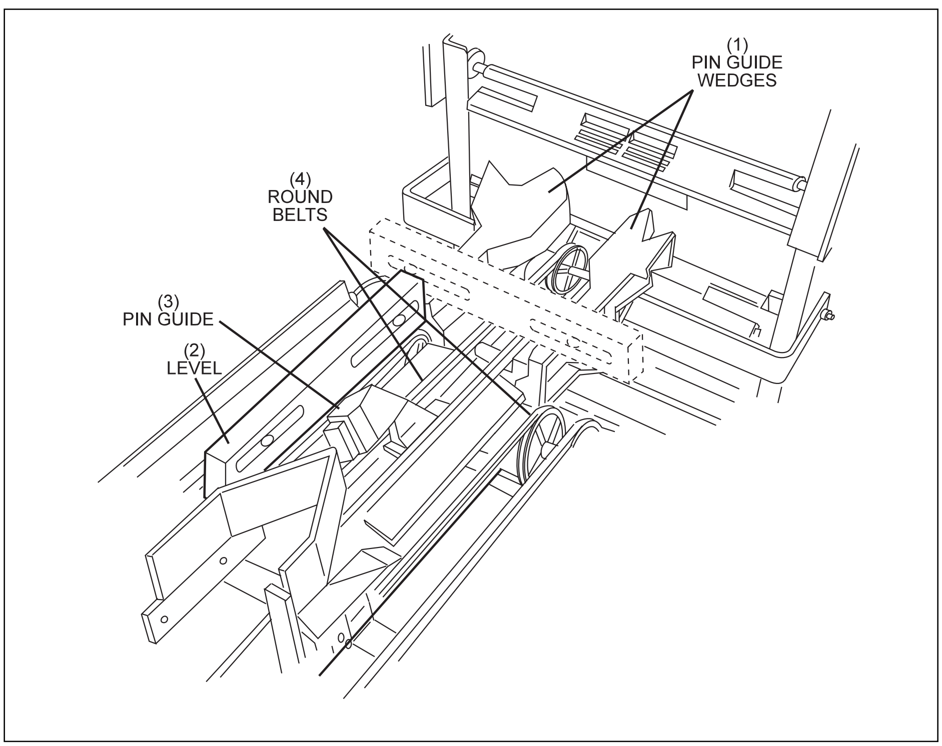


Figure 6-29. Shark Switch Leveling Adjustment - Front to Back.

16. Pin Station Position in the Distributor

Each pin station has four mounting slots that are used to bolt the pin station onto the distributor frame. After repairing or replacing a pin station, position it so the station can easily accommodate the pin and the pin release lever is properly positioned over the pin holder's gripper. Retighten the four mounting bolts. Refer to *Figures 6-30* and *6-40*.

NOTE: *While making this adjustment on Pinsetters with Universal Pin Stations, recheck Adjustment #21 for proper pin release lever clearance.*

NOTE*: You must remove the pin release lever as a complete assembly before you can remove the pin station.*

(1) SLOTS

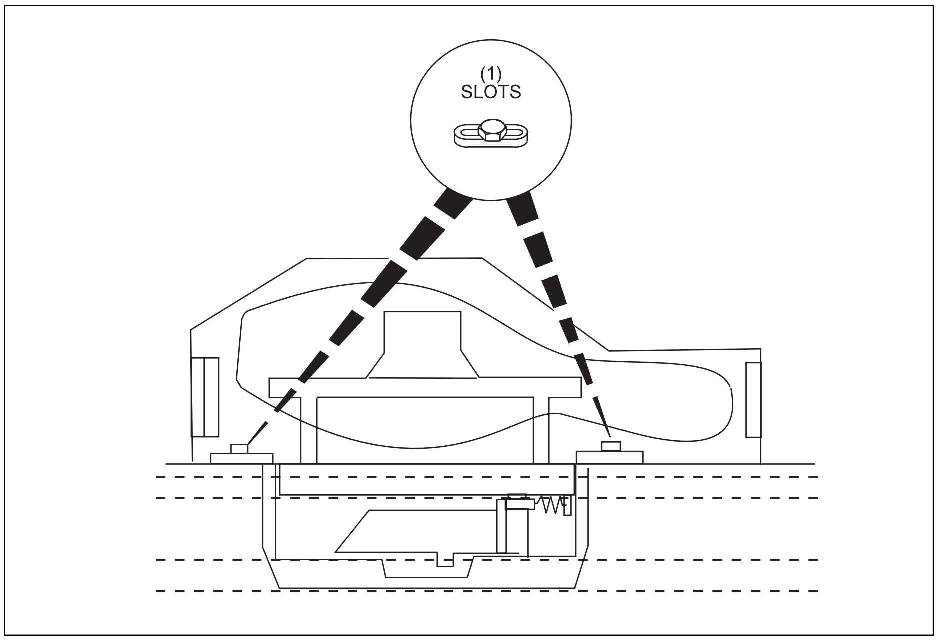


Figure 6-30. Position of Pin Station in Distributor.

17. Pin Overflow Socks

The overflow socks must be clamped and adjusted properly to prevent any overflow pins from causing distributor or ball door jams and to transfer the pin quickly to the elevator.

The stitched seam must be positioned away from the pin head contact area. Failure to do this will cause the pins to continuously land against this seam resulting in pin jams as pins are caught in the open seams.

A minimum of 25 mm (1") of the sock must be above the clamp to insure sufficient clamping strength when mounting the sock onto the overflow chute.

The overflow socks must face each other so the pin lands on the transport band ***between*** the rear transport band roller and the rear ball support board. Refer to *Figure 6-31*.

(1) OVERFLOW SOCKS
(2) REAR BOARD
(3) REAR TRANSPORT BAND ROLLER

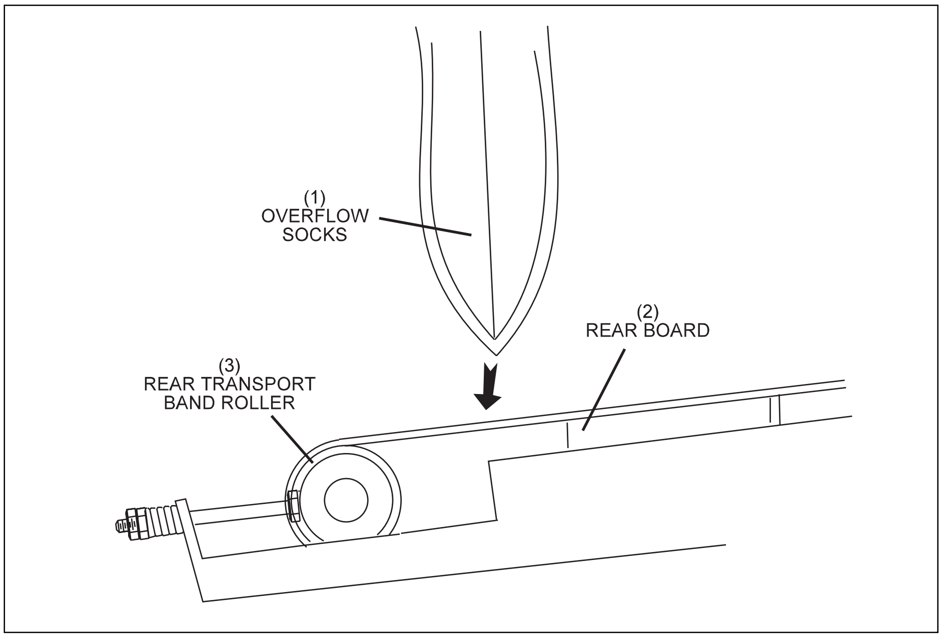


Figure 6-31. Sock Placement.

18. Setting Table Levelness Adjustment

(1) ALIGN TO SIDE
(2) GUIDE ROLLERS
(3) TABLE RACK
(4) PINION GEAR

The setting table must be level in order for pins to be loaded and set properly.

a. Check the top and bottom guide rollers for tightness on the table rack. Align the table rack with these guide rollers so it rides evenly in the pinion gear. The same amount of tooth gap (1 mm) should be evident when the table is all the way up and all the way down and the table rack is level vertically. Refer to *Figure 6-32*.

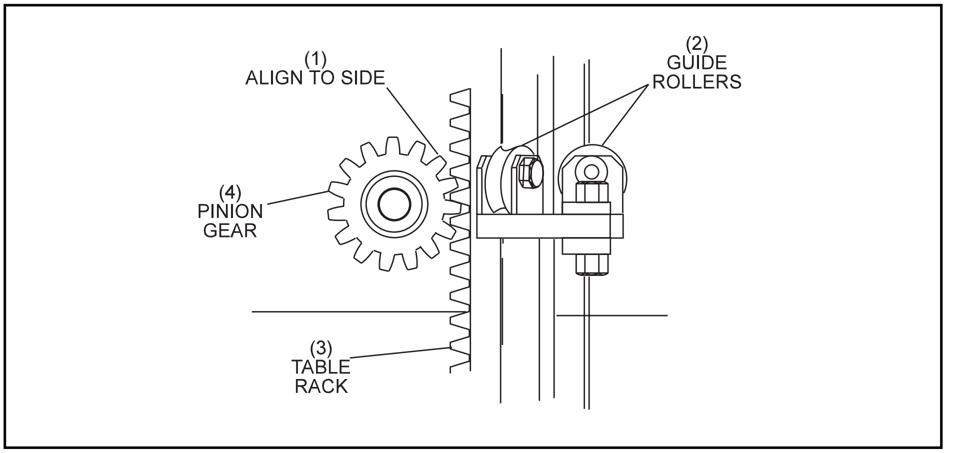


Figure 6-32. Table Rack Guide Rollers.

b. Lower the setting table to the new pinsetting position and shut off the power when the grippers open.

c. Manually rotate the table motor “V” belt pulley until the setting table’s crank arm and the lift chain form a straight line as shown in *Figure 6-38*. (Refer to the Service section of this manual for the proper table lowering procedure.)

d. Measure the height of the setting table from the pin deck at the three pin cutouts for the 1, 7 and 10 pin positions. The dimension at these three points must be within 3 mm of each other.

CAUTION: Do not lean on the table while checking these measurements.

e. To adjust, lower or raise the large hex nuts (24 mm socket and drive required) on the setting table's studs until the table is level. Refer to *Figure 6-33*.

NOTE: Do not try to get your 15 mm +/- 5 mm dimension at this point. Refer to Adjustment 20 for the procedure to achieve the correct height in the lowest position.

(1) 16 mm HEX NUT AND LOCKWASHER
(2) SETTING TABLE STUDS
(3) DECK RACK

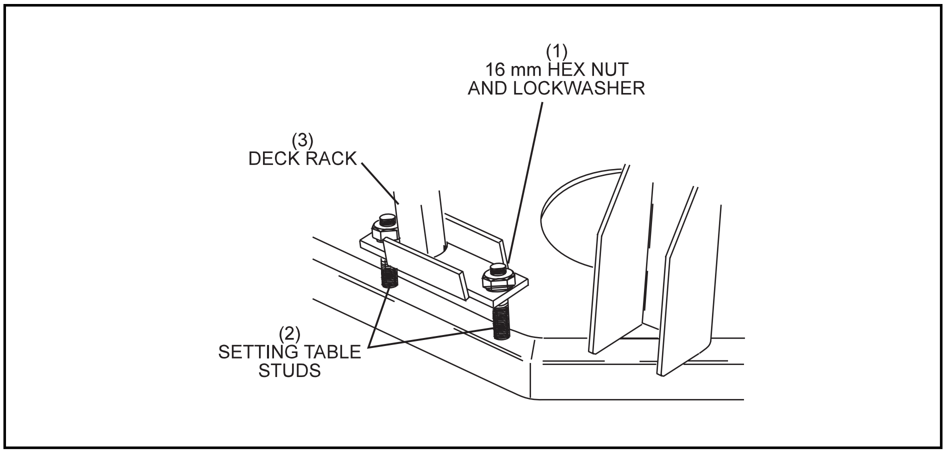


Figure 6-33. Setting Table Studs.

19. Setting Table Height Adjustment (Angles "A" and "B") - At Home Position on "A" Switch

This adjustment is to assure that the setting table reaches the proper operating position for the A, B, C and D switches at the correct time. It also allows the pins to be released into the setting table's pin holders regardless of the direction the table motor is operated (clockwise or counterclockwise.) The table must always stop at the same height when the "A" switch is made.

a. Turn on the pinsetter. Start a setting cycle by pressing the "SET" switch on the Universal High Voltage box or the Consolidated Low Voltage box or the "SET" switch on the mechanic's rear control box.

b. Check at the end of the detection portion of the set cycle to determine Angle "B." After the sweeping action, the table will lower to set new pins. At the end of this cycle, check Angle "A." These two angles must be equal to allow the table to always come up to the same height. The angle is determined by the difference between the center line of the chain and the centerline of the crank arm. Refer to *Figure 6-34*.

(1) ANGLE "A"
(2) ANGLE "B"
(3) CENTER LINE OF CRANK ARM
(4) CHAIN
(5) CRANK ARM
(6) CENTER LINE OF CHAIN
(7) FRONT OF MACHINE

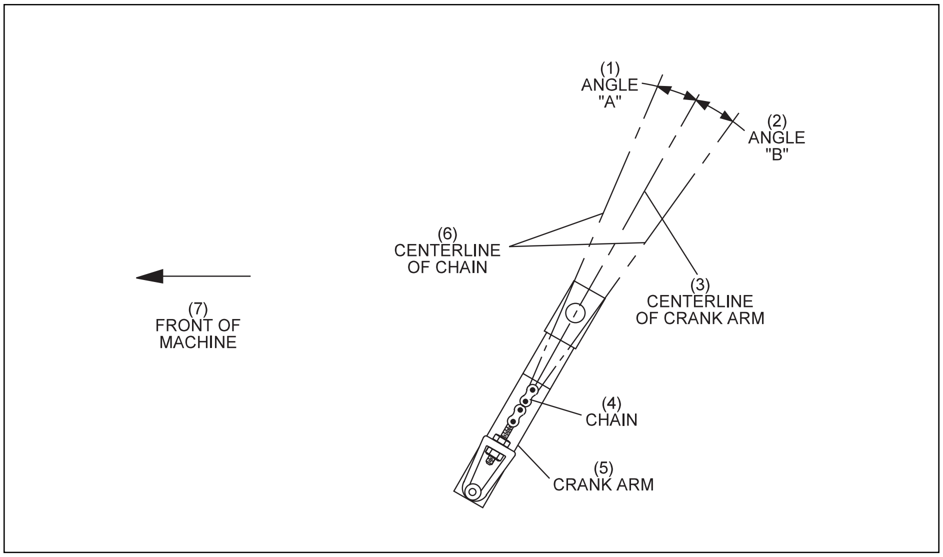


Figure 6-34. Crank Arm Angles.

NOTE: *The chain may or may not intersect the center line of the crank arm and the sizes of Angles "A" and "B" may vary from pinsetter to pinsetter. This is caused by the size of the switch cluster cam's lobe, the bend of the "A" switch's activator and the table motor operating clockwise and counterclockwise.*

c. If Angles “A” and “B” are not equal, use the following guidelines for adjusting the switch cluster cam.

Angle "A"	Angle "B"	Corrective Action
Too Large	Too Small	Rotate Cam Toward Switch "B"
Too Small	Too Large	Rotate Cam Toward Switch "D"

d. To adjust:

1. Turn off power to the pinsetter by using the Consolidated Low Voltage Stop/Run switch or the Universal High Voltage On/Off switch.

2. Draw a line across the cam and table shaft as a reference. Then, using a 3 mm Allen wrench, loosen the cam on the main table shaft.

3. Rotate the cam in 3 mm or <u>less</u> increments in the proper direction and retighten the cam. Refer to *Figure 6-35*.

4. Recheck using the “SET” cycle to determine if Angles “A” and “B” are now equal. Repeat steps 1, 2 and 3 until both angles are even.

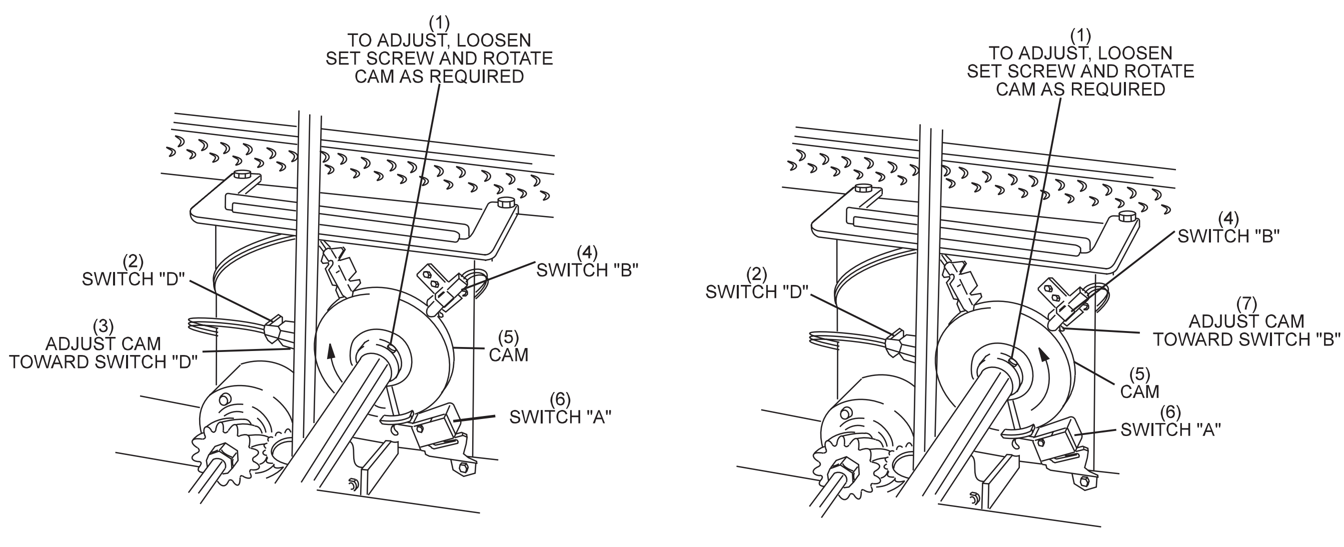


Figure 6-35. Adjusting Angles "A" and "B."

(1) TO ADJUST, LOOSEN SET SCREW AND ROTATE CAM AS REQUIRED
(2) SWITCH “D”
(3) ADJUST CAM TOWARD SWITCH “D”
(4) SWITCH “B”
(5) CAM
(6) SWITCH “A”
(7) ADJUST CAM TOWARD SWITCH “B”

20. Table Height Adjustment

NOTE: Prior to making any of the following table adjustments, it is necessary that the setting table is level with the pin deck and that Angle "A" and Angle "B" on the table shaft's crank arm be equal. Refer to Adjustments 18 and 19 in this manual.

The table height must be checked in two places to ensure proper operation. First, the pin holders must raise to the proper height to receive pins from the distributor **and** second, the table must lower to the proper new pinsetting height.

To determine what needs to be done to get the proper setting table heights in the raised and lowered position, measurements will need to be taken at these points. An adjustment will then be made to either the lift chain, the crank arm or both.

Raised Position Measurement

With the setting table in the raised position, measure the distance from second or third swing shaft support to the bottom of the distributor frame. The dimension should be **140 mm +/- 2 mm.** *Figure 6-36.*

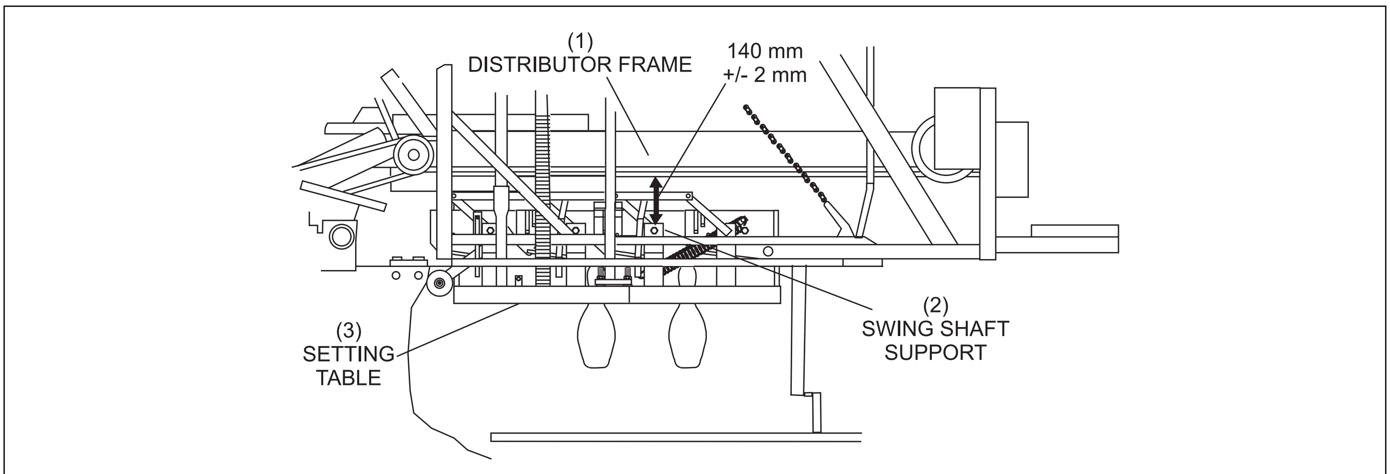


Figure 6-36. Raised Position Measurement.

(1) DISTRIBUTOR FRAME (2) SWING SHAFT SUPPORT (3) SETTING TABLE

Lower Position Measurement

To check the lowest position, the table must be down at the new pinsetting height. The lift chain and the table crank arm must form a straight line with each other as shown in *Figure 6-37.*

(1) LIFT CHAIN
(2) TOOTHED RACK
(3) MAIN TABLE SHAFT
(4) CRANK ARM
(5) CRANK ARM ADJUSTING SCREWS
(6) CHAIN ADJUSTMENT SCREW

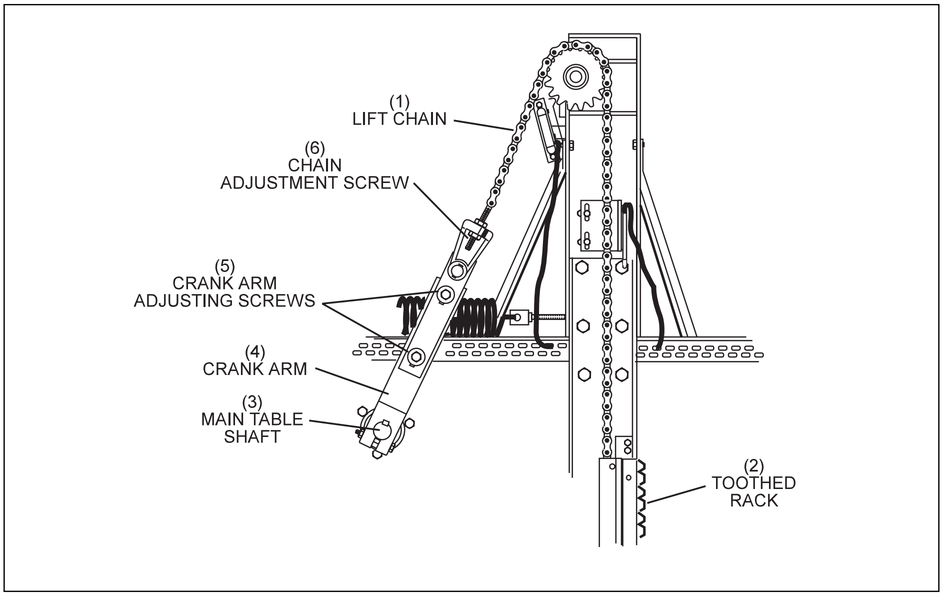


Figure 6-37. Table in Lowest Position (Universal Pin Station).

The proper height for the table in this position is **15 mm +/- 5 mm** from the lane surface to the bottom of the table. Refer to *Figure 6-38*. Check this dimension at the 1, 7, and 10 pin spots to make sure it is level as well as being at the proper height.

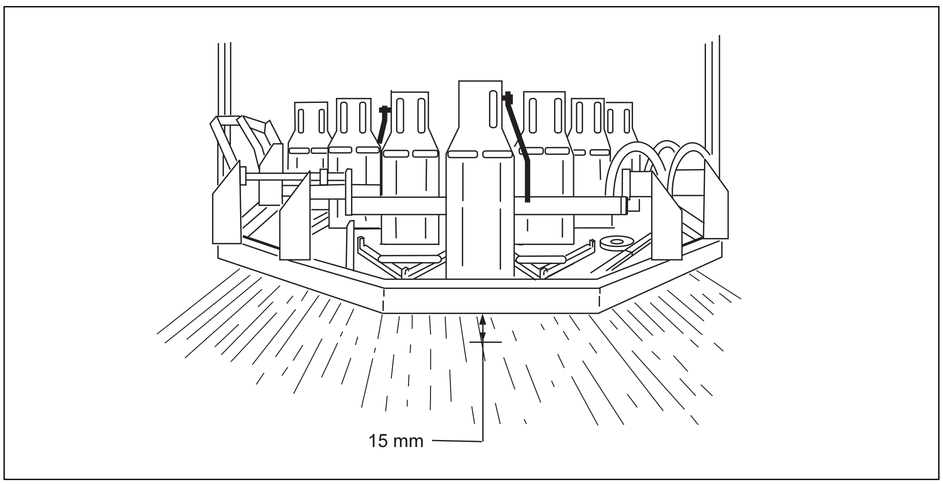


Figure 6-38. Checking Table's Lowest Position.

If adjustment is necessary, the table must be lowered in a detection stroke so the weight of the table rests fully on the stroke limiter plate. This releases the tension on the chain and crank arm. To adjust the two positions, the lift chain and the crank arm must be shortened or lengthened using the following charts. The chain length is adjusted by loosening the jam nuts holding the adjustment screw inside the clevis and changing their position on the screw. The two piece crank arm is held together by two adjusting screws which are loosened to shorten or lengthen the crank arm. Refer to *Figure 6-38*.

Use the following Table Height Adjustment Chart and Table Height Matrix to adjust the table height to the required position. Notice that when only one position (highest or lowest) is to be changed, the chain and crank arm must be adjusted in equal amounts. Example: shortening the chain 6 mm and lengthening the crank arm 6 mm will raise the table's highest position only.

Table Height Adjustment Chart

Table Height Change Needed	Direction	Corrective Action
H L Adjust Highest Position Only	Lower the Table	Shorten the Crank and Lengthen the Chain equally
	Raise the Table	Shorten the Chain and Lengthen the Crank equally
H L Adjust Lowest Position Only	Lower the Table	Lengthen the Chain and Lengthen the Crank equally
	Raise the Table	Shorten the Chain and Shorten the Crank equally
H L Adjust the Highest and Lowest Positions in the Same Direction	Lower the Table	Lengthen the Chain only No change to Crank
	Raise the Table	Shorten the Chain only No change to the Crank
H L Move the Highest and Lowest Positions in the Opposite Direction	H L Lower Highest Raise Lowest	Shorten the Crank only No change to the Chain
	H L Raise Highest Lower Lowest	Lengthen the Crank only No change to Chain

TABLE HEIGHT MATRIX

RAISED POSITION OF SETTING TABLE

LOWER POSITION OF SETTING TABLE

TABLE HEIGHTS →		135 mm	136 mm	137 mm	138 mm	139 mm	140 mm	141 mm	142 mm	143 mm	144 mm	145 mm	146 mm	147 mm	148 mm	149 mm	150 mm
↓	CHANGE	↓ 5 mm	↓ 4 mm	↓ 3 mm	OK	OK	OK	OK	OK	↑ 3 mm	↑ 4 mm	↑ 5 mm	↑ 6 mm	↑ 7 mm	↑ 8 mm	↑ 9 mm	↑ 10 mm
5 mm	↑ 10 mm	SH3 SR8	SH3 SR7	SH4 SR7	SH5 SR5	SH5 SR5	SH5 SR5	SH5 SR5	SH5 SR5	SH7 SR4	SH7 SR3	SH8 SR3	SH8 SR2	SH9 SR2	SH9 SR1	SH10 SR1	SH10
6 mm	↑ 9 mm	SH2 SR7	SH3 SR7	SH3 SR6	SH5 SR5	SH5 SR5	SH5 SR5	SH5 SR5	SH5 SR5	SH6 SR3	SH7 SR3	SH7 SR2	SH8 SR2	SH8 SR1	SH9 SR1	SH9	SH10 LR1
7 mm	↑ 8 mm	SH2 SR7	SH2 SR6	SH3 SR6	SH4 SR4	SH4 SR4	SH4 SR4	SH4 SR4	SH4 SR4	SH6 SR3	SH6 SR2	SH7 SR2	SH7 SR1	SH8 SR1	SH8	SH9 LR1	SH9 LR1
8 mm	↑ 7 mm	SH1 SR6	SH2 SR6	SH2 SR5	SH4 SR4	SH4 SR4	SH4 SR4	SH4 SR4	SH4 SR4	SH5 SR2	SH6 SR2	SH6 SR1	SH7 SR1	SH7	SH8 LR1	SH8 LR1	SH9 LR2
9 mm	↑ 6 mm	SH1 SR6	SH1 SR5	SH2 SR5	SH3 SR3	SH3 SR3	SH3 SR3	SH3 SR3	SH3 SR3	SH5 SR2	SH5 SR1	SH6 SR1	SH6	SH7	SH7 LR1	SH8 LR2	SH8 LR2
10 mm	OK	LH3 SR3	LH2 SR2	LH2 SR2	OK	OK	OK	OK	OK	SH2 LR2	SH2 LR2	SH3 LR3	SH3 LR3	SH4 LR4	SH4 LR4	SH5 LR5	SH5 LR5
11 mm	OK	LH3 SR3	LH2 SR2	LH2 SR2	OK	OK	OK	OK	OK	SH2 LR2	SH2 LR2	SH3 LR3	SH3 LR3	SH4 LR4	SH4 LR4	SH5 LR5	SH5 LR5
12 mm	OK	LH3 SR3	LH2 SR2	LH2 SR2	OK	OK	OK	OK	OK	SH2 LR2	SH2 LR2	SH3 LR3	SH3 LR3	SH4 LR4	SH4 LR4	SH5 LR5	SH5 LR5
13 mm	OK	LH3 SR3	LH2 SR2	LH2 SR2	OK	OK	OK	OK	OK	SH2 LR2	SH2 LR2	SH3 LR3	SH3 LR3	SH4 LR4	SH4 LR4	SH5 LR5	SH5 LR5
14 mm	OK	LH3 SR3	LH2 SR2	LH2 SR2	OK	OK	OK	OK	OK	SH2 LR2	SH2 LR2	SH3 LR3	SH3 LR3	SH4 LR4	SH4 LR4	SH5 LR5	SH5 LR5
15 mm	OK	LH3 SR3	LH2 SR2	LH2 SR2	OK	OK	OK	OK	OK	SH2 LR2	SH2 LR2	SH3 LR3	SH3 LR3	SH4 LR4	SH4 LR4	SH5 LR5	SH5 LR5
16 mm	OK	LH3 SR3	LH2 SR2	LH2 SR2	OK	OK	OK	OK	OK	SH2 LR2	SH2 LR2	SH3 LR3	SH3 LR3	SH4 LR4	SH4 LR4	SH5 LR5	SH5 LR5
17 mm	OK	LH3 SR3	LH2 SR2	LH2 SR2	OK	OK	OK	OK	OK	SH2 LR2	SH2 LR2	SH3 LR3	SH3 LR3	SH4 LR4	SH4 LR4	SH5 LR5	SH5 LR5
18 mm	OK	LH3 SR3	LH2 SR2	LH2 SR2	OK	OK	OK	OK	OK	SH2 LR2	SH2 LR2	SH3 LR3	SH3 LR3	SH4 LR4	SH4 LR4	SH5 LR5	SH5 LR5
19 mm	OK	LH3 SR3	LH2 SR2	LH2 SR2	OK	OK	OK	OK	OK	SH2 LR2	SH2 LR2	SH3 LR3	SH3 LR3	SH4 LR4	SH4 LR4	SH5 LR5	SH5 LR5
20 mm	OK	LH3 SR3	LH2 SR2	LH2 SR2	OK	OK	OK	OK	OK	SH2 LR2	SH2 LR2	SH3 LR3	SH3 LR3	SH4 LR4	SH4 LR4	SH5 LR5	SH5 LR5
21 mm	↓ 6 mm	LH6 LR1	LH5 LR1	LH5 LR2	LH3 LR3	LH3 LR3	LH3 LR3	LH3 LR3	LH3 LR3	LH5 LR7	LH1 LR5	LH1 LR6	LR6	SH1 LR7	SH1 LR7	SH2 LR8	SH2 LR8
22 mm	↓ 7 mm	LH6 LR1	LH6 LR2	LH5 LR2	LH4 LR4	LH4 LR4	LH4 LR4	LH4 LR4	LH4 LR4	LH5 LR2	LH2 LR6	LH1 LR6	LH1 LR7	LR7	SH1 LR7	SH1 LR8	SH2 LR9
23 mm	↓ 8 mm	LH7 LR2	LH6 LR2	LH6 LR3	LH4 LR4	LH4 LR4	LH4 LR4	LH4 LR4	LH4 LR4	LH6 LR3	LH2 LR6	LH2 LR7	LH1 LR7	SH1 LR8	LR8	SH1 LR9	SH1 LR9
24 mm	↓ 9 mm	LH7 LR2	LH7 LR3	LH6 LR3	LH5 LR5	LH5 LR5	LH5 LR5	LH5 LR5	LH5 LR5	LH6 LR3	LH3 LR7	LH2 LR7	LH2 LR8	LH1 LR8	LH1 LR9	LR9	SH1 LR10
25 mm	↓ 10 mm	LH8 LR3	LH7 LR3	LH7 LR4	LH5 LR5	LH5 LR5	LH5 LR5	LH5 LR5	LH5 LR5	LH7 LR4	LH3 LR7	LH3 LR8	LH2 LR8	LH2 LR9	LH1 LR9	LH1 LR10	LR10

SR = Shorten Crank Arm   SH = Shorten Chain   LR = Lengthen Crank Arm   LH = Lenthen Chain   Numbers are in millimeters

The Table Height Matrix chart on the previous page does all the calculating for you. Simply find the measurements for the Raised Position of the Setting Table (across the top of the chart) and the Lower Position of the Setting Table (down the left side of the chart). Where they meet are directions for a proper adjustment. In some instances, there is no adjustment needed (where it indicates "OK.")

For example: If the setting table in the raised position is 147 mm and the table height in the lower position is 21 mm, the directions say "LR7 SH1" which means the crank is lengthened 7 mm and the chain is shortened 1 mm.

Below are some of the possible problems that can occur if the setting table is not at the proper heights in the Highest and Lowest positions.

Lowest Position

Setting Table Low	1. Setting table makes contact with lane surface. 2. Pins wobble when set on lane.
Setting Table High	1. Weight of pin will not allow grippers to open to release pins to the lane.

Highest Position

Setting Table Low	1. Pin grippers may not make enough contact with the pin release levers to allow pins to enter the pin holder. 2. Pins may not drop into the pin holders properly, resulting in pin jams.
Setting Table High	1. Number 3 swing shaft may make contact with right-hand tower support. 2. Setting table may hit distributor.

21. Pin Release Lever Adjustment

With the setting table at the highest point (switch "A" actuated), measure the clearance between the bottom leg of the pin release lever and the "closed" gripper. A clearance of 7 mm $\pm$ 3 mm should be visible between all ten pin release levers and the ten grippers. Refer to *Figure 6-40*.

Original Pin Release Lever

To adjust, lengthen or shorten the two piece assembly as needed. The center metal brackets can be bent to raise or lower the lever so it will maintain contact with an open gripper during a pin loading sequence.

(1) METAL BRACKETS
(2) PIN RELEASE LEVER
(3) PIN HOLDER
(4) TOP OF PIN GRIPPER MUST BE PARALLEL TO CORNER OF RELEASE LEVER

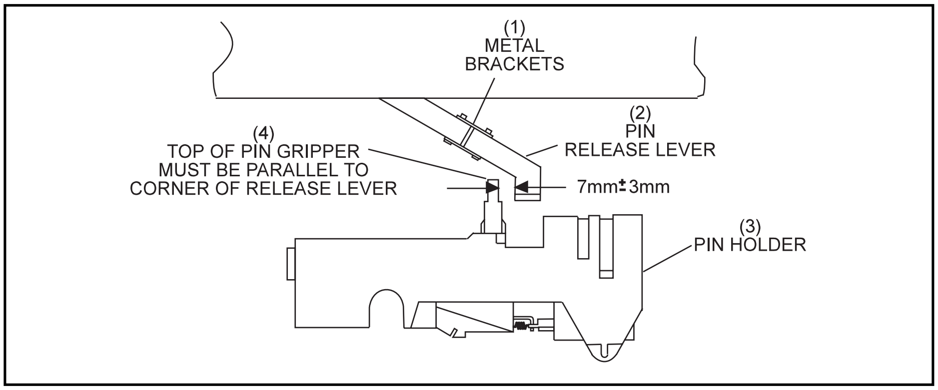


Figure 6-40. Pin Release Lever.

Universal Pin Release Lever

To adjust a Universal pin station, loosen the mounting hardware and position the assembly to obtain the 7 mm $\pm$ 3 mm .

(1) UNIVERSAL PIN STATION
(2) UNIVERSAL PIN RELEASE LEVER
(3) PIN HOLDER
(4) MOUNTING HARDWARE
(5) GRIPPER

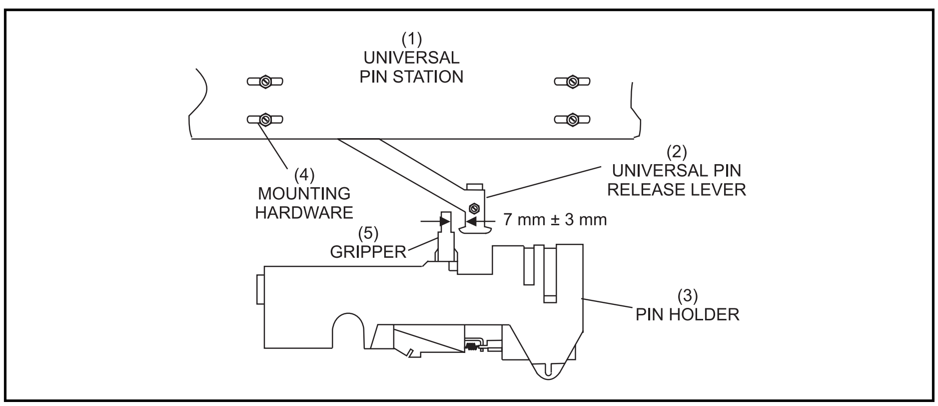


Figure 6-41. Universal Pin Release Lever.

NOTE: *After making the adjustments, verify that the release lever is contacting the gripper correctly. If the release lever gets caught behind the gripper when opened, reduce the dimension between the release lever and gripper. See* Figure 6-41.

22. Pin Position Adjustment

This adjustment will be necessary when pins are not being set on spot per ABC or FIQ requirements.

a. Push the “SET” switch on the Universal High Voltage box or the Consolidated Low Voltage box. As the table lowers to set new pins, shut off the pinsetter when the grippers open to leave the pins on the lane.

b. Check the position of all ten bowling pins in relation to their pin spots. Check that the pins are fully seated in the pin holders. Determine which pins are off spot and adjust as follows.

NOTE: *With the pin fully seated in the pin holder, there will 3-6 mm of pin spot showing under the front of the pin. Refer to* Figure 6-42.

(1) FRONT OF PIN
(2) PIN SPOT
(3) PIN DECK

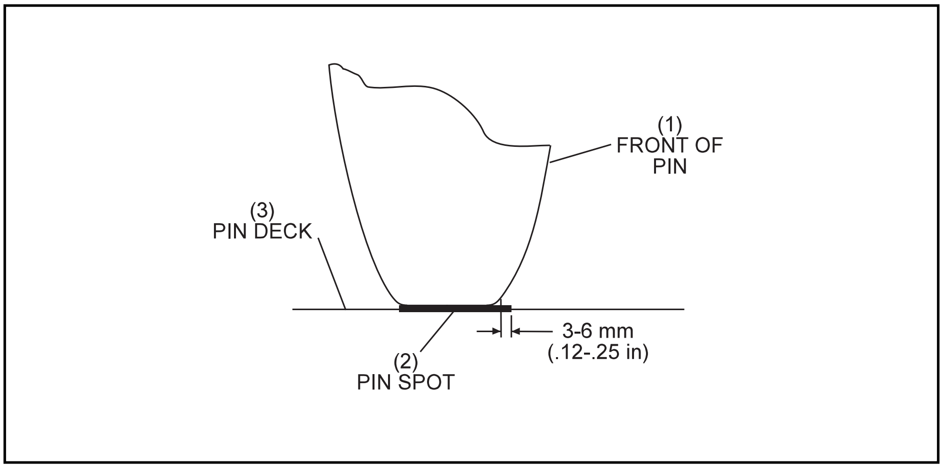


Figure 6-42. Proper Pin Position.

c. To adjust an entire row of pin holders to the right or left, loosen the stop collar on each end of the shaft and position the pin holders correctly. Retighten the set screws and locknuts. Refer to *Figure 6-43*.

(1) PIN HOLDER SHAFT
(2) STOP COLLAR

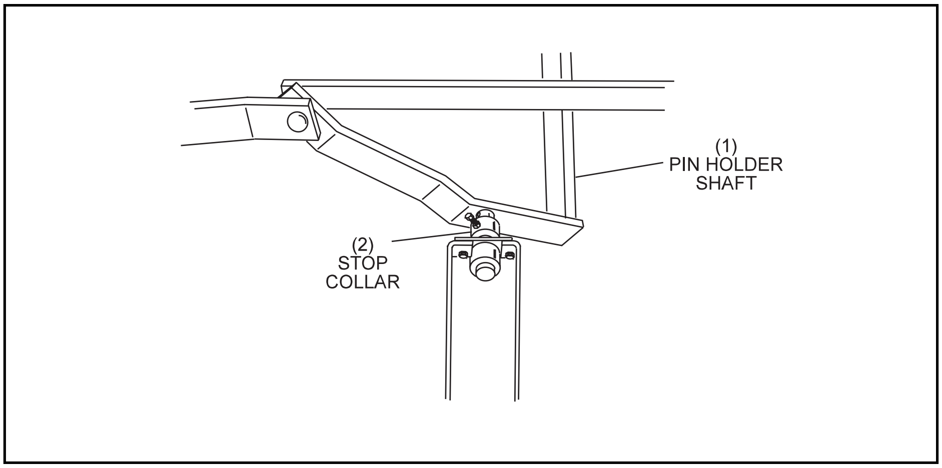


Figure 6-43. Adjusting an Entire Row of Pin Holders.

d. To adjust individual pin holders left or right, loosen one of the top adjusting screws and the four pin holder fastening screws. Refer to *Figure 6-44*. Adjust the pin holder as needed and retighten all five screws.

NOTE: *Check the clearance between the pin detector plates and the pin holders in front of them after making any side-to-side adjustment.*

(1) TOP ADJUSTING SCREWS
(2) PIN HOLDER FASTENING SCREWS
(3) PIN HOLDER SHAFT
(4) BACK VIEW OF PIN HOLDER

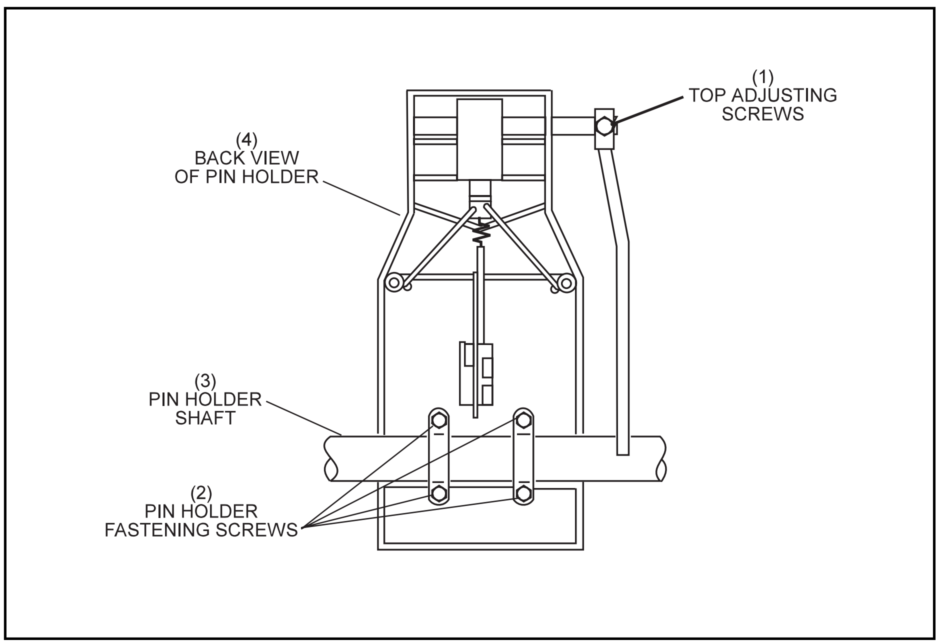


Figure 6-44. Adjusting an Individual Pin Holder.

e. To adjust individual pin holders forward or rearward, loosen the top adjusting screws and tilt the pin holder. It is not recommended to tip the pin holders too far forward, as the bottom of the pin holder may hit the belly of the pin as the table raises. Refer to *Figure 6-45*. Retighten the adjusting screws in the new position.

(1) TOP ADJUSTING SCREWS
(2) PIN HOLDERS

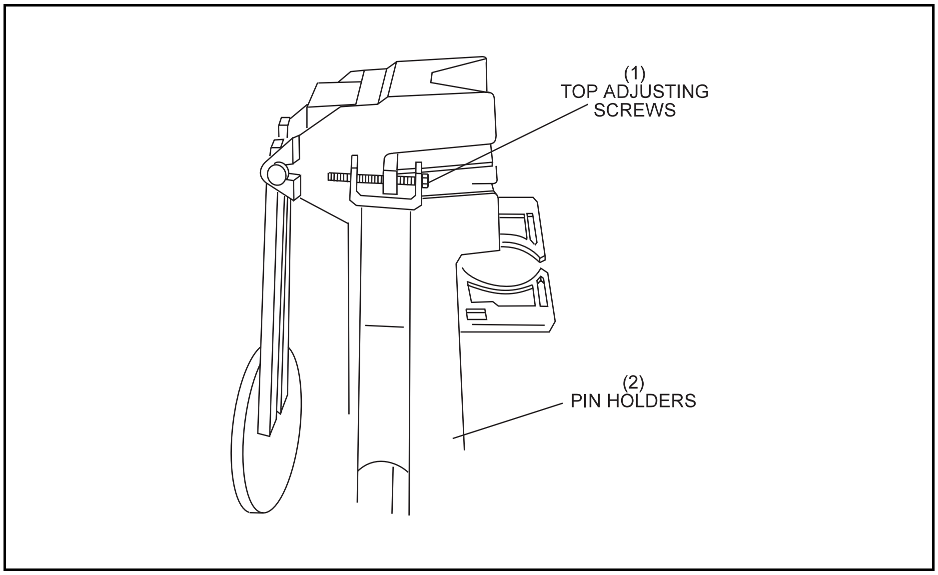


Figure 6-45. Adjusting an Individual Pin Holder.

f. To adjust all ten pin holders forward or rearward, loosen the jam nut on the vertical stop bolt mounted onto the rear right frame of the table. This bolt stops the vertical rotation of the rear pin holder swing shaft when it is spring-urged into the vertical position as the table goes all the way down for a new pinsetting stroke. Refer to *Figure 6-46*. Shortening the bolt will allow all the pins to be moved rearward while lengthening the bolt will set all the pins forward.

23. Pin Detector Plate's Vertical Position Adjustment

With the pin holder in the vertical position, check the clearance between the pin detector plate and the stop bow. This bow prevents switch bounce when the pin holder is vertical. A gap of 5-10 mm is needed between the plate and the bow on all ten pin holders. To adjust, carefully bend the stop bow to get the proper gap. Refer to *Figure 6-46*.

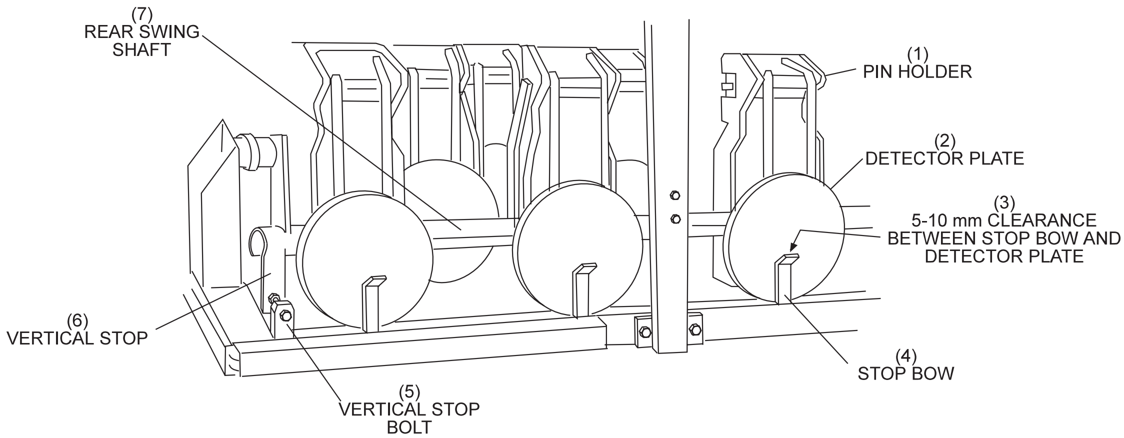


Figure 6-46. Pin Detector Plate's Vertical Adjustment.

(1) PIN HOLDER	(2) DETECTOR PLATE	(3) 5-10 mm CLEARANCE BETWEEN STOP BOW AND DETECTOR PLATE
(4) STOP BOW	(5) VERTICAL STOP BOLT	(6) VERTICAL STOP
(7) REAR SWING SHAFT		

24. Pin Detector Plate's Horizontal Adjustment (GS-92 and Earlier)

With the table in the raised position and the pin holders horizontal, check the positioning of all ten pin detector plates.

a. Each plate should be level from left to right. Carefully bend the plate until it is level.

b. From front to back, the plate should have a slight tilt with the front edge of the plate being 3° lower than the back edge of the plate. The back tab on the plate's left support bracket can be bent to increase or decrease the forward tilt.

c. The switch should be closed when the plate is approximately horizontal. Make sure the pin detector plates do not catch on the pin holders in the preceding row.

25. Setting Table Height for Pin Detection Adjustment

This adjustment is to ensure that the setting table is at the correct pin detection height when switch "B" is actuated. This is determined by the positioning of the stroke limiter plate assembly.

a. Set 10 pins on spot on the lane surface.

b. Lower the setting table so its weight is fully resting on the stroke limiter plate and the stroke limiter's compression spring and hydraulic are fully compressed.

NOTE: *All the pin holders must be empty on GS-92 and earlier pinsetters. All the pin holders must be full on GS-96 and later pinsetters.*

c. At this point the pins should be pushing up against the pin detector plates.

d. With the pin detector plate held up manually to the highest point, check for a clearance of 10 mm ± 3 mm between the top of the pin and the center of the pin detector plate. Refer to *Figure 6-47*.

(1) PIN HOLDER
(2) DETECTOR PLATE

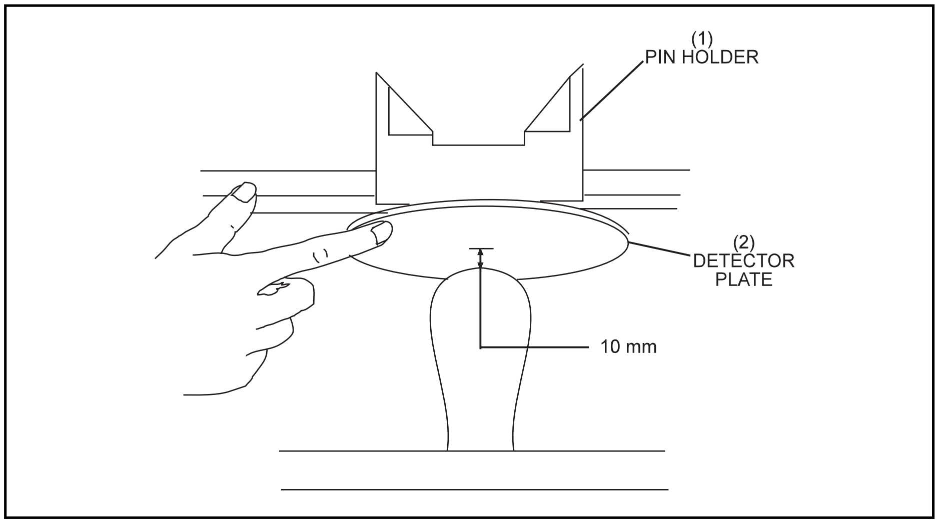


Figure 6-47. Pin Detector Plate Clearance.

e. If an adjustment is required, raise the table off the stroke limiter. Loosen the locknuts on the stroke limiter mounting bracket's vertical bolt. Next, loosen the two mounting bolts illustrated in *Figure 6-48*. Adjust the two top nuts on the vertical mounting bolt to lower or raise the stroke limiter as needed. Repeat steps a - d until the 10 mm clearance is obtained.

(1) ADJUST LOCKNUTS: UP TO RAISE, DOWN TO LOWER
(2) HYDRAULIC SHOCK
(3) SET COLLARS
(4) LOOSEN SCREWS
(5) LOOSEN LOCKNUT

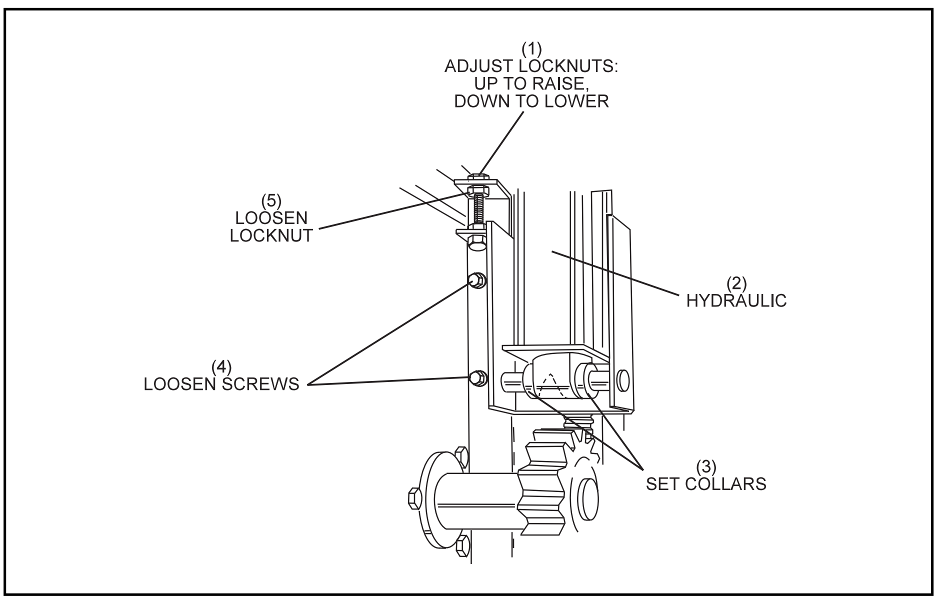


Figure 6-48. Adjusting Stroke Limiter Mounting Bracket.

f. If the stroke limiter is correct but pin detection is wrong, check the pin holder and pin detection plate adjustments.

26. Stroke Limiter Plate Adjustment

a. Manually lower the setting table until the stroke limiter "T" stop **lightly touches** the stroke limiter plate.

b. Check for a 1 mm protrusion of the stroke limiter plate beyond the "T" stop. Refer to *Figure 6-49*. Adjust using the bolt on the bottom of the stroke limiter's vertical arm. Refer to *Figure 6-51*.

(1) STROKE LIMITER PLATE
(2) PROTRUDES 1 mm
(3) "T" STOP
(4) TABLE RACK TEETH

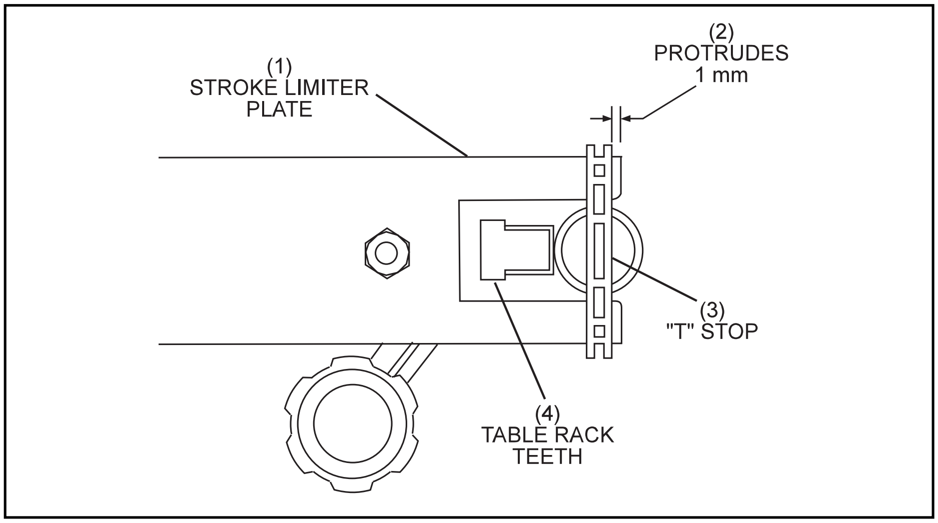


Figure 6-49. Stroke Limiter Plate.

c. Manually press in the plunger of the stroke limiter solenoid. Check for a clearance of 5 mm ± 1 mm between the "T" stop and the stroke limiter plate. Refer to *Figure 6-50*. To adjust, loosen both solenoid mounting screws and position the solenoid so the plunger is bottomed in the solenoid and the clearance is 5 mm. Retighten the mounting screws.

(1) STROKE LIMITER PLATE

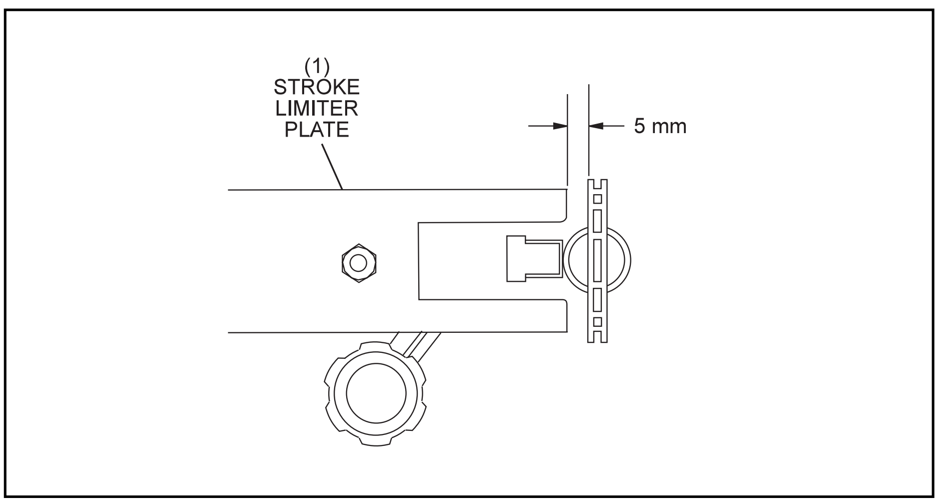


Figure 6-50. Stroke Limiter Clearance.

(1) SOLENOID
(2) PLUNGER
(3) ADJUSTING BOLT
(4) SWING LEVER
(5) PIVOT POINT

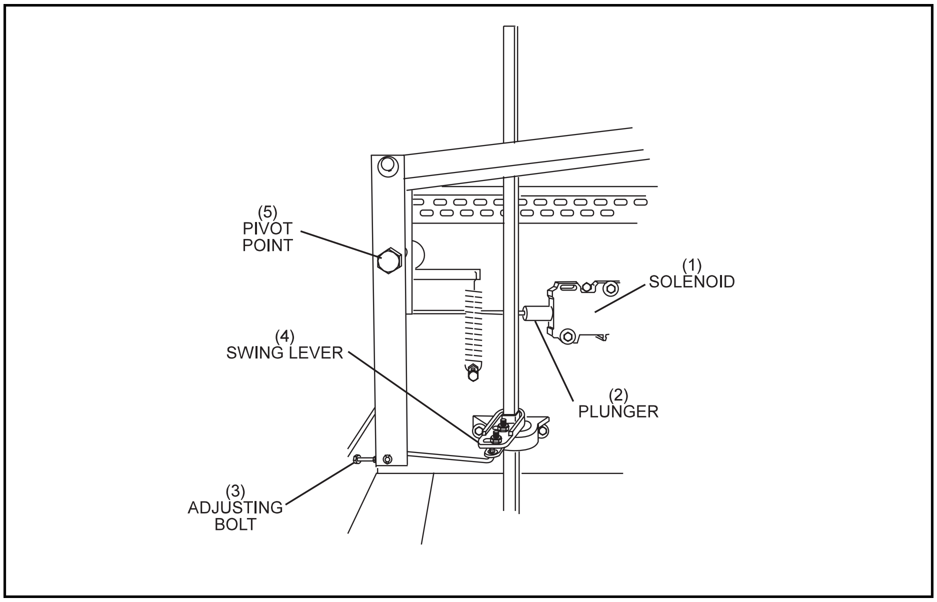


Figure 6-51. Stroke Limiter Adjustment.

d. With the stroke limiter plate forward in its normal position, check that the plate is centered on the "T" stop. If not, adjust the stroke limiter plate mounting bolt and center the hydraulic shock on its lower mounting shaft by loosening the set collars and moving the hydraulic left or right. Refer to *Figures 6-48 and 6-52*.

(1) ADJUST HERE AND AT BASE OF STROKE LIMITER HYDRAULIC SHOCK

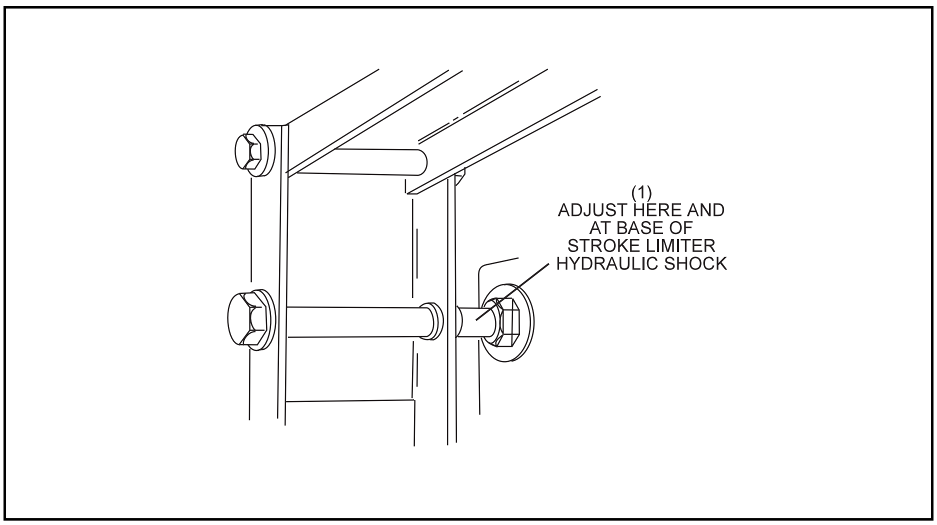


Figure 6-52. Stroke Limiter Centering Adjustment.

27. Pin Holder Switch Adjustments

GS-92 and Earlier

a. With the table in the raised position and the pin holders in their horizontal position, check for a clearance of 3 mm between the switch spring and the bottom switch finger. The pin holders must be empty during this check. Refer to *Figure 6-53*.

b. To adjust, carefully bend the rigid metal piece mounted with the switch spring.

CAUTION: Do not bend the switch spring separately as this will warp the spring and make adjusting difficult.

(1) RIDGED METAL PIECE
(2) SWITCH SPRING
(3) PIN HOLDER DETECTOR PLATE
(4) 3 mm BETWEEN SWITCH SPRING AND SWITCH BOW

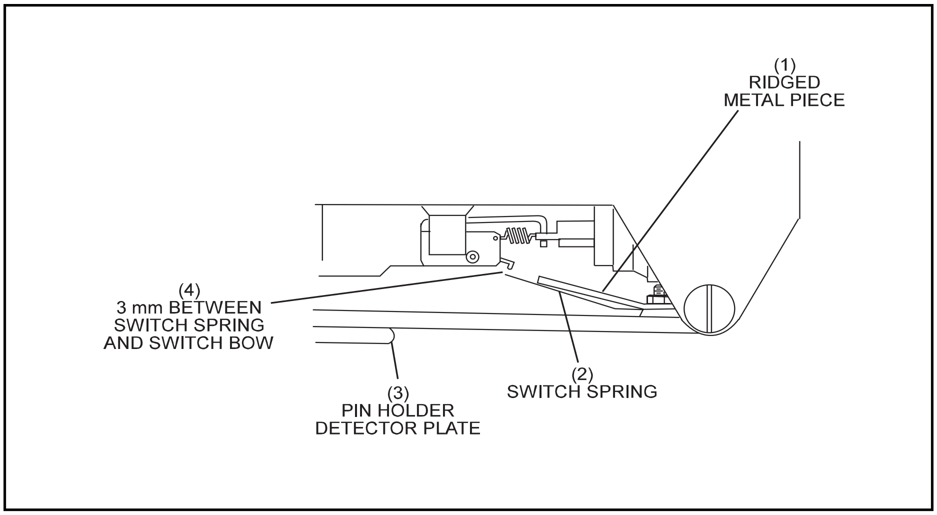


Figure 6-53. Pin Holder Switch Adjustment.

GS-96 and Some GS-98 Pinsetters

The pin holder has two switches for determining if a pin is present. The pin loading switch is actuated from the top by the neck of the bowling pin when dropped from the distributor. No adjustment is available for this switch. The pin detection switch is actuated by a pin pushing up on the pin detector plate when the table is down resting on the stroke limiter. A spring loaded bolt is used by the plate to push up on the lower switch finger to close the pin detection switch.

There should be 12 mm from the top of the spring loaded bolt to the surface of the pin detector plate. Tighten or loosen the spring loaded bolt to obtain this measurement. Refer to *Figure 6-54* for the location.

NOTE: *If a pin is still not detected, increase the dimension in 2 mm increments until the pin detect switch is closed when a pin is present.*

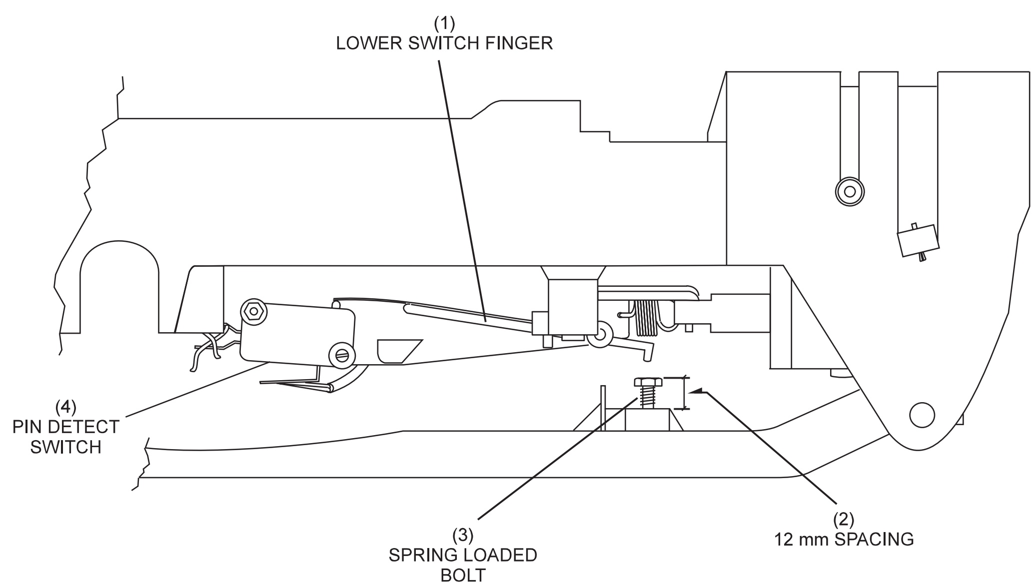


Figure 6-54. Pin Detect Switch Adjustment

(1) LOWER SWITCH FINGER (2) 12 mm SPACING (3) SPRING LOADED BOLT
(4) PIN DETECT SWITCH

28. "B" Switch Adjustment

All GS Pinsetters

Three things need to be monitored to determine if the "B" switch is adjusted properly: proper scoring or pin fall display, proper closing of the tongs and proper timing for the 7 and 10 pin double loading on GS-96 and later pinsetters.

If a Player Control Station is mounted on the ball lift, use the display to determine if all ten pins are being detected.

If either BowlerVision or the Pin Sensor System is available, use the scoring to determine if the pinfall is correct.

To check for proper spotting tong operation, run the pinsetter in Machine Cycle Diagnostics. This will cause the tongs to pick up all ten pins to test for full closure at maximum weight.

a. If the pinfall is incorrect, loosen the switch "B" bracket and move switch "B" toward switch "C."

b. If the spotting tongs do not close sufficiently, move switch "B" toward switch "A." Refer to *Figure 6-55*.

GS-96 and Later

To check for proper gripper operation when double loading the 7 and 10 pin, run the pinsetter in Machine Cycle Diagnostics. This will cause the 7 and 10 pin grippers to open to double load the 7 and 10 pin.

NOTE: *After making the adjustment to correct double loading, make sure that the pinsetter scores correctly and the spotting tongs operate properly.*

1. If the 7 and/or 10 pin grippers do not open to double load, move switch "B" toward switch "C."

2. If the 7 and/or 10 pin grippers open, but do not stay opened long enough to double load, move switch "B" towards "A."

(1) SWITCH "C"
(2) ADJUSTABLE BRACKET
(3) SWITCH "B"
(4) CAM
(5) SWITCH "A"
(6) SWITCH "D"

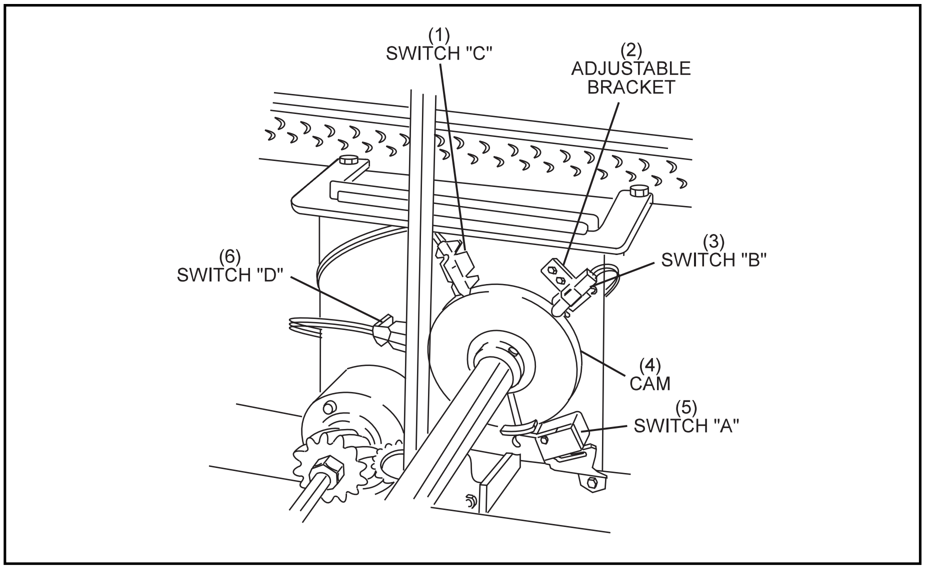


Figure 6-55. "B" Switch Adjustment.

29. Pin Holder Swing Shaft's Latch Hook Adjustment

The latch hook holds the pin holders in the horizontal position for pin detection and pin loading. When the latch is released, the pin holders are allowed to rotate vertically to set "new" pins.

a. Raise the setting table to its highest position.

b. Check for a clearance of 3 mm between the rear swing shaft's latch bow and the latch hook. Adjust the horizontal stop bolt on the rear swing shaft to obtain the 3 mm clearance. Refer to *Figure 6-56*.

(1) 3 mm CLEARANCE
(2) LATCH BOW
(3) LEFT-HAND SQUARE SHAFT
(4) HORIZONTAL STOP BOLT
(5) LATCH HOOK

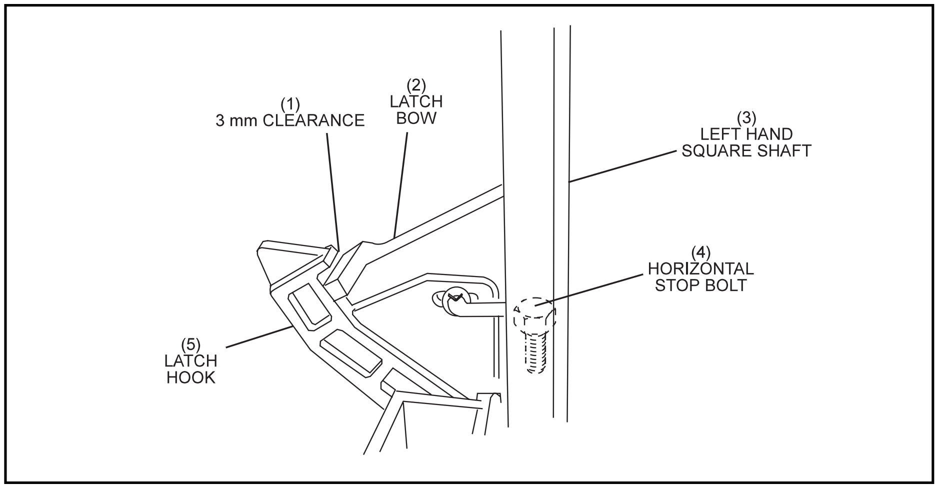


Figure 6-56. Rear Swing Shaft's Latch Bow and Latch Hook.

c. Manually bottom the plunger in the stroke limiter solenoid. The latch hook will pull rearward and away from the latch bow to release the swing shafts. A 3 mm clearance is necessary at this point. Adjust the swing lever at the top of the left square shaft to get the proper clearance. Refer to *Figures 6-51 and 6-57*.

(1) ROTATED SQUARE SHAFT
(2) LATCH BOW
(3) REAR SWING SHAFT
(4) LATCH HOOK

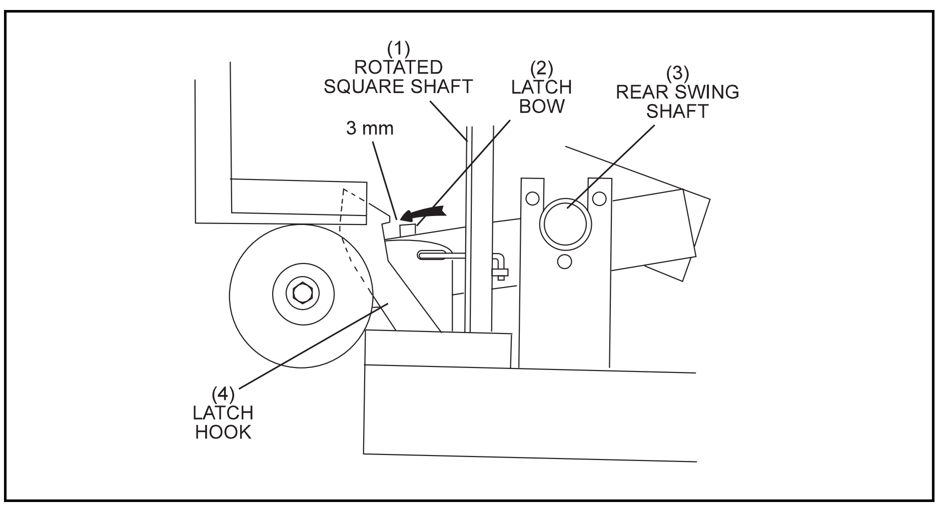


Figure 6-57. Adjusting Swing Lever.

30. Spotting Tong Drive Adjustment

The spotting tongs are gear driven closed and open. The setting table motor and the spotting tong solenoid provide the movement necessary to operate the tongs.

The spotting tong spindle shaft has a clutch that slips when the table motor has driven the tongs fully open or closed. This clutch has three tension settings to provide proper closing and reopening of the tongs. The normal setting for this clutch is the middle notch. Refer to *Figure 6-58*.

(1) SPINDLE SHAFT
(2) 3 NOTCHES USED FOR ADJUSTING
(3) SAFETY CLUTCH

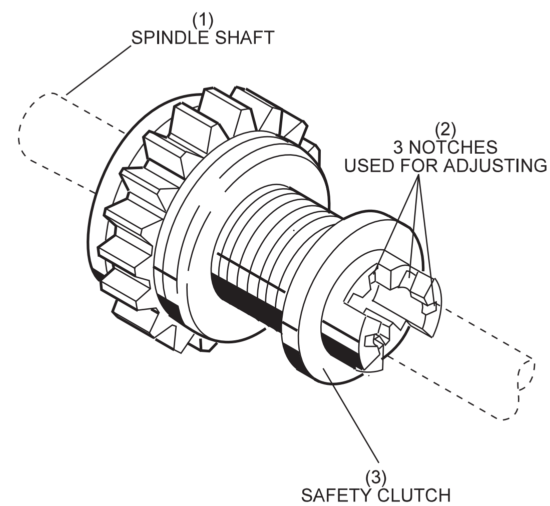


Figure 6-58. Spotting Tong Spindle Shaft Clutch.

There are two adjustable stops on the setting table's tong rack which stop the closing and reopening of the tongs and causes the spotting tong clutch to slip. They are necessary to stop the movement of the gear rack to protect the tongs and ensure the spotting tong switch is made at the proper time. The stops may need to be adjusted when the tongs do not pick up all pins and it is determined the clutch is operating properly. Refer to *Figure 6-59*.

(1) OPEN STOP
(2) GEAR RACK
(3) SPOTTING TONG SWITCH
(4) RIGHT-HAND SQUARE SHAFT
(5) CLOSED STOP

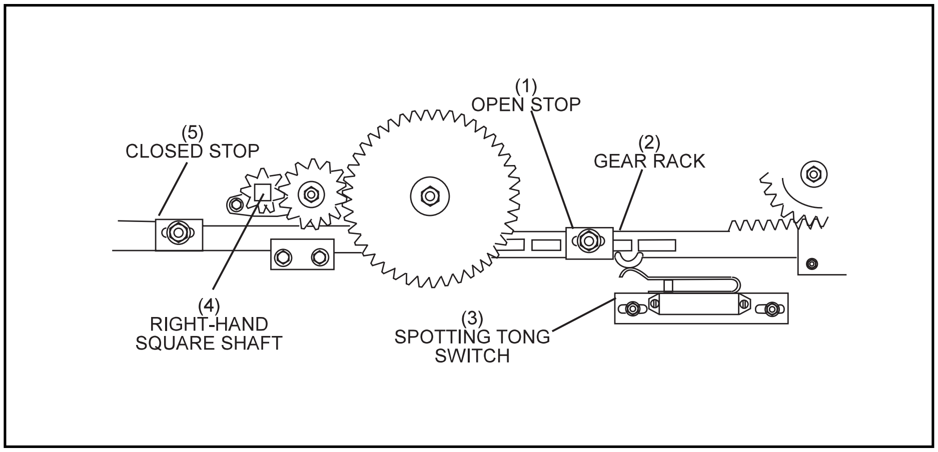


Figure 6-59. Adjustable Stops on Setting Table Tong Rack.

31. Out-Of-Range Switch Adjustment

The out-of-range (OOR) switch informs the Pinsetter CPU of whether or not the setting table was able to lower to the normal detecting height.

a. With power off to the pinsetter, place an OOR pin between the 4 and 5 pin positions.

b. Lower the table onto the OOR pin.

c. In this position, the cam on the right hand table rack **must not** touch the OOR switch. There should be a minimum vertical space of 20 mm between the cam and switch. Refer to *Figure 6-60*.

(1) PLASTIC CAM
(2) OUT-OF-RANGE SWITCH
(3) SWITCH BOW
(4) MINIMUM VERTICAL SPACE OF 20 mm (.8 in)

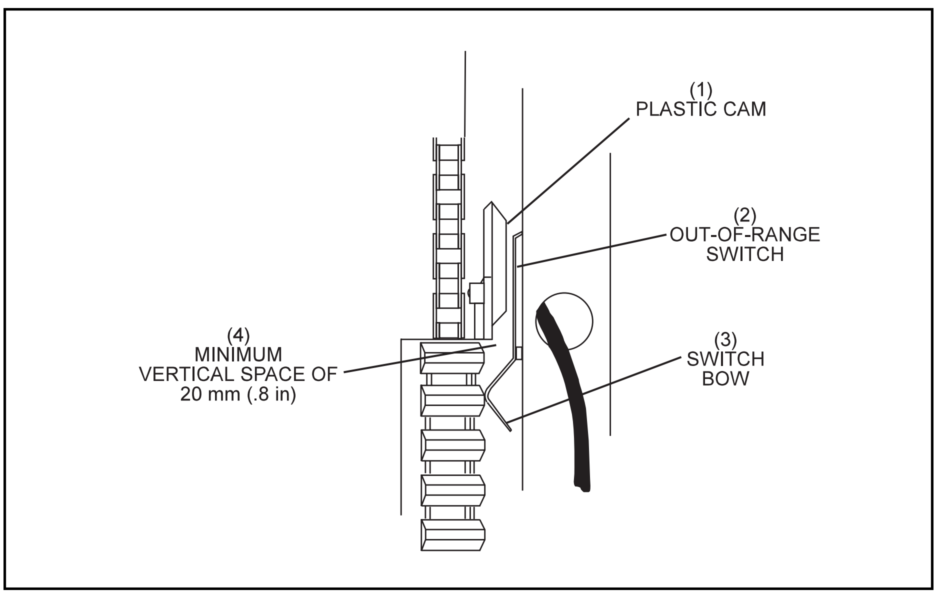


Figure 6-60. Table Rack Cam and Switch.

d. The mounting bracket for the switch can be loosened and raised or lowered as needed. Use caution when adjusting the switch or bending the switch's bow because the cam could damage the switch when the table is raised.

e. Manually raise the setting table until the OOR pin is free and remove it. Lower the setting table slowly until the OOR cam touches the OOR switch actuator and closes the contacts. You can verify the switch closure with an ohm meter attached to the switches' connector in the wire channel.

f. In this position, switch "B" on the switch cluster **should not** be actuated yet. Check for an open switch with an ohm meter. There should be at least 10º of space on the cam between the magnet and the "B" switch location when the OOR switch closes. Refer to *Figure 6-61*.

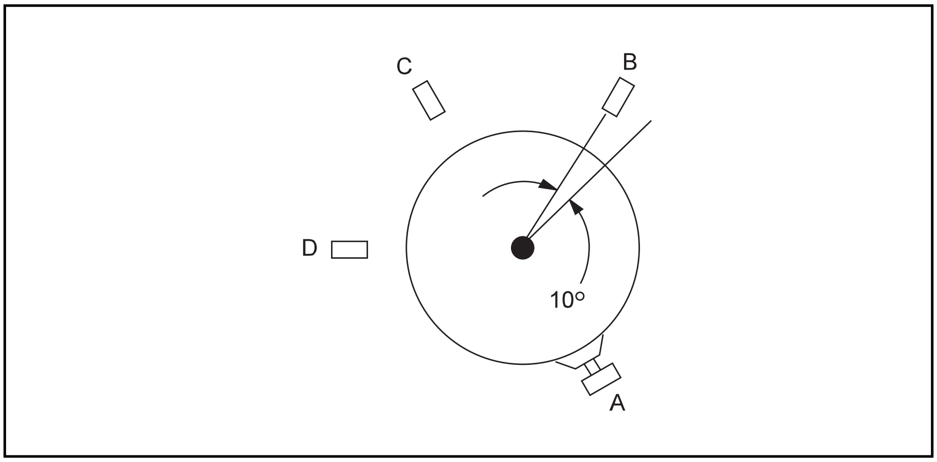


Figure 6-61. Out-Of-Range Switch Adjustment.

32. Sweep Motor Switch Adjustment

The sweep motor switch “SM” informs the Pinsetter CPU of the sweep wagon’s position. A cam on the right sweep crank arm will make this switch when the sweep is all the way forward.

a. To adjust, make sure the sweep’s crank arms and turnbuckles are parallel. Refer to *Figure 6-62*.

b. Loosen the two bolts holding the cam onto its mounting plate and use the slots to center the cam on the crank arm.

c. Adjust the SM switch to the closed position. Make sure the plunger has free play when the switch actuator contacts it. Refer to *Figure 6-62*.

(1) CRANK ARM
(2) SWITCH SM
(3) PLUNGER FREE PLAY WITH SWITCH CLOSED
(4) CAM
(5) TURN BUCKLE

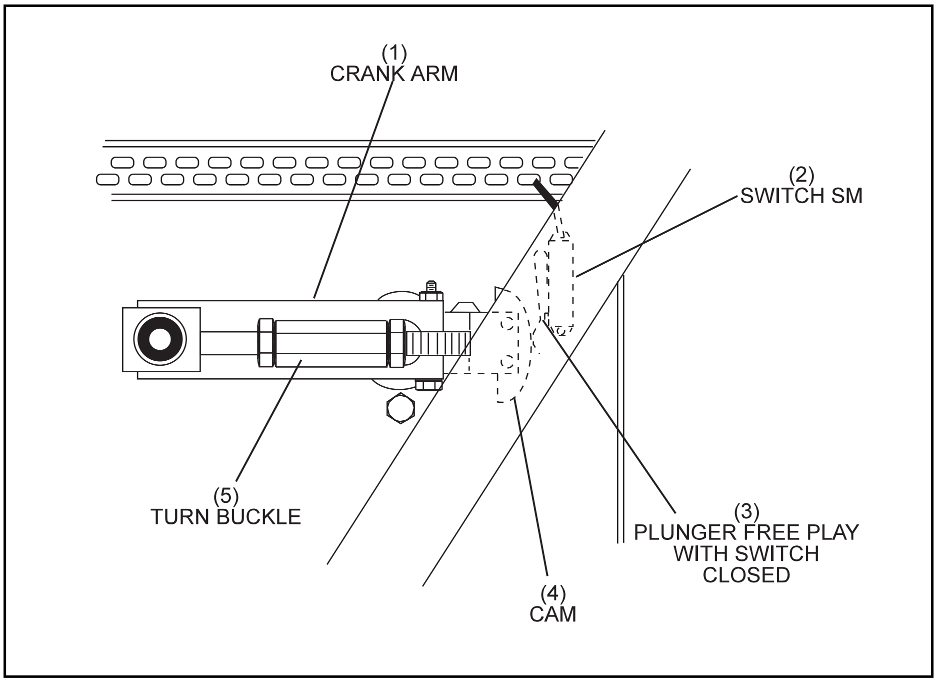


Figure 6-62. Sweep Motor Switch "SM" Adjustment.

33. Sweep Attenuator / Switch "G" Adjustment

(1) SWITCH "G"
(2) FRONT MOUNTING PLATE
(3) STOP SCREW
(4) HEX NUTS
(5) SWEEP ATTENUATOR
(6) PLUNGER FREE PLAY WITH SWITCH CLOSED

a. The attenuator rests against a stop screw when the sweep is all the way down in the guarding position. Adjust the length of this screw to 85 mm ± 1 mm between the frame and the front of the attenuator. Refer to *Figure 6-63*.

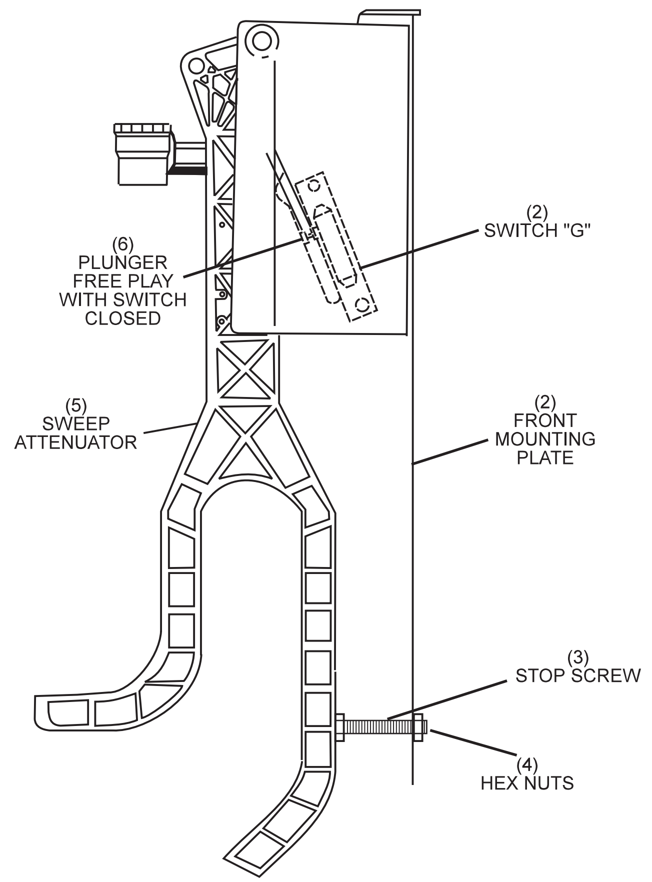


Figure 6-63. Sweep Attenuator/Switch "G" Adjustment.

b. Adjust the "G" switch with the attenuator down. The switch's plunger must have free play with the switch closed. Refer to *Figures 6-63* and *6-77*.

NOTE: *If free play in the plunger cannot be attained by moving the switch, increase the 85 mm dimension 1 mm at a time until there is free play with the switch closed.*

34. Sweep Wagon Adjustment

The sweep wagon rides back and forth on guide rollers that ride in two guide rails on the pinsetter frame. The rollers must be adjusted so the mounting bolts have a minimum clearance of 5 mm from the inside wall of the side frame. To adjust, loosen the mounting hardware for the horizontal guide rollers and position the sweep. Refer to *Figure 6-64*.

NOTE: *Check the sweep wagon in the forward and rearward position for clearance.*

(1) SWEEP WAGON
(2) KICKBACK
(3) FRAME
(4) HORIZONTAL GUIDE ROLLER
(5) MOUNTING HARDWARE

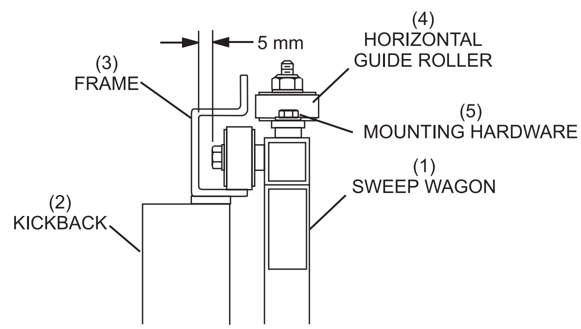


Figure 6-64. Sweep Wagon Adjustment.

The gap between the front guide roller and the attenuator must be 4-5 mm. To make this adjustment, loosen the mounting hardware attaching the attenuator to the front mounting plate and move the attenuator up or down to the proper dimensions so that the attenuator does not touch the guide rail when in the lowered “sweep down” position. Refer to *Figure 6-65* for the location.

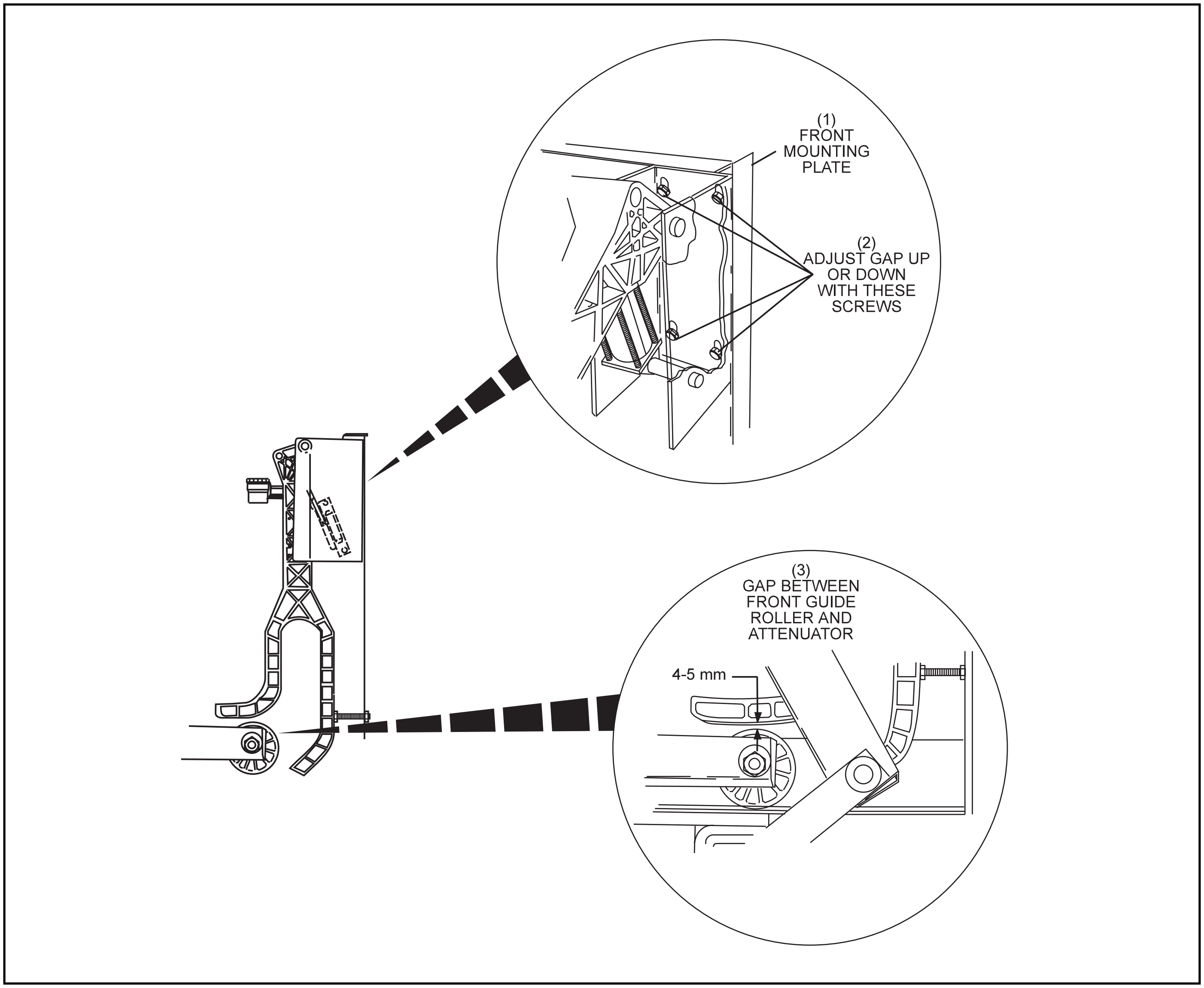


Figure 6-65. Gap Between Front Guide Roller and Attenuator.

(1) FRONT MOUNTING PLATE

(2) ADJUST GAP UP OR DOWN WITH THESE SCREWS

(3) GAP BETWEEN FRONT GUIDE ROLLER AND ATTENUATOR

Both sweep arms must be parallel and equal distance from the front pinsetter frame. The dimension for both arms is 85 mm from the pinsetter frame to the center of the sweep wagon's connecting link shaft ***or*** 50 mm from the pinsetter frame to the front of the sweep arm. Refer to *Figure 6-66*.

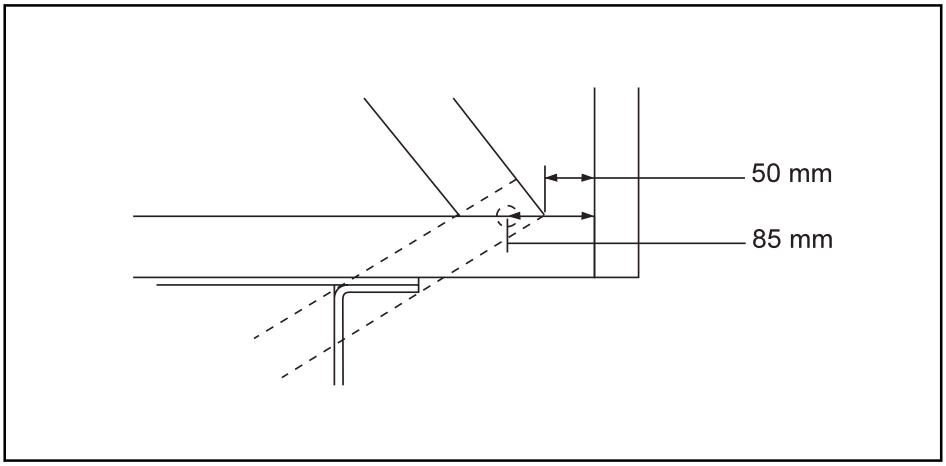


Figure 6-66. Dimension Viewed from Left Side of Pinsetter.

a. Adjust by loosening the turnbuckle jam nuts on each side of the pinsetter and rotate the turnbuckle until the dimension is obtained. Refer to *Figure 6-67*. Check the sweep arm on the other side and then retighten the jam nuts.

(1) JAM NUTS
(2) SWEEP ARM
(3) TURNBUCKLE

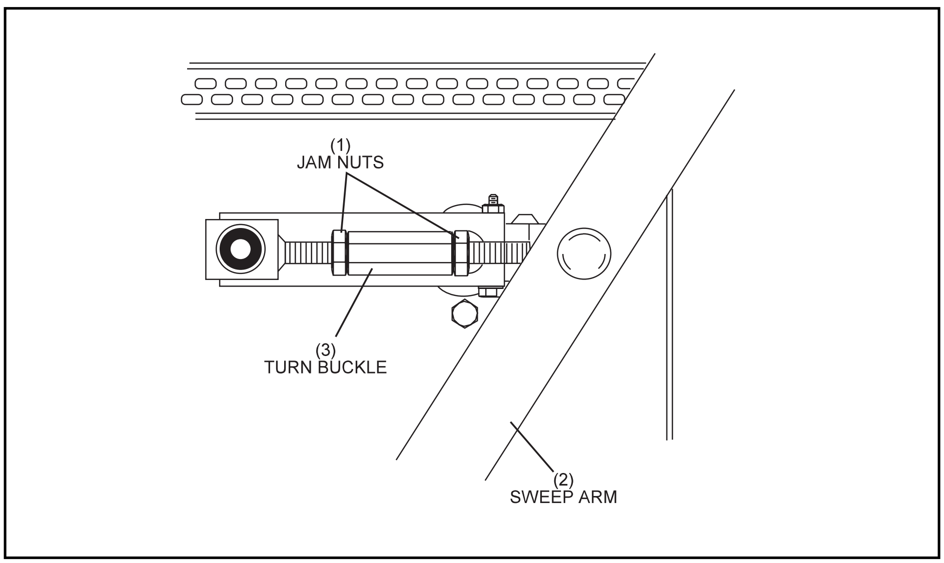


Figure 6-67. Turnbuckle Jam Nuts Viewed from Right Side of Pinsetter.

35. Sweep Board Height Adjustment

The sweep board is held in the raised position by the sweep release mechanism. The sweep release mechanism is connected to the table drive gear via a lift chain and clevis. The proper height, 50 cm + or -1 cm is checked by measuring between the bottom of the sweep board assembly and the lane surface. To adjust the height, loosen the hex nuts on the bolt attaching the lift chain to the clevis, and move the nuts to raise or lower the sweep as needed. Refer to *Figure 6-68*.

(1) LOCK WASHER
(2) FLAT WASHER
(3) SWEEP RELEASE CHAIN
(4) HEX NUTS
(5) SETTING TABLE GEAR
(6) CHAIN SUPPORT CLEVIS

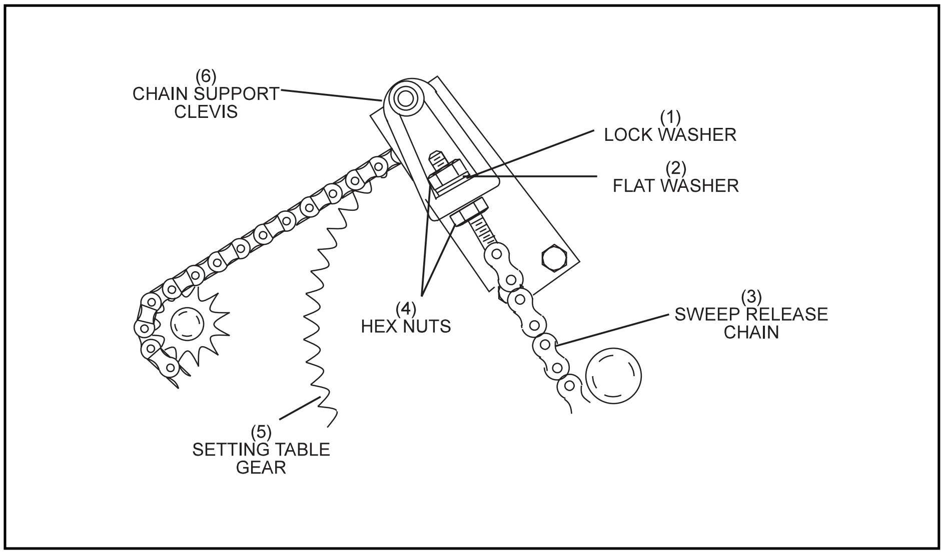


Figure 6-68. Sweep Board Height Adjustment.

36. Sweep Board Gutter Adapter Adjustment

With the sweep board down and fully forward, adjust the gutter adapter to obtain a maximum of 5 mm clearance between the adapter and the gutter. Refer to *Figure 6-69*.

(1) ADJUST ELEVATION USING THESE SCREWS
(2) SWEEP BOARD
(3) GUTTER
(4) GUTTER ADAPTER

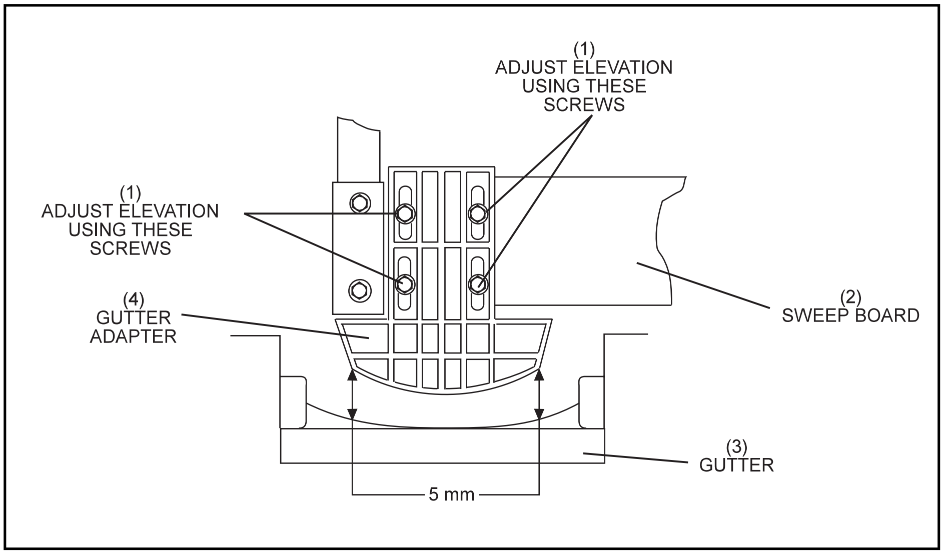


Figure 6-69. Sweep Board Gutter Adapter Adjustment.

37. Distributor Drive Belt Adjustment

The two distributor V-belts may need occasional adjustment. When replacing these V-belts, they should be done in pairs with both belts being as close to the same length as possible.

To adjust, loosen the two bolts on the side tensioning plate. Tighten or loosen the adjusting screw to obtain 10-15 mm of free play in both belts. Refer to *Figure 6-70*.

(1) LOOSEN BOLTS BEFORE ADJUSTING
(2) DISTRIBUTOR V-BELTS 10-15 mm FREE PLAY
(3) ADJUSTING SCREW

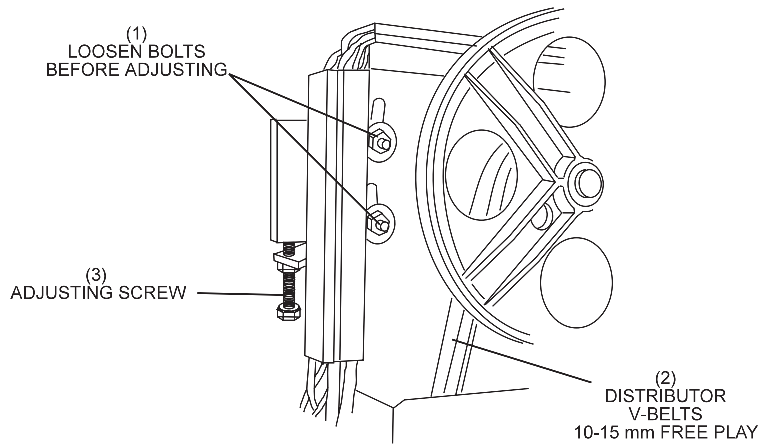


Figure 6-70. Adjusting Distributor V-Belts.

38. Chain Adjustments

Drive Motors

The tension of the sweep and table motor chains should be set for 5-8 mm of free play. Refer to *Figure 6-71*.

To adjust, loosen the four bolts mounting the bearing plate to the left drive frame. Use the chain tension adjuster to obtain the desired amount of free play. Refer to *Figure 6-72*.

CAUTION: If the chains are stretched too tight, the shaft bearings may be strained. If they are too loose, they may slip off and cause damage to the pinsetter or the person servicing the machine.

(1) 5-8 mm TOTAL FREE PLAY

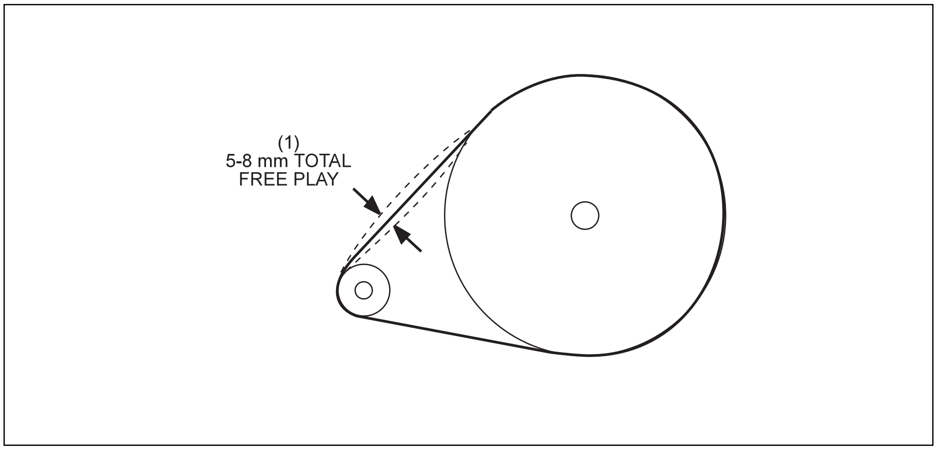


Figure 6-71. Sweep and Table Motor Chain Free Play.

(1) BEARING PLATE
(2) TABLE OR SWEEP SHAFT
(3) CHAIN TENSION ADJUSTER

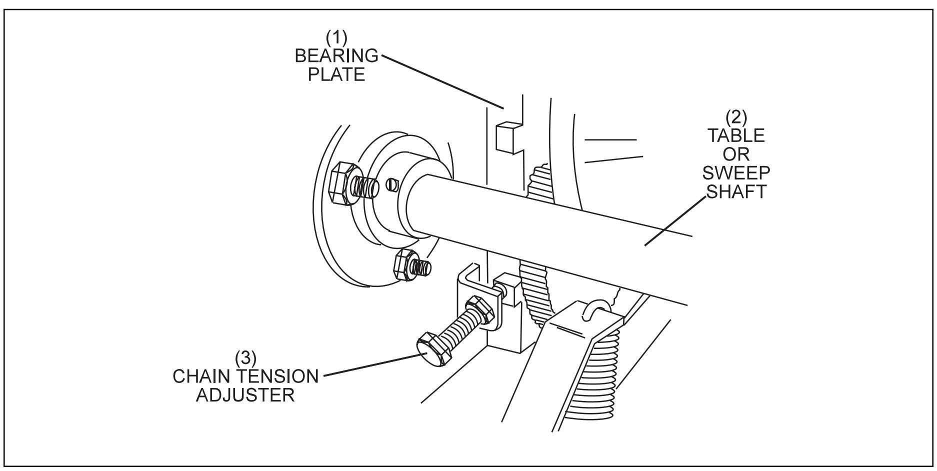


Figure 6-72. Chain Tension Adjuster.

Elevator

The two parallel elevator chains may need occasional adjustment to remove excessive free play due to the chain stretching.

To adjust, loosen the two bolts on both tensioning plates on the sides of the elevator. Tighten or loosen the adjusting screws to obtain minimal free play in both chains.

NOTE: *The adjusting screws should be rotated the same amount to eliminate the possibility of chain damage or binding.*

(1) ELEVATOR
(2) SIDE TENSION PLATE
(3) ADJUSTMENT SCREW

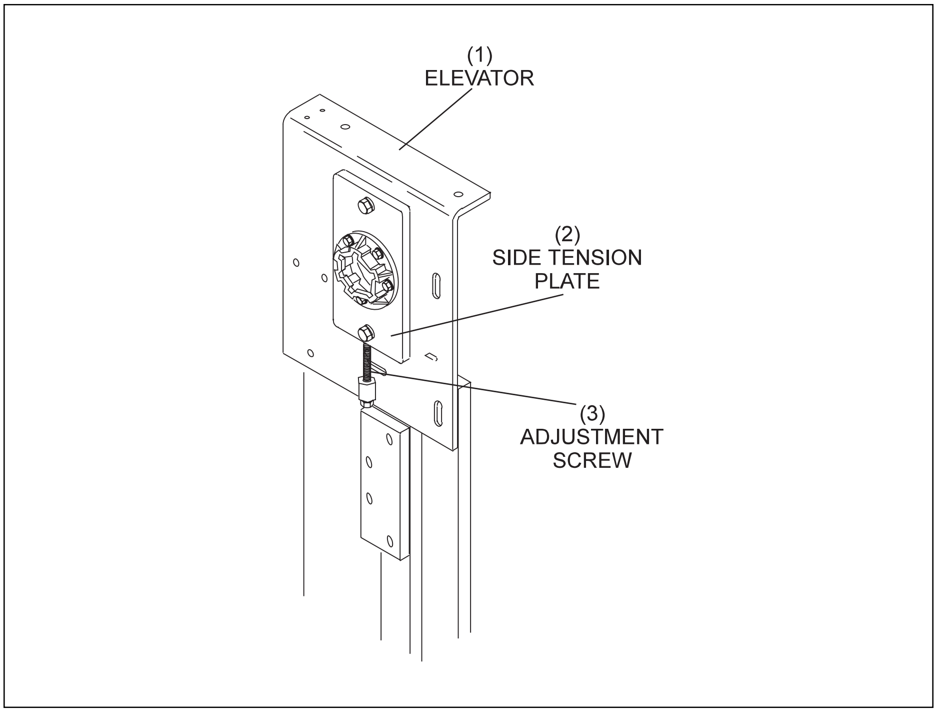


Figure 6-73. Elevator Chains.

39. Gear Adjustment - General

All gears ***must*** have tooth gap. If gears are set too loose, they may slip and/or strip. If they are set too tight, jams and breakage may occur. Refer to *Figure 6-74*.

(1) TEETH SHOULD NOT BE FULLY SEATED

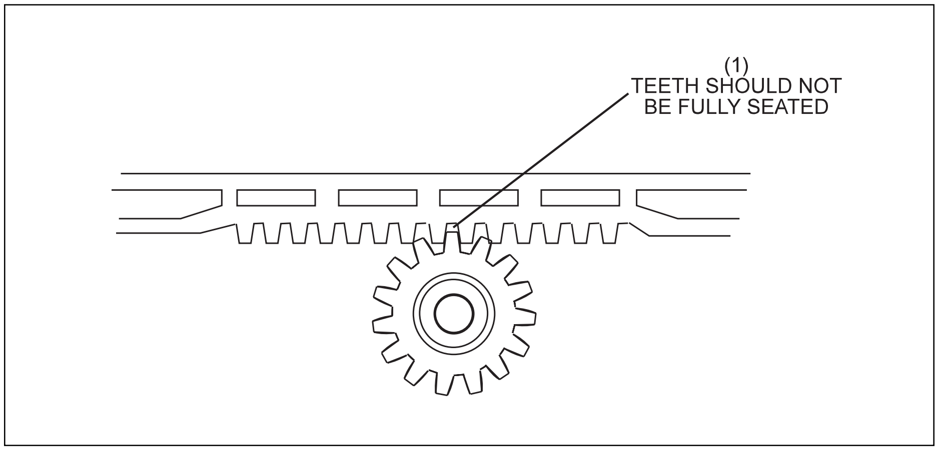


Figure 6-74. Adjusting for Proper Tooth Gap.

NOTE: *When adjusting for proper tooth gap, it is important to check the entire travel area. It is possible to have a gear rack properly adjusted in one area and be too loose or too tight in another area of travel.*

40. Switch Adjustment - General

Table position switches "B", "C" and "D" on the switch cluster are adjusted for a gap of 3 mm between the switch and the magnet on the switch cam. Refer to *Figure 6-75*.

(1) SWITCHES B, C & D
3 mm GAP

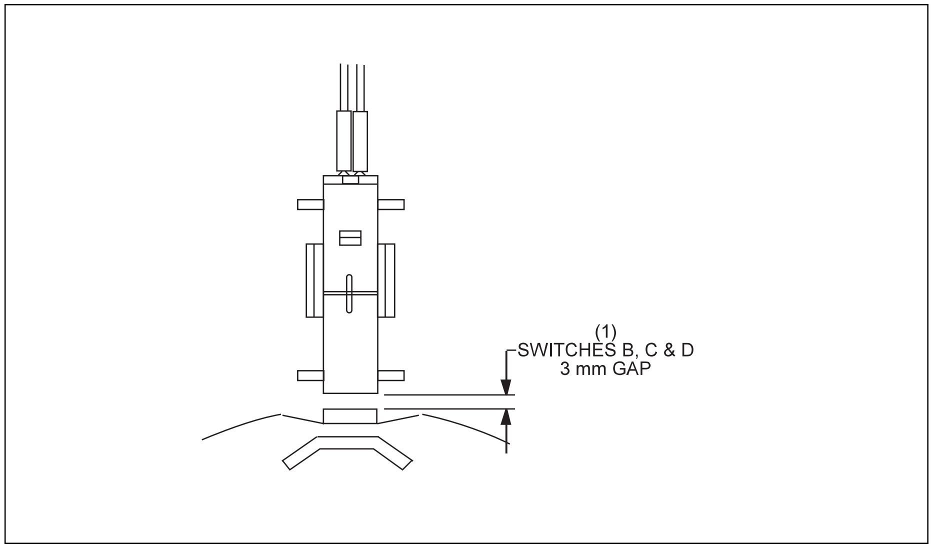


Figure 6-75. Adjusting Table Position Switches.

The “A” switch is adjusted to be contacted by the switch cam’s actuator when the table is in its highest position. Refer to *Figure 6-76*. For further information on adjusting the “A” switch, refer to Adjustment # 19 in this manual.

(1) SWITCH A IS ADJUSTED TO CONTACT CAM WHEN SETTING TABLE IS IN HIGHEST POSITION

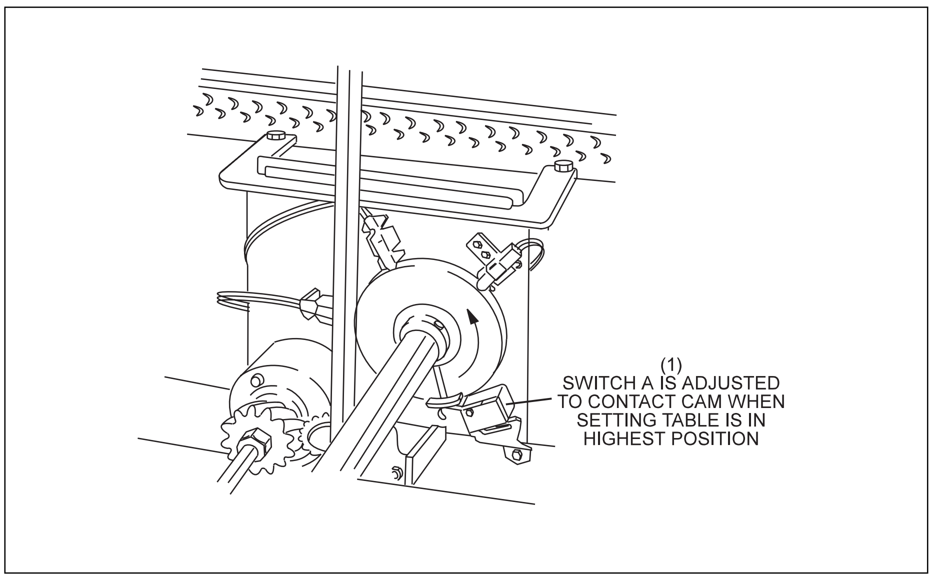


Figure 6-76. Adjusting Switch "A."

Function switches, such as the Spotting Tong switch illustrated in *Figure 6-77*, are to be adjusted as shown in View A. Views B and C illustrate being adjusted too far away and too close for proper operation.

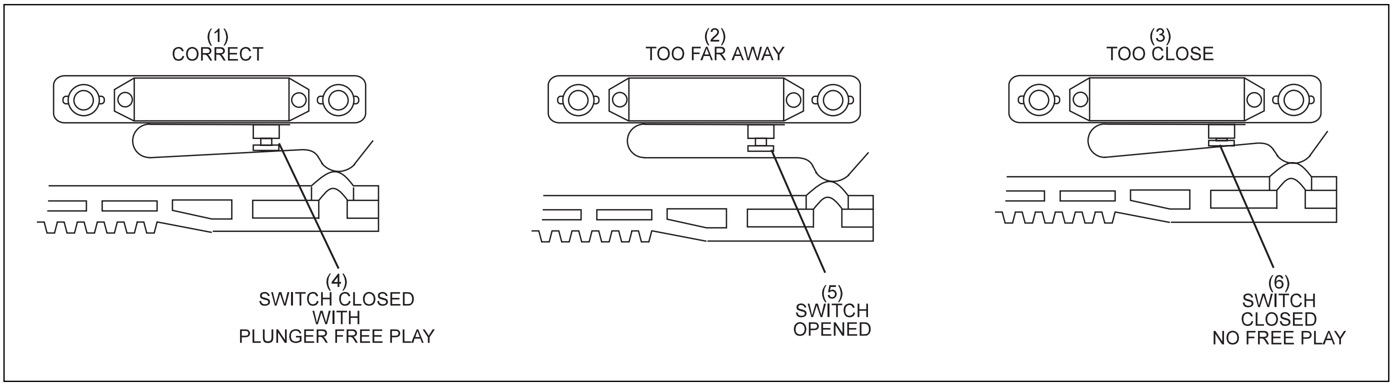


Figure 6-77. Spotting Tong Switches.

(1)	CORRECT	(2)	TOO FAR AWAY	(3)	TOO CLOSE
(4)	SWITCH CLOSED WITH PLUNGER FREE PLAY	(5)	SWITCH OPENED	(6)	SWITCH CLOSED NO FREE PLAY

When a switch is adjusted correctly, some free play should be available on the actuating switch plunger when the switch is closed.

41. 5 Volt DC Adjustment

Universal Electronics

The Gamesetter and the ball detects rely on the +5 volt power supply located in the Common box. For proper operation of both units, this voltage must be set precisely at +5.14 VDC and checked on a quarterly basis.

Test Point: Checking the voltage will require a digital voltmeter set to the “DC Volts” (---) scale. The voltage is to be checked on pins 1 and 3 of connector J5-GS on the left side of the Gamesetter. Refer to *Figure 6-78*.

(1) PIN 3
(2) PIN 1
(3) J5 TO COMMON BOX GAMESETTER D.C. POWER
(4) J4 TO LEFT LANE HIGH VOLTAGE BOX SWITCH INPUTS

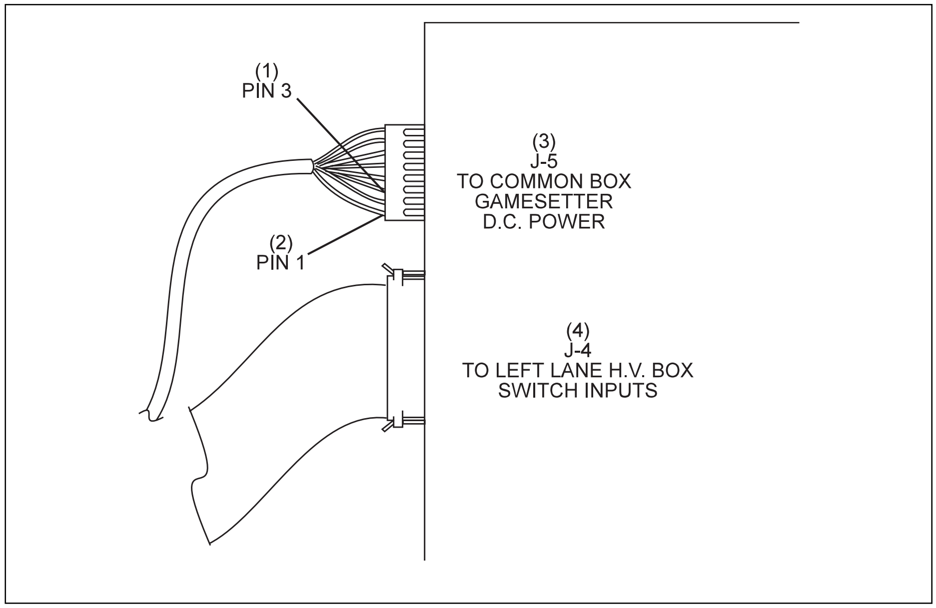
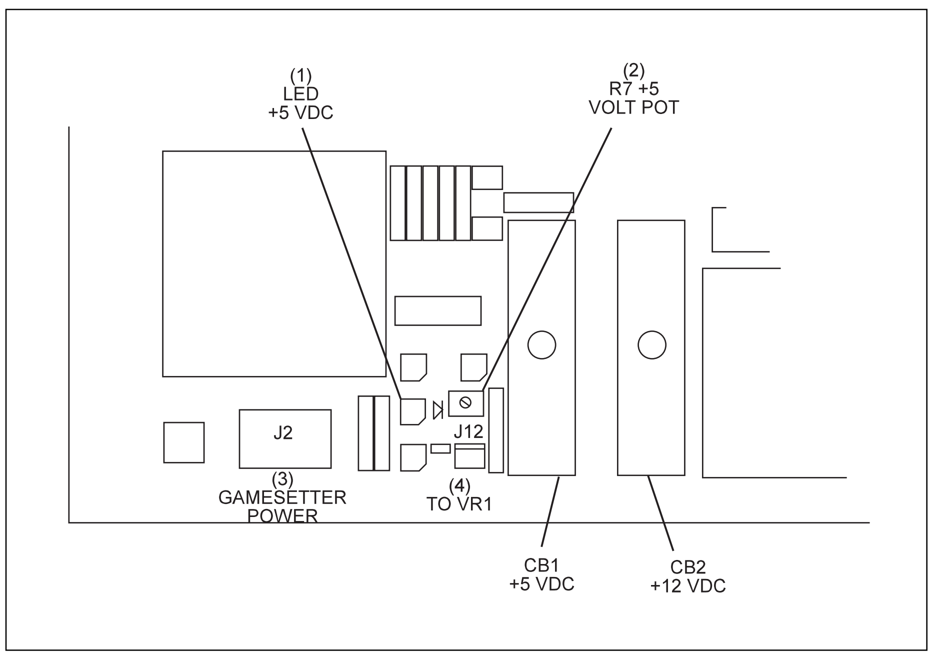


Figure 6-78. Checking +5 Volts on Gamesetter.

Adjustment: A potentiometer (R7) is located on the printed circuit board in the Common box. This "pot" is an adjustable resister used to regulate the voltage being measured at J5 on the Gamesetter. Refer to *Figure 6-79*. Adjust the voltage slowly and in small increments with a nonmetallic screwdriver.

(1) LED +5 VDC
(2) R7 +5 VOLT POT
(3) GAMESETTER POWER
(4) TO VR1



NOTE: *The 5 volts should be kept as close to +5.14 VDC as possible.*

Figure 6-79. Adjusting +5 Volts in Common Box.

Consolidated Electronics

The Consolidated Low Voltage CPU and two I/O PCBs, as well as the ball detects rely on the +5 volt power supplied by the Consolidated High Voltage box. For proper operation of both pinsetters, the voltage must be set precisely at +5.14 VDC and checked on a quarterly basis.

CAUTION: Carefully, remove the front cover of the Consolidated Low Voltage box before starting this adjustment as the test points are located in this box.

Test Points: Checking the voltage will require a digital voltmeter set to the DC Volts (- - -) scale. The voltage is to be checked on pins 1 (red wire) and 2 (black wire) of connector J1-I/O on the upper left side of either of the two I/O PCBs. The J1 connector on both I/O PCBs connects to J12 on the CPU PCB. Refer to *Figure 6-80.*

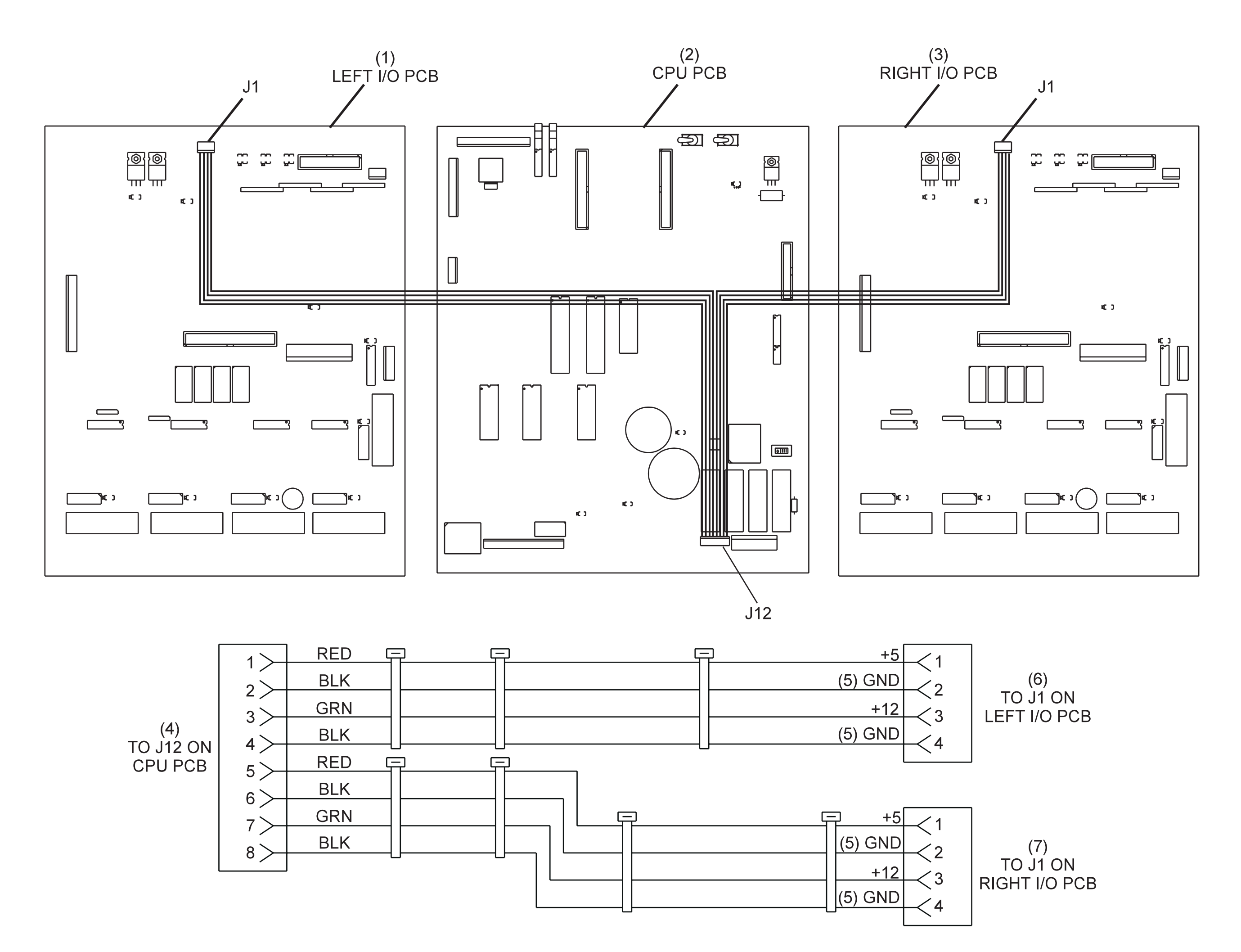


Figure 6-80. Checking Voltage on the I/O PCB

(1) LEFT INPUT/OUTPUT PRINTED CIRCUIT BOARD
(2) CPU PRINTED CIRCUIT BOARD
(3) RIGHT INPUT/OUTPUT PRINTED CIRCUIT BOARD
(4) TO J12 ON CPU PRINTED CIRCUIT BOARD
(5) GROUND
(6) TO J1 ON LEFT INPUT/OUTPUT PRINTED CIRCUIT BOARD
(7) TO J1 ON RIGHT INPUT/OUTPUT PRINTED CIRCUIT BOARD

Adjustment: A potentiometer (R145) is located on the CPU PCB in the Low Voltage box. This “pot” is an adjustable resistor used to regulate the voltage being measured at J1 on the I/O PCBs. Refer to *Figure 6-81*. Adjust the voltage slowly and in small increments with a nonmetallic screwdriver. A quarter turn of the resistor represents approximately 0.25 VDC.

NOTE: *The 5 volts should be kept as close to +5.14 VDC as possible.*

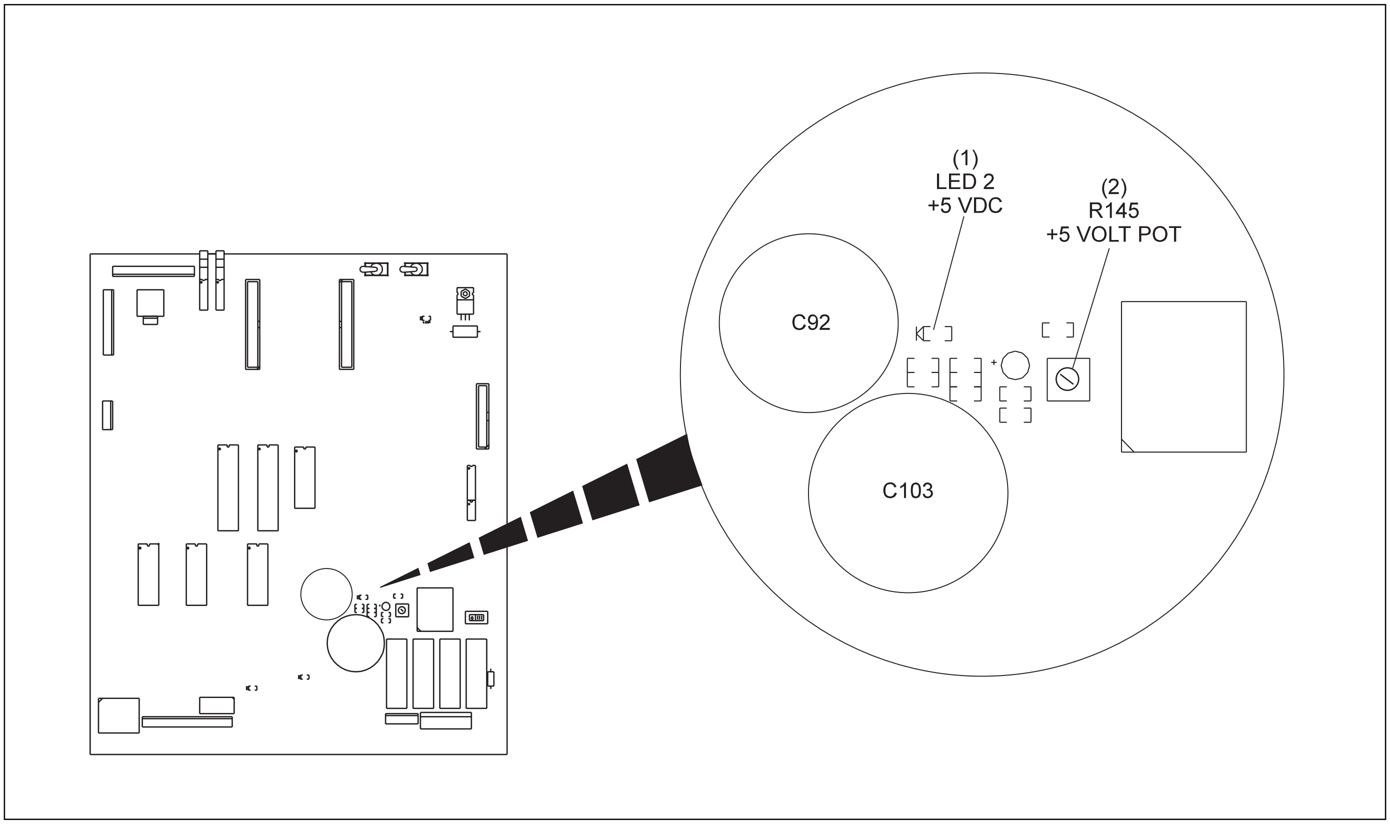


Figure 6-81. Adjusting +5VDC Potentiometer

(1) LIGHT EMITTING DIODE (LED) 2, +5 VDC (2) R145, +5 VOLT POTENTIOMETER

Table of Contents

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Troubleshooting

Bowling in Progress

The following information and procedures will be used for solving pinsetter stops. Follow safety guidelines in the Servicing section.

Using a combination of procedures (the Electronic Diagnostic Display, Problem-Cause-Corrective Action section, and the cable information schematics) will be required to solve stops.

When a pinsetter experiences a stop, the switches diagnostic system, controlled through the Pinsetter CPU, will shut down the pinsetter. This turns on a flashing red trouble light located on top of the elevator assembly.

Stop information may initially be received from the manager's control desk.

Pinsetter Clearing Procedure After Stop

1. When approaching the pinsetter from the rear, turn off the rear mechanic's stop switch. When approaching the pinsetter from the front, turn off the high voltage switch on the top of the universal High Voltage box. On consolidated electronics, turn the stop/run switch on top of the Low Voltage box to the stop position.

2. Visually note if pins are being carried up the elevator.

3. When mounting and crossing between the pinsetters, visually look for jammed pins on the Y-chute assembly, (or shark switch assembly), the belt tracks on the distributor, the pin stations, and the front belt pin transfer points.

WARNING: Do not attempt to clear jams or cause of blackout at this point!

4. For universal electronics, turn off the high voltage toggle switch on the High Voltage box if not already done. Remove the power cable connecting the High Voltage box to the Common box. For consolidated electronics, turn the stop/run switch on the top of the Low Voltage box to the stop position. Turn off the main power switch on the High Voltage box and disconnect the main 3 phase power.

5. To determine the detected reason for the stop, look at the Diagnostic Display located on the top of the universal Gamesetter box (*Figure 6-1*) or the top of the consolidated Low Voltage box (*Figure 6-2*).

(1) LANE ERROR SWITCH
(2) ERROR CODE DISPLAY
(3) MODE SELECTION KEY

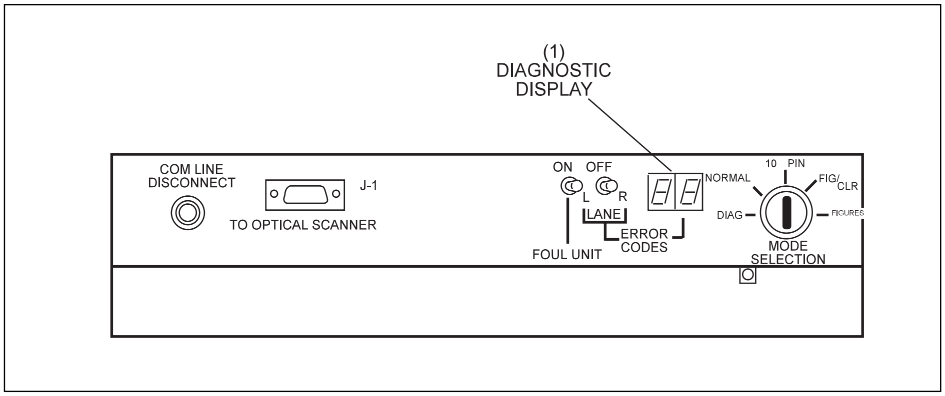

Figure 7-1. Top of Universal Gamesetter Box.

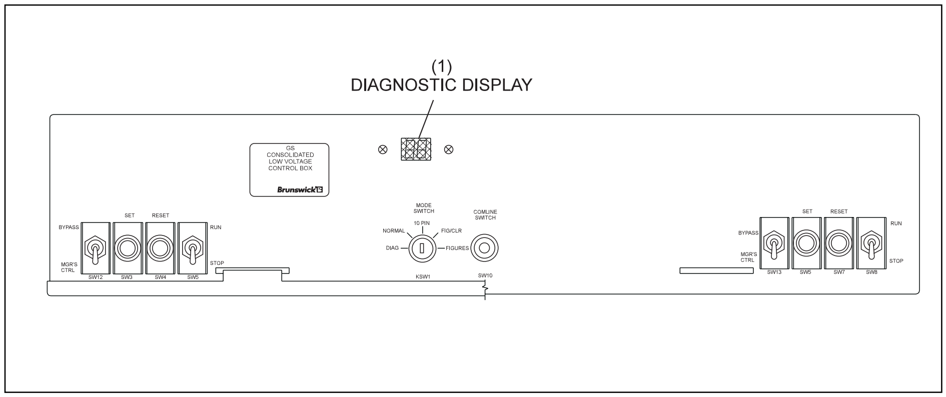

Figure 7-2. Top of Consolidated Low Voltage Box.

Tables 7-1 and *7-2* list the error codes that may be displayed when the Pinsetter CPU has detected a problem with the pinsetter.

The Error Display symbol indicates which switch failed to act normally. A description and possible cause of failing are contained in this section of the manual.

I--I	Power Up in Progress
-II-	No Errors
None	The Lane Initialized
A0	PCS Not Communicating
A1	PCS Not Sending Correct Response
F0	External RAM Testing Failure
F1	Prom Check Sum Failure
FF	CPU Lost
80	Battery Back-up RAM Failure
P0	Can't Pick up These Pins
P0	Out-of-Range
01	Pin Loading Time Out Pin 1
02	Pin Loading Time Out Pin 2
03	Pin Loading Time Out Pin 3
04	Pin Loading Time Out Pin 4
05	Pin Loading Time Out Pin 5
06	Pin Loading Time Out Pin 6
07	Pin Loading Time Out Pin 7
08	Pin Loading Time Out Pin 8
09	Pin Loading Time Out Pin 9
10	Pin Loading Time Out Pin 10
50	#10 Pin Not Detected in Diagnostics
51	#1 Pin Not Detected in Diagnostics
52	#2 Pin Not Detected in Diagnostics
53	#3 Pin Not Detected in Diagnostics
54	#4 Pin Not Detected in Diagnostics
55	#5 Pin Not Detected in Diagnostics
56	#6 Pin Not Detected In Diagnostics
57	#7 Pin Not Detected in Diagnostics
58	#8 Pin Not Detected in Diagnostics
59	#9 Pin Not Detected in Diagnostics
60	Switch A is Not Expected But Found
61	Switch B is Not Expected But Found
62	Switch C is Not Expected But Found
63	Switch D is Not Expected But Found
64	Switch SM is Not Expected But Found
65	Switch G is Not Expected But Found
66	Switch ST Is Not Expected But Found
67	SW. OOR is Not Expected But Found
70	Switch A Expected But Not Found
71	Switch B Expected But Not Found
72	Switch C Expected But Not Found
73	Switch D Expected But Not Found
74	Switch SM Expected But Not Found
75	Switch G Expected But Not Found
76	Switch ST Expected But Not Found
90	Invalid Machine State 0
91	Invalid Machine State 1
92	Invalid Machine State 2
93	Invalid Machine State 3
94	Invalid Machine State 4
95	Invalid Machine State 5
EJ	Elevator Jam
EL	Pin Count Switch Shorted for 5 Seconds
J1	Jam Switch TS1
J2	Jam Switch TS2 (Tower)

Table 7-1. Error Display

Invalid Machine State	Spotting Tongs Switch	Table		Sweep Assembly			
		Position	"A" Switch	"G" Switch		"SM" Switch	
0 (90)	Closed	Home	Closed	Open	Sweep Up	Open	Not Forward
1 (91)	Closed	Not Home	Open	Open	Sweep Up	Open	Not Forward
2 (92)	Closed	Not Home	Open	Closed	Sweep Down	Open	Not Forward
3 (93)	Open	Home	Closed	Open	Sweep Up	Open	Not Forward
4 (94)	Open	Not Home	Open	Open	Sweep Up	Open	Not Forward
5 (95)	Open	Not Home	Open	Closed	Sweep Down	Open	Not Forward

Table 7-2. Invalid Machine States.

NOTE: *Some errors or problems with the pinsetter may not be detected by the Pinsetter CPU. Examples are ball accelerator problems and incorrect pinfall detection.*

6. To clear either a mechanical or electrical jam, follow the steps below.

Universal Electronics

a. Be certain the high voltage toggle switch on the High Voltage box is turned off.

b. Remove the high voltage cable connecting the Common box to the High Voltage box *before* clearing jams on or in the pinsetter. Remove the power cable for *all* mechanical inspections. Use a jack-stand or suitable support when clearing pins from under the setting table.

c. Clear the jam, repair or replace the failed part, or make the adjustment. Reconnect the power cable and restart the machine.

Consolidated Electronics

a. Be certain the stop/run switch on the Low Voltage box is turned to the stop position.

b. Turn off the main power switch on the High Voltage box and disconnect the incoming 3 phase power cord ***before*** clearing jams on or in the pinsetter. Also, follow the same procedure when inspecting the pinsetter's mechanical assemblies. Use a jack-stand or suitable support when clearing pins from under the setting table.

c. Clear the jam, repair or replace the failed part, or make the adjustment. Reconnect the incoming power cord and restart the pinsetter.

7. If the machine will not restart, recheck the error code diagnostic display. If an invalid state is displayed, you must return the table (up) or sweep (forward) to its home position.

8. When a cable is "inoperative" on a pinsetter, swap the cable with a spare cable. If a spare cable is not available, swap the cable with one from another pinsetter to see if the one in question is good or bad.

a. To repair a cable, carefully inspect connections on each end of the cable for damage, such as bent or broken pins or loose, crimped connections and hold down springs. Ribbon cables generally cannot be repaired and must be replaced.

b. Use an ohm meter for checking continuity through pins and wires. See cable wiring diagrams for pin connection identification. On long cables, jumper two pins and check the other ends with meter for continuity.

NOTE: *Refer to the cable drawings in Sections 10 and 11 for identification and part numbers.*

Error Code Description and Causes

CODE	FAILURE DESCRIPTION	POSSIBLE CAUSES
|--|	POWER UP IN PROGRESS - The Pinsetter CPU displays this code while the pinsetter is turning on.	This is not a failure but is designed as a signal to inform you that the Pinsetter CPU is checking the system to see if it is OK to turn on the pinsetters.
-||-	NO ERRORS - This code displays briefly after a successful turn on of the Pinsetter CPU.	This is not a failure and only displays briefly after a successful power up. Immediately after displaying this code, the display should go completely blank.
NONE	THE LANE INITIALIZED - After the start up process is complete, the display will go blank.	No defects have been detected by the Pinsetter CPU. If the pinsetter is malfunctioning or out of adjustment, the CPU is unable to detect the failure.
A0	PCS NOT COMMUNICATING - Information between the Player Control Station at the ball rack and the Pinsetter CPU is not transferring. This error will not shut down the pinsetter or turn on the trouble light.	1. Player Control Station printed circuit board is not working properly. 2. Universal Electronics - Cable between the PCS and P-3 on the Gamesetter Box unconnected, loose or defective. 3. Universal Electronics - Gamesetter Box defective. Consolidated Electronics - Low Voltage CPU PCB defective.
A1	PCS NOT SENDING CORRECT RESPONSE - Pinsetter CPU is unable to use information it has received from the Player Control Station. This error will not shut down the pinsetter or turn on the trouble light.	1. Player Control Station PCB defective. 2. Universal Electronics - Cable between the PCS and P-3 on the Gamesetter loose or defective. 3. Universal Electronics - Gamesetter Box defective. Consolidated Electronics - Low Voltage CPU PCB defective.
FO	EXTERNAL RAM TEST FAILURE - Pinsetter CPU is not operating properly. RAM = Random Access Memory.	Universal Electronics: 1. Gamesetter has gone off program - shut off the Lane Pair Power switch on the Common Box and turn back on to restart the Gamesetter. The restart may clear the problem. 2. +5 volts from the Common Box out of tolerance - adjust if necessary. 3. Gamesetter defective. Consolidated Electronics: 1. Pinsetter CPU has gone off program - shut off the main power switch on the High Voltage box and turn back on to restart CPU. The restart may clear the problem. 2. +5 volt from the High Voltage box out of tolerance - adjust if necessary. 3. Low Voltage CPU PCB defective.
F1	PROM CHECK SUM FAILURE - Pinsetter CPU is not working properly. PROM = Programmable Read Only Memory	Univeral Electronics: 1. Gamesetter has gone off program - shut off the Lane Pair Power switch on the Common Box. Turn switch back on to restart the Gamesetter. The restart may clear the problem. 2. +5 volts from the Common Box out of tolerance - adjust if necessary. 3. Gamesetter defective. Consolidated Electronics: 1. Pinsetter CPU has gone off program - shut off the main power switch on the High Voltage box and turn back on to restart CPU. The restart may clear the problem. 2. +5 volt from the High Voltage box out of tolerance - adjust if necessary. 3. Low Voltage CPU PCB defective.

CODE	FAILURE DESCRIPTION	POSSIBLE CAUSES
FF	CPU LOST - Central Processing Unit in Pinsetter CPU is not working properly.	Universal Electronics: 1. Gamesetter has gone off program - shut off the Lane Pair Power switch on the Common Box. Turn switch back on to restart the Gamesetter. The restart may clear the problem. 2. 5 volts from the Common Box out of tolerance - adjust ifnecessary. 3. Gamesetter defective. Consolidated Electronics: 1. Pinsetter CPU has gone off program - shut off the main power switch on the High Voltage box and turn back on to restart CPU. The restart may clear the problem. 2. +5 volt from the High Voltage box out of tolerance - adjust if necessary. 3. Low Voltage CPU PCB defective.
80	BATTERY BACKUP RAM FAILURE - Temporary storage of the pinsetter's current activity is not protected. Note: This failure will not shut down the pinsetter or turn on the trouble light. It is for the mechanic's information as the pinsetter can run with out memory backup.	1. Battery mounted on Pinsetter CPU PCB is defective. 2. Battery charging circuit on the CPU is defective. 3. If spare replacement has been installed, battery may be discharged. Allow 24-48 hours for the spare's battery to be recharged. Check and replace if the "80" code remains. ***NOTE:*** *Reinitializing the CPU PCB may clear an "80" code.*
PO	CAN'T PICK UP THESE PINS, OUT-OF-RANGE - The Table was unable to lower to it's normal detecting height.	1. A bowling pin has been moved off its normal spot when the bowler rolled the ball. The table came down to the 15" (381 mm) height as it was resting on top of the pin. Turn off the power, clear any fallen pins still on the playing surface of the lane, and turn power back on. 2. The OOR switch mounted on the tower is not being actuated. Check the switch and actuating cam for proper adjustment. Check the wiring and connections between the switch and P-11 on the Universal High Voltage box or P-2/P-23 on the Consolidated Low Voltage box. 3. Table is not lowering properly. Check for binds in the table racks or the chain lowering mechanism.
01 02 03 04 05 06 07 08 09 10	PIN LOADING TIME OUT PIN 1, 2, 3 etc. Any time one of these error codes 01-10 appear means that the pin holder in the table had waited 90 seconds for a pin to be dropped from the distributor's pin station.	1. Pins jammed in one of the distributor lanes preventing the pin station form receiving a pin. 2. Pin holder switch not working properly. Check for broken switch or wiring. 3. Pin Holder solenoid not energizing. Check the solenoid, the wiring and either the Universal High Voltage box or Consolidated Low Voltage box. 4. Table height too high, preventing the pin from lowering fully into the pin holder to make the switch. 5. Table height too low preventing the pin holder's open gripper from pushing up on the pin release lever to drop the pin. Also check individual pin release lever for proper positioning. 6. Pin count switch not functioning properly. 7. Universal Electronics - Swap the High Voltage box, the Gamesetter, and interconnecting cables to isolate the problem. Consolidated Electronics - Swap the Low Voltage box I/O and CPU PCBs with another lane or reliable spares. Also, swap the interconnecting cables to help isolate the problem.

CODE	FAILURE DESCRIPTION	POSSIBLE CAUSES
50 51 52 53 54 55 56 57 58 59	#10 PIN NOT DETECTED IN DIAGNOSTICS - These ten codes are used during Machine Cycling diagnostics only. If a pin is not detected when the pinsetter is operating in this mode, the pinsetter will stop and display the code for the pin not detected. To activate this option, position 3 on SW2 of the Universal Gamesetter Box must be turned on. To activate this option on Consolidated Electronics, position 3 on SW4 of the Low Voltage CPU PCB must be turned on (to the right).	1. Check the pin detector plate for proper positioning. Is it level from left to right and does it have a 3 tilt from back to front? 2. Check the pinholder switch adjustment (pin detecting). 3. Check the Stroke Limiter height adjustment. 4. Check the "B" switch adjustment.
60	SWITCH A NOT EXPECTED BUT FOUND - Pinsetter CPU has requested that the table be lowered but the "A" switch is still being held closed.	1. Table Motor or brake defective preventing table from being lowered. 2. Table motor overload relay in HV box tripped. Reset and isolate reason for breaker being tripped. 3. "A" switch shorted or wiring between the switch and P-11 on the Universal HV box defective. Or for Consolidated Electronics, the wiring between the switch and P-2/P-23 on the Consolidated Low Voltage box is defective. Bad contactor in the HV box. 4. Masking unit switch turned off. 5. Masking unit to pinsetter cable is defective.
61	SWITCH B NOT EXPECTED BUT FOUND - This switch was made at the wrong time or is made continuously.	1. Switch "B" on the switch cluster is shorted. Check the wiring and the switch. 2. Table motor has been changed. Swap two of the three power wires to reverse motor’s direction of rotation.
62	SWITCH C NOT EXPECTED BUT FOUND - This switch was made at the wrong time or is made continuously.	1. Switch "C" on the switch cluster is shorted. Check the wiring and the switch. 2. Universal High Voltage box or Gamesetter box defective. Check the wiring and swap boxes with a working lane pair. Consolidated Low Voltage I/O or CPU defective. Check the wiring and swap the PCBs with a working lane pair.
63	SWITCH D NOT EXPECTED BUT FOUND - This switch was made at the wrong time or is made continuously.	1. Switch "D" on the switch cluster is shorted. Check the wiring and the switch. 2. Table motor has been changed. Change two of the three wires to the motor to get it to rotate in the proper direction. 3. Universal High Voltage box or Gamesetter box defective. Check the wiring and swap boxes with a working lane pair. Consolidated Low Voltage I/O or CPU defective. Check the wiring and swap the PCBs with a working lane pair.
64	SWITCH SM NOT EXPECTED BUT FOUND - This sweep motor switch is made when it should not have been. When made the sweep should be forward.	1. Sweep motor defective. 2. Sweep motor brake defective or stuck on the motor shaft. 3. No power to the sweep motor and/or brake. Check wiring for damage and proper hookup. 4. Sweep motor circuit breaker tripped. Check the contactor and overload relay in the HV Box. If it continues to trip, check the motor, brake and sweep assembly for proper motion. 5. "SM" switch shorted. Wiring between the Universal HV box and the switch is shorted or with Consolidated, the wiring between the Consolidated Low Voltage box and the switch is shorted. 6. Sweep wagon or sweep arms binding or out of adjustment. Check sweep adjustments.

CODE	FAILURE DESCRIPTION	POSSIBLE CAUSES
65	SWITCH G NOT EXPECTED BUT FOUND - This error is detected when the sweep is down when it should be up in the raised "waiting for a ball" position.	1. Sweep release assembly defective. Check for broken parts, missing spring or a sticky solenoid plunger. 2. Sweep release assembly out of alignment causing it to miss the sweep during the clockwise rotation of the table shaft. 3. Sweep wagon's forward position out of adjustment. Check both sweep arms and make sure both sweep crank turnbuckles on the sweep shaft are tight. 4. "G" Switch shorted. Universal Electronics: Wiring between the Universal HV box and the switch is shorted. Consolidated Electronics: Wiring between the Consolidated Low Voltage box and the switch is shorted.
66	SWITCH ST NOT EXPECTED BUT FOUND - Spotting tong switch is made when it should not have been. This means that the tongs are still open when they should have closed.	1. Spotting tong solenoid not energizing. Universal Electronics: Check solenoid and CB 2 on the HV box PCB. Change solenoid and the HV box. Check the wiring in between both. Consolidated Electronics: Check CB 2 on the Consolidated Low Voltage box I/O PCB. 2. Spotting tong clutch slipping. Clean, reset tension and readjust. 3. One or more set of spotting tongs damaged or binding. 4. Drive gears on the square shaft or out of adjustment. 5. "ST" shorted or wiring on the table damaged.
67	SWITCH OOR NOT EXPECTED BUT FOUND - The Out-of-Range switch, located on the tower, is made when it should not have been.	1. The "OOR" switch is shorted or damaged. 2. Universal: The wiring from the switch to the Universal HV Box is shorted. Consolidated: The wiring from the switch to the Consolidated Low Voltage box is shorted. 3. Universal Electronics: The Universal HV box or the Gamesetter may be defective. Consolidated Electronics: The Consolidated Low Voltage box I/O or CPU PCB may be defective.
70	SWITCH A EXPECTED BUT NOT FOUND - Table is not at the fully raised "home" position.	1. "A" switch is defective or out of adjustment. 2. Table motor or brake defective. 3. Table motor overload relay in the HV box tripped. Check wiring connections and motor and brake connections. 4. Masking unit switch turned off. 5. Masking unit to pinsetter cable is defective.
71	SWITCH B EXPECTED BUT NOT FOUND - "B" switch was not made when table lowered to detect or set pins.	1. Switch "B" defective or out of adjustment. 2. Universal: The wiring from the switch to the Universal HV Box is shorted. Consolidated: The wiring from the switch to the Consolidated Low Voltage box is shorted. 3. Universal Electronics: The Universal HV box or the Gamesetter may be defective. Consolidated Electronics: The Consolidated Low Voltage box I/O or CPU PCB may be defective. 4. Masking unit switch turned off. 5. Masking unit to pinsetter cable is defective.

CODE	FAILURE DESCRIPTION	POSSIBLE CAUSES
72	SWITCH C EXPECTED BUT NOT FOUND - Switch "C" is the table recovery switch. When the pinsetter is turned on and the Pinsetter CPU determines that the table and sweep are not up, it will run the table motor until switch "C" is made. Then the table will run clockwise to raise the sweep and table back up to the "home" position.	1. Table motor or brake defective. 2. Table motor circuit breaker in the High Voltage box tripped. Check the wiring from the High Voltage box to the table motor and brake. Check wiring from HV Box to table motor and brake. 3. Table motor wired to run backward. Reverse any two of the "hot" leads coming into the motor terminal block. 4. Switch "C" defective or adjusted too far away from the magnetic switch activator. 5. Universal Electronics: The HV box or the Gamesetter may be defective. Consolidated Electronics: The Consolidated Low Voltage box I/O or CPU PCB may be defective. 6. Masking unit switch turned off. 7. Masking unit to pinsetter cable is defective.
73	SWITCH D EXPECTED BUT NOT FOUND - "D" switch was not made when table lowered to detect or set pins.	1. Switch "D" defective or out of adjustment. 2. Universal: The wiring from the switch to the Universal HV box is shorted. Consolidated: The wiring from the switch to the Consolidated Low Voltage box is shorted. 3. Universal Electronics: The HV Box or Gamesetter may be defective. Consolidated Electronics: The Consolidated Low Voltage box I/O or CPU may be defective. 4. Masking unit switch turned off. 5. Masking unit to pinsetter cable is defective.
74	SWITCH SM EXPECTED BUT NOT FOUND - This error indicates that the sweep is not forward or is unable to stop at the forward position.	1. Sweep motor brake not preventing the motor from coasting. 2. "SM" switch not being made. 3. Sweep motor contactor defective. 4. Universal Electronics: The HV Box or Gamesetter may be defective. Consolidated Electronics: The Consolidated Low Voltage box I/O or CPU PCB may be defective. 5. Masking unit switch turned off. 6. Masking unit to pinsetter cable is defective.
75	SWITCH G EXPECTED BUT NOT FOUND - Indicates that the sweep did not lower all the way down to the guarding "ready to sweep" position.	1. Sweep down on top of a pin or ball. 2. Sweep release solenoid defective. 3. Sweep release mechanism damaged or defective. 4. Switch "G" out of adjustment. 5. Universal Electronics: The wiring between the Universal High Voltage box and the sweep release solenoid or the "G" switch is defective. Consolidated Electronics: The wiring between the Consolidated Low Voltage box and the sweep release solenoid or the "G" switch is defective. Universal Electronics: CB 3 on the HV Box PCB may have tripped. 6. Consolidated Electronics: CB 3 on the Low Voltage box I/O PCB may have tripped. Universal Electronics: The HV Box or the Gamesetter may be defective. 7. Consolidated Electronics: The Consolidated Low Voltage box I/O or CPU PCB may be defective.
76	SWITCH ST EXPECTED BUT NOT FOUND - Indicates that the spotting tongs are not all the way open.	1. Spotting tong clutch - clean and adjust. 2. Spotting tong switch damaged or out of adjustment. 3. Spotting tong solenoid not working properly. 4. Universal Electronics: The wiring between the Universal HV box and the switch is loose or damaged. Consolidated Electronics: The wiring between the Consolidated Low Voltage box and the switch is loose or damaged. Spotting tongs not working properly - damaged or binding. 5. A replacement set of tongs could have been installed out of time with the other tongs. "B" switch is adjusted too close to "C". Not enough time for the tongs to 6. be driven open completely.

CODE	FAILURE DESCRIPTION	POSSIBLE CAUSES
90 91 92 93 94 95	INVALID MACHINE STATES 0-5 These states are situations which the Pinsetter CPU is not able to determine where the table, sweep and spotting tongs are. Most times this is caused by an incomplete clearing of a table or sweep jam by the mechanic.	1. Check the position of the table, sweep and spotting tongs. Moving the sweep to the fully forward position will normally allow the pinsetter to restart itself. 2. The sweep is not making the "SM" switch in order for the table motor to run. 3. The table is not "up" making the "A" switch in order for the sweep motor to run. 4. Check the "SM" switch with the sweep forward. 5. Check the "G" switch the sweep up. 6. Check the "A" switch with the table up. 7. Check the "ST" switch with the tongs fully open. 8. Universal Electronics: Check the Universal HB box and Gamesetter cables for proper connections. Consolidated Electronics: Check the Consolidated Low Voltage box I/O and CPU PCB cables for proper connections, both internally and externally.
EL	Pin count switch closed continuously.	1. Pin jam at the Shark switch pin guides. 2. Switch is stuck in the closed position. 3. Universal: The wiring between the Universal High Voltage box and the switch is shorted. Consolidated: The wiring between the Consolidated Low Voltage box and the switch is shorted. 4. Universal Electronics: The Universal HV box or Gamesetter is defective. Consolidated Electronics: The Consolidated Low Voltage box I/O or CPU PCB is defective.
EJ	ELEVATOR JAM - Elevator shovels not rotating properly. "EC" switch on elevator not being pulsed by a pin shovel at least once every 6 seconds.	1. Elevator pin shovel flipped and wedged in the elevator. 2. Pin caught in the elevator preventing rotation of the shovels. 3. Transport drive has a bind which prevents the rear distributor shaft from rotating elevator fast enough to keep pulsing "EC" switch. 4. Distributor motor defective or breaker on distributor overload relay tripped. 5. Belt drive from the motor to the distributor shafts is too loose. 6. **MASKING UNIT SWITCH TURNED OFF.** 7. Masking unit to pinsetter cable is defective.
J1	JAM SWITCH TS1 - The switch is made when the rear pin holder swing shaft is unable to return to the horizontal position after setting pins.	1. A pin, broken part or tool is stuck in the table preventing rotation of the swing shafts. 2. The TS1 jam mechanism is out of adjustment and allows the switch to be made during proper rotation of the swing shafts. 3. Universal Electronics: The TS1 switch or its wiring to the Universal High Voltage box is shorted. Consolidated Electronics: The TS1 switch or its wiring to the Consolidated Low Voltage box is possibly shorted.
J2	JAM SWITCH TS2 (TOWER) - This switch is made when the table is not able to raise back to its home position @ "A".	1. A pin, broken part or tool is wedged between the table and distributor. 2. The table height adjustment is wrong allowing the table to be pulled up against the distributor. Check the Angle "A" & "B" adjustment of the "A" switch and the table height in the raised position adjustments. 3. Check the TS2 adjustment to make sure the spring tension is adjusted properly. 4. Setting table cable tower making contact with distributor frame when the table is rising. 5. Universal Electronics: The TS2 switch or its wiring to the Universal High Voltage box is shorted. Consolidated Electronics: The wiring to the Consolidated Low Voltage box is possibly shorted.

PROBLEM	CAUSE	CORRECTIVE ACTION
1. Ball does not return.	1. Pins in accelerator.	1. Remove pins.
	2. Adjoining machine transport band binding ball door.	2. Adjust transport band.
	3. Ball doors do not move freely.	3. Adjust ball door.
	4. Pin stuck between transport band and ball cushion board.	4. Adjust ball cushion.
	5. Transport band drive belt broken.	5. Replace or weld belt. See Servicing section.
	6. Broken transport band.	6. Replace transport band.
	7. Faulty ball door solenoid.	7. Replace or adjust solenoid.
	8. Ball cushion board lodged on deflector plate.	8. Adjust ball cushion.
	9. Accelerator motor/overload switch in Universal Common box may have tripped. On consolidated electronics, the overload switch in the Consolidated High Voltage box may have tripped.	9. Reset the breaker.
	10. Accelerator flat belt and/or motor drive belt.	10. Tighten or replace belt as required.
	11. Ball fell off transition track.	11. Remove capping, retrieve ball and clear any obstruction on or near the track.
2. Ball door blocked by pins.	1. Ball cushion not adjusted properly.	1. Adjust ball cushion.
	2. Loose transport band.	2. Tighten transport band.
	3. Loose transport band drive belt.	3. Cut off a piece and weld back together.
	4. Worn transport band.	4. Replace transport band.
	5. Ball door not adjusted properly.	5. Adjust ball door.
	6. Faulty ball door solenoid.	6. Replace or adjust soleniod.
	7. Door solenoid actuation too short.	7. Replace Gamesetter if universal electronics are used. Replace Consolidated Low Voltage box I/O and CPU PCBs if consolidated electronics are used.

PROBLEM	CAUSE	CORRECTIVE ACTION
3. Pinsetter does not operate.	1. TS1 or TS2 safety switch actuated.	1. Determine cause of trouble, repair, and restart machine.
	2. Photocell not adjusted properly.	2. Adjust ball detector.
	3. Faulty switch "A" or "SM".	3. Replace or adjust switch.
	4. Universal Common box or the Consolidated High Voltage box main switch is off. The main power cable is unplugged, the mechanic's rear stop switch, or the manager's control switch is not on.	4. Turn on all switches. Check plugs and connectors.
	5. Disconnected high voltage cable between the Universal High Voltage box and Common box. On consolidated electronics, disconnected cables between the Consolidated High Voltage and Low Voltage boxes.	5. Reconnect cable.
	6. Faulty relay contacts.	6. Replace relays.
	7. Main house breaker box (if two pinsetters are down.)	7. Reset breakers.
	8. Incorrect line voltage.	8. Have line voltage corrected.
	9. Faulty cables to player control station and/or manager's control.	9. Check cable continuity. Replace or repair as required.
4. Pinsetter cycles independently. (One cycle only.) CAUTION: Camera flash may cause pinsetter to cycle independantly.	1. Photocell not mounted properly.	1. Remount with proper hardware and adjust.
	2. Loose reflector mounting.	2. Remount with proper hardware and adjust.
	3. Faulty power supply connections.	3. Tighten connections.
	4. The mode selector switch positioned wrong on the Universal Gamesetter or the top of the Consolidated Low Voltage box.	4. Place key mode in 10-pin position.
	5. +5 volts to the CPU out of adjustment.	5. Make the corrective +5 volts adjustment using the Adjustments section.
	6. Incoming 3 phase power surges.	6. As a last resort, consult a qualified electrician to help identify the surge and correct the problem.

PROBLEM	CAUSE	CORRECTIVE ACTION
5. Pinsetter cycles continuously.	1. "SET" switch on player control station stuck or faulty.	1. Replace or repair as needed.
	2. "SET" switch on mechanic's rear control box stuck or faulty.	2. Replace or repair as needed.
	3. Player control station cable is shorted.	3. Check cable continuity. Repair or replace as required.
	4. Bowler's reset button stuck or cable is shorted.	4. Check reset button, check cable, repair or replace.
6a. No pinsetter motor will operate.	1. Safety switches TS1 or TS2 actuated.	1. Determine cause of trouble, repair, and restart machine.
	2. Manager's remote control unit not turned on.	2. Turn on switch.
	3. Faulty contactor.	3. Check all contactors. Replace as required.
6b. Individual motor does not operate.	1. Motor circuit breaker tripped.	1. Clear pin jam. Reset breaker.
	2. Main house breaker box or faulty power supply connections.	2. Check breaker box and tighten power connections.
	3. Faulty cables.	3. Check for shorted or loose pins, continuity, faulty connectors. Repair or replace.
	4. Damaged motor.	4. Replace motor.
	5. All above checked. Faulty universal electronic assemblies (High Voltage, Gamesetter or Common box). Faulty consolidated electronic assemblies (High Voltage or Low Voltage box).	5. Power down and exchange faulty box.
7. Pinsetter fails to sweep.	1. Pin under or on top of sweep.	1. Remove pin.
	2. Faulty switch G, OOR or SM.	2. Adjust or replace switch.
	3. Faulty sweep relay.	3. Remove and check coil and contacts. Replace faulty relay.
	4. Motor overload protectors actuated.	4. Reset overload protectors.
	5. Sweep wagon guide rollers not adjusted properly.	5. Adjust guide rollers.
	6. Broken or worn sweep drive belt.	6. Replace belt.

PROBLEM	CAUSE	CORRECTIVE ACTION
8. Sweep motor runs continuously.	1. Sweep motor brake not adjusted properly. 2. Faulty switch SM. 3. Faulty sweep motor relay. 4. All above checked. Faulty universal electronic assemblies (High Voltage, Gamesetter or Common box). Faulty consolidated electronic assemblies (High Voltage or Low Voltage box).	1. Adjust motor. 2. Adjust or replace switch. 3. Replace motor relay. 4. Power down and exchange faulty box.
9. Pins jammed in distributor.	1. Pin chute system not adjusted properly for pin transfer. 2. Oil/grease on pins or belts. 3. Belts not tensioned properly. 4. Dirty or broken pin ejectors. 5. Pin turn not adjusted properly. 6. Belts off or broken. 7. Broken pin guides in pin station. 8. Front distributor and idler gears do not have proper tooth gap or belts are not tensioned properly. 9. Belts not level on distributor.	1. Adjust pin chutes. 2. Clean with all-purpose cleaner. 3. Remove section of belt and weld back together. 4. Clean or replace as needed. 5. Adjust pin turn. 6. Replace or weld belt. 7. Replace as required. 8. Adjust for proper tooth gap. Replace or weld belt for proper tension. 9. Carefully level belt profile. Adjust rear track splice.
10. Shark switch not flipping to load pins on the #10 pin side.	1. Shark solenoid. 2. Pin count switch not closing.	1. Change solenoid or make sure solenoid is plugged in. 2. Check wiring to universal High Voltage box or consolidated Low Voltage box. Adjust switch, switch is defective, or wiring is defective.
11. Shark switch flipping randomly.	1. Pin count switch not working properly.	1. Switch needs adjustment or the switch is defect as contacts are closing intermittently.
12. Incorrect score.	1. Pin detect switch.	1. Switch is sticking or defective. Pin detector plate actuator bolt is out of adjustment.

PROBLEM	CAUSE	CORRECTIVE ACTION
13. Pins jammed in chute.	1. Dirty pins and/or dirt built up in pin chute.	1. Clean pins with pin cleaner and/or clean chute with all purpose cleaner.
	2. Pin turn not adjusted properly.	2. Adjust pin turn.
	3. Drive belts off or broken.	3. Replace or weld belt.
	4. Pins jammed in elevator or elevator shovel guide not working properly.	4. Remove jam or repair shovel guide.
14. Pin elevator turns continuously.	1 Faulty relay.	1 Replace distributor motor relay.
15. Pin elevator runs for six seconds then turns off.	1. Elevator switch not pulsed.	1. Replace or adjust switch.
	2. Pin jam.	2. Remove pins.
	3. Elevator pin ejector flaps not working properly.	3. Repair flaps.
	4. Faulty Universal Gamesetter. Faulty Consolidated Low Voltage box I/O or CPU PCB.	4. Replace faulty electronic assembly.
16. Table motor runs continuously.	1. Faulty switch A, or cam misadjusted.	1. Adjust or replace switch.
	2. Missing set screw in switch cluster cam or damaged cam.	2. Replace screw or switch cluster cam as required.
	3. Review problem No. 5.	3. Repeat corrections.
	4. Faulty Universal Gamesetter. Faulty Consolidated Low Voltage box I/O or CPU PCB.	4. Replace faulty electronic assembly.
17. Table sets pins but sweep stays down.	1. Sweep not fully forward.	1. Move sweep manually by turning middle pulley.
	2. Sweep attenuator stop screw not adjusted properly.	2. Adjust stop screw.
	3. Sweep pick up chain not adjusted to proper length.	3. Adjust to proper length using screw on end of chain.
	4. Sweep contacting gutter adapter blocks.	4. Adjust sweep board.
	5. Photocell not adjusted properly .	5. Adjust photocell.
	6. "SET" key on player control station stuck or faulty.	6. Repair or replace keys.

PROBLEM	CAUSE	CORRECTIVE ACTION
18. Full table lowers but does not release all pins.	1. Setting table not adjusted for proper height. 2. Faulty pin holder solenoids or pin holder microswitches. 3. Faulty stroke limiter (no long stroke.) 4. Faulty electrical connections. 5. Pin holder stop brackets not adjusted properly.	1. Adjust setting table. 2. Repair or replace faulty solenoid or microswitch. 3. Check solenoid and adjust. 4. Repair connections. 5. Adjust brackets.
19. Table does not set full rack of pins.	1. Timing of switch B not right. 2. Faulty pin detector switches or switch spring. 3. Pin detectors not allowed free movement. 4. Faulty pin holder solenoid(s).	1. Adjust switch B. 2. Adjust switch or switch spring. 3. Determine cause and adjust as required. 4. Replace solenoid(s). Check harness cable and connectors.
20. Table makes long stroke only.	1. Stroke limiter not adjusted properly. 2. Faulty solenoid.	1. Adjust stroke limiter. 2. Replace or adjust solenoid as required.
21. Table makes short stroke only.	1. Faulty pin holder switch. 2. Faulty stroke limiter solenoid. 3. Pin holder shaft latch not adjusted properly.	1. Replace switch or adjust . 2. Replace solenoid as required. 3. Adjust pin holder shaft latch.

PROBLEM	CAUSE	CORRECTIVE ACTION
22. Table does not set pins after second ball or table is not full.	1. Pin jam in distributor.	1. Remove jam.
	2. Bent pin distributor guide tabs.	2. Adjust as required.
	3. Top adjusting screw on pin holder not making contact.	3. Tighten screws.
	4. Faulty pin holder solenoid.	4. Replace solenoid as required.
	5. Switch B timing is off.	5. Adjust switch B.
	6. Table not adjusted to proper height.	6. Adjust table.
	7. Broken or missing spring on pin station ejector.	7. Repair or replace as required.
	8. Broken pin ejector on distributor.	8. Replace as required.
	9. Not enough pins in machine.	9. Be certain 21 pins are in machine.
	10. Broken pin holder electrical connections.	10. Repair connections.
	11. Faulty electronics.	11. Exchange Universal HV or Gamesetter box. On consolidated electronics, change the Consolidated Low Voltage box components.
23. Table is full but does not lower.	1. Faulty pinholder microswitches.	1. Adjust or replace microswitches.
	2. Table circuit breaker tripped.	2. Determine cause, repair and restart machine.
	3. Faulty table relays/contactors in high voltage box.	3. Replace relays. Note : Two relays -one clockwise and the other counterclockwise.
	4. Faulty control box.	4. Replace faulty box. See Servicing section.
24. Pins wobble or fall over while being set.	1. Pin holders not plumb.	1. Make sure pin holders are plumb.
	2. Table not adjusted for proper height.	2. Adjust table height.
	3. Table is not completely level.	3. Level table.
	4. Pin holder stop brackets not adjusted properly.	4. Adjust pin holder stop brackets.
	5. Faulty table spring.	5. Replace spring.
	6. Pin bottoms are worn.	6. Scrap or repair worn pins.

PROBLEM	CAUSE	CORRECTIVE ACTION
25. Spotting tongs do not close - table does not pick up standing pins.	1. Foul was committed.	1. Press "SET" key on player control station.
	2. Switch B faulty or not adjusted properly.	2. Adjust switch or timing of switch.
	3. Tong drive clutch dirty or lubricated.	3. Remove all lubricants and dirt from clutch face.
	4. Tong drive shaft clutch not adjusted to proper tension.	4. Adjust tension.
	5. Faulty spotting tong solenoid.	5. Change solenoid.
	6. Faulty spotting tong switch or out-of-range switch.	6. Adjust or replace switches as required.
	7. Faulty spotting tong drive shaft.	7. Clear any fault through this drive system.
	8. Spotting tongs are obstructed.	8. Clear obstruction.
	9. After above checks, electronics.	9. Exchange the Universal High Voltage or Gamesetter box. On consolidated electronics, change the Consolidated Low Voltage box components.
26. Pins drop from tongs.	1. Spotting tong drive shaft clutch not adjusted to proper tension.	1. Adjust for proper tension.
	2. Table gears obstructed.	2. Clear obstruction.
	3. Faulty cables.	3. Repair or replace cables.
	4. Switches B or D are faulty or not adjusted properly.	4. Adjust switch for gap or timing of cam. Replace if switch is faulty.
	5. Above checked first: a. Left or right machine only. b. Both left and right machines.	5. a. Universal Electronics: Change the High Voltage box. Consolidated Electronics: Change the left or right Low Voltage I/O PCB. b. Universal Electronics: change the Gamesetter box. Consolidated Electronics: change the Low Voltage CPU PCB.
	6. Missing or worn tong insert.	6. Replace tong insert.
	7. Broken tong.	7. Replace broken tong.

PROBLEM	CAUSE	CORRECTIVE ACTION
27. Player control station displays incorrect pinfall.	1. Pressure spring on pin holder not adjusted to proper gap. 2. Switch B timing is incorrect. 3. Table not adjusted to proper height. 4. Faulty pin holder switch. 5. Broken wiring or connections on setting table. 6. Faulty ribbon or lane cable. 7. Wrong plug used in cable junction box or direct short. 8. Inoperable player control station. 9. Electronics.	1. Adjust for proper gap. 2. Adjust timing. 3. Adjust table height. 4. Adjust or replace switch. 5. Repair wiring or connections. 6. Repair or replace cable. 7. Insert correct plug or repiar as required. 8. Change player control statioin. See Servicing section. 9. Change the Universal Gamesetter box or Consolidated Low Voltage CPU PCB.
28. Ball accelerator belt not centering.	1. Front pulley not bolted correctly or front yoke is loose (parts incorrectly installed.)	1. Loosen bolts on yoke and operate accelerator. Align both yoke halves until the belt runs true. Tighten bolts.

PROBLEM	CAUSE	CORRECTIVE ACTION
29. Pinsetter operates erratically.	1. Faulty switch A.	1. Replace switch.
	2. Loose or faulty cables and connections.	2. Use solenoid and cable checker.
	3. Switches B, C, or D, (on switch cluster) or switch OOR (on setting table guide tower) not adjusted properly.	3. Adjust switches or cam for B, C, or D and OOR.
	4. Setting table height not adjusted properly.	4. Adjust table height.
	5. Belts not tensioned properly.	5. Check all belts for proper tension. Replace or weld belts as required.
	6. Damaged pinsetter parts.	6. Repair or replace parts.
	7. Pin holder latch not adjusted properly.	7. Adjust latch.
	8. Release levers damaged or not adjusted properly.	8. Replace levers or adjust as required.
	9. Switch adjustment faulty or faulty assembly.	9. Check leaf switch mountings. Check adjustments.
	10. Photocell adjustment not correct.	10. Adjust ball detect.
	11. Faulty motor rotation.	11. Determine proper rotation and adjust to proper phase status.
	12. Main power supply on too low a voltage.	12. Use proper line voltage.
	13. Faulty switch cluster cable, trouble light, and ball door cable.	13. Substitute spare cable (to check).
	14. Faulty player control cable, ball lift cable, foul & optical trigger cable, or manager's cable (2 cables - left & right).	14. Check cables and repair or exchange. Reference Service section cable drawing.
	15. After above checked, electronics.	15. Change the Universal electronic assemblies. Change the Consolidated electronic assemblies.

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Servicing

Safety Guidelines

As with all machinery, there is an element of risk in working on the GS-Series Pinsetter if the rules of safety are disregarded. Common sense, a knowledge of the pinsetter, and a knowledge of basic safety procedures will prevent injury to personnel working on the machines.

1. ONLY properly trained people should work on the pinsetter.

2. Always use the correct tools for the job at hand. Remove all tools from the machine before turning it on.

3. Wear the proper clothing when working on the pinsetter. Do not wear neckties or loose clothing that may be caught by the machine. Wear shoes with safety nonslip soles.

4. Avoid using cleaners which may be toxic or poisonous.

5. Fire extinguishers must be on hand and maintained properly. Store oily rags in a fire proof container.

6. Care should be taken while near the front of the machine. If it is turned on, you may accidentally trigger the photocell with your foot or hand which will cycle the pinsetter.

7. When working on one GS-Series Pinsetter, turn off either the High Voltage box toggle switch or the rear mechanic's switch mounted on the pin elevator. If consolidated electronics are used, toggle the stop/run switch on the Low Voltage box to the stop position. If more than one person is working on the machines, turn off both switches to prevent one person from turning on the pinsetter before the other person is clear of the pinsetter.

8. When working on both machines of a lane pair (for example - an electronic control box or the ball accelerator) power must be turned off at the Common box and the input power cable must be removed from the Common box. If Consolidated Electronics are used, turn off power at the Consolidated High Voltage box and remove the input power cable from the High Voltage box.

9. The sweep board should always be lowered when working on the pinsetter or the ball accelerator.

10. When service work is to be performed by entering underneath the setting table, set a jack stand or suitable support under the center of the table.

Manually Raising or Lowering Setting Table

1. Turn off power.

    a. Universal Electronics: Turn off the high voltage switch on top of the High Voltage box. Remove the high voltage power cable connecting the Common box to the High Voltage box.

    b. Consolidated Electronics: Turn off the main power switch on the High Voltage box and disconnect the incoming 3 phase power.

2. Remove all pins from the pin deck.

CAUTION: Never remove the V-belt with table in highest position <u>or</u> in a partially lowered position. The setting table uses the motor brake and V-belt for position holding. Table will fall to lowest position if belt is removed.

3. *Firmly grip* the top of the large table V-belt pulley. Refer to *Figure 8-1*.

(1) V-BELT
(2) LIFT MOTOR BEFORE ROTATING PULLEY

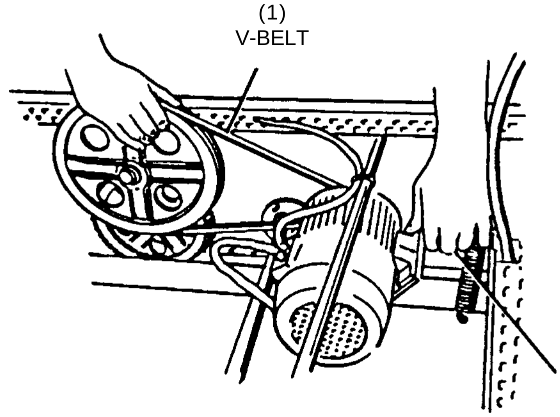

Figure 8-1. Manually Raising or Lowering the Setting Table.

4. Before rotating the pulley, use your other hand to lift the motor while carefully rotating the pulley. Watch the V-belt in the motor pulley. The belt must stay seated in both pulleys. DO NOT RELEASE PULLEY GRIP.

5. *Lower the motor* so it brakes the table drive shaft *before* releasing the pulley grip.

6. Repeat this procedure until the desired height is obtained.

Changing Setting Table V-Belt

1. Turn off power.

    a. Universal Electronics: Turn off the high voltage switch on the High Voltage box.

    b. Consolidated Electronics: Turn the stop/run switch on the Low Voltage box to the stop position.

2. Manually lower the setting table to the new pin setting position. See previous page.

NOTE: *As an alternative, lower the table onto a jack-stand.*

3. Change the V-belt.

Setting Table Assembly Removal

1. Place three 914 mm (3') long 1 x 4 spacers on the pin deck positioned so the deck will be supported front and back. Refer to *Figure 8-2*.

(1) 914 mm LONG SPACER
(2) SETTING TABLE

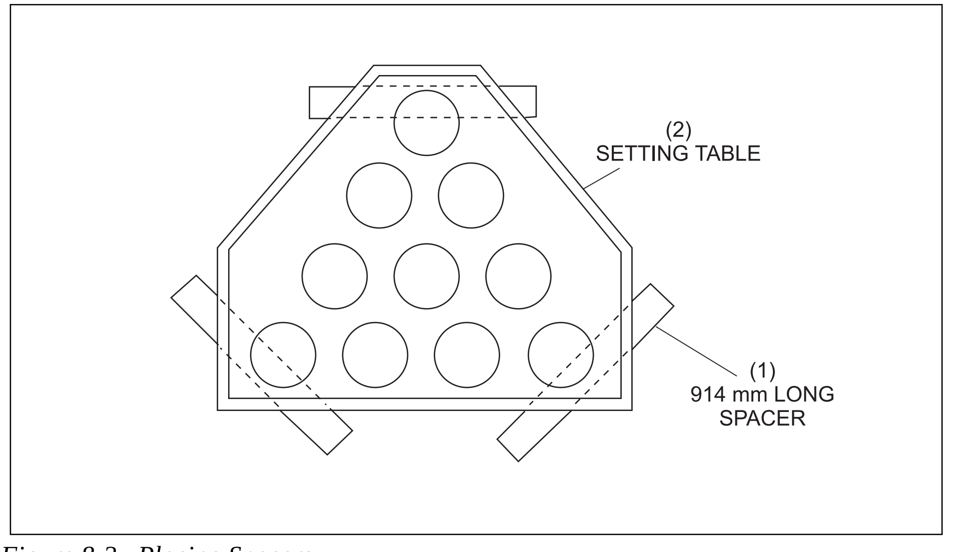

Figure 8-2. Placing Spacers.

2. Remove the two tension springs from the setting table. Refer to *Figure 8-3*.

(1) TENSIONSPRING

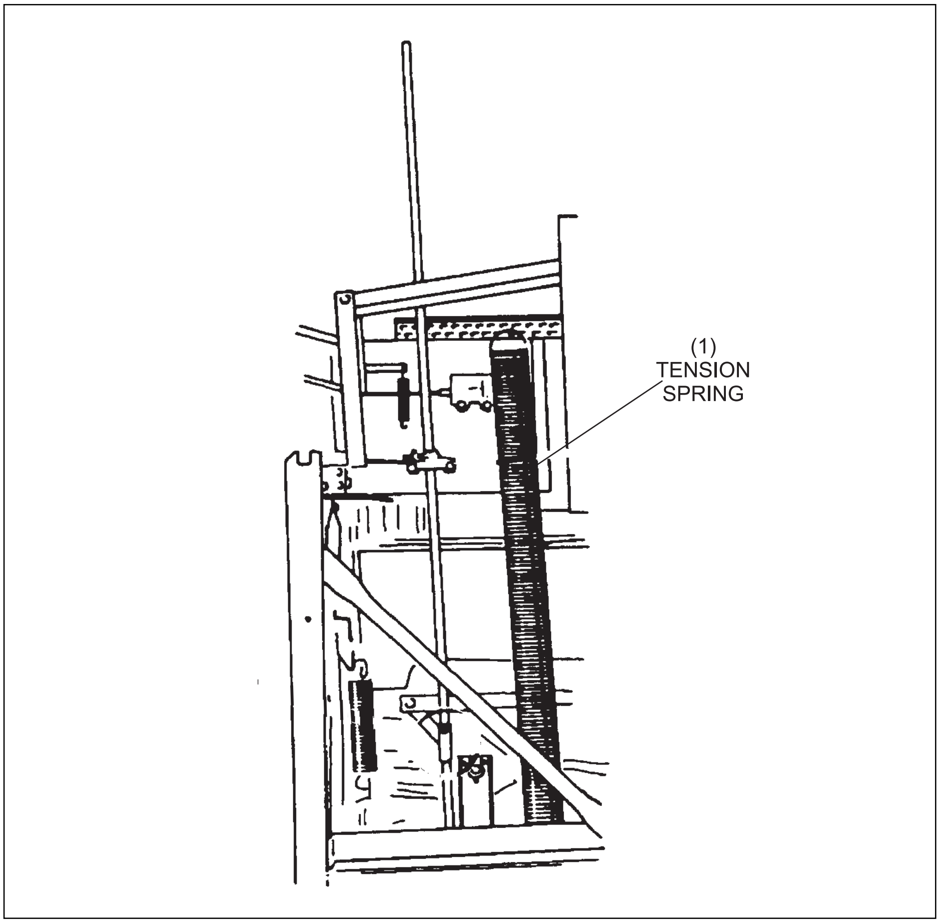

Figure 8-3. Removing Tension Springs.

3. Manually lower the setting table assembly so it is supported by the spacers. Refer to *Figures 8-1* and *8-2.*

4. Turn the high voltage switch on the top of the Common box to the off position. Disconnect the power plug from the Common box.

(1) CABLE CHANNEL
(2) REMOVE 6 X 12 mm HEX HEAD SCREWS AND LOCKWASHERS

5. Disconnect the setting table electrical cable and remove the cable channel. Refer to *Figure 8-4*.

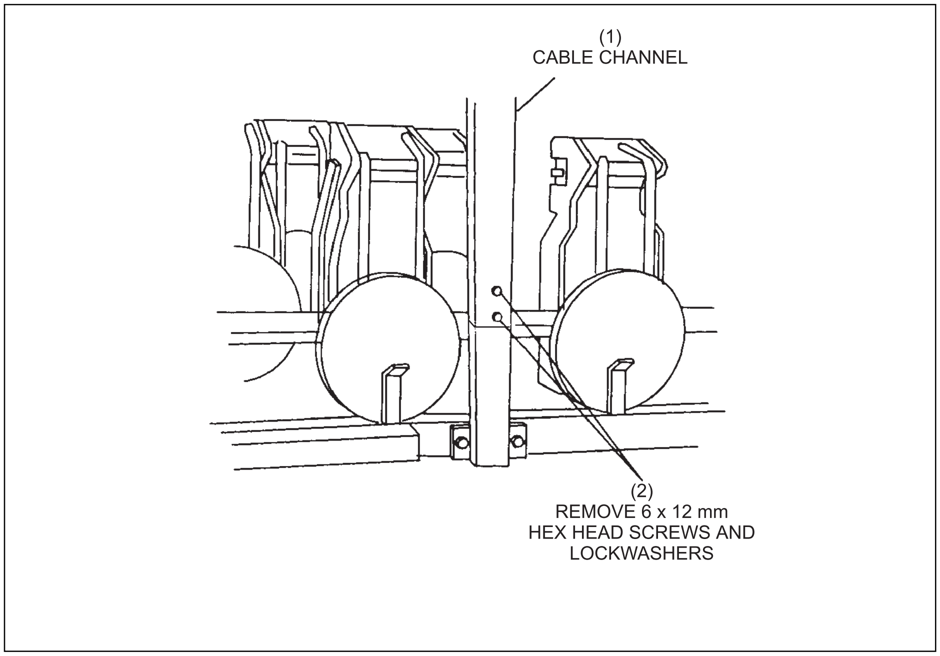

Figure 8-4. Removing Cable Channel.

6. Disconnect the square shaft assemblies from the setting table. Refer to *Figure 8-5*.

(1) SETTING TABLE LATCH SQUARE SHAFT OR LEFT-HAND SQUARE SHAFT
(2) 6 X 25 mm HEX HEAD SCREW AND NYLOK
(3) SPOTTING TONG OR RIGHT-HAND SQUARE SHAFT
(4) SQUARE SHAFT DRIVE GEAR
(5) BEARING BLOCK AND SWING LEVER ASSEMBLY

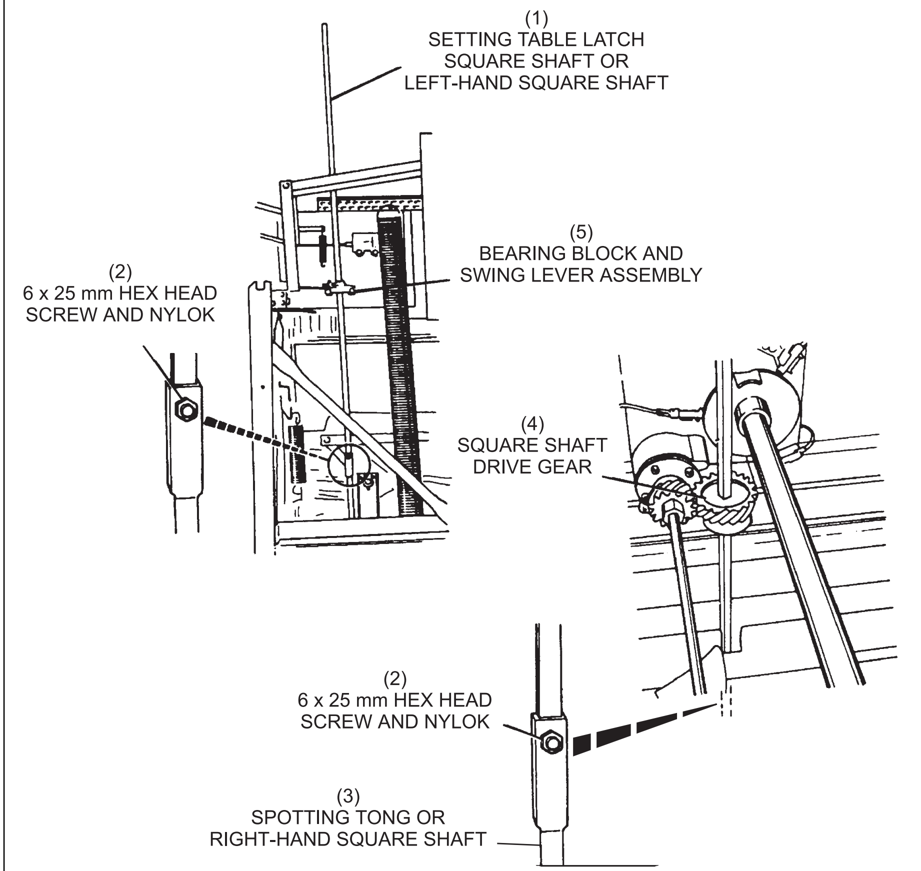

Figure 8-5. Disconnecting Square Shafts.

7. Remove the four upper 16 mm nuts that secure the table to the deck rack tubes. Refer to *Figure 8-6.*

(1) 16 mm NUTS
(2) DECK RACK TUBE
(3) SETTING TABLE STUDS

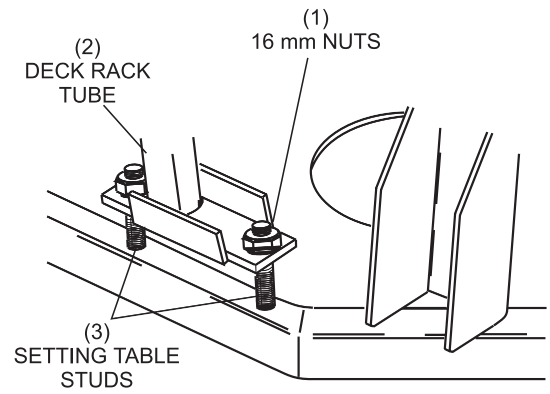

Figure 8-6. Removing Table from Deck Rack Tubes.

NOTE: *If the lower nuts are not moved, it makes leveling the reinstalled deck easier.*

8. Manually rotate the setting table motor pulley to raise the deck rack tubes. Manually lift the sweep to the up position. Refer to *Figure 8-1*.

9. Remove the setting table assembly from the pin deck area.

10. Perform the necessary maintenance or repair.

11. To reinstall, reverse the removal procedure.

Clearing Pins Jammed in Distributor

1. Turn off power.

   a. Universal Electronics: Turn off the high voltage switch on top of the High Voltage box. Remove the high voltage cable connecting the Common box to the High Voltage box.

   b. Consolidated Electronics: Turn the stop/run switch on the Low Voltage box to the stop position. Also, turn off the rear mechanic's on/off switch. If possible, turn off the main power switch on the High Voltage box and remove the incoming 3 phase power.

2. Check for pins jammed at track ejector points. Check for pins jammed at belt turning points. Remove the jammed pins and place them on the outside return belt track.

3. Check the pin ejector assemblies for proper positions.

4. Continuous jams require checking the pin station assemblies for broken parts. Check pin release levers.

5. Upon completion of clearing the jams, replace the high voltage power cable and turn on the high voltage switch.

6. Check pinsetter operation.

Stopping Machine in Mid-Cycle

Universal Electronics: A machine may be stopped in mid-cycle by turning off the high voltage toggle switch on top of the High Voltage box. If internal service work is to be performed, remove the high voltage power cable connecting the Common box to the High Voltage box. Upon completion of work, reconnect the cable, turn on the high voltage switch, and the machine will return to the "ready to bowl" position.

Consolidated Electronics: A machine may be stopped in mid-cycle by turning the stop/run switch on top of the Low Voltage box to the stop position. If internal service work is to be performed, turn off the main power switch and disconnect the incoming 3 phase power.

NOTE: *Removing the incoming 3 phase power will disable both pinsetters. Upon completion of work, reconnect the 3 phase power, turn the High Voltage main power switch on, and turn the stop/run switch to the run position. The machine will return to the "ready to bowl" position.*

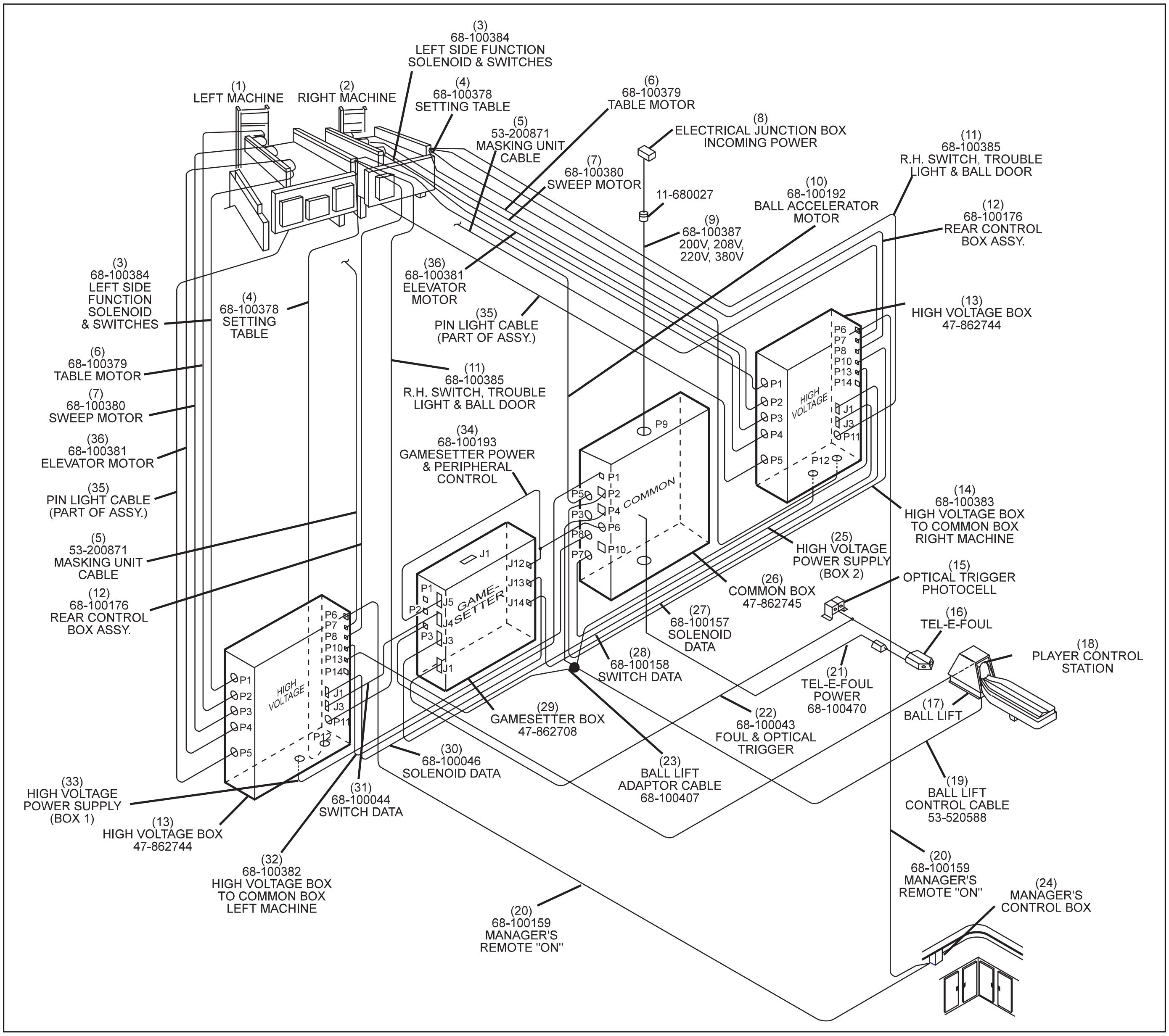

Figure 8-7. Universal Voltage Cable Connections and Routing.

(1)	LEFT MACHINE	(2)	RIGHT MACHINE	(3)	68-100384 LEFT SIDE FUNCTION SOLENOID & SWITCHES
(4)	68-100378 SETTING TABLE	(5)	52-200871 MASKING UNIT CABLE	(6)	68-100379 TABLE MOTOR
(7)	68-100380 SWEEP MOTOR	(8)	ELECTRICAL JUNCTION BOX INCOMING POWER	(9)	68-100387 200 VOLTS, 208 VOLTS 220 VOLTS, 380 VOLTS
(10)	68-100192 BALL ACCELERATOR MOTOR	(11)	68-100385 RIGHT-HAND SWITCH, TROUBLE LIGHT & BALL DOOR	(12)	68-100176 REAR CONTROL BOX ASSEMBLY
(13)	HIGH VOLTAGE BOX 47-862744	(14)	68-100383 HIGH VOLTAGE BOX TO COMMON BOX RIGHT MACHINE	(15)	OPTICAL TRIGGER PHOTOCELL
(16)	TEL-E-FOUL	(17)	BALL LIFT	(18)	PLAYER CONTROL STATION
(19)	BALL LIFT CONTROL CABLE 53-520588	(20)	68-100159 MANAGER'S REMOTE ON	(21)	TEL-E-FOUL POWER 68-100470
(22)	68-100043 FOUL & OPTICAL TRIGGER	(23)	BALL LIFT ADAPTOR CABLE 68-100407	(24)	MANAGER'S CONTROL BOX
(25)	HIGH VOLTAGE POWER SUPPLY (BOX 2)	(26)	COMMON BOX 47-862745	(27)	68-100157 SOLENOID DATA
(28)	68-100158 SWITCH DATA	(29)	GAMESETTER BOX 47-862708	(30)	68-100046 SOLENOID DATA
(31)	68-100044 SWITCH DATA	(32)	68-100382 HIGH VOLTAGE BOX TO COMMON BOX LEFT MACHINE	(33)	HIGH VOLTAGE POWER SUPPLY (BOX 1)
(34)	68-100193 GAMESETTER POWER & PERIPHERAL CONTROL	(35)	PIN LIGHT CABLE (PART OF ASSEMBLY)	(36)	68-100381 ELEVATOR MOTOR

Changing Universal Electronic Assemblies

Upon verifying that an electronic box has failed, the following steps must be taken.

***NOTE**: Changing these boxes makes it easier to diagnose pinsetter defects but experience has shown that problems rarely occur in these units. It is recommended that before the boxes are changed, all other possibilities (i.e. cable connections, adjustments, part failures, etc.) be checked first.*

***NOTE:** The electronic boxes and printed circuit boards must be handled and stored carefully to protect the external connectors and housings from damage. PCBs must be wrapped in black conductive wrap to prevent static damage. When the units are to be sent for repair, they must be carefully packaged in large boxes which have been well-lined with foam rubber, bubble wrap, and/or styrofoam.*

*When an assembly or PCB is received back from an authorized repair center, **immediately** install the part onto a machine to verify that it is functioning properly. By doing so you will get full use of your warranty and guarantee that the spare unit will be working correctly.*

Replacement of High Voltage Box

1. Turn off the high voltage switch on the Common box.

2. Disconnect the power cord connecting the High Voltage box to the Common box. Refer to *Figure 8-8* for location.

(1) DISCONNECTHERE

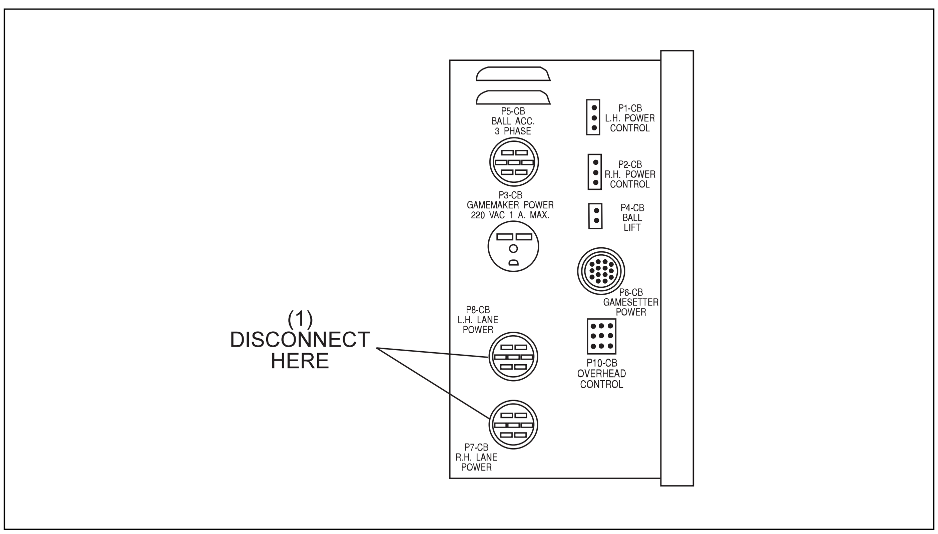

Figure 8-8. Universal Common Box Power Cord Locations.

3. Disconnect three motor cables and pin light cable.

NOTE: *Boxes and cables are labeled at connection points.*

4. Disconnect remaining cables from the High Voltage box.

5. Turn the four Quick-Lock bolts one-half turn to disconnect the High Voltage box from the pinsetter frame.

6. Replace the defective box with a working unit from the spare parts kit.

7. If this does not solve the problem, reevaluate the failure and look for alternative causes for the failure.

8. If changing the box does solve the problem, reinsert the failed unit to make certain the unit has failed. Bad or intermittent connections may make it appear the problem has been solved only to have it reappear later.

9. After confirming the failure, fill out an Electronic Assembly Repair Traveler form and send a copy of the form along with the defective box to your authorized Brunswick Electronic Repair Center or your local Brunswick Distributor. Keep a copy of the form for your records.

Replacement of Common Box

1. Turn off the high voltage switch on the Common box.

2. Disconnect the power cord on top of the Common box.

3. Disconnect the remaining cables from the Common box.

4. Turn the four Quick-Lock bolts one-half turn and remove the Common box from the pinsetter frame.

5. Replace the defective box with a working unit from the spare parts kit.

NOTE*: Boxes and cables are labeled at connection points.*

6. If this does not solve the problem, reevaluate the failure and look for alternative causes for the failure.

7. If changing the box does solve the problem, reinsert the failed unit on another lane pair to make certain the unit has failed. Bad or intermittent connections may make it appear the problem has been solved only to have it reappear later.

8. After confirming the failure, fill out an Electronic Assembly Repair Traveler form and send a copy of the form along with the defective box to your authorized Brunswick Electronic Repair Center or your local Brunswick Distributor. Keep a copy of the form for your records.

9. Check the +5 volt adjustment found in the Adjustment section of this manual.

Replacement of Gamesetter Box

1. Turn off the high voltage switch on the Common box.

2. Disconnect the power drop cord from the Common box.

3. Remove all cable connections to the Gamesetter box.

4. Turn the four Quick-Lock bolts one-half turn and remove the Gamesetter box from the pinsetter frame.

5. Install the replacement Gamesetter box and reconnect *all* Gamesetter cables to their proper location. Refer to *Figure 8-7*.

NOTE: *Boxes are labeled at connection points.*

6. Remove the four cover screws to the replacement Gamesetter box.

7. Set the 8-position DIP switch (SW1) to the binary lane I.D. number. Refer to *Figure 8-9*. Use chart in *Figure 8-10* to determine which switches must be on. The lane number is set to one-half of the even lane number.

NOTE: *If pinsetters are installed with Brunswick Source Command, Command Network, BowlerVision, or Frameworx Systems, the 8-position switch should be set with only position one "on" as indicated in* Figure 8-9.

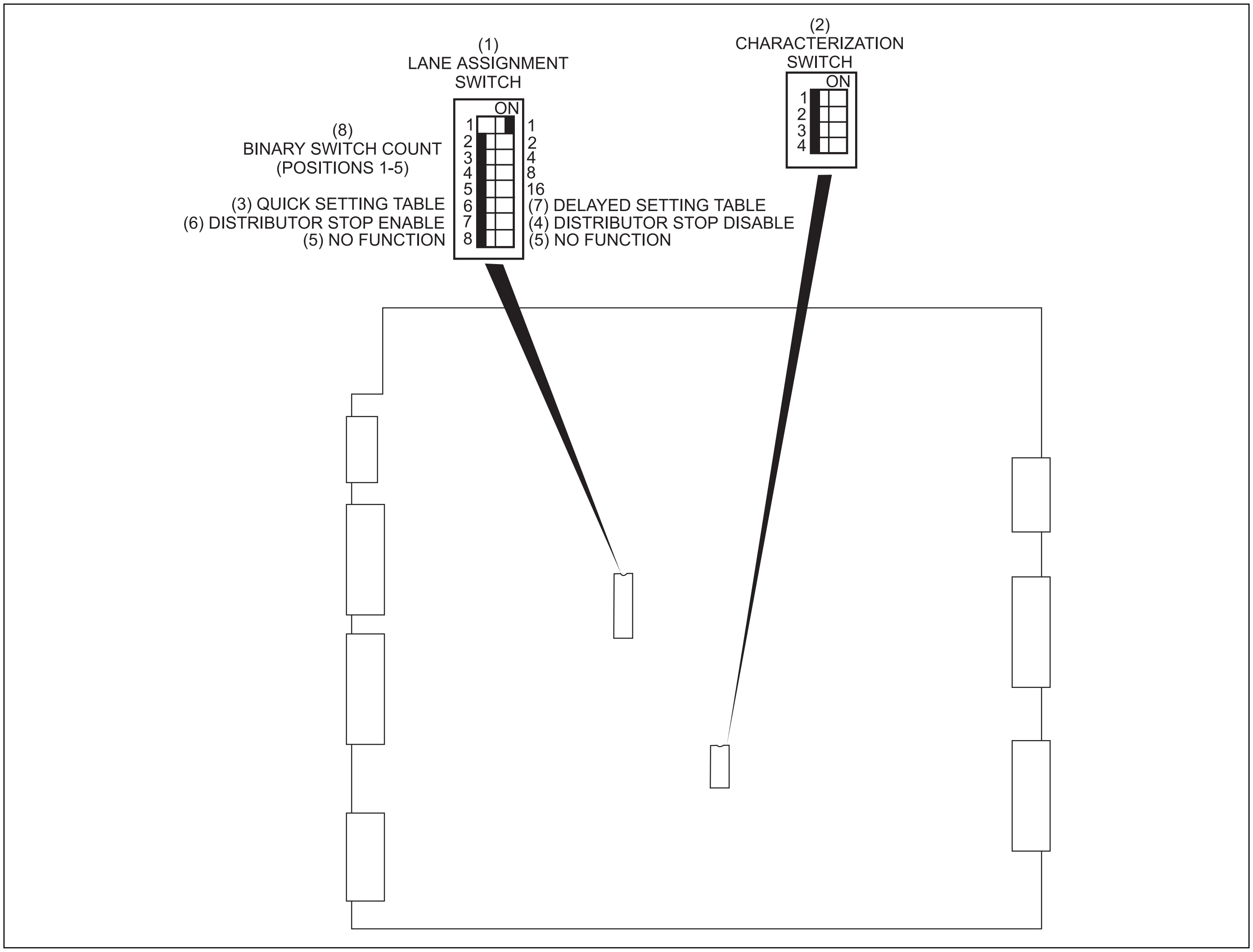

Figure 8-9. Gamesetter Switch Settings.

(1) LANE ASSIGNMENT SWITCH	(2) CHARACTERIZATION SWITCH	(3) QUICK SETTING TABLE
(4) DISTRIBUTOR STOP DISABLE	(5) NO FUNCTION	(6) DISTRIBUTOR STOP ENABLE
(7) DELAYED SETTING TABLE	(8) BINARY SWITCH COUNT (POSITIONS 1-5)	

		# of Lanes	Binary #	Switches (X = On/Right)							
				1	2	3	4	5	6	7	8
Positions 1 - 5 Lane Assignment		2	1	X	-	-	-	-			
		4	2	-	X	-	-	-			
		6	3	X	X	-	-	-			
		8	4	-	-	X	-	-			
		10	5	X	-	X	-	-			
		12	6	-	X	X	-	-			
		14	7	X	X	X	-	-			
		16	8	-	-	-	X	-			
		18	9	X	-	-	X	-			
		20	10	-	X	-	X	-			
		22	11	X	X	-	X	-			
		24	12	-	-	X	X	-			
		26	13	X	-	X	X	-			
		28	14	-	X	X	X	-			
		30	15	X	X	X	X	-			
		32	16	-	-	-	-	X			
		34	17	X	-	-	-	X			
		36	18	-	X	-	-	X			
		38	19	X	X	-	-	X			
		40	20	-	-	X	-	X			
		42	21	X	-	X	-	X			
		44	22	-	X	X	-	X			
		46	23	X	X	X	-	X			
		48	24	-	-	-	X	X			
		50	25	X	-	-	X	X			
		52	26	-	X	-	X	X			
		54	27	X	X	-	X	X			
		56	28	-	-	X	X	X			
		58	29	X	-	X	X	X			
		60	30	-	X	X	X	X			
		62	31	X	X	X	X	X			
Position 6	Delayed Setting Table (Off)								X		
	Quick Setting Table (On)								-		
Position 7	Distributor Stop Disable (On)									X	
	Distributor Stop Enable (Off)									-	
Position 8	Not Available (On or Off)										

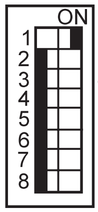

Figure 8-10. 8-Position DIP Switch Position Chart.

(1) DOUBLE DETECT (BOWLERVISION OR FRAMEWORX)
(2) SINGLE DETECT (STAND-ALONE) AUTOMATIC SCORERS WITH SCANNERS OR CCD
(3) DOUBLE DETECT AUTOMATIC SCORERS WITHOUT SCANNERS OR CCD

8. Set the positions of the DIP switch (SW2) to one of the three positions shown in *Figure 8-11*. The positions will depend on which type of scoring system you have.

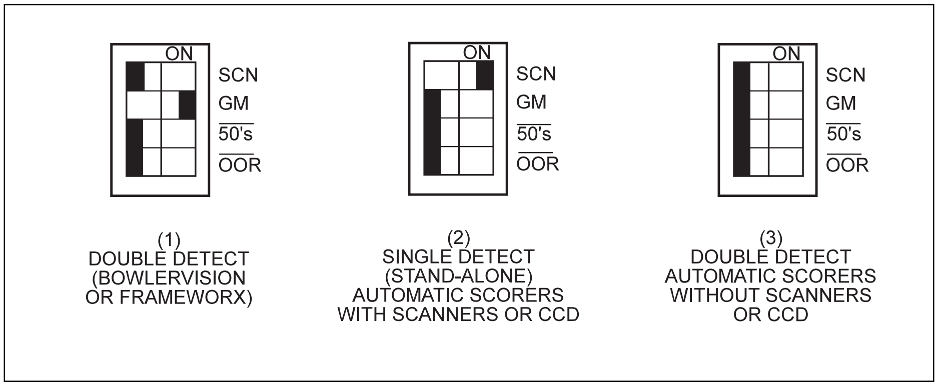

Figure 8-11. Characterization Switch Positions

9. Reconnect the cables and reinsert the power drop cord into the Common box. Refer to *Figure 8-7* for proper cable connections.

10. If the new box does not solve the problem, reevaluate the failure and look for alternative causes for the failure.

11. If changing the box does solve the problem, reinstall the failed box to make certain the unit has failed. Bad or intermittent connections may make it appear the problem has been solved only to have it reappear later.

12. After confirming the failure, fill out an Electronic Assembly Repair Traveler form and send a copy of the form along with the defective unit to your authorized Brunswick Electronic Repair Center or your local Brunswick Distributor. Keep a copy of the form for your records.

Replacement of Player Control Station

1. Turn off power to the Player Control Station (power and transmission signals come from the Gamesetter box, therefore, make certain the pinsetter is turned off.)

2. Remove the ball lift hood.

3. Disconnect the cable from the Player Control Station assembly mounted in the ball lift face panel.

4. Remove the Player Control Station assembly and reinstall a spare unit.

5. If the new assembly does not solve the problem, reevaluate the failure and look for alternative causes for the failure.

6. If changing the assembly does solve the problem, reinstall the failed assembly to make certain the unit has failed. Bad or intermittent connections may make it appear the problem has been solved only to have it reappear later.

7. After confirming the failure, fill out an Electronic Assembly Repair Traveler form and send a copy of the form along with the defective assembly to your authorized Brunswick Electronic Repair Center or your local Brunswick Distributor. Keep a copy of the form for your records.

Changing Consolidated Electronic Assemblies

Occasionally electronic boxes or PCBs will need to be changed in order to troubleshoot pinsetter malfunctions. Keep a written log of malfunctions and what board or assembly was replaced in order to resolve the pinsetter problem. This will dramatically reduce the amount of time required for troubleshooting the pinsetter at a later date.

NOTE: Never *change circuit boards or complete assemblies without troubleshooting related components. It is recommended that before the assemblies are changed, check for the obvious failures such as cable connections, part failures (motors, solenoids, switches and shorted wiring) or misadjustments.*

NOTE: *The electronic boxes and PCBs must be handled and stored carefully to protect the external connectors and housings from damage. PCBs must be wrapped in black conductive wrap to prevent static damage. When the units are to be sent for repair, they must be carefully packaged in large boxes which have been well lined with foam rubber, bubble wrap, and/or styrofoam.*

When an assembly or PCB is received back from an authorized repair center, ***immediately*** *install the part onto a machine to verify that is functioning properly. By doing so you will get full use of your warranty and guarantee that the spare unit will be working correctly.*

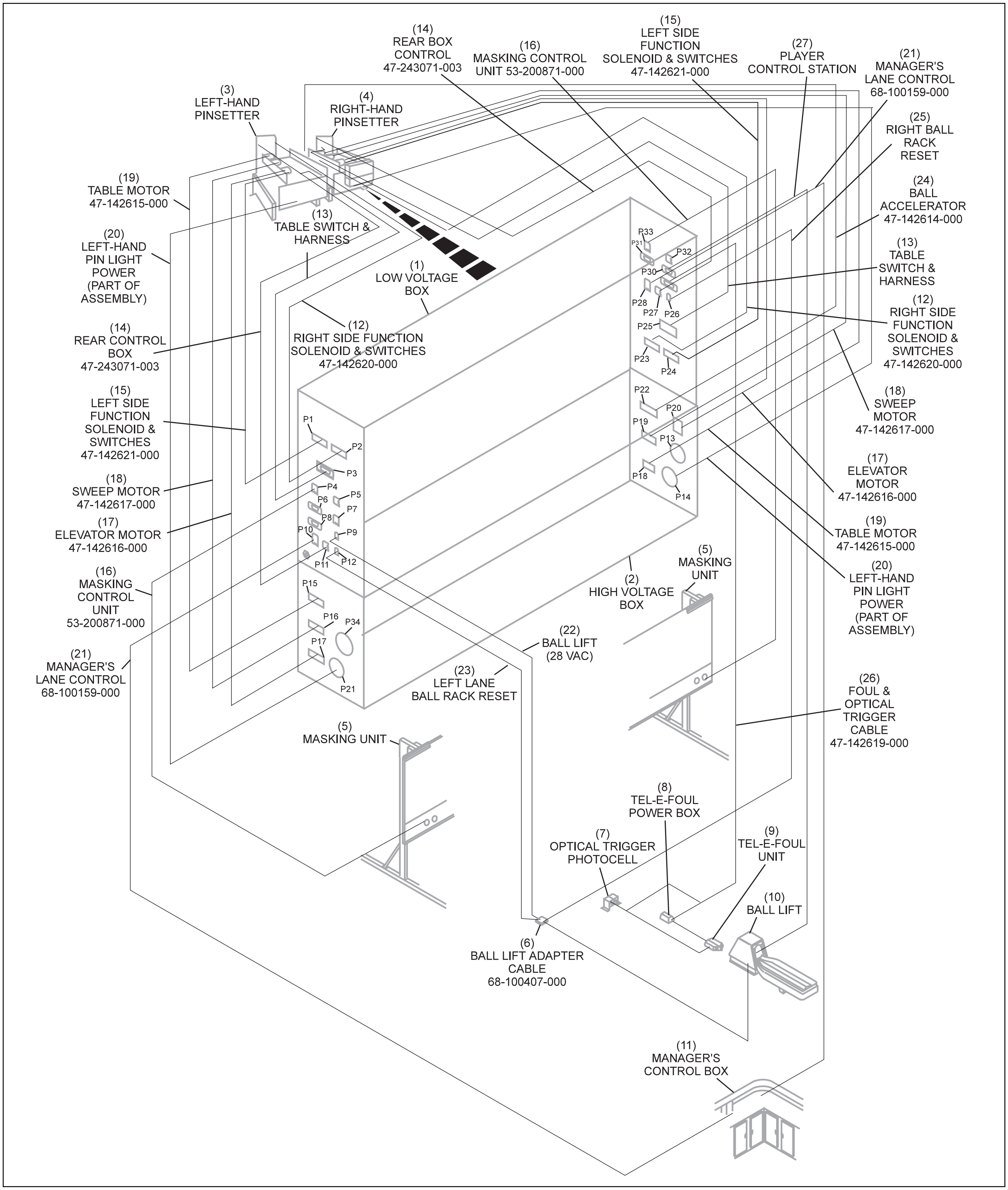

Figure 8-12. Consolidated Voltage Cable Connections and Routing.

Figure 8-12. Consolidated Voltage Cable Connections and Routing.

(1) LOW VOLTAGE BOX
(2) HIGH VOLTAGE BOX
(3) LEFT-HAND PINSETTER
(4) RIGHT-HAND PINSETTER
(5) MASKING UNIT
(6) BALL LIFT ADAPTER CABLE 68-100407-000
(7) OPTICAL TRIGGER PHOTOCELL
(8) TEL-E-FOUL POWER BOX
(9) TEL-E-FOUL UNIT
(10) BALL LIFT
(11) MANAGER'S CONTROL BOX
(12) RIGHT SIDE FUNCTION SOLENOID & SWITCHES 47-142620-000
(13) TABLE SWITCH AND HARNESS
(14) REAR BOX CONTROL 47-243071-003
(15) LEFT SIDE FUNCTION SOLENOID & SWITCHES 47-142621-000
(16) MASKING CONTROL UNIT 53-200871-000
(17) ELEVATOR MOTOR 47-142616-000
(18) SWEEP MOTOR 47-142617-000
(19) TABLE MOTOR 47-142615-000
(20) LEFT-HAND PIN LIGHT POWER (PART OF ASSEMBLY)
(21) MANAGER'S LANE CONTROL 68-100159-000
(22) BALL LIFT (28 VAC)
(23) LEFT LANE BALL RACK RESET
(24) BALL ACCELERATOR 47-142614-000
(25) RIGHT BALL RACK RESET
(26) FOUL AND OPTICAL TRIGGER CABLE 47-142619-000
(27) PLAYER CONTROL STATION

Replacement of Consolidated High Voltage Box (Complete)

Upon verifying that the High Voltage box has failed, the following steps must be taken.

1. Turn off the main power switch (SW9) on the left side of the High Voltage box.

2. Disconnect the incoming 3 phase power cord connected to AC Power In (P34). Refer to *Figure 8-13*.

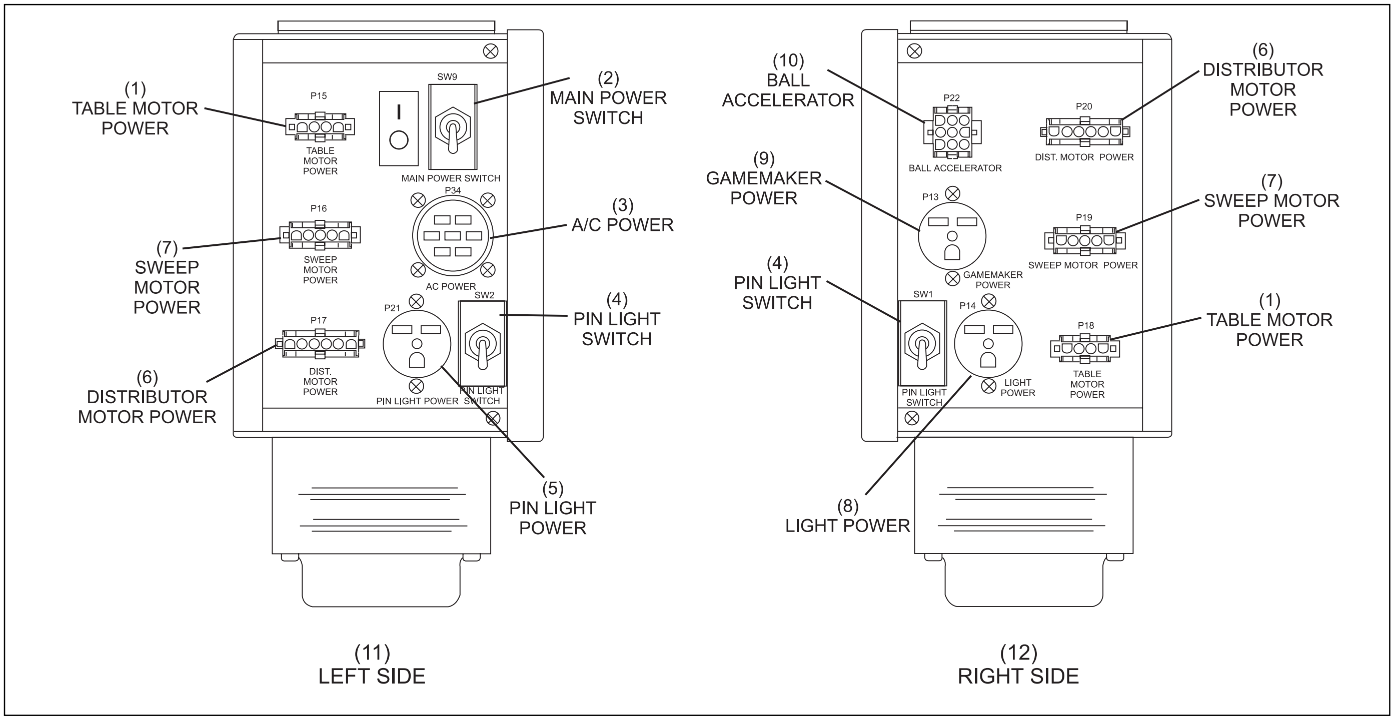

Figure 8-13. Left and Right Side Views - Consolidated High Voltage Box.

(1)	TABLE MOTOR POWER	(2)	MAIN POWER SWITCH	(3)	A/C POWER
(4)	PIN LIGHT SWITCH	(5)	PIN LIGHT POWER	(6)	DISTRIBUTOR MOTOR POWER
(7)	SWEEP MOTOR POWER	(8)	LIGHT POWER	(9)	GAMEMAKER POWER
(10)	BALL ACCELERATOR	(11)	LEFT SIDE	(12)	RIGHT SIDE

3. Disconnect the motor cables (table, sweep, distributor, and accelerator) and the pin light cables from the left and right sides of the High Voltage box. Refer to *Figure 8-13*.

NOTE: *In order to proceed with the following steps, removal of the front cover of the Consolidated Low Voltage box is necessary.*

NOTE: *Use Figures 8-14 and 8-15 for hardware and connector location when proceeding with steps 4 through 8.*

4. Remove J7 and J11 connectors from both I/O PCBs and pull them into the High Voltage box. Refer to *Figure 8-14*.

5. Remove the J13 connector from the CPU PCB and pull it into the High Voltage box. Refer to *Figure 8-14*.

6. Remove P36 (2-wire connector) from the wiring attached to J9 on the CPU PCB. Refer to *Figure 8-14*.

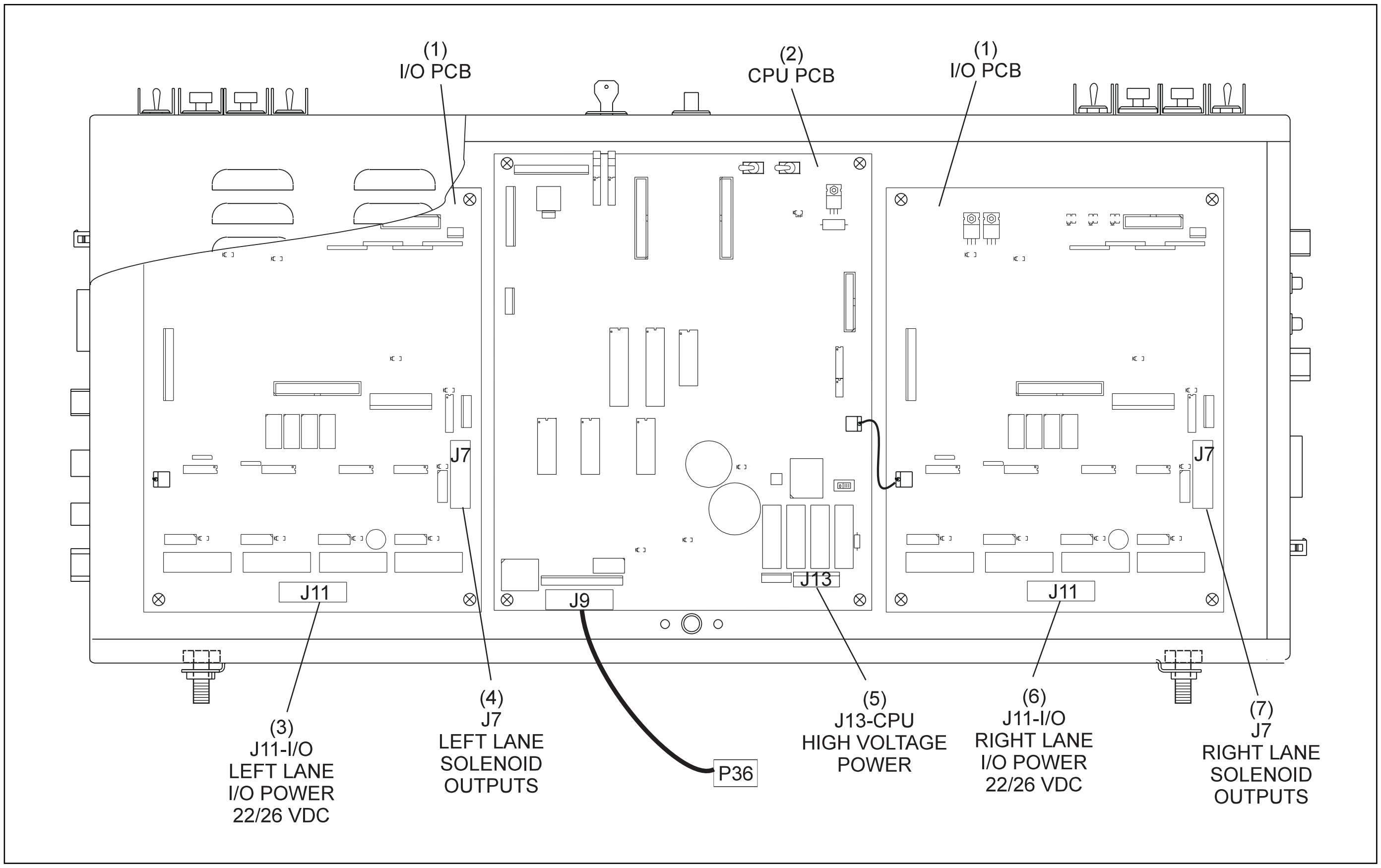

Figure 8-14. Internal View - Consolidated Low Voltage Control Box.

(1) I/O PCB
(2) CPU PCB
(3) J11-I/O LEFT LANE I/O POWER 22/26 VDC
(4) J7 LEFT LANE SOLENOID OUTPUTS
(5) J13-CPU HIGH VOLTAGE POWER
(6) J11-1/O RIGHT LANE I/O POWER 22/26 VDC
(7) J7 RIGHT LANE SOLENOID OUTPUTS

7. Remove the two hex head machine screws (1/4-20 x 3/8”) which secure the bottom of the High Voltage box to the long mounting plate. Refer to *Figure 8-15*.

8. Carefully remove the two 1/4-20 x 3/8” hex head screws which attach the High Voltage box to the Low Voltage box. They are located in the corners at the bottom of the Low Voltage box. Refer to *Figure 8-15*.

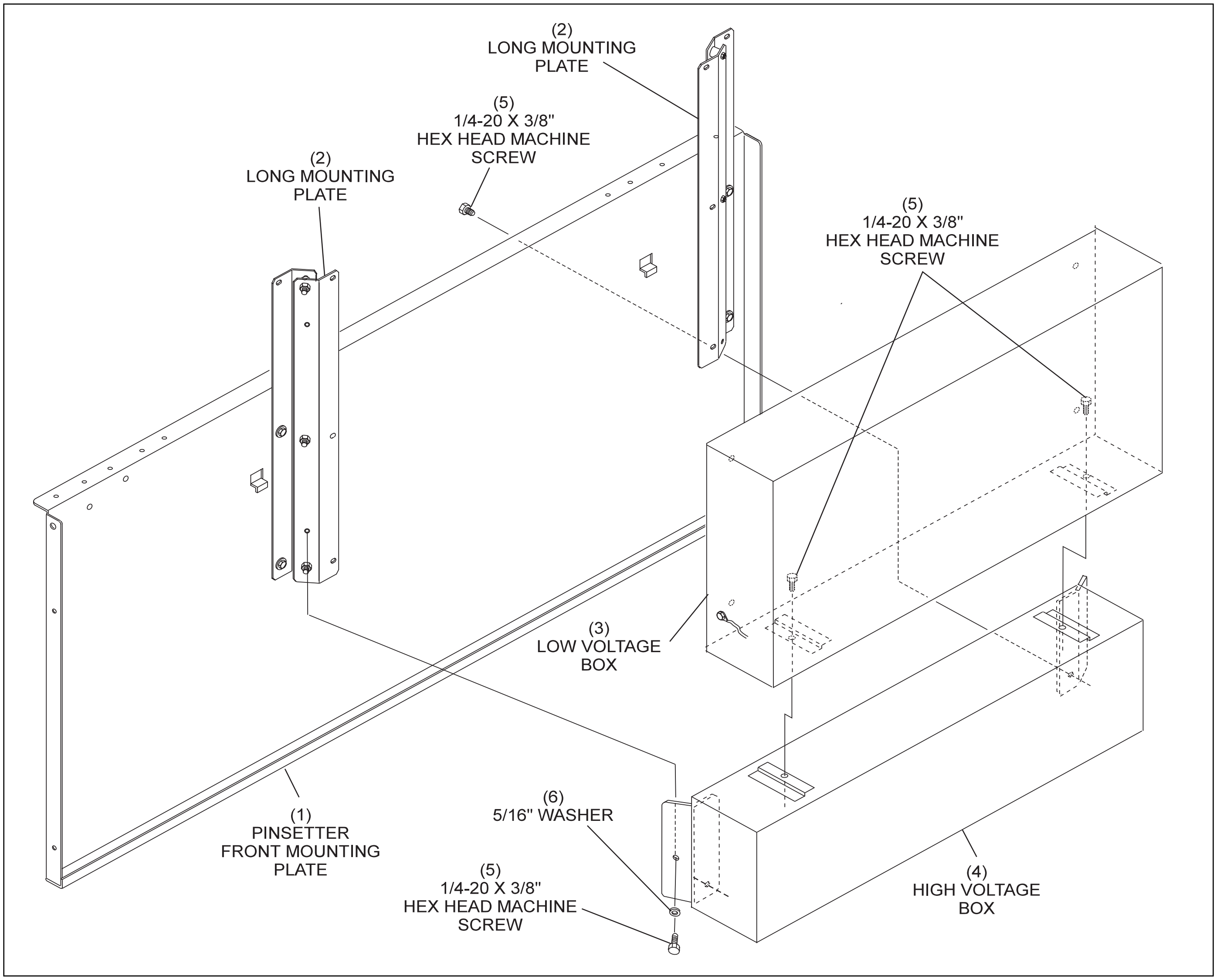

Figure 8-15. Consolidated High Voltage Box and Low Voltage Box Mounting Hardware.

(1) PINSETTER FRONT MOUNTING PLATE	(2) LONG MOUNTING PLATE	(3) LOW VOLTAGE BOX
(4) HIGH VOLTAGE BOX	(5) 1/4-20 X 3/8" HEX HEAD MOUNTING SCREW	(6) 5/16" WASHER

9. The High Voltage box can now be removed as an assembly.

CAUTION: To avoid personal injury and damage to the pinsetter cabling, visually inspect that all wires connected to the left and right side of the High Voltage box have been removed as well as wires connected between the High Voltage box and Low Voltage box.

10. Replace the defective box with a working unit from the spare parts kit or another lane pair that is functioning correctly. Reverse the removal procedure.

11. If this does not solve the problem, reevaluate the failure and look for alternative causes for the failure. Refer to the Troubleshooting section of this manual for other possible causes for the failure.

12. If changing the box does not solve the problem, reinsert the failed unit to make certain the unit has failed. Bad or intermittent connections may make it appear the problem has been solved only to have it reappear later.

13. Sometimes troubleshooting individual components can determine whether to replace the defective parts or send the complete unit to an authorized distributor for repair. If the unit needs to be sent back, fill out an Electronic Assembly Repair Traveler form and send a copy of the form along with the defective box to your authorized Brunswick Distributor. Keep a copy of the form for your records.

NOTE: *A copy of this form is in Appendix B of this manual.*

Replacement of the Consolidated Low Voltage Box (Complete)

1. Turn off the main power switch (SW9) on the left side of the High Voltage box. Refer to *Figure 8-13*.

2. Disconnect the incoming 3 phase power cord connected to AC Power In P34. Refer to *Figure 8-13*.

3. Disconnect all the external cables attached to the right and left side of the Low Voltage box, including the ground strap. Refer to *Figure 8-16*.

(1) LEFT SIDE LOW VOLTAGE BOX
(2) RIGHT SIDE LOW VOLTAGE BOX
(3) GROUND STRAP

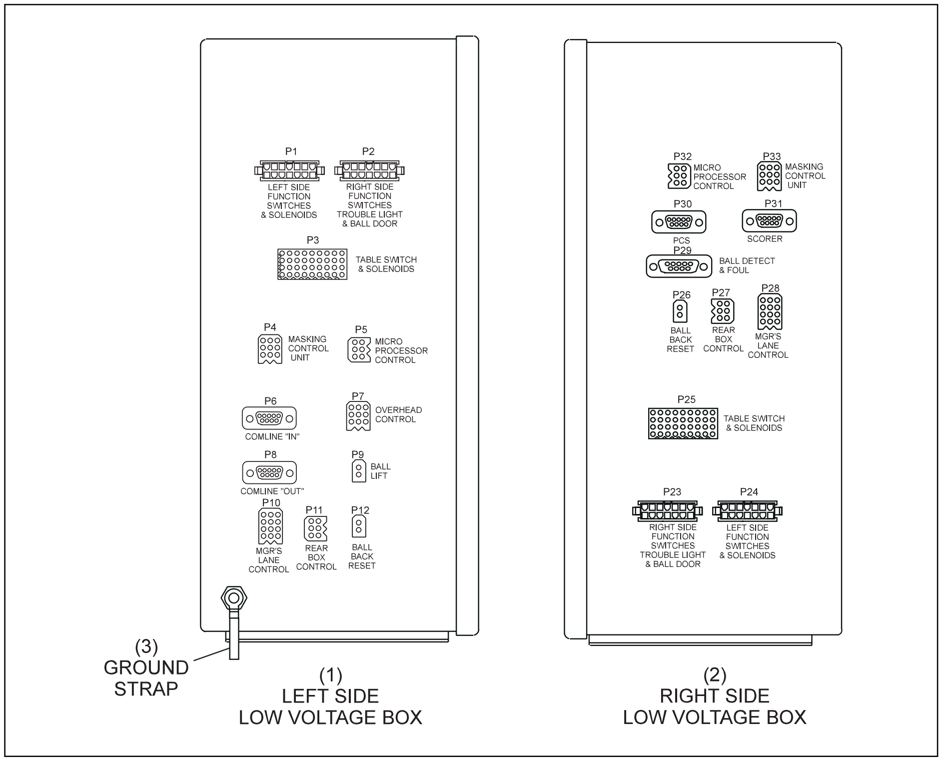

Figure 8-16. Left and Right Side Views - Consolidated Low Voltage Box.

NOTE: *Remove the front cover to the Low Voltage box before proceeding with the following steps.*

4. Remove J7 and J11 connectors from both I/O PCBs and pull them into the High Voltage box. Refer to *Figure 8-14*.

5. Remove the J13 connector from the CPU PCB and pull it into the High Voltage box. Refer to *Figure 8-14*.

6. Remove P36 (2-wire connector) from the wiring attached to J9 on the CPU PCB. Refer to *Figure 8-14*.

7. Remove the four 1/4-20 x 3/8” hex head screws that secure the Low Voltage box to the long mounted plates located on the front of the left pinsetter on a pair of lanes. Also remove the two 1/4-20 x 3/8” hex head screws that help support the High Voltage box. This hardware attaches the High and Low Voltage boxes together. Refer to *Figure 8-17*.

CAUTION: To avoid personal injury and damage to pinsetter cabling, visually inspect that all wires connected to the left and right sides of the Low Voltage box have been removed as well as wires connected between the High and Low Voltage boxes.

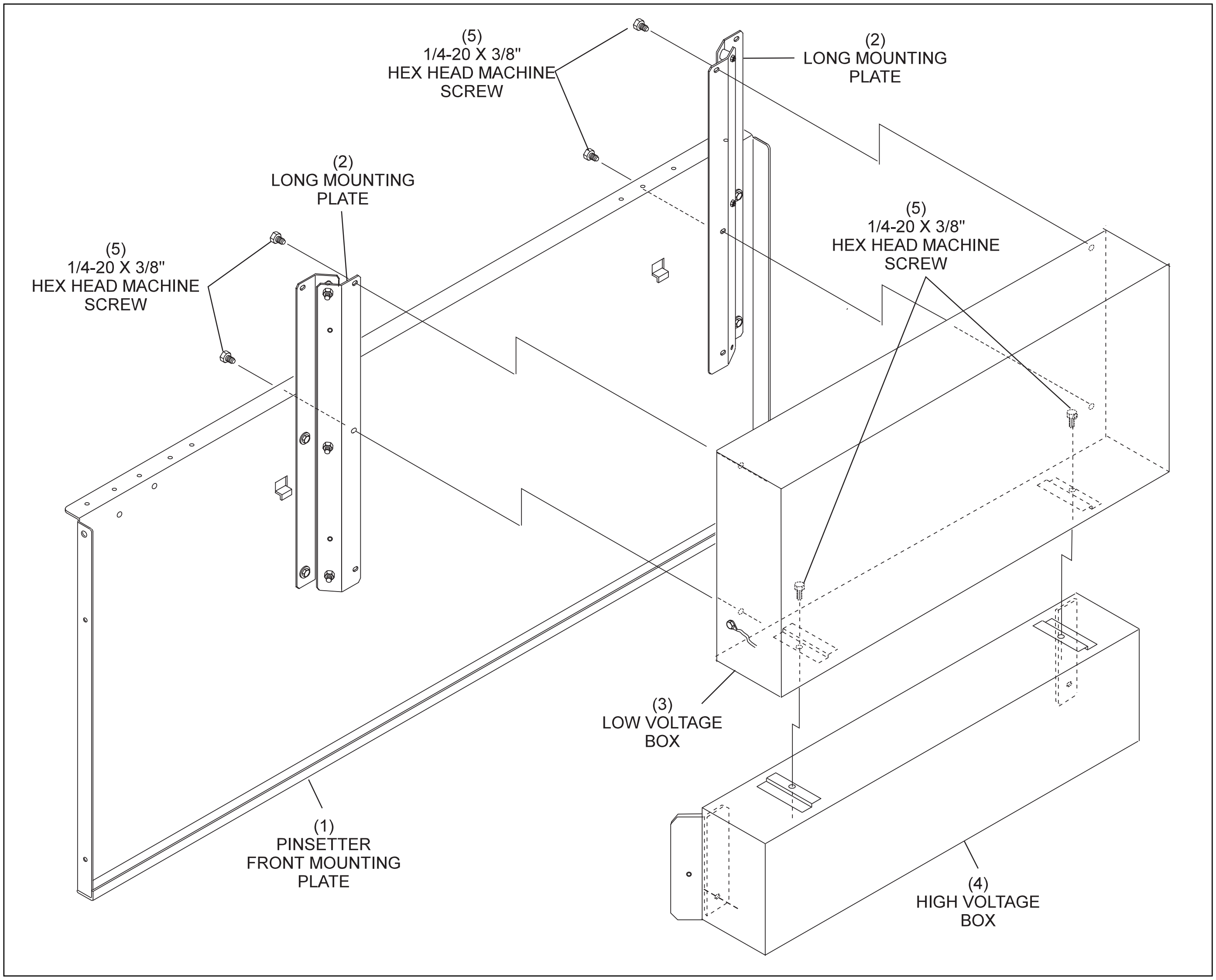

Figure 8-17. Consolidated High Voltage Box and Low Voltage Box Attaching Hardware.

(1) PINSETTER FRONT MOUNTING PLATE	(2) LONG MOUNTING PLATE	(3) LOW VOLTAGE BOX
(4) HIGH VOLTAGE BOX	(5) 1/4-20 X 3/8" HEX HEAD MACHINE SCREW	

8. Replace the defective box with a working unit from a spare parts kit or another lane pair that is functioning correctly. Reverse the procedure described above to correctly reattach all the cables and hardware.

9. Check the +5 volts adjustment at the CPU PCB. Refer to the Adjustments section of your service manual for a detailed description.

10. Confirm that the switch settings are correct on the characterization (4-position DIP) and the lane assignment (8-position DIP) switches located on the CPU PCB. Use the removed assembly to verify these settings. Refer to the Consolidated Electronics section for the switch settings that apply to your operating environment.

11. If this does not solve the problem, reevaluate the failure and look for alternative causes for the failure. Refer to the Troubleshooting section of this manual for other possible causes.

12. If changing the box does not solve the problem, reinsert the failed unit to make certain the unit has failed. Bad or intermittent connections may make it appear the problem has been solved only to have it reappear later.

13. Further troubleshooting can determine which printed circuit board in the assembly needs to be replaced. If the unit or an individual circuit board needs to be sent back, fill out an Electronic Assembly Repair Traveler form and send a copy of the form along with the defective box to your authorized Brunswick Distributor. Keep a copy of the form for your records.

Replacement of Consolidated Low Voltage I/O PCBs

If it is determined that one pinsetter in a lane pair is malfunctioning, replacement of either the left or right I/O PCB may restore the pinsetter to normal operation.

NOTE: *The two I/O PCBs in a Low Voltage box are identical and can be interchanged with each other to troubleshoot a specific lane problem.*

Follow the steps below to safely replace a defective I/O PCB.

1. Turn off the main power switch (SW9) on the left side of the High Voltage box. Refer to *Figure 8-13*.

2. Disconnect the incoming 3 phase power cord connected to AC Power In (P34). Refer to *Figure 8-13*.

NOTE: *Remove the front cover of the Low Voltage box before proceeding with the following.*

CAUTION: Be careful when removing and replacing all connectors from printed circuit boards. Failure to do so could cause major damage to the PCBs involved. DO NOT remove any connectors by pulling on the wires that attach to them. Instead, firmly grasp the connector and remove it from the PCB.

3. Disconnect J1 through J11 connectors from the I/O board. Refer to *Figure 8-18* for the location of each connector.

4. Remove the green ground wire connected to SPADE 3. Refer to *Figure 8-18*.

5. Remove the five phillips head screws that secure the I/O PCB to the Low Voltage box. Refer to *Figure 8-18*.

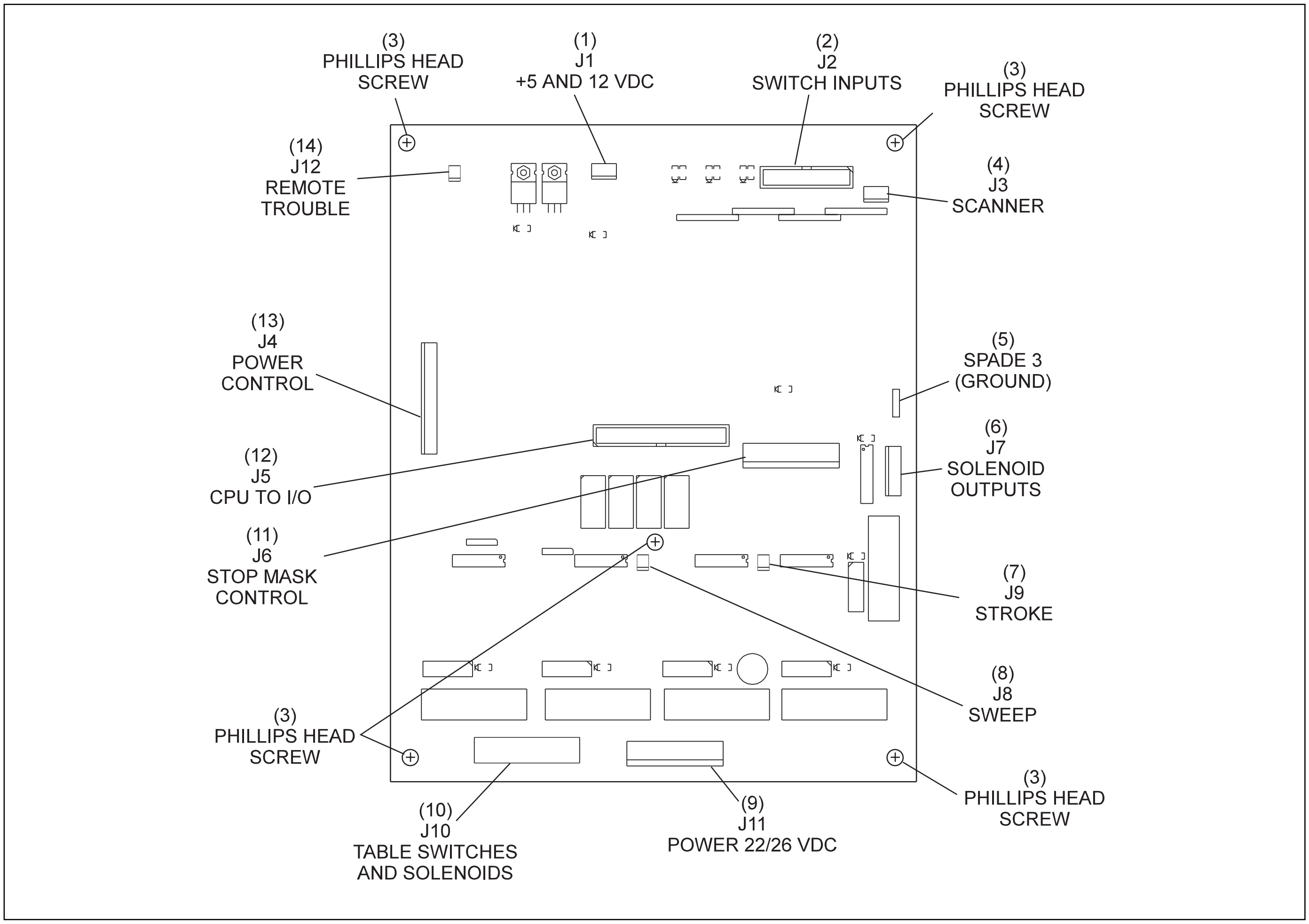

Figure 8-18. Consolidated Low Voltage Box I/O PCB Removal.

(1)	J1 +5 AND 12 VDC	(2)	J2 SWITCH INPUTS	(3)	PHILLIPS HEAD SCREW
(4)	J3 SCANNER	(5)	SPADE 3 (GROUND)	(6)	J7 SOLENOID OUTPUTS
(7)	J9 STROKE	(8)	J8 SWEEP	(9)	J11 POWER 22/26 VDC
(10)	J10 TABLE SWITCHES AND SOLENOIDS	(11)	J6 STOP MASK CONTROL	(12)	J5 CPU TO I/O
(13)	J4 POWER CONTROL	(14)	J12 REMOTE TROUBLE		

6. At this point, the I/O PCB can be removed. Brunswick recommends that you install the suspect board into another lane pair to verify that the board is malfunctioning.

7. If this does not solve the problem, reevaluate the failure and look for alternative causes for the failure. Refer to the Troubleshooting section of this manual for other possible causes.

8. If changing the printed circuit board solves the problem on the malfunctioning pinsetter but moves the problem to the lane in which you exchanged the board, remove the defective board. If the circuit board will be sent in for repair, fill out an Electronic Assembly Repair Traveler form and send a copy of the form along with the defective board to your authorized Brunswick distributor. Keep a copy of the form for your records.

Replacement of Consolidated Low Voltage CPU PCB

If a malfunction is affecting both lanes of a lane pair, and all the associated cables and connectors have been checked, the Consolidated Low Voltage CPU PCB may be defective.

Follow the steps below to successfully replace a defective CPU PCB.

1. Turn off the main power switch (SW9) on the left side of the High Voltage box. Refer to *Figure 8-13*.

2. Disconnect the incoming 3 phase power cord connected to AC Power In (P34). Refer to *Figure 8-13* for the location.

NOTE: *Remove the front cover of the Low Voltage box before proceeding with the following steps.*

CAUTION: Be careful when removing and replacing all connectors from printed circuit boards. Failure to do so could cause major damage to the PCBs involved. DO NOT remove any connectors by pulling on the wires that attach to them. Instead, firmly grasp the connector and remove it from the PCB.

3. Disconnect J1 through J12 connectors from the I/O PCB. Refer to *Figure 8-18*.

4. Remove the green ground wires connected to SPADE 2 and 3. Refer to *Figure 8-19*.

5. Remove the eight phillips head screws that secure the CPU PCB to the Low Voltage box. Refer to *Figure 8-19*.

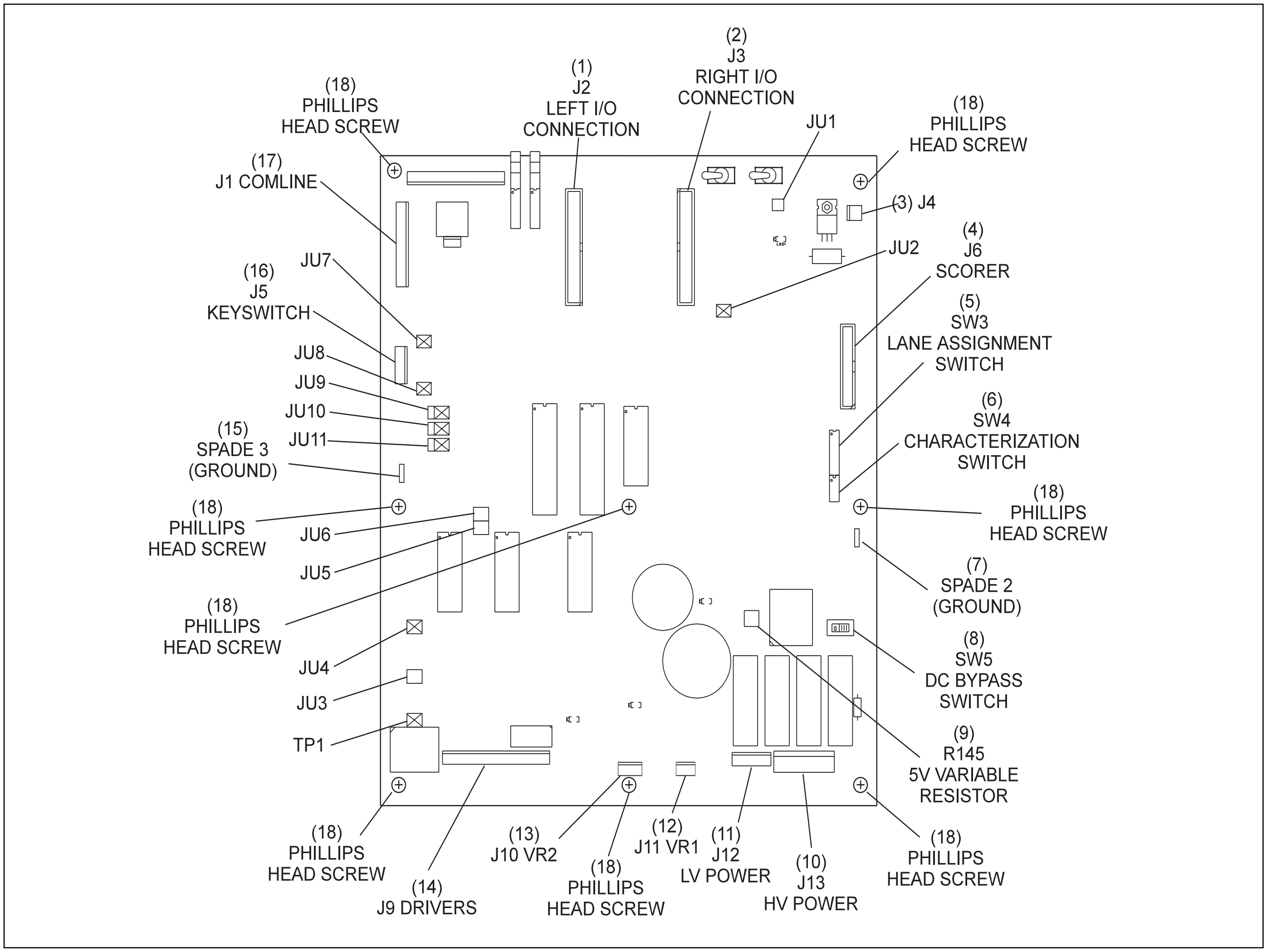

Figure 8-19. Consolidated Low Voltage Box CPU PCB Removal.

(1) J2 LEFT I/O CONNECTION	(2) J3 RIGHT I/O CONNECTION	(3) J4
(4) J6 SCORER	(5) SW3 LANE ASSIGNMENT SWITCH	(6) SW4 CHARACTERIZATION SWITCH
(7) SPADE 2 (GROUND)	(8) SW5 DC BYPASS SWITCH	(9) R145 5 V VARIABLE RESISTOR
(10) J3 HIGH VOLTAGE POWER	(11) J12 LOW VOLTAGE POWER	(12) J11 VR1
(13) J10 VR2	(14) J9 DRIVERS	(15) SPADE 3 (GROUND)
(16) J5 KEYSWITCH	(17) J1 COMLINE	(18) PHILLIPS HEAD SCREW

6. At this point, the CPU PCB can be removed. Brunswick recommends that you install the suspect board into another lane pair to verify that the board is defective before returning it for repair.

7. Before installing the replacement board, be sure that jumpers JU1 through JU11 are properly connected. Use the removed board as a reference. Refer to *Figure 8-19* for location.

8. Verify that the lane assignment and characterization switches are set to the correct operating environment. Use the remove board as reference. Refer to *Figure 8-19* for location.

9. Check the +5 volts adjustment on the CPU PCB. Refer to the Adjustments section of the service manual for a detailed description.

10. If this does not solve the problem, reevaluate the failure and look for alternative causes for the failure. Refer to the Troubleshooting section of this manual for other possible causes.

11. If changing the printed circuit board solves the problem on the malfunctioning pinsetter but moves the problem to the lane in which you exchanged the board, remove the defective board. If the circuit board will be sent in for repair, fill out an Electronic Assembly Repair Traveler form and send a copy of the form along with the defective board to your authorized Brunswick distributor. Keep a copy of the form for your records.

Round Belt Repair and Replacement

The GS-Series pinsetter uses green polycord belts of various lengths to move pins through the transport band, elevator and distributor. These belts stretch and become loose and slip on their pulleys. They also crack and break which is a result of a normal aging process.

If the belt stretches and becomes loose, you may cut out a section of the belt and reweld it to the proper length. The belt is 12 mm in diameter when new. Once the belt has stretched and been recut several times, its diameter will be reduced. This will decrease its gripping power and effectiveness in handling pins. Belts with a diameter under 10 mm or showing cracks should be replaced to keep this area reliably handling pins.

Welding Round Belts

1. *Figure 8-15* gives nominal lengths of all distributor belts. The dotted lines represent belts that are not factory installed.

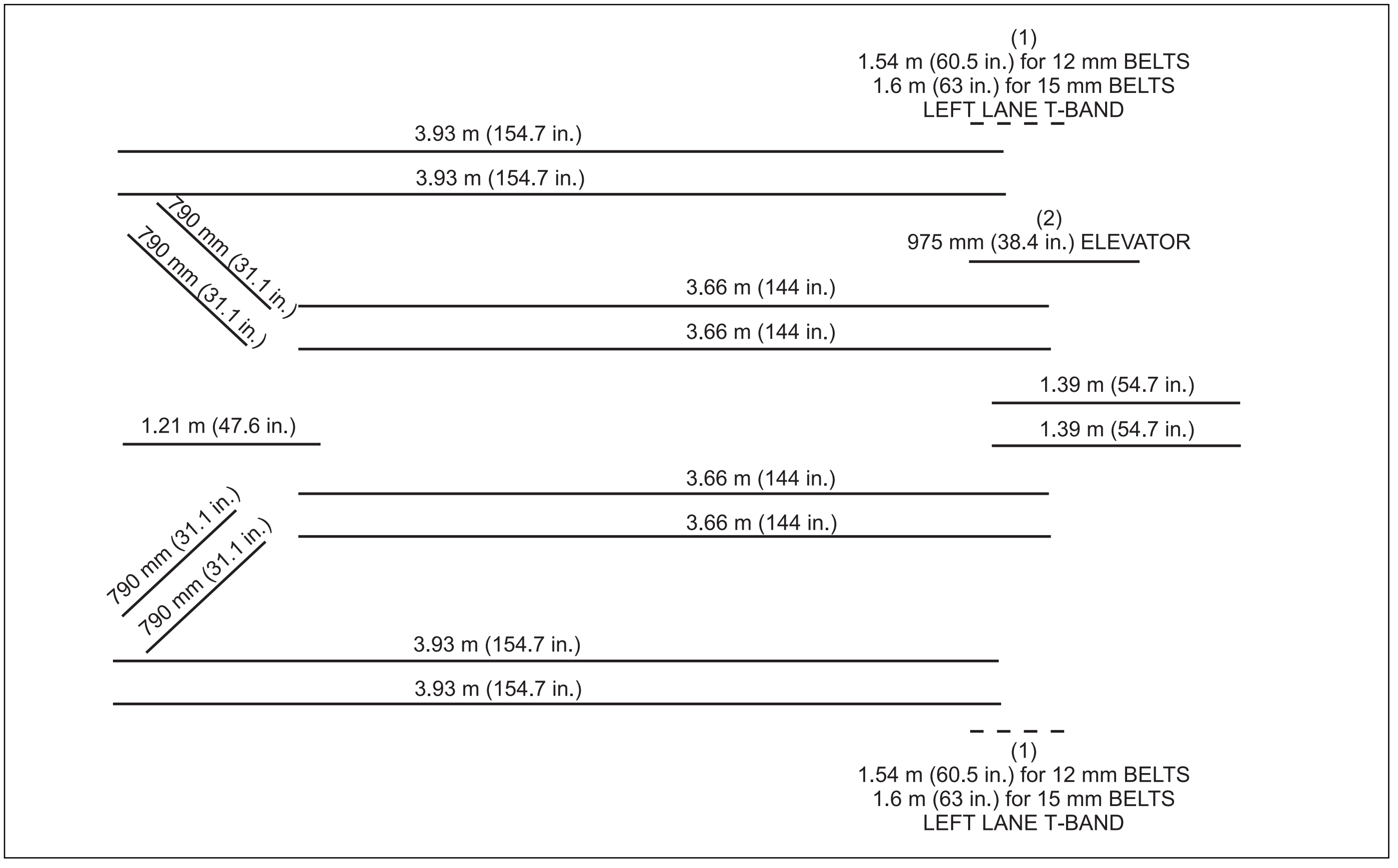

Figure 8-20. Round Belt Lengths.

(1) 1.54 m (60.5 in.) FOR 12 mm BELTS
1.6 m (63 in.) FOR 15 mm BELTS
LEFT LANE TRANSPORT BAND

(2) 975 mm (38.4 in.) ELEVATOR

2. Cut off both ends of the belt neatly and vertical to the belt axis with the belt cutter found in your belt welding kit.

3. Pull the belt around the shaft the pulleys are mounted on.

4. Place each belt end in the belt holder so they are *slightly* pressed together. Refer to *Figure 8-21*.

5. Push the soldering iron blade between them and heat the belt.

NOTE: *Both ends of the belt must be on the same axis on both sides of the blade.*

6. As soon as the belt begins to melt, tighten the knurling screws of the holder slightly.

7. When a pad of melted polycord has formed, withdraw the soldering iron. Refer to *Figure 8-21*.

8. Tighten the knurling screws.

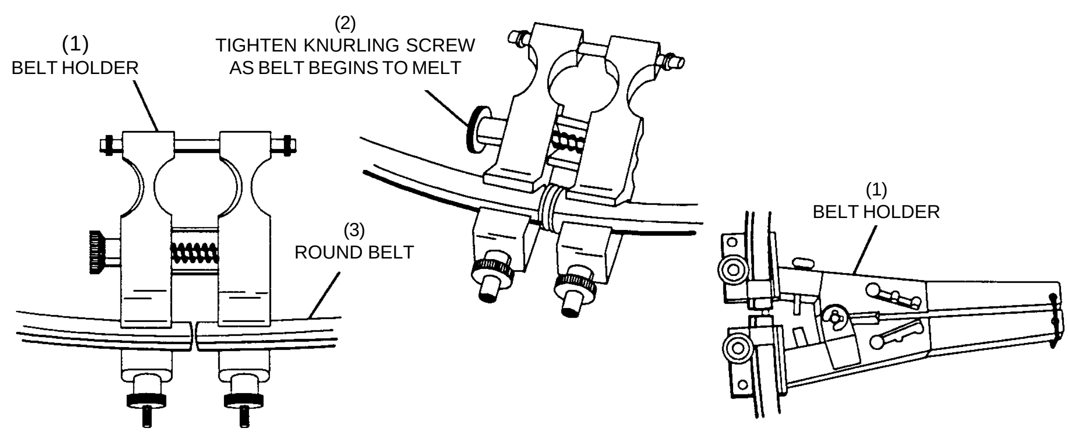

Figure 8-21. Welding Round Belts.

(1) BELT HOLDER (2) TIGHTEN KNURLING SCREW AS BELT BEGINS TO MELT (3) ROUND BELT

NOTE: *DO NOT OVERTIGHTEN. The melted polycord will be pushed out and the cold polycord left in the center will not form a weld.*

9. Allow to cool for approximately two minutes.

10. Cut the bead from around the belt with a sharp knife or single edge razor blade.

11. Wait another 5-10 minutes.

12. Install the belt onto the pulleys.

Changing Spotting Tongs

If a spotting tong becomes damaged and needs to be removed for repair, use the following instructions.

1. Turn off the power.

   a. Universal Electronics: Turn off the High Voltage box toggle switch and the Mechanic's Rear Control Box toggle switch to prevent anyone else from starting the pinsetter while you are servicing this machine. Disconnect power to the High Voltage box if you will be leaving the machine unattended.

   b. Consolidate Electronics: Turn the Low Voltage stop/run switch to the stop position and the mechanic’s rear control box toggle switch to the off position to prevent anyone else from starting the pinsetter while you are servicing the machine. Disconnect power to the High Voltage box if you will be leaving the machine unattended.

2. Turn on the Pin Light Bypass switch to assist you in removal of the spotting tongs.

3. Manually lower the setting table onto a jack stand or other suitable support.

NOTE: *If suspending the setting table on the stroke limiter plate, it must still be supported by a jack stand or some means of support to prevent the table from dropping if the stroke limiter is bumped or slips.*

4. Turn the spotting tong square shaft until the spotting tongs are open completely. The “ST” switch should be closed. Refer to *Figure 8-22*.

(1) CLOSED STOP
(2) OPEN STOP
(3) GEAR RACK
(4) SPOTTING TONG SWITCH CLOSED
(5) RIGHT-HAND SQUARE SHAFT

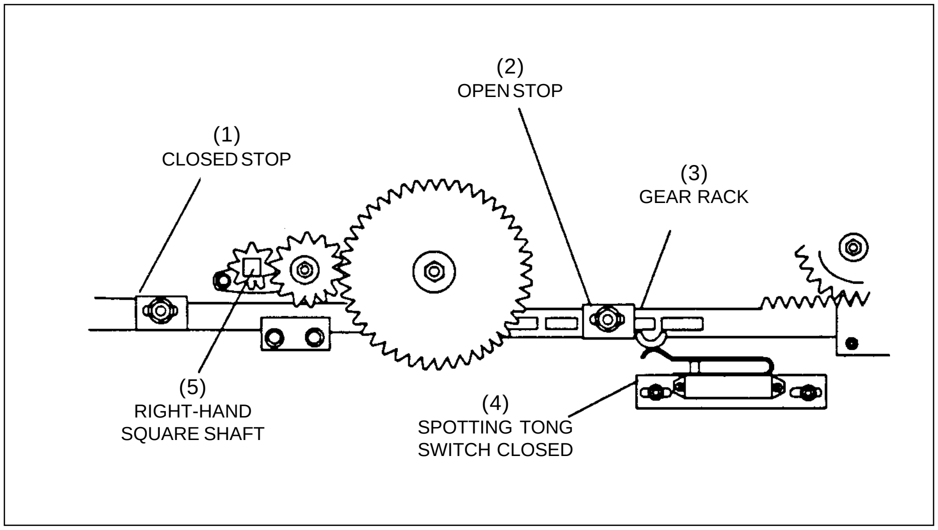

Figure 8-22. Spotting Tongs Open.

(1) REMOVE HARDWARE AND REMOVE TONGS

5. Remove the hardware holding the spotting tongs to the setting table. Refer to *Figure 8-23*. Retain the hardware. To keep the tongs timed properly, it is advisable to only remove one set of tongs at a time.

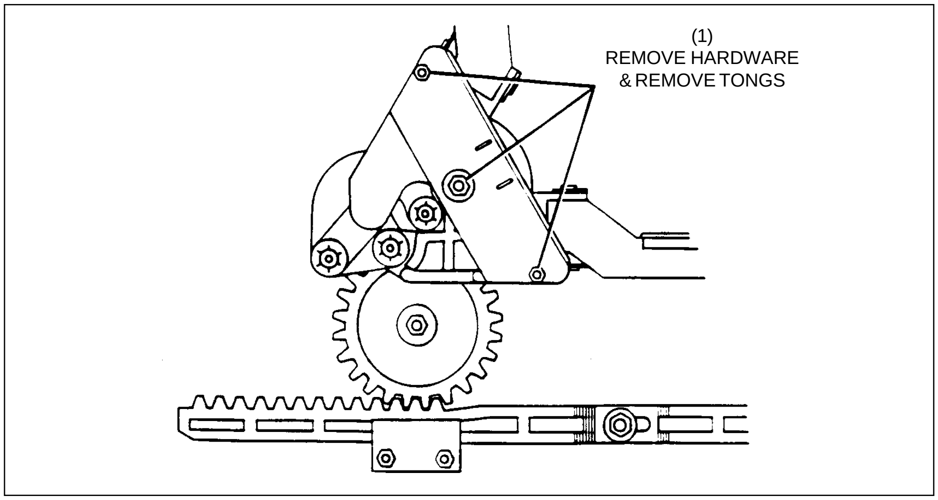

Figure 8-23. Spotting Tongs Open.

(1) SPOTTING TONGS PIN STATIONS 1, 4, 5, AND 6
(2) SPOTTING TONGS PIN STATIONS 2, 3, 7, 8, 9, AND 10

6. When replacing the tongs, select the correct type depending on the position of the tongs in the table. Refer to *Figure 8-24*. If the cover plate is not on at this time, close the tongs, align the holes and install the cover plate.

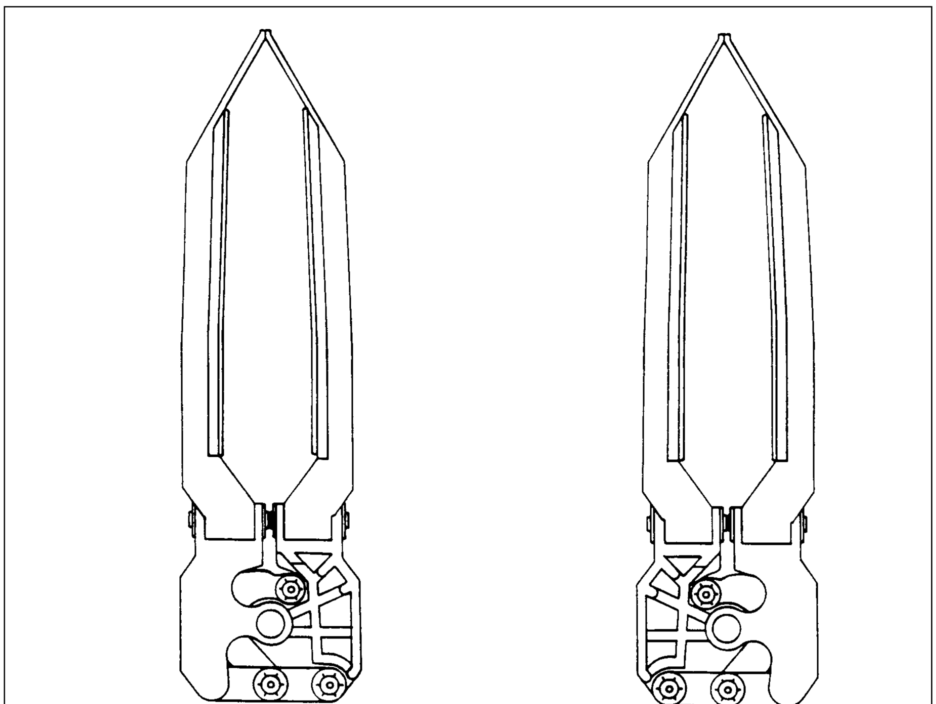

Figure 8-24. Spotting Tongs.

7. Turn the gear on the bottom of the assembly until the tongs are completely open to the stop. Refer to *Figure 8-25*.

(1) TURN GEAR TO OPEN TONGS
(2) TONGS MUST BE COMPLETELY OPEN TO THE STOP

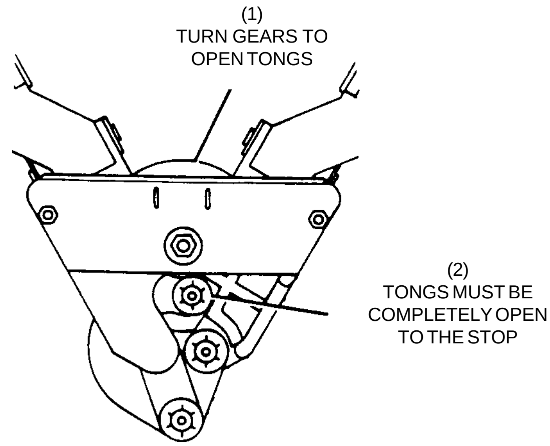

Figure 8-25. Spotting Tongs Completely Open.

8. Place the open spotting tongs on the setting table so the gears mesh. Reinstall the mounting hardware through the cover plate and the mounting holes.

9. Manually rotate the square shaft to close and reopen the tongs to check for proper movement of the tongs.

Spotting Tong Clutch And Shaft Removal Procedure

NOTE: *Disconnect incoming power to the Universal Common box or Consolidated High Voltage box before proceeding with the removal of the spotting tong clutch and shaft.*

1. When removing the spotting tong clutch and shaft, loosen the 3 mm allen head set screw which secures the clutch shaft gear to the shaft and slide it toward the spotting tong clutch. *Figure 8-26*.

2. Remove the four 5 mm allen head socket screws which hold the spindle flange to the switch cluster assembly.

(1) CLUTCH SHAFT GEAR
(2) SPINDLE FLANGE
(3) ALLEN HEAD BOLTS
(4) SWITCH CLUSTER ASSEMBLY
(5) SET SCREW

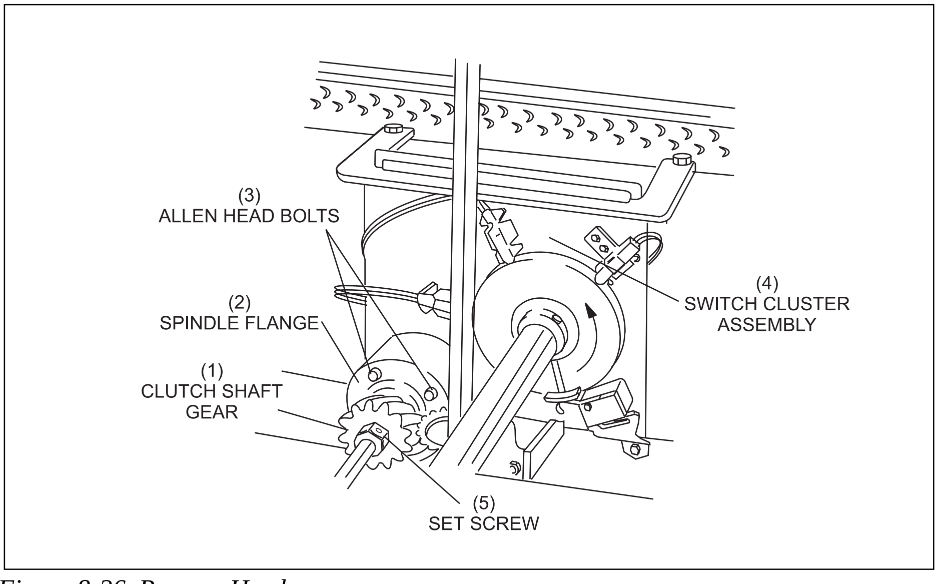

Figure 8-26. Remove Hardware.

3. Slide the shaft out of the spotting tong solenoid and remove it from the pinsetter.

4. Disassemble the clutch assembly by compressing the clutch spring with the spring tightener and rotating the spring tightener to the open slot. By doing so, the clutch assembly can then be disassembled.

5. Clean all the components with a water based cleaner and a dry towel. When reassembling the clutch, position the shiny sides of the two clutch discs to contact the clutch gear. *Figure 8-27*.

6. Compress the clutch spring tighter in the middle notch. Use Adjustment #30 as a guide.

(1) SPINDLE SHAFT
(2) CLUTCH DISCS
(3) 3 NOTCHES USED FOR ADJUSTING
(4) SAFETY CLUTCH
(5) CLUTCH GEAR

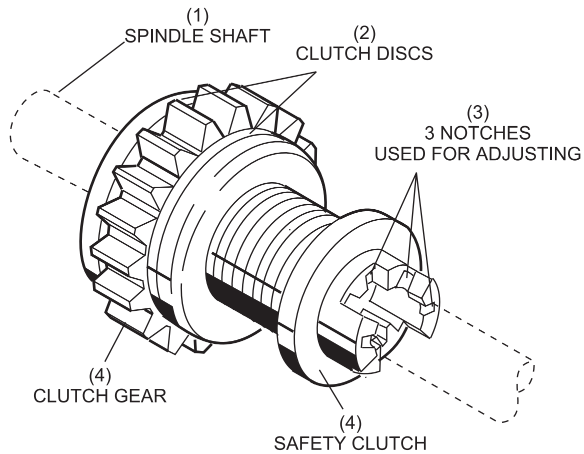

Figure 8-27. Reassembling Clutch.

Spotting Tong Clutch and Shaft Reinstallation

1. Reinstall the spotting tong clutch and shaft, reversing the removal procedure. One millimeter (1 mm) of side play in the shaft should exist when it is reinstalled to prevent binding in the assembly.

2. To increase the side play, hold the clutch shaft gear and move the shaft toward the switch cluster. To decrease the side play, move the shaft toward the spotting tong clutch. Lock the set screw and verify 1 mm of side play exists.

3. Make the second half of Adjustment 30.

4. Operate the pinsetter to verify the spotting tong clutch is operating correctly.

Changing Motors

The GS-Series Pinsetter uses three different motors. If a motor has to be changed, use the following guidelines.

Motor Removal

1. Turn off the power.

    a. Universal Electronics: Turn off the HV power toggle switch on the High Voltage box. Remove the High Voltage box power cable from the Common box.

    b. Consolidated Electronics: Turn the stop/run switch on the Low Voltage box to the stop position. Turn off the high voltage main power switch and disconnect the incoming 3 phase power.

2. Unplug the motor from the High Voltage box.

3. Table Motor - if the motor being changed is the table motor, manually lower the table onto a jack stand or all the way down to the new pin setting height. The table chain and crank arm should be in a straight line. Do not lower the table onto the stroke limiter plate; bumping or vibrating the pinsetter may cause it to slip and damage the pinsetter or cause serious injury to the person working on the machine.

4. Sweep Motor - if the motor being changed is the sweep motor, drop the sweep into the guard position.

5. Lift up against the belt tensioner spring and remove the "V" belt from the pulley.

6. Remove motor support bracket from the left drive frame and lift the motor out of the pinsetter.

7. Remove the motor wire cover plate and disconnect the four wires attached to the terminal block and ground screw.

Motor Pulley

If a pulley is to be removed from a defective motor and installed on a replacement motor, care must be exercised in putting the pulley on in the correct direction. Some distributor and table motors have a dual pulley. The smaller side (55 mm) is for use when the pinsetter is powered by a 60 cycle (60 hz) supply. The larger size (65 mm) is used when the power supplied is 50 cycles (50 hz). Refer to *Figure 8-28*. The sweep motor pulleys and accelerator pulleys are the same for 50 and 60 cycle. Motor pulleys that are put on backward can result in pin handling problems in the distributor and lowering the table too fast and causing pinfall errors and excessive wear on the stroke limiter assembly and setting table.

(1) 60 CYCLE SIDE
(2) 50 CYCLE SIDE

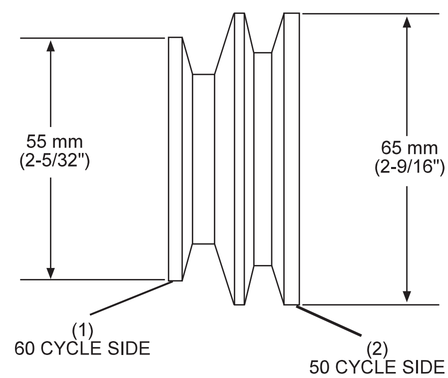

Figure 8-28. Dual Pulley.

Motor Pulley Removal

1. Loosen the pulley's set screw with a 3 mm Allen wrench (hex key) and save.

2. Use a gear puller to slide the pulley off the shaft. Note and save the key.

Motor Pulley Installation

1. Make certain the key is properly seated in the motor shaft.

2. Tap the pulley onto the shaft with a soft faced hammer.

3. Align the pulley so that the “V” belt will ride in the center of the motor pulley and the large drive pulley.

4. Tighten the set screw to prevent the pulley from moving out of position.

Motor Rewiring

When replacing a defective motor with a spare, it will be necessary to swap the cable from the old motor to the replacement. Make sure that the cable is unplugged from the High Voltage box before starting the wiring transfer. It is necessary that the replacement motor be wired for the proper three phase voltage. *Figures 8-29* and *8-30* illustrate how the wiring straps should be arranged for a 220-240 volt system and for a 380-420 volt system. The table and sweep motors have electrical brakes that work only on the 220/240 volts. Use caution in making sure you have attached the wires and positioned the straps properly as the replacement motor's terminal block may be backward in relation to the motor you are removing.

(1) MOTOR WIRING FOR 220 TO 240 VOLTS
(2) MOTOR CABLE FROM HIGH VOLTAGE BOX
(3) GROUND
(4) WIRING STRAPS
(5) BRAKE 220 V
(6) GROUND CONNECTION

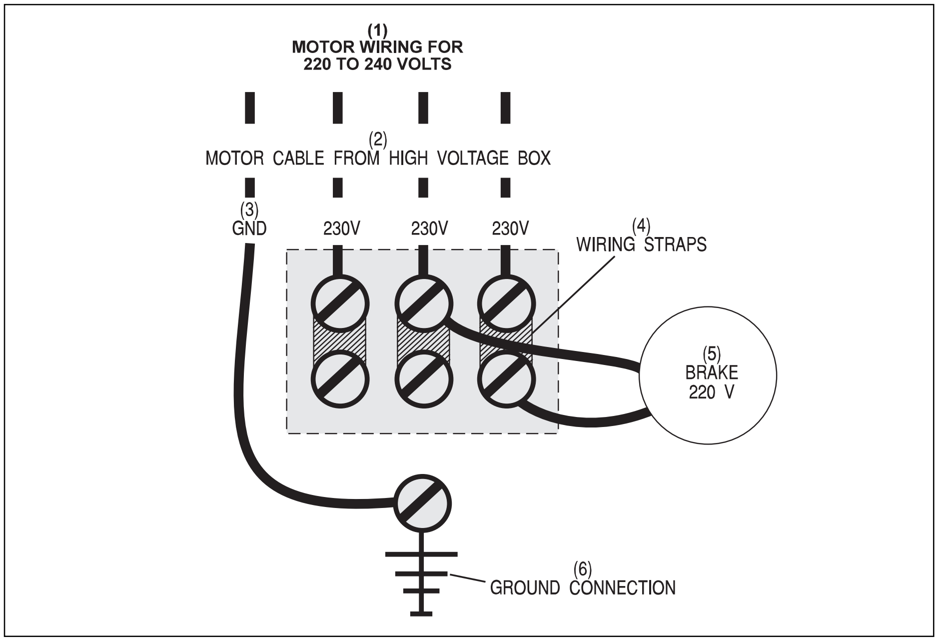

Figure 8-29. 230 Volt Motor Connection.

(1) MOTOR WIRING FOR 380 TO 420 VOLTS
(2) MOTOR CABLE FROM HIGH VOLTAGE BOX
(3) GROUND
(4) WIRING STRAPS
(5) BRAKE 220 V
(6) MOTOR WIRING BLOCK
(6) GROUND CONNECTION

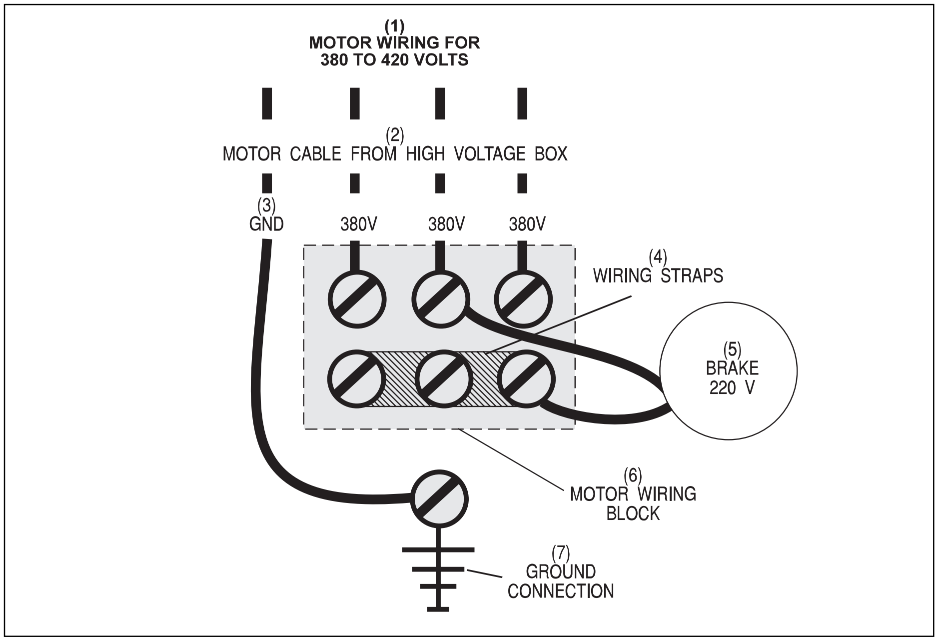

Figure 8-30. 380 Volt Motor Connection.

Motor Rotation

After the wiring has been completed, it will be necessary to check for proper motor rotation. Reinstall the motor into the pinsetter, put the "V" belt back on and plug the cable back into the High Voltage box. Turn on the pinsetter briefly and watch the rotation for proper direction as noted *:

* Table Motor - Watch the table cam. It should leave the "A" switch and go to the "B" switch when making a detection stroke.

* Sweep Motor - Watch the cam on the crank arm on the right side of the pinsetter. It must leave the "SM" switch in the 3 o'clock position and go toward the 12 o'clock position.

* Distributor Motor - Watch the green pin handling belts. Make sure they move the pins through the distributor in the proper direction. Running in a reverse direction can cause a shovel jam in the elevator.

Accelerator Motor - Check that the large belt will propel the ball forward.

If a motor is running backward, all that is needed is to swap any two of the three supply wires connected to the motor's terminal block. This will reverse the direction of the motor shaft.

WARNING: Never swap the ground (earth) wire with one of the supply wires.

Motor Brake Replacement

The electric motor brake has a coil which disengages the brake when power is applied to the motor and the brake. When the power is turned off, the brake grips the motor shaft. This prevents coasting and stops the motor and holds what it operates (the table or sweep) in that position until power is applied again.

If the brake fails to release the motor shaft or allows coasting, it may be necessary to change the break as follows:

1. Turn off the pinsetter at the High Voltage box.

2. Unplug the motor from the High Voltage box.

3. Remove the motor from the pinsetter. Refer to the Motor Replacement section of this manual.

4. Remove the brake wiring terminal cover and disconnect the two wires for the brake coil. Refer to *Figure 8-31*.

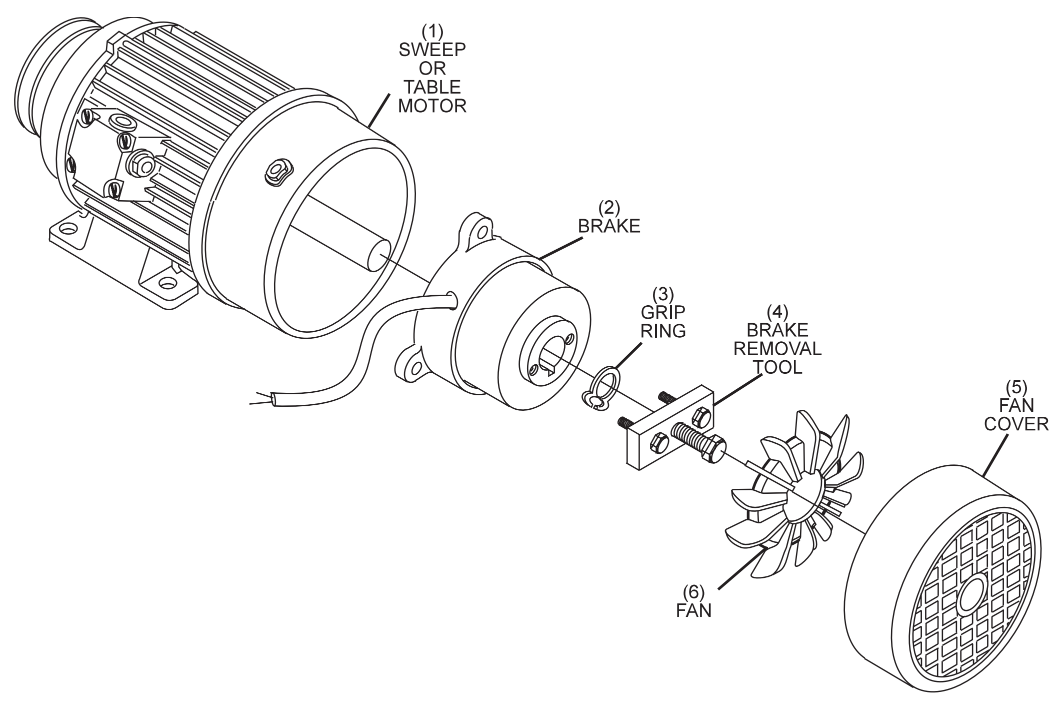

Figure 8-31. Motor Brake Replacement

(1) SWEEP OR TABLE MOTOR	(2) BRAKE	(3) GRIP RING
(4) BRAKE REMOVAL TOOL	(5) FAN COVER	(6) FAN

5. Remove the three fan cover screws and the fan cover.

6. Gently pry off the plastic fan. (Use two medium size screw drivers to apply even pressure to both sides.)

7. Remove the three mounting screws that hold the brake housing onto the motor.

8. Remove the large grip ring on the shaft with a strong pair of snap ring pliers. Caution, wear safety glasses for this operation.

9. Attach the brake removal tool which can be purchased from Brunswick. Consult the Drive Frame section of your Service Parts Catalog. Refer to *Figure 8-31*.

10. Tighten the large center bolt of the brake removal tool to pull the brake off the motor shaft.

11. Install the new brake using a soft face (plastic) hammer to avoid damaging the brake and motor shaft.

12. Start with step "8" and work back to "1" to complete the installation of the new brake.

Chain Repair or Replacement

The elevator, table lift, sweep lift and motor shaft chains may need repair or replacement. Brunswick offers a repair kit to assist you in the repair of your chain. Consult the Elevator section of your Brunswick Service Parts catalog for ordering this kit.

The elevator chains are different than the other chains. These chains have longer pins that fit into the end of the pit shovel shaft. When repairing or replacing these chains, it is necessary to keep the pins on both chains running evenly to allow the shovels to lift the pin shovel horizontally.

Chain Repair

1. Remove the chain from the pinsetter.

2. Install the chain repair tool in a vise as illustrated in *Figure 8-32*.

3. Place the pin of the link you wish to place over the bottom hole in the repair tool. Tighten the repair tool to push out through the bottom hole.

(1) CHAIN REPAIR TOOL
(2) BENCH VISE

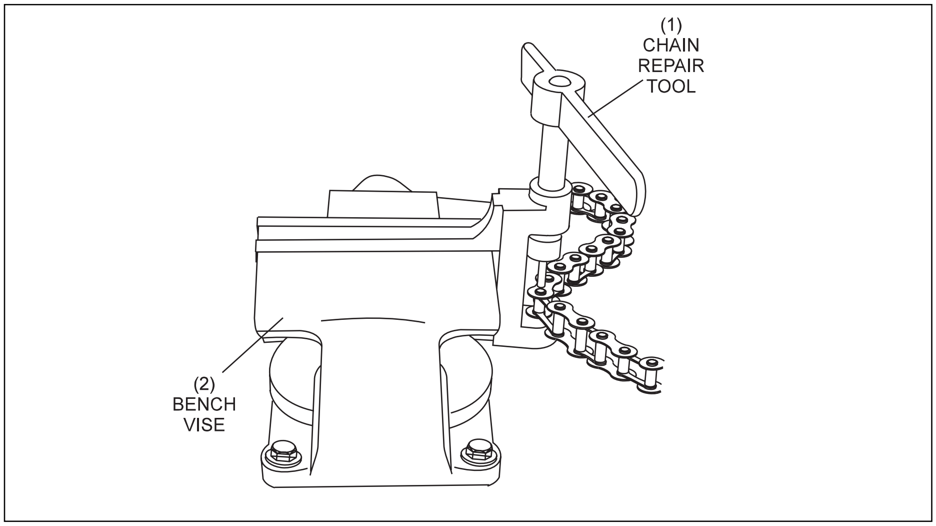

Figure 8-32. Chain Repair Using Vice.

4. Repeat this procedure on the other end of the links to be replaced.

5. Install a master link between the new and old section of chains.

6. Place the cap on both pins of the master link. Refer to *Figure 8-33*.

7. Slide the clip-on spring over the cap and into the notches until both pins are securely locked.

(1) CLIP-ON SPRING
(2) CAP
(3) MASTER LINK

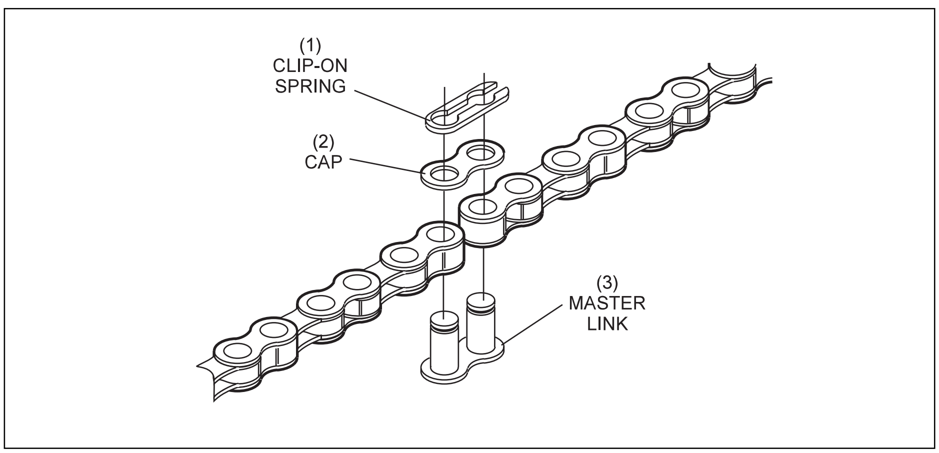

Figure 8-33. Chain Repair.

Chain Replacement

If you are installing a new chain, use a master link to connect both ends of the chain. Use steps 5, 6 and 7 of the Repair procedure.

Adjust the chain for the proper tension or adjustment using the adjustment section of this manual.

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Preventive Maintenance

The performance of scheduled preventive maintenance is the most important responsibility of the pinsetter mechanic. Properly performed preventive maintenance will decrease the malfunction rate, prevent major breakdowns and lengthen the life of the pinsetter.

Scheduled preventive maintenance should be instituted as soon as the pinsetters are installed. Do not wait until the pinsetters are dirty and operating poorly to start the program. The job is simple if done correctly, but if the work is neglected and allowed to get ahead of the mechanic, the situation will very shortly become unmanageable.

It is a very poor practice to rely on memory in servicing any machinery. An example of a typical work schedule is included that will allow you to track the maintenance as it is being done. The following pages of this section list step by step guidelines on what should be done and how often. Careful study of the contents of this section and proper use of the work schedule will result in clean, well operating machines and in addition, will greatly lengthen the useful life of your pinsetters.

Materials Required for Preventive Maintenance

- Standard tools required for adjustment and assembly of the GS-Series Pinsetter. (Brunswick sells a basic GS-Series Tool Kit which contains most of the basic tools required to service these pinsetters.)

- Vacuum cleaner - tank style

- Small paint brush

- Cleaning cloths

- Bucket and scrubbing brush (and/or a scrubbing mop)

- Oil can with long rigid or flexible spout

- Lubricating oil (light machine oil - 30 weight non-detergent) - such as
  Brunswick Part No. 11-676353-000 (1 gallon container)

- Lubricating grease - medium duty non-lithium - such as
  Brunswick Part No. 12-700120-002 (3 each 3 1/2 oz. cartridges)
  Brunswick Part No. 11-676305-000 (1 each 14 oz. cartridge)
  Lubriplate “1200-2”
  Mobil “M-437-SL”

- Grease Needles “Vita”
  Brunswick Part No. 12-700126-000 (12 each Needles)

- Grease Gun with needle adaptor
  Brunswick Part No. 12 700120-000

- Hydraulic Fluid - such as
  Brunswick Part No. 34-205052-000 (1 each 3 1/2 oz. can)
  Mobil “DTE II”

- General purpose cleaner - a non-residue detergent type such as
  Brunswick Zip Cleaner Part No. 62-860085-005 (5 gallon container)

- Brunswick Pinsetter Cleaner - Part No. 62-860083-005 (5 gallon container)

- Chain Lubricant - such as
  Lubriplate “Chain & Cable Fluid” (Part No. 13563)

Maintenance Schedule

This schedule is designed to be used as a guideline for keeping the machines running at their best. A detailed description of each item on this schedule is given later in this chapter.

Daily Maintenance

All Machines Daily

1. Check stop sheet for each pinsetter.
2. Check stop sheet at the manager's control desk.
3. Troubleshoot, repair or adjust all reported failures.
4. Clean shark switch pin guide assemblies.
5. Change pin wipes in the overflow chutes.
6. Check the position of each transport band and adjust if necessary.
7. Completely clean one pinsetter.
8. Clean one lane pair of pins.

Weekly Maintenance

1/4 of all Machines Per Day - Monday, Tuesday, Wednesday and Thursday

9. Clean the transport band with a general purpose cleaner.
10. Check for worn "V" belts that are cracked, split or causing motors to bounce.
11. Check the green belts for proper tension on the distributor, elevator and transport band drives.
12. Check all hydraulic shock absorbers for leakage; verify proper operation.
13. Check all ball door shaft collars and split pins/hitch pins.
14. Check the overflow socks for wear and proper alignment.

Monthly Maintenance

1/4 of All Machines Each Friday

15. Clean the front of the ball cushion and the pit curtain.

16. Check and tighten all fastening screws on the ball cushion.

17. Check and tighten all fastening screws on the transport band boards.

18. Examine the setting table cable conduits for damage.

19. Check the ball door locking mechanism for proper adjustment.

20. Check the pin feed deflectors for proper clearance above the transport band.

21. Check the fluid levels of the hydraulic shock absorbers.

22. Lubricate all items listed in the monthly section of the Lubrication Schedule.

23. Clean distributor belts.

24. Vacuum the distributor's dust pan.

25. Clean overflow socks.

26. Check the operation of the pin count switch and smart shark for proper pin distribution.

Quarterly Maintenance

1/3 of All Machines Each Month

27. Check the +5 Volts DC at J5 on the Gamesetter box and adjust if necessary.

28. Check the +5 volts DC at J1 on the Consolidated Low Voltage I/O PCB. Adjust if necessary.

29. Clean the ball detector lens and reflectors.

30. Check the drive gears, pinions and pulleys for the sweep and table.

31. Check the sweep tracks and sweep wagon guide rollers.

32. Check all four table rack guide roller assemblies for proper tightness and operation.

33. Verify the tooth gap clearance between the table racks and the pinion gears is 1-3 mm in the raised and lowered positions of the table.
34. Examine the ball accelerator rails for signs of wear.

35. Check the sweep wagon’s gutter adapters for proper clearance.

36. Check the overflow chutes for signs of wear or loose hardware.

37. Check the adjustment and hardware connections for all 11 function switches.

38. Check and tighten all pin holder mounting hardware.

39. Check and adjust the tension of the table and elevator motor drive chains.

40. Check the distributor’s bearings, shafts and drive pulleys.

41. Tighten the mounting bolt and check the key for the table shaft’s crank arm.

42. Check Angles “A” & “B” on the table shaft’s crank arm and chain.

43. Check the table chain clevice for wear and relubricate.

44. Check the sweep release chain clevice for wear.

45. Check all distributor hardware for tightness.

46. Lubricate all items listed in the quarterly section of the Lubrication Schedule.

47. Check tooth gap between shark drive and spur gear.

48. Check all shark switch adjustments.

Semi-Annual Maintenance

1/6th of All Machines Each Month

49. Check the ball impact protection strips on the ball cushion board.

50. Inspect the ball cushion frame, stop collars and bearings.

51. Check and tighten all hardware on the kickback and accelerator box fiber plates.

52. Inspect and clean the accelerator belt, driving drums and discs.

53. Check the accelerator motor suspension and the mounting shaft bushings.

54. Check the sweep release mechanism for wear, cracks and proper operation.

55. Check and tighten the fastening hardware on the sweep shaft bearing retainers.

56. Check and tighten the sweep arm connecting rods and turnbuckles' hardware.

57. Check and adjust the clearance between the sweep track and guide rollers.

58. Check the plastic protector strips on the sweep wagon frame.

59. Check the stroke limiter assembly for proper operation and adjustment.

60. Check the pin holder swing shaft bushings.

61. Check the spotting tong toothed racks and gears.

62. Check all drive frame hardware for tightness.

63. Check all elevator hardware for tightness.

64. Lubricate all items listed in the semi-annual section of the Lubrication Schedule.

Annual Maintenance

1/12 of All Machines Each Month

65. Tighten all pit curtain support bracket bolts and curtain mounting bolts.

66. Check and tighten the ball door protector wedges and ball door protector rings.

67. Check the electronic boxes mounting hardware.

68. Check all cabling for signs of stress and wear.

69. Check all welded assemblies for signs of breakage.

70. Check all pivot and wear points.

71. Lubricate all items listed in the annual section of the Lubrication Schedule.

72. Review the Safety Guidelines with all personnel working on or around the pinsetters.

Detailed Maintenance Schedule

The following detailed instructions explain each item on the work schedule. These items are discussed in the identical order in which they appear on the maintenance schedule.

Daily Maintenance

1. Check Stop Sheet for Each Pinsetter

It is important that all stops be recorded. This is best accomplished by having individual stop sheets mounted on each pinsetter. The best recommendation is to have a clip board mounted in the Elevator with a pencil/pen available. Doing this allows the persons taking care of the stop to record it immediately instead of trying to remember to do it later when he is back in the mechanic's room. This allows the head mechanic to keep in touch with how the machines are running all of the time. It also prevents problems from lingering and developing into repeat situations that frustrate bowlers, managers and proprietors.

2. Check Stop Sheet at the Manager's Control Desk

Having a stop sheet at the control desk enables the control desk personnel to recap all the stops and checks to make sure stops are being registered. Also, this stop sheet can be customized to incorporate other maintenance problems such as automatic scorers, foul units, ball lifts, ball cleaners, etc.

3. Troubleshoot, Repair or Adjust all Reported Failures

After checking the stop sheets, you must decide what is in need of repair and make sure it is taken care of prior to the next time that bowling lane will be needed.

4. Clean Shark Switch Pin Guide Assemblies

The shark switch pin guide wedges must be cleaned with a general purpose cleaner daily. This will prevent lane oil and dirt from building up on the surface and causing pin jams.

5. Change Pin Wipes in the Overflow Chutes

Cleaning the pin wipes daily helps reduce dirt in the machines. Wash in warm water. Do not use bleach or fabric softener.

6. Check the Position of Each Transport Band; Adjust if Necessary

Make sure the bands are centered on the rollers. A band that is allowed to drift will become frayed and damaged and result in premature failure.

7. Completely Clean One Pinsetter

Developing a procedure in which you remove the dirt and loose particles from a machine has two benefits. First it keeps the pinsetter free of dirt and second, it also causes the person doing the cleaning to look over the entire machine. This allows this person to notice loose or worn parts, welds that are cracking or any other problem that can be fixed before it causes a machine down situation.

8. Clean One Lane Pair of Pins

Cleaning the pins with pin cleaner regularly will extend the useful life of the pins.

Weekly Maintenance

9. Clean the Transport Band with a General Purpose Cleaner

The band can be cleaned using a cloth or a scrubbing mop to remove the oil and dirt. Advance the band to clean the entire band.

10. Check for Worn “V” Belts That Are Cracked, Split or Causing Motors to Bounce

Wipe the belts with a dry cloth while inspecting them. Especially note the table motor drive belt. Failure of this belt will cause a sudden dropping of the table which can result in severe machine damage and possible personal injury.

11. Check the Green Belts for Proper Tension on the Distributor, Elevator and Transport Band Drives

Check for squealing, slipping or sagging belts. Replace or resize as necessary.

12. Check All Hydraulic Shock Absorbers for Leakage; Verify Proper Operation

Look for leakage around the seals. Check for shock absorption on ball impact and on lowering the sweep and table.

13. Check the Ball Door Shaft Collars and Split Pins/Hitch Pins

Verify that the collars are tight and holding the ball door in the correct position.

14. Check the Overflow Socks for Wear and Proper Alignment

Change worn out overflow socks as they do not retard the impact of the pins onto the transport band. Failure to maintain the socks can cause transport band and board damage. Make sure they are adjusted properly; refer to the Overflow Sock Adjustment in this manual.

Monthly Maintenance

15. Clean the Front of the Ball Cushion and Pit Curtain

Wipe off the accumulated dirt and oil with a cloth dampened with a general purpose cleaner.

16. Check and Tighten All Fastening Screws on the Ball Cushion

Keeping these tight helps prevent damage to the cushion, balls and pins.

17. Check and Tighten All Fastening Screws on the Transport Band Boards

Keeping these screws tight helps keep the boards in place and prevents damage to the boards and band.

18. Examine the Setting Table Cable Conduits for Damage

Flying pins can cause damage to the conduits which may lead to broken wires in the cable harness.

19. Check the Ball Door Locking Mechanism for Proper Adjustment

Keeping this properly adjusted helps to prevent pins from entering and allows balls to enter without interference.

20. Check the Pin Feed Deflectors for Proper Clearance Above the Transport Band

The pin feed deflectors should not touch the transport band. Nor should they be too high as this may allow pins to jam under the deflector and stop the machine.

21. Check the Fluid Levels of the Hydraulic Shock Absorbers

Levels of all three shock absorbers must be filled to the rim as indicated in *Figure 9-1*. The shaft should be out in the relaxed position when checking the fill level.

(1) FLUID LEVEL
(2) O-RING
(3) HYDRAULIC SHOCK ABSORBER

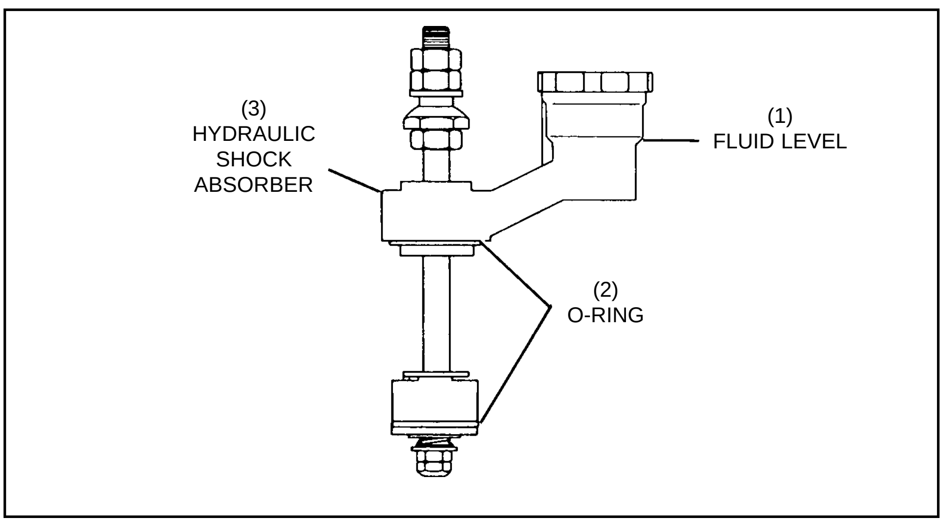


Figure 9-1. Hydraulic Fluid Level.

22. Lubricate All Items Listed in the Monthly Section of the Lubrication Schedule

Lubrication Schedule located in this section of the manual.

23. Clean Distributor Belts

Clean all the belts with a cloth dampened with general purpose cleaner.

24. Vacuum the Distributor's Dust Pan

Vacuuming removes any dirt and loose particles that accumulate here. Vacuuming allows you to get the dirt out of the bowling center instead of pushing it somewhere else.

25. Clean the Overflow Socks

Remove and wash the overflow socks in a basic laundry cleaner (Tide); do not use bleach as it weakens the stitching.

26. Adjust the Pin Count Switch and Smart Shark

Adjust the pin count switch to ensure proper pin distribution on a 60/40 split.

Quarterly Maintenance

27. Check the +5 Volts DC at J5 on the Gamesetter Box; Adjust if Necessary

Refer to the adjustment section of this manual for the +5 Volt adjustment procedure.

28. Check the +5 Volts DC at J1 on the Consolidated Low Voltage I/O PCB

Adjust if necessary.

29. Clean the Ball Detect Lens and Reflectors

Oil and dust may build up on these causing intermittent ball detect problems. Clean only with a glass cleaner that will not harm plastics such as Brunswick Tele-Brite Part No. 53-860357-000.

30. Check the Drive Gears, Pinions and Pulleys for the Sweep and Table

Look for cracked, bent or worn parts that could stop the machine.

31. Check the Sweep Tracks and Sweep Wagon Guide Rollers

Remove any dirt or old grease buildup. Make sure the guide rollers are moving freely and are not rubbing on the side frames.

32. Check All Four Table Rack Guide Roller Assemblies for Proper Tightness and Operation

A minimum of two of the three rollers must be riding on the table rack tube on both the upper and lower of each side.

33. Verify That the Tooth Gap Clearance Between the Table Racks and the Pinion Gears is 1-3 mm in the Raised and Lowered Positions of the Table

Refer to the Adjustment Section of this manual for proper testing and adjusting procedures.

34. Examine the Accelerator Rails for Signs of Wear

The ball entry point will wear. Inspect and replace the defective section when needed.

35. Check the Sweep Wagon's Gutter Adapters for Proper Clearance

The adapters must be low enough to pull any pins out of the gutter but cannot touch the gutter themselves.

36. Check the Overflow Chutes for Signs of Wear or Loose Hardware

Cracked chutes or loose hardware can cause pin damage and jams.

37. Check the Adjustment and Hardware Connections for All 11 Function Switches

Carefully tighten all switch hardware.

38. Check and Tighten All Pin Holder Mounting Hardware

Loose holders can cause damage or pin setting and detection problems.

39. Check and Adjust the Tension of the Table and Elevator Motor Drive Chains

Use the adjustment in this manual for reference.

40. Check the Distributor's Bearings, Shafts and Drive Pulleys

Look for worn or loose parts.

41. Tighten the Mounting Bolt and Check the Key for the Table Shaft's Crank Arm

This crank arm lifts the table from both directions (clockwise and counter-clockwise). If it comes loose, damage to the shaft and/or erratic table heights may occur.

42. Check Angles "A" and "B" on the Table Shaft's Crank Arm and Chain

Refer to the Adjustment section of this manual.

43. Check the Table Chain Clevice for Wear and Relubricate

The pivoting of this link will cause the clevice to wear if not lubricated properly. Lower the table onto a jack stand or suitable support, remove the clevice and inspect. Relubricate the crank arm shaft with grease and reinstall the clevice.

44. Check the Sweep Release Chain Clevice for Wear

This clevice only lifts the sweep and will not wear if oiled lightly.

45. Check All Distributor Hardware for Tightness

Loose hardware causes noise, worn parts and damaged pins.

46. Lubricate All Items Listed in the Quarterly Section of the Lubrication Schedule

Refer to this schedule found in this section of the manual.

47. Check Tooth Gap Between the Shark Drive and Spur Gears

A 1 to 3 mm gap must be found between these gears.

48. Check All Shark Switch Adjustments

Refer to the adjustment section of this manual when checking these adjustments.

Semi-Annually Maintenance

49. Check the Ball Impact Protection Strips on the Ball Cushion Board

These impact strips can interfere with the ball moving to the ball door. They can also damage balls and pins when loose or broken.

50. Inspect the Ball Cushion Frame, Stop Collars and Bearings

The stop collars and bearings can come loose and prevent the ball cushion from hanging properly.

51. Check and Tighten All Hardware on the Kickback and Accelerator Box Fiber Plates

Loose hardware and exposed nails can damage pins and bowling balls.

52. Inspect and Clean the Accelerator Belt, Driving Drums and Discs

Look over the outer surface of the belt for cracking or other signs of wear. Clean the belt with a cloth dampened with a general purpose cleaner.

53. Check the Accelerator Motor Suspension and the Mounting Shaft Bushings

Make sure the spring and V belt are keeping the motor operating properly.

54. Check the Sweep Release Mechanism for Wear, Cracks and Proper Operation

55. Check and Tighten the Fastening Hardware on the Sweep Shaft Bearing Retainers

Failure to tighten can cause the sweep shaft to shift and the arms to hit the table.

56. Check and Tighten the Sweep Arm Connecting Rods and Turnbuckles' Hardware

Loose turnbuckles can cause uneven sweep problems that may lead to sweep jams.

57. Check and Adjust the Clearance Between the Sweep Track and Guide Rollers

Refer to the Adjustment section of this manual for proper dimensions.

58. Check the Plastic Protector Strips on the Sweep Wagon Frame

These strips should be kept in good condition as they protect the pins being knocked down after second ball is rolled.

59. Check the Stroke Limiter Assembly for Proper Operation and Adjustment

Make sure the stroke limiter lowers the table slowly during a detection stroke. Check the adjustments found in this manual for verification.

60. Check the Pin Holder Swing Shaft Bushings

Worn or loose bushings can interfere with the movement of the swing shafts causing erratic pinsetting and possible pin jams.

61. Check the Spotting Tong Toothed Racks and Gears

Clean and inspect for cracks that may prevent the racks from closing and opening properly.

62. Check All Drive Frame Hardware for Tightness

63. Check All Elevator Hardware for Tightness

64. Lubricate All Items Listed in the Semi-Annual Section of the Lubrication Schedule

Annual Maintenance

65. Tighten All Pit Curtain Support Bracket Bolts and Curtain Mounting Bolts

Loose hardware in this area can cause premature failure wear and tearing of the pit curtain.

66. Check and Tighten the Ball Doort Protector Wedges and the Ball Door Protector Rings

Loose parts in this area can cause ball jams or damage in addition to broken parts that would have to be replaced.

67. Check the Electronic Boxes Mounting Hardware

Make sure they are tight and check to see if all grounding straps are installed properly.

68. Check All Cabling for Signs of Stress and Wear

Inspect the cables that are flexed by machine movements. Also make sure plastic wire ties are in place where needed.

69. Check All Welded Assemblies for Signs of Breakage

Carefully look for hairline cracks that may lead to major part failures. Reweld or replace the part to prevent extensive downtime when you can least afford it.

70. Check All Pivot and Wear Points

Parts with excessive play in a pivot point may need to be tightened, adjusted or replaced.

71. Lubricate All Items Listed in the Annual Section of the Lubrication Schedule

Refer to the Lubrication Schedule found in this section of the manual.

72. Review the Safety Guidelines Listed in this Manual with All Personnel Working on or Around the GS-Series Pinsetters

Safety around any machinery is something that must always be reinforced. An annual review is one way employees can be reminded of the need to maintain a safety conscious working environment.

Lubricating Schedule

About Lubricating

Oiling

Always use a metered oil can. This will prevent over oiling parts where too much oil will drip or sling off into the wrong area and cause a problem, part failure or interfere with bowling activity.

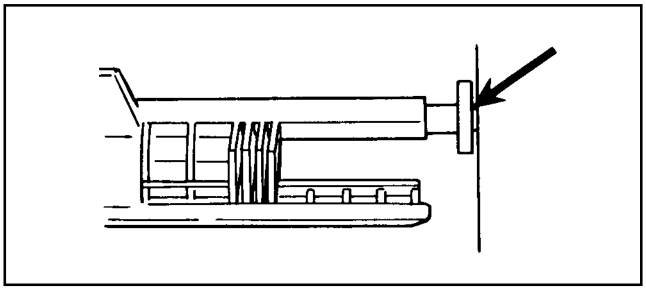
Greasing

It is always a good practice to wipe off the old grease and any dirt it has collected with it BEFORE applying a new coat of grease. Do not over grease the part as the grease can get into areas that can cause problems or interfere with the machine operation.

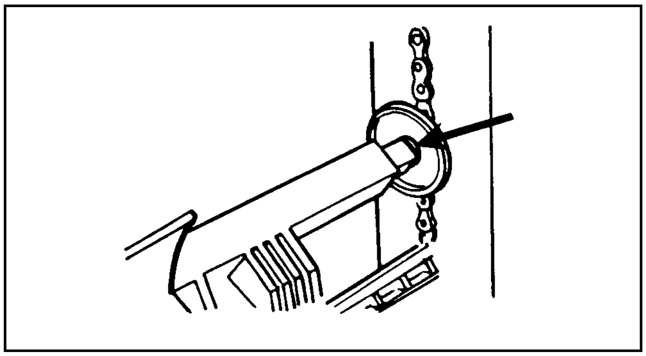
Proper Lubricants

Always use the proper lubricant such as those specified in the front of this section. Penetrating oils do not last long and leave parts exposed to premature failure. Some Lithium greases have a tendency to dry and harden quickly. This can lead to sticky parts or premature parts failure.

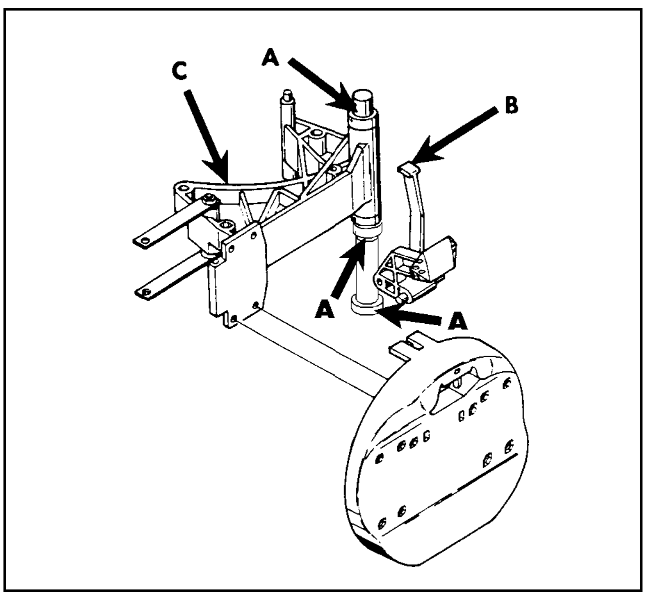
Monthly



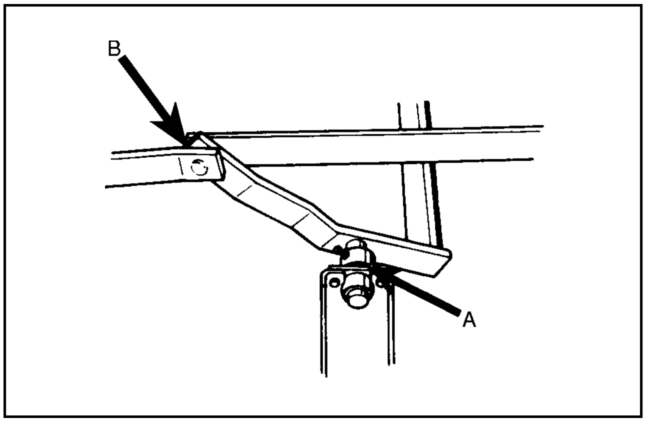
1. **Pin Shovel Shafts**
   One drop of oil on each pivot point.



2. **Pin Shovel Rollers**
   One drop of oil on each roller.

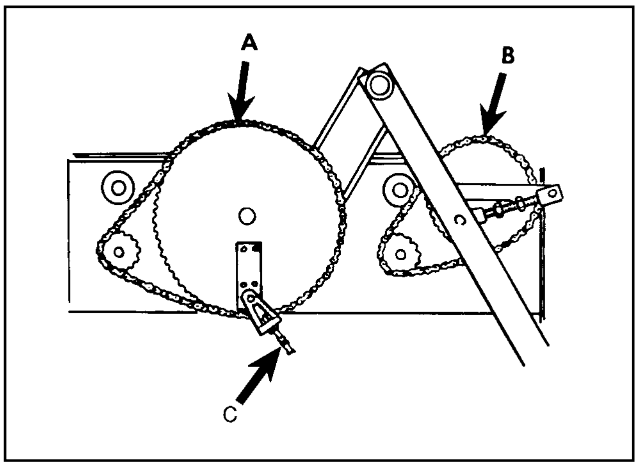


3. **Ball Door**
   A. Shaft - One drop of oil on each of the three collars.
   B. Latch - Cover with a light film of grease.
   C. Arms - Cover with a light film of oil.



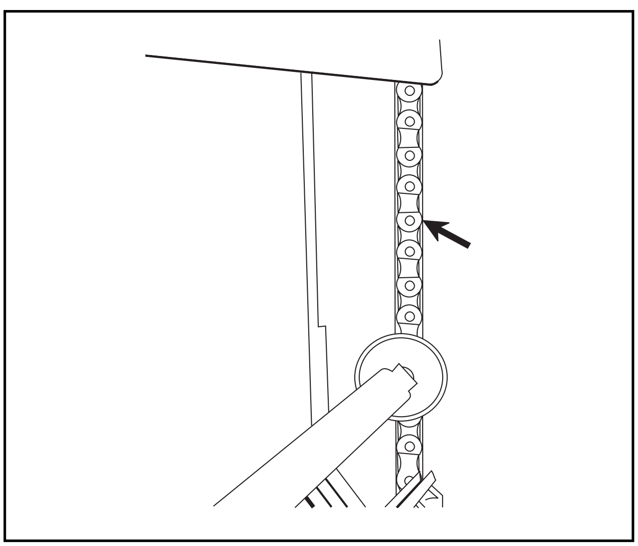
4. **Pin Holder Swing Shafts**
   A. Swing Shaft - One drop of oil on the bushing at each end of the four swing shafts.
   B. Connector Link - One drop of oil on each connection point for the three links.

Quarterly

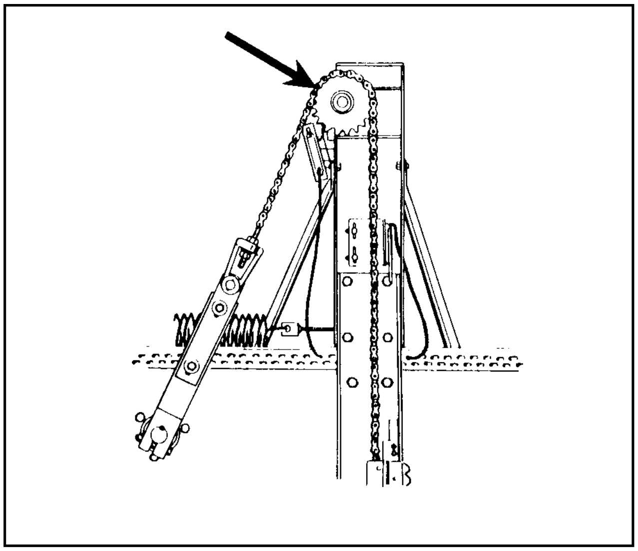


1. **Drive Chains**
   A. Table Shaft - A light coating of chain lubricant.
   B. Sweep Shaft - A light coating of chain lubricant.

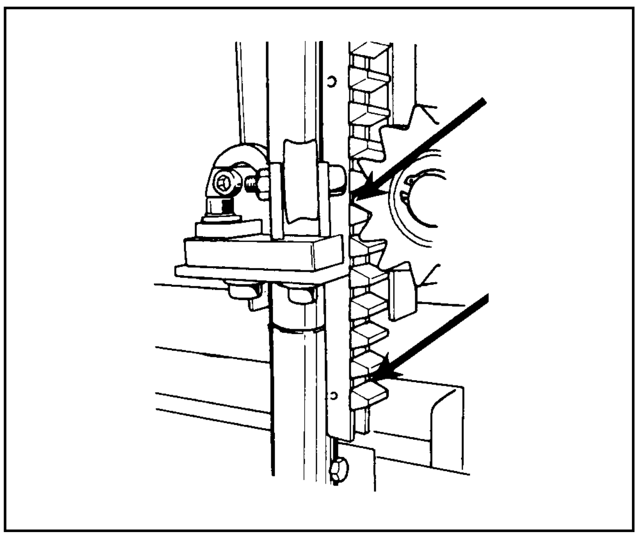
2. **Sweep Release Chain**
   C. Apply a light coating of chain lubricant.



3. **Elevator Chains**
   Put a light coating of chain lubricant on both chains.

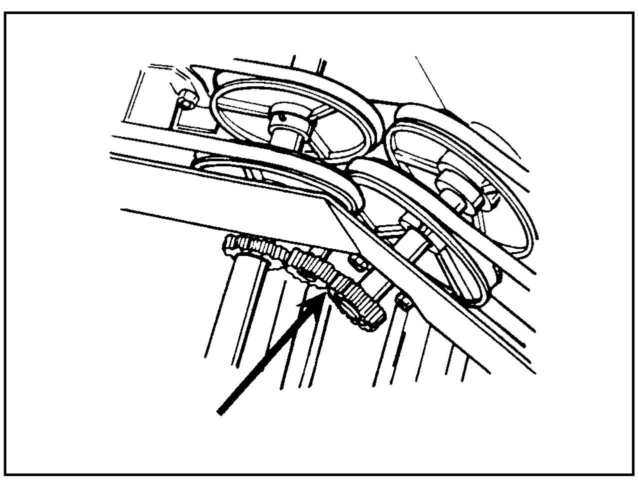


4. Setting Table Pinion Gears
Entire chain needs a light coating of chain lubricant.

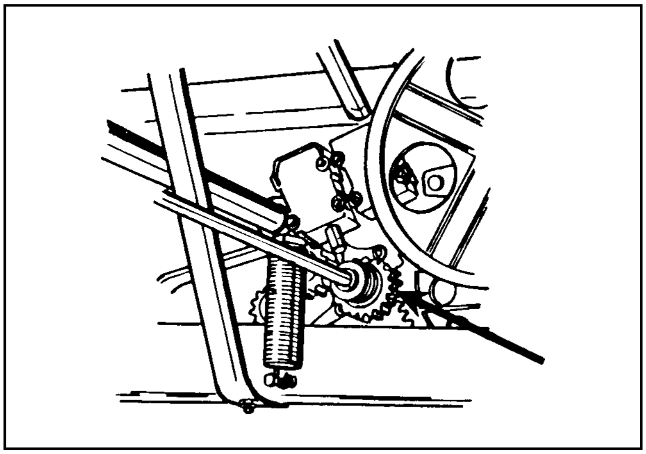


5. Setting Table Pinion Gears
Put a light film of grease on both gears.

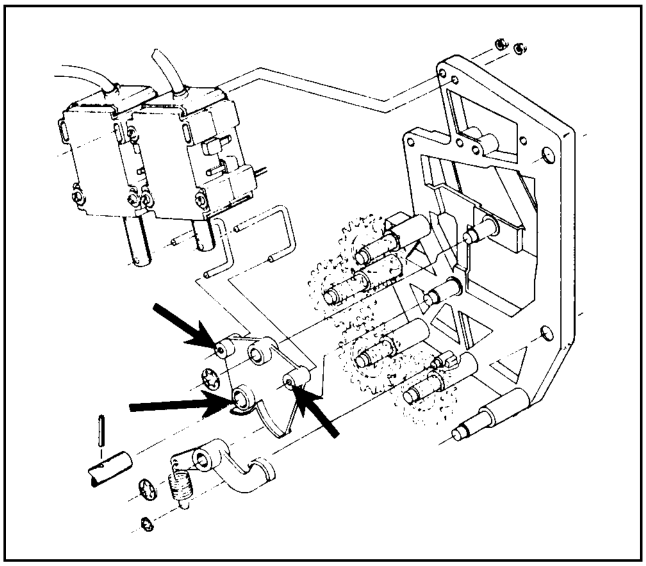
6. Table Rack
Grease both racks entirely with a light film.



7. Distributor Spur Gears
Grease both sets with a light film.

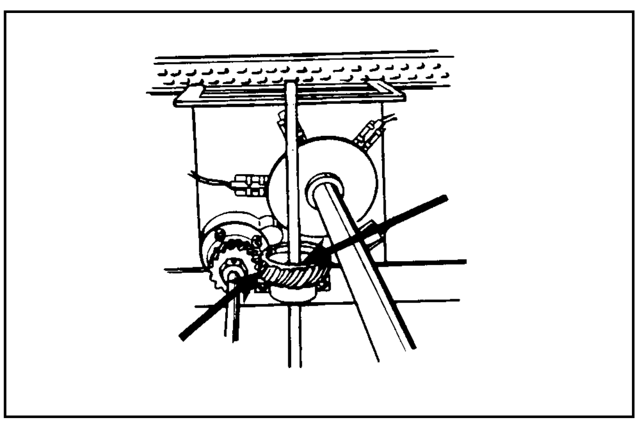


8. Spotting Tong Clutch Gear Cluster
Grease the one or four gears lightly - DO NOT allow grease to get into the clutch mechanism.



9. Gear Cluster Pivot Lever Plate
Apply one drop of oil to each pivot point.

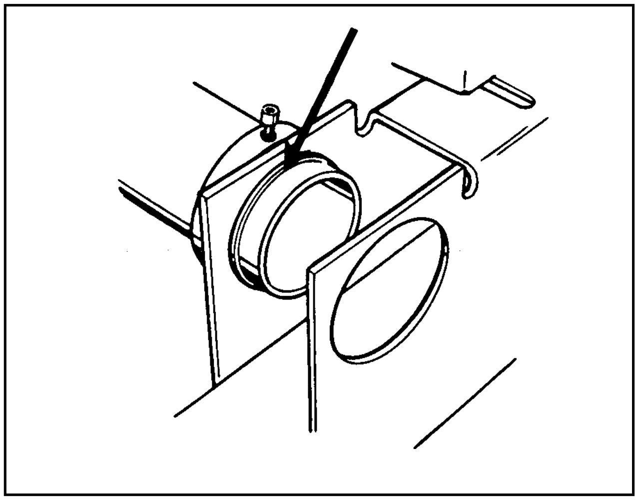
NOTE: *Some Model GS-92s have two solenoids located on this cluster.*



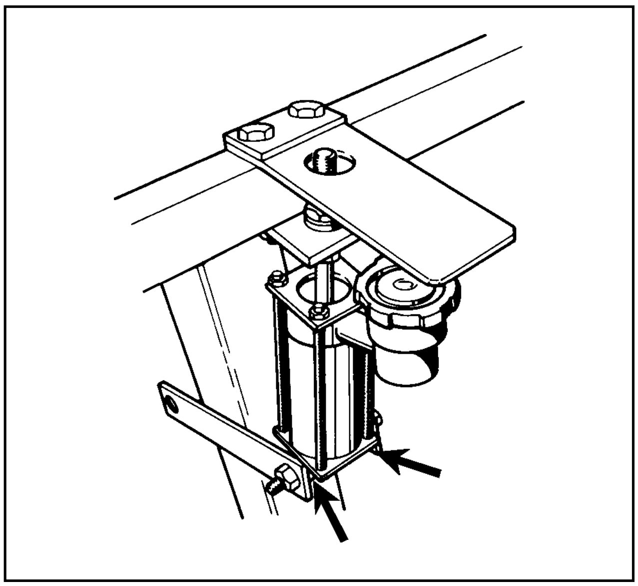
10. Spotting Tong Square Shaft and Bevel Gears

A. Put a light of grease on the entire travel area of the square shaft

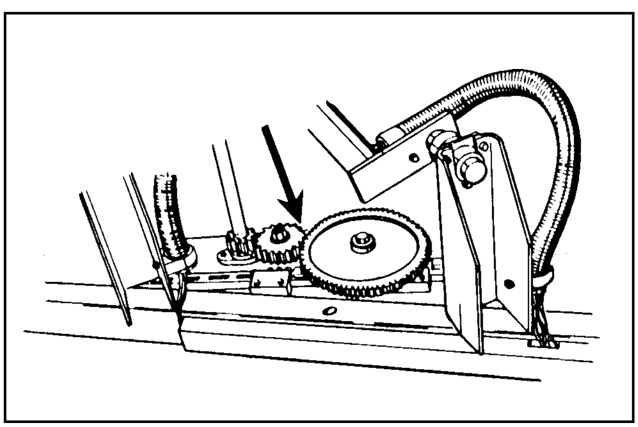
B. Put a light film of grease on both bevel gears



11. Ball Cushion Bushings
Grease both sides as required.

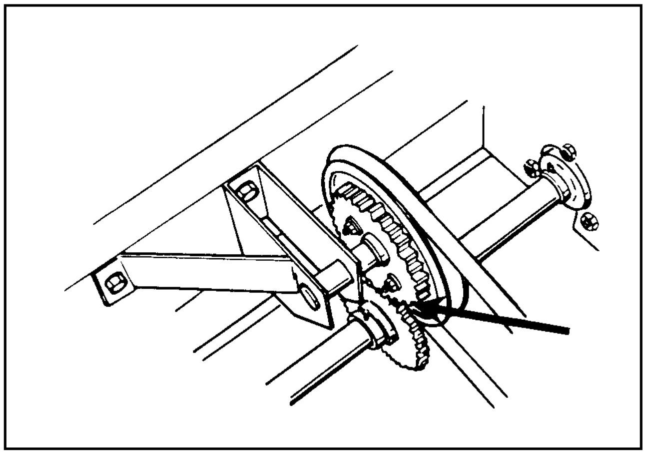


12. Hydraulic Shock Absorber
One drop of oil on each side of the bushing.

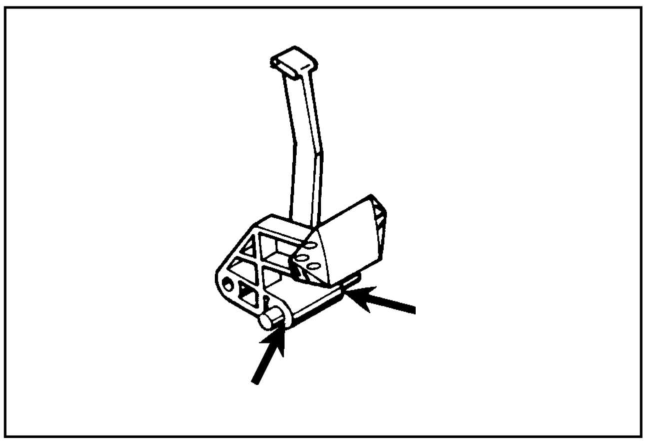


13. Spotting Tong Drive Gears
Put a light film of grease on all four gears.

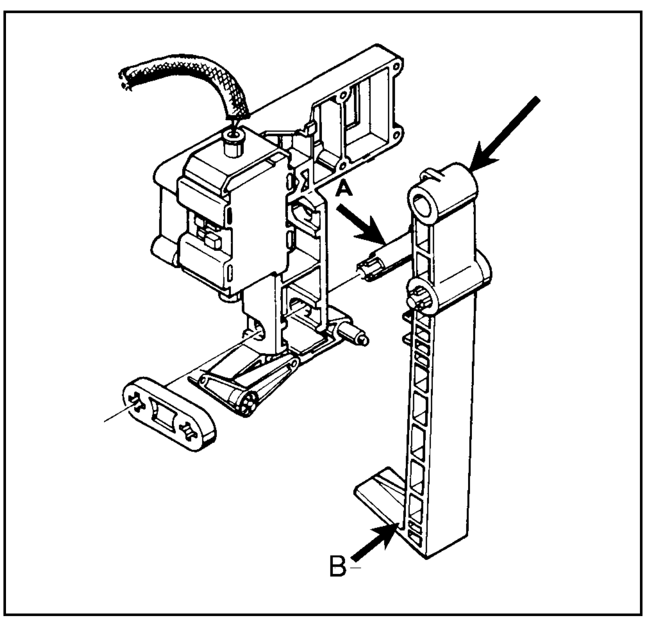
NOTE: *There is a small gear located under the largest gear. Also, remove the old grease and dirt before applying the new grease.*



14. Front Distributor Shaft and Idler Gears
Put a light film of grease on both gears.

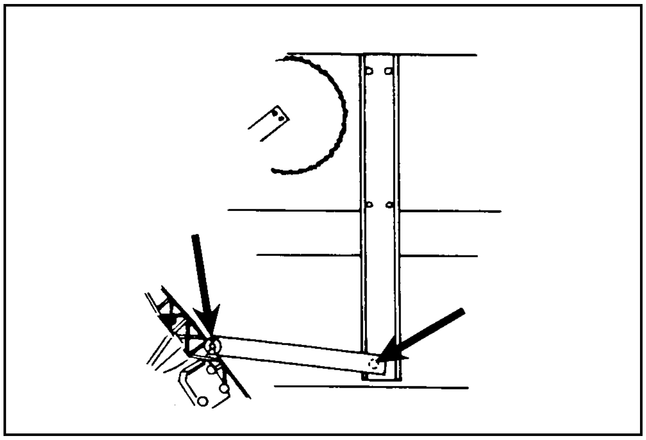


15. Ball Door Button Shaft
One drop of oil on each side of the shaft.



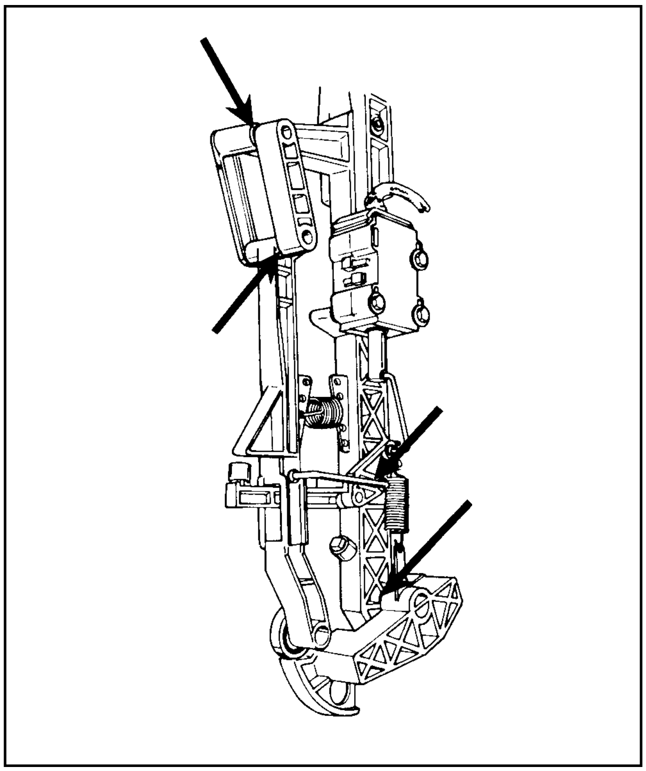
16. Ball Door Locking Mechanism

A. Connecting links need one drop at each pivot point.
B. Bottom of locking bolt needs a light film of grease.



17. Sweep Release Pivot Link

One drop of oil to both ends of the link.

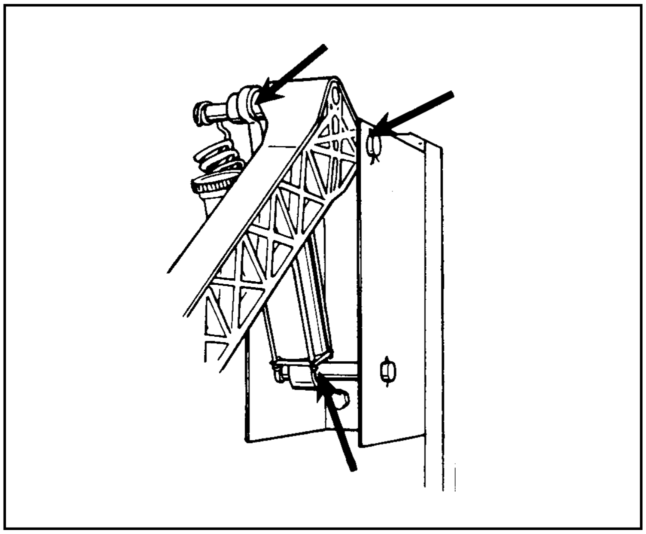


18. Sweep Release Mechanism

A. Front arm needs 1 drop of oil on each pivot point.

B. Swing lever needs 1 drop of oil on each pivot point.

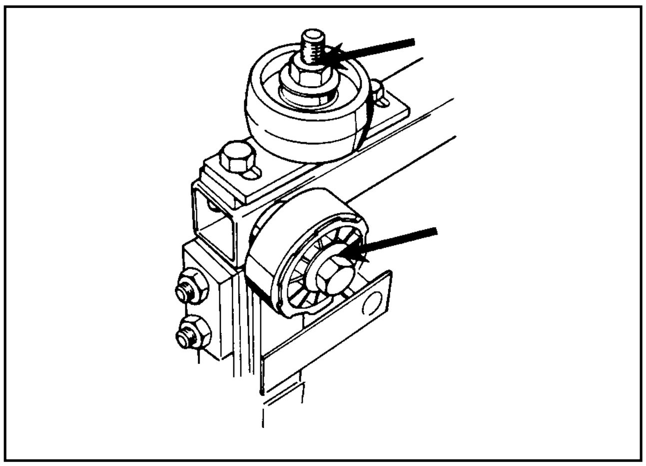
C. Tipper needs 1 drop of oil at its pivot point.



19. Sweep Attentuator

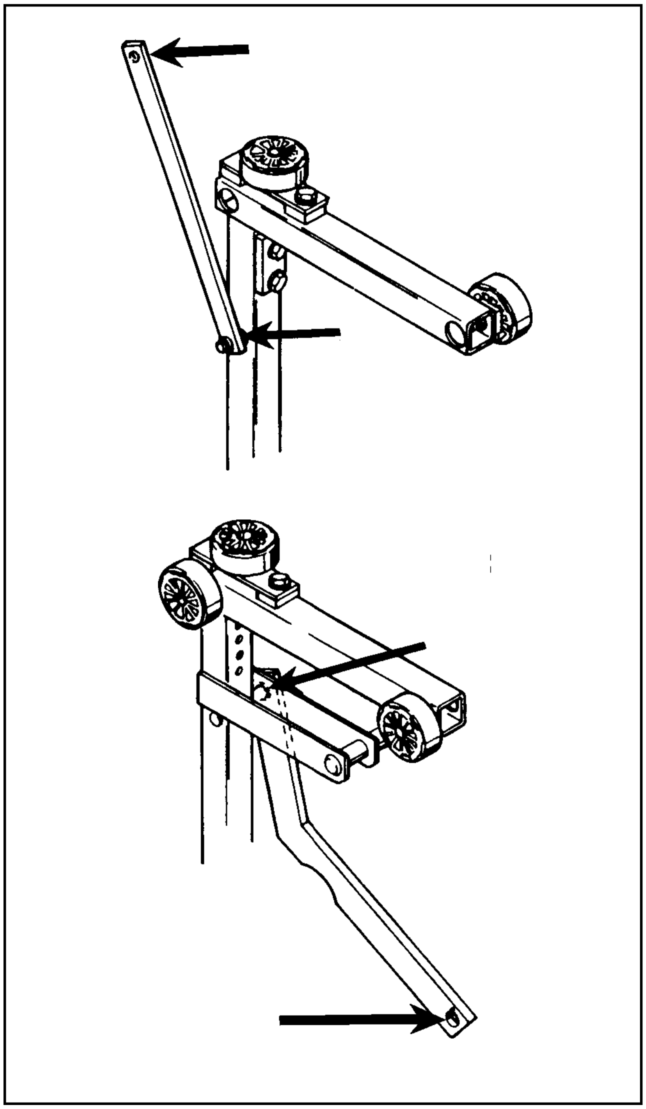
A. Apply one drop of oil to each end of the top shaft.

B. Apply one drop of oil to the top and bottom mounting points of the attenuator shock absorber.

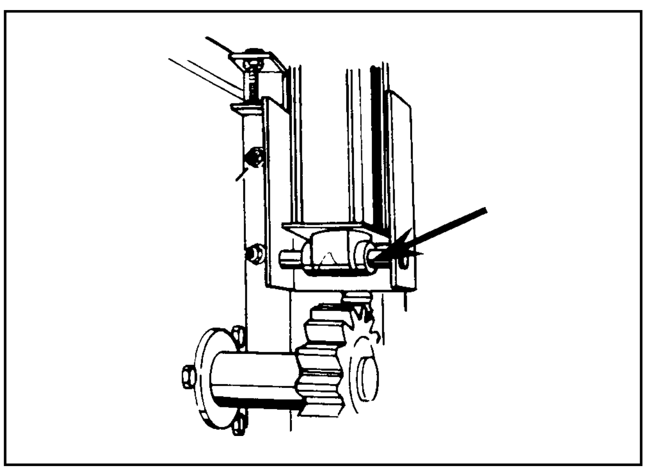


20. Sweep Wagon Roller Shafts

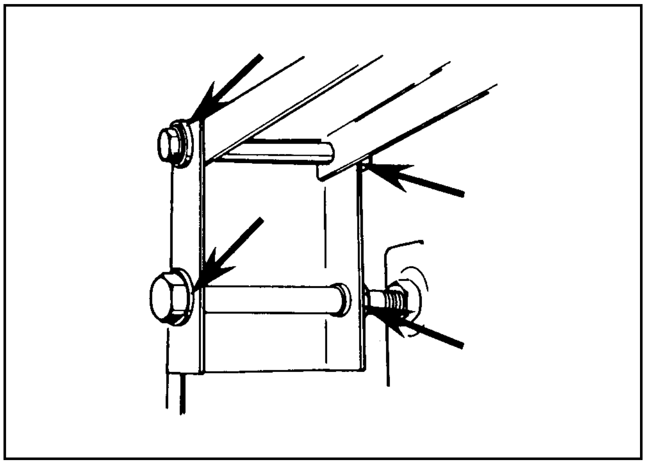
Apply one drop of oil to each of the six shafts.



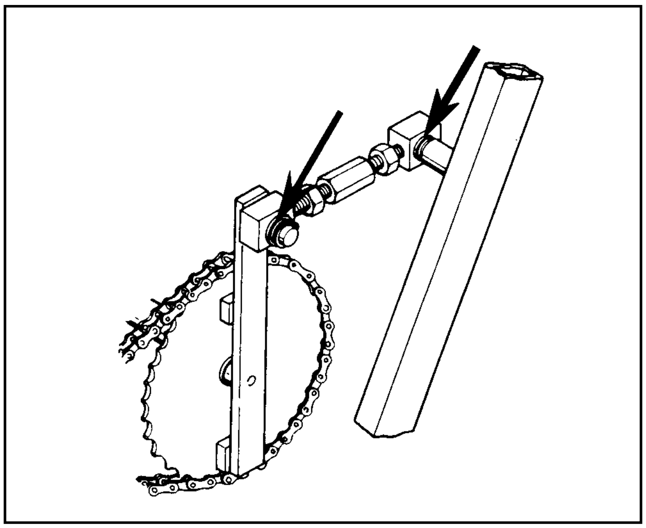
21. Sweep Wagon Connector Link Bearings
Apply one drop of oil to the top and bottom bearing on each side.



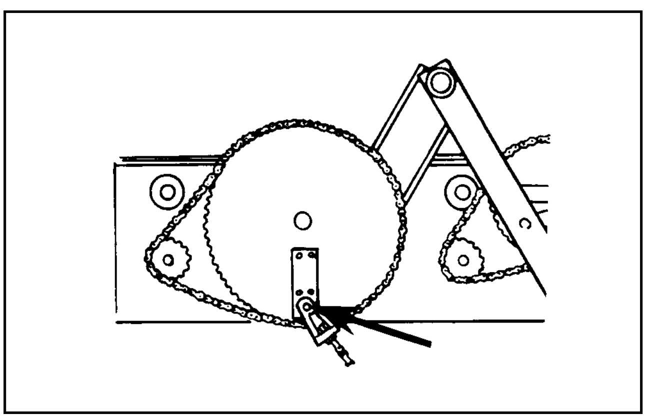
22. Stroke Limiter Shock Absorber
Apply one drop of oil to each stop collar on the lower mounting shaft.



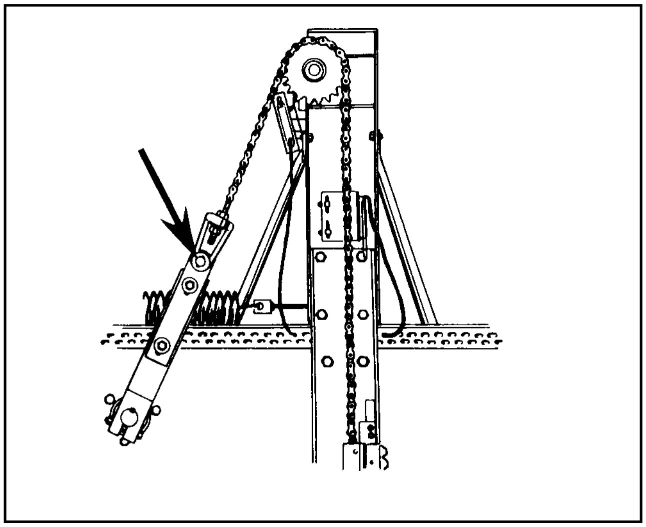
23. Stroke Limiter Plate's Bushings
Apply one drop of oil to each of the four bushings



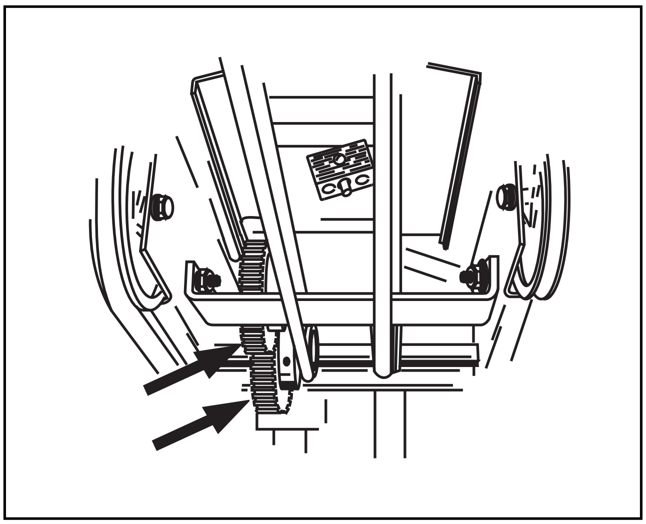
24. Sweep Drive's Turnbuckle Bushings
Apply one drop of oil to each end of the turnbuckles.



25. Sweep Release Chain Clevice
Apply one drop of oil to the clevice's pivot point.

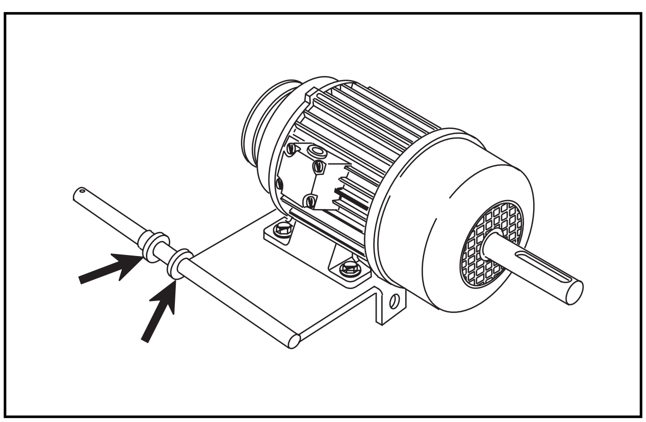


26. Table Lift Chain Clevice
Lower the setting table onto a jackstand or other suitable support to release tension on the chain. Remove the clevice from the table shaft crank arm and grease the crank arm's shaft. Reinstall the clevice.

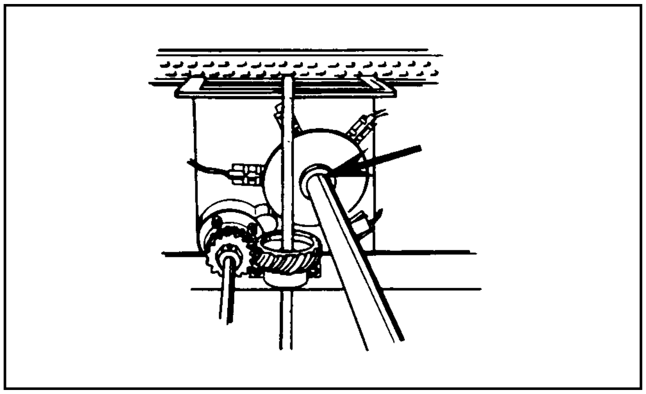


27. Shark Switch Drive Gears
Apply a light film of grease to both gears.

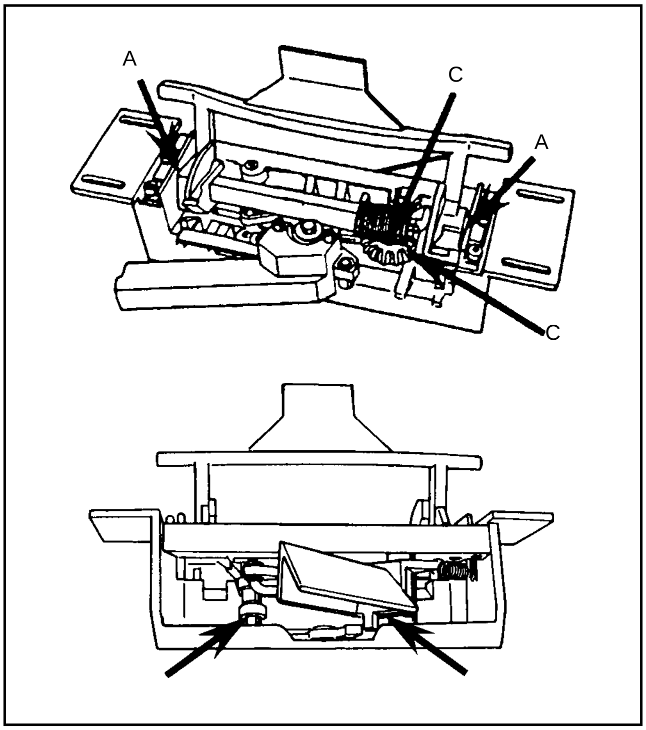
Semi-Annual



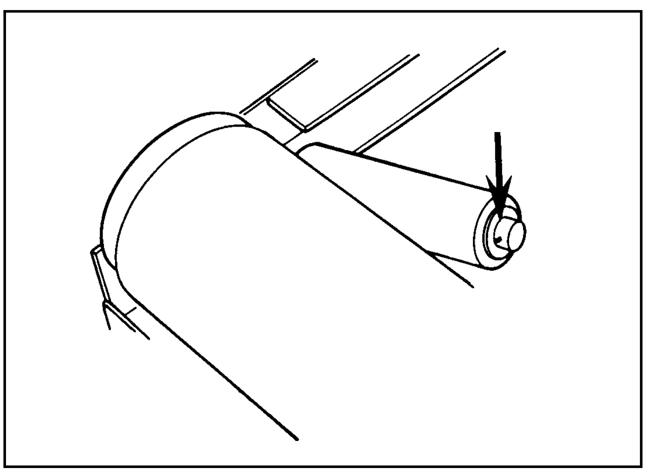
1. Motor Mounting Bracket Shafts
Apply two drops of oil to each bushing on the shafts. This should be done for the table sweep, and distributor/accelerator motors.



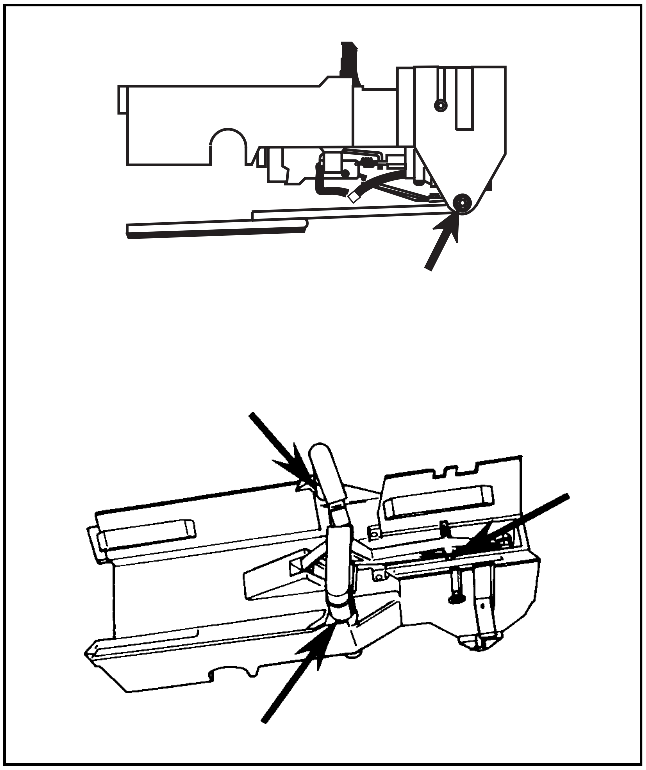
2. **Switch Cluster Shaft**
   Apply one drop of oil to the shaft. This prevents the switch cam from seizing up on the shaft.



3. **Pin Station Assembly**
   The various pivot points on all ten pin stations need to be oiled semi-annually.
   A. Each end of the square spindle needs one drop of oil.
   B. Apply one drop of oil to the ejector flap's pivot shaft.
   C. Apply two drops of oil to the bevel gears.
   D. Apply one drop of oil to the bevel gear's shaft.

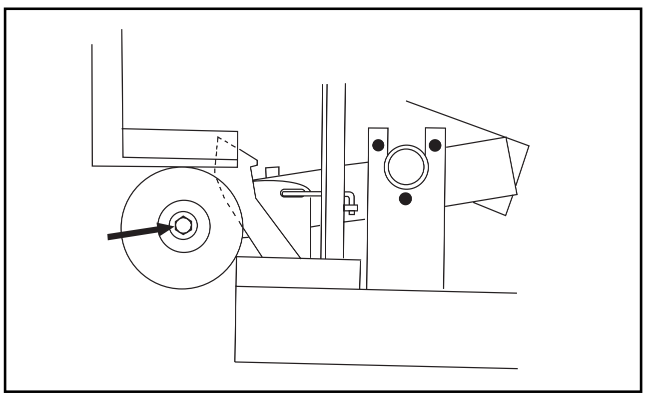


4. **Transport Band Frame Rollers**
   Remove the rollers from their shafts and grease the entire shaft.

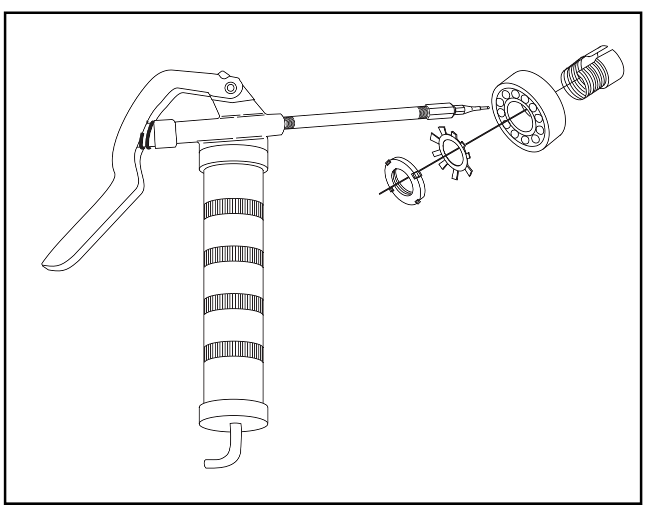


5. **Pin Holders**
   Several pivot points need to be oiled on each pin holder.
   A. Apply one drop of oil to each end of the pin detector plate’s shaft.
   B. Apply one drop of oil to each pin gripper shaft.
   C. Apply one drop of oil to each switch finger shaft.

NOTE: *Never apply any type of lubricant to the solenoid or its plunger. When a plunger becomes dirty or sticky, it must be cleaned with electrical contact cleaner and then dried to leave* **no** *residue.*

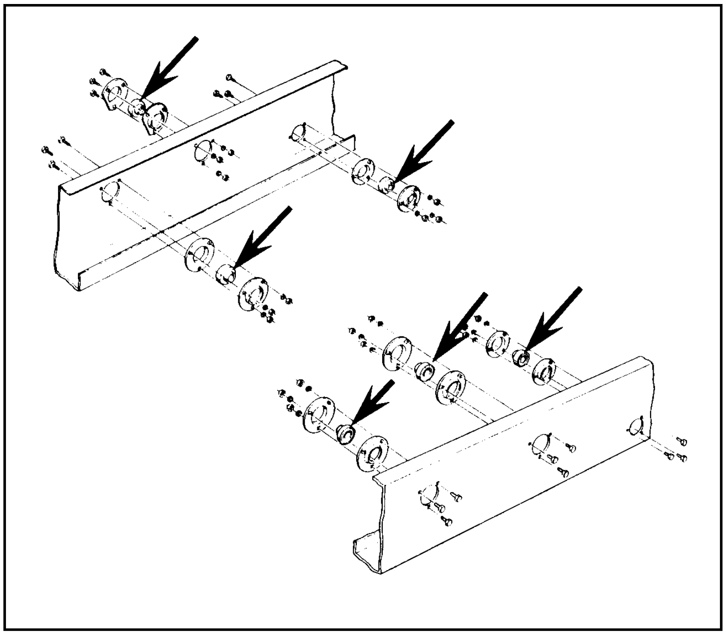


6. **Setting Table Swing Shaft Roller**
   Apply one drop of oil to the shaft on each side of the roller.

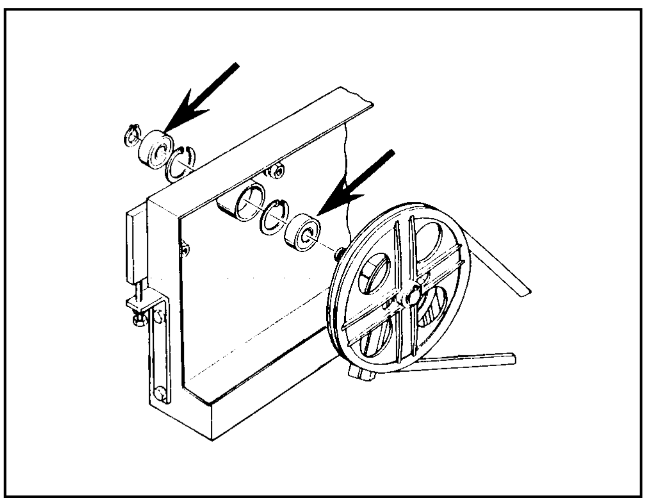


7. **Elevator Shaft Bearings**
   Remove plastic bearing seals and inject a small amount of grease into the roller bearing assembly with a “Vita” needle.

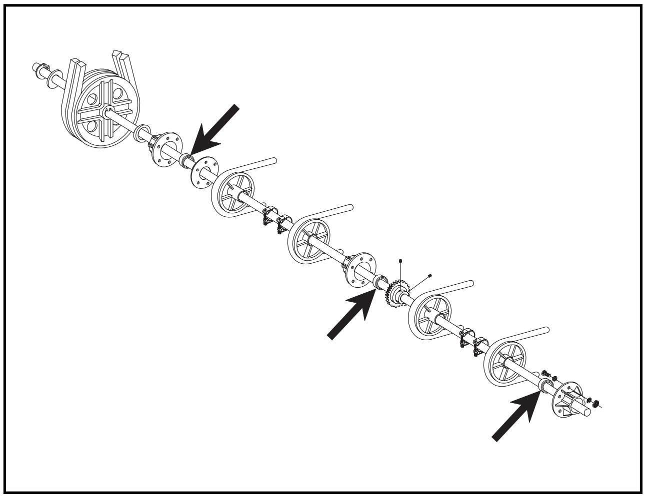
Annual



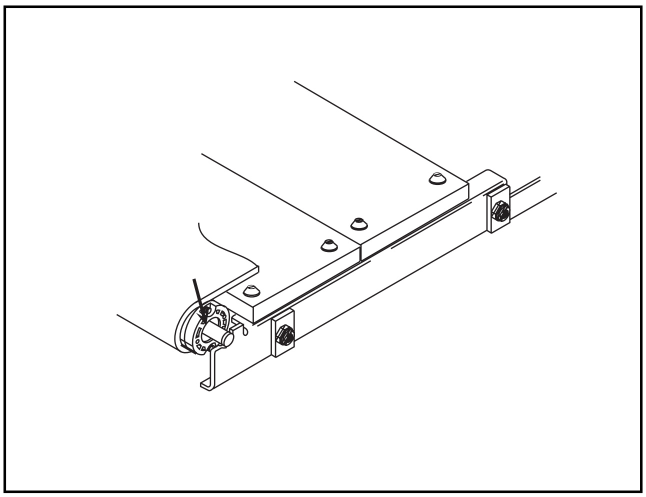
1. **Drive Train Shaft Bearings**
   Grease with Vita Needle.



2. **Distributor Drive V-Belt Tensioner Bearings**
   Remove and grease bearings with a Vita needle.



3. Distributor Shaft Bearings
These are sealed and do not need to be greased. Apply one drop of oil to the shaft to allow the bearing to be removed when needed.



4. Transport Band Rollers
Apply one drop of oil to each bearing to allow for easier bearing removal when needed.

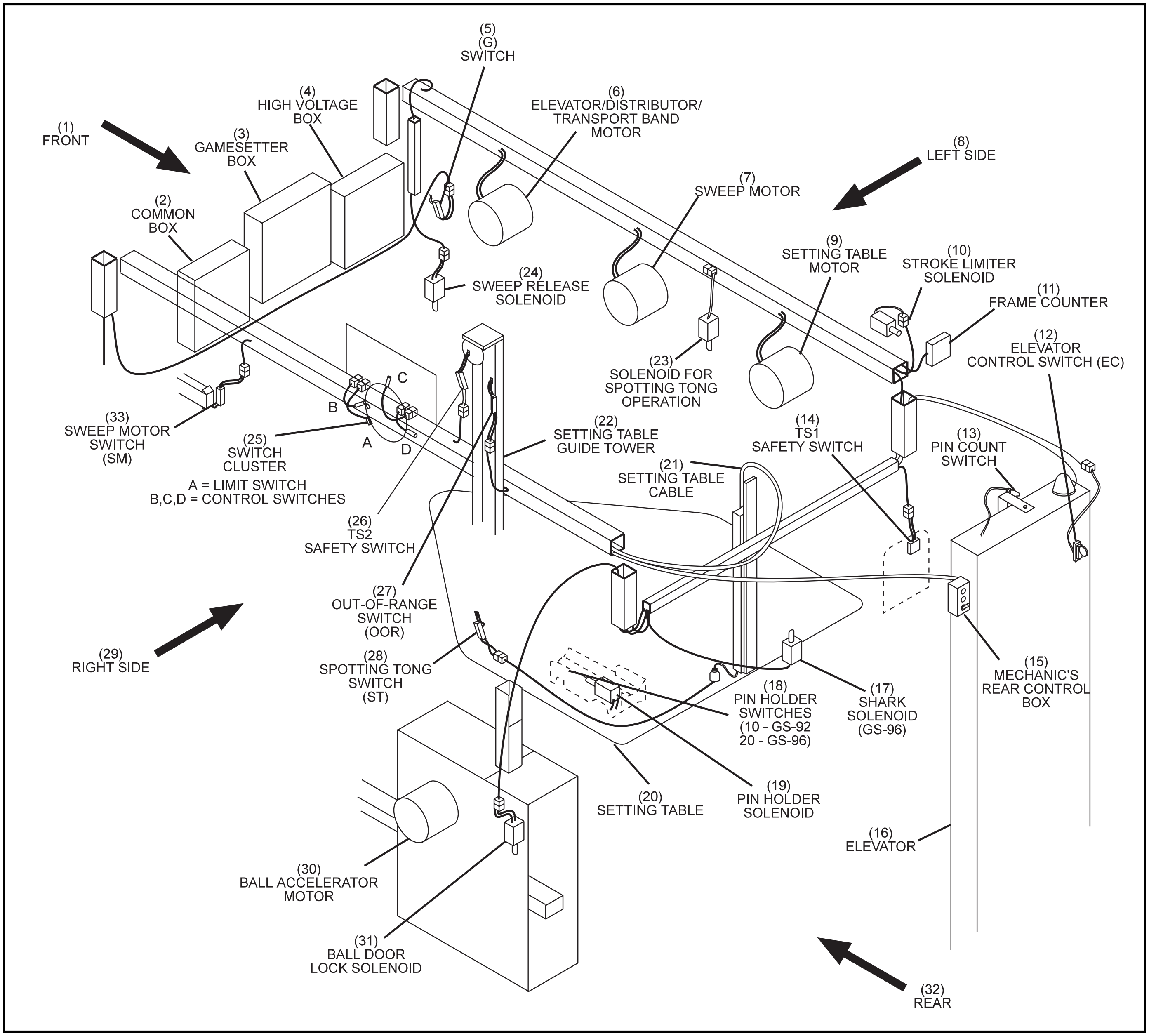


Figure 10-1. GS-92/96 Pinsetter Electrical System Overview with Universal Electronics

(1) FRONT	(2) COMMON BOX	(3) GAMESETTER BOX
(4) HIGH VOLTAGE BOX	(5) (G) SWITCH	(6) ELEVATOR/DISTRIBUTOR/ TRANSPORT BAND MOTOR
(7) SWEEP MOTOR	(8) LEFT SIDE	(9) SETTING TABLE MOTOR
(10) STROKE LIMITER SOLENOID	(11) FRAME COUNTER	(12) ELEVATOR CONTROL SWITCH (EC)
(13) PIN COUNT SWITCH	(14) TS1 SAFETY SWITCH	(15) MECHANIC'S REAR CONTROL BOX
(16) ELEVATOR	(17) SHARK SOLENOID (GS-96)	(18) PIN HOLDER SWITCHES (10 - GS-92, 20 - GS-96)
(19) PIN HOLDER SOLENOID	(20) SETTING TABLE	(21) SETTING TABLE CABLE
(22) SETTING TABLE GUIDE TOWER	(23) SOLENOID FOR SPOTTING TONG OPERATION	(24) SWEEP RELEASE SOLENOID
(25) SWITCH CLUSTER A = LIMIT SWITCH, B,C,D = CONTROL SWITCHES	(26) TS2 SAFETY SWITCH	(27) OUT-OF-RANGE SWITCH
(28) SPOTTING TONG SWITCH (ST)	(29) RIGHT SIDE	(30) BALL ACCELERATOR MOTOR
(31) BALL DOOR LOCK SOLENOID	(32) REAR	(33) SWEEP MOTOR SWITCH (SM)

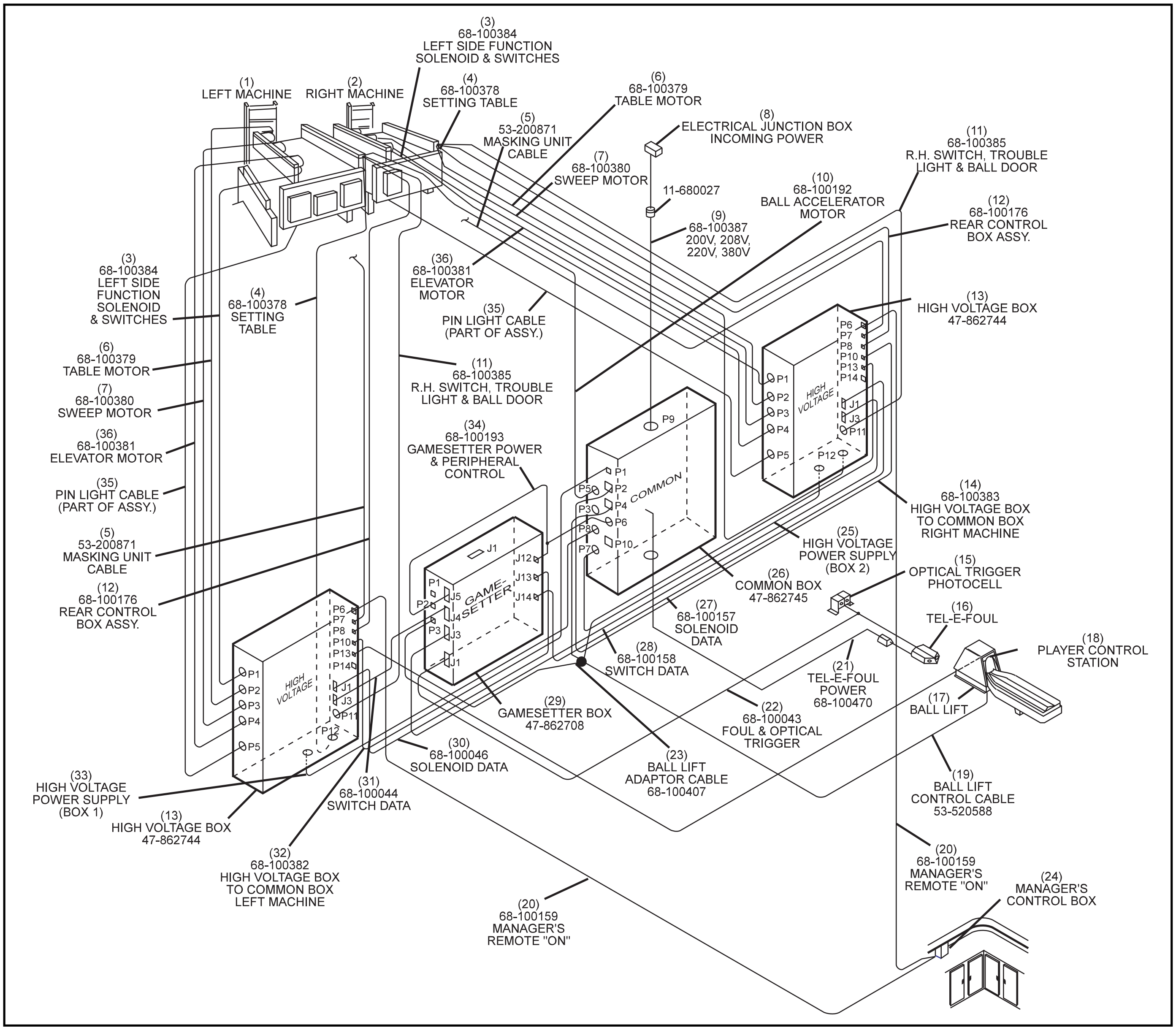


Figure 10-2. Universal Electronic Control System (Includes GS-92/96)

(1)	LEFT MACHINE	(2)	RIGHT MACHINE	(3)	68-100384 LEFT SIDE FUNCTION SOLENOID & SWITCHES
(4)	68-100378 SETTING TABLE	(5)	52-200871 MASKING UNIT CABLE	(6)	68-100379 TABLE MOTOR
(7)	68-100380 SWEEP MOTOR	(8)	ELECTRICAL JUNCTION BOX INCOMING POWER	(9)	68-100381 200 VOLTS, 208 VOLTS 220 VOLTS, 380 VOLTS
(10)	68-100192 BALL ACCELERATOR MOTOR	(11)	68-100385 RIGHT-HAND SWITCH, TROUBLE LIGHT & BALL DOOR	(12)	68-100176 REAR CONTROL BOX ASSEMBLY
(13)	HIGH VOLTAGE BOX 47-862744	(14)	68-100383 HIGH VOLTAGE BOX TO COMMON BOX RIGHT MACHINE	(15)	OPTICAL TRIGGER PHOTOCELL
(16)	TEL-E-FOUL	(17)	BALL LIFT	(18)	PLAYER CONTROL STATION
(19)	BALL LIFT CONTROL CABLE 53-520588	(20)	68-100159 MANAGER'S REMOTE ON	(21)	TEL-E-FOUL POWER 68-100470
(22)	68-100043 FOUL & OPTICAL TRIGGER	(23)	BALL LIFT ADAPTOR CABLE 68-100407	(24)	MANAGER'S CONTROL BOX
(25)	HIGH VOLTAGE POWER SUPPLY (BOX 2)	(26)	COMMON BOX 47-862745	(27)	68-100157 SOLENOID DATA
(28)	68-100158 SWITCH DATA	(29)	GAMESETTER BOX 47-862708	(30)	68-100046 SOLENOID DATA
(31)	68-100044 SWITCH DATA	(32)	68-100382 HIGH VOLTAGE BOX TO COMMON BOX LEFT MACHINE	(33)	HIGH VOLTAGE POWRE SUPPLY (BOX 1)
(34)	68-100193 GAMESETTER POWER & PERIPHERAL CONTROL	(35)	PIN LIGHT CABLE (PART OF ASSEMBLY)	(36)	68-100381 ELEVATOR MOTOR

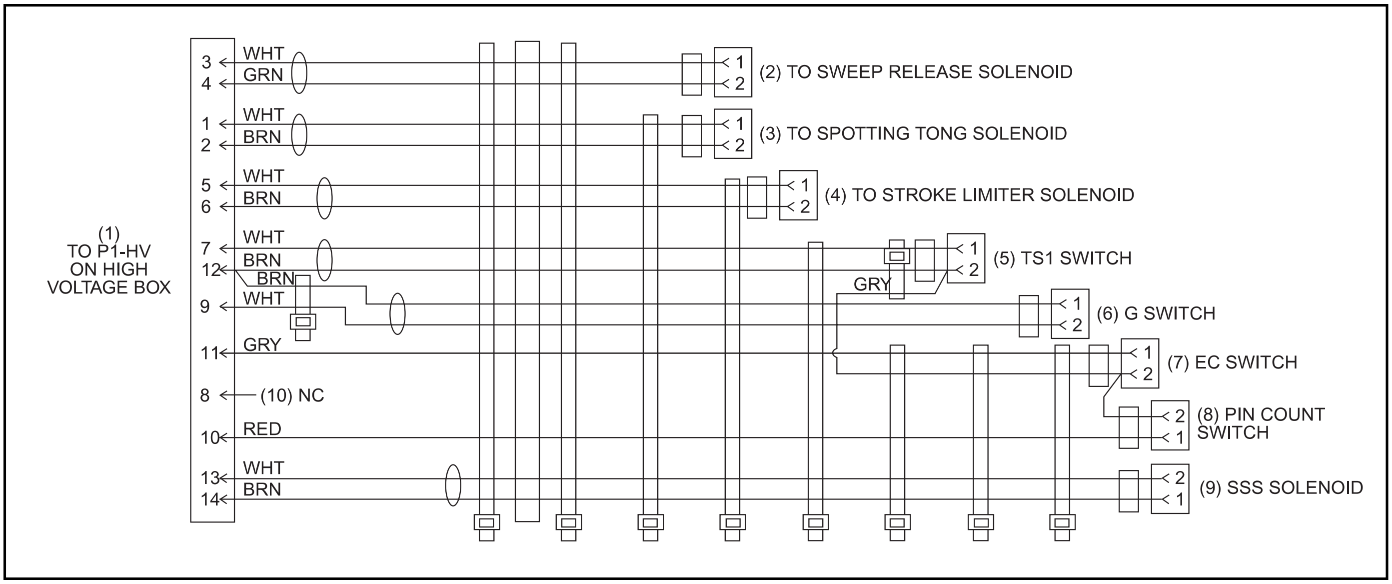


Figure 10-3. Left Side Function Cable (Part No. 47-162944-000)

(1)	TO P1-HV ON HIGH VOLTAGE BOX	(2)	TO SWEEP RELEASE SOLENOID	(3)	TO SPOTTING TONG SOLENOID
(4)	TO STROKE LIMITER SOLENOID	(5)	TS1 SWITCH	(6)	G SWITCH
(7)	EC SWITCH	(8)	PIN COUNT SWITCH	(9)	SHARK SOLENOID
(10)	NO CONNECTION				

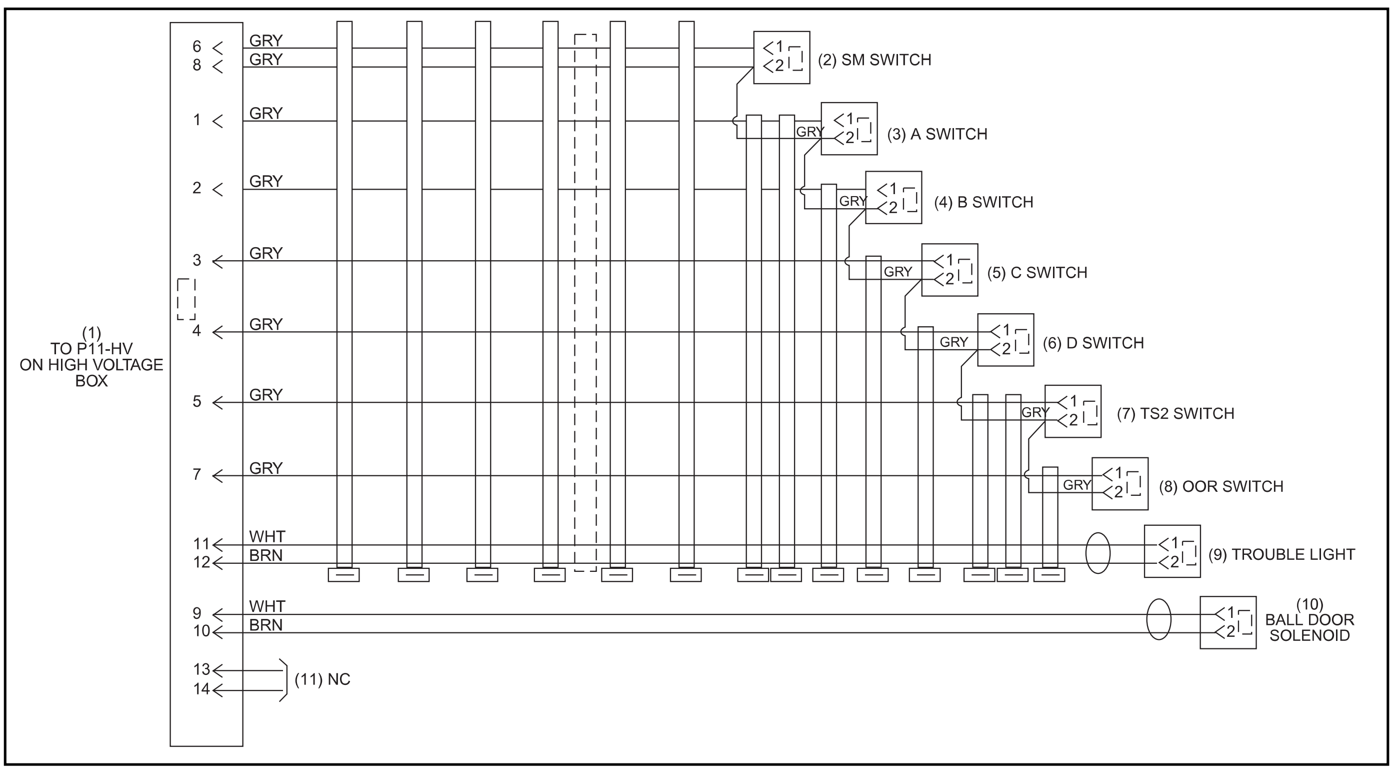


Figure 10-4. Right Side Function Cable (Part No. 68-100385-000)

(1)	TO P11-HV ON HIGH VOLTAGE BOX	(2)	SM SWITCH	(3)	A SWITCH
(4)	B SWITCH	(5)	C SWITCH	(6)	D SWITCH
(7)	TS2 SWITCH	(8)	OOR SWITCH	(9)	TROUBLE LIGHT
(10)	BALL DOOR SOLENOID	(11)	NO CONNECTION		

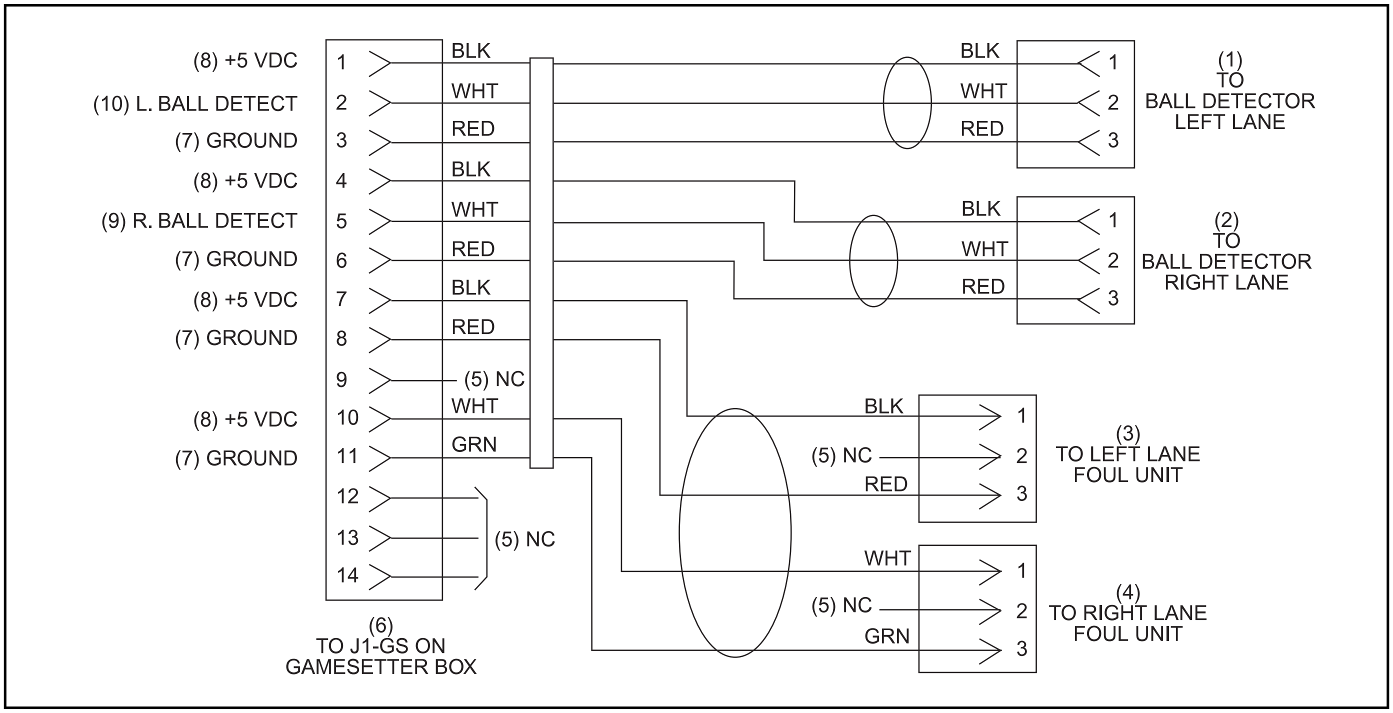


Figure 10-5. Optical Trigger & Foul Cable (Part No. 47-192592-000)

(1) TO BALL DETECTOR LEFT LANE
(2) TO BALL DETECTOR RIGHT LANE
(3) TO LEFT LANE FOUL UNIT
(4) TO RIGHT LANE FOUL UNIT
(5) NO CONNECTION
(6) TO J1-GS ON GAMESETTER BOX
(7) GROUND
(8) +5 VOLTS DC
(9) RIGHT BALL DETECT
(10) LEFT BALL DETECT

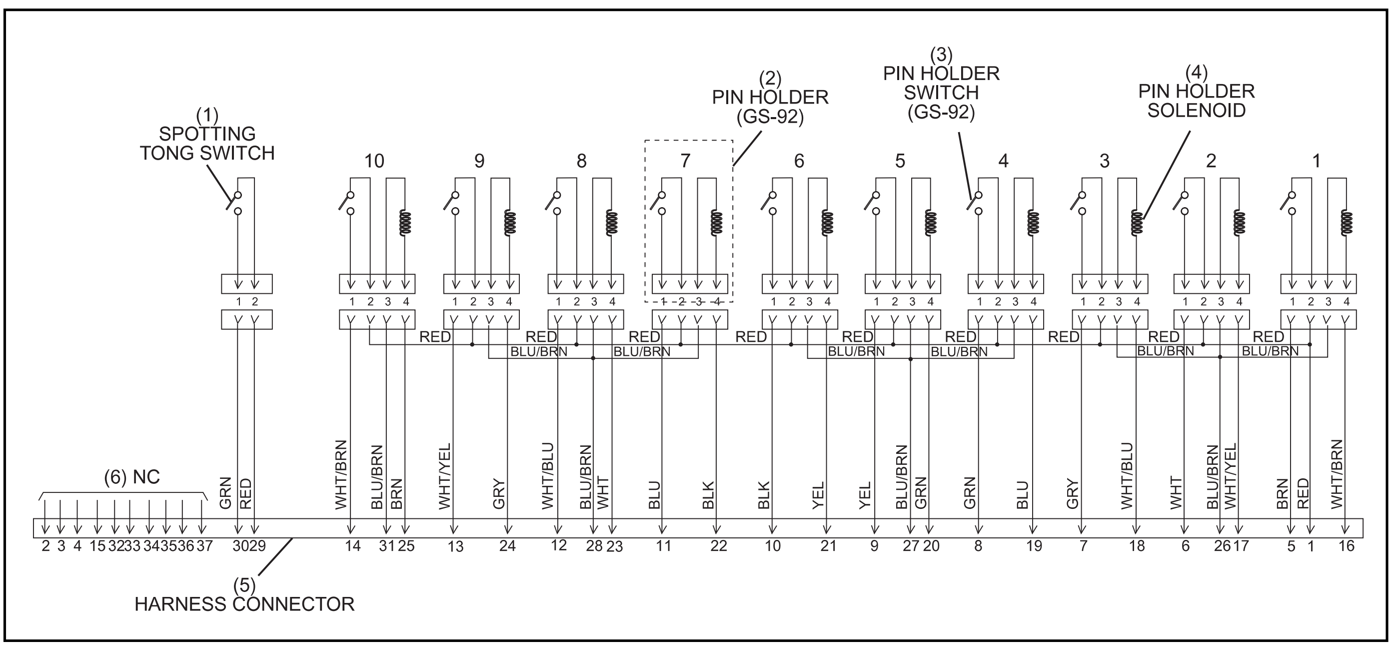


Figure 10-6. Schematic for Setting Table Harness Cable with One Pinholder Switch (Part No. 47-243025-003)

(1) SPOTTING TONG SWITCH
(2) PIN HOLDER (GS-92)
(3) PIN HOLDER SWITCH (GS-92)
(4) PIN HOLDER SOLENOID
(5) HARNESS CONNECTOR
(6) NO CONNECTION

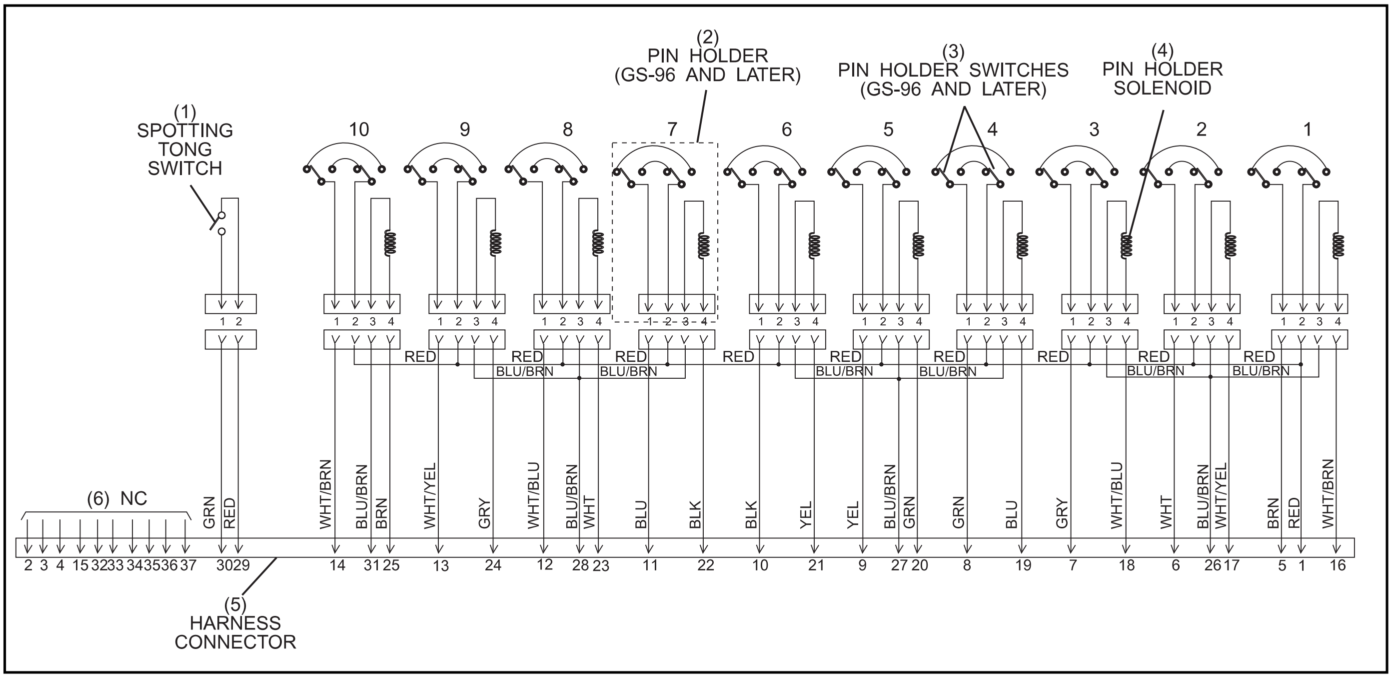


Figure 10-7. Schematic for Setting Table Harness Cable with Two Pinholder Switches (Part No. 47-243025-003)

(1) SPOTTING TONG SWITCH	(2) PIN HOLDER (GS-96 AND LATER)	(3) PIN HOLDER SWITCHES (GS-96 AND LATER)
(4) PIN HOLDER SOLENOID	(5) HARNESS CONNECTOR	(6) NO CONNECTION

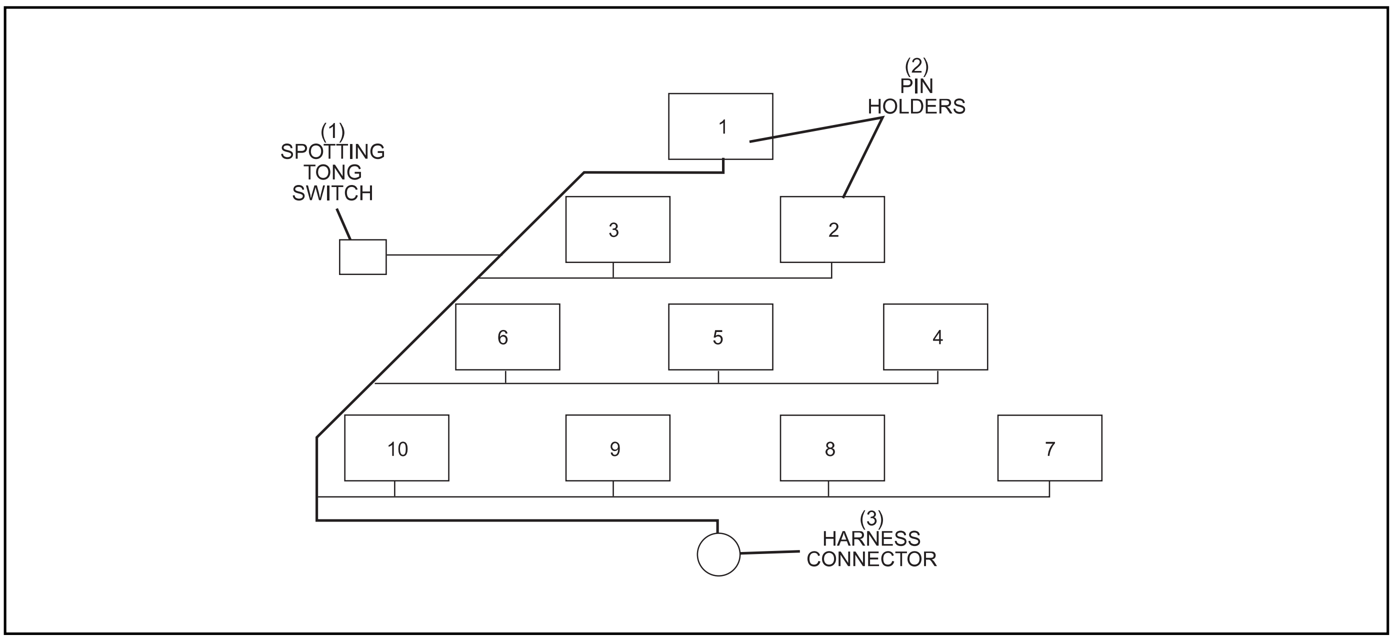


Figure 10-8. Pictorial of Setting Table Harness Cable (Part No. 47-243025-003)

(1) SPOTTING TONG SWITCH	(2) PIN HOLDERS	(3) HARNESS CONNECTOR

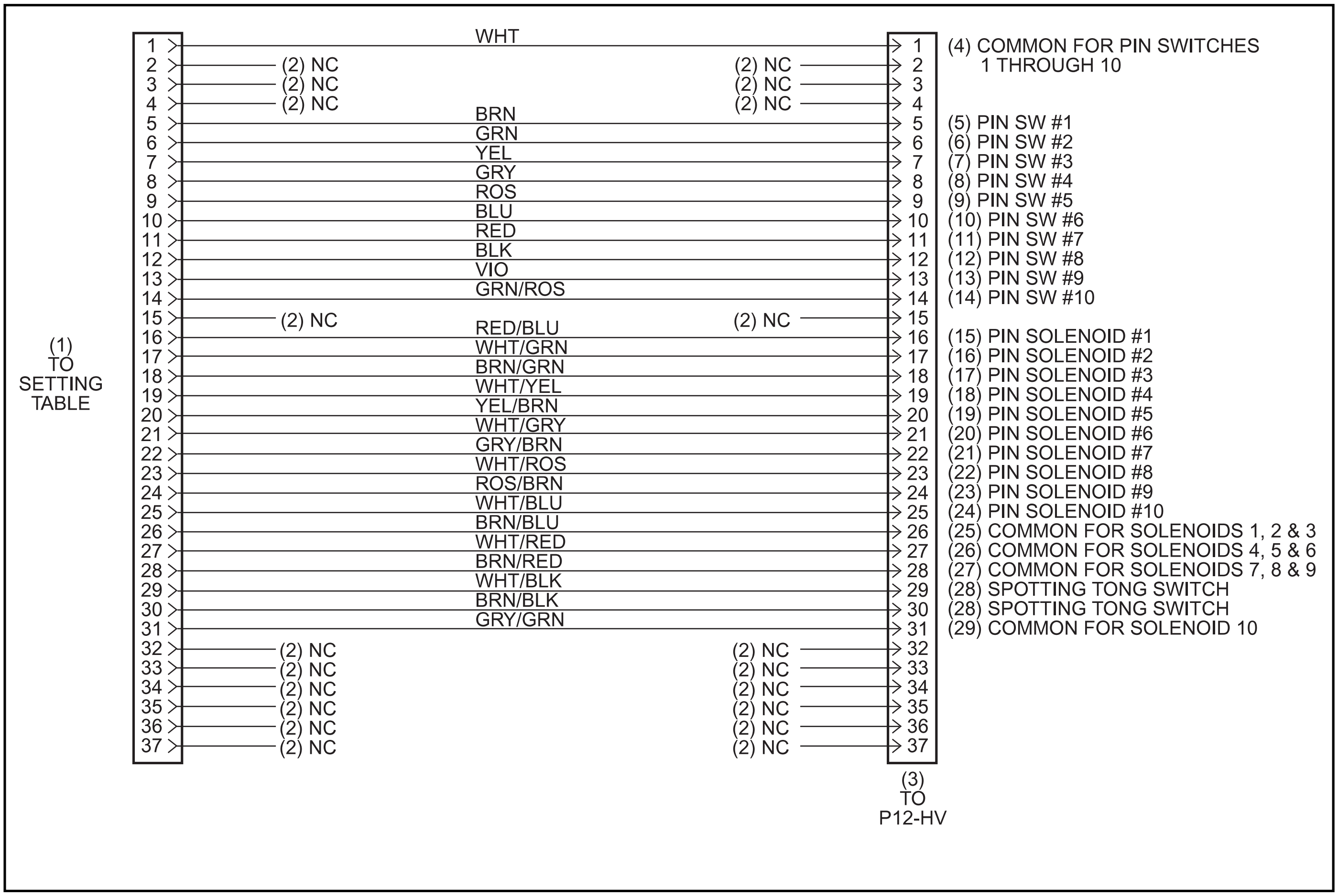


Figure 10-9. External Table Setting Cable (Part No. 68-100378-000)

(1)	TO SETTING TABLE	(2)	NO CONNECTION	(3)	TO P12-HV
(4)	COMMON FOR PIN SWITCHES 1 THROUGH 10	(5)	PIN SWITCH #1	(6)	PIN SWITCH #2
(7)	PIN SWITCH #3	(8)	PIN SWITCH #4	(9)	PIN SWITCH #5
(10)	PIN SWITCH #6	(11)	PIN SWITCH #7	(12)	PIN SWITCH #8
(13)	PIN SWITCH #9	(14)	PIN SWITCH #10	(15)	PIN SOLENOID #1
(16)	PIN SOLENOID #2	(17)	PIN SOLENOID #3	(18)	PIN SOLENOID #4
(19)	PIN SOLENOID #5	(20)	PIN SOLENOID #6	(21)	PIN SOLENOID #7
(22)	PIN SOLENOID #8	(23)	PIN SOLENOID #9	(24)	PIN SOLENOID #10
(25)	COMMON FOR SOLENOIDS 1, 2 & 3	(26)	COMMON FOR SOLENOIDS 4, 5 & 6	(27)	PIN SOLENOIDS FOR 7, 8 & 9
(28)	SPOTTING TONG SWITCH	(29)	COMMON FOR SOLENOID		

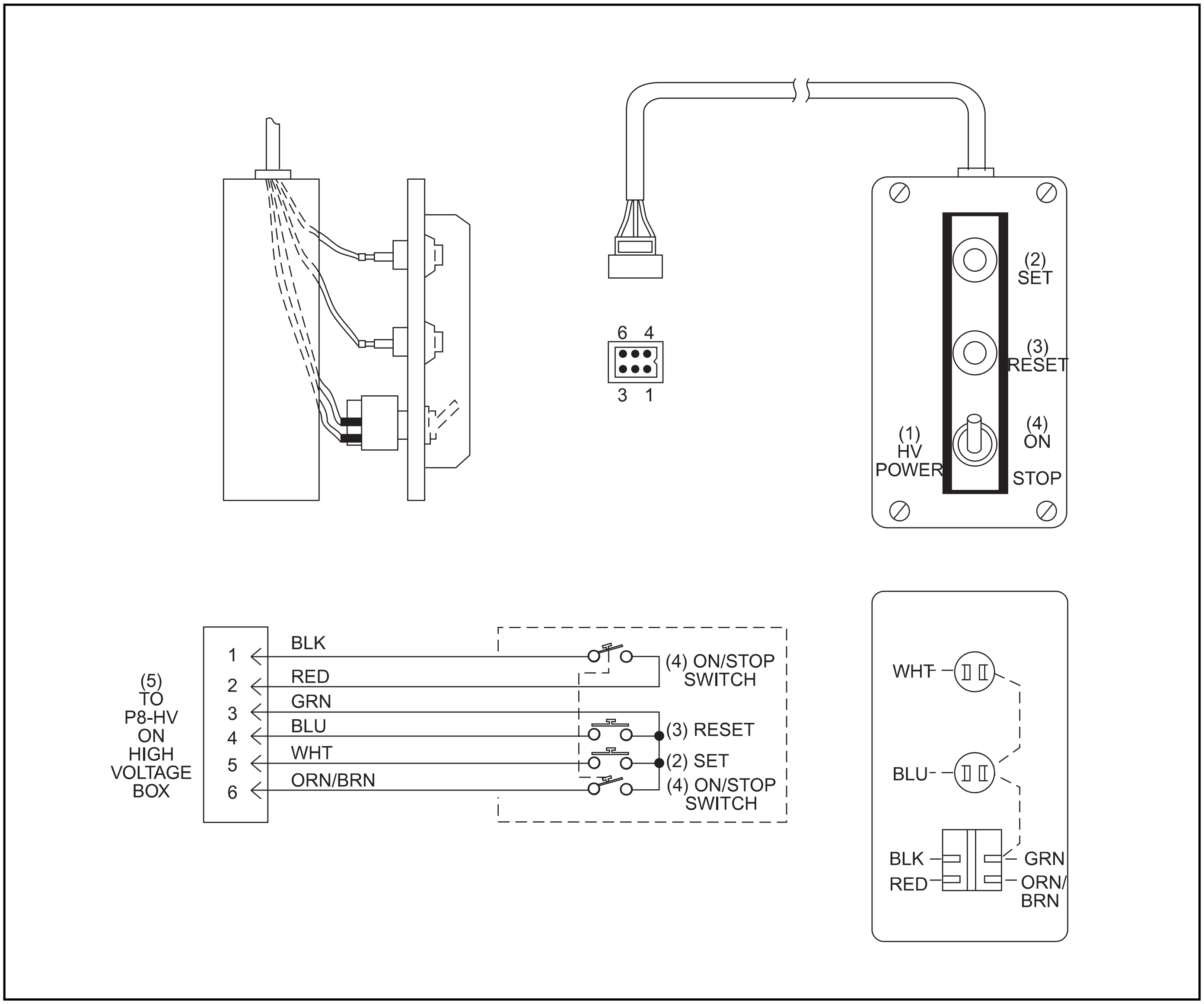


Figure 10-10. Rear Control Box Cable (Part No. 47-243071-003)

(1)	HIGH VOLTAGE POWER	(2)	SET	(3)	RESET
(4)	ON/STOP SWITCH	(5)	TO P8-HV ON HIGH VOLTAGE BOX		

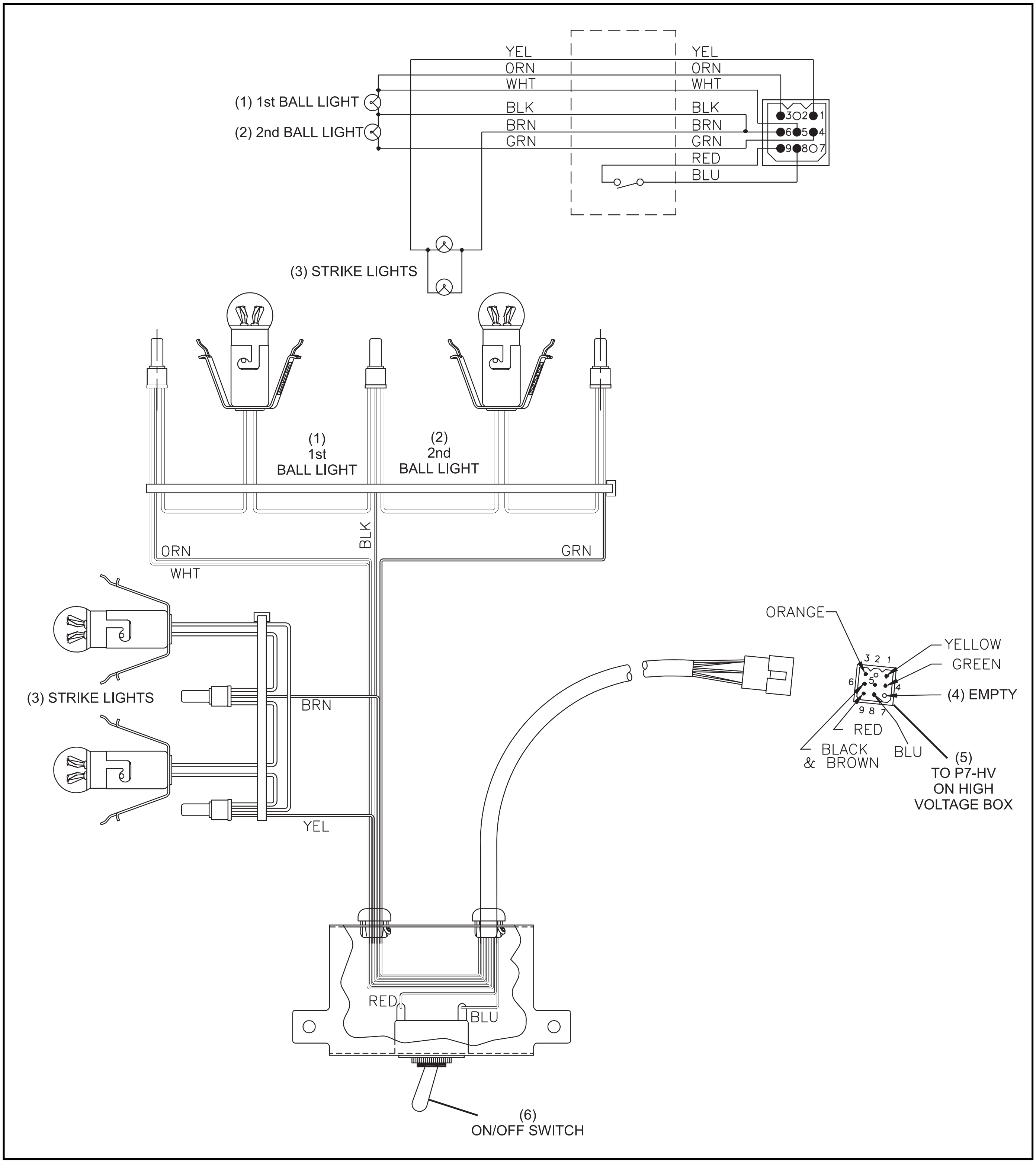


Figure 10-11. Masking Unit Cable (Part No. 53-200871-000)

(1) FIRST BALL LIGHT	(2) SECOND BALL LIGHT	(3) STRIKE LIGHTS
(4) EMPTY	(5) TO P7-HV ON HIGH VOLTAGE BOX	(6) ON/OFF SWITCH

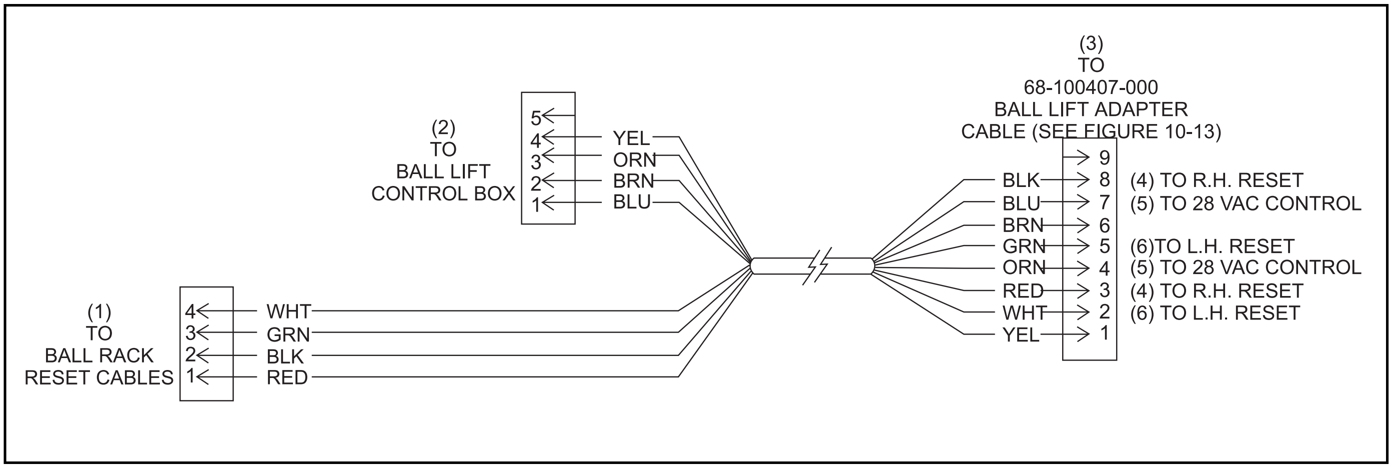


Figure 10-12. Ball Rack Lane Cable (Part No. 53-520588-000)

(1) TO BALL RACK RESET CABLES	(2) TO BALL LIFT CONTROL BOX	(3) TO 68-100407-000 BALL LIFT ADAPTER CABLE (SEE FIGURE 10-13)
(4) TO RIGHT-HAND RESET	(5) TO 28 VAC CONTROL	(6) TO LEFT-HAND RESET

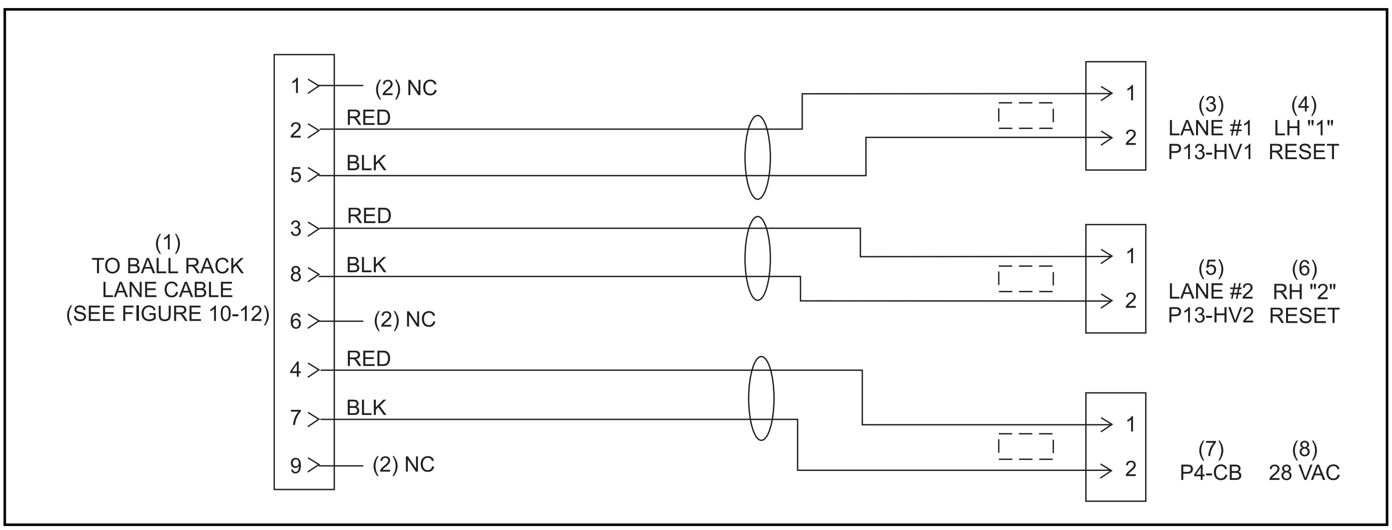


Figure 10-13. Ball Lift Adapter Cable (Part No. 68-100407-000)

(1) TO BALL RACK LANE CABLE (SEE FIGURE 10-12)	(2) NO CONNECTION	(3) LANE #1 P13-HV1
(4) LEFT-HAND "1" RESET	(5) LANE #2 P13-HV2	(6) RIGHT-HAND "2" RESET
(7) P4-CB	(8) 28 VAC	

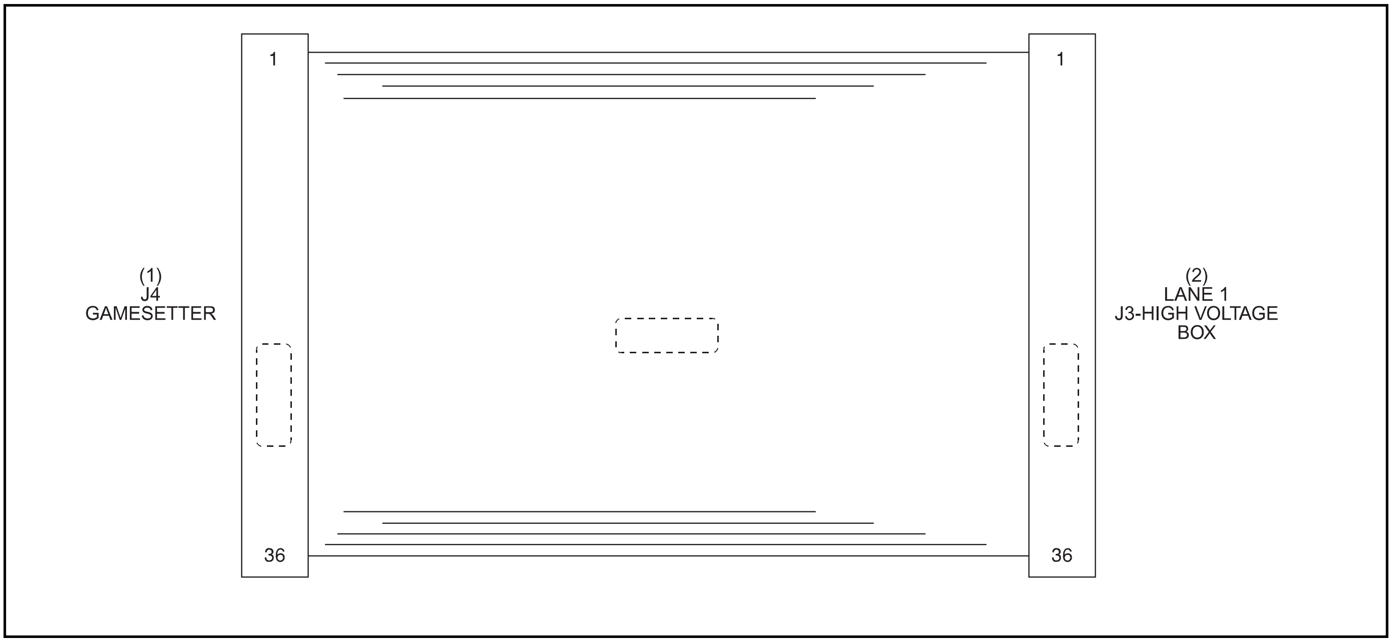


Figure 10-14. Switch Data Cable (Part No. 68-100044-000)

(1) J4 GAMESETTER (2) LANE 1 J3 - HIGH VOLTAGE BOX

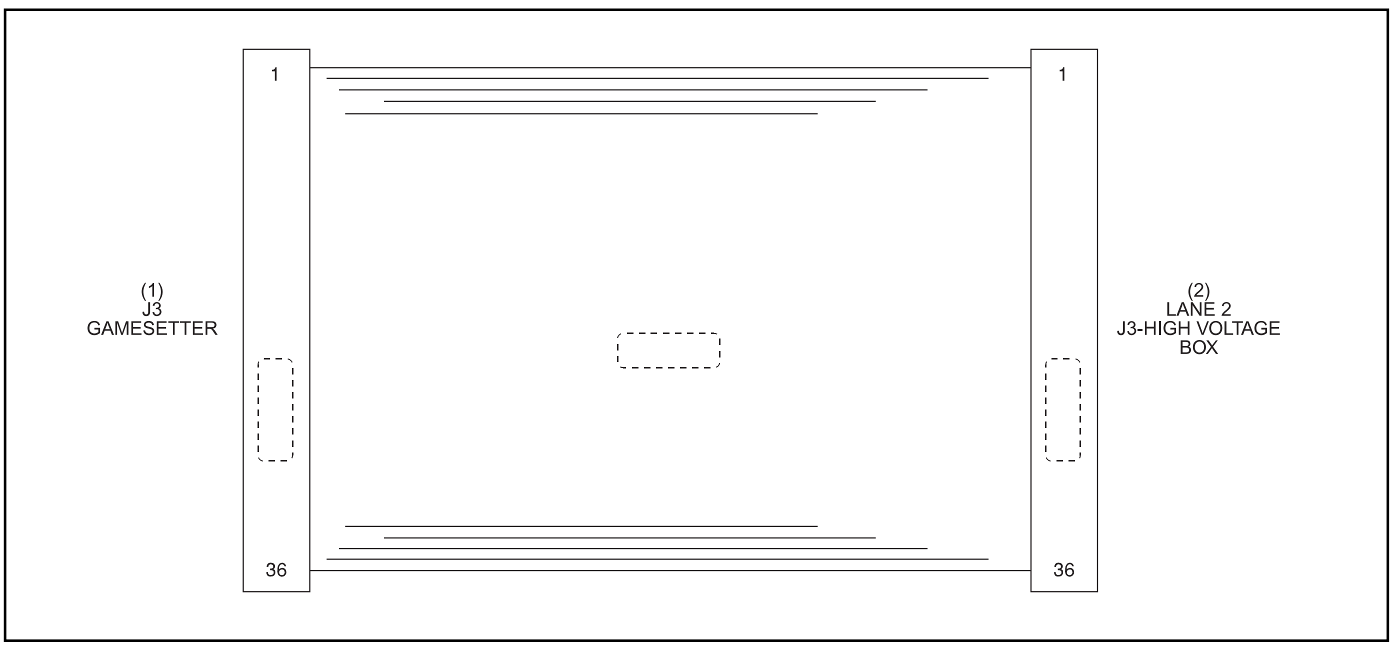


Figure 10-15. Switch Data Cable (Part No. 68-100158-000)

(1) J3 GAMESETTER (2) LANE 2 J3 - HIGH VOLTAGE BOX

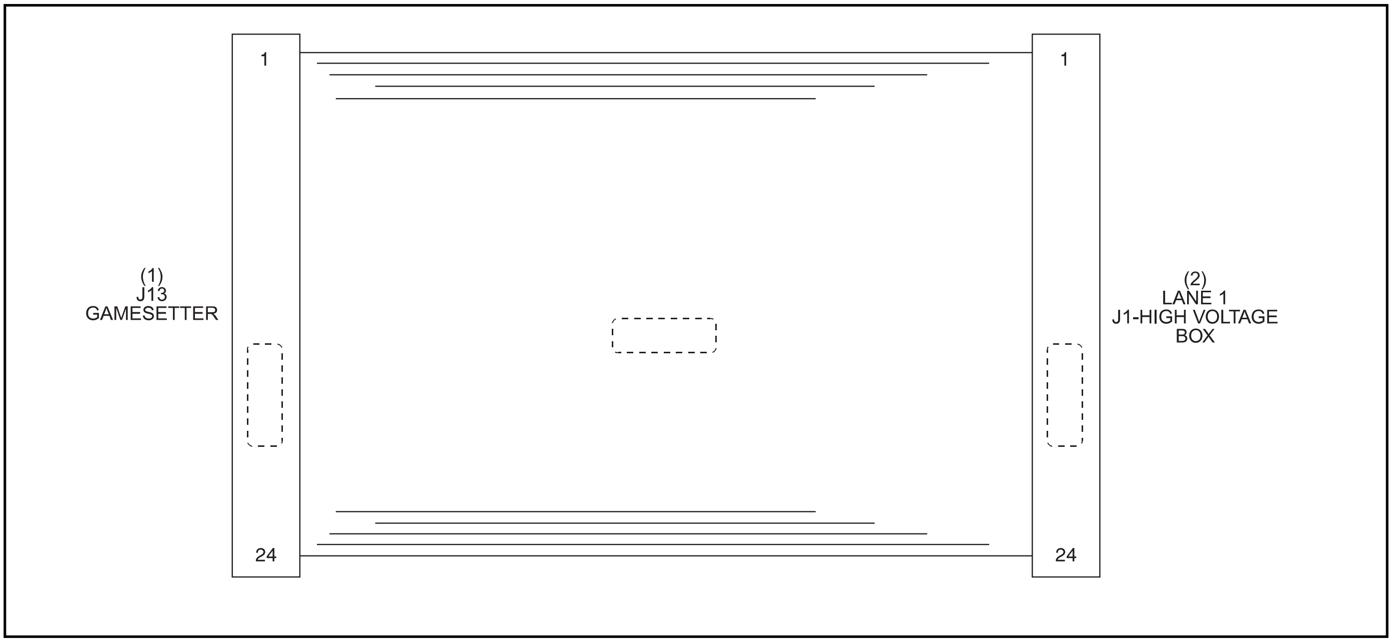


Figure 10-16. Solenoid Data Cable (Part No. 68-100046-000)

(1) J13 GAMESETTER (2) LANE 1 J1 - HIGH VOLTAGE BOX

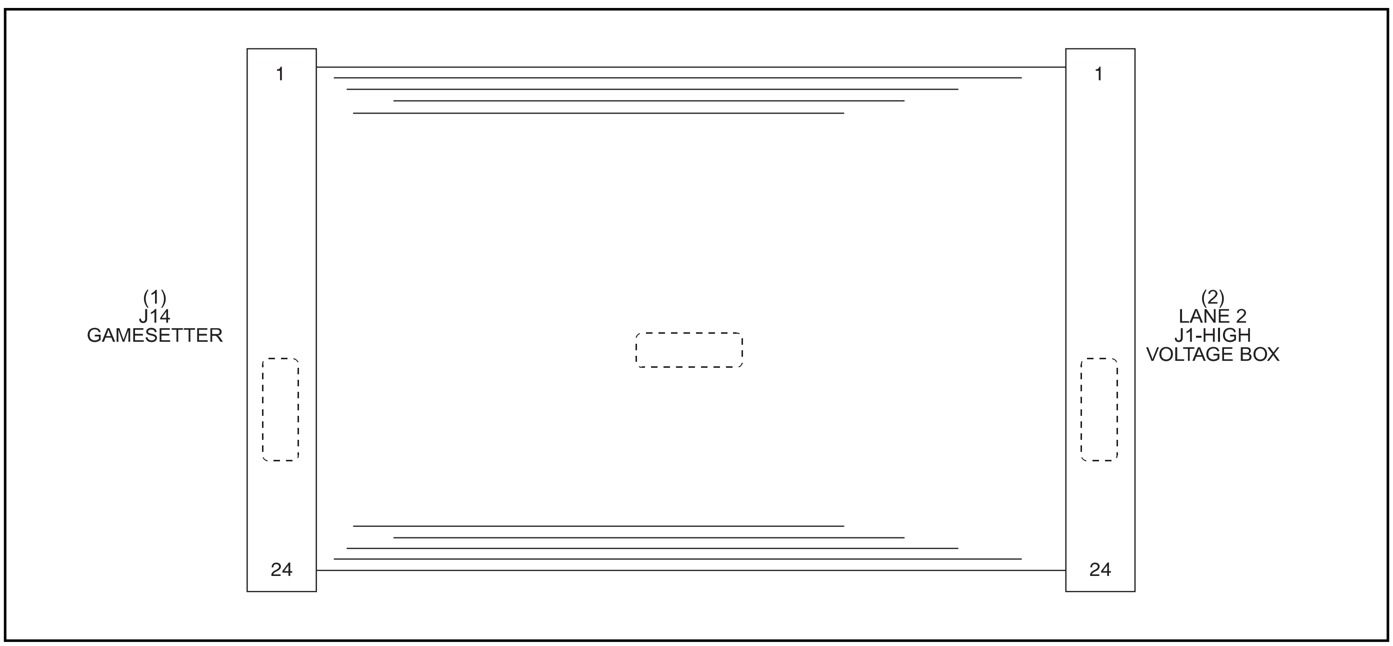


Figure 10-17. Solenoid Data Cable (Part No. 68-100157-000)

(1) J14 GAMESETTER (2) LANE 2 J1 - HIGH VOLTAGE BOX

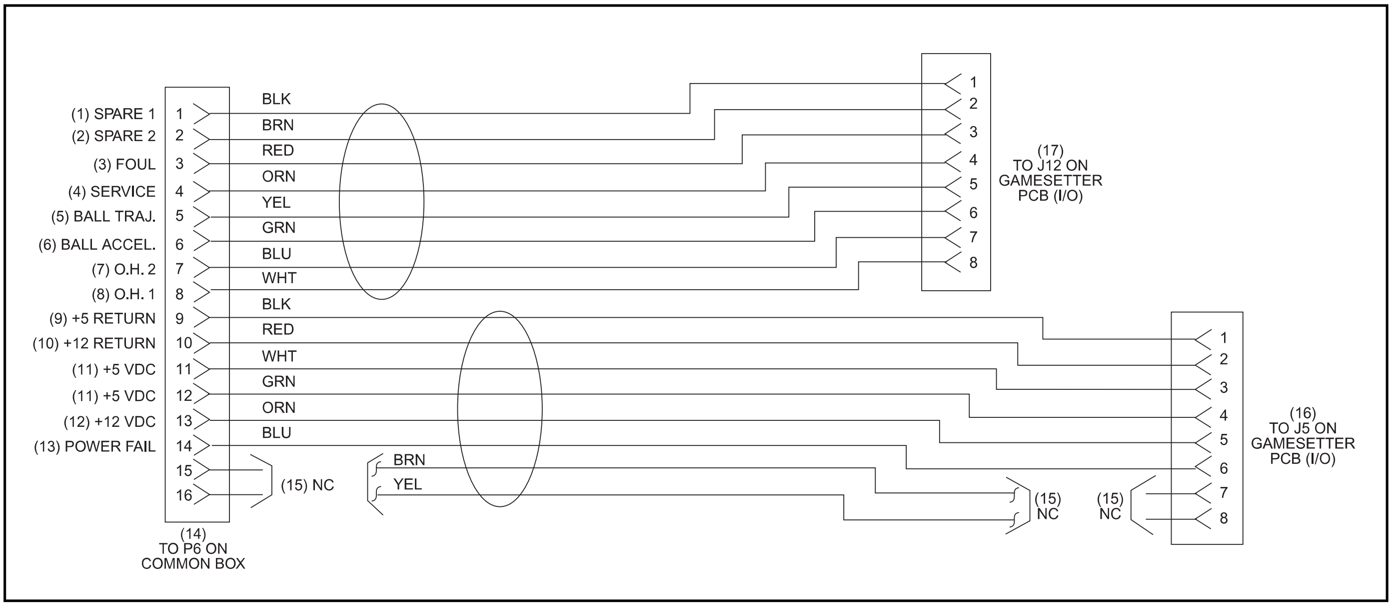


Figure 10-18. GS Power & Peripheral Control Cable (Part No. 68-100048-000)

(1) SPARE 1	(2) SPARE 2	(3) FOUL
(4) SERVICE	(5) BALL TRAJECTORY	(6) BALL ACCELERATOR
(7) OVERHEAD 2	(8) OVERHEAD 1	(9) +5 RETURN
(10) +12 RETURN	(11) +5 VOLTS DC	(12) +12 VOLTS DC
(13) POWER FAIL	(14) TO P6 ON COMMON BOX	(15) NO CONNECTION
(16) TO J5 ON GAMESETTER PCB (I/O)	(17) TO J12 ON GAMESETTER PCB (I/O)	

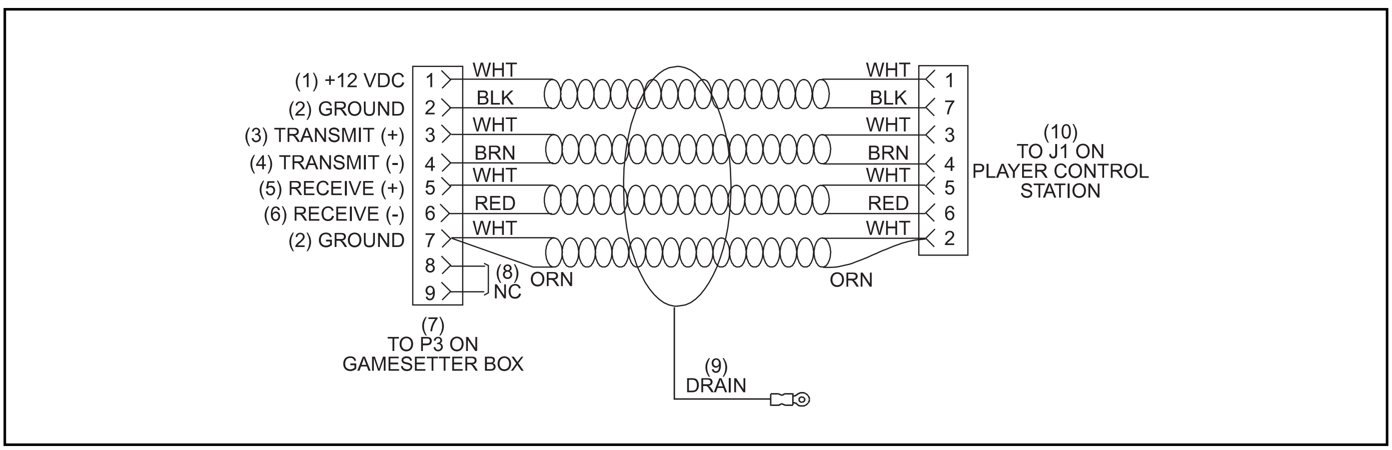


Figure 10-19. Player Control Station Cable (Part No. 68-100050-000)

(1) +12 VOLTS DC	(2) GROUND	(3) TRANSMIT (+)
(4) TRANSMIT (-)	(5) RECEIVE (+)	(6) RECEIVE (-)
(7) TO P3 ON GAMESETTER BOX	(8) NO CONNECTION	(9) DRAIN
(10) TO J1 ON PLAYER CONTROL STATION		

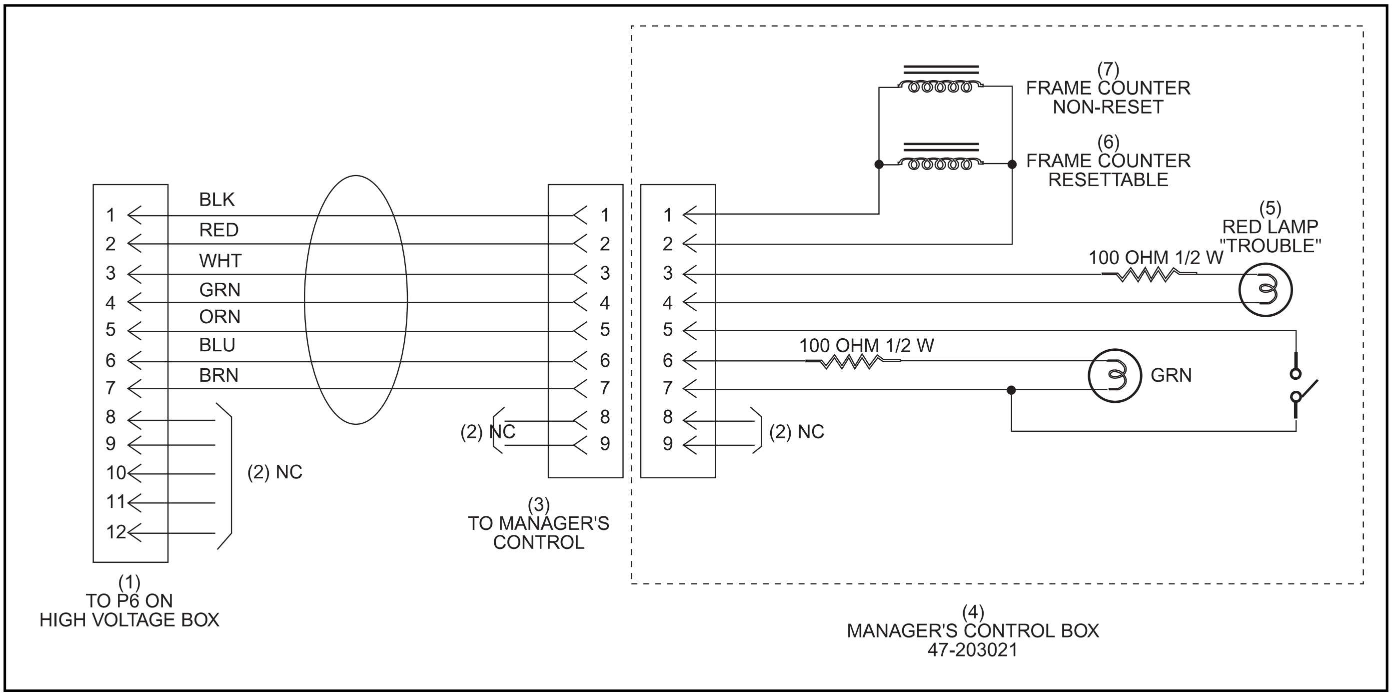


Figure 10-20. Manager's Remote Control Cable (Part No. 68-100159-000)

(1) TO P6 ON HIGH VOLTAGE BOX (2) NO CONNECTION (3) TO MANAGER'S CONTROL
(4) MANAGER'S CONTROL BOX 47-203021 (5) RED LAMP "TROUBLE" (6) FRAME COUNTER RESETTABLE
(7) FRAME COUNTER NON-RESET

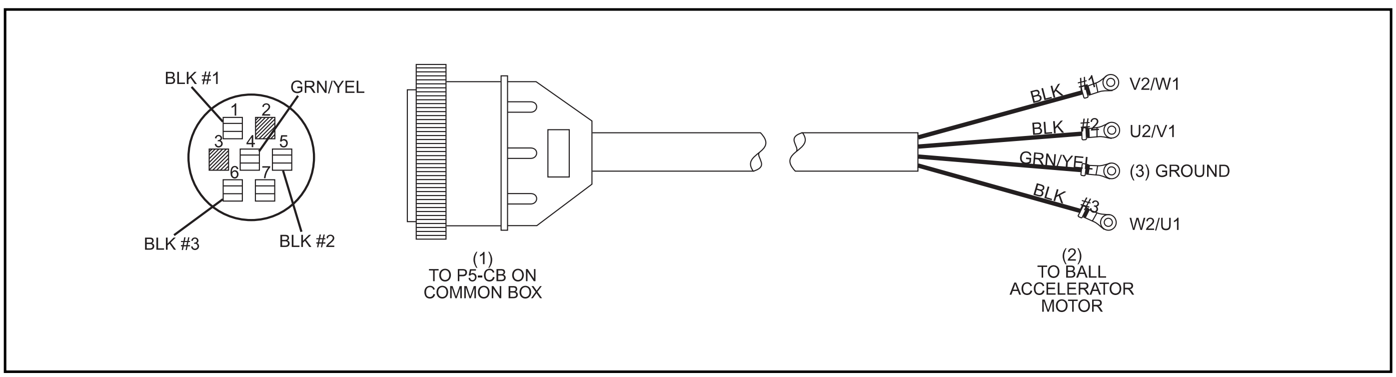


Figure 10-21. Ball Accelerator Cable (Part No. 68-100192-000)

(1) TO P5-CB ON COMMON BOX (2) TO BALL ACCELERATOR MOTOR (3) GROUND

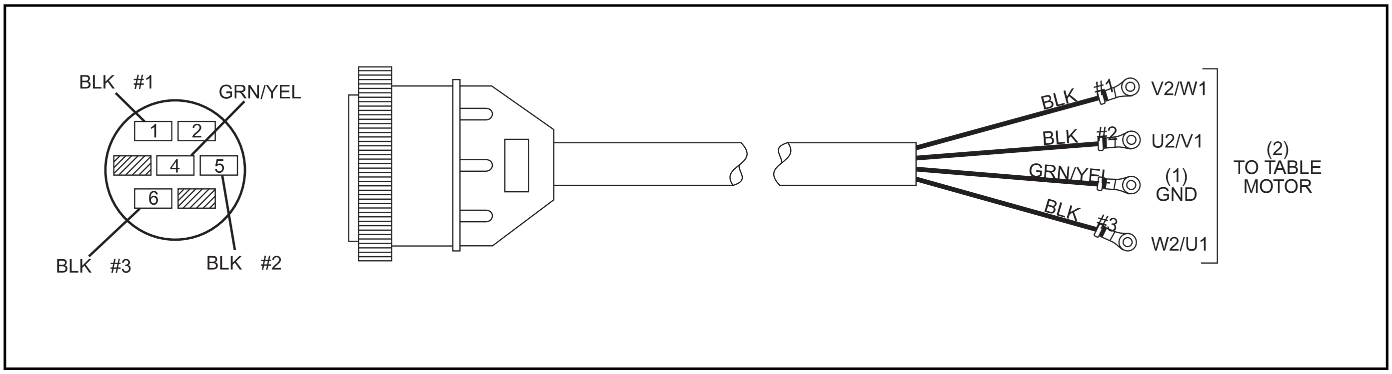


Figure 10-22. P2-HV Table Motor Cable (Part No. 68-100379-000)

(1) GROUND (2) TO TABLE MOTOR

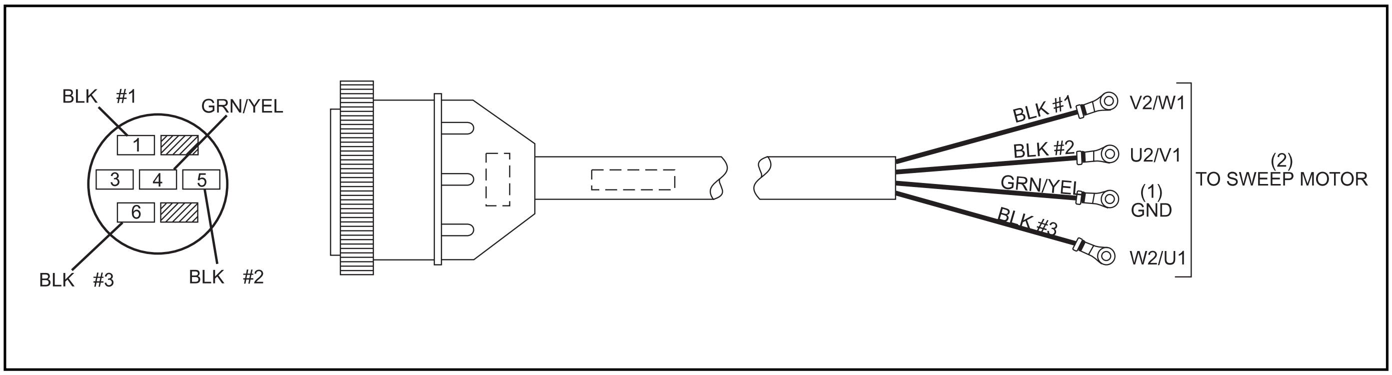


Figure 10-23. P3-HV Sweep Motor Cable (Part No. 68-100380-000)

(1) GROUND (2) TO SWEEP MOTOR

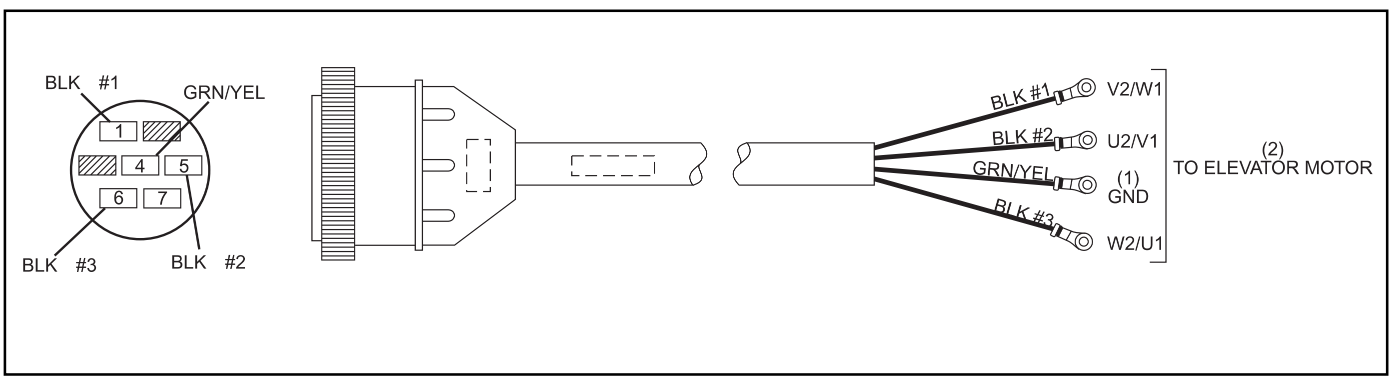


Figure 10-24. P4-HV Elevator Motor Cable (Part No. 68-100381-000)

(1) GROUND (2) TO ELEVATOR MOTOR

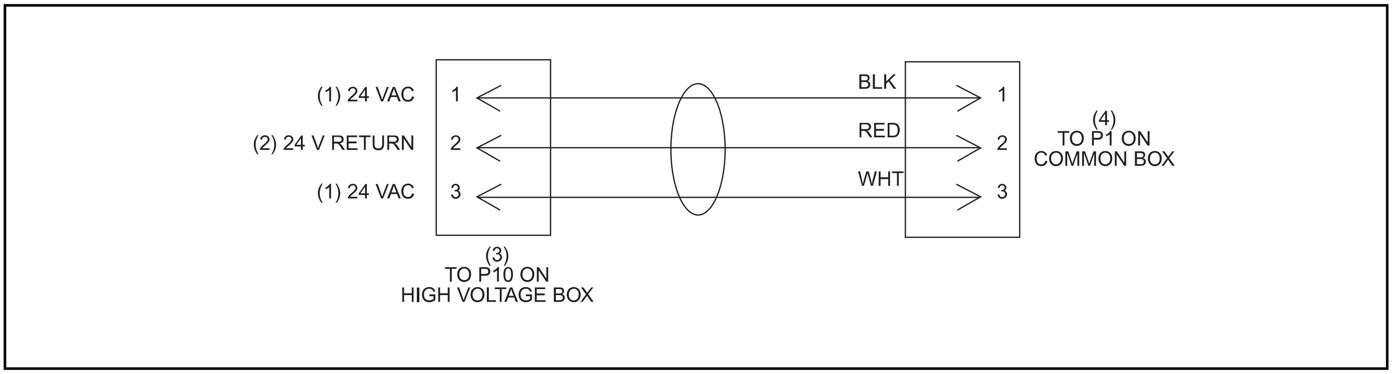


Figure 10-25. Remote “On” Left Lane Cable (Part No. 68-100382-000)

(1) 24 VOLTS AC (2) 24 VOLTS RETURN (3) TO P10 ON HIGH VOLTAGE BOX
(4) TO P1 ON COMMON BOX

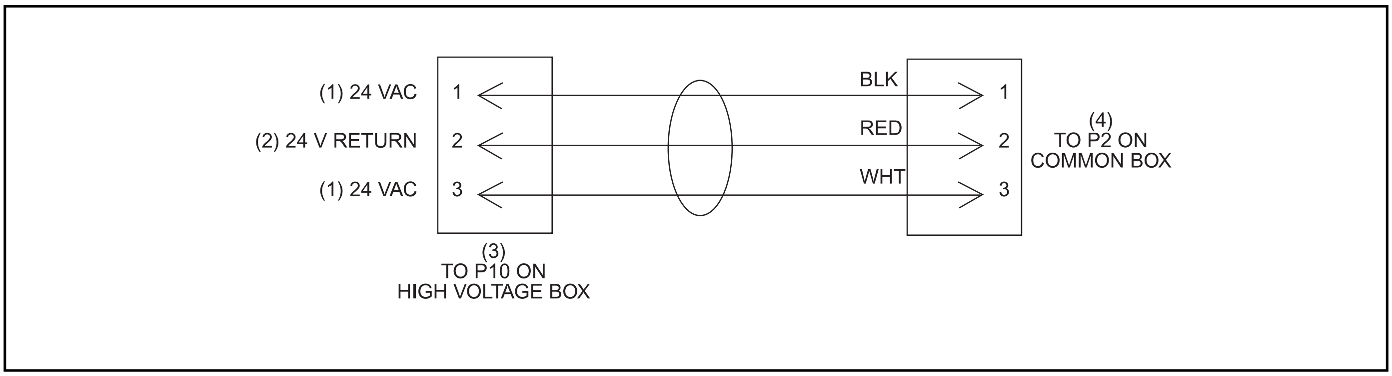


Figure 10-26. Remote “On” Right Lane Cable (Part No. 68-100383-000)

(1) 24 VOLTS AC (2) 24 VOLTS RETURN (3) TO P10 ON HIGH VOLTAGE BOX
(4) TO P2 ON COMMON BOX

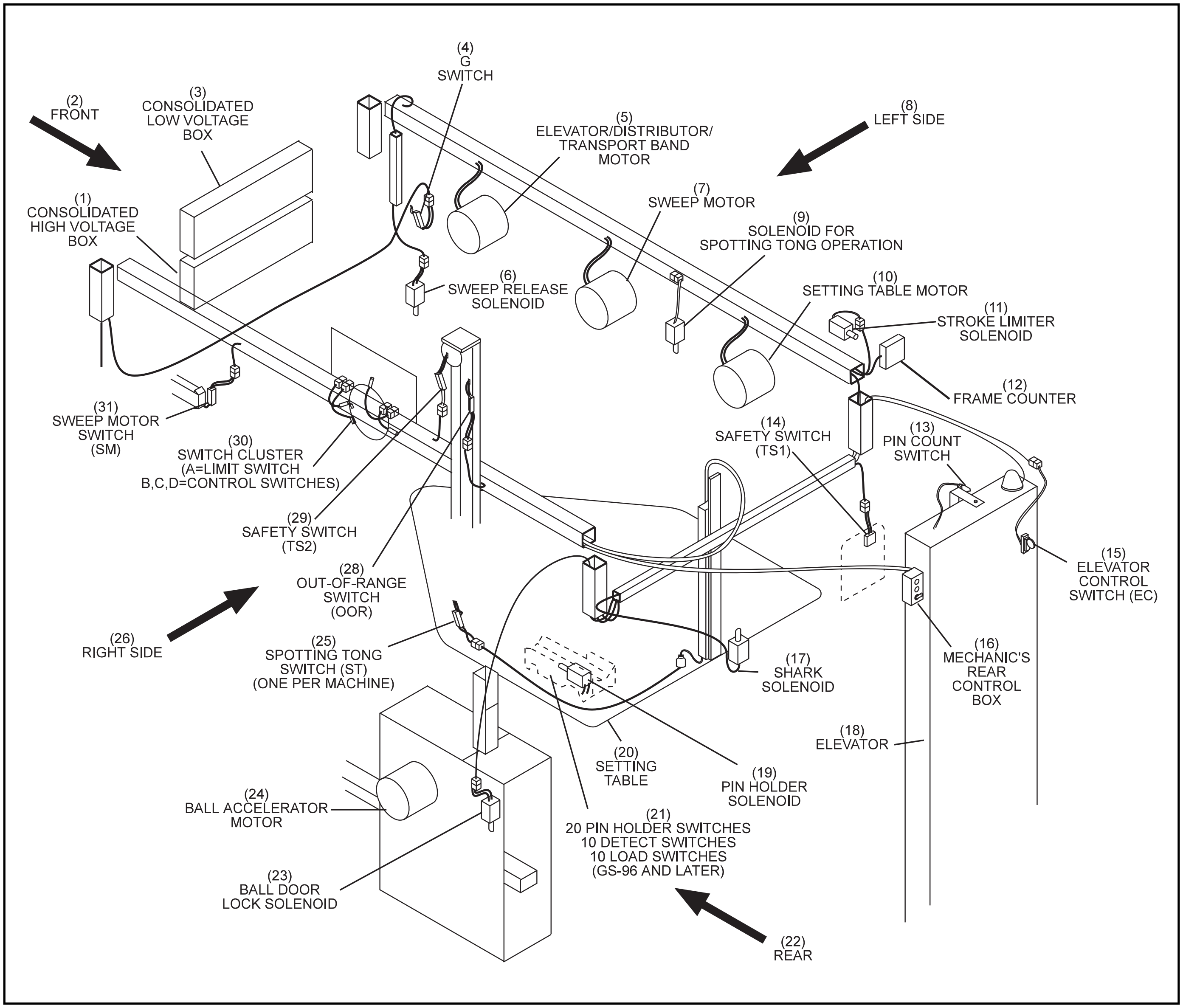


Figure 11-1. GS-98 Pinsetter Electrical System Overview with Consolidated Electronics

(1)	CONSOLIDATED HIGH VOLTAGE BOX	(2)	FRONT	(3)	CONSOLIDATED LOW VOLTAGE BOX
(4)	G SWITCH	(5)	ELEVATOR/DISTRIBUTOR/ TRANSPORT BAND MOTOR	(6)	SWEEP RELEASE SOLENOID
(7)	SWEEP MOTOR	(8)	LEFT SIDE	(9)	SOLENOID FOR SPOTTING TONG OPERATION
(10)	SETTING TABLE MOTOR	(11)	STROKE LIMITER SOLENOID	(12)	FRAME COUNTER
(13)	PIN COUNT SWITCH	(14)	SAFETY SWITCH (TS1)	(15)	ELEVATOR CONTROL SWITCH (EC)
(16)	MECHANIC’S REAR CONTROL BOX	(17)	SHARK SOLENOID	(18)	ELEVATOR
(19)	PIN HOLDER SOLENOID	(20)	SETTING TABLE	(21)	20 PIN HOLDER SWITCHES, 10 DETECT SWITCHES, 10 LOAD SWITCHES (GS-96 AND LATER)
(22)	REAR	(23)	BALL DOOR LOCK SOLENOID	(24)	BALL ACCELERATOR MOTOR
(25)	SPOTTING TONG SWITCH (ST) (ONE PER MACHINE)	(26)	RIGHT SIDE	(27)	SETTING TABLE CABLE
(28)	OUT-OF-RANGE SWITCH (OOR)	(29)	SAFETY SWITCH (TS2)	(30)	SWITCH CLUSTER (A=LIMIT SWITCH, B,C,D=CONTROL SWITCHES

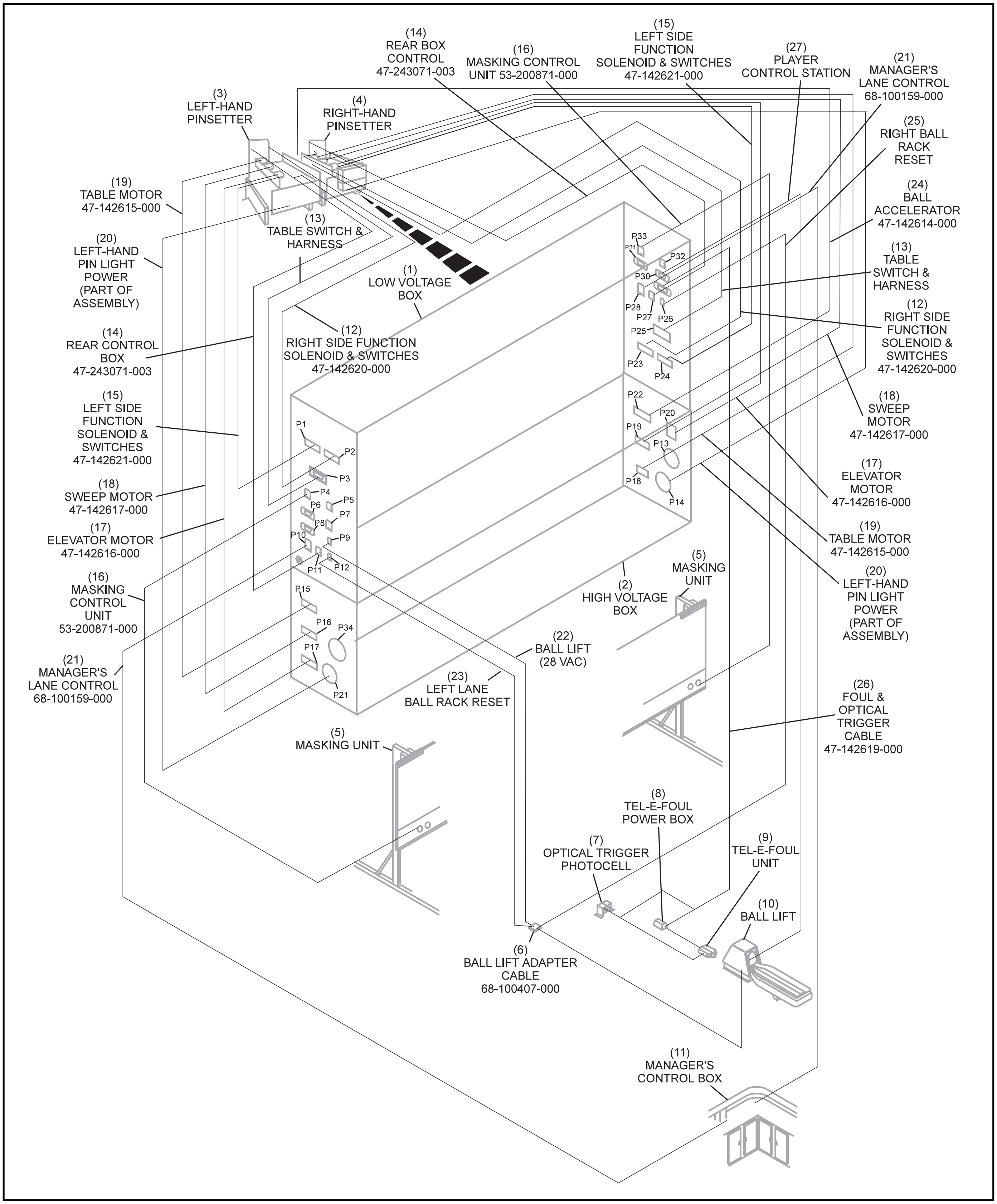


Figure 11-2. Consolidated Electronics Control System

Figure 11-2. Consolidated Electrnoics Control System

(1) LOW VOLTAGE BOX
(2) HIGH VOLTAGE BOX
(3) LEFT-HAND PINSETTER
(4) RIGHT-HAND PINSETTER
(5) MASKING UNIT
(6) BALL LIFT ADAPTER CABLE 68-100407-000
(7) OPTICAL TRIGGER PHOTOCELL
(8) TEL-E-FOUL POWER BOX
(9) TEL-E-FOUL UNIT
(10) BALL LIFT
(11) MANAGER'S CONTROL BOX
(12) RIGHT SIDE FUNCTION SOLENOID & SWITCHES 47-142620-000
(13) TABLE SWITCH AND HARNESS
(14) REAR BOX CONTROL 47-243071-003
(15) LEFT SIDE FUNCTION SOLENOID & SWITCHES 47-142621-000
(16) MASKING CONTROL UNIT 53-200871-000
(17) ELEVATOR MOTOR 47-142616-000
(18) SWEEP MOTOR 47-142617-000
(19) TABLE MOTOR 47-142615-000
(20) LEFT-HAND PIN LIGHT POWER (PART OF ASSEMBLY)
(21) MANAGER'S LANE CONTROL 68-100159-000
(22) BALL LIFT (28 VAC)
(23) LEFT LANE BALL RACK RESET
(24) BALL ACCELERATOR 47-142614-000
(25) RIGHT BALL RACK RESET
(26) FOUL AND OPTICAL TRIGGER CABLE 47-142619-000
(27) PLAYER CONTROL STATION

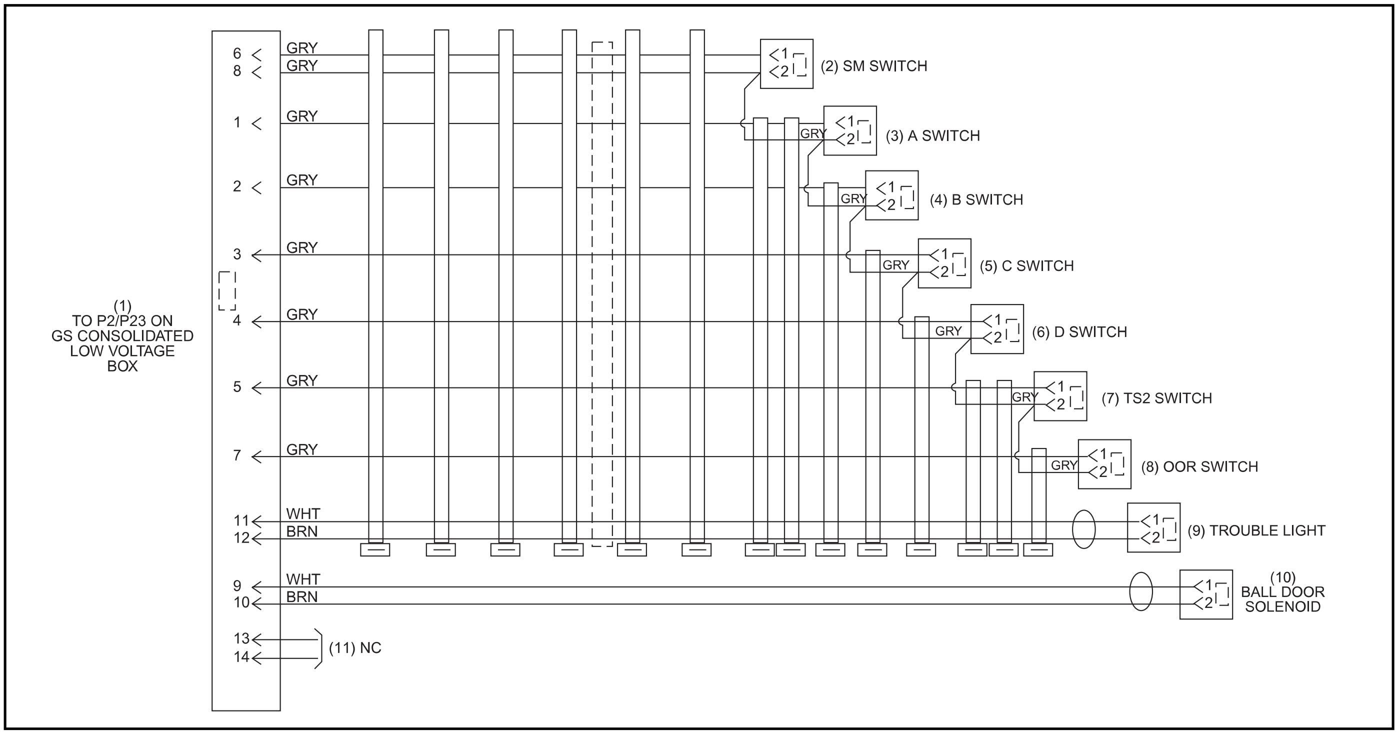


Figure 11-3. Right Side Function Cable (Part No. 47-142620-000)

(1) TO P2/P3 GS CONSOLIDATED CONTROL BOX	(2) SM SWITCH	(3) A SWITCH
(4) B SWITCH	(5) C SWITCH	(6) D SWITCH
(7) TS2 SWITCH	(8) OOR SWITCH	(9) TROUBLE LIGHT
(10) BALL DOOR SOLENOID	(11) NO CONNECTION	

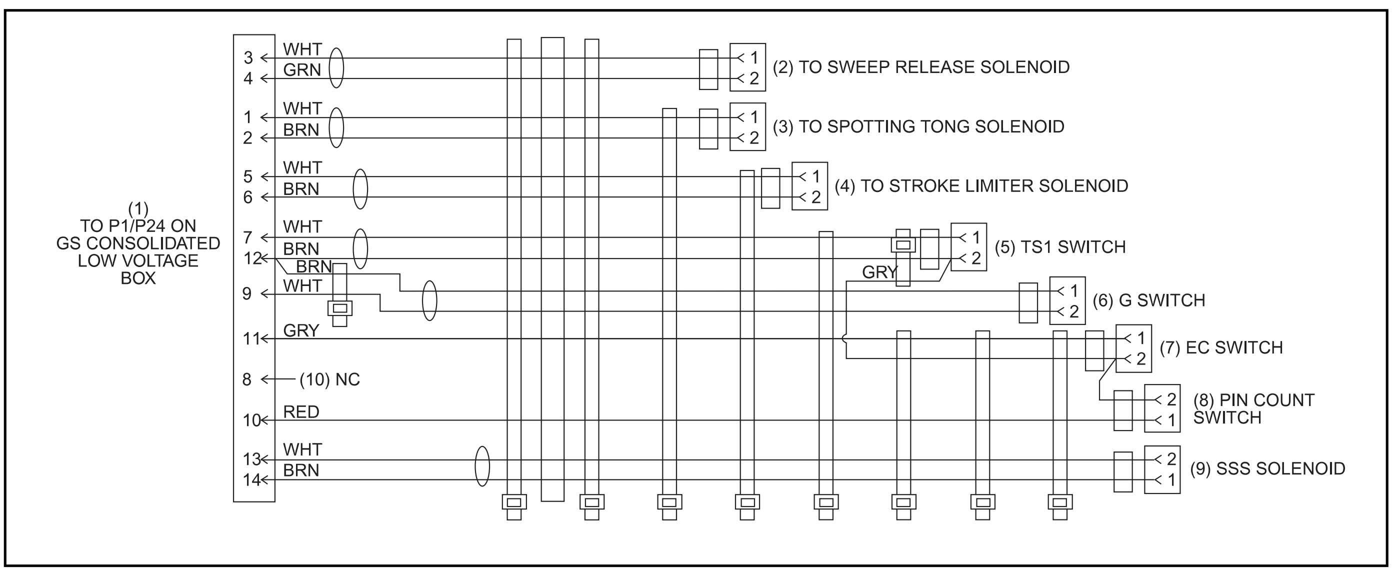


Figure 11-4. Left Side Function Cable (Part No. 47-142621-000)

(1) TO P1/P24 GS CONSOLIDATED CONTROL BOX	(2) TO SWEEP RELEASE SOLENOID	(3) TO SPOTTING TONG SOLENOID
(4) TO STROKE LIMITER SOLENOID	(5) TS1 SWITCH	(6) G SWITCH
(7) EC SWITCH	(8) PIN COUNT SWITCH	(9) SHARK SOLENOID
(10) NO CONNECTION		

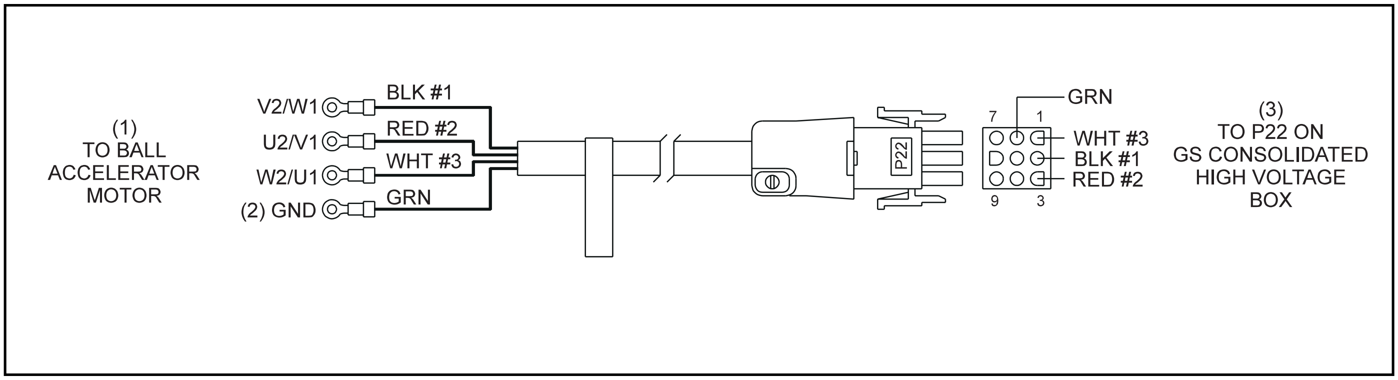


Figure 11-5. External Ball Accelerator Motor GS Consolidated Control Box Cable Assembly (Part No. 47-142614-000)

(1) TO BALL ACCELERATOR MOTOR	(2) GROUND	(3) TO P22 ON GS CONSOLIDATED HIGH VOLTAGE BOX

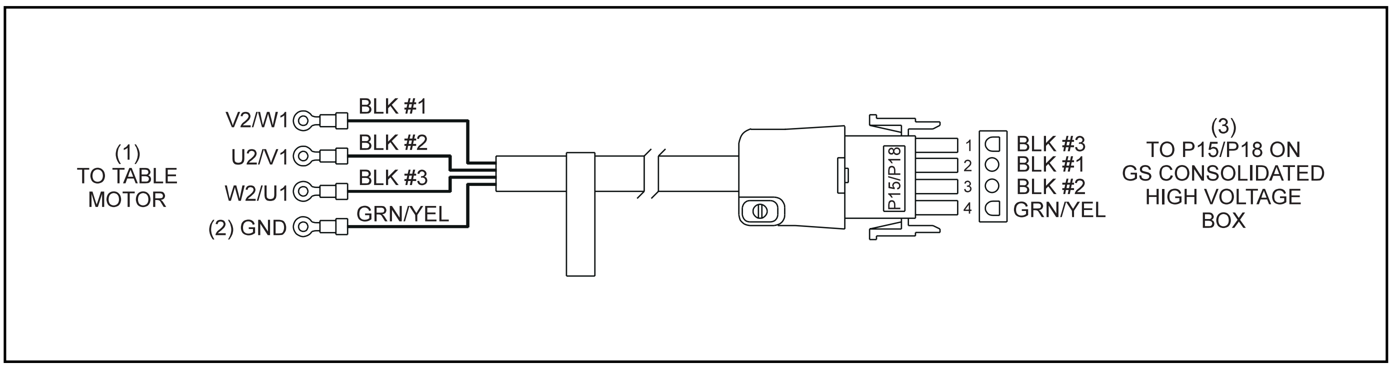


Figure 11-6. External TAble Motor GS Consolidated Control Box Cable Assembly (Part No. 47-142615-000)

(1) TO TABLE MOTOR	(2) GROUND	(3) TO P15/P18 ON GS CONSOLIDATED HIGH VOLTAGE BOX

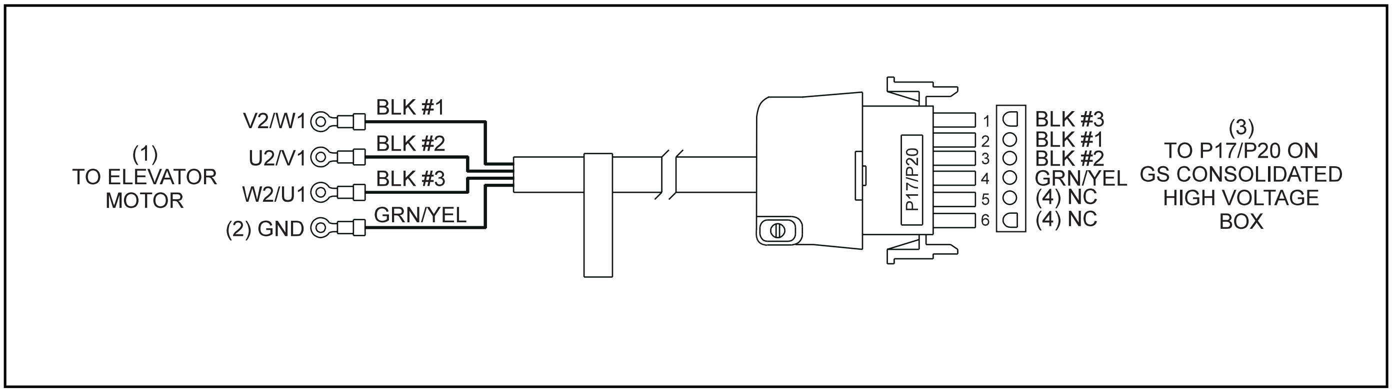


Figure 11-7. External Elevator Motor GS Consolidated Control Box Cable Assembly (Part No. 47-142616-000)

(1) TO ELEVATOR MOTOR

(2) GROUND

(3) TO P17/P20 ON GS CONSOLIDATED HIGH VOLTAGE BOX

(4) NO CONNECTION

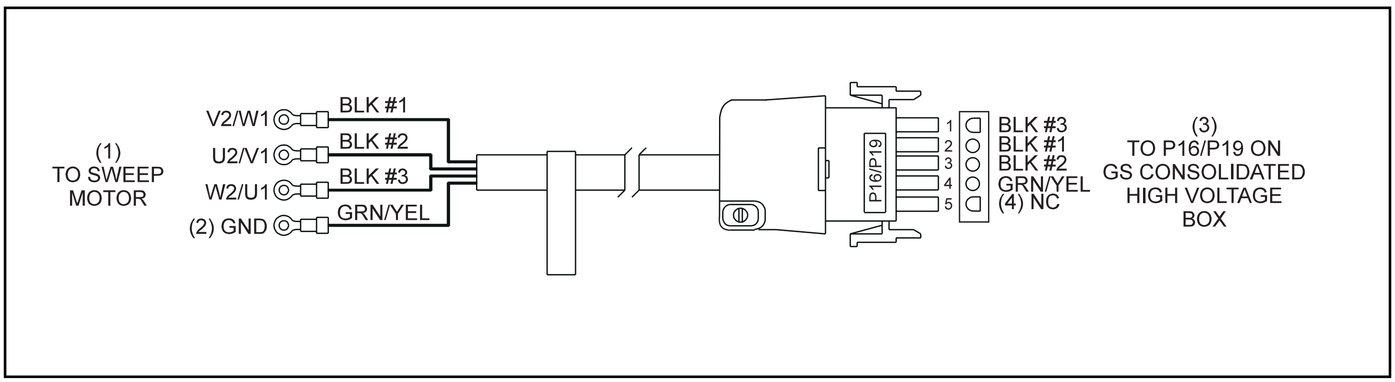


Figure 11-8. External Sweep Motor GS Consolidated Control Box Cable Assembly (Part No. 47-142617-000)

(1) TO SWEEP MOTOR

(2) GROUND

(3) TO P16/P19 ON GS CONSOLIDATED HIGH VOLTAGE BOX

(4) NO CONNECTION

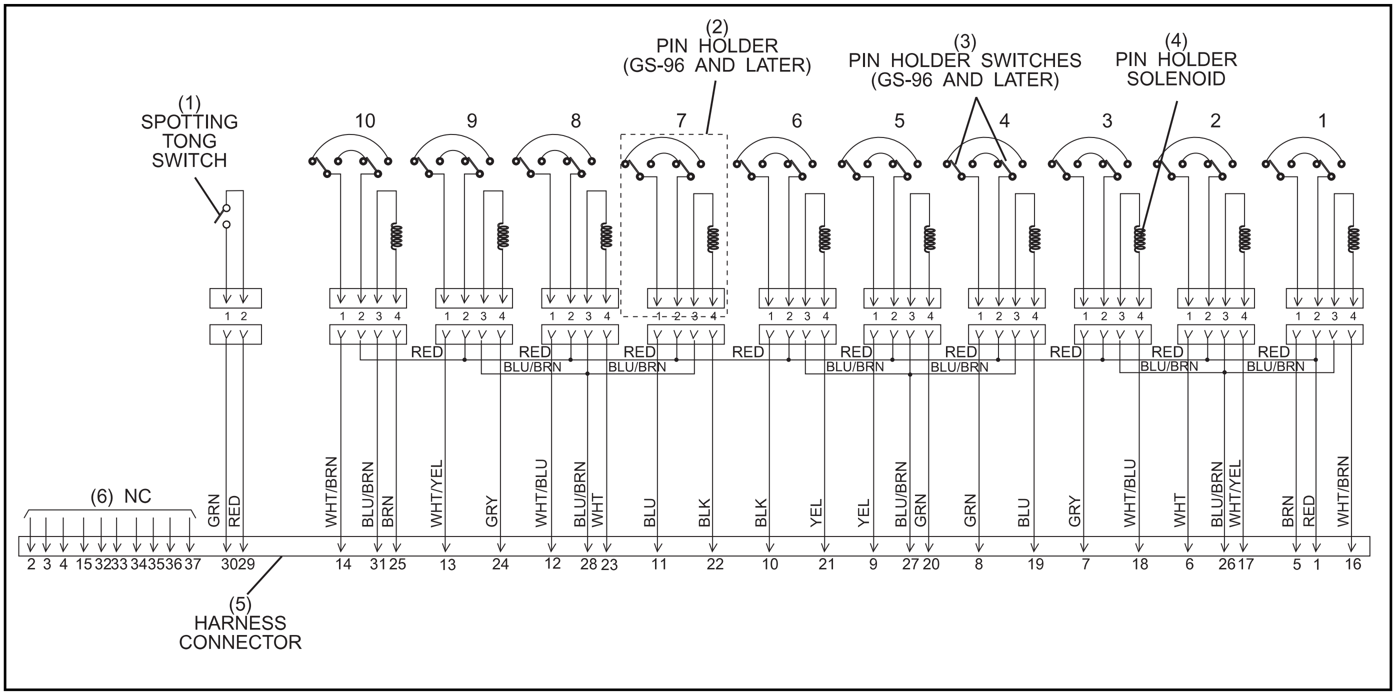


Figure 11-9. Schematic for Setting Table Harness with Two Pin Holder Switches (Part No. 47-243025-003)

(1) SPOTTING TONG SWITCH
(2) PIN HOLDER (GS-96 AND LATER)
(3) PIN HOLDER SWITCHES (GS-96 AND LATER)
(4) PIN HOLDER SOLENOID
(5) HARNESS CONNECTOR
(6) NO CONNECTION

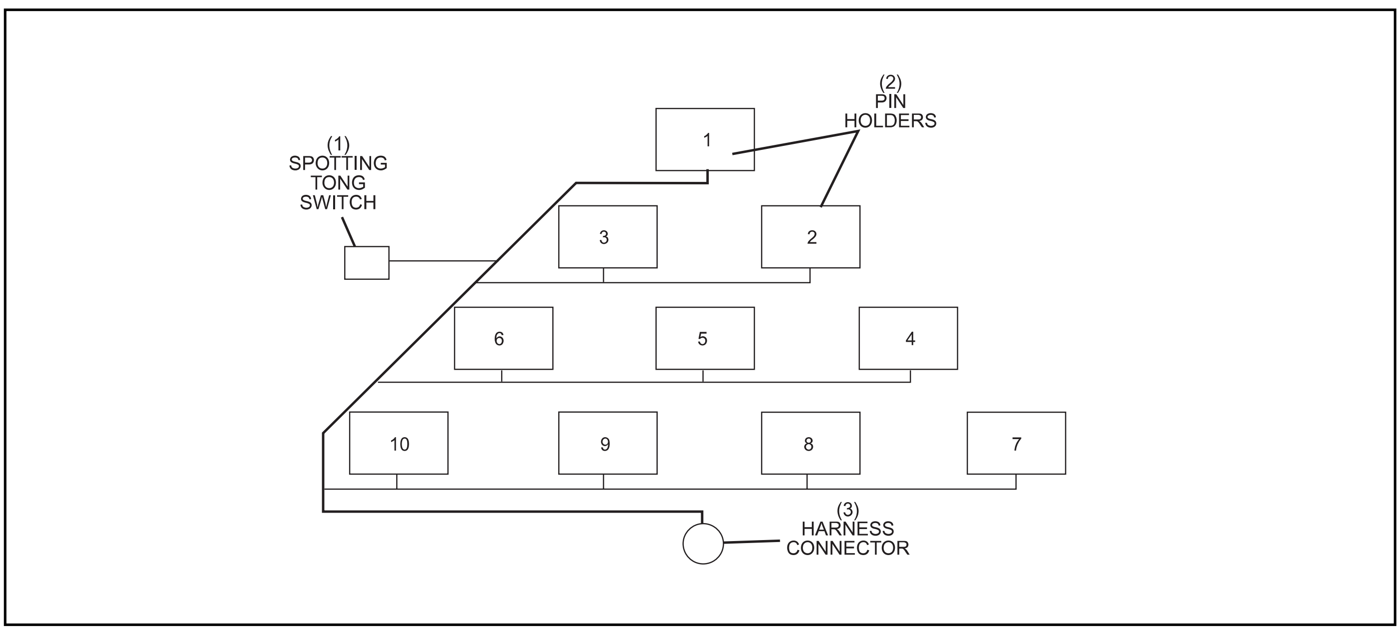


Figure 11-10. Pictorial for Setting Table Harness (Part No. 47-243025-003)

(1) SPOTTING TONG SWITCH
(2) PIN HOLDERS
(3) HARNESS CONNECTOR

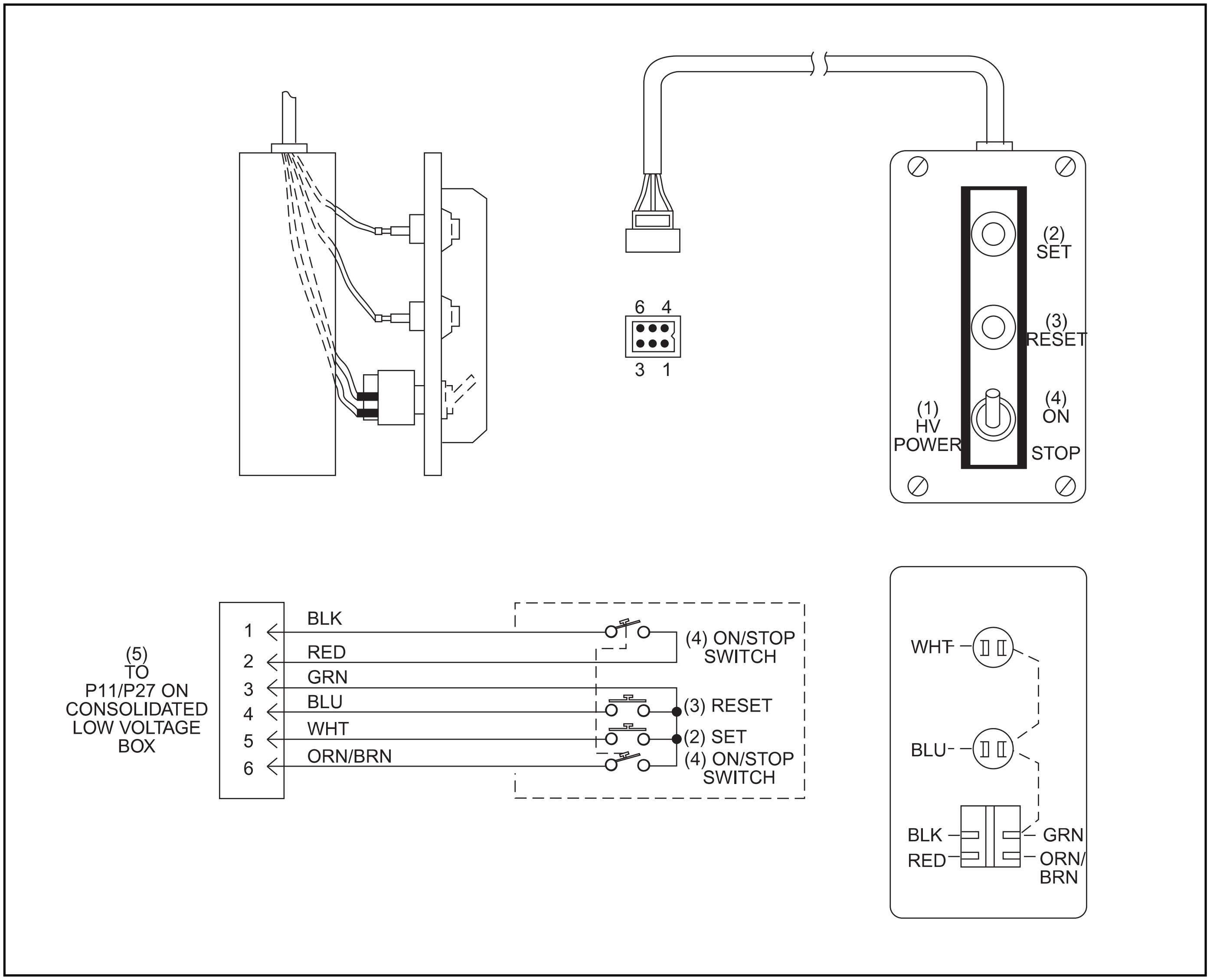


Figure 11-11. Rear Control Box Cable Assembly (Part No. 47-243071-003)

(1) HIGH VOLTAGE POWER
(2) SET
(3) RESET
(4) ON/STOP SWITCH
(5) TO P11/P27 ON CONSOLIDATED LOW VOLTAGE BOX

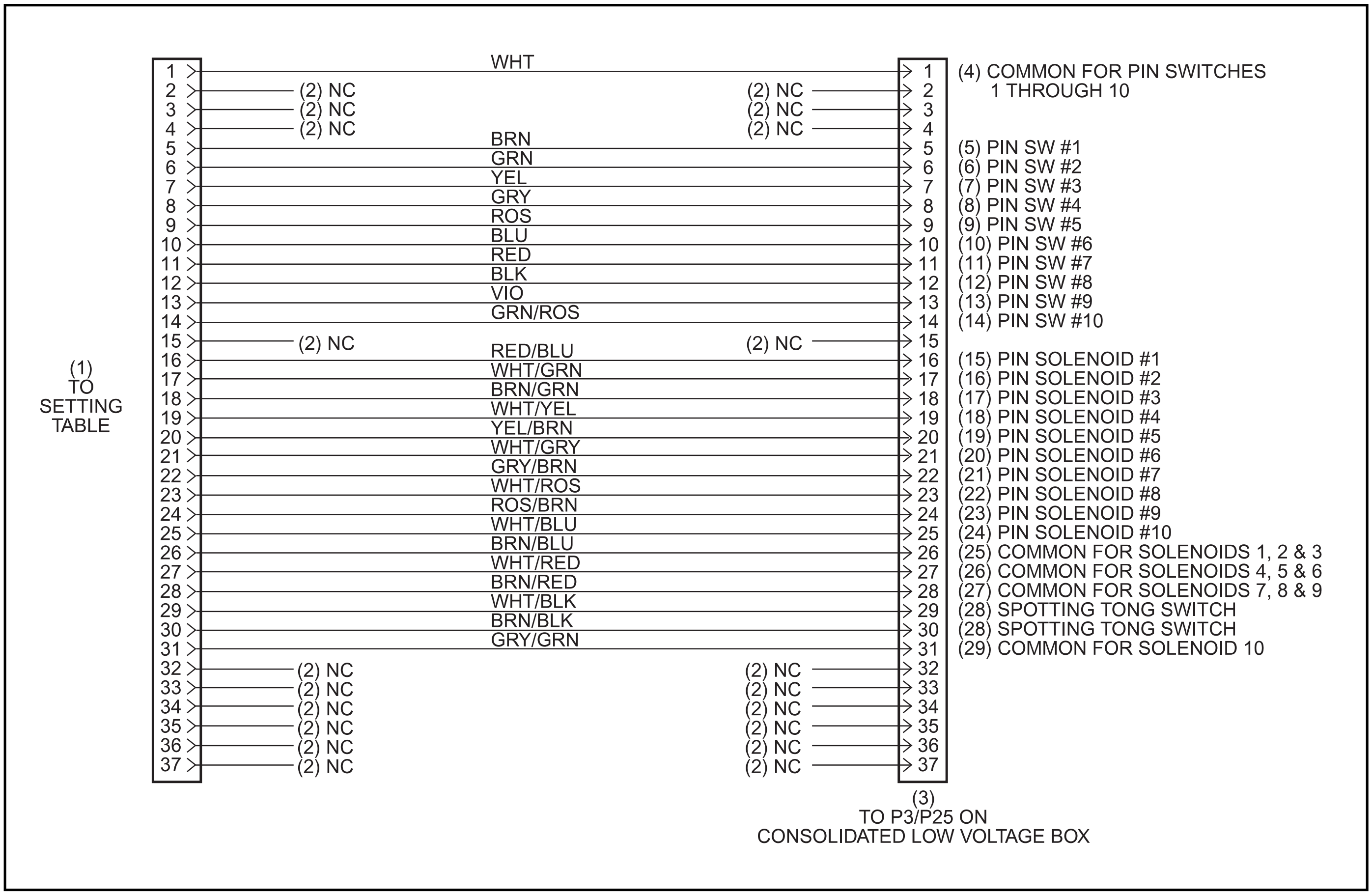


Figure 11-12. External Setting Table Cable Assembly (Part No. 47-244922-004)

(1)	TO SETTING TABLE	(2)	NO CONNECTION	(3)	TO P3/P25 ON CONSOLIDATED LOW VOLTAGE BOX
(4)	COMMON FOR PIN SWITCHES 1 THROUGH 10	(5)	PIN SWITCH #1	(6)	PIN SWITCH #2
(7)	PIN SWITCH #3	(8)	PIN SWITCH #4	(9)	PIN SWITCH #5
(10)	PIN SWITCH #6	(11)	PIN SWITCH #7	(12)	PIN SWITCH #8
(13)	PIN SWITCH #9	(14)	PIN SWITCH #10	(15)	PIN SOLENOID #1
(16)	PIN SOLENOID #2	(17)	PIN SOLENOID #3	(18)	PIN SOLENOID #4
(19)	PIN SOLENOID #5	(20)	PIN SOLENOID #6	(21)	PIN SOLENOID #7
(22)	PIN SOLENOID #8	(23)	PIN SOLENOID #9	(24)	PIN SOLENOID #10
(25)	COMMON FOR SOLENOIDS 1, 2 & 3	(26)	COMMON FOR SOLENOIDS 4, 5 & 6	(27)	PIN SOLENOIDS FOR 7, 8 & 9
(28)	SPOTTING TONG SWITCH	(29)	COMMON FOR SOLENOID		

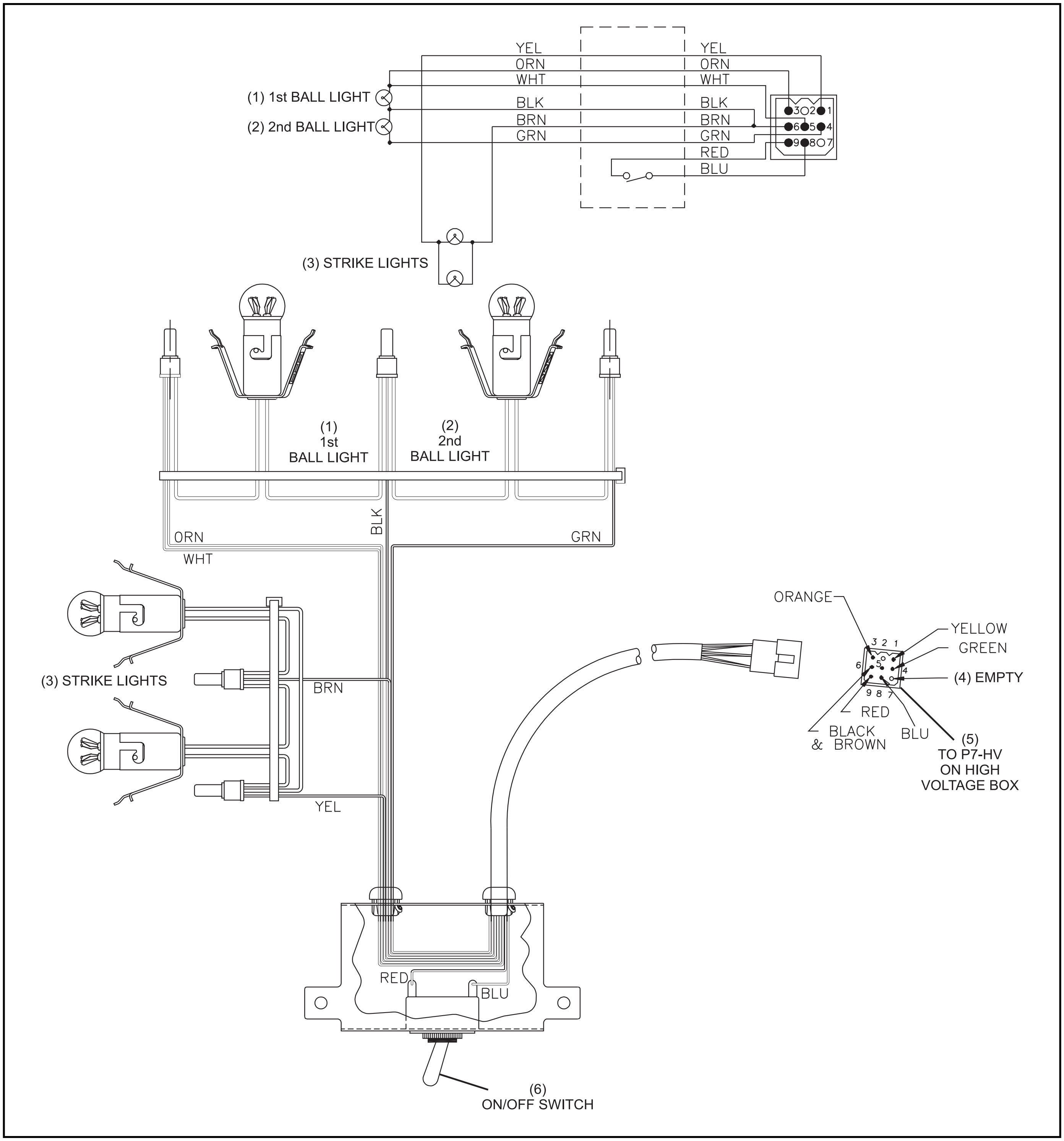


Figure 11-13. Masking Unit Cable Assembly (Part No. 53-200871-000)

(1) FIRST BALL LIGHT	(2) SECOND BALL LIGHT	(3) STRIKE LIGHTS
(4) EMPTY	(5) TO P4/P33 ON CONSOLIDATED LOW VOLTAGE BOX	(6) ON/OFF SWITCH

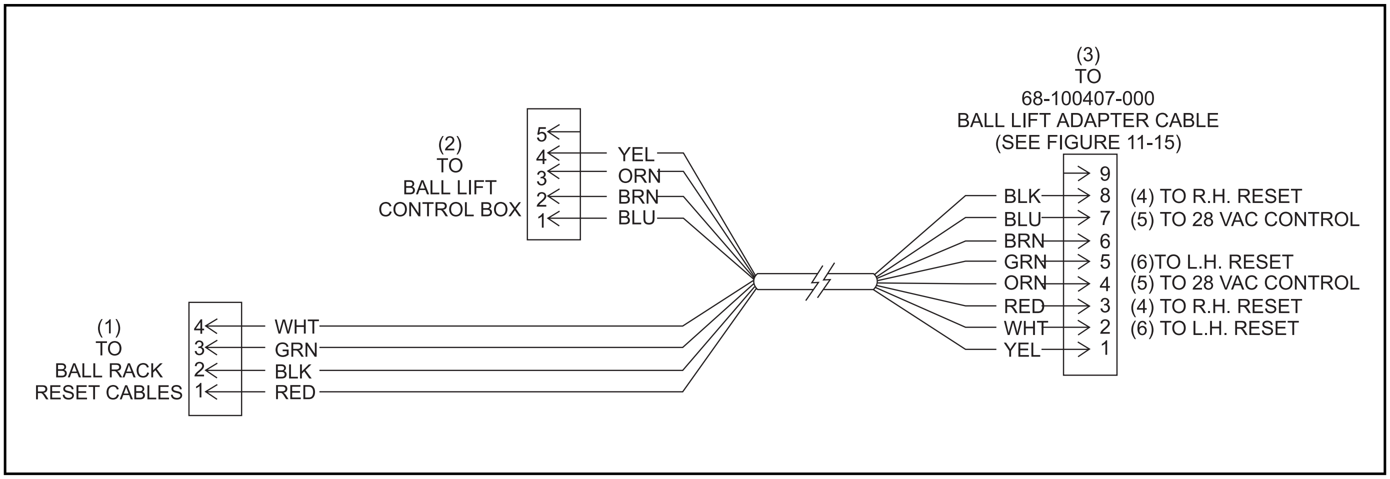


Figure 11-14. Ball Rack Lane Cable Assembly (Part No. 53-520588-000)

(1) TO BALL RACK RESET CABLES	(2) TO BALL LIFT CONTROL BOX	(3) TO 68-100407-000 BALL LIFT ADAPTER CABLE
(4) TO RIGHT-HAND RESET	(5) TO 28 VAC CONTROL	(6) TO LEFT-HAND RESET

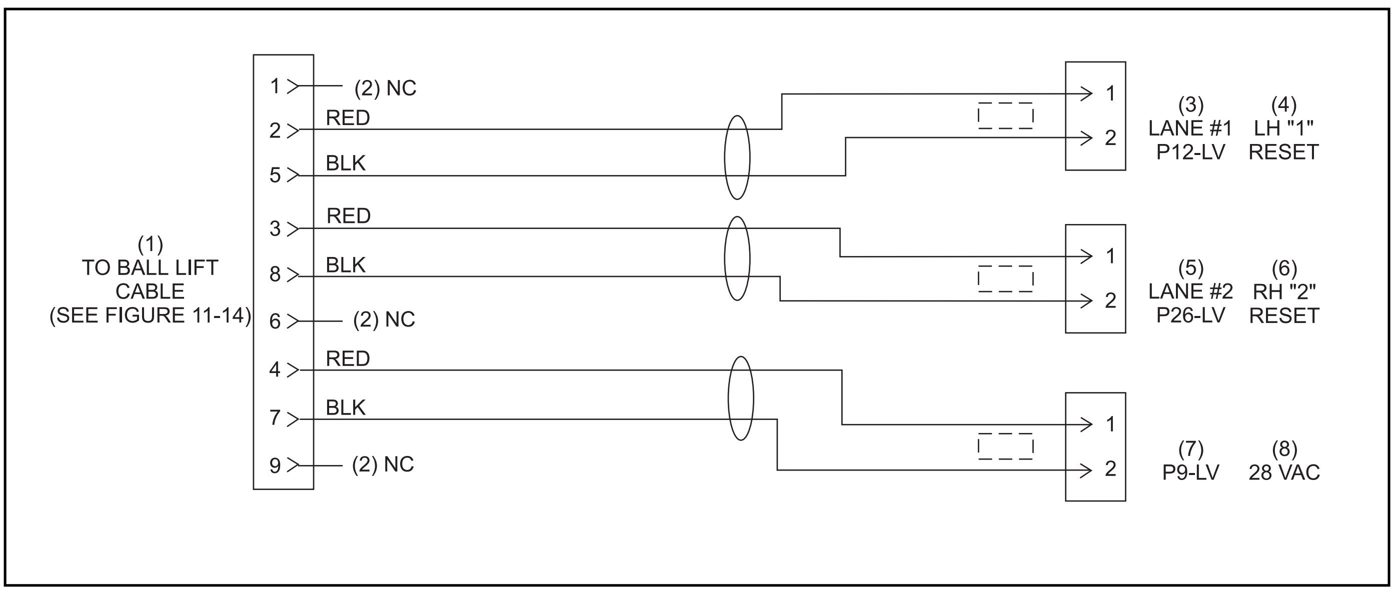


Figure 11-15. Ball Lift Adapter Cable Assembly (Part No. 68-100407-000)

(1) TO BALL LIFT CABLE	(2) NO CONNECTION	(3) LANE #1 P12-LV
(4) LEFT-HAND "1" RESET	(5) LANE #2 P26-LV	(6) RIGHT-HAND "2" RESET
(7) P9-LV	(8) 28 VAC	

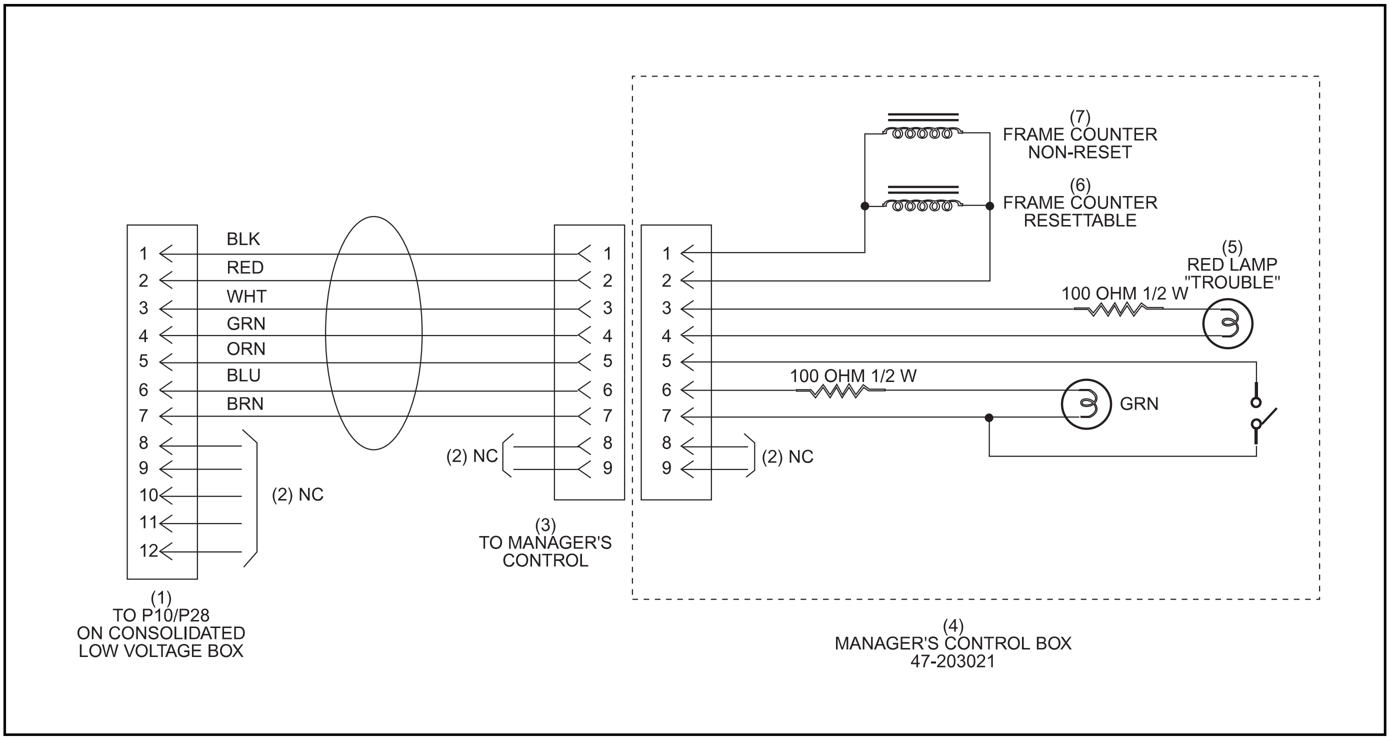


Figure 11-16. Manager's Remote Control Cable Assembly (Part No. 68-100159-000)

(1) TO P10/P28 ON CONSOLIDATED LOW VOLTAGE BOX	(2) NO CONNECTION	(3) TO MANAGER'S CONTROL
(4) MANAGER'S CONTROL BOX 47-203021	(5) RED LAMP "TROUBLE"	(6) FRAME COUNTER RESETTABLE
(7) FRAME COUNTER NON-RESET		

Glossary

10 Pin	Game of bowling in which bowler has two chances to knock down ten pins.
“A” Switch	Switch used by pinsetter to identify when the setting table is up in the home position.
Accelerator	Assembly positioned between the two pinsetters to return the ball to the bowler.
AS-80	Type of Brunswick Automatic Scorer installed from 1979 to 1990; keeps bowlers’ scores automatically.
AS-90	Type of Brunswick Automatic Scorer installed from 1990 to present; keeps bowlers’ scores automatically.
AS-K	Brunswick Automatic Scorer for bowling centers with 16 lanes and under.
Attenuator	Slows the lowering action of the sweep wagon.
“B” Switch	One of four switches used by the Pinsetter CPU to determine the setting table position.
Ball Accelerator	Assembly positioned between the two pinsetters to return the ball to the bowler.
Ball Lift	Ball return assembly located in the bowlers’ area. Used to raise the ball from the track below the lane to the ball rack.
Ball Cushion	Device in the pit area of the pinsetter that is used to stop and direct the ball.
Ball Detect	Detects balls entering the pinsetter area.
Ball Door	Part of the ball accelerator that allows the entry of balls but not pins into the ball accelerator.
Ball Door Button	Part of the ball door; used by the ball to open the ball door for entry into the ball accelerator.
Ball Door Protector Ring	Protective ring that prevents balls from hitting the metal edge of the opening in the accelerator box.
Ball Door Locking Solenoid	Locks the ball door for three seconds after ball detect to keep pins out of the ball accelerator.

Binary	System of numbers having 2 as its base. Uses multiples of 0's and 1's for counting, lane assignments etc.
BowlerVision	Brunswick's advanced electronic scoring system - the new way to play.
"C" Switch	One of four Setting Table position switches. The table will be at its lowest point when this switch's contacts are closed.
Cable Channels	Plastic channels routed along drive frames and the setting table to keep cables contained and free of moving parts.
Chain Guide	Wooden guides used to keep the elevator chain in place as it lowers the shovels along the back of the elevator.
Characterization Switch	Four position switch used to program the a GS-Series Pinsetter to work in a specific environment.
Circuit Breaker	Protective electrical device that prevents a circuit from operating when then current draw becomes too high.
Clevice	Device used to connect a lift chain to a crank arm.
Clockwise	Direction of rotation used for description of moving parts. Corresponds to the direction the hands move on a clock or watch.
Closed	Switch position in which two contacts are touching to create a path.
Comline	Communication path between two electronic devices.
Common	Switch connection used to supply power or a signal to one of two circuits.
Connecting Rods	Rods used to rotate all four swing shafts and their pin holders vertically or horizontally in unison.
Consolidated Electronics	Operating system for the GS-98 Pinsetter. It consists of two control boxes; the Consolidated High and Low Voltage boxes. The Consolidated Electronics replaces the Universal Electronic Control system.
Consolidated High Voltage Box	Receives incoming three phase power and makes it available for all the motors, the pin lights, and the three transformers used to provide power to the Consolidated Low Voltage Box.
Consolidated Low Voltage Box	Consists of three printed circuit boards and many cable and switch connections. This box can be referred to as the brains of a pair of pinsetters. It monitors the switches and other external devices.

Contactor	Electrical device typically used to turn a motor on and off.
Counterclockwise	Direction of rotation used for description of moving parts. Corresponds to the direction opposite the hand movement on a clock or watch.
CPU	(Central Processing Unit) - circuit board in the Universal Gamesetter and Consolidated Low Voltage Box that performs as the brain for the pinsetter.
Cycle	A series of events that recur regularly and ends back at the starting point.
"D" Switch	One of four switches used by the Pinsetter CPU to determine the setting table position.
Damper Plate	Plate located in the bottom of the elevator used to help the pins settle into the pin shovels. Helps controls the vibration in the elevator.
Data	Switch information gathered by the Pinsetter CPU to determine what the pinsetter must be do next.
Detection Stroke	Initial lowering of the setting table after ball detect. Used to determine what the bowler did and what the pinsetter must do to get ready for the next ball.
Diagnostics	A self test mode used by pinsetter to locate problems and to check performance.
Distributor	Assembly that moves and positions pins over the setting table for eventual loading.
Distributor Extensions	Extensions mounted on the back of the distributor to assist in the transfer of pins from the shark switch assembly to the inside distributor lanes.
Distributor Rails	Guide rails for keeping the green belts in place as they move pins throughout the distributor.
Double Detect	Method of pinsetter operation when the pinsetter detects for pins on first ball and second ball. This is used when the pin holders' switches are used for providing pin count to the automatic scorer.
Double Load	A pinsetter feature available on GS-96 and later pinsetters. It allows a double loading of the 7 and 10 pin positions. This allows the pinsetter to reduce overflow conditions and increase pinsetter efficiency.

Driving Drum	Large pulleys which support the ball accelerator's flat belt.
Dust Pan	Sheet metal "pan" located under the front of the distributor to collect dust and dirt that falls off the green belts and bowling pins as they transfer from one set of belts to another.
EC Switch	Elevator control switch that monitors movement of the pin shovels.
Elevator	Assembly used to lift pins up from the transport band to the distributor.
Error Codes	Codes provided by the Pinsetter CPU to direct you to specific problem it has detected in the pinsetter.
Figures Clearing	Pinsetter operating mode which allows the bowler a choice in the position and number of pins the GS-Series Pinsetter will set. Bowler then has an unlimited number of chances to knock all the pins down.
Figures	Pinsetter operating mode which allows the bowler a choice in the position and number of pins the GS-Series Pinsetter will set. The bowler has only one chance to knock down the pins.
Foul Line	Black line on the lane dividing the bowlers approach area from the playing area in which the ball rolls down the lane.
Foul	Condition in which a bowler crosses the foul line. Results in loss of pincount on that ball.
Frameworx	Type of Brunswick Automatic Scorer installed from 1994 to present; keeps bowlers' scores automatically.
Function Switch	A switch which monitors a specific operation or function of the pinsetter's movements.
Function Solenoid	A solenoid that controls a specific operation for the pinsetter.
"G" Switch	A function switch that monitors the sweep wagon's up and down positioning.
Gamemaker	The BowlerVision's "brain" for the scoring operation of the lane pair.
Gripper	Part of the pin holder used to trip the pin release lever and keep the pin in the pin holder.
Ground	(Earth) -A conducting connection, whether intentional or accidental, between an electrical circuit or equipment and the earth. Generally used as a reference point for measuring voltages in a circuit.

GS-10	Pinsetter model replaced by the GS-92 Pinsetter.
GS-92	Pinsetter introduced in 1991 as a replacement for the GS-10 Pinsetter. Incorporated changes which enabled the pinsetter to operate more efficiently and be installed easier.
GS-96	Pinsetter model introduced in 1995 as a replacement for the GS-92 Pinsetter. Several software and hardware changes were made to speed up the loading time of the pinsetter.
GS-98	Pinsetter introduced in 1997 as a replacement for the GS-96 Pinsetter. Consolidated Electronics replaces the Universal Electronics. This change decreased the amount of control boxes and printed circuit boards in the electrical system.
Gutter Adapter	Plastic appendages protruding down from the sweep wagon that clear any pins left in the flat gutters on either side of the pin deck.
Gutter	Channel on each side of the lane which guides the ball back to the pinsetter after it has left the lane surface.
Hertz	Cycles per second. The unit of measure for frequency.
High Voltage	Voltage typically used to power motors and transformers.
Hydraulic Shock Absorber	Shock absorber that uses hydraulic fluid to dampen the impact of the ball, the lowering of the setting table and the lowering of the sweep wagon.
I/O	(Input/Output) - An electronic circuit board that directs into and out of the CPU.
Invalid Machine State	A condition in which the Pinsetter CPU is not able to determine the position of the sweep wagon, setting table and spotting tongs.
Lane Assignment Switch	An 8-position switch which is designed to stagger the power up time and control when the setting table lowers and the operation of the distributor motor.
LED	(Light Emitting Diode) - A diode that produces light when electricity is applied to it. LED's are used to indicate on/off, yes/no or stop/go functions. GS-Series Pinsetters use single red LEDs on all the Electronic Control Boxes and two 7-segment LEDs for digital display on the Universal Gamesetter Box and Consolidated Low Voltage box.
Locking Bolt	Part of the ball door locking mechanism. Prevents the ball door from opening at the wrong time.

Low Voltage	A voltage typically in the 5, 12 or 24 volt range used to control or monitor the pinsetter.
Machine Cycle Diagnostics	A self test mode used by the mechanic to locate problems by continuously cycling to check for proper operation.
Manager's Control	Capability to turn the pinsetter on and off is given to the control desk.
Masking Unit	Device that is mounted in front of the pinsetter to hide it from the bowlers' view.
Mode	Type of operation the pinsetter will be operated under.
New Pin Setting Stroke	The second table operation during a cycle in which the table will lower to the 15 mm level to provide a smooth transfer of the pins from the table to the lane surface.
Normal	Pinsetter operating mode used to operate with BowlerVision and Frameworx automatic scoring systems.
Normally Closed	A switch connection in which a path only exists between the "Common" and the "NC" when the switch is in an at-rest condition.
Normally Open	A switch connection in which a path only exists between the "Common" and the "NO" when the switch is actuated.
Open	Contacts which are not connected or touching.
Optical Scanner	An optical device which counts pins for a pair of lanes.
Out-Of-Range	Bowling condition in which a bowling pin is moved off its spot but is still left standing on the pin deck. Pinsetter cannot handle this pin automatically.
Overload Relay	Protective device used to shut down a motor if it becomes over heated.
PCB	Printed Circuit Board.
Pin Count Switch	Switch mounted to the top of the elevator to monitor pins leaving the pin shovels.
Pin Detector Plate	Plate on the bottom of the pin holder that is pushed up by the top of a bowling pin when the table lowers to detect for pins left standing.

Pin Detection Switch	The pin detection switch is actuated by a pin pushing up on the pin detector plate. It informs the pinsetter that a pin has been knocked down or is still standing.
Pin Holder	One of 10 assemblies on the setting table used to hold pins while setting them on the lane surface.
Pin Light	Light mounted on the front of the pinsetter. Provides light to the bowling pins when they are standing on the pin deck.
Pin Loading Switch	Switch actuated from the top by the neck of the bowling pin when dropped from the distributor to the pin holder.
Pin Release Lever	Part of the pin station contacted by the pin holder's gripper to drop the pin into the pin holder.
Pin Shovel	One of 14 assemblies in the elevator used to lift pins from the pit to the distributor.
Pin Station	One of 10 temporary storage devices the distributor uses for holding pins until the table is ready for them.
Pinion Gears	Two gears meshed in with the table racks to keep the table level as it raises and lowers.
Player Control Station	PCB mounted on the ball rack. Displays standing pins and allows bowlers to choose pins when "Figures" or "Figures/Clearing" are in use.
Polycord	Type of material used in the pinsetter's pin handling belts.
POT	(Potentiometer)- The variable resister used to adjust the DC voltage in the Universal Common Box and the Consolidated Low Voltage Box.
Preload	A pinsetter feature available on GS-96 and later pinsetters. It allows the pinsetter to load all ten pin positions when it will proceed to a second ball cycle.
Preventive Maintenance	Scheduled activity; cleaning, lubrication and adjusting required on any machinery to keep it working reliably.
Protector Wedge	Wedges mounted in front of the ball door to guide the ball and pins away from the door during their initial impact.
Rear Control Box	A switch box mounted on the side of the elevator.
Relay	An electrically controlled switch.

Reset	A switch signal that cycles the pinsetter to the next ball.
Retroreflector	A reflector that sends a transmitted beam back to the original source.
Scanner	An optical device which counts pins for a pair of lanes.
Set	Switch that provides the pinsetter the capability of setting the last known combination of pins once again.
Setting Table	Assembly used to detect standing pins on the pin deck and also to transfer pins from the distributor to the pin deck.
Shark Solenoid	The red solenoid has been added to GS-96 and later pinsetters to control the direction of the pin guide while feeding pins to the distributor's pin stations.
Shark Switch	A switching assembly that alternates pins to the left and right side of the distributor.
Short Cycle	An abbreviated pinsetter cycle in which the sweep operation is not performed.
Short Pit	A description of the pit area of the GS-92, GS-96 and GS-98 Pinsetters. The GS-10 had a longer transport band and a taller elevator to handle pins in the pit area - "Long Pit".
Single Detect	Method of pinsetter operation when it detects for pins on first ball only. This is used when no automatic scoring is available or when an external pin counting device (Scanner or CCD camera) is used.
Single Phase Power	An alternating current circuit in which only phase of current and voltage is available in a two conductor or three conductor system.
SM Switch	Sweep Motor switch - informs the Pinsetter CPU that the sweep is forward when its contacts are closed.
Spotting Tongs	Set of ten pairs of plastic devices mounted on the setting table. They are gear driven closed and open to pick up pins during respotting for a second ball.
Solenoid - Continuous Duty	A solenoid designed to be energized for extended periods of time. (Red - Pin Holder Solenoids and Shark Solenoids).
Solenoid - Intermittent Duty	A solenoid designed to be energized only long enough to perform one brief function. (Black - Function Solenoids)
Square Shafts	Two shafts used to remotely drive or control operations on the setting table. Left - swing shafts; Right - spotting tongs.

ST Switch	Spotting Tong switch - monitors the position of the spotting tongs.
Standalone	Used to describe GS-Series Pinsetters operations in which BowlerVision does not control pinsetter movement or decision making.
Strike	A condition in which all ten pins were knocked down by the bowler's first ball of the frame.
Stroke Limiter Plate	Used to allow the setting table to lower only part of the way for pin detection and respotting pins.
Stroke Limiter Solenoid	Energizes to allow the table to lower to the new pin setting height and allows the pin holders to go vertical.
Sweep Release Lever	Part of the sweep release mechanism that is pulled rearward to allow the sweep release to collapse and lower the sweep.
Sweep Release Arm	Main frame of the sweep release mechanism.
Sweep Wagon	Assembly used to clear deadwood and unwanted pins off of the pin deck and out of the flat gutters.
Swing Shafts	Setting table shafts on which the pin holders are mounted. These shafts are swung to the vertical position to set pins and returned to the horizontal position to detect and load pins.
Switch	A device used for making, breaking or changing connections in an electrical circuit.
Switch Cluster	Group of four switches ("A," "B," "C" and "D") located on the right-hand drive frame and used by the pinsetter to monitor the setting table's position.
T Stop	Device mounted on the top of the left-hand tower rack. Stops the lowering of the setting table when it contacts the stroke limiter plate.
Table	(Setting Table)- Assembly used to detect for pins standing on the pin deck and also to set pins on the pin deck.
Tel-E-Foul	Brunswick electrical assembly mounted at the foul line of the lane. Detects when a bowler has crossed the foul line.
Three Phase Power	Three separate outputs from a single source. There is a phase difference of 120 degrees between any two of the three voltages and currents.

Tipper	Part of the sweep release mechanism that rotates to allow the sweep to drop into the guarding, ready to sweep position.
Tongs	See Spotting Tongs.
Transformer	An electrical device that converts voltage from one level to another level.
Transport Band	Band in the GS-Series Pinsetter pit area that carries the ball and bowling pins rearward to the accelerator and elevator.
TS-1 Switch	A jam switch provided to protect the pinsetter when the pin holders are unable to return to the horizontal position after setting new pins.
TS-2 Switch	A jam switch mounted on the tower to protect the pinsetter if a pin jam or broken part prevents the setting table from raising to its highest position.
Universal Common Box	Electrical/Electronic subassembly that routes the operating power to both High Voltage Boxes, the Gamesetter Box and the Ball Accelerator.
Universal Electronics	Used on GS-10, GS-92 and GS-96 Pinsetters. It consists of four control boxes; the Common box, Gamesetter, and two High Voltage boxes. This system replaced the Red and Silver Box electrical system.
Universal Gamesetter	The electronic box which serves as the “brains” for a pair of GS-92 pinsetters.
Universal High Voltage Box	Electrical control box that provides power to the motors, solenoids and lights. A middleman between the Universal Gamesetter and the pinsetter.
VAC	Voltage - Alternating Current
VDC	Voltage - Direct Current
Video Switcher	BowlerVision electronic box mounted on the right hand pinsetter. Controls what video signal is displayed on the scorer console and overhead displays.
Voltage	The electromotive force needed to carry current through a circuit to operate the motors, solenoids, etc.
Work Platform	Wooden stand mounted onto the front of the pinsetter. Used by the mechanic to stand on while viewing or working on the front of the pinsetter.

Table of Contents

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Appendix B: Forms

The following pages contain forms to be used in conjunction with maintenance on the Brunswick GS-Series Pinsetters.

GS-Series Pinsetter Weekly Report

Center Name ____________________ Week Ending ____________________

	Daily Frame Totals								
	Daily Stop Totals								
Error Code	Description	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Total
01	Pin 1 - Time Out or Jam								
02	Pin 2 - Time Out or Jam								
03	Pin 3 - Time Out or Jam								
04	Pin 4 - Time Out or Jam								
05	Pin 5 - Time Out or Jam								
06	Pin 6 - Time Out or Jam								
07	Pin 7 - Time Out or Jam								
08	Pin 8 - Time Out or Jam								
09	Pin 9 - Time Out or Jam								
10	Pin 10 - Time Out or Jam								
*11	Pin Jam - Left-Hand Corner								
*12	Pin Jam - Right-Hand Corner								
*13	Pin Jam - Left Distributor Lane 1								
*14	Pin Jam - Left Center Distributor Lane 2								
*15	Pin Jam - Right Center Distributor Lane 3								
*16	Pin Jam - Right Distributor Lane 4								
*17	Pin Jam - Shark Switch								
*18	Pin Jam - Pin Guide Wedges								
*19	Pin Jam - Pin Head First								
*20	Pin Stuck in Elevator								
*21	Pin Under Pin Feed Deflector								
*22	Pin in Ball Accelerator								
*23	Ball Stuck in Pit								
*24	Ball Stuck in Ball Lift								
*25	Pin Blocking Ball Door								
*26	Pin Jammed in Setting Table								
*27	Spotting Tongs Jammed								
*28	Sweep Roller Not in Slot								
*29	Belt Broken								
*30	Belt Loose								
*31	Overflow Chute / Sock Jam #7 Pin Side								
*32	Overflow Chute / Sock Jam #10 Pin Side								
*50	Pin Holder Switch Malfunction								
60	Switch A Not Expected but Found								
61	Switch B Not Expected but Found								
62	Switch C Not Expected but Found								
63	Switch D Not Expected but Found								
64	Switch SM Not Expected but Found								
65	Switch G Not Expected but Found								
66	Switch ST Not Expected but Found								
67	Switch OOR Not Expected but Found								
70	Switch A Expected but Not Found								
71	Switch B Expected but Not Found								
72	Switch C Expected but Not Found								
73	Switch D Expected but Not Found								
74	Switch SM Expected but Not Found								
75	Switch G Expected but Not Found								
76	Switch ST Expected but Not Found								
90	Invalid Machine State 0								
91	Invalid Machine State 1								
92	Invalid Machine State 2								
93	Invalid Machine State 3								
94	Invalid Machine State 4								
95	Invalid Machine State 5								
98	Electronic Box Failure								
99	Part Broken / Other (Explain on Back)								
EJ	Elevator Jam								
EL	Pin Count Switch Failure								
J1	Jam Switch TSI								
J2	Jam Switch TS2 (Tower)								
PO	Out-of-Range								

**These code numbers are not displayed by the Pinsetter CPU LED display.*
Explain problems or irregularities on the back of this report.

GS-Series Pinsetter Monthly Report

Center Name ______________________ Month______________ Date________________

	Daily Frame Totals				
	Daily Stop Totals				
Error Code	Description	Week 1	Week 2	Week 3	Week 4
01	Pin 1 - Time Out or Jam				
02	Pin 2 - Time Out or Jam				
03	Pin 3 - Time Out or Jam				
04	Pin 4 - Time Out or Jam				
05	Pin 5 - Time Out or Jam				
06	Pin 6 - Time Out or Jam				
07	Pin 7 - Time Out or Jam				
08	Pin 8 - Time Out or Jam				
09	Pin 9 - Time Out or Jam				
10	Pin 10 - Time Out or Jam				
*11	Pin Jam - Left-Hand Corner				
*12	Pin Jam - Right-Hand Corner				
*13	Pin Jam - Left Distributor Lane 1				
*14	Pin Jam - Left Center Distributor Lane 2				
*15	Pin Jam - Right Center Distributor Lane 3				
*16	Pin Jam - Right Distributor Lane 4				
*17	Pin Jam - Shark Switch				
*18	Pin Jam - Pin Guide Wedges				
*19	Pin Jam - Pin Head First				
*20	Pin Stuck in Elevator				
*21	Pin Under Pin Feed Deflector				
*22	Pin in Ball Accelerator				
*23	Ball Stuck in Pit				
*24	Ball Stuck in Ball Lift				
*25	Pin Blocking Ball Door				
*26	Pin Jammed in Setting Table				
*27	Spotting Tongs Jammed				
*28	Sweep Roller Not in Slot				
*29	Belt Broken				
*30	Belt Loose				
*31	Overflow Chute / Sock Jam #7 Pin Side				
*32	Overflow Chute / Sock Jam #10 Pin Side				
*50	Pin Holder Switch Malfunction				
60	Switch A Not Expected but Found				
61	Switch B Not Expected but Found				
62	Switch C Not Expected but Found				
63	Switch D Not Expected but Found				
64	Switch SM Not Expected but Found				
65	Switch G Not Expected but Found				
66	Switch ST Not Expected but Found				
67	Switch OOR Not Expected but Found				
70	Switch A Expected but Not Found				
71	Switch B Expected but Not Found				
72	Switch C Expected but Not Found				
73	Switch D Expected but Not Found				
74	Switch SM Expected but Not Found				
75	Switch G Expected but Not Found				
76	Switch ST Expected but Not Found				
90	Invalid Machine State 0				
91	Invalid Machine State 1				
92	Invalid Machine State 2				
93	Invalid Machine State 3				
94	Invalid Machine State 4				
95	Invalid Machine State 5				
98	Electronic Box Failure				
99	Part Broken / Other (Explain on Back)				
EJ	Elevator Jam				
EL	Pin Count Switch Failure				
J1	Jam Switch TS1				
J2	Jam Switch TS2 (Tower)				
PO	Out-of-Range				

**These code numbers are not displayed by the Pinsetter CPU LED display.*
Explain problems or irregularities on the back of this report.

GS-Series Stop Sheet			Machine No. _______________	
Date	Frame Count	Error Code	Corrective Action	Mech. Initials

Error Codes

Error Code	Error Explanation
|--|	Power Up In Progress
-||-	No Errors
None	The Lane Initialized
A0	PCS Not Communicating
A1	PCS Not Sending Correct Response
FO	External Ram Test Failure
F1	Prom Check Sum Failure
FF	CPU Lost
80	Battery Backup Ram Failure
PO	Can't Pickup These Pins
PO	Out-of-Range
01	Pin Loading Time Out Pin 1
02	Pin Loading Time Out Pin 2
03	Pin Loading Time Out Pin 3
04	Pin Loading Time Out Pin 4
05	Pin Loading Time Out Pin 5
06	Pin Loading Time Out Pin 6
07	Pin Loading Time Out Pin 7
08	Pin Loading Time Out Pin 8
09	Pin Loading Time Out Pin 9
10	Pin Loading Time Out Pin 10
*11	Pin Jam - Left Hand Corner
*12	Pin Jam - Right Hand Corner
*13	Pin Jam - Left Distributor Lane 1
*14	Pin Jam - Left Center Distributor Lane 2
*15	Pin Jam - Right Center Distributor Lane 3
*16	Pin Jam - Right Distributor Lane 4
*17	Pin Jam - Shark Switch
*18	Pin Jam - Pin Guide Wedges
*19	Pin Jam - Pin Head First
*20	Pin Stuck in Elevator
*21	Pin Under Pin Feed Deflector
*22	Pin in Ball Accelerator
*23	Ball Stuck in Pit
*24	Ball Stuck in Ball Lift
*25	Pin Blocking Ball Door
*26	Pin Jammed in Setting Table
*27	Spotting Tongs Jammed
*28	Sweep Roller Not in Slot
*29	Belt Broken

Error Code	Error Explanation
*30	Belt Loose
*31	Overflow Chute / Sock Jam #7 Pin Side
*32	Overflow Chute / Sock Jam #10 Pin Side
50	#10 Pin Not Detected in Diagnostics
51	#1 Pin Not Detected in Diagnostics
52	#2 Pin Not Detected in Diagnostics
53	#3 Pin Not Detected in Diagnostics
54	#4 Pin Not Detected in Diagnostics
55	#5 Pin Not Detected in Diagnostics
56	#6 Pin Not Detected in Diagnostics
57	#7 Pin Not Detected in Diagnostics
58	#8 Pin Not Detected in Diagnostics
59	#9 Pin Not Detected in Diagnostics
60	Switch A is Not Expected but Found
61	Switch B is Not Expected but Found
62	Switch C is Not Expected but Found
63	Switch D is Not Expected but found
64	Switch SM is Not Expected but Found
65	Switch G is Not Expected but Found
66	Switch ST is Not Expected but Found
67	Switch OOR is Not Expected but Found
70	Switch A Expected but Not Found
71	Switch B Expected but Not Found
72	Switch C Expected but Not Found
73	Switch D Expected but Not Found
74	Switch SM Expected but Not Found
75	Switch G Expected but Not Found
76	Switch ST Expected but Not Found
90	Invalid Machine State 0
91	Invalid Machine State 1
92	Invalid Machine State 2
93	Invalid Machine State 3
94	Invalid Machine State 4
95	Invalid Machine State 5
98	Electronic Box Failure
99	Part Broken / Other (Explain on Back)
EJ	Elevator Jam
EL	Pin Count Switch Shorted
J1	Jam Switch TS1
J2	Jam Switch TS2 (Tower)

**These code numbers are not displayed by the Pinsetter CPU LED display.*

Reproducible Copy

Brunswick

ELECTRONIC ASSEMBLY REPAIR TRAVELER

FROM: ______________________________
____
____
______________________ ZIP ________

TO: *BRUNSWICK CORPORATION*
ELECTRONIC REPAIR CENTER
525 W. LAKETON AVE.
MUSKEGON, MICHIGAN 49441

CUSTOMER NO. ☐☐☐☐☐–☐

DATE SENT ☐☐–☐☐–☐☐

ORIGINAL INSTALLATION DATE ☐☐–☐☐–☐☐

PART NAME ______________________________ SERIAL NO. ______________

LANES AFFECTED ☐ A ☐ B ☐ SAMPLE PRINT-OUT INCLUDED

MALFUNCTION ☐ CONSTANT ☐ INTERMITTENT: HOW OFTEN? ______________

FAILURE TYPE - BE SPECIFIC

SCORER

- ☐ INCORRECT/NO NEW PINS OPERATION
- ☐ INCORRECT/NO FOUL OPERATION
- ☐ FAILED TO SCORE 1ST BALL
- ☐ FAILED TO SCORE 2ND BALL
- ☐ FAILED TO SCORE 1ST OR 2ND BALL
- ☐ INCORRECT PINFALL SCORES
- ☐ NO MANUAL KEYBOARD ENTRY
- ☐ INCORRECT MANUAL KEYBOARD ENTRY
- ☐ FAILS TO PRINT
- ☐ INCORRECT MOTOR OPERATION
- ☐ UNREADABLE PRINT
- ☐ MISSING ONE OR MORE LINES
- ☐ EXTRA LINE(S) PRINTED
- ☐ PRINT NOT CENTERED
- ☐ CONSTANT SCAN
- ☐ NO BALL DETECT
- ☐ CONSTANT BALL DETECT
- ☐ NO DATA FROM SCANNER
- ☐ SCANNER NOT TALKING
- ☐ SCANNER INPUT FAILURE
- ☐ CAN'T ADJUST BIAS & GAIN POTS
- ☐ NO SCANNER START
- ☐ TRIPS CIRCUIT BREAKER
- ☐ POWER SUPPLY - NO VOLTAGE OUT
- ☐ POWER SUPPLY MALFUNCTION - +5V
- ☐ POWER SUPPLY MALFUNCTION - -5V
- ☐ POWER SUPPLY MALFUNCTION - +12V
- ☐ POWER SUPPLY MALFUNCTION - -12V
- ☐ NO AUDIO COMMUNICATIONS TO SCORER CONSOLE
- ☐ NO AUDIO COMMUNICATIONS TO MGR'S CONSOLE
- ☐ DISTORTED AUDIO COMMUNICATIONS
- ☐ COMLINE FAILURE - UNABLE TO CLEAR
- ☐ PRIMARY UART FAILURE
- ☐ SECONDARY UART FAILURE
- ☐ INOPERATIVE SWITCH
- ☐ INCORRECT CONVERGENCE
- ☐ INCORRECT VERTICAL OUTPUT
- ☐ INCORRECT HORIZONTAL OUTPUT
- ☐ FORMS/CHARACTERS WON'T ADJUST
- ☐ VIDEO UNIT STAYS ON
- ☐ NO VIDEO DISPLAY
- ☐ VIDEO DISPLAY ERROR - UPPER SCREENS
- ☐ VIDEO DISPLAY ERROR - LOWER SCREENS
- ☐ VIDEO DISPLAY ERROR - UPPER & LOWER SCREENS
- ☐ VIDEO BLACKS OUT - RETAINS SCORES
- ☐ VIDEO BLACKS OUT - SCORES LOST
- ☐ LOSS OF VIDEO FORMS
- ☐ INCORRECT VIDEO SWITCHING
- ☐ INCORRECT VIDEO OUTPUT
- ☐ LOSS OF MEMORY

NON-SCORER

- ☐ CONTINUOUS FOUL
- ☐ CONTINUOUS BUZZER
- ☐ NO FOUL RIGHT LANE
- ☐ NO FOUL LEFT LANE
- ☐ INTERMITTENT FOUL
- ☐ INCORRECT PIN INDICATOR LIGHTS
- ☐ INCORRECT/NO BALL DIRECTOR OPERATION
- ☐ NO TRIGGER FIRST BALL
- ☐ NO TRIGGER SECOND BALL
- ☐ WRONG TIME DELAY

OTHER-EXPLAIN: ______________________________

SENT BY: ______________________________
(FILL OUT IN DUPLICATE - KEEP SECOND COPY FOR YOUR RECORDS)

FOR ELECTRONIC REPAIR CENTER USE ONLY

DATE RECEIVED ☐☐–☐☐–☐☐ REPAIR TYPE ______________

COMMENTS ______________________________

Table of Contents

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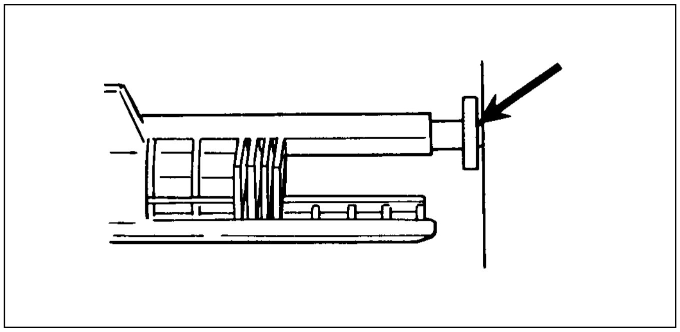
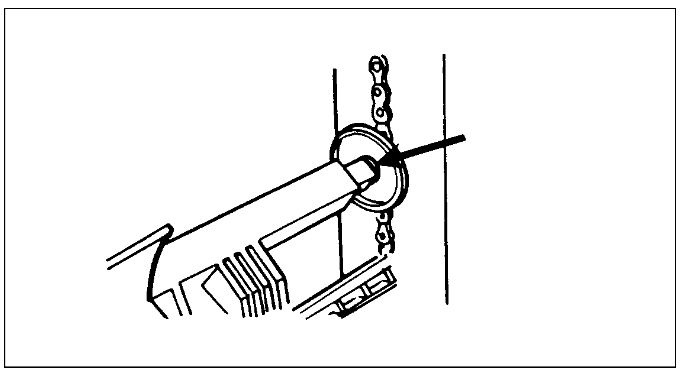
Appendix C: Lubrication

Monthly



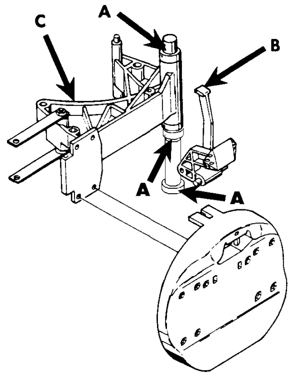
1. Pin Shovel Shafts
   A. One drop of oil on each pivot point.

LANE#	1/2	3/4	5/6	7/8	9/10	11/12	13/14	15/16	17/18	19/20
INITIALS										
DATE										
LANE#	21/22	23/24	25/26	27/28	29/30	31/32	33/34	35/36	37/38	39/40
INITIALS										
DATE										
LANE#	41/42	43/44	45/46	47/48	49/50	51/52	53/54	55/56	57/58	59/60
INITIALS										
DATE										



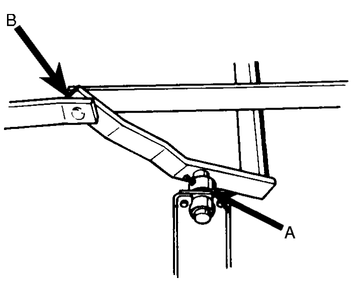
2. Pin Shovel Rollers
   B. One drop of oil on each roller.

LANE#	1/2	3/4	5/6	7/8	9/10	11/12	13/14	15/16	17/18	19/20
INITIALS										
DATE										
LANE#	21/22	23/24	25/26	27/28	29/30	31/32	33/34	35/36	37/38	39/40
INITIALS										
DATE										
LANE#	41/42	43/44	45/46	47/48	49/50	51/52	53/54	55/56	57/58	59/60
INITIALS										
DATE										



3. Ball Door
   - A. Shaft - one drop of oil on each of three collars.
   - B. Latch - cover with a light film of grease.
   - C. Arms - cover with a light film of oil.

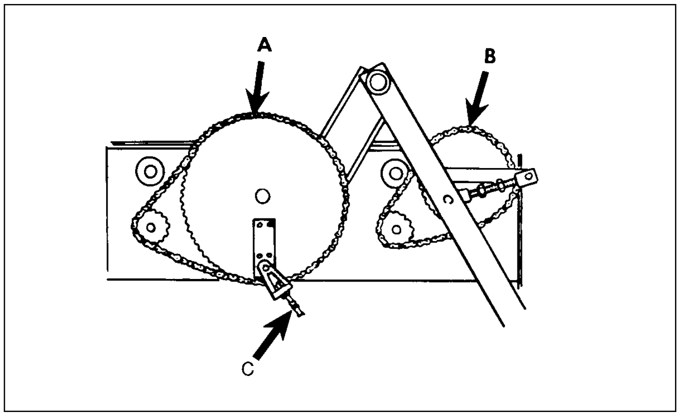
LANE#	1/2	3/4	5/6	7/8	9/10	11/12	13/14	15/16	17/18	19/20
INITIALS										
DATE										
LANE#	21/22	23/24	25/26	27/28	29/30	31/32	33/34	35/36	37/38	39/40
INITIALS										
DATE										
LANE#	41/42	43/44	45/46	47/48	49/50	51/52	53/54	55/56	57/58	59/60
INITIALS										
DATE										



4. Pin Holder Swing Shafts
   - A. Swing Shaft - one drop of oil on the bushing at end of each of the four swing shafts.
   - B. Connector Link - drop of oil on each connection point for the three links.

LANE#	1/2	3/4	5/6	7/8	9/10	11/12	13/14	15/16	17/18	19/20
INITIALS										
DATE										
LANE#	21/22	23/24	25/26	27/28	29/30	31/32	33/34	35/36	37/38	39/40
INITIALS										
DATE										
LANE#	41/42	43/44	45/46	47/48	49/50	51/52	53/54	55/56	57/58	59/60
INITIALS										
DATE										

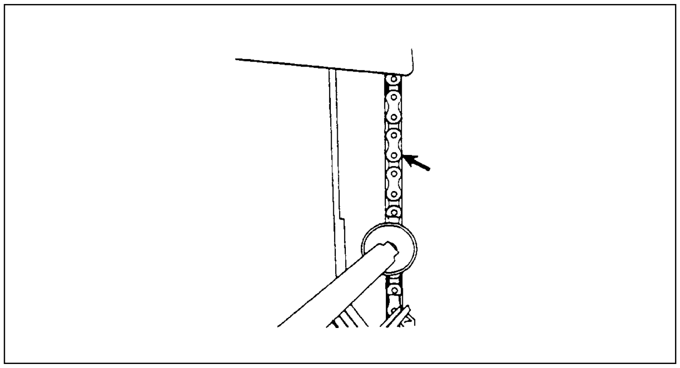
Quarterly



1. Drive Chains
   A. Table Shaft - a light coating of chain lubricant.
   B. Sweep Shaft - a light coating of chain lubricant.

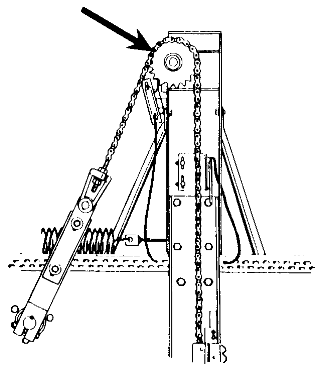
2. Sweep Release Chain
   A. A light coating of chain lubricant.

LANE#	1/2	3/4	5/6	7/8	9/10	11/12	13/14	15/16	17/18	19/20
INITIALS										
DATE										
LANE#	21/22	23/24	25/26	27/28	29/30	31/32	33/34	35/36	37/38	39/40
INITIALS										
DATE										
LANE#	41/42	43/44	45/46	47/48	49/50	51/52	53/54	55/56	57/58	59/60
INITIALS										
DATE										



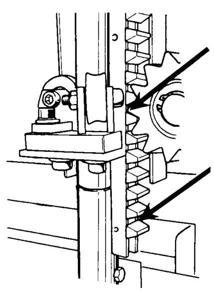
3. Elevator Chains
   A. Put a light coating of chain lubricant on both chains.

LANE#	1/2	3/4	5/6	7/8	9/10	11/12	13/14	15/16	17/18	19/20
INITIALS										
DATE										
LANE#	21/22	23/24	25/26	27/28	29/30	31/32	33/34	35/36	37/38	39/40
INITIALS										
DATE										
LANE#	41/42	43/44	45/46	47/48	49/50	51/52	53/54	55/56	57/58	59/60
INITIALS										
DATE										



4. Setting Table Pinion Gears
   A. Entire chain needs a light coating of chains lubricant.

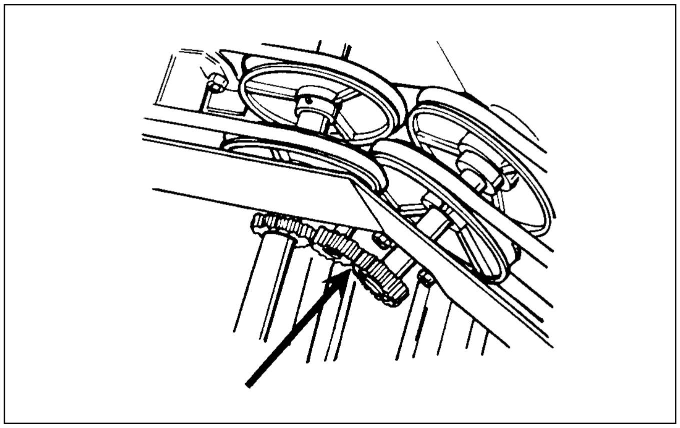
LANE#	1/2	3/4	5/6	7/8	9/10	11/12	13/14	15/16	17/18	19/20
INITIALS										
DATE										
LANE#	21/22	23/24	25/26	27/28	29/30	31/32	33/34	35/36	37/38	39/40
INITIALS										
DATE										
LANE#	41/42	43/44	45/46	47/48	49/50	51/52	53/54	55/56	57/58	59/60
INITIALS										
DATE										



5. Setting Table Pinion Gears
   A. Apply a light film of grease on both gears.

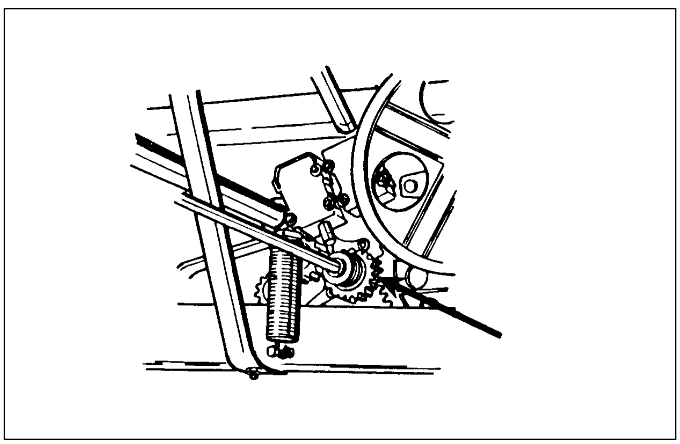
6. Table Rack
   A. Grease both racks entirely with a light film.

LANE#	1/2	3/4	5/6	7/8	9/10	11/12	13/14	15/16	17/18	19/20
INITIALS										
DATE										
LANE#	21/22	23/24	25/26	27/28	29/30	31/32	33/34	35/36	37/38	39/40
INITIALS										
DATE										
LANE#	41/42	43/44	45/46	47/48	49/50	51/52	53/54	55/56	57/58	59/60
INITIALS										
DATE										



7. Distributor Spur Gears
   A. Grease both sets with a light film.

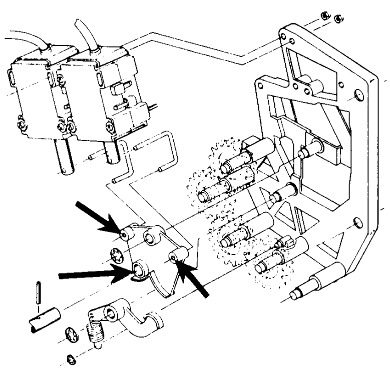
LANE#	1/2	3/4	5/6	7/8	9/10	11/12	13/14	15/16	17/18	19/20
INITIALS										
DATE										
LANE#	21/22	23/24	25/26	27/28	29/30	31/32	33/34	35/36	37/38	39/40
INITIALS										
DATE										
LANE#	41/42	43/44	45/46	47/48	49/50	51/52	53/54	55/56	57/58	59/60
INITIALS										
DATE										



8. Spotting Tong Clutch Gear Cluster
   A. Grease the 1 or 4 gears lightly.

NOTE: *Do not allow grease to get into the clutch mechanism.*

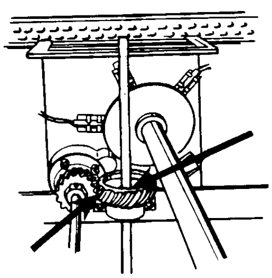
LANE#	1/2	3/4	5/6	7/8	9/10	11/12	13/14	15/16	17/18	19/20
INITIALS										
DATE										
LANE#	21/22	23/24	25/26	27/28	29/30	31/32	33/34	35/36	37/38	39/40
INITIALS										
DATE										
LANE#	41/42	43/44	45/46	47/48	49/50	51/52	53/54	55/56	57/58	59/60
INITIALS										
DATE										



9. Gear Cluster Pivot Lever Plate
   a. Apply one drop of oil to each pivot point.

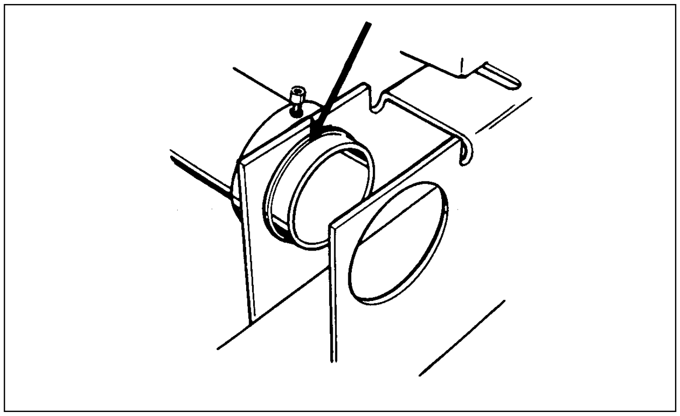
NOTE: *Some Model GS-92s have two solenoids located on this cluster.*

LANE#	1/2	3/4	5/6	7/8	9/10	11/12	13/14	15/16	17/18	19/20
INITIALS										
DATE										
LANE#	21/22	23/24	25/26	27/28	29/30	31/32	33/34	35/36	37/38	39/40
INITIALS										
DATE										
LANE#	41/42	43/44	45/46	47/48	49/50	51/52	53/54	55/56	57/58	59/60
INITIALS										
DATE										



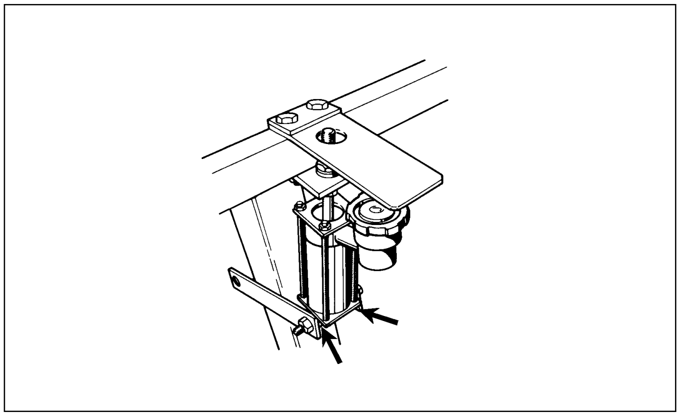
10. Spotting Tong Square Shaft and Bevel Gears
   A. Apply a light film of grease on the entire travel area of the square shaft.
   B. Apply a light film of grease on both bevel gears.

LANE#	1/2	3/4	5/6	7/8	9/10	11/12	13/14	15/16	17/18	19/20
INITIALS										
DATE										
LANE#	21/22	23/24	25/26	27/28	29/30	31/32	33/34	35/36	37/38	39/40
INITIALS										
DATE										
LANE#	41/42	43/44	45/46	47/48	49/50	51/52	53/54	55/56	57/58	59/60
INITIALS										
DATE										



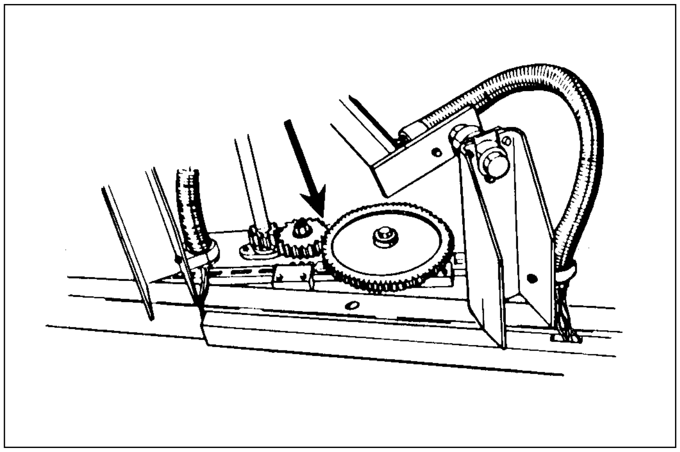
11. Ball Cushion Bushings
    A. Grease both sises as required.

LANE#	1/2	3/4	5/6	7/8	9/10	11/12	13/14	15/16	17/18	19/20
INITIALS										
DATE										
LANE#	21/22	23/24	25/26	27/28	29/30	31/32	33/34	35/36	37/38	39/40
INITIALS										
DATE										
LANE#	41/42	43/44	45/46	47/48	49/50	51/52	53/54	55/56	57/58	59/60
INITIALS										
DATE										



12. Hydraulic Shock Absorber Bushing
    A. One drop of oil each side of the bushing.

LANE#	1/2	3/4	5/6	7/8	9/10	11/12	13/14	15/16	17/18	19/20
INITIALS										
DATE										
LANE#	21/22	23/24	25/26	27/28	29/30	31/32	33/34	35/36	37/38	39/40
INITIALS										
DATE										
LANE#	41/42	43/44	45/46	47/48	49/50	51/52	53/54	55/56	57/58	59/60
INITIALS										
DATE										

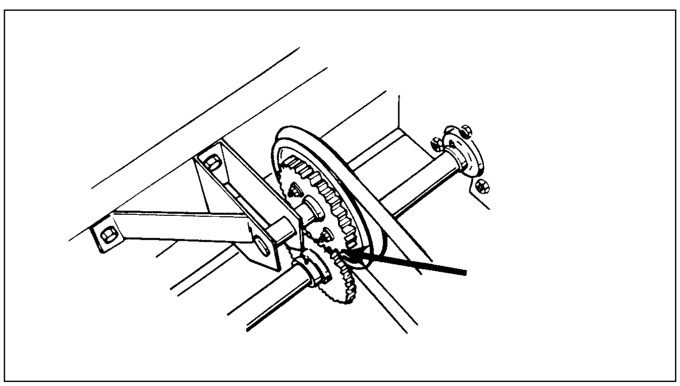


13. Spotting Tong Drive Gears
    A. Apply a light film of grease on all four gears

NOTE: *There is a small gear located under the largest gear.*

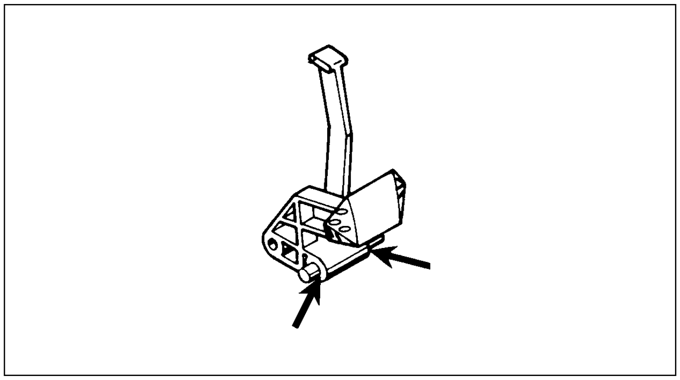
NOTE: *You should always remove the old grease and dirt before applying new grease.*

LANE#	1/2	3/4	5/6	7/8	9/10	11/12	13/14	15/16	17/18	19/20
INITIALS										
DATE										
LANE#	21/22	23/24	25/26	27/28	29/30	31/32	33/34	35/36	37/38	39/40
INITIALS										
DATE										
LANE#	41/42	43/44	45/46	47/48	49/50	51/52	53/54	55/56	57/58	59/60
INITIALS										
DATE										



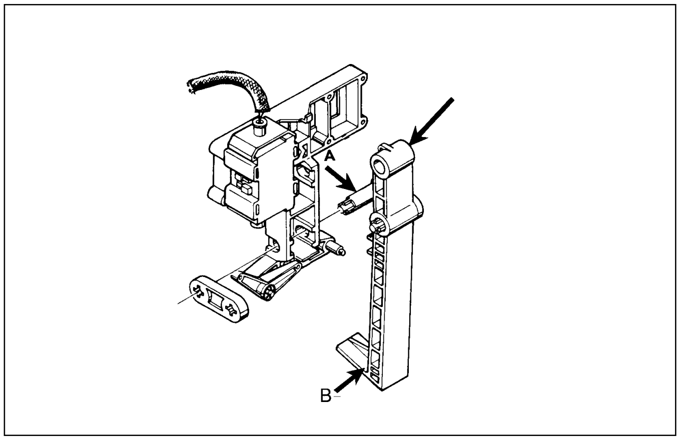
14. Front Distributor Shaft and Idler Gears
    a. Apply a light film of grease on both gears.

LANE#	1/2	3/4	5/6	7/8	9/10	11/12	13/14	15/16	17/18	19/20
INITIALS										
DATE										
LANE#	21/22	23/24	25/26	27/28	29/30	31/32	33/34	35/36	37/38	39/40
INITIALS										
DATE										
LANE#	41/42	43/44	45/46	47/48	49/50	51/52	53/54	55/56	57/58	59/60
INITIALS										
DATE										



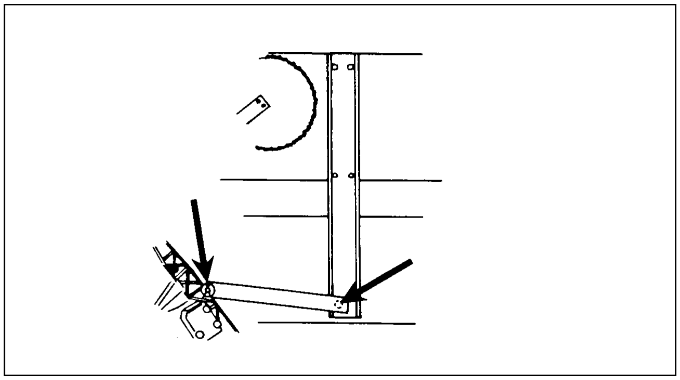
15. Ball Door Button Shaft
    A. One drop of oil on each side of the shaft.

LANE#	1/2	3/4	5/6	7/8	9/10	11/12	13/14	15/16	17/18	19/20
INITIALS										
DATE										
LANE#	21/22	23/24	25/26	27/28	29/30	31/32	33/34	35/36	37/38	39/40
INITIALS										
DATE										
LANE#	41/42	43/44	45/46	47/48	49/50	51/52	53/54	55/56	57/58	59/60
INITIALS										
DATE										



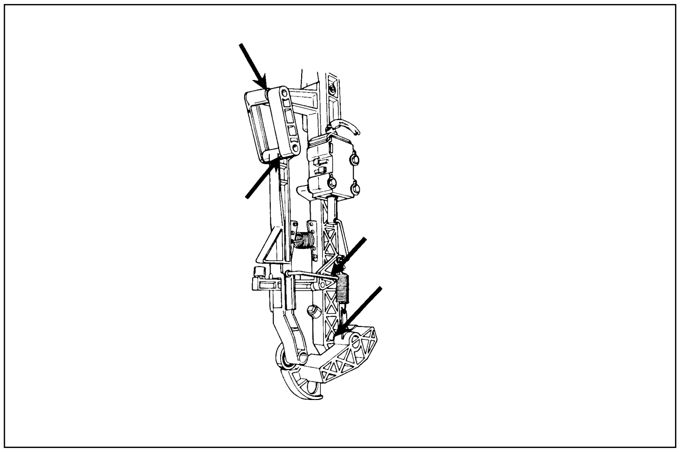
16. Ball Door Locking Mechanism
    A. Connecting links need 1 drop at each pivot point.
    B. Bottom of locking bolt needs a light film of grease.

LANE#	1/2	3/4	5/6	7/8	9/10	11/12	13/14	15/16	17/18	19/20
INITIALS										
DATE										
LANE#	21/22	23/24	25/26	27/28	29/30	31/32	33/34	35/36	37/38	39/40
INITIALS										
DATE										
LANE#	41/42	43/44	45/46	47/48	49/50	51/52	53/54	55/56	57/58	59/60
INITIALS										
DATE										



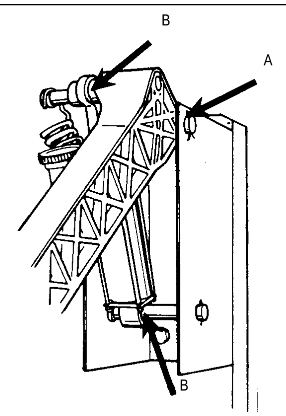
17. Sweep Release Pivot Link
    A. One drop of oil to both ends of the link.

LANE#	1/2	3/4	5/6	7/8	9/10	11/12	13/14	15/16	17/18	19/20
INITIALS										
DATE										
LANE#	21/22	23/24	25/26	27/28	29/30	31/32	33/34	35/36	37/38	39/40
INITIALS										
DATE										
LANE#	41/42	43/44	45/46	47/48	49/50	51/52	53/54	55/56	57/58	59/60
INITIALS										
DATE										



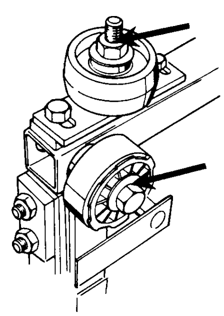
18. Sweep Release Mechanism
    A. Front arm needs one drop of oil on each pivot point.
    B. Swing lever needs one drop of oil on each pivot point.
    C. Tipper needs one drop of oil at its pivot point.

LANE#	1/2	3/4	5/6	7/8	9/10	11/12	13/14	15/16	17/18	19/20
INITIALS										
DATE										
LANE#	21/22	23/24	25/26	27/28	29/30	31/32	33/34	35/36	37/38	39/40
INITIALS										
DATE										
LANE#	41/42	43/44	45/46	47/48	49/50	51/52	53/54	55/56	57/58	59/60
INITIALS										
DATE										



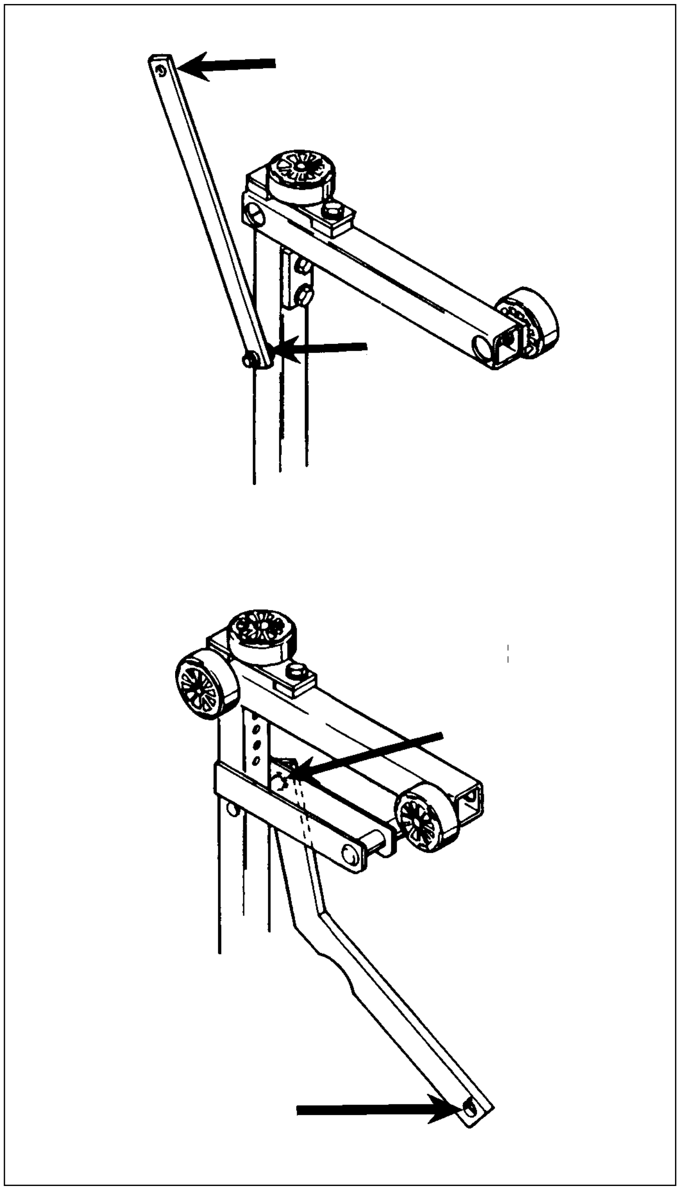
19. Sweep Attenuator
    A. Apply one drop of oil to each end of the top shaft.
    B. Apply one drop of oil to the top and bottom mounting points of the attenuator shock absorber.

LANE#	1/2	3/4	5/6	7/8	9/10	11/12	13/14	15/16	17/18	19/20
INITIALS										
DATE										
LANE#	21/22	23/24	25/26	27/28	29/30	31/32	33/34	35/36	37/38	39/40
INITIALS										
DATE										
LANE#	41/42	43/44	45/46	47/48	49/50	51/52	53/54	55/56	57/58	59/60
INITIALS										
DATE										



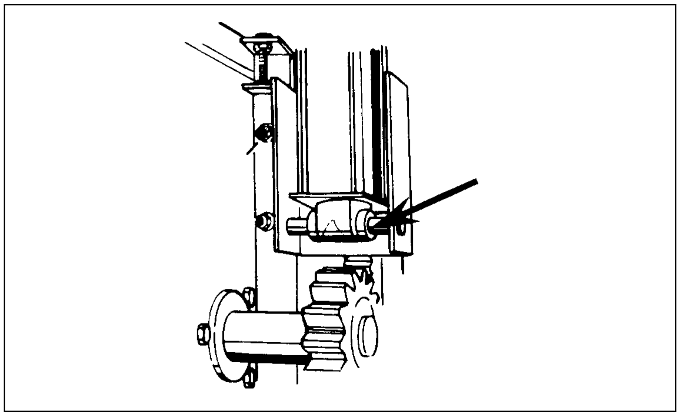
20. Sweep Wagon Roller Shafts
    A. Apply one drop of oil to each of the six shafts.

LANE#	1/2	3/4	5/6	7/8	9/10	11/12	13/14	15/16	17/18	19/20
INITIALS										
DATE										
LANE#	21/22	23/24	25/26	27/28	29/30	31/32	33/34	35/36	37/38	39/40
INITIALS										
DATE										
LANE#	41/42	43/44	45/46	47/48	49/50	51/52	53/54	55/56	57/58	59/60
INITIALS										
DATE										



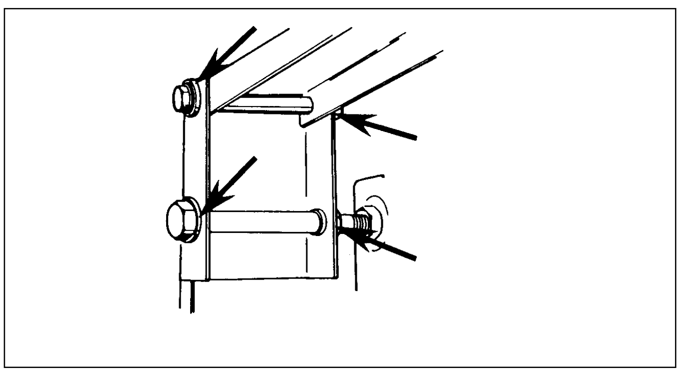
21. Sweep Sweep Wagon Link Bearings
    a. Apply one drop of oil to the top and bottom bearings on each side.

LANE#	1/2	3/4	5/6	7/8	9/10	11/12	13/14	15/16	17/18	19/20
INITIALS										
DATE										
LANE#	21/22	23/24	25/26	27/28	29/30	31/32	33/34	35/36	37/38	39/40
INITIALS										
DATE										
LANE#	41/42	43/44	45/46	47/48	49/50	51/52	53/54	55/56	57/58	59/60
INITIALS										
DATE										



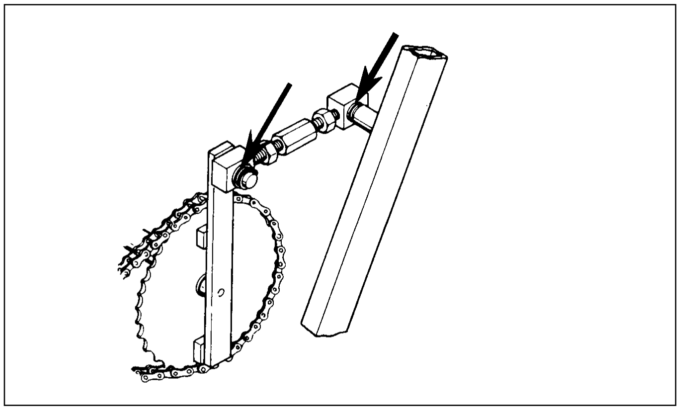
22. Stroke Limiter Shock Absorber
    A. Apply one drop of oil to each stop collar on the lower mounting shaft.

LANE#	1/2	3/4	5/6	7/8	9/10	11/12	13/14	15/16	17/18	19/20
INITIALS										
DATE										
LANE#	21/22	23/24	25/26	27/28	29/30	31/32	33/34	35/36	37/38	39/40
INITIALS										
DATE										
LANE#	41/42	43/44	45/46	47/48	49/50	51/52	53/54	55/56	57/58	59/60
INITIALS										
DATE										



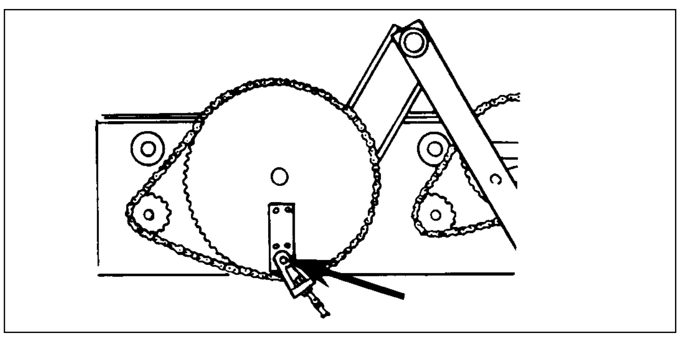
23. Stroker Limiter Plate's Bushing
    A. Apply one drop of oil to each of the four bushings.

LANE#	1/2	3/4	5/6	7/8	9/10	11/12	13/14	15/16	17/18	19/20
INITIALS										
DATE										
LANE#	21/22	23/24	25/26	27/28	29/30	31/32	33/34	35/36	37/38	39/40
INITIALS										
DATE										
LANE#	41/42	43/44	45/46	47/48	49/50	51/52	53/54	55/56	57/58	59/60
INITIALS										
DATE										



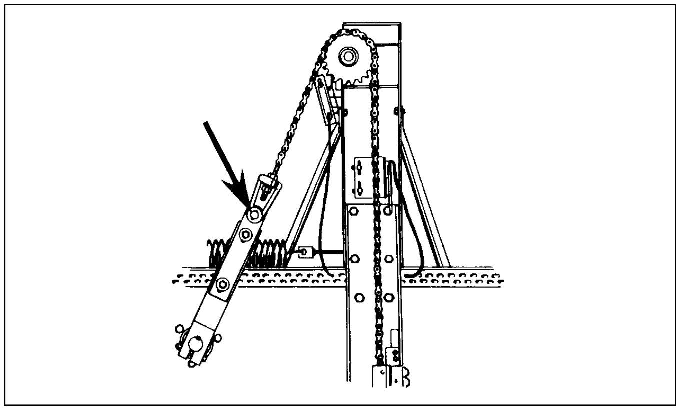
24. Sweep Drive's Turnbuckle Bushings
    A. Apply one drop of oil to each end of the turnbuckles.

LANE#	1/2	3/4	5/6	7/8	9/10	11/12	13/14	15/16	17/18	19/20
INITIALS										
DATE										
LANE#	21/22	23/24	25/26	27/28	29/30	31/32	33/34	35/36	37/38	39/40
INITIALS										
DATE										
LANE#	41/42	43/44	45/46	47/48	49/50	51/52	53/54	55/56	57/58	59/60
INITIALS										
DATE										



25. Sweep Release Chain Clevis
    A. Apply one drop of oil to the clevis's pivot point.

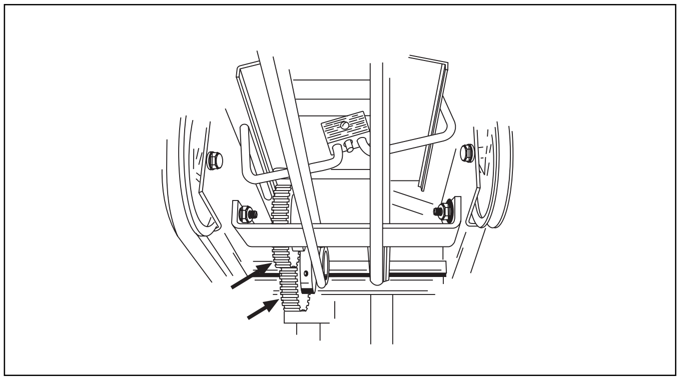
LANE#	1/2	3/4	5/6	7/8	9/10	11/12	13/14	15/16	17/18	19/20
INITIALS										
DATE										
LANE#	21/22	23/24	25/26	27/28	29/30	31/32	33/34	35/36	37/38	39/40
INITIALS										
DATE										
LANE#	41/42	43/44	45/46	47/48	49/50	51/52	53/54	55/56	57/58	59/60
INITIALS										
DATE										



26. Table Lift Chain Clevice

A. Lower the setting table onto a jackstand or other suitable support to release tension on the chain. Remove the clevice from the table shaft crank arm and grease the crank arm's shaft. Reinstall the clevice.

LANE#	1/2	3/4	5/6	7/8	9/10	11/12	13/14	15/16	17/18	19/20
INITIALS										
DATE										
LANE#	21/22	23/24	25/26	27/28	29/30	31/32	33/34	35/36	37/38	39/40
INITIALS										
DATE										
LANE#	41/42	43/44	45/46	47/48	49/50	51/52	53/54	55/56	57/58	59/60
INITIALS										
DATE										

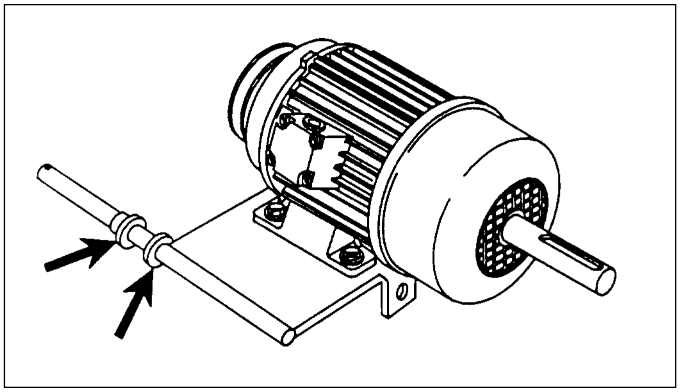


27. Shark Switch Gears

A. Apply a light film of grease to both gears.

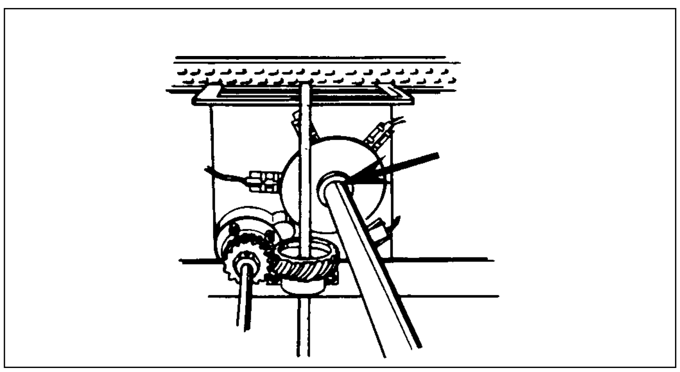
LANE#	1/2	3/4	5/6	7/8	9/10	11/12	13/14	15/16	17/18	19/20
INITIALS										
DATE										
LANE#	21/22	23/24	25/26	27/28	29/30	31/32	33/34	35/36	37/38	39/40
INITIALS										
DATE										
LANE#	41/42	43/44	45/46	47/48	49/50	51/52	53/54	55/56	57/58	59/60
INITIALS										
DATE										

Semi-Annual



1. Motor Mounting Brackets Shafts
   A. apply two drops of oil to each bushing on the shafts. This should be done for the table, sweep, and distributor accelerator motors.

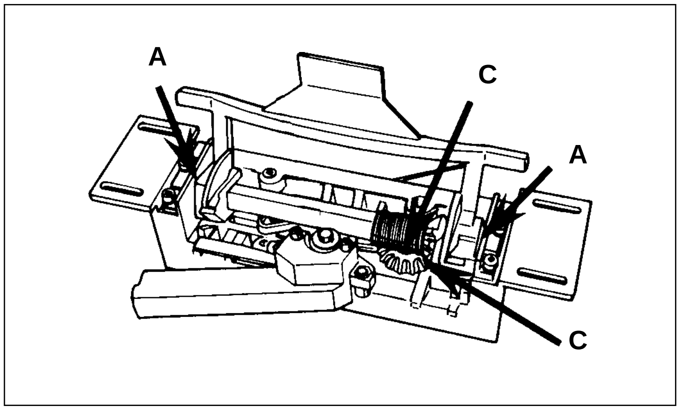
LANE#	1/2	3/4	5/6	7/8	9/10	11/12	13/14	15/16	17/18	19/20
INITIALS										
DATE										
LANE#	21/22	23/24	25/26	27/28	29/30	31/32	33/34	35/36	37/38	39/40
INITIALS										
DATE										
LANE#	41/42	43/44	45/46	47/48	49/50	51/52	53/54	55/56	57/58	59/60
INITIALS										
DATE										

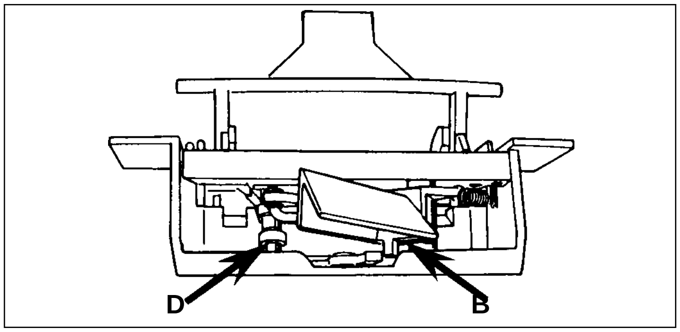


2. Switch Cluster Shaft
   A. Apply one drop of oil to the shaft.

NOTE: *This prevents the switch cam from seizing up on the shaft.*

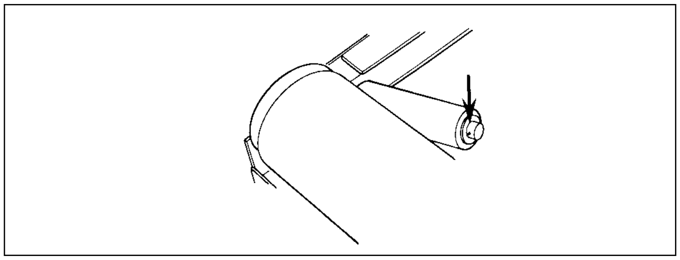
LANE#	1/2	3/4	5/6	7/8	9/10	11/12	13/14	15/16	17/18	19/20
INITIALS										
DATE										
LANE#	21/22	23/24	25/26	27/28	29/30	31/32	33/34	35/36	37/38	39/40
INITIALS										
DATE										
LANE#	41/42	43/44	45/46	47/48	49/50	51/52	53/54	55/56	57/58	59/60
INITIALS										
DATE										





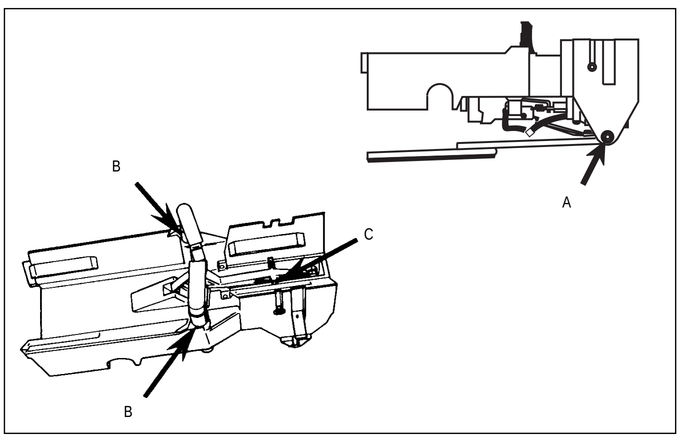
3. Pin Station Assembly
   The various pivot points on all ten pin stations need to be oiled semi-annually.
   A. Each end of the square spindle needs 1 drop of oil.
   B. Apply one drop of oil to the ejector flap's pivot shaft.
   C. Apply two drops of oil to the bevel gears.
   D. Apply one drop of oil to the bevel gear's shaft.

LANE#	1/2	3/4	5/6	7/8	9/10	11/12	13/14	15/16	17/18	19/20
INITIALS										
DATE										
LANE#	21/22	23/24	25/26	27/28	29/30	31/32	33/34	35/36	37/38	39/40
INITIALS										
DATE										
LANE#	41/42	43/44	45/46	47/48	49/50	51/52	53/54	55/56	57/58	59/60
INITIALS										
DATE										



4. Transport Band Frame Rollers
    A. Remove the rollers from their shafts and grease the entire shaft.

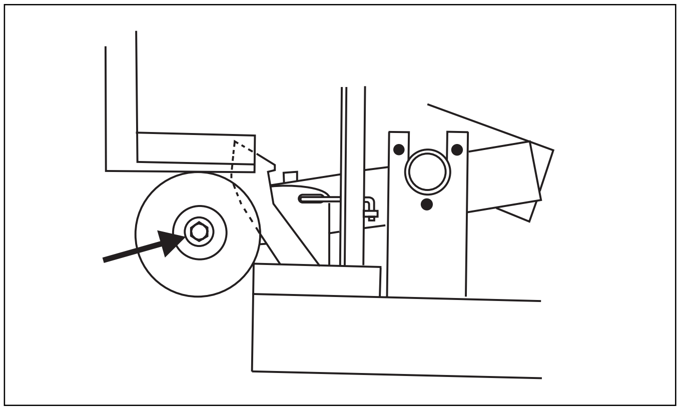
LANE#	1/2	3/4	5/6	7/8	9/10	11/12	13/14	15/16	17/18	19/20
INITIALS										
DATE										
LANE#	21/22	23/24	25/26	27/28	29/30	31/32	33/34	35/36	37/38	39/40
INITIALS										
DATE										
LANE#	41/42	43/44	45/46	47/48	49/50	51/52	53/54	55/56	57/58	59/60
INITIALS										
DATE										



5. Pin Holders
    Several pivot points need to be oiled on each pin holder.
    A. Apply one drop of oil to each end of the pin detector plate’s shaft.
    B. Apply one drop of oil to each pin gripper shaft.
    C. Apply one drop of oil to each switch finger.

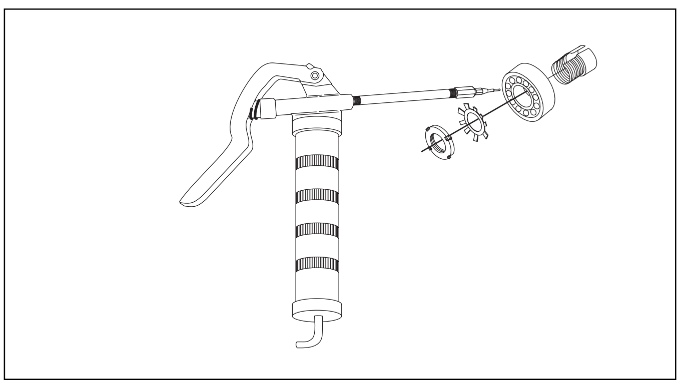
NOTE: *Never apply any type of lubricant to the solenoid or its plunger. When a plunger becomes dirty or sticky. It must be cleaned with electrical contact cleaner and them dried to leave no residue.*

LANE#	1/2	3/4	5/6	7/8	9/10	11/12	13/14	15/16	17/18	19/20
INITIALS										
DATE										
LANE#	21/22	23/24	25/26	27/28	29/30	31/32	33/34	35/36	37/38	39/40
INITIALS										
DATE										
LANE#	41/42	43/44	45/46	47/48	49/50	51/52	53/54	55/56	57/58	59/60
INITIALS										
DATE										



6. Setting Table Swing Shaft Roller
   A. Apply one drop of oil to the shaft on each side of the roller.

LANE#	1/2	3/4	5/6	7/8	9/10	11/12	13/14	15/16	17/18	19/20
INITIALS										
DATE										
LANE#	21/22	23/24	25/26	27/28	29/30	31/32	33/34	35/36	37/38	39/40
INITIALS										
DATE										
LANE#	41/42	43/44	45/46	47/48	49/50	51/52	53/54	55/56	57/58	59/60
INITIALS										
DATE										



7. Elevator Shaft Bearings
   A. Remove plastic bearing seals and inject a small amount of grease into the roller bearing assembly with a “Vita“ needle.

LANE#	1/2	3/4	5/6	7/8	9/10	11/12	13/14	15/16	17/18	19/20
INITIALS										
DATE										
LANE#	21/22	23/24	25/26	27/28	29/30	31/32	33/34	35/36	37/38	39/40
INITIALS										
DATE										
LANE#	41/42	43/44	45/46	47/48	49/50	51/52	53/54	55/56	57/58	59/60
INITIALS										
DATE										

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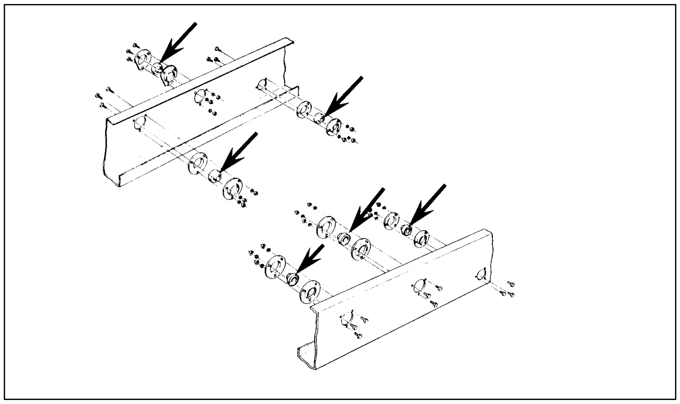
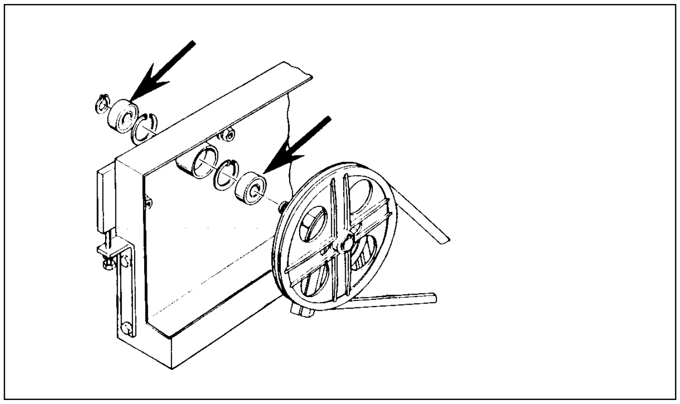


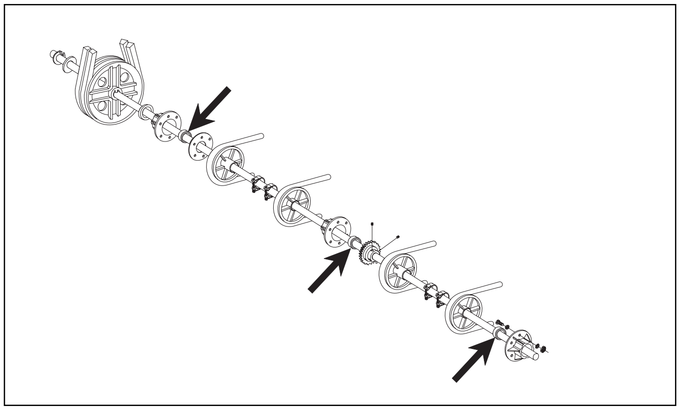
1. Drive Train Shaft Bearings
   A. Grease with "Vita" needle.

LANE#	1/2	3/4	5/6	7/8	9/10	11/12	13/14	15/16	17/18	19/20
INITIALS										
DATE										
LANE#	21/22	23/24	25/26	27/28	29/30	31/32	33/34	35/36	37/38	39/40
INITIALS										
DATE										
LANE#	41/42	43/44	45/46	47/48	49/50	51/52	53/54	55/56	57/58	59/60
INITIALS										
DATE										



2. Distributor Drive V-Belt Tensioner Bearings
   A. Remove and grease with "Vita" needle.

LANE#	1/2	3/4	5/6	7/8	9/10	11/12	13/14	15/16	17/18	19/20
INITIALS										
DATE										
LANE#	21/22	23/24	25/26	27/28	29/30	31/32	33/34	35/36	37/38	39/40
INITIALS										
DATE										
LANE#	41/42	43/44	45/46	47/48	49/50	51/52	53/54	55/56	57/58	59/60
INITIALS										
DATE										



3. Distributor Shaft Bearings
   Bearings are sealed and do not need to be greased.
   A. Apply one drop of oil to the shaft to allow the bearing to be removed when needed.

LANE#	1/2	3/4	5/6	7/8	9/10	11/12	13/14	15/16	17/18	19/20
INITIALS										
DATE										
LANE#	21/22	23/24	25/26	27/28	29/30	31/32	33/34	35/36	37/38	39/40
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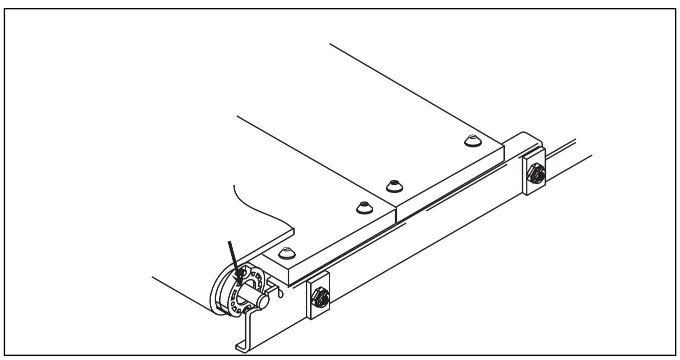

4. Transport Band Rollers
   A. Apply one drop of oil to each bearing to allow for easier bearing removal when needed.

LANE#	1/2	3/4	5/6	7/8	9/10	11/12	13/14	15/16	17/18	19/20
INITIALS										
DATE										
LANE#	21/22	23/24	25/26	27/28	29/30	31/32	33/34	35/36	37/38	39/40
INITIALS										
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LANE#	41/42	43/44	45/46	47/48	49/50	51/52	53/54	55/56	57/58	59/60
INITIALS										
DATE										

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GS-Series Pinsetter Preventive Maintenance Inspection

Center Name ______________________ **Lane #** __________

Mechanic Name ______________________ **Date** __________

Inspection Period	1	2	3	4	Inspection Period	1	2	3	4
Elevator Assembly					**Drive Frame Assembly**				
1. Frame/Welded Assemblies					1. Sweep Shaft / Drive				
2. Drive Train / Shovels					2. Right / Left Drive Frame Assembly				
3. Pinsetter Guards					3. Spotting Tong Drive Assembly				
4. Rubber Cords/Ejecting Flaps					4. Motors / Belts / Motor Mountings				
5. Pin Turn Wires					5. Stroke Limiter Assembly				
6. Pin Chute Assembly (Single & Dual Feed)					6. Front Pulley / V-Belt Tensioner				
7. Elevator Electrical Components					7. Setting Table / Sweep Motor Drives				
8. Shark Switch / Pin Turn Assemblies					8. Guide Tower Assembly				
9. Pin Count Switch (Smart Shark)					9. Sweep / Table / Pinion Drive Shaft Assembly				
10. Smart Shark Solenoid / Linkage					10. Switch Cluster / Scorer Switches				
Transport Band Assembly					**Main Frame Assembly**				
1. Frame & Feet / Side Frames					1. Frame / Welded Assemblies				
2. T-Band Boards / Carpet / Rollers					2. Pinlight Fixture				
3. T-Band Drive Belts / Pulleys					3. Guards / Work Platform				
4. Pin Feed Deflectors					4. Electrical Boxes / Mounting Hardware				
Ball Cushion / Pit Curtain					**Distributor Assembly**				
1. Cushion Board / Frame / Facing / Bearings					1. Frame / Welded Assemblies				
2. Shock Absorbers / Pulleys					2. Shafts / Pulleys / Belting				
3. Single & Dual Feed Overflow Chutes					3. Pin Separators / Centering Devices				
4. Pit Curtain					4. Pin Stations / Sliders				
Ball Accelerator Assembly					**Electrical Components**				
1. Frame / Welded Assemblies					1. Boxes / Mounting Hardware				
2. Door Protector Ring / Wedges / Fiber Plates					2. Ball Detector / Reflectors				
3. Motor / Drive Belt					3. Player Control Station				
4. Flat Belt / Driving Drums					4. Ball Rack Reset Button				
5. Ball Doors / Locking Assemblies					5. Managers Control Box				
Sweep Wagon Assembly					**Power Ball Lift**				
1. Sweep Wagon Frame					1. Ball Lift Tires				
2. Sweep Board / Adapters					2. Motor / Drive Belt				
3. Sweep Release Mechanism					3. Ball Lift Tracks				
4. Sweep Attentuator / Hydraulic									
Setting Table Assembly					**Administration and Organization**				
1. Frame / Welded Assemblies					1. Spare Parts / Inventory Control				
2. Spotting Tongs / Geared Racks					2. Tools / Maintenance Equipment				
3. Table Harness / Cable Channels					3. Cleaning / Lubrication Supplies				
4. Swing Shafts / Connecting Rods					4. Preventive Maintenance Program				
5. Table Jam Switch					5. Manuals and Service Bulletins				
6. Pin Holders / Pin Switches					6. Stop Sheets / Recap Forms				
7. Setting Table Racks / Roller Supports									

Preventive Maintenance Work Schedule

Elevator Assembly

1. Inspect condition of the frame and frame welds. Check for loose or missing hardware.

2. Inspect all shafts, bearings, sprockets, chains and pulleys for condition and adjustment. Check all pin shovels and shovel hardware. Inspect all shovel pivot levers. Inspect centering guide condition.

3. Inspect condition and mounting of guards and verify guard identification labels are in place.

4. (Series 42 and below). Inspect condition, location and adjustment of rubber knockout cords and pin ejecting flap.

5. (Series 42 and below). Inspect condition adjustment and hardware on pin turn wires.

6. (Series 12 and below). Inspect welds, hardware and adjustment of single feed pin chute assembly.

   (Series 13 through 42). Check the adjustment mounting hardware, welds and condition of the dual feed pin chute. Inspect the "Y" switch, flipper stoppers, deflector shoes and rubber cords for proper adjustment and condition.

7. Inspect the mounting and adjustment of the elevator control switch. Check the mounting and function of the mechanics' rear control box and the trouble light. Verify that all elevator cables are intact and routed correctly.

8. (Series 43 and above). Inspect the mounting hardware, condition and adjustment of the shark assembly and pin guide wedges. Check the shovel cam for adjustment and condition. Check the alignment and mesh of the drive and the drive spur gears. Inspect the condition and operation of the fin switch. Inspect the tensioning and condition of the transfer belts. Inspect the mounting hardware and condition of the deflector shoe.

9. (Smart Shark). Inspect the condition, alignment, adjustment and operation of the pin count switch. Check that all switch and switch mounting bracket hardware is tight. Check for correct cable routing.

10. (Smart Shark). Check the smart shark solenoid and solenoid linkage. Check for proper operation of the smart shark. Check all mounting hardware and fasteners.

Transport Band Assembly

1. Inspect the condition of the welds and feet on the long pit transport frame. Inspect the condition of the welds and mounting hardware on the short pit side frames.

2. Inspect the mounting hardware and condition of the transport band boards. Check the condition and tracking of the transport band carpet. Inspect the front and rear rollers for bearing and shaft condition, correct tensioning and alignment in mounting slots. Inspect the condition and operation of the centering guide rollers.

3. Inspect the condition and tensioning of the transport band drive belts. Inspect the mounting hardware on the idler and tensioner assemblies. Check the condition of the idler pulleys.

4. Inspect the condition and mounting hardware on the pin feed deflectors and mounting brackets. Check the adjustment on the pin feed deflectors.

Ball Cushion and Pit Curtain

1. Inspect the condition and mounting hardware on the ball cushion board and the impact strips. Check the attachment of the rubber cushion to the board and the facing to the rubber cushion. Inspect the cushion frame welds, and check the mounting hardware. Inspect the nylon cushion bearings for wear and check the location and hardware on the stop collars. Inspect the cushion assembly for proper adjustment.

2. Inspect the mounting, adjustment and fluid level in the ball cushion shock absorber. Inspect the mounting and location of the shock absorber adjustment plate.

3. Inspect the mounting and rubber overflow pad on the single feed overflow chute. Inspect the condition and mounting of the dual feed overflow chute. Inspect the condition of the chute felt and check the bond to the metal. Check the condition of the pin wipers. Inspect the condition and adjustment of the overflow socks.

4. Inspect the condition of the pit curtain and check the mounting hardware.

Ball Accelerator Assembly

1. Inspect the condition of the frame welds. Check that foot guards are in place. Inspect the condition and location of the ladder.

2. Inspect the condition and mounting hardware on the ball door protector ring. Inspect the condition and mounting hardware on the ball door wedges. Inspect the condition and mounting hardware on the fiber plates.

3. Inspect the accelerator motor and motor bushings for smooth operation. Check the motor belt condition and alignment of the motor pulley. Check for excessive vibration.

4. Inspect the condition of the flat belt. Inspect the flat belt guard for proper adjustment. Inspect the driving drum condition and check for smooth operation. Verify that all driving drum hardware is in place.

5. Inspect the ball door and ball door locking mechanism for proper adjustment. Check the condition of the ball door, ball door button and door locking bolt. Inspect the ball door solenoid for correct operation. Check the routing of the solenoid cable. Verify that ball door shafts and collars rotate freely.

Sweep Wagon Assembly

1. Inspect the condition of the sweep wagon frame and frame welds. Check the roller mounting and adjustment. Inspect the condition of the leaf springs. Check the conditions of the pusher rods and pusher rod bushings. Inspect the conditions of the protector blocks and block mounting hardware. Check all sweep wagon hardware.

2. Inspect the condition of the sweep board and adapters. Check the adjustment of the sweep board and adapters.

3. Inspect the condition of all sweep release mechanism components. Check all sweep release mounting hardware. Inspect for missing springs or worn linkage and pivot bushings. Check the condition of the chain and the clevice. Check the operation of the solenoid. Inspect the solenoid cable routing.

4. Inspect the sweep attenuator and sweep shock absorber for loose or missing hardware. Check the sweep shock absorber fluid level. Check the attentuator and “G” switch for proper adjustment. Inspect all pivot points for wear. Inspect the “G” switch cable routing.

Setting Table Assembly

1. Inspect the setting table frame for wear of broken welds. Check for loose or missing hardware. Check the vertical swing shaft stop bolt for proper adjustment. Inspect the condition of the vertical helper springs.

2. Check for loose or missing spotting tong and geared rack hardware. Inspect the "ST" switch mounting and check the adjustment. Inspect the condition of the tongs, gears and toothed racks. Check the operation of the tongs and inspect the tong dampers for wear.

3. Inspect all cable channels and conduits for wear. Check that all channels and conduits are secured to the frame. Inspect the condition of the table harness plug and its mounting bracket.

4. Inspect all welds on the swing shafts and connecting rods. Check for loose or missing connecting rod hardware. Check the adjustment on the stop collars. Inspect the swing shaft bearings for wear. Inspect the condition of the table spring. Inspect the condition and mounting of the table jam roller. Check the adjustment of the horizontal stop bolt. Verify that all pin holder leveling bolts/ground screws are in place and secure.

5. Inspect the TS-1 jam switch mounting and adjustment. Check the actuator arm and cam for free operation. Check for loose or missing hardware and springs.

6. Inspect all pin holders and pin holder solenoids for correct mounting. Check the switch fingers for correct pivoting. Inspect all pin holder switches for tight mounting. Check all pin holder connectors and wiring for routing and connection. Inspect the adjustment on the pin detector plates. Check the adjustment on the switch actuator springs.

7. Inspect the mounting of the table racks to the table. Check the adjustment and condition of the small and large roller support assemblies. Inspect the condition of the toothed racks. Check the condition of the T-stop. Check the mounting of the OOR actuator cam. Inspect the condition of the chain and clevice.

Drive Frame Assembly

1. Inspect the welds and condition of the sweep shaft. Check the sweep shaft supports for secure mounting. Inspect the sweep shaft bearings for signs of wear. Inspect the connecting rods and verify all hardware is in place and secure.

2. Inspect the condition and welds on the left hand and right hand drive frame assemblies. Check for loose or missing hardware. Inspect all cable channels and cables for condition and routing. Check for any worn shaft bearings. Check the chain tensioners for condition and adjustment. Inspect the frame counter for correct operation.

3. Inspect the spotting tong drive for loose or missing hardware. Check for loose or worn gears. Check the spotting tong solenoids for proper operation. Check the spotting tong clutch for correct operation, and check the condition of the clutch shaft. Inspect the mesh between the square shaft drive gear and the spur gear. Check the condition of the square shaft drive gear.

4. Inspect the motors for correct mounting and alignment. Check the condition of all V-belts. Inspect the motor cables for correct routing. Check the condition of the motor tensioning springs. Inspect the external sweep motor brake if you have this style sweep motor. Check all motor mounting plate bushings. Check for excessive vibration in motor and belt operation.

5. Inspect the stroke limiter for a bent or cracked plate and loose or missing hardware. Check the mounting and fluid level in the stroke limiter shock absorber. Check the condition of the rubber bumper. Check the solenoid for proper operation. Inspect the square shaft, the linkage and the square shaft latch for correct adjustment.

6. Inspect the condition of the double V-belts. Check for loose or missing tensioner mounting hardware. Check the tensioner shaft and bearings for loose or noisy operation.

7. Inspect the condition of the setting table and sweep motor drive assemblies. Check for worn or damaged chains. Inspect the pinion shafts and gears for adjustment and condition. Check for loose or missing bearing plate hardware. Inspect the condition of bearing plate bearings and drive sprocket shafts.

8. Inspect the condition of the guide tower assembly. Check the mounting and adjustment on the TS-2 and OOR switch. Check for correct switch cable mounting. Check for loose or missing guide tower hardware. Inspect the condition of the lift chain sprocket. Check the condition of the jam lever and spring.

9. Inspect the sweep and table drive shaft assemblies. Check for shaft wear. Check for chain wear and proper tensioning. Inspect the crank arms and verify they are secure on the shafts. Check the sprockets for wear. Inspect the pinion shaft assembly. Check the shaft and bearings for wear. Inspect the pinion gears for wear. Check the adjustment of the pinion gears to the tower racks.

10. Inspect the switch cluster. Check the switch cluster housing to make sure it is secure. Check the adjustment on the “A,” “B,” “C,” and “D” switches. Check the adjustment on the switch cam. Check all scorer switches on pinsetters so equipped.

Main Frame Assembly

1. Inspect the main frame. Check for wear points or broken welds. Check for loose or missing hardware. Check the main support braces and verify they are secure.

2. Inspect the pinlight fixture. Check and verify that the fixture is secure. Check the lamp and lamp sockets. Check the power cord routing.

3. Inspect the guards. Check for wear points or broken welds. Check for loose or missing hardware. Check for any missing guards. Check the work platform and the work platform braces and hardware.

4. Inspect the electrical box mounting plate. Check and verify that the mounting plate and rubber bumpers are secure. Check and verify that all electrical box mounting receptacles and hardware are secure.

Distributor Assembly

1. Inspect the distributor frame assembly. Check for worn or damaged frame components and welds. Check for loose or missing hardware. Check and verify that the dust pan is secure. Check the distributor rails and extensions for wear or cracks. Check the distributor stations for wear or cracks. Inspect the lower pin guides for bent or missing parts. Check the corner turn rails and corner pin turn devices for loose or missing hardware and for correct adjustment.

2. Inspect the distributor shafts, pulleys and belting. Check for worn or damaged shafts or bearings. Check for worn or cracked pulleys. Inspect the condition of the distributor belting. Check the condition of distributor gears and verify proper gear mesh. Check the alignment of all shafts, pulleys and belting. Check for any missing shaft, bearing or pulley hardware.

3. (Series 12 and Below). Inspect the pin separators and pin centering devices. Check the condition, mounting and adjustment on the pin separators. Check the condition mounting and adjustment on the pin centering devices.

4. Inspect the distributor pin stations. Verify all pin stops are in place. Check the pin sliders for free operation. Check the pin sliders for cracks or breaks. Check for loose or missing pin station hardware. Check the ejector flaps for wear or cracking. Check the retaining bows for wear or cracking. Check for worn, cracked or misadjusted pin release levers. Verify that all pin station springs are in place. Inspect the top and bottom housings for cracks or wear.

Electrical

1. Inspect the electrical boxes and box mounting hardware. Check the ground straps and verify that they are in place and secure. Verify that all cables are routed correctly. Inspect all box covers to verify they are in place and secure. Check the pinlight bypass switch for operation. Are all box switch guards in place? Check all cable and box connectors for correct seating. Check the 5 volt power supply adjustment.

2. Inspect the ball detect and reflector. Check and verify all mounting hardware is secure. Check the ball detector assembly for proper adjustment.

3. On stand-alone units, inspect the player control station (PCS). Verify that the PCS is mounted securely, the cable is routed correctly and that the unit is operating properly.

4. Inspect the ball rack reset button. Check for correct operation and check the cable routing and connection.

5. On units so equipped, inspect the manager's control box. Check the on/off switches for proper operation. Are both indicator lamps working? Verify that both frame counters work.

Power Ball Lift

1. Check the condition and mounting of the ball lift tires. Check the condition of the lift tire shafts and bearings. Check the condition and operation of the ball lift clutch.

2. Check the ball lift motor for correct mounting. Check the motor pulley for proper alignment. Check the drive belt condition and alignment.

3. Check the ball lift tracks for correct mounting. Check the condition of the rubber and leather tracks and verify they are secure.

Administration and Organization

1. Is a spare parts and inventory control system in place? Are adequate spare parts on hand and are those parts organized and accessible? Check for inventory control.

2. Verify that the correct hand tools are in place. Are the hand tools organized for ready access?

3. Verify that the correct cleaning and lubrication supplies are on hand. Check and verify the supplies are adequate and that the correct approved materials are in use.

4. Is a preventive maintenance program in use? Is a lubrication program in use? Is a cleaning program in use?

5. Verify that current operations manuals, service parts manuals and service bulletins are in the center.

6. Verify that stop sheets, recap forms and frames per stop data is being used in the center.

GS-Series Pinsetter Pending Items Work List

Center Name ______________________________ **Lane #** ______________

Mechanic Name ______________________________ **Date** ______________

Pending Work Item	Date Complete	Mechanic