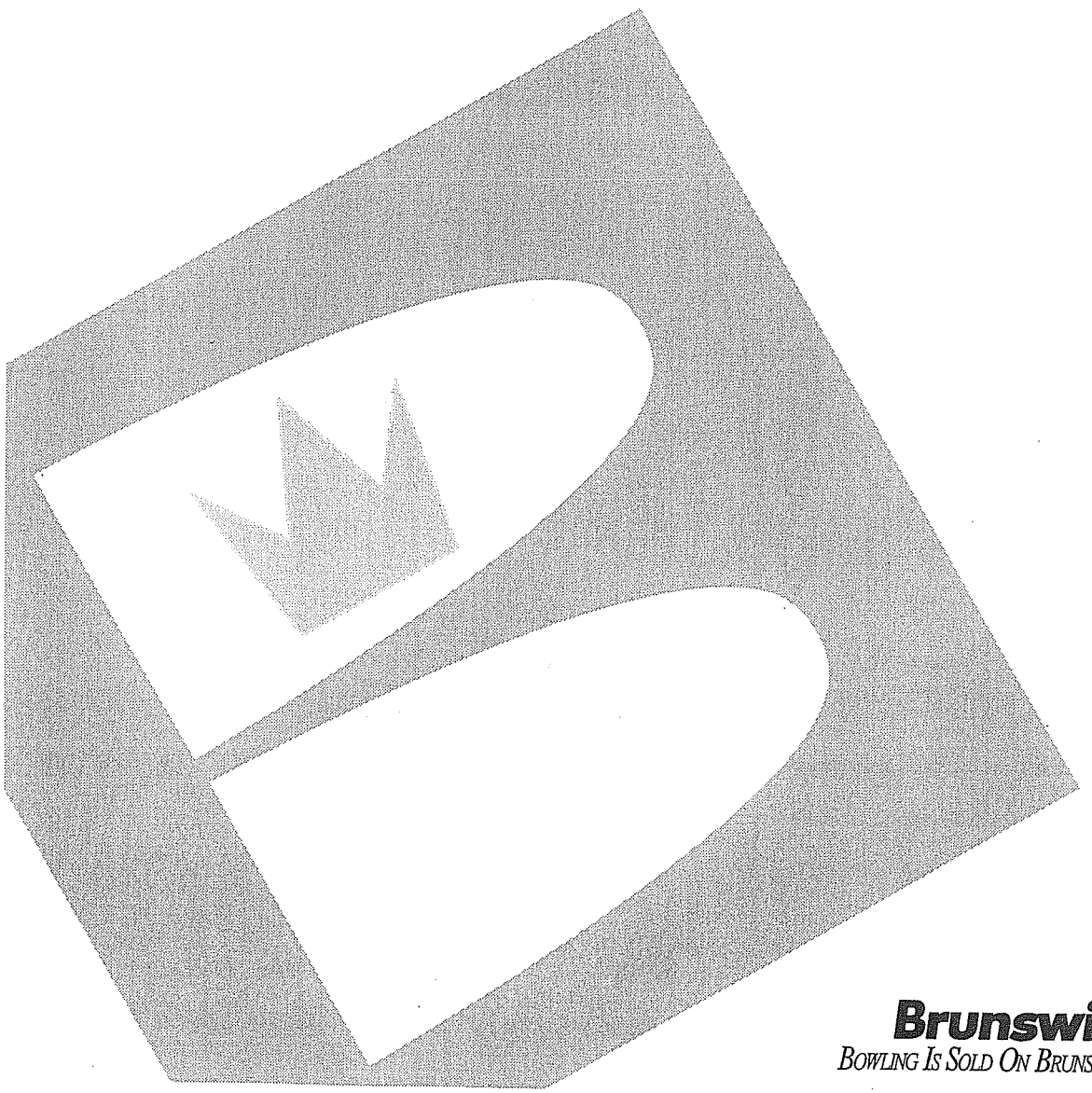
Disassembly Manual

BRUNSWICK AUTOMATIC PINSETTER GEAR BOX

12-900903-000



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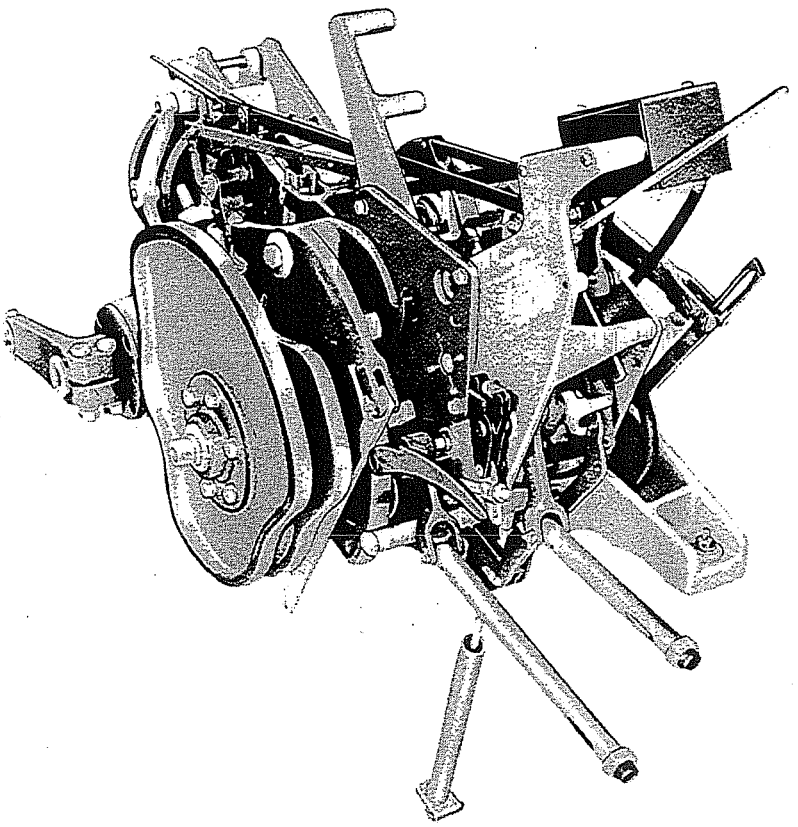
GEAR BOX DISASSEMBLY MANUAL



BRUNSWICK CORPORATION
AUTOMATIC PINSETTER INSTALLATION AND SERVICE DEPARTMENT

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TOOLS AND EQUIPMENT

The following tools and equipment are required to perform the disassembly and repair procedures described in this manual.

1. Standard Pinsetter Tool Kit
2. Holl-O-Ram Hydraulic Unit or equivalent
3. 2 x 4 x 18-inch block of wood
4. Two 6 inch C-clamps
5. Narrow dental mirror with handle
6. Funnel (for draining and replacing Gear Box oil)
7. Permatex No. 1372
8. Flashlight
9. Drop cloth
10. Detector timing pin
11. Threaded Rod: 3/8-inch diameter x 39 inches long
    3/8-16 thread x 3 inches long on each end
12. Pipe: 1-1/2-inch inner diameter x 1-3/4-inch outer diameter
    9-1/2 inches long

INTRODUCTION

This manual is designed to serve as a complete, step-by-step guide to enable the mechanic to disassemble, repair, and replace any major shaft assembly of the Gear Box, including the Detector 1 to 1 Shaft.

The manual is divided into five chapters, with a separate chapter devoted to each of the following major shaft assemblies: Worm Shaft Assembly, 4 to 1 Shaft Assembly, 2 to 1 Shaft Assembly, 1 to 1 Shaft Assembly, and the Detector Assembly. Each chapter is then divided into four separate sections as follows:

Removal of Shaft Assembly - provides the step-by-step information necessary for removing the shaft assembly from the Gear Box, with the steps listed in numerical order (1, 2, 3, etc.).

Disassembly Procedure - provides the step-by-step information required to disassemble the shaft assembly into its prime components. These steps are listed in alphabetical order (A, B, C, etc.).

Assembly Procedure - provides the step-by-step procedure for properly reassembling the prime components to the shaft. These steps are also given in alphabetical order.

Installation of Shaft Assembly - provides the step-by-step information required to install the shaft assembly to the Gear Box. Adjustments to assure proper operation of the machine are also to be included. These steps are again in numerical order.

The division of each chapter into four sections is to simplify the procedure for the mechanic. If an entirely new shaft assembly is to be installed in the Gear Box, the mechanic would remove the existing shaft assembly in accordance with the removal section and install the new shaft assembly per the installation section, following the procedures designated by numerals. All removal and installation steps are referenced to illustrations at the beginning of each chapter. These illustrations should be used in conjunction with the text. The symbol  designates a removal operation, while the symbol  indicates an installation operation.

If a prime component of the shaft assembly is to be replaced, the mechanic must follow the disassembly procedure to remove the defective part. The shaft would then be reassembled in accordance with the assembly section as well as the removal and installation sections. These steps are illustrated individually in the disassembly and assembly sections.

The efficiency and ultimate success of changing or repairing a shaft assembly depends entirely upon the mechanic's abilities and techniques. For this reason, it is essential that the mechanic possess a basic understanding of pressing and pulling operations together with a few standard rules.

Most gears, cams, and bearings are mounted on their shafts as press fits. A press fit indicates that the shaft diameter is slightly larger than the hole into which it fits and must, therefore, be forced into the hole. A hydraulic press is generally employed to force or press the shaft into the hole, with the required pressure dependent upon the amount of interference between the shaft and hole. The pressures required for components of the pinsetter Gear Box generally range from 1 to 10 tons.

Removing a component that has been pressed onto a shaft is known as pulling and requires mechanical or hydraulic pressure to remove the component from the shaft. A common mechanical, screw-type gear puller will not generally be adequate in removing components from the Gear Box shaft assemblies.

Illustrations in this manual incorporate the use of the Holl-O-Ram Hydraulic Unit, which is available from the Blackhawk Manufacturing Company, Milwaukee 46, Wisconsin. It is recommended that this or an equivalent unit be used for work performed at the bowling establishment. A local machine shop may be utilized to perform the pulling and pressing operations under the direction of the pinsetter mechanic. The safety precautions listed by the manufacturers of hydraulic equipment should always be respected to prevent injury to personnel and equipment.

A few standard rules for pulling and pressing operations are listed in the following steps. Adherence to these simple rules will assure quality workmanship and must be practiced where applicable.

1. The shaft and bore should be inspected for cleanliness prior to any pressing operation. Metal filings, burrs, dirt, etc. must be completely removed from the shaft and bore surfaces.

2. A lubricant should be applied to the shaft and bore prior to every pressing operation to reduce the tendency of abrasion. White lead and lard oil, mixed to the consistency of paint, is generally the commercial recommendation, although general purpose grease will usually suffice.

3. Bearings must always be pressed onto a shaft by pressing against the inner bearing race only. Do not attempt to press a bearing onto a shaft or remove it by applying pressure to the outer bearing race. Severe damage to the bearing may result if the inner race is forced in a direction opposite of the outer race.

4. Be certain that components with keyways are in alignment with the key prior to pressing. The key should be checked to assure it is seated properly in its keyseat and is free of metal filings, burrs, etc.

5. In all pressing operations, be certain that the shaft and bore are aligned as close as possible before applying hydraulic pressure. Misalignment at the beginning of a pressing operation could severely damage the shaft and bore.

6. Oil seals must be installed with caution to obtain maximum sealing efficiency. To replace an oil seal, place the housing of the oil seal face down on two blocks of wood. Force out the old seal by using light taps on a wooden block to prevent possible damage to the bore. Inspect the bore for burrs and/or sharp edges that could damage the new seal. Prelubrication of the new seal is required. This consists of lubricating (by dipping or wiping) the sealing member in a suitable lubricant immediately before installation. Gear Box oil may be used as the prelubricant. Soaking or dipping in hot oil is not required. Application

of a light coat of shellac or Permatex No. 1372 gasket cement to the outside circumference of the seal just before assembly into the bore will provide a margin of safety against seepage between the seal and bore. Care must be exercised to avoid getting gasket material on the sealing member of the seal. Install the seal by forcing the oil seal into the bore with light taps on a block of wood held against the oil seal. Be certain the seal seats firmly in the bore.

7. Permatex No. 1372 gasket cement is used frequently on the machine to prevent oil leaks from the Gear Box. The Permatex must be applied carefully to prevent it from mixing with the Gear Box oil and causing erratic time delay operations.

Basically, the Gear Box consists of four shafts: the Worm Shaft, 4 to 1 Shaft, 2 to 1 Shaft, and 1 to 1 Shaft, arranged as a reduction gear train. The Worm Shaft drives the 4 to 1 Shaft, the 4 to 1 Shaft drives the 2 to 1 Shaft, and the 2 to 1 Shaft drives the 1 to 1 Shaft. The Detector 1 to 1 Shaft is externally mounted to the Gear Box and is meshed to the 1 to 1 Shaft through an idler gear. Since the various shafts control the many different operations of the machine, it is obvious that these shafts must all be in time with each other. The mating gears of these shafts have been provided with timing marks to obtain proper timing of the shafts.

The timing marks consist of three dots, either red or white, on three gear teeth. When the shafts are in time, the single gear tooth with the dot of the driving gear will be meshed directly between the two dotted teeth of the driven gear (figure 1). These timing marks are visible through holes provided in the Gear Box, but are only visible at 0 degree. There is no timed relationship between the Worm Shaft and the 4 to 1 Shaft.

All index and page number references are referred to the latest Parts Catalog (revised May 1959). The new Parts Catalog can be identified by the red cover.

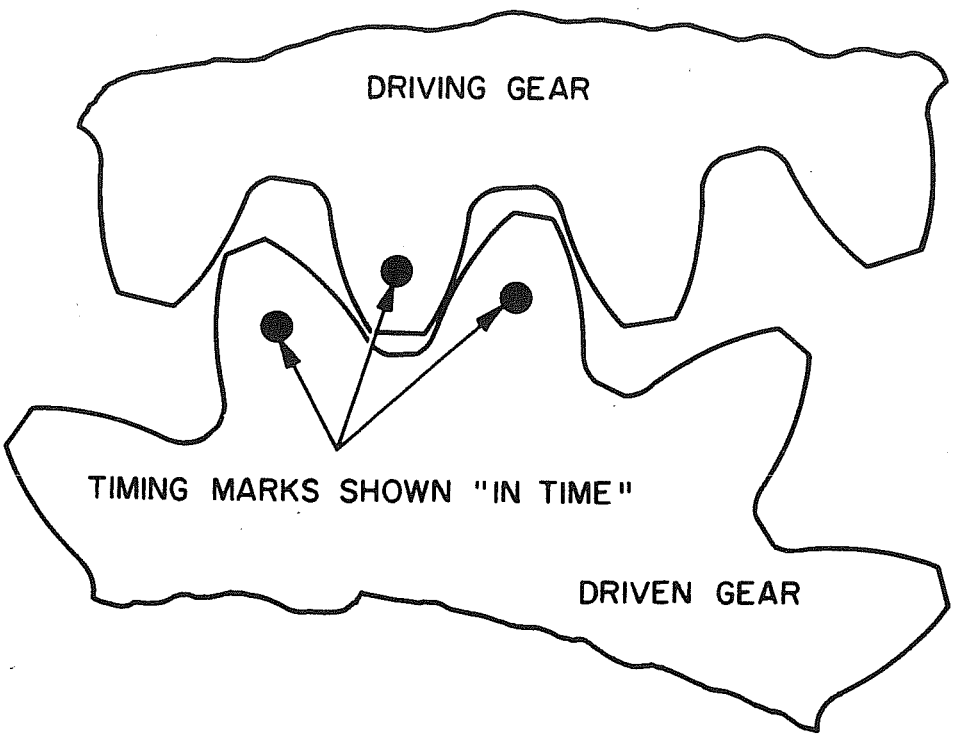

Figure 1. Gears, In Time

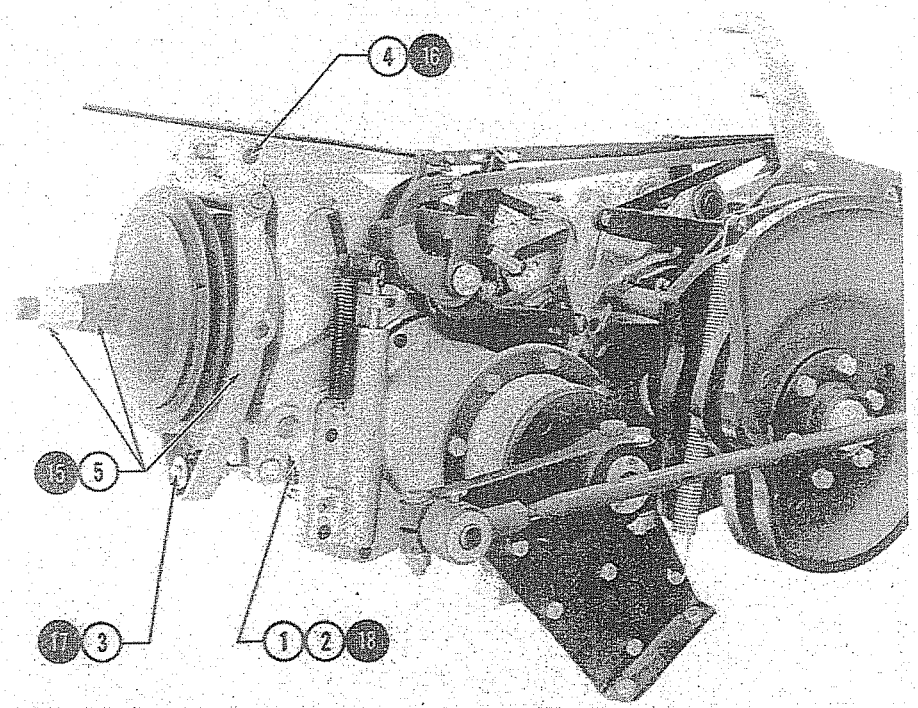

Figure 2a. Worm Shaft, Removal and Installation Sequence

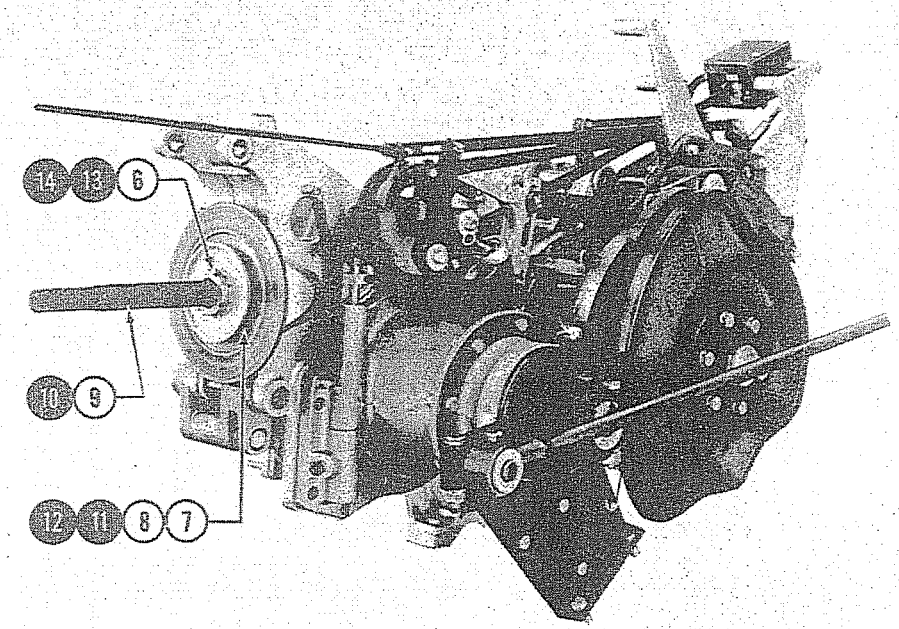

Figure 2b. Worm Shaft, Removal and Installation Sequence

Chapter I
WORM SHAFT ASSEMBLY

Unless otherwise specified, all index part numbers are referred to pages 7 and 9 of the Parts Catalog.

REMOVAL OF WORM SHAFT ASSEMBLY (SEE FIGURES 2A AND 2B)

1. Stop the machine at 270 degrees, with the deck at its full, new pinsetting depth. Shut off the power.

2. Remove Nut GB124 and Spacer GB125.

3. Unscrew Bolt GB117 from Pin GB126. Do not disturb Nuts GB115.

4. Remove Retaining Ring GB154A, Washer GB119, and Pin GB154.

5. Remove Hex Nuts GB130, Clutch Drive Disc GB131, Pulley Assembly GB132, Clutch Drive Disc Assembly GB133 with Yoke and Bearing Assembly GB120, and Compression Spring GB134.

6. Unlock Lockwasher GB136 and remove Locknut GB135, lockwasher, and Spring Disc GB137.

7. Remove four Socket Head Screws GB160D (GB36 prior to machine serial number 8603). Remove Clutch Brake Disc Assembly GB138.

   Caution: Exercise care in sliding the clutch brake disc assembly over the worm shaft to prevent possible damage to Oil Seal GB138A.

8. Remove Spacer GB139 and Shims GB160B and/or GB160C. Remove Cork Gasket GB160E on machines later than serial number 21,883.

9. The Worm Shaft Assembly, part number 12-100388 (page 9A of Parts Catalog), may be removed from the Gear Box by rotating the worm shaft clockwise as viewed from the front of the machine. This clockwise rotation will essentially unscrew the worm shaft from the worm gear, freeing the Worm Shaft Assembly from the Gear Box.

WORM SHAFT DISASSEMBLY PROCEDURE

A. Bearing GB141 may be removed by securing a bearing pulling attachment or gear pulling fingers behind the shoulder of Spacer GB142 and applying approximately 2 tons pressure to the worm shaft. Bearing GB141 and Spacer GB142 will be removed together (figure 3).

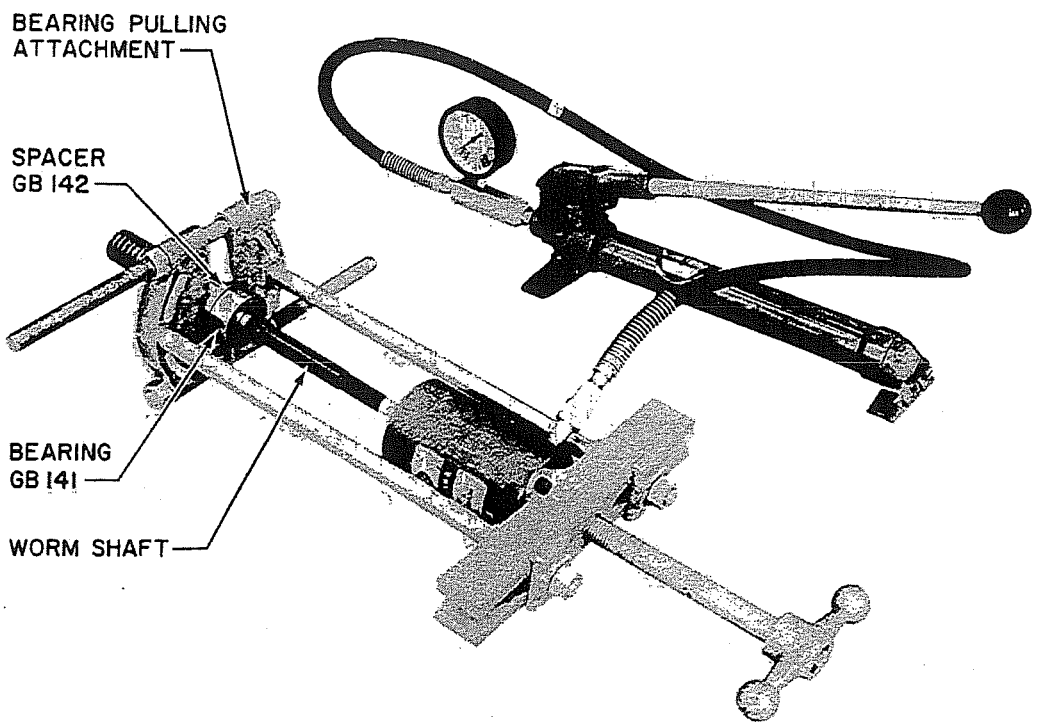

Figure 3. Worm Shaft, Removal of Bearing GB141 and Spacer GB142

B. Spacer GB143 and Outer Bearing Ring GB144 will slide off the shaft easily.

C. Inner Bearing Ring GB145 is originally installed as a hand fit. However, if the bearing has become defective, necessitating its replacement, it may become necessary to force it from the shaft.

On machines later than serial number 18,301, the shoulder directly behind the bearing ring will have two flat surfaces that will make the bearing ring accessible for the gear pulling fingers.

On machines prior to serial number 18,301, the bearing ring will require being moved forward by a knife blade or similar method to create a gap between the bearing ring and the shoulder to allow insertion of a sharp-edged bearing pulling attachment or equivalent (figure 4).

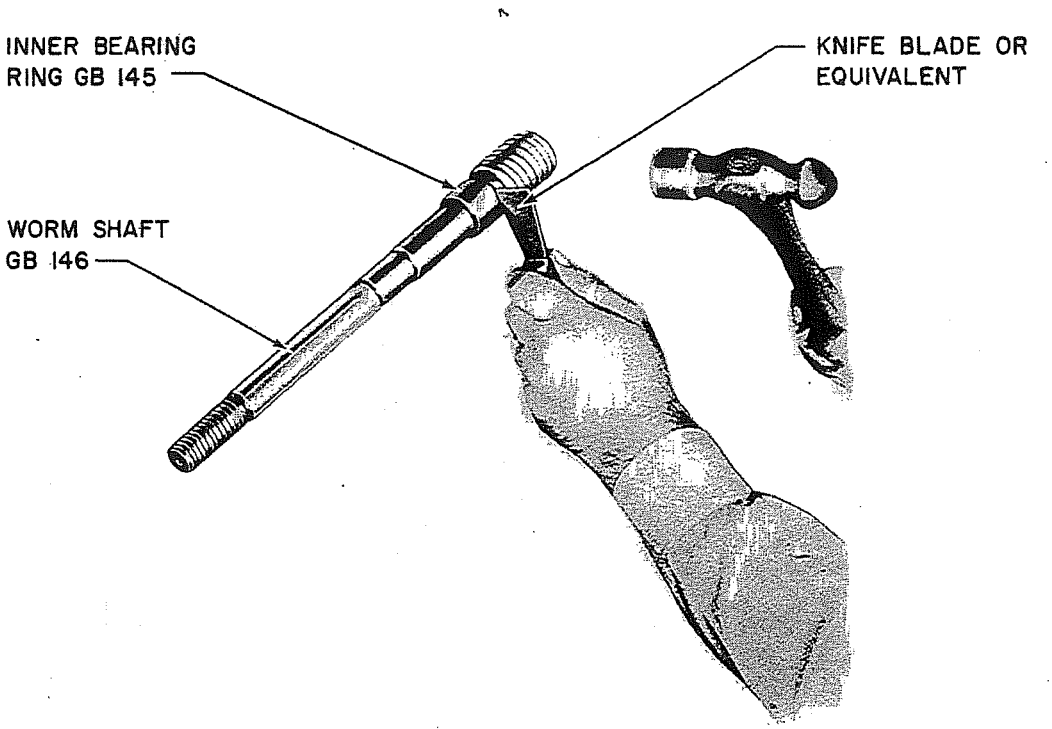

Figure 4. Worm Shaft, Method of Loosening Inner Bearing Ring GB145

D. Engage the bearing pulling attachment or gear pulling fingers behind Inner Bearing Ring GB145 and apply pressure to worm shaft GB146. Upon removal of the bearing ring from the worm shaft, the shoulder of the shaft where the bearing ring seats should be examined for burrs, gouges, and scoring. This surface must be smooth and clean before installing the bearing ring.

WORM SHAFT ASSEMBLY PROCEDURE

E. Apply a light film of oil to the seat of the worm shaft bearing, then slide Inner Bearing Ring GB145 onto Worm Shaft GB146. The inner bearing ring must be free to turn on the shaft and installed by hand pressure alone.

F. The outer area of Inner Bearing Ring GB145 must be cleaned and a light film of oil applied. Carefully slide Outer Bearing Ring GB144 over the inner bearing ring.

G. Install Spacers GB143 and GB142, again using a light film of oil for ease in assembly.

H. Secure the bearing pulling attachment in front of Bearing GB141 and apply an approximate 2-ton push to the worm shaft (figure 5). The bearing must seat firmly against Spacer GB143. The shaft should be cleaned and lubricated prior to installing the bearing.

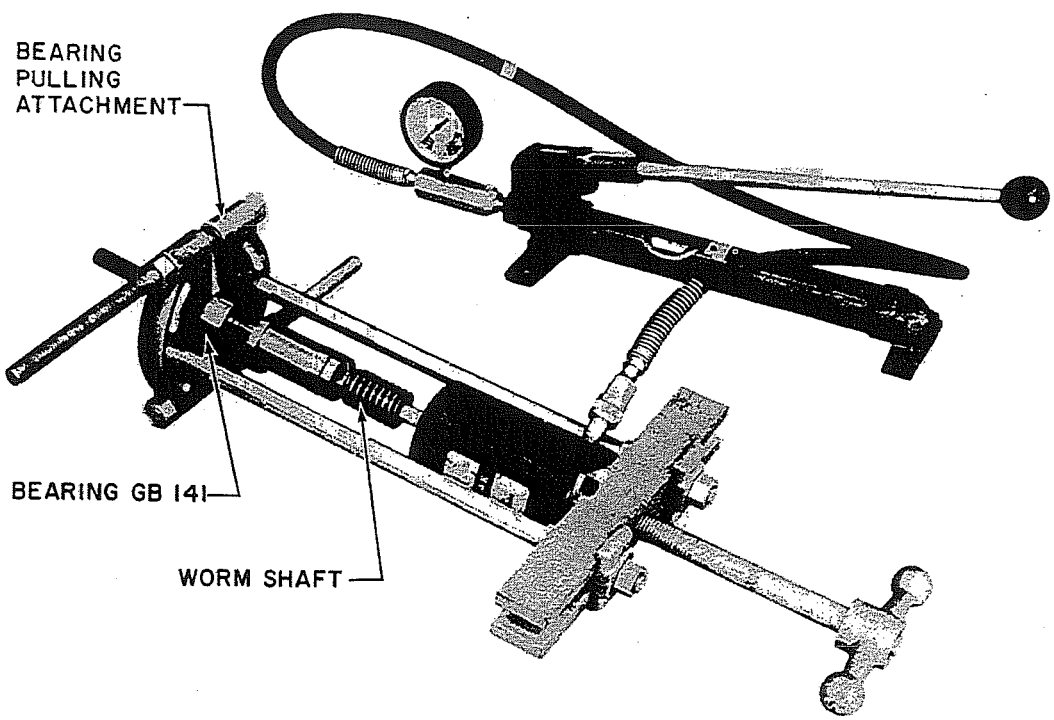

Figure 5. Worm Shaft, Installation of Bearing GB141

INSTALLATION OF WORM SHAFT ASSEMBLY (SEE FIGURES 2A AND 2B)

10. The Worm Shaft Assembly, part number 12-100388, can be installed in the Gear Box by placing the assembly into the Gear Box and rotating the shaft counter-clockwise to engage the worm shaft to the worm wheel. Turn the shaft until the bearing fully seats in the Gear Box housing. Thoroughly clean the Gear Box bore and apply a light film of oil prior to installation of the Worm Shaft Assembly.

11. On machines later than serial number 21,833, replace Cork Gasket GB160E.

12. Install Shims GB160B and/or GB160C, as required, Clutch Brake Disc Assembly GB138, and four Socket Head Screws GB160D. Adhere to the caution given in step 7.

13. Install Spacer GB139 with its rounded leading edge toward the front of the machine.

    Caution: Do not install backwards to prevent damage to the oil seal.

14. Install Spring Disc GB137, Lockwasher GB136, and Locknut GB135. Tighten locknut securely and lock in place by bending a tab of the lockwasher.

15. Install Compression Spring GB134, Clutch Drive Disc Assembly GB133 with Yoke and Bearing Assembly GB120, Pulley Assembly GB132, Clutch Drive Disc Assembly GB131, and Hex Nuts GB130. Run locknut up securely, then back off until a clearance of 0.010 inch is obtained between Clutch Drive Disc Assembly GB133 and Clutch Brake Disc Assembly GB138. Run jam nut up and lock securely.

16. Install Pin GB154, Washer GB119, and Retaining Ring GB154A. Clean and lubricate the pin prior to installation to assure freedom of movement.

17. Screw Bolt GB117 through Pin GB126.

18. Replace Spacer GB125 and Nut GB124.

    The following adjustments must be made:

    (a) Gear Box Clutch Adjustment
    Adjustment No. 15 (page 77 of Service Manual)

    (b) Gear Box Clutch Lever Adjustment
    Adjustment No. 16 (page 77 of Service Manual)

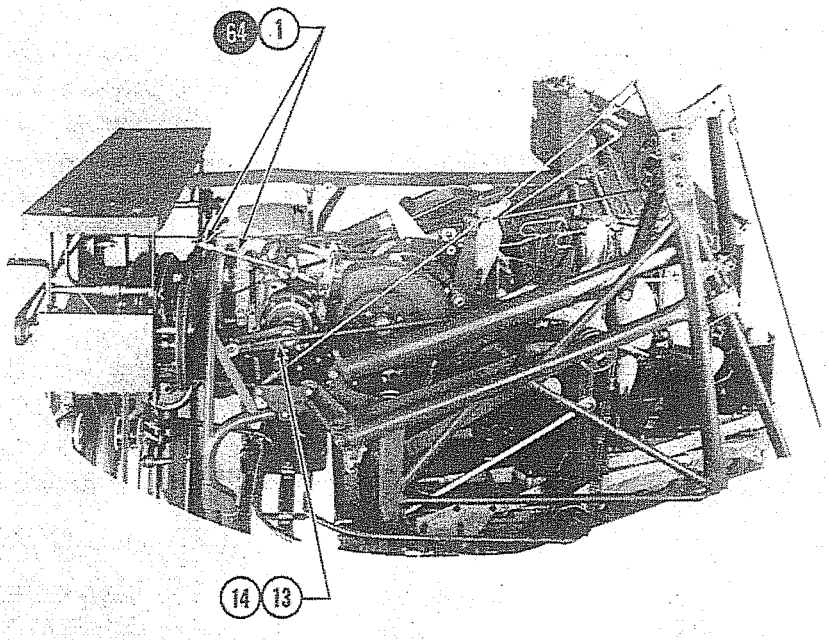

Figure 6a. 4 to 1 Shaft, Removal and Installation Sequence

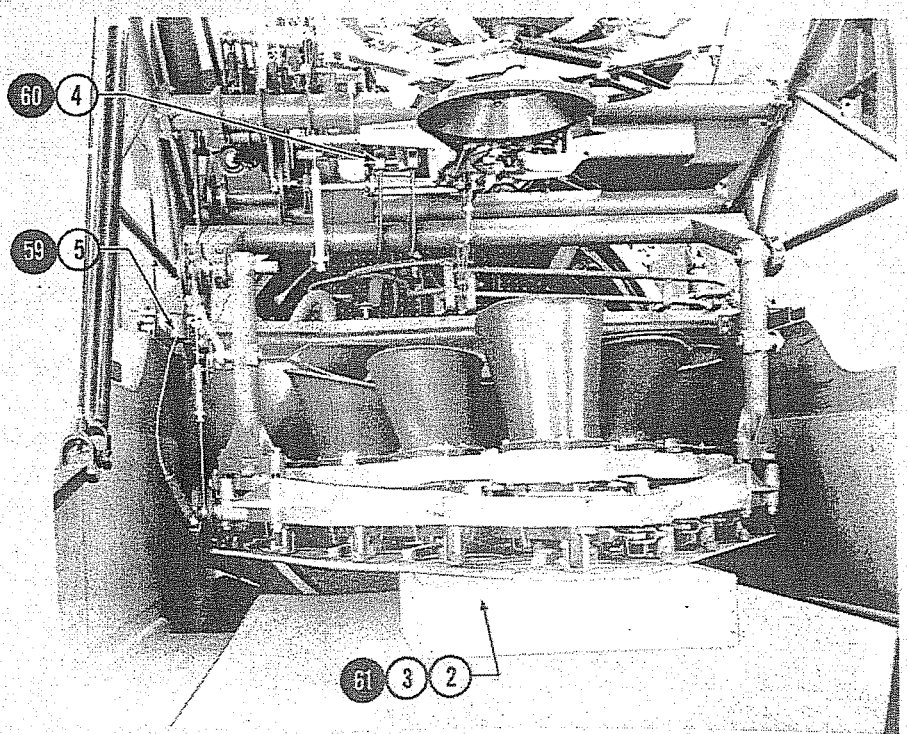

Figure 6b. 4 to 1 Shaft, Removal and Installation Sequence

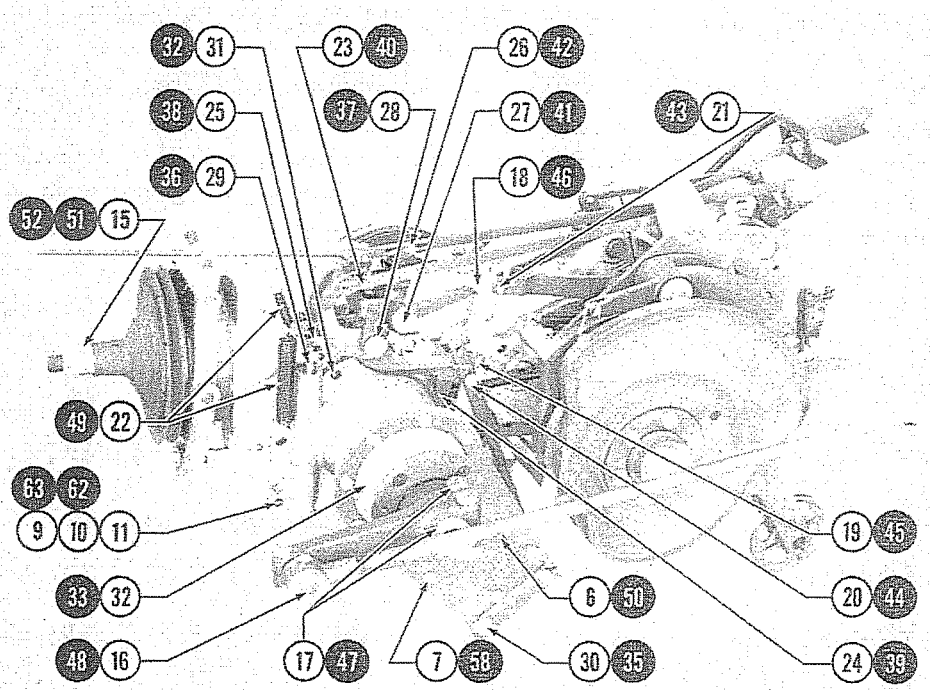

Figure 6c. 4 to 1 Shaft, Removal and Installation Sequence

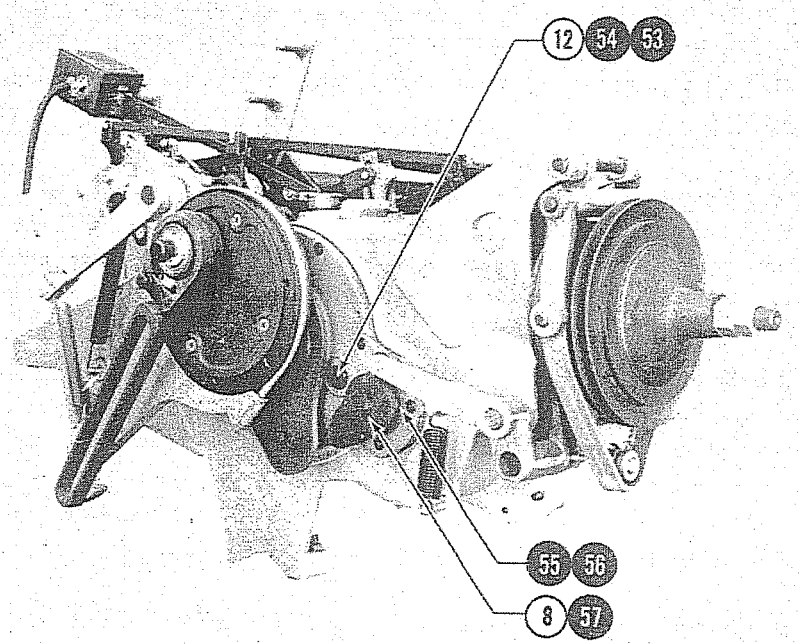

Figure 6d. 4 to 1 Shaft, Removal and Installation Sequence

Chapter II
4 TO 1 SHAFT ASSEMBLY

Unless otherwise specified, all index part numbers are referred to page 37 of the Parts Catalog.

REMOVAL OF 4 TO 1 SHAFT ASSEMBLY (SEE FIGURES 6A THROUGH 6D)

Before removing the 4 to 1 Shaft Assembly from the Gear Box, it will be necessary to remove the Worm Shaft Assembly. Unless the Worm Shaft Assembly is removed first, the shaft assembly and worm wheel of the 4 to 1 Shaft will be engaged, preventing removal of the 4 to 1 Shaft Assembly. The removal procedure for the Worm Shaft Assembly is contained in Chapter I and is directed by step 15 in the following procedure.

1. Cycle the machine to 180 degrees and remove two Hex Jam Nuts R13, Trip Rod Assembly R17, and Trip Spring R16 (page 51 of Parts Catalog).

2. Cycle the machine to 270 degrees, with the deck assembly at its lowest, new pinsetting depth. Shut off the power.

3. Lift the deck assembly by hand and firmly support it on blocks or boxes to free the deck lowering link from the weight of the deck assembly.

4. Remove Retaining Ring or Spirolox Ring F43, Washer F44, and Shaft (deck lowering pin) F45 from the deck lift shaft (page 83 of Parts Catalog).

5. Remove the moving deck cable from its pulley at the top of the deck support arm and allow the cable to rest free to the left of the deck assembly.

6. Remove the two screws that mount the deck jam micro switch, and allow the micro switch and cable to hang freely from the rear crossbrace.

7. Remove three Hex Nuts GB438A, three Washers GB439, and three Hex Head Bolts GB440. Remove Cable and Tube Assembly GB437 and allow the tube assembly to hang free from the pulley on the moving deck cam follower.

8. Remove two Socket Head Cap Screws GB36 or GB36A and Clutch Cam GB35 (page 3 of Parts Catalog).

9. Remove Socket Head Cap Screw GB28B, Gasket GB28C, and Hex Nut GB28D. Remove Gear Box Oil Pan GB28A (page 3 of Parts Catalog).

10. Remove Gear Box Drain Plug GB464 (page 41 of Parts Catalog) and drain the oil from the Gear Box.

11. Replace Gear Box Drain Plug GB464 (page 41 of Parts Catalog). The threads of the plug should be coated with Permatex No. 1372 before installing.

12. Advance the machine by hand until Pipe Plug GB413 is accessible, and remove the pipe plug from Gear Box Cover GB414 (page 33 of Parts Catalog).

13. Manually advance the machine to 0 degree, making certain that Rake Crank Link R83 bisects the 4 to 1 Shaft.

    Note: Removal of Pipe Plug GB413 will provide access to the timing marks on the mating gears of the 4 to 1 and 2 to 1 Shaft Assemblies. A mirror will be required to view the timing marks and a preliminary check should be made to assure that the timing marks are visible. Refer to the Introduction.

14. Place a 2 x 4-inch block of wood between the two rake cams and firmly C-clamp the block to the outer rake cam. Then C-clamp the block to the rake cam follower (figure 7). Clamping is required to prevent the 1 to 1 and 2 to 1 Shafts from rotating after the 4 to 1 Shaft Assembly has been removed from the Gear Box.

15. Remove the Worm Shaft Assembly from the Gear Box. The Worm Shaft Assembly can be removed at 0 degree instead of 270 degrees as directed in Chapter I. Refer to Chapter I.

16. Remove Retaining Ring R61, two Washers R82, Flexloc Nut R84A, and Hex Head Cap Screw R86A. On machines prior to serial number 24,001, remove Retaining Ring R84, two Washers R85, and Pin R86 (page 53 of Parts Catalog). Remove rake crank link assembly (figure 26, page 61 of Parts Catalog).

17. Remove Flat Head Socket Cap Screw GB110 and Washer GB111. Loosen two Hex Nuts GB106 and remove Rake Crank Assembly GB103 and Square Key GB112 (page 7 of Parts Catalog).

18. Remove X-washer GB12 and Pin GB70 to free Link GB69 from Clutch Latch GB71 (page 5 of Parts Catalog). On later machines, the pin and X-washer have been replaced with Roll Pin GB70.

19. Remove X-washer GB12, Pin GB62, and Roller GB63 to free the plunger lever from the clutch actuator link (page 5 of Parts Catalog).

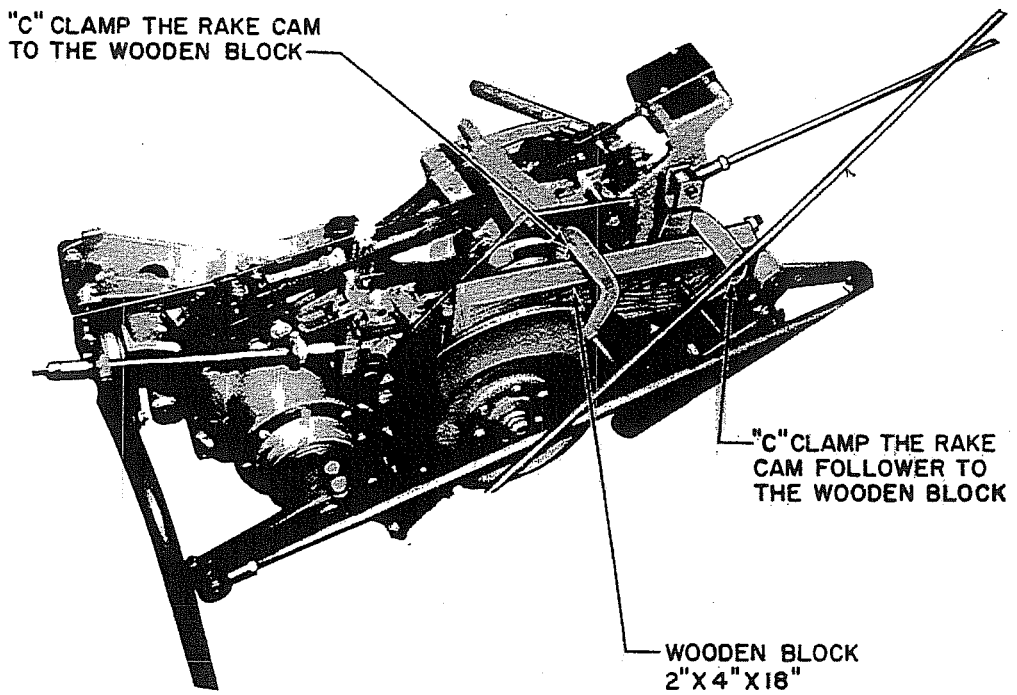

Figure 7. Rake Cams, Locked in Place with C-clamps

20. Remove X-washer GB339, two Plain Washers GB340, Rollers GB343 and GB344, and Pin GB341 to free Interlock Link GB338 from Release Lever GB346 (page 29 of Parts Catalog).

21. Remove Hex Nut GB367C, Lockwasher GB366, Roller GB367F, Washer GB367D, Stripper Bolt GB367E, and Roller GB63A or GB63B to free the clutch actuator link from the clutch reset lever (page 29 of Parts Catalog). On earlier machines, remove X-washer GB12 and Pin GB91B.

22. Remove Tension Spring GB86 from the plunger lever, Tension Spring GB85 from the clutch actuator lever, and Tension Spring GB55 from the scissor cam follower (page 5 of Parts Catalog).

23. For machine serial number 1593 and later machines, remove X-washer GB91E, Flexloc Nut GB97A and Pin GB97B or X-washer GB91E and Pin GB91D, and Spring GB61 to disconnect Out-of-Range Lever GB91A from Out-of-Range Link GB91C (page 5 of Parts Catalog). Earlier machines have an electrical out-of-range mechanism and this step may be disregarded.

24. Remove Roll Pin GB345 and Tension Spring GB98 that runs from the clutch reset lever to the clutch release lever (page 7 of Parts Catalog).

25. Remove three-part Connecting Link (bicycle link) GB349 from Plunger Lever Assembly GB353 to Plunger Assembly GB352 (page 29 of Parts Catalog).

26. Remove X-washer GB12 and Pin GB70 to free Link GB75A from Starter Bellcrank Assembly GB76 (page 5 of Parts Catalog).

27. Remove Hex Head Bolt GB82, Lockwasher GB83, Washer GB84, and Starter Bellcrank Assembly GB76 with Link GB77A (page 5 of Parts Catalog).

28. Remove Hex Head Bolt GB87, Lockwasher GB83, Plain Washer GB84, Plunger Lever Assembly GB353, two Spacers GB89, Clutch Release Lever Assembly GB91, Out-of-Range Lever GB91A for machines later than serial number 1593, and Clutch Actuator Lever GB90B. For machines prior to serial number 2295, remove two Spacers GB90 (page 5 of Parts Catalog).

29. Carefully remove Plunger Assembly GB352, together with Stop Collar GB350, from the rake crank housing (page 29 of Parts Catalog).

30. Remove two Hex Head Bolts GB34, two Lockwashers GB32, and two Hex Nuts GB31 that mount the support plate to the pinsetter frame (page 3 of Parts Catalog).

31. Remove seven Socket Head Cap Screws GB140, one Socket Head Cap Screw GB28B, and eight Copper Gaskets GB101A that mount the 4 to 1 Shaft Assembly to the Gear Box (page 9 of Parts Catalog).

Note: A drop cloth should be spread under the working area of the Gear Box to catch oil drippings.

32. Remove Rake Crank Housing Assembly GB129 from the Gear Box.

Caution: Exercise care in removing the 4 to 1 Shaft Assembly to prevent damage to Gasket GB160A on machines later than serial number 874 (page 9 of Parts Catalog). If the gasket is damaged, the Gear Box surface must be thoroughly cleaned and a new gasket installed with a thin layer of Permatex No. 1372 between the Gear Box and gasket.

4 TO 1 SHAFT DISASSEMBLY PROCEDURE

A. Remove eight Hex Nuts and Lockwashers GB438 and eight Hex Head Bolts GB442. Remove Support Plate Assembly GB441.

B. Remove four Flat Head Cap Screws GB433 and Bearing Cap GB432.

C. Bearing Housing GB434B can be removed from Rake Crank Housing GB452 by threading two Flat Head Cap Screws GB433 into the two tapped holes on the front surface of Bearing Housing GB434B. As the screws are installed, the bearing housing can be lifted free of the rake crank housing. If the bearing housing will not lift free, secure the bearing pulling attachment behind the flange and apply pressure to the shaft (figure 8).

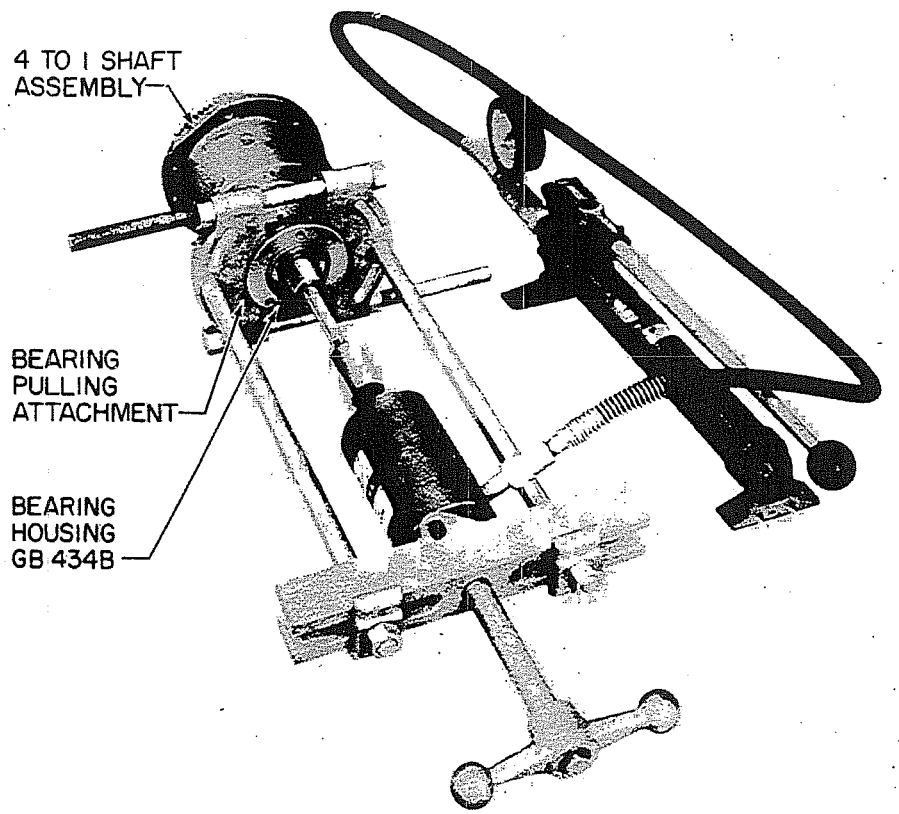

Figure 8. 4 to 1 Shaft, Removal of Bearing Housing GB434B

Oil Seal GB435, O-ring GB436, Shims GB434C, and Bearing GB434A will be removed with Bearing Housing GB434B.

Note: Care should be taken when removing the shims to allow the shims to be replaced in their original position at reassembly.

D. Secure the bearing pulling attachment behind the flange of Rake Crank Housing Assembly GB452 and apply pressure to the shaft (figure 9). This will remove the 4 to 1 Shaft Assembly from the rake crank housing.

E. Remove Spacer GB443 and O-ring GB448A from Shaft GB448.

F. Secure the bearing pulling attachment behind Worm Wheel GB445 and apply pressure to the shaft (figure 10). The worm wheel and spur gear GB444 will be removed together. Remove Square Key GB447.

Caution: Do not attempt to remove Bearing GB446 prior to removing Square Key GB447.

G. Secure the bearing pulling attachment behind the inner race of Bearing GB446 and apply pressure to the shaft to free the bearing from Shaft GB448 (figure 11).

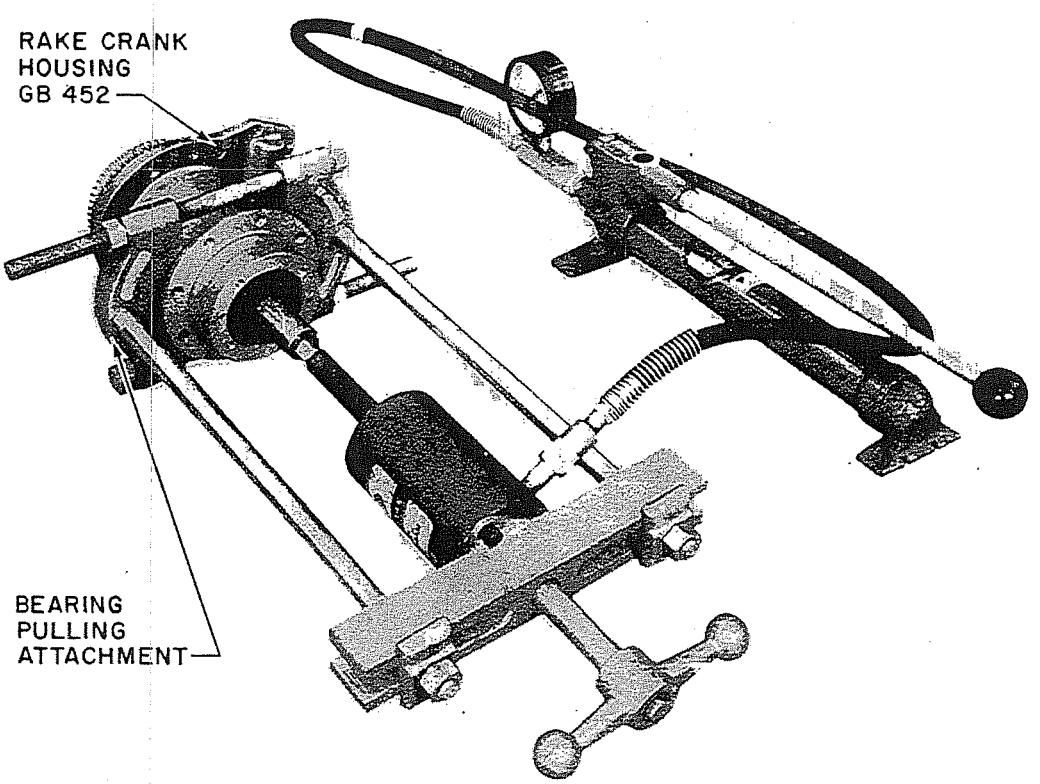

Figure 9. 4 to 1 Shaft, Removal of Rake Crank Housing GB452

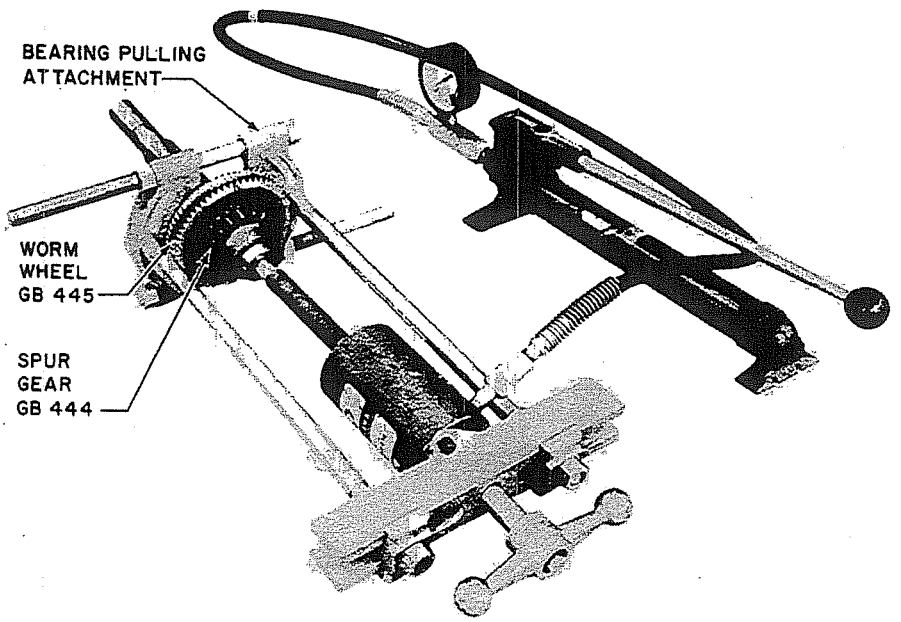

Figure 10. 4 to 1 Shaft, Removal of Worm Wheel GB445 and Spur Gear GB444

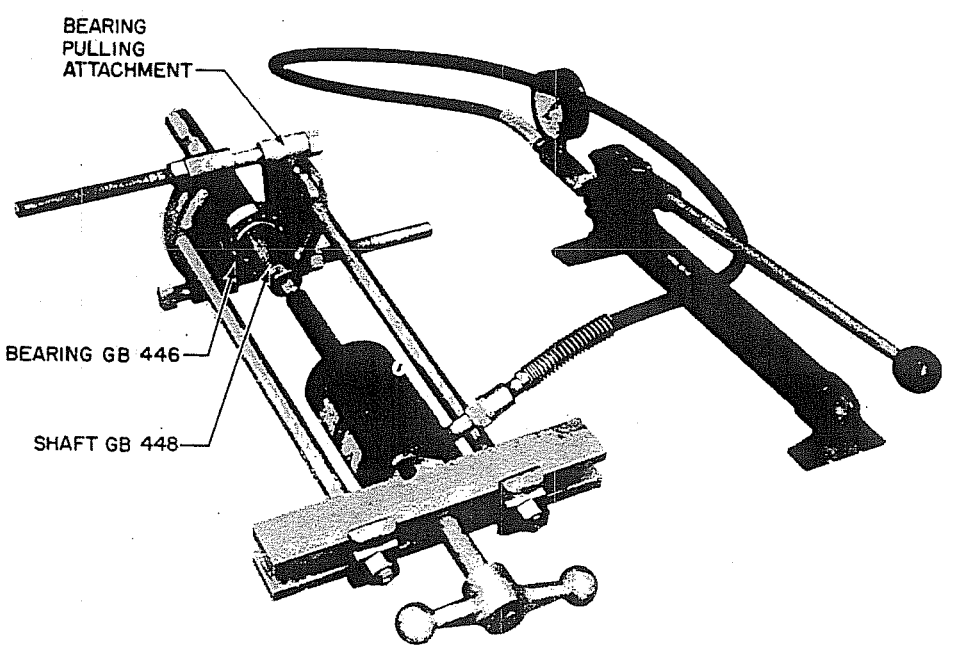

Figure 11. 4 to 1 Shaft, Removal of Bearing GB446

4 TO 1 SHAFT ASSEMBLY PROCEDURE

H. Secure the bearing pulling attachment behind the inner race of Bearing GB446 and apply pressure to the shaft (figure 12). The shaft should be cleaned and lubricated prior to installing the bearing.

I. Install Square Key GB447 in the key seat of Shaft GB448. The key should be inspected for burrs and should seat firmly in the keyway.

J. Secure the bearing pulling attachment behind Worm Wheel GB445 and press on by applying pressure to the shaft (figure 13).

Caution: Be sure the key slot of the worm wheel is aligned with the key during the pressing operation.

K. Secure the bearing pulling attachment behind Spur Gear GB444 and apply pressure to the shaft (figure 14).

Caution: Be sure the key slot in the gear is aligned with the key during the pressing operation.

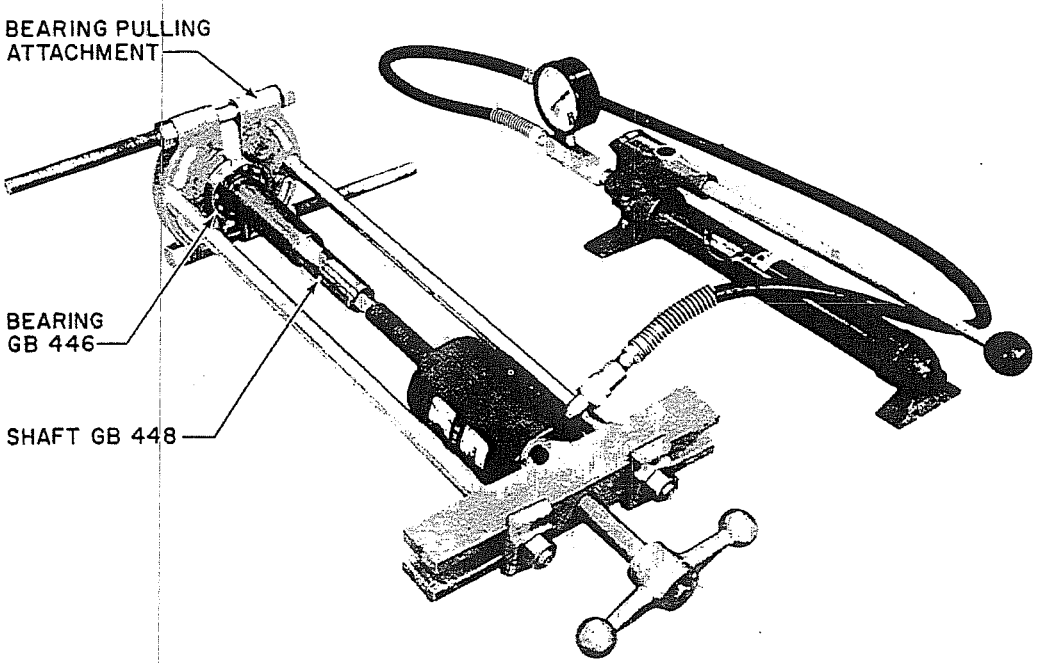

Figure 12. 4 to 1 Shaft, Installation of Bearing GB446

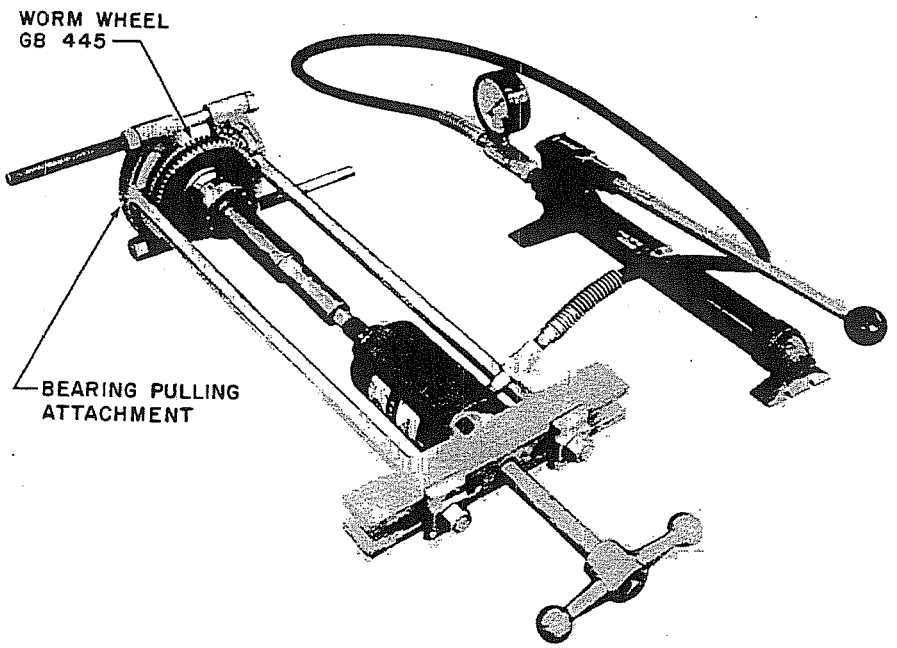

Figure 13. 4 to 1 Shaft, Installation of Worm Wheel GB445

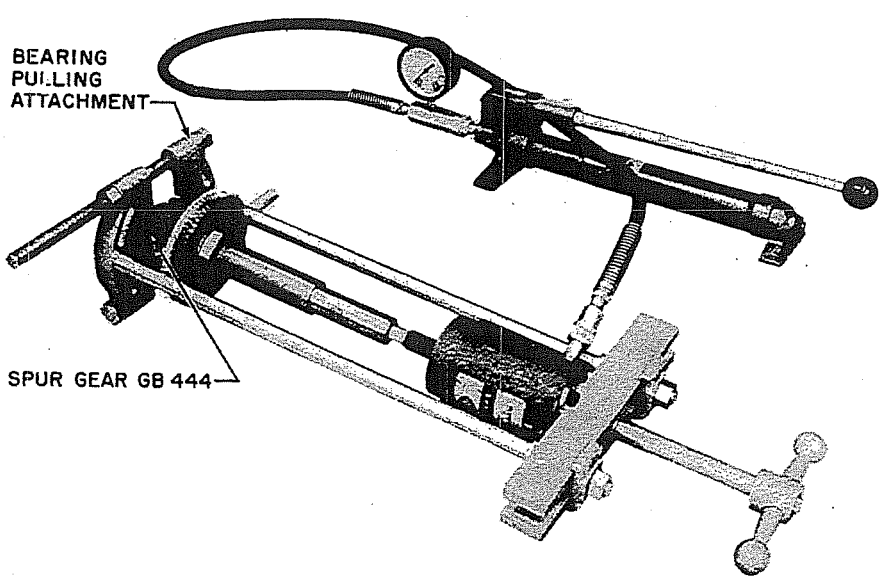

Figure 14. 4 to 1 Shaft, Installation of Spur Gear GB444

L. Replace Shims GB434C in their original position and insert Bearing Housing GB434B into Rake Crank Housing GB452 by applying light taps with a plastic hammer. Oil Seal GB435, O-ring GB436, and Bearing GB434A will be replaced with Bearing Housing GB434B. Replace Bearing Cap GB432 and four Flat Head Cap Screws GB433.

M. Secure the bearing pulling attachment behind the flange of Rake Crank Housing GB452 and press the shaft assembly into the housing until the shaft seats firmly against Bearing GB434A (figure 15).

Caution: Be sure the shaft and bearing are aligned before starting the pressing operation.

N. Replace Support Plate Assembly GB441, eight Hex Nuts and Lockwashers GB438, and eight Hex Head Bolts GB442.

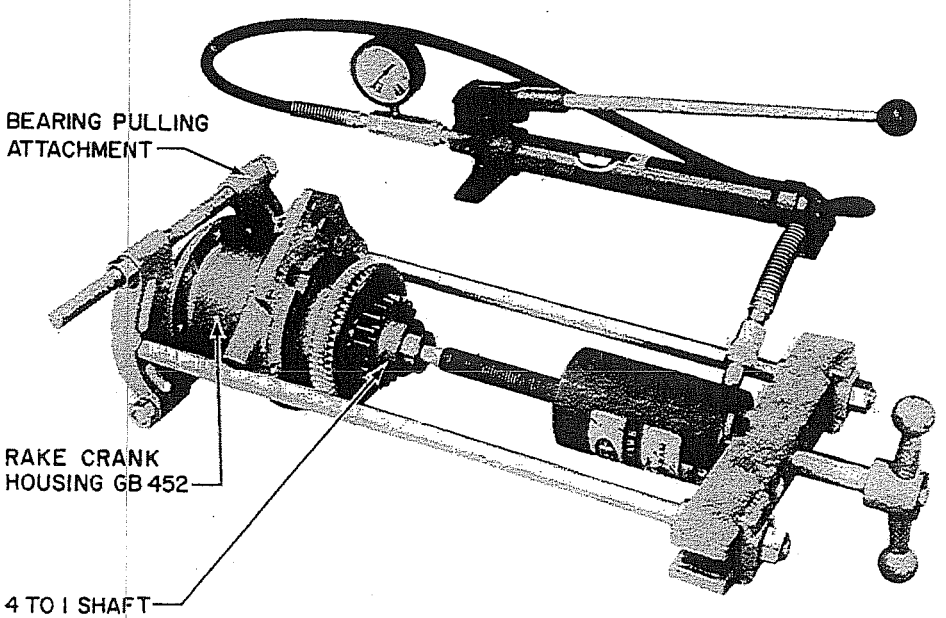

Figure 15. 4 to 1 Shaft, Installation of Rake Crank Housing GB452

INSTALLATION OF 4 TO 1 SHAFT ASSEMBLY (SEE FIGURES 6A THROUGH 6D)

33. Replace Gasket GB160A and Rake Crank Housing Assembly GB129 in Gear Box (page 9 of Parts Catalog).

    Caution: Check the timing marks of the mating gears of the 4 to 1 and 2 to 1 Shafts. The gears must be meshed in time. Several attempts may be required to properly align the timing marks (figure 1). Refer to the Introduction.

34. Replace eight Copper Gaskets GB101A, seven Socket Head Cap Screws GB140, and one Socket Head Cap Screw GB28B to mount the 4 to 1 Shaft Assembly to the Gear Box (page 9 of Parts Catalog).

35. Replace two Hex Head Bolts GB34, two Lockwashers GB32, and two Hex Nuts GB31 that mount Support Plate GB441 to the pinsetter frame.

36. Carefully replace Plunger Assembly GB352, together with Stop Collar GB350, in the dashpot cylinder (page 29 of Parts Catalog).

37. Replace Clutch Actuator Lever GB90B, Out-of-Range Lever GB91A for machines later than serial number 1593, Clutch Release Lever Assembly GB91, two Spacers GB89, Plunger Lever Assembly GB353, Plain Washer GB84, Lockwasher GB83, and Hex Head Bolt GB87 (page 5 of Parts Catalog). On machines prior to serial number 2295, replace two Spacers GB90.

38. Replace three-part Connecting Link (bicycle link) GB349 that joins Plunger Assembly GB352 to Plunger Lever Assembly GB353 (page 29 of Parts Catalog).

39. Replace Tension Spring GB98 that runs from clutch reset lever to clutch release lever and Roll Pin GB345 (page 7 of Parts Catalog).

40. For machine serial number 1593 and later machines, connect Out-of-Range Lever GB91A to Out-of-Range Link GB91C by replacing Pin GB91D and X-washer GB91E or Flexloc Nut GB97A and Pin GB97B and Spring GB61 (page 5 of Parts Catalog).

41. Replace Starter Bellcrank Assembly GB76 with Link GB77A, Lockwasher GB83, and Hex Head Bolt GB82.

42. Replace Pin GB70 and X-washer GB12 to connect Starter Bellcrank Assembly GB76 to Link GB75A.

43. Replace Hex Nut GB367C, Lockwasher GB366, Roller GB367F, Roller GB367E, Stripper Bolt GB367E, and Roller GB63A or GB63B to fasten the clutch actuator link to the clutch reset lever (page 5 of Parts Catalog). On earlier machines, replace Pin GB91B and X-washer GB12 only.

44. Replace Roller GB343, Roller GB344, two Plain Washers GB340, Pin GB341, and X-washer GB339 that attach the 180-degree turret interlock link to the clutch release lever (page 29 of Parts Catalog).

45. Replace Roller GB63, Pin GB62, and X-washer GB12 to attach the clutch actuator link to the plunger lever (page 5 of Parts Catalog).

46. Replace Roll Pin GB70 and X-washer GB12 to attach Link GB69 to Clutch Latch GB71 (page 5 of Parts Catalog). On later machines, the pin and X-washer have been replaced with Roll Pin GB70.

47. Replace Square Key GB112 and replace Rake Crank Assembly GB103. Tighten two Hex Nuts GB106. Replace Washer GB111 and Flat Head Socket Cap Screw GB110 (page 7 of Parts Catalog).

48. Replace Rake Crank Link Assembly (figure 26, page 61 of Parts Catalog) by replacing two Washers R82, Retaining Ring R84, Flexloc Nut R84A, and Hex Head Cap Screw R84A. On machines prior to serial number 24,001, replace two Washers R85, Pin R86, and Retaining Ring R84 (page 53 of Parts Catalog).

49. Replace Tension Spring GB86 to the plunger lever, Tension Spring GB85 to the clutch actuator lever, and Tension Spring GB55 to the scissor cam follower (page 5 of Parts Catalog).

50. Replace the two screws that mount the deck jam micro switch to the Gear Box.

51. Install the Worm Shaft Assembly in the Gear Box. Refer to Chapter I.

52. Remove the two C-clamps and the block of wood from the rake cams.

53. Manually rotate the Gear Box backward until Pipe Plug GB413 is accessible. The deck lowering link and deck lowering hook assemblies must be held above the crossbrace and the moving deck-scissor flag held in position to block the scissor cam follower.

54. Replace Pipe Plug GB413 in Gear Box Cover GB414. Permatex No. 1372 should be applied to the threads of the plug prior to installation.

55. Manually rotate the Gear Box backward to 270 degrees.

56. Replace O-ring GB448A and Spacer GB443. The spacer must be installed with its rounded leading edge toward the gears.

57. Replace Clutch Cam GB35 and two Socket Head Cap Screws GB36 or GB36A (page 3 of Parts Catalog).

58. Position Cable and Tube Assembly GB437 and install three Hex Head Bolts GB440, three Washers GB439, and three Hex Nuts GB438A.

59. Replace the moving deck cable on its pulley at the top of the deck support arm, making certain that the moving deck cable and moving deck control cable are both properly positioned on their respective pulleys.

60. Place the deck lowering link between the brackets of the deck lift shaft and replace Shaft (deck lowering pin) F45, Washer F44, and Retaining Ring or Spirolox Ring F43 (page 83 of Parts Catalog).

61. Remove the blocks or boxes used to support the deck assembly.

62. Replace Gear Box Oil Pan GB28A, Gasket GB28C, Socket Head Cap Screw GB28B, and Hex Nut GB28D.

63. Replace the Gear Box oil.

64. Cycle the machine to 180 degrees and replace Trip Rod Assembly R17, Trip Spring R16, and two Hex Jam Nuts R13.

    The following adjustments must be made:

    (a) Trigger Link Adjustment
    Adjustment No. 22 (page 84 of Service Manual)

    (b) Deck Height and Level Adjustment
    Adjustment No. 7 (page 72 of Service Manual)

    (c) Gear Box Clutch Lever Adjustment
    Adjustment No. 16 (page 77 of Service Manual)

    (d) Gear Box Stop Collar Adjustment
    Adjustment No. 17 (page 78 of Service Manual)

    (e) Gear Box 180-Degree Stop Interlock Adjustment
    Adjustment No. 19 (page 81 of Service Manual)

    (f) Moving Deck Jam Micro Switch Adjustment
    Adjustment No. 49 (page 107 of Service Manual)

A functional check should then be made on the entire triggering and reset mechanisms to assure satisfactory performance.

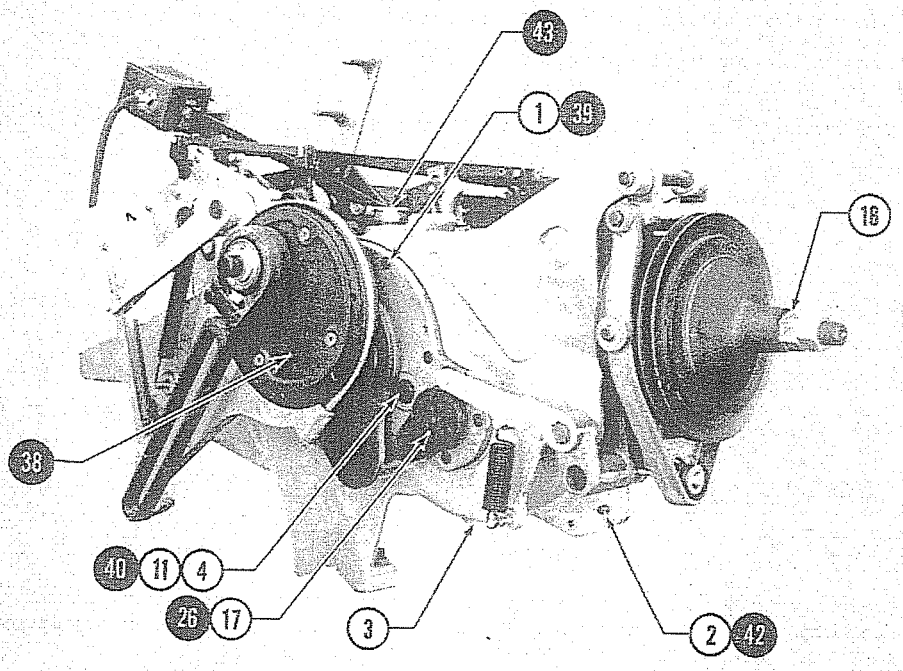

Figure 16a. 2 to 1 Shaft, Removal and Installation Sequence

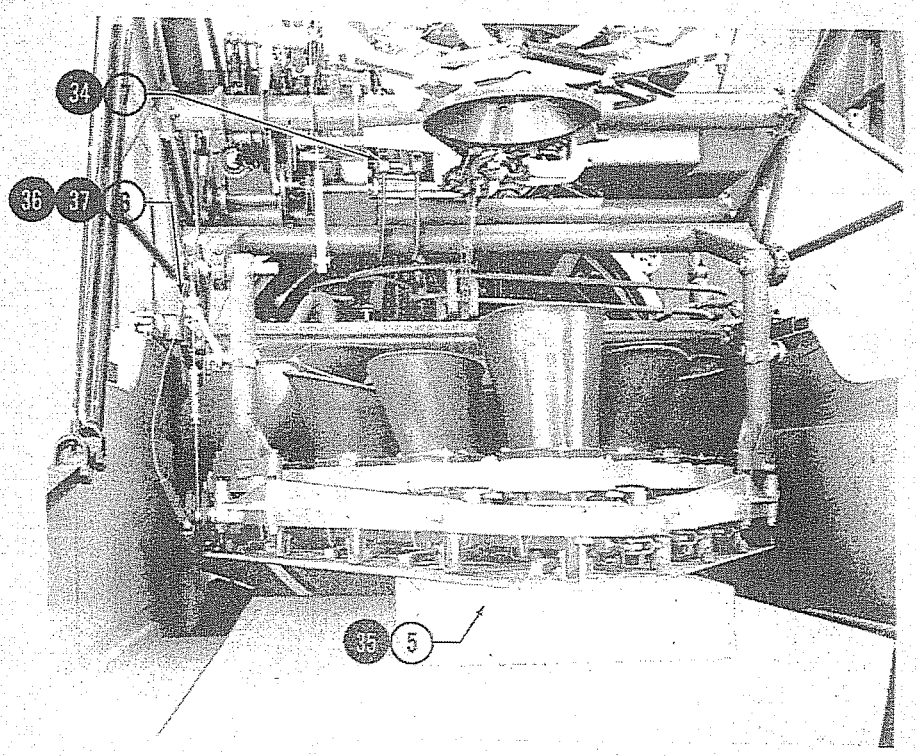

Figure 16b. 2 to 1 Shaft, Removal and Installation Sequence

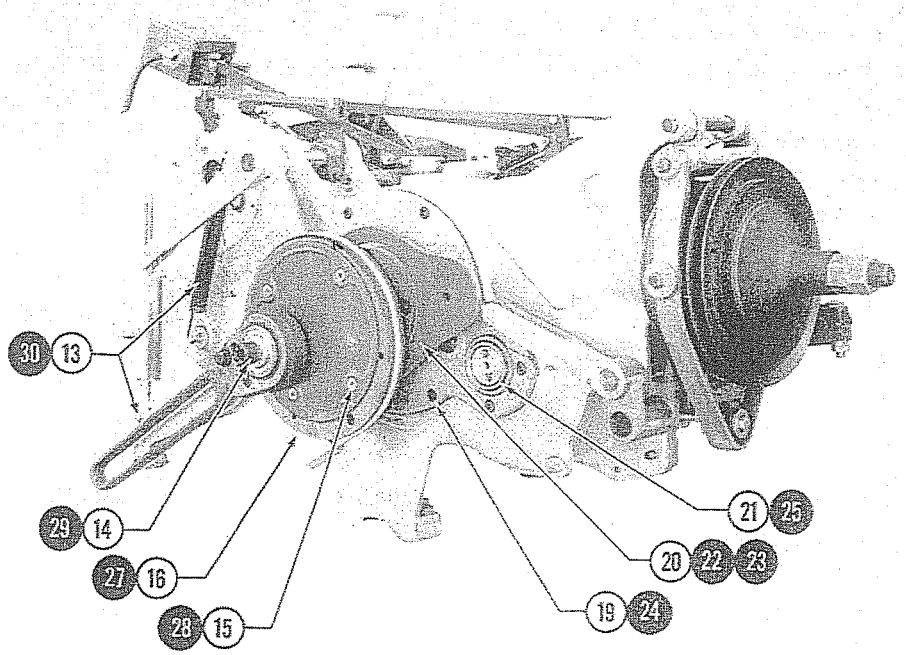

Figure 16c. 2 to 1 Shaft, Removal and Installation Sequence

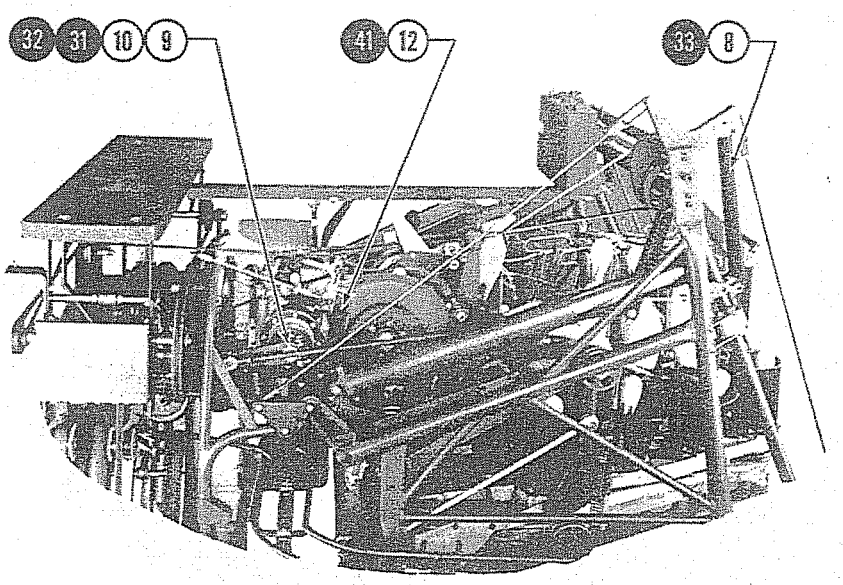

Figure 16d. 2 to 1 Shaft, Removal and Installation Sequence

Chapter III
2 TO 1 SHAFT ASSEMBLY

Unless otherwise specified, all index part numbers are referred to page 33 of the Parts Catalog.

REMOVAL OF 2 TO 1 SHAFT ASSEMBLY (SEE FIGURES 16A THROUGH 16D)

1. Cycle the machine until the three Socket Head Cap Screws GB36 and Gaskets GB101A, located at 9, 1, and 3 o'clock on the cover of the 2 to 1 Shaft Assembly GB102, are accessible (page 7 of Parts Catalog). Remove the three screws and gaskets.

2. Remove Hex Nut GB28D, Gasket GB28C, Socket Head Cap Screw GB28B, and Gear Box Oil Pan GB28A (page 3 of Parts Catalog).

3. Remove Drain Plug GB464 from the Gear Box and drain the Gear Box oil. Replace the drain plug (page 41 of Parts Catalog). The threads of the plug should be coated with Permatex No. 1372 before installing.

4. Advance the machine until Pipe Plug GB413 is accessible, and remove the pipe plug from Gear Box Cover GB414.

5. Stop the machine at 270 degrees, with the deck assembly at its full, new pin-setting depth. Shut off the power. Lift the deck assembly by hand and firmly support it on blocks or boxes to free the deck lowering link from the weight of the deck assembly.

6. Remove the moving deck cable from its pulley at the top of the deck support arm and allow the cable to rest free of the deck assembly. This will relieve the pressure of the moving deck cam follower from the moving deck-scissor cam.

7. Remove Retaining Ring or Spirolox Ring F43, Washer F44, and Shaft (deck lowering pin) F45 from the deck lift shaft (page 83 of Parts Catalog).

8. Remove the two Tension Springs R89 (page 53 of Parts Catalog) that run from the V-levers on Rake Lift Arm Assembly R93 to Rake Support Arms R97. Removal of these springs will eliminate the pressure of the rake cam followers against the rake cams.

Caution: Prevent the rake board from rising too fast by keeping one foot on the board when removing the springs. Allow the rake board to rise slowly.

9. Manually advance the machine to 0 degree, making certain that the rake sweep link bisects the 4 to 1 Shaft.

10. Place a 2 x 4-inch block of wood between the two rake cams and firmly C-clamp the block to the outer rake cam. Then C-clamp the block to the rake cam follower (figure 7). Clamping is required to prevent the 1 to 1 Shaft from rotating after the 2 to 1 Shaft Assembly has been removed from the Gear Box.

11. Removal of Pipe Plug GB413 (step 4) will provide access to the timing marks on the mating gears of the 4 to 1 and 2 to 1 Shaft Assemblies. A mirror will be required to view the timing marks and a preliminary check should be made to assure that the timing marks are visible. Refer to the introduction.

12. Remove Pipe Plug GB382 from Gear Box Cover GB383 (page 31 of Parts Catalog).

    Note: Removal of this plug will allow inspection of the Timing Marks on the mating gears of the 2 to 1 Shaft and the 1 to 1 Shaft. A mirror will again be required and a preliminary check should be made to assure that the timing marks are visible.

13. Remove X-washer GB426, Pin GB425, and Connecting Link GB424 from the deck lowering hook (page 35 of Parts Catalog). Remove Tension Springs GB2 and GB3 and pivot the deck lowering hook cam lever away from the cam (page 3 of Parts Catalog). Block the cam lever in this position for access to the 2 to 1 Shaft Assembly.

14. Remove Socket Head Cap Screw GB384, Washer GB385, two Bearings GB386, Spacer GB387, and the deck lowering link assembly. If the bearings cannot be removed easily, remove the link assembly only. The bearings can be removed easier upon removal of the 2 to 1 Shaft Assembly from the Gear Box.

15. Remove four Flat Head Cap Screws GB398, O-ring GB400, and Clamp Ring GB397.

    Note: A drop cloth should be spread under the working area of the Gear Box to catch oil drops from the oil reservoir in Deck Lift Crank Eccentric GB418.

16. Slide the bronze eccentric, together with the entire deck lowering hook assembly, off Deck Lift Crank GB418.

17. Remove two Socket Head Cap Screws GB36 or GB36A and Clutch Cam GB35 (page 3 of Parts Catalog).

18. Engage the gear box clutch and rotate the input worm shaft very slightly in the reverse direction until backlash can be felt on the 2 to 1 Shaft. Check the timing marks to be certain that they are still visible through the viewing ports.

19. Remove the remaining five Socket Head Cap Screws GB36 and Gaskets GB101A that hold Gear Box Cover GB414 to the Gear Box.

    Note: A drop cloth should be spread under the working area of the Gear Box to catch oil drippings.

20. Remove 2 to 1 Shaft Assembly GB102 from the Gear Box (page 7 of Parts Catalog).

    Caution: Exercise care in removing the 2 to 1 Shaft Assembly to prevent damage to Gasket GB102A on machines later than serial number 874. If the gasket is damaged, the Gear Box surface must be thoroughly cleaned and a new gasket installed with a thin layer of Permatex No. 1372 between the Gear Box and gasket.

21. Remove Spacer GB443 from the 4 to 1 Shaft Assembly (page 37 of Parts Catalog).

2 TO 1 SHAFT DISASSEMBLY PROCEDURE

A. Remove Flat Head Socket Cap Screw GB403 and Washer GB404.

B. Secure the bearing pulling attachment between the gears of Gear GB406. This gear, Spacer GB405, and Bearing GB402 will be removed with approximately 12 tons of pressure applied to the shaft (figure 17).

C. Remove Square Key GB415.

D. Remove two Flat Head Cap Screws GB410 and two Bearing Retainers GB409A. On earlier machines, remove four Flat Head Cap Screws GB410.

E. The Gear Box Cover GB414 should slide off under hand pressure together with Oil Seal GB408 and Spacer GB407. If the Gear Box cover is too tight, the cover can be removed by applying light taps to the shaft assembly with a plastic hammer.

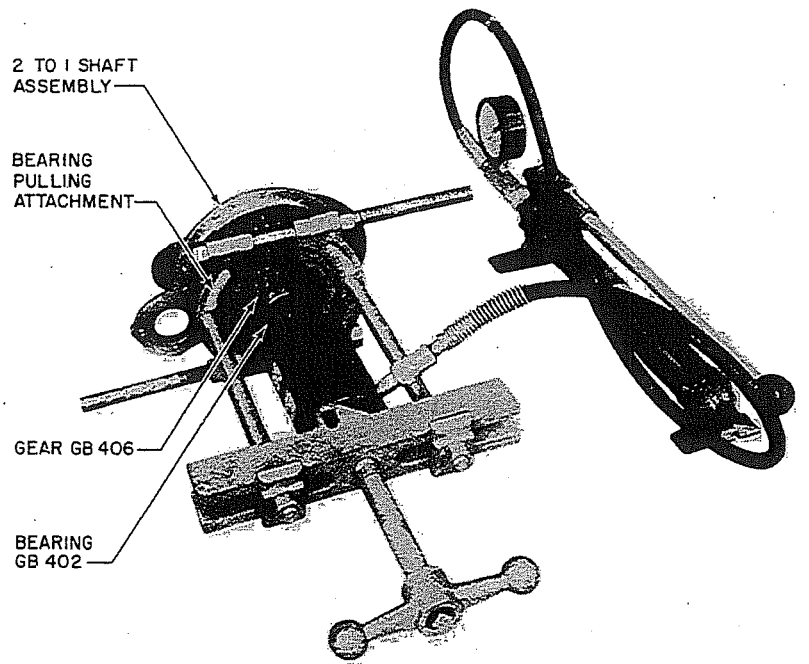

Figure 17. 2 to 1 Shaft, Removal of Gear GB406, Spacer GB405, and Bearing GB402

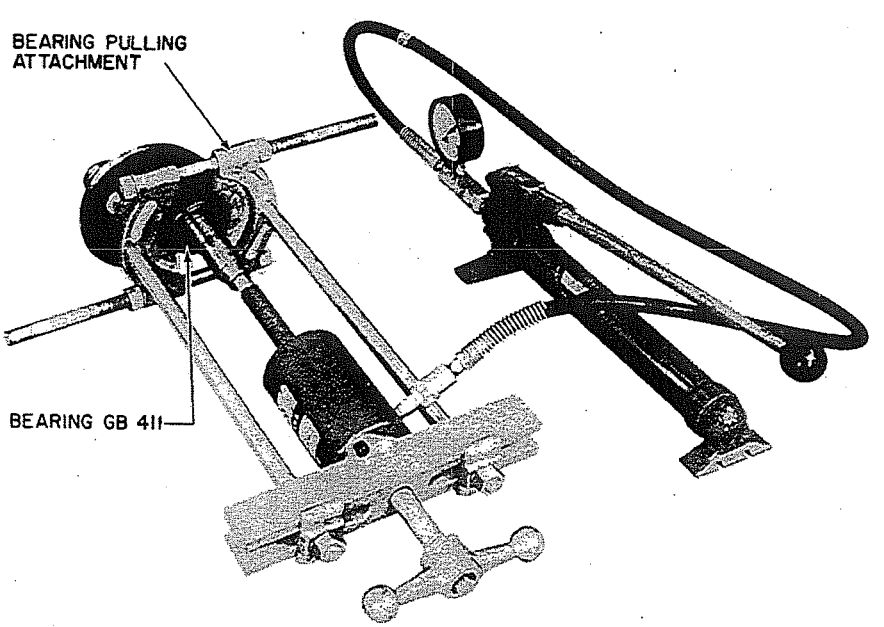

Figure 18. 2 to 1 Shaft, Removal of Bearing GB411

F. Remove three Socket Head Cap Screws GB417 and Deck Lift Hook Cam GB416. On later machines the socket head cap screws have been replaced with three Flat Head Cap Screws GB417A and three Spacers GB416A.

G. Secure the Bearing Pulling Attachment behind Bearing GB411 (figure 18). The bearing will be removed with approximately 2 tons of pressure.

Note: On earlier machines using Bearing Retainer GB409, the bearing pulling attachment must be secured behind the bearing retainer to remove both the retainer and Bearing GB411.

H. Secure the bearing pulling attachment behind Deck Lift Crank Eccentric GB418.

Caution: Be certain the blocks of the bearing pulling attachment are open sufficiently to allow the head of Crank Pin GB395 to pass between them. The crank pin will then be removed with approximately 2 tons of pressure (figure 19).

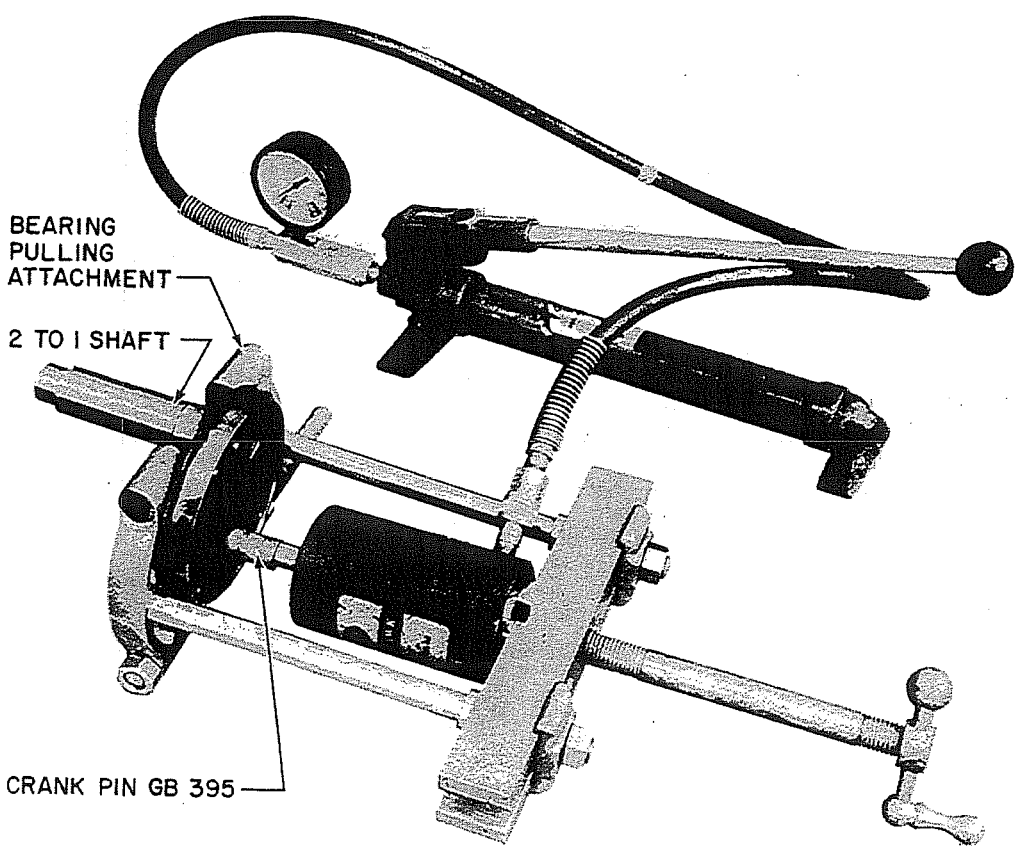

Figure 19. 2 to 1 Shaft, Removal of Crank Pin GB395

2 TO 1 SHAFT ASSEMBLY PROCEDURE

I. Secure the bearing pulling attachment behind Deck Lift Crank Eccentric GB418.

Caution: Be certain the blocks of the bearing pulling attachment are sufficiently spread to allow the body of Crank Pin GB395 to pass between them. The crank pin can then be pressed in by applying pressure to the head of the pin (figure 20).

J. Secure the bearing pulling attachment behind Bearing GB411 and apply pressure to Deck Lift Crank Eccentric GB418 at the axial center line of the shaft (figure 21). The shaft should be cleaned and lubricated prior to assembly.

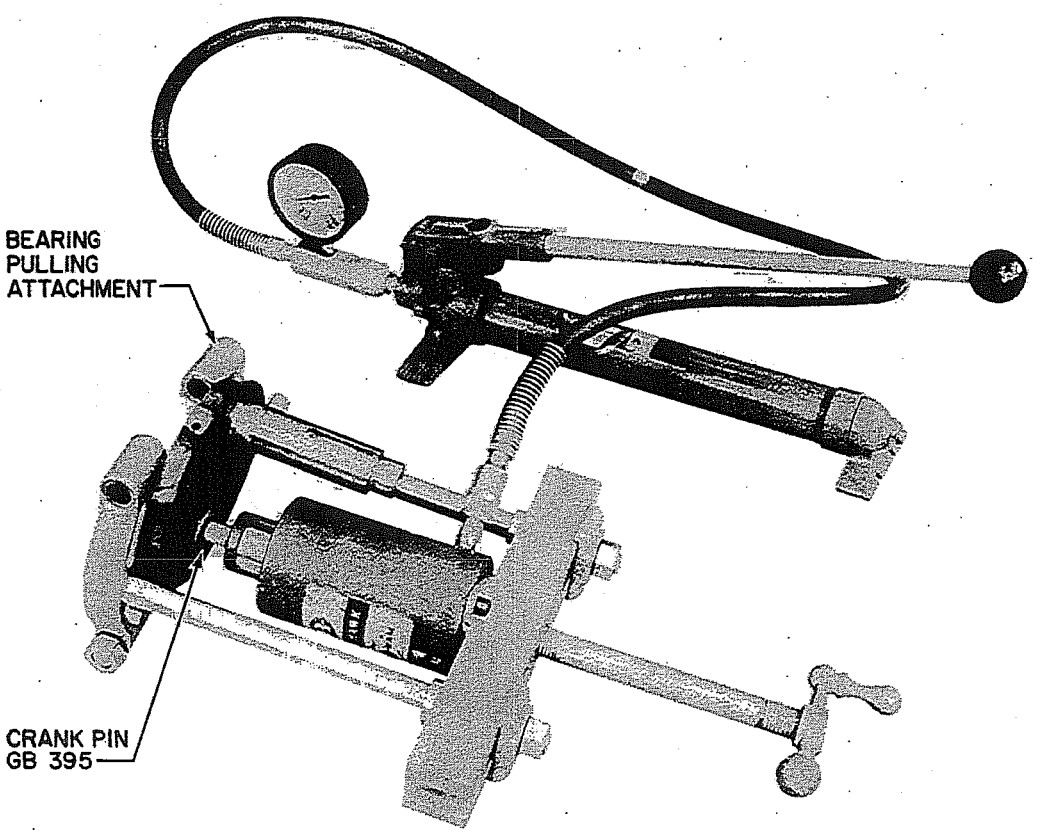

Figure 20. 2 to 1 Shaft, Installation of Crank Pin GB395

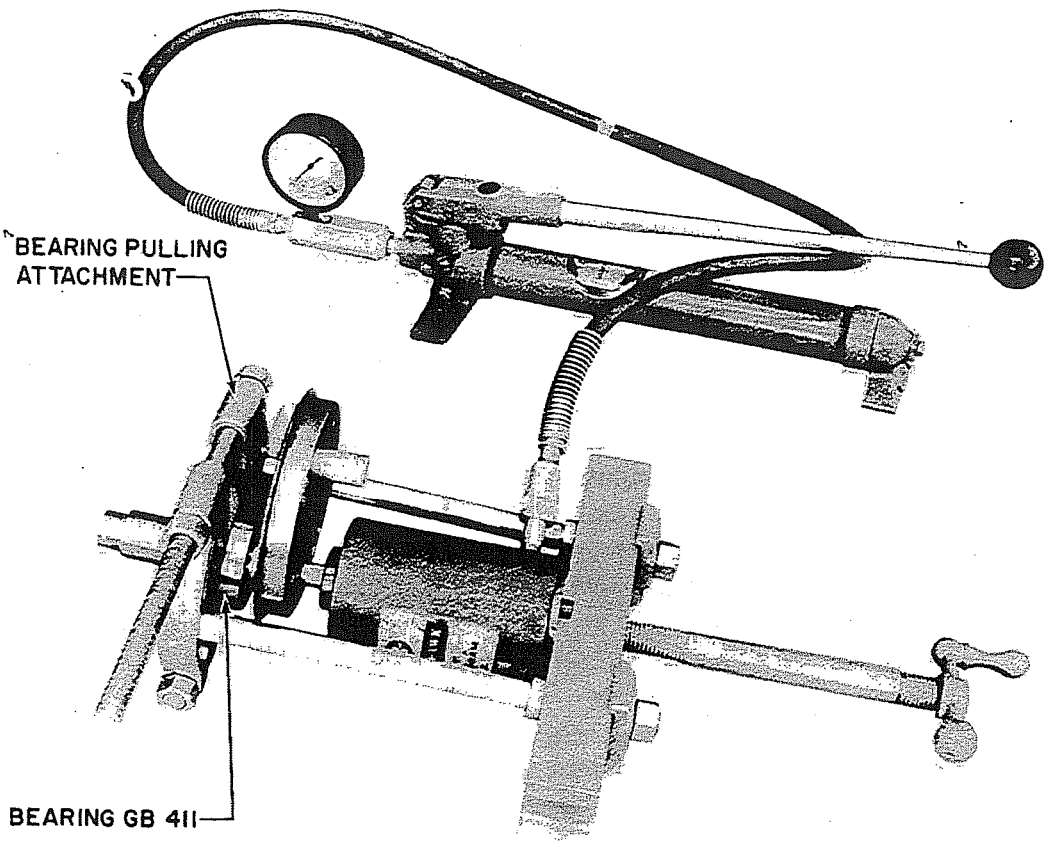

Figure 21. 2 to 1 Shaft, Installation of Bearing GB411

Note: On earlier machines using Bearing Retainer GB409, position the retainer on the shaft before installing Bearing GB411. Be certain the bearing retainer is in position to allow clearance for the bearing during the pressing operation.

K. Install Deck Lift Hook Cam GB416, three Spacers GB416A, and three Flat Head Cap Screws GB417A. On earlier machines, install three Socket Head Cap Screws GB417 only.

L. Install Spacer GB407 and Gear Box Cover GB414.

Caution: Exercise care when sliding the gear box cover over the shaft to avoid damage to Oil Seal GB408.

M. Install two Flat Head Cap Screws GB410 and two Bearing Retainers GB409A. On earlier machines, mount the bearing retainer to the cover with four Flat Head Cap Screws GB410.

N. Install Square Key GB415. The key should be inspected for burrs and should seat firmly in the keyway.

O. Prelubricate the shaft and secure the bearing pulling attachment behind Gear GB406. The gear may then be pressed on by applying pressure to Deck Lift Crank Eccentric GB418 at the axial center line of the shaft.

Caution: The key slot in the gear must be aligned with the key during the pressing operation (figure 22).

P. Install Spacer GB405.

Q. Secure the bearing pulling attachment behind Bearing GB402 and apply pressure to Deck Lift Crank Eccentric GB418 at the axial center line of the shaft. The shaft and bearing should be cleaned and lubricated prior to assembly. The bearing can also be installed by tapping it on with a hammer and wooden block (figure 23).

R. Install Washer GB404 and Flat Head Socket Cap Screw GB403.

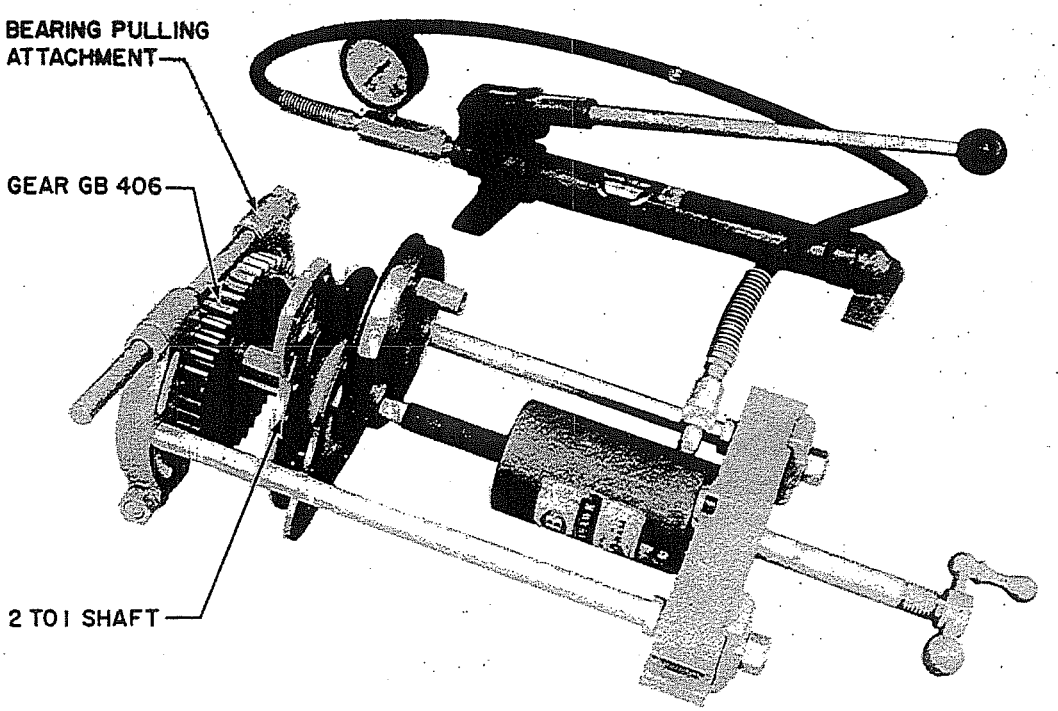

Figure 22. 2 to 1 Shaft, Installation of Gear GB406

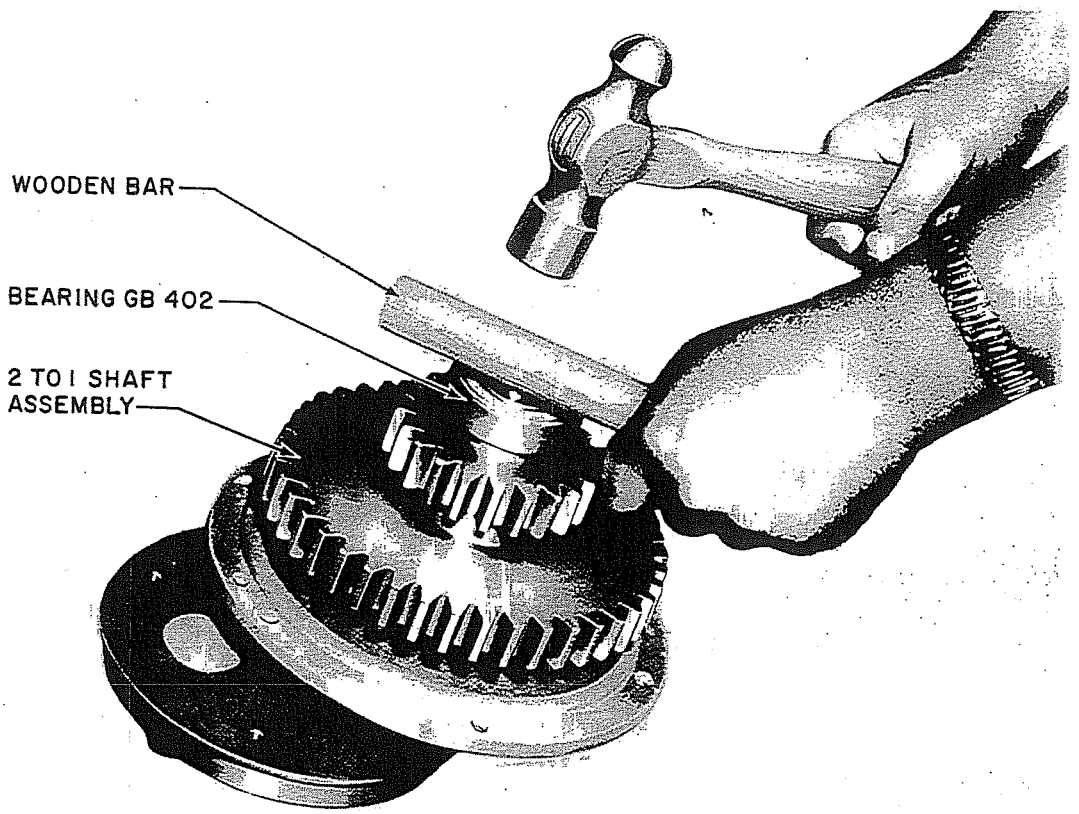

Figure 23. 2 to 1 Shaft, Installation of Bearing GB402

INSTALLATION OF 2 TO 1 SHAFT ASSEMBLY (SEE FIGURES 16A THROUGH 16D)

22. Replace Gasket GB102A (page 7 of Parts Catalog).

23. Locate the timing mark on Gear GB406 in its approximate position with respect to the mating gear of the 4 to 1 Shaft. Install the 2 to 1 Shaft Assembly to the Gear Box.

    Caution: Check the timing marks of both the 4 to 1 and 1 to 1 Shafts to be sure the shafts are in time. Several attempts may be required to properly align the timing marks (figure 1). Refer to the Introduction.

24. Install five Socket Head Cap Screws GB36 and Gaskets GB101A that are accessible at this time (page 7 of Parts Catalog).

25. Replace Spacer GB443 on the 4 to 1 Shaft Assembly (page 37 of Parts Catalog). The spacer may be installed with light taps of a plastic hammer.

26. Replace Clutch Cam GB35 and two Socket Head Cap Screws GB36 or GB36A (page 3 of Parts Catalog).

27. Slide the bronze eccentric, together with the deck lowering hook assembly, onto Deck Lift Crank Eccentric GB418. The shoulder of the deck lift crank eccentric should be cleaned and lightly oiled prior to assembly.

28. Install Clamp Ring GB397, O-ring GB400, and four Flat Head Cap Screws GB398.

29. Install Spacer GB387, two Bearings GB386, the deck lowering link assembly, Washer GB385, and Socket Head Cap Screw GB384.

    Note: Bearings GB386 may have to be forced onto the crank pin by tapping them with a plastic hammer. The crank pin should be lubricated before installing the bearings and Spacer GB387.

30. Unblock the deck lowering hook cam lever and attach Connecting Link GB424 by replacing Pin GB425 and X-washer GB426 (page 35 of Parts Catalog). Replace Tension Springs GB2 and GB3 (page 3 of Parts Catalog).

31. Remove the two C-clamps and block of wood from the rake cams.

32. Manually cycle the machine to 90 degrees, while holding the deck lowering hook assembly and deck lowering link assembly above the deck lift shaft.

33. Replace two Tension Springs R89 (page 53 of Parts Catalog) that run from the rake lift shaft to the rake support arms.

34. Place the deck lowering link assembly between the brackets of the deck lift shaft and replace Shaft (deck lowering pin) F45, Washer F44, and Retaining Ring or Spirolox Ring F43 (page 83 of Parts Catalog).

35. Lift the deck assembly by hand and remove the blocks or boxes used to support the deck.

36. Manually reverse the machine to 270 degrees, while holding the moving deck-scissor flag in position to allow the moving deck cam follower to follow the low dwell of the moving deck-scissor cam.

37. Replace the moving deck cable on its pulley at the top of the deck support arm.

38. Fill the reservoir of Deck Lift Crank Eccentric GB418 through the ball valve oiler, following the Gear Box lubrication instructions in the Preventive Maintenance Manual.

39. Cycle the machine until the location of the three Socket Head Cap Screws GB36 and Gaskets GB101A, at the 9, 1, and 3 o'clock positions of the cover of the 2 to 1 Shaft Assembly, are accessible. Install the screws (page 7 of Parts Catalog).

40. Cycle the machine until Pipe Plug GB413 can be installed. Permatex No. 1372 should be applied to the pipe plug threads prior to installation.

41. Cycle the machine until Pipe Plug GB382 can be installed. Permatex No. 1372 should be applied to the pipe plug threads prior to installation.

42. Replace Gear Box Oil Pan GB28A, Socket Head Cap Screw GB28B, Gasket GB28C, and Hex Nut GB28D.

43. Replace the Gear Box oil.

This procedure does not normally disturb any adjustments, but it is recommended that the following adjustments be checked for accuracy:

(a) Deck Height and Level Adjustment
Adjustment No. 7 (page 72 of Service Manual)

(b) Deck Eccentric Adjustment
Adjustment No. 11 (page 75 of Service Manual)

(c) Deck Lowering Hook Latch Adjustment
Adjustment No. 12 (page 77 of Service Manual)

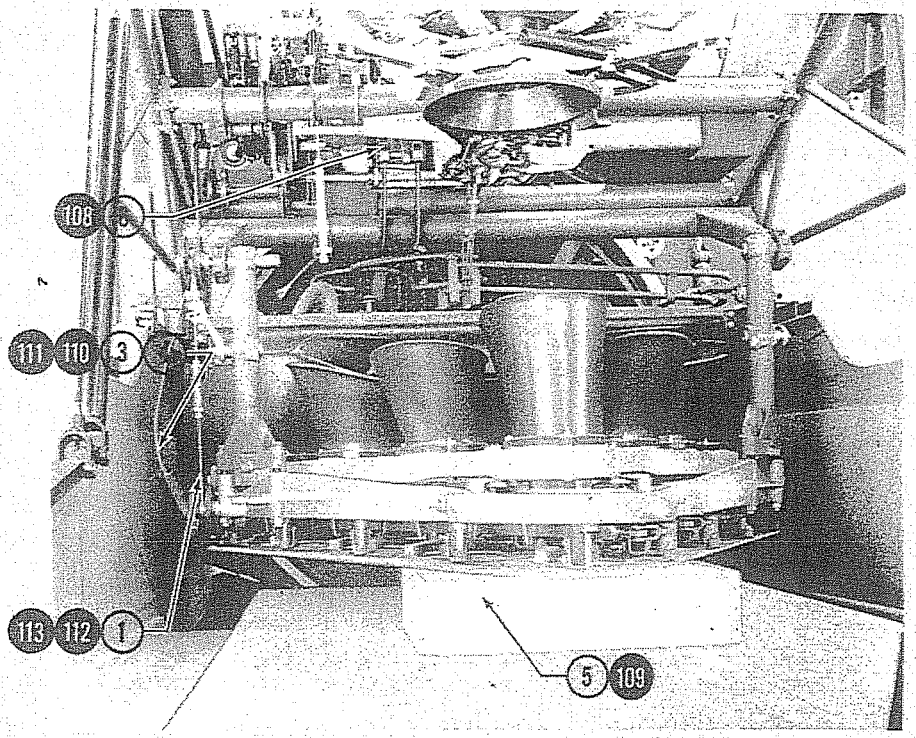

Figure 24a. 1 to 1 Shaft, Removal and Installation Sequence

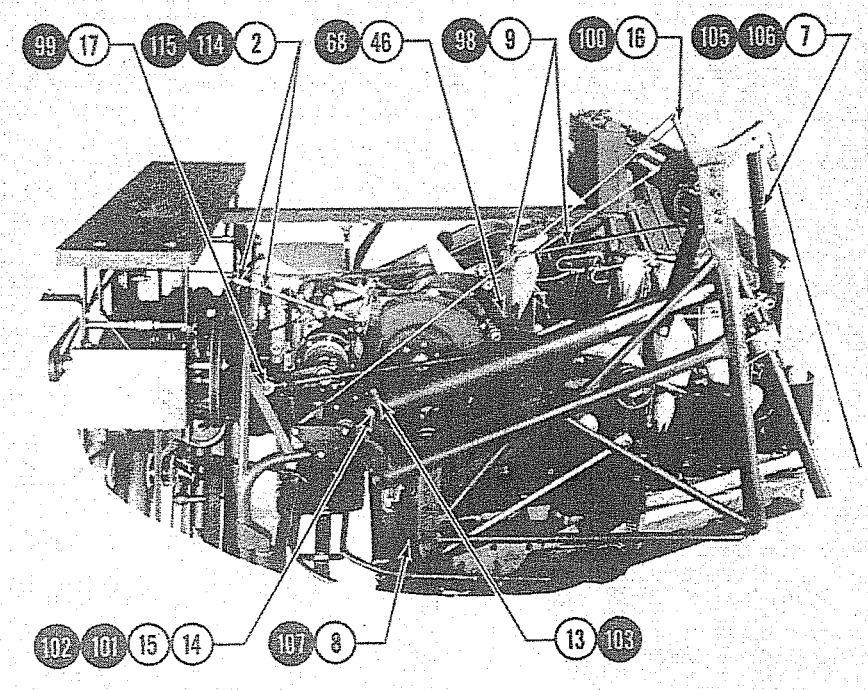

Figure 24b. 1 to 1 Shaft, Removal and Installation Sequence

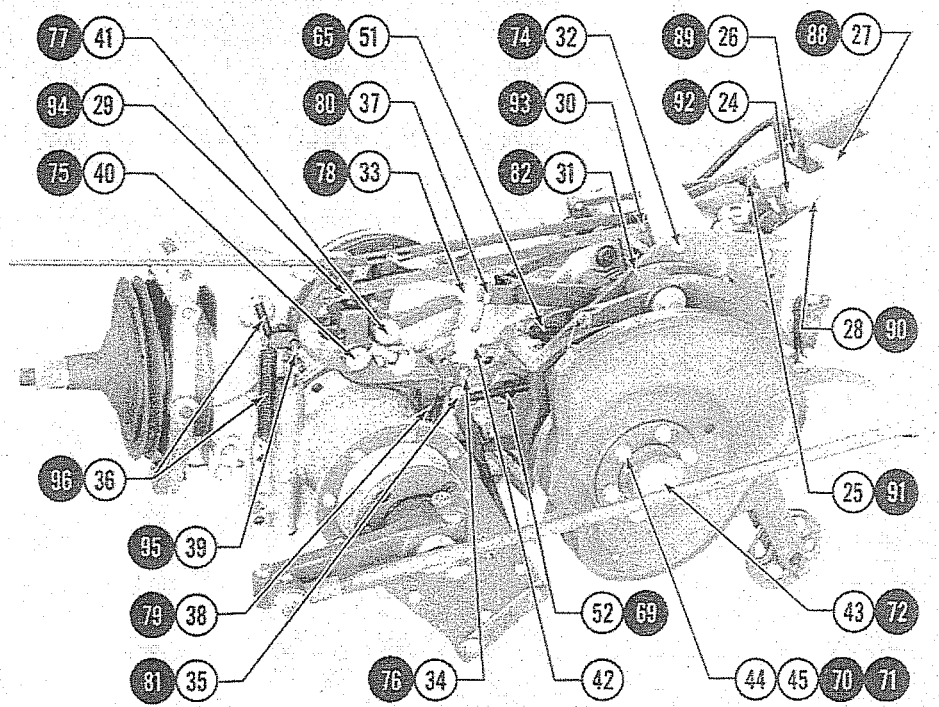

Figure 24c. 1 to 1 Shaft, Removal and Installation Sequence

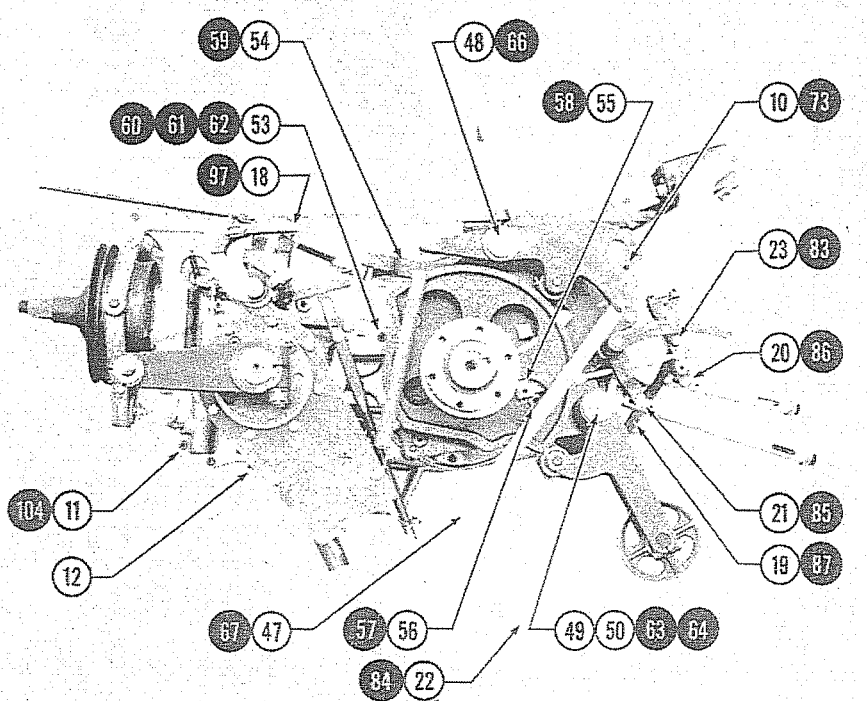

Figure 24d. 1 to 1 Shaft, Removal and Installation Sequence

Chapter IV
1 TO 1 SHAFT ASSEMBLY

Unless otherwise specified, all index part numbers are referred to page 31 of the Parts Catalog.

REMOVAL OF 1 TO 1 SHAFT ASSEMBLY (SEE FIGURES 24A THROUGH 24D)

1. Cycle the machine to 90 degrees, detecting standing pins. Allow the machine to pass 90 degrees until the scissors close (approximately 95 degrees). Remove the scissor cable from its top and bottom pulleys on the deck support arm and place the cable on the shafts between the two upper and lower pulleys. Pull the cable to release the pins from the scissors.

2. Stop the machine at 180 degrees and remove two Jam Nuts R13, Trip Rod Assembly R17, and Trip Spring R16 (page 51 of Parts Catalog).

3. Cycle the machine to 270 degrees, setting new pins. Shut off the power.

4. Remove the moving deck cable from its pulley at the top of the deck support arm and allow the cable to rest free to the left of the deck assembly. This will relieve the pressure of the moving deck cam follower from the moving deck-scissor cam.

5. Lift the deck assembly by hand and firmly support it on blocks or boxes to free the deck lowering link from the weight of the deck assembly.

6. Remove Retaining Ring or Spirolox Ring F43, Washer F44, and Shaft (deck lowering pin) F45 from the deck lift shaft (page 83 of Parts Catalog).

7. Remove the two Tension Springs R89 (page 53 of Parts Catalog) that run from the V-levers on Rake Lift Arm Assembly R93 to Rake Support Arms R97. Removal of these springs will eliminate the pressure of the rake cam followers against the rake cams.

8. Remove Scissor Closing Spring D5 from the deck assembly (page 43 of Parts Catalog). This will relieve the pressure of the scissor cam follower against the moving deck-scissor cam.

9. On machines later than serial number 18,001, remove Flexloc Nut R81C, Spacer R81B, and Hex Head Cap Screw R81A (page 53 of Parts Catalog), and Spacer and X-washer from Pivot Stud R126D (page 59 of Parts Catalog). Remove Link Assembly R87 (page 53 of Parts Catalog).

   On machines prior to serial number 18,001, remove Flexloc Nut R126Q, Spacer R126P, and Hex Head Cap Screw R126N (page 59 of Parts Catalog). Remove X-washer R81D, Pin R81, and Link Assembly R87 (page 53 of Parts Catalog).

10. Manually advance the machine to 0 degree, making certain that Rake Crank Link R83 bisects the 4 to 1 Shaft. Check the detector timing by inserting the detector timing pin through the hole provided in the detector mounting plate and through the hole in the detector drive gear. If the pin can be inserted, the detector is in time. Remove the timing pin.

11. Remove Hex Nut GB28D, Gasket GB28C, Socket Head Cap Screw GB28B, and Gear Box Oil Pan GB28A (page 3 of Parts Catalog).

12. Remove Drain Plug GB464 from the Gear Box and drain the Gear Box oil. Replace the drain plug (page 41 of Parts Catalog). The threads of the plug should be coated with Permatex No. 1372 before installing.

13. Insert a threaded rod through the two eyelets of the spring guide tube assembly on the left side of the machine (page 79 of Parts Catalog).

    Caution: Thread the nuts on both ends of the rod to prevent the spring guide tube assembly from expanding. Do not attempt to compress the tube assembly.

14. On machines prior to serial number 14,501, remove Flexloc Nut F1H, two Bushings F1G, and Hex Head Bolt F1F (page 79 of Parts Catalog).

    On machines later than serial number 14,501, remove Flexloc Nut F1C, two Washers F1E, two Bushings F1D, and Hex Head Bolt F1B (page 79 of Parts Catalog).

15. Remove X-washer F3 and Pin F5. Remove the entire spring guide tube assembly from the machine (page 79 of Parts Catalog).

16. Remove X-washer R44, two Washers R45, Bumper R46, and Pin R43 from the left-hand V-lever on the rake lift shaft to free Link Assembly R42 from V-lever of Rake Lift Arm Assembly R93 (page 53 of Parts Catalog). Pivot the link assembly to the rear for access to the 1 to 1 Shaft Assembly.

17. Remove Retaining Ring R61 and two Washers R82. On machines later than serial number 24,001, remove Flexloc Nut R84A and Hex Head Cap Screw R86A. On machines prior to serial number 24,001, remove Retaining Ring R84, two Washers R85, and Pin R86. Remove Rake Crank Link Assembly R83 (page 53 of Parts Catalog).

18. Remove X-washer GB12, Pin GB70, and Tension Spring GB61 to free Starter Bellcrank Lever GB76 from Link GB75A (page 5 of Parts Catalog).

19. Remove X-washer GB161 and Pin GB166 to free Pin Detector Link GB65 from the strike cam follower (page 13 of Parts Catalog).

20. Remove X-washer GB267 and Pin GB266 to free the upper deck hook link from Hook Selector Assembly GB268 (page 21 of Parts Catalog).

21. Remove X-washer GB295 and Pin GB294 to free the lower deck hook link from C-shaft Lever GB296 (page 25 of Parts Catalog).

22. Remove X-washer F65 and Pin F66 to free the detector rod assembly from the deck lift shaft (page 89 of Parts Catalog).

23. Remove X-washer GB199 and Pin GB222 to free the moving deck-scissor selector from the link to the moving deck-scissor latch (page 15 of Parts Catalog).

24. Remove X-washer GB161 and Pin GB208A to free Hook Selector Assembly GB201 from the link of Out-of-Range Reset Lever GB75A (page 13 of Parts Catalog). On machines later than serial number 23,001, remove X-washer only.

25. Remove X-washer GB161 and Pin GB166 to free Deck Hook Latch Assembly GB176 from Connecting Bar GB20 (page 11 of Parts Catalog).

26. Remove X-washer GB161 and Pin GB162 to free the cycle solenoid from the link to Starter Bellcrank Lever GB76 (page 11 of Parts Catalog).

27. Remove two Hex Head Bolt and Lockwasher Assemblies GB163A and the cycle solenoid (page 11 of Parts Catalog). Later machines have Phillips-head screws mounting the solenoid.

28. Remove X-washer GB199, Spacer, and Tension Spring GB197 to free Hook Selector Assembly GB201 (page 13 of Parts Catalog) from Link Assembly R49 (page 53 of Parts Catalog). On machines prior to serial number 23,001, remove Pin GB198. Pivot link assembly over crossbrace for access to the Detector Assembly.

29. On machines later than serial number 1593, remove X-washer GB91E, Flexloc Nut GB97A, and Pin GB97B or GB91D and Spring GB61 to free Out-of-Range Lever GB91A from Out-of-Range Link GB91C (page 5 of Parts Catalog). On machines prior to serial number 1593, remove two Hex Nuts GB188, Screw GB186, Screw GB185, Washer GB187, and Spacer GB189. Allow the micro switch to rest free of the Detector Assembly (page 11 of Parts Catalog).

30. Remove X-washer GB161 and Pin GB200A. Remove Out-of-Range Link GB91C on machines later than serial number 1593 (page 13 of Parts Catalog).

31. Remove Tension Spring GB94 (page 5 of Parts Catalog) from Reset Lever Assembly GB99 (page 7 of Parts Catalog). Unhook Wire Link Assembly GB210 (page 15 of Parts Catalog) from Reset Lever Latch GB357 (page 29 of Parts Catalog).

32. Remove three Hex Head Bolts GB164 and Lockwashers GB165 that mount the Detector Assembly to the Gear Box. Carefully lift the entire Detector Assembly from the Gear Box (page 11 of Parts Catalog).

33. Remove X-washer GB12 and Pin GB70 to free Link GB69 from Clutch Latch GB71 (page 5 of Parts Catalog). On later machines, the pin and X-washer have been replaced with Roll Pin GB70.

34. Remove X-washer GB12, Pin GB62, and Roller GB63 to free the plunger lever assembly from the clutch actuator link (page 5 of Parts Catalog).

35. Remove X-washer GB339, two Plain Washers GB340, Rollers GB343 and GB344, and Pin GB341 to free Clutch Release Lever GB346 from 180-degree Turret Interlock Link GB338 (page 29 of Parts Catalog).

36. Remove Tension Spring GB86 from the plunger lever, Tension Spring GB385 from the clutch actuator lever, and Tension Spring GB55 from the scissor cam follower (page 5 of Parts Catalog).

37. Remove Hex Nut GB367C, Lockwasher GB366, Roller GB367F, Washer GB367D, Stripper Bolt GB367E, and Roller GB63A or GB63B to free the clutch actuator link assembly from the clutch reset lever. On earlier machines, remove X-washer GB12 and Pin GB91B (page 29 of Parts Catalog).

38. Remove Roll Pin GB345 and Tension Spring GB98 from the clutch reset lever to the clutch release lever (page 7 of Parts Catalog).

39. Remove three-part Connecting Link (bicycle link) GB349 that connects Plunger Lever Assembly GB353 to Plunger Assembly GB352 (page 29 of Parts Catalog).

40. Remove Hex Head Bolt GB87, Lockwasher GB83, Plain Washer GB84, Plunger Lever Assembly GB353, two Spacers GB89, Clutch Release Lever Assembly GB91, Out-of-Range Lever GB91A on machines later than serial number 1593, and Clutch Actuator Lever GB90B. On machines prior to serial number 2295, remove two Spacers GB90 (page 5 of Parts Catalog).

    Note: When removing Clutch Actuator Lever GB90B, the stop arm portion of the lever will be straddled by the clutch lever. The clutch lever must be lifted clear of the stop arm while removing the aforementioned parts.

41. Remove Hex Head Bolt GB82, Lockwasher GB83, Washer GB84, and Starter Bellcrank Assembly GB76 with Link GB77A (page 5 of Parts Catalog).

42. Remove Clutch Actuator Link Assembly GB74 and Pin Detector Link GB65 from the Gear Box (page 5 of Parts Catalog).

43. Remove Hex Head Bolt GB37A or GB37, Lockwasher GB33, and Washer GB38A or GB38 (page 5 of Parts Catalog).

44. Remove six Hex Head Bolts GB37, six Lockwashers GB32, and Clamp Ring GB39 (page 5 of Parts Catalog).

    Note: If the same Rake Cam GB40 and Rake Cam Hub GB41 are to be used at assembly, a scribe line should be placed on the cam and hub to locate the position of the cam on the hub at reassembly prior to performing step 44. If a new cam or hub is to be used, the cam can only be located in a relative position at assembly.

45. Slide Rake Cam GB40 off Rake Cam Hub GB41 (page 5 of Parts Catalog).

46. Remove entire Rake Cam Follower Assembly R80A by removing Flexloc Nut R61A, Spacer R61B, and Hex Head Cap Screw R61C (page 53 of Parts Catalog). On machines prior to serial number 28,701, Rake Cam Follower Assembly R80 can be removed by removing Retaining Ring R61, two Washers R64, and Pin R79 (page 53 of Parts Catalog).

47. Remove X-washer and pin to free the link of Scissor Cam Follower GB299 (page 27 of Parts Catalog) from Scissor Pulley Assembly F61 (page 87 of Parts Catalog).

48. Remove Hex Head Bolt GB303, Washer GB301, Spacer GB302, Lockwasher GB304, and Hex Nut GB300. Remove Scissor Cam Follower Assembly GB299 from the Gear Box (page 27 of Parts Catalog).

49. Remove Retaining Ring GB17 and slide Moving Deck Cam Follower Assembly GB52 from Shaft GB58 (page 5 of Parts Catalog). Allow the moving deck cam follower assembly to rest on top of the deck assembly still engaged with the moving deck cable.

50. Remove Hex Head Bolt GB59, Lockwasher GB60, and Shaft GB58 (page 5 of Parts Catalog).

51. Remove Tension Springs GB95 and GB96 (page 5 of Parts Catalog) from Clutch Reset Lever Assembly GB99 (page 7 of Parts Catalog) to Gear Box Cover GB383 (page 31 of Parts Catalog).

52. Remove Pipe Plug GB382 from Gear Box Cover GB383 (page 31 of Parts Catalog).

    Note: Removal of this plug will allow inspection of the timing marks on the mating gears of the 2 to 1 and 1 to 1 Shaft Assemblies. A mirror will be required to view the timing marks and a preliminary check should be made to assure that the timing marks are visible. Refer to the Introduction.

53. Remove eight Socket Head Cap Screws GB101 and Copper Gaskets GB101A and carefully remove 1 to 1 Shaft Assembly 12-100389 (page 9A of Parts Catalog). The 1 to 1 Shaft Assembly may be removed by threading three Screws GB101 into the three threaded holes in Gear Box Cover GB383. As the screws are turned in, the 1 to 1 Shaft Assembly will be drawn free of the Gear Box.

    Caution: Exercise care in removing the 1 to 1 Shaft Assembly to prevent damage to Gasket GB100A on machines later than serial number 874 (page 7 of Parts Catalog).

Note: A drop cloth should be spread under the working area of the Gear Box to catch oil drippings.

54. Remove Reset Lever Assembly GB99 (page 7 of Parts Catalog) together with Shaft GB354 (page 29 of Parts Catalog).

55. Remove Hex Head Bolt GB312, Washer GB314, and Latch Stud GB311. Remove Moving Deck-Scissor Latch GB310 from Mounting Plate GB324 (page 27 of Parts Catalog).

56. If the entire 1 to 1 Shaft is to be replaced or Mounting Plate GB324 or Idler Gear GB315 is to be replaced, remove Flexloc Nut GB321, Washer GB323, Idler Gear Assembly GB315, Stud GB320, and Flat Head Cap Screw GB319 (page 27 of Parts Catalog).

1 TO 1 SHAFT DISASSEMBLY PROCEDURE

A. Secure the bearing pulling attachment behind the flange of Rake Cam Hub GB41 (page 5 of Parts Catalog). The rake cam hub will be withdrawn by applying pressure to the 1 to 1 Shaft (figure 25).

B. Secure the triple grip puller behind Moving Deck-Scissor Cam GB42 (page 5 of Parts Catalog), with the legs of the puller through the openings of the cam (figure 26). The moving deck-scissor cam should be moved far enough to allow insertion of the bearing pulling attachment to remove the cam. If the cam cannot be moved with the mechanical puller, a stationary press will be required to remove the cam from the shaft.

C. Remove three Flat Head Cap Screws GB57 and remove Mounting Plate Assembly GB56 (page 5 of Parts Catalog).

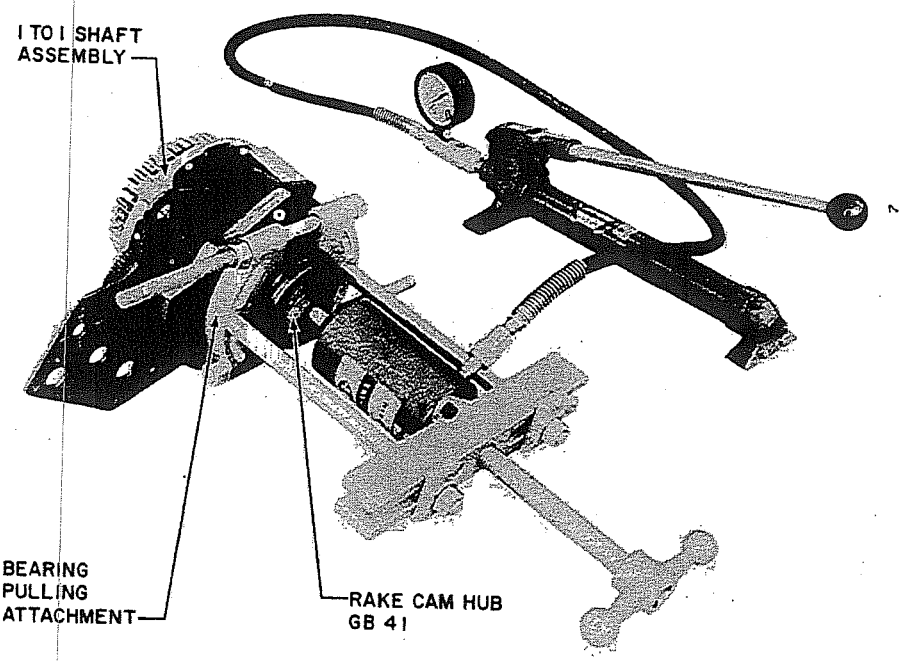

Figure 25. 1 to 1 Shaft, Removal of Rake Cam Hub GB41

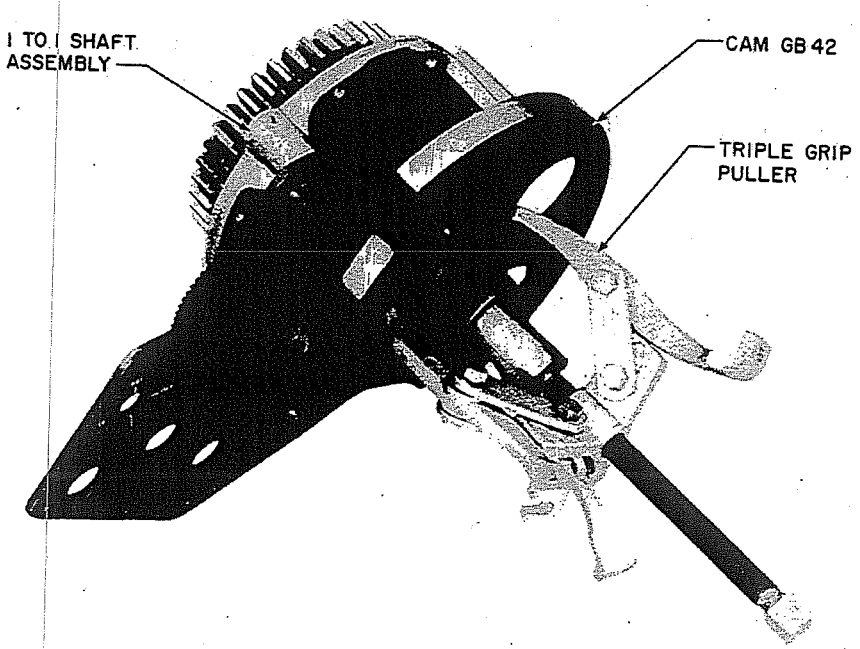

Figure 26. 1 to 1 Shaft, Removal of Cam GB42

D. Remove Square Key GB53 and Spacer GB54 from the 1 to 1 Shaft Assembly (page 5 of Parts Catalog).

E. Remove two Hex Head Bolts GB369, two Lockwashers GB370, and Washer GB371.

F. Secure the bearing pulling attachment or triple grip puller behind Spur Gear GB368 and remove with approximately 7 tons of pressure applied to the 1 to 1 Shaft (figure 27).

G. Remove Square Key GB372.

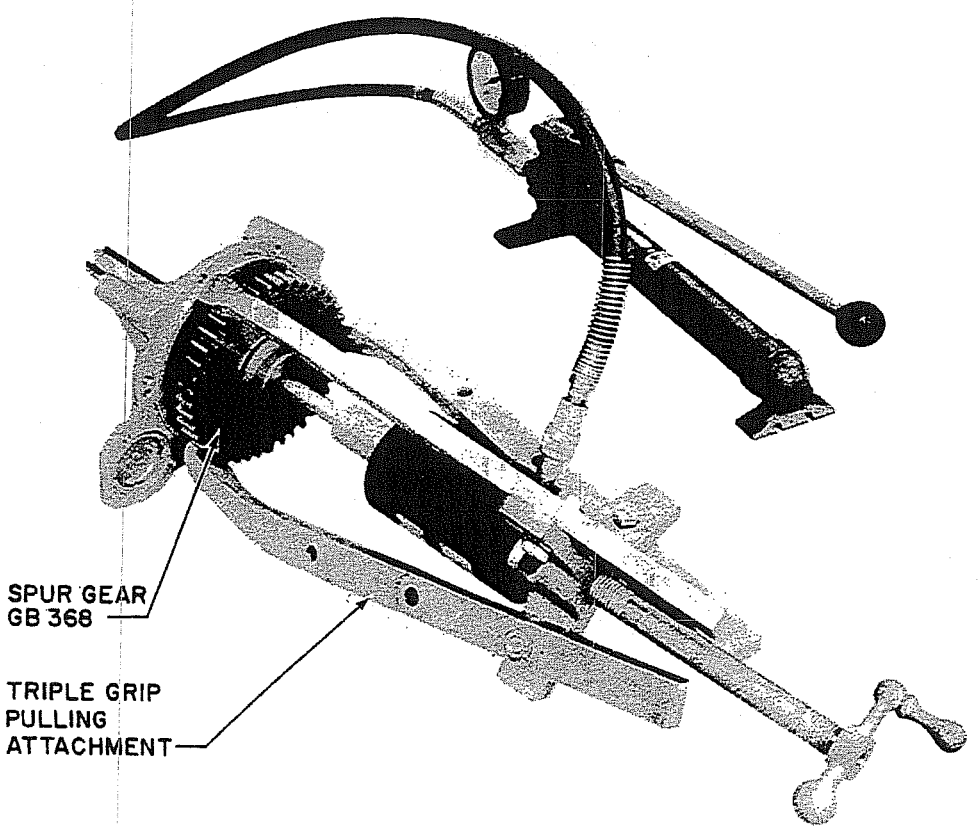

Figure 27. 1 to 1 Shaft, Removal of Spur Gear GB368

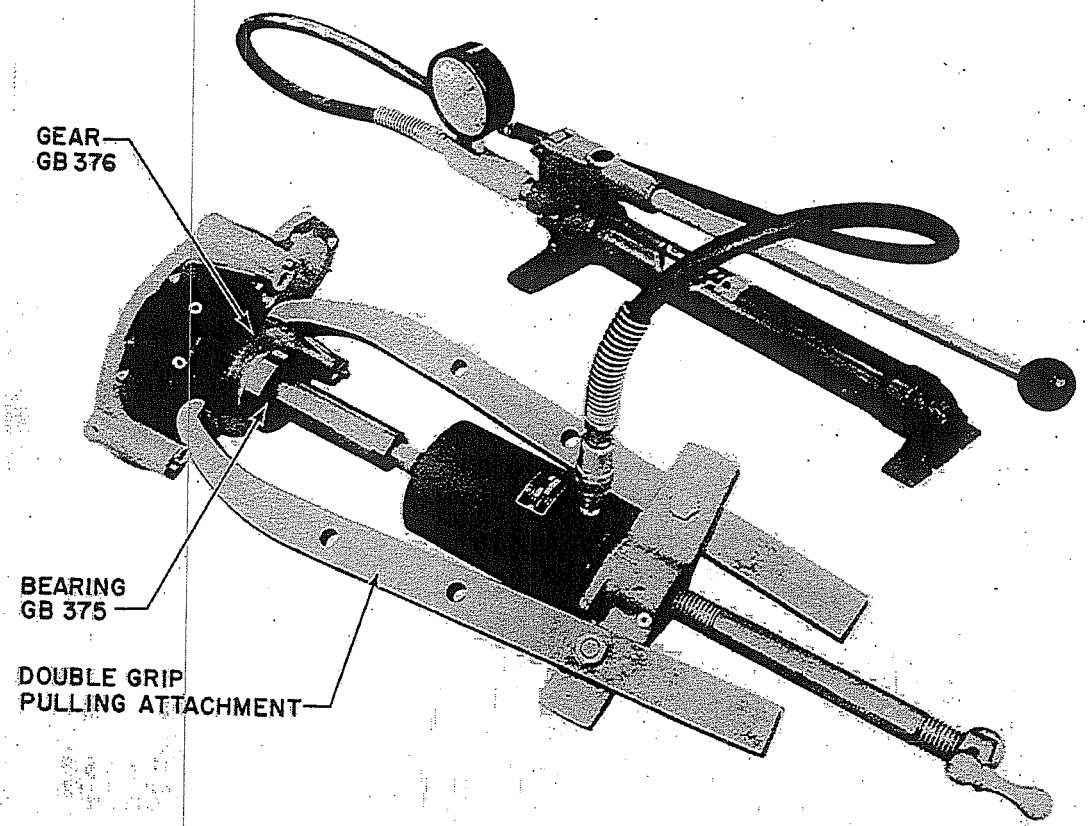

Figure 28. 1 to 1 Shaft, Removal of Gear GB376 and Bearing GB375

H. Secure the double or triple grip pulling attachment behind Drive Gear GB376. The drive gear and bearing GB375 will be removed with approximately 4 tons of pressure applied to the 1 to 1 Shaft (figure 28).

I. Remove four Hex Head Bolt and Washer Assemblies GB374 and Bearing Retaining Ring GB373. Later machines have two Bearing Retainers GB383B, no Retaining Ring GB373, and only two Bolts GB374.

J. Secure the bearing pulling attachment behind Cover and Pin Assembly GB383.

Caution: Be certain the bearing pulling attachment is spread sufficiently to allow Bearing GB375 to pass between the blocks. Cover and Pin Assembly GB383, Oil Seal GB379, Inner Extended Cycle Cam GB378, and Outer Extended Cycle Cam GB377 will be removed with approximately 4 tons of pressure applied to Shaft GB381 (figure 29).

K. Remove Flat Key GB380.

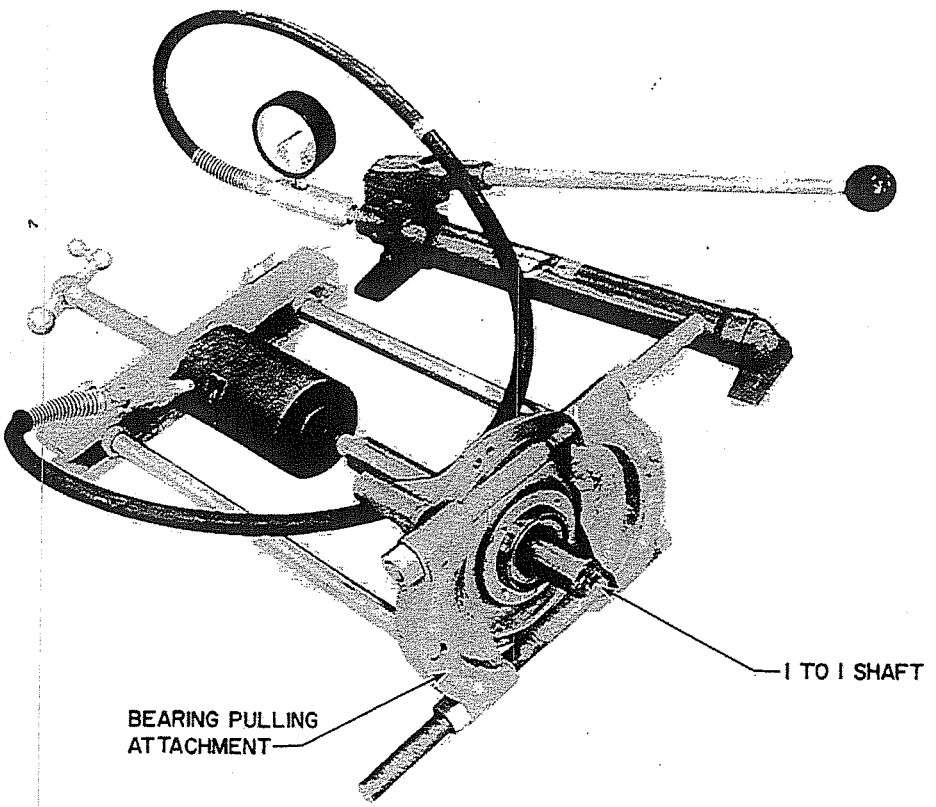

Figure 29. 1 to 1 Shaft, Removal of Cover and Pin Assembly GB383 and Cycle Cams GB377 and GB378

L. Secure the bearing pulling attachment behind the inner race of Bearing GB375. The bearing will be removed as pressure is applied to Shaft GB381 (figure 30).

1 TO 1 SHAFT ASSEMBLY PROCEDURE

M. Secure the Bearing Pulling Attachment behind Bearing GB375 and install by applying pressure to Shaft GB381. The bearing seat on the shaft should be cleaned and lubricated prior to installation (figure 31).

N. Install Cover and Pin Assembly GB383 and tap with a plastic hammer until Bearing GB375 fully seats in the bore of the cover assembly.

O. Replace Bearing Retaining Ring GB373 or two Bearing Retainers GB383B and Hex Head Bolt and Washer Assemblies GB374.

P. Replace Square Key GB372. The key should be inspected for burrs and should seat firmly in the keyway.

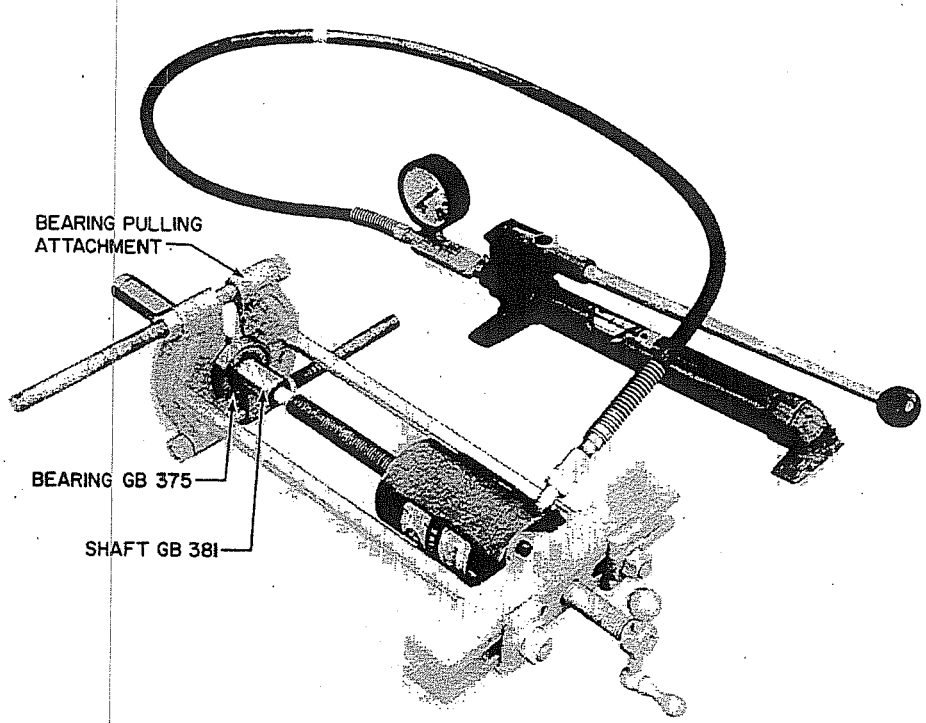

Figure 30. 1 to 1 Shaft, Removal of Bearing GB375

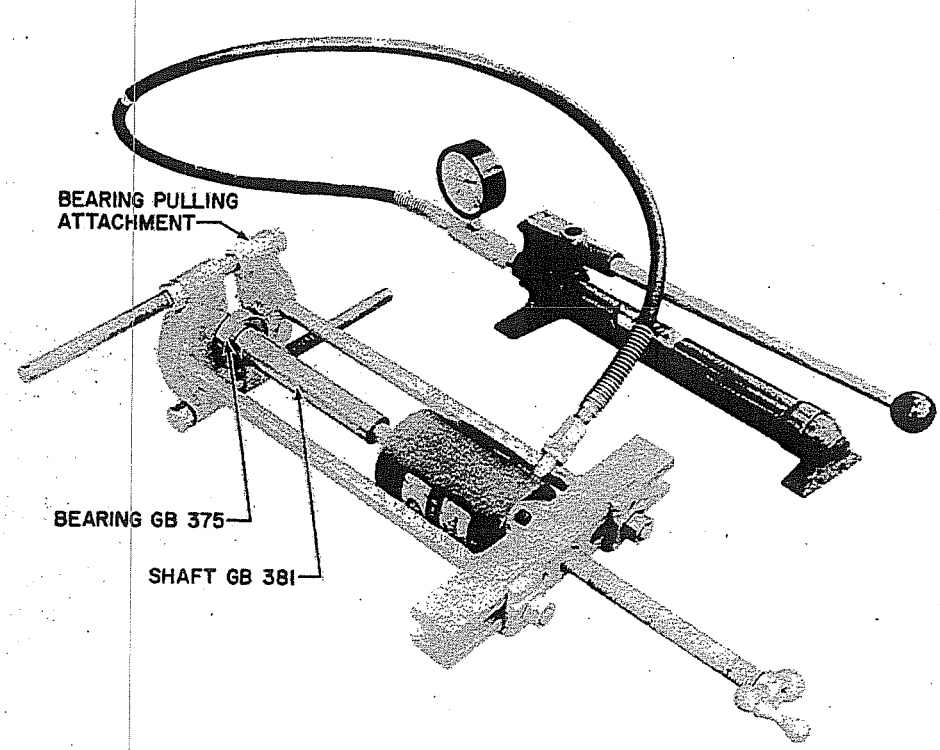

Figure 31. 1 to 1 Shaft, Installation of Bearing GB375

Q. Secure the bearing pulling attachment or triple grip puller behind Spur Gear GB368 and apply pressure to Shaft GB381 (figure 32).

Caution: Be certain the keyslot of the gear and Square Key GB372 are aligned prior to pressing. The shaft should be cleaned and lubricated prior to assembly.

R. Replace Flat Key GB380. The key should be inspected for burrs and should seat firmly in the keyway.

S. Secure the bearing pulling attachment behind Spur Gear GB368. Use pipe (1-1/2-inch inner diameter x 1-3/4-inch outer diameter x 9-1/2 inches long) to press Inner Extended Cycle Cam GB378 onto Shaft GB381 (figure 33). The shaft should be cleaned and lubricated prior to assembly.

T. Secure the bearing pulling attachment behind Spur Gear GB368. Use pipe specified in step S to press Outer Extended Cycle Cam GB377 onto Shaft GB381 (figure 34). The shaft should be cleaned and lubricated prior to assembly.

U. Secure the bearing pulling attachment behind Spur Gear GB368. Use pipe specified in step S to press Drive Gear GB376 onto Shaft GB381 (figure 35). The shaft should be cleaned and lubricated prior to assembly.

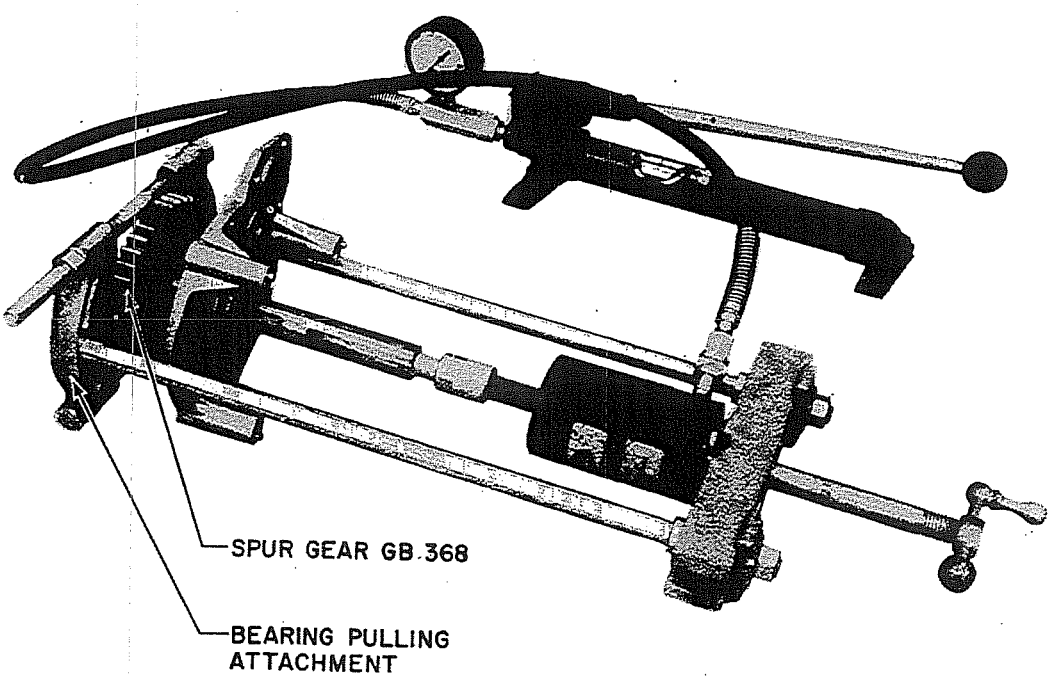

Figure 32. 1 to 1 Shaft, Installation of Spur Gear GB368

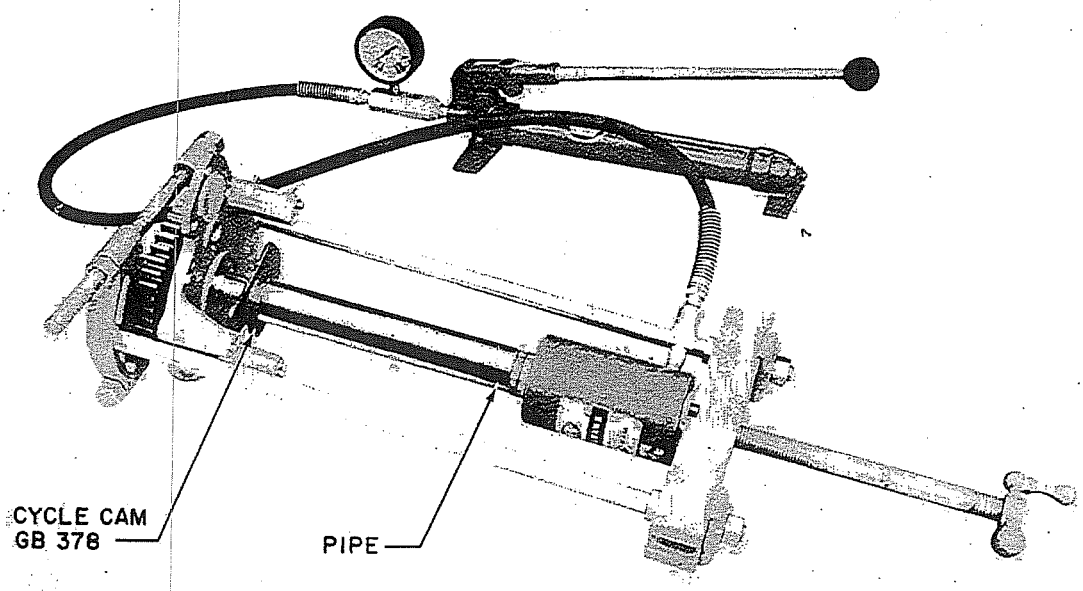

Figure 33. 1 to 1 Shaft, Installation of Cycle Cam GB378

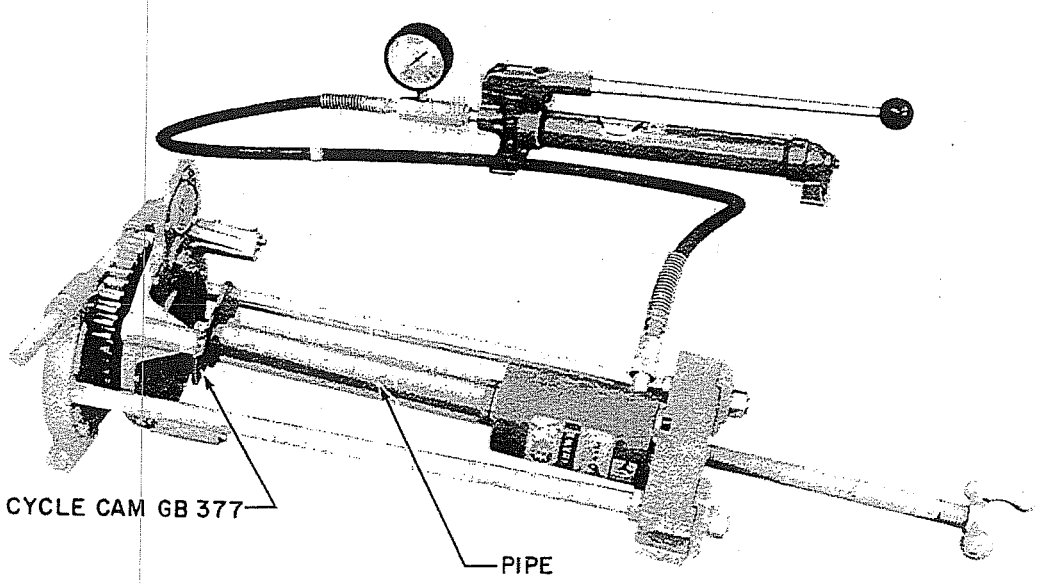

Figure 34. 1 to 1 Shaft, Installation of Cycle Cam GB377

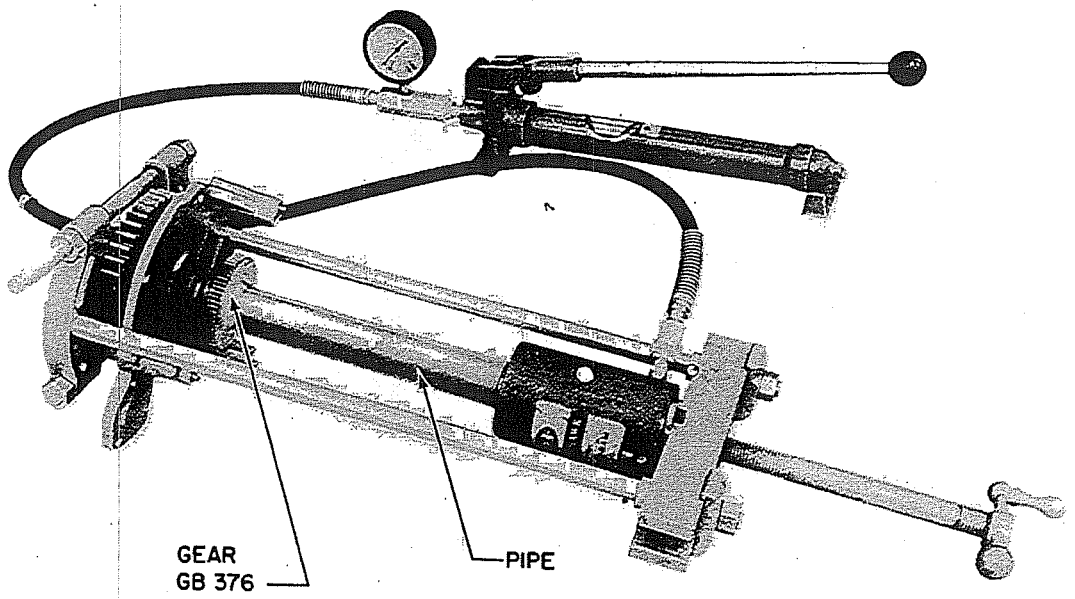

Figure 35. 1 to 1 Shaft, Installation of Gear GB376

V. Secure the bearing pulling attachment behind Spur Gear GB368. Use pipe specified in step S to press Bearing GB375 onto Shaft GB381 (figure 36). The shaft should be cleaned and lubricated prior to assembly.

W. Replace Mounting Plate Assembly GB56 (page 5 of Parts Catalog) on Cover and Pin Assembly GB383 with the three dowel holes over the dowel pins. Install three Flat Head Cap Screws GB57 (page 5 of Parts Catalog).

X. Install Spacer GB54 and Square Key GB53 (page 5 of Parts Catalog). The key should be inspected for burrs and should seat firmly in the keyway.

Y. Secure the bearing pulling attachment behind Moving Deck-Scissor Cam GB42 (page 5 of Parts Catalog) and install by applying pressure to the shaft (figure 37). The shaft should be cleaned and lubricated prior to assembly.

Caution: Be certain the keyway of the cam and key are aligned before pressing.

Z. Rake Cam Hub GB41 (page 5 of Parts Catalog) can be installed by securing the bearing pulling attachment behind the hub and applying pressure to the shaft. The hub can easily be driven onto the shaft by hand, using a hammer and bar (figure 38). The shaft should be cleaned and lubricated prior to assembly.

Caution: Be certain the key and keyway of the hub are aligned before installing.

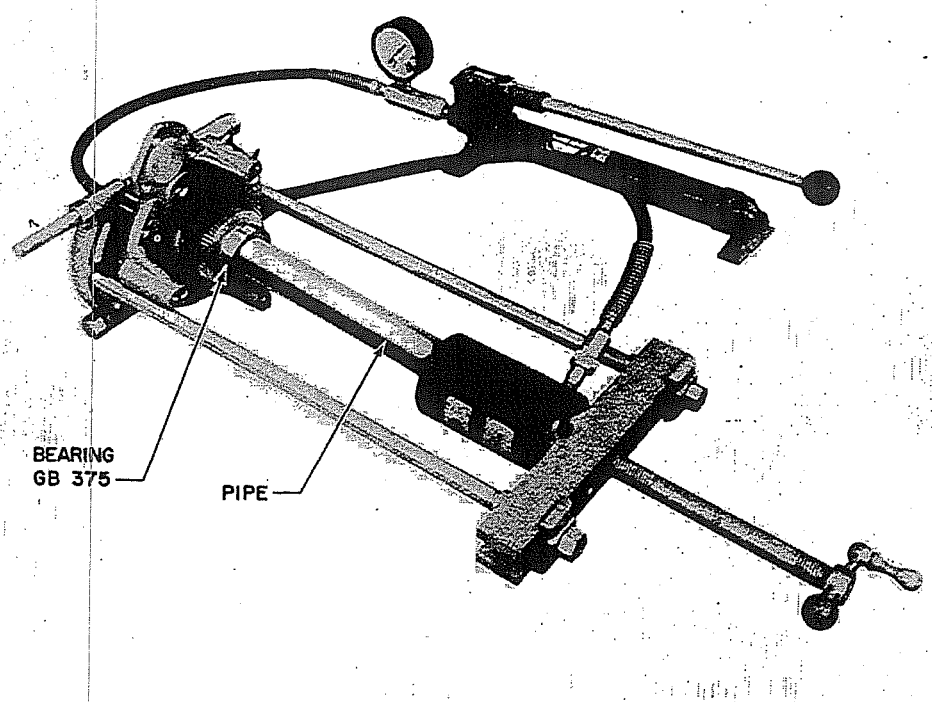

Figure 36. 1 to 1 Shaft, Installation of Bearing GB375

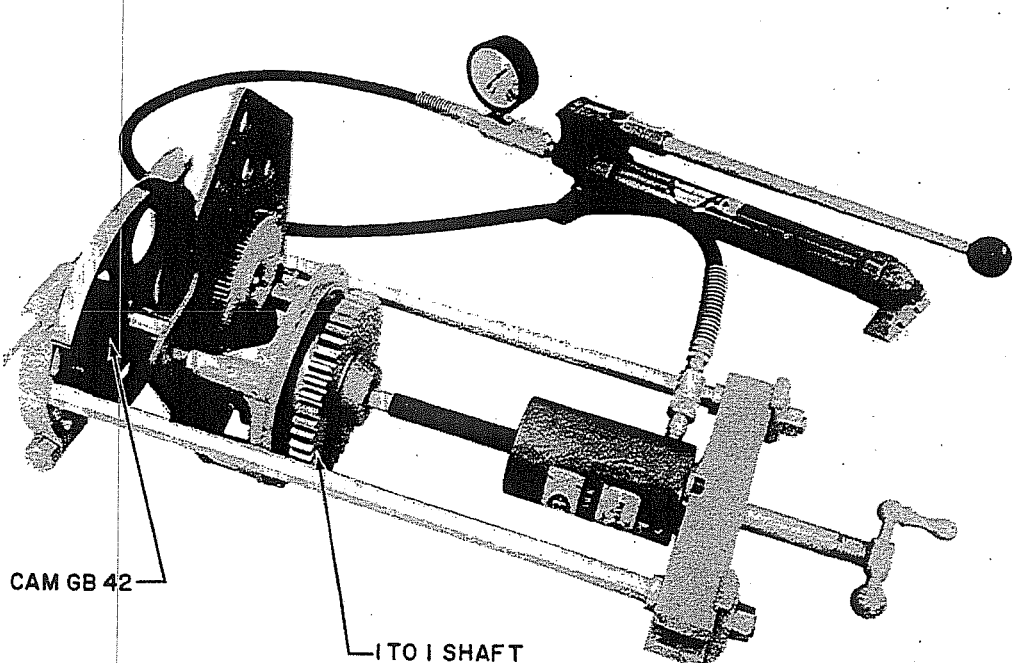

Figure 37. 1 to 1 Shaft, Installation of Cam GB42

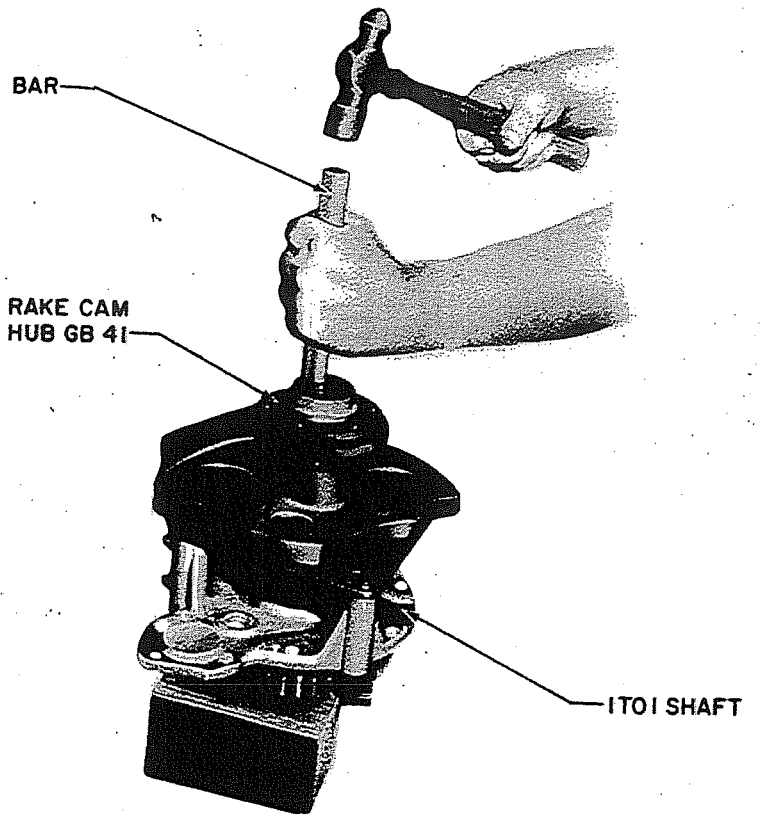

Figure 38. 1 to 1 Shaft, Installation of Rake Cam Hub GB41

AA. Replace Washer GB371, two Lockwashers GB370, and two Hex Head Bolts GB369.

INST''LATION OF 1 TO 1 SHAFT ASSEMBLY (SEE FIGURES 24A THROUGH 24D)

57. Replace Flexloc Nut GB321, Washer GB323, Idler Gear Assembly GB315, Stud GB320, and Flat Head Cap Screw GB319 (page 27 of Parts Catalog).

58. Replace Moving Deck-Scissor Latch GB310, Hex Head Bolt GB312, Washer GB314, and Latch Stud GB311 (page 27 of Parts Catalog).

59. Replace Reset Lever Assembly GB99 (page 7 of Parts Catalog) with Shaft GB354 (page 29 of Parts Catalog). This assembly must be in its approximate final position as the 1 to 1 Shaft Assembly is positioned in the Gear Box.

60. Replace Gasket GB100A (page 7 of Parts Catalog). A thin layer of Permatex No. 1372 should be applied to the Gear Box gasket surface before locating the gasket on the Gear Box.

61. Locate the timing mark on Spur Gear GB368 in its approximately position with respect to the mating gear of the 2 to 1 Shaft. Install the 1 to 1 Shaft Assembly to the Gear Box.

    Caution: Check the timing marks between the 1 to 1 and 2 to 1 Shafts to be sure the shafts are in time. Several attempts may be required to properly align the timing marks. Be sure to position the shaft of Reset Lever Assembly GB99 to mate with its bore in the Gear Box when installing the 1 to 1 Shaft Assembly.

62. Replace eight Copper Gaskets GB101A and Socket Head Cap Screws GB101 (page 7 of Parts Catalog).

63. Replace Shaft GB58, Lockwasher GB60, and Hex Head Bolt GB59 (page 5 of Parts Catalog).

64. Replace Moving Deck Cam Follower Assembly GB52 on Shaft GB58, making certain the moving deck cable is not twisted. Replace Retaining Ring GB17 (page 5 of Parts Catalog).

65. Replace Tension Springs GB95 and GB96 (page 5 of Parts Catalog) from Clutch Reset Lever Assembly GB99 (page 7 of Parts Catalog) to Gear Box Cover GB383 (page 31 of Parts Catalog).

66. Replace Scissor Cam Follower Assembly GB299, Hex Head Bolt GB303, Washer GB301, Spacer GB302, Lockwasher GB304, and Hex Nut GB300 (page 27 of Parts Parts Catalog).

67. Replace X-washer and pin to connect the link of Scissor Cam Follower GB299 (page 27 of Parts Catalog) to Scissor Pulley Assembly F61 (page 87 of Parts Catalog).

68. Replace entire Rake Cam Follower Assembly R80A with Hex Head Cap Screw R61C, Spacer R61B, and Flexloc Nut R61A (page 53 of Parts Catalog). On machines prior to serial number 28,701, Rake Cam Follower Assembly R80 can be installed with Pin R79, two Washers R64, and Retaining Ring R61 (page 53 of Parts Catalog).

69. Replace Pipe Plug GB382 in Gear Box Cover GB383 (page 31 of Parts Catalog). Permatex No. 1372 should be applied to the threads of the plug prior to installation.

70. Place Rake Cam GB40 on Rake Cam Hub GB41 (page 5 of Parts Catalog).

71. Replace Clamp Ring GB39, six Lockwashers GB32, and six Hex Head Bolts GB37 (page 5 of Parts Catalog).

    Note: If Rake Cam GB40 and Rake Cam Hub GB41 were scribed for locating purposes in step 44, locate the cam in its exact position before tightening Bolts GB37. If no scribe lines were possible, locate the rake cam in its approximate position by judging the position of the cam on another machine.

72. Replace Washer GB38A or GB38, Lockwasher GB33, and Hex Head Bolt GB37A or GB37 (page 5 of Parts Catalog).

73. Mount the Detector Assembly in position on the Gear Box. If the detector timing pin can be inserted through the mounting plate, detector cover, and gear, the detector is in time. If the timing pin cannot be inserted, the detector must be removed and reinstalled in time. Refer to detector timing (page 63 of Service Manual).

74. Replace three Lockwashers GB165 and Hex Head Bolts GB164 that mount the Detector Assembly to the Gear Box.

75. Replace Clutch Actuator Lever GB90B and two Spacers GB90 on machines prior to serial number 2295, Out-of-Range Lever GB91A on machines later than serial number 1593, Clutch Release Lever Assembly GB91, two Spacers GB89, Plunger Lever Assembly GB353, Plain Washer GB84, Lockwasher GB83, and Hex Head Bolt GB87 (page 5 of Parts Catalog).

    Note: When replacing Clutch Actuator Lever GB90B, the stop arm portion of the lever will interfere with the clutch lever. The clutch lever must be lifted by hand to allow the stop arm to pass under it.

76. Place Clutch Actuator Link Assembly GB74, with Pin Detector Link GB65, in its position on the Gear Box. Replace Roller GB63, Pin GB62, and X-washer GB12 to connect the clutch actuator link assembly to the plunger lever assembly (page 5 of Parts Catalog).

77. Replace Starter Bellcrank Assembly GB76 with Link GB77A, Washer GB84, Lockwasher GB83, and Hex Head Bolt GB82 (page 5 of Parts Catalog).

78. Replace Pin GB70 and X-washer GB12 to connect Link (short connection) GB69 to Clutch Latch GB71 (page 5 of Parts Catalog). On later machines, Roll Pin GB70 replaces the X-washer and pin.

79. Replace Roll Pin GB345 and Tension Spring GB98 from the clutch reset lever to the clutch release lever (page 7 of Parts Catalog).

80. Replace Pin GB91B and X-washer GB12 to connect the clutch actuator link assembly to the clutch reset lever (page 5 of Parts Catalog). On later machines, replace Stripper Bolt GB367E, Roller GB63A or GB63B, Washer GB367D, Roller GB367F, Lockwasher GB366, and Hex Nut GB367C.

81. Replace Pin GB341, Rollers GB343 and GB344, two Plain Washers GB340, and X-washer GB339 to connect 180-degree Turret Interlock Link GB338 to Clutch Release Lever GB346 (page 29 of Parts Catalog).

82. Replace Tension Spring GB94 (page 5 of Parts Catalog) from Reset Lever Assembly GB99 (page 7 of Parts Catalog) to Reset Lever Latch GB357 (page 29 of Parts Catalog). Hook Wire Link Assembly GB210 (page 15 of Parts Catalog) over the pin of the reset lever latch (page 29 of Parts Catalog).

83. Replace Pin GB222 and X-washer GB199 to connect the link from the moving deck-scissor latch (flag) to the moving deck-scissor selector (page 15 of Parts Catalog).

84. Replace Pin F66 and X-washer F65 to connect the detector rod assembly to the deck lift shaft (page 89 of Parts Catalog).

85. Replace Pin GB294 and X-washer GB295 to connect the lower deck hook link to C-shaft Lever GB296 (page 25 of Parts Catalog).

86. Replace Pin GB266 and X-washer GB267 to connect the upper deck hook link to Hook Selector Assembly GB268 (page 21 of Parts Catalog).

87. Replace Pin GB166 and X-washer GB161 to connect Pin Detector Link GB65 to the strike cam follower (page 13 of Parts Catalog).

88. Replace the cycle solenoid and two Hex Head Bolt and Lockwasher Assemblies GB163A (page 11 of Parts Catalog).

89. Replace Pin GB162 and X-washer GB161 to connect the cycle solenoid to the link from Starter Bellcrank Lever GB76 (page 11 of Parts Catalog).

90. Replace spacer and X-washer GB199 to connect Hook Selector Assembly GB201 (page 13 of Parts Catalog) to Link Assembly R49 (page 53 of Parts Catalog). On earlier machines, replace Pin GB198.

91. Replace Pin GB166 and X-washer GB161 to connect Deck Hook Latch Assembly GB176 to Connecting Bar GB20 (page 11 of Parts Catalog).

92. Replace Pin GB208A and X-washer GB161 to connect link of Out-of-Range Reset Lever GB75A to Hook Selector Assembly GB201 (page 13 of Parts Catalog). On later machines, replace X-washer only.

93. On machines later than serial number 1593, replace Out-of-Range Link GB91C, Pin GB200A, and X-washer GB161 (page 13 of Parts Catalog).

    On machines prior to serial number 1593, replace the out-of-range micro switch, Screws GB185 and GB186, Washer GB187, Spacer GB189, and two Hex Nuts GB188 (page 11 of Parts Catalog).

94. On machines later than serial number 1593, replace Pin GB91D or GB97B, X-washer GB91E, Flexloc Nut GB97A, and Spring GB61 to connect Out-of-Range Link GB91C to Out-of-Range Lever GB91A (page 5 of Parts Catalog).

95. Replace three-part Connecting Link (bicycle link) GB349 to connect Plunger Lever Assembly GB353 to Plunger Assembly GB352 (page 29 of Parts Catalog).

96. Replace Tension Spring GB86 to the plunger lever, Tension Spring GB85 to the clutch actuator lever, and Tension Spring GB55 to the scissor cam follower (page 5 of Parts Catalog).

97. Replace Pin GB70, X-washer GB12, and Tension Spring GB61 on Starter Bell-crank Lever GB76 and link of Out-of-Range Reset Lever GB75A (page 5 of Parts Catalog).

98. On machines later than serial number 18,001, replace Link Assembly R87, Hex Head Cap Screw R81A, Spacer R81B, and Flexloc Nut R81C (page 53 of Parts Catalog), and spacer and X-washer to Pivot Stud R26D (page 59 of Parts Catalog).

    On machines prior to serial number 18,001, replace Link Assembly R87, Hex Cap Screw R126N, Spacer R126P, and Flexloc Nut R126Q (page 59 of Parts Catalog), and Pin R81 and X-washer R81D (page 53 of Parts Catalog).

99. Replace Rake Crank Link Assembly R83, Retaining Ring R61, and two Washers R82. On machines later than serial number 24,001, replace Flexloc Nut R84A and Hex Head Cap Screw R86A. On machines prior to serial number 24,001, replace Pin R86, two Washers R85, and Retaining Ring R84 (page 53 of Parts Catalog).

100. Pivot Link Assembly R42 into position with the V-lever of Rake Lift Arm Assembly R93. Install Pin R43, two Washers R45, Bumper R46, and X-washer R44 (page 53 of Parts Catalog).

101. Replace entire spring guide tube assembly on the machine with the assembly still captivated by the threaded Rod (step 13). Replace Pin F5 and X-washer F3 (page 79 of Parts Catalog).

102. On machines prior to serial number 14,501, replace Hex Head Bolt F1F, two Bushings F1G, and Flexloc Nut F1H (page 79 of Parts Catalog).

On machines later than serial number 14,501, replace Hex Head Bolt F1B, two Bushings F1D, two Washers F1E, and Flexloc Nut F1C (page 79 of Parts Catalog).

103. Remove the threaded rod used to captivate the spring guide tube assembly.

104. Replace Gear Box Oil Pan GB28A, Socket Head Cap Screw GB28B, Gasket GB28C, and Hex Nut GB28D (page 3 of Parts Catalog).

105. Manually rotate the Gear Box backward to 270 degrees. The deck lowering link and hook assembly must be held above the crossbrace and the moving deck-scissor latch (flag) held in position to block out the scissor cam follower.

106. Replace two Tension Springs R89 from the V-levers on Rake Lift Arm Assembly R93 to Rake Support Arms R97 (page 53 of Parts Catalog).

107. With the scissor cable still between the two pulleys at the top of the deck support arms, replace Scissor Closing Spring D5 in its position at the rear of the deck assembly (page 43 of Parts Catalog).

108. Place the deck lowering link assembly between the brackets of the deck lift shaft and replace Shaft (deck lowering pin) F45, Washer F44, and Retaining Ring or Spirolox Ring F43 (page 83 of Parts Catalog).

109. Remove the blocks or boxes used to support the deck assembly in step 5.

110. Replace the moving deck cable over its pulley at the top of the deck support arm.

Note: Make certain that all cables are routed properly over their respective pulleys.

111. Manually cycle the machine to 0 degree and check the moving deck-scissor latch adjustment (adjustment No. 8, page 73 of Service Manual) to assure proper operation.

112. With the power on, allow the machine to detect an out-of-range pin. Restart the machine and shut it off when the scissor cam follower falls to the low level of the moving deck-scissor cam.

113. Replace the scissor cable over its pulleys at the top and bottom of the deck support arm.

114. Stop the machine at 180 degrees and replace Trip Rod Assembly R17, Trip Spring R16, and two Jam Nuts R13 (page 51 of Parts Catalog).

115. Replace the Gear Box oil.

This procedure does not normally disturb any adjustments, but it is recommended that the following adjustments be checked for accuracy:

(a) Rake Board Height Adjustment
Adjustment No. 3 (page 67 of Service Manual)

(b) Deck Height and Level Adjustment
Adjustment No. 7 (page 72 of Service Manual)

(c) Moving Deck-Scissor Latch Adjustment
Adjustment No. 8 (page 83 of Service Manual)

A functional check should then be made on the entire triggering and reset mechanisms to assure satisfactory performance.

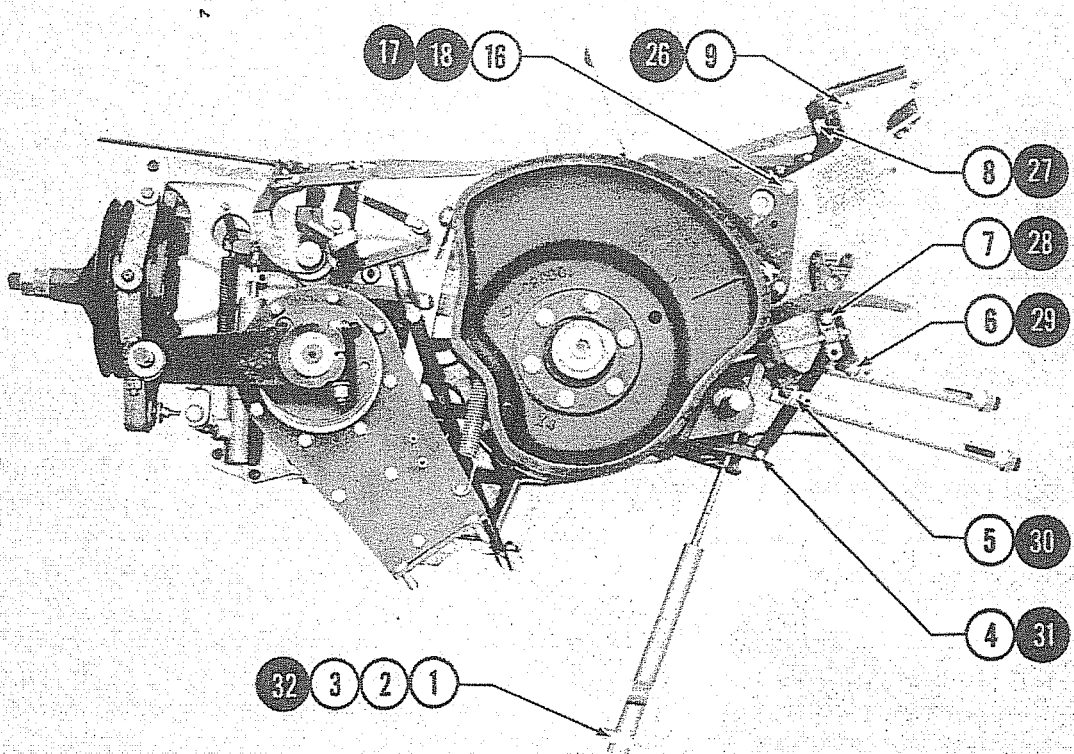

Figure 39a. Detector, Removal and Installation Sequence

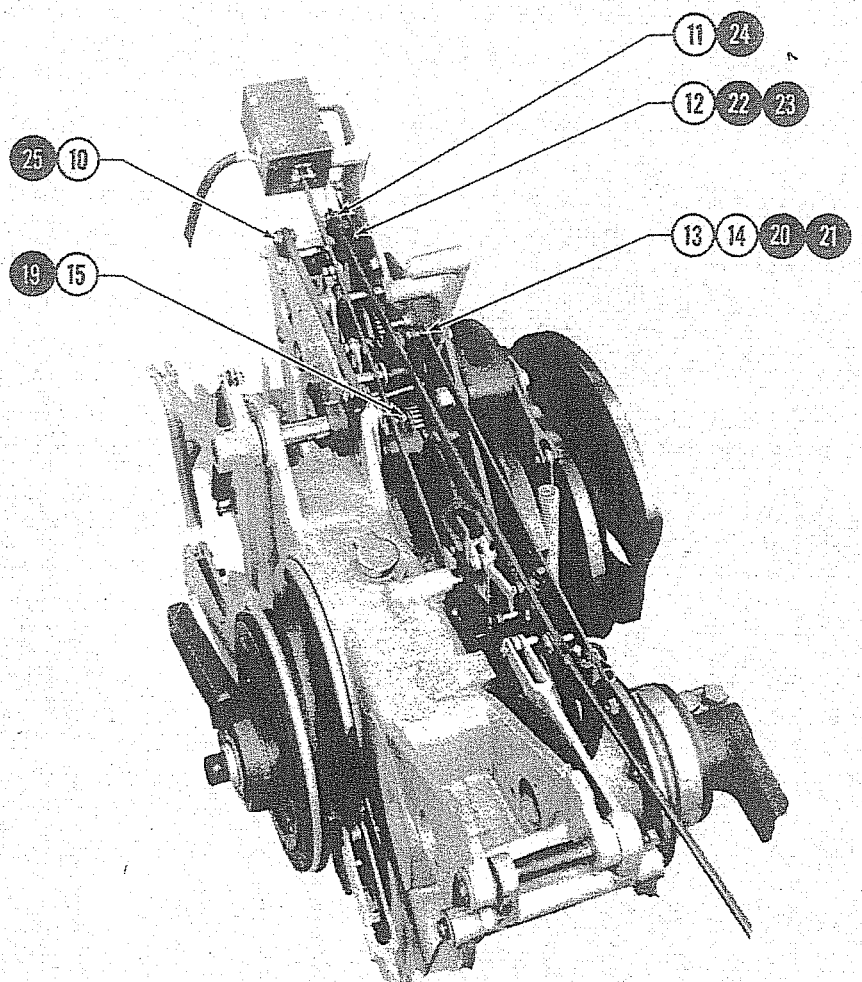

Figure 39b. Detector, Removal and Installation Sequence

Chapter V
DETECTOR ASSEMBLY

REMOVAL OF DETECTOR ASSEMBLY (SEE FIGURES 39A AND 39B)

1. Before removing the Detector Assembly from the Gear Box, it is advisable to check the position of the rake crank link with respect to the 4 to 1 Shaft, in accordance with the gear box clutch lever adjustment (adjustment No. 16, page 77 of Service Manual).

2. Cycle the machine to 90 degrees, detecting a strike. Shut off the power. Note that the strike cam follower is at the low dwell of the timing cam, with the radius of the roller mating directly with the contour of the timing cam. Refer to detector timing (page 63 of Service Manual).

3. Remove X-washer F65 and Pin F66 to free the detector rod assembly from the deck lift shaft (page 89 of Parts Catalog).

4. Remove X-washer GB161 and Pin GB166 to free Pin Detector Link GB65 from the strike cam follower (page 13 of Parts Catalog).

5. Remove X-washer GB295 and Pin GB294 to free the lower deck hook link from C-shaft Lever GB296 (page 25 of Parts Catalog).

6. Remove X-washer GB267 and Pin GB266 to free the upper deck hook link from Hook Selector Assembly GB268 (page 21 of Parts Catalog).

7. Remove X-washer GB199 and Pin GB222 to free the moving deck-scissor selector from the link to the moving deck-scissor latch (page 15 of Parts Catalog).

8. Remove X-washer GB161 and Pin GB162 to free the cycle solenoid from the link to Starter Bellcrank Lever GB76 (page 11 of Parts Catalog).

9. Remove two Hex Head Bolt and Lockwasher Assemblies GB163A and the cycle solenoid (page 11 of Parts Catalog). On later machines, the two hex head bolts have been replaced by two Phillips-head screws.

10. Remove X-washer GB161 and Pin GB166 to free Deck Hook Latch Assembly GB176 from Connecting Bar GB20 (page 11 of Parts Catalog).

11. Remove X-washer GB161 to free Hook Selector Assembly GB201 from the link of Out-of-Range Reset Lever GB75A (page 13 of Parts Catalog). On machines prior to serial number 23,001, remove X-washer GB161 and Pin GB208A.

12. Remove X-washer GB199, Spacer, and Tension Spring GB197 to free Hook Selector Assembly GB201 (page 13 of Parts Catalog) from Link Assembly R49 (page 53 of Parts Catalog). On machines prior to serial number 23,001, remove Pin GB198. Pivot link assembly over crossbrace for access to the Detector Assembly.

13. Remove X-washer GB161 and Pin GB200A to free Out-of-Range Link GB91C from Intermediate Lever Assembly (bellcrank) GB205 (page 13 of Parts Catalog).

14. On machines prior to serial number 1593, remove two Hex Nuts GB188, Screw GB186, Screw GB185, Washer GB187, and Spacer GB189. Allow the micro switch to rest free of the Detector Assembly (page 11 of Parts Catalog).

15. Remove Tension Spring GB94 (page 5 of Parts Catalog) from Reset Lever Latch GB357 (page 29 of Parts Catalog). Unhook Wire Link Assembly GB210 (page 15 of Parts Catalog) from Reset Lever Latch GB357 (page 29 of Parts Catalog).

16. Remove three Hex Head Bolts GB164 and Lockwashers GB165 that mount the Detector Assembly to the Gear Box (page 11 of Parts Catalog). Carefully lift the entire Detector Assembly from the Gear Box.

DETECTOR DISASSEMBLY PROCEDURE (SEE FIGURES 40A THROUGH 40C)

A. Loosen Hex Nut GB168 and remove Micro Switch Lever GB167 from the C-shaft (page 11 of Parts Catalog).

B. Remove Spirol Pin GB231 and Shoe GB230 from C-shaft GB232 (page 15 of Parts Catalog).

C. Remove Spirol Pin GB297 and Lever GB296 from C-shaft GB232 (page 25 of Parts Catalog).

D. Remove Spirol Pin GB259D and Moving Deck-Scissor Latch GB259G from the D-shaft (page 21 of Parts Catalog).

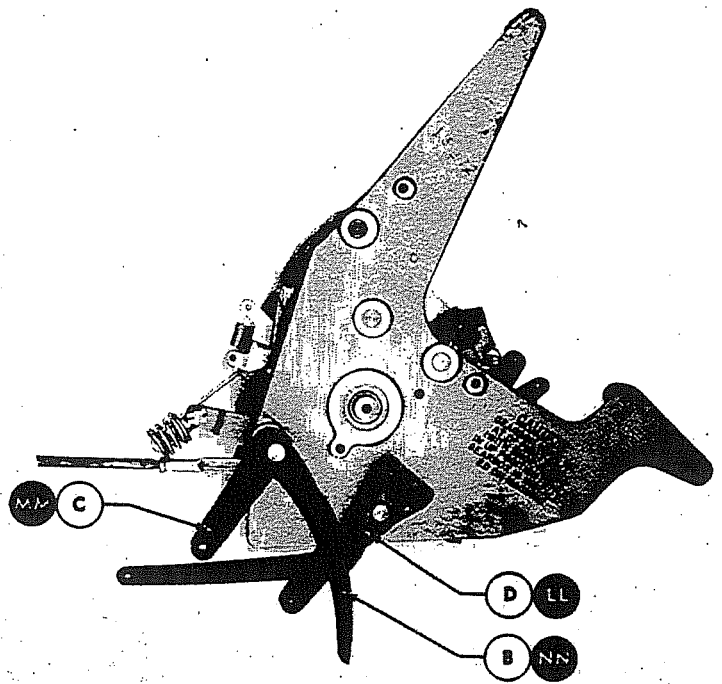

Figure 40a. Detector, Assembly and Disassembly Sequence

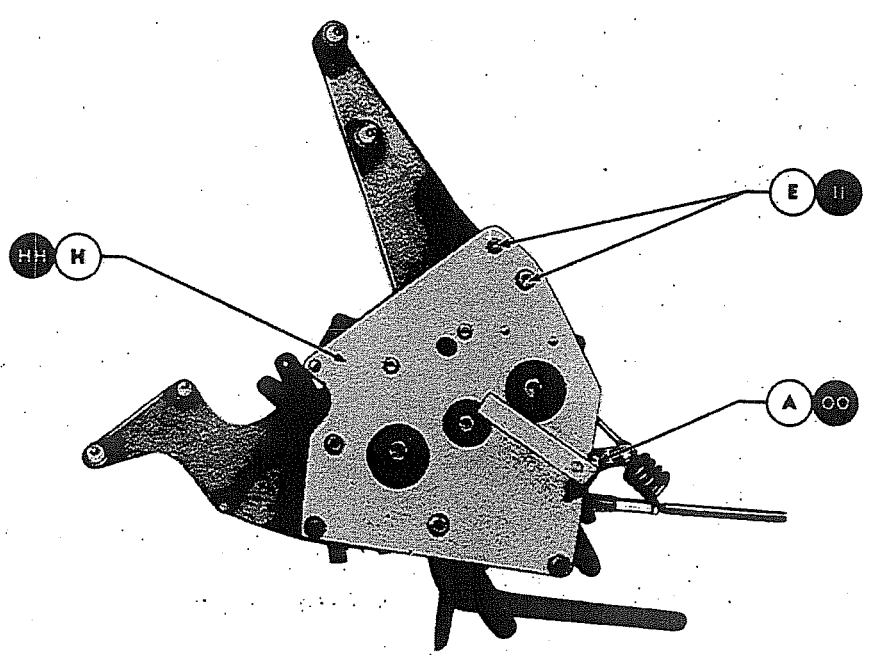

Figure 40b. Detector, Assembly and Disassembly Sequence

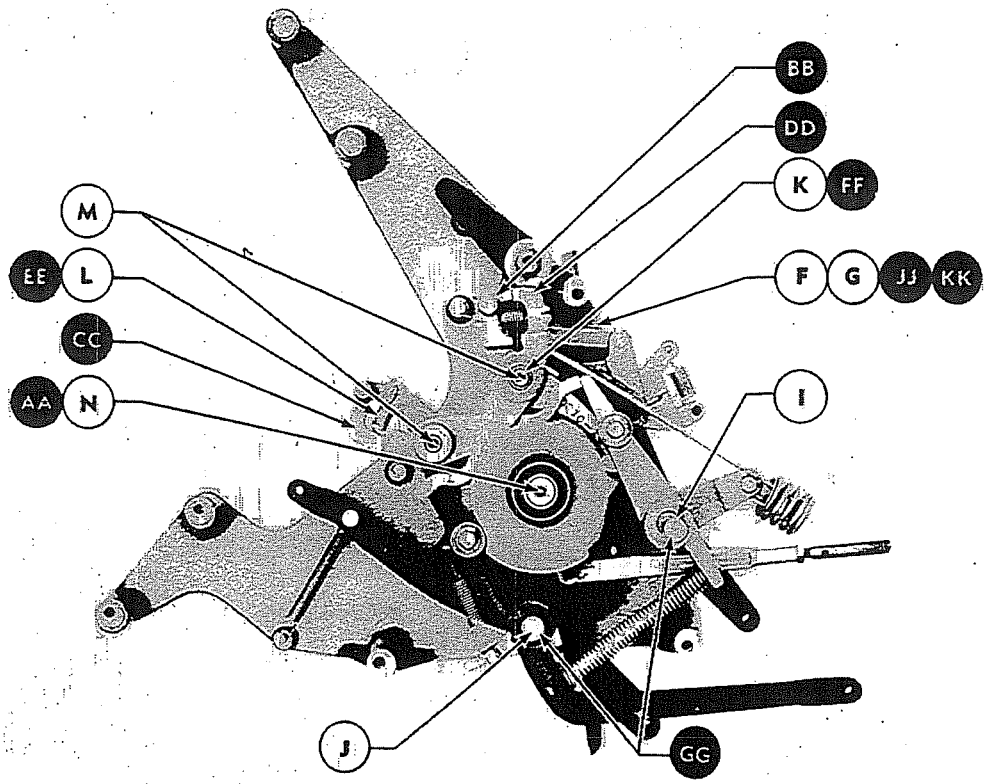

Figure 40c. Detector, Assembly and Disassembly Sequence

E. Remove three Hex Head Bolt and Lockwasher Assemblies GB174, three Body Fit Cap Screws GB164, and three Lockwashers GB165 to free Detector Mounting Plate GB182 from the Detector Assembly (page 11 of Parts Catalog).

F. Remove Tension Spring GB173 from Detector Mounting Plate GB182 to the standing pin controller and remove Tension Springs GB171 and GB172 on machines prior to serial number 12,001 (page 11 of Parts Catalog).

G. Remove Tension Spring GB203 from the detector mounting assembly to the out-of-range selector (page 13 of Parts Catalog).

H. Carefully remove Detector Mounting Plate GB182 from the detector mounting assembly (page 11 of Parts Catalog). The plate may be freed by applying light taps to the 1 to 1 Shaft of the Detector Assembly while lifting on the plate.

I. Remove the C-shaft assembly from the Detector Assembly by lightly tapping the C-shaft through the detector mounting plate.

Caution: As the C-shaft is removed, Compression Spring GB192 (page 13 of Parts Catalog) will jump from its position as the standing pin controller moves off the timing cam (page 15 of Parts Catalog).

J. Remove D-shaft GB223 (page 15 of Parts Catalog) together with Strike Cam Follower GB195, Deck Hook Latch GB196, and Hook Selector Assembly GB201 (page 13 of Parts Catalog). The D-shaft may be removed by applying light taps to the shaft.

K. On machines prior to serial number 12,001, remove Washer GB269, Spring Lever GB270A, Lever GB271, Washer GB272, and Latch GB273 (page 23 of Parts Catalog).

Note: These parts are obsolete and may be replaced in the Detector Assembly or Spacer GB270 may be inserted in their place. On machines later than serial number 23,001, neither these parts or the spacer are required.

L. Remove Tension Spring GB275 from Detector Latch (strike selector) GB276 to Detector Lever Assembly (strike controller) GB277 (page 23 of Parts Catalog). Remove Tension Spring GB215 from Detector Latch Assembly (standing pin selector) GB216 to Detector Lever Assembly (standing pin controller) GB218 (page 15 of Parts Catalog).

M. Remove Washer GB274, Detector Latch (strike selector) GB276 or GB288 and Washer GB269 from the B-shaft (pages 23 and 23A of Parts Catalog). Remove Detector Latch Assembly (standing pin selector) GB216, Washer GB217 or GB218, and Washer GB219 from A-shaft GB220 (page 15 of Parts Catalog). Remove Detector Lever Assembly (strike controller) GB277 or GB288A and Washer GB274 from the B-shaft (pages 23 and 23A of Parts Catalog).

N. Remove the entire Detector 1 to 1 Shaft Assembly from Detector Mounting Assembly GB233 by lightly tapping the shaft with a plastic hammer.

O. Secure the bearing pulling attachment behind the smaller shoulder of Timing Cam GB247 and apply pressure to Shaft GB256 (figure 41). The timing cam, Washers GB246, and Bearing GB245 will be removed together (page 19 of Parts Catalog).

P. Secure the bearing pulling attachment behind the shoulder of Out-of-Range Selector Cam GB252 and apply pressure to Shaft GB256 (figure 42). Selector Cam GB248, Detector Disc GB251, and the out-of-range selector cam will be removed together.

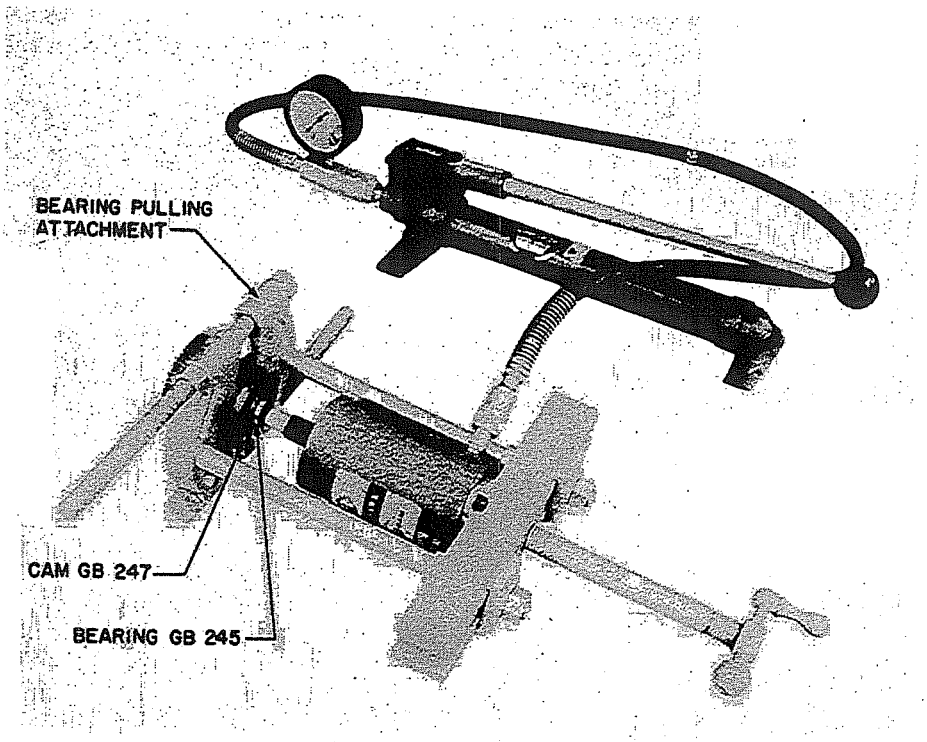

Figure 41. Detector, Removal of Cam GB247 and Bearing GB245

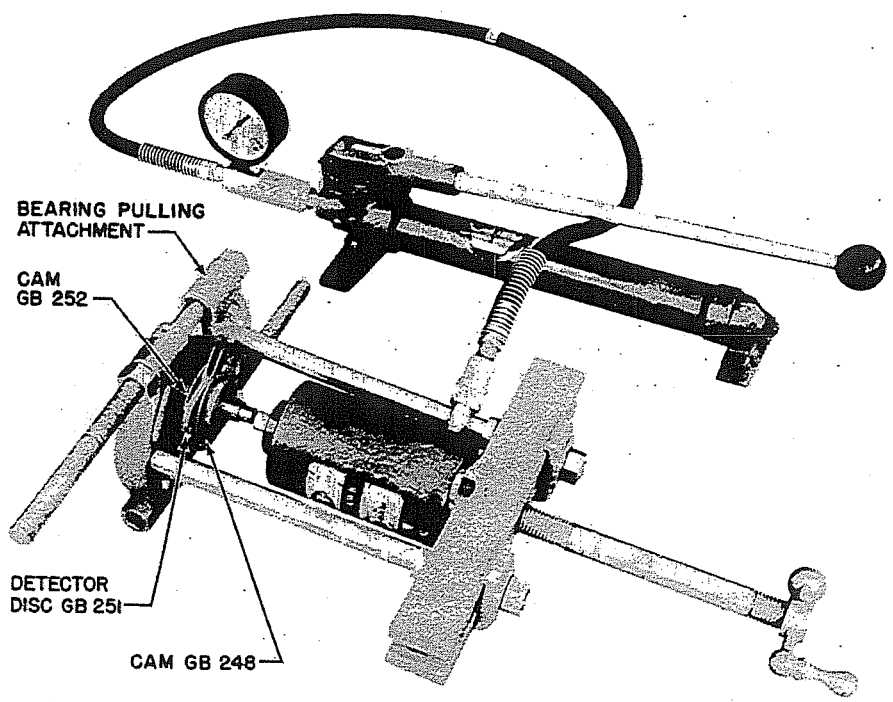

Figure 42. Detector, Removal of Cam GB248, Disc GB251, and Cam GB252

Q. Secure the bearing pulling attachment behind the shoulder of Rake Hook Cam GB253 and apply pressure to the shaft to remove the rake hook cam, Detector Gear GB254, and Bearing GB244 (figure 43).

R. Remove Square Key GB255.

DETECTOR ASSEMBLY PROCEDURE (SEE FIGURES 40A THROUGH 40C)

S. Replace Square Key GB255. The key should be inspected for burrs and should seat firmly in the keyway.

T. Replace Washers GB246 and Bearing GB245 by securing the bearing pulling attachment behind Bearing GB245 (figure 44). Lubricate the shaft and bore prior to installing the bearing.

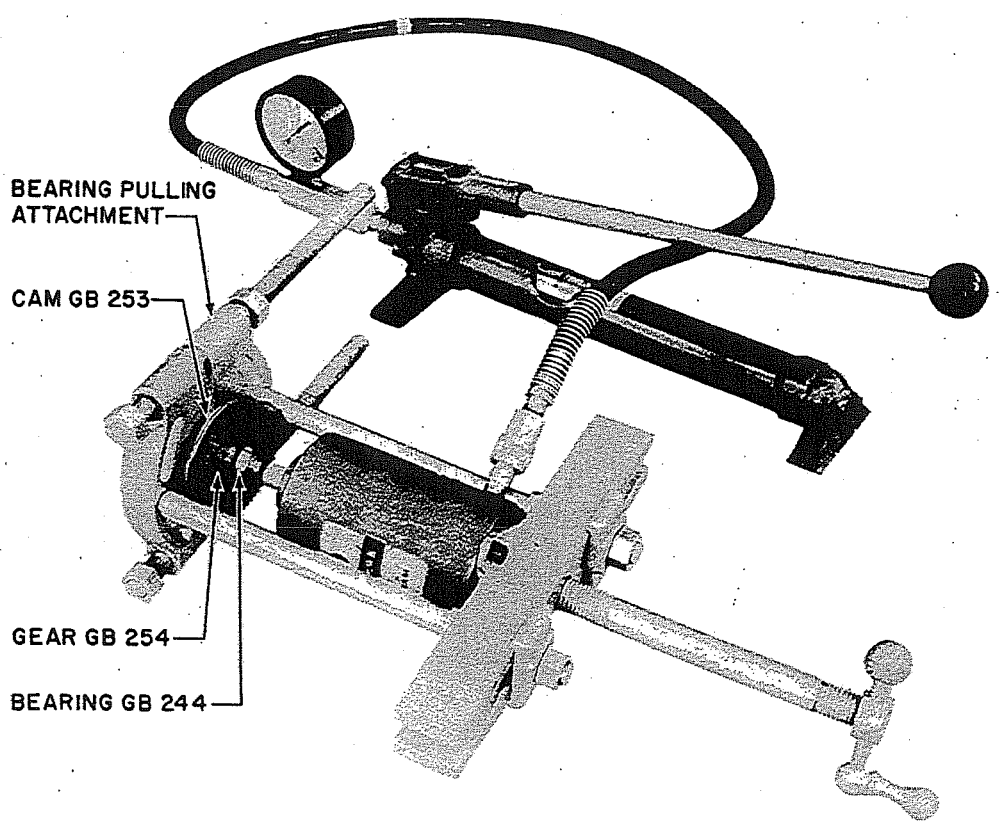

Figure 43. Detector, Removal of Bearing GB244, Gear GB254, and Cam GB253

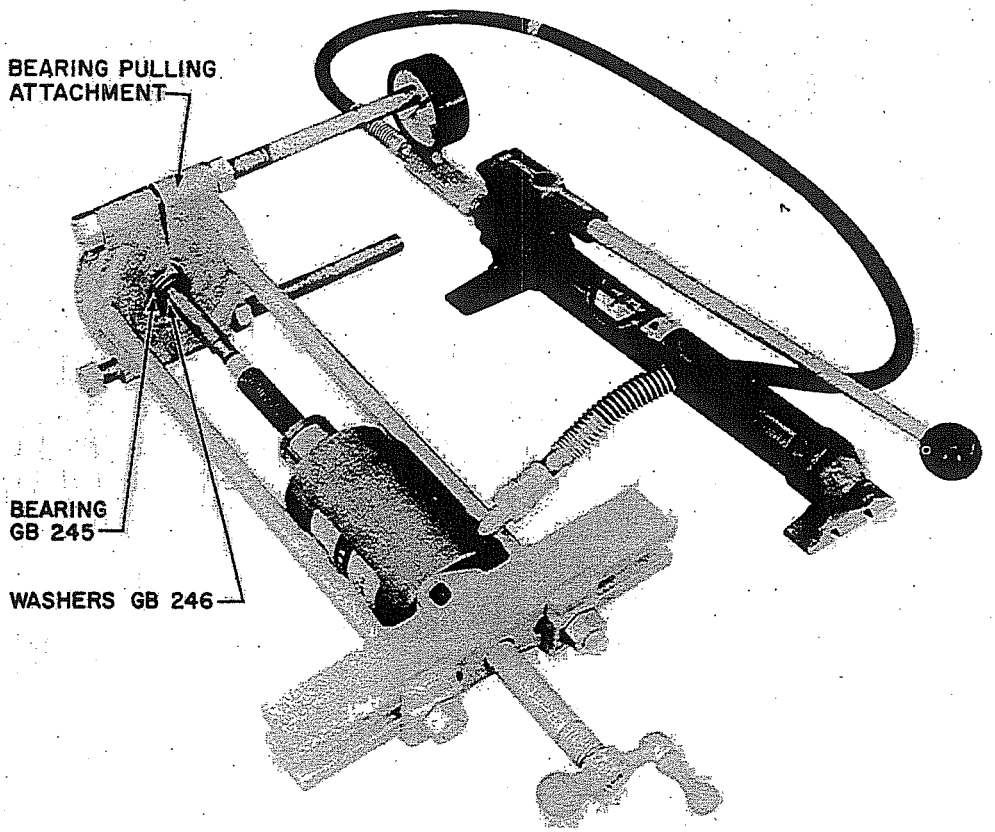

Figure 44. Detector, Installation of Bearing GB245 and Washers GB246

U. Secure the bearing pulling attachment behind Timing Cam GB247 and press it onto Shaft GB256 until it positions against Washers GB246 (figure 45). Lubricate the entire length of the shaft prior to this operation.

V. Secure the bearing pulling attachment behind Selector Cam GB248 and install (figure 46). Place Detector Disc GB251 in its proper position on the hub of the selector cam.

W. Secure the bearing pulling attachment behind Out-of-Range Selector Cam GB252 and install (figure 47).

X. Secure the bearing pulling attachment behind Rake Hook Cam GB253 and install (figure 48).

Y. Secure the bearing pulling attachment behind Detector Gear GB254 and install (figure 49).

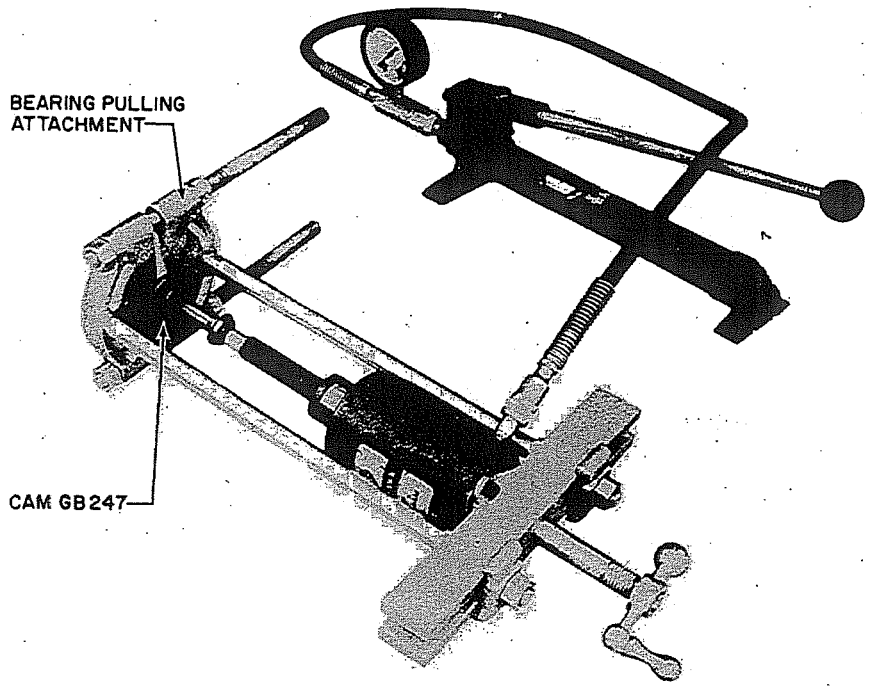

Figure 45. Detector, Installation of Cam GB247

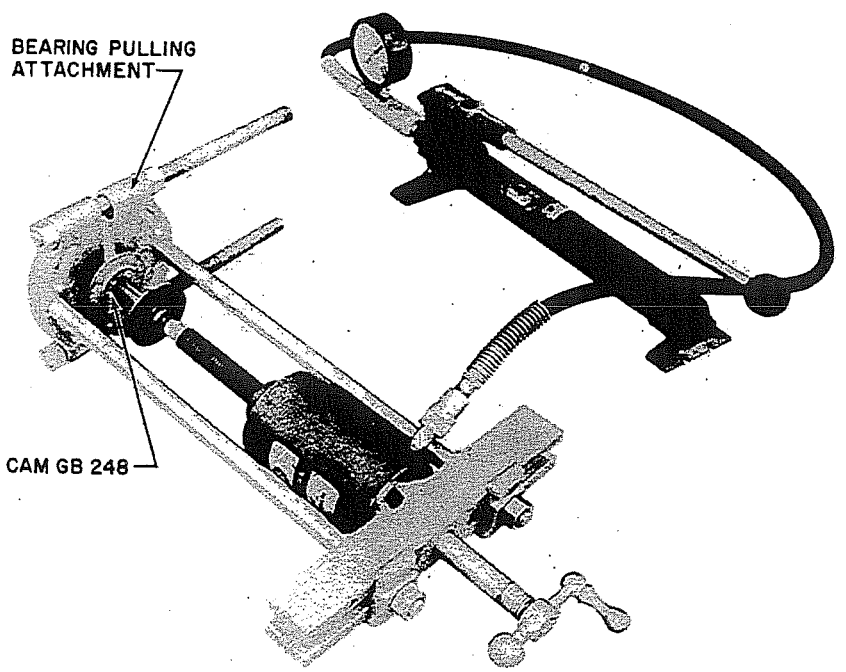

Figure 46. Detector, Installation of Cam GB248

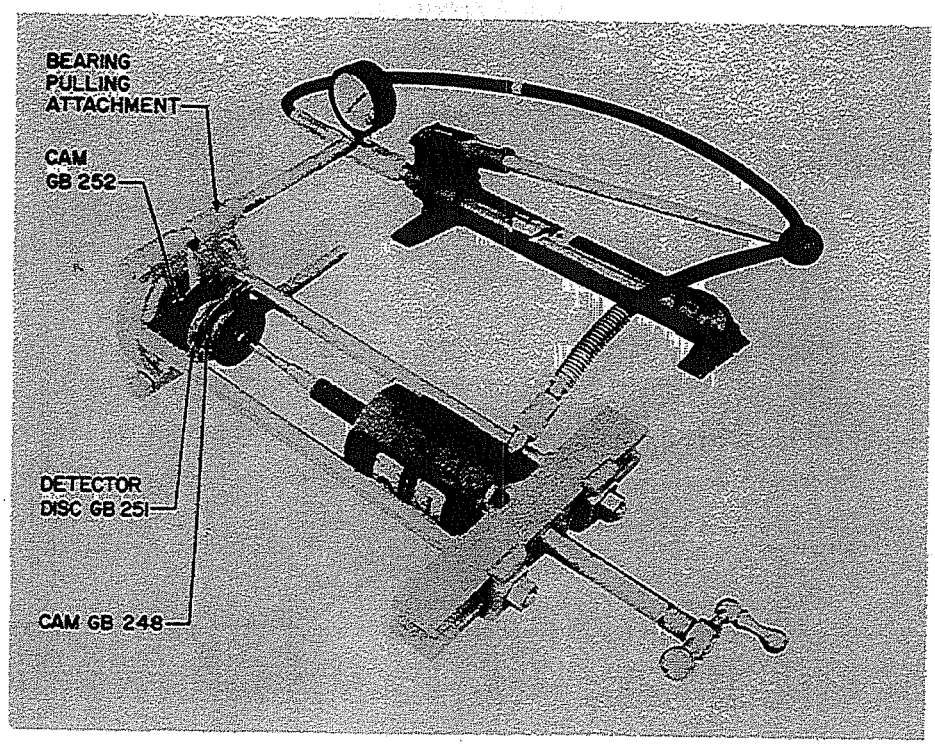

Figure 47. Detector, Installation of Cam GB252

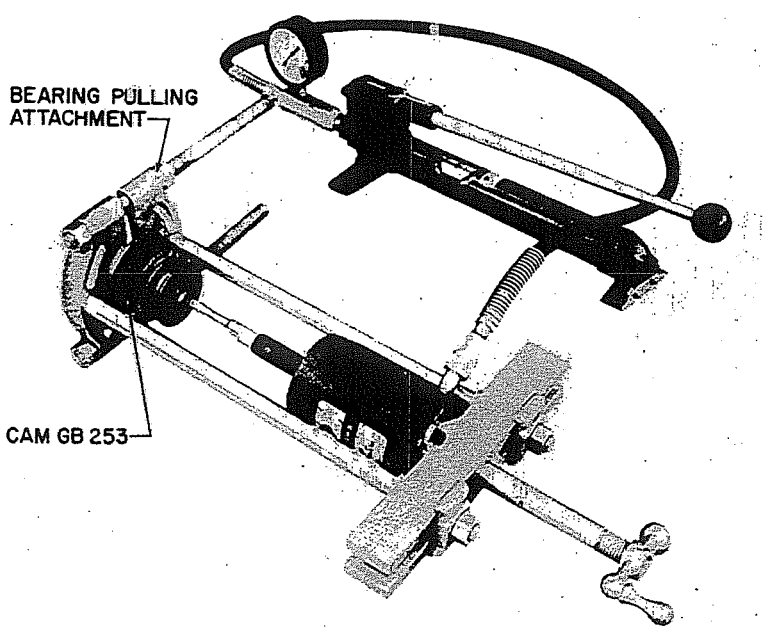

Figure 48. Detector, Installation of Cam GB253

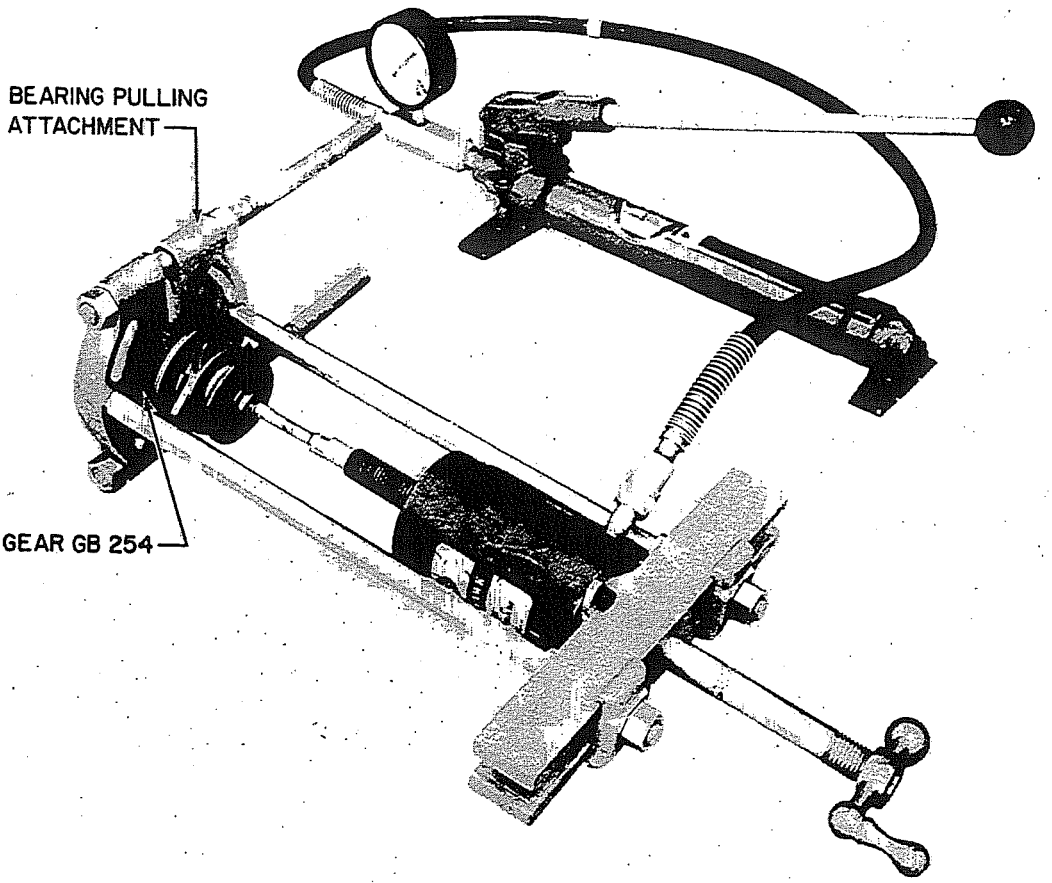

Figure 49. Detector, Installation of Gear GB254

Z. Secure the bearing pulling attachment behind Bearing GB244 and install, making certain that the bearing is seated firmly against the shoulder of the shaft (figure 50).

AA. Replace the 1 to 1 Shaft in Detector Mounting Assembly GB233 by tapping the shaft with a plastic hammer. Make certain that Detector Rod GB250 (page 19 of Parts Catalog) is in its proper position when installing the shaft to the detector mounting assembly.

BB. Replace Washer GB274 and Detector Lever Assembly (strike controller) GB277 or GB288A on the B-shaft (pages 23 and 23A of Parts Catalog).

CC. Replace Washer GB219, Detector Lever Assembly (standing pin controller) GB218, Washer GB217 or GB217B, and Detector Latch Assembly (standing pin selector) GB216 on the A-shaft (page 15 of Parts Catalog).

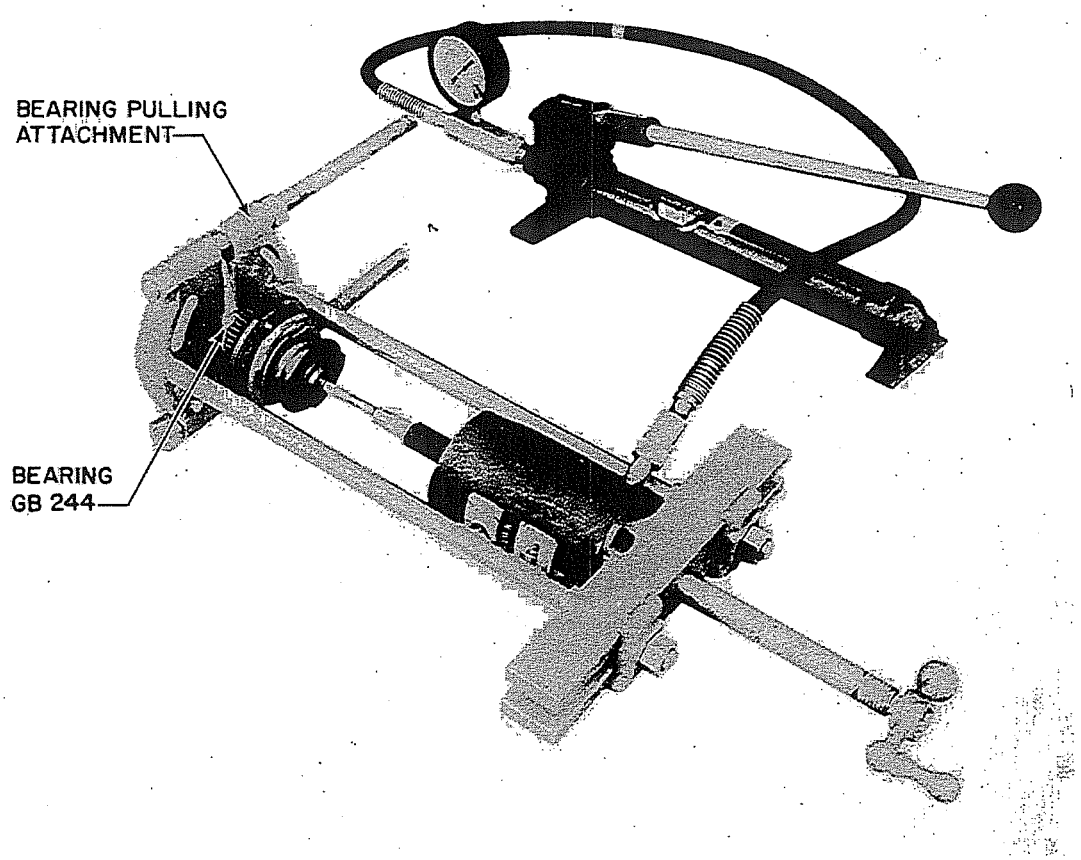

Figure 50. Detector, Installation of Bearing GB244

DD. Replace Washer GB269, Detector Latch (strike selector) GB276, and Washer GB274 on the B-shaft (pages 23 and 23A of Parts Catalog).

EE. Replace Tension Spring GB215 from Detector Latch Assembly (standing pin selector) GB216 to Detector Lever Assembly (standing pin controller) GB218 (page 15 of Parts Catalog) and replace Tension Spring GB275 from Detector Lever Assembly (strike controller) GB277 to Detector Latch (strike selector) GB276 (page 23 of Parts Catalog).

FF. On machines prior to serial number 23,001, replace Washer GB269, Spring Lever GB270A, Lever GB271, Washer GB272, and Latch GB273 or Spacer GB270. On machines later than serial number 23,001, these parts have been eliminated.

GG. Place D-shaft Assembly GB223, together with Strike Cam Follower GB195, Deck Hook Latch GB196, and Hook Selector Assembly GB201 (page 15 of Parts Catalog), in its approximate position, with the roller of the strike cam follower slightly higher than the timing cam. Place the C-shaft assembly in its bore, with the roller of the standing pin cam follower slightly higher than

the timing cam. Place Compression Spring GB192 on the rod between the two cam followers and insert the rod through the hole provided in the standing pin cam follower. While holding the two cam followers together to capture the compression spring, lightly tap their respective shafts into their bores on the detector mounting assembly until the rollers of the cam followers are on the same plane as the timing cam. Carefully release the two cam followers.

HH. Replace Detector Mounting Plate GB182 on the detector mounting assembly (page 11 of Parts Catalog). All shafts must be aligned with the bores while installing the plate. Light taps with a plastic hammer will seat the plate in its proper position.

II. Replace three Body Fit Cap Screws GB164 and Lockwashers GB165 to mount Detector Mounting Plate GB182 to the detector mounting assembly. Replace three Hex Head Bolt and Lockwasher Assemblies GB174 (page 11 of Parts Catalog).

JJ. Replace Tension Spring GB203 from the detector mounting assembly to the out-of-range selector (page 13 of Parts Catalog).

KK. On machines prior to serial number 12,001, replace Tension Spring GB172 from Detector Mounting Plate GB182 to Spring Lever Assembly GB270A. Replace Tension Spring GB173 from the mounting plate to the standing pin controller and replace Tension Spring GB171 from the mounting plate to the strike controller (page 11 of Parts Catalog).

LL. Replace Moving Deck-Scissor Latch GB259G and Spirol Pin GB259D (page 21 of Parts Catalog).

MM. Replace Lever GB296 and Spirol Pin GB297 (page 25 of Parts Catalog).

NN. Replace Shoe GB230 and Spirol Pin GB231 (page 15 of Parts Catalog).

OO. Replace Micro Switch Lever GB167, but do not tighten Hex Head Nut GB168. This nut will require adjustment after assembly to the Gear Box.

INSTALLATION OF DETECTOR ASSEMBLY (SEE FIGURES 39A AND 39B)

17. Locate the Detector Assembly in its proper mounting position on the Gear Box, making certain that the Detector Assembly is in time with the Gear Box. The roller of the strike cam follower must be on the low dwell of the timing cam, with the radius of the roller mating directly with the contour of the timing cam. Refer to detector timing (page 63 of Service Manual).

18. Replace three Lockwashers GB165 and Hex Head Bolts GB164 that mount the Detector Assembly to the Gear Box (page 11 of Parts Catalog). Again check the detector timing to make certain that rotation of the Detector Assembly in aligning the mounting holes has not moved the assembly out of time.

19. Connect Wire Link Assembly GB210 (page 15 of Parts Catalog) to Reset Lever Latch GB357 (page 29 of Parts Catalog) and Tension Spring GB94 (page 5 of Parts Catalog).

20. Replace Pin GB200A and X-washer GB161 to connect Out-of-Range Link GB91C to Intermediate Lever Assembly (bellcrank) GB205 (page 13 of Parts Catalog).

21. On machines prior to serial number 1593, replace the micro switch, Spacer GB189, Washer GB187, Screw GB185, Screw GB186, and two Hex Nuts GB188 (page 11 of Parts Catalog).

22. Replace Spacer and X-washer GB199 to connect Link Assembly R49 (page 53 of Parts Catalog) to Hook Selector Assembly GB201 (page 13 of Parts Catalog). On machines prior to serial number 23,001, replace Pin GB198.

23. Replace Tension Spring GB197 from the detector mounting assembly to Hook Selector Assembly GB201 (page 13 of Parts Catalog).

24. Replace X-washer GB161 to connect the link from Out-of-Range Reset Lever GB75A to Hook Selector Assembly GB201 (page 13 of Parts Catalog). On machines prior to serial number 23,001, replace Pin GB208A.

25. Replace Pin GB166 and X-washer GB161 to connect Connecting Bar GB20 to Deck Hook Latch Assembly GB176 (page 11 of Parts Catalog).

26. Replace the cycle solenoid and two Hex Head Bolt and Lockwasher Assemblies GB163A or two Phillips-head screws (page 11 of Parts Catalog).

27. Replace Pin GB162 and X-washer GB161 to connect the link from Starter Bellcrank Lever GB76 to the cycle solenoid (page 11 of Parts Catalog).

28. Replace Pin GB222 and X-washer GB199 to connect the moving deck-scissor link to the moving deck-scissor selector (page 15 of Parts Catalog).

29. Replace Pin GB266 and X-washer GB267 to connect the upper deck hook link to Hook Selector Assembly GB268 (page 21 of Parts Catalog).

30. Replace Pin GB294 and X-washer GB295 to connect the lower deck hook link to C-shaft Lever GB296 (page 25 of Parts Catalog).

31. Replace Pin GB166 and X-washer GB161 to connect Pin Detector Link GB65 to the strike cam follower (page 13 of Parts Catalog).

32. Replace Pin F66 and X-washer F65 to connect the detector assembly rod to the deck lift shaft (page 89 of Parts Catalog).

Adjust the first and second ball light micro switch in accordance with adjustment No. 46 (page 105 of Service Manual).

Cycle the machine through several cycles and observe the functions of the Detector Assembly. The Detector Assembly should successfully direct the machine through complete strike, standing pins, and out-of-range cycles.