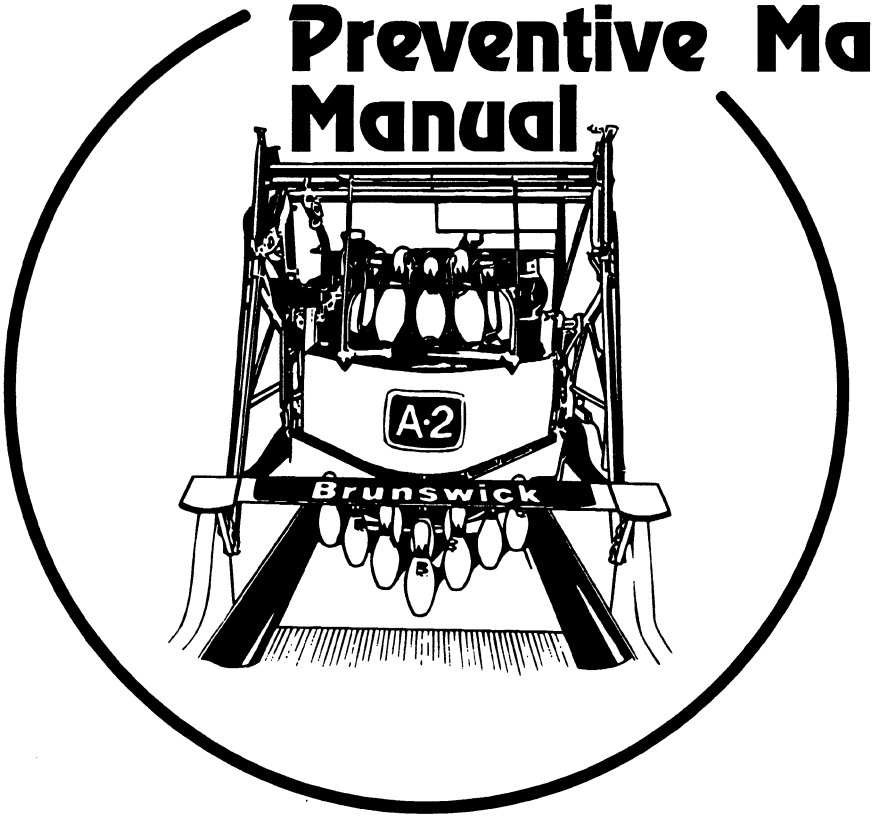
BrunsParts Preventive Maintenance Manual



Brunswick

BRUNSWICK BOWLING & BILLIARDS CORPORATION • SERVICE PARTS AND SUPPLIES

12-900260

APRIL, 1993

Brunswick®
BOWLING & BILLIARDS CORPORATION · MUSKEGON, MICHIGAN

Ask Us About...

THE *NEW*
KINGPIN CLUB

Select Only Genuine Brunswick Replacement Parts

CALL BRUNSWICK TOLL FREE
1 800 • YES
BOWL
(1-800-937-2695)
IN CANADA CALL 416-607-3316

BRUNSPARTS PREVENTIVE MAINTENANCE MANUAL

Reorder Part No. 12-900260-000

Brunswick Bowling and Billiards Corporation
525 West Laketon Avenue
P.O. Box 329
Muskegon, Michigan 49443-0329

Brunsparts Preventive Maintenance Manual

Table Of Contents

Part 1
Introduction

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 untenable.

It is very poor practice to rely on memory in servicing any machinery. Brunswick, therefore, has made available a printed form entitled "preventive Maintenance Work Schedule". This schedule gives a step-by-step procedure for maintaining the pinsetters. 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 their useful life.

In addition to the "Preventive Maintenance Work Schedule", Brunswick has made available a printed form entitled "Preventive Maintenance Functional Tune-Up Sheet". This tune-up sheet is organized according to the major assemblies of the pinsetter. Under each assembly are several items pertaining to the area that must be inspected and corrected. This tune-up sheet differs from the work schedule sheet in that one pinsetter is functionally checked completely before moving on to the next pinsetter. The two preventive maintenance sheets complement each other to assure that all pinsetters receive scheduled cleaning, lubrication and general inspection while each individual pinsetter is also systematically tuned-up and adjusted for trouble free operation of each function.

Safety Procedures

General Safety Regulations

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

1. Wear the proper clothing when working on the pinsetter. Don not wear neckties or loose clothing that may be caught by the machine. Wear trousers without cuffs to prevent tripping. Wear shoes with safety, non-lip soles.

2. Use the right tool for each job to prevent injury to yourself and to the machine. Remove all tools from the machine before turning it on.

3. Avoid the use of cleaners which are toxic.

4. Immediately wipe up any oil or liquids that have spilled to prevent slipping.

5. Store oily rags and any other combustibles in a fireproof container.

Pinsetter Safety Regulations

1. The mechanic must teach all personnel who will work on the pinsetters enough about the machine to prevent accidents through ignorance.

2. When safety guards are removed from the pinsetter, be extra cautious when the machine is turned on. Replace the guards immediately when work is completed.

3. Always open the pinsetter circuit breaker or disconnect the pinsetter power plug from the electrical box before working on the machine.

4. When the pinsetter shuts itself off electrically, be sure to open the circuit breaker or disconnect the pinsetter power plug from the electrical box before looking for, and clearing, the cause of the jam.

5. Always reach over or around the machine assemblies, never through or between the shafts, arms and levers.

6. Use the rods provided to securely lock the rake compression spring guide tube before assembling the rake or deck.

7. The desk man must never turn on a machine from the manager's control desk without first making sure that no one is working on the machine.

8. Position the rake in its down position when working on the front of the machine to prevent being hit by a bowling ball.

9. When more than one person is working on the machines, never turn on a machine without checking to see if everyone is clear of the machine.

10. Under no circumstances allow an unqualified person to work on the pinsetter.

How to Use the Work Schedule

The Work Schedule on the next page contains a list of all items which require scheduled maintenance. These items are divided into five groups: Tri-weekly Service, Weekly Service, Monthly Service, Quarterly Service and Annual Service.

One Work Schedule sheet is sufficient to record the maintenance performed on all pinsetters in a center for a four week period. When performing one of the maintenance items listed on the sheet, do not check it off as completed until the number of pinsetters designated in the instructions have all received that service. For example, the instructions for "Weekly Service" state that 1/4 of the machines are to be done on Monday, 1/4 on Tuesday, 1/4 on Wednesday and 1/4 on Thursday. One of the items under "Weekly Service" is "Deck Chutes (Wipe)". On Monday, do not check this item as completed until the deck chutes have been wiped on the first 1/4 of the machines. On Tuesday, do not check it as completed until the deck chutes have been wiped on the second 1/4 of the pinsetters, etc.

To simplify its use, and as a valuable aid in properly scheduling maintenance, the work schedule has been coded. To use the code, divide the machines into four groups as nearly equal as possible. For example, a 12 lane center would be divided into four groups of three machines each. A 14 lane center would be divided into four groups of three, three, four and four machines. A 30 lane center would be divided into four groups of seven, seven, eight and eight machines.

At the top of the work schedule are four coded blocks with spaces to enter the group of machines assigned to each block. For example, a 12 lane center would enter machines 1-3 at the first coded block, machines 4-6 at the second coded block, machines 7-9 at the third coded block and machines 10-12 at the fourth coded block. By assigning a different coded block to each of the four groups of machines, the workload is automatically scheduled in advance. Wherever the code in the first block appears under Tri-Weekly, Weekly and Monthly Service, the group of machines assigned to that code are scheduled for maintenance. For example, in a 12 lane center, machines 1-3 are assigned to the first coded block. This same code appears on Monday, Wednesday, and Friday under Tri-Weekly Service. This means machines 1-3 would receive the designated service on those days. The check marks which signify completion of each service will be easily visible over the coded blocks on the work schedule.

As a further aid in scheduling maintenance, there is a column on the work schedule entitled "Assign To". Use this column to enter the initials of the individuals to whom the various services are assigned. When a four week work schedule is completed, the chief mechanic should sign in the designated place. In addition, the proprietor should sign the work schedule, thus acknowledging his satisfaction with the current status of the maintenance program.

The instructions for the work schedule are covered in Part 2 with Lubrication covered in Part 3.

MACHINES #____ THRU #____ 

MACHINES #____ THRU #____ 

MACHINES #____ THRU #____ 

MACHINES #____ THRU #____ 

PREVENTIVE MAINTENANCE WORK SCHEDULE
BRUNSWICK AUTOMATIC PINSETTER (MODEL A-2)

FOUR WEEK PERIOD ENDING

		ASSIGN TO	TRI-WEEKLY SERVICE (½ OF PINSETTERS PER DAY)																										
			M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S
1	CHECK STOP SHEET (ALL MACHINES DAILY)																												
	CLEANING																												
2	BALL & PIN ELEVATORS & PIN GUIDE (WIPE)																												
3	TURNAROUND PAN (WIPE)																												
4	BALL LIFT RODS & RETURN TRACKS (WIPE)																												
5	PIT CUSHION & PIT CURTAIN (WIPE)																												
6	CROSS CONVEYOR BELTS, SIDES & PLATE (WIPE)																												
7	TURRET 5 PIN CHUTE, SPOONS & SNUBBER (WIPE)																												
8	PIT CARPET (VACUUM CLEAN)																												
9	WORK AREA (BENCH, ROOM & AISLE)																												

			WEEKLY SERVICE (¼ OF PINSETTERS PER DAY)																										
	CLEANING		M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S
10	ALL BELTS (WIPE)																												
11	DECK CHUTES (WIPE)																												
	LUBRICATION																												
12	GEAR BOX OIL LEVEL (CHECK)																												
13	DETECTOR (CLEAN & OIL)																												
14	LUBRICATION CHARTS (WEEKLY ITEMS)																												

			MONTHLY SERVICE (¼ OF PINSETTERS PER WEEK)																										
	INSPECT AND CORRECT		M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S
15	CHECK JAM SWITCHES (ALL MACHINES)																												
	CLEANING																												
16	ACCELERATOR BELTS (CLEAN)																												
17	FRAMES & CROSS MEMBERS (WIPE)																												
18	GEAR BOX (WIPE)																												
19	DECK (WIPE)																												
20	PIT CARPET (CLEAN)																												
	LUBRICATION																												
21	CAM SURFACES (CLEAN & OIL)																												
22	LUBRICATION CHARTS (MONTHLY ITEMS)																												

			QUARTERLY SERVICE (⅓ OF PINSETTERS PER MONTH)																										
	MACHINE NUMBER																												
	LUBRICATION																												
23	LUBRICATION CHARTS (QUARTERLY ITEMS)																												
	TIGHTEN																												
24	KICKBACK CHANNELS & SIDE FRAMES																												
25	ALL PULLEY BOLTS & NUTS																												
26	GEAR BOX SUPPORTS																												
27	MOTOR SUPPORTS																												
28	DETECTOR MOUNTING BOLTS																												
29	SCISSOR CAM FOLLOWER MOUNTING BOLT																												
30	DECK SHAFT BOLTS																												
31	ELEVATOR GUIDE ROLLER BOLTS & NUTS																												
32	PIT CUSHION BOLTS																												
33	PIT CUSHION ARM TRIANGULAR PLATES																												
34	FIXED RAKE ARM STOPS																												
35	SCISSOR DECK SCREWS																												
36	TURRET INDEX PULLEY SCREWS																												
37	SUB PLATE & PIT CONVEYOR BOLTS																												
38	BALL TRACK & PREFERENCE BAR																												

			ANNUAL SERVICE (1/12 OF PINSETTERS PER MONTH)																										
	MACHINE NUMBER		M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S
	LUBRICATION																												
39	GEAR BOX OIL (CHANGE)																												
40	GEAR BOX CLUTCH																												
41	ELECTRIC MOTOR (GREASE)																												
42	LUBRICATION CHARTS (ANNUAL ITEMS																												
	INSPECT & CORRECT																												
43	BALL LIFT ROD COVERS																												
44	SHOCK ABSORBERS																												
45	MOVING DECK & SCISSOR CABLES																												
46	ELECTRICAL CONTACT POINTS																												
47	WELDED ASSEMBLIES																												
48	PIVOT & WEAR POINTS																												

REMARKS:

100 72

CHIEF MECHANIC'S SIGNATURE

PROPRIETOR'S SIGNATURE

How to Use the Functional Tune-Up Sheets

The Functional Tune-Up Sheet on the next page is divided into the eleven major assemblies of the pinsetting machine. Each assembly is broken down by item and each item is numbered to allow a step-by-step check of each individual pinsetter. Do not tune up a group of machines by assemblies, but complete the entire sequence on one machine before starting on another. A routine schedule is to be established to result in one or two machines being tuned up per week depending on the total number of machines. A suggested goal would be to have every machine at your center completely tuned up at least once or twice a year.

Starting at the top of the Functional Tune-Up sheet, each item should be inspected in sequence, then take any corrective or preventive action necessary. All items should be completed and an X should be marked in the column corresponding to that pinsetter number before moving to the next item. Defer only those items for which parts or down time is not available. Record the problem at the time of the inspection rather than trying to remember it until a deferred item is completed. These items should be obvious on the tune-up sheet by the absence of an X and should be attended to as soon as parts or time are available. All stops should be recorded for each machine as they occur to identify the frequency and the type of problem experienced. Corrective action and new parts installed should be recorded for each machine to provide a maintenance history. It is suggested that a separate Functional Tune Up Sheet, Stop Sheet and Maintenance History Sheet be included on a clipboard attached to the back of each pinsetter. A Master Parts Usage Sheet should be kept in a central location to monitor trends in parts usage and for inventory purposes. Samples of a Pinsetter Malfunction (Stop) Sheet, a Maintenance History Sheet and a Master Parts Usage Sheet are included following the Functional Tune Up Sheet.

A step-by-step comprehensive guide follows in Part 4 with detailed instructions and adjustments for each item of the functional tune-up sheet. The items are listed in identical order in which they appear on the tune-up sheet. Since lubrication is part of the preventive maintenance work schedule, it is not covered again in the preventive maintenance function checks.

A separate summarized set of instructions for each item on the tune-up sheet is included in Part 5 for reference for the experienced mechanic along with a separate adjustment appendix in Part 6 for reference to individual adjustments.

Brunswick PREVENTIVE MAINTENANCE FUNCTIONAL TUNE-UP SHEET

LANE NO. _____

			REVIEW PERIOD 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
RAKE/PIT CUSHION ASSY.			
SECTION I	1	STRUCTURAL PARTS	
	2	ADJUSTMENT & OPERATION	
	3	PIT CUSHION	
	4	TRIGGERING ADJUSTMENT	
GEAR BOX			
SECTION II	5	GEAR BOX CLUTCH	
	6	GEAR TRAIN	
	7	TRIGGERING & RESET LINKAGE	
	8	SCISSOR MOVING DECK LATCH	
	9	DECK HOLDING HOOK	
	10	OIL LEVEL & LEAKS	
	11	CYCLE SOLENOID	
DECK ASSY.			
SECTION III	12	STRUCTURAL PARTS	
	13	SCISSOR DECK	
	14	MOVING DECK	
	15	DECK HEIGHT & LEVEL	
	16	PIN SPOTTING	
	17	DECK JAM SWITCH	
DETECTOR			
SECTION IV	18	STRUCTURAL PARTS	
	19	DETECTOR ROD	
	20	OUT-OF RANGE	
	21	1 & 2 BALL MICRO SWITCH	
	22	STRIKE LIGHT SWITCH	
	23	SWITCH CLUSTER (AUTO SCORER)	
PIT CONVEYOR			
SECTION V	24	PIT BOARD & CARPET	
	25	SHAKER ASSY.	
	26	POWER TRANSMISSION	
ELEVATOR ASSY.			
SECTION VI	27	BALL WHEEL	
	28	PIN WHEEL	
	29	POWER TRANSMISSION PARTS	
	30	BALL LIFT RODS	
	31	BALL RETURN TRACKS	
	32	PIN GUIDE & TURN PAN	
	33	STRUCTURAL PARTS	
CROSS CONVEYOR			
SECTION VII	34	POWER TRANSMISSION	
	35	MICRO SWITCH	
	36	PIN GATE	
	37	SNUBBER	
TURRET ASSY.			
SECTION VIII	38	TURRET LEVEL	
	39	BASKET ASSY.	
	40	SPIDER RING	
	41	INDEXING CAM	
	42	INDEXING LINKAGE	
	43	HALO RING	
	44	TURRET CLUTCH & BELTS	
	45	INTERLOCK SYSTEM	
	46	TURRET JAM SWITCH	
PINSETTER MOTOR			
SECTION IX	47	BELTS & PULLEYS	
	48	POWER CORD	
ACCELERATOR/BOOSTER			
SECTION X	49	STRUCTURAL PARTS	
	50	BELTS	
	51	MOTOR	
BALL LIFT			
SECTION XI	52	DRIVE SYSTEM	
	53	RETARDER TRACKS	
	54	MOTOR/ELECTRICAL BOX	
DATE PERFORMED			

Pinsetter Daily Malfunction (Stop) Sheet

Establishment: Lane No.: Week Ending:

	Daily Frame Totals:								
	Daily Stop Totals:								
STOP	DESCRIPTIONS	MON	TUE	WED	THU	FRI	SAT	SUN	TOTALS
TRIGGER	Failed to Trigger								
	Recycled								
	180° Stop								
	270° Stop								
PIN STOPS	Deck Jams								
	Pin Gate did not Lock								
	Pin Gate did not Open								
	Jam in Pin Guide								
	Jam in Turn Pan								
	Carried Past Turn Pan								
	Head First on Conveyor								
	Jam Against Halo Ring								
	Pin on Top of Deck								
	Respots								
BALL STOPS	Spinning on Ball Wheel								
	In Pin Elevator								
	In Front of Cushion								
	On Top of Cushion								
	In Front of Lift Rods								
	At Top of Lift Rods								
	Preference Bar Failure								
	Pin in Return Track								
	Accelerator Belt Off								
	Power Lift Problem								
TURRET	No Index after 5 Pin								
	Failed to Index								
	Multiple Index								
	Spider Failed to Lock								
	Spider Failed to Release								
INTER-LOCK	Restricted Drop								
	Turret Interlock								
MISC.	Overload Open								
	Part Loose								
	Part Broken								
	Belt Off								
	Out of Range								
	Other Stops *								

* Record these stops on reverse side in addition to any irregularities in machine operation such as ball damage, broken part, noisy operation, etc.

TOTAL FRAMES _____
TOTAL STOPS _____
FRAMES PER STOP _____

Pinsetter Maintenance History

Establishment: Lane No.:

DATE	ITEM NO.*	PROBLEM & CORRECTIVE ACTION (Include Part Numbers Installed, Adjustments Made, etc.)	STATUS**

* Item number on Functional Tune-Up Sheet
** LEGEND: Compl., W.D.T. (Waiting Available Machine Down Time), P.O. (Parts Ordered)

Master Parts Usage Sheet

Establishment:

DATE	LANE NO.	PART NUMBER	DESCRIPTION	INSTALLED BY

Materials Required for Preventive Maintenance

1. "Preventive Maintenance Work Schedule" charts. (Available from Brunswick, 12-700108)

2. Standard pinsetter tool kit, including pistol oil can (12-700105-000) and grease gun (12-700120-000) with needle attachment. (Now available from Brunswick)

3. Vacuum cleaner.

4. Cleaning cloths.

5. Wire brush - medium, fine bristles.

6. Gear box oil (for refilling gear box only). Commercially available gear box oils are listed below and are available nationwide at auto service stations and supply stores.

   For A-2 pinsetters prior to 1980 (sand cast gear box) use 1-1/5 qts. and after 1980 (die cast gear box), 24 oz.:

   -Brunswick Gear Box Oil (12-752024) 1 gal.
   -Brunswick Stop Leak Oil* (12-700127) 32 oz.
   -Mobiloil EP 80-90 (Socony Mobile Oil Co.)
   -Shell Spirax EP 90 (Shell Oil Co.)
   -Texaco Universal Gear Lubricant EP 90 (Texas Oil Co.)
   -Lubriplate APG80W-90 (Lubriplate Co.)

   *Not for machines with Dashpot Triggering

   For "A" pinsetters (use 1-1/5 qts.)

   -10W30 Oil

7. General lubrication oil, Used on all general lubrications such as oilites, pivots, external gear teeth, sliding surfaces and cam surfaces. Commercially available general lubrication oils are listed below.

   -Brunswick General Purpose Oil (11-676353-000) 1 gal.
   -Mobile DTE Heavy Medium Oil (Socony Mobile Oil Co.)
   -Shell Tellus #33 (Shell Oil Co.)
   -Texaco Regal Oil PC (R & O) (Texas Oil Co.)

8. Grease for all pinsetter greasing. Commercially available greases are listed below.

   -Brunswick Grease (12-700120-002) 3 1/2 oz. containers
   -Mobilux Grease #2
   -Shell Alvania #2
   -Texaco Marfax #2
   -Lubriplate 1200-2

9. Brake fluid. Available from all auto service stations and supply stores.

10. Loctite Threadlocker 242 - Medium Strength and removable.

11. Brunswick All-Purpose Pinsetter Cleaner (62-860083-005/5 gal.). Used for all metal pinsetter parts cleaning.

NOTE: Brunswick All-Purpose Cleaner is the best cleaner presently available for cleaning the pinsetter. Pressurized spray-on cleaners are not recommended as the excess fluid can wash dirt and other foreign matter into pinsetter parts. The overspray can penetrate pre-packed bearings and contaminate the lubricant, thus reducing their service life. Cleaners containing naphtha, benzine, acetone, carbon tetrachloride and many other synthetic solvents can leave harmful deposits and cause rapid deterioration of many rubber and metal parts. Silicone aerosol sprays can cause belt slippage.

Part 2
Instructions for the Work Schedule

Instructions for the Work Schedule

NOTE: The following detailed instructions completely explain each item on the work schedule. These items are listed in the identical order in which they appear on the work schedule.

TRI-WEEKLY SERVICE

1. CHECK STOP SHEETS (ALL MACHINES). Six days a week, from Monday through Saturday, check all stops recorded on the "Daily Malfunction Sheets" for the previous day and correct the causes. This item should average approximately 25 minutes per day per each 12 machines over an extended period of time.

The following items, 2-9, should be accomplished three times per week per machine. Do the first half of the machines on Monday, the second half of the machines on Tuesday, the first half on Wednesday, etc., from Monday through Saturday, thereby doing each machine three times per week. Items 2-9 should take approximately six minutes per machine.

2. BALL AND PIN ELEVATORS AND PIN GUIDE (WIPE). Wipe the inside surfaces of the ball elevator wheel, pin elevator wheel and pin guide with a dry cloth. If any oil or grease has accumulated on the surfaces, wipe with a cloth moistened with Pinsetter Cleaner.

3. TURNAROUND PAN (WIPE). Wipe the turnaround pan with a dry cloth. If any oil or grease has accumulated on the surface, wipe with a cloth moistened with Pinsetter Cleaner.

4. BALL LIFT RODS AND RETURN TRACKS (WIPE). Wipe the lift rods and ball return tracks with a dry cloth. If any oil or grease has accumulated on the surface, wipe with a cloth moistened with Pinsetter Cleaner.

5. PIT CUSHION AND PIT CURTAIN (WIPE). Wipe the faces of the pit cushion and pit curtain with a dry cloth. If any oil or grease has accumulated on the surfaces, wipe with a cloth moistened with Pinsetter Cleaner.

6. CROSS CONVEYOR BELTS, SIDES AND PLATE (WIPE). Wipe the belts, sides, and bottom plate with a dry cloth. If any oil or grease has accumulated on the surfaces, wipe with a cloth moistened with Pinsetter Cleaner.

7. TURRET, 5-PIN CHUTE, SPOONS, AND SNUBBER (WIPE). Wipe the turret, the inside of the 5-pin chute, snubber, the spider spoons and top of the turret clutch with a dry cloth. If any oil or grease has accumulated on the surfaces, wipe with a cloth moistened with Pinsetter Cleaner.

8. PIT CARPET (VACUUM CLEAN). Thoroughly vacuum the pit carpet.

9. WORK AREA (BENCH, ROOM, AND AISLE). Keep the work area, work bench, parts room, and service aisle clean and orderly at all times.

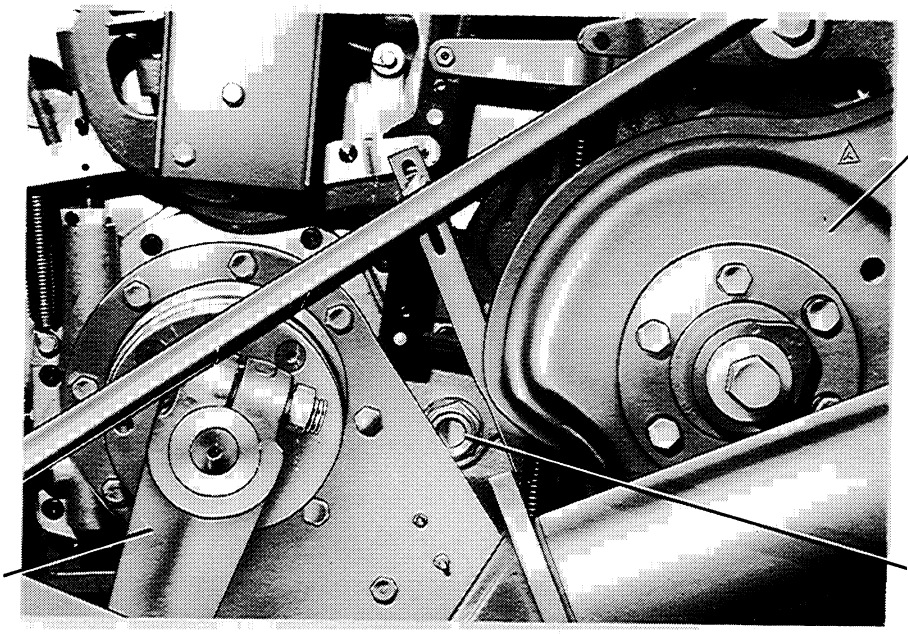
WEEKLY SERVICE

The following items, 10-14, should be accomplished once per week per machine. Do the first 1/4 of the machines on Monday, the second 1/4 on Tuesday, the third 1/4 on Wednesday, and the final 1/4 on Thursday, thereby completing all of the machines once every week. Items 10-11 should take approximately four minutes per machine and Items 12-14 should take approximately 15 minutes per machine.

10. ALL BELTS (WIPE). Wipe all belts with a dry cloth.

11. DECK CHUTES (WIPE). Wipe the interior of the deck chutes with a cloth moistened with Pinsetter Cleaner. Be sure to remove all deposits that have built up on the interior surfaces.

12. GEAR BOX OIL LEVEL (CHECK). Check the oil level through the view port in the side of the gear box. (Figure 2.) The oil should show halfway up on the port. Add an approved gear box oil if necessary.



GEAR BOX OIL LEVEL

FIGURE 2

13. DETECTOR (CLEAN AND OIL). Lubricate roller bearings, cam surfaces, and bearings with the metered oil can. Put a light film on the cam surfaces and three or four drops on bearings and pivot points.

14. LUBRICATION CHARTS (WEEKLY ITEMS). Carefully check the lubrication charts and accomplish all the items marked with the weekly symbol. (Figures 8-12.)

MONTHLY SERVICE

The following items, 15-22, should be accomplished once every four weeks per machine. On the first Friday, do the first 1/8 of the machines, and on the first Saturday, do the second 1/8 of the machines. On the second Friday, do the third 1/8 of the machines, and on the second Saturday, do the fourth 1/8 of the machines. On the third Friday, do the fifth 1/8 of the machines, and on the third Saturday, do the sixth 1/8 of the machines. On the fourth Friday, do the seventh 1/8 of the machines, and on the fourth Saturday, do the last 1/8 of the machines, thereby completing all of the machines once in each four week period. Items 15-20 should take approximately 50 minutes per machine and Items 21 and 22 should take approximately 12 minutes per machine.

15. JAM SWITCHES (ALL MACHINES). Check the adjustment and operation of the turret jam microswitch and the deck jam microswitch on all pinsetters each month. Damage to the pinsetter may result if these switches do not function properly. Refer to Adjustment Section, Numbers 48 and 49. Do NOT bypass the electrical control circuit by inserting the motor plug into the power cord to check a pinsetter jam or malfunction. Severe damage to the pinsetter or personnel can result from such practice. Lubricate the rubber dust covers with brake fluid.

16. ACCELERATOR BELT (CLEAN). Shut off the power to the ball accelerator. Use a wire brush to clean the contact surface of the belt. Brush the belt sideways to remove dirt and residue.

17. FRAMES AND CROSS MEMBERS (WIPE). Wipe all frames and cross members with a dry cloth. If any oil or grease has accumulated on the surface, wipe with a cloth moistened with Pinsetter Cleaner.

18. GEAR BOX (WIPE). Wipe the gear box with a dry cloth. If any oil or grease has accumulated on the surfaces, wipe with a cloth moistened with Pinsetter Cleaner.

19. DECK (WIPE). Wipe the scissor deck and moving deck with a dry cloth. If any oil or grease has accumulated on the surfaces, wipe with a cloth moistened with Pinsetter Cleaner.

20. PIT CARPET (CLEAN). The dirt and dust can most easily be removed from the pit carpet with an air compressor. Remove the pit board from the machine and take it outside the building for cleaning. Blow all the dirt and dust out of the carpet with the compressor. If an air compressor is not available, a vacuum cleaner reversed for blowing may be used. Never attempt to blow the dirt out of the carpet while inside the building.

    After blowing the dirt and dust out of the carpet, any oil or grease that has accumulated on the carpet may be cleaned as follows:

    a. Mix a solution of 1/2 cup of *Tide* detergent per gallon of water.

    b. Lightly scrub the carpet with an ordinary scrub brush, using enough solution to just wet the pile.

    c. Use a clean rag to wipe the carpet as dry as possible.

    d. When the carpet is thoroughly dry, vacuum it to pick up any dirt which remains in the pile.

    e. For heavy concentrations of grease or oil, sprinkle dry *Tide* powder into the spots and work it into the pile with a brush. Then follow the wetting, scrubbing, drying, and vacuuming as detailed in Steps a-d.

21. CAM SURFACES (CLEAN AND OIL). Clean all gear box cam and cam follower contact surfaces with a cloth moistened with Pinsetter Cleaner. Then apply a light film of oil to the cleaned surfaces.

22. LUBRICATION CHARTS (MONTHLY ITEMS). Carefully check the lubrication charts and accomplish all the items marked with the monthly symbol. (Figures 8-12.)

QUARTERLY SERVICE

The following items, 23-38, should be accomplished once every three months per machine. Do 1/3 of the machines in every four week period, thereby completing all of the machines once every three months. Enter the machine number in the designated space on the work schedule as each machine receives the quarterly service. In this way, a permanent record is maintained and no machine will be accidently overlooked during the three month period. Item 23 should take approximately 18 minutes per machine. Items 24-38 should take approximately 45 minutes per machine.

23. LUBRICATION CHARTS (QUARTERLY ITEMS). Carefully check the lubrication charts and accomplish all the items marked with the quarterly symbol. (Figures 8-12.)

NOTE: The following items require periodic checking to insure that they have not become loose. In addition to these items, other loose nuts, bolts, etc., may be found. Liquid "Loctite" may be applied to all troublesome items as a preventive measure, thereby reducing the possibility of a recurrence.

24. KICKBACK CHANNELS AND SIDE FRAMES. Tighten the mounting channels to the kick-backs and the side frames to the mounting channels.

25. ALL PULLEY NUTS AND BOLTS. Tighten all the bolts on which the pulleys turn.

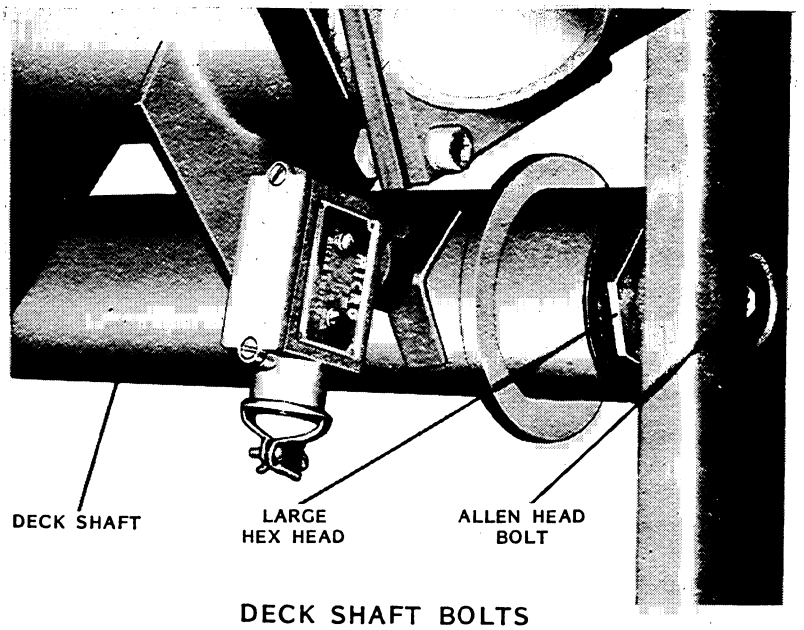
26. GEAR BOX SUPPORTS. Tighten all bolts which connect the gear box to the frame.

27. MOTOR SUPPORTS. Tighten the motor mount shaft bolts and the bolts connecting the motor to the mounting plate.

28. DETECTOR MOUNTING BOLTS. Carefully tighten the three bolts which attach the detector to the gear box.

29. SCISSOR CAM FOLLOWER ARM MOUNTING BOLT AND MOVING DECK BOLTS. Tighten the bolt that the scissor cam follower arm pivots on. Also check the moving deck cam follower shaft bolt and the moving deck and scissors latch bolt.

30. DECK SHAFT BOLTS. Hold the large hex heads at the ends of the deck shaft while tightening the allen head bolts. (Figure 3.)



DECK SHAFT BOLTS
FIGURE 3

31. ELEVATOR GUIDE ROLLER BOLTS. Tighten the bolts on which the ball and pin wheel guide rollers turn. Tighten the "U" bolts on the upper guide roller arms.

32. PIT CUSHION BOLTS. Tighten the bolts connecting the pit cushion to the pit cushion support arms.

33. PIT CUSHION ARM TRIANGULAR PLATES. Tighten the bolts on the triangular plates which connect the pit cushion links and the link to the "V" levers. Do this very carefully to prevent any possible binding in the three pivot points.

34. FIXED RAKE ARM STOPS. Tighten the bolts on the two fixed rake arm stops which are mounted on the side frames. (Figure 4.)

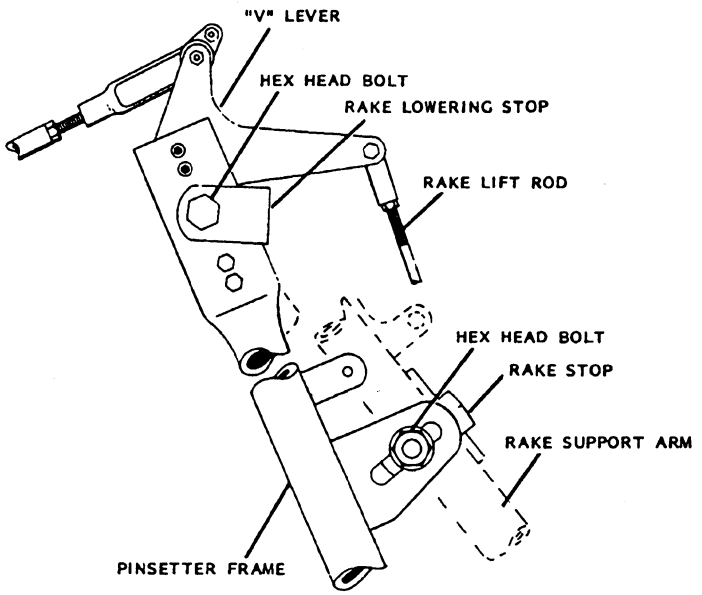


FIGURE 4. RAKE ARM STOPS AND LOWERING STOP

35. SCISSOR DECK SCREWS. Tighten the flat head screws on the underside of the scissor deck.

36. TURRET INDEX PULLEY SCREWS. Tighten the button head screws connecting the index pulley to the bottom of the turret.

37. SUB-PLATE AND PIT CONVEYOR BOLTS. Remove the pit board and carefully tighten the sub-plate to pit floor screws and the pit conveyor to sub-plate bolts.

38. BALL TRACK AND PREFERENCE BAR. Tighten all ball track and ball preference mounting bolts.

ANNUAL SERVICE

The following items, 39-48, should be accomplished once per year per machine. Do 1/12 of the machines in every four week period, thereby completing all of the machines once every year. Enter the machine number in the designated space on the work schedule as each machine receives the annual service. In this way, a permanent record is maintained and no machine will be accidently overlooked during the one year period. Items 39-42 should take approximately 60 minutes per machine. Items 43-48 cannot list times as the workload is contingent upon the number of defective items the inspection reveals. The inspection should take approximately 20 minutes per machine.

39. GEAR BOX OIL - NEW MACHINES (CHANGE).
    a. At the end of the first month of pinsetter operation, drain the gear box oil by removing the drain plug in the bottom of the gear box. Replace the drain plug.

    b. Flush the gear box by pouring one quart of Pinsetter Cleaner through the oil filter cap in the top of the gear box.

    c. Drain the gear box by removing the drain plug. Replace the drain plug.

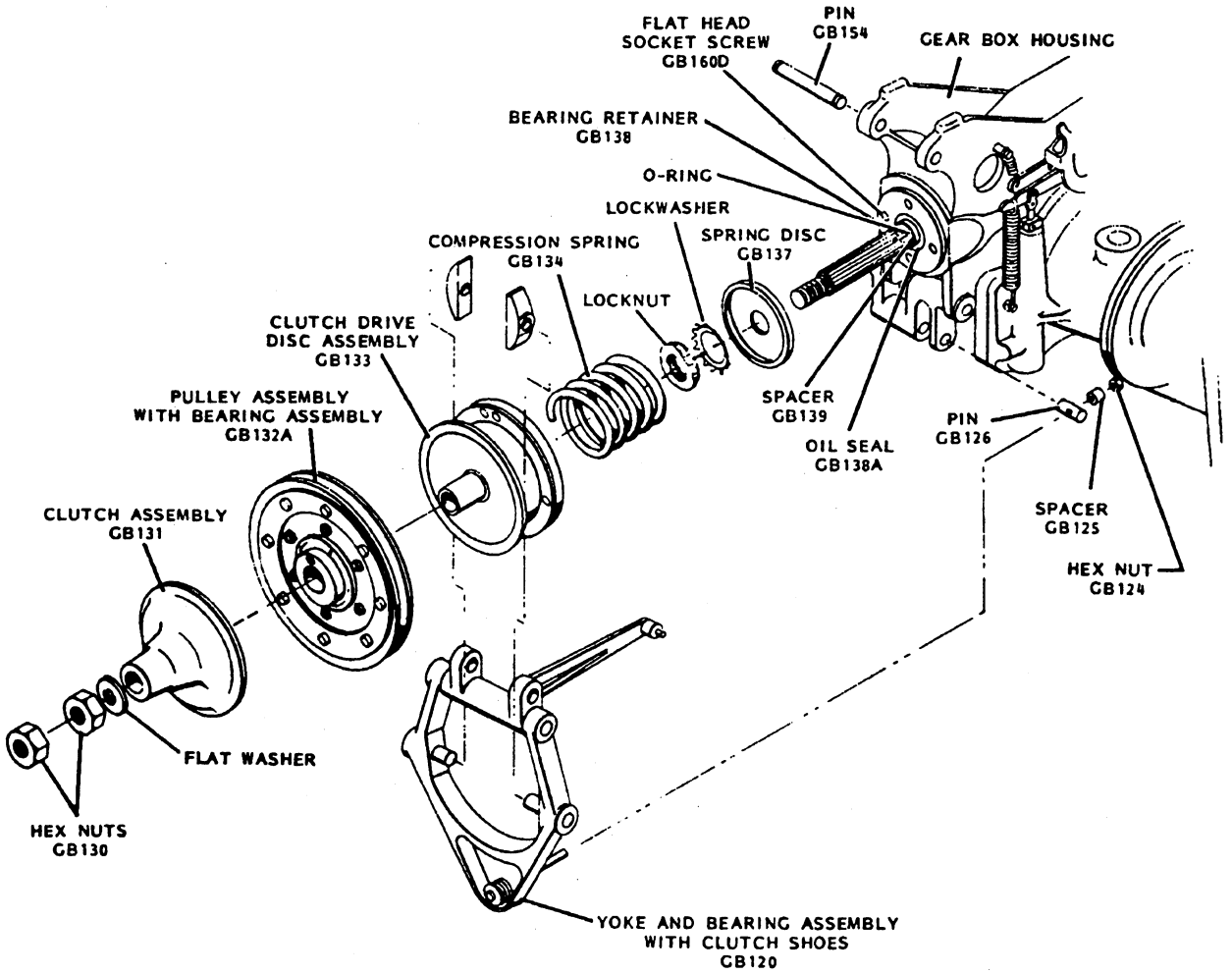
    d. Fill the gear box with 1-1/5 quarts of the recommended gear box oil. The oil should show halfway up on the view port.

    e. At the end of the six months, drain and refill the gear box and thereafter drain and refill the gear box annually.

40. GEAR BOX CLUTCH (Figure 5).
    a. Expose the splined section of the worm shaft by removing the following parts:
    - Hex Nuts GB130
    - Clutch Drive Disc
    - Pulley Assembly with Bearing Assembly GB132A
    - Yoke and Bearing Assembly with Clutch Shoes GB120

    NOTE: To remove the yoke and bearing assembly, it is necessary to remove the hex nut GB124, spacer GB125 and pin GB126 from the hex head bolt GB117. Remove either pivot pin from the top of the yoke.
    - Clutch Drive Disc Assembly GB133
    - Compression Spring GB134

b. Carefully inspect all clutch components and replace as required. Particular attention should be given to the clutch facings, shoes, the bearing in the pulley assembly, and the hub of the clutch drive disc assembly which carries the pulley bearing.



GEAR BOX CLUTCH LUBRICATION

FIGURE 5

c. Using Brunswick All-Purpose Pinsetter Cleaner, thoroughly clean the worm shaft, the splined bore in the clutch drive disc, the I.D. of the pulley bearing, the pivot pins for the clutch shoes, the bore in the clutch shoes, the splined bore in the clutch disc assembly, and the hub of the clutch disc assembly that carries the pulley bearing.

d. Using a cloth, carefully apply a light film of the recommended general lubricating oil on all surfaces just cleaned. Extreme care must be taken to avoid overlubrication and getting oil on any of the clutch facings.

e. Reassemble and adjust the clutch as shown in a previous section.

41. ELECTRIC MOTOR - EARLY MACHINES (GREASE).
    a. Remove the upper and lower grease plugs in both end shields.

    b. Insert standard 1/8" grease fittings in both upper holes.

    c. Pump in grease until fresh grease appears at the lower grease hole. Do this at both end shields. (Place a can or cup under the lower holes to prevent grease from spilling onto the machine.)

    d. After greasing, run the motor for ten minutes. Replace the lower grease plugs.

    e. Remove the grease fittings and replace the upper grease plugs.

42. LUBRICATION CHARTS (ANNUAL ITEMS). Carefully check the lubrication charts and accomplish all the items marked with the annual symbol. (Figures 8-12.)

43. BALL LIFT ROD COVERS. Check rubber covers for wear on the ball contact surface. The rod covers may be turned slightly to bring new surface to the ball contact area. Urethane caps should also be checked.

44. SHOCK ABSORBERS. Disconnect one end of the shock absorbers on the pit cushion and rake lift shaft. Check for proper shock resisting action by rapidly working up and down. Replace as required.

45. MOVING DECK AND SCISSOR CABLES. Check for frayed or worn cables. Replace as required.

46. MOTOR CONTACTORS. Badly pitted motor contactors should be replaced.

47. WELDED ASSEMBLIES. Check all welded assemblies for cracks or breaks. Replace or repair as required.

48. PIVOT AND WEAR POINTS. Check all pivot and wear points, oilites, bearings, roll pins, and all metal-to-metal contact points for wear. Repair or replace as required.

49. DETECTOR (CLEAN AND OIL). Proper lubrication is important for maintaining the life of the cam rollers and bearings. Place a large drop cloth and pan under the detector to catch cleaning material. Wash the detector down using a 1" paint brush.

    Lubricate roller bearings, cam surfaces, and bearings with the metered oil can. Put a light film on cam surfaces and three or four drops on bearings and pivot points.

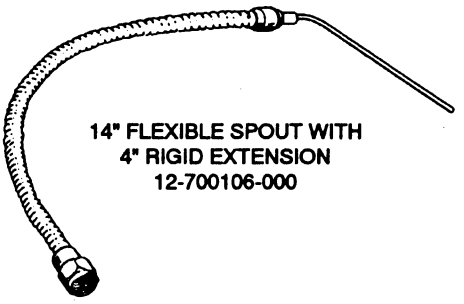
Part 3
Lubrication

Lubrication

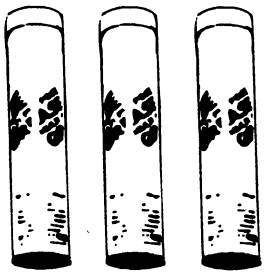
GENERAL INFORMATION

The majority of the lubrication is performed with two tools. One is a pistol oil can with two spouts, 6" flexible and 14" flexible with 4" rigid extension. The other is a grease gun with two tips. The grease gun has a standard tip to accomodate the regular grease fittings on the pinsetter. In addition, it has a hollow needle tip which is used to re-lubricate the shielded bearings in the idler pulleys. The needle is used to pierce the bearing shields so that grease may be pumped into the bearings. Lubrication tools available from Brunswick are shown below.

PISTOL OIL CAN
WITH 6" FLEXIBLE SPOUT
12-700105-000

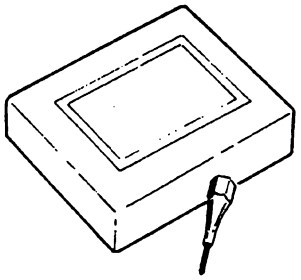


14" FLEXIBLE SPOUT WITH
4" RIGID EXTENSION
12-700106-000



3-1/2 OZ. GREASE CARTRIDGES
PACKAGE OF THREE
12-700120-002

GREASE GUN KIT
CONTAINS GUN, NIPPLE ADAPTOR
AND GREASE CARTRIDGE
12-700120-000



GREASE NEEDLES
PACKAGE OF 12
12-700126-000

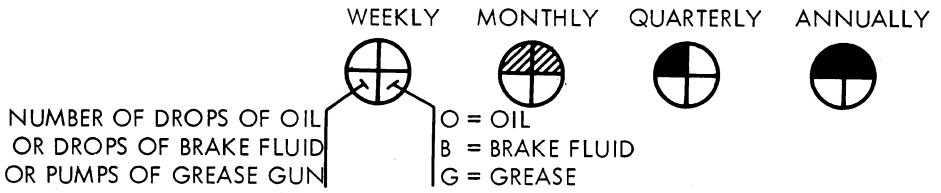
4" NIPPLE FOR
NEEDLE ADAPTOR
12-700122-000

NEEDLE ADAPTOR
12-700121-000

EXPLANATION OF SYMBOLS

All items on the charts requiring lubrication are marked with one of the symbols shown in Figure 7. The upper half of the symbol indicates the frequency of lubrication. If the upper half of the symbol is blank, the item should be lubricated weekly; if it is marked with diagonal lines, the item should be lubricated monthly; if the left side of the upper half is blocked in, the item should be lubricated quarterly; if the entire upper half is blocked in, the item should be lubricated annually.

The lower half of the symbol indicates the type and quantity of lubrication. The lower left side indicates the quantity and the lower right side indicates the type. For example, a symbol marked 2-0 requires two drops of oil; a symbol marked 2-B requires two drops of brake fluid; a symbol marked 3-G requires three pumps of grease.



LUBRICATION CHART LEGEND

FIGURE 7

Whenever these symbols cannot completely identify the required lubrication, special instructions will be noted directly on the lubrication charts.

If there are more than one of the same item, the item will only be shown once on the charts. For example, there are two side frames, but only one is illustrated. There are ten pairs of scissors with their connecting linkage, but only one pair is illustrated.

Part 4
Instructions for the Functional Tune-Up Sheet

Section I - Rake and Pit Cushion Assembly

RAKE/PIT CUSHION ASSY.			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
SECTION I	1	STRUCTURAL PARTS																								
	2	ADJUSTMENT & OPERATION																								
	3	PIT CUSHION																								
	4	TRIGGERING ADJUSTMENT																								

1 - STRUCTURAL PARTS

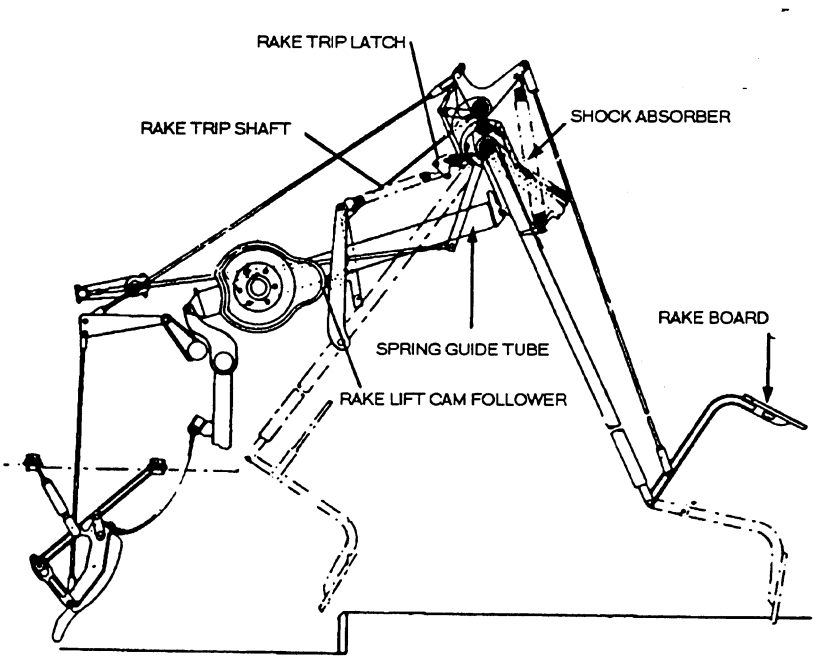
Let's begin the functional tune-up by looking at the items to inspect and correct in the rake and pit cushion assembly.

First inspect the structural parts of the rake assembly. Check the condition of the rake arms, making sure they are straight. If they are not straight, they need to be straightened by a qualified mechanic. You should assist him. Then, cycle the pinsetter to see if the rake arms make contact with the frame. Usually worn off paint on the sides of the rake arms indicates they have made contact with the frame. It is still a good idea, however, to check for any contact by cycling the pinsetter.

Check the bolts on the rake board and shock absorber with a wrench to make sure they are tight (see figure following).

Check the weld joints, pin and mounting bolt of the spring guide tube. See that the weld joints are not broken and the mounting bolt and pin are tight.

Check the rake lift cam follower and the rake trip shaft for wear. Make sure that the rake trip shaft latches properly and that it is kept clean.



2 - ADJUSTMENT AND OPERATION

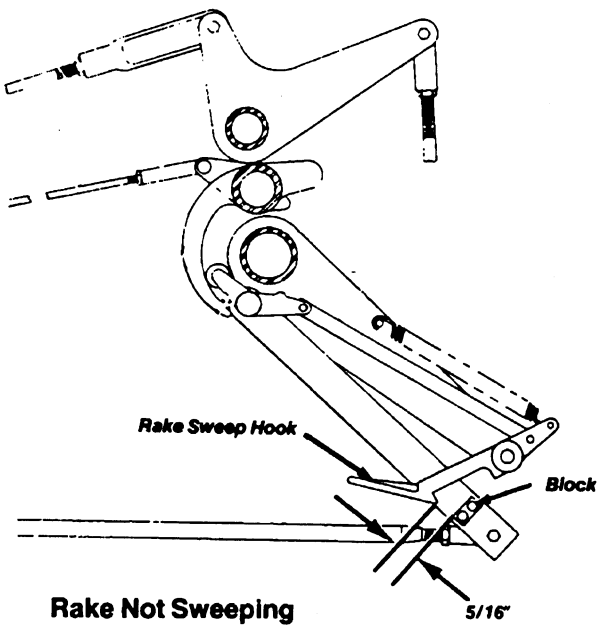
The next item to check on the rake assembly is the adjustment and operation of the rake sweep hook (see following figure). Because the operation of the rake sweep hook is critical to the correct movements of the rake, have a qualified mechanic show you what to look for.

Briefly, when the rake is not sweeping, the rake sweep hook should be lifted clear of the block. When the rake sweeps, the rake sweep hook should be engaged with the block. If an adjustment is needed, refer to adjustment #2.

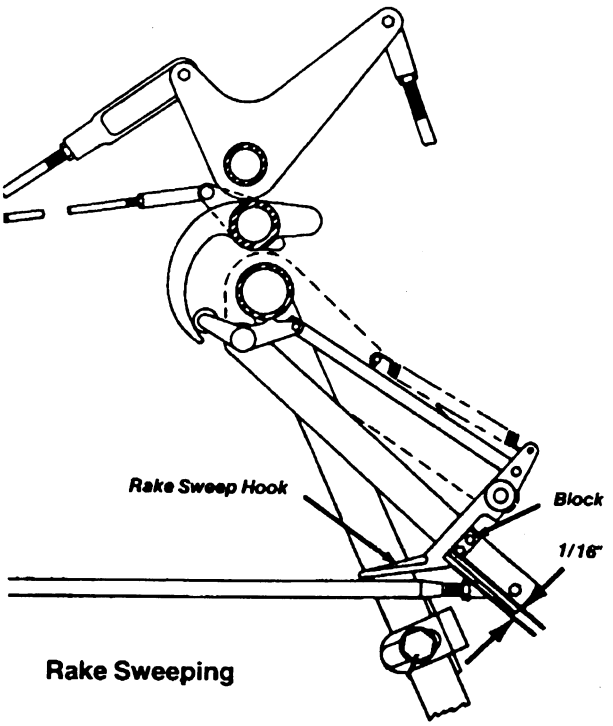
As the rake sweeps, the rake board should not hit the deck or the lane. Of course, the rake should always be parallel with the lane as it sweeps.

The best way to check the operation of the rake is to set three pins in the gutters with the heads toward the rake. If the rake is able to sweep all the pins from the gutter, it is working properly.

Refer to adjustment #3 to reset the rake board height.



Rake Not Sweeping



Rake Sweeping

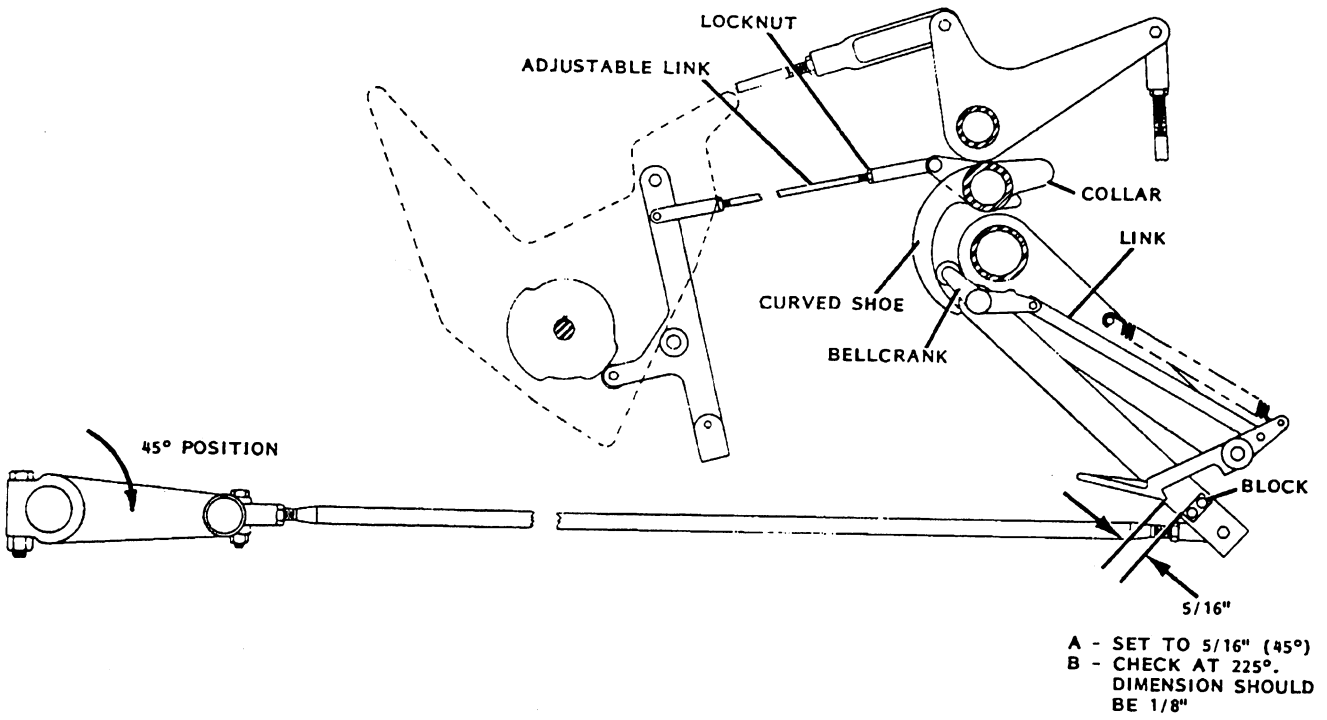
ADJUSTMENTS

2. RAKE SWEEP HOOK ADJUSTMENT

The rake sweep hook adjustment is made to insure that the sweep hook makes a positive engagement with the block when the rake sweeps, and that the sweep hook is lifted clear of the block when the rake must not sweep. The rake motion is obtained from the rake sweep link on the 4:1 shaft, and a large compression spring urges the rake in its forward motion. It is extremely important, therefore, that this adjustment be made carefully to avoid injury to personnel working around the pinsetter.

1. Cycle the pinsetter until the rake crank link is a direct continuation of the main rake crank on the 4:1 shaft (this will occur at 45°).

2. Loosen the locknuts on both ends of the link which runs from the detector assembly to the collar on the overhead cross brace, and turn the rod until the lower edge of the vertical surface of the rake sweep hook is 5/16" (+1/16 -0) above the latch block that the hook engages (Figure 2). Tighten the locknuts. As a check, jog the pinsetter and make sure the hook fully engages the block during the sweep motion, and that the hook lifts at least 1/8" above the block when the hook disengages at 225°.

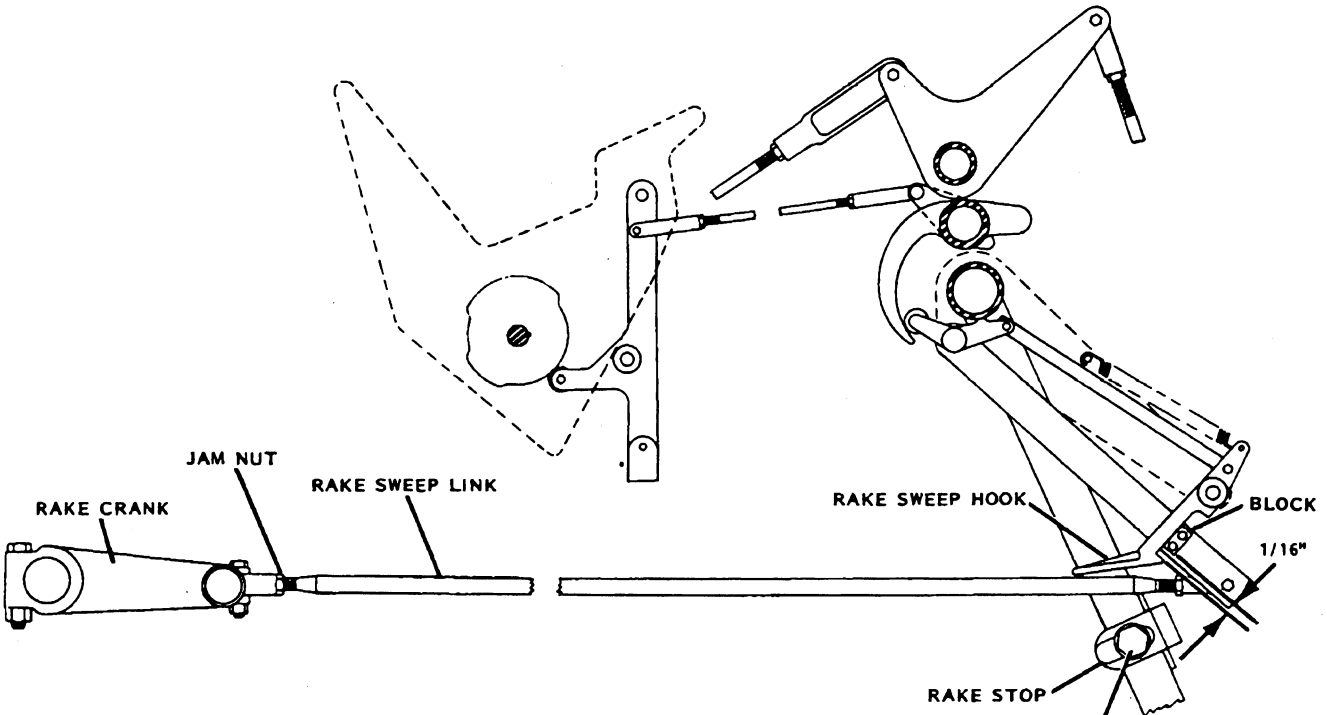


RAKE SWEEP HOOK ADJUSTMENT AT 45°

FIGURE 2

ADJUSTMENTS

3. Cycle the pinsetter to exactly 135° until the rake sweep link is a direct continuation of the rake crank. Loosen the locknuts on both ends of the rake sweep link and turn the rake sweep link until the vertical surface of the rake sweep hook is 1/16" (+1/32 -0) behind the latch block that the sweep hook engages (Figure 3). Tighten the locknuts.



RAKE SWEEP HOOK ADJUSTMENT AT 135°

FIGURE 3

4. Cycle the pinsetter to exactly 180°, with the rake in its rearmost position.

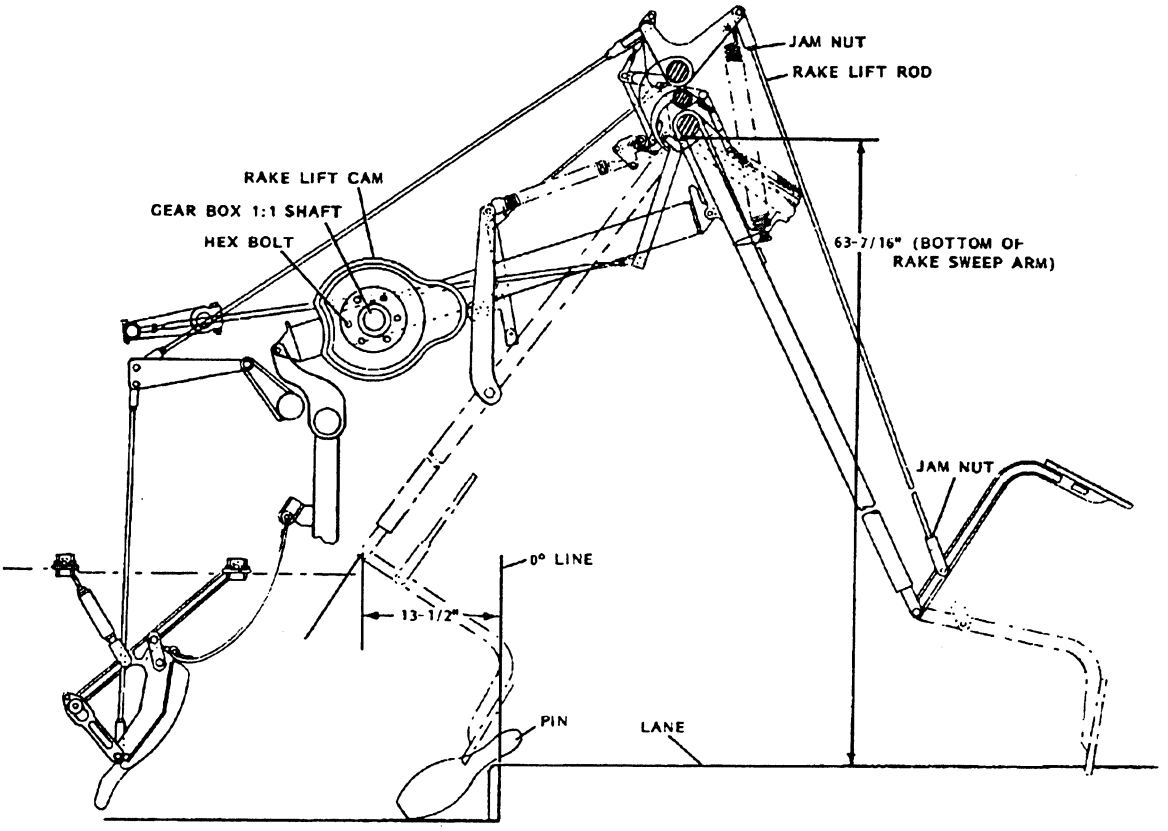
5. Measure the horizontal distance from the zero line of the lane to the lower hinge pin on the bottom of the rake support arm (Figure 4). This dimension must be 13-1/2" (±1/8), and may be obtained by readjusting the rake sweep link which was previously adjusted in step 3.

6. Manually cycle the pinsetter to exactly 225°, where the rake sweep link will again be a direct continuation of the rake crank arm on the 4:1 shaft.

7. Loosen the hex nut that mounts the left hand rake stop bracket to the left hand side of the pinsetter frame. Adjust the left hand rake stop bracket so that the vertical surface of the rake sweep hook is again 1/16" (+1/32 -0) behind the rear surface of the block. Tighten the nut securely.

8. Loosen the bolt that mounts the right hand stop bracket to the right hand side of the pinsetter frame. Push the right hand rake support arm rearward until the left hand support arm starts to lose contact with the left hand rake stop bracket. While holding the rake support arm in this position, snug the right hand rake stop bracket against the rake support arm. Tighten the nut securely.

ADJUSTMENTS



RAKE BOARD HEIGHT ADJUSTMENT

FIGURE 4

3. RAKE BOARD HEIGHT ADJUSTMENT

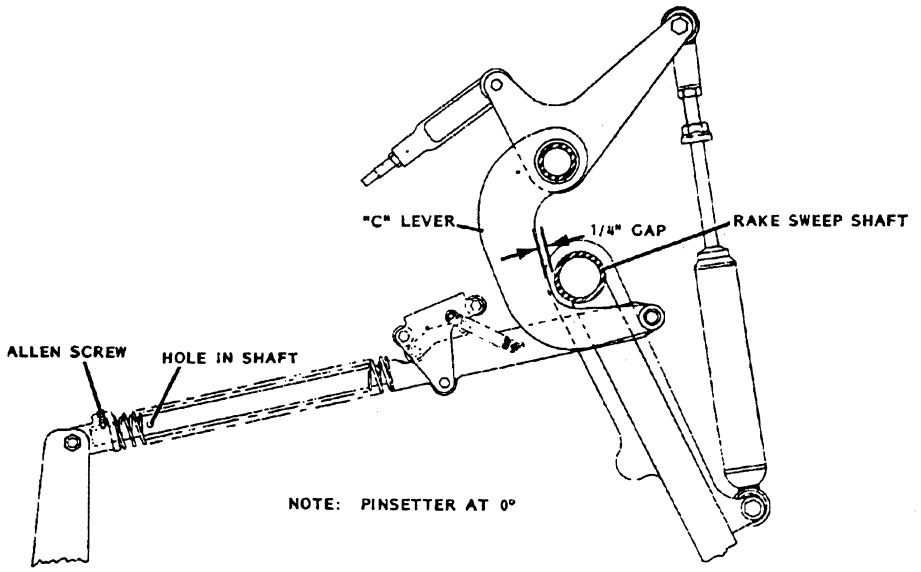
This adjustment is made to insure that the rake board stays at the correct height above the lane surface during the entire sweep motion.

1. Cycle the pinsetter to 0°.

2. Measure the horizontal distance from the rear edge of the rake sweep shaft to the forward edge of the C-shaped lever on the rake lift shaft. This dimension must be 1/4" (+1/8 -0) and can be obtained in the following manner: Cycle the pinsetter to 45° and shut off the power to the pinsetter. Loosen the allen screw on the rear, upper rake trip shaft connection to the rake cam follower (Figure 5). Insert a pin through the hole provided in the rake trip shaft and rotate the shaft one full revolution counterclockwise to decrease the gap 1/32", or one full revolution clockwise to increase the gap by 1/32". Tighten the set screw.

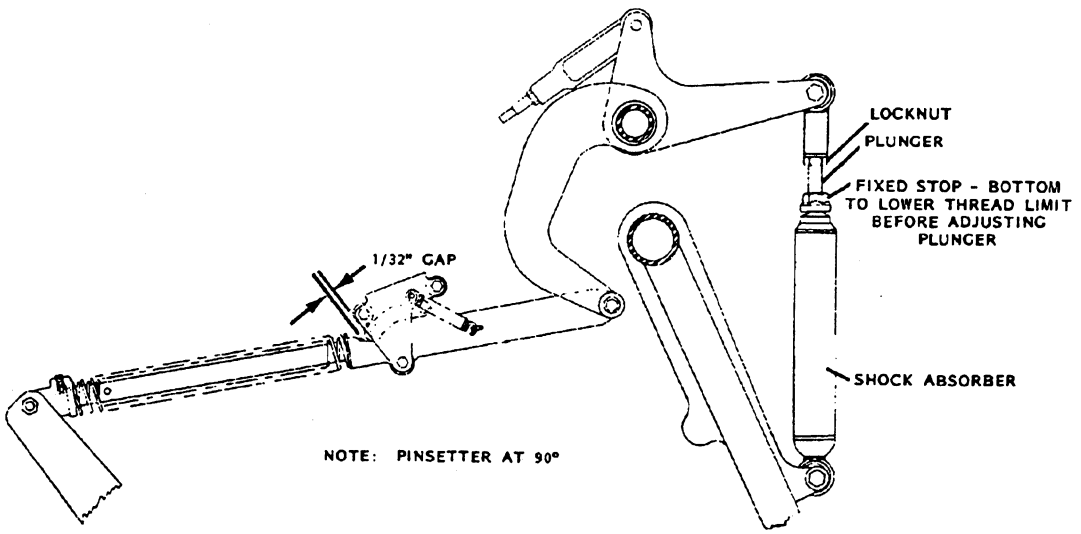
NOTE: The rake trip shaft has an axial "V" groove on its rear end that must face upward to receive the allen screw. The shaft adjustments must therefore be made in increments of a full rotation. One full revolution of the rake trip shaft will increase or decrease the gap by 1/32".

ADJUSTMENTS



RAKE BOARD HEIGHT ADJUSTMENT
FIGURE 5

3. Cycle the pinsetter to 90° and shut off the power. Tighten the fixed stop nut against the bottom thread limits of the plunger. Loosen the locknut at the top of the shock absorber plunger. Turn the plunger to obtain a 1/32" (+1/32 -0) gap between the rear surface of the latch roller and the rear edge of the notch in the rake trip shaft (Figure 6).



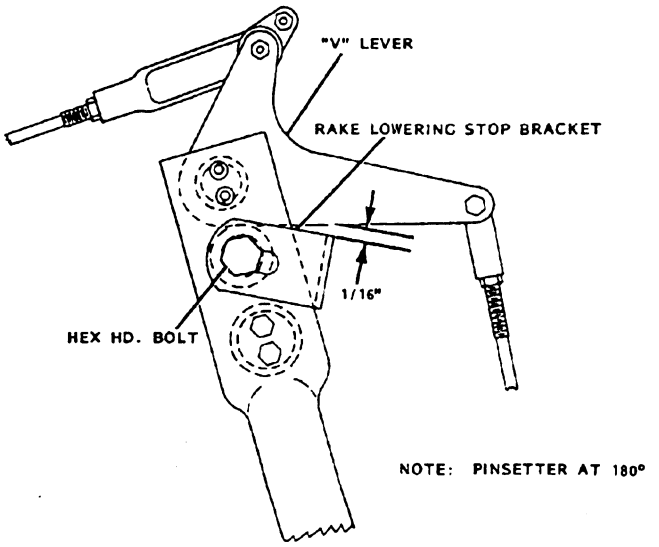
RAKE BOARD DASHPOT ADJUSTMENT
FIGURE 6

4. If the plunger is adjusted too low, the gap will decrease, and if the plunger is adjusted too high, the gap will increase. Tighten the locknut.

ADJUSTMENTS

5. Cycle the pinsetter to exactly 180°, with the rake in its rearmost position. Shut off the power. Manually engage the gear box clutch and rotate the input worm shaft two full revolutions in the reverse direction (clockwise when viewed from the rear of the pinsetter). Loosen the six bolts around the hub of the rake lift cam and allow the pressure of the rake cam follower to rotate the cam as the follower seeks the low level of the cam. This action will place the rake lift can "in time" with the gear box. Tighten the six mounting bolts.

6. With the rake still at 180°, loosen the bolt that mounts the rake lowering stop bracket to the top, left hand side of the pinsetter frame (Figure 7). Rotate the stop bracket until its upper surface is 1/16" below the bottom of the "V" lever. Tighten the bolt. This adjustment is made to insure that the rake board will not jam against the header plank in the event the rake trip latch should fail to re-engage.



RAKE LOWERING STOP ADJUSTMENT

FIGURE 7

7. Manually reverse the pinsetter until the rake board is positioned between the 2, 3 and 4, 5 and 6 spots. Loosen the jam nuts on both ends of the rake lift rods and adjust the rods until the bottom of the rake board is 5/8" (±1/8) above the lane surface and parallel to the lane surface within 1/32" from one end of the rake board to the other. Tighten the jam nuts.

8. After making this adjustment, check the Out-of-Range Latch Adjustment, Adjustment 21.

3 - PIT CUSHION

Another item to inspect is the pit cushion, located at the rear of the pit. Often, it is the most neglected area of the pinsetter; yet it is subject to a large amount of wear because it stops the ball. A badly worn pit cushion will slow down the pinsetter triggering mechanism that initiates the pinsetter cycle. This in turn can cause customer irritation, since the bowler will have to wait longer before rolling the next ball.

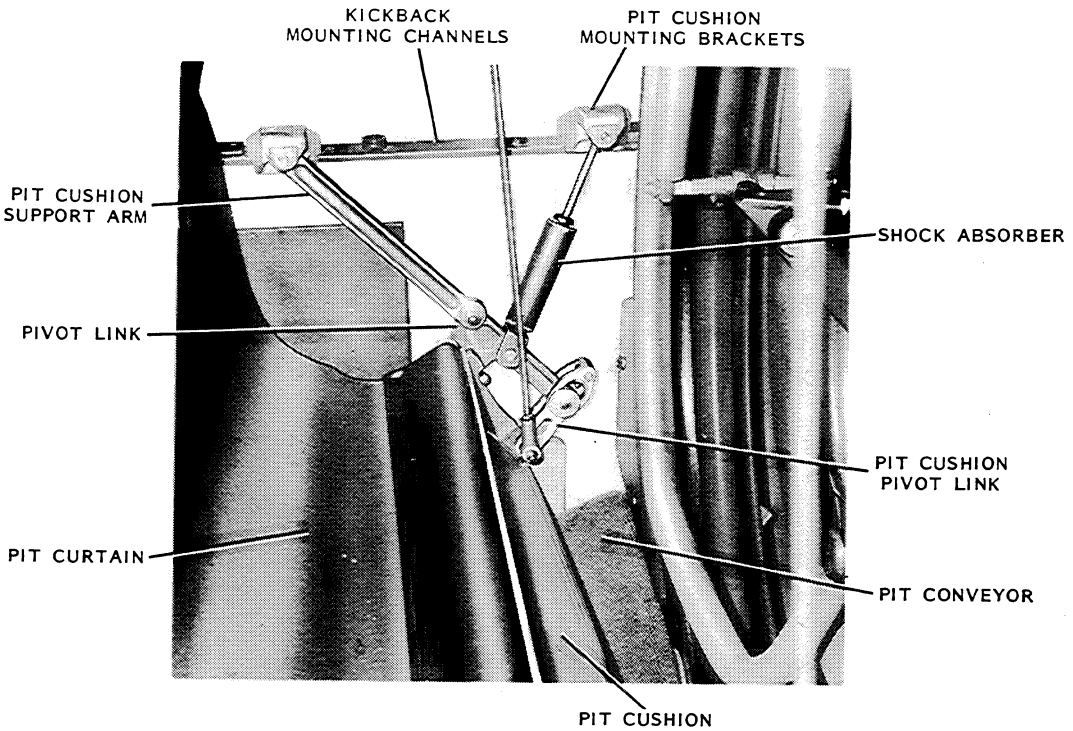
Check the uniball and linkage bolts to make sure they are tight by using a wrench.

Move the pit cushion up and down to see if it binds. Binding may indicate that some of the parts are worn and will need to be replaced. Check the bolts and brackets that connect the pit curtain to the pit cushion. Make sure they are tight. If they are not kept tight, the aluminum will wear and will need to be replaced.

Check the condition of the shock absorber by looking for oil leaks and wear (see following figure). Note any problems on the stop sheet.

Physically check the operation of the shock absorber by pushing on it to compress it. Once compressed, it should return to the original position.

Finally, check the bolts that connect the pit cushion to the kickback. It is important to remember that loose bolts will cause premature wear and failure of the parts. Thus tighten all bolts when necessary.



4 - TRIGGERING ADJUSTMENT

The last item to inspect on the rake and pit cushion assembly is the triggering adjustments.

Check the triggering mechanism by having a ball lightly contact the pit cushion. Even light contact should trigger the pinsetter to start its cycle. When this happens, the rake lowering mechanism lowers the rake. If the pinsetter does not cycle and the rake lowering mechanism is not triggered, correct as necessary.

Refer to the pit cushion lift rod adjustment #4, pit cushion trigger link adjustment #5, and trigger switch adjustment #6.

ADJUSTMENTS

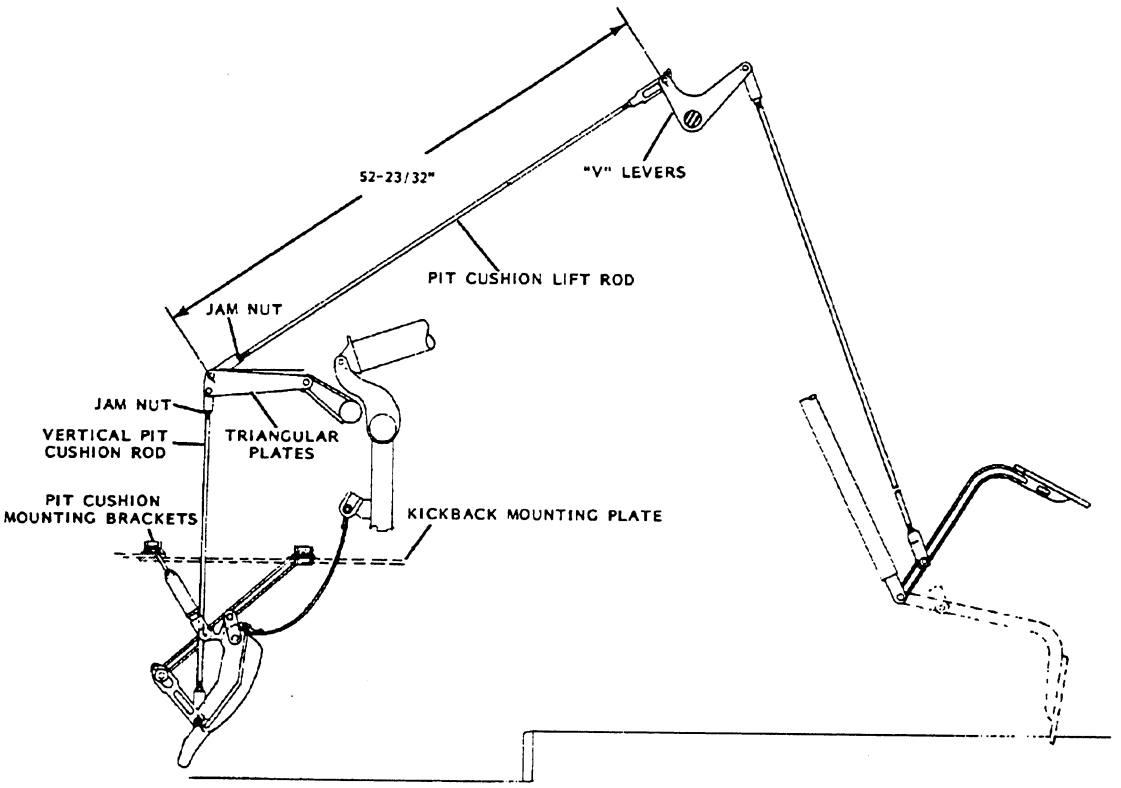
4. PIT CUSHION LIFT ROD ADJUSTMENT

This adjustment is made to insure that the pit cushion is positioned properly to trigger the pinsetter and provide adequate clearance for the ball to return to the bowler.

1. Cycle the pinsetter to 0° and shut off the power.

2. Loosen the jam nuts on both ends of the pit cushion lift rods from the triangular plates to the "V" levers on the rake lift shaft.

3. Turn the rods until the center of the pin on the triangular plates is 52-23/32" (±1/16) from the pivot pin on the "V" lever (Figure 8). Tighten the jam nuts. Be certain the vertical links from the triangular plates are <u>not</u> supporting the pit cushion when making this adjustment.



PIT CUSHION LIFT ROD ADJUSTMENT

FIGURE 8

4. Check the motion of the pit cushion to insure that there is no restriction or binding in the pit cushion linkages.

5. With the pinsetter still shut off, and the rake board in its raised position, loosen the jam nuts at both ends of the vertical pit cushion rods and turn the rods in until the pit cushion lifts. Screw the rods out until a downward motion of the pit cushion stops, then continue 1/2 turn to insure that the rods are not supporting the weight of the cushion. Tighten the jam nuts.

ADJUSTMENTS

6. Manually trip the rake mechanism and place a standard size ball between the pit cushion and pit conveyor. A minimum clearance of 1/8" must be obtained between the bottom of the cushion and the top of the ball. If this clearance is less than 1/8" check the position of the pit conveyor. Adjustment 23. If the pit conveyor is positioned properly, shims may be added between the kickback mounting plates and pit cushion mounting brackets to obtain the required clearance. DO NOT use the pit cushion rods to lift the pit cushion for ball clearance.

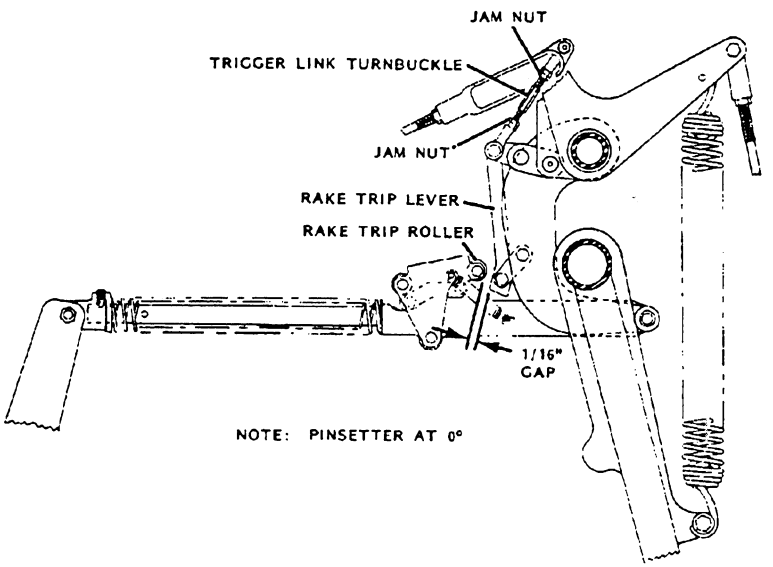
NOTE: Any change in this adjustment will affect the pit cushion trigger link adjustment, Adjustment 5, below.

5. PIT CUSHION TRIGGER LINK ADJUSTMENT

This adjustment is made to insure that ball impact against the pit cushion will effectively trip the rake lowering mechanism to lower the rake.

1. Cycle the pinsetter to 0° and shut off the power to the pinsetter.

2. Loosen the jam nut on the trigger link turnbuckle. Rotate the turnbuckle until 1/16" (+1/64 - 0) gap is obtained between the front surface of the rake trip roller and the rear surface of the rake trip lever. Tighten the jam nuts. (Figure 9)



PIT CUSHION TRIGGER LINK ADJUSTMENT
FIGURE 9

ADJUSTMENTS

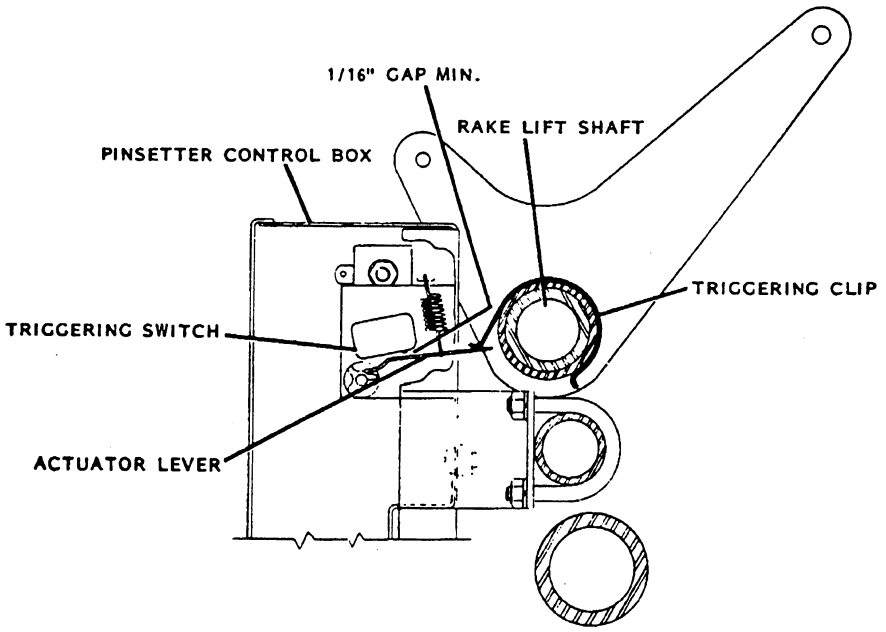
6. TRIGGER SWITCH ADJUSTMENT

This adjustment is made to insure that the triggering circuit is energizing by the lowering motion of the rake.

1. Cycle the pinsetter to 0° with the rake in its raised position. Shut off the power to the pinsetter.

2. Rotate the triggering clip on the rake lift shaft clockwise until the spring-loaded actuator lever closes the switch. (Figure 10)

3. Rotate the clip counterclockwise until it depresses the actuator lever far enough to open the switch (an audible click can be heard when the switch opens). Carefully rotate the clip to depress the lever an additional 1/16" (+1/16 -0).



TRIGGER SWITCH ADJUSTMENT

FIGURE 10

Section II - Gear Box

GEAR BOX			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
SECTION II	5	GEAR BOX CLUTCH																								
	6	GEAR TRAIN																								
	7	TRIGGERING & RESET LINKAGE																								
	8	SCISSOR MOVING DECK LATCH																								
	9	DECK HOLDING HOOK																								
	10	OIL LEVEL & LEAKS																								
	11	CYCLE SOLENOID																								

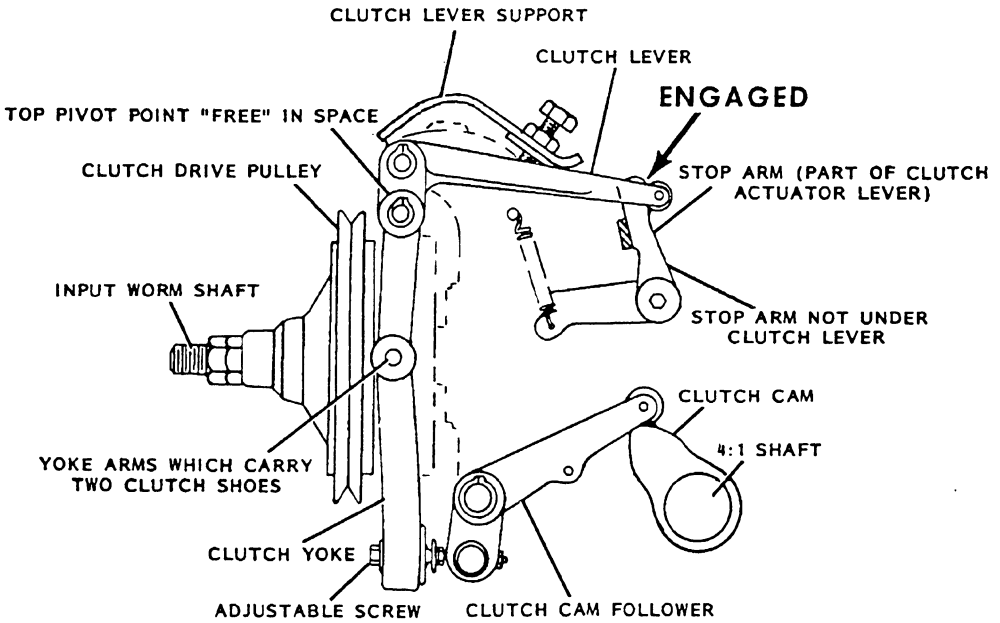
5 - GEARBOX CLUTCH

The next major area to inspect for the functional check is the gear box. The gear box is considered a low failure area because it is well designed. With proper preventive maintenance and lubrication, this area should give you little difficulty.

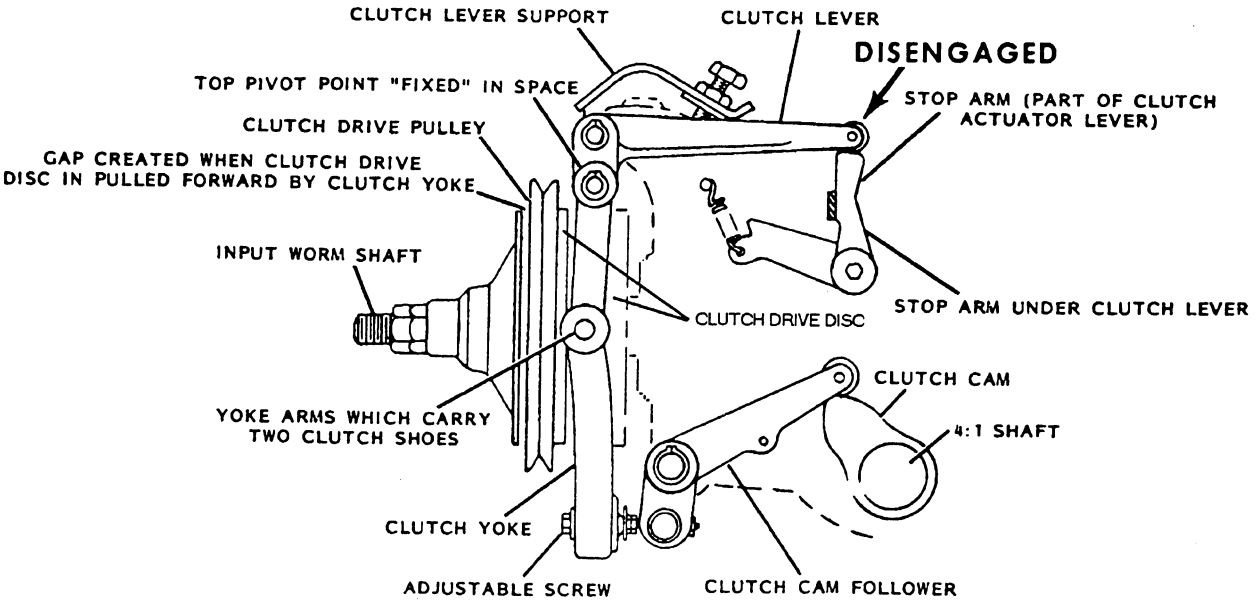
Begin the functional check by inspecting the gear box clutch, located on the back of the gear box.

Visually inspect the parts for excessive wear. Listen for unusual noises that may indicate worn parts or bad bearings.

As shown (see following figure) turn on the pinsetter and check to make sure the clutch engages upon ball impact and disengages at the end of a cycle or in case of a malfunction such as a out-of-range pin. Check to see that the clutch mechanism pivots. If any problems are evident, correct them.



GEAR BOX CLUTCH - ENGAGED



GEAR BOX CLUTCH - DISENGAGED

Refer to gear box clutch adjustment #7, gear box clutch cam follower adjustment #8, and gear box clutch lever adjustment #9.

ADJUSTMENTS

7. GEAR BOX CLUTCH ADJUSTMENT

This adjustment is made to insure that the clutch is not too loose, causing noisy operation, or too tight, causing overheating of the friction surfaces.

PINSETTERS WITHOUT GEAR BOX STOP SURFACE (FACTORY EQUIPPED)

1. Cycle the pinsetter to 0° and shut off the power.

2. With the gear box clutch engaged, loosen the jam nut on the end of the input worm shaft. (Figure 11)

3. Turn the front adjusting nut until the front surface of the clutch drive disc assembly is even with the rear surface of the bearing retainer. Holding the front nut, tighten the rear jam nut.

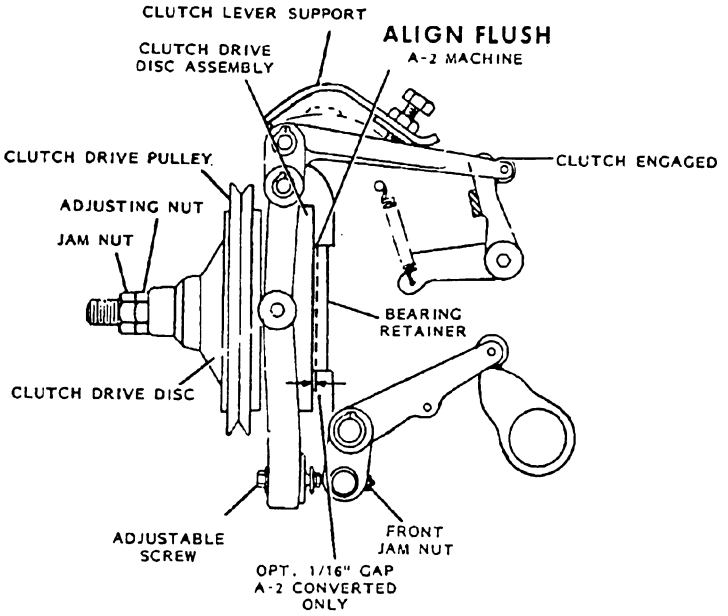
PINSETTERS WITH GEAR BOX STOP SURFACE (CONVERTED)

1. Cycle the pinsetter to 0° and shut off the power.

2. Engage the gear box clutch and loosen the jam nut on the end of the input worm shaft. (Figure 11)

3. Turn the inner nut until a gap of 1/16" (±1/64) is obtained between the front surface of the clutch drive disc assembly and the bearing retainer disc. Tighten rear jam nut.

NOTE: Whenever the gear box clutch is readjusted, Adjustments 8 and 9, Gear Box Clutch Cam Follower and Gear Box Clutch Lever, will require readjustment.



GEAR BOX CLUTCH ADJUSTMENT
FIGURE 11

ADJUSTMENTS

8. GEAR BOX CLUTCH CAM FOLLOWER ADJUSTMENT

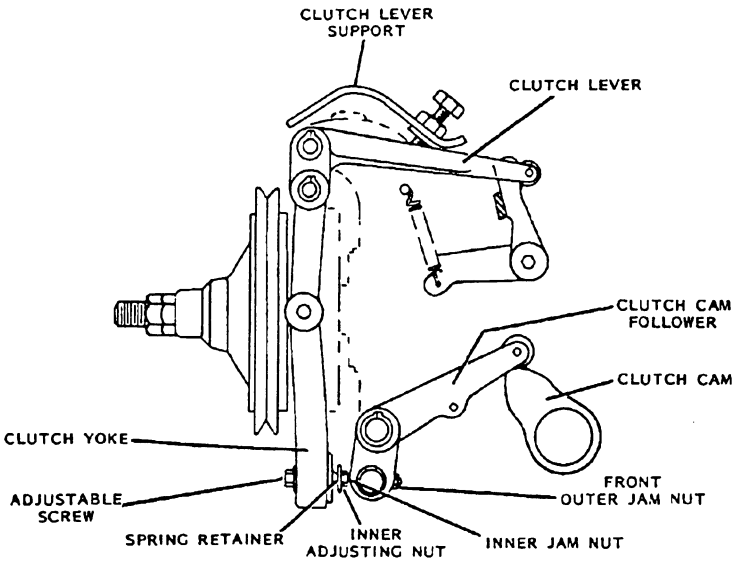
This adjustment is made to insure that the clutch cam follower is urged to follow the contour of the clutch cam to properly control the motion of the clutch lever.

1. Cycle the pinsetter to 0° and shut off the power.

2. Engage the gear box clutch, with the power off, and loosen the inner jam nut on the threaded connection between the clutch can follower and the clutch yoke. (Figure 12)

3. Turn the inner adjusting nut in until the spring retainer is pressed lightly against the clutch yoke.

4. Tighten the forward jam nut against the inner adjusting nut.



CLUTCH CAM FOLLOWER ADJUSTMENT

FIGURE 12

9. GEAR BOX CLUTCH LEVER ADJUSTMENT

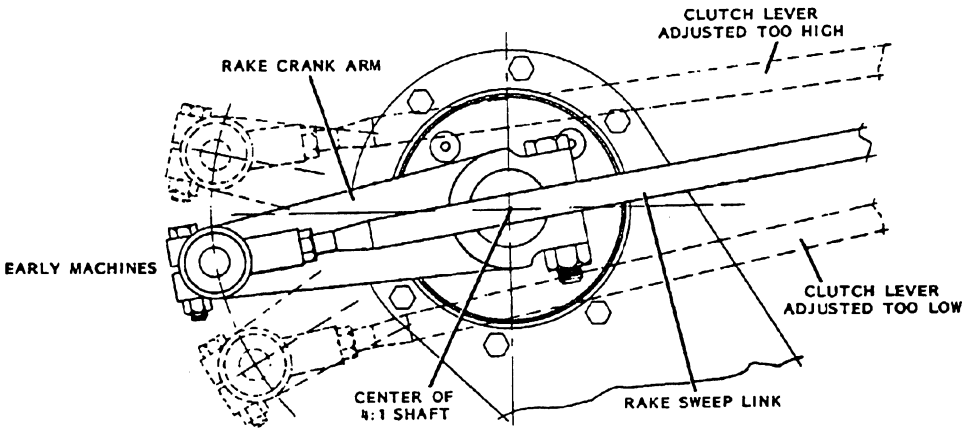
This adjustment is made to insure that the roller on the clutch lever engages the stop arm to disengage the gear box clutch at exactly 0°.

1. Cycle the pinsetter and allow it to come to a normal 0° stop, first ball cycle.

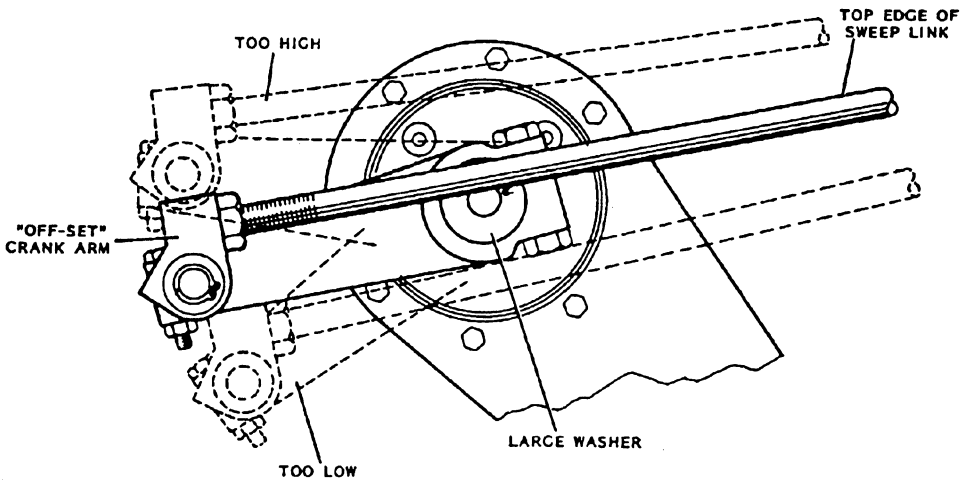
2. Check the position of the rake crank arm and the rake sweep link. The sweep link and crank arm should be in the same horizontal plane, with the sweep link bisecting the center of the 4:1 shaft on A-2 converted machines (Figure 13). On factory A-2 machines, the sweep link will be even with the top of the large washers (Figure 14).

3. If the sweep link is higher than the crank arm, the clutch lever must be lowered. If the sweep link is lower than the crank arm, the clutch lever must be raised.

ADJUSTMENTS



GEAR BOX CLUTCH LEVER ADJUSTMENT (A-2 CONVERTED)
FIGURE 13



GEAR BOX CLUTCH LEVER ADJUSTMENT (A-2 MACHINES)
FIGURE 14

4. To adjust the clutch lever, loosen the most forward jam nut on the forward end of the adjustable connection at the lower end of the yoke. To raise the clutch lever, screw the adjustable connection out; to lower the clutch lever, screw the adjustable connection in. Tighten the most forward jam nut after checking for 0° stop.

5. Cycle the pinsetter and observe whether the crank and link stop in the same plane. Repeat adjustment if necessary.

6 - GEAR TRAIN

The next area to check is the gear train. Very simply, this is done by cycling the pinsetter and listening for noisy gears and bearings. Again, indicate any unusual noises on your Tune-Up Sheet.

7 - TRIGGERING AND RESET LINKAGE

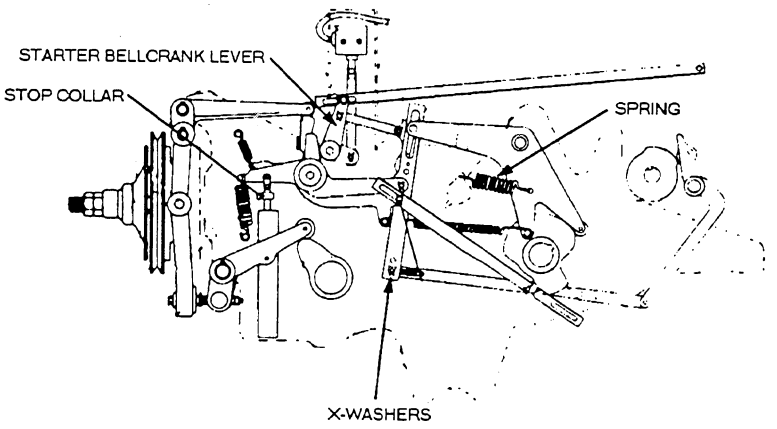
The triggering and reset linkage is the a complex area of the pinsetter to inspect.

Check to see that it is operating properly. As shown below, this is most easily done by depressing the starter bell crank lever to start the pinsetter. Briefly, if the pinsetter stops after each cycle at 360 degrees, you know that it is working properly. Record abnormal operation on the stop sheet.

Check to make sure all the springs are not stretched or worn.

Make sure that the many X-washers of the gear box are in place. Replace all missing X-washers immediately.

Check the gear box stop collar adjustment or the bumper stop. Refer to adjustment #10 to make corrections.



ADJUSTMENTS

10. GEAR BOX STOP COLLAR ADJUSTMENT

This adjustment is made to insure that the triggering and reset mechanism will function properly to disengage the gear box clutch as required.

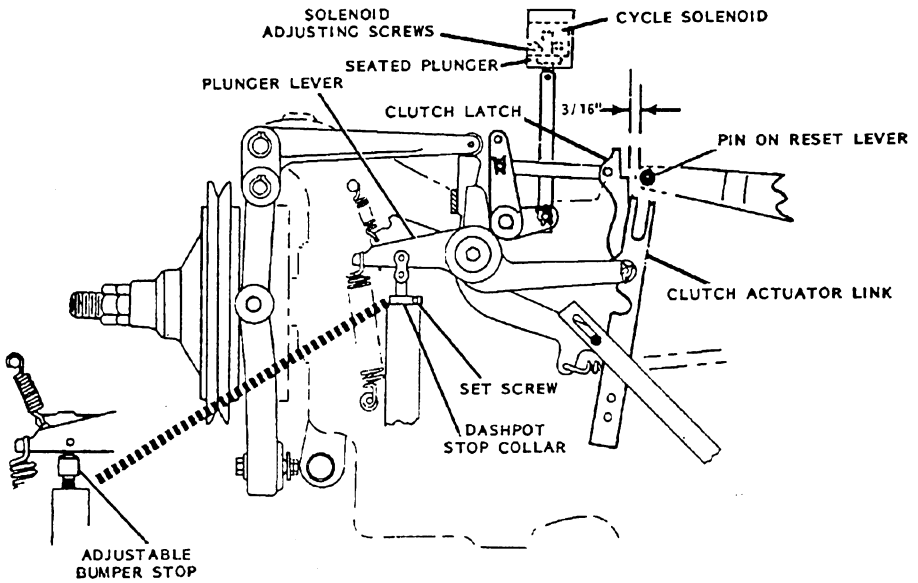
1. Cycle the pinsetter to a normal 180° stop, waiting for pins. Shut off power to the pinsetter.

2. Loosen the set screw on the dashpot stop collar, or loosen jam nut on bumper stop. (Figure 15)

3. Position the clutch actuator link so that the shoulder of the clutch latch is opposite the center of the pin in the end of the clutch reset lever.

4. Hold the clutch actuator link in this position and slide the stop collar down against the top of the dashpot and tighten the set screw.

5. As a check, if the stop collar is set too high, the pinsetter will recycle; if set too low, the gear box clutch will disengage at 270°.

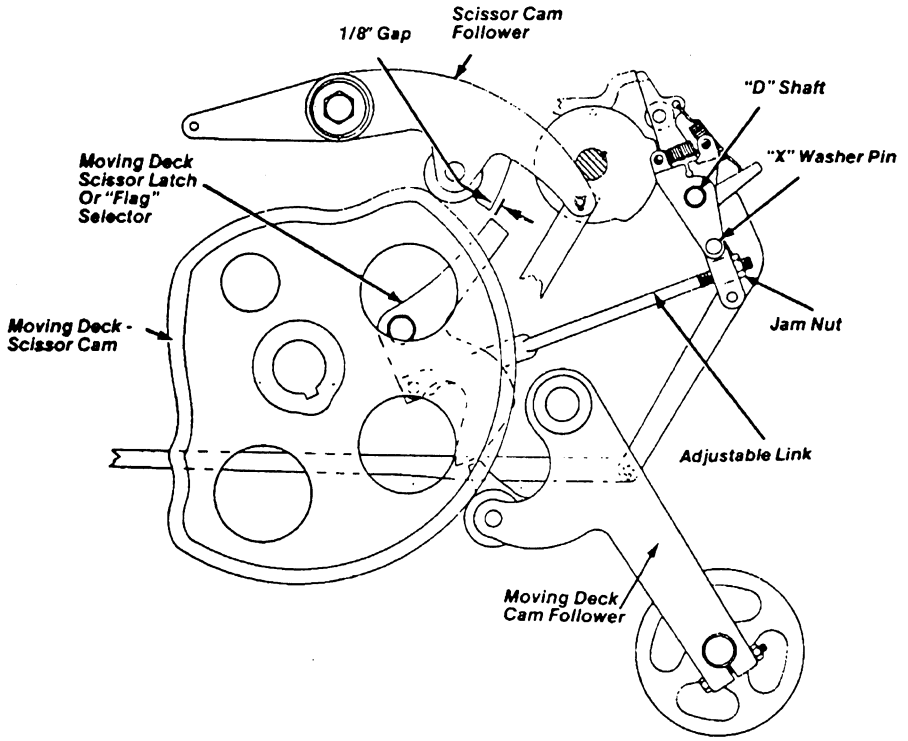


GEAR BOX STOP COLLAR AND CYCLE SOLENOID ADJUSTMENTS

FIGURE 15

8 - SCISSORS MOVING DECK LATCH

Another item to inspect is the moving deck scissor latch, commonly known as the "flag" selector. As shown below, it has a cam follower at each end: the scissor cam follower at one end and the moving deck cam follower at the other end. The "flag" selector is able to pivot, thereby blocking one cam follower and allowing the other cam follower to operate. Thus only one cam follower/s can operate at the same time.



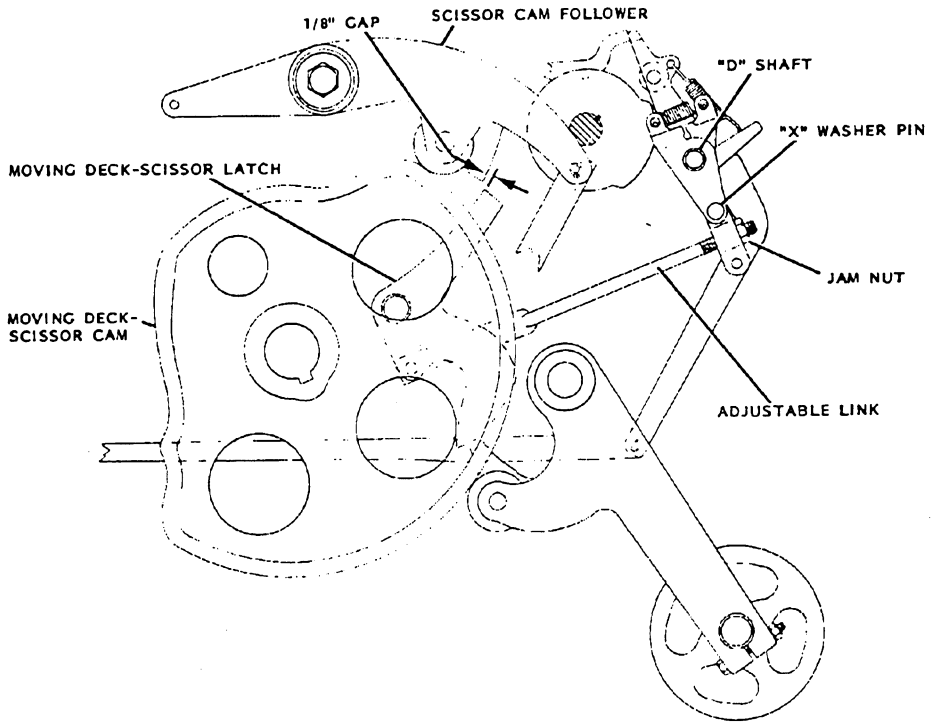
Cycle the pinsetter and observe the action of the scissors and the moving deck. If both operate at the same time, the moving deck scissor latch needs to be adjusted. Adjust as necessary referring to adjustment #18.

ADJUSTMENTS

18. MOVING DECK-SCISSOR LATCH ADJUSTMENT

This adjustment is made to insure that the moving deck cam, follower and scissor cam follower are blocked out as required.

1. With the pinsetter at 90° detecting no-strike, measure the gap between the rear of the latch and the front surface of the scissor cam follower arm. This gap should be 1/8" (±1/32). (Figure 24)



MOVING DECK-SCISSOR LATCH ADJUSTMENT

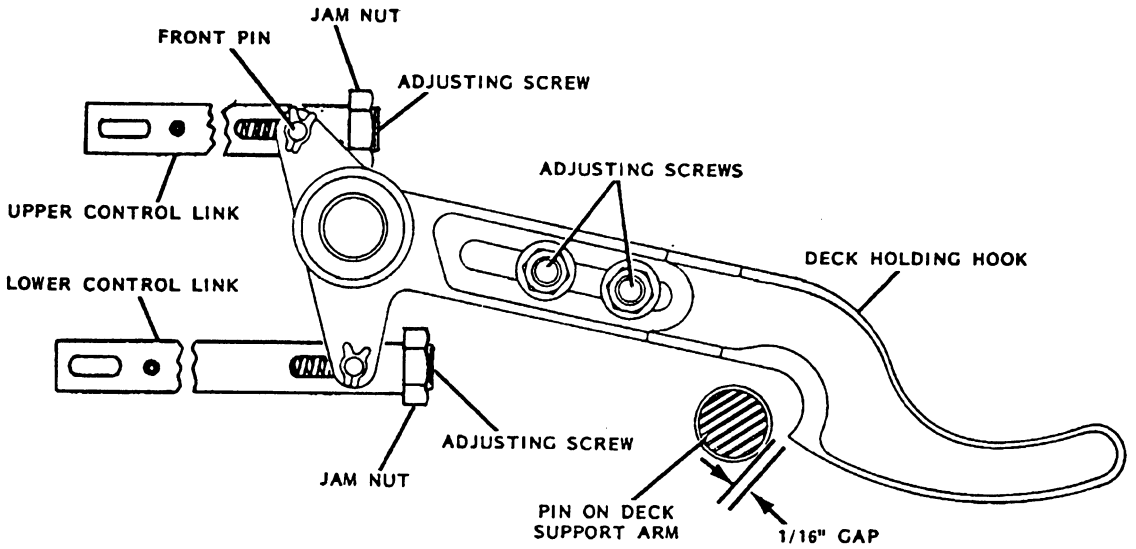
FIGURE 24

2. If the gap must be changed, the link connecting the latch to the detector is adjustable and may be lengthened or shortened, as required.

3. As a check cycle the pinsetter to 90° detecting a strike. A minimum of 3/16" of the blocking surface of the latch should contact the lower surface of the scissor cam follower arm. If it is less than 3/16", adjust accordingly.

9 - DECK HOLDING HOOK

The next item of the gear box to inspect is the deck holding hook (see following figure).



DECK HOLDING HOOK ADJUSTMENT

First check to see that the hook pivots properly by pushing up and down on it.

Then visually check to make sure it is in proper adjustment. The curved part of the hook should be approximately halfway above and about 1/16" in front of the pin on the deck support arm.

If an adjustment is needed, refer to adjustment #22 to make the adjustment.

ADJUSTMENTS

22. DECK HOLDING ADJUSTMENT

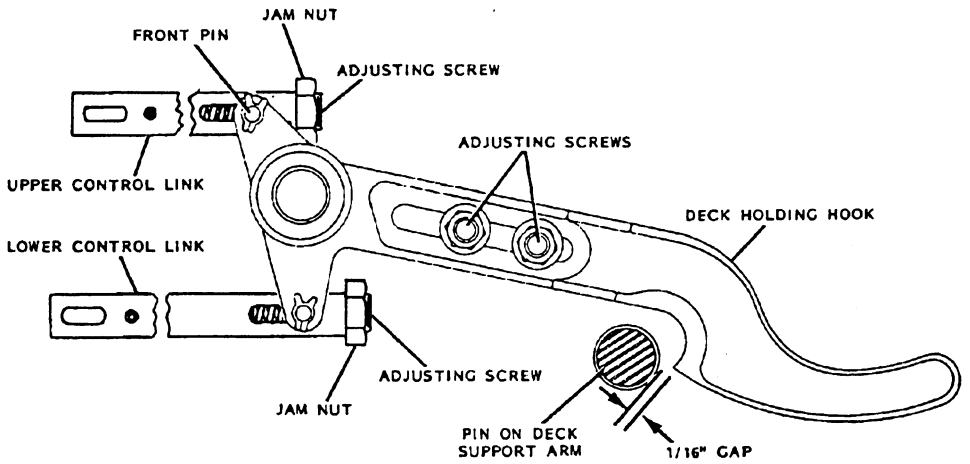
This adjustment is made to insure that the deck holding hook fully engages the pin on the deck support arm to hold the deck up from 180° to 360° during a first ball, out-of-range cycle and from 0° to 180° during a second ball cycle; and that it clears the pin when the deck lowers.

NOTE 1. Before making this adjustment make sure Adjustment 21, Out-of-Range Latch, is correct.

2. Make this adjustment carefully, as the hook is the only support for the deck when it engages the pin.

1. Cycle the pinsetter to 0°, waiting for the first ball delivery, and allow the pinsetter to run until the turret delivers ten pins to the deck. Remove the jam nuts and allen head adjusting screws from both the upper and lower control links. (Figure 28)

2. Replace the adjusting screw in the upper link and turn it in until the sharp edge of the hook is opposite the horizontal center of the pin in the deck support arm. Tighten the locknut.



DECK HOLDING HOOK ADJUSTMENT
FIGURE 28

3. Replace the adjusting screw in the lower link and carefully turn it in until the screw just touches the front pin in the link. This should result in NO FREEPLAY in the hook. Tighten the jam nut.

4. With the pinsetter still at 0°, waiting for the first ball delivery with the deck full, loosen the two clamping screws that connect the rear and forward sections of the deck holding hook.

5. Pivot the hook up and down, and adjust the forward section of the hook to obtain a 1/16" (±1/64) gap between the sharp edge of the hook and the pin at their closest point. Tighten the clamping screws.

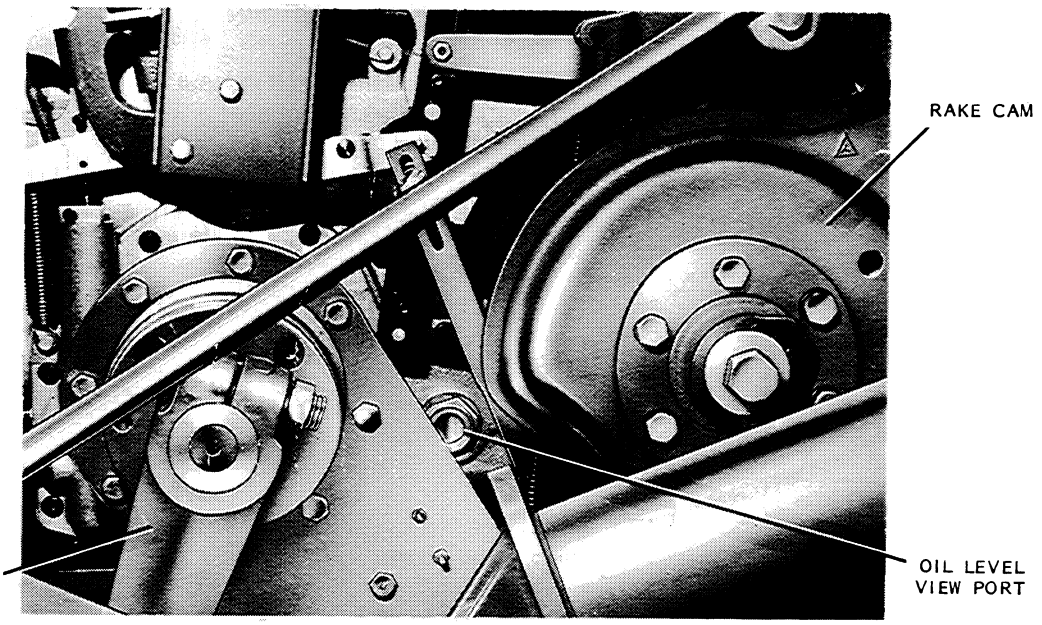
6. As a check, jog the pinsetter through a second ball cycle and observe if the hook fully engages the pin and if it clears the pin when the deck lowers after 180°, second ball. As a second check, first ball, out-of-range after an out-of-range stop, pull the out-of-range handle and jog the pinsetter. Observe if the hook fully engages the pin for the remainder of the first ball cycle.

10 - OIL LEVEL AND LEAKS

Lubrication of the gear box is important to prolong the life of its components. Oil will reduce the friction involved in metal-to-metal contact. Thus, the gear box oil level must be checked (see following figure).

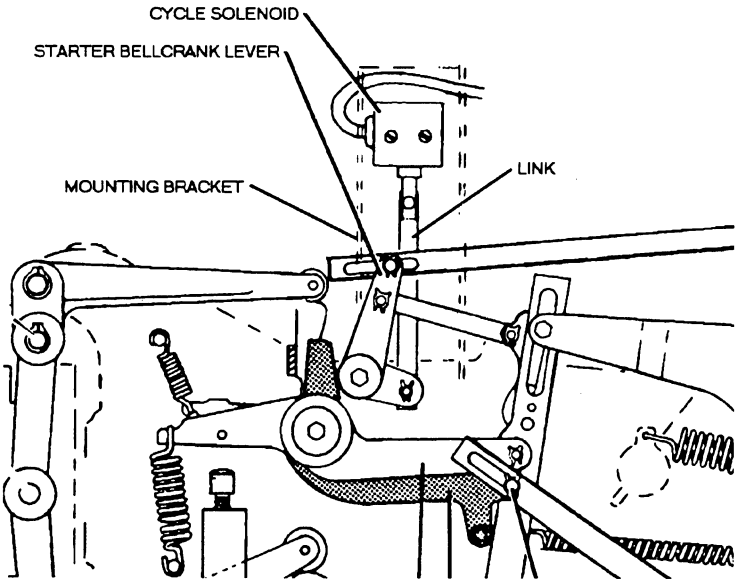
Check the oil level by looking through the view port. Because this is a hard-to-see area, you may want to use a mirror and a flashlight. The correct oil level should be halfway up the view port. If the level is low, add an approved gear box oil.

Below the gear box is an oil catch pan. Check the pan for the presence of oil. This will indicate oil leaks, most likely resulting from poor gaskets or seals. Note any oil leaks on the tune-up sheet so that a qualified mechanic can replace the bad gaskets or seals.



11 - CYCLE SOLENOID

The last item of the gear box to check is the cycle solenoid, located on top of the gear box (as shown below). The cycle solenoid, like all solenoids, converts electrical energy into mechanical energy.



Check its operation by depressing the reset button at the bowler's end of the lane. If the pinsetter cycles and spots new pins, the solenoid is working properly. If the pinsetter does not cycle, refer to adjustment #11.

ADJUSTMENTS

11. CYCLE SOLENOID ADJUSTMENT

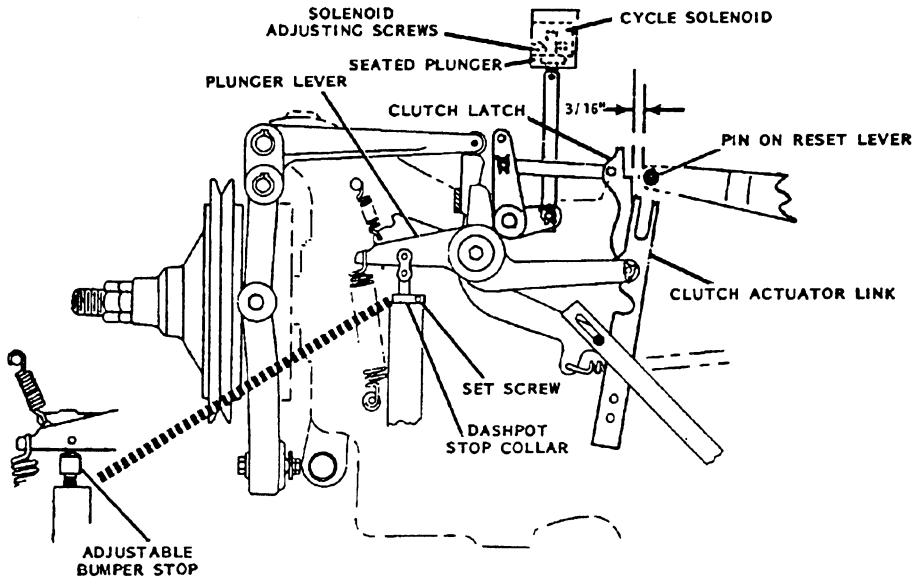
This adjustment is made to insure that the solenoid plunger is fully seated when the solenoid becomes energized to trigger the pinsetter.

1. Cycle the pinsetter to a normal 180° stop. Shut off the power.

2. With the gear box clutch disengaged, loosen the two screws that mount the solenoid to the support bracket.

3. Rotate the clutch latch counterclockwise until a 3/16" (+1/8 -0) gap is obtained between the front surface of the latch and the rear surface of the pin in the clutch reset lever. (Figure 15)

4. While holding the clutch latch in this position, slide the solenoid down until the solenoid is fully seated° on the plunger. The mounting holes are slotted for vertical adjustment. Tighten the hex head adjusting screws. Check the plunger clearance through box cover when energized after assembly.



GEAR BOX STOP COLLAR AND CYCLE SOLENOID ADJUSTMENTS

FIGURE 15

Section III - Deck Assembly

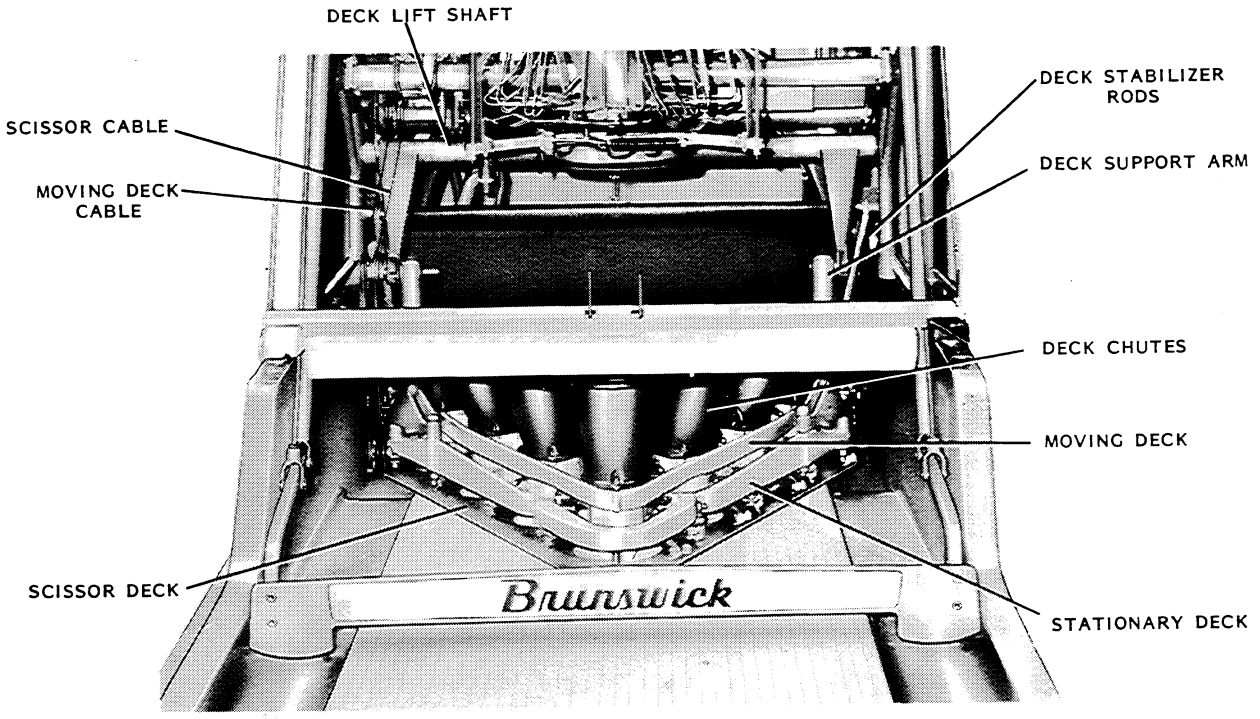
DECK ASSY.			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
SECTION III	12	STRUCTURAL PARTS																								
	13	SCISSOR DECK																								
	14	MOVING DECK																								
	15	DECK HEIGHT & LEVEL																								
	16	PIN SPOTTING																								
	17	DECK JAM SWITCH																								

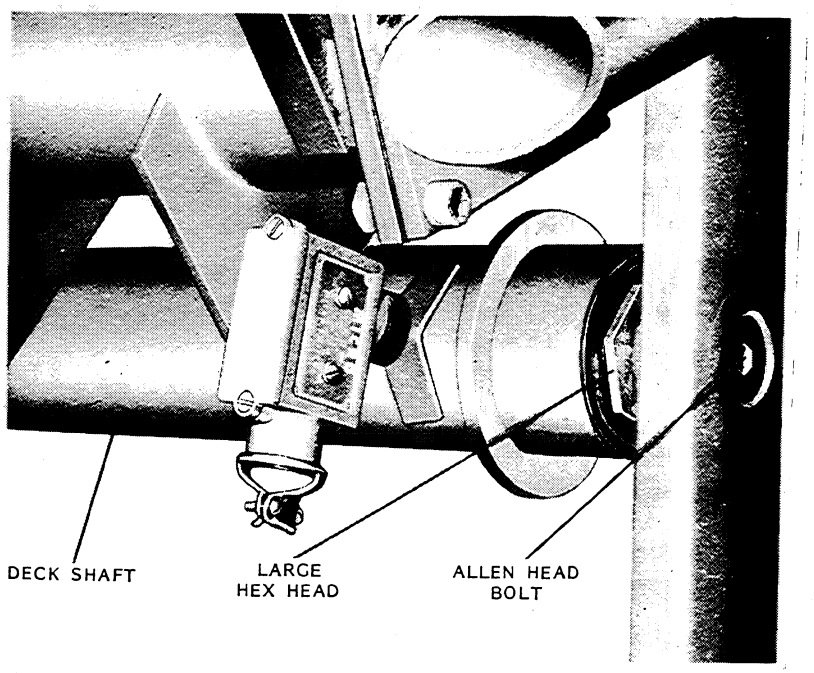
12 - STRUCTURAL PARTS

Now let's move on to the next major assembly: the deck assembly.

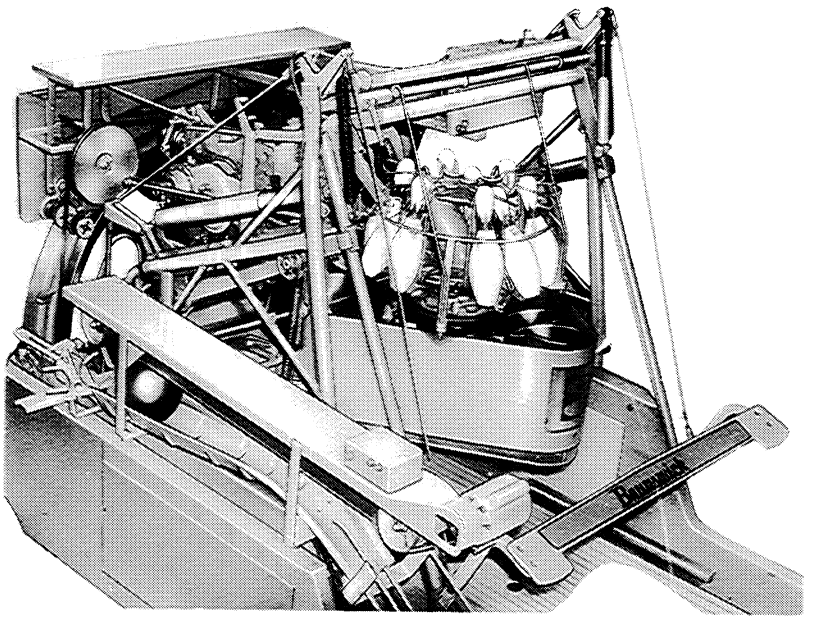
First, the structural parts are checked. Following are two pictures. The second picture is a close-up view of the deck lift shaft, the deck stabilizer rods and the deck support arm. If these bolts are loose, tighten them with a wrench.

Check the deck stabilizer rods for wear and tightness. Make sure they are able to pivot and make sure to grease the fittings.



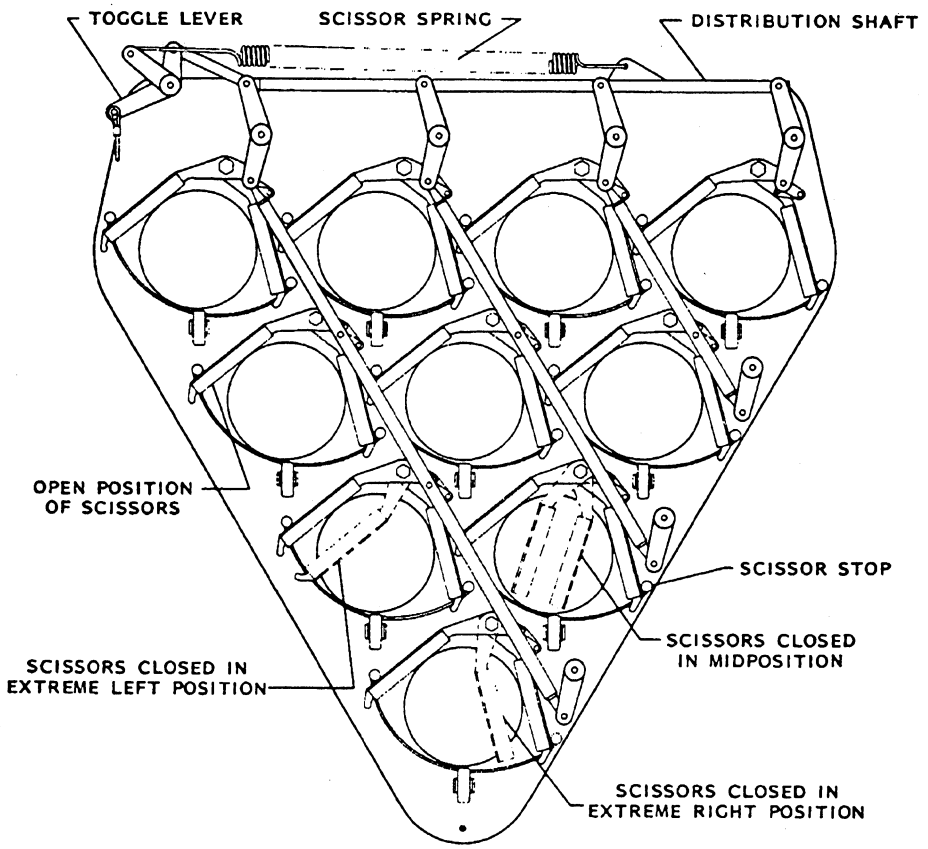


Next, check the deck shield that covers the deck assembly (shown below). Make sure that the five bolts which mount it to the deck assembly are tight.



13 - SCISSORS DECK

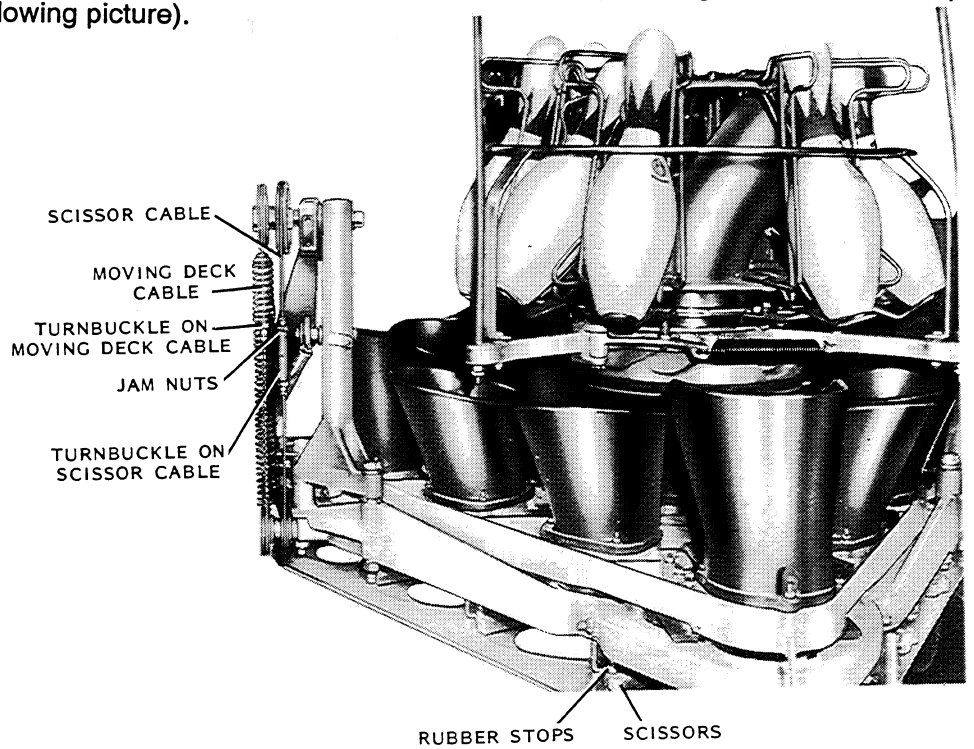
The next area of the deck assembly to check is the scissor deck (shown below). Although it is a rather hard area to get to, it has many parts that need inspection. First check the rubber gripper pads for wear. If the pads are worn through to the metal, replace them. If badly worn pads are not replaced, damage to the pins may occur. Visually inspect the rubber deck rollers for cracks and wear. Any cracked or broken rollers should be replaced.



SCISSOR MECHANISM

Check the condition of the slide wires making sure they are not frayed or broken.

Check the condition of the scissor cable and pulley making sure that it tracks properly on the pulley (see following picture).



Check to make sure that the scissors open and do not interfere with the setting of new pins by the moving deck. Refer to adjustment #19 for corrections.

ADJUSTMENTS

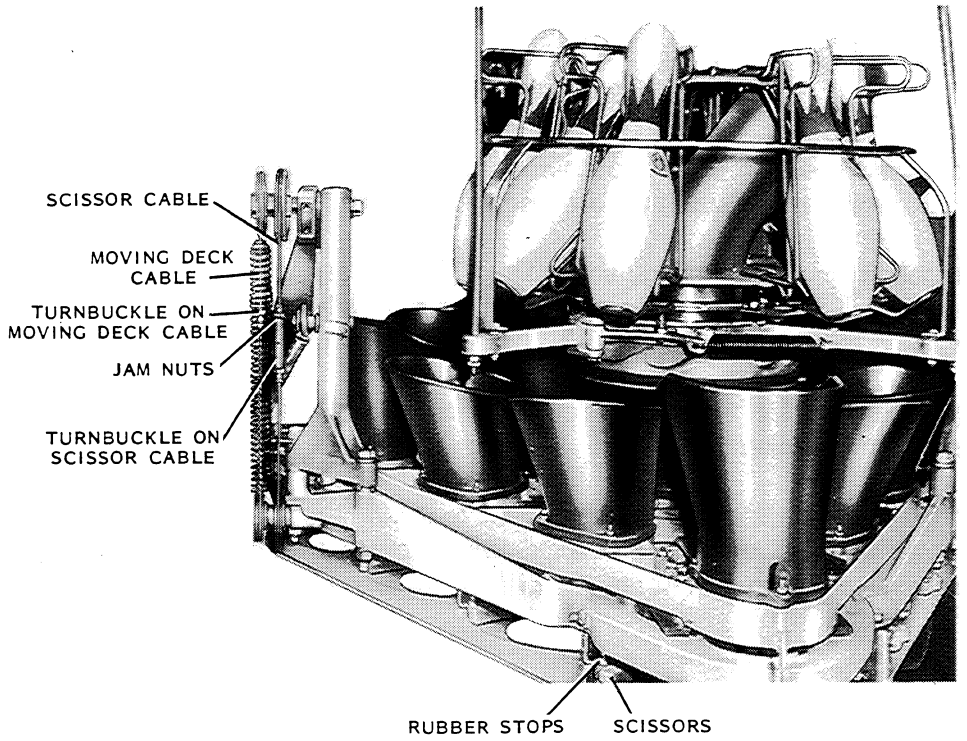
19. SCISSOR CABLE ADJUSTMENT

This adjustment is made to insure that the scissors open fully and do not interfere with the setting of new pins by the moving deck.

1. Cycle the pinsetter to 0° with the scissor cam follower on the high level of the moving deck-scissor cam.

2. Loosen the locknuts on the cable turnbuckle and adjust the scissor cable until the first pair of scissors are fully open, resting firmly against their rubber stops. The remaining pairs of scissors may not touch their rubber stops at this time, however, they will not interfere with the new pinsetting action. Tighten the locknuts. Do NOT attempt to tighten the cable until all scissors touch their rubber stops. (Figure 25)

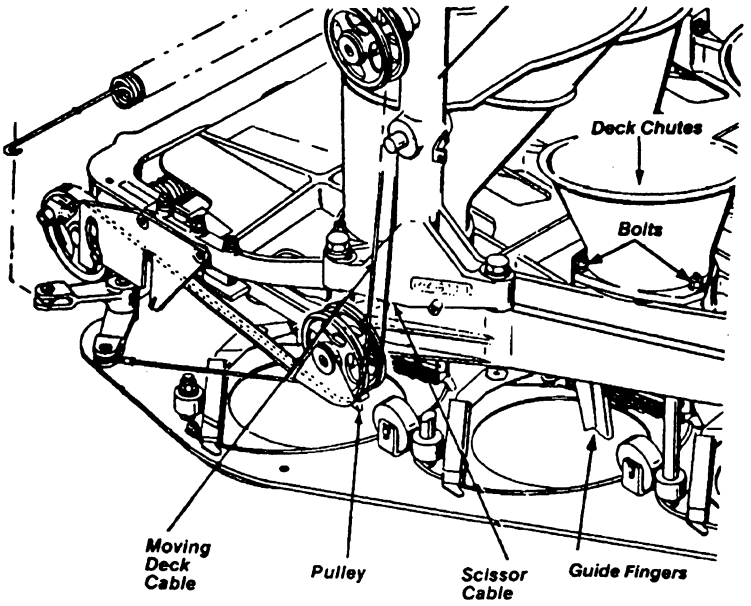
NOTE: When adjusting the turnbuckle, hold the threaded studs and rotate the barrel with a pin punch to avoid twisting and fraying the cable.



SCISSOR CABLE ADJUSTMENT
FIGURE 25

14 - MOVING DECK

Another area of the deck assembly to inspect is the moving deck (shown below). Unlike the scissor deck the moving deck is more accessible to inspection and correction.



Inspect the condition of the deck chutes to insure that they are in place and the bolts are tight. Visually check the guide fingers to make sure they are also in place and in good condition.

Next, check the condition of the moving deck cable. Check to see that it is not frayed or broken and that it properly tracks on the pulley. If the moving deck cable is frayed it will not effectively support the deck as it moves.

In a similar way, the scissors of the scissor deck will not be able to effectively open and close if the scissor cable is frayed or broken.

If the cable is broken, the deck will not be able to move at all. Any frayed or broken cables should be noted and corrected with the center mechanic. Correct moving deck cable adjustment is necessary to insure that pins do not wobble when set by the deck, refer to adjustment #20.

ADJUSTMENTS

20. MOVING DECK CABLE ADJUSTMENT

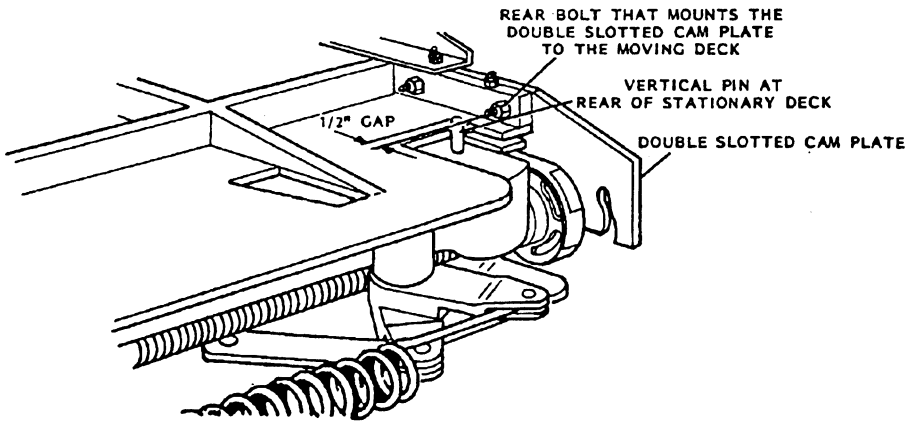
This adjustment is made to insure that the pins do not wobble when set by the deck.

1. Cycle the pinsetter until the moving deck is in its extreme rearward position (approximately 290°, first ball strike or second ball cycle).

2. Loosen the locknuts on the cable turnbuckle and adjust the moving deck cable until the center of the rear bolt that mounts the left hand geneva cam plate is 1/2" (±1/16) from the center of the vertical roll pin at the rear of the stationary deck. Tightening the cable will increase the gap and loosening the cable will decrease the gap. Tighten both locknuts. (Figure 26)

NOTE: When adjusting the turnbuckle, hold the threaded studs and rotate the barrel with a pin punch to avoid twisting and fraying the cable.

3. Run the pinsetter through several strike cycles and observe if pins wobble when placed on the lane. If the pins wobble, cycle the pinsetter manually and observe if the guide fingers or the lower, front edges of the deck chutes contact the pins as the deck goes up.



MOVING DECK CABLE ADJUSTMENT
FIGURE 26

4. If the guide fingers contact the pins as the deck goes up, the cable must be slackened. If the lower, front edges of the deck chutes contact the pins as the deck goes up, the cable must be tightened. The clearances to the pin should be equal at the front and rear as the deck raises.

15 - DECK HEIGHT

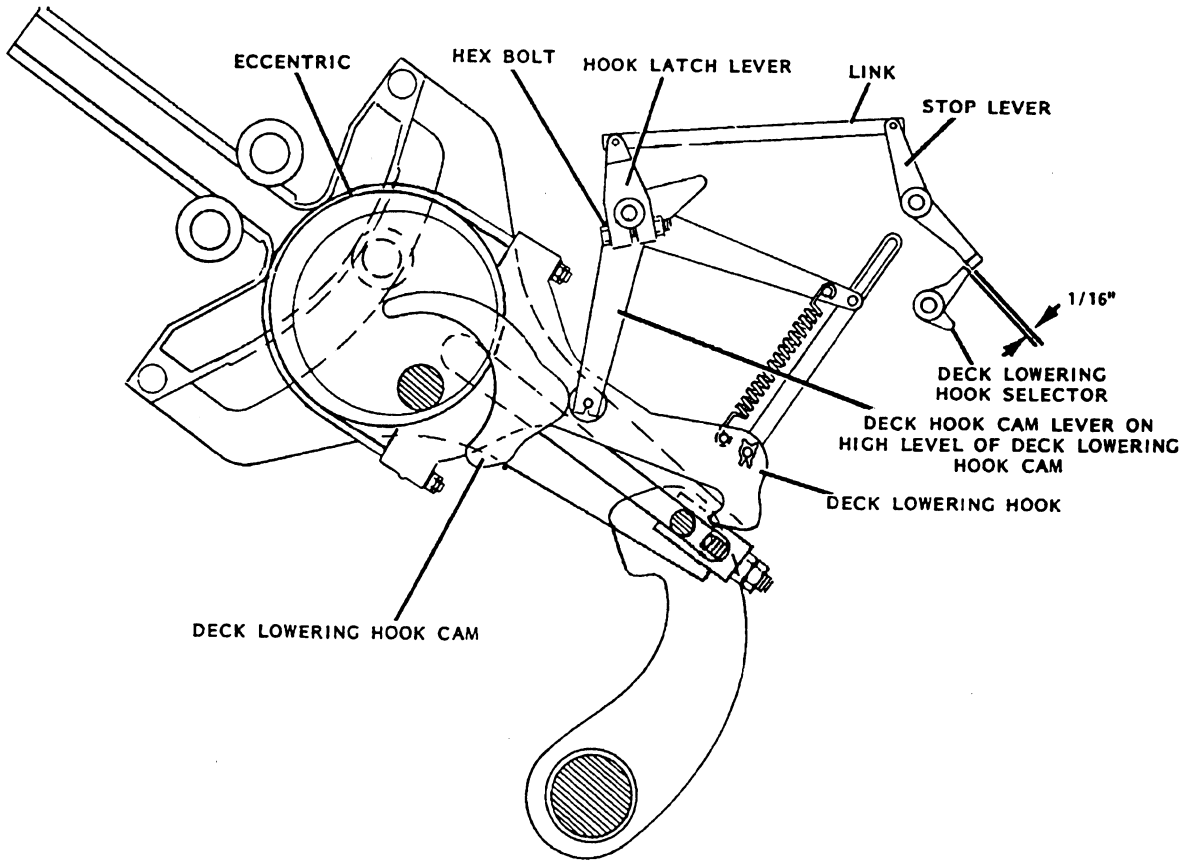
The deck height and levelness must be checked. Check the deck levelness with a level.

When the deck is set all the way down, check the deck height from the playing surface with a ruler. This distance should be 7/8".

If either the deck height or levelness need to be adjusted, refer to adjustment #14 to correct the problem.

Check that the deck lowering hook engages pin when the deck is detecting or re-spotting, and that the hook will be held out when the deck sets new pins (see figure below). Refer to adjustment #16 for corrections.

Also check the deck eccentric to assure that the deck lowers far enough beyond the standing pins detection level at 90 degrees to detect a strike. Refer to adjustment #17 to inspect and correct.



ADJUSTMENTS

14. DECK HEIGHT AND LEVEL ADJUSTMENT

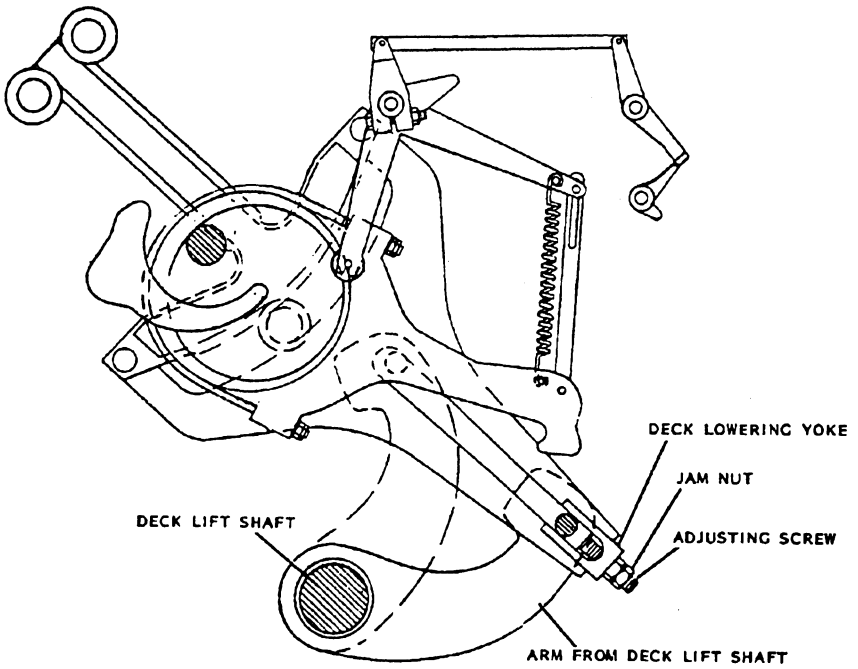
This adjustment is made to insure that the deck is level with the lane surface and the correct height above the lane surface.

1. With the pinsetter at exactly 270°, setting new pins, level the deck to the lane surface. If the apex or rear of the deck requires adjustment, loosen the jam nuts on the stabilizer rods. Length or shorten to make the deck an equal height at the front and the rear corners. Lock the jam nuts.

2. With the pinsetter still at 270°, set the height of the deck as follows:

PINSETTERS WITH DECK LOWERING YOKE (FACTORY EQUIPPED)

To raise or lower the deck, loosen the jam nut at the bottom of the deck lowering yoke and turn the adjusting screw until the bottom of the scissor deck is 15/16" (±1/32) above the lane surface. (Figure 18)

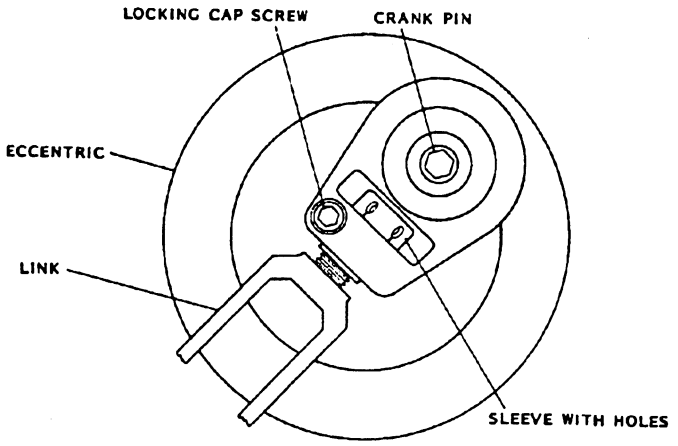


DECK HEIGHT ADJUSTMENT (FACTORY EQUIPPED PINSETTERS ONLY)
FIGURE 18

ADJUSTMENTS

PINSETTERS WITH DECK LOWERING LINK (CONVERTED)

To raise or lower the deck, loosen the locking cap screw where the deck lowering link is threaded into the pin on the 2:1 shaft. Rotate the adjusting sleeve until the deck is 1" (±1/32) above the lane surface. The sleeve may be rotated by means of a pin punch placed in the holes of the sleeve. (Figure 19). Tighten the cap screw. The sleeve is easily rotated if the deck is blocked up to take the weight off the lowering link.



DECK HEIGHT ADJUSTMENT (CONVERTED PINSETTERS ONLY)
FIGURE 19

NOTE:1. If the deck has to be lowered beyond the limits obtainable with both the jack screws and lowering adjustments, shims may be added between the top of the deck and the deck support arms.

2. Whenever the deck height is changed by means of the deck lowering adjustments, be sure to readjust the restricted drop interlock (Adjustment 43) and the deck holding hook (Adjustment 22).

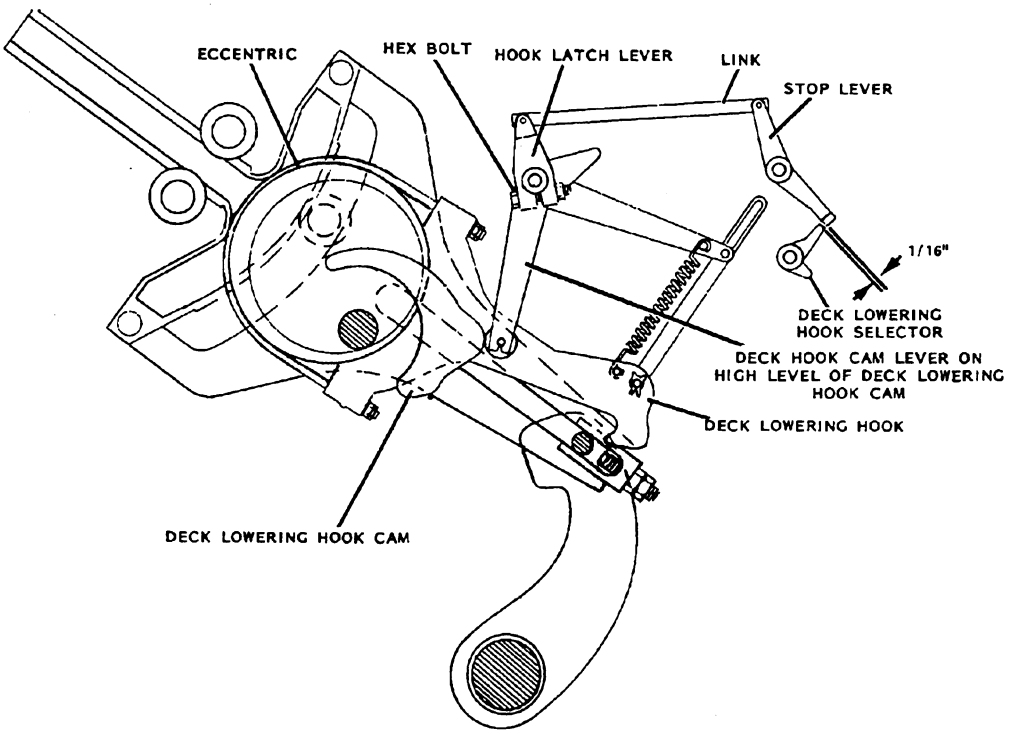
ADJUSTMENTS

16. DECK LOWERING HOOK LATCH ADJUSTMENT

This adjustment is made to insure that the deck lowering hook will engage the pin when the deck is detecting or respotting, and that the hook will be held out when the deck sets new pins.

1. Cycle the pinsetter until the roller on the deck hook cam lever is on the highest level of the deck lowering hook cam during a first ball strike or second ball cycle. Shut off the power. (Figure 21)

2. Loosen the bolt on the hook latch lever and set the gap between the rear of the deck lowering hook stop lever and the front of the deck lowering hook selector at 1/16" (±1/64). (The stop lever and deck lowering hook selector are in the front end of the detector assembly.) Tighten the bolt.



DECK LOWERING HOOK LATCH ADJUSTMENT
FIGURE 21

ADJUSTMENTS

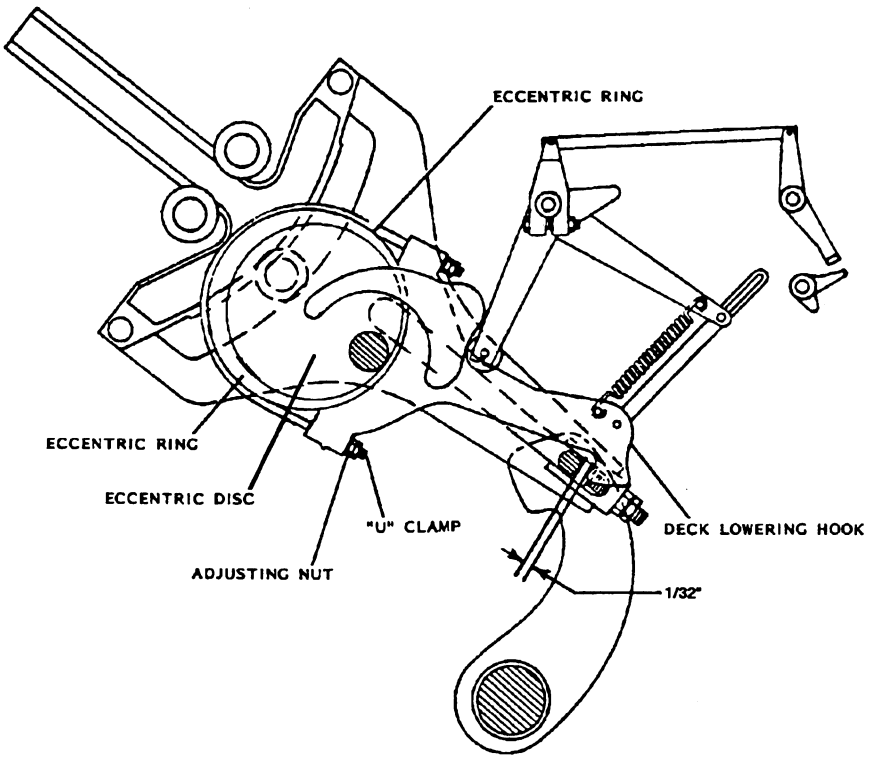
17. DECK ECCENTRIC ADJUSTMENT

This adjustment is made to insure that the deck lowers far enough beyond the standing pins detection level at 90°, first ball strike cycle, to permit proper functioning of the detector assembly and deck lowering mechanism.

PINSETTERS WITH DECK LOWERING YOKE (FACTORY EQUIPPED)

1. Cycle the pinsetter to 0° and shut off the power.

2. Loosen the two nuts on the deck lowering hook "U" clamp and rotate the eccentric ring until the edge of the deck lowering hook just clears the deck lowering pin by 1/32" (Figure 22). Tighten the nuts. Be careful not to overtighten the "U" clamp as the eccentric ring may become deformed.



DECK ECCENTRIC ADJUSTMENT (FACTORY EQUIPPED PINSETTERS ONLY)
FIGURE 22

PINSETTER WITH DECK LOWERING LINK (CONVERTED)

1. Allow the pinsetter to run until the deck receives ten pins.

2. Place a pin on the #5 pin spot only, and cycle the pinsetter to 90° with the weight of the full deck resting on the #5 pin.

3. Measure the vertical distance from the bottom of the scissor deck to the top of the lane surface.

4. Cycle the pinsetter to exactly 90°, first ball strike cycle (no pins on the lane).

ADJUSTMENTS

5. Measure the vertical distance from the bottom of the scissor deck to the top of the lane surface.

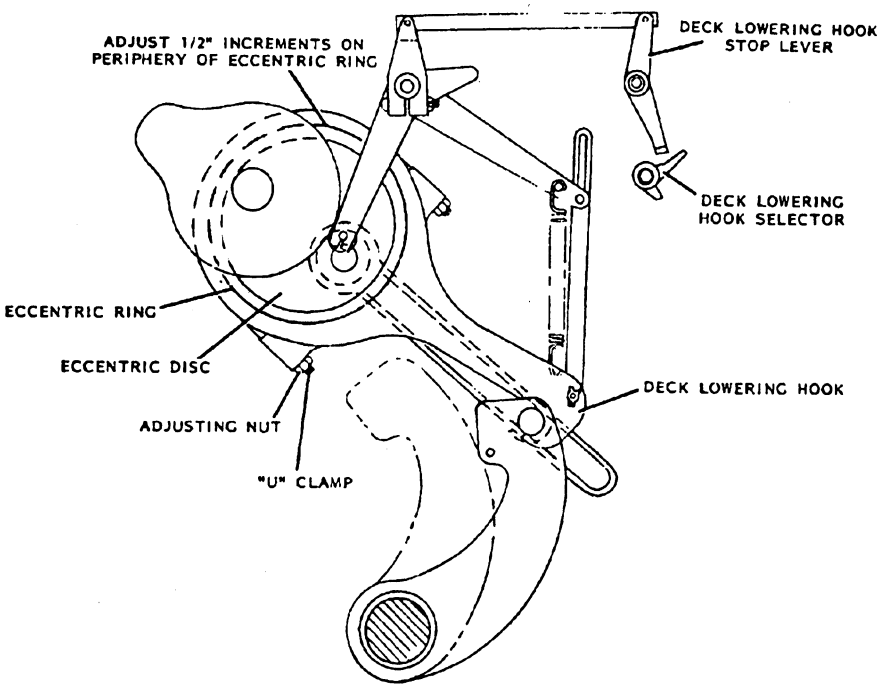
6. The deck must be 1-1/4" lower when detecting a strike than when detecting a single standing pin with a full deck.

7. Loosen the two nuts on the deck lowering hook "U" clamp (figure 23) and rotate the eccentric ring until the bottom of the scissor deck is positioned 1-1/4" lower than the dimension obtained in Adjustment 17, step 3. Tighten the nuts. Be careful not to overtighten the "U" clamp as the eccentric ring may become deformed. the eccentric ring may be rotated by placing a pin punch in the hole provided on the eccentric ring. Rotate the ring in 1/2" increments until the proper height of the deck is obtained.

NOTE:1. Check deck lowering hook at 90° and 270°, standing pins for overtravel clearance between bottom end of hook and frame cross member.

2. In making the above adjustment, it is helpful to scribe a mark on the eccentric ring and eccentric disc so that the amount of rotation will be readily visible.

3. Whenever the deck height is changed by means of the eccentric ring, it will be necessary to readjust the detector rod. (Adjustment 1.)



DECK ECCENTRIC ADJUSTMENT (CONVERTED PINSETTERS ONLY)
FIGURE 23

16 - PIN SPOTTING

The next area to check on the deck assembly is pin spotting.

It is always important that the pins are accurately placed on the pin spots by the deck.

This is best checked by watching the deck set the pins on the lane. If any of the pins are off the pin spots, make note of this and correct. Refer to adjustment #15. Also check that the frame counter counts once each time the deck sets 10 new pins. Check that the rubber boot on the switch is flexible. Refer to adjustment #47 for correct microswitch positioning.

ADJUSTMENTS

15. DECK PINSPOTTING ADJUSTMENT

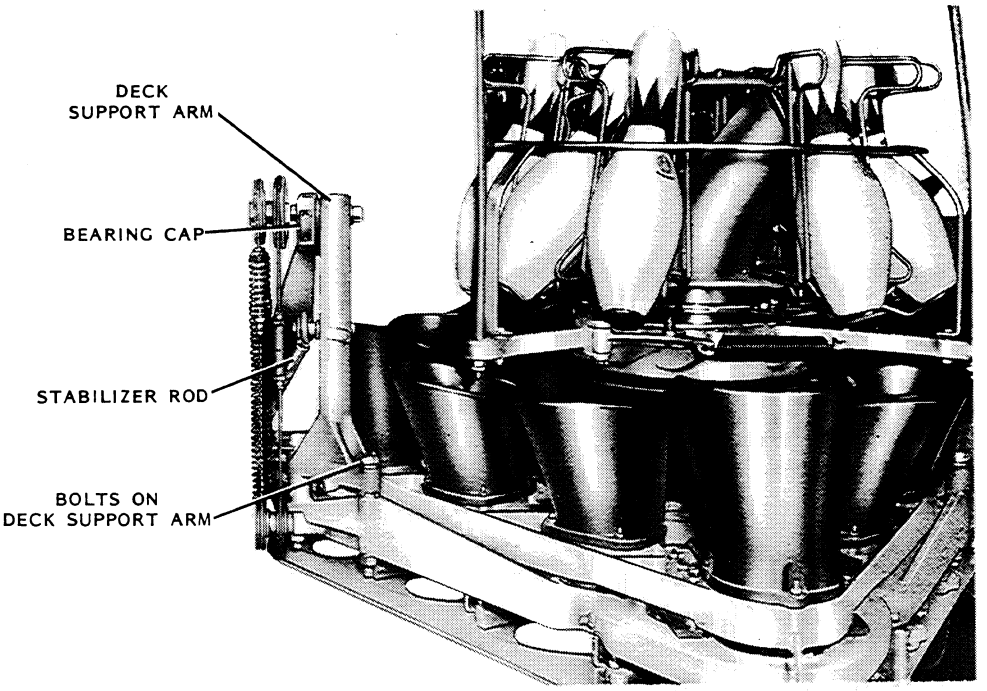
This adjustment is made to insure that the deck accurately sets new pins on the spots.

1. Cycle the pinsetter through several new pinsetting cycles and observe whether the pins are accurately placed on the spots.

2. If pins are spotted too far to the left or right, it must be determined whether the pinsetter must be shifted on the kickbacks to obtain proper pinspotting, or if the deck assembly must be shifted to obtain proper pinspotting. If the side frames and rake board are positioned to the right or left of the lane, the frame must be shifted. If the frames and rake board are centered with the lane, the deck assembly must be shifted.

3. To shift the frame, loosen the four mounting bolts that secure the side frames to the kickback mounting plates. Shift the pinsetter as required, then tighten the mounting bolts.

4. To shift the deck, cycle the pinsetter until the deck is all the way down (270°) with the weight of the deck supported on blocks. Loosen the bearing caps on the front of the deck support arms, and move the deck right or left as required. Tighten the bearing caps. (Figure 20)



DECK PINSPOTTING ADJUSTMENT
FIGURE 20

5. After making these adjustments, cycle the pinsetter and observe if there is interference between the rake board and edge of the lanes, or interference between the rake arms and the deck assembly. If interference exists, readjust as required.

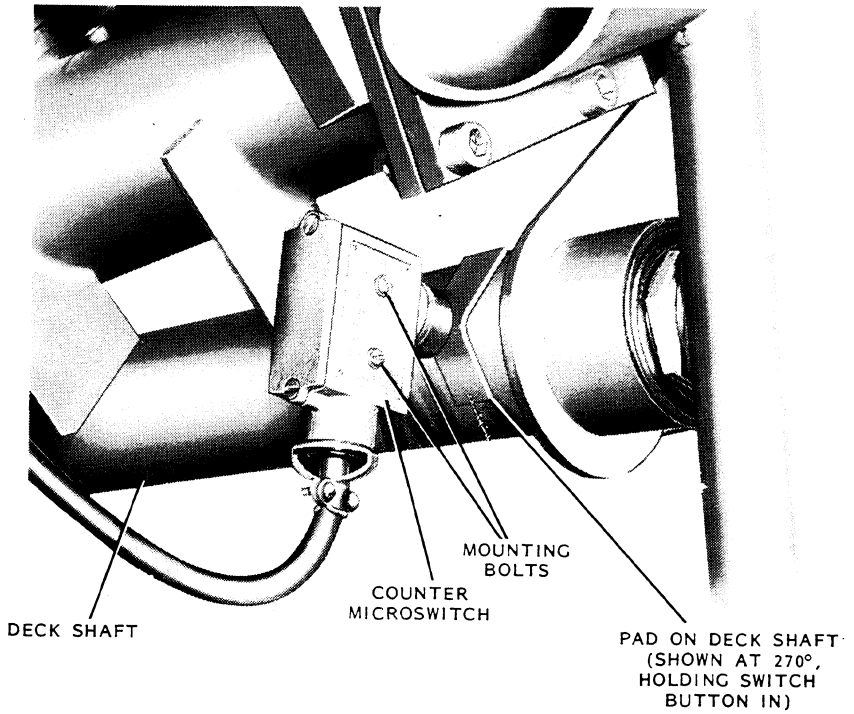
6. If the pins are spotted too far forward or to the rear, loosen the two bolts on the lower end of each deck support arm and slide the deck forward or rearward. Tighten the four bolts.

ADJUSTMENTS

47. COUNTER MICROSWITCH ADJUSTMENT

This adjustment is made to insure that the frame counter counts once, each time the deck sets ten new pins.

1. Cycle the pinsetter to exactly 270°, setting new pins.



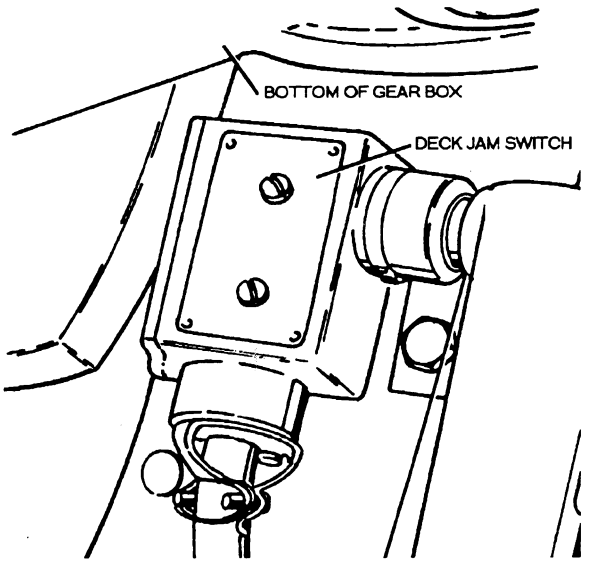
COUNTER MICROSWITCH ADJUSTMENT
FIGURE 48

2. Loosen the counter microswitch mounting bolts and position the switch so that the pad on the deck shaft is holding the switch button in. Tighten the mounting bolts. Care should be taken to prevent the switch from being positioned to permit the pad to hit the microswitch twice, once going down and again on the way up. (Figure 48)

NOTE: If the deck must remain in its lowered position for any length of time with the power on, raise the deck enough to prevent the pad on the deck shaft from depressing the counter. The solenoids controlling the counters are not rated for continuous duty and they will burn out, if left on for any length of time.

17 - DECK JAM SWITCH

The last item to check is the deck jam switch. When a deck jam occurs, this switch opens and shuts off the pinsetter (see picture below).



The easiest way to check the switch is to manually set up a deck jam by mispositioning a pin. To insure no damage occurs, unplug the motor. Then, turn on the machine to see if it starts. If it does, the deck jam switch is bad.

With the machine turned off, manually move the deck to make sure it pulls down on the moving deck cable. As the cable moves down, it opens the deck jam switch to shut off the pinsetter. Check that the rubber boot on the jam switch is flexible and doesn't restrict the plunger movement. A return spring (12-700041-000) is available to assist the return of the switch plunger.

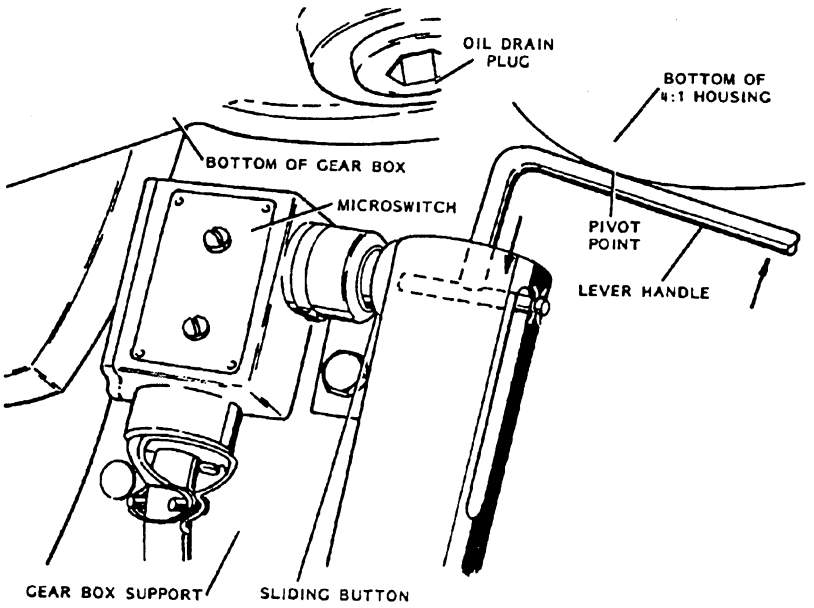
If the switch is not working properly, correct immediately with the center mechanic. Refer to adjustment #49. Check the deck jam clutch release mechanism if installed per adjustment #50.

ADJUSTMENTS

49. MOVING DECK JAM MICROSWITCH ADJUSTMENT

This adjustment is made to insure that the microswitch remains closed during normal operation, and to insure that the switch will open to shut off the machine in the event a deck jam occurs.

1. At 0°, check the position of the microswitch button, with relation to the sliding button which holds the microswitch closed. (Figure 50)



MOVING DECK JAM MICROSWITCH ADJUSTMENT
FIGURE 50

2. If the microswitch button is not in contact with the center of the sliding button, reposition the microswitch until this center contact is obtained. The microswitch can be moved by adding spacers between the switch and the gear box support and also by elongating the mounting holes in the gear box support.

3. As a check, lever the button down and observe if the sliding button moves away from the switch, thereby shutting off the power.

If the center contact of step 2 is not obtained, the pin lights will tend to blink off and on when the deck is setting new pins.

CAUTION: The moving deck jam microswitch, when properly adjusted, will adequately protect the pinsetter from damage due to deck jams. If the purpose of the switch is ever nullified, severe damage to the gear box may result.

1. Under no circumstances should the machine ever be placed under power by bypassing the deck jam microswitch.

2. Under no circumstances should the machine ever be forced to rotate forward manually if a deck jam has opened the microswitch.

ADJUSTMENTS

TO PROPERLY CLEAR A DECK JAM, PROCEED AS FOLLOWS:

1. Shut off the power by opening the control box circuit breaker.

2. Rotate the gear box drive pulley backward (clockwise when observed from the rear of the machine). This will cause the moving deck to shift to the rear, releasing the jammed pin or pins. It may be necessary to rotate the moving deck-scissor latch to unblock the moving deck cam follower when manually reversing the pinsetter.

3. Remove the pins from the deck and resume normal operation.

NOTE: Newer machines contain a deck jam protection kit (Figure 51).

50. DECK JAM CLUTCH RELEASE MECHANISM ADJUSTMENT

This adjustment is made to insure that the pinsetter will not be damaged by the deck jams. With the deck jam clutch release mechanism installed, the pinsetter clutch is disengaged when a deck jam occurs, assuring that no abnormal stresses are placed on any of the deck or gear box parts.

This system also incorporates an electrical shutoff device which prevents the pinsetter from restarting until the circuit breaker is turned off and then on. This greatly reduces the possibility that inexperienced personnel will be injured by clearing a deck or turret jam with the pinsetter power on.

DECK JAM

1. A deck jam occurs when the moving deck is prevented from moving forward by some obstruction after setting new pins. (Usually a pin has failed to drop from the deck.)

2. As the moving deck cam follower continues up the moving deck-scissors cam, increased tension is applied to the moving deck cable.

3. The increased tension on the cable causes the spring in the spring tube mounted on the 4:1 housing to compress. (Figure 51)

4. As the spring is compressed, the pin in the spring tube moves downward pulling the link spring with it. The spring in turn causes the bellcrank to rotate, moving the latch upward.

5. The latch raises the clutch lever, disengaging the clutch, stopping the pinsetter.

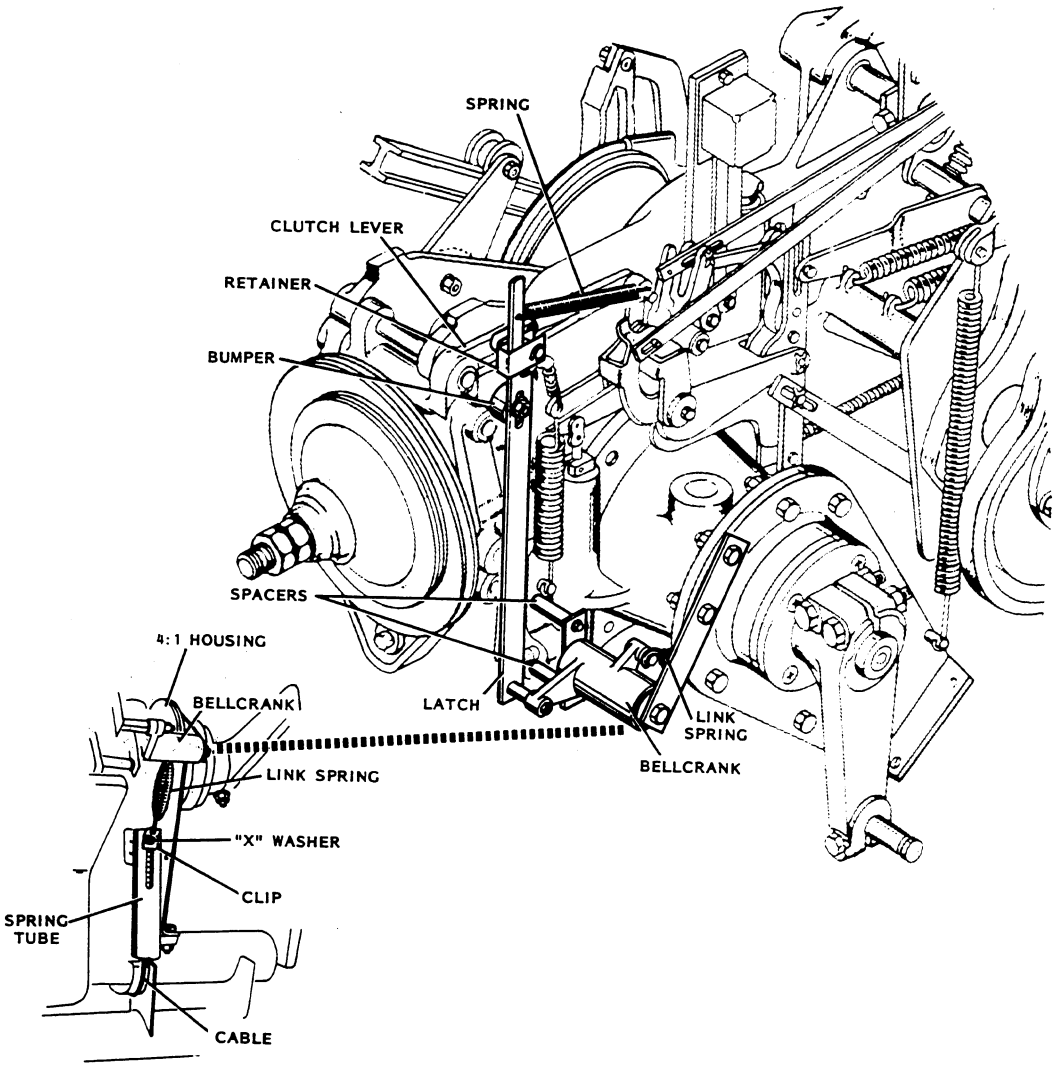
6. At the same time, the pin in the spring tube moves off the deck jam switch actuator. The normally closed contacts of the switch close, energizing relay RL4. RL4's normally closed contacts open, de-energizing the motor start relay which de-energized the motor contactor, turning off the pinsetter motor.

7. The normally open contacts of RL4 close, electrically latching RL4 in the energized state. RL4 will remain energized until the circuit breaker is turned off. Therefore, the motor can only be restarted by clearing the jam and turning the breaker off, then on.

NOTE: Some machines may not include the electrical relay system. This requires turning off the electrical power to clear the jam.

ADJUSTMENTS

8. To clear a jam, the clutch can be re-engaged by moving the top of the latch rearward. This allows the pin on the clutch lever to disengage from the latch, re-engaging the clutch. The gear box can now be manually reversed with the belts to clear the jam.



DECK JAM CLUTCH RELEASE MECHANISM ADJUSTMENT
FIGURE 51

TURRET JAM

1. When a turret jam occurs, the turret frame moves away from the turret jam switch causing its normally closed contacts to close. RL4 energizes, de-energizing the motor start relay RL2 and the motor contactor RL3, turning off the motor. As with a deck jam, the normally closed contacts of RL4 close, latching RL4 in its energized position. Again, RL4 can only be de-energized by clearing the jam and turning the breaker off, then on.

ADJUSTMENTS

CLEARING A DECK JAM

1. Turn off the pinsetter circuit breaker.

2. Move the top of the new latch rearward. This will release the clutch lever and re-engage the clutch.

3. Using the motor to gear box belt, manually reverse the gear box until the pin or pins causing the jam can be removed.

4. Remove the pins and turn the circuit breaker on. The pinsetter will restart.

5. On pinsetters with electrical triggering, the trigger solenoid will energize shortly after the circuit breaker is turned on.

6. This will cause the pinsetter to continue to cycle past 0° and stop at 180° with pins in the scissors. The pinsetter is restarted by raising 180° turret interlock link. The pinsetter will then cycle to 0°, waiting for second ball. If a full set of pins are on the playing surface, switch the pinsetter to first ball by raising the deck holding hook. If a full set of pins is not present, recycle the pinsetter to set new pins.

CLEARING A TURRET JAM

1. Turn off the circuit breaker.

2. Using the motor to gear box belt, manually reverse the gear box, lowering the deck until the pins causing the jam can be removed.

3. Turn the circuit breaker on.

Section IV - Detector

DETECTOR			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
SECTION IV	18	STRUCTURAL PARTS																								
	19	DETECTOR ROD																								
	20	OUT-OF RANGE																								
	21	1 & 2 BALL MICRO SWITCH																								
	22	STRIKE LIGHT SWITCH																								
	23	SWITCH CLUSTER (AUTO SCORER)																								

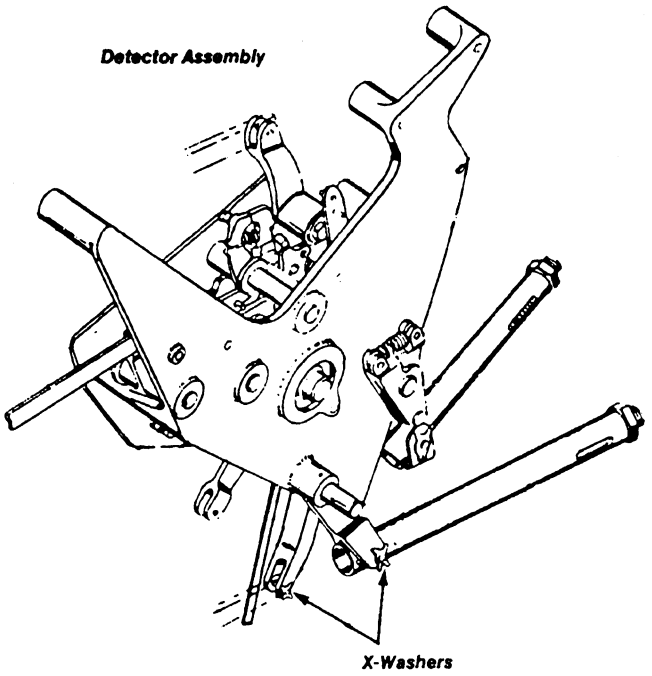
18 - STRUCTURAL PARTS

Let's move on now to another area of the functional check that is closely related to the gear box: the detector assembly.

First examine the structural parts (shown below). Check for missing X-washers and replace them if they are missing.

Check the three mounting bolts with a wrench to insure they are tight.

Look for loose or broken bearings and record them on the tune-up sheet.



19 - DETECTOR ROD

The next item to inspect is the detector rod. It detects strikes, standing pins and out-of-range pins, and transfers this information to the detector. Thus, its operation and adjustment are of critical importance.

The easiest way to check its operation is to set up the three situations it is able to detect. First check the strike situation. This is set up by having no pins on the lane. Cycle the pinsetter and observe the action of the deck.

At the 90 degree, the deck lowers and detects a strike situation. A 180 degree, the deck should have raised to await new pins. If the deck does not lower, raise, and then set new pins the detector rod may need an adjustment, refer to adjustment #1.

Next, check the standing pins situation by spotting three pins on the #1, 7, and 10 pin spots. The deck should be full of pins for this check. Setting the pins on the corner spots will compensate for any unlevel condition of the deck as it lowers.

Again, observe the pinsetter as it cycles. At 90 degrees, the deck should lower and detect a no strike situation. The scissors should close around the necks of the standing pins. At 180 degrees, the deck has raised and lifted the #1, 7, and 10 pins.

If the deck fails to detect the standing pins, the detector rod may need to be adjusted.

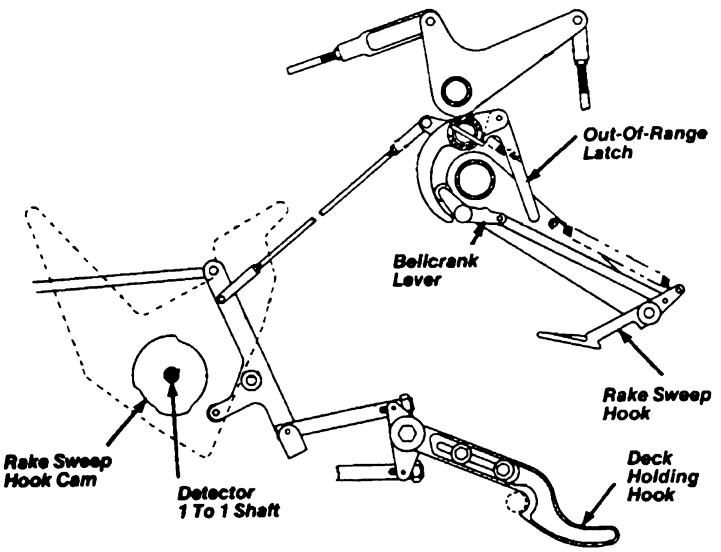
Finally, check the out-of-range situation by spotting a pin off the pin spot.

When the pinsetter cycles, the deck should lower at 90 degrees and rest on top of the out-of-range pin. This should disengage the gearbox clutch and stop the cycle of the pinsetter, thereby allowing the deadwood to be manually removed.

If the gearbox clutch does not disengage, the detector rod will require and adjustment. Note any wrong detections by the detector rod on the tune-up sheet, and correct. Refer to adjustment #1.

20 - OUT-OF-RANGE

When you are check the detector rod for the out-of-range pin, check the out-of-range latch function (see following figure).



Very simply, when an out-of-range cycle occurs, the rake is prevented from sweeping by the out-of-range sweeping latch. Instead, the deadwood must be cleared manually.

If the rake sweeps the deadwood during an out-of-range cycle, refer to adjustment #21 to adjust the out-of-range latch.

ADJUSTMENTS

1. DETECTOR ROD ADJUSTMENT

The purpose of the detector rod adjustment is to insure that the pinsetter accurately detects:

1. Strikes
2. Any number of standing pins, with maximum deck weight.
3. Out-of-range pins

This is a combined adjustment, normally only Part B needs to be made, Part A is necessary when the detector rod has been removed and replaced.

NOTE: After installation of the rod, make sure the exposed stop pins on the rod are perpendicular to the slots in the stop bracket with one pin above and one pin below the stop bracket. (Figure 1)

A. 1. With the deck in the fully up position at 0° measure the distance between the rear face of the projection on the out-of-range controller and its blocking surface on the detector disc. The distance must not be less than 1/16". It is preferable to maintain the 1/16" dimension as close as possible.

2. To obtain this measurement, the detector rod will have to be threaded in or out of the part of the rod which is attached to the detector disc.

3. If the rod cannot be threaded in far enough, it should be removed and about 1/8" cut off the threaded end. When this is done, make sure the jam nut is left on the rod, as it can be used to clear the threads for easy replacement.

4. Repeat steps 1 and 2.

5. The distance between the lower stop pin on the detector rod and the point of connection at the disc is now correct. The deck down position of the disc can now be adjusted.

B. 1. Cycle the pinsetter to exactly 90° first ball strike.

2. Check the position of the strike cam follower roller and see if it is nested in the low level of the timing cam. If not, manually lift the strike selector out of its blocking position, permitting the strike cam follower roller to enter the low level of the timing cam. Loosen the pivot block screw and lower the detector rod until the upper stop pin on the rod hits the stop bracket. (Figure 1)

3. Carefully push the detector rod and tube assembly upward until the motion of the rod stops. Be careful not to compress the spring in the tube.

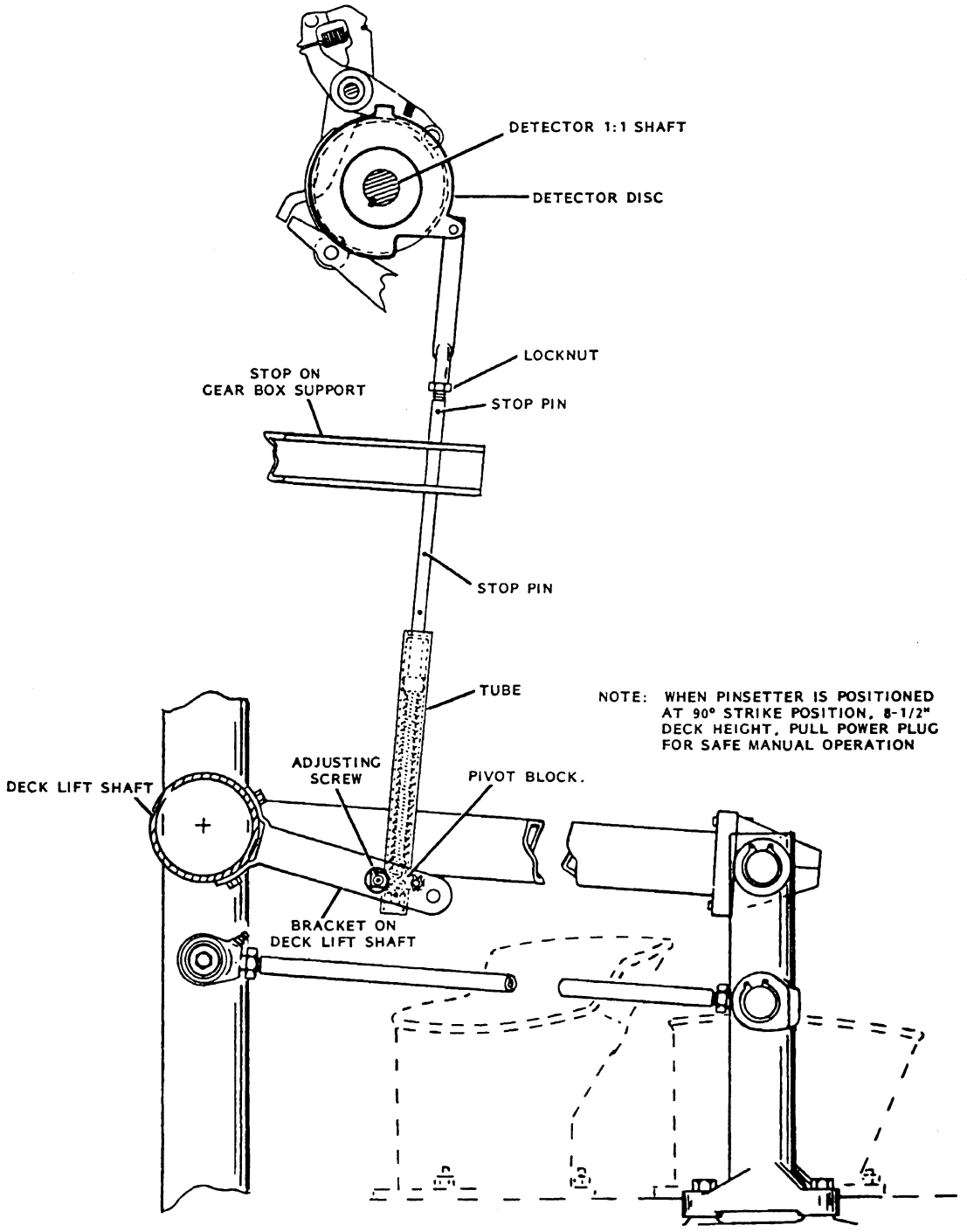
4. Carefully work the tube and rod down 1/16" to 1/8", then tighten the pivot block screw. Check now if the rod can be pushed up against the spring this 1/16".

5. As a check, cycle the pinsetter through all cycle and combination of standing pins.

6. If detection is incorrect, return to 90° strike position.

ADJUSTMENTS

7. Mark tube assembly at top of block. Lower additional 1/16" (total 1/8"). Lock adjusting screw and repeat test of detection. Maximum tolerance 3/8". If still failing detections, return to step B1 and repeat adjustment.



DETECTOR ROD ADJUSTMENT AT 90°

FIGURE 1

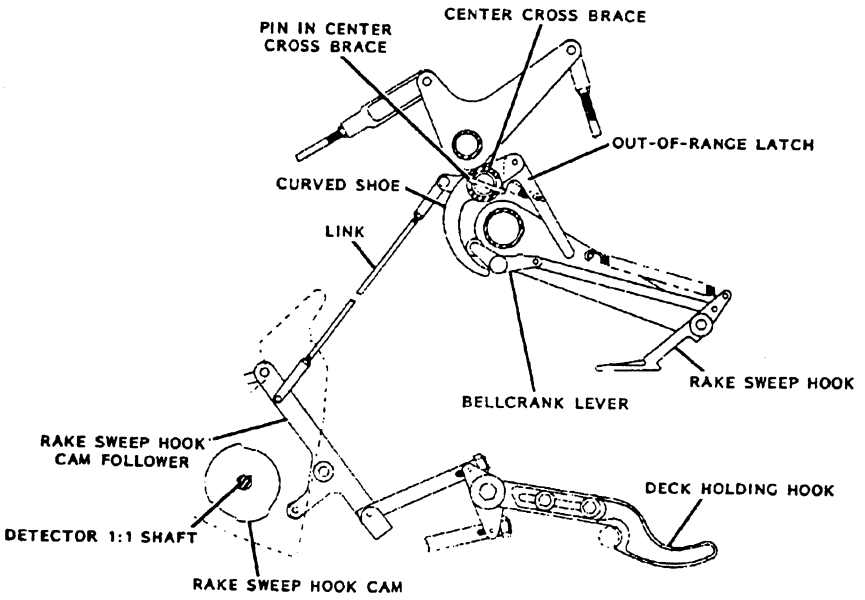
ADJUSTMENTS

21. OUT-OF-RANGE LATCH ADJUSTMENT

This adjustment is made to insure that the rake does not sweep during an out-of-range cycle.

1. Set a pin out-of-range and cycle the pinsetter until the clutch automatically disengages. Then turn off the power by opening the circuit breaker.

2. Loosen the large bolts which mount the center cross brace to the overhead frame and the "U" bolts which mount the control box to the center cross brace.



OUT-OF-RANGE LATCH ADJUSTMENT
FIGURE 27

3. Pull the out-of-range reset lever at the rear of the pinsetter and while holding it in its rearmost position, rotate the middle cross brace until the short inner arm on the out-of-range blocking latch just drops over the pin in the cross brace. Tighten the bolts. The cross brace may be rotated by placing a pin punch through one of the roll pins in the center cross brace. (Figure 27)

4. At the end of the out-of-range cycle, the front end of the link from the inner rake cam follower arm must come forward far enough to push the out-of range blocking latch off the pin in the cross brace. If the latch does not come off the pin, the pin may be carefully driven further into the cross brace.

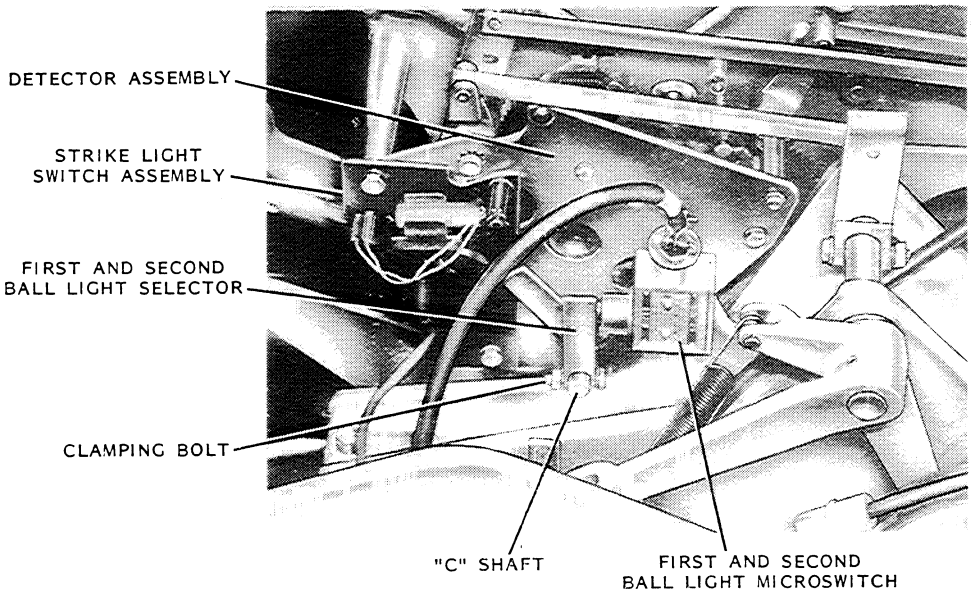
5. Tighten the mounting bolts.

6. After rotating the center cross brace, check the Trigger Switch Adjustment (Adjustment 6) and the Rake Lowering Stop Adjustment (Adjustment 3).

21 - 1ST AND 2ND BALL MICRO SWITCH

Another item to inspect of the detector assembly is the #1 and #2 ball micro switch.

Located at the front of the pinsetter are two lights, called the #1 and #2 ball lights, which indicate whether the bowler is throwing a first or second ball (see figure below).



Visually check to see that these lights are lit at the proper times. Of course, at the beginning of each frame, the #1 ball should be lit. After the first ball is thrown, the #2 ball light should light up, if the bowler has not rolled a strike.

Check that the first and second ball light selector presses against the micro switch button when the first ball should be lit and is away from the micro switch button when the second ball light should be lit. Refer to adjustment #46 to make corrections.

If the lights do not light up, check to see if they are burned out, and replace them if necessary.

If the problem is not a burned out bulb, it may involve the electrical wiring. In this case, note the problem on the tune-up sheet.

Do not attempt to correct any electrical problems by yourself since serious injury may result. Do so with a qualified mechanic.

ADJUSTMENTS

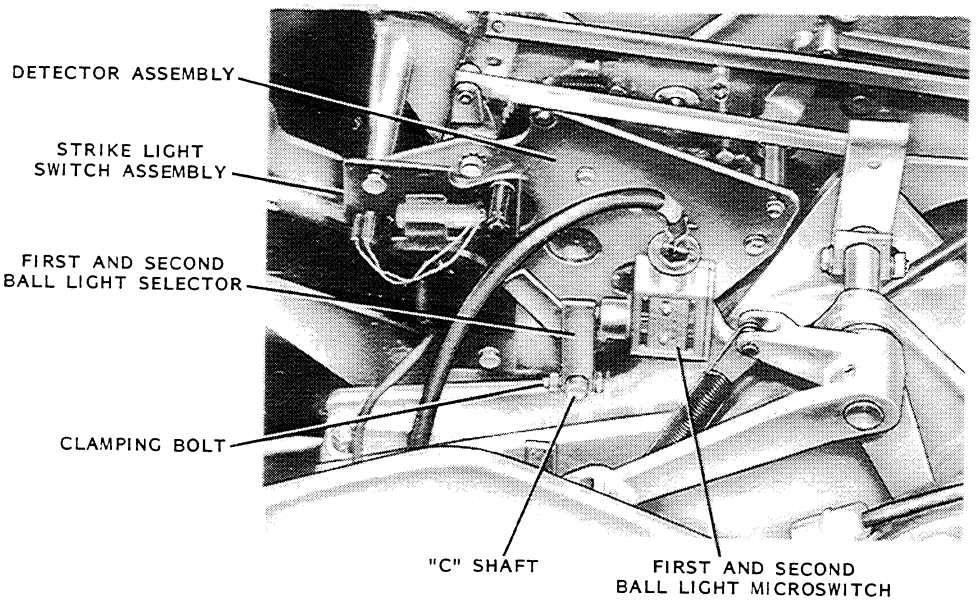
46. FIRST AND SECOND BALL LIFT MICROSWITCH ADJUSTMENT

This adjustment is made to insure that the first ball light is lit during the first ball cycle and then changes to the second ball light in the event that standing pins are left:

1. With the pinsetter at 0°, first ball, loosen the clamping bolt on the lever from the detector assembly that contacts the first and second ball light microswitch. (Figure 47)

2. Slowly push the lever against the button on the microswitch until the first ball light goes on and then carefully push the lever in another 1/16". Tighten the bolt.

3. As a check, cycle the pinsetter and observe whether the first and second ball lights operate at the proper time.



FIRST AND SECOND BALL LIGHT MICROSWITCH ADJUSTMENT

FIGURE 47

22 - STRIKE LIGHT SWITCH

In front of the pinsetter is the masking unit. A strike light is mounted near the bottom with the 1 & 2 ball lights. As its name implies, it lights up to indicate strikes.

Set up a strike situation and visually check to see that the strike light lights up. If it does not light up, check to see if the bulb has burned out and replace it if necessary.

If the bulb is not the problem, either the electrical wiring or the strike light switch may be malfunctioning. Refer to adjustment #52 to check for proper strike light switch adjustment.

Again, do not attempt to replace any faulty wiring on your own as this may result in serious injury. Correct as necessary with a qualified mechanic.

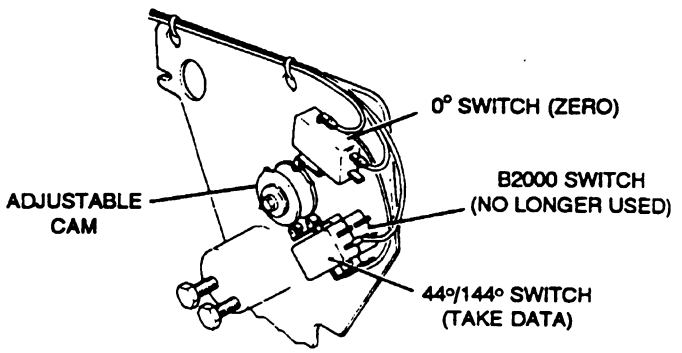
23 - SWITCH CLUSTER (AUTO SCORER)

The last item of the functional check for the detector is the switch cluster, for the auto scorer.

The switch cluster indicates what is happening in the pinsetter cycle. This includes:

- If a foul was committed
- The degrees the pinsetter is at during a cycle
- How many pins fell down

Briefly check to see that the switches are not loose, are in proper adjustment and are in good physical condition (see following figure). Also check to see that the wires are routed properly and that they do not interfere with any gears or moving parts. Refer to auto scorer manual for adjustments.



ADJUSTMENTS

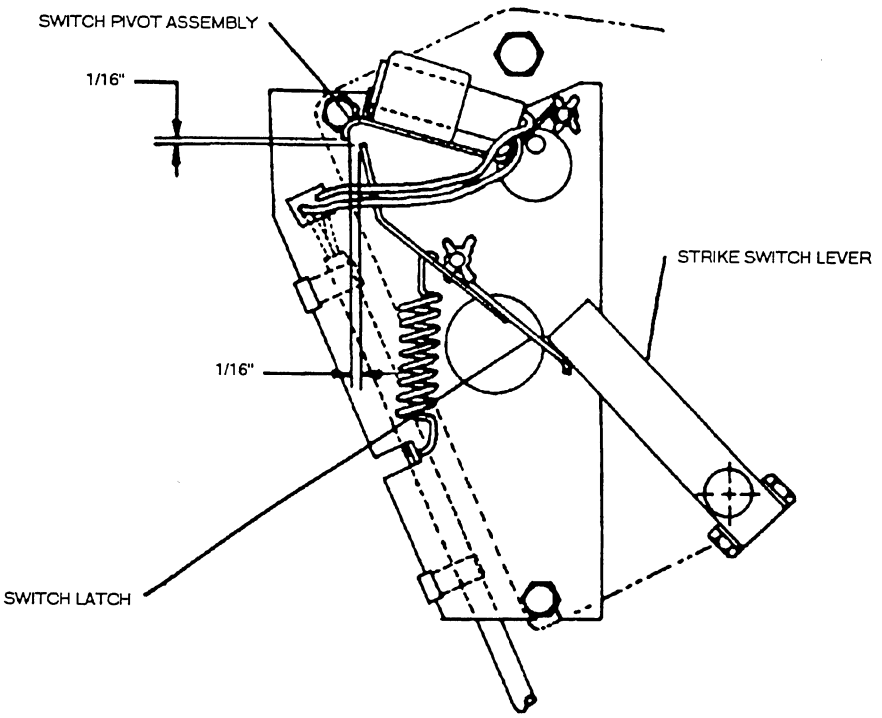
52. STRIKE LIGHT SELECTOR ADJUSTMENT

Cycle the pinsetter to 45 degrees second ball and adjust the strike mechanism as follows:

1. The upper mounting hole of the strike mechanism is slotted and the assembly can be moved forward or rearward. Position the assembly to obtain 1/16" clearance between the top of the switch latch and the bottom of the vertical end of the switch pivot assembly. Holding this 1/16" clearance, carefully tighten the two detector side plate bolts.

2. Position the first and second ball light microswitch lever to obtain 1/16" clearance between the front of the switch latch assembly and the rear of the vertical end of the switch pivot assembly. Holding this 1/16" clearance, carefully tighten the microswitch lever. This lever now becomes the strike switch lever.

3. As a check, cycle the pinsetter and observe if the Mercury Switch drops when a strike is detected at 90° and lifts at the end of the cycle.



Section V - Pit Conveyor

PIT CONVEYOR			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
SECTION V	24	PIT BOARD & CARPET																								
	25	SHAKER ASSY.																								
	26	POWER TRANSMISSION																								

24 - PIT BOARD AND CARPET

Moving on to the next major area of the functional check is the pit conveyor.

First, check the condition of the pit board and carpet. Inspect the carpet for wear and cleanliness. Thoroughly vacuum it so that dirt and dust are not carried back to the bowler.

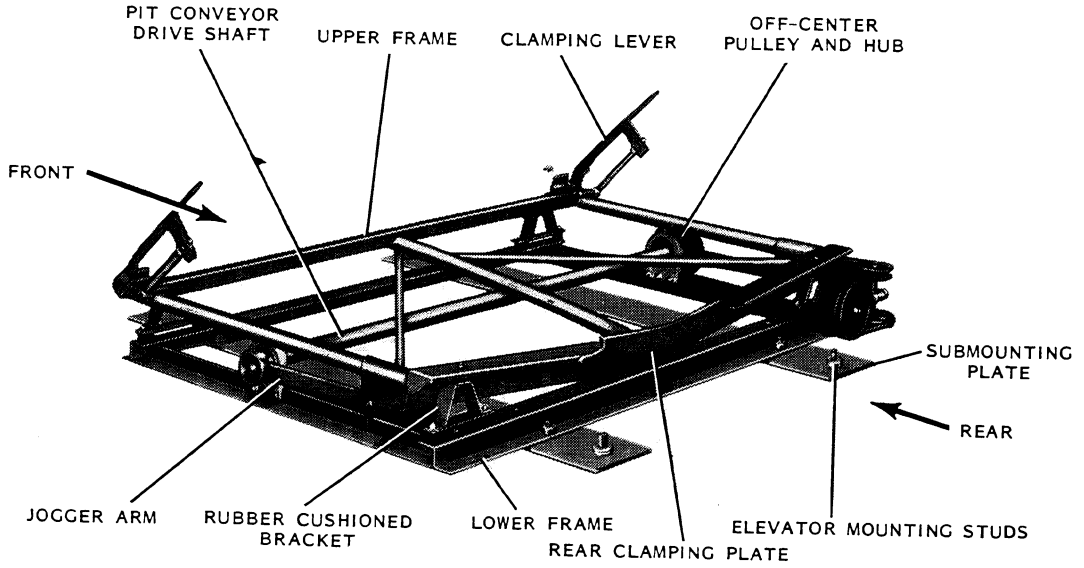
Remove the pit board and check its condition, make sure it is not broken.

On newer pinsetters the pit board is easily removed by a quick release mechanism. Older pinsetters will require a wrench to back out the three bolts which fasten it to the frame. Make sure you know if you are working with a newer or older model before attempting to remove the pit board.

Once the pit board is removed, check to see if the deflector plate bolts are in place and are tight.

25 - SHAKER ASSY

Now, check the shaker assembly (shown below). Inspect for broken or worn rubber or santoprene mounts. All cracked mounts must be replaced immediately since they will cause the good mounts to fail prematurely.



With the pinsetter on, check for a tapping or rapping metal-to-metal noise. This will indicate that the bearings are bad or that lubrication is insufficient.

Check the jogger arm bearings and cross shaft bearings for noise.

Correct any problems as necessary. Grab the frame to see if the submounting plate and mounting bolts are tight.

Check that the pit conveyor is the A.B.C. required distance below the lane surface of 4-3/4" min. Refer to adjustment #23 if adjustments are required.

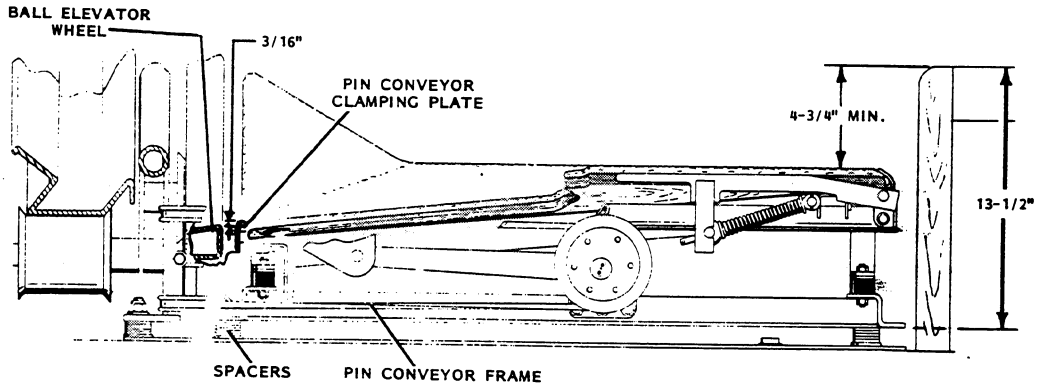
ADJUSTMENTS

23. PIT CONVEYOR ADJUSTMENT

This adjustment is made to insure that the pit conveyor is the A.B.C. required distance below the lane surface to prevent pins rebounding from the pit to the lane. The adjustment is also made to insure that the ball and pins will easily transfer from the pit to the elevator.

1. Remove the pit board from the pit conveyor and measure the distance from the lane surface to the bottom of the pit conveyor frame. This dimension should be 13-1/2" (±1/16) and can be obtained by adding or removing shims between the submounting plates and the pit conveyor frame. (Figure 29)

2. Check the pit conveyor frame at all four corners to insure that the frame is level. Shims can be added or removed between the submounting plates and pit conveyor frame to level the pit conveyor. Replace the pit board.



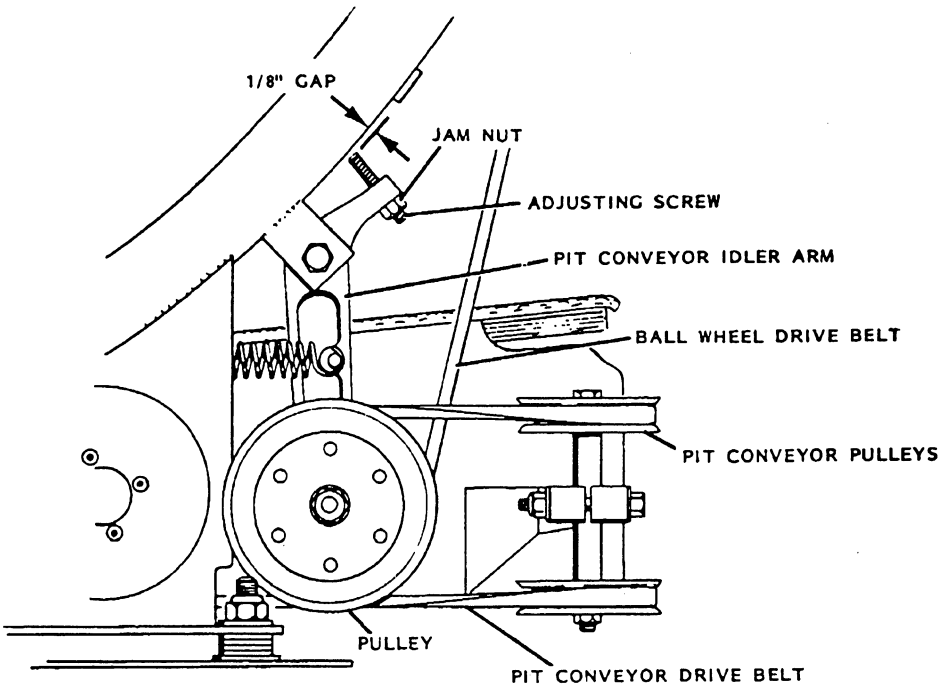
PIT CONVEYOR AND ELEVATOR FRAME ADJUSTMENTS

FIGURE 29

26 - POWER TRANSMISSION

The third item of the pit conveyor to inspect is the power transmission parts.

As shown below, inspect the belt that drives the shaker assembly. Check its condition, tension and alignment. The belt is properly aligned when the upper pulley is in the same line with the top of the pulley that is attached to the cross shaft. A properly aligned belt will minimize belt wear.



PIT CONVEYOR IDLER ARM ADJUSTMENT

This belt is considered a high failure belt because of the number of turns it makes. It is also considered a quick change belt, and if worn, should be replaced immediately.

The belt should not jump off the pulleys. If they jump off the pulleys, the pit conveyor idler arm will need an adjustment.

Refer to adjustment 30 and correct the problem.

Check for noise coming from the pulleys that might indicate bad bearings. Replace or lubricate as required.

Vacuum the dirt underneath the pit board.

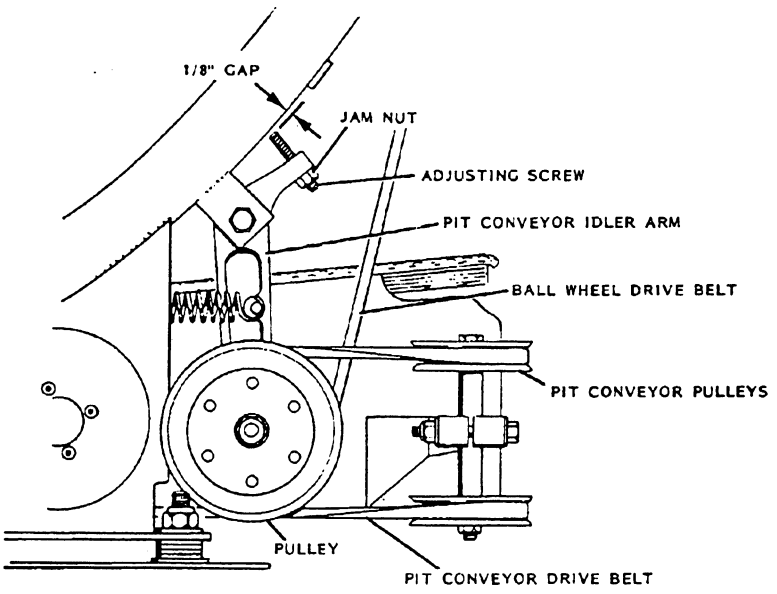
ADJUSTMENTS

30. PIT CONVEYOR IDLER ARM ADJUSTMENT

This adjustment is made to limit the travel of the pit conveyor idler pulley arm to prevent the pit conveyor belt from slipping off the pulley when installing a new belt.

1. Shut off the machine and loosen the adjusting screw jam nut on the pit conveyor idler pulley arm. (Figure 36)

2. Turn the adjusting screw until a clearance of 1/8" is obtained between the point of the set screw and the elevator frame. This 1/8" is measured with the machine turned off. Tighten the locknut.



PIT CONVEYOR IDLER ARM ADJUSTMENT
FIGURE 36

Section VI - Elevator Assembly

ELEVATOR ASSY.			1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
SECTION VI	27	BALL WHEEL	
	28	PIN WHEEL	
	29	POWER TRANSMISSION PARTS	
	30	BALL LIFT RODS	
	31	BALL RETURN TRACKS	
	32	PIN GUIDE & TURN PAN	
	33	STRUCTURAL PARTS	

27 - BALL WHEEL

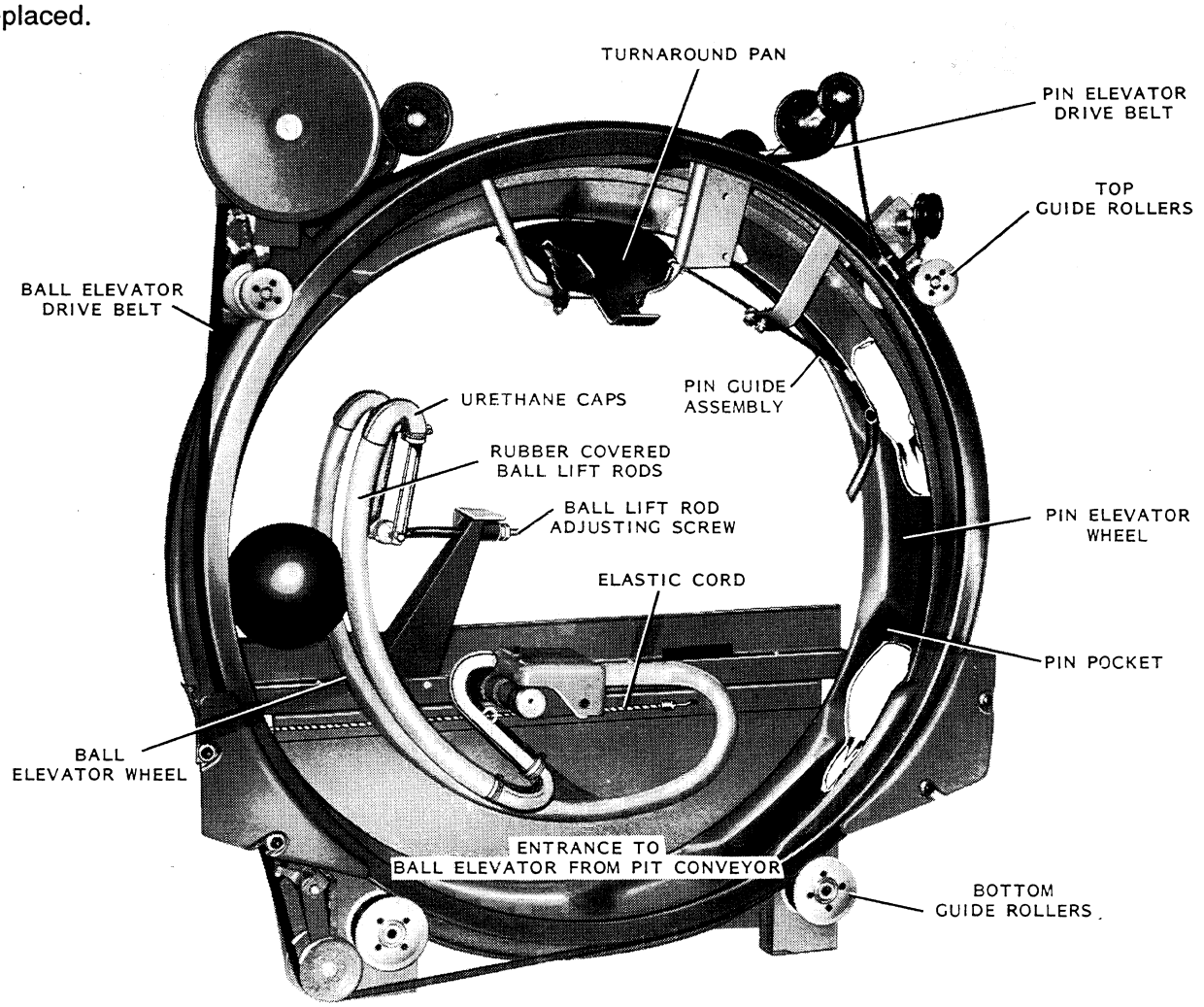
Let's continue the functional check looking at the items to inspect and correct for the elevator assembly (see following figure).

The first item to inspect is the ball wheel. The ball wheel should be tight so it doesn't wobble.

Turn on the pinsetter to check the ball's path. Make sure that the ball wheel picks up the ball, carries it to the top and deposits it on the ball return tracks.

The upper and lower guide roller which support the ball wheel must be in good condition.

Visually inspect for worn or broken tires and flanges. If the rollers or flanges are cracked, they need to be replaced.



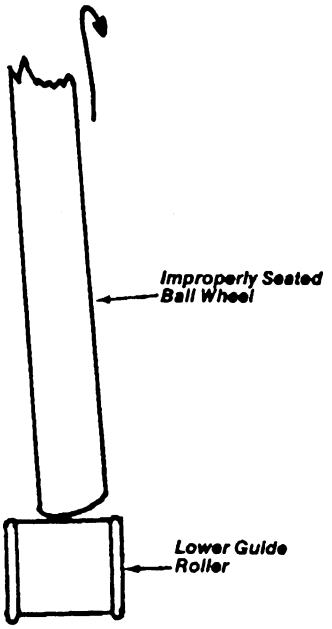
Turn on the pinsetter and listen for noisy bearings. Any unusual noise coming from the guide rollers indicates the bearings are bad. Correct any bad bearings or cracked rollers and flanges as necessary.

Inspect the condition of the ball wheel belt, making sure it is the endless type and not the spliced type. A frayed belt can be left on the machine since it is still functional. A broken belt, must be replaced.

If the belt breaks while the bowler is bowling, use a spliced belt for the time being as this is quicker than replacing it. Then, make a note that an endless type belt should be installed during a less busy time.

When checking the belt, make sure that it tracks properly and does not ride against the guide rollers.

Check to see that the ball wheel is properly seated on both lower guide rollers. When the ball wheel is improperly seated (as shown below), or tilted, excessive wear will occur on the guide rollers. Correct as necessary. Refer to adjustment #25.



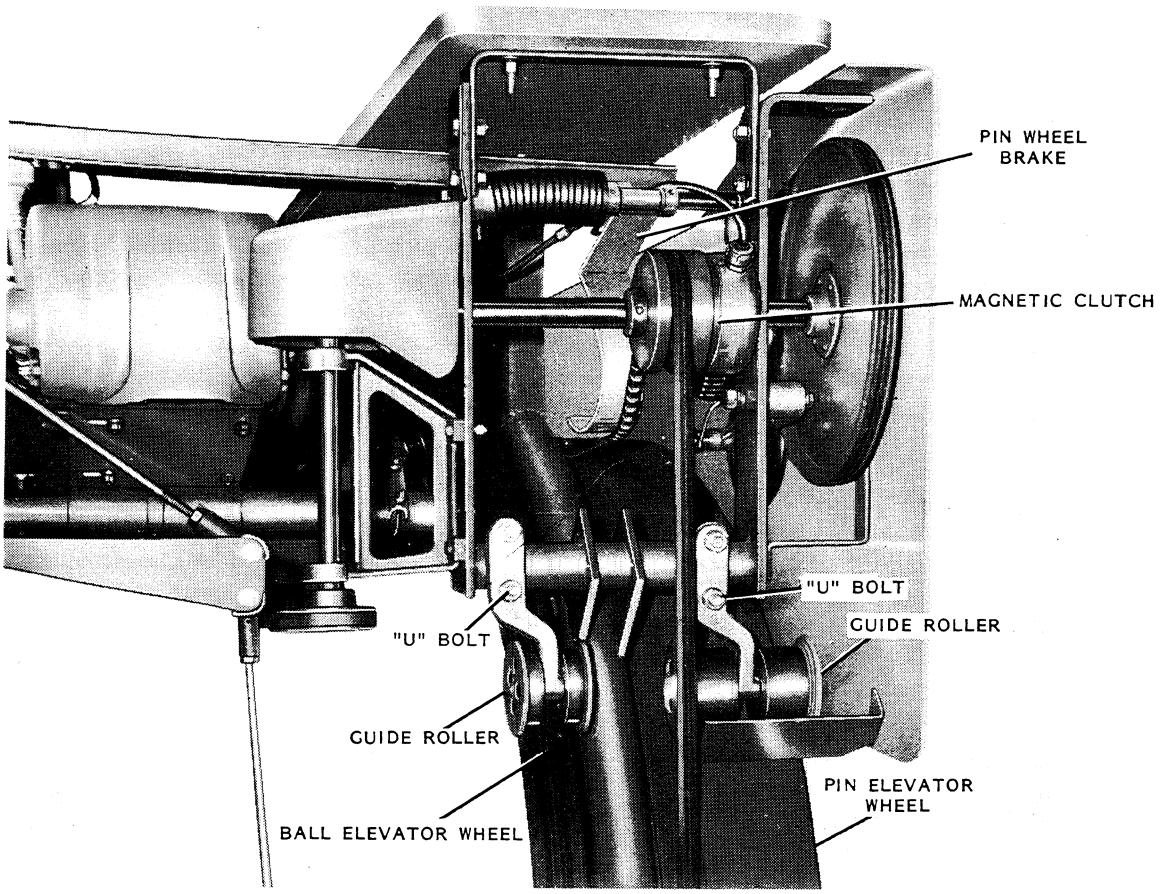
ADJUSTMENTS

25. ELEVATOR GUIDE ROLLER ADJUSTMENT

This adjustment is made to prevent undue wear to the guide rollers or to the ball and pin wheels.

1. Release the spring-loaded belt tension pulleys on each wheel's drive belt.

2. Loosen the "U" bolts on all four upper guide rollers (two each wheel) and move them upward until they lose contact with the wheels. (Figure 30)



ELEVATOR GUIDE ROLLER ADJUSTMENT
FIGURE 30

PIN WHEEL

3. Check to insure that the elevator pin wheel is properly seated on both the lower guide rollers.

4. Lower the two upper guide rollers on the pin wheel until they just contact the wheel and tighten the "U" bolts.

NOTE: Slowly rotate the wheel by hand and observe if an out-of-round condition exists, causing binding in the rollers at the high spots of the wheel. If such high spots exist, loosen the "U" bolts and set the guide rollers so that the rubber in the rollers contacts the wheel at the high spots.

ADJUSTMENTS

BALL WHEEL

5. To adjust the ball wheel, loosen set screws on the collars on both sides of the idler pulley arm that provides spring tension for the ball wheel belt. Slide the idler pulley arm forward or rearward to align the idler pulley with the ball wheel drive pulley. Snug the collars against both sides of the idler arm and tighten the set screws.

6. Check to insure that the ball wheel is properly seated on both the lower guide rollers.

7. Lower the two upper guide rollers until they just contact the wheel and tighten the "U" bolts. (Figure 30)

NOTE: Slowly rotate the wheel by hand and observe if an out-of-round condition exists, causing binding in the rollers at the high spots of the wheel. If such high spots exist, loosen the "U" bolts and set the guide rollers so that the rubber in the rollers contacts the wheel at the high spots.

NOTE: Check jack shaft pulley for centering with belt. Note also, that the rollers should be checked periodically for proper adjustment.

NOTE: Check pin wheel brake for centering on pin wheel belt. Lock set screws in collars on each side of pin wheel brake.

The following adjustments, number 26-28 are closely related and changing one will affect the others. For efficient ball pickup, ball transfer and preference bar operation, care must be taken when changing one adjustment, to make compensation adjustments as required. These adjustments should be made in the sequence indicated.

28 - PIN WHEEL

The next item to inspect is the pin wheel. Since the pin wheel operates much like the ball wheel, the inspection procedures are the same.

The upper and lower guide rollers are checked for bad bearings and worn or broken tires and flanges. If these conditions exist, correct them as necessary. The pin wheel belt is also checked to make sure that it is in good condition and that it is the endless type.

The pin wheel should be properly seated on the lower guide rollers with no interference from machine parts or kickbacks. Proper seating will prevent excessive wear of the guide rollers.

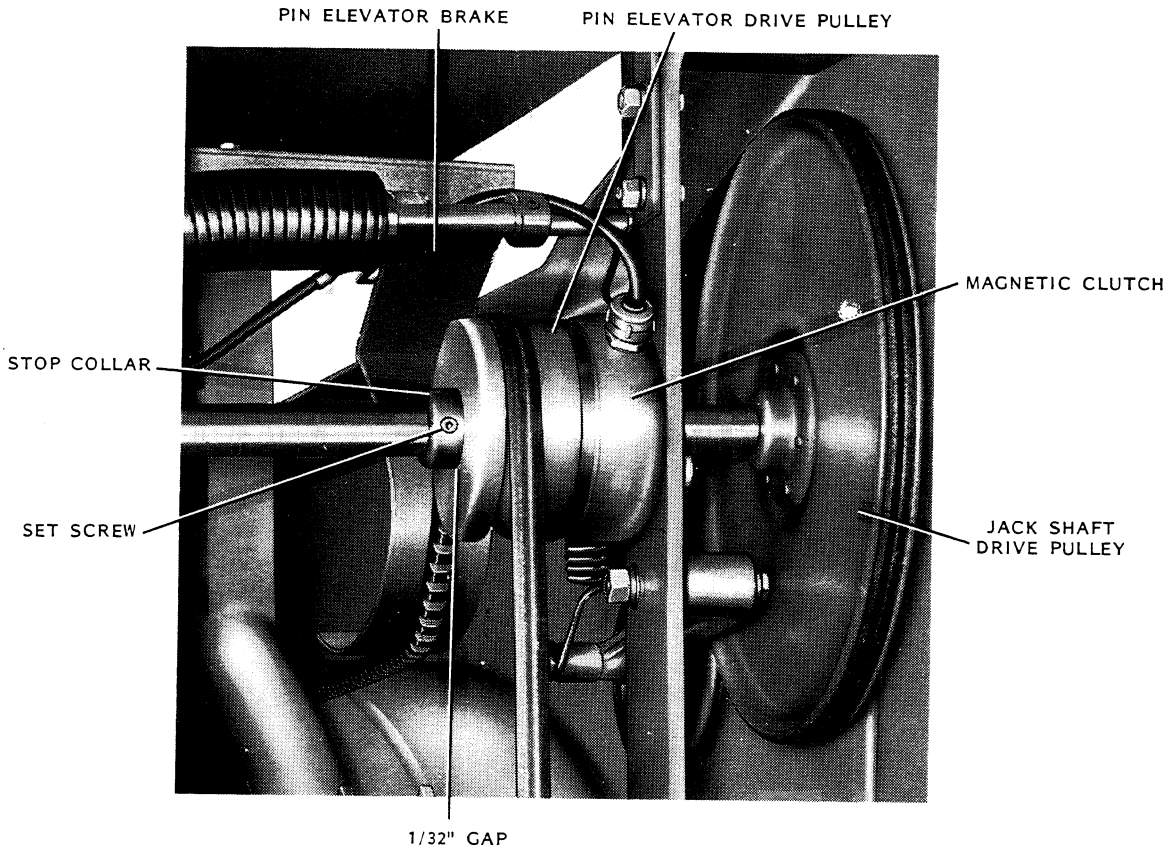
In addition to proper seating, the pin wheel should not ride against the elevator frame. If it rests or rides against the frame, an adjustment will be needed. Refer to previous adjustment #25.

29 - POWER TRANSMISSION PARTS

The next item listed on the preventive maintenance schedule is the power transmission parts.

The jack shaft should be tight enough in its mountings so that there is no play (see figure below). Rap on the jack shaft to check its tightness. Listen for noise coming from the bearings. Any noise will indicate bad bearings and should be corrected as necessary.

The magnetic clutch, if working properly, will disengage when two pins are lifting both rollers on the side of the cross conveyor. If the magnetic clutch does not disengage, an adjustment will be necessary. To make the adjustment, refer to adjustment #45.



ADJUSTMENTS

45. MAGNETIC CLUTCH ADJUSTMENT

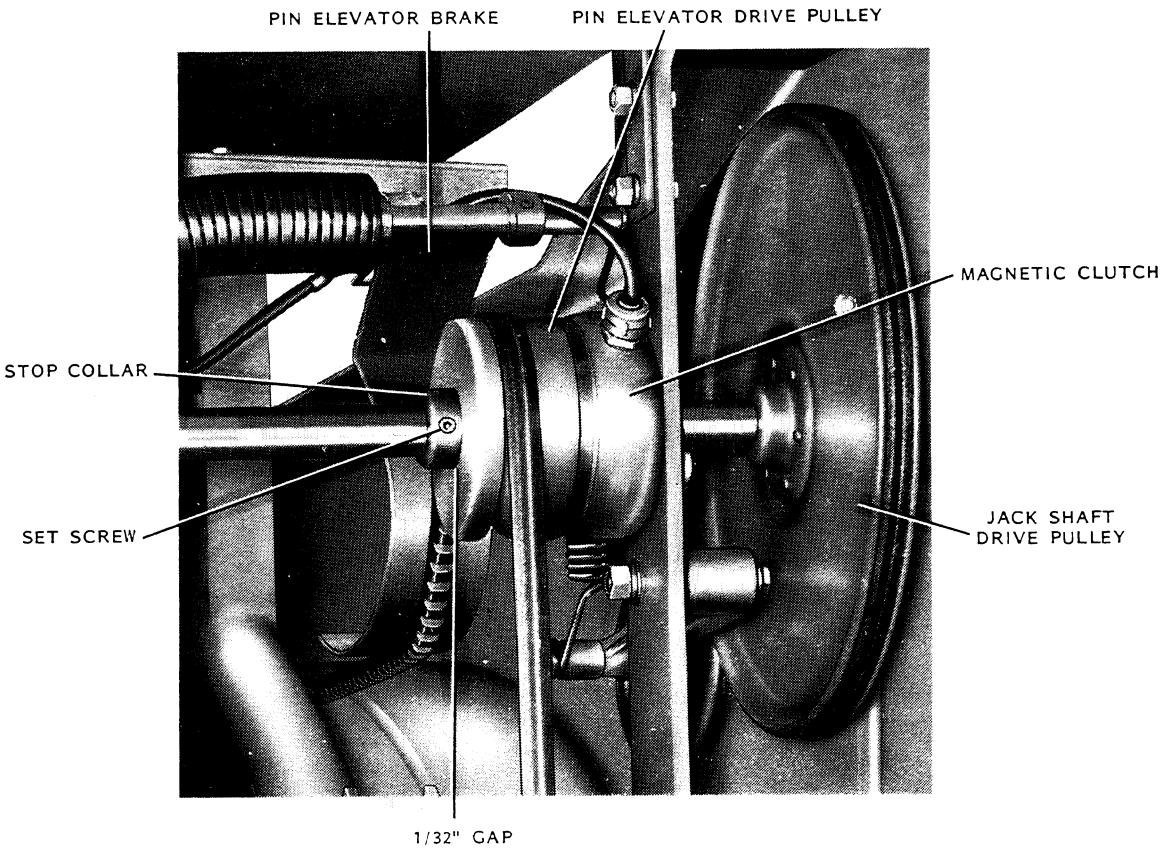
This adjustment is made to insure that the magnetic clutch has sufficient clearance to disengage and to insure that the magnetic clutch will be de-energized when both levers on the cross conveyor are raised at the same time.

1. With the clutch de-energized (power shut off), loosen the set screw on the stop collar which positions the pin elevator drive pulley. (Figure 45)

2. Push the pulley firmly against the magnetic clutch.

3. Set the gap between the pulley and the stop collar at 1/32". Tighten the set screw.

4. Latch the pin gate so that no pins can be delivered to the turret and allow two pins to be delivered to the cross conveyor and be stopped by the latched pin gate.

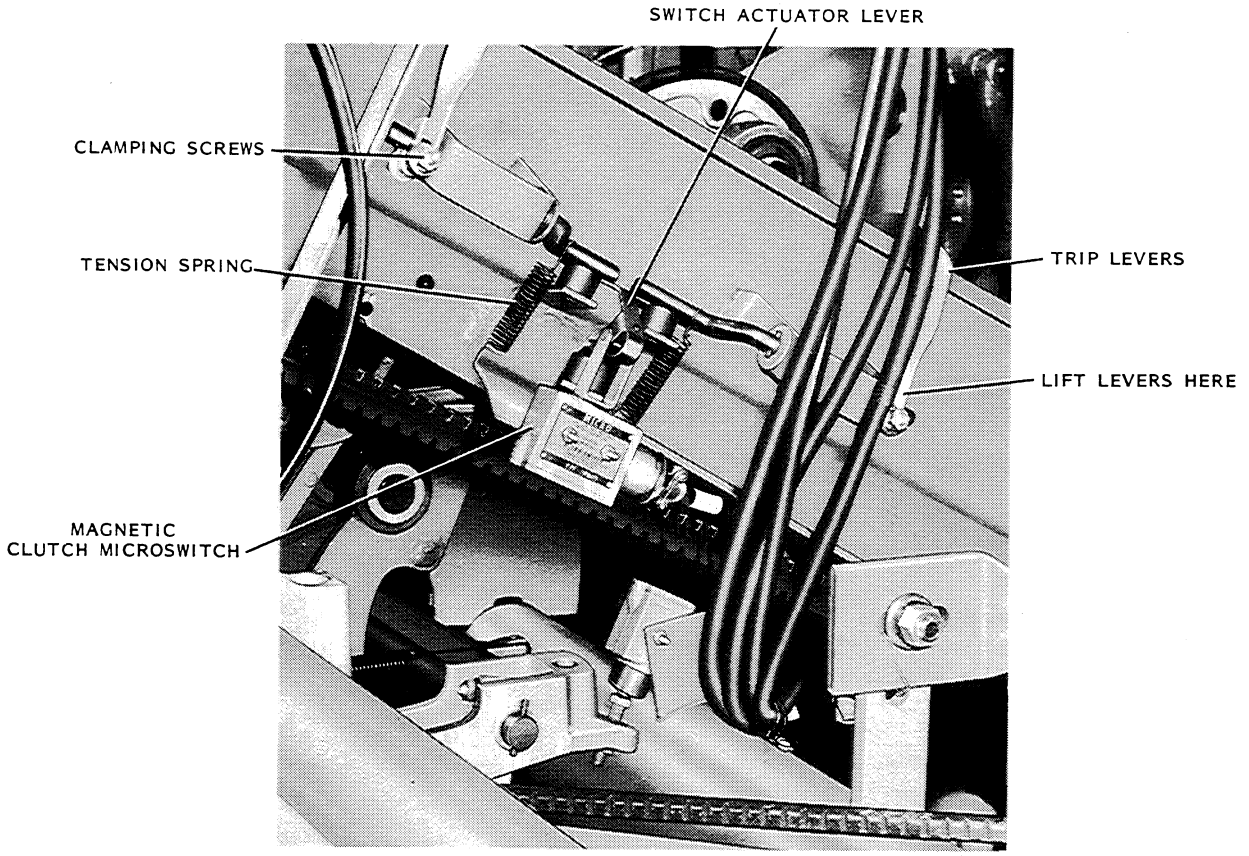


MAGNETIC CLUTCH ADJUSTMENT

FIGURE 45

ADJUSTMENTS

5. Loosen the two clamping screws at the ends of the trip levers. While holding the rollers firmly against the pins on the cross conveyor, push the lower ends of both levers down against the microswitch. While holding the rollers on the pins, slowly lift the lower ends of both trip levers, until the microswitch just clicks, indicating the switch has opened. Tighten the clamping screws to hold the levers in this position. (Figure 46)



CROSS CONVEYOR MICROSWITCH ADJUSTMENT

FIGURE 46

30 - BALL LIFT RODS

Another item to inspect and correct is the ball lift rods (shown below). The ball lift rod covers should be reasonably clean, and should not be stretched or ripped. If the rod covers are worn along the ball contact area, they should be turned slightly to expose a new contact area.

Check for cracks or worn areas on the rubber bumpers and replace them as necessary.

The ball lift rods should be operating correctly. If they fail to lift the ball and place it on the ball return tracks, an adjustment is necessary. Refer to adjustments 26 and 27 to make the adjustment.

ADJUSTMENTS

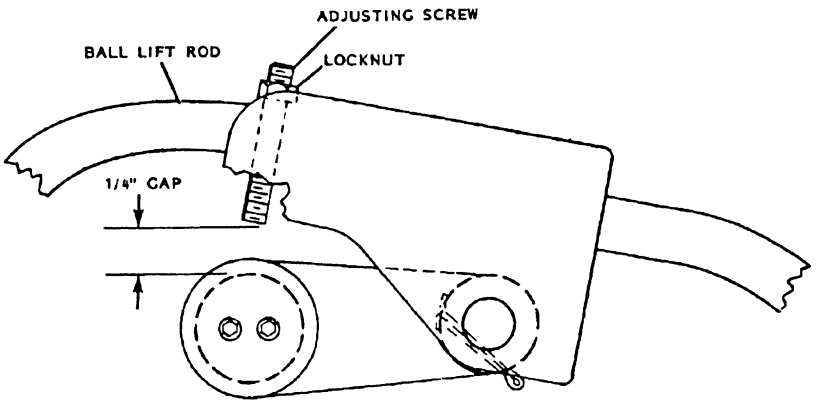
26. BALL LIFT ROD ADJUSTMENT

This adjustment is made to obtain maximum ball pickup efficiency.

1. Make sure the elevator frame (Adjustment 24) and the elevator guide rollers (Adjustment 25) are correct.

2. Place a standard size ball between the lift rods and ball elevator wheel, and manually rotate the ball elevator wheel until the ball wedges itself, thus lifting the ball lift rods. Loosen the jam nuts and turn the adjusting screw on the clapper block until the bottom of the screw is 1/4" (±1/16) from the surface of the lower clapper block (Figure 31).

3. Place a standard size ball between the ball lift rods and ball elevator wheel near the top of the lift rods. Loosen the jam nut and turn the adjusting nut on the spring rod until a 9/16" (+1/16 -0) gap is obtained between the rubber bumper and the ball trip bracket. Tighten the jam nut against the adjusting nut. (Figure 32)



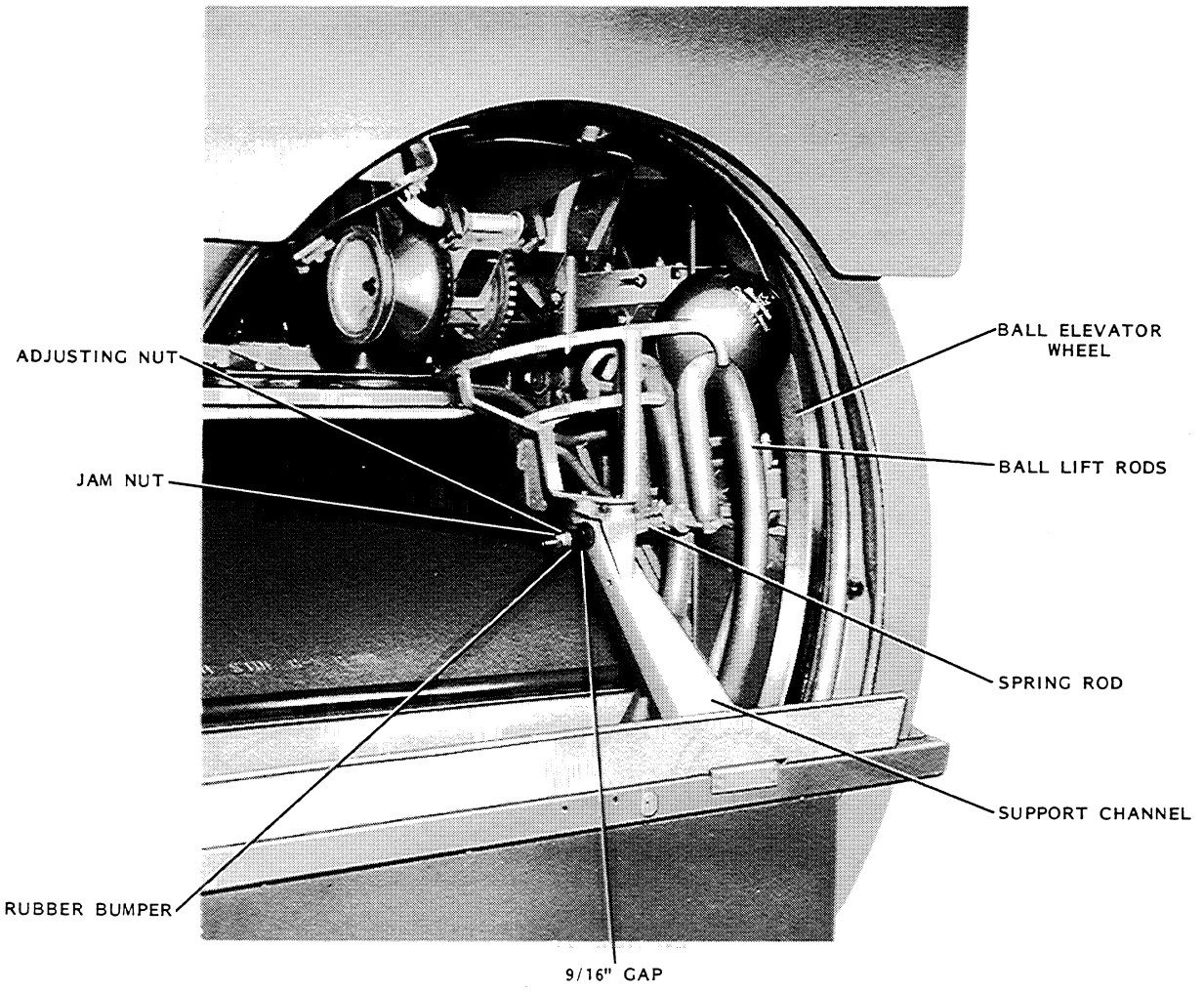
BALL LIFT ROD ADJUSTMENT
FIGURE 31

4. Place a standard size ball at the lower center of the ball wheel so that it is resting against the rear ball lift rod. With the pit conveyor in its rearmost position, there should be 1/16" minimum clearance between the lower portion of the ball and the rear edge of the pit conveyor clamping plate.

5. If the clearance is less than 1/16", check the Elevator Guide Roller Adjustment (Adjustment 25), Pit Conveyor Adjustment (Adjustment 23) and Elevator Frame Adjustment (Adjustment 24). If all adjustments are correct, the ball lift rods must be raised to increase the dimension. To raise the ball lift rods, loosen the locknut on the upper clapper block and turn the adjusting screw until the 1/16" dimension is obtained. Tighten the jam nut.

6. Check the ball lift rods to assure they are parallel with the ball lift wheel.

ADJUSTMENTS



BALL LIFT ROD ADJUSTMENT

FIGURE 32

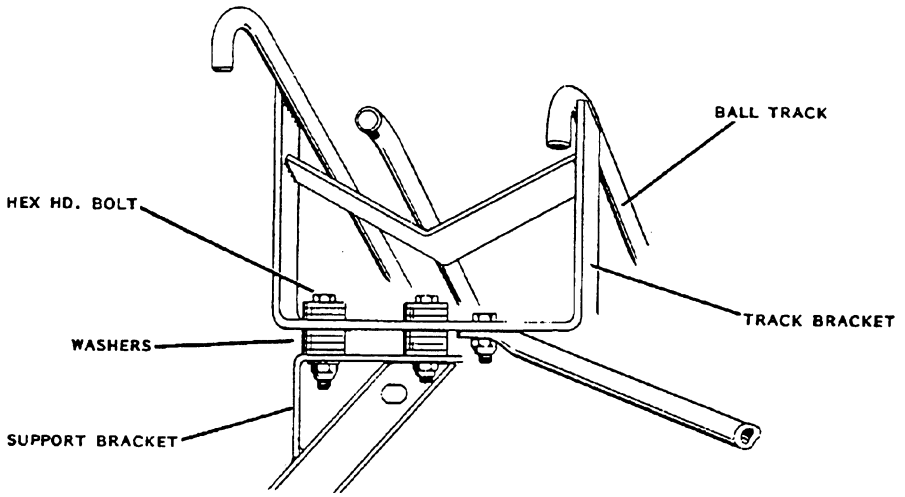
27. BALL TRANSFER ADJUSTMENT

This adjustment is made to obtain smooth ball transfer from the ball lift rods to return tracks, and from the return tracks to the switch track and accelerator track.

1. If rough transfer is observed as the ball transfers from the lift rods to the return tracks, the return tracks must be adjusted at the junction with the ball lift rods.

2. Remove the two bolts that secure the ball track to the support channel. Add or remove shim washers between the support channel and ball track bracket to obtain the proper height of the tracks. (Figure 33)

ADJUSTMENTS



BALL TRANSFER ADJUSTMENT

FIGURE 33

NOTE: Extra shim washers are placed between the bolt head and track bracket. If the track must be raised, move the required amount of shim washers from the top of the track bracket and insert them between the bracket and support channel. Conversely, if the track must be lowered, transfer the proper amount of shim washers from under the bracket to the top of the bracket.

3. Replace and tighten both mounting bolts.

4. When the tracks have been raised, a careful check must be made to insure that the end of the tracks do not contact the ball, thereby causing possible damage to the ball.

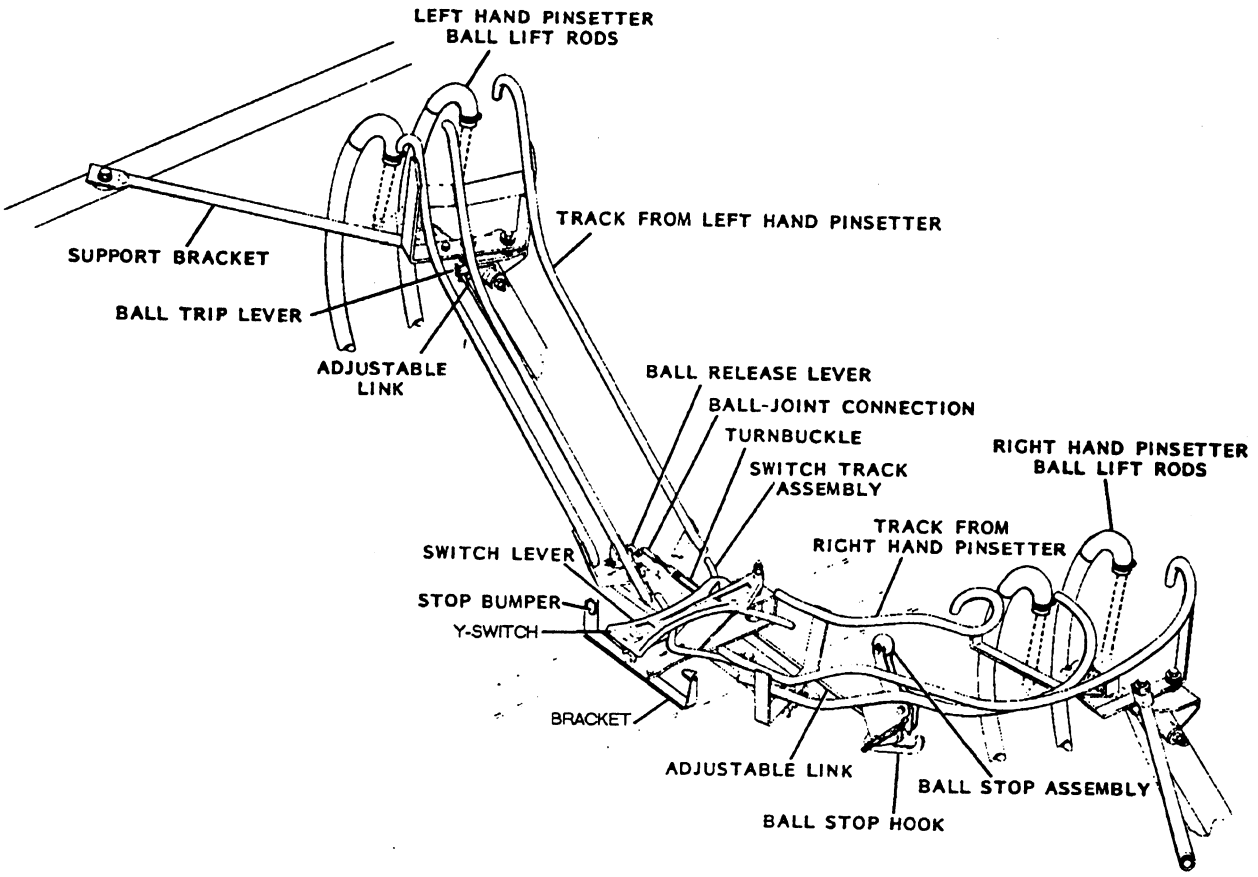
5. Place a ball in the pit and slowly jog the pinsetter until the ball is at the top of the ball lift rods. At this point, check the position of the track ends with relation to the ball. If the track ends can contact the ball, the track must be carefully bent down to avoid any possible ball contact. Extreme care must be taken to avoid distorting the rest of the track or the mounting brackets, when bending the track ends down.

6. Loosen both hex bolts that mount the switch track assembly to the kickback mounting plates and center the switch track assembly with the accelerator. Shims must be added under the low side of the switch track to assure that it is level from side to side within 1/16".

7. Slide the switch track assembly forward or rearward to obtain smooth transfer between the return tracks, switch track and accelerator track. Tighten the hex bolts. Check the switch lever stops for alignment to accelerator track.

31 - BALL RETURN TRACKS

The ball return tracks are the next item to inspect (see following figure).



CENTRAL BALL RETURN

Check the physical condition of the return tracks, paying close attention to the weld joints and the mounting bolts.

As the ball travels from the ball lift rods to the ball return tracks, it is dropped onto the return tracks. In time, this repeated dropping of the ball can cause the weld joints and mounting bolts to break or become loosened.

If any weld joints or mounting bolts are loose, tighten them immediately. Any broken weld joints should be repaired as soon as possible.

The Y-switch must be properly aligned with the ball accelerator for a smooth ball transfer and to prevent a ball stop. If the Y-switch is bent out of shape and contacts the bracket, it must be bent back to original shape.

The stop bumpers, which position the Y-switch to drop the ball onto the accelerator, should not be worn. If they are worn enough to cause the Y-switch to hit the bracket, they must be replaced.

The preference system, which prevents two balls from meeting at the common switch track assembly at the same time, should work properly to insure that a ball stop will not occur.

The easiest way to check the preference system is to place a ball on the right and left pinsetter tracks. If the arm on the left hand pinsetter comes up and locks the arm on the right hand pinsetter, you know the preference system is working properly. If both balls collide at the Y-switch, the preference system is not working. Record this on the stop sheet. Refer to adjustment #28 to make the adjustment.

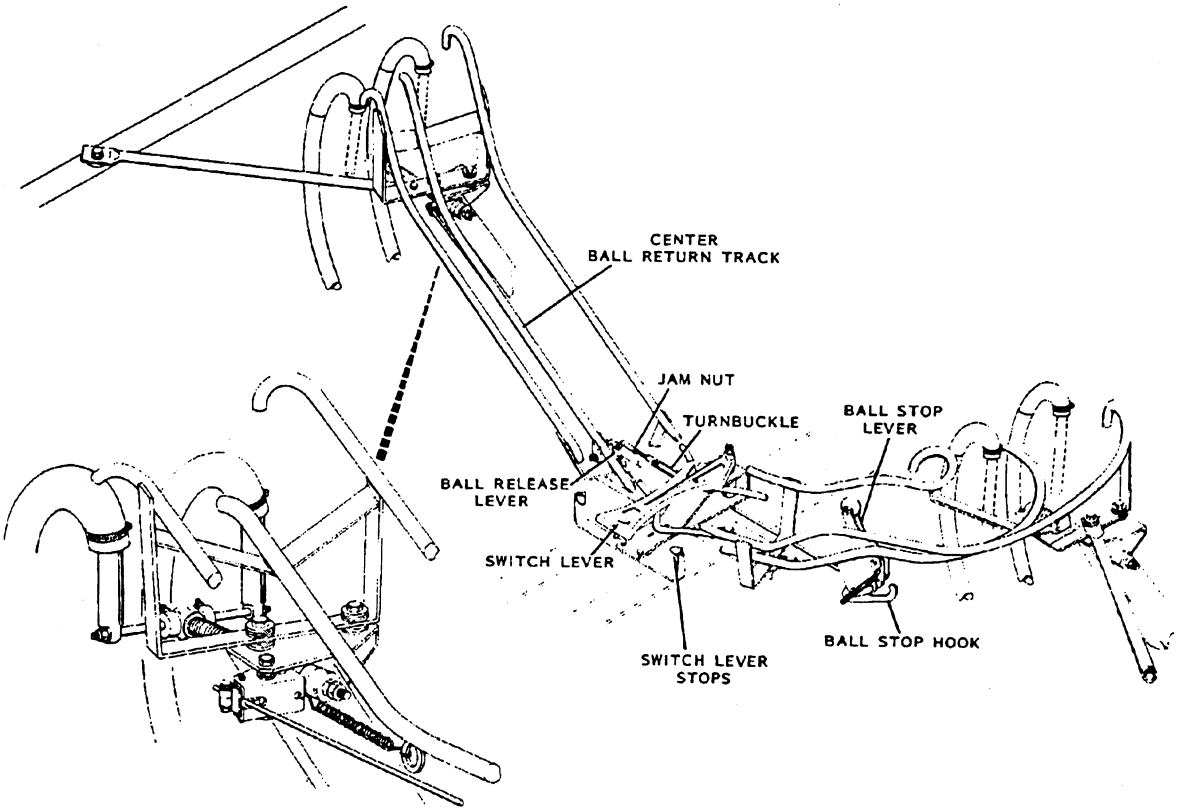
Finally, wipe the ball tracks with a dry cloth or one moistened with pinsetter cleaner, since dirt and grease can easily be transmitted back to the bowler.

ADJUSTMENTS

28. BALL PREFERENCE ADJUSTMENT - CENTER RETURNS

This adjustment is made to prevent two balls from adjacent pinsetters from meeting at the common switch track assembly.

1. Loosen the jam nuts at both ends of the turnbuckle on the rod that connects the ball stop hook to the ball release lever. (Figure 34)



BALL PREFERENCE ADJUSTMENT

FIGURE 34

2. While holding the ball stop hook in its unlatched position, turn the turnbuckle until the extreme end of the ball release lever is at the same height as the top of the center track. Tighten both jam nuts.

3. With the ball stop hook still in its unlatched position, place a standard size ball between the ball lift rods and the ball elevator wheel of the left hand pinsetter. Stop the machine as the ball nears the top of the lift rods.

4. Check the gap between the ball trip bracket and the rubber bumper on the spring rod. This dimension must be 3/8" (+1/16 -0). Readjust if required.

ADJUSTMENTS

5. Remove the ball and unlatch the ball stop hook. Loosen the locknut on the stop clamp. Position the clamp to obtain a 1/32" (±1/64) gap between the clamp and the block. Tighten the locknut.

6. As a check, allow a standard size ball to be lifted and placed on the return track which rotates the ball trip lever, thus rotating the ball stop hook in its latching position. At this time, allow a second ball to roll against the ball stop lever on the mating return track. The latching action of the hook should prevent rotation of the ball stop lever, thereby stopping the second ball.

   As the first ball continues to roll and approaches the switch track assembly, it will depress the ball release lever and pivot the ball stop hook to its unlatching position. The weight of the second ball should rotate the ball stop lever and proceed to the switch track. Readjust if necessary.

7. Check all pivot points of the ball preference mechanism to insure that all components have freedom of motion.

32 - PIN GUIDE AND TURN PAN

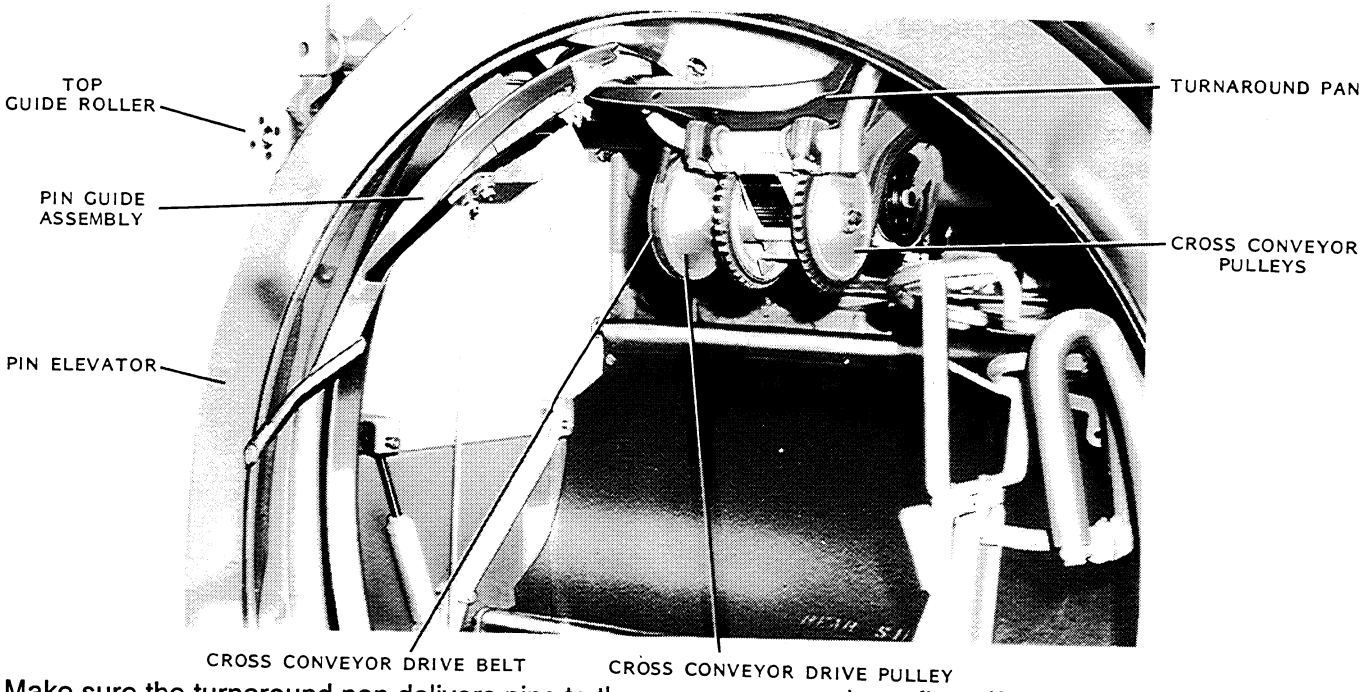
The pin guide and turnaround pan should be checked next.

Circulate the pins through the system to make sure they are held securely by the pin guide and that they are properly released to the turnaround pan for orientation.

Pins that are delivered base first to the turnaround pan should not ride up the opposite side of the pan.

To make a pin guide adjustment, refer to adjustment #32. Whenever a pin guide adjustment is made, a turnaround pan adjustment must also be made because they are directly related to each other.

Check the turnaround pan to see how easily it pivots up and down (see following figure). As pins drop into the pan, the back of the pan should move up and down no more than 1/2".



Make sure the turnaround pan delivers pins to the cross conveyor base first. If a turnaround pan adjustment is required, refer to adjustment #31.

ADJUSTMENTS

32. PIN GUIDE ADJUSTMENT

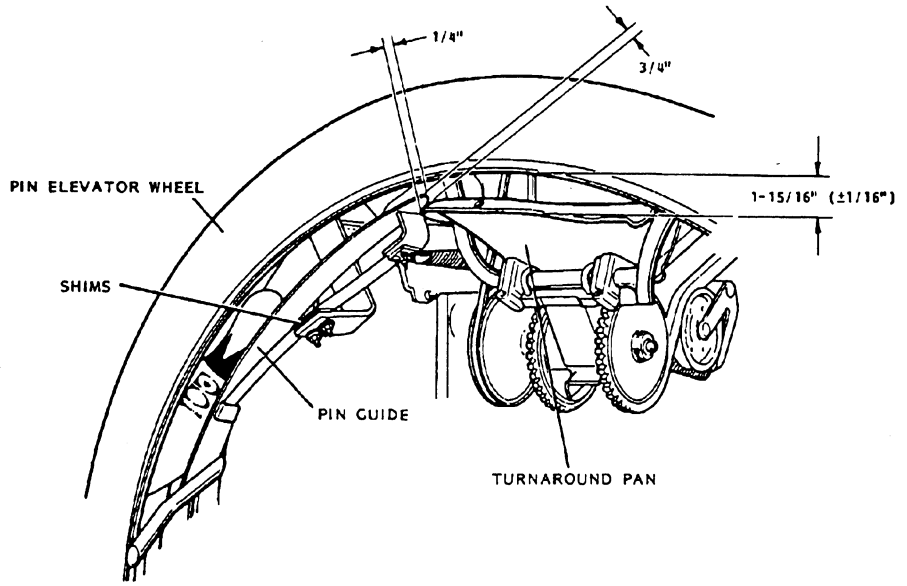
This adjustment is made to insure that the pins are held securely in the pin elevator and that they are properly released to the turnaround pan for head first orientation.

NOTE: Adjustments 31 and 32, Turnaround Pan and Pin Guide Adjustments, are directly related to each other, and changing one will affect the other.

1. Center the cross conveyor and turnaround pan between the elevator frame prior to pin guide adjustment. Loosen the "J" bolts to center the cross conveyor and turnaround pan.

2. The pin guide must be positioned with the lip of the pin guide 3/4" (±1/16) above the top edge of the turnaround pan. This dimension may be obtained by adding or removing shims between the steel spring and mounting bracket.

3. Loosen the two pin guide mounting bolts and position as follows: The mounting holes are oversized for adjustments. Pivot the top of the pin guide forward until the top end of the pin guide is 1/4" (±1/16) beyond the top edge of the turnaround pan. (Figure 37)



TURNAROUND PAN ADJUSTMENT
FIGURE 37

4. As a check, observe the action of pins being delivered head first and base first to the turnaround pan. Pins delivered base first should be properly oriented to ride half way up the side of the turnaround pan.

5. The pin guide assembly may require readjustment to compensate for proper orientation of base first and head first pins by the turnaround pan. Moving the pin guide forward at the top will cause the pins to be delivered later on the turnaround pan, while moving the pin guide rearward will cause the pins to be delivered earlier to the turnaround pan. The pin guide should be positioned to obtain optimum performance of base first and head first pins.

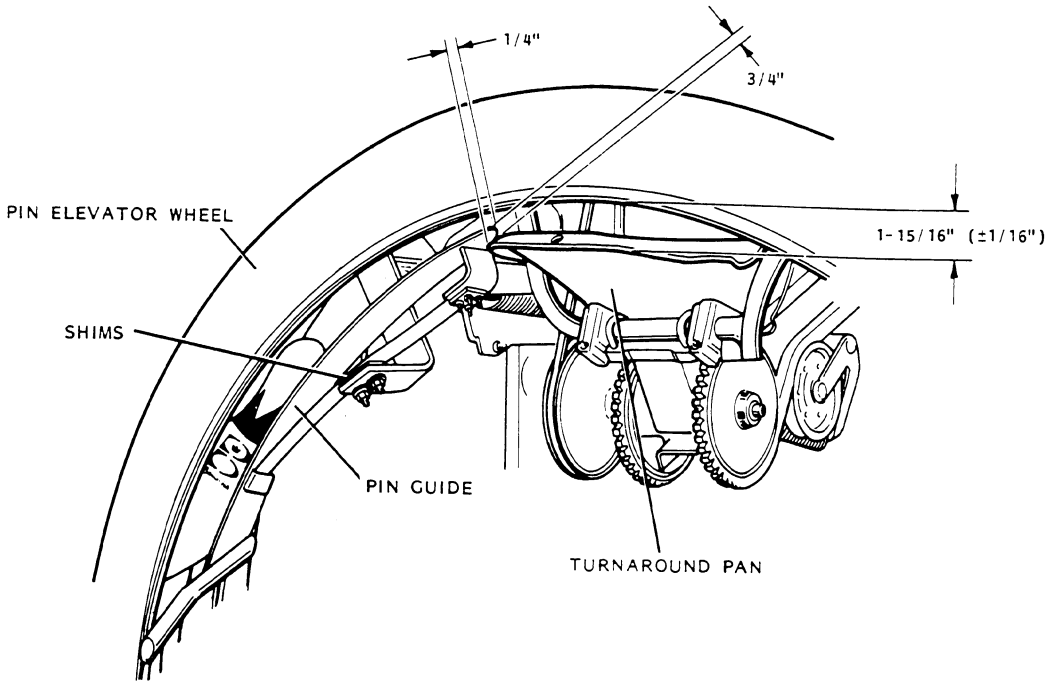
ADJUSTMENTS

31. TURNAROUND PAN ADJUSTMENT

This adjustment is made to insure that the turnaround pan orients pins base first on the cross conveyor whether they are received head first or base first from the pin elevator.

1. With the turnaround pan in its normal, spring-urged position, measure the vertical distance from the bottom, rear edge of the turnaround pan to the rear inside edge of the pin elevator wheel. This dimension must be 1-15/16" (±1/16). (Figure 37)

2. Carefully bend the tongue of the turnaround pan to obtain the desired dimension.

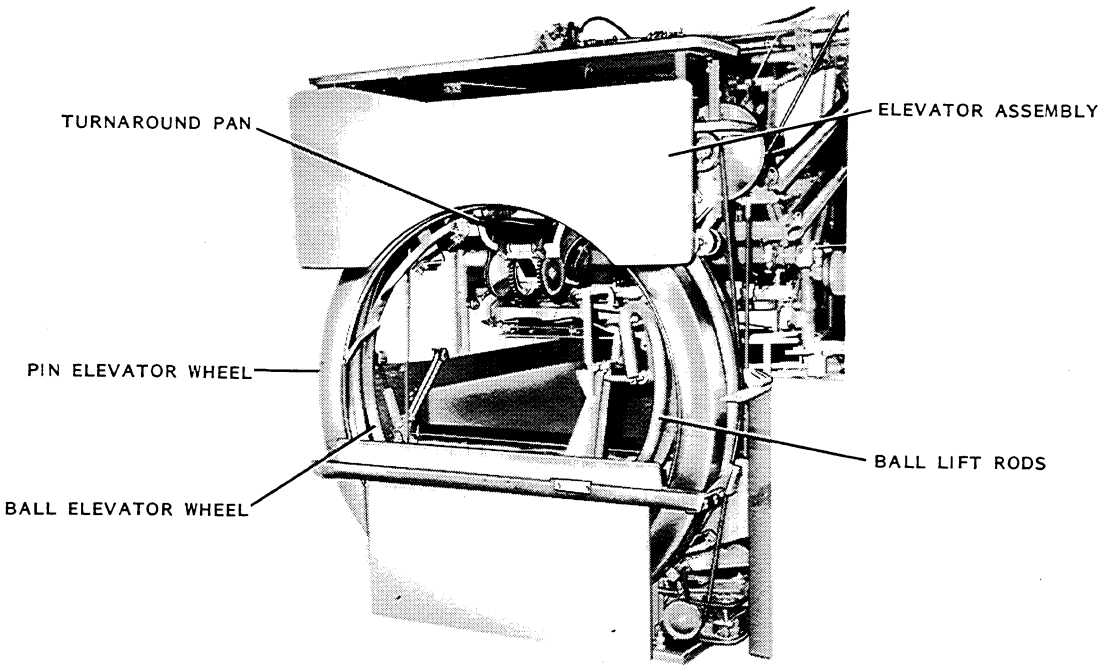


TURNAROUND PAN ADJUSTMENT
FIGURE 37

33 - STRUCTURAL PARTS

Finally, the structural parts of the elevator assembly are checked.

To prevent damage to the pins and pinsetter, the pin deflector plates must be present and mounted tightly. If they are missing, replace them (shown below).



The rear guard assembly and the top board must also be tightly mounted. Check the condition of the welds and tighten all loose nuts and screws immediately.

Check that elevator frame is vertical with a plumb line or vertical level. Check that front edge of ball elevator wheel is 3/16" (+0 - 1/16) below the rear clamping plate of the pit conveyor. Refer to adjustment #24 to make adjustments.

ADJUSTMENTS

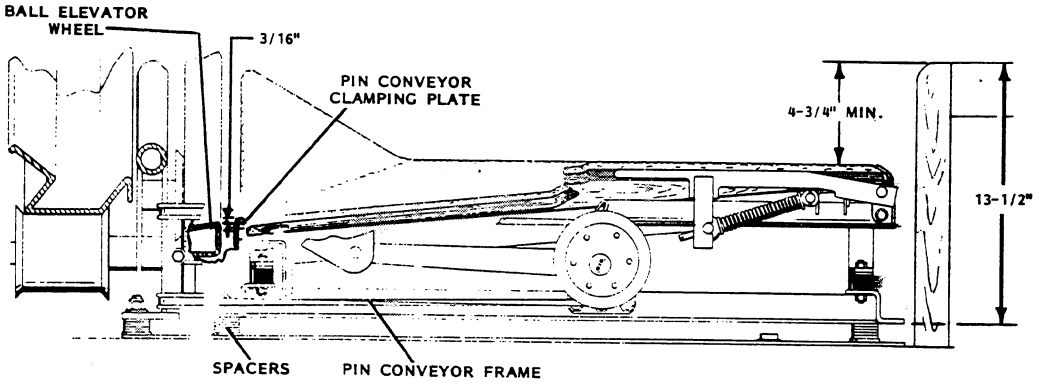
24. ELEVATOR FRAME ADJUSTMENT

This adjustment is made to insure that the elevator frame is positioned correctly.

1. Place a vertical level or plumb line on the elevator frame and loosen the mounting bolt in the slot of the motor mount shaft, both mounting bolts to the kickback mounting plates and both "J" bolts at the rear of the cross conveyor.

2. Tilt the elevator frame forward or rearward until the frame is plumb. Tighten all bolts.

3. Position the elevator frame assembly so that the front edge of the ball elevator wheel is 3/16" (+0 -1/16) below the rear clamping plate of the pit conveyor. This dimension can be obtained by adding or removing shims between the submounting plates and the elevator mounting feet. (Figure 29)



PIT CONVEYOR AND ELEVATOR FRAME ADJUSTMENTS

FIGURE 29

Section VII - Cross Conveyor

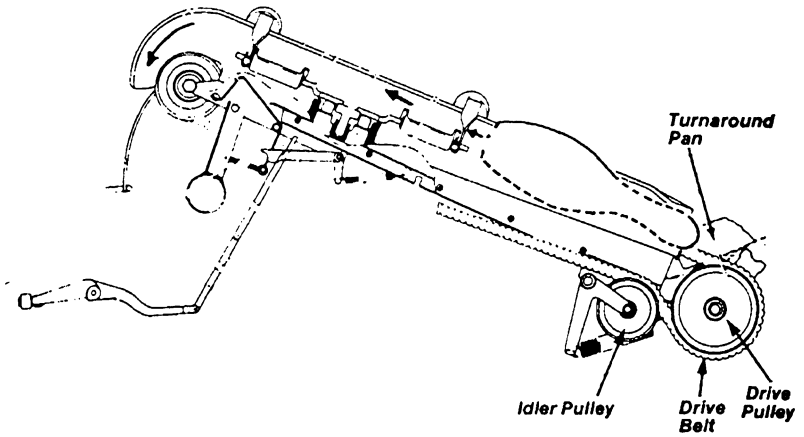
CROSS CONVEYOR			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
SECTION VII	34	POWER TRANSMISSION																								
	35	MICRO SWITCH																								
	36	PIN GATE																								
	37	SNUBBER																								

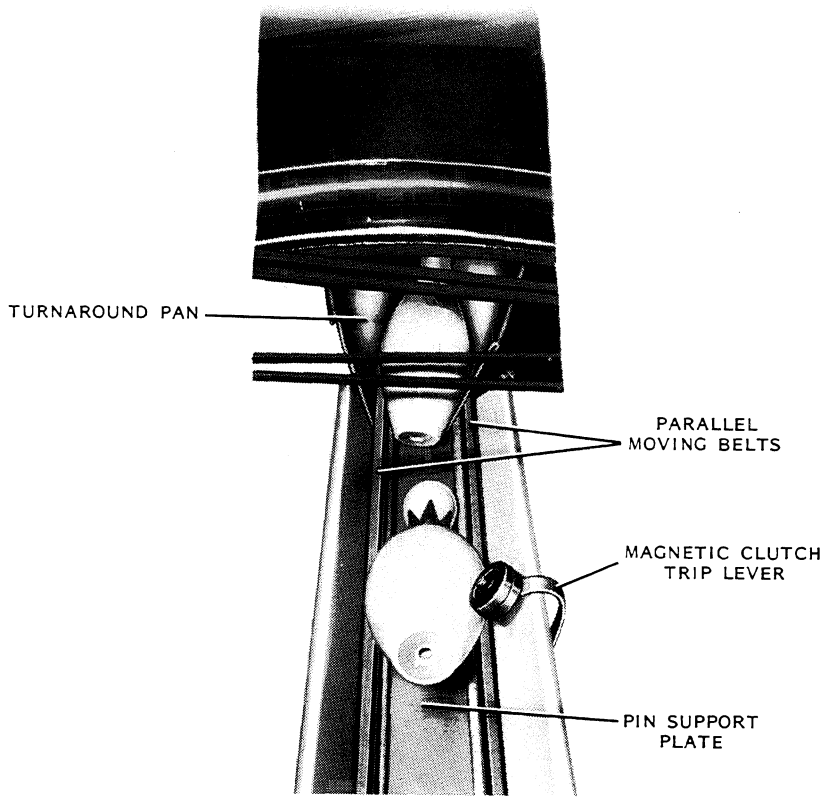
34 - POWER TRANSMISSION

The next area of the functional check is the cross conveyor. As you recall, the pins travel base first up the conveyor toward the turret. They are carried by two parallel conveyor belts.

Check the condition of the two parallel conveyor belts to make sure they move the pins up the cross conveyor and that they are not broken.

Check the drive belt to insure that it is aligned to minimize belt wear and properly tensioned. Refer to adjustment #33.





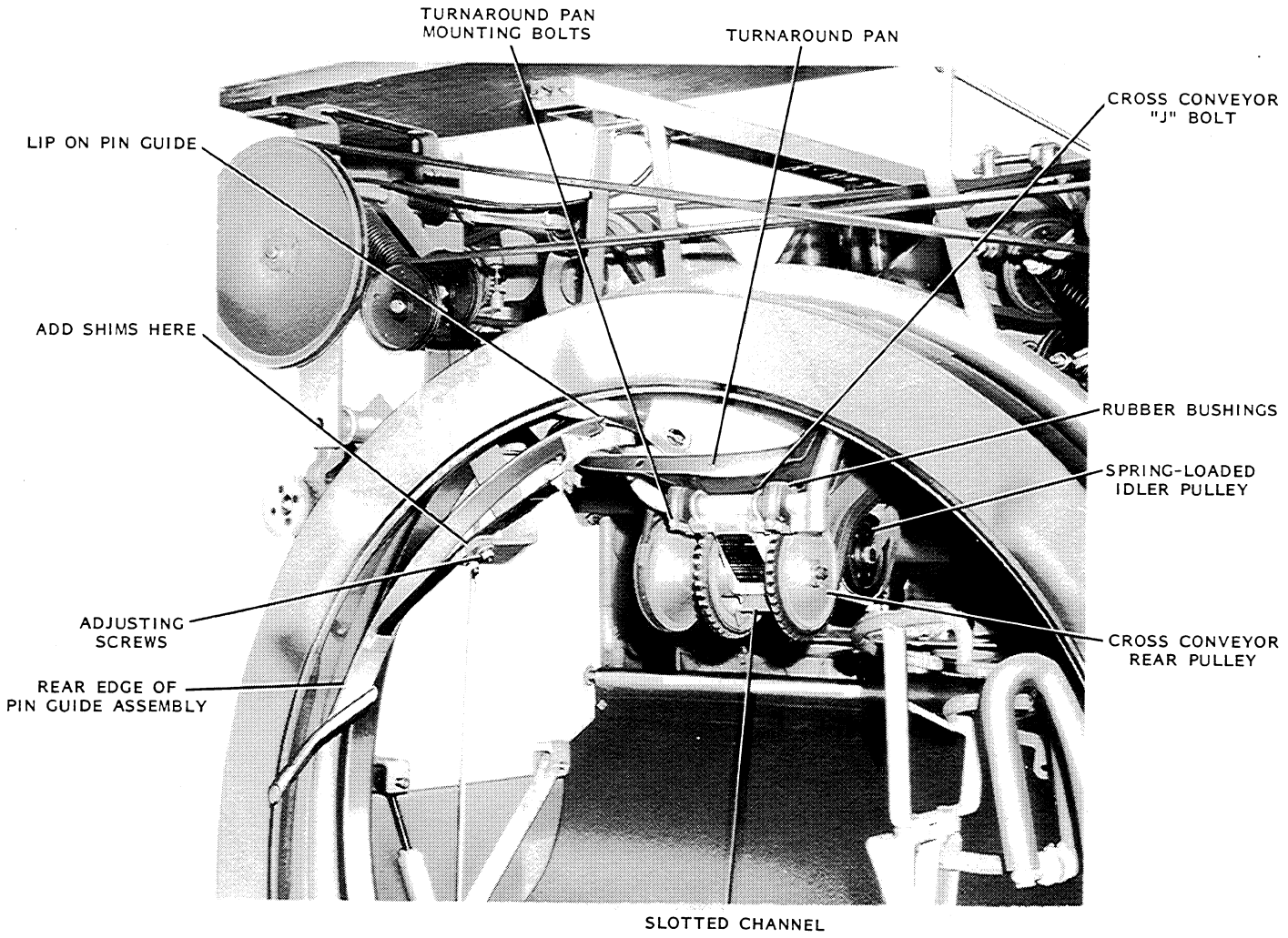
ADJUSTMENTS

33. CROSS CONVEYOR BELT ADJUSTMENT

This adjustment is made to insure that the belts are properly tensioned to carry the pins up the cross conveyor to the turret.

1. Remove the spring-loaded idler pulleys from the cross conveyor belts and loosen the rear pulley assembly "J" bolts and the lower bolts in the slotted channel. (Figure 38)

2. Swing the rear pulley assembly tot he rear until the belts are tensioned. Tighten the bolts and replace the spring-loaded idler pulleys. Make certain that the belts do not rub against the idler pulley arms. A-2 converted machines may have idler pulleys. Factory A-2 machines have no idlers.



PIN GUIDE AND CROSS CONVEYOR ADJUSTMENTS
FIGURE 38

35 - MICRO SWITCH

Another item to check on the cross conveyor is the micro switch (as shown below).

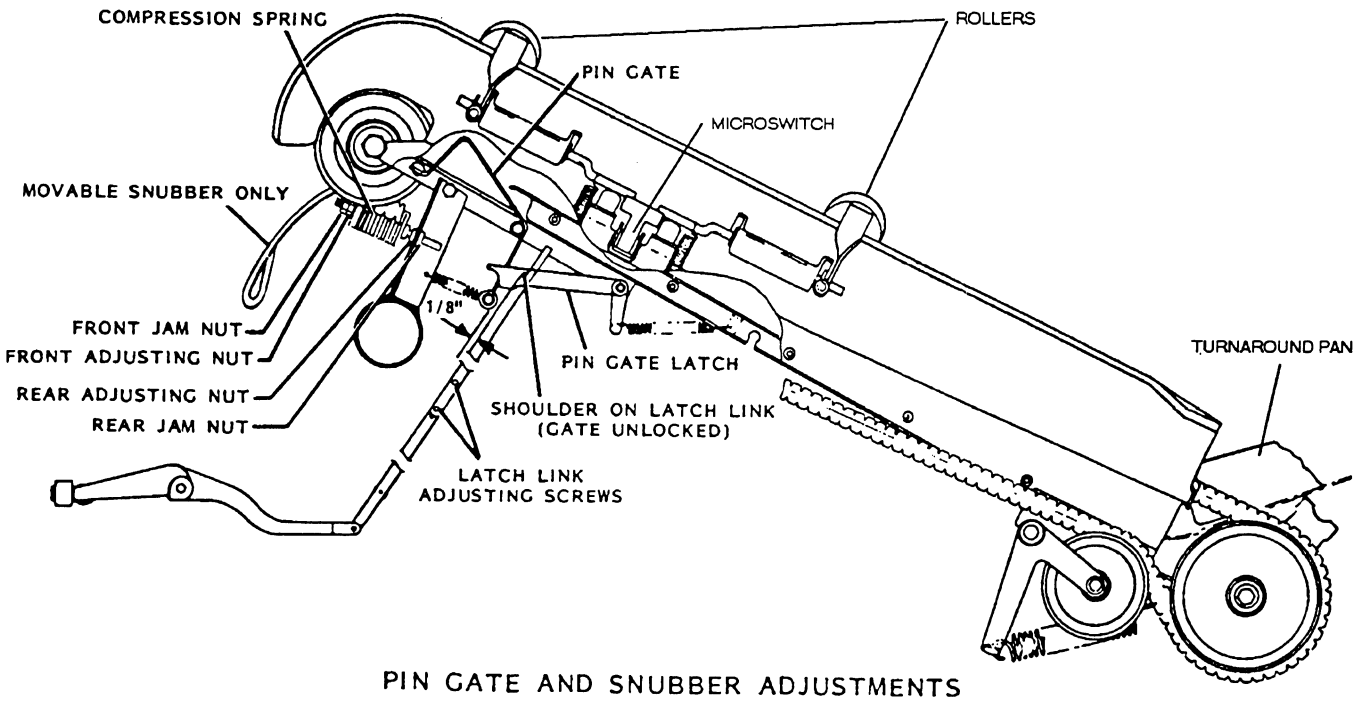
Check the micro switch by turning on the pinsetter and watching the pins travel up the cross conveyor. Hold three pins in the cross conveyor. The pins will lift up both rollers, which open the micro switch. When the micro switch opens, the pin wheel should stop through the disengagement caused by the magnetic clutch. If the pin wheel does not stop, an adjustment may be needed. Refer to adjustment #45.

36 - PIN GATE

The last two items to check on the cross conveyor are the pin gate and the snubber. Inspect the linkage of the pin gate for wear. Correct as necessary.

Turn on the pinsetter to check the operation of the pin gate. The pin gate (shown below) should lock each time a pin travels over it. This prevents two pins from being delivered to the turret at the same time. Once the turret indexes, the pin gate unlocks.

If two pins are delivered at the same time, the pin gate will need an adjustment. Refer to adjustment #34 to make the adjustment.



PIN GATE AND SNUBBER ADJUSTMENTS

37 - SNUBBER

Check the snubber for loose bolts and tighten them if necessary. Check to make sure that the snubber properly seats the pins in the turret.

Refer to adjustment #39 for any corrections.

ADJUSTMENTS

45. MAGNETIC CLUTCH ADJUSTMENT

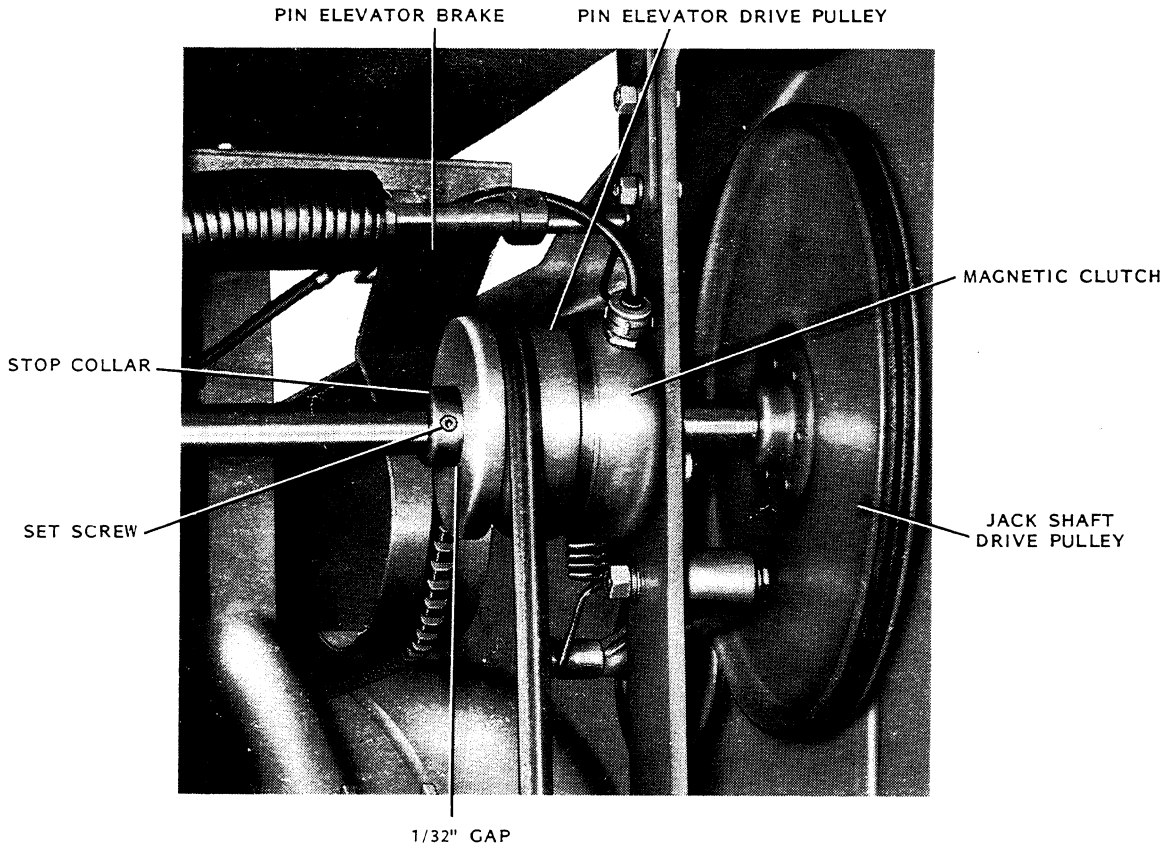
This adjustment is made to insure that the magnetic clutch has sufficient clearance to disengage and to insure that the magnetic clutch will be de-energized when both levers on the cross conveyor are raised at the same time.

1. With the clutch de-energized (power shut off), loosen the set screw on the stop collar which positions the pin elevator drive pulley. (Figure 45)

2. Push the pulley firmly against the magnetic clutch.

3. Set the gap between the pulley and the stop collar at 1/32". Tighten the set screw.

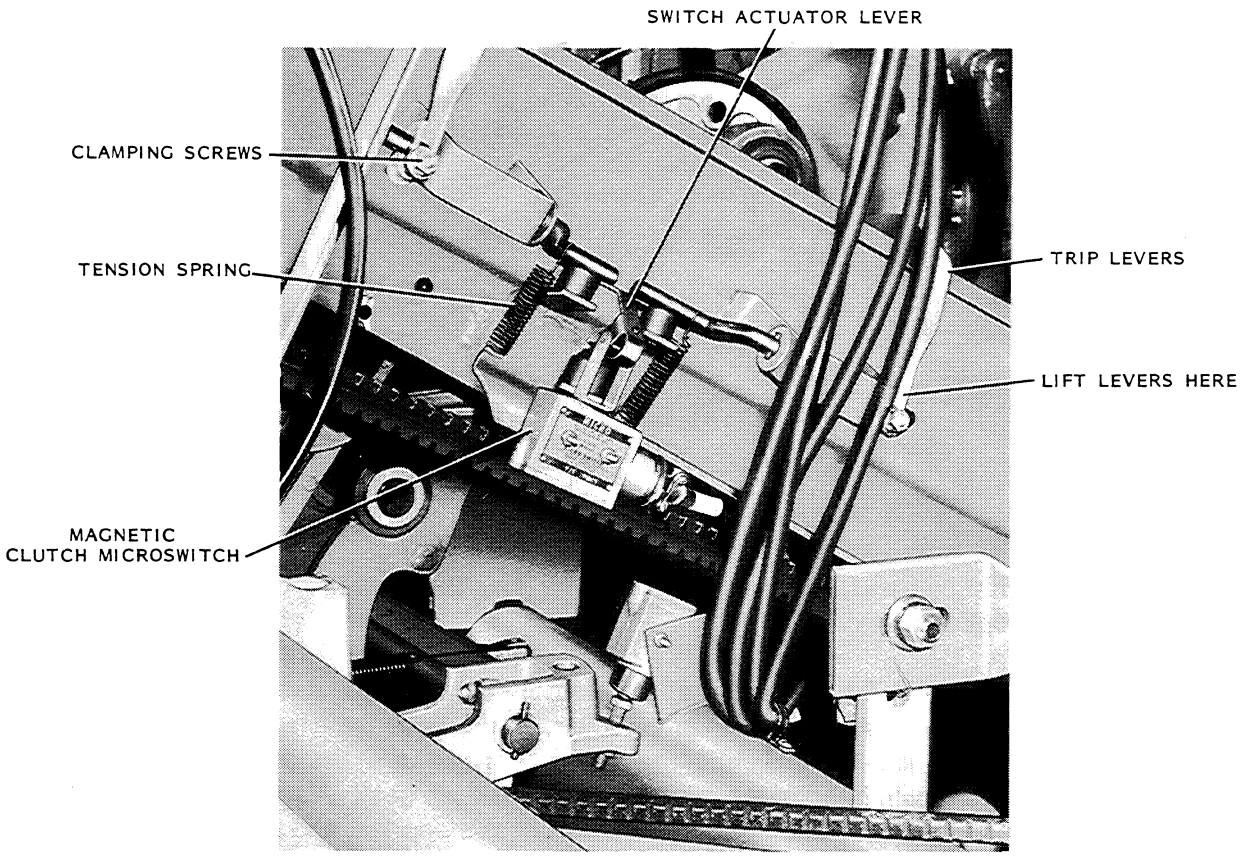
4. Latch the pin gate so that no pins can be delivered to the turret and allow two pins to be delivered to the cross conveyor and be stopped by the latched pin gate.



MAGNETIC CLUTCH ADJUSTMENT

FIGURE 45

5. Loosen the two clamping screws at the end of the trip levers. While holding the rollers firmly against the pins on the cross conveyor, push the lower ends of both levers down against the microswitch. While holding the rollers on the pins, slowly lift the lower ends of both trip levers, until the microswitch just clicks, indicating the switch has opened. Tighten the clamping screws to hold the levers in this position. (Figure 46)



CROSS CONVEYOR MICROSWITCH ADJUSTMENT

FIGURE 46

34. PIN GATE ADJUSTMENT

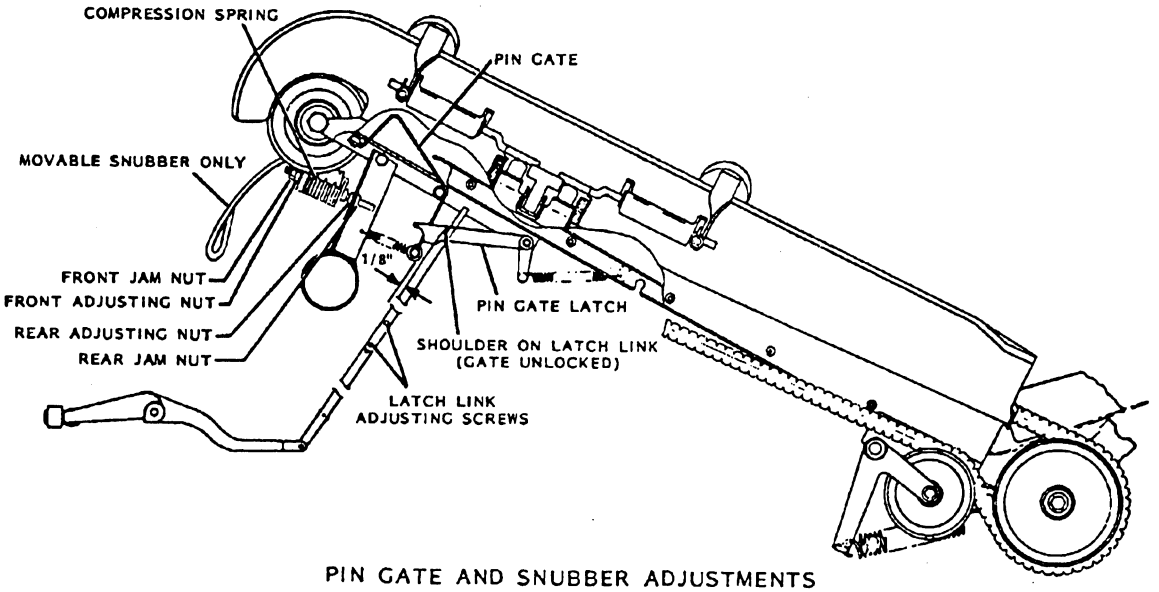
This adjustment is made to insure that the pin gate latches after a pin passes over it and that the gate is released as the turret indexed after receiving that pin.

NOTE: Before proceeding with the adjustment, a preliminary check must be made of the components. Check the up and down motion of the latch to insure there is no binding on the latch link. Check the shoulder on the latch link to insure there is no wear on the step. If worn, replace. Check side play of latch link through pin gate latch.

1. Index the turret by hand until stop lever roller is on a high level of the turret indexing cam. This will locate the latch link in its lowest position.

ADJUSTMENTS

2. Loosen the two screws which fasten the upper and lower parts of the latch link together. Move the upper part of the link up or down until the shoulder on the link is 1/8" to 3/16" below the bottom of the pin in the pin gate latch. Tighten the two screws. (Figure 39)



PIN GATE AND SNUBBER ADJUSTMENTS
FIGURE 39

3. Index the turret by hand until the stop lever roller is on a low level of the turret indexing cam. This will unlock the pin gate.

4. Slowly move a pin up the cross conveyor until the body of the pin despresses the pin gate. The pin gate latch must drop on top of the roller. Then move the pin up until the neck of the pin is over the pin gate. At this point, the gate must come up in the neck of the pin and become locked as the head of the pin passes over the pin gate. Also check the 1/8" dimension with the pin gate unlocked (Figure 39). Recheck steps 1, 2 and 3.

5. As a final pin gate test, lock the pin gate and allow three pins to line up on the cross conveyor. Release the pin gate and observe the pin gate action as the three pins are delivered to the turret. The pin gate should latch as the neck of each pin passes over and release after the turret has indexed after receiving that pin.

ADJUSTMENTS

39. SNUBBER ADJUSTMENT

This adjustment is made to insure that the snubber assists the pins into the turret wires.

PINSETTERS WITH MOVABLE SNUBBERS ONLY

1. Position the #2, #3, #4, #6, #8 or #9 basket under the cross conveyor and fully seat a pin in the basket.

2. Loosen the jam nut at the rear end of the snubber spring and turn the adjusting nut until depressing the snubber 3/16" (±1/16) will fully compress the snubber spring. Tighten the locknut. (Figure 39)

3. Loosen the locknut at the front of the snubber spring. Turn the adjusting nut until the snubber can move 5/8" forward from the position established in step 2. Tighten the lock nut.

PINSETTERS WITH FIXED SNUBBERS

1. Loosen the two mounting bolts that mount the snubber to the cross conveyor.

2. Position the turret with the #8 or #9 pin basket in front of the cross conveyor.

3. Place a pin in the #8 or #9 pin basket with a pin in a vertical position.

4. Adjust the snubber until there is a 3/16" (±1/16) gap between the snubber and the pin. Tighten the mounting bolts.

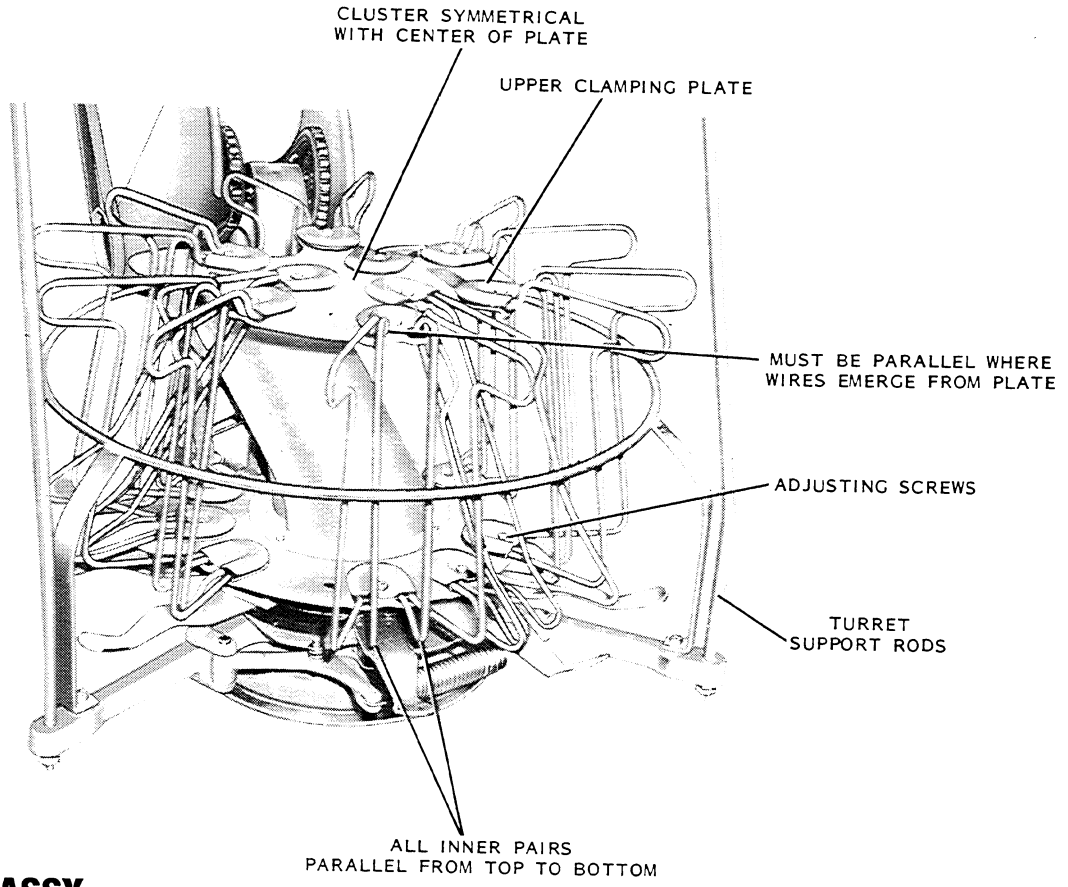
Section VIII - Turret Assembly

TURRET ASSY.			1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
SECTION VIII	38	TURRET LEVEL	
	39	BASKET ASSY.	
	40	SPIDER RING	
	41	INDEXING CAM	
	42	INDEXING LINKAGE	
	43	HALO RING	
	44	TURRET CLUTCH & BELTS	
	45	INTERLOCK SYSTEM	
	46	TURRET JAM SWITCH	

38 - TURRET LEVEL

The next major assembly to inspect is the turret assembly.

Check to make sure that the turret is level. This is best checked by placing a level under the turret and checking from front to back and side to side. If it is not level, it can be corrected by turning the adjusting nuts located at the bottom of the support arms (shown below). Refer to adjustment #35.



39 - BASKET ASSY

Check the basket assembly. Inspect the nine pin baskets for broken or misaligned wires. Each group of four wires must be symmetrical with the center of the plate located at the top of the turret. The two inside wires must be parallel to each other from top to bottom.

Check to make sure all upper and lower clamping plate bolts that attach the pin baskets to the turret, are tight. Also check for loose or missing bolts of the #5 pin chute and tighten if necessary. Refer to adjustment #36.

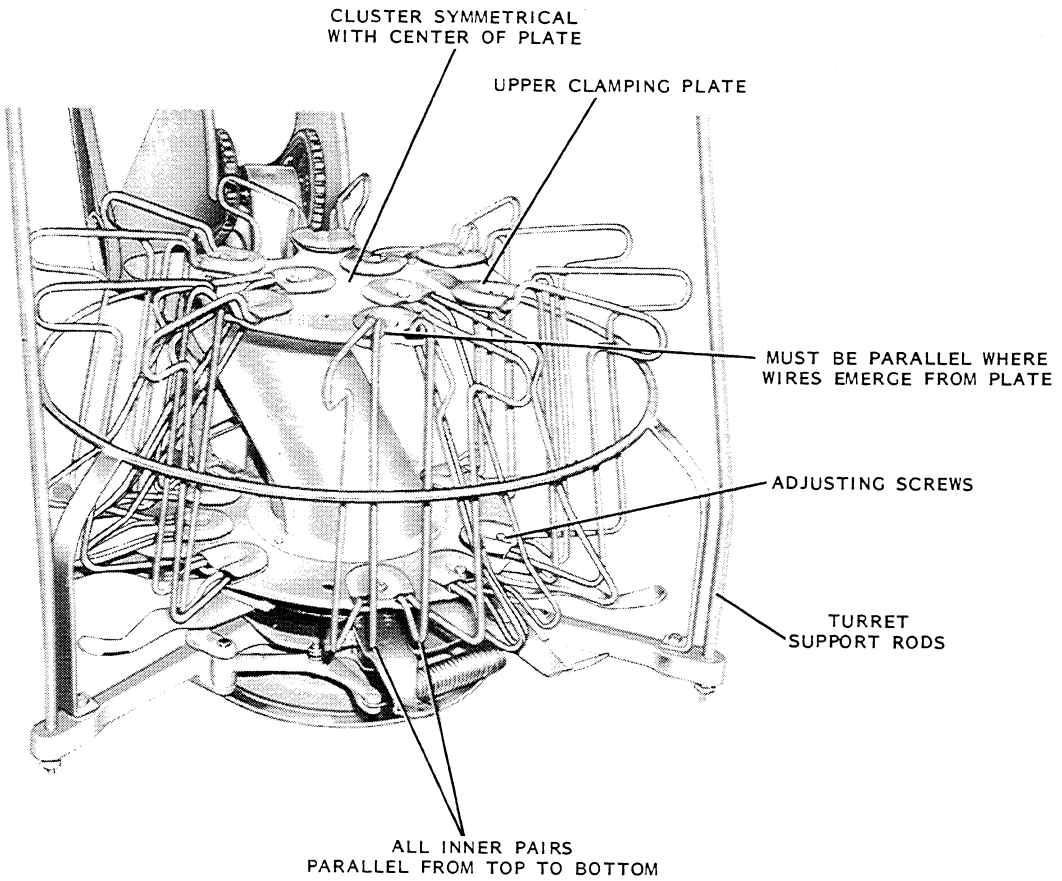
ADJUSTMENTS

35. TURRET LEVEL ADJUSTMENT

This adjustment is made to insure that the turret is level with the lane surface, thereby preventing any interference with the turret by pins in the deck when the deck is in its up position.

1. Loosen the jam nuts on the two front turret supports and place a level under the main turret pulley, front to rear.

2. Turn the adjusting nuts until the turret is level front to rear. Tighten the jam nuts. check each rod for equal support. (Figure 40)



TURRET LEVEL AND TURRET WIRE ADJUSTMENTS

FIGURE 40

ADJUSTMENTS

36. TURRET WIRE ADJUSTMENT

This adjustment is made to insure that the turret properly seats the pins and that the turret accurately delivers the pins tot he deck chutes.

1. Make sure each cluster of four wires is symmetrical with the center of the turret at the top and bottom of the turret.

2. Make sure that the outer pair of wires on the 1, 7 and 10 baskets extended from the upper clamping plate parallel with each other to obtain sufficient pin inclination for accurate delivery of these pins to their respective pin chutes.

3. Make sure the inner wires of all nine baskets are parallel with each other from top to bottom. (Figure 40)

4. Fill the turret with nine pins. Adjust the lower ends of all the outside wires to obtain 1/16" (-0 +1/16) clearance between the wires and the pin bodies.

5. With the turret empty, position the spider in its open, pin releasing position. Slide a pin down through each pin basket and observe if there is any binding or restriction of the passage, caused by tight turret wires. Adjust as required.

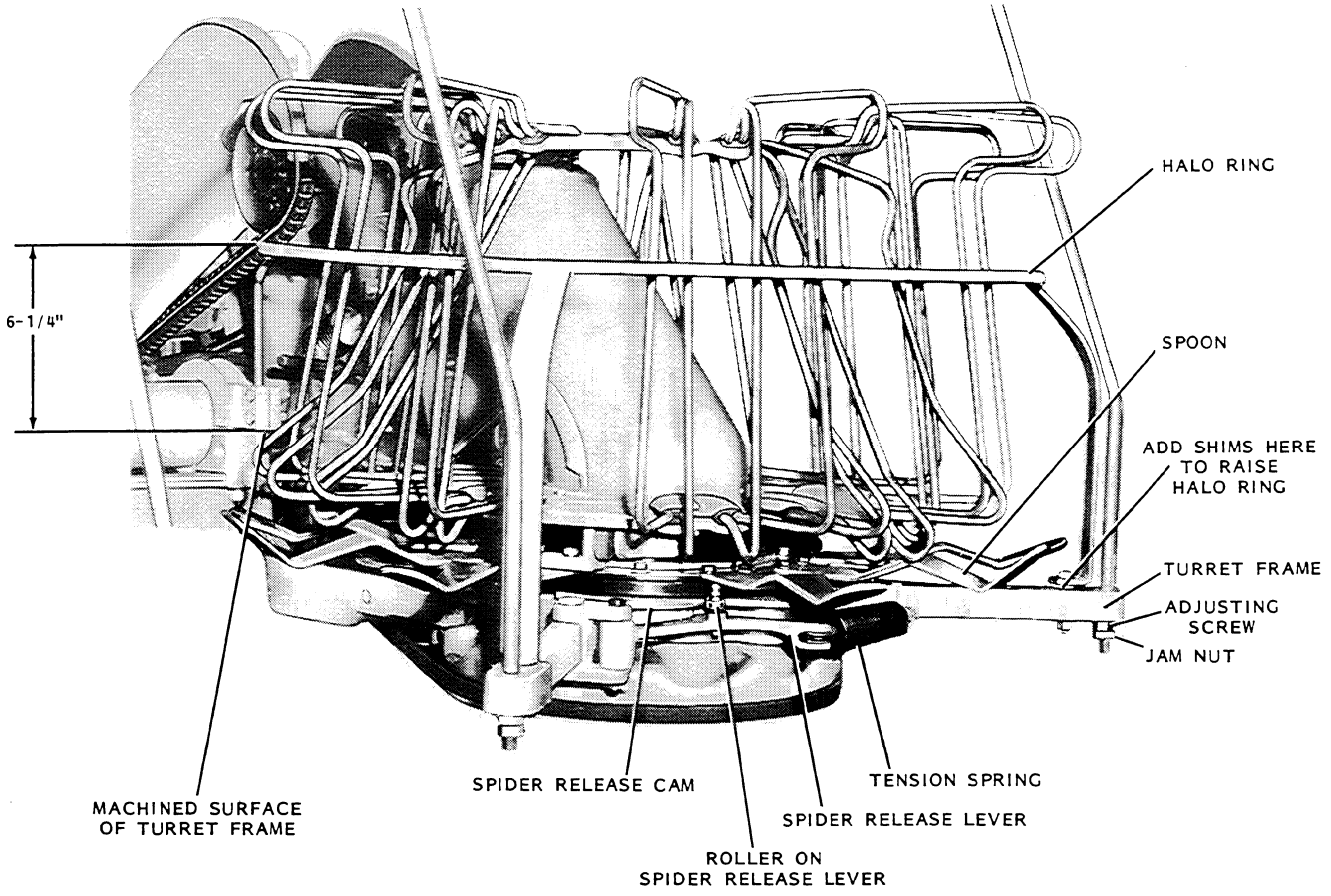
6. Be certain that all upper and lower clamping plate bolts are tight.

7. As the pins are being delivered from the cross conveyor to the turret, to the deck, check the operation of the pin gate, trip lever, turret and interlocks, for proper operation. Readjust as required.

40 - SPIDER RING

Another item to inspect is the spider ring (see following figure). Check to make sure the spider rotates or pivots freely to release the pins to the deck. As pins are released, they must clear the spoons completely. This happens because the spoons have been moved out of the way by the unlatching of the turret spider latch. Once the pins are released to the deck, the turret spider latch will re-latch to the turret. The turret is now ready to accept 10 new pins.

If an adjustment is needed, refer to adjustment #37 or record the problem on the tune-up sheet.



TURRET SPIDER AND HALO RING ADJUSTMENTS
FIGURE 41

ADJUSTMENTS

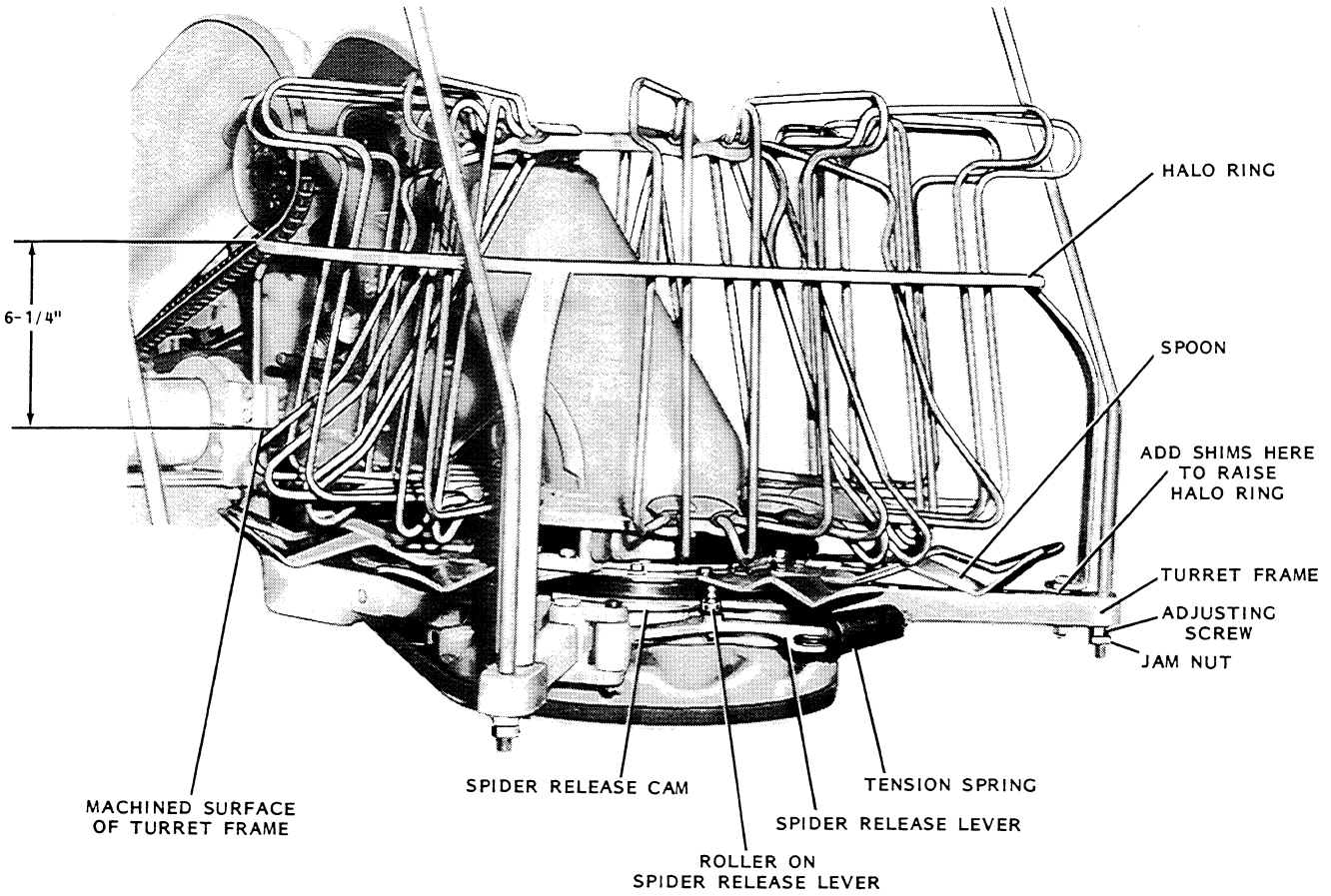
37. TURRET SPIDER ADJUSTMENT

This adjustment is made to insure that the spider rotates to release the pins to the deck, that the pins clear the spoons completely and that the spider is re-attached after releasing the pins.

1. Position the #5 pin chute under the cross conveyor and release the spider to its open, pin release position. (Figure 41)

2. Check the roller of the spider release lever when it is in the low dwell of the spider cam. The roller should be tight enough to resist spinning by the fingers. If the roller can be rotated freely, it indicates that the inner stop on the spider release lever is pressed against the turret frame instead of being slightly away from the frame. File the inner stop until the roller is tight in the low dwell of the spider cam.

3. Position the spider in its open, pin releasing position. Slide a pin down through each turret basket and observe if the pin touches any spoon as the pin moves down to the deck. If the pin touches any spoon, loosen the two bolts which fasten the spoon to the spider ring and position the spoon until it clears the pin. Tighten the bolts.



TURRET SPIDER AND HALO RING ADJUSTMENTS

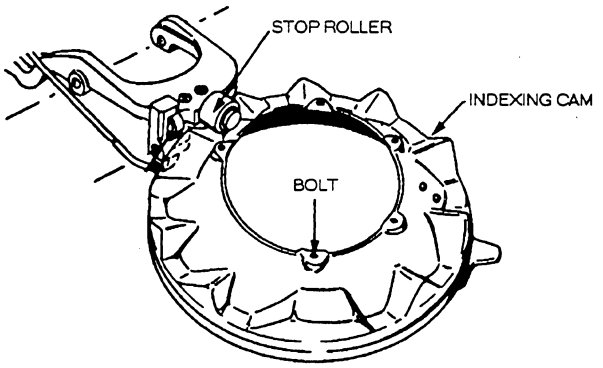
FIGURE 41

41 - INDEXING CAM

Check the five bolts on the indexing cam to make sure they are tight (as shown below).

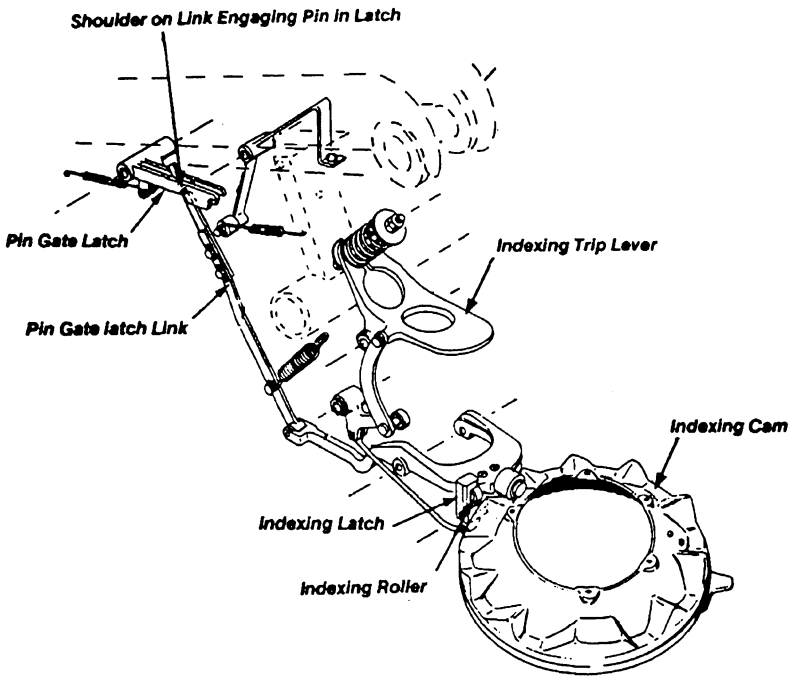
Oil and grease that has built up on the indexing cam surface must be cleaned up with pinsetter cleaner. The cam should always run dry on the stop roller.

Check the stop roller for wear or oil lodging.



42 - INDEXING LINKAGE

The next area to check on the turret assembly is the indexing linkage (shown below). Close to 90 percent of the problems or stops on a pinsetter are a result of wear and slack in the linkage. When wear or slack occurs, the turret will fail to index.



To check for wear and slack, hold the indexing latch firmly and try to shake the indexing trip lever up and down. If the trip lever moves, an adjustment is required. To make the adjustment, refer to adjustment #41. Also check the turret time delay gear adjustment #42.

ADJUSTMENTS

41. TURRET INDEX TRIP LEVER ADJUSTMENT

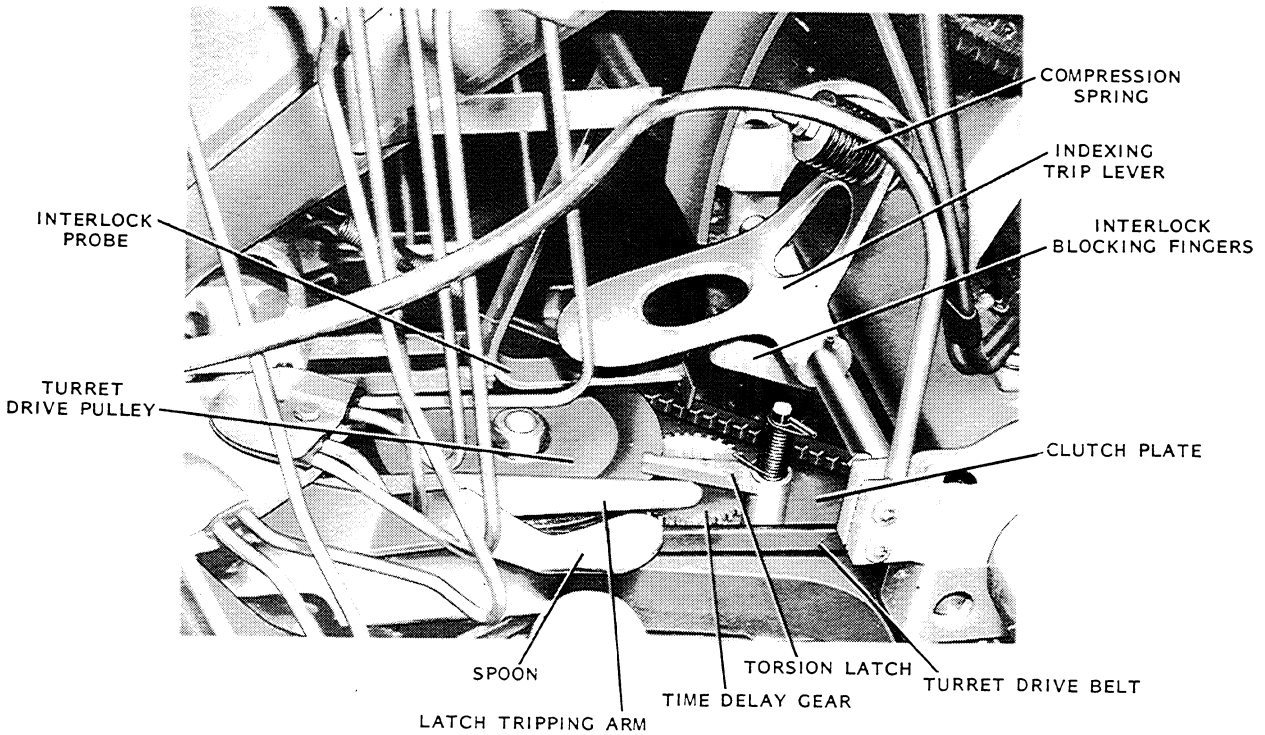
This adjustment is made to insure that the turret indexes one position after each pin is delivered from the cross conveyor.

1. Position the turret so that the stop roller on the stop lever assembly is in a low dwell of the indexing cam. Loosen the locknut at the rear of the trip lever spring and turn the rear adjusting nut until the front face of the indexing latch is vertical. Tighten the lock nut.

2. Position the turret so that the stop roller on the stop lever assembly is on a high level of the indexing cam. Loosen the locknut at the front of the trip lever spring and turn the front adjusting nut until depressing the trip lever 1/8" will solidly compress the spring. Tighten the locknut. (Figure 42)

3. Position the #5 pin chute under the cross conveyor. Check the index trip lever in its down position to insure that it does not contact the interlock probe. Check the trip lever in its up position to insure that it does not contact any of the turret wires as the turret indexes. If any turret wires contact the trip lever, carefully bend the wires upward to provide clearance. Do not disturb the trip lever adjustment at this point.

4. Allow the turret to collect nine pins, then shut off the power when the #5 pin chute is in front of the cross conveyor. Try to manually force the turret beyond the #5 pin position with the power off. If the turret can be manually forced beyond the #5 position, the indexing trip lever must be readjusted to bring the indexing latch further rearward to provide a more positive latching action. Check each pin position in this manner.



TURRET INTERLOCK PROBE, INDEX TRIP LEVER, AND TIME DELAY GEAR ADJUSTMENTS

FIGURE 42

ADJUSTMENTS

42. TURRET TIME DELAY GEAR ADJUSTMENT

This adjustment is made to insure that the turret indexes once, after delivering ten pins to the deck.

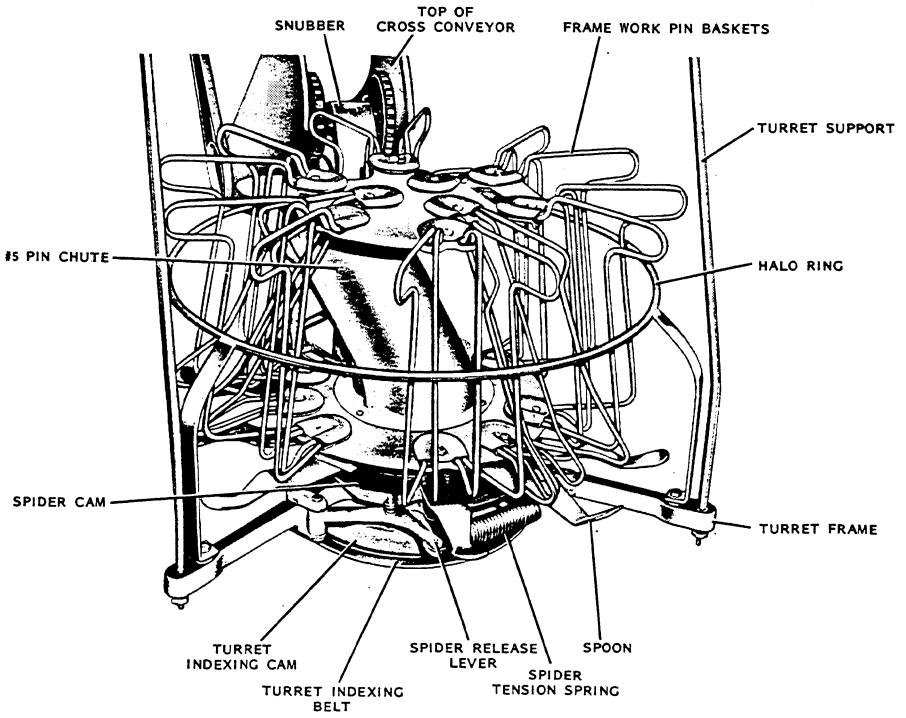
NOTE: Check lower left finger of torsion latch for blocking of time delay gear. Position for blocking by trimming rubber stop, if necessary.

1. Position the #5 pin chute under the cross conveyor. Check the position of the latch tripping arm with relation to the torsion latch. The latch tripping arm should be in a horizontal plane with the center of the arm of the torsion latch. The latch tripping arm may be carefully bent to insure that it will properly contact the torsion latch. (Figure 42)

2. Position an empty pin basket in front of the cross conveyor and trip the torsion latch by hand. If the delay gear is working correctly, the index trip lever will dip once and the turret will index one position. If the trip lever dips twice and the turret indexes two positions, it indicates the torsion latch did not return to its latching position to arrest the rotation of the delay gear. If the trip lever does not dip at all, and the turret does not index, check for binding of the delay gear or torsion latch. Also check to insure the two gears are properly meshed. Check clutch plate for flatness and proper positioning in slide bolts.

43 - HALO RING

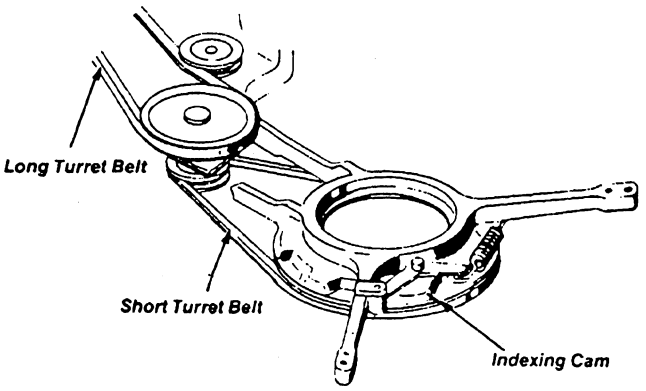
Load the turret with pins to check the halo ring (shown in following figure). A properly adjusted halo ring will not contact the pins in the turret.



The halo ring must not make contact with the #5 pin chute as the turret indexes. If contact is made, refer to adjustment #38 to make the adjustment.

44 - TURRET CLUTCH AND BELTS

Inspect the condition of the belt that rides around the indexing cam (shown below), called the short turret belt. Make sure it is not stretched as this may prevent the turret from indexing. A stretched belt will appear to be out of position. If the belt is stretched, replace it.



Then check the clutch for abnormal action and note any problems.

ADJUSTMENTS

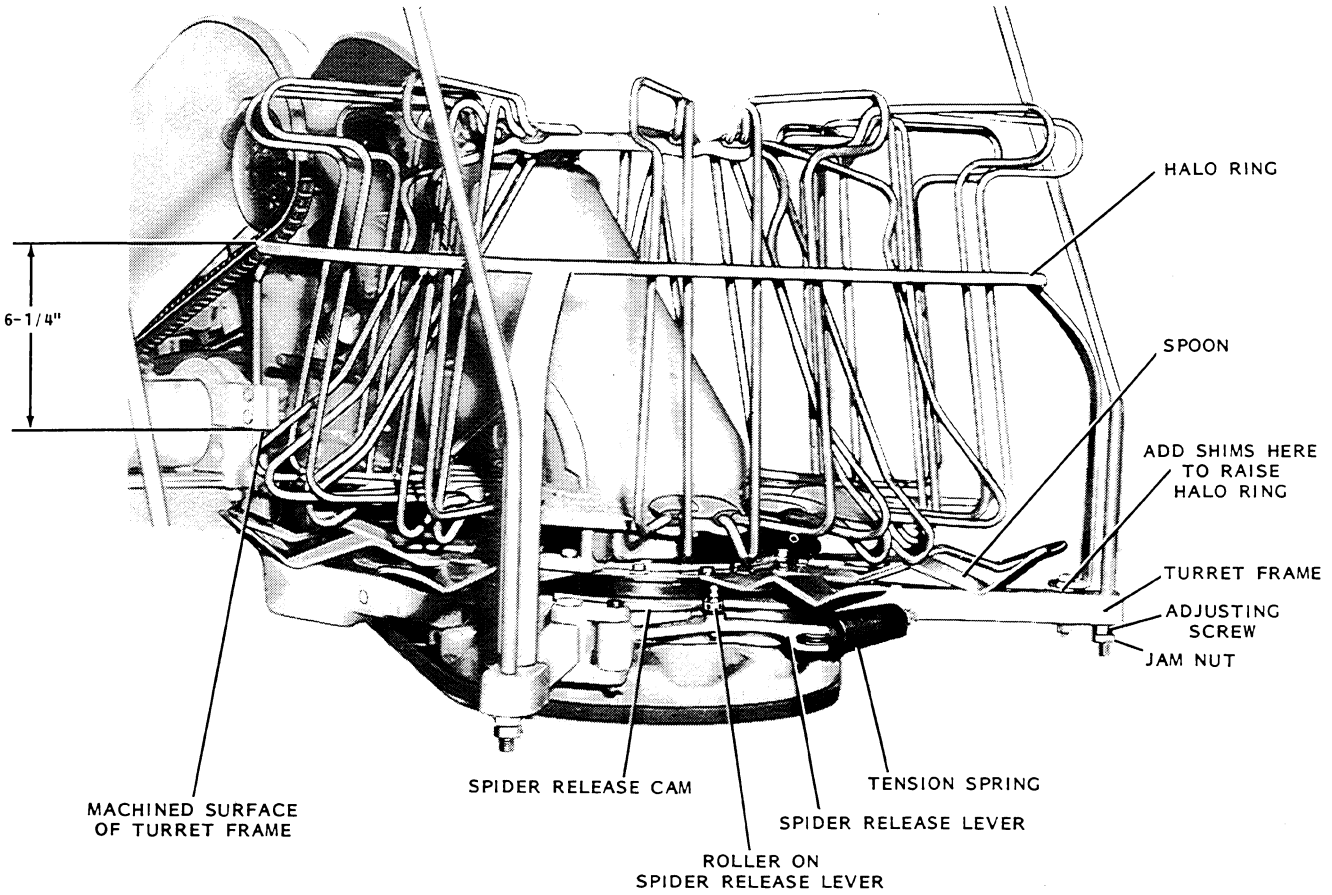
38. TURRET HALO RING ADJUSTMENT

This adjustment is made to insure that the halo ring does not contact the pins in the turret or the #5 pin chute as the turret indexes.

1. Loosen the clamps supporting the two rear legs of the halo ring.

2. Move the halo ring up or down until the top of the halo ring is 6-1/4" (+0 - 1/16) above the machined surfaces on which the clamps are mounted. Tighten the clamps. (Figure 41)

3. As a check, observe if the halo ring rubs the #5 pin chute or pins in the turret as the turret indexes. Adjust as required. If the front of the ring must be raised, shims may be added under the two front legs of the halo ring.



45 - INTERLOCK SYSTEM

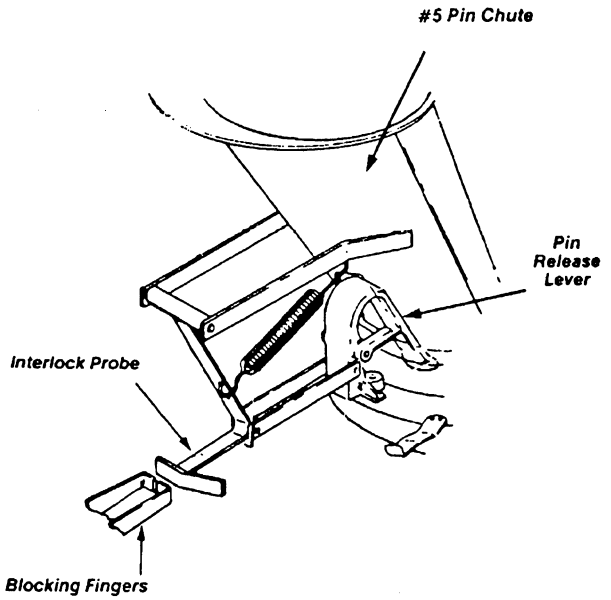
The interlock system is the next item to check on the turret assembly (shown below). As you may recall, it prevents a fully loaded turret from delivering pins to the deck until the deck is ready to receive them. The deck is ready to receive pins when it is:

- Empty

- All the way up and

- All the way forward.

When all three conditions are met, both blocking fingers are up, allowing the interlock probe to move under the blocking fingers and release the pins.



Check that there is no interference with the motion of the interlock probe and the top of the torsion latch or the bottom of the blocking fingers in their "up" position. Refer to adjustment #40.

First, visually inspect the interlock parts for wear and binding. The interlock should move or pivot freely without interference or binding.

Next, check the operation of the interlock probe and the blocking fingers, making sure that they move at the proper time according to the deck's condition. When the deck is empty and forward, one of the blocking fingers should be up. When the deck is all the way up, the other blocking finger should be up. If both fingers are not up when the deck is ready, refer to adjustments #42 and 43 to make the adjustment.

Check the function of the 180 degree turret interlock link (waiting for pins) by checking that the gearbox clutch disengages at 180 degrees when waiting for pins and then re-engages when the turret indexes after delivering ten pins to the deck. Refer to adjustment #12 for corrections. An alternate adjustment #12 is also included, which allows for worn parts.

ADJUSTMENTS

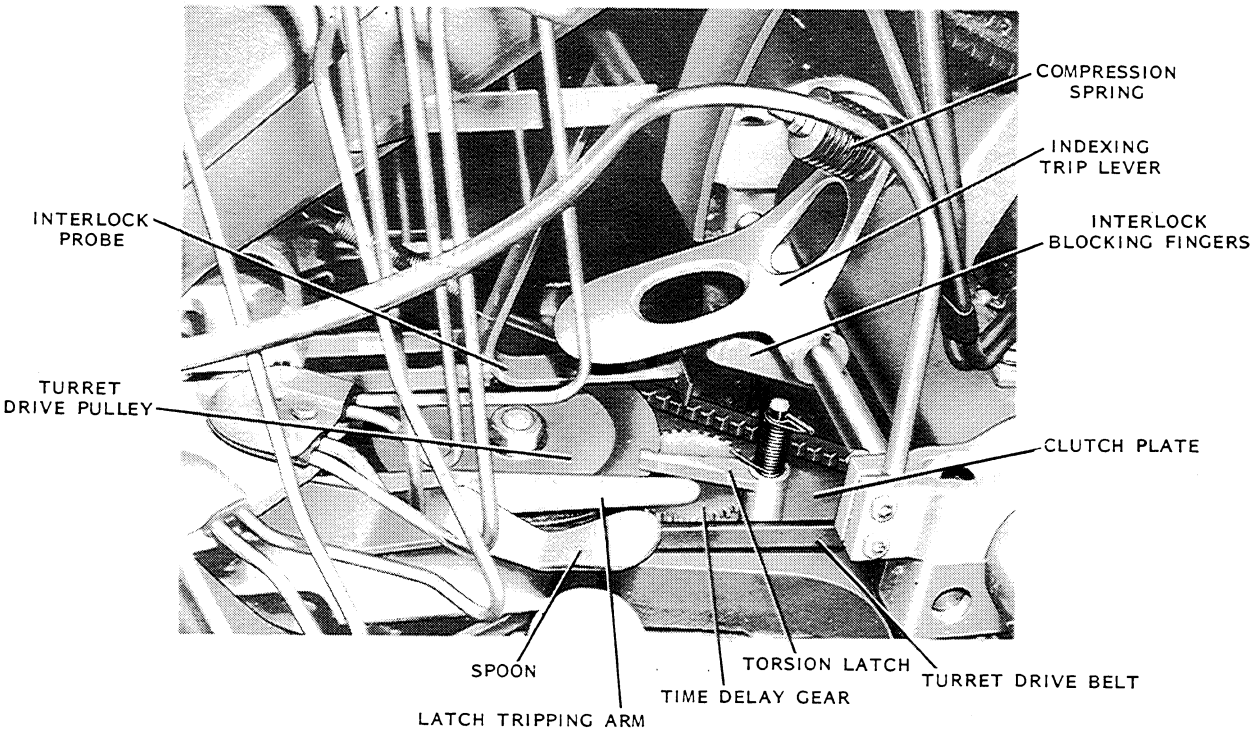
40. TURRET INTERLOCK PROBE ADJUSTMENT

This adjustment is made to insure that there is no interference with the motion of the probe.

1. Rotate the turret until the interlock probe is over the torsion latch. The clearance between the bottom of the probe and the top of the latch must be at least 1/32". (Figure 42)

2. Position the #5 pin chute under the cross conveyor and release the spider by pulling the probe to its rearmost position. The clearance between the top of the probe and the bottom of the two interlock blocking fingers (in their up position) must be at least 1/16".

3. These two dimensions may be obtained by carefully bending the probe in the required direction. (Only bend the probe after checking adjustment 43.)



TURRET INTERLOCK PROBE, INDEX TRIP LEVER, AND TIME DELAY GEAR ADJUSTMENTS

FIGURE 42

ADJUSTMENTS

43. RESTRICTED DROP INTERLOCK ADJUSTMENT

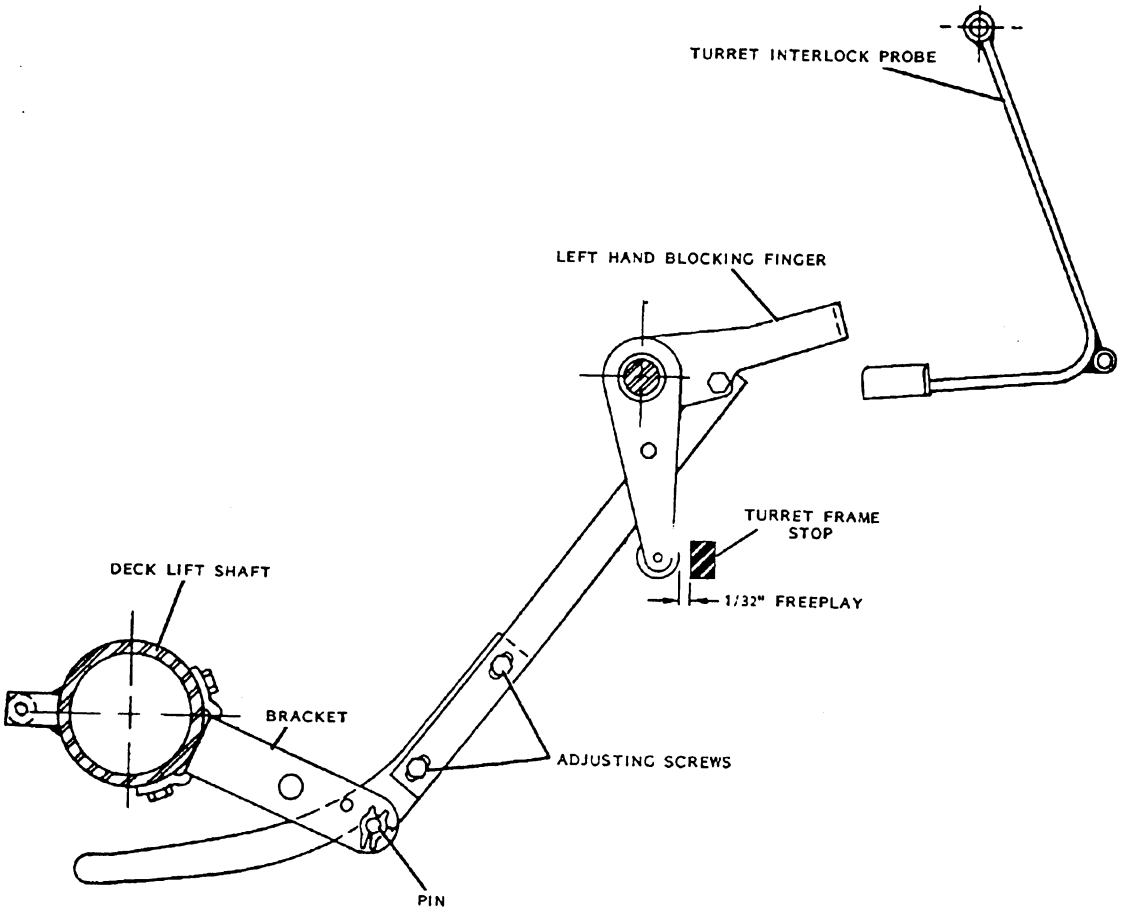
This adjustment is made to insure that the turret does not release pins to the deck, when the deck is not in its up position.

1. With the pinsetter at 0°, disconnect the tension spring to the left blocking finger and loosen the two bolts which connect the upper and lower parts of the restricted drop link.

2. Move the upper part of the link upward, until the blocking finger is in its full up position.

3. Carefully work the upper part of the link down, until there is a 1/32" freeplay in the blocking finger. This is very important, as no freeplay can result in severe damage to the restricted drop mechanism. (Figure 43)

4. Make sure the 1/32" freeplay is maintained. Tighten the two bolts and replace the tension spring.



RESTRICTED DROP INTERLOCK ADJUSTMENT
FIGURE 43

ADJUSTMENTS

44. FULL DECK-MOVING DECK INTERLOCK ADJUSTMENT

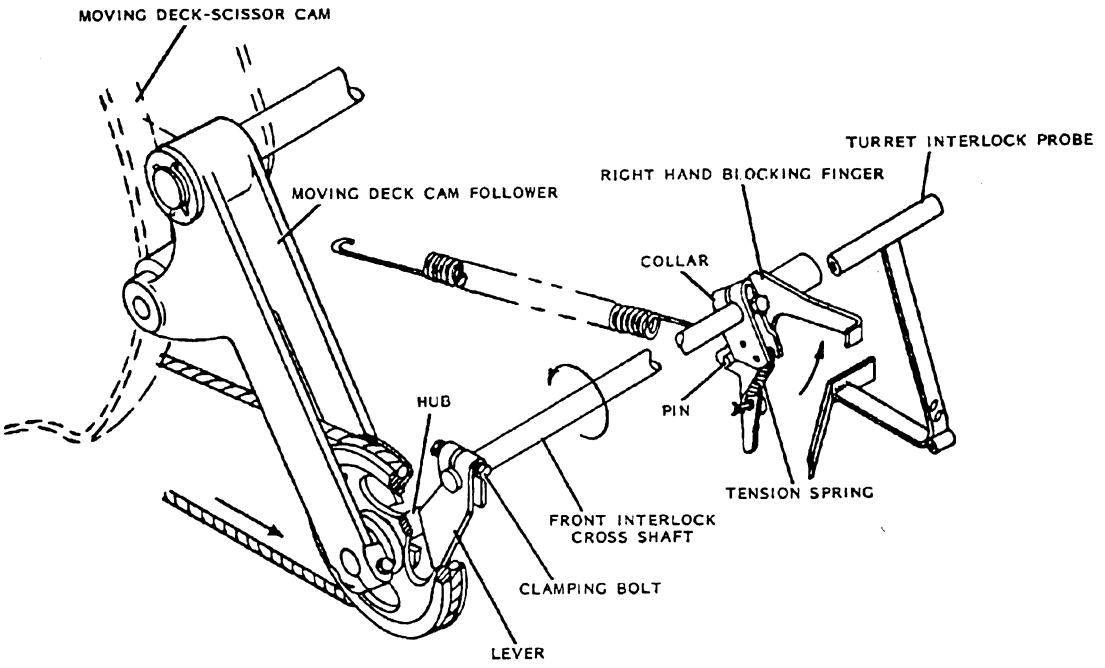
This adjustment is made to insure that the right blocking finger is in its down, blocking position, when either the moving deck is rearward or when the deck is full; and to insure that the right blocking finger is up when the moving deck is fully forward and when the deck is empty.

1. The long link is not adjustable. To check the operation of the full deck interlock, allow the turret to receive ten pins and deliver them to the deck. As the turret indexes after delivering the pins to the deck, the single rise on the outer perimeter of the turret indexing cam should push the long link back until the link is caught by the latch and held back. Then cycle the pinsetter and observe if the projection on the deck shaft frees the latch as it should when the deck reaches its full, new pinsetting depth at 270°. The latch must not release when the deck is at detecting height.

2. To adjust the moving deck interlock, cycle the pinsetter to exactly 0° and position the #5 pin chute under the cross conveyor, waiting for a pin. Make sure the hook latch is not holding the long link in its rear position.

3. Loosen the clamping bolt on the lever which contacts the hub of the moving deck pulley. Rotate the front interlock cross shaft counterclockwise until the upward motion of the right hand blocking finger stops. Stretch the tension spring slightly. (Figure 44)

4. While holding the shaft in this position, rotate the lever against the hub on the moving deck pulley. Tighten the clamping bolt.



FULL DECK-MOVING DECK INTERLOCK ADJUSTMENT
FIGURE 44

ADJUSTMENTS

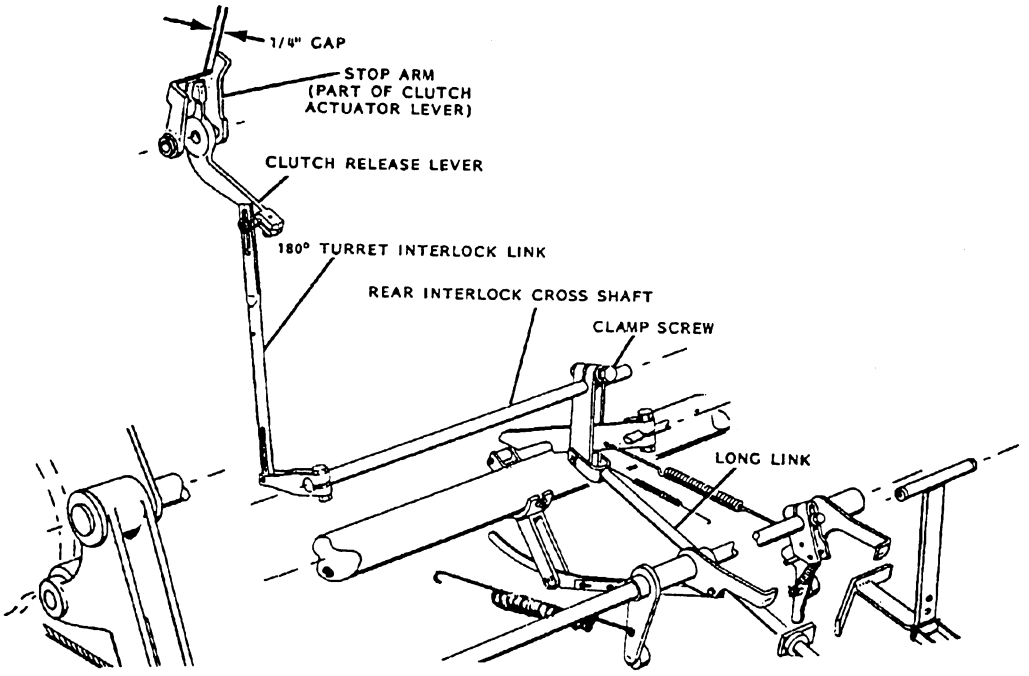
12. GEAR BOX 180° TURRET INTERLOCK ADJUSTMENT

This adjustment is made to insure that the clutch will disengage at 180° when the deck must wait for pins to deliver to the lane, and that the clutch will then automatically re-engage when the turret delivers ten pins to the deck.

1. Allow the pinsetter to come to a normal 180° stop, waiting for pins. Be certain that the long link is in its forward position (empty deck signal).

2. Loosen the clamp screw on the lever at the right hand end of the rear interlock cross shaft. (Figure 16)

3. Rotate the rear interlock cross shaft until a gap of 1/4" (±1/64) is obtained between the rear face of the projection on the clutch release lever and the contact surface of the stop arm. Tighten the clamp screw.



180° TURRET INTERLOCK ADJUSTMENT
FIGURE 16

4. As a check, cycle the pinsetter and observe if the clutch disengages at 180° when it must wait for pins and then re-engages automatically when the turret indexes after delivering ten pins to the deck. If the pinsetter stops at 180°, and then fails to restart automatically, the link is set too low. If the pinsetter fails to stop at 180° to wait for pins, the link is set too high.

5. As a further check, let the pinsetter run at 0° without engaging the clutch. Allow the cross conveyor to deliver ten pins to the turret and observe if the pinsetter triggers itself, when the turret indexes after delivering ten pins to the deck. If it does trigger itself, the link is set too high.

ADJUSTMENTS

ALTERNATE FOR ADJUSTMENT #12 - 180° TURRET INTERLOCK LINK

1. Cycle the pinsetter to a 180° stop position and shut off the power. (Waiting for pins)

2. Loosen the clamp screw at the right end of the rear interlock cross shaft.

3. Apply a "full deck" signal by moving the long link rearward, allowing the hook latch to capture the long link.

4. Slowly rotate the rear interlock cross shaft counterclockwise to raise the 180° turret interlock link.

5. When the stop arm releases the clutch lever, hold the cross shaft in that position and retighten the clamping screw on the right end of the cross shaft.

6. To check your adjustment, do a thumb pressure test.

   a. Cycle the pinsetter to 0° which the deck full of pins.

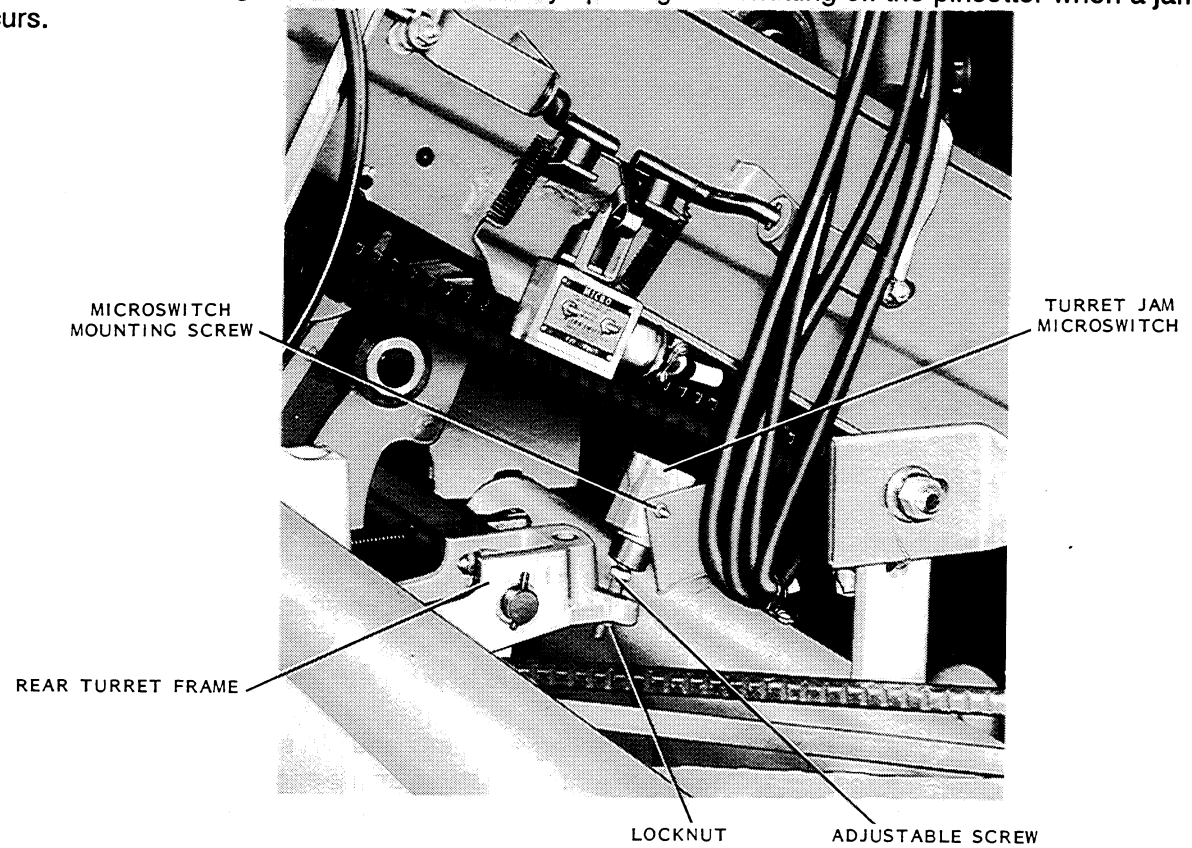
   b. Push down on the top of the 180° turret interlock link with your thumb.

   c. If the adjustment is proper, you should be able to push the link down 1/16" to 1/4".

NOTE: Less than 1/16" (solid) will cause recycling problems and stress on the cycle cam's reset lever. More than 1/4" may prevent the clutch from re-engaging after a 180° stop when the deck has been filled.

46 - TURRET JAM SWITCH

The last item to check on the turret assembly is the turret jam switch (shown in following figure). This switch prevents damage to the turret or deck by opening and shutting off the pinsetter when a jam occurs.



For example, when a pin or other foreign object becomes jammed on the deck and presses against the turret, the turret moves up. To prevent the deck from destroying itself or damaging the turret, the turret jam switch opens. As the switch opens, the pinsetter shuts off. This is sometimes referred to as a blackout.

Check that the rubber boot on the jam switch is flexible and doesn't restrict the switch plunger movement. A return spring (12-700041-000) is available to assist the return of the switch plunger. If the switch fails to shut off the pinsetter, refer to adjustment #48 to correct the problem. Any time the turret has been leveled, the jam switch must be adjusted.

ADJUSTMENTS

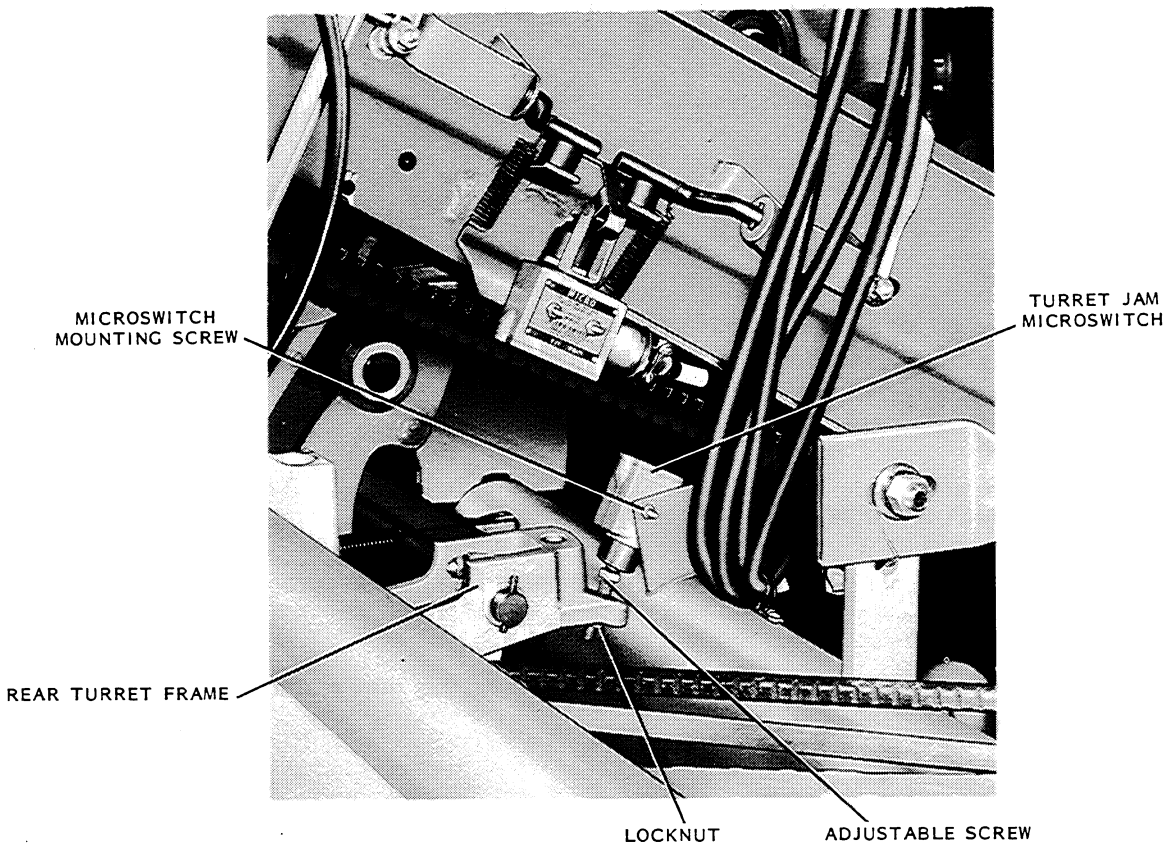
48. TURRET JAM MICROSWITCH ADJUSTMENT

This adjustment is made to insure that the turret jam microswitch will open, thereby shutting off the pinsetter, in the event a pin or other foreign object on top of the deck contacts the turret.

1. Loosen the locknut on the adjustable screw located under the turret jam microswitch. (Figure 49)

2. Be certain that the turret is lever per Adjustment 35.

3. With the turret frame resting on the turret leveling nuts, turn the microswitch adjusting screw down until the switch opens. Turn the adjusting screw out until the switch just closes. Then turn the adjusting screw one additional full turn. Tighten the locknut.



TURRET JAM MICROSWITCH ADJUSTMENT

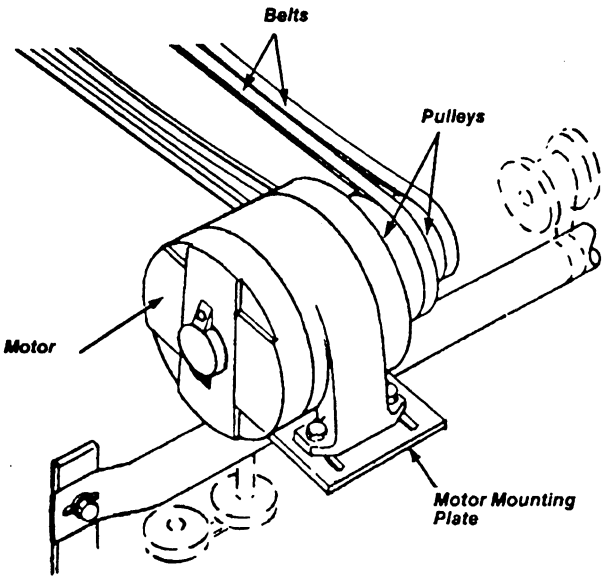
FIGURE 49

Section IX - Pinsetter Motor

PINSETTER MOTOR			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
SECTION IX	47	BELTS & PULLEYS																								
	48	POWER CORD																								

47 - BELTS AND PULLEYS

Moving on with the functional check, the next major item to inspect is the pinsetter motor, shown below.



Turn on the motor and listen for straining noises or bad bearings. Make sure it is mounted tightly on the mounting plate. Visually check for a frayed or stretched condition of the two belts. Make sure they are aligned and tracking properly on the pulleys. Refer to adjustment #51 for proper belt tension.

48 - POWER CORD

Finally, check the condition of the pinsetter motor power cord.

Of course, the power cord cannot be loose or frayed and should be held securely on the motor by the relief bushing.

Again, do not attempt to replace any faulty wiring on your own as this may result in serious injury. Correct as necessary with a qualified mechanic.

ADJUSTMENTS

51. MOTOR MOUNT ADJUSTMENT

This adjustment is made to insure that the motor is positioned properly to provide adequate tensions on the motor to gear box belt and motor to elevator belt.

1. Remove the spring-tensioned idler pulley from the motor to elevator belt.

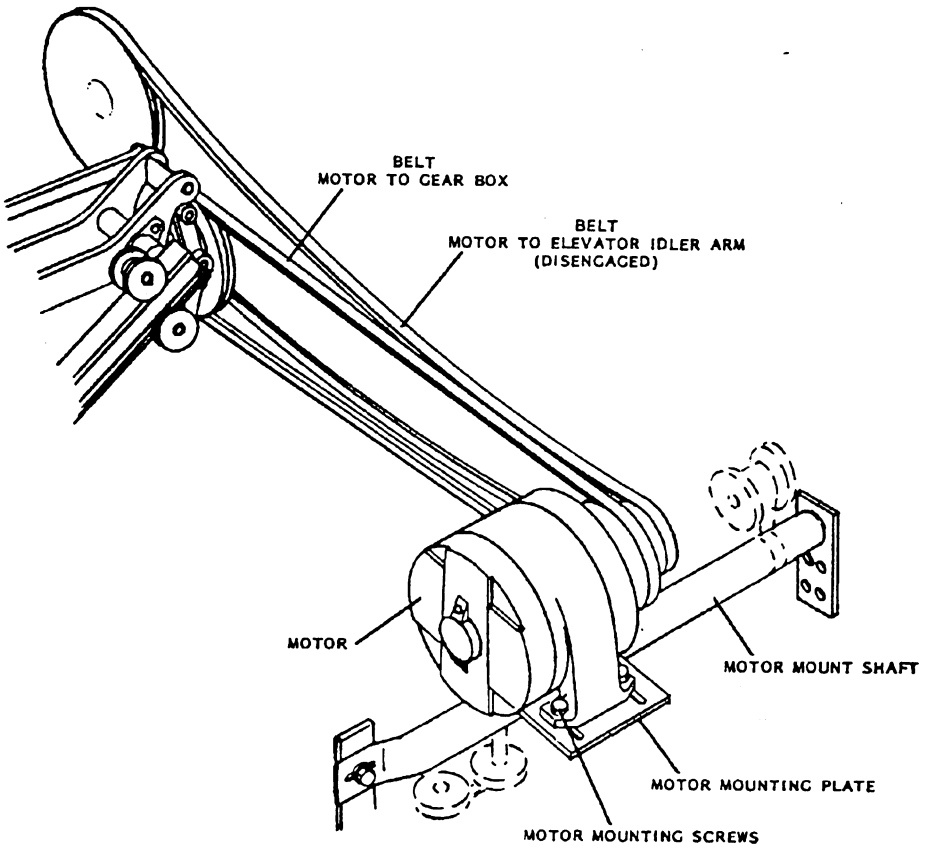
2. Loosen the four bolts that mount the motor to the plate on the motor mount shaft. The four mounting holes are elongated for adjustment. (Figure 52)

3. Move the motor to right until adequate tension is placed on the motor to gear box belt. Tighten the four mounting bolts.

4. Replace the idler pulley on the motor to elevator belt.

5. Improper motor to gear box belt tension can cause belt slippage and overloading of motor while lifting deck.

6. Check belt lengths carefully. Measure around motor pulley and gear box pulley with 1/2" wide measuring tape for closest belt length.



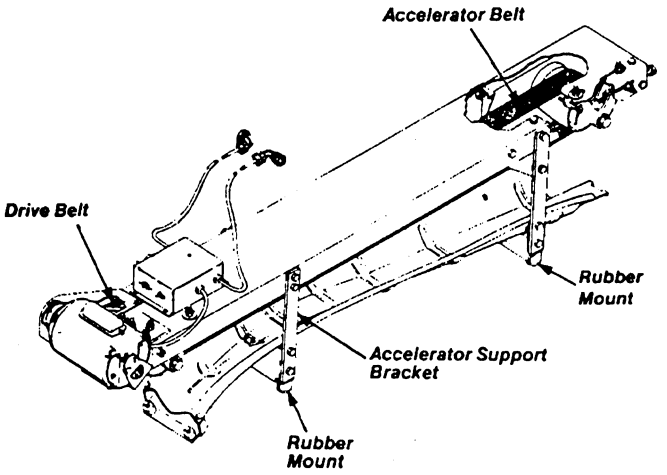
MOTOR MOUNT ADJUSTMENT
FIGURE 52

Section X - Accelerator/Booster

ACCELERATOR/BOOSTER			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
SECTION X	49	STRUCTURAL PARTS																								
	50	BELTS																								
	51	MOTOR																								

49 - STRUCTURAL PARTS

The next item of the functional check is the accelerator/booster, which accelerates the ball back to the bowler (see figure below).



Check the structural parts to make sure they are in place and tight. Tighten all loose bolts as you discover them. Check the condition of the four rubber mounts, two which you can see located below the accelerator support bracket. Make sure they are not cracked or missing.

50 - BELTS

Visually inspect both the wide accelerator belt and the narrow drive belt for wear. Badly, worn belts that are close to the breaking point should be noted in the tune-up sheet, and replaced as soon as possible.

Tune on the accelerator/booster and listen for bad bearings or any whining noise coming from the accelerator motor and pulleys. As the belts are moving, check to see they are tracking properly on the pulleys. If they are off track, the pulleys may need to be repositioned. Feed several balls onto the trough to insure they accelerate back to the bowler. As you do this, watch the accelerator belt to make sure it is aligned and does not slide from side to side on the pulleys. Refer to adjustment #29 to make correction.

You already know that the pinsetter must be kept as clean as possible. Underneath the pulley support bracket is a wire brush designed to clean the accelerator belt as it moves. To keep the dirt from getting back on the belt, clean off the wire brush.

ADJUSTMENTS

29. BALL ACCELERATOR ADJUSTMENT

This adjustment is made to insure that the accelerator belt is properly tensioned and positioned to effectively return balls to the ball return rack. The accelerator must be properly mounted on the kick-backs prior to making belt adjustments. The mounting surface on each kickback must be lever across the two kickbacks to within 1/32". Shim washers can be added or removed to obtain lever condition. Set accelerator on kickback mounts. Shim as required. Do not draw accelerator frame down when tightening belts.

1. Loosen the three nuts holding the rear pulley assembly. Two nuts are located on top and one nut on side of the top frame.

2. Loosen the rear belt tension screw. (Figure 35)

3. Remove old belt and install new belt.

NOTE: The belt is marked on the inside surface. Place this surface on the pulleys.

4. Viewing the accelerator from the rear of the machines, locate the belt 1" from the edge of the pulley facing the right machine side.

NOTE: The motor drive belt is located on the left machine side.

5. Manually rotate the pulley to position the belt on the front pulley in a like manner.

6. Manually pull the rear pulley assembly rearward and hand tighten the rear belt tensioning screw. Snug the three nuts holding the bearing bracket as assembly tot he frame.

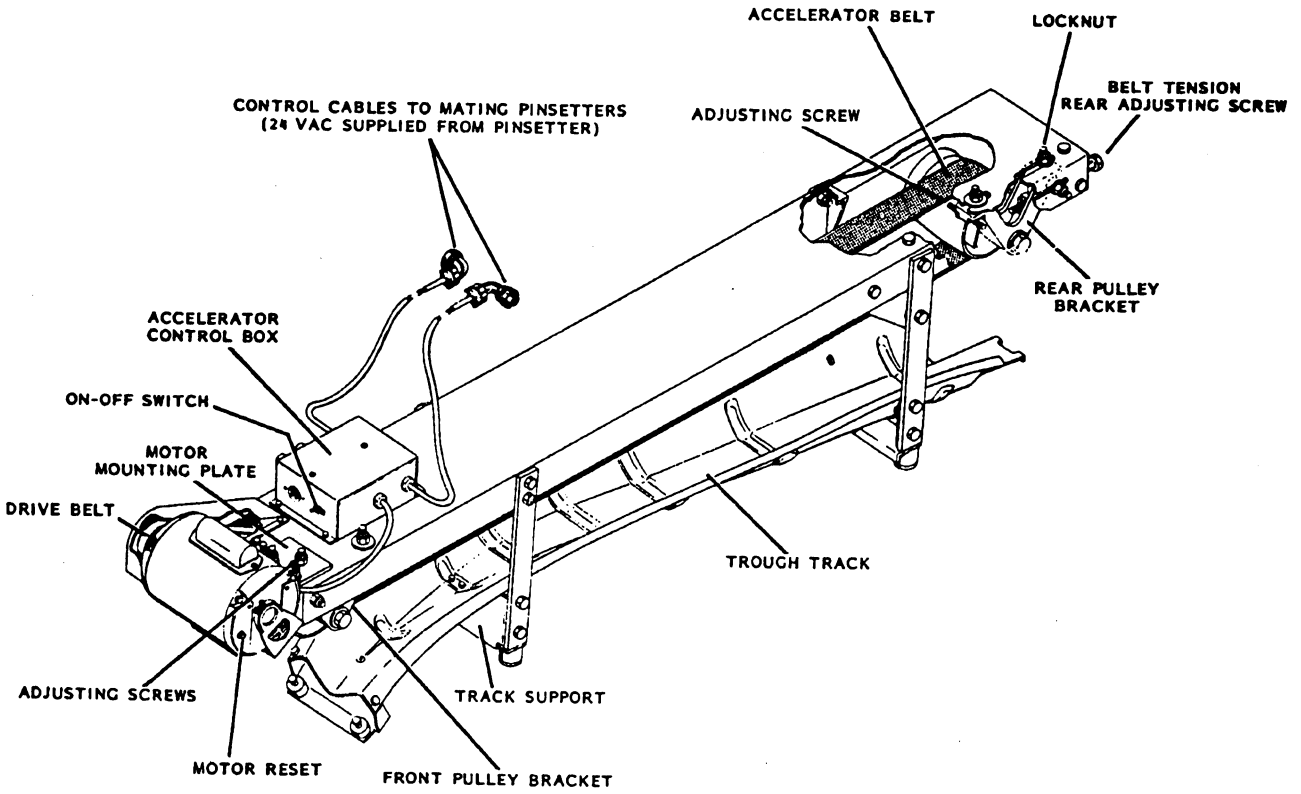
NOTE: There is an adjustable set screw through the side of the pulley brackets. This adjustment screw moves the belt left or right for proper tracking operation. Turn this screw in until it touches the frame side. Lock the jam nut.

Continue tightening the rear tension screw until the belt is lever between the pulleys. Tighten the tension screw four additional Turns. Then tighten the two top locknuts and the side locknut.

7. Start the accelerator and run idle (no ball). Check the belt tracking. Maximum permissible belt wobble is 1/8". Belt should run 1" from the edge of the pulley. If not, loosen the lock-nuts holding the rear bearing assembly. Loosen the jam nut on the adjustable screw and move set screw one turn to move belt toward left machine. Retighten adjusting screw jam nut and the three locknuts on the bearing assembly before testing.

NOTE: One-half turn of the adjusting screw moves the belt 1/8".

ADJUSTMENTS



BALL ACCELERATOR ADJUSTMENT

FIGURE 35

MOTOR BELT ADJUSTMENT

The motor is to be mounted with the mounting bolts located centrally in the elongated motor base slots. Adjust the motor belt by moving the motor or adding shims under the motor base as required to make the motor belt track 3/16" (±1/16) from the edge of the motor pulley and 3/16" (+1/8 -1/16) from the edge of the accelerator pulley.

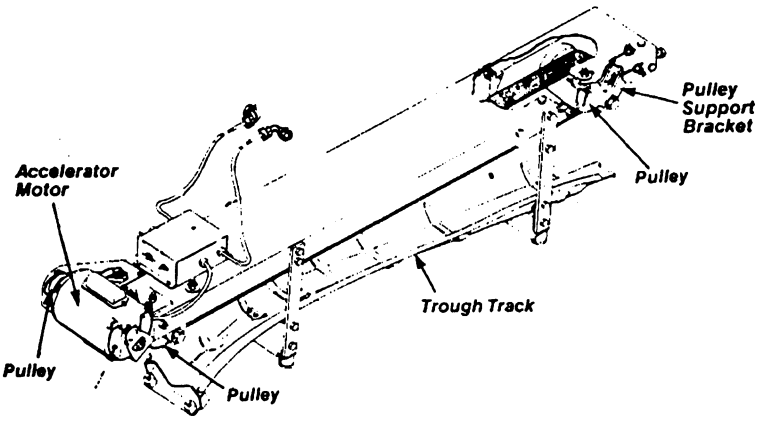
BALL TEST

1. Run a drilled ball through the accelerator and observe belt movement. Allowable belt movement:
   - Used belt - 1/4"
   - New belt - 1/16" to 1/4" toward motor belt.

2. Adjust if necessary. Check set screws, making sure they sit against frame with tightened jam nuts. Check all bearing locknuts. Recheck accelerator mounting on kickbacks.

51 - MOTOR

Check the accelerator motor connections to insure they are tight and not frayed. Do not attempt to change frayed power cords without a qualified mechanic, or serious injury may result.



Section XI - Ball Lift

BALL LIFT			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
SECTION XI	52	DRIVE SYSTEM																								
	53	RETARDER TRACKS																								
	54	MOTOR/ELECTRICAL BOX																								

52 - DRIVE SYSTEM

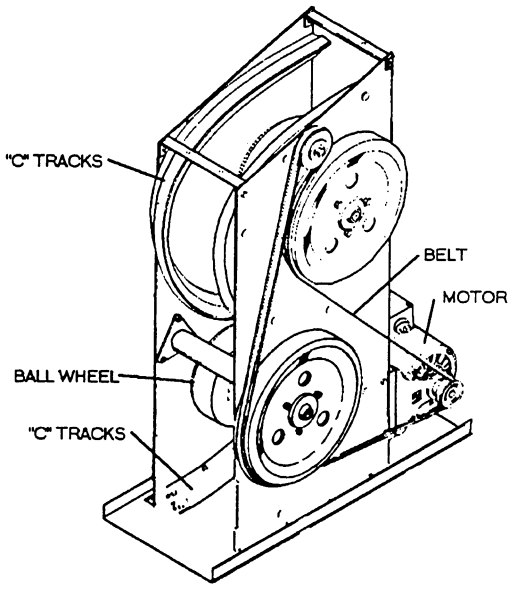
The last items of the functional check covers the power ball lift system. First, check the drive system by inspecting the belt, pulleys, shafts, bearings, and clutch. Replace any worn or damaged parts. Check belt for proper adjustment. Inspect the ball lift wheels or tire and rim assembly and replace if necessary. Check the lift mounting bolts for tightness.

53 - RETARDER/TRACKS

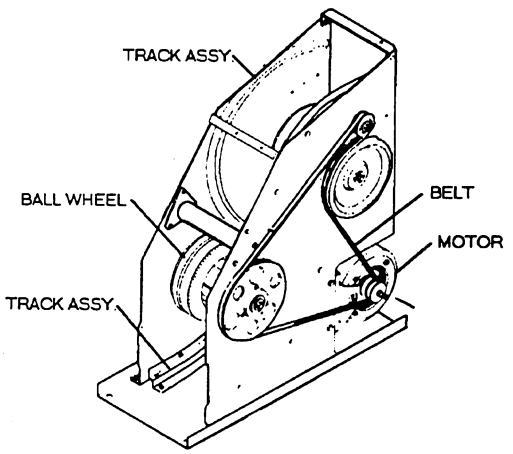
Inspect the retarder. Look for loose or broken bolts, worn or dirty carpet, and loose transition track leather and replace as required. Check for proper operation to insure heavy balls are adequately retarded and light balls pass through. Inspect "C" tracks for wear and replace as required. Place a vertical level or plumb line on the side of the power lift frame. Reshim at concrete fasteners under power lift base as required to level the frame. Ball damage and uneven "C" track wear can result from out of level frames.

54 - MOTOR/ELECTRICAL BOX

Inspect motor for proper operation, lubrication, and check for loose or frayed electrical connections. Do not attempt to change frayed power cords without a qualified mechanic or serious injury may result. check electrical control box for loose or frayed wiring and make sure box is properly mounted and cover is secured in place. Check electrical function boxes for proper connections and covers secured.



SUBWAY POWER LIFT ASSEMBLY



CONCEALED POWER LIFT ASSEMBLY

Part 5
Functional Tune-Up Summary

Functional Tune-Up Summary

SECTION I - RAKE/PIT CUSHION ASSEMBLY

1. Structural Parts
Inspect rake arm assembly for straightness; make sure it is not hitting frame. Check rake board bolts, rake shock absorber mounting bolts, spring guide tube mounting bolt and pin. Check rake lift cam follower and rake trip shaft for worn parts.

2. Adjustment & Operation
Check rake adjustment. Adjustment #2 and #3.

3. Pit Cushion Adjustment
Inspect Uniball and linkage bolts for tightness. If these bolts are too tight and the pit cushion binds, then new bushings, spacers, slide links and bolts will have to be installed. Check shock absorbers for oil leaks and proper action. Check bolts and tighten where pit cushion mounts to kickback.

4. Triggering Adjustment
Inspect pit cushion triggering adjustments, lift rod, trigger link, and trigger switch adjustments #4, 5, and 6.

SECTION II - GEARBOX

5. Gear Box Clutch
Inspect gear box clutch for wear and adjustment. Adjustment No. 7, No. 8, and No. 9.

6. Gear Train
Inspect gear train for noisy operation or indication of worn gears or bearing.

7. Triggering and Reset Linkage
Inspect reset linkage for proper operation. check for missing X-washers. Check stop collar or bumper stop. Adjustment No. 10.

8. Scissors Moving Deck Latch
Inspect moving deck scissor latch condition. Check Adjustment No. 18.

9. Deck Holding Hook
Inspect deck holding hook. Check Adjustment No. 22.

10. Oil Level and Leaks
Inspect gear box for oil leaks and repair.

11. Cycle Solenoid
Inspect cycle solenoid for rubber "O" rings and make sure cover is properly mounted. Check Adjustment No. 11.

SECTION III - DECK ASSEMBLY

12. Structural Parts
Inspect deck shaft mounting bolts, deck arm bolts and stabilizer bearings and bolts. Check deck shield for proper attachment.

13. Scissors Deck
Inspect scissors for loose parts, grippers, deck rollers and scissor slide wires. Check scissor cable, pulleys and cam follower. Check scissor cable. Adjustment No. 19.

14. Moving Deck
Inspect all deck chutes and spotting fingers. Check condition of slotted cam follower bearings. Check moving deck cable, pulleys and cam follower condition. Check moving deck cable. Adjustment No. 20.

15. Deck Height and Level
Check deck height and level. Adjustment No. 14. Also check deck lowering hook latch and deck eccentric. Adjustments No. 16 and 17.

16. Pin Spotting
Inspect pin spotting so pins are set on spot. Adjustment No. 15. Check frame counter microswitch. Adjustment No. 47.

17. Deck Jam Switch
Check deck jam micro switch. Adjustment No. 49. Check deck jam clutch release mechanism if installed. Adjustment No. 50.

SECTION IV - DETECTOR

18. Structural Parts
Inspect for missing X-washers, loose or broken bearings and loose mounting bolts.

19. Detector Rod
Inspect detector rod for proper adjustment. Adjustment No. 1.

20. Outof Range
Inspect out-of-range system for proper operation. Adjustment No. 21.

21. 1 and 2 Ball Microswitch
Inspect 1 and 2 ball light micro switch for adjustment. Adjustment No. 46.

22. Strike Light Switch
Inspect strike light microswitch for proper adjustment. Adjustment No. 52.

23. Switch Cluster (Auto Scorer)
Inspect switch cluster for proper timing and switch adjustment. Refer to auto scorer manual.

SECTION V - PIT CONVEYOR

24. Pit Board and Carpet

Inspect pit carpet for wear and check for broken pit board. Tighten pit board deflector plate bolts.

25. Shaker Assembly

Inspect for broken rubber mounts. Replace all that are cracked as these will cause the good ones to fail prematurely. Check jogger arms and bearings and mounting bolts. Check distance of pit conveyor below lane surface. Adjustment No. 23.

26. Power Transmission

Inspect belt tension and alignment. Check pit conveyor idler arm for freedom of movement, pulley condition, and bearings. Check for proper adjustment. Adjustment No. 30.

SECTION VI - ELEVATOR ASSEMBLY

27. Ball Wheel

Inspect condition of lower and upper guide rollers. Look for bad bearings, worn or broken tires and flanges. Inspect condition of ball wheel belt. Use endless type belt only and adjust so that belt does not ride against any of the guide rollers. Check for proper ball wheel adjustment. Adjustment No. 25.

28. Pin Wheel

Inspect condition of lower and upper guide rollers. Look for bad bearings, worn or broken tires and flanges. Inspect condition of pin wheel belt. Make sure pin wheel is not riding against elevator frame. Check for proper pin wheel adjustment. Adjustment No. 25.

29. Power Transmission Parts

Inspect condition of jack-shafts and bearings, idler arm pivot points, idler pulleys and tension springs. Check condition of belts. Check magnetic clutch wiring and for proper adjustment. Adjustment No. 45.

30. Ball Lift Rods

Inspect condition of rod covers and rubber bumpers. Check for proper adjustment. Adjustment No. 26 and No. 27.

31. Ball Return Tracks

Inspect for loose or broken return tracks and braces. Inspect Y-Switch assembly and stop bumpers. Check preference bar for proper adjustment. Adjustment No. 28.

32. Pin Guide and Turn Pan

Inspect for loose pin guide and check pin guide and turn for proper adjustment. Adjustment No. 32 and No. 31.

33. Structural Parts

Inspect for any broken welds or loose parts such as pin deflector plates and rear guard assembly and cat walk boards. Check for proper elevator frame adjustment. Adjustment No. 24.

SECTION VII - CROSS CONVEYOR

34. Power Transmission
Inspect conveyor belts, drive belt, and idler pulleys. Make sure drive belt is tensioned and aligned properly to minimize wear. Adjustment No. 33.

35. Microswitch
Check microswitch for proper adjustment. Adjustment No. 45. Make sure micro switch plunger is not sticking.

36. Pin Gate
Inspect pin gate parts for wear. Check latch roll pin and shoulder or latch link. Check for proper adjustment. Adjustment No. 34.

37. Snubber
Inspect snubber for loose bolts and proper adjustment. Adjustment No. 39.

SECTION VIII - TURRET ASSEMBLY

38. Turret Level
Inspect turret for level. Adjustment No. 35.

39. Basket Assembly
Inspect for broken turret wires and missing or loose 5-pin chute bolts. Check 5-pin probe for proper action. Check turret wire adjustment. Adjustment No. 36.

40. Spider Ring
Inspect spider rings for proper adjustment. Adjustment No. 37.

41. Indexing Cam
Inspect indexing cam to be sure it is not loose. Clean any build-up of oil and grease from cam surface as this cam should be run dry. Inspect indexing stop roller for wear or oil lodging.

42. Indexing Linkage
Inspect entire linkage train for wear and slack in parts. Check for proper adjustment. Adjustments No. 41 and No. 42.

43. Halo Ring
Inspect halo ring for proper adjustment. Adjustment No. 38.

44. Turret Clutch and Belts
Inspect for stretched short turret drive belt. Check clutch and bearings.

45. Interlock System
Inspect interlock parts for wear and check for proper adjustment. Adjustment No. 40, No. 43, and No. 44. Check function of 180 degrees waiting for pins interlock. Adjustment No. 12.

46. Turret Jam Switch
Inspect turret jam microswitch for proper function and adjustment. Adjustment No. 48.

SECTION IX - PINSETTER MOTOR

47. Belts and Pulleys
Inspect belts and pulley. Adjustment No. 51.

48. Power Cord
Inspect power cord for loose or frayed condition.

SECTION X - ACCELERATOR/BOOSTER

49. Structural Parts
Inspect mounting parts and pulley bearings and/or shafts.

50. Belts
Inspect belts for wear and adjustment. Adjustment No. 29.

51. Motor
Inspect motor filter and wiring condition for loose or frayed connections.

SECTION XI - BALL LIFT

52. Drive System
Inspect drive belt, pulleys, shafts, bearings, clutch, tire and rim assembly. Check belt for proper adjustment. Check lift mounting bolts.

53. Retarder/Tracks
Inspect retarder, look for loose or broken bolts, worn or dirty carpet, and loose transition track. Check transition track leather, replace as required. Check for proper operation to insure heavy balls are adequately retarded and light balls pass through. Inspect "C" tracks for wear and replace as required. Check power lift frame for levelness and reshim base as required.

54. Motor/Electrical Box
Inspect motor for proper operation, lubrication, and check for loose or frayed electrical connections. Check electrical control box for loose or frayed wiring, and make sure box is properly mounted and cover is secured in place. Check electrical function boxes for proper connections and covers secured.

Part 6
Adjustment Appendix

Adjustment Appendix

Table of Contents

Adjustments

The following pages describe the recommended procedures in making functional adjustments on the automatic pinsetter. The adjustments are listed in sequences that are directly related to each other and, as will be noted in the text, the adjustments should be performed in their proper sequence.

All measurements in the adjustments are described in inches and carry their respective dimensional tolerances. A tolerance is an allowable variation in the adjustment which will permit the mechanism to function properly. Each tolerance is enclosed by parenthesis and follows the nominal dimension for each adjustment.

Example 1: 3-1/4" (±1/8)

NOMINAL DIMENSION — TOLERANCE

In this example, the measurement is 3-1/4" with an allowable tolerance of plus 1/8" or minus 1/8". The measurement is then permissable to be between 3-1/8" and 3-3/8".

Example 2: 3-1/4" (+1/8 -0)

In this example, the measurement is 3-1/4" with an allowable tolerance of plus 1/8" or minus 0. The measurement is then permissable to be between 3-1/4" and 3-3/8"

Example 3: 3-1/4" (+0 -1/8)

In this example, the measurement is 3-1/4" with an allowable tolerance of plus 0 and minus 1/8". The measurement is then permissable to be between 3-1/8" and 3-1/4".

NOTE: In checking rake sweep hook adjustments, it is wise to "jog" the machine through the first cycle. Be alert for interferences.

1. DETECTOR ROD ADJUSTMENT

The purpose of the detector rod adjustment is to insure that the pinsetter accurately detects:

1. Strikes
2. Any number of standing pins, with maximum deck weight
3. Out-of-range pins

This is a combined adjustment, normally only Part B needs to be made, Part A is necessary when the detector rod has been removed and replaced.

NOTE: After installation of the rod, make sure the exposed stop pins on the rod are perpendicular to the slots in the stop bracket with one pin above and one pin below the stop bracket. (Figure 1)

A. 1. With the deck in the fully up position at 0°, measure the distance between the rear face of the projection on the out-of-range controller and its blocking surface on the detector disc. The distance must not be less than 1/16". It is preferable to maintain the 1/16" dimension as close as possible.

2. To obtain this measurement, the detector rod will have to be threaded in or out of the part of the rod which is attached to the detector disc.

3. If the rod cannot be threaded in far enough, it should be removed and about 1/8" cut off the threaded end. When this is done, make sure the jam nut is left on the rod, as it can be used to clear the threads for easy replacement.

4. Repeat steps 1 and 2.

5. The distance between the lower top pin on the detector rod and the point of connection at the disc is now correct. The deck down position of the disc can now be adjusted.

B. 1. Cycle the pinsetter to exactly 90° first ball strike.

2. Check the position of the strike cam follower roller and see if it is nested in the low level of the timing cam. If not, manually lift the strike selector out of its blocking position, permitting the strike cam follower roller to enter the low level of the timing cam. Loosen the pivot block screw and lower the detector rod until the upper stop pin on the rod hits the stop bracket. (Figure 1)

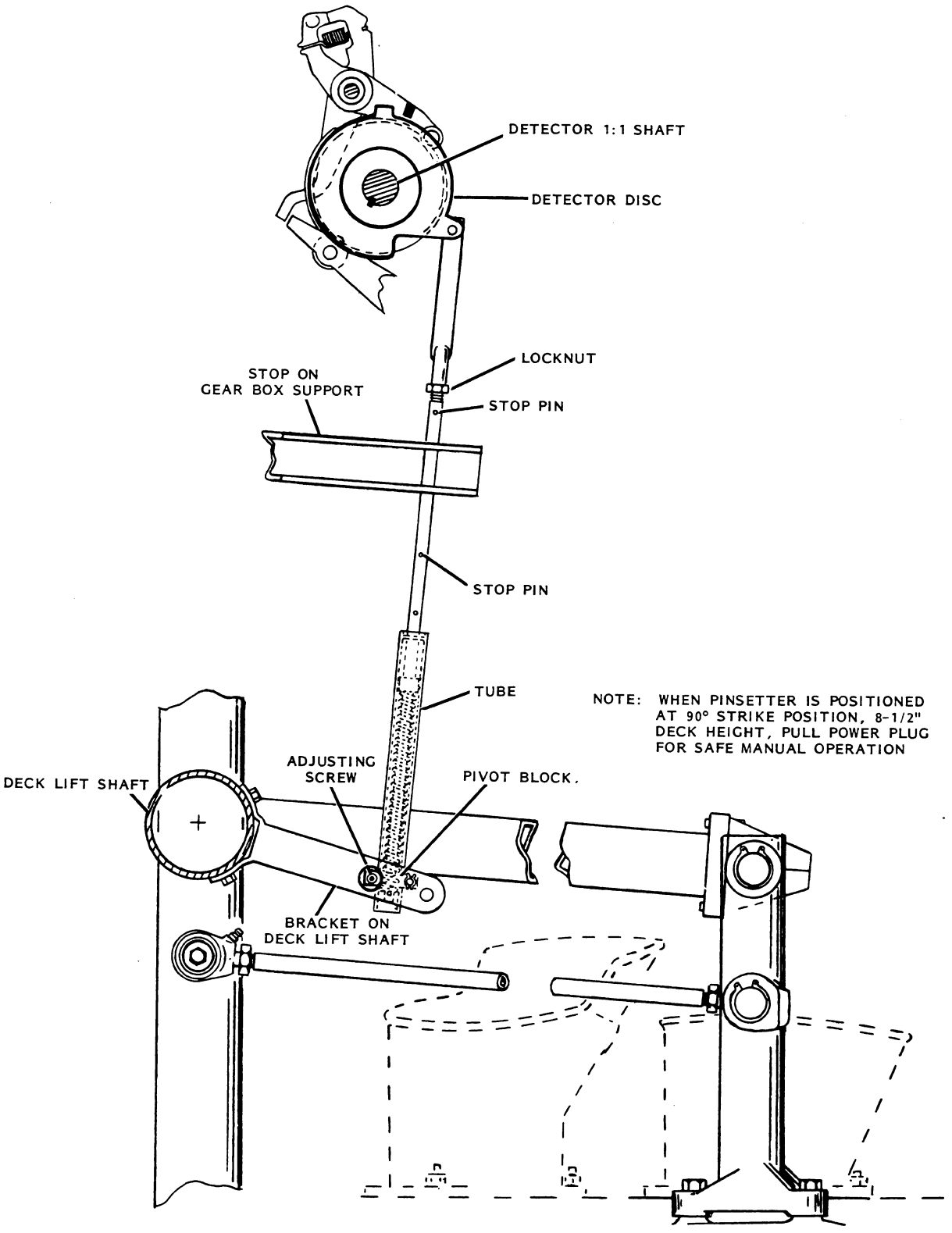
3. Carefully push the detector rod and tube assembly upward until the motion of the rod stops. Be careful not to compress the spring in the tube.

4. Carefully work the tube and rod down 1/16" to 1/8", then tighten the pivot block screw. Check now if the rod can be pushed up against the spring this 1/16".

5. As a check, cycle the pinsetter through all cycle and combination of standing pins.

6. If detection is incorrect, return to 90° strike position.

7. Mark tube assembly at top of block. Lower additional 1/16" (total 1/8"). Lock adjusting screw and repeat test of detection. Maximum tolerance 3/8". If still failing detections, return to step B1 and repeat adjustment.



DETECTOR ROD ADJUSTMENT AT 90°

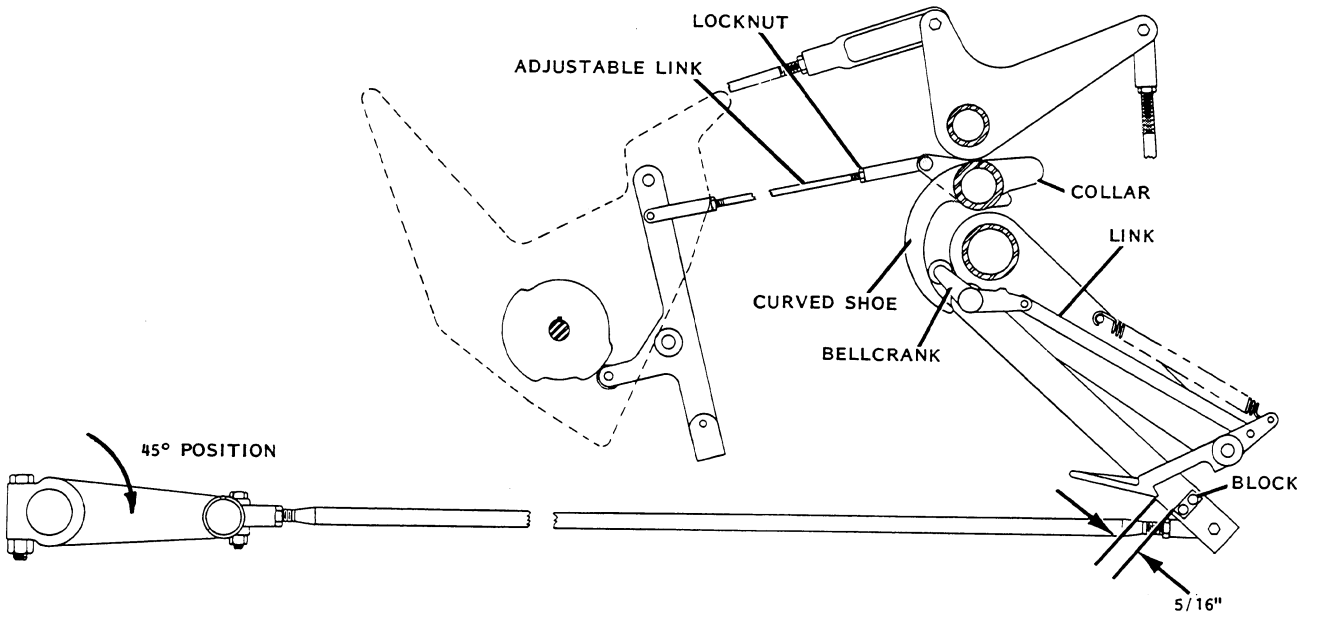
FIGURE 1

2. RAKE SWEEP HOOK ADJUSTMENT

The rake sweep hook adjustment is made to insure that the sweep hook makes a positive engagement with the block when the rake sweeps, and that the sweep hook is lifted clear of the block when the rake must not sweep. The rake motion is obtained from the rake sweep link on the 4:1 shaft, and a large compression spring urges the rake in its forward motion. It is extremely important, therefore, that this adjustment be made carefully to avoid injury to personnel working around the pinsetter.

1. Cycle the pinsetter until the rake crank link is a direct continuation of the main rake crank on the 4:1 shaft (this will occur at 45°).

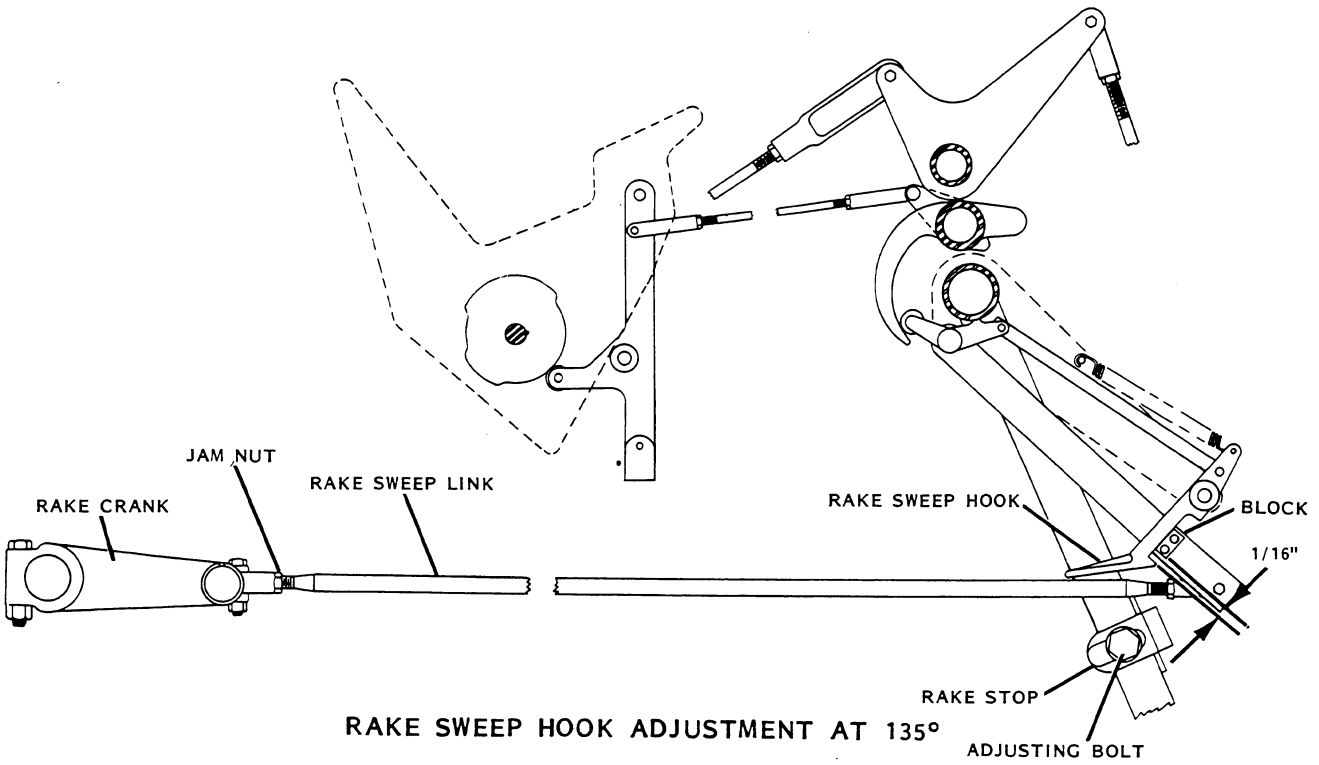
2. Loosen the locknuts on both ends of the link which runs from the detector assembly to the collar on the overhead cross brace, and turn the rod until the lower edge of the vertical surface of the rake sweep hook is 5/16" (+1/16 -0) above the latch block that the hook engages (Figure 2). Tighten the locknuts. As a check, jog the pinsetter and make sure the hook fully engages the block during the sweep motion, and that the hook lifts at least 1/8" above the block when the hook disengages at 225°.



RAKE SWEEP HOOK ADJUSTMENT AT 45°

FIGURE 2

3. Cycle the pinsetter to exactly 135° until the rake sweep link is a direct continuation of the rake crank. Loosen the locknuts on both ends of the rake sweep link and turn the rake sweep link until the vertical surface of the rake sweep hook is 1/16" (+1/32 -0) behind the latch block that the sweep hook engages (Figure 3). Tighten the locknuts.



RAKE SWEEP HOOK ADJUSTMENT AT 135°

FIGURE 3

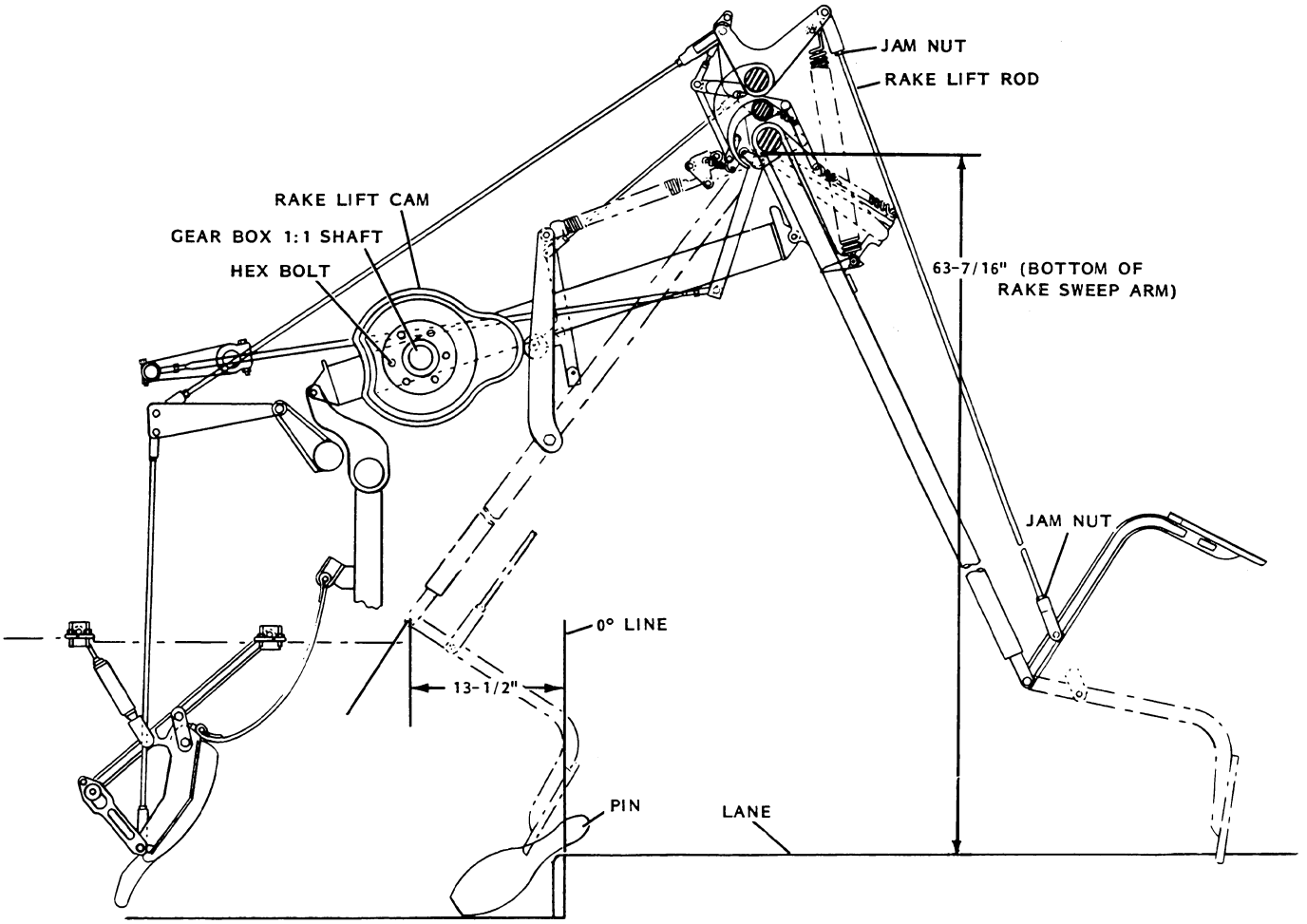
4. Cycle the pinsetter to exactly 180°, with the rake in its rearmost position.

5. Measure the horizontal distance from the zero line of the lane to the lower hinge pin on the bottom of the rake support arm (Figure 4). This dimension must be 13-1/2" (±1/8), and may be obtained be readjusting the rake sweep link which was previously adjusted in step 2c.

6. Manually cycle the pinsetter to exactly 225°, where the rake sweep link will again be a direct continuation of the rake crank arm on the 4:1 shaft.

7. Loosen the hex nut that mounts the left hand rake stop bracket to the left hand side of the pinsetter frame. Adjust the left hand rake stop bracket so that the vertical surface of the rake sweep hook is again 1/16" (+1/32 -0) behind the rear surface of the block. Tighten the nut securely.

8. Loosen the bolt that mounts the right hand stop bracket to the right hand side of the pinsetter frame. Push the right hand rake support arm rearward until the left hand support arm starts to lose contact with the left hand rake stop bracket. While holding the rake support arm in this position, snug the right hand rake stop bracket against the rake support arm. Tighten the nut securely.



RAKE BOARD HEIGHT ADJUSTMENT

FIGURE 4

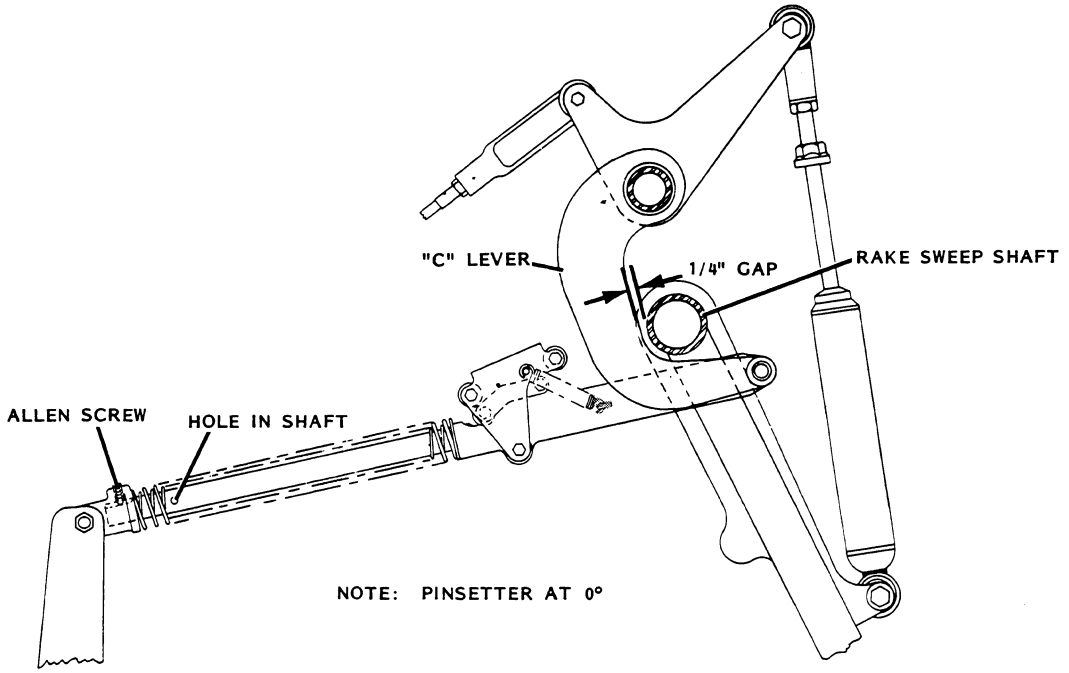
3. RAKE BOARD HEIGHT ADJUSTMENT

This adjustment is made to insure that the rake board stays at the correct height above the lane surface during the entire sweep motion.

1. Cycle the pinsetter to 0°.

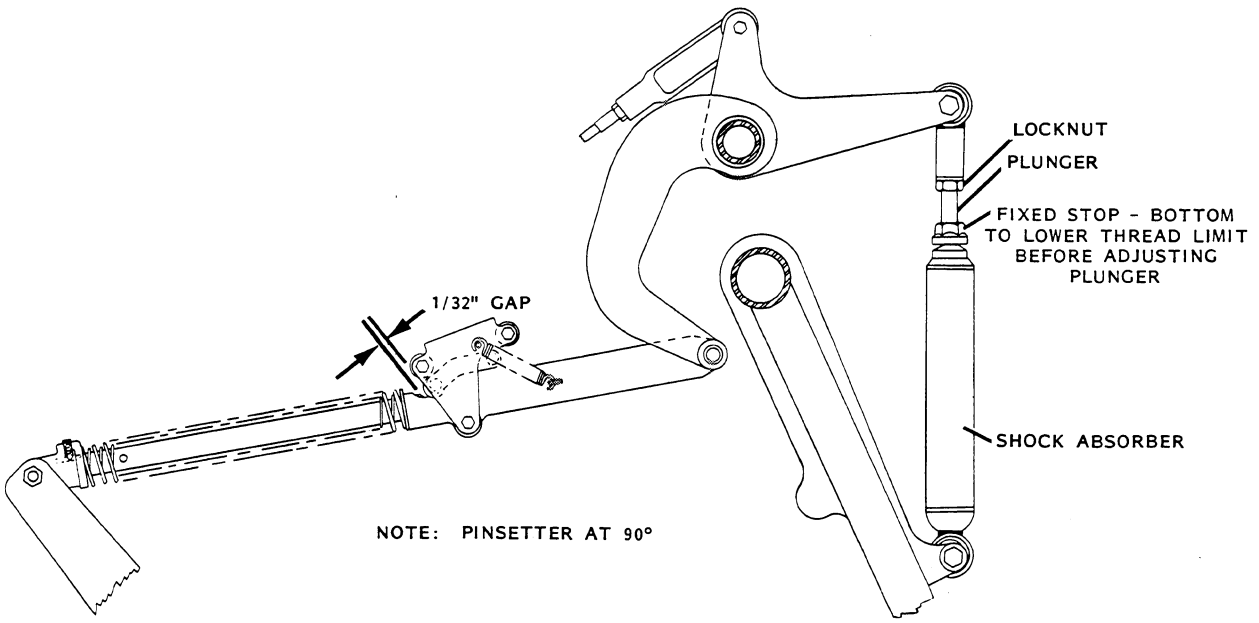
2. Measure the horizontal distance from the rear edge of the rake sweep shaft to the forward edge of the C-shaped lever on the rake lift shaft. This dimension must be 1/4" (+1/8 -0) and can be obtained in the following manner: Cycle the pinsetter to 45° and shut off the power to the pinsetter. Loosen the allen screw on the rear, upper rake trip shaft connection to the rake cam follower (Figure 5). Insert a pin through the hole provided in the rake trip shaft and rotate the shaft one full revolution counterclockwise to decrease the gap 1/32", or one full revolution clockwise to increase the gap by 1/32". Tighten the set screw.

   NOTE: The rake trip shaft has an axial "V" groove on its rear end that must face upward to receive the allen screw. The shaft adjustments must therefore be made in increments of a full rotation. One full revolution of the rake trip shaft will increase or decrease the gap by 1/32".



RAKE BOARD HEIGHT ADJUSTMENT
FIGURE 5

3. Cycle the pinsetter to 90° and shut off the power. Tighten the fixed stop nut against the bottom thread limits of the plunger. Loosen the locknut at the top of the shock absorber plunger. Turn the plunger to obtain a 1/32" (+1/32 -0) gap between the rear surface of the latch roller and the rear edge of the notch in the rake trip shaft (Figure 6).

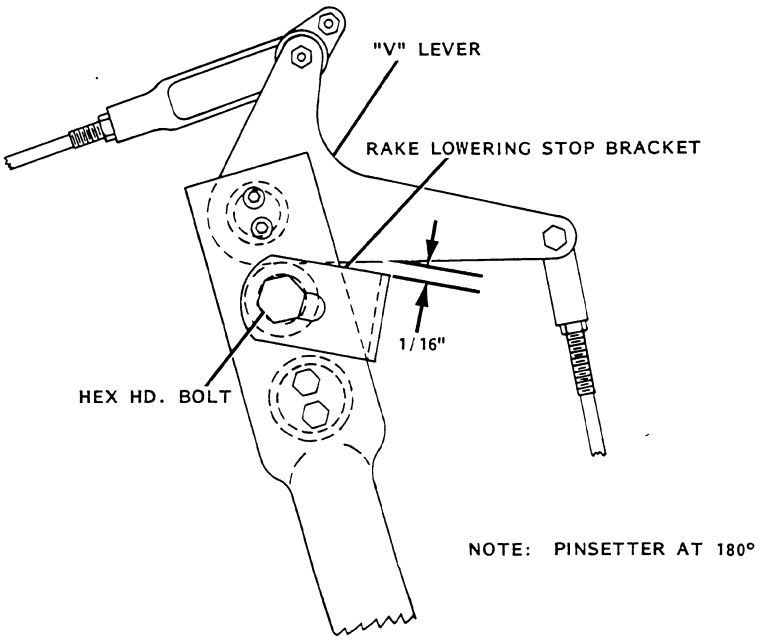


RAKE BOARD DASHPOT ADJUSTMENT
FIGURE 6

4. If the plunger is adjusted too low, the gap will decrease, and if the plunger is adjusted too high, the gap will increase. Tighten the locknut.

5. Cycle the pinsetter to exactly 180°, with the rake in its rearmost position. Shut off the power. Manually engage the gear box clutch and rotate the input worm shaft two full revolutions in the reverse direction (clockwise when viewed from the rear of the pinsetter). Loosen the six bolts around the hub of the rake lift cam and allow the pressure of the rake cam follower to rotate the cam as the follower seeks the low level of the cam. This action will place the rake lift cam "in time" with the gear box. Tighten the six mounting bolts.

6. With the rake still at 180°, loosen the bolt that mounts the rake lowering stop bracket to the top, left hand side of the pinsetter frame (Figure 7). Rotate the stop bracket until its upper surface is 1/16" below the bottom of the "V" lever. Tighten the bolt. This adjustment is made to insure that the rake board will not jam against the header plank in event the rake trip latch should fail to re-engage.



RAKE LOWERING STOP ADJUSTMENT

FIGURE 7

7. Manually reverse the pinsetter until the rake board is positioned between the 2, 3 and 4, 5 and 6 spots. Loosen the jam nuts on both ends of the rake lift rods and adjust the rods until the bottom of the rake board is 5/8" (±1/8) above the lane surface and parallel to the lane surface within 1/32" from one end of the rake board to the other. Tighten the jam nuts.

8. After making this adjustment, check the Out-of-Range Latch Adjustment, Adjustment 21, page 3-25.

NOTE: The following series of adjustments, numbers 4-12, while seemingly unrelated, all affect triggering efficiency. To obtain maximum triggering efficiency, all of these adjustments must be correct.

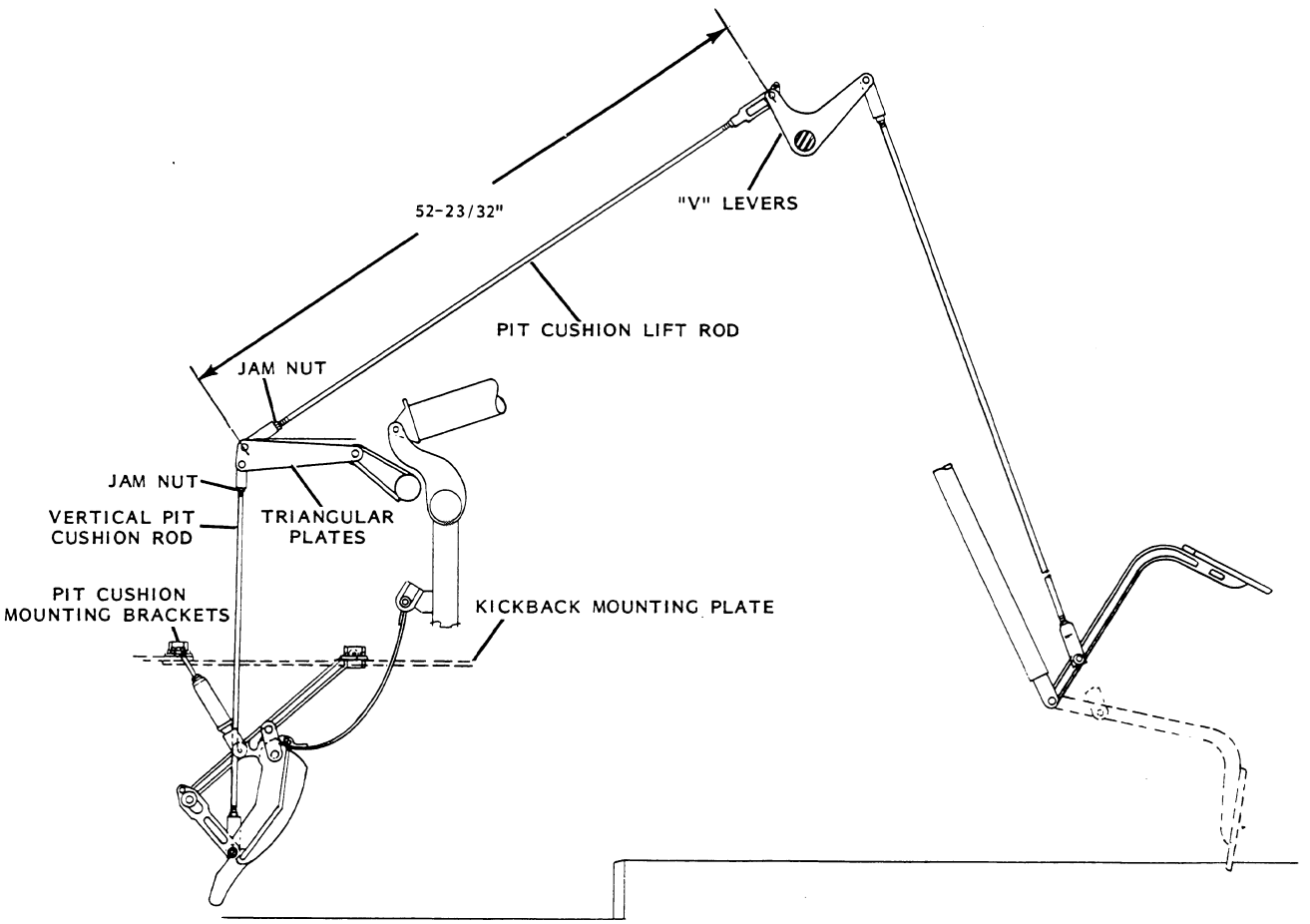
4. PIT CUSHION LIFT ROD ADJUSTMENT

This adjustment is made to insure that the pit cushion is positioned properly to trigger the pinsetter and provide adequate clearance for the ball to return to the bowler.

1. Cycle the pinsetter to 0° and shut off the power.

2. Loosen the jam nuts on both ends of the pit cushion lift rods from the triangular plates to the "V" levers on the rake lift shaft.

3. Turn the rods until the center of the pin on the triangular plates is 52-23/32" (±1/16) from the pivot pin on the "V" lever (Figure 8). Tighten the jam nuts. Be certain the vertical links from the triangular plates are <u>not</u> supporting the pit cushion when making this adjustment.



PIT CUSHION LIFT ROD ADJUSTMENT

FIGURE 8

4. Check the motion of the pit cushion to insure that there is no restriction or binding in the pit cushion linkages.

5. With the pinsetter still shut off, and the rake board in its raised position, loosen the jam nuts at both ends of the vertical pit cushion rods and turn the rods in until the pit cushion lifts. Screw the rods out until a downward motion of the pit cushion stops, then continue 1/2 turn to insure that the rods are not supporting the weight of the cushion. Tighten the jam nuts.

6. Manually trip the rake mechanism and place a standard size ball between the pit cushion and pit conveyor. A minimum clearance of 1/8" must be obtained between the bottom of the cushion and the top of the ball. If this clearance is less than 1/8" check the position of the pit conveyor, Adjustment 23, page 3-28. If the pit conveyor is positioned properly, shims may be added between the kickback mounting plates and pit cushion mounting brackets to obtain the required clearance. DO NOT use the pit cushion rods to lift the pit cushion for ball clearance.

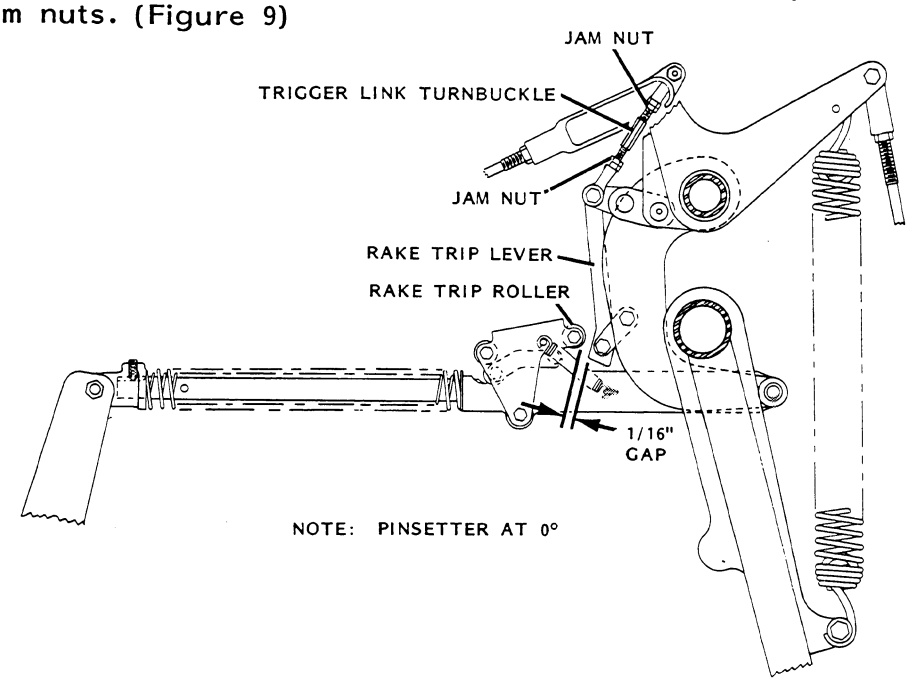
   NOTE: Any change in this adjustment will affect the pit cushion trigger link adjustment, Adjustment 5, below.

5. PIT CUSHION TRIGGER LINK ADJUSTMENT

This adjustment is made to insure that ball impact against the pit cushion will effectively trip the rake lowering mechanism to lower the rake.

1. Cycle the pinsetter to 0° and shut off the power to the pinsetter.

2. Loosen the jam nut on the trigger link turnbuckle. Rotate the turnbuckle until a 1/16" (+1/64 -0) gap is obtained between the front surface of the rake trip roller and the rear surface of the rake trip lever. Tighten the jam nuts. (Figure 9)



PIT CUSHION TRIGGER LINK ADJUSTMENT
FIGURE 9

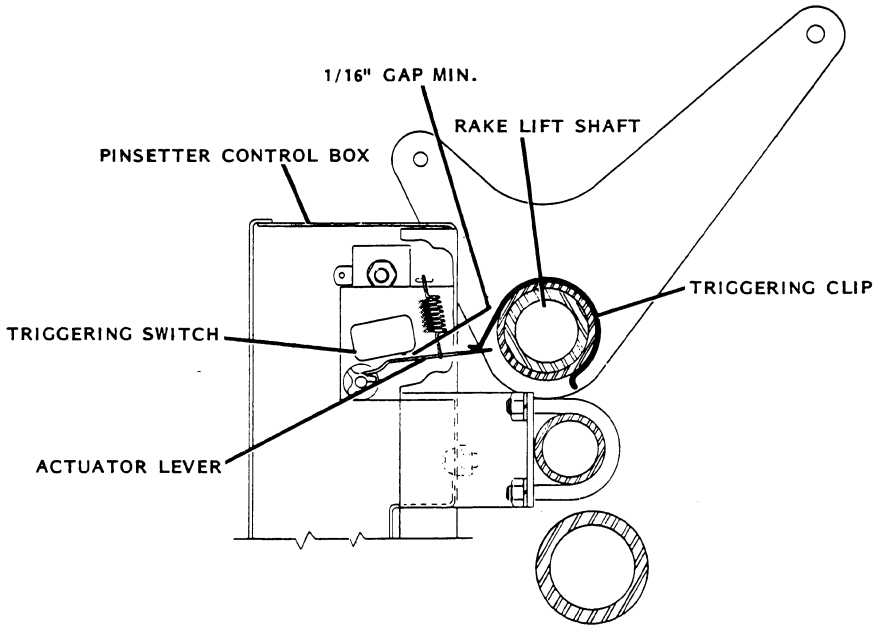
6. TRIGGER SWITCH ADJUSTMENT

This adjustment is made to insure that the triggering circuit is energized by the lowering motion of the rake.

1. Cycle the pinsetter to 0° with the rake in its raised position. Shut off the power to the pinsetter.

2. Rotate the triggering clip on the rake lift shaft clockwise until the spring-loaded actuator lever closes the switch. (Figure 10)

3. Rotate the clip counterclockwise until it depresses the actuator lever far enough to open the switch (an audible click can be heard when the switch opens). Carefully rotate the clip to depress the lever an additional 1/16" (+1/16 -0).



TRIGGER SWITCH ADJUSTMENT

FIGURE 10

7. GEAR BOX CLUTCH ADJUSTMENT

This adjustment is made to insure that the clutch is not too loose, causing noisy operation, or too tight, causing overheating of the friction surfaces.

PINSETTERS WITHOUT GEAR BOX STOP SURFACE (FACTORY EQUIPPED)

1. Cycle the pinsetter to 0° and shut off the power.

2. With the gear box clutch engaged, loosen the jam nut on the end of the input worm shaft. (Figure 11)

3. Turn the front adjusting nut until the front surface of the clutch drive disc assembly is even with the rear surface of the bearing retainer. Holding the front nut, tighten the rear jam nut.

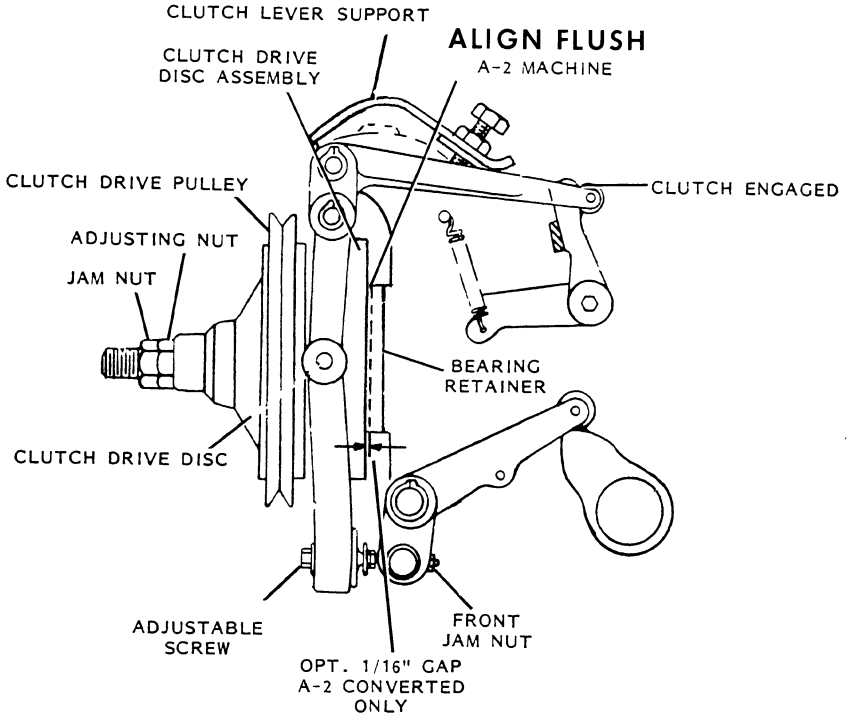
PINSETTERS WITH GEAR BOX STOP SURFACE (CONVERTED)

1. Cycle the pinsetter to 0° and shut off the power.

2. Engage the gear box clutch and loosen the jam nut on the end of the input worm shaft. (Figure 11)

3. Turn the inner nut until a gap of 1/16" (±1/64) is obtained between the front surface of the clutch drive disc assembly and the bearing retainer disc. Tighten rear jam nut.

   NOTE: Whenever the gear box clutch is readjusted, Adjustments 8 and 9, Gear Box Clutch Cam Follower and Gear Box Clutch Lever, will require readjustment.



GEAR BOX CLUTCH ADJUSTMENT
FIGURE 11

8. GEAR BOX CLUTCH CAM FOLLOWER ADJUSTMENT

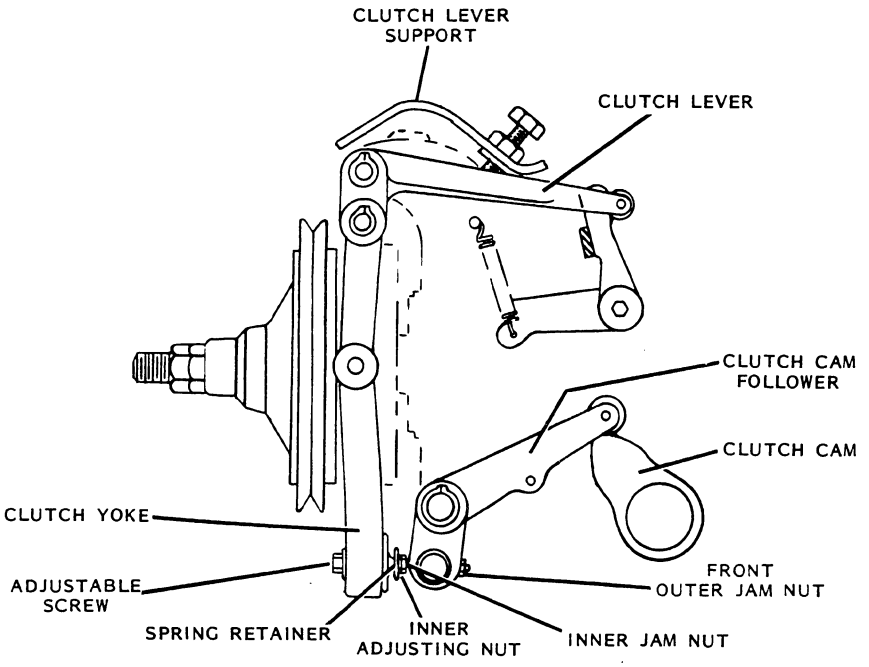
This adjustment is made to insure that the clutch cam follower is urged to follow the contour of the clutch cam to properly control the motion of the clutch lever.

1. Cycle the pinsetter to 0° and shut off the power.

2. Engage the gear box clutch, with the power off, and loosen the inner jam nut on the threaded connection between the clutch cam follower and the clutch yoke. (Figure 12)

3. Turn the inner adjusting nut in until the spring retainer is pressed lightly against the clutch yoke.

4. Tighten the forward jam nut against the inner adjusting nut.



CLUTCH CAM FOLLOWER ADJUSTMENT

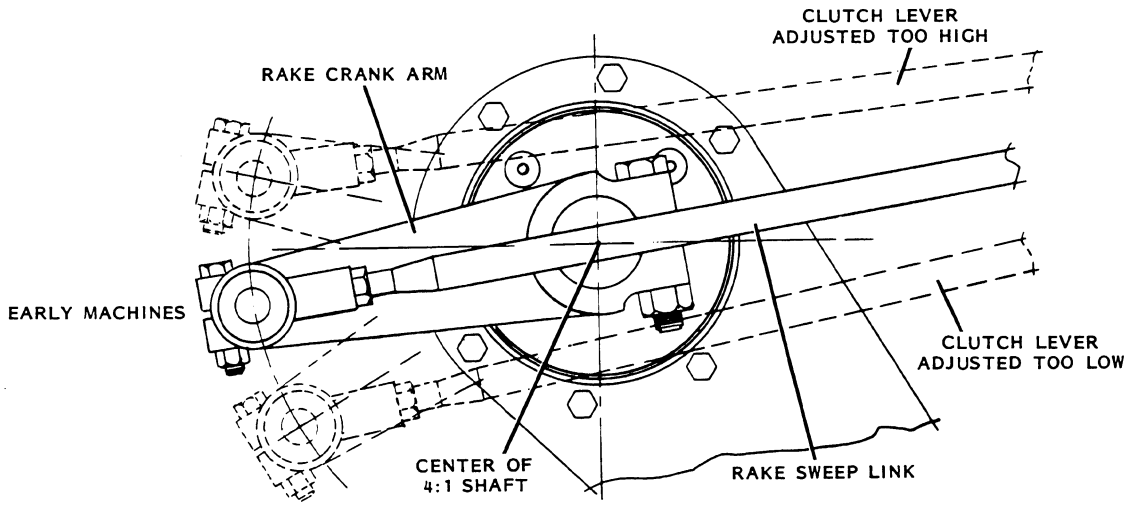
FIGURE 12

9. GEAR BOX CLUTCH LEVER ADJUSTMENT

This adjustment is made to insure that the roller on the clutch lever engages the stop arm to disengage the gear box clutch at exactly 0°.

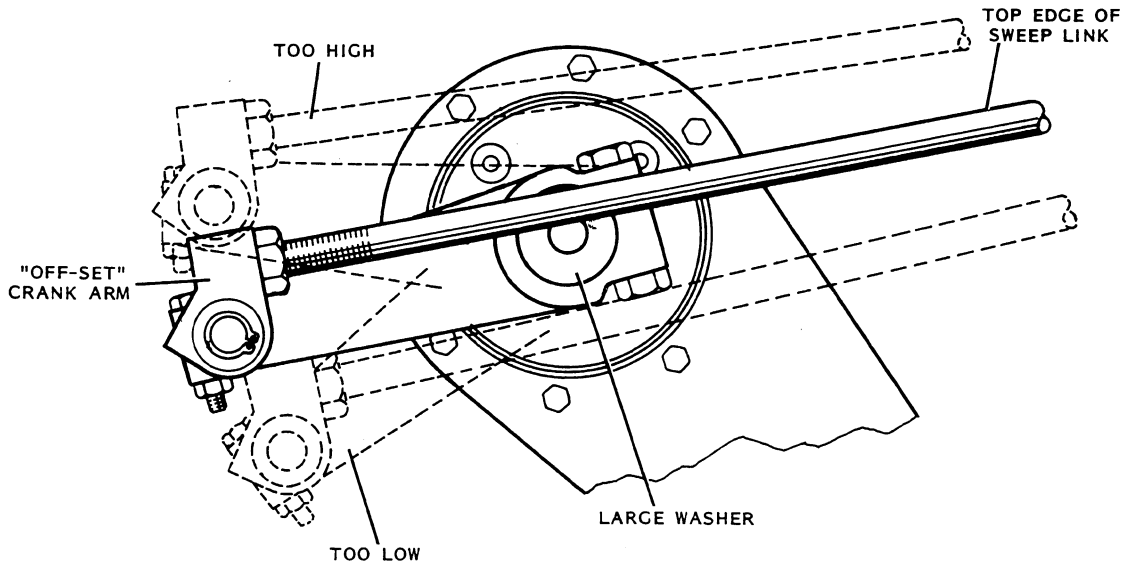
1. Cycle the pinsetter and allow it to come to a normal 0° stop, first ball cycle.

2. Check the position of the rake crank arm and the rake sweep link. The sweep link and crank arm should be in the same horizontal plane, with the sweep link bisecting the center of the 4:1 shaft on A-2 converted machines (Figure 13). On factory A-2 machines, the sweep link will be even with the top of the large washers (Figure 14).



GEAR BOX CLUTCH LEVER ADJUSTMENT (A-2 CONVERTED)

FIGURE 13



GEAR BOX CLUTCH LEVER ADJUSTMENT (A-2 MACHINES)
FIGURE 14

3. If the sweep link is higher than the crank arm, the clutch lever must be lowered. If the sweep link is lower than the crank arm, the clutch lever must be raised.

4. To adjust the clutch lever, loosen the most forward jam nut on the forward end of the adjustable connection at the lower end of the yoke. To raise the clutch lever, screw the adjustable connection out; to lower the clutch lever, screw the adjustable connection in. Tighten the most forward jam nut (ref. page 5-11) after checking for 0° stop.

5. Cycle the pinsetter and observe whether the crank and link stop in the same plane. Repeat adjustment if necessary.

10. GEAR BOX STOP COLLAR ADJUSTMENT

This adjustment is made to insure that the triggering and reset mechanism will function properly to disengage the gear box clutch as required.

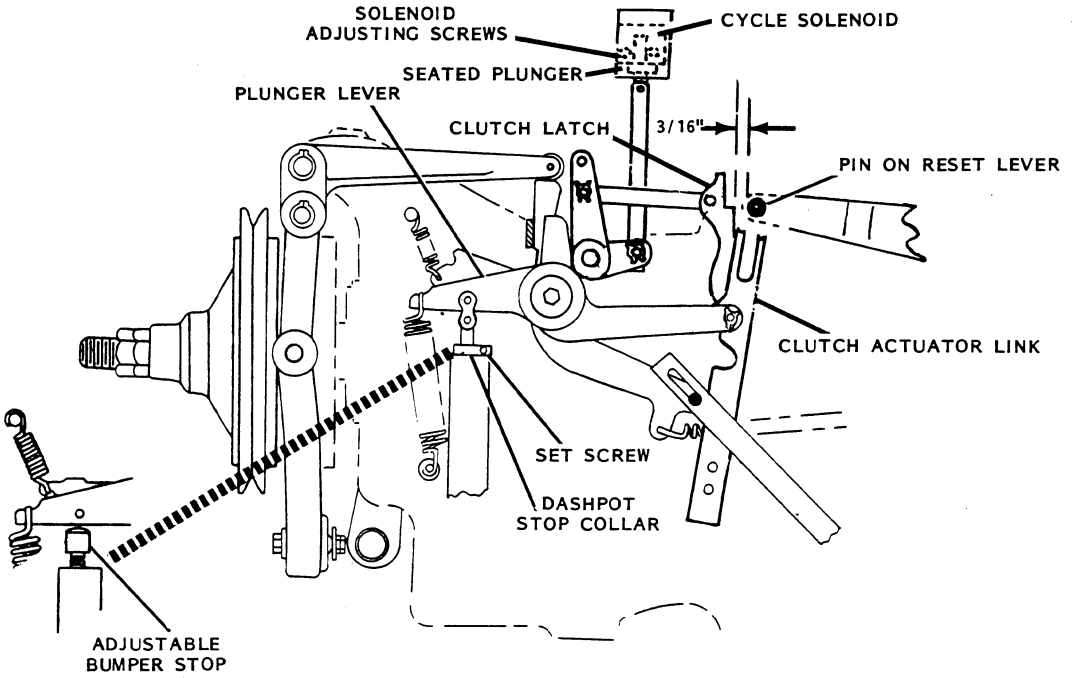
1. Cycle the pinsetter to a normal 180° stop, waiting for pins. Shut off power to the pinsetter.

2. Loosen the set screw on the dashpot stop collar, or loosen jam nut on bumper stop. (Figure 15)

3. Position the clutch actuator link so that the shoulder of the clutch latch is opposite the center of the pin in the end of the clutch reset lever.

4. Hold the clutch actuator link in this position and slide the stop collar down against the top of the dashpot and tighten the set screw.

5. As a check, if the stop collar is set too high, the pinsetter will recycle; if set too low, the gear box clutch will disengage at 270°.



GEAR BOX STOP COLLAR AND CYCLE SOLENOID ADJUSTMENTS

FIGURE 15

11. CYCLE SOLENOID ADJUSTMENT

This adjustment is made to insure that the solenoid plunger is fully seated when the solenoid becomes energized to trigger the pinsetter.

1. Cycle the pinsetter to a normal 180° stop. Shut off the power.

2. With the gear box clutch disengaged, loosen the two screws that mount the solenoid to the support bracket.

3. Rotate the clutch latch counterclockwise until a 3/16" (+1/8 -0) gap is obtained between the front surface of the latch and the rear surface of the pin in the clutch reset lever. (Figure 15)

4. While holding the clutch latch in this position, slide the solenoid down until the solenoid is fully seated on the plunger. The mounting holes are slotted for vertical adjustment. Tighten the hex head adjusting screws. Check plunger clearance through box cover when energized after assembly.

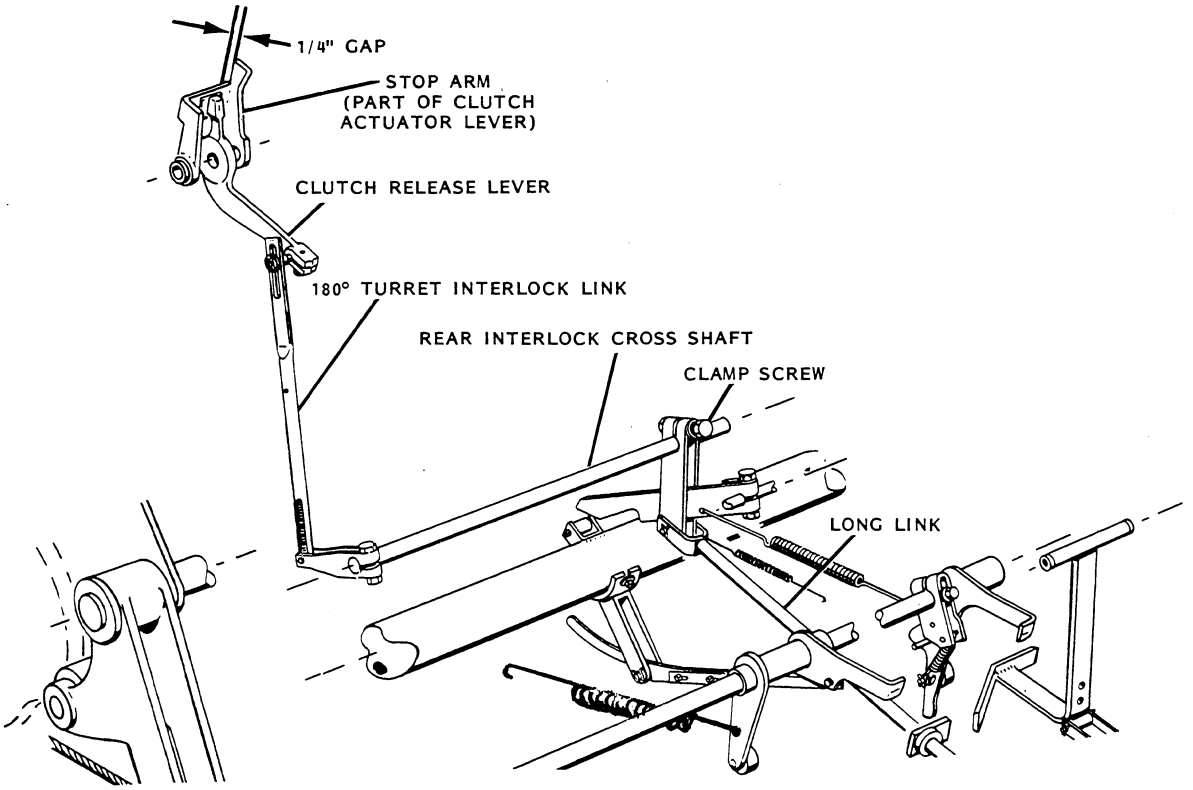
12. GEAR BOX 180° TURRET INTERLOCK ADJUSTMENT

This adjustment is made to insure that the clutch will disengage at 180° when the deck must wait for pins to deliver to the lane, and that the clutch will then automatically re-engage when the turret delivers ten pins to the deck.

1. Allow the pinsetter to come to a normal 180° stop, waiting for pins. Be certain that the long link is in its forward position (empty deck signal).

2. Loosen the clamp screw on the lever at the right hand end of the rear interlock cross shaft. (Figure 16)

3. Rotate the rear interlock cross shaft until a gap of 1/4" (±1/64) is obtained between the rear face of the projection on the clutch release lever and the contact surface of the stop arm. Tighten the clamp screw.



180° TURRET INTERLOCK ADJUSTMENT
FIGURE 16

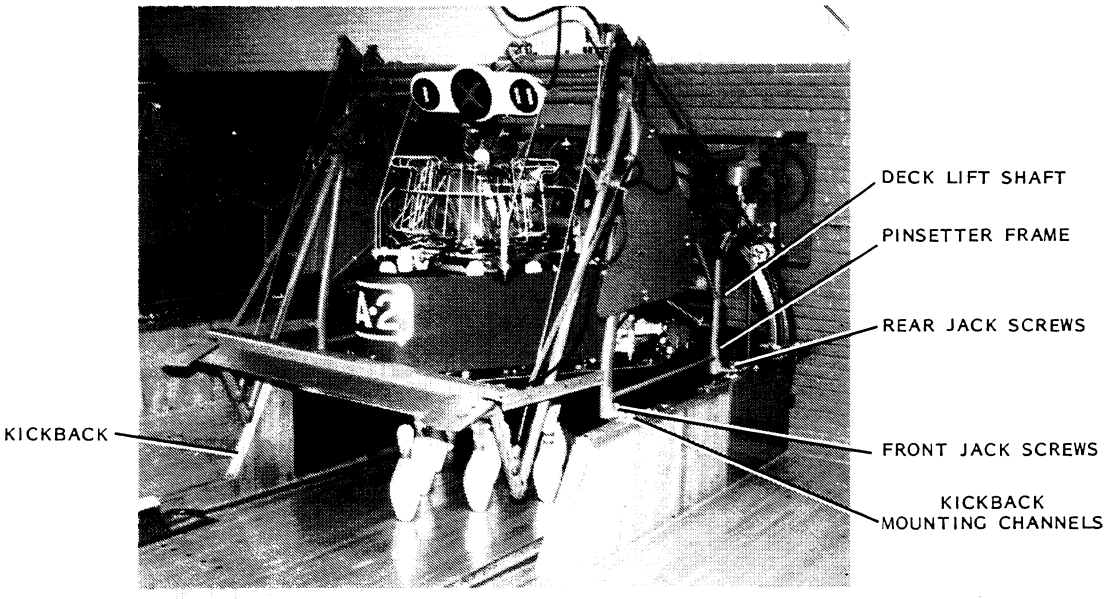
4. As a check, cycle the pinsetter and observe if the clutch disengages at 180° when it must wait for pins and then re-engages automatically when the turret indexes after delivering ten pins to the deck. If the pinsetter stops at 180°, and then fails to restart automatically, the link is set too low. If the pinsetter fails to stop at 180° to wait for pins, the link is set too high.

5. As a further check, let the pinsetter run at 0° without engaging the clutch. Allow the cross conveyor to deliver ten pins to the turret and observe if the pinsetter triggers itself, when the turret indexes after delivering ten pins to the deck. If it does trigger itself, the link is set too high.

13. DECK LIFT SHAFT ADJUSTMENT

This adjustment is made to insure that the deck shaft is correctly positioned with relation to the lane surface.

1. Set the deck lift shaft at 15-13/16" (+0 -1/8) from the rear of the deck lift shaft to the center of the 7, 8, 9 and 10 spots. To move the pinsetter forward or backward, loosen the bolts at the four anchor points on the top of the kickbacks. (Figure 17)



DECK LIFT SHAFT ADJUSTMENT
FIGURE 17

2. Set the deck lift shaft at 32 5/8" (±1/16) from the bottom of the deck lift shaft to the playing surface of the lane, at both ends of the deck lift shaft. The shaft may be raised or lowered by means of the REAR jack screws on both side frames.

3. Position the front of the pinsetter frame 63-7/16" (±1/8) from the bottom of the rake sweep shaft to the lane surface. This dimension is obtained with the jack screws at the front legs of the side frame.

   NOTE: When using the jack screws in making any adjustment, always use the jack screws in pairs so that the weight of the machine is never supported by a single screw.

14. DECK HEIGHT AND LEVEL ADJUSTMENT

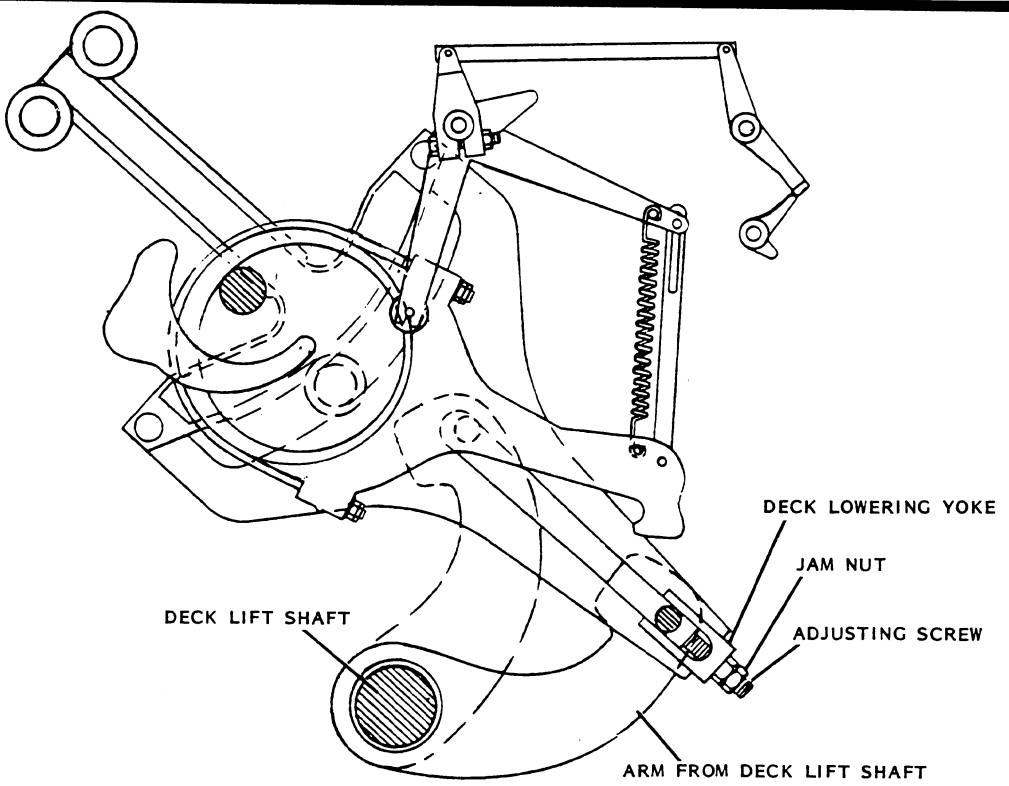
This adjustment is made to insure that the deck is level with the lane surface and the correct height above the lane surface.

1. With the pinsetter at exactly 270°, setting new pins, level the deck to the lane surface. If the apex or rear of the deck requires adjustment, loosen the jam nuts on the stabilizer rods. Length or shorten to make the deck an equal height at the front and the rear corners. Lock the jam nuts.

2. With the pinsetter still at 270°, set the height of the deck as follows:

   PINSETTERS WITH DECK LOWERING YOKE (FACTORY EQUIPPED)

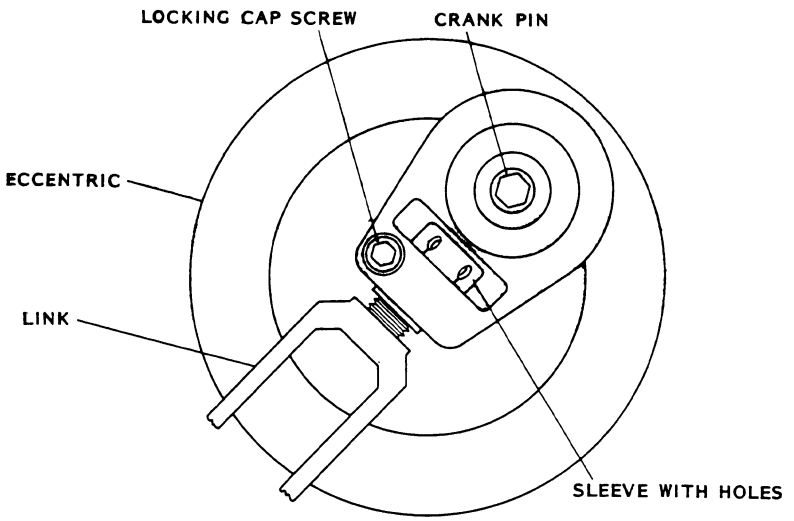
   To raise or lower the deck, loosen the jam nut at the bottom of the deck lowering yoke and turn the adjusting screw until the bottom of the scissor deck is 15/16" (±1/32) above the lane surface. (Figure 18)



DECK HEIGHT ADJUSTMENT (FACTORY EQUIPPED PINSETTERS ONLY)
FIGURE 18

PINSETTERS WITH DECK LOWERING LINK (CONVERTED)

To raise or lower the deck, loosen the locking cap screw where the deck lowering link is threaded into the pin on the 2:1 shaft. Rotate the adjusting sleeve until the deck is 1" (±1/32) above the lane surface. The sleeve may be rotated by means of a pin punch placed in the holes of the sleeve. (Figure 19). Tighten the cap screw. The sleeve is easily rotated if the deck is blocked up to take the weight off the lowering link.



DECK HEIGHT ADJUSTMENT (CONVERTED PINSETTERS ONLY)
FIGURE 19

NOTE: 1. If the deck has to be lowered beyond the limits obtainable with both the jack screws and lowering adjustments, shims may be added between the top of the deck and the deck support arms.

2. Whenever the deck height is changed by means of the deck lowering adjustments, be sure to readjust the restricted drop interlock (Adjustment 43, page 3-46) and the deck holding hook (Adjustment 22, page 3-26).

15. DECK PINSPOTTING ADJUSTMENT

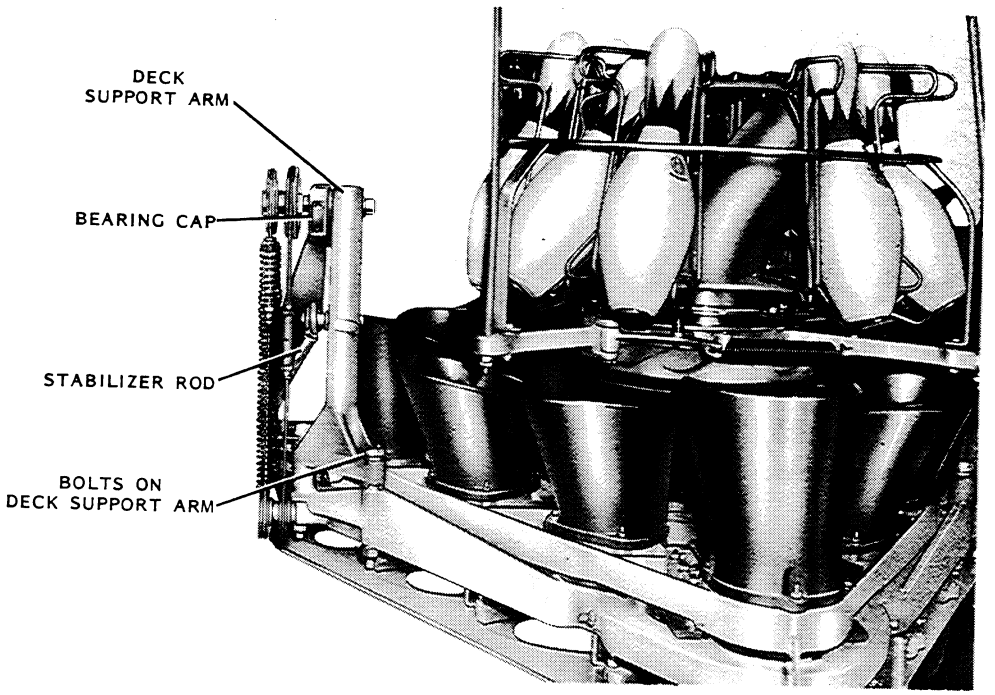
This adjustment is made to insure that the deck accurately sets new pins on the spots.

1. Cycle the pinsetter through several new pinsetting cycles and observe whether the pins are accurately placed on the spots.

2. If pins are spotted too far to the left or right, it must be determined whether the pinsetter must be shifted on the kickbacks to obtain proper pinspotting, or if the deck assembly must be shifted to obtain proper pinspotting. If the side frames and rake board are positioned to the right or left of the lane, the frame must be shifted. If the frames and rake board are centered with the lane, the deck assembly must be shifted.

3. To shift the frame, loosen the four mounting bolts that secure the side frames to the kickback mounting plates. Shift the pinsetter as required, then tighten the mounting bolts.

4. To shift the deck, cycle the pinsetter until the deck is all the way down (270°) with the weight of the deck supported on blocks. Loosen the bearing caps on the front of the deck support arms, and move the deck right or left as required. Tighten the bearing caps. (Figure 20)



DECK PINSPOTTING ADJUSTMENT
FIGURE 20

5. After making these adjustments, cycle the pinsetter and observe if there is interference between the rake board and edge of the lanes, or interference between the rake arms and the deck assembly. If interference exists, readjust as required.

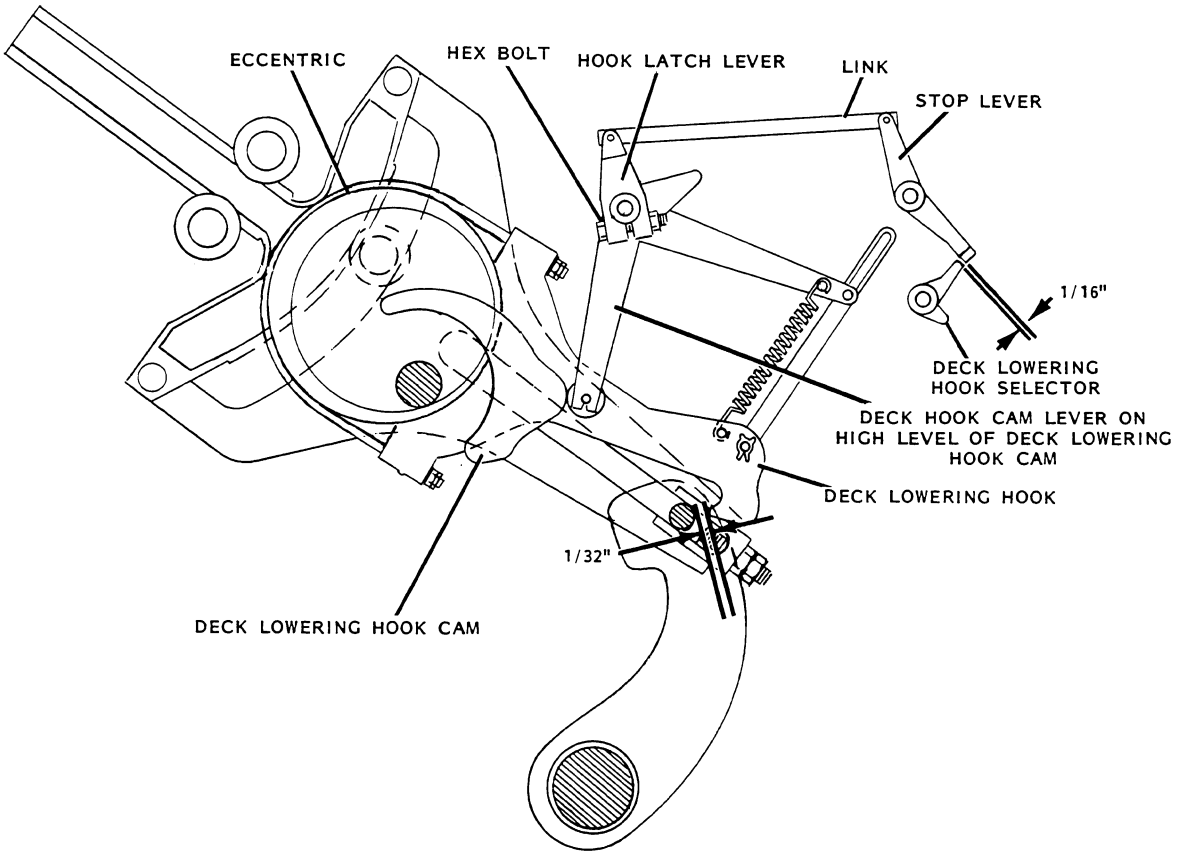
6. If the pins are spotted too far forward or to the rear, loosen the two bolts on the lower end of each deck support arm and slide the deck forward or rearward. Tighten the four bolts.

16. DECK LOWERING HOOK LATCH ADJUSTMENT

This adjustment is made to insure that the deck lowering hook will engage the pin when the deck is detecting or respotting, and that the hook will be held out when the deck sets new pins.

1. Cycle the pinsetter until the roller on the deck hook cam lever is on the highest level of the deck lowering hook cam during a first ball strike or second ball cycle. Shut off the power. (Figure 21)

2. Loosen the bolt on the hook latch lever and set the gap between the rear of the deck lowering hook stop lever and the front of the deck lowering hook selector at 1/16" (±1/64). (The stop lever and deck lowering hook selector are in the front end of the detector assembly.) Tighten the bolt.



DECK LOWERING HOOK LATCH ADJUSTMENT
FIGURE 21

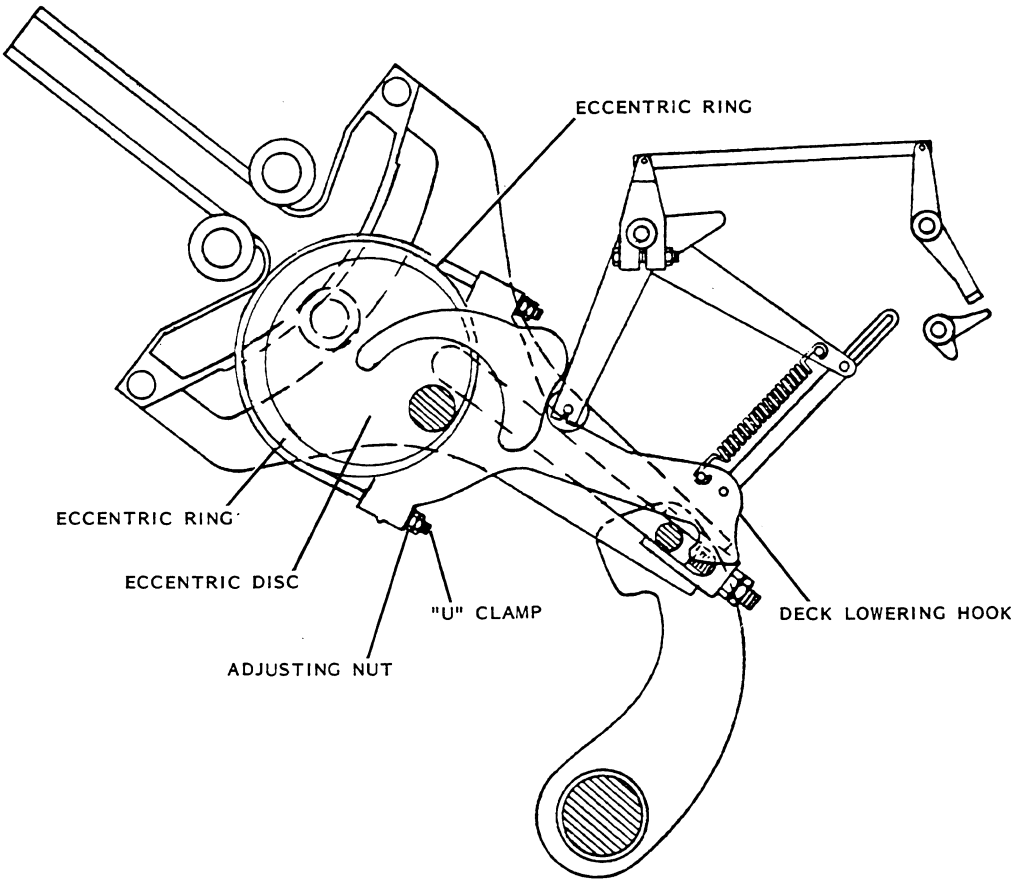
17. DECK ECCENTRIC ADJUSTMENT

This adjustment is made to insure that the deck lowers far enough beyond the standing pins detection level at 90°, first ball strike cycle, to permit proper functioning of the detector assembly and deck lowering mechanism.

PINSETTERS WITH DECK LOWERING YOKE (FACTORY EQUIPPED)

1. Cycle the pinsetter to 0° and shut off the power.

2. Loosen the two nuts on the deck lowering hook "U" clamp and rotate the eccentric ring until the edge of the deck lowering hook just clears the deck lowering pin by 1/32" (Figure 22). Tighten the nuts. Be careful not to overtighten the "U" clamp as the eccentric ring may become deformed.



DECK ECCENTRIC ADJUSTMENT (FACTORY EQUIPPED PINSETTERS ONLY)
FIGURE 22

PINSETTER WITH DECK LOWERING LINK (CONVERTED)

1. Allow the pinsetter to run until the deck receives ten pins.

2. Place a pin on the #5 pin spot only, and cycle the pinsetter to 90° with the weight of the full deck resting on the #5 pin.

3. Measure the vertical distance from the bottom of the scissor deck to the top of the lane surface.

4. Cycle the pinsetter to exactly 90°, first ball strike cycle (no pins on the lane).

5. Measure the vertical distance from the bottom of the scissor deck to the top of the lane surface.

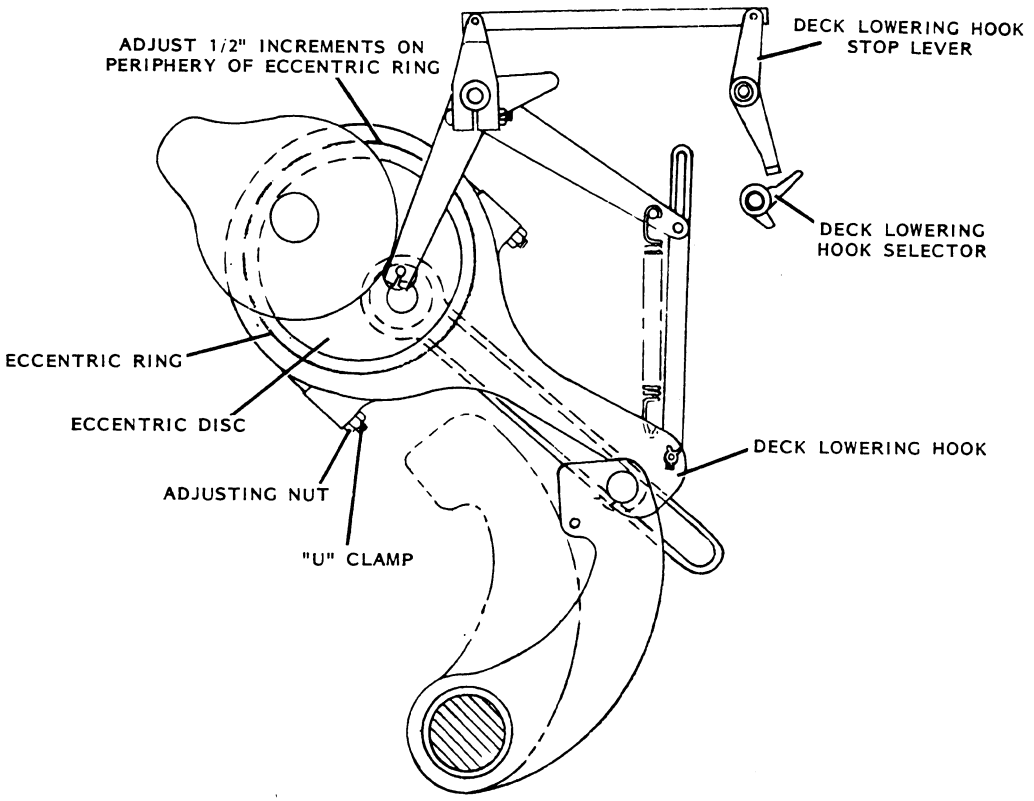
6. The deck must be 1-1/4" lower when detecting a strike than when detecting a single standing pin with a full deck.

7. Loosen the two nuts on the deck lowering hook "U" clamp (Figure 23) and rotate the eccentric ring until the bottom of the scissor deck is positioned 1-1/4" lower than the dimension obtained in Adjustment 17, step 3. Tighten the nuts. Be careful not to overtighten the "U" clamp as the eccentric ring may become deformed. The eccentric ring may be rotated by placing a pin punch in the hole provided on the eccentric ring. Rotate the ring in 1/2" increments until the proper height of the deck is obtained.

NOTE: 1. Check deck lowering hook at 90° and 270°, standing pins for overtravel clearance between bottom end of hook and frame cross member.

2. In making the above adjustment, it is helpful to scribe a mark on the eccentric ring and eccentric disc so that the amount of rotation will be readily visible.

3. Whenever the deck height is changed by means of the eccentric ring, it will be necessary to readjust the detector rod. (Adjustment 1.)



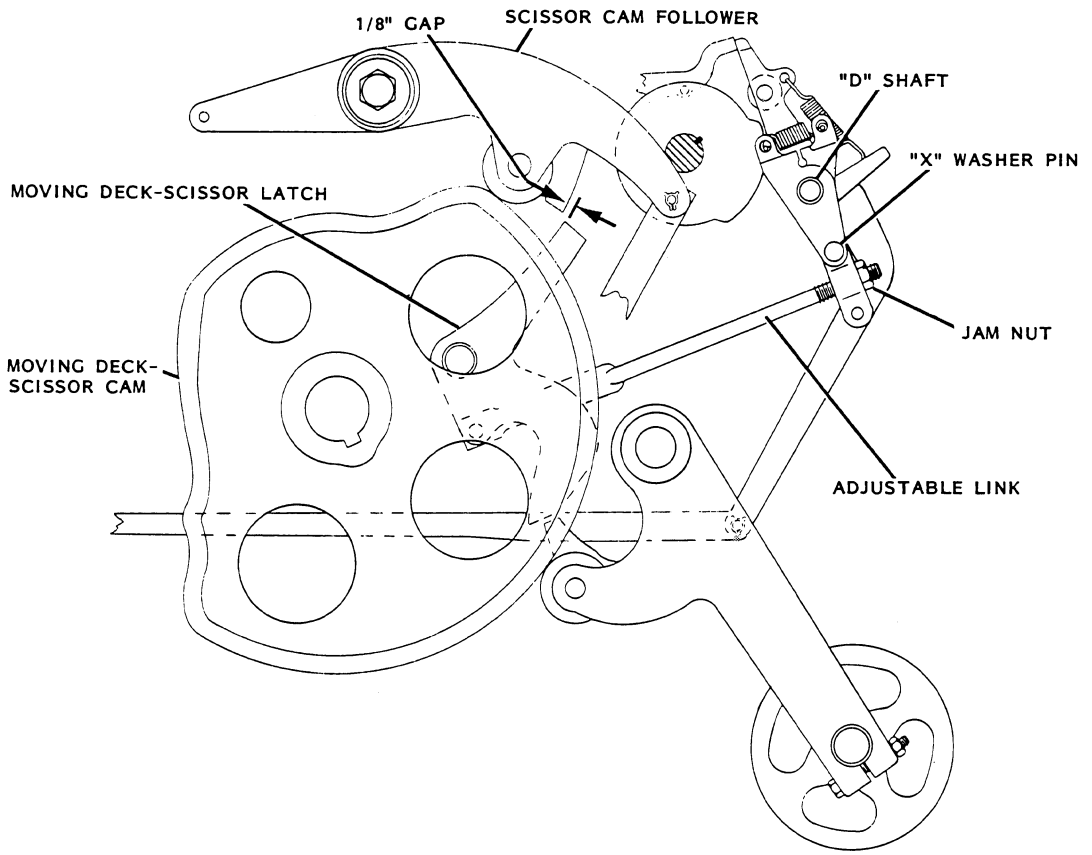
DECK ECCENTRIC ADJUSTMENT (CONVERTED PINSETTERS ONLY)

FIGURE 23

18. MOVING DECK-SCISSOR LATCH ADJUSTMENT

This adjustment is made to insure that the moving deck cam follower and scissor cam follower are blocked out as required.

1. With the pinsetter at 90° detecting no-strike, measure the gap between the rear of the latch and the front surface of the scissor cam follower arm. This gap should be 1/8" (±1/32). (Figure 24)



MOVING DECK-SCISSOR LATCH ADJUSTMENT

FIGURE 24

2. If the gap must be changed, the link connecting the latch to the detector is adjustable and may be lengthened or shortened, as required.

3. As a check, cycle the pinsetter to 90° detecting a strike. A minimum of 3/16" of the blocking surface of the latch should contact the lower surface of the scissor cam follower arm. If it is less than 3/16", adjust accordingly.

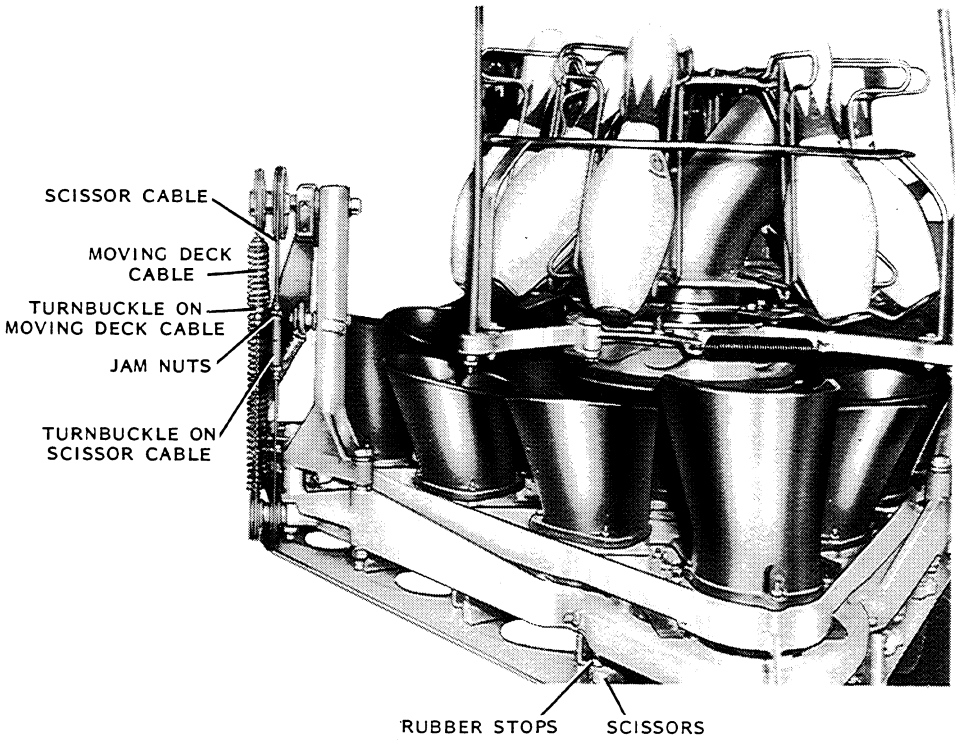
19. SCISSOR CABLE ADJUSTMENT

This adjustment is made to insure that the scissors open fully and do not interfere with the setting of new pins by the moving deck.

1. Cycle the pinsetter to 0° with the scissor cam follower on the high level of the moving deck-scissor cam.

2. Loosen the locknuts on the cable turnbuckle and adjust the scissor cable until the first pair of scissors are fully open, resting firmly against their rubber stops. The remaining pairs of scissors may not touch their rubber stops at this time, however, they will not interfere with the new pinsetting action. Tighten the locknuts. Do NOT attempt to tighten the cable until all scissors touch their rubber stops. (Figure 25)

   NOTE: When adjusting the turnbuckle, hold the threaded studs and rotate the barrel with a pin punch to avoid twisting and fraying the cable.



SCISSOR CABLE ADJUSTMENT
FIGURE 25

20. MOVING DECK CABLE ADJUSTMENT

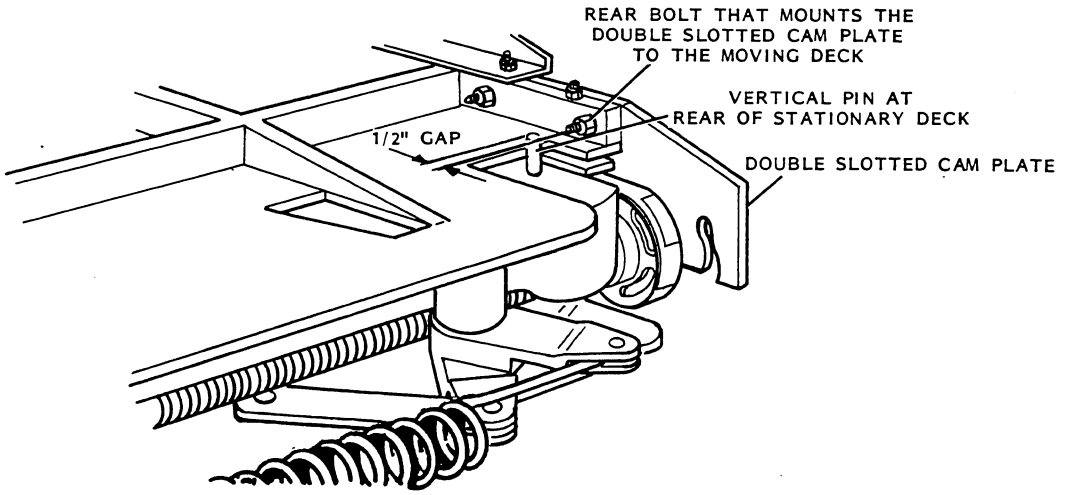
This adjustment is made to insure that the pins do not wobble when set by the deck.

1. Cycle the pinsetter until the moving deck is in its extreme rearward position (approximately 290°, first ball strike or second ball cycle).

2. Loosen the locknuts on the cable turnbuckle and adjust the moving deck cable until the center of the rear bolt that mounts the left hand geneva cam plate is 1/2" (±1/16) from the center of the vertical roll pin at the rear of the stationary deck. Tightening the cable will increase the gap and loosening the cable will decrease the gap. Tighten both locknuts. (Figure 26)

   NOTE: When adjusting the turnbuckle, hold the threaded studs and rotate the barrel with a pin punch to avoid twisting and fraying the cable.

3. Run the pinsetter through several strike cycles and observe if pins wobble when placed on the lane. If the pins wobble, cycle the pinsetter manually and observe if the guide fingers or the lower, front edges of the deck chutes contact the pins as the deck goes up.



MOVING DECK CABLE ADJUSTMENT
FIGURE 26

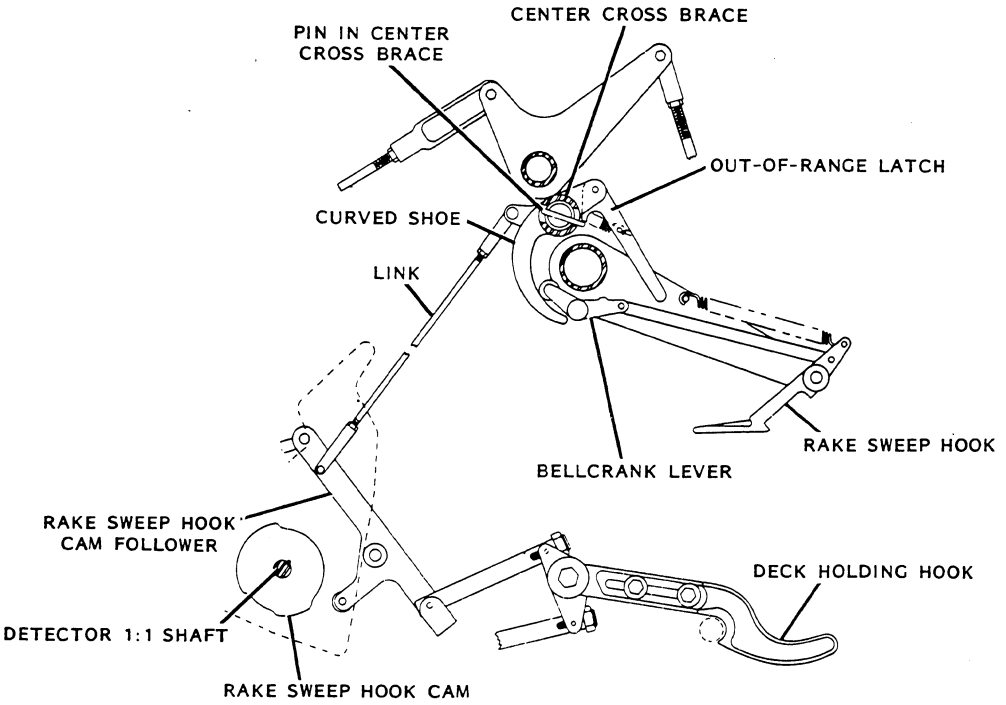
4. If the guide fingers contact the pins as the deck goes up, the cable must be slackened. If the lower, front edges of the deck chutes contact the pins as the deck goes up, the cable must be tightened. The clearances to the pin should be equal at the front and rear as the deck raises.

21. OUT-OF-RANGE LATCH ADJUSTMENT

This adjustment is made to insure that the rake does not sweep during an out-of-range cycle.

1. Set a pin out-of-range and cycle the pinsetter until the clutch automatically disengages. Then turn off the power by opening the circuit breaker.

2. Loosen the large bolts which mount the center cross brace to the overhead frame and the "U" bolts which mount the control box to the center cross brace.



OUT-OF-RANGE LATCH ADJUSTMENT
FIGURE 27

3. Pull the out-of-range reset lever at the rear of the pinsetter and while holding it in its rearmost position, rotate the middle cross brace until the short inner arm on the out-of-range blocking latch just drops over the pin in the cross brace. Tighten the bolts. The cross brace may be rotated by placing a pin punch through one of the roll pins in the center cross brace. (Figure 27)

4. At the end of the out-of-range cycle, the front end of the link from the inner rake cam follower arm must come forward far enough to push the out-of-range blocking latch off the pin in the cross brace. If the latch does not come off the pin, the pin may be carefully driven further into the cross brace.

5. Tighten the mounting bolts.

6. After rotating the center cross brace, check the Trigger Switch Adjustment (Adjustment 6, page 3-11) and the Rake Lowering Stop Adjustment (Adjustment 3, page 3-8).

22. DECK HOLDING HOOK ADJUSTMENT

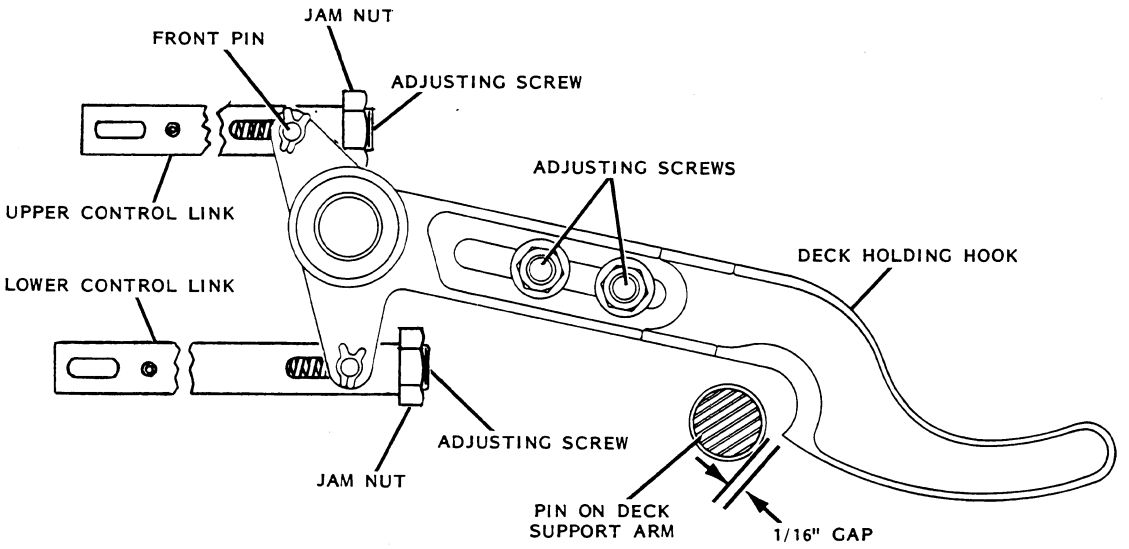
This adjustment is made to insure that the deck holding hook fully engages the pin on the deck support arm to hold the deck up from 180° to 360° during a first ball, out-of-range cycle and from 0° to 180° during a second ball cycle; and that it clears the pin when the deck lowers.

NOTE: 1. Before making this adjustment make sure Adjustment 21, Out-of-Range Latch, is correct.

2. Make this adjustment carefully, as the hook is the only support for the deck when it engages the pin.

1. Cycle the pinsetter to 0°, waiting for the first ball delivery, and allow the pinsetter to run until the turret delivers ten pins to the deck. Remove the jam nuts and allen head adjusting screws from both the upper and lower control links. (Figure 28)

2. Replace the adjusting screw in the upper link and turn it in until the sharp edge of the hook is opposite the horizontal center of the pin in the deck support arm. Tighten the locknut.



DECK HOLDING HOOK ADJUSTMENT
FIGURE 28

3. Replace the adjusting screw in the lower link and carefully turn it in until the screw just touches the front pin in the link. This should result in NO FREEPLAY in the hook. Tighten the jam nut.

4. With the pinsetter still at 0°, waiting for the first ball delivery with the deck full, loosen the two clamping screws that connect the rear and forward sections of the deck holding hook.

5. Pivot the hook up and down, and adjust the forward section of the hook to obtain a 1/16" (±1/64) gap between the sharp edge of the hook and the pin at their closest point. Tighten the clamping screws.

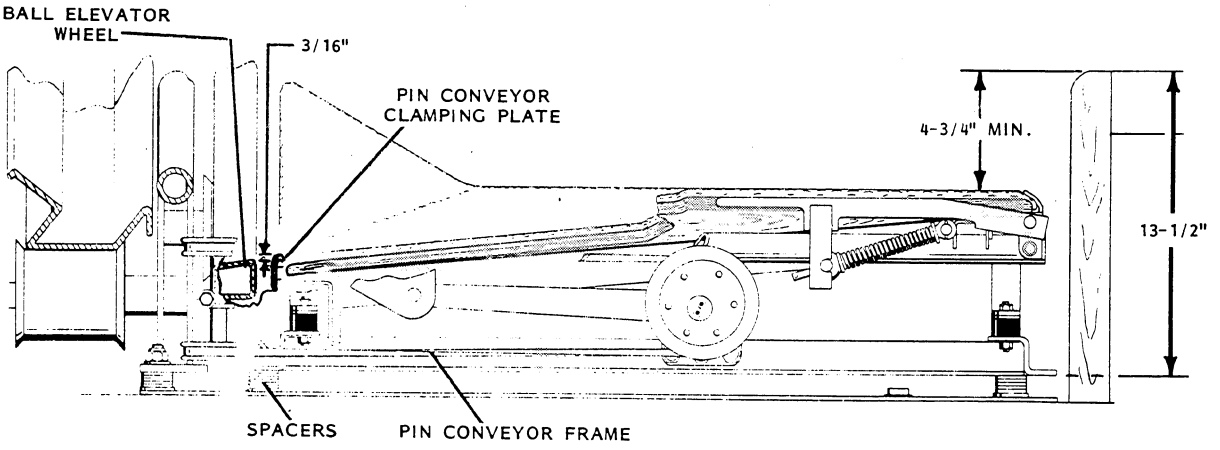
6. As a check, jog the pinsetter through a second ball cycle and observe if the hook fully engages the pin and if it clears the pin when the deck lowers after 180°, second ball. As a second check, first ball, out-of-range after an out-of-range stop, pull the out-of-range handle and jog the pinsetter. Observe if the hook fully engages the pin for the remainder of the first ball cycle.

23. PIT CONVEYOR ADJUSTMENT

This adjustment is made to insure that the pit conveyor is the A.B.C. required distance below the lane surface to prevent pins rebounding from the pit to the lane. The adjustment is also made to insure that the ball and pins will easily transfer from the pit to the elevator.

1. Remove the pit board from the pit conveyor and measure the distance from the lane surface to the bottom of the pit conveyor frame. This dimension should be 13-1/2" (±1/16) and can be obtained by adding or removing shims between the submounting plates and the pit conveyor frame. (Figure 29)

2. Check the pit conveyor frame at all four corners to insure that the frame is level. Shims can be added or removed between the submounting plates and pit conveyor frame to level the pit conveyor. Replace the pit board.



PIT CONVEYOR AND ELEVATOR FRAME ADJUSTMENTS

FIGURE 29

24. ELEVATOR FRAME ADJUSTMENT

This adjustment is made to insure that the elevator frame is positioned correctly.

1. Place a vertical level or plumb line on the elevator frame and loosen the mounting bolt in the slot of the motor mount shaft, both mounting bolts to the kickback mounting plates and both "J" bolts at the rear of the cross conveyor.

2. Tilt the elevator frame forward or rearward until the frame is plumb. Tighten all bolts.

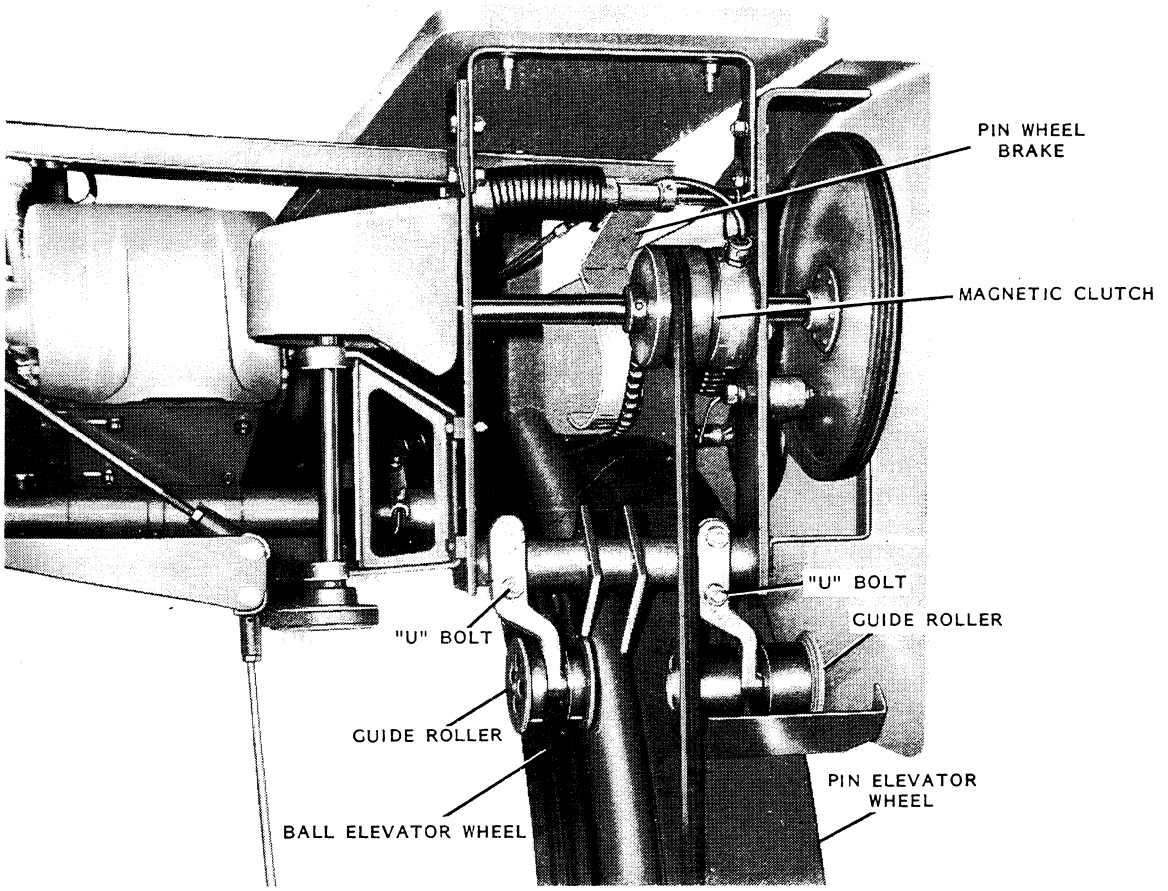
3. Position the elevator frame assembly so that the front edge of the ball elevator wheel is 3/16" (+0-1/16) below the rear clamping plate of the pit conveyor. This dimension can be obtained by adding or removing shims between the submounting plates and the elevator mounting feet. (Figure 29)

25. ELEVATOR GUIDE ROLLER ADJUSTMENT

This adjustment is made to prevent undue wear to the guide rollers or to the ball and pin wheels.

1. Release the spring-loaded belt tension pulleys on each wheel's drive belt.

2. Loosen the "U" bolts on all four upper guide rollers (two each wheel) and move them upward until they lose contact with the wheels. (Figure 30)



ELEVATOR GUIDE ROLLER ADJUSTMENT
FIGURE 30

PIN WHEEL

3. Check to insure that the elevator pin wheel is properly seated on both the lower guide rollers.

4. Lower the two upper guide rollers on the pin wheel until they just contact the wheel and tighten the "U" bolts.

NOTE: Slowly rotate the wheel by hand and observe if an out-of-round condition exists, causing binding in the rollers at the high spots of the wheel. If such high spots exist, loosen the "U" bolts and set the guide rollers so that the rubber in the rollers contacts the wheel at the high spots.

BALL WHEEL

5. To adjust the ball wheel, loosen set screws on the collars on both sides of the idler pulley arm that provides spring tension for the ball wheel belt. Slide the idler pulley arm forward or rearward to align the idler pulley with the ball wheel drive pulley. Snug the collars against both sides of the idler arm and tighten the set screws.

6. Check to insure that the ball wheel is properly seated on both the lower guide rollers.

7. Lower the two upper guide rollers until they just contact the wheel and tighten the "U" bolts. (Figure 30)

   NOTE: Slowly rotate the wheel by hand and observe if an out-of-round condition exists, causing binding in the rollers at the high spots of the wheel. If such high spots exist, loosen the "U" bolts and set the guide rollers so that the rubber in the rollers contacts the wheel at the high spots.

   NOTE: Check jack shaft pulley for centering with belt. Note also, that the rollers should be checked periodically for proper adjustment.

   NOTE: Check pin wheel brake for centering on pin wheel belt. Lock set screws in collars on each side of pin wheel brake.

The following adjustments, numbers 26-29, are closely related and changing one will affect the others. For efficient ball pickup, ball transfer and preference bar operation, care must be taken when changing one adjustment, to make compensating adjustments as required. These adjustments should be made in the sequence indicated.

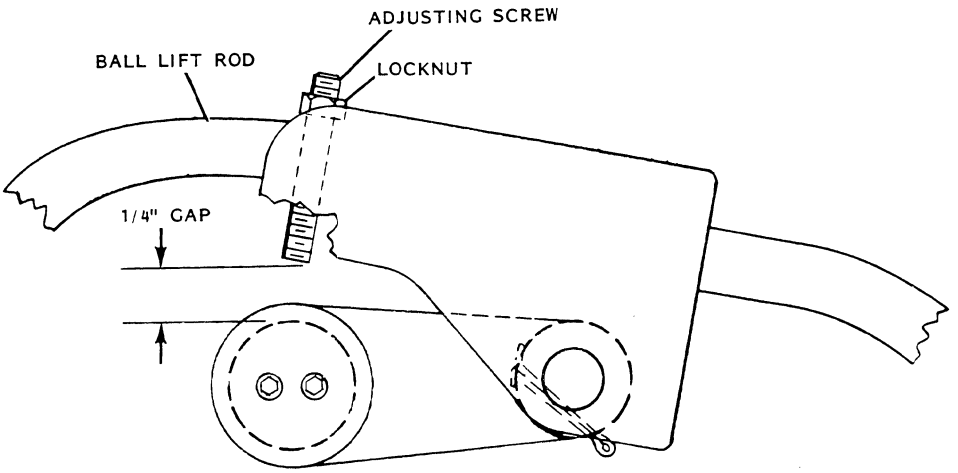
26. BALL LIFT ROD ADJUSTMENT

This adjustment is made to obtain maximum ball pickup efficiency.

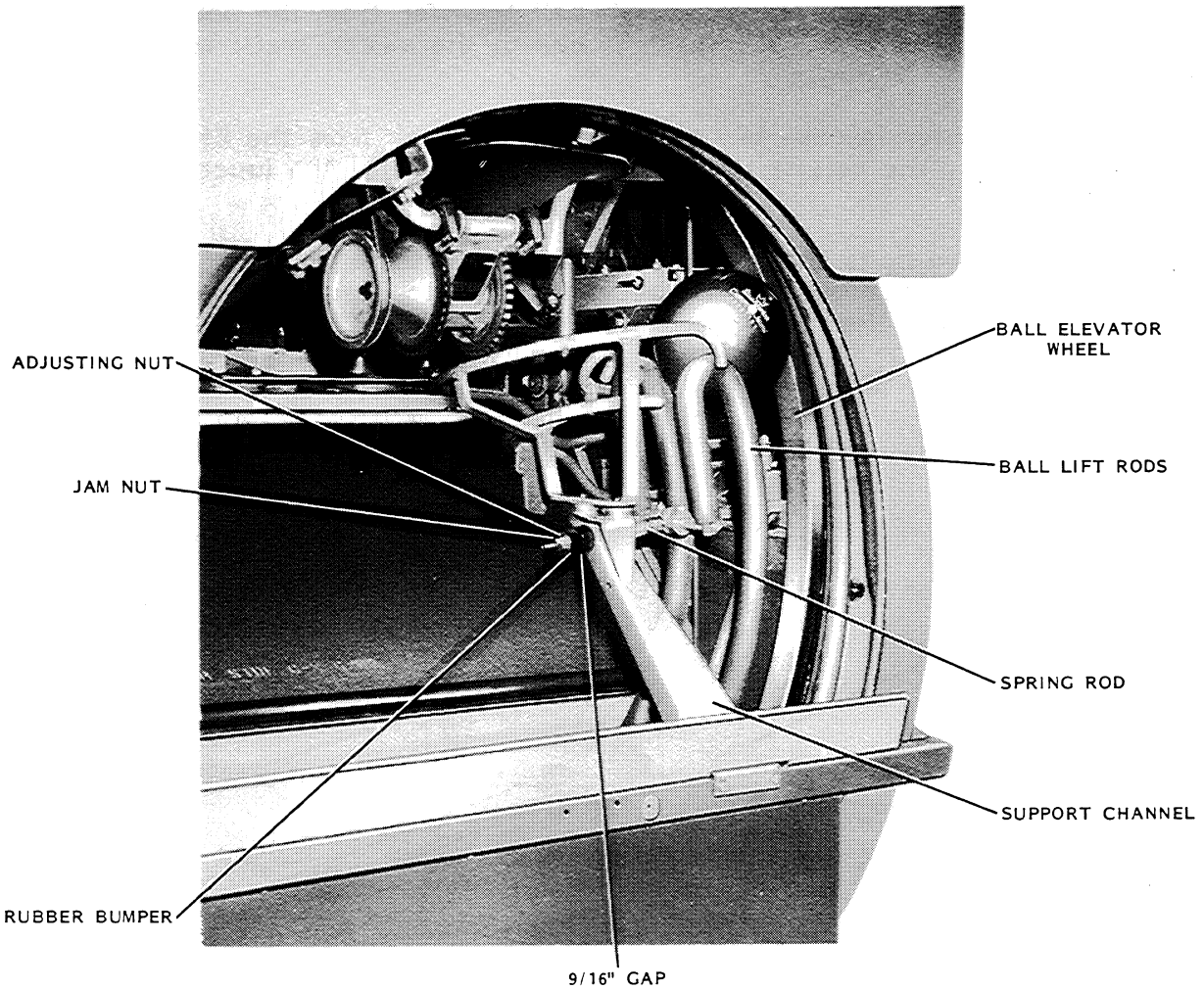
1. Make sure the elevator frame (Adjustment 24) and the elevator guide rollers (Adjustment 25) are correct.

2. Place a standard size ball between the lift rods and ball elevator wheel, and manually rotate the ball elevator wheel until the ball wedges itself, thus lifting the ball lift rods. Loosen the jam nut and turn the adjusting screw on the clapper block until the bottom of the screw is 1/4" (±1/16) from the surface of the lower clapper block (Figure 31).

3. Place a standard size ball between the ball lift rods and ball elevator wheel near the top of the lift rods. Loosen the jam nut and turn the adjusting nut on the spring rod until a 9/16" (+1/16 -0) gap is obtained between the rubber bumper and the ball trip bracket. Tighten the jam nut against the adjusting nut. (Figure 32)



BALL LIFT ROD ADJUSTMENT
FIGURE 31



BALL LIFT ROD ADJUSTMENT
FIGURE 32

4. Place a standard size ball at the lower center of the ball wheel so that it is resting against the rear ball lift rod. With the pit conveyor in its rearmost position, there should be 1/16" minimum clearance between the lower portion of the ball and the rear edge of the pit conveyor clamping plate.

5. If the clearance is less than 1/16", check the Elevator Guide Roller Adjustment (Adjustment 25), Pit Conveyor Adjustment (Adjustment 23) and Elevator Frame Adjustment (Adjustment 24). If all adjustments are correct, the ball lift rods must be raised to increase the dimension. To raise the ball lift rods, loosen the locknut on the upper clapper block and turn the adjusting screw until the 1/16" dimension is obtained. Tighten the jam nut.

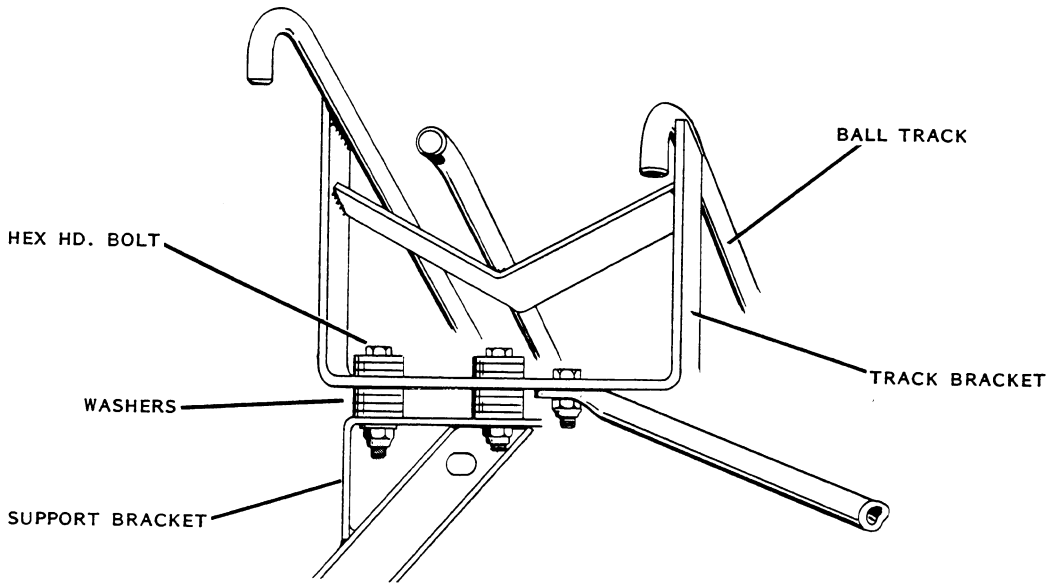
6. Check the ball lift rods to assure they are parallel with the ball lift wheel.

27. BALL TRANSFER ADJUSTMENT

This adjustment is made to obtain smooth ball transfer from the ball lift rods to return tracks, and from the return tracks to the switch track and accelerator track.

1. If rough transfer is observed as the ball transfers from the lift rods to the return tracks, the return tracks must be adjusted at the junction with the ball lift rods.

2. Remove the two bolts that secure the ball track to the support channel. Add or remove shim washers between the support channel and ball track bracket to obtain the proper height of the tracks. (Figure 33)



BALL TRANSFER ADJUSTMENT

FIGURE 33

NOTE: Extra shim washers are placed between the bolt head and track bracket. If the track must be raised, move the required amount of shim washers from the top of the track bracket and insert them between the bracket and support channel. Conversely, if the track must be lowered, transfer the proper amount of shim washers from under the bracket to the top of the bracket.

3. Replace and tighten both mounting bolts.

4. When the tracks have been raised, a careful check must be made to insure that the ends of the tracks do not contact the ball, thereby causing possible damage to the ball.

5. Place a ball in the pit and slowly jog the pinsetter until the ball is at the top of the ball lift rods. At this point, check the position of the track ends with relation to the ball. If the track ends can contact the ball, the track must be carefully bent down to avoid any possible ball contact. Extreme care must be taken to avoid distorting the rest of the track or the mounting brackets, when bending the track ends down.

6. Loosen both hex bolts that mount the switch track assembly to the kickback mounting plates and center the switch track assembly with the accelerator. Shims must be added under the low side of the switch track to assure that it is level from side to side within 1/16".

7. Slide the switch track assembly forward or rearward to obtain smooth transfer between the return tracks, switch track and accelerator track. Tighten the hex bolts. Check the switch lever stops for alignment to accelerator track.

28. BALL PREFERENCE ADJUSTMENT - CENTER RETURNS

This adjustment is made to prevent two balls from adjacent pinsetters from meeting at the common switch track assembly.

1. Loosen the jam nuts at both ends of the turnbuckle on the rod that connects the ball stop hook to the ball release lever. (Figure 34)

2. While holding the ball stop hook in its unlatched position, turn the turnbuckle until the extreme end of the ball release lever is at the same height as the top of the center track. Tighten both jam nuts.

3. With the ball stop hook still in its unlatched position, place a standard size ball between the ball lift rods and the ball elevator wheel of the left hand pinsetter. Stop the machine as the ball nears the top of the lift rods.

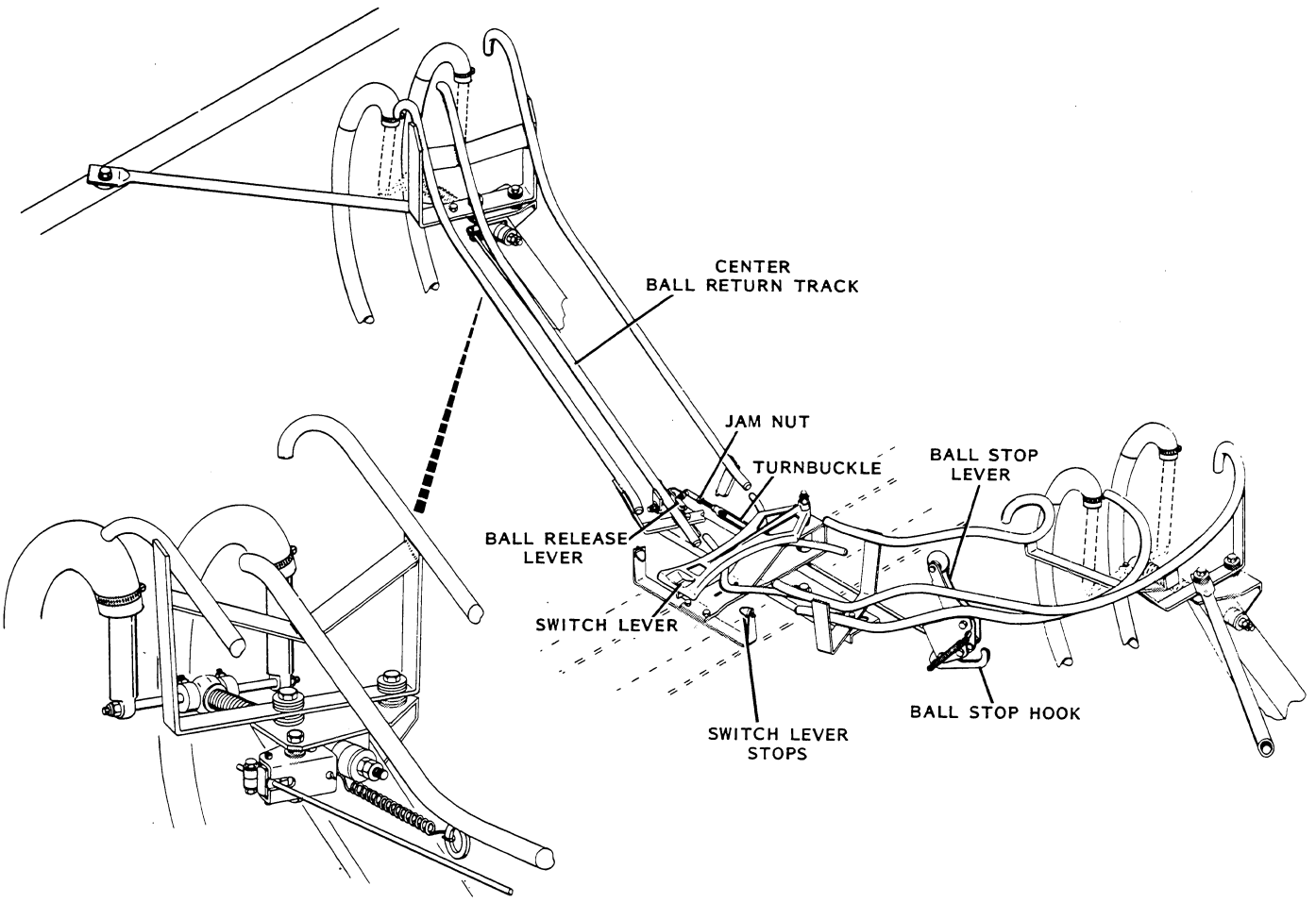
4. Check the gap between the ball trip bracket and the rubber bumper on the spring rod. This dimension must be 3/8" (+1/16 -0). Readjust if required.

5. Remove the ball and unlatch the ball stop hook. Loosen the locknut on the stop clamp. Position the clamp to obtain a 1/32" (±1/64) gap between the clamp and the block. Tighten the locknut.

6. As a check, allow a standard size ball to be lifted and placed on the return track which rotates the ball trip lever, thus rotating the ball stop hook in its latching position. At this time, allow a second ball to roll against the ball stop lever on the mating return track. The latching action of the hook should prevent rotation of the ball stop lever, thereby stopping the second ball.

   As the first ball continues to roll and approaches the switch track assembly, it will depress the ball release lever and pivot the ball stop hook to its unlatching position. The weight of the second ball should rotate the ball stop lever and proceed to the switch track. Readjust if necessary.

7. Check all pivot points of the ball preference mechanism to insure that all components have freedom of motion.



BALL PREFERENCE ADJUSTMENT

FIGURE 34

29. BALL ACCELERATOR ADJUSTMENT

This adjustment is made to insure that the accelerator belt is properly tensioned and positioned to effectively return balls to the ball return rack. The accelerator must be properly mounted on the kickbacks prior to making belt adjustments. The mounting surface on each kickback must be level across the two kickbacks to within 1/32". Shim washers can be added or removed to obtain level condition. Set accelerator on kickback mounts. Shim as required. Do not draw accelerator frame down when tightening belts.

1. Loosen the three nuts holding the rear pulley assembly. Two nuts are located on top and one nut on side of the top frame.

2. Loosen the rear belt tension screw. (Figure 35)

3. Remove old belt and install new belt.

   NOTE: The belt is marked on the inside surface. Place this surface on the pulleys.

4. Viewing the accelerator from the rear of the machines, locate the belt 1" from the edge of the pulley facing the right machine side.

   NOTE: The motor drive belt is located on the left machine side.

5. Manually rotate the pulley to position the belt on the front pulley in a like manner.

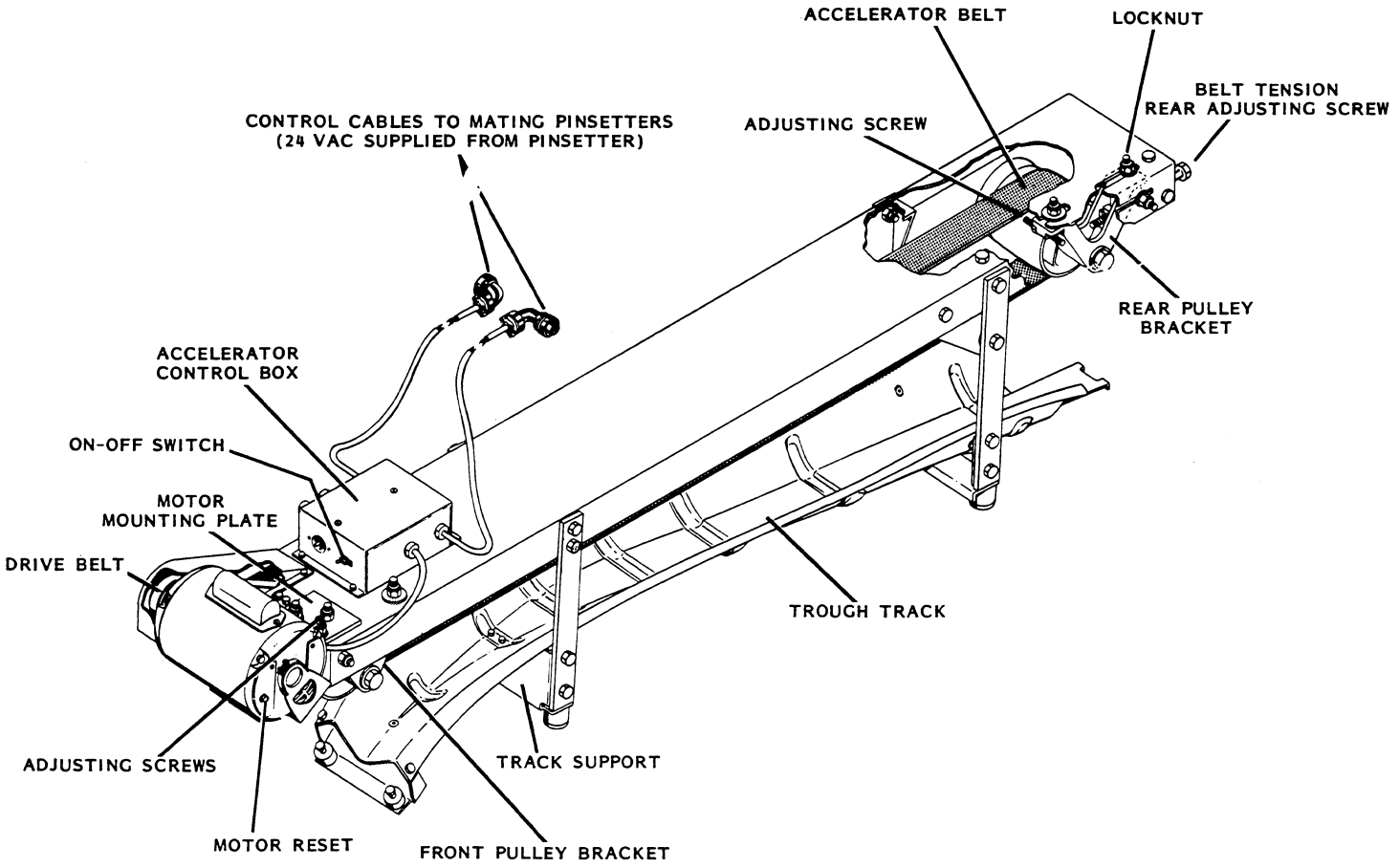
6. Manually pull the rear pulley assembly rearward and hand tighten the rear belt tensioning screw. Snug the three nuts holding the bearing bracket assembly to the frame.

   NOTE: There is an adjustable set screw through the side of the pulley brackets. This adjustment screw moves the belt left or right for proper tracking operation. Turn this screw in until it touches the frame side. Lock the jam nut.

   Continue tightening the rear tension screw until the belt is level between the pulleys. Tighten the tension screw four additional turns. Then tighten the two top locknuts and the side locknut.

7. Start the accelerator and run idle (no ball). Check the belt tracking. Maximum permissible belt wobble is 1/8". Belt should run 1" from the edge of the pulley. If not, loosen the locknuts holding the rear bearing assembly. Loosen the jam nut on the adjustable screw and move set screw one turn "in" to move belt toward right machine. Back set screw "out" one turn to move belt toward left machine. Retighten adjusting screw jam nut and the three locknuts on the bearing assembly before testing.

   NOTE: One-half turn of the adjusting screw moves the belt 1/8".



BALL ACCELERATOR ADJUSTMENT

FIGURE 35

MOTOR BELT ADJUSTMENT

The motor is to be mounted with the mounting bolts located centrally in the elongated motor base slots. Adjust the motor belt by moving the motor or adding shims under the motor base as required to make the motor belt track 3/16" (±1/16) from the edge of the motor pulley and 3/16" (+1/8-1/16) from the edge of the accelerator pulley.

BALL TEST

1. Run a drilled ball through the accelerator and observe belt movement. Allowable belt movement:

   Used belt - 1/4"
   New belt - 1/16" to 1/4" toward motor belt.

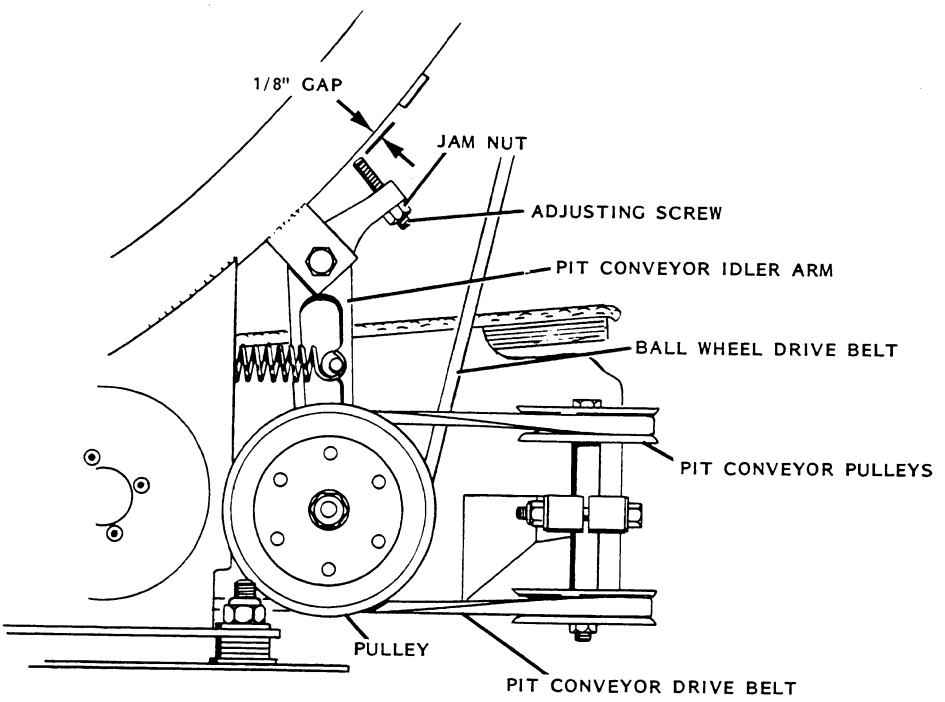
2. Adjust if necessary. Check set screws, making sure they sit against frame with tightened jam nuts. Check all bearing locknuts. Recheck accelerator mounting on kickbacks.

30. PIT CONVEYOR IDLER ARM ADJUSTMENT

This adjustment is made to limit the travel of the pit conveyor idler pulley arm to prevent the pit conveyor belt from slipping off the pulley when installing a new belt.

1. Shut off the machine and loosen the adjusting screw jam nut on the pit conveyor idler pulley arm. (Figure 36)

2. Turn the adjusting screw until a clearance of 1/8" is obtained between the point of the set screw and the elevator frame. This 1/8" is measured with the machine turned off. Tighten the locknut.



PIT CONVEYOR IDLER ARM ADJUSTMENT

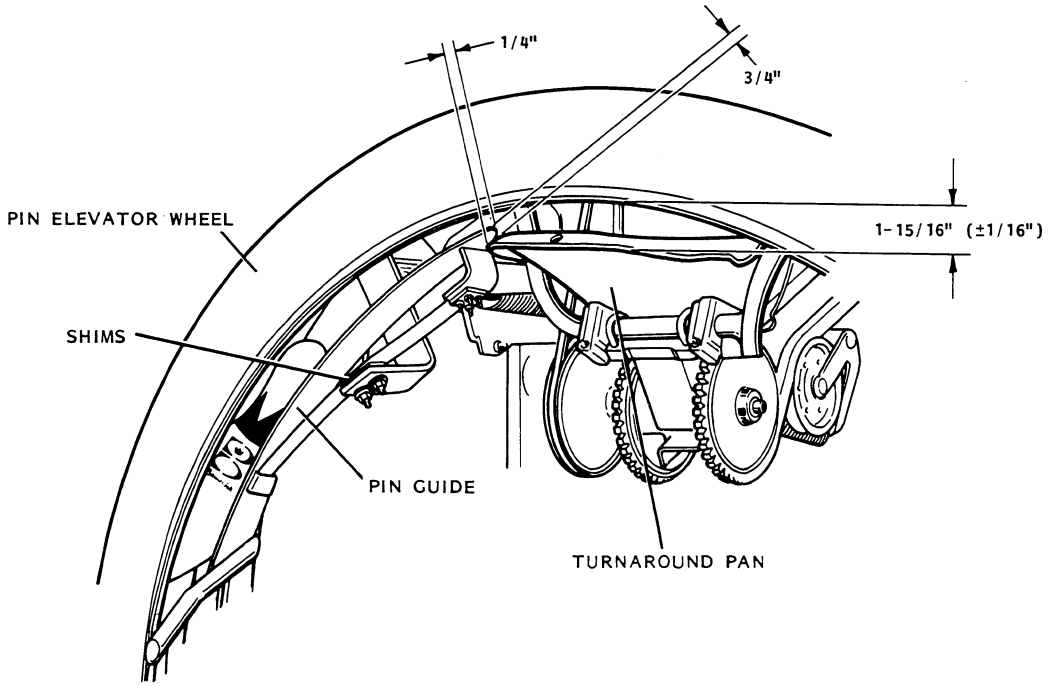
FIGURE 36

31. TURNAROUND PAN ADJUSTMENT

This adjustment is made to insure that the turnaround pan orients pins base first on the cross conveyor whether they are received head first or base first from the pin elevator.

1. With the turnaround pan in its normal, spring-urged position, measure the vertical distance from the bottom, rear edge of the turnaround pan to the rear inside edge of the pin elevator wheel. This dimension must be 1-15/16" (±1/16). (Figure 37)

2. Carefully bend the tongue of the turnaround pan to obtain the desired dimension.



TURNAROUND PAN ADJUSTMENT
FIGURE 37

32. PIN GUIDE ADJUSTMENT

This adjustment is made to insure that the pins are held securely in the pin elevator and that they are properly released to the turnaround pan for head first orientation.

NOTE: Adjustments 31 and 32, Turnaround Pan and Pin Guide Adjustments, are directly related to each other, and changing one will affect the other.

1. Center the cross conveyor and turnaround pan between the elevator frame prior to pin guide adjustment. Loosen the "J" bolts to center the cross conveyor and turnaround pan.

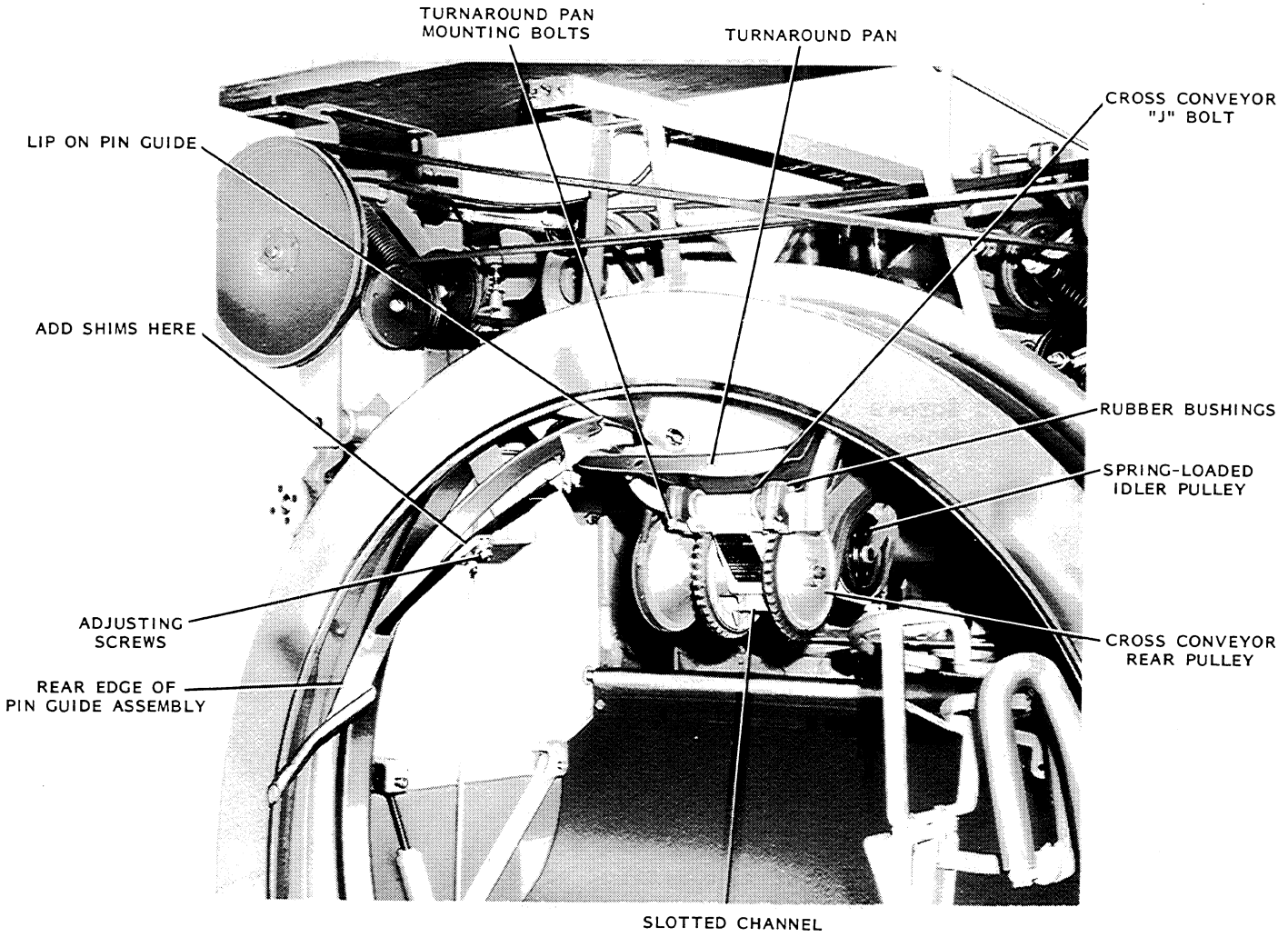
2. The pin guide must be positioned with the lip of the pin guide 3/4" (±1/16) above the top edge of the turnaround pan. This dimension may be obtained by adding or removing shims between the steel spring and mounting bracket.

3. Loosen the two pin guide mounting bolts and position as follows: The mounting holes are oversized for adjustments. Pivot the top of the pin guide forward until the top end of the pin guide is 1/4" (±1/16) beyond the top edge of the turnaround pan. (Figure 37)

4. As a check, observe the action of pins being delivered head first and base first to the turnaround pan. Pins delivered base first should be properly oriented to ride half way up the side of the turnaround pan.

5. The pin guide assembly may require readjustment to compensate for proper orientation of base first and head first pins by the turnaround pan. Moving the pin guide forward at the top will cause the pins to be delivered later on

the turnaround pan, while moving the pin guide rearward will cause the pins to be delivered earlier to the turnaround pan. The pin guide should be positioned to obtain optimum performance of base first and head first pins.



PIN GUIDE AND CROSS CONVEYOR ADJUSTMENTS
FIGURE 38

33. CROSS CONVEYOR BELT ADJUSTMENT

This adjustment is made to insure that the belts are properly tensioned to carry the pins up the cross conveyor to the turret.

1. Remove the spring-loaded idler pulleys from the cross conveyor belts and loosen the rear pulley assembly "J" bolts and the lower bolts in the slotted channel. (Figure 38)

2. Swing the rear pulley assembly to the rear until the belts are tensioned. Tighten the bolts and replace the spring-loaded idler pulleys. Make certain that the belts do not rub against the idler pulley arms. A-2 converted machines may have idler pulleys. Factory A-2 machines have no idlers.

NOTE: The following series of adjustments, Numbers 34-44, are closely related and changing one may affect the others. All adjustments in this series must be correct to insure proper pin transfer from cross conveyor to turret, proper turret operation and proper pin transfer from turret to deck.

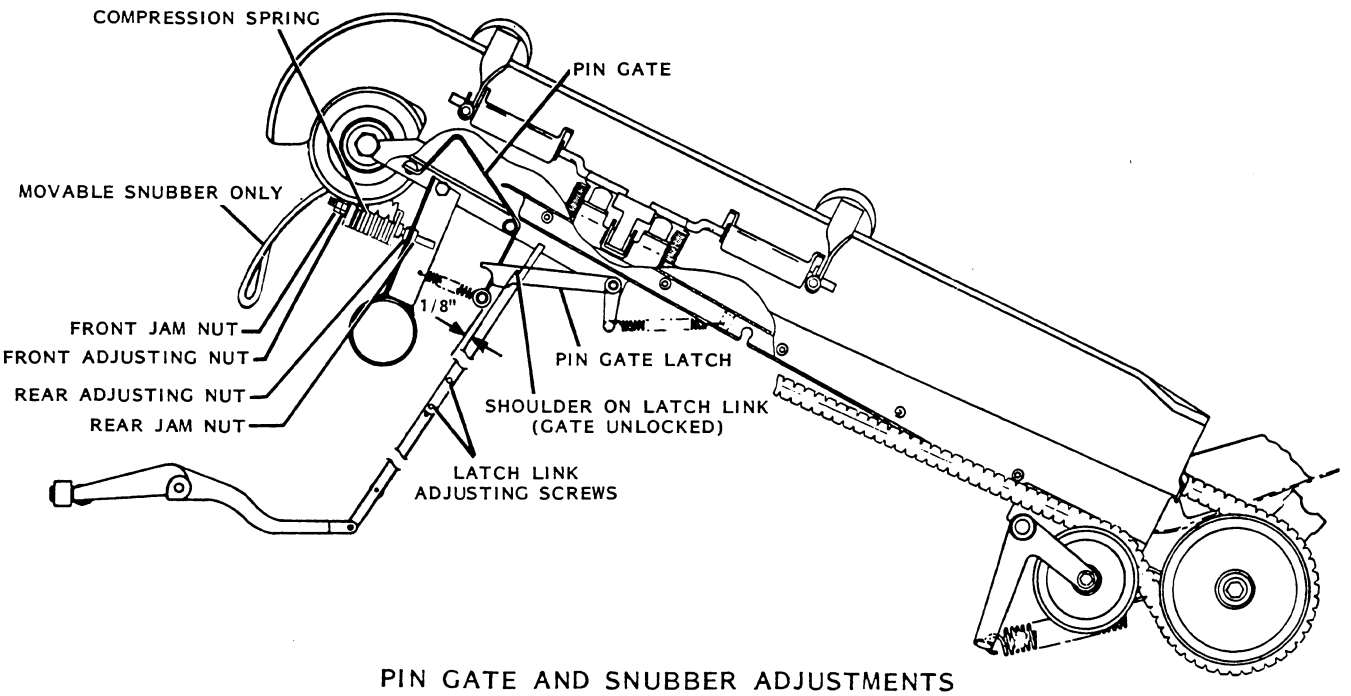
34. PIN GATE ADJUSTMENT

This adjustment is made to insure that the pin gate latches after a pin passes over it and that the gate is released as the turret indexes after receiving that pin.

NOTE: Before proceeding with the adjustment, a preliminary check must be made of the components. Check the up and down motion of the latch to insure there is no binding on the latch link. Check the shoulder on the latch link to insure there is no wear on the step. If worn, replace. Check side play of latch link through pin gate latch.

1. Index the turret by hand until the stop lever roller is on a high level of the turret indexing cam. This will locate the latch link in its lowest position.

2. Loosen the two screws which fasten the upper and lower parts of the latch link together. Move the upper part of the link up or down until the shoulder on the link is 1/8" to 3/16" below the bottom of the pin in the pin gate latch. Tighten the two screws. (Figure 39)



PIN GATE AND SNUBBER ADJUSTMENTS
FIGURE 39

3. Index the turret by hand until the stop lever roller is on a low level of the turret indexing cam. This will unlock the pin gate.

4. Slowly move a pin up the cross conveyor until the body of the pin despresses the pin gate. The pin gate latch must drop on top of the roller. Then move the pin up until the neck of the pin is over the pin gate. At this point, the gate must come up in the neck of the pin and become locked as the head of the pin passes over the pin gate. If the pin gate cannot come up high enough in the neck of the pin to automatically lock the gate, check the tension spring and pivot point of the pin gate. Also check the 1/8" dimension with the pin gate unlocked (Figure 39). Recheck steps 1, 2 and 3.

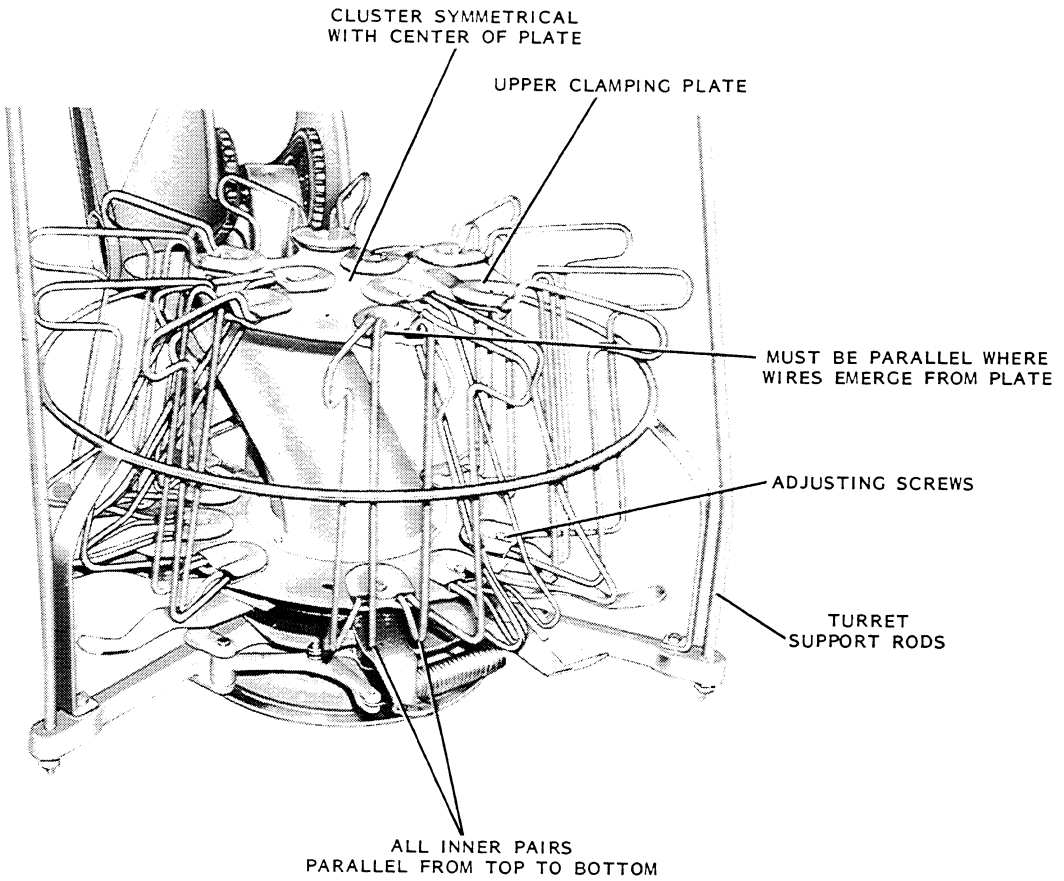
5. As a final pin gate test, lock the pin gate and allow three pins to line up on the cross conveyor. Release the pin gate and observe the pin gate action as the three pins are delivered to the turret. The pin gate should latch as the neck of each pin passes over and release after the turret has indexed after receiving that pin.

35. TURRET LEVEL ADJUSTMENT

This adjustment is made to insure that the turret is level with the lane surface, thereby preventing any interference with the turret by pins in the deck when the deck is in its up position.

1. Loosen the jam nuts on the two front turret supports and place a level under the main turret pulley, front to rear.

2. Turn the adjusting nuts until the turret is level front to rear. Tighten the jam nuts. Check each rod for equal support. (Figure 40)



TURRET LEVEL AND TURRET WIRE ADJUSTMENTS

FIGURE 40

36. TURRET WIRE ADJUSTMENT

This adjustment is made to insure that the turret properly seats the pins and that the turret accurately delivers the pins to the deck chutes.

1. Make sure each cluster of four wires is symmetrical with the center of the turret at the top and bottom of the turret.

2. Make sure that the outer pair of wires on the 1, 7 and 10 baskets extend from the upper clamping plate parallel with each other to obtain sufficient pin inclination for accurate delivery of these pins to their respective pin chutes.

3. Make sure the inner wires of all nine baskets are parallel with each other from top to bottom. (Figure 40)

4. Fill the turret with nine pins. Adjust the lower ends of all the outside wires to obtain 1/16" (-0+1/16) clearance between the wires and the pin bodies.

5. With the turret empty, position the spider in its open, pin releasing position. Slide a pin down through each pin basket and observe if there is any binding or restriction of the passage, caused by tight turret wires. Adjust as required.

6. Be certain that all upper and lower clamping plate bolts are tight.

7. As the pins are being delivered from the cross conveyor to the turret, to the deck, check the operation of the pin gate, trip lever, turret and interlocks, for proper operation. Readjust as required.

37. TURRET SPIDER ADJUSTMENT

This adjustment is made to insure that the spider rotates to release the pins to the deck, that the pins clear the spoons completely and that the spider is reattached after releasing the pins.

1. Position the #5 pin chute under the cross conveyor and release the spider to its open, pin release position. (Figure 41)

2. Check the roller of the spider release lever when it is in the low dwell of the spider cam. The roller should be tight enough to resist spinning by the fingers. If the roller can be rotated freely, it indicates that the inner stop on the spider release lever is pressed against the turret frame instead of being slightly away from the frame. File the inner stop until the roller is tight in the low dwell of the spider cam.

3. Position the spider in its open, pin releasing position. Slide a pin down through each turret basket and observe if the pin touches any spoon as the pin moves down to the deck. If the pin touches any spoon, loosen the two bolts which fasten the spoon to the spider ring and position the spoon until it clears the pin. Tighten the bolts.

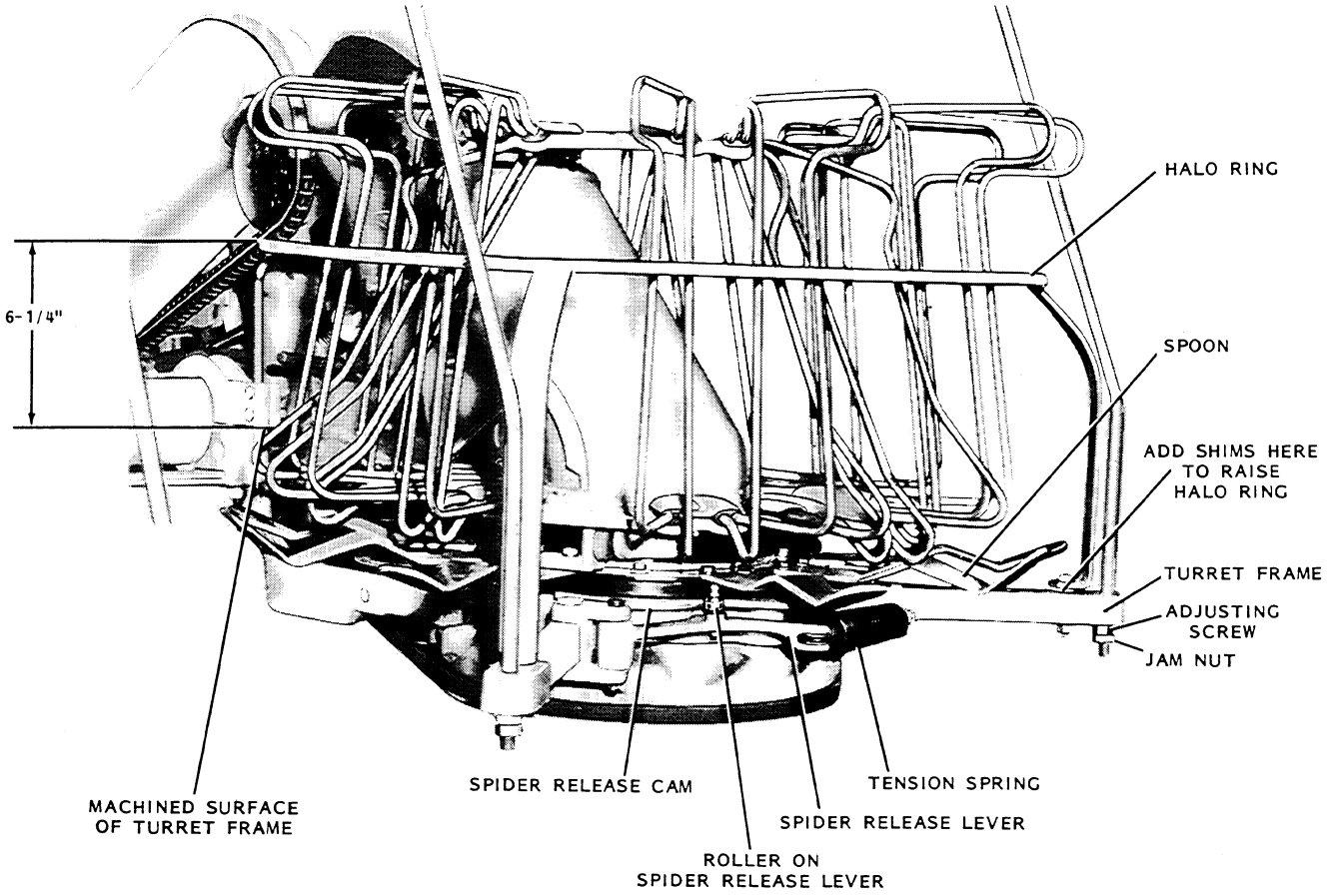
38. TURRET HALO RING ADJUSTMENT

This adjustment is made to insure that the halo ring does not contact the pins in the turret or the #5 pin chute as the turret indexes.

1. Loosen the clamps supporting the two rear legs of the halo ring.

2. Move the halo ring up or down until the top of the halo ring is 6-1/4" (+0 -1/16) above the machined surfaces on which the clamps are mounted. Tighten the clamps. (Figure 41)

3. As a check, observe if the halo ring rubs the #5 pin chute or pins in the turret as the turret indexes. Adjust as required. If the front of the ring must be raised, shims may be added under the two front legs of the halo ring.



TURRET SPIDER AND HALO RING ADJUSTMENTS
FIGURE 41

39. SNUBBER ADJUSTMENT

This adjustment is made to insure that the snubber assists the pins into the turret wires.

PINSETTERS WITH MOVABLE SNUBBERS ONLY

1. Position the #2, #3, #4, #6, #8 or #9 basket under the cross conveyor and fully seat a pin in the basket.

2. Loosen the jam nut at the rear end of the snubber spring and turn the adjusting nut until depressing the snubber 3/16" (±1/16) will fully compress the snubber spring. Tighten the locknut. (Figure 39)

3. Loosen the locknut at the front of the snubber spring. Turn the adjusting nut until the snubber can move 5/8" forward from the position established in step 2. Tighten the lock nut.

PINSETTERS WITH FIXED SNUBBERS

1. Loosen the two mounting bolts that mount the snubber to the cross conveyor.

2. Position the turret with the #8 or #9 pin basket in front of the cross conveyor.

3. Place a pin in the #8 or #9 pin basket with a pin in a vertical position.

4. Adjust the snubber until there is a 3/16" (±1/16) gap between the snubber and the pin. Tighten the mounting bolts.

40. TURRET INTERLOCK PROBE ADJUSTMENT

This adjustment is made to insure that there is no interference with the motion of the probe.

1. Rotate the turret until the interlock probe is over the torsion latch. The clearance between the bottom of the probe and the top of the latch must be at least 1/32". (Figure 42)

2. Position the #5 pin chute under the cross conveyor and release the spider by pulling the probe to its rearmost position. The clearance between the top of the probe and the bottom of the two interlock blocking fingers (in their up position) must be at least 1/16".

3. These two dimensions may be obtained by carefully bending the probe in the required direction.

41. TURRET INDEX TRIP LEVER ADJUSTMENT

This adjustment is made to insure that the turret indexes one position after each pin is delivered from the cross conveyor.

1. Position the turret so that the stop roller on the stop lever assembly is in a low dwell of the indexing cam. Loosen the locknut at the rear of the trip lever spring and turn the rear adjusting nut until the front face of the indexing latch is vertical. Tighten the lock nut.

2. Position the turret so that the stop roller on the stop lever assembly is on a high level of the indexing cam. Loosen the locknut at the front of the trip lever spring and turn the front adjusting nut until depressing the trip lever 1/8" will solidly compress the spring. Tighten the locknut. (Figure 42)

3. Position the #5 pin chute under the cross conveyor. Check the index trip lever in its down position to insure that it does not contact the interlock probe. Check the trip lever in its up position to insure that it does not contact any of the turret wires as the turret indexes. If any turret wires contact the trip lever, carefully bend the wires upward to provide clearance. Do not disturb the trip lever adjustment at this point.

4. Allow the turret to collect nine pins, then shut off the power when the #5 pin chute is in front of the cross conveyor. Try to manually force the turret beyond the #5 pin position with the power off. If the turret can be manually forced beyond the #5 pin position, the indexing trip lever must be readjusted to bring the indexing latch further rearward to provide a more positive latching action. Check each pin position in this manner.

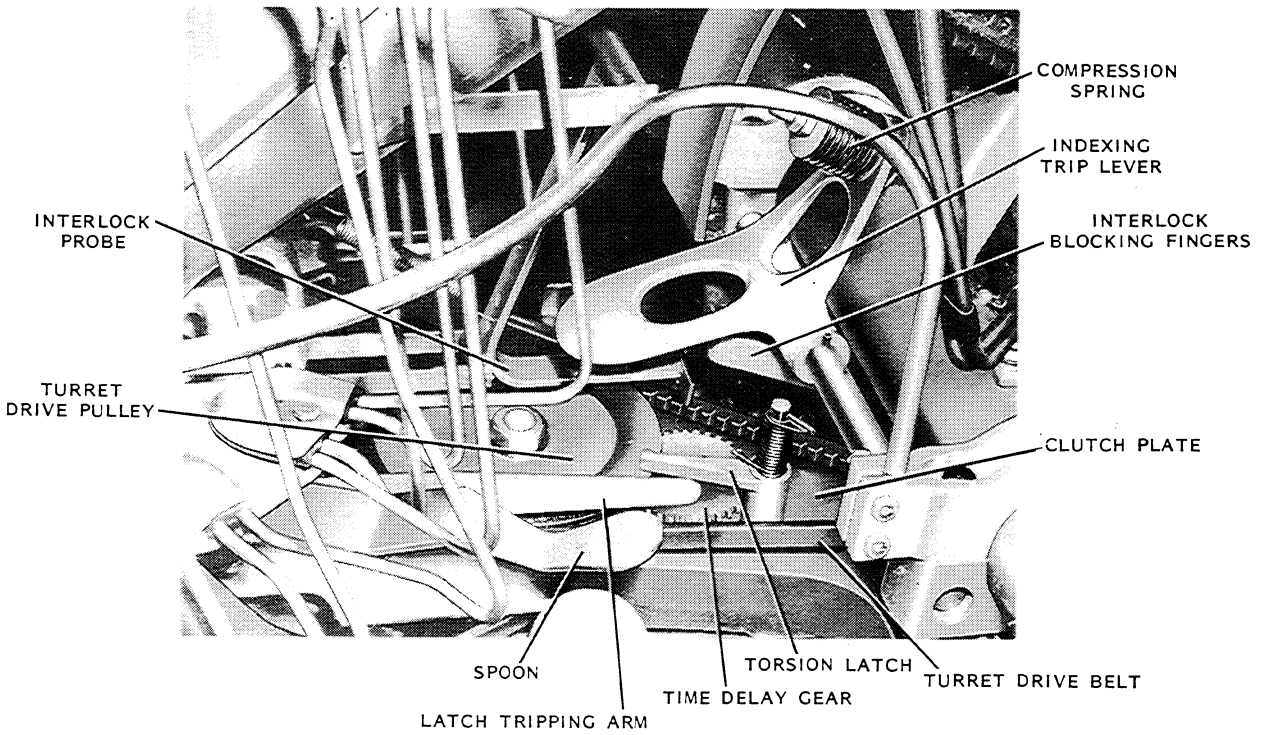
42. TURRET TIME DELAY GEAR ADJUSTMENT

This adjustment is made to insure that the turret indexes once, after delivering ten pins to the deck.

NOTE: Check lower left finger of torsion latch for blocking of time delay gear. Position for blocking by trimming rubber stop, if necessary.

1. Position the #5 pin chute under the cross conveyor. Check the position of the latch tripping arm with relation to the torsion latch. The latch tripping arm should be in a horizontal plane with the center of the arm of the torsion latch. The latch tripping arm may be carefully bent to insure that it will properly contact the torsion latch. (Figure 42)

2. Position an empty pin basket in front of the cross conveyor and trip the torsion latch by hand. If the delay gear is working correctly, the index trip lever will dip once and the turret will index one position. If the trip lever dips twice and the turret indexes two positions, it indicates the torsion latch did not return to its latching position to arrest the rotation of the delay gear. If the trip lever does not dip at all, and the turret does not index, check for binding of the delay gear or torsion latch. Also check to insure the two gears are properly meshed. Check clutch plate for flatness and proper positioning in slide bolts.



TURRET INTERLOCK PROBE, INDEX TRIP LEVER, AND TIME DELAY GEAR ADJUSTMENTS

FIGURE 42

43. RESTRICTED DROP INTERLOCK ADJUSTMENT

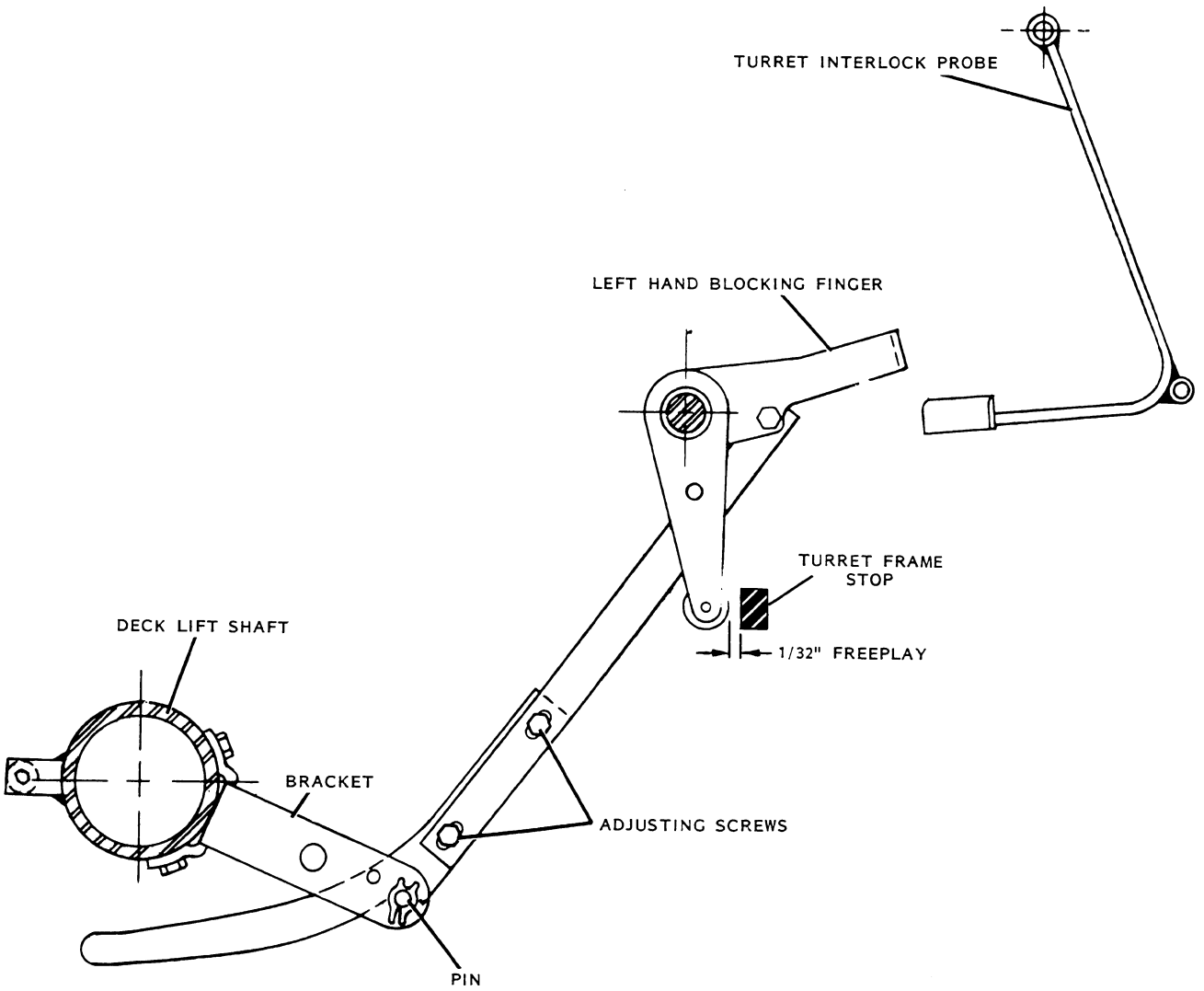
This adjustment is made to insure that the turret does not release pins to the deck, when the deck is not in its up position.

1. With the pinsetter at 0°, disconnect the tension spring to the left blocking finger and loosen the two bolts which connect the upper and lower parts of the restricted drop link.

2. Move the upper part of the link upward, until the blocking finger is in its full up position.

3. Carefully work the upper part of the link down, until there is a 1/32" freeplay in the blocking finger. This is very important, as no freeplay can result in severe damage to the restricted drop mechanism. (Figure 43)

4. Make sure the 1/32" freeplay is maintained. Tighten the two bolts and replace the tension spring.



RESTRICTED DROP INTERLOCK ADJUSTMENT
FIGURE 43

44. FULL DECK-MOVING DECK INTERLOCK ADJUSTMENT

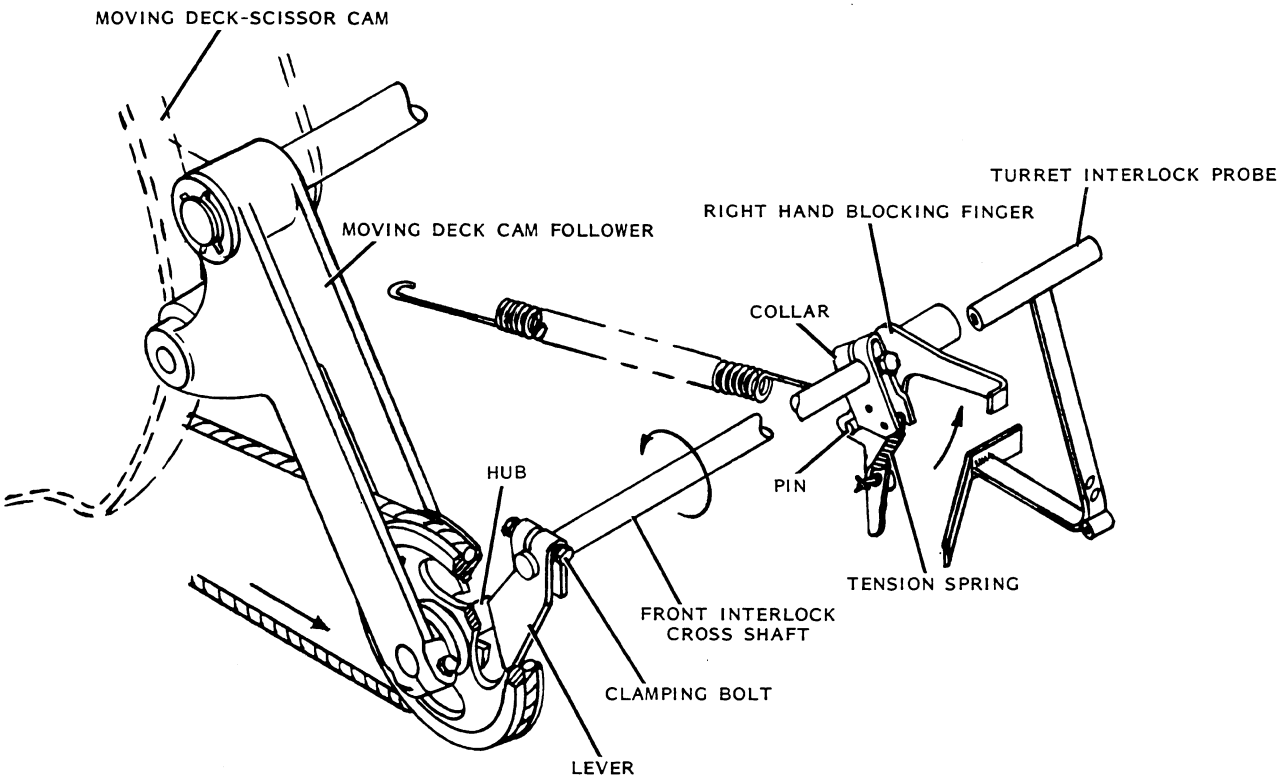
This adjustment is made to insure that the right blocking finger is in its down, blocking position, when either the moving deck is rearward or when the deck is full; and to insure that the right blocking finger is up when the moving deck is fully forward and when the deck is empty.

1. The long link is not adjustable. To check the operation of the full deck interlock, allow the turret to receive ten pins and deliver them to the deck. As the turret indexes after delivering the pins to the deck, the single rise on the outer perimeter of the turret indexing cam should push the long link back until the link is caught by the latch and held back. Then cycle the pinsetter and observe if the projection on the deck shaft frees the latch as it should when the deck reaches its full, new pinsetting depth at 270°. The latch must not release when the deck is at detecting height.

2. To adjust the moving deck interlock, cycle the pinsetter to exactly 0° and position the #5 pin chute under the cross conveyor, waiting for a pin. Make sure the hook latch is not holding the long link in its rear position.

3. Loosen the clamping bolt on the lever which contacts the hub of the moving deck pulley. Rotate the front interlock cross shaft counterclockwise until the upward motion of the right hand blocking finger stops. Stretch the tension spring slightly. (Figure 44)

4. While holding the shaft in this position, rotate the lever against the hub on the moving deck pulley. Tighten the clamping bolt.



FULL DECK-MOVING DECK INTERLOCK ADJUSTMENT
FIGURE 44

45. MAGNETIC CLUTCH ADJUSTMENT

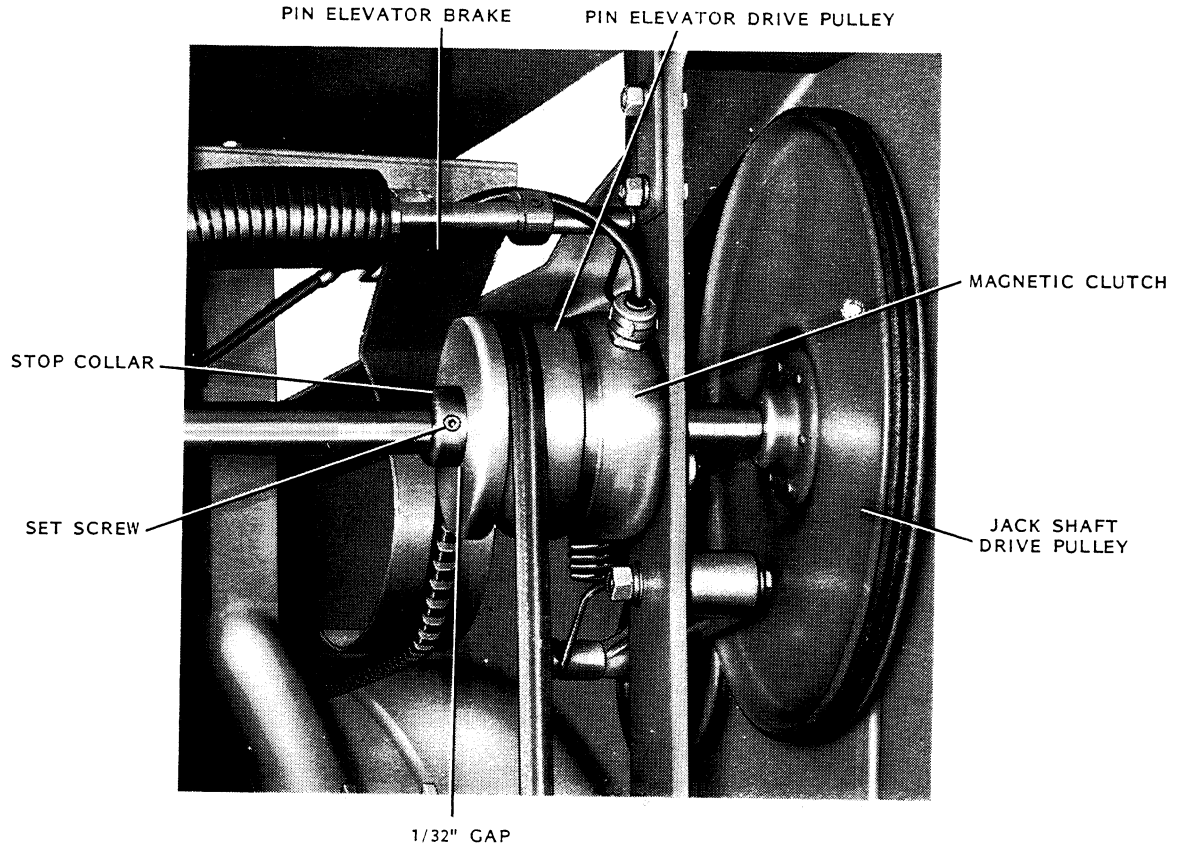
This adjustment is made to insure that the magnetic clutch has sufficient clearance to disengage and to insure that the magnetic clutch will be de-energized when both levers on the cross conveyor are raised at the same time.

1. With the clutch de-energized (power shut off), loosen the set screw on the stop collar which positions the pin elevator drive pulley. (Figure 45)

2. Push the pulley firmly against the magnetic clutch.

3. Set the gap between the pulley and the stop collar at 1/32". Tighten the set screw.

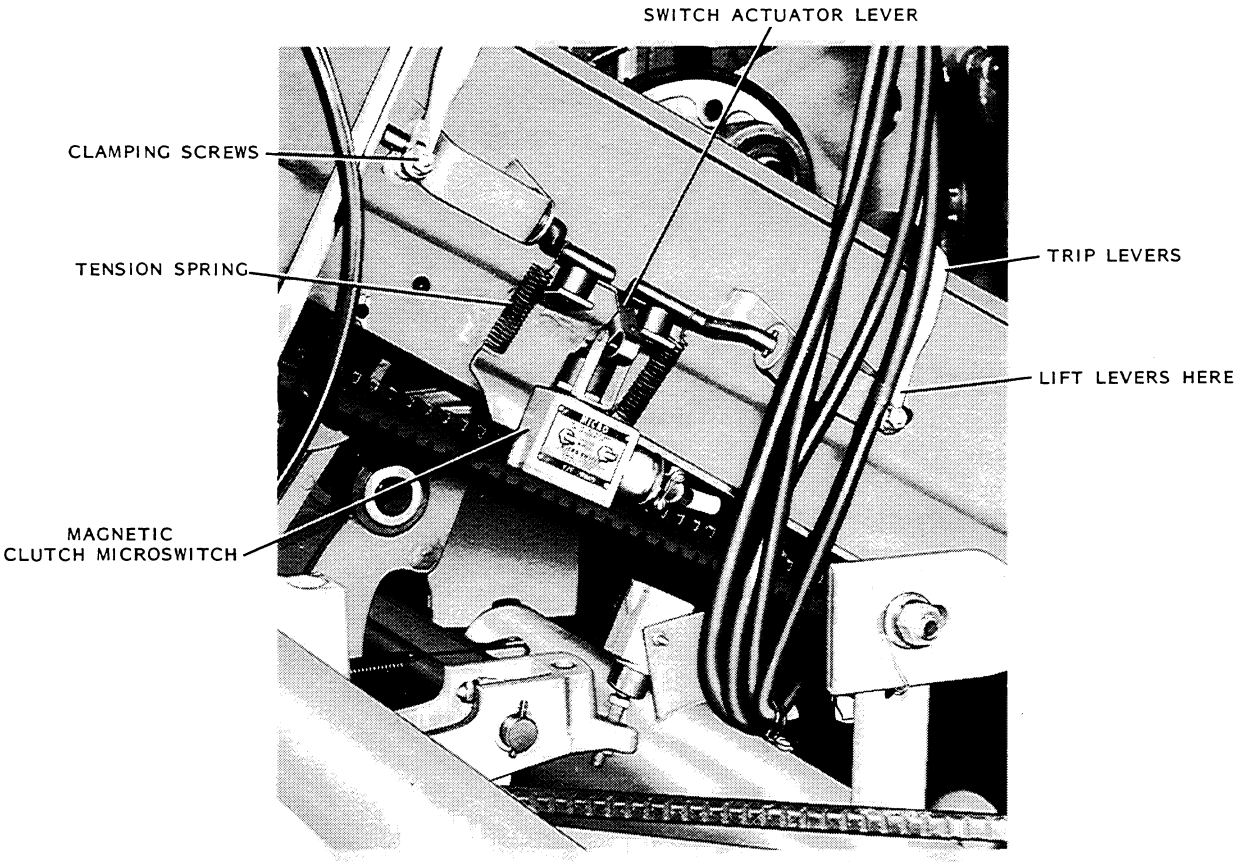
4. Latch the pin gate so that no pins can be delivered to the turret and allow two pins to be delivered to the cross conveyor and be stopped by the latched pin gate.



MAGNETIC CLUTCH ADJUSTMENT

FIGURE 45

5. Loosen the two clamping screws at the ends of the trip levers. While holding the rollers firmly against the pins on the cross conveyor, push the lower ends of both levers down against the microswitch. While holding the rollers on the pins, slowly lift the lower ends of both trip levers, until the microswitch just clicks, indicating the switch has opened. Tighten the clamping screws to hold the levers in this position. (Figure 46)



CROSS CONVEYOR MICROSWITCH ADJUSTMENT

FIGURE 46

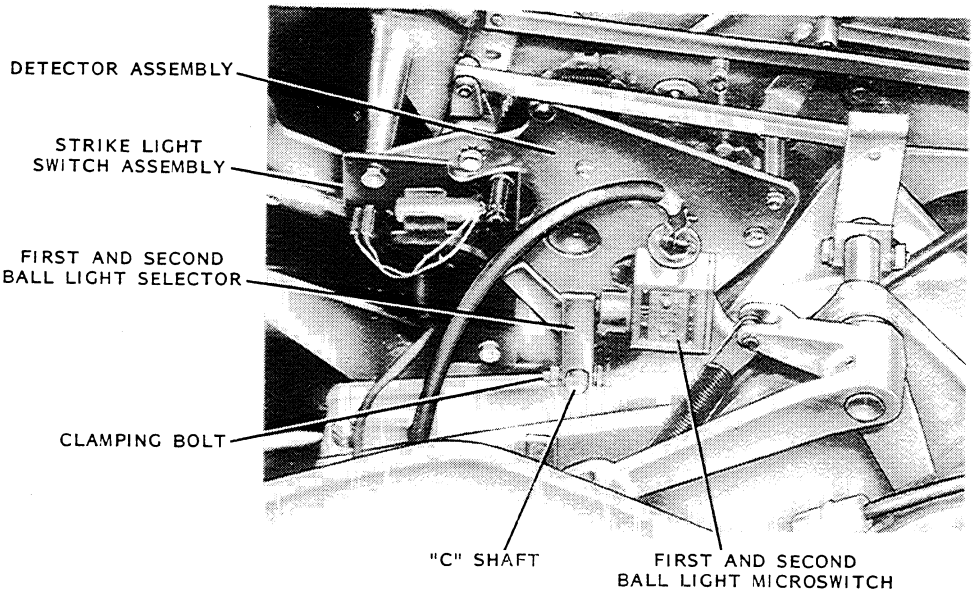
46. FIRST AND SECOND BALL LIGHT MICROSWITCH ADJUSTMENT

This adjustment is made to insure that the first ball light is lit during the first ball cycle and then changes to the second ball light in the event that standing pins are left:

1. With the pinsetter at 0°, first ball, loosen the clamping bolt on the lever from the detector assembly that contacts the first and second ball light microswitch. (Figure 47)

2. Slowly push the lever against the button on the microswitch until the first ball light goes on and then carefully push the lever in another 1/16". Tighten the bolt.

3. As a check, cycle the pinsetter and observe whether the first and second ball lights operate at the proper time.



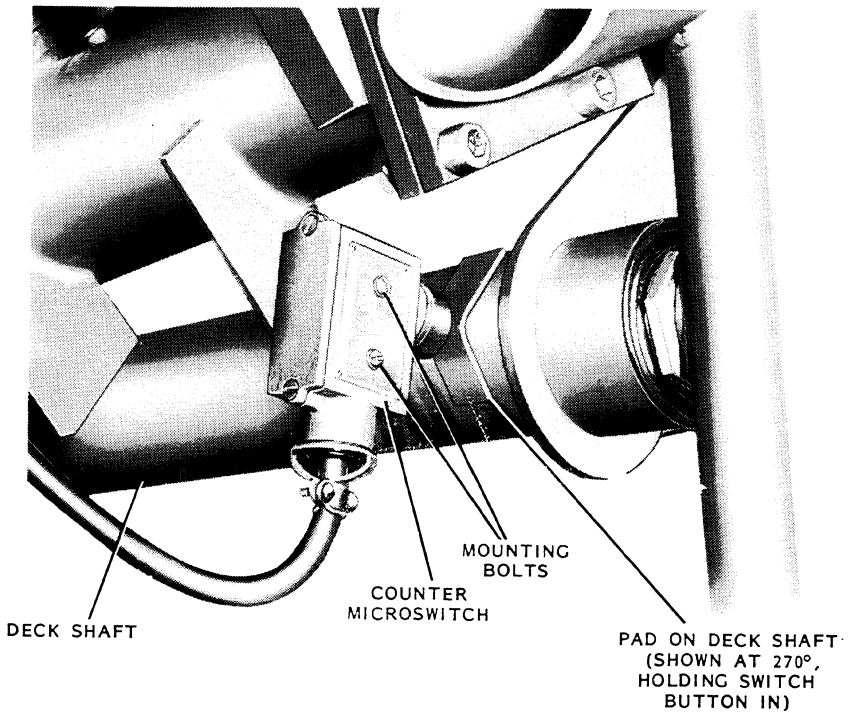
FIRST AND SECOND BALL LIGHT MICROSWITCH ADJUSTMENT

FIGURE 47

47. COUNTER MICROSWITCH ADJUSTMENT

This adjustment is made to insure that the frame counter counts once, each time the deck sets ten new pins.

1. Cycle the pinsetter to exactly 270°, setting new pins.



COUNTER MICROSWITCH ADJUSTMENT

FIGURE 48

2. Loosen the counter microswitch mounting bolts and position the switch so that the pad on the deck shaft is holding the switch button in. Tighten the mounting bolts. Care should be taken to prevent the switch from being positioned to permit the pad to hit the microswitch twice, once going down and again on the way up. (Figure 48)

   NOTE: If the deck must remain in its lowered position for any length of time with the power on, raise the deck enough to prevent the pad on the deck shaft from depressing the counter. The solenoids controlling the counters are not rated for continuous duty and they will burn out, if left on for any length of time.

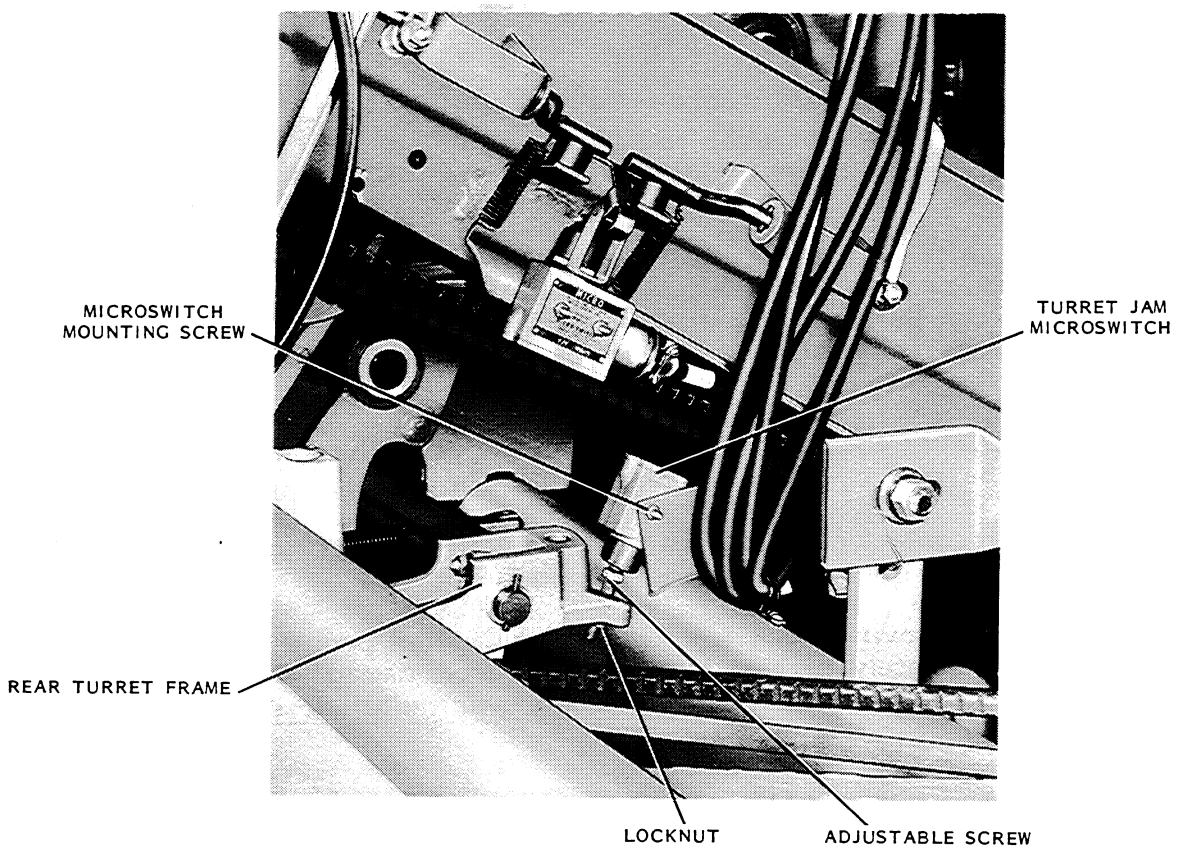
48. TURRET JAM MICROSWITCH ADJUSTMENT

This adjustment is made to insure that the turret jam microswitch will open, thereby shutting off the pinsetter, in the event a pin or other foreign object on top of the deck contacts the turret.

1. Loosen the locknut on the adjustable screw located under the turret jam microswitch. (Figure 49)

2. Be certain that the turret is level per Adjustment 35.

3. With the turret frame resting on the turret leveling nuts, turn the microswitch adjusting screw down until the switch opens. Turn the adjusting screw out until the switch just closes. Then turn the adjusting screw one additional full turn. Tighten the locknut.



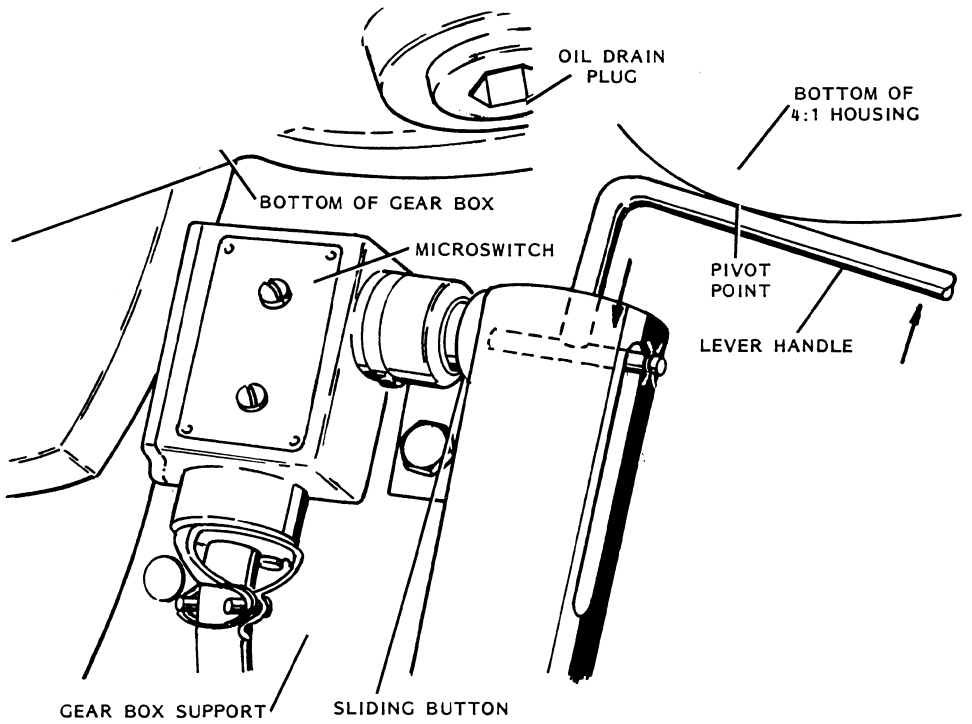
TURRET JAM MICROSWITCH ADJUSTMENT

FIGURE 49

49. MOVING DECK JAM MICROSWITCH ADJUSTMENT

This adjustment is made to insure that the microswitch remains closed during normal operation, and to insure that the switch will open to shut off the machine in the event a deck jam occurs.

1. At 0°, check the position of the microswitch button, with relation to the sliding button which holds the microswitch closed. (Figure 50)



MOVING DECK JAM MICROSWITCH ADJUSTMENT
FIGURE 50

2. If the microswitch button is not in contact with the center of the sliding button, reposition the microswitch until this center contact is obtained. The microswitch can be moved by adding spacers between the switch and the gear box support and also by elongating the mounting holes in the gear box support.

3. As a check, lever the button down and observe if the sliding button moves away from the switch, thereby shutting off the power.

   If the center contact of step 2 is not obtained, the pin lights will tend to blink off and on when the deck is setting new pins.

   CAUTION: The moving deck jam microswitch, when properly adjusted, will adequately protect the pinsetter from damage due to deck jams. If the purpose of the switch is ever nullified, severe damage to the gear box may result.

   1. Under no circumstances should the machine ever be placed under power by bypassing the deck jam microswitch.

   2. Under no circumstances should the machine ever be forced to rotate forward manually if a deck jam has opened the microswitch.

TO PROPERLY CLEAR A DECK JAM, PROCEED AS FOLLOWS:

1. Shut off the power by opening the control box circuit breaker.

2. Rotate the gear box drive pulley backward (clockwise when observed from the rear of the machine). This will cause the moving deck to shift to the rear, releasing the jammed pin or pins. It may be necessary to rotate the moving deck-scissor latch to unblock the moving deck cam follower when manually reversing the pinsetter.

3. Remove the pins from the deck and resume normal operation.

   NOTE: Newer machines contain a deck jam protection kit (Figure 51).

50. DECK JAM CLUTCH RELEASE MECHANISM ADJUSTMENT

This adjustment is made is insure that the pinsetter will not be damaged by deck jams. With the deck jam clutch release mechanism installed, the pinsetter clutch is disengaged when a deck jam occurs, assuring that no abnormal stresses are placed on any of the deck or gear box parts.

This system also incorporates an electrical shutoff device which prevents the pinsetter from restarting until the circuit breaker is turned off and then on. This greatly reduces the possibility that inexperienced personnel will be injured by clearing a deck or turret jam with the pinsetter power on.

DECK JAM

1. A deck jam occurs when the moving deck is prevented from moving forward by some obstruction after setting new pins. (Usually a pin has failed to drop from the deck.)

2. As the moving deck cam follower continues up the moving deck-scissors cam, increased tension is applied to the moving deck cable.

3. The increased tension on the cable causes the spring in the spring tube mounted on the 4:1 housing to compress. (Figure 51)

4. As the spring is compressed, the pin in the spring tube moves downward pulling the link spring with it. The spring in turn causes the bellcrank to rotate, moving the latch upward.

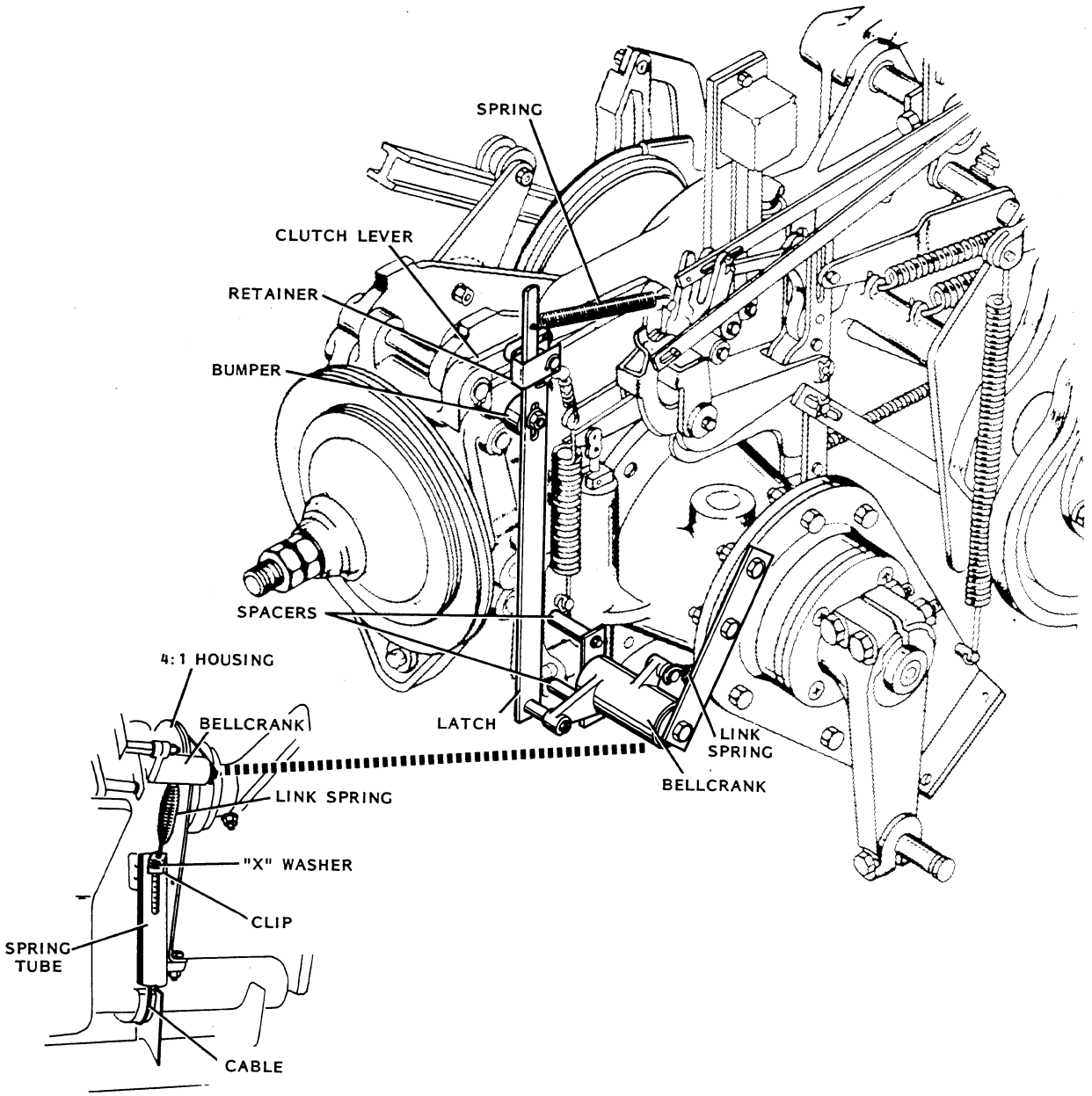
5. The latch raises the clutch lever, disengaging the clutch, stopping the pinsetter.

6. At the same time, the pin in the spring tube moves off the deck jam switch actuator. The normally closed contacts of the switch close, energizing relay RL4. RL4's normally closed contacts open, de-energizing the motor start relay which de-energizes the motor contactor, turning off the pinsetter motor.

7. The normally open contacts of RL4 close, electrically latching RL4 in the energized state. RL4 will remain energized until the circuit breaker is turned off. Therefore, the motor can only be restarted by clearing the jam and turning the breaker off, then on.

NOTE: Some machines may not include the electrical relay system. This requires turning off the electrical power to clear the jam.

8. To clear a jam, the clutch can be re-engaged by moving the top of the latch rearward. This allows the pin on the clutch lever to disengage from the latch, re-engaging the clutch. The gear box can now be manually reversed with the belts to clear the jam.



DECK JAM CLUTCH RELEASE MECHANISM ADJUSTMENT

FIGURE 51

TURRET JAM

1. When a turret jam occurs, the turret frame moves away from the turret jam switch causing its normally closed contacts to close. RL4 energizes, de-energizing the motor start relay RL2 and the motor contactor RL3, turning off the motor. As with a deck jam, the normally closed contacts of RL4 close, latching RL4 in its energized position. Again, RL4 can only be de-energized by clearing the jam and turning the breaker off, then on.

CLEARING A DECK JAM

1. Turn off the pinsetter circuit breaker.

2. Move the top of the new latch rearward. This will release the clutch lever and re-engage the clutch.

3. Using the motor to gear box belt, manually reverse the gear box until the pin or pins causing the jam can be removed.

4. Remove the pins and turn the circuit breaker on. The pinsetter will restart.

5. On pinsetters with electrical triggering, the trigger solenoid will energize shortly after the circuit breaker is turned on.

6. This will cause the pinsetter to continue to cycle past 0° and stop at 180° with pins in the scissors. The pinsetter is restarted by raising 180° turret interlock link. The pinsetter will then cycle to 0°, waiting for second ball. If a full set of pins are on the playing surface, switch the pinsetter to first ball by raising the deck holding hook. If a full set of pins is not present, recycle the pinsetter to set new pins.

CLEARING A TURRET JAM

1. Turn off the circuit breaker.

2. Using the motor to gear box belt, manually reverse the gear box, lowering the deck until the pins causing the jam can be removed.

3. Turn the circuit breaker on.

51. MOTOR MOUNT ADJUSTMENT

This adjustment is made to insure that the motor is positioned properly to provide adequate tensions on the motor to gear box belt and motor to elevator belt.

1. Remove the spring-tensioned idler pulley from the motor to elevator belt.

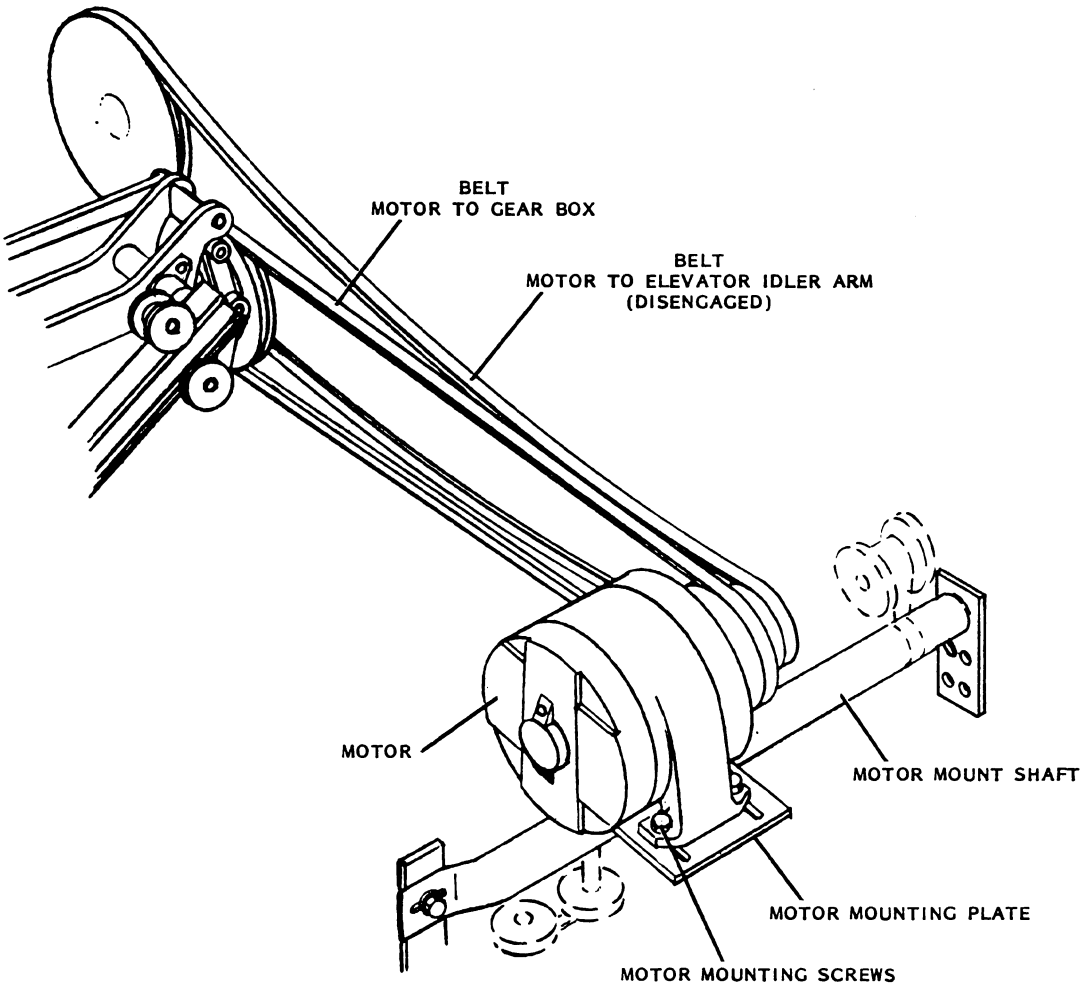
2. Loosen the four bolts that mount the motor to the plate on the motor mount shaft. The four mounting holes are elongated for adjustment. (Figure 52)

3. Move the motor to the right until adequate tension is placed on the motor to gear box belt. Tighten the four mounting bolts.

4. Replace the idler pulley on the motor to elevator belt.

5. Improper motor to gear box belt tension can cause belt slippage and overloading of motor while lifting deck.

6. Check belt lengths carefully. Measure around motor pulley and gear box pulley with 1/2" wide measuring tape for closest belt length.



MOTOR MOUNT ADJUSTMENT
FIGURE 52

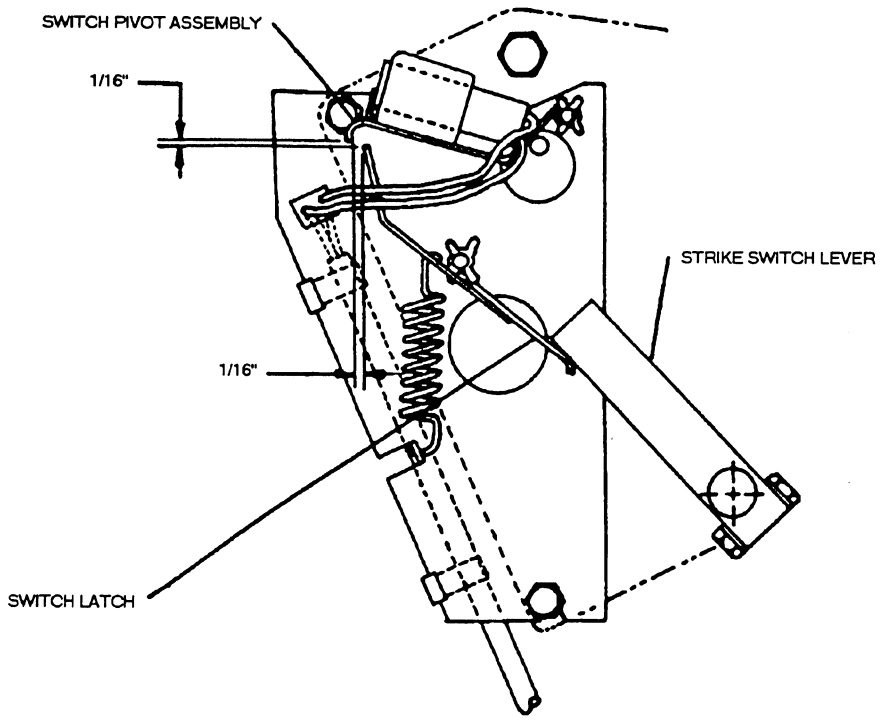
52. STRIKE LIGHT SELECTOR ADJUSTMENT

Cycle the pinsetter to 45 degrees second ball and adjust the strike mechanism as follows:

1. The upper mounting hole of the strike mechanism is slotted and the assembly can be moved forward or rearward. Position the assembly to obtain 1/16" clearance between the top of the switch latch and the bottom of the vertical end of the switch pivot assembly. Holding this 1/16" clearance, carefully tighten the two detector side plate bolts.

2. Position the first and second ball light microswitch lever to obtain 1/16" clearance between the front of the switch latch assembly and the rear of the vertical end of the switch pivot assembly. Holding this 1/16" clearance, carefully tighten the microswitch lever. This lever now becomes the strike switch lever.

3. As a check, cycle the pinsetter and observe if the Mercury Switch drops when a strike is detected at 90° and lifts at the end of the cycle.



ALTERNATE FOR ADJUSTMENT #12 - 180° TURRET INTERLOCK LINK

1. Cycle the pinsetter to a 180° stop position and shut off the power. (Waiting for pins)

2. Loosen the clamp screw at the right end of the rear interlock cross shaft.

3. Apply a "full deck" signal by moving the long link rearward, allowing the hook latch to capture the long link.

4. Slowly rotate the rear interlock cross shaft counterclockwise to raise the 180° turret interlock link.

5. When the stop arm releases the clutch lever, hold the cross shaft in that position and retighten the clamping screw on the right end of the cross shaft.

6. To check your adjustment, do a thumb pressure test.

   a. Cycle the pinsetter to 0° which the deck full of pins.

   b. Push down on the top of the 180° turret interlock link with your thumb.

12-900260-000

BRUNSPARTS PREVENTIVE
MAINTENANCE MANUAL

1 EACH

4/93