TM 55-4920-201-14

TECHNICAL MANUAL

OPERATOR'S, ORGANIZATIONAL, DS, AND GS MAINTENANCE MANUAL INCLUDING REPAIR PARTS AND SPECIAL TOOLS LIST

BALANCING AND ADAPTER KITS (MARVEL)

BALANCING KITS	FEDERAL STOCK NUMBER
7A050	4920-572-0987
7HEL053	4920-623-5956

ADAPTER KITS	FEDERAL STOCK NUMBER
7A052	4920-687-9314
7A055	4920-730-6788
7HEL051	4920-572-0986
7HEL052	4920-623-5955
7HEL054	4320-623-5957
7HEL055	4920-623-5958
7HEL056	4920-623-5959
7HEL061	4920-536-8214
7HEL065	4920-937-9418
7HEL066	4920-924-5708
7HEL069	4920-111-3063
7HEL354	4920-755-6686
AA920-8053	4920-168-9797

This manual supersedes TM 53-4920-201-15, 23 February 1966, including all changes.

HEADQUARTERS, DEPARTMENT OF THE ARMY

This copy is a reprint which includes current pages from Changes 1 though 6.

20 MAY 1971

SAFETY PRECAUTIONS

Avoid any equipment damage by adhering to the precautions listed below. There is no potential danger to human life since high voltages, radioactive material, toxic chemicals, etc., are nonexistent in this balancing and adaptering equipment.

Place part no. 7A050 balancing kit storage case flat on the floor with the top half up as identified by the stencilled instructions and decal on the storage case top. Opening the case in any other position may result in spilling of, and damage to, the precision machined parts. When raising bottom half of 7A050 kit storage case for as the third leg of the support stand, avoid tilting the case beyond the vertical position, else cones, bushings, etc., will drop out and be damaged.

Do not immerse part no.2259 and part no.. 2516 balancing arbor assemblies in a vapor degreaser or heated cleaning solvents, as the delicate, flexible internal suspension element may be adversely affected. Never immerse part no. 2363 indicator assembly, or part no. 2420 and part no. 2421 trammeling scopes in any cleaning solvents or fluids whatsoever.

Avoid imparting excessive downward or sidewise pressure on arbor suspension rod, as damage to the flexible suspension element within the arbor may result. Should the coupling fail to engage with moderate downward pressure, inspect coupling and suspension rod end for foreign matter which might cause interference.

When installing or removing quick-disconnect coupling from small balancing arbor, part no. 2516, grasp upper suspension rod and decoupler assembly only, so as to prevent excessive compression load of the sensitive suspension element.

Upward travel of the ram piston is limited by a piston stop washer and retaining ring. With the ram piston against this stop, further actuation of the pressure pump will result in a build-up of internal pressure which may cause damage to the load indicating gage or to internal pump parts. Never operate the pump beyond an indicated load of 700 pounds.

Do not exceed load limits engraved on load indicator gage of hydraulic pump for either 1/16-inch or 3/16-inch suspension cable. General use of the 3/16-inch cable is recommended so as to avoid inadvertent overloading of the 1/16-inch cable.

Block or hold round propeller hub barrel of two-blade assemblies to prevent propeller assembly from rolling off stand table assembly.

In using available shop hoist for suspending rotor head assembly, care should be. exercised to avoid excessive acceleration loading (jerking) of the arbor suspension rod.

Do not attempt to disassemble balancing arbors. Except for adjusting indicator bushings and removing oil filler screws, the arbors are permanent assemblies. Any disassembly by the using activity will result in critical damage requiring factory repair.

CHANGE NO. 6

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 5 June 1989

Operator's, Organizational,
DS, and GS Maintenance Manual
Including Repair Parts and Special Tools List

BALANCING AND ADAPTER KITS
(MARVEL)

TM 55-4920-201-14, 20 May 1971, is changed as follows:

1. Remove and insert pages as indicated below. New or changed text material is indicated by a vertical bar in the margin. An illustration change is indicated by a miniature pointing hand.

Remove pages	Insert pages
iii and iv	iii and iv
1-1 and 1-2	1-1 and 1-2
4-35 through 4-40	4-35 through 4-40
A-1 and A-2	A-1 and A-2
B-1 and B-2	B-1 and B-2

2. Retain this sheet in front of manual for reference purposes.

By Order of the Secretary of the Army:

CARL E. VUONO
General, United States Army
Chief of Staff

Official:

WILLIAM J. MEEHAN II
Brigadier General, United States Army
The Adjutant General

DISTRIBUTION:
To be distributed in accordance with DA Form 12-31, Operator's, Organizational, DS, and GS Maintenance requirements for All Rotor Wing Aircraft and All Fixed Wing Aircraft.

CHANGE
NO. 5

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 28 September 1985

Operator's, Organizational,
DS, and GS Maintenance Manual
Including Repair Parts and Special Tools List

BALANCING AND ADAPTER KITS
(MARVEL)

TM 55-4920-201-14, 20 May 1971, is changed as follows:

1. Remove and insert pages as indicated below. New or changed text material is indicated by a vertical bar in the margin. An illustration change is indicated by a miniature pointing hand.

Remove pages	Insert pages
1-1 and 1-2	1-1 and 1-2
A-1 and A-2	A-1 and A-2

2. Retain this sheet in front of manual for reference purposes.

By Order of the Secretary of the Army:

JOHN A. WICKHAM, JR.
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Section I
Introduction and Description

1-1. INTRODUCTIONS.

This technical manual contains operation and service instruction for propeller balancing and adapter kits, part numbers 7A050,7HEL053, AVSCOM kit AA4920-8503 and the related supplementary adapter kits and miscellaneous parts listed in table 1-1. Sections I through VII of this technical manual contain operation and maintenance instructions as prescribed by the maintenance allocation chart. Appendix A, References, contains a standard list of all publications applicable to this manual and available to operators and maintenance personnel. Appendix B contains the maintenance allocation chart. This chart assigns maintenance functions and repair operations to be performed at the applicable maintenance level.

Table 1-1. Marvel Kits and Parts Required for Balancing Propellers and Helicopter Rotating Components Covered in This Manual

KIT OR PART NO.	KIT AND PART NUMBER NOMENCLATURE	FEDERAL PART NO.
7A050	Kit, Propeller Balancing	4920-572-0987
7A052	Kit, Propeller Adapter	4920-679-9314
7A055	Kit, Propeller Spinner Balancing Adapter	4920-738-6788
7HEL051	Kit, Tail Rotor Balancing Adapter	4920-572-0986
7HEL052	Kit, Tail Rotor & Fan Balancing Adapter	4920-623-5955
7HEL053	Kit, Small Parts Balancing	4920-623-5956
7HEL054	Kit, Main Rotor Balancing Adapter	4920-623-5957
7HEL055	Kit, Fan Track & Concentricity Checking	4920-623-5958
7HEL056	Kit, Optical Trammeling	4920-623-5959
7HEL061	Kit, Main Rotor Balancing Adapter	4920-536-8214
7HEL065	Kit, Tail Rotor Balance Positioning	4920-937-9418
7HEL066	Kit, Main Rotor Hub Balancing Adapter	4920-924-5708
7HEL079	Kit, Main & Tail Rotor Balancing Adapter	4920-111-3063
7HEL354	Kit, Main Rotor Balancing Adapter	4920-738-6788
AA4920-8503	Kit, Tail Rotor Balance Positioning	4920-168-9797
2586	Plate, Squaring	4920-536-8217
2769	Tube, Assembly, 38” Length	4920-02l-7544
2792	Plate, Base	4920-902-5110
2793	Plate, Stand Adapter	4920-902-5106
2816	Adapter, Propeller Flange	4920-932-7697

1-2. FORMS AND RECORDS.

Maintenance forms, records, and reports which are to be used by maintenance personnel at all maintenance levels are listed in and prescribed by DA PAM 738-751.

1-3. REPORTING OF ERRORS.

Report of errors, omissions, and recommendations for improving this publication by the individual user is encouraged. Reports should be submitted on DA Form 2028 (Recommended Changes to

Publications) and forwarded directly to Commander, US Army Aviation Systems Command, ATTN: AMSAV-MMD, 4300 Goodfellow Blvd., St. Louis, MO 63120-1798.

1-4. GENERAL INFORMATION.

a. The part number 7A050 kit is shown in figure l-l with the work stand and hoist structure components erected in preparation for use. The balance indicating device (arbor assembly) is also in place, suspended from the hydraulic pump assembly. Normally, this work stand and hoist structure is utilized for most of the balance applications covered in this manual.

b. Figures 1-2 through 1-12 inclusive illustrate various, typical support and suspension applications of the 7A050 kit with, and without, supplementary adapter kit comporents. These illustrations are presented for general familiarization purposes only. Specific balance operation applications covering the propellers and helicopters rotating components are included through section IV with the accompanying technical procedures.

c. The part number 7HEL053 kit, small parts balancing, is shown in figure 1-18 and requires no assembly to prepare it for use. The kit includes an arbor assembly and adapters for use on small bore equipment that cannot be accommodated on the 7A050 balance arbor assembly.

d. The primary component of both the part number 7A050 balance kit and part number 7HEL053 balance kit is a horizontal suspension-type balance arbor assembly. Precisely balanced adapters and other components included in these and the supplementary adapter kits and miscellaneous parts are designed to control the installation of the various propeller and helicopter rotating components on the respective arbor assembly so that all mass is concentric.

Figure 1-1. Part No. 7A050 Balancing Kit Shown with Work Stand and Hoist Structure Erected in Preparation for Use.

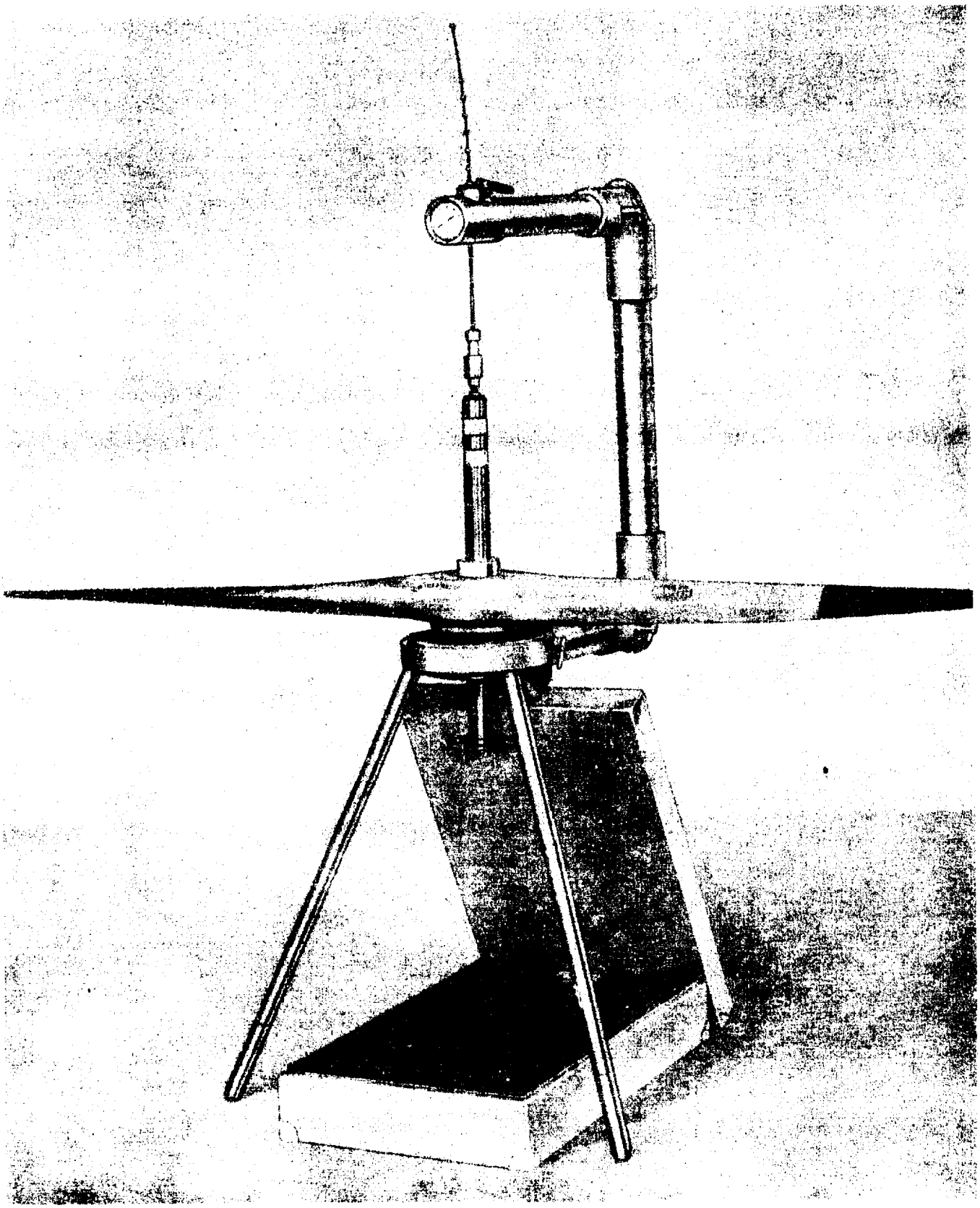


Figure 1-2. Typical Suspension - Fixed Pitch Flange-mounted Propeller Assembly.

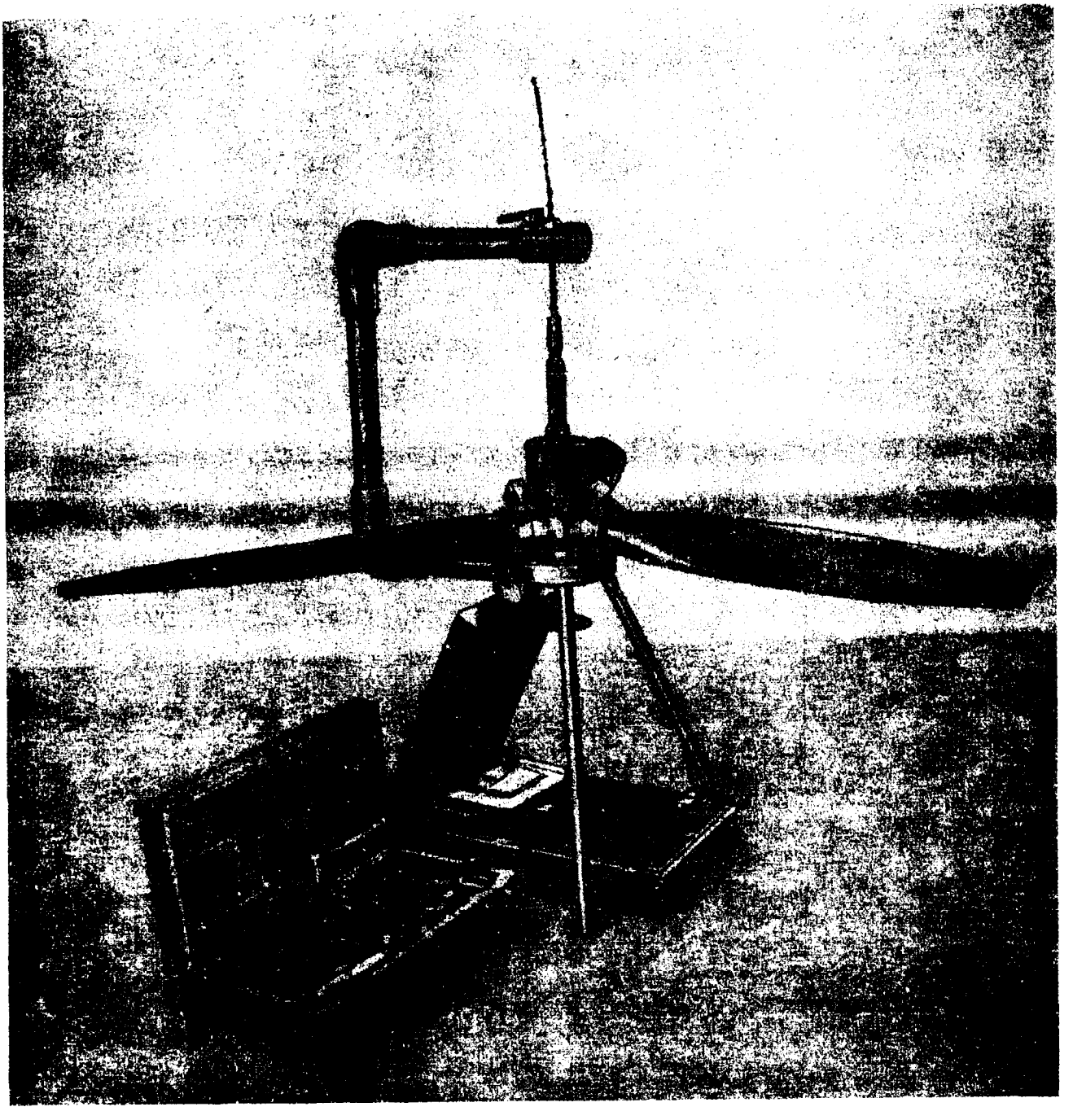


Figure 1-3. Typical Suspension -- Propeller Assembly Having the Shaft Nut Retained in the Hub (a Pitch Positioning Plate is also shown).

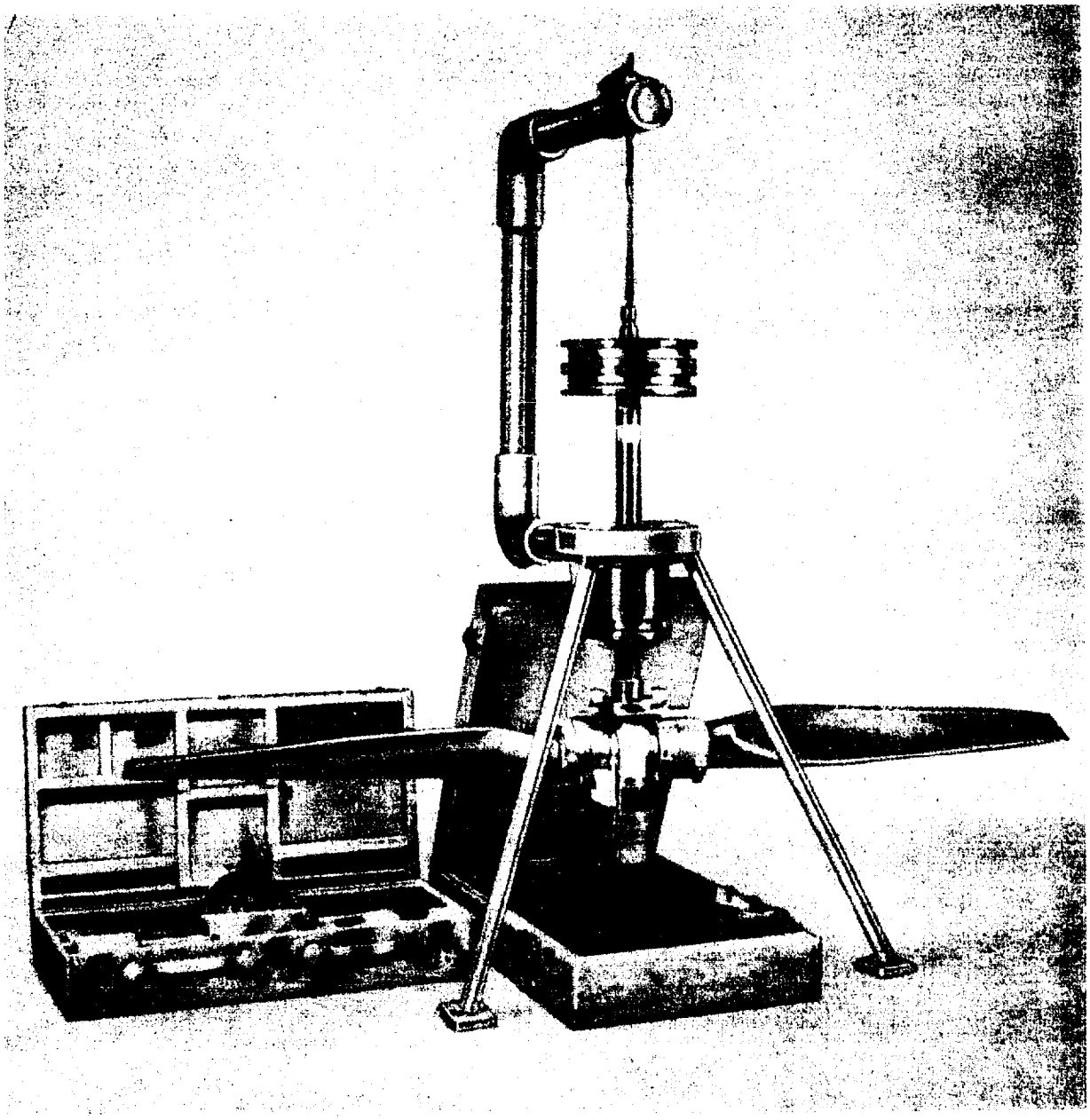


Figure 1-4. Typical Underslung Suspension - Flange-mounted Propeller Assembly Having no Center Hole for Installation of Balancing Arbor Through Propeller Bore.

Figure 1-5. Typical Balance Checking Arrangement - Helicopter Engine Fan Assembly.

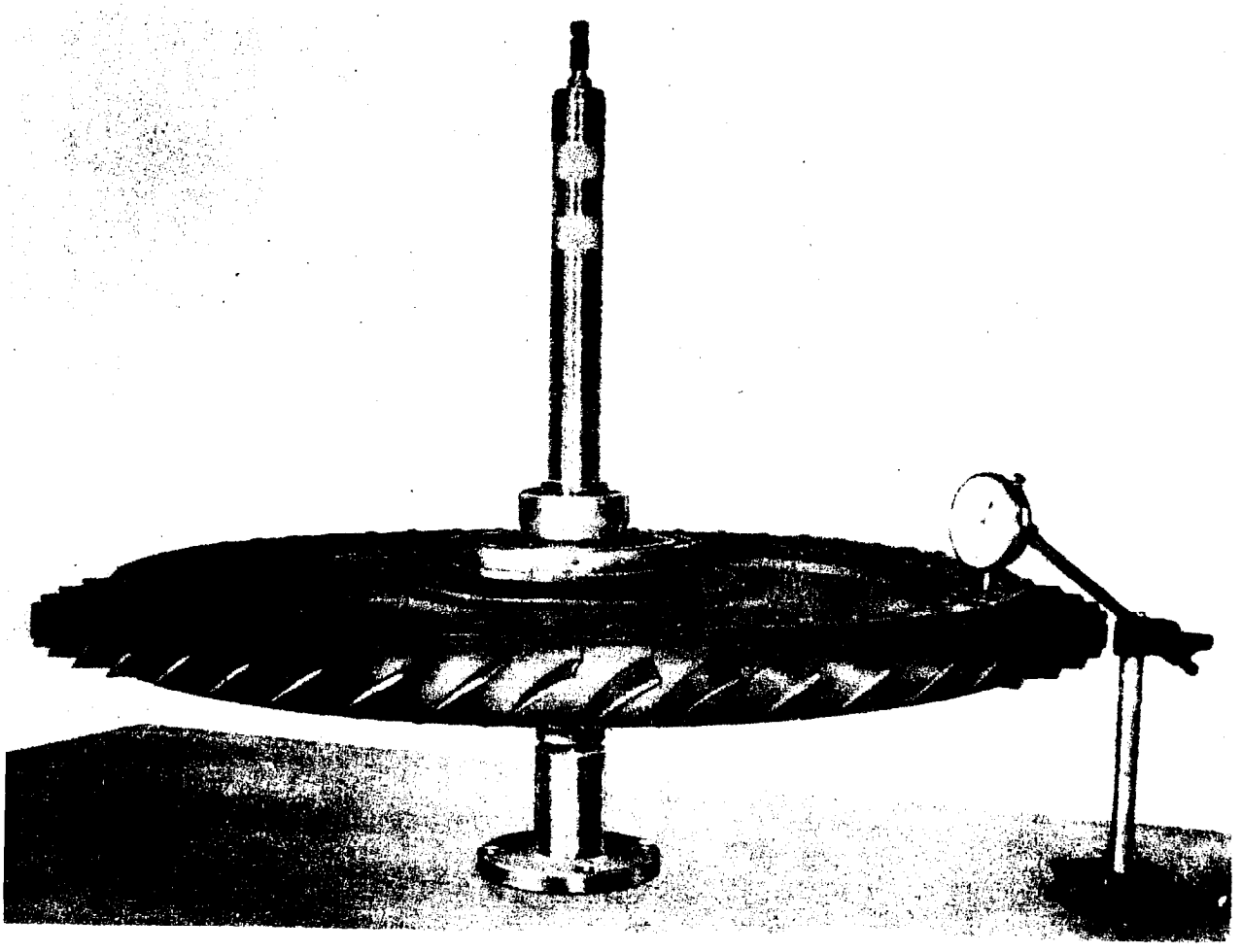


Figure 1-6. Typical Track and Concentricity Checking Arrangement - Helicopter Engine Fan Assembly.

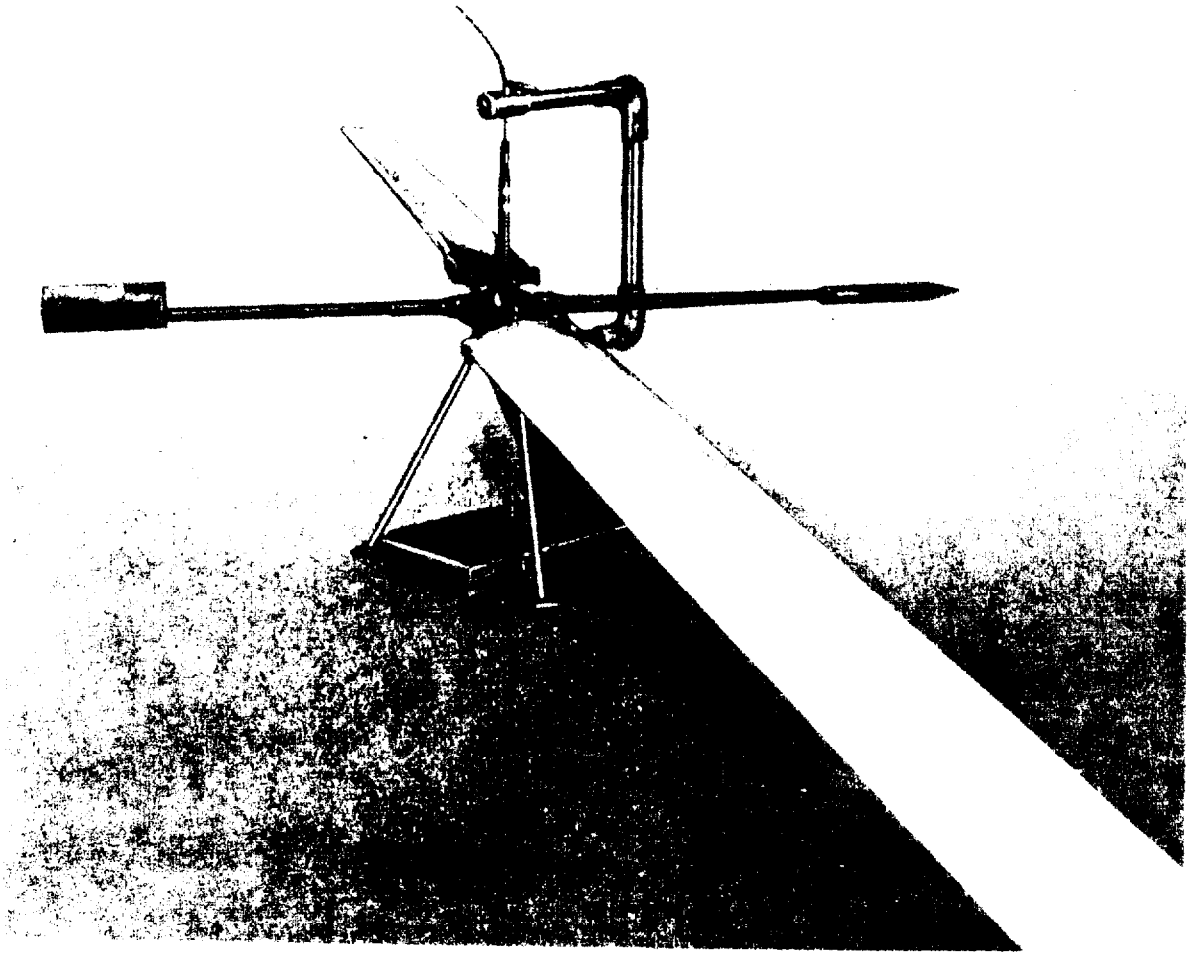


Figure 1-7. Typical Balance Checking Set-Up - Helicopter Main Rotor Assembly.

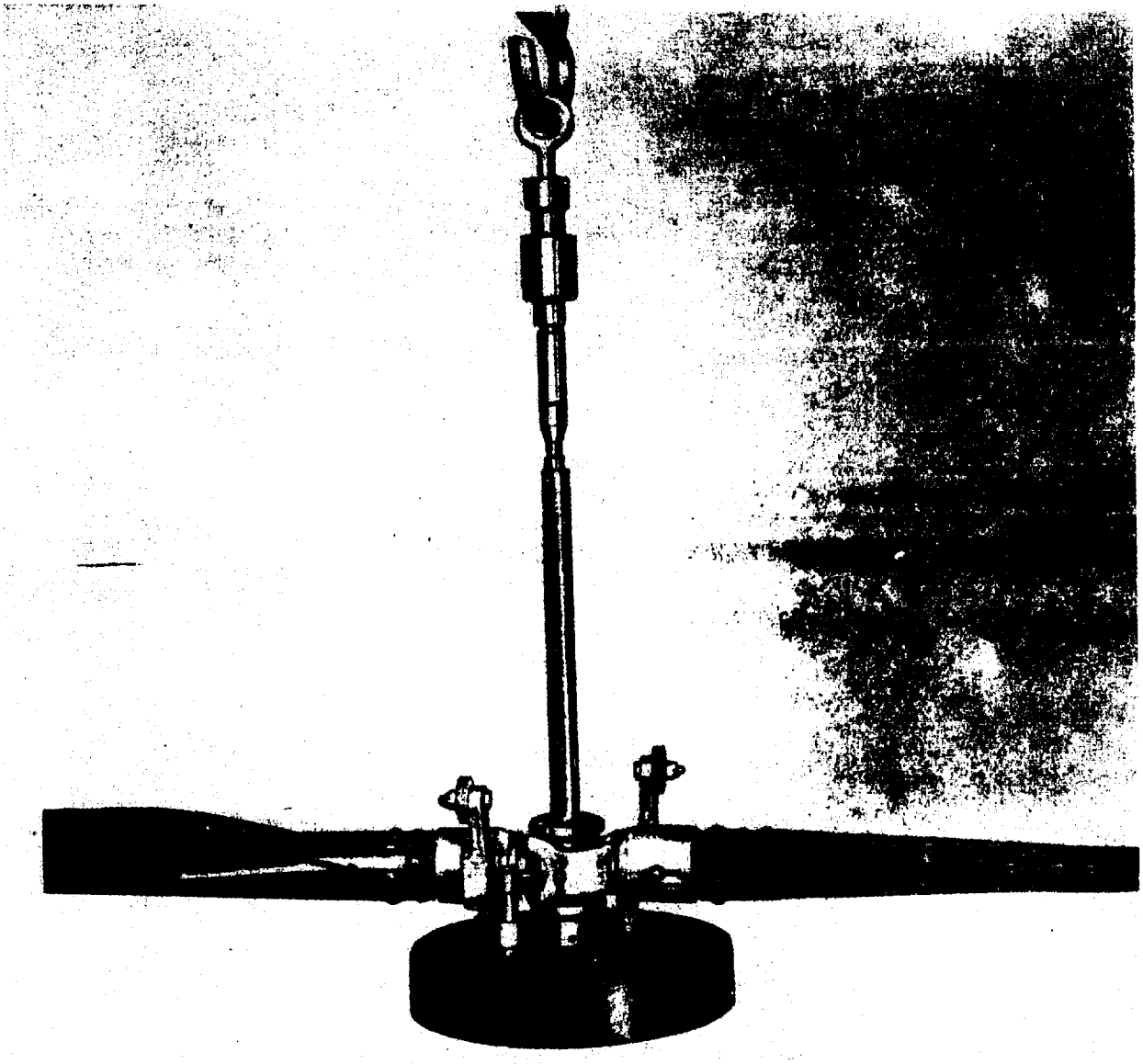


Figure 1-8. Typical Balance Checking Set-up - Two-bladed Helicopter Tail Rotor Assembly.

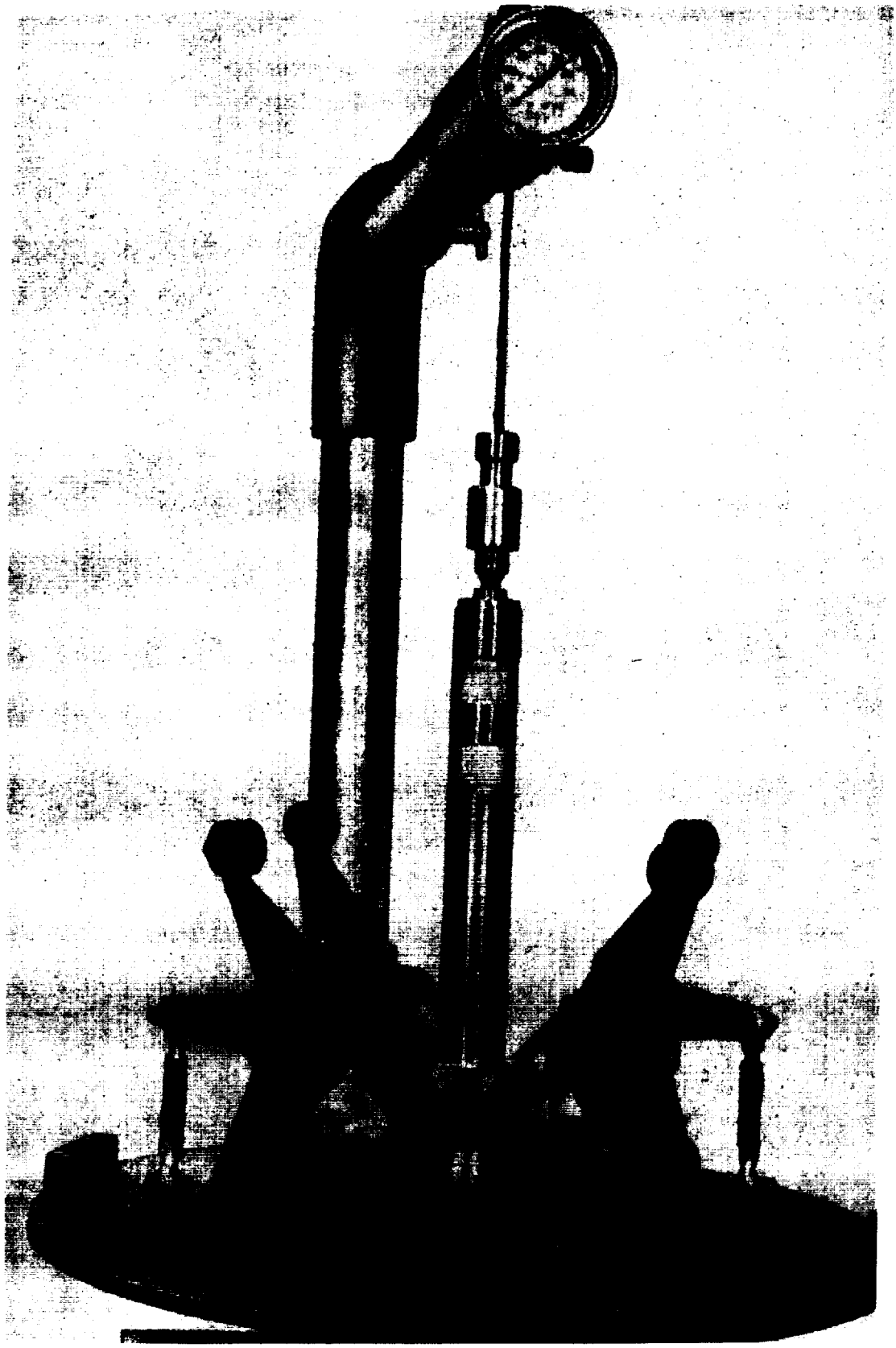


Figure 1-9. Typical Balance Checking Set-up - Helicopter Tail Rotor Counterweight Assembly.

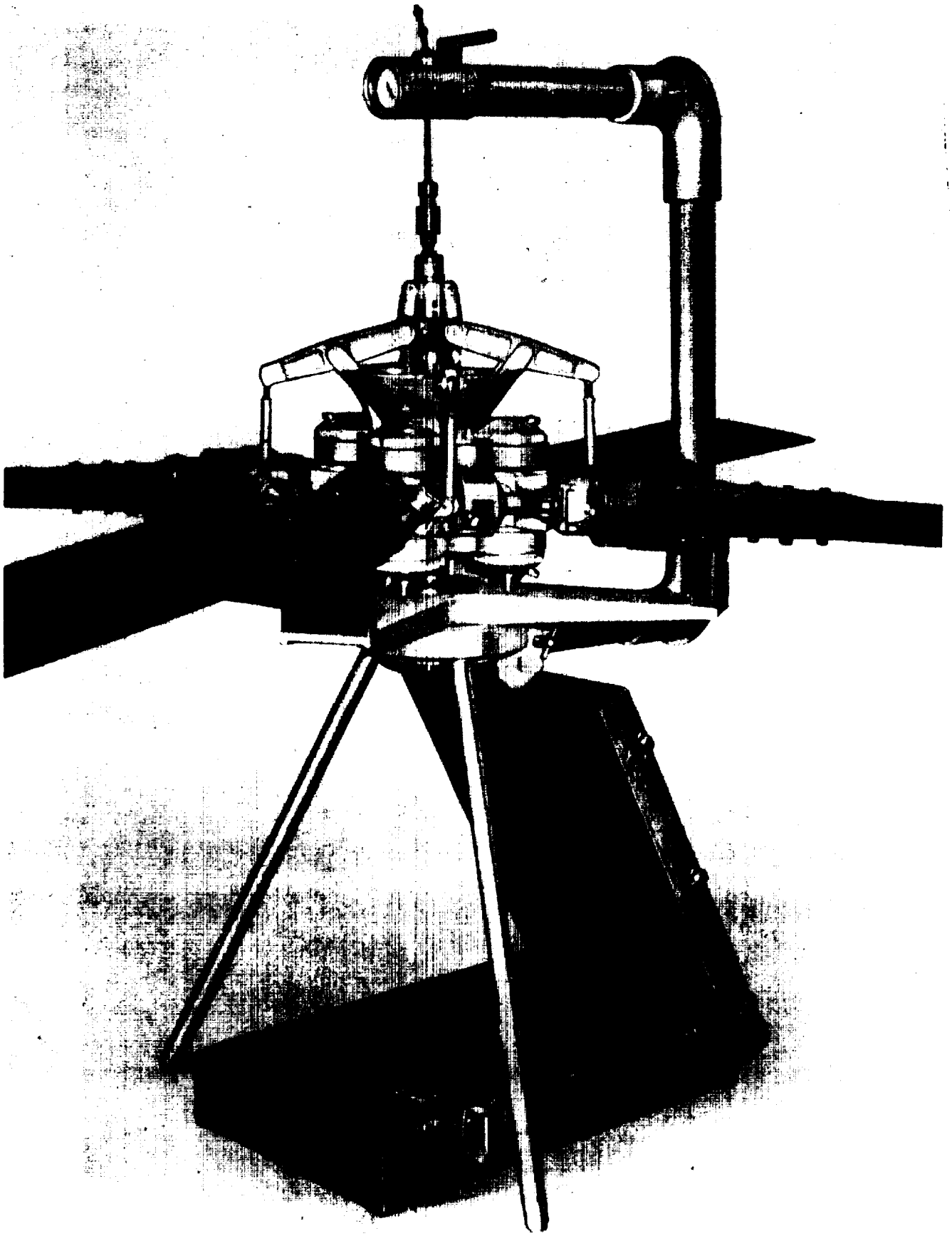


Figure 1-10. Typical Balance Checking Set-up - Four-bladed Helicopter Tail Rotor Assembly.

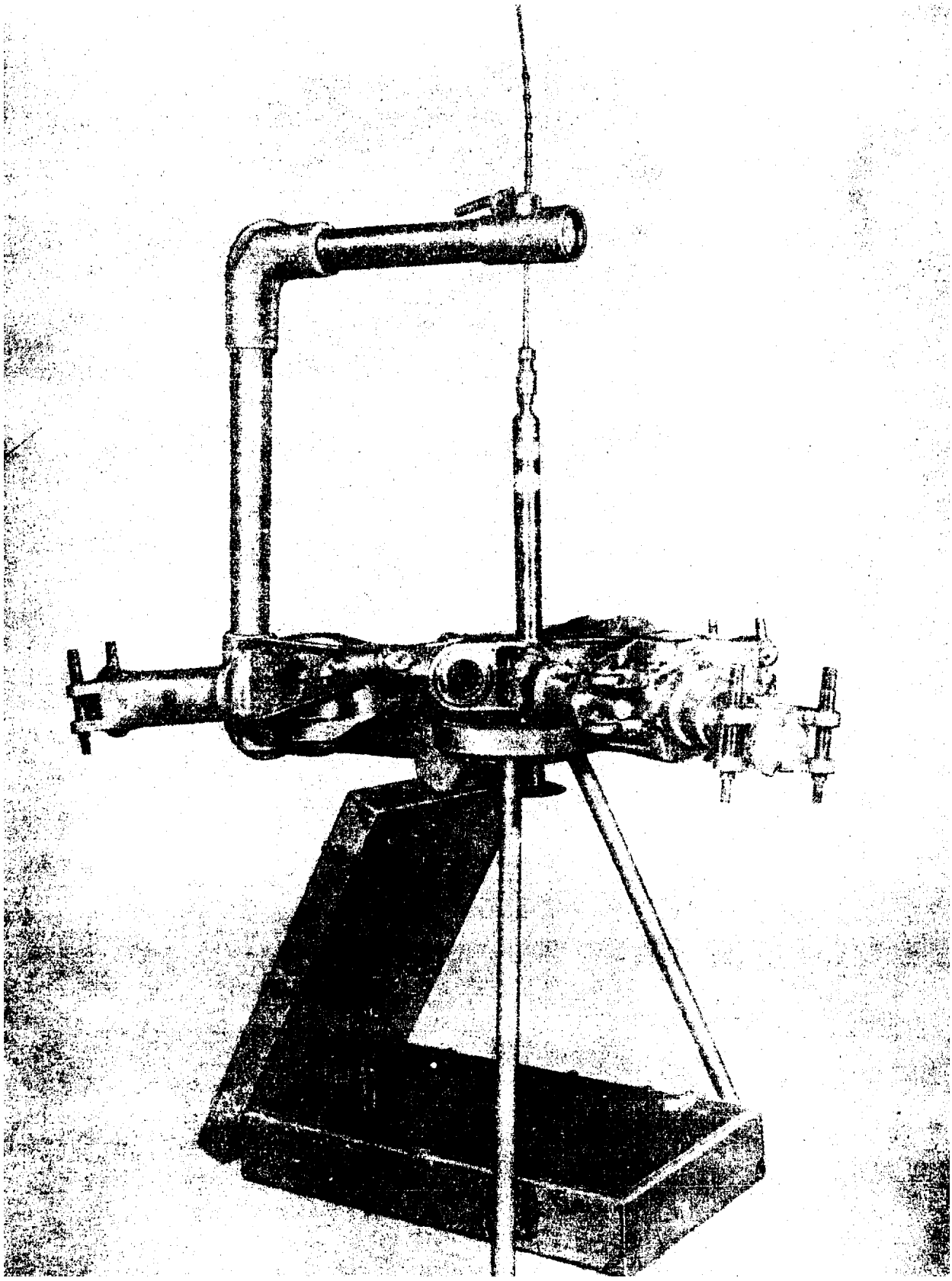


Figure 1-11. Typical Balance Checking Set-up - Helicopter Rotor Head Assembly.

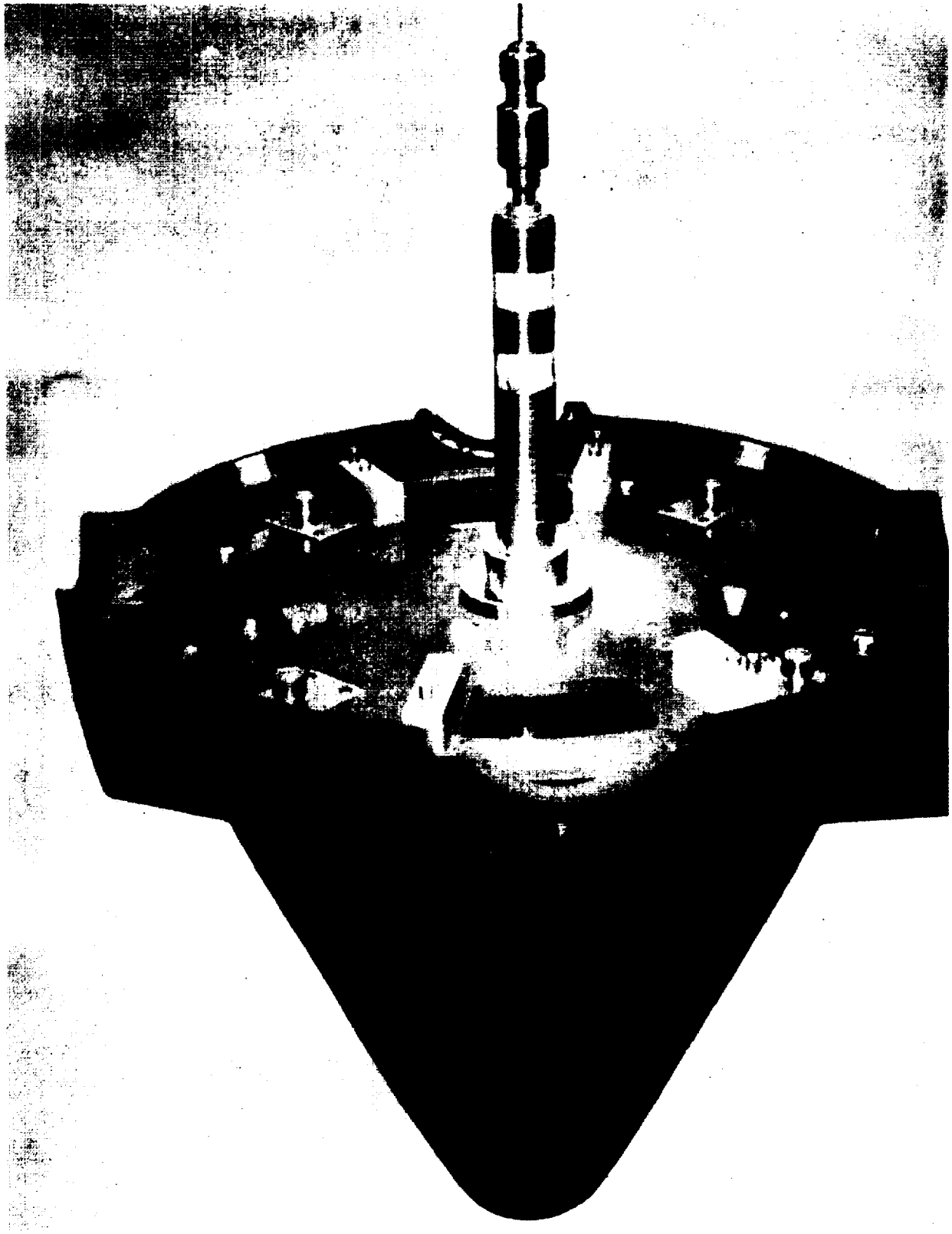


Figure 1-12. Typical Balance Checking Set-up - Propeller Spinner Assembly.

1.8 DESCRIPTION

1.9. PROPELLER BALANCING KIT 7A050. (See figure 1-13).

1- 10. (General. The parts comprising propeller balancing kit 7A050 are packed in a finished hardwood, portable storage and work support case. The case measures 7 x 20 x 30 inches and, when packed with all kit parts, weighs 130 pounds. The kit can be quickly assembled without any tools, and. for most applications. requires no supplemental shop facilities. It consists of work stand and hoist structure components (1). (2), (3), (4), (5), (6). (7). (9), (15), (28). and (29); a 3/16. inch suspension cable (13) and quick-disconnect coupling (10): a 1/16-inch suspension cable (14): altcrnate hoist eye assembly (12); supplementary coupling (11); balancing arbor (23); a handwheel assembly (26); spacers (20); and adapters (17). (18). (22). and (25) for the installation and balance testing of propellers of SAE 20 through SAE 50 spline size and for SAE flange type 1, 2, 3, and 4. A spline front bushing (21) also is provided for the installation and balance testing of propellers having a cylindrical insert in place of the 30-degree front seat. Recommended maximum load limit for suspension of assemblies to be balance checked is ,550 pounds. This limit provider a large safety factor for all kit components.

1-11. Work Stand and Hoist. (See figure 1-3). The work stand and hoist structure are comprised of demountable components for convenient storage in the 7A050 balancing kit storage case. When assembled. the two tubular legs, a circular stand casting. and the reinforced bottom half of the storage case form the work stand upon which the assemblies are prepared for balancing. The work stand has sufficient strength and rigidity for supporting the propeller and helicopter assemblies described in this handbook with a large safety factor. Thc overhead hoist structure eliminates a requirement for auxiliary shop hoists in most application of the balancing kit, and the offset support arm provides for freedom of movement in performing balancing operations and from interference with suspended loads. The upper arm of the hoist structure incorporates a hydraulic pump assembly which providcs for precisely controlled suspension of assemblies to be balance checked.

(12.) Hydraulic Pump Assembly (15, figure 1-13). The hydraulic, pump assembly contains a manually-operated pressure pump and integral hydraulic ram deigned for .cable suspension of ads. through the hollow center of the ram piston. Ram cylinder pressure is continuously indicated by a load indicating gage, which calibrated in pounds of weight actually suspended from the ram piston. Engraved lines on the dial window indicate load limits for the 7A050 balancing kit's 1/16. inch and 3/16-inch suspension cables. The integral hydraulic fluid reservoir provides for years of normal service without refilling. A pump valve provides for hypassing ram pressure to the fluid reservoir at closely controllable rates so that lowering of the hydraulic ram may be done quickly or slowly as desired. A movable lifting plate on top of the ram piston provides for engaging any one of the suspension cable balls.

1-13. Suspension Cables and Quick-disconnect Coupling Assemblies.. (See figure 1-13). The 3/16-inch suspension cable (13), normally assembled to the quick-disconnect coupling (10), incorporates a series of swaged balls, any one of which may be engaged by the lifting plate of the hydraulic pump assembly. Choice of ball engagements provides an effective selection of cable lengths to accommodate the suspension of various balancing assemblies. A second, shorter cable, incorporating an alternate hoist eye assembly (12) and "quickie" coupling (11), may be quickly coupled to the end of the first cable for use with regular shop hoists if desired. A third suspension cable (14) similar to the first but having a diameter of 1/16 inch, is provided for use with extremely light loads if desired. Its terminal fitting provides for assembly in quick-disconnect coupling (10) in place of the 3/16-inch cable. The quick-disconnect coupling provides for instantaneous engagement and disengagement 'with the suspension rod of the balancing arbor. The coupling is so designed that, while normal no-load coupling and uncoupling are accomplished easily with one hand, it cannot be disengaged under load.

1-14. Balancing Arbor (23), figure 1-13). The balancing arbor, upon which an assembly to be balance checked is mounted, is of the horizontal suspension type and features. high sensitivity and accuracy. The arbor is so designed that there are no internal wearing surfaces; consequently, there is no frictional resistance or requirement for internal inspection, reconditioning, or parts replacement. An integral fail-safe feature effectively prevents dropping of a suspended load in case of internal suspension failure. External load-bearing and piloting surfaces of the arbor are nitrided. The bottom end of the arbor is internally threaded to receive a hand wheel assembly which supports arbor loads and provides for clamping adapters and balance loads securely in position. The top end of the arbor suspension rod is machined for engagement with the quick-disconnect coupling. A

fluid reservior in the balancing arbor, filled with nil, provides a dash-pot for dam ping out excessive oscillation of the sensitive balance indication. Oil fill and drain holes are sealed by two screws on opposite sides of the arbor near the upper end. Degree of oscillation damping may be regulated by raising or lowering the dash-pot oil level or by using oil of higher or lower viscosity.

1-15. Adapter Cones and Bushings. (See figure 1-13.) Precise piloting of assemblies to be balance checked to insure that their axis of rotation coincides with the center-line of the balancing arbor. is accomplishcd by adapter cones an bushings. These components provide [redacted] fits on the balancing arbor and ve[redacted] centricity and squareness between arbor an propeller mounting surfaces. They are of high-allo steel. heat treated to a high degree of har[redacted] preclude wear of piloting surfaces, an[redacted] plated on nonpiloting surfaces to mini[redacted] possibility of corrosion. Setscrews are provided for locking cones and bushings in position on th balancing arbor when desired.

Key to figure 1-13:

1. Stand table assembly (2291)
2. Tube (2288) long, 2-7/8-inch diameter, with legs (28) (P/N 2364) stored inside tube
3. Pin-hoist support (2285)
4. Elbow (2284-1)
5. Elbow (2284-2)
6. Stand leg extensions (2365)
7. Stub leg (2366)
8. 1/8-Inch hex wrench
9. Tube (2287) 2-7/8-inch dia. Normally stored inside tube (29) (part no. 2286) 3-inch dia.
10. Quick-disconnect coupling (2266)
11. "Quickie" Coupling (2260-1)
12. Alternate hoist eye assembly (2261)
13. 3/16-Inch suspension cable (2264)
14. 1/16-Inch suspension cable (2262)
15. Hydraulic pump assembly (2282)
16. Storage. carrying. and work support case (2272)
17. SAE 20, 30, 40, 50 and 51 spline rear cones (2223. 2205, 2207, and 2228)
18. Flange type 1, 2, 3, and 4 rear bushing (2210)
IO. Work stand stub leg support
20. Spacers (2201, 2202, 2203 and 2204)
21. SAE 20 spline front bushing (2211)
22. SAE 20, 30, 40, 50 and 51 spline front cones (2224, 2206. 2208. and 2227)
23. Balancing arbor (2259)
24. Packing layout
25. Flanged type 1,2,3, and 4 front plate (2209)
26. Hand wheel (2215)
27. Safety spring arbor retaining
28. Stand leg assemblie (2364)
29. Tube (2286) 3-inch dia.

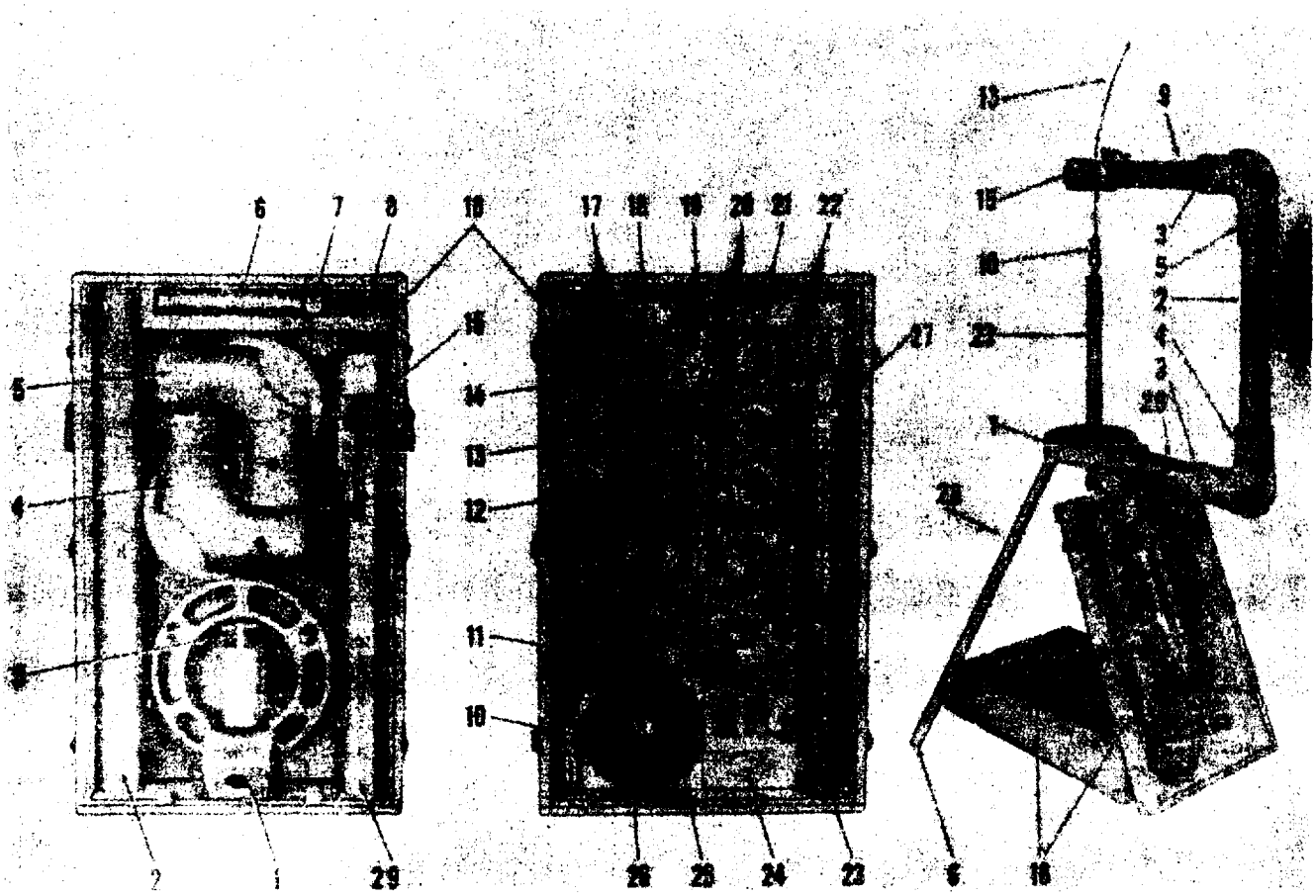


Figure 1-13. 7A050 Kit Components and Assembly.

1-16. PROPELLER ADAPTER KIT 7A052. (See figure 1-4.)

1-17. The adapters comprising propeller hardwood, portable storage case. The case measures approximately 20½ x 15 x 7½ inches and, when packed with all adapters, weighs approximately 146 pounds. Kit adapter components are of high alloy steel, heat treated to a high degree of hardness, to insure virtually unlimited service life. Piloting fits are controlled to very close tolerances and are superfinished to within a few micro-inches. Nonpiloting surfaces are chrome plated for protection against corrosion. The 7A052 adapter kit extends the utility of propeller balancing kit 7A050 by making possible balance checking of the following additional types of assemblies.

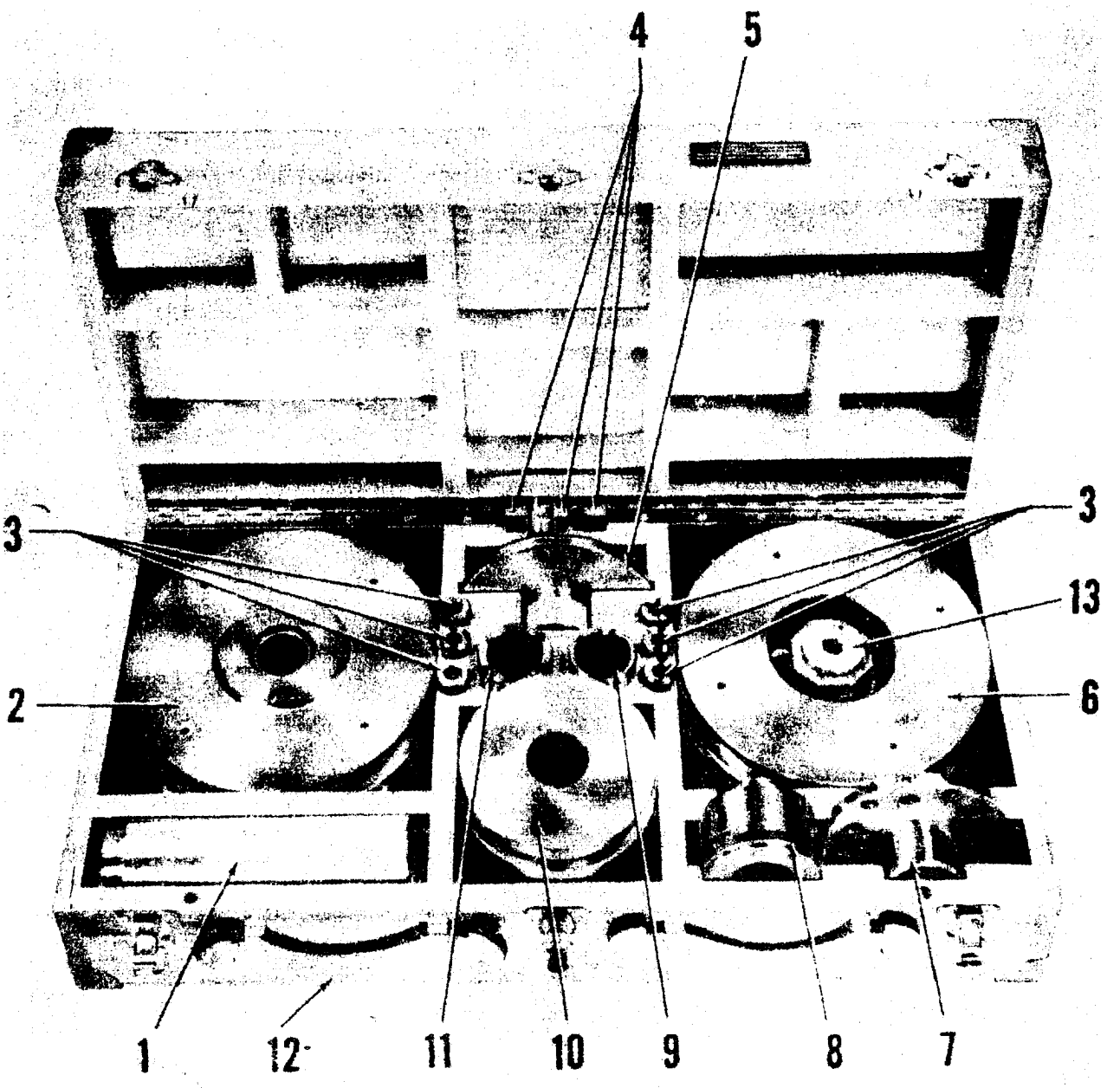
a. Flange-mounted propeller assemblies having no center hole through the hub for installation of the balancing arbor.

b. Single-cone, SAE no. 20 and no. 30 splined hub propeller assemblies with shaft nuts enclosed in the hub.

c. Balancing of double-cone, SAE no. 50 splined hub propeller assemblies with shaft nuts and front cones enclosed in hub.

d. Special propeller assembly configurations, such as propeller assemblies with dome or cylinder-counterweight assemblies.

e. Flange-mounted propellers of the reversing type.



1. Installing tool (2452)
2. Weight assembly (2432)
3. Dowel bushing (2451)
4. Blade positioning wedges (2247)
5. Link arm plate assembly (2455)
6. Counterweight (2450)
7. Flange adapter (2433)
8. SAE 50 spline adapter (2459)
9. SAE 20 spline adapter (2453)
10. Weight (2434)
11. SAE 30 spline adapter (2454)
12. Kit case (2476)
13. Plug-screw (2435)

Figure 1-14. Propeller Adapter Kit 7A052.

1-18. PROPELLER SPINNER ADAPTER KIT 7A055. (See figure 1-15).

This kit consists of balancing adapter components for use with the 7A050 kit in balancing components of the model 53C51 spinner assemblies. The 7A055 kit is supplied in a finished hardwood case measuring approximately 18 x 23 x 4½ inches and the complete kit weighs approximately 40 pounds.

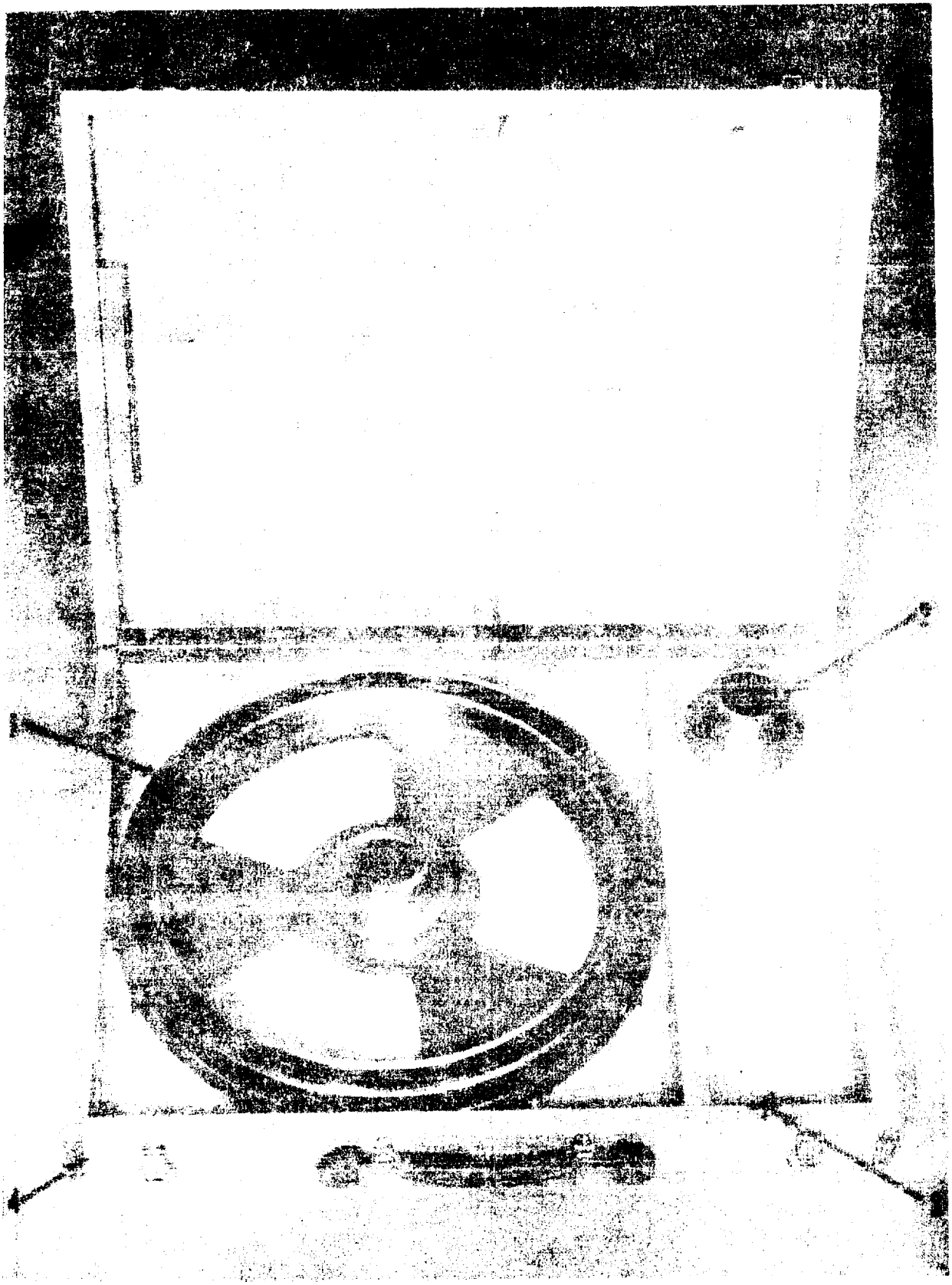


Figure 1-15. Propeller Spinner Balancing Adapter Kit 7A055.

Key to figure 1-15:
1. Adapter assembly (2753)
2. Adapter (2582)
3. Wrench (1/8hex)
4. Case (2754)

1-19. TAIL ROTOR BALANCING KIT 7HEL051. (See figure 1-16).

This kit contains adapters for use with the 7A050 kit to enable balance checking of CH-34 helicopter tail rotor hub and blade assembly and tail rotor counterweight assembly. The kit storage case measures approximately 23¾ x 23¾ x 2¾ inches and, complete with all kit components, weighs approximately 34 pounds.

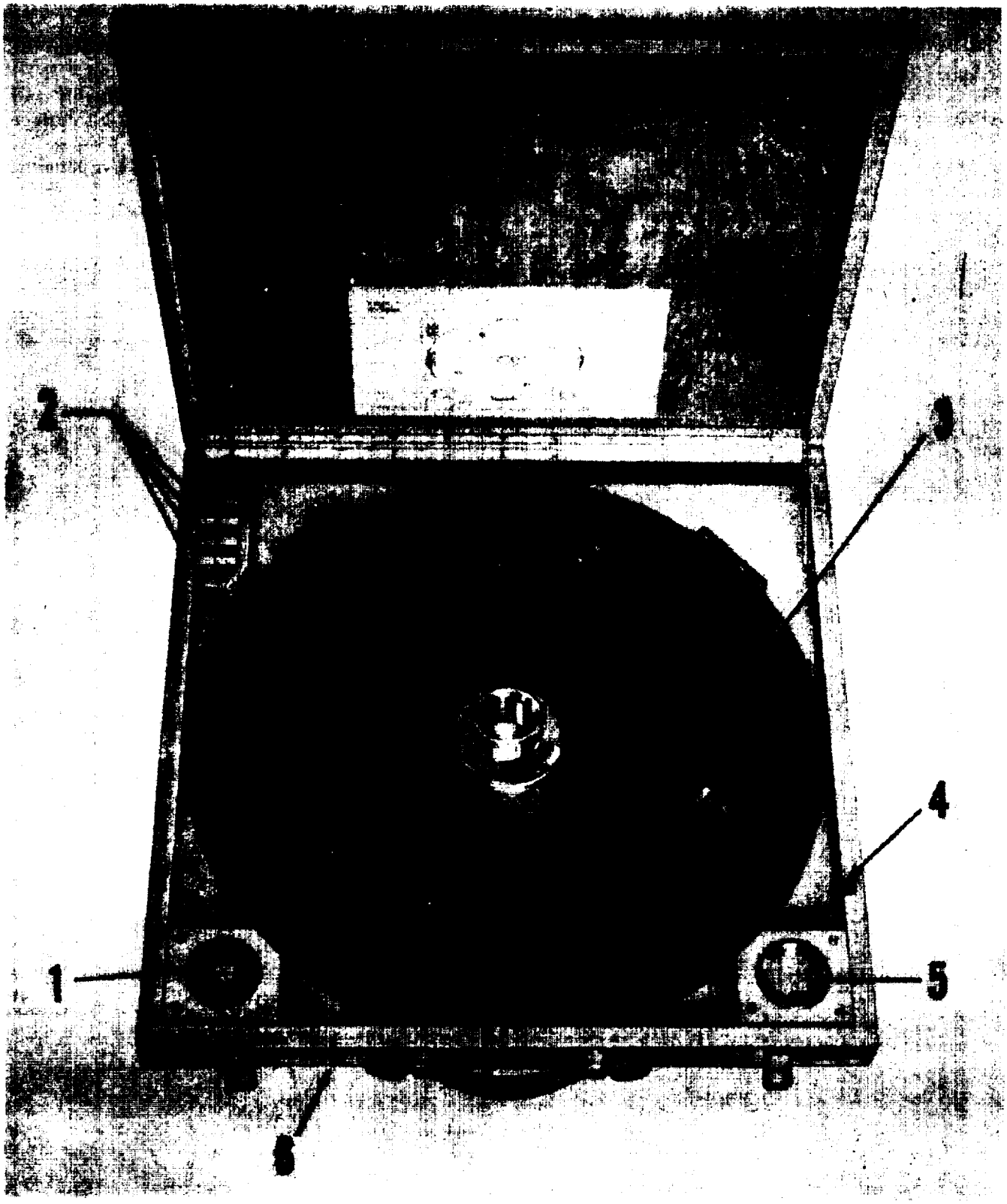


Figure 1-16. Tail Rotor Balancing Kit 7HEL051.

Key to figure 1-16:
1. Pilot bushing (2242)
2. Blade positioning wedge (2247)
3. Adapter assembly (2238)
4. 1/8-Inch hex wrench
5. Counterweight support spacer (2246)
6. Kit carrying and storage case (2248)

1-20. TAIL ROTOR AND FAN BALANCING KIT 7HEL052. (See figure 1-7).

Components of this kit include adapters for use with the 7A050 kit to enable balance checking of CH-37 helicopter tail rotors and engine fans, for use with 7A050 and 7HEL055 kits to enable track and concentricity checking of CH-37 helicopter engine fans, and for use with 7A050 and 7HEL056 kits to enable optical trammeling of CH-37 helicopter tail rotors. The kit storage case measures approximately 31 x 31 x 7¾ inches and, complete with parts, weighs approximately 88 pounds.

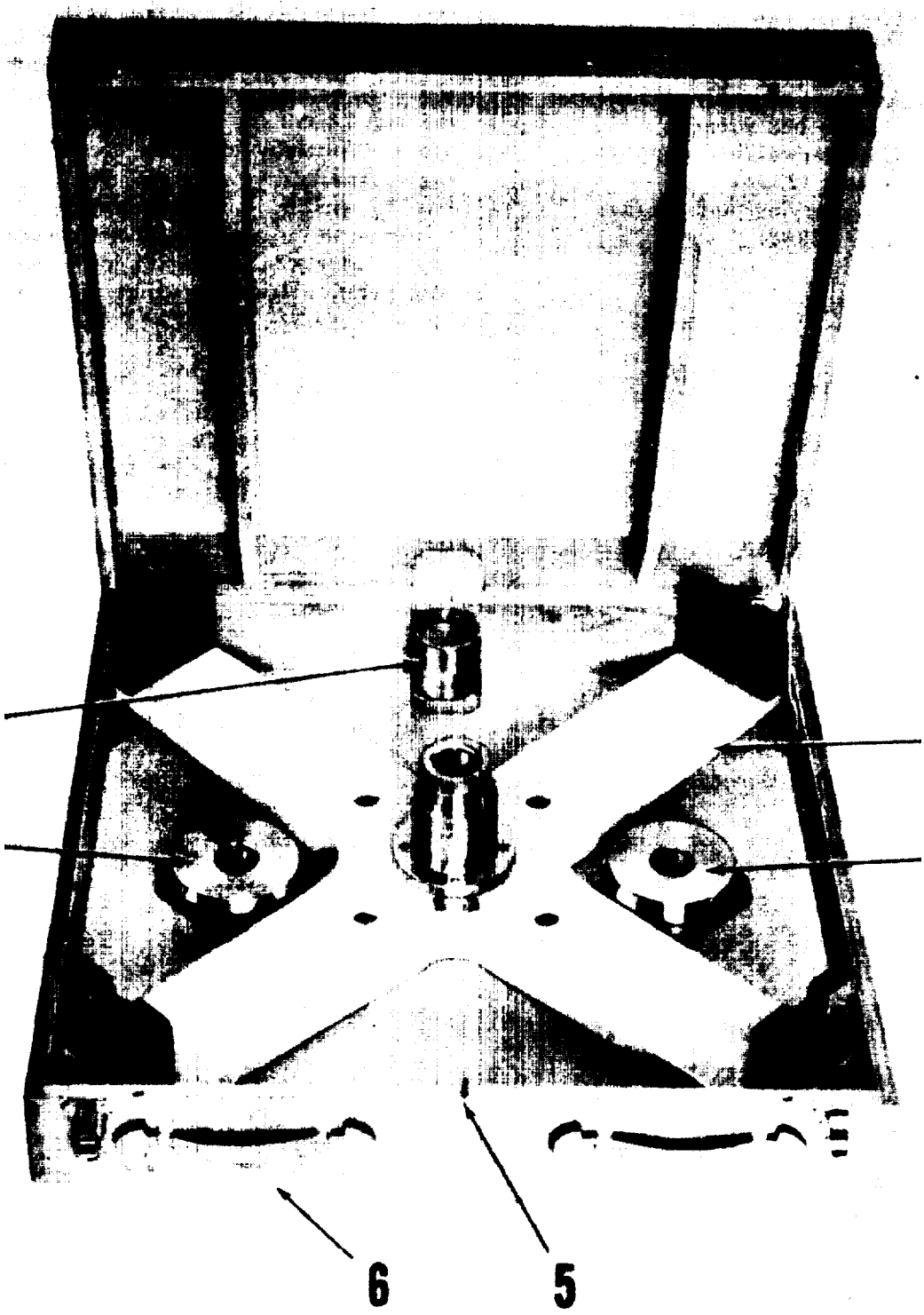


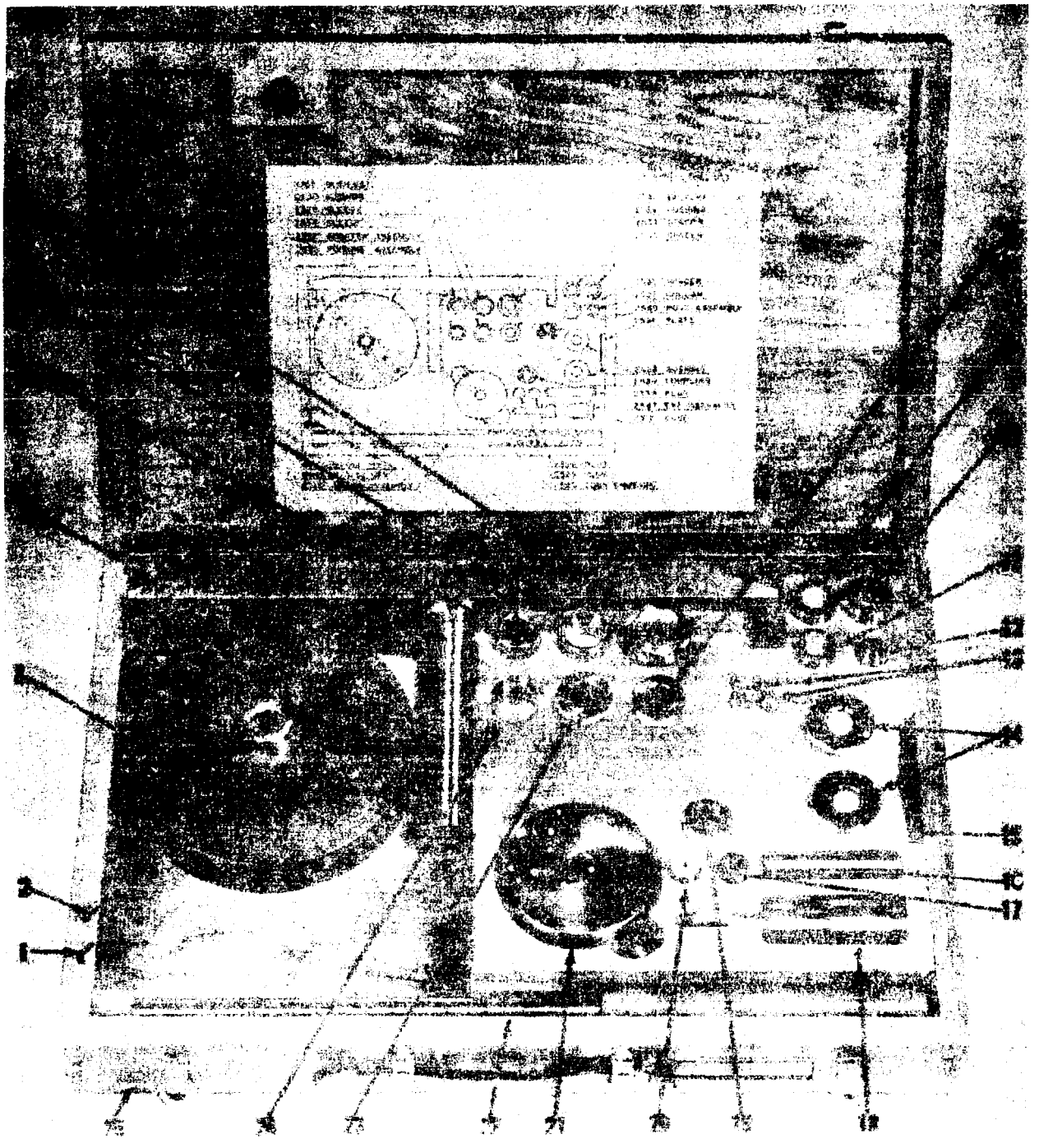
Figure 1-17. Tail Rotor and Fan Balancing Kit 7HEL052.

Key to figure 1-17:

1. SAE 60 Spline front cone (2296)
2. Vertical spacer sleeve (2398)
3. Fixture assembly (2319)
4. SAE 60 spline rear cone (2297)
5. ½-Inch hex wrench
6. Kit storage case (2386)

1-21. SMALL PARTS BALANCING KIT 7HEL053. (See figure 1-18).

Components of this kit are used for a multitude of applications and its primary component is a small balancing arbor for use on helicopter assemblies having center bores too small for mounting on the 7A050 kit balancing arbor. Numerous adapters in this kit and the small balancing arbor enables the balance checking of OH-13 and UH-1 helicopter tail rotors, UH-19 helicopter tail rotors, OH-23 helicopter tail rotors and tail rotor hubs, and OH-13 and OH-23 helicopter engine fans. Used with 7HEL055 kit, the 7HEL053 kit enables the track and concentricity checking of OH-13 and OH-23 helicopter engine fans. Quick-disconnect coupling provisions for the small balancing arbor are interchangeable with similar provisions in the 7A050 kit suspension system. Consequently, the 7HEL053 kit may be used in conjunction with the 7A050 kit work stand and hoist assembly. Maximum load limit for the small balancing arbor is 100 pounds. The kit storage case measures approximately 23 x 15 x 4 inches and, complete with kit components, weighs approximately 38 pounds.

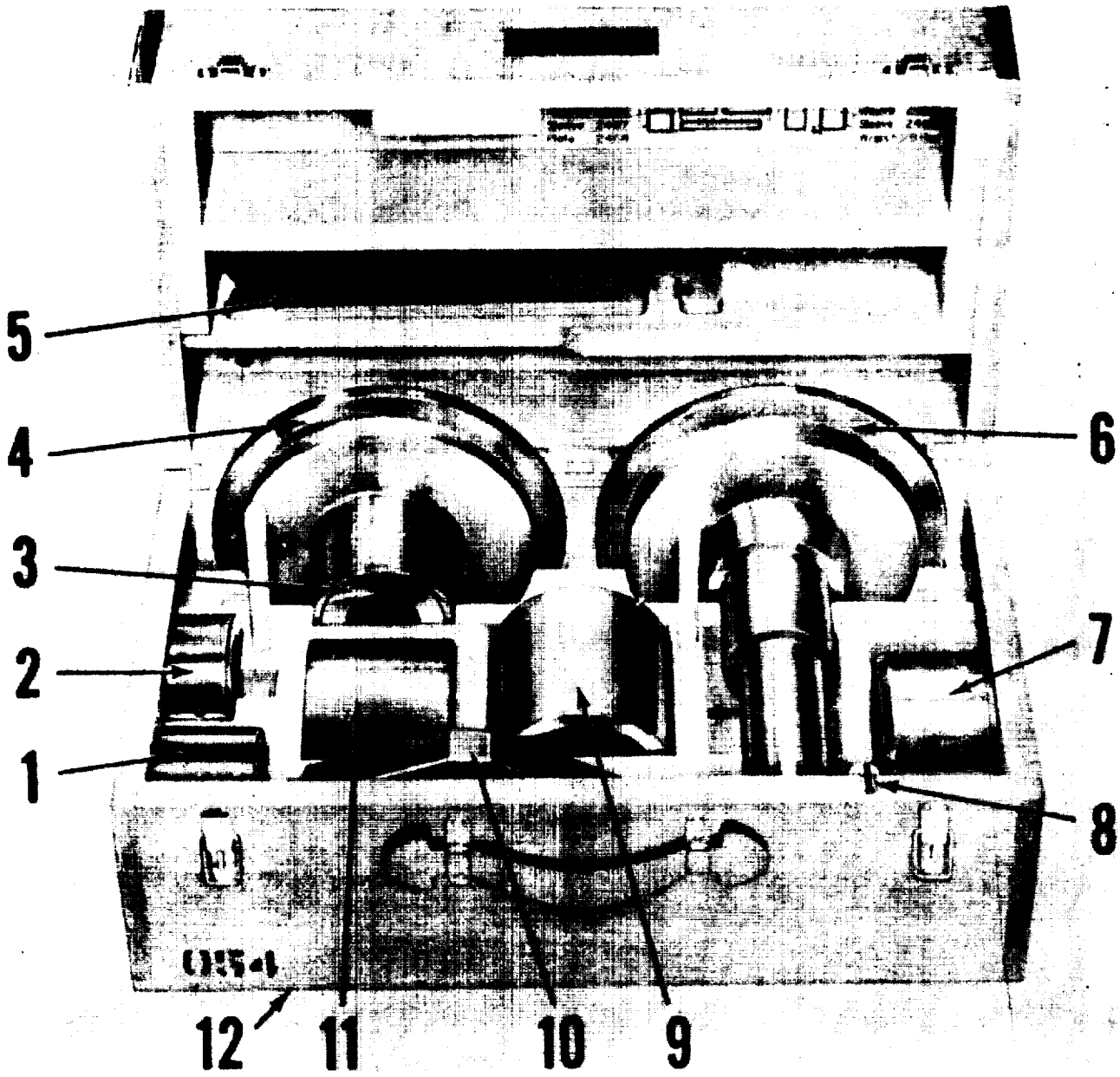


1. 1 / 16-Inch hex Wrench
2. 3 / 32-Inch hex Wrench
3. Fixture (2532)
4. Adapter assy. (2522)
5. Sleeve (2329)
6. Bushing (2355)
7. Bushing (2533)
8. Bushing (2529)
9. Spacer (2534)
10. Spacer (2535)
11. Spacer (2536)
12. Collar (2527)
13. Post assy. (2539) (2)
14. Bushing (2528) (2)
15. Plate (2531)
16. Plug (2338)
17. Plug (2526)
18. Eye assy. (2387)
19. Coupling (2524)
20. Plug (2525)
21. Counterweight (2523)
22. Arbor assy. (2516)
23. Bushing (2530)
24. Sleeve (2356)
25. Case assy. (2512)

Figure 1-18. Small Parts Balancing Kit 7HEL053.

1-22. **MAIN ROTOR BALANCING KIT 7HEL054.** (See figure 1-19).

Adapters are included in this kit to be used with the 7A050 kit components to provide for the balance checking of OH-13. UH-1, and OH-23 helicopter main rotor hubs (with blades or without blades) and UH-1B and UH-1C helicopter rotor hub assemblies. The kit storage case measures approximately 11½ x 21¼; x 10 inches and, complete with kit components, weighs approximately 100 pounds.



1. Sleeve (2467)
2. Adapter (2373)
3. Bushing (2463)
4. Plug (2250)
5. Strut gage (2489)
6. Fixture (2337)
7. Sleeve (2465)
8. 1/8-Inch hex wrench
9. Sleeve (2464)
10. Plate (2468)
11. Adapter (2466)
12. Kit carrying and storage case (24881

Figure 1-19. Main Rotor Balancing Kit 7HEL054.

1-23. FAN TRACK AND CONCENTRICITY CHECKING KIT 7HEL055. (See figure 1-20.)

The kit storage case measures approximately 9 x 15 x 7½ inches and complete with kit components, weighs approximately 28 pounds. An indicator assembly and applicable adapters are provided in this kit for use with the following kits listed in the left hand column to check the track and concentricity of corresponding aircraft engine fans listed in the right hand column:

Kit	Aircraft Engine Fan
7A050	UH-19, CH-34
*7A050, 7HEL052	CH 37
*7HEL053	OH-13, OH-23
7A050	UH-19

*Dial Indicator, FSN 5210-277-8840, which is in the shop sets, may be used in lieu of 7HEL055 kit.

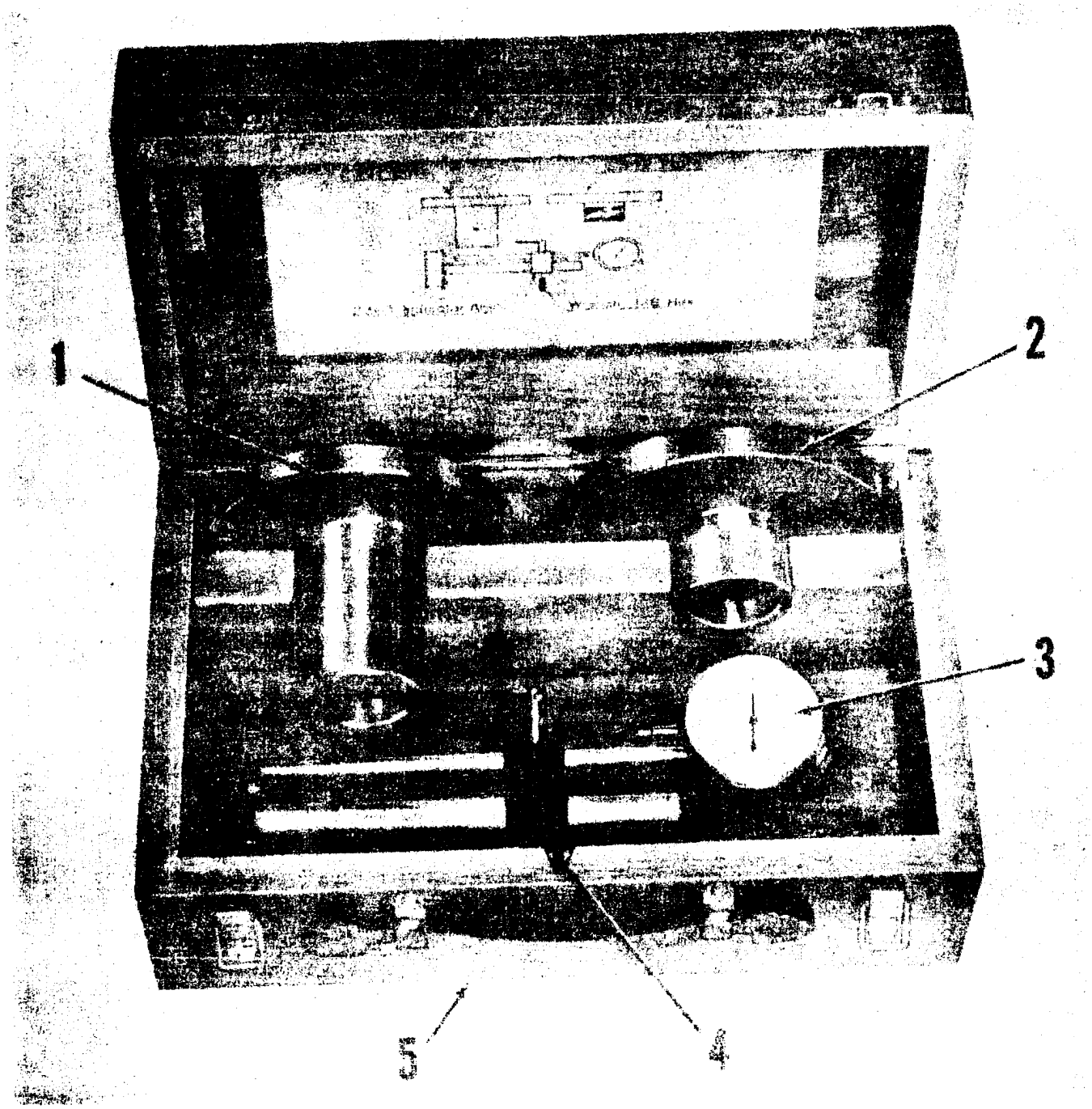


Figure. 1-20. Fan Track and Concentricity Checking Kit 7HEL055.

Key to figure 1-20:
1. Base (2341)
2. Adapter (2342)
3. Indicator (2363)
4. 1/8-Inch hex wrench
5. Case assembly (2395)

1-24. OPTICAL TRAMMELING KIT 7HEL056. (See figure 1-21).

Components of this kit include adapters scopes, scope support, and aligning target for use with the 7A050 and 7HEL052 kits to enable optical trammeling of CH-37 helicopter tail rotors. The kit storage case measures approximately 20 x 19 x 7 inches and, complete with kit compenents, weighs approximately 49 pounds.

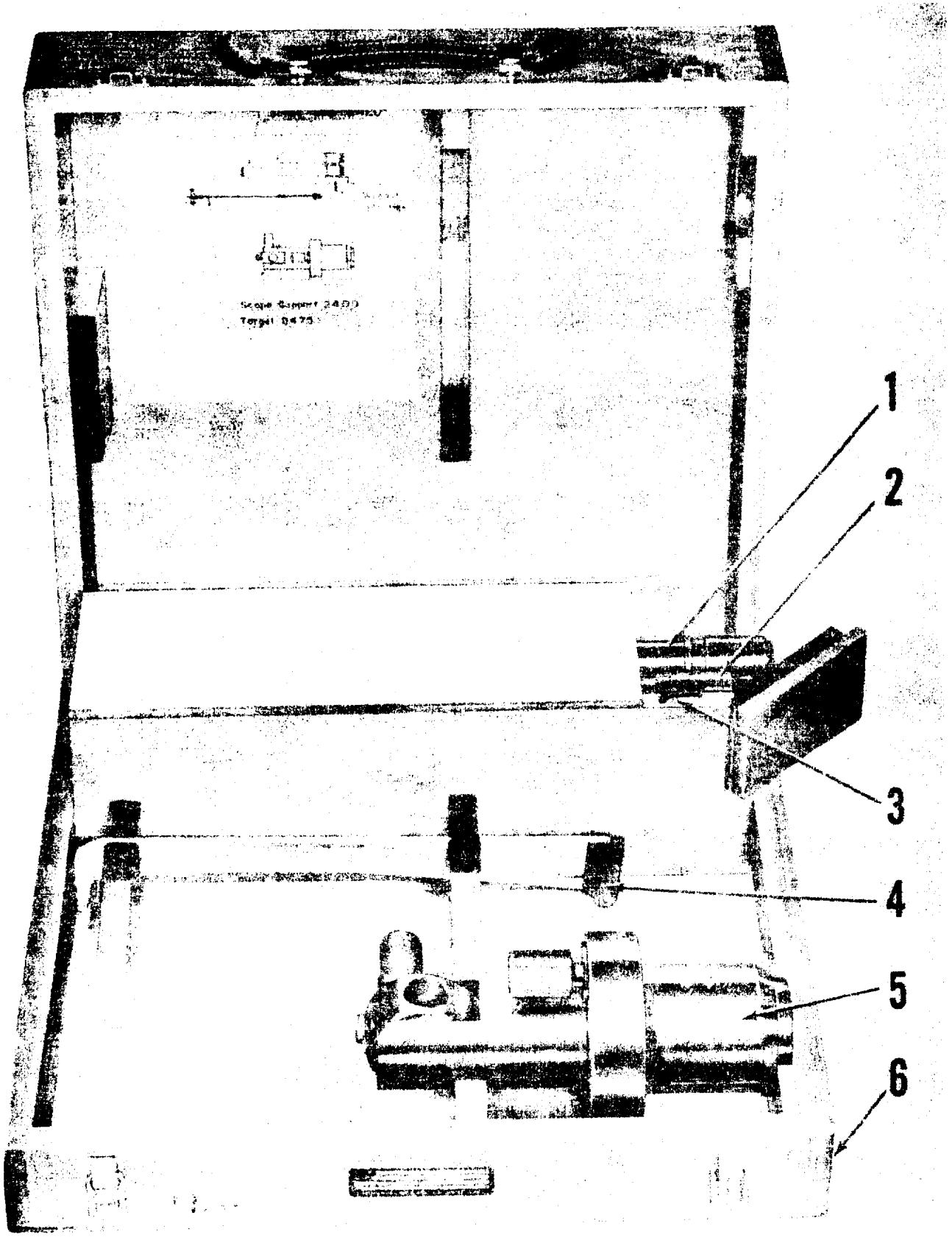


Figure 1-21. Optical Trammeling Kit 7HEL056.

Key to figure 1-2:
1. Short scope (2420)
2. Long scope (2421)
3. 3/16-Inch hex wrench
4. Target assembly (2475)
5. Scope support assembly (2400)
6. Kit carrying and storage case (2415)

1-25. MAIN ROTOR (MODEL 204) BALANCING ADAPTER KIT 7HEL061. (See figure 1-22).

This kit supplements the 7HEL054 kit to provide applicable adapter components for use with the 7A050 kit to balance UH-1A, B, D, F and H helicopter main rotor assemblies. The finished hardwood case for this kit measures approximately 17¾ x 10 X 4½ inches and the complete kit weighs approximately 32 pounds.

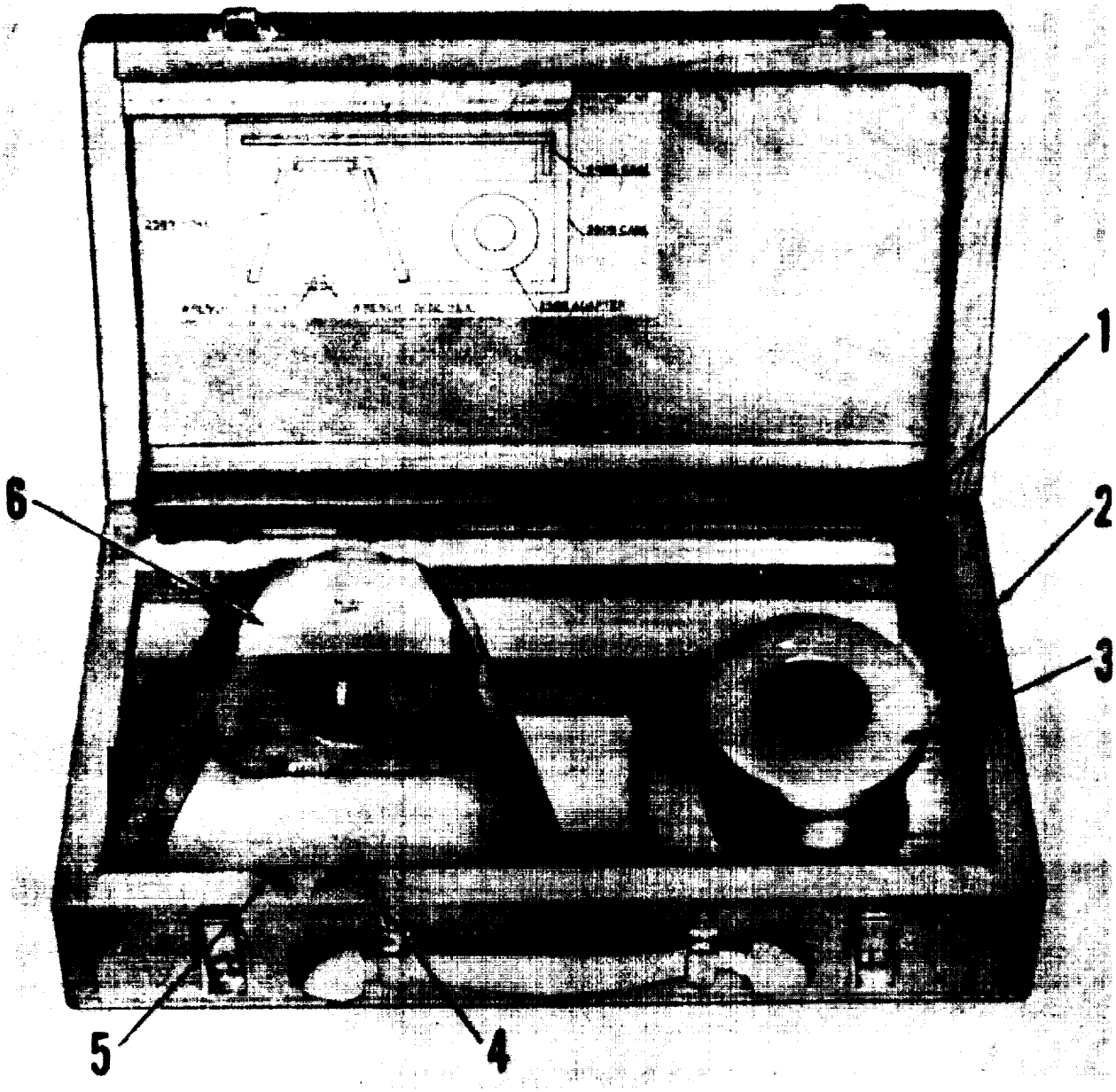


Figure 1-22. Main Rotor Balancing Adapter Kit 7HEL061.

Key to figure 1-22:
1. Gage (2386)
2. Case assembly (2605)
3. Adapter (2588)
4. 5/32-Inch hex wrench
5. 1/8-Inch hex wrench
6. Yoke (2589)

1-24. TAIL ROTOR BALANCING POSITIONING KIT 7HEL065. (See figure 1-23)

This kit provides a series of matched bar pairs of various but precise matched lengths to be used in conjunction with the 7HEL053. (Part no. 2586) and 7A050 balancing kits to enable balancing of UH-1A, B, C, D, E, H and M and AH-1G and TH-IG tail rotor hub and blade assemblies. The eleven sets of matched pairs of bars and two post assemblies are packed in an attache type hardwood case whose dimensions are 1¾ x 11 x 19 inches. Weight of a completely packed kit is approximately 18 pounds.

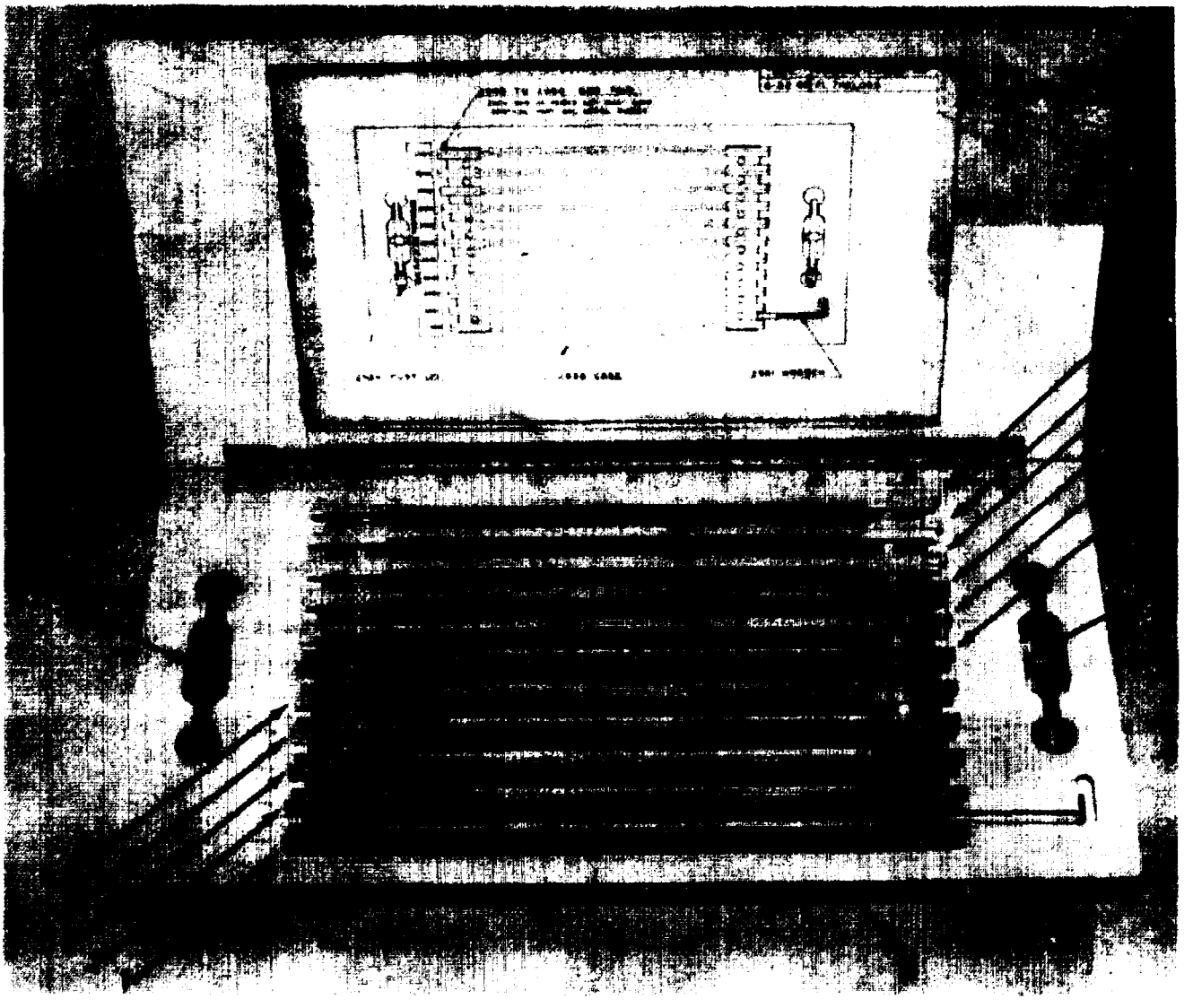


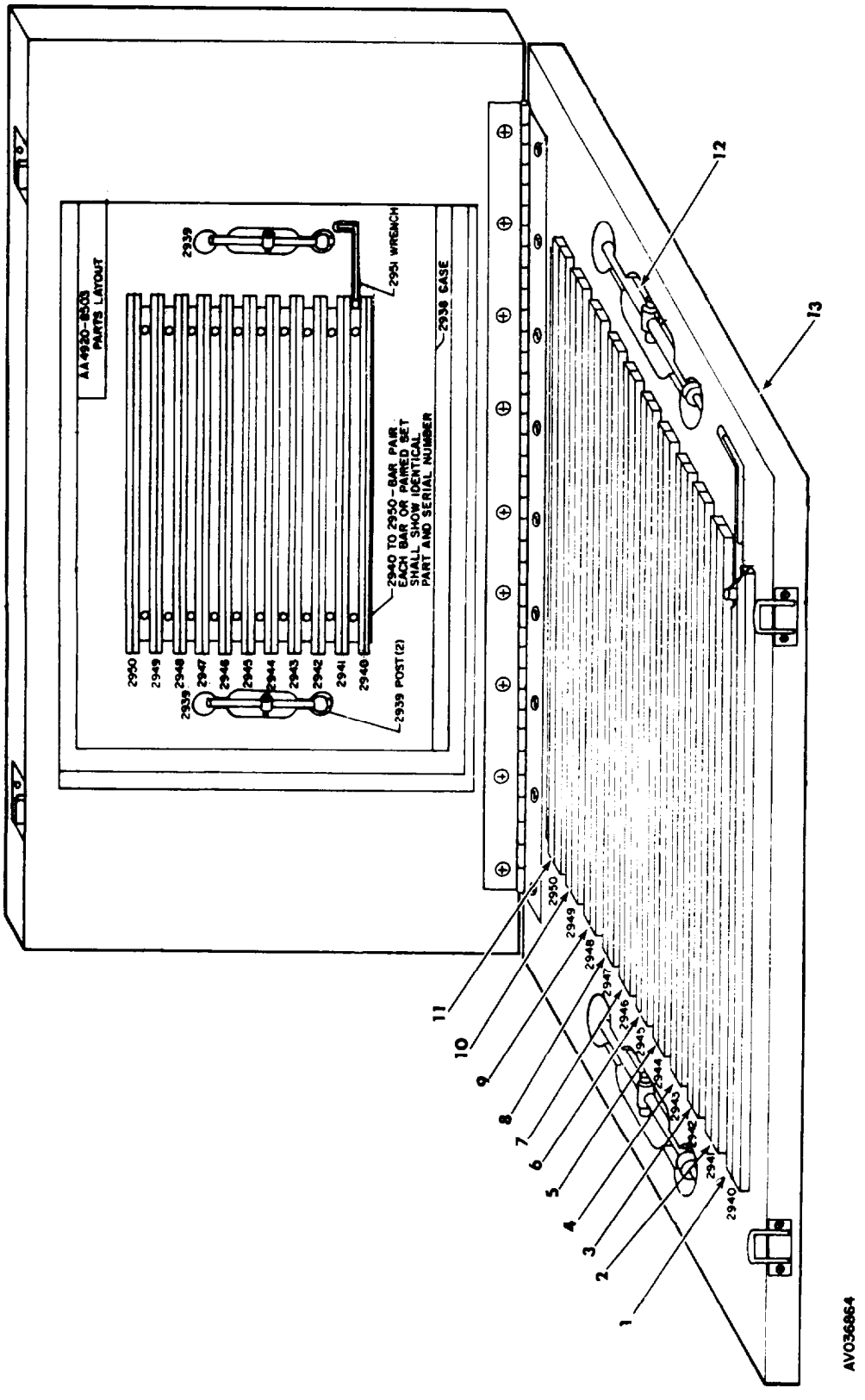
Figure 1-23. Tail Rotor Balancing Positioning Kit 7HEL065.

1-26A. TAIL ROTOR BALANCE POSITIONING KIT AA 4920-8503. **(See figure 1-23A).**

The kit AA4920-8503 is AVSCOM produced. This kit is functionally interchangeable with kit 7HEL065. When using the matched bars from the AA4920-8503 kit a different arbor setting on the arbor scale is used. This setting is listed in the applicable instructions of section IV, Operating Instructions. Weight of a complete kit is approximately 19 pounds.

KEY to figure 1-23A:

1. Bar, pair, positioning 4920-8503-2940
2. Bar, pair, positioning 4920-8503-2941
3. Bar, pair, positioning 4920-8503-2942
4. Bar, pair, positioning 4920-8503-2943
5. Bar, pair, positioning 4920-8503-2944
6. Bar, pair, positioning 4920-8503-2945
7. Bar, pair, positioning 4920-8503-2946
8. Bar, pair, positioning 4920-8503-2947
9. Bar, pair, positioning 4920-8503-2948
10. Bar, pair, positioning 4920-8503-2949
11. Bar, pair, positioning 4920-8503-2950
12. Post, pitch, positioning 4920-8503.2939
13, Case, assy, kit carrier 4920-8503-2938

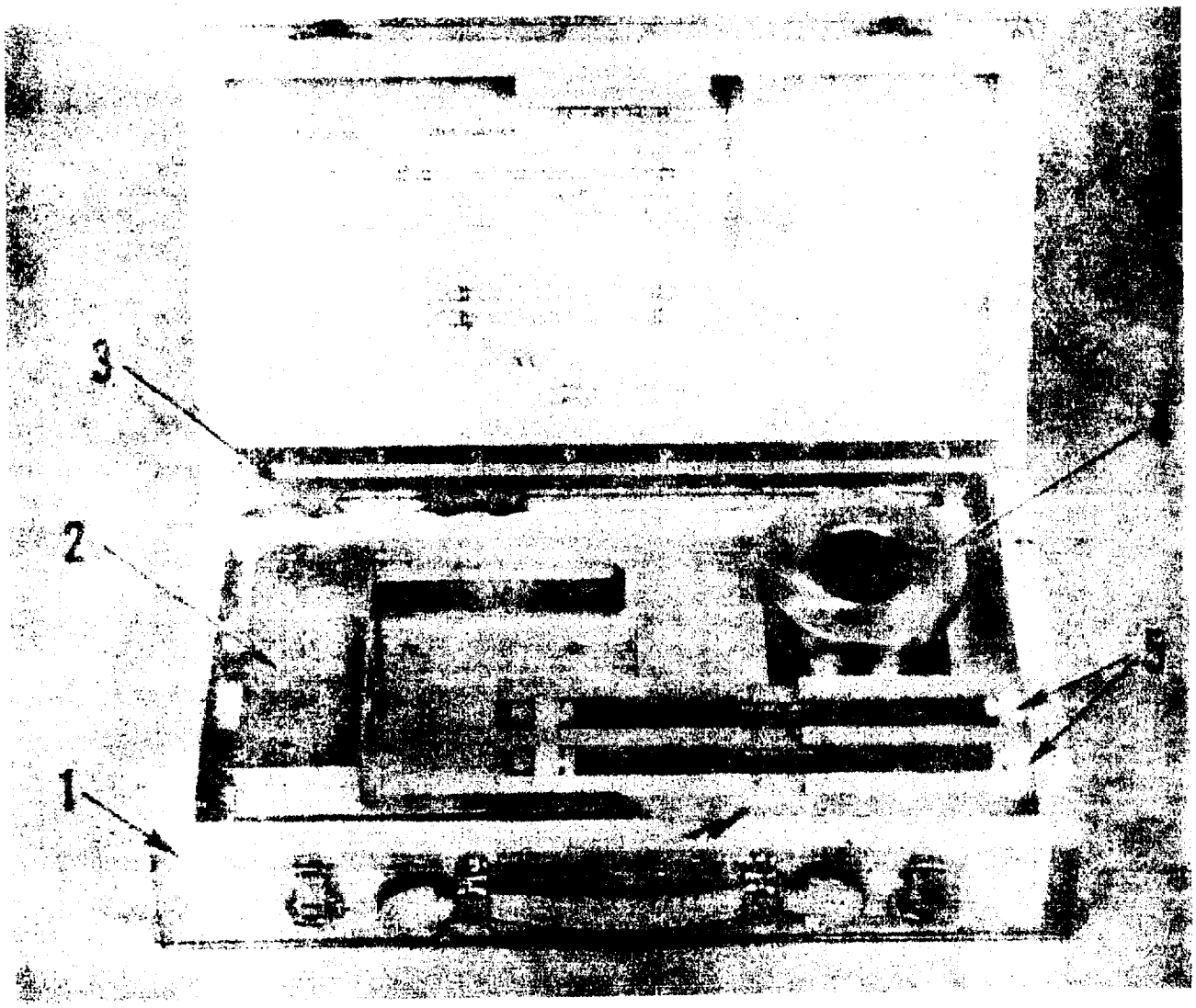

AA 4920-8503
PARTS LAYOUT
2939
2954 WRENCH
2938 CASE
2940 TO 2950 - BAR PAIR
EACH BAR OR PAIRED SET
SHALL SHOW IDENTICAL
PART AND SERIAL NUMBER
2939 POST (2)
2950
2949
2948
2947
2946
2945
2944
2943
2942
2941
2940
1
2
3
4
5
6
7
8
9
10
11
12
13
AV036864

Key to figure 1-23:

1. Bar pair (2940)
2. Bar pair (2941)
3. Bar pair (29421
4. Bar pair (2943)
5. Bar pair (2944)
6. Bar pair (2945)
7. Bar pair (2946)
8. Bar pair (2947)
9. Bar pair (2948)
10. Bar pair (2949)
11. Bar pair (2950)
12. Post assy. (2939) (2)
13. Case assy. (29381

1-27. MAIN ROTOR HUB (MODEL 540) BALANCING ADAPTER KIT 7HEL066. (See figure 1-24.)

The adapter components contained in this kit are used with the 7A050 and 7HEL054 kite to balance the rigid type model 540 rotor hubs (UH-1C, UH-1E, UH-1M, TH-1G and AH-1G). The complete kit also includes a finished hardwood case whose dimensions are 5½ x 12½ x 19½ inches and the total weight, when packed, is approximately 42 pounds. 1

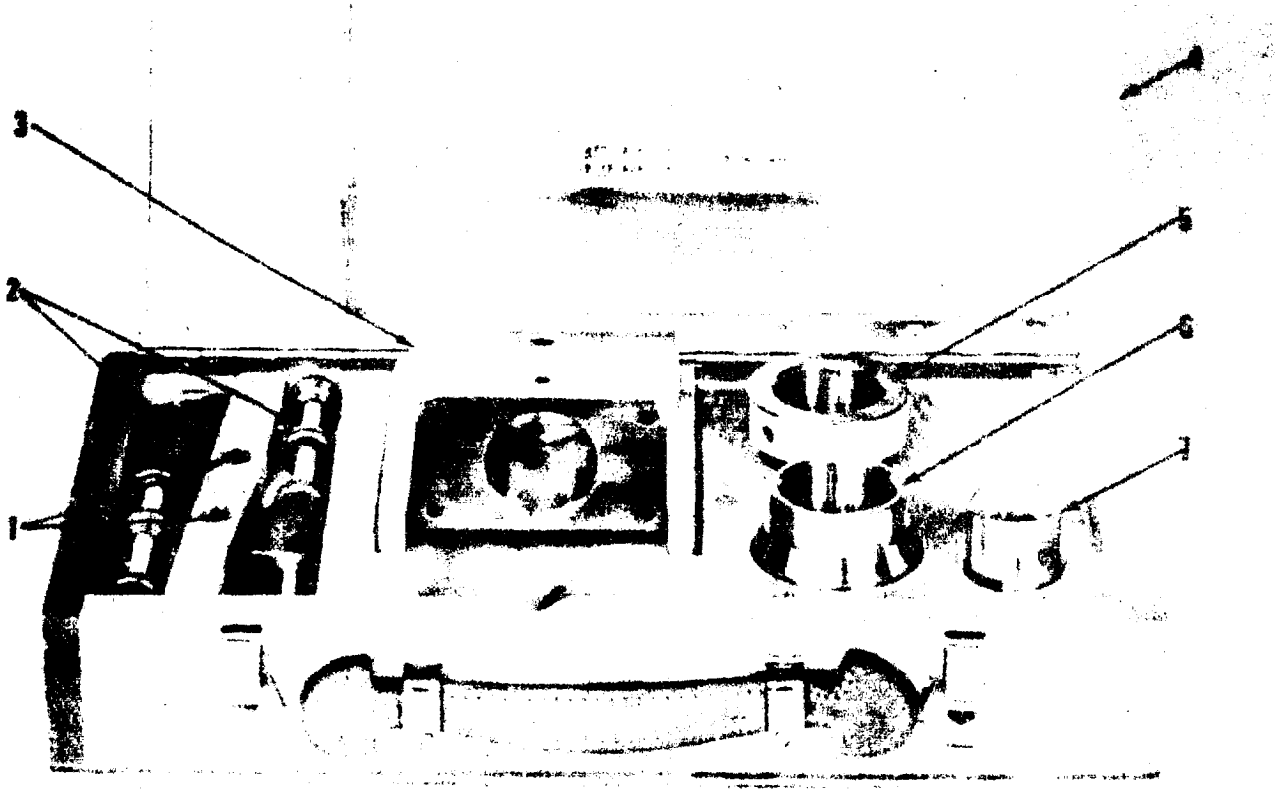


1. Case Assembly (2850)
2. Yoke (2846)
3. Gage (2486)
4. Adapter (2588)
5. Jack (2865) (2)

Figure 1-24. Main Rotor Hub Balancing Adapter Kit 7HEL066.

1-28. MAIN AND TAIL ROTOR HUB AND BLADE ASSEMBLIES BALANCING ADAPTER KIT 7HEL069. (See figure 1-25).

This kit contains adaptering components to be used in conjunction with the 7A050, 7HEL054, and 7HEL053 balancing kits and supplementary items' to balance the model OH-58A main and tail rotor hub and blade assemblies. The finished hardwood case supplied with this kit measures 5½ x 11½ x 18½ inches and the entire kit weighs approximately 28 pounds.



1. Spacer (3063) (2)
2. Lock assembly (3035) (2)
3. Yoke assembly (2780)
4. Case assembly (3036)
5. Bushing (2777)
6. Adapter (2775)
7. Adapter 13077)

Figure 1-25. Main and Tail Rotor Hub and Blade Assemblies Balancing Adapter Kit 7HEL069.

1-29. MAIN ROTOR BALANCING ADAPTER KIT 7HEL354. (See figure 1-26).

Components of this kit provide the adaptering necessary to balance CH-47 model main rotor head assemblies in conjunction with the components of the 7A050 kit except for the hoist structure. Part numbers 2250 plug and 2463 bushing are also in the 7HEL054 kit. Because of the heavier load of these rotor heads, the hoist structure shall not be used. Suspension by means of shop hoisting facilities is preferred. The plug, bushing and sleeve are supplied in a finished hardwood case measuring 9 x 9 x10½ inches. Weight of this kit is approximately 50 pounds.

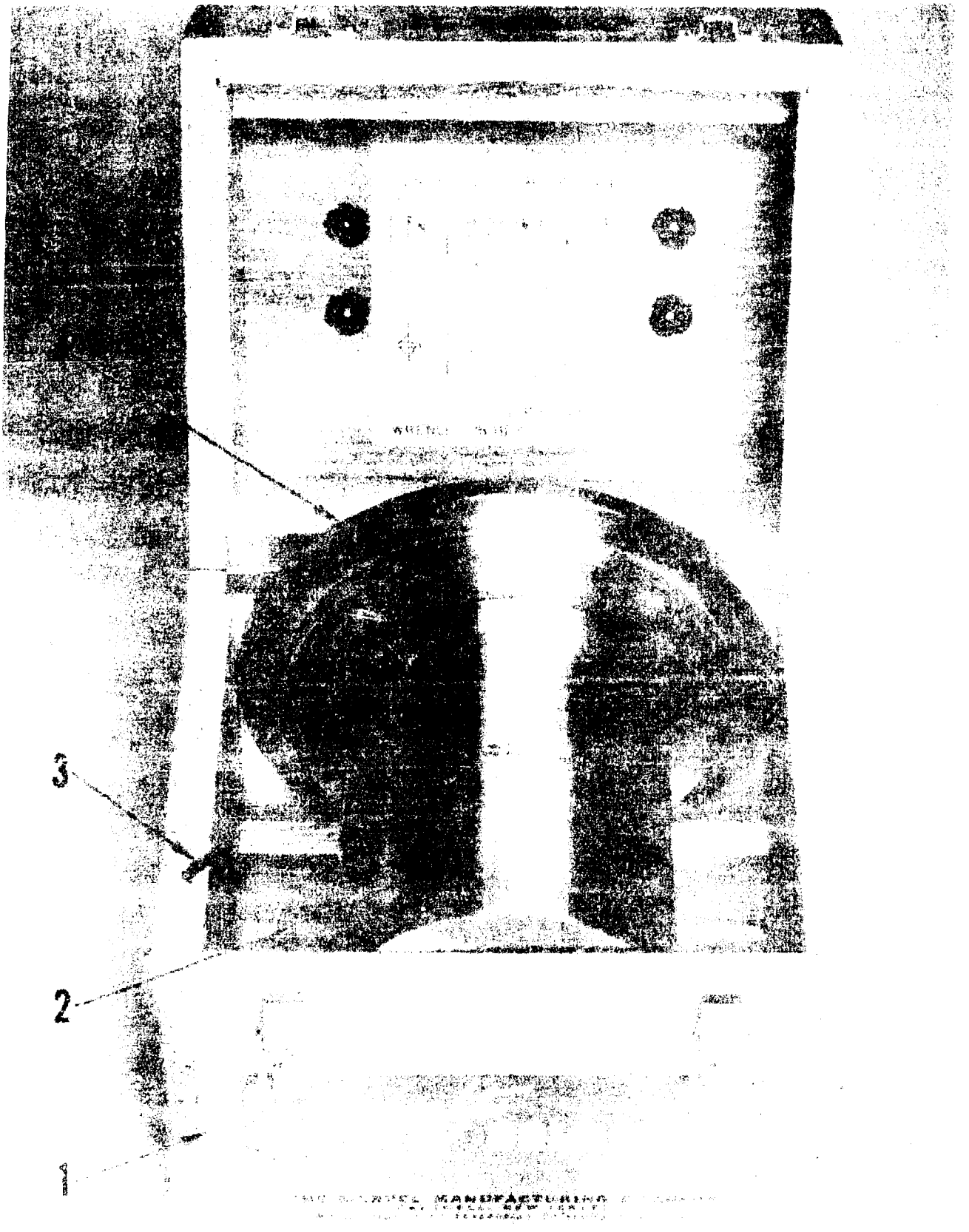
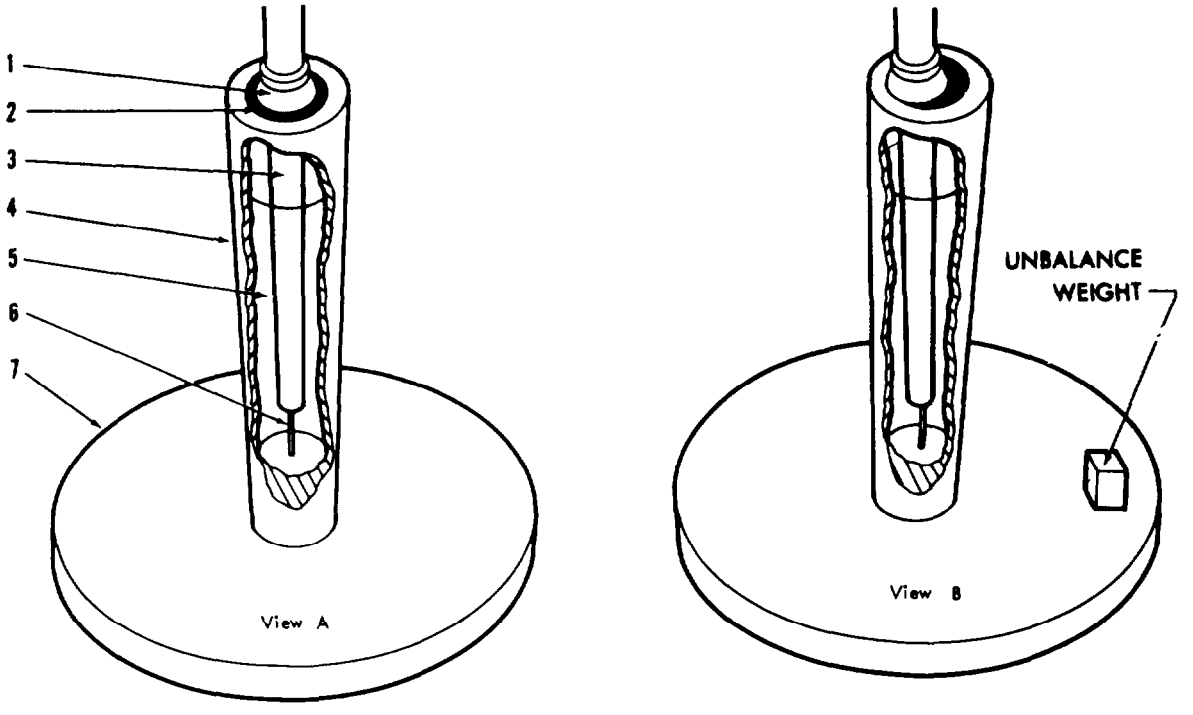


Figure 1-26. Main Rotor Balancing Kit 7HEL354.

Key to figure 1-26:
1. Case assembly (2552)
2. Sleeve (2484)
3. 1/8-Inch hex wrench
4. Plug (2250) with bushing (2463) in bore.

1-30. BALANCING ARBOR PRINCIPLES OF OPERATION.

1-31. General. (See figure 1-27). The characteristic response of the suspended balancing arbor to an assembly in a state,of unbalance is a tilting action (view B). This tilting action occurs through an internal flexible suspension element (6) at the lower end of the arbor suspension rod (3). The upper end of the arbor is free to tilt around the suspension rod to the extent necessary to indicate direction and relative magnitude of unbalance forces.



1. Indicator bushing
2. Indicator disc
3. Suspension rod
4. Balancing arbor
5. Fluid Reservoir
6. Flexible suepension element
7. Assembly being checked

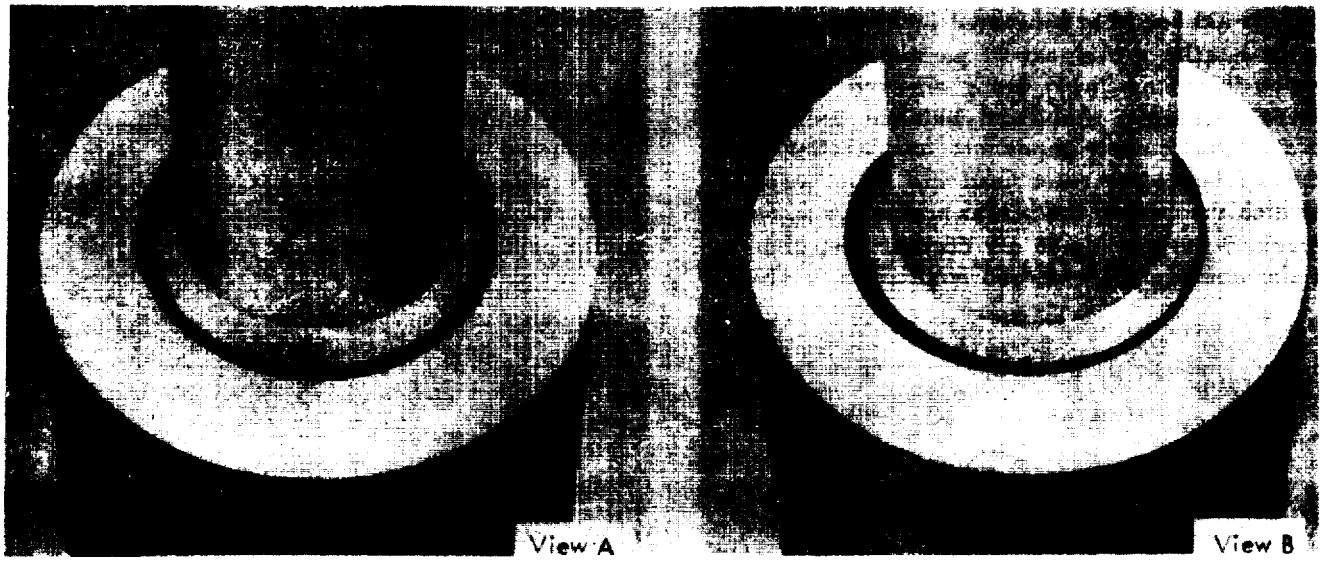
Figure 1-27. Basic Operation of Suspension Balancer.

1-32. Balance Indications. (See figure 1-28). Because of the length cd the arbor assembly (from the flexible suspension element to the indicator disc), arbor tilt produces a magnified displacement of the top end of the arbor with relation to the vertical line of suspension. The resulting eccentricity between the black indicator disc, which moves with the tilt of the arbor, and the indicator bushing, which remains in the line of suspension, reveals the direction and degree of unbalance.

1-33. If an assembly has been properly mounted and the specified sensitivity setting for that assembly has been observed in accordance with section IV, operation instructions, an assembly perfectly balanced will be indicated by the indicator bushing being concentric (perfectly centered) within the back indicator disc, as shown in view A. If the assembly is slightly out of balance, but within allowable balance tolerance, the black indicator disc will be slightly eccentric with the indicator bushing (more of the black disc will be visible on one aide of the bushing than on the opposite side), as shown in view B. If the assembly is out of balance to its maximum allowable balance tolerance, one edge of the black disc will be exactly even (tangent! with one edge of the indicator bushing, as shown in view C. If the assembly is out of balance beyond its allowable balance tolerance, an edge of the black indicator disc will pass under the edge of the indicator bushing, as shown in view D.

NOTE

If the assembly being balanced is positioned too high on the balancing arbor, the system become, unstable, like an inverted pendulum. When this condition is present, the arbor will remain tilted in whatever direction it is manually pushed. Even though an assembly is in perfect balance, no balance indication can be achieved while this condition exists.



VIEW A
INDICATOR CIRCLES CONCENTRIC (ASSEMBLY IN PERFECT BALANCE)

VIEW B
INDICATOR CIRCLES SLIGHTLY ECCENTRIC (ASSEMBLY SLIGHTLY OUT-OF-BALANCE BUT WITHIN ALLOWABLE UNBALANCE TOLERANCE)

VIEW C
INDICATOR CIRCLES TANGENT (ASSEMBLY OUT-OF-BALANCE TO MAXIMUM ALLOWABLE UNBALANCE TOLERANCE)

VIEW D
INDICATOR CIRCLES OVERLAPPING (ASSEMBLY OUT-OF-BALANCE BEYOND ALLOWABLE UNBALANCE TOLERANCE)

Figure l-28. Interpretation of Balancer Indications.

1-34. AIR CURRENT PROTECTION.

1-35. Balance checking operations shall be performed whenever practicable in a draft-free area, as aid currents generated in drafty rooms or by the nearby movement of personnel may cause motion in the assembly being checked which will prevent accurate, stabilized balance indications. This is a particularly important consideration in the case of a helicopter rotor head and blade assembly in which the span of the blades makes the assembly especially susceptible to air current distrubances. In the absence of draft-free conditions, a shroud may be constructed to enclose the blades for localized protection from air currents. (See figure 1-19). The shroud may consist of transparent plastic sections formed so as to enclose the blade around the sides, top, and outboard end, and be supported by a carriage which can be rolled on casters into position under the blade. The shroud, however constructed, should provide sufficient rigidity so that surrounding air currents cannot collapse or curve the sides, thereby creating a bellows which would cause air disturbances within.

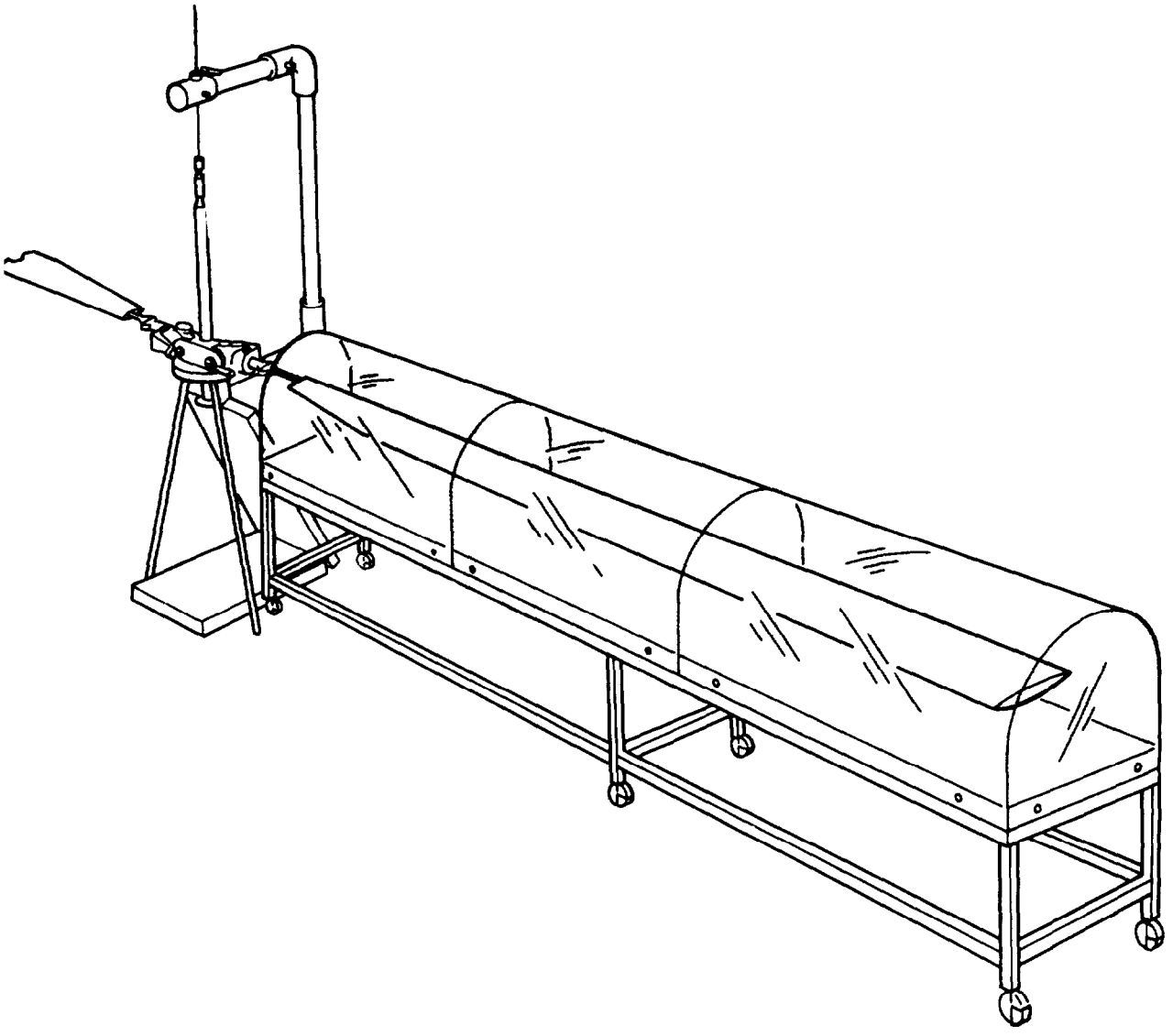


Figure 1-29. Shroud for Protection of Assembly Being Balance Checked in Drafty Area.

SECTION II

SPECIAL SERVICE TOOLS

2-1. GENERAL.

2-2. The following listed tools are required to perform the operations described in this manual.

NOMENCLATURE	PART NO.
Pitch positioning locks	Bell tool no. T101402
Grip positioning links	Bell tool no. T101466

SECTION III

PREPARATION FOR USE, STORAGE, OR SHIPMENT

3-1. PREPARATION FOR SUE.

3-2. Unpacking. Normally, each balancing and / or adapter storage case is packed for shipment in a wooden, overseas-type shipping box. The heavier shipping boxes also are metal banded for added protection from damage during shipment. Identifying labels are glued to both the top and sides of each shipping box.

3-3. By cutting the metal bands, if used, and pulling the nails securing the one-piece plywood top, each kit storage case may be easily removed while preserving the shipping box for possible future use.

NOTE

Each kit case has glued on the underside of the top cover, a packing layout to help identify the parts therein and their location in the storage case.

3-4. OPENING 7A050 KIT STORAGE CASE.

a. Lay balancing kit storage case flat on floor with decal upward. (See figure 3-1). Observe stencil "To open lay flat this side up."

CAUTION

The balancing kit storage case is designed to be opened from this position only. Opening case in any other position may result in spilling of, and damage to, the precision finished parts.

Figure 3-1. 7A050 Kit Storage Case Positioned Correctly for Opening.

b. Release six trunk-type latches on sides of case and, grasping handles, lift top half of case from bottom half. (See figure 3-2).

c. Lay top half, felt side upward, flat on floor beside bottom half, and remove felt-covered tray by releasing two tray latches and lifting tray from case.

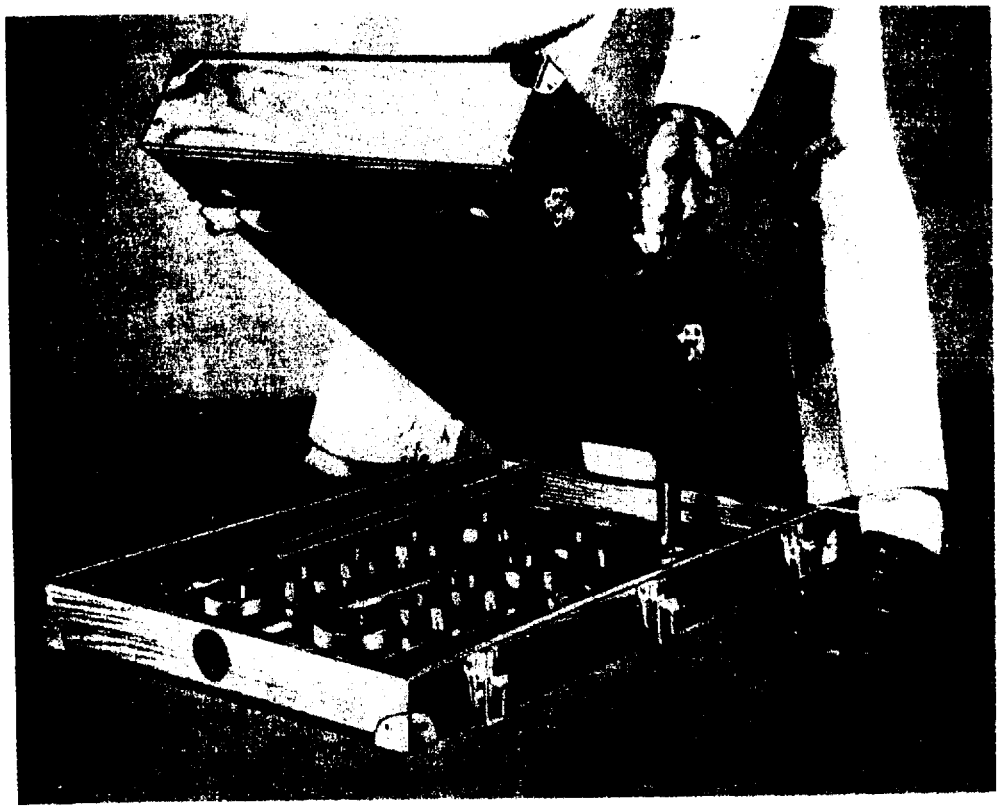


Figure 3-2. Opening 7A050 Kit Storage Case.

3-5. Assembly of Work (Stand and Hoist. (See Figure 3-3.)

a. Remove vertical tube (4) from top half of balancing kit 7A050 storage case. Remove two stand legs (11) from inside tube.

b. Leaving stand table (1) in storage case, push small ends of stand legs (11) (with friction lock rings) into the two bores provided in circular part of stand table, making certain legs are fully bottomed in borer.

c. Install two leg extensions (12) in end of stand legs (11). making certain leg extensions are fully seated.

d. Install stub leg (9) in bore of heavy boss on stand table (1). making certain stub leg is fully seated.

e. Remove stand table and leg assembly from case and hold in upright position (table up, legs down). Carefully tilt bottom half of storage case (10) upward and insert stub leg (9) of stand table into hole of stub leg support (19, figure 1-13) in upper end of storage case bottom half. (See figure 3-4). Seat large no. 1 boss of stand table solidly on top of storage case bottom half.

CAUTION

To avoid spilling cones, bushings, and balancing arbor, do not tilt bottom half of storage beyond the vertical position.

f. Remove horizontal tube (6, figure 3-3) and hydraulic pump assembly (7) from storage case top half. Remove horizontal tube (2) from horizontal tube (6).

NOTE

Except as otherwise called for in specific application instructiona, section IV, assemble hoist structure components in numerical sequence with all red numbers on components facing operator and right side up, as shown in figure 3-3.

g. Assemble horizontal tube (2) in stand table (1), and secure connection by inserting engaging pin (8) through pin hole in tube and stand table.

h. Assemble elbow (3) to horizontal tube (2), and &cure connection by inserting engaging pin (8) through elbow pin hole and inner pin hole (A) of tube.

NOTE

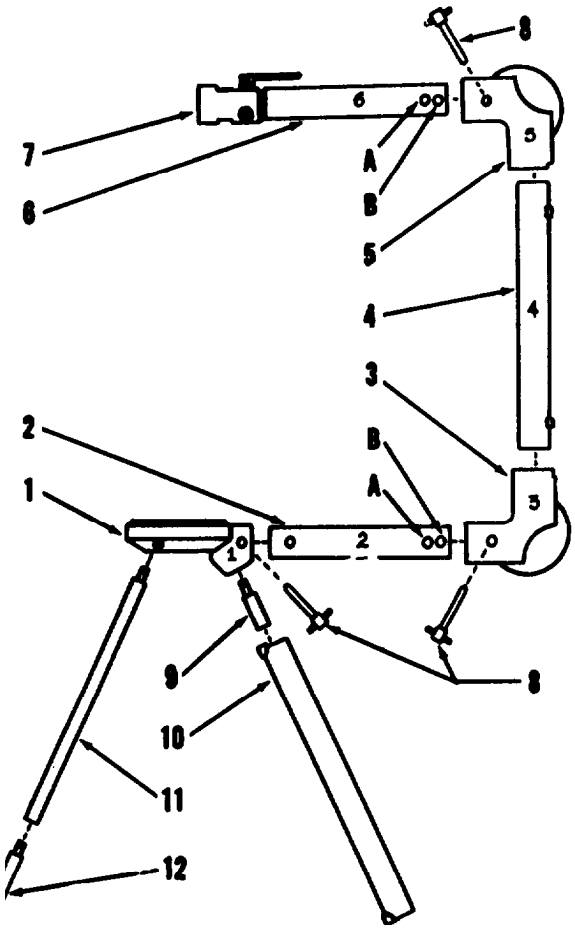
In assembling elbows to horizontal tubes, insert engaging pins (8) in inner set of pin holes (A). In the event of insufficient radial clearance, elbows may be moved outward on horizontal tubes so that pins (8) engage outer set of pin holes (B). Since this arrangement provides shorter load bearing surface of tubes in elbows, limit loads to 200 pounds when hoist support is assembled in this manner.

i. Assemble vertical tube (4) to elbow (3) and elbow (5), engaging lugs on tube with central portion of aligning slots in elbows to avoid damage.

NOTE

In some applications, a supplementary, longer tube part no. 2769) must be substituted in place of the vertical tube (4) (part no. 2288).

j. Assemble horizontal tube (6) to elbow (5), and secure connection by inserting pin (8) through elbow pin hole and inner pin hole (A) of tube.



1. Stand table
2. Horizontal tube, no. 2
3. Elbow
4. Vertical tube, no. 4
5. Elbow
6. Horizontal tube, no. 6
7. Hydraulic pump assembly
8. Engaging pin
9. Stub leg
10. Storage case bottom half
11. Stand leg
12. Leg extension
A. Inner pin hole
B. Outer pin hole

Figure 3-3. Assembly of 7A050 Kit Work Stand and Hoist Structure.

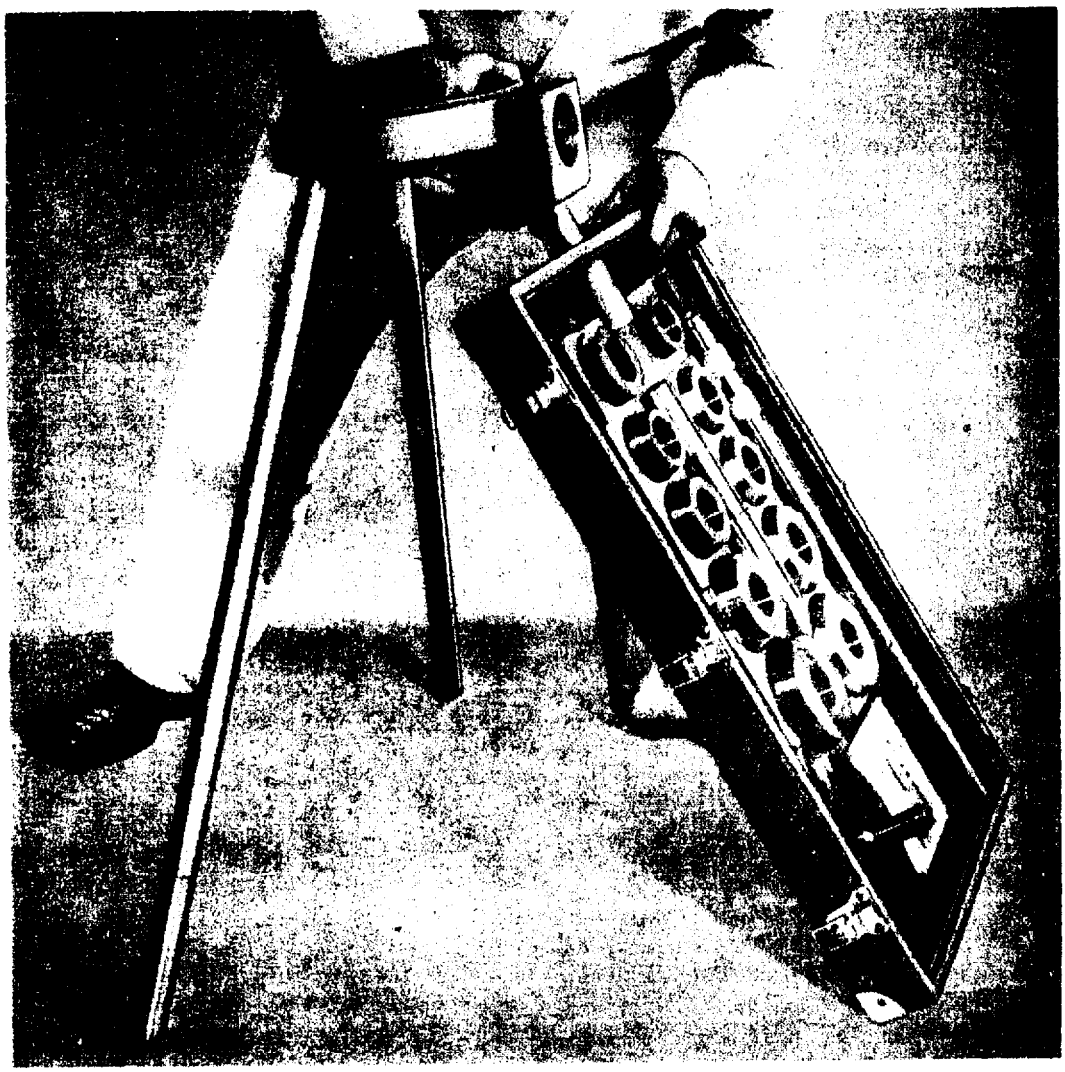


Figure 3-4. Assembling Stand Table to Bottom Half of Storage Case.

3-4. BALANCING ARBOR PART NO. 2259.

3-7. Unpacking.

a. Disengage arbor retaining spring (27, figure 1-13). Remove balancing arbor (23, figure 1-13) from 7A050 storage came, and screw hand wheel (26) into bottom end of arbor. Stand arbor and hand wheel assembly safely upright on bench.

b. Using tag string, pull upper oil seal sleeve off end of arbor suspension rod.

WARNING

Cleaning may be toxic. Use in well-ventilated area. Avoid prolonged inhalation of fumes or direct contact with akin. Do not use solvent near open flame or in area where very high temperatures prevail.

CAUTION

Before removing arbor from storage case, read paragraph 3-8, Handling Precautions.

c. Loosen set screw of indicator bushing (See figure 3-5) and lift indicator bushing from suspension rod. Remove lower oil seal (O-ring) from suspension rod outer sleeve. Retain O-ring for inactive storage or shipment (see paragraph 3-46). Carefully clean all residual oil and preservative compound from top surface of arbor, suspension rod assembly and indicator bushing, For best indicator contrast, thoroughly de-grease there surfaces, using clean cloth moistened with solvent, Federal Specification P-D-660, or equivalent volatile cleaner.

d. Using two small pieces of paper under indicator bushing as shims, re-install indicator bushing and tighten set screw, (See figure 3-5.)

a. Remove paper shims, and check to insure that indicator bushing mover freely over black indicator dire (2, figure 1-27) without binding.

NOTE

For temporary storage, keep arbor in upright position, as dash-pot damping oil can leak out after removal of sealing tape and sealing gasket from under indicator bushing if arbor lies on its side.

3-8. Handling. The balancing arbors are precision instruments and, if treated accordingly, will give good services indefinitely. However, to prevent critical damage, always observe the following handling precautions.

a. Particularly avoid excessive sidewire or downward loading of the projecting suspension rod end, since internal damage to the sensitive internal suspension element may result. For example: dropping the inverted arbor on the suspension rod end, from any appreciable height will result in permanent critical damage. Similarly, any bumping of the projecting suspension rod end, in any position, shall always be avoided.

b. The outride diameter of the arbor is a precision finished piloting surface. This surface shall always be protected against accidental contacts which would cause nicks, burrs, abrasion, or corrosion. Leaving the bare arbor standing on end where it may be knocked over is a particularly bad practice.

c. Always handle the arbor by the knurled section while supporting the lower end with the other hand. Make it a practice to return the arbor to its place in the storage case when not actually in we.

d. Do not disturb pressed-in plugs in eight holes in lower section of arbor, and do not attempt removal of the arbor top cap. Arbor must be returned to factory for repair if these parts are disturbed.

e. For lubrication instructions to be obrerved prior to each application of the arbor and for instructions on adding damping oil to the arbor fluid reservoir, refer to section V.

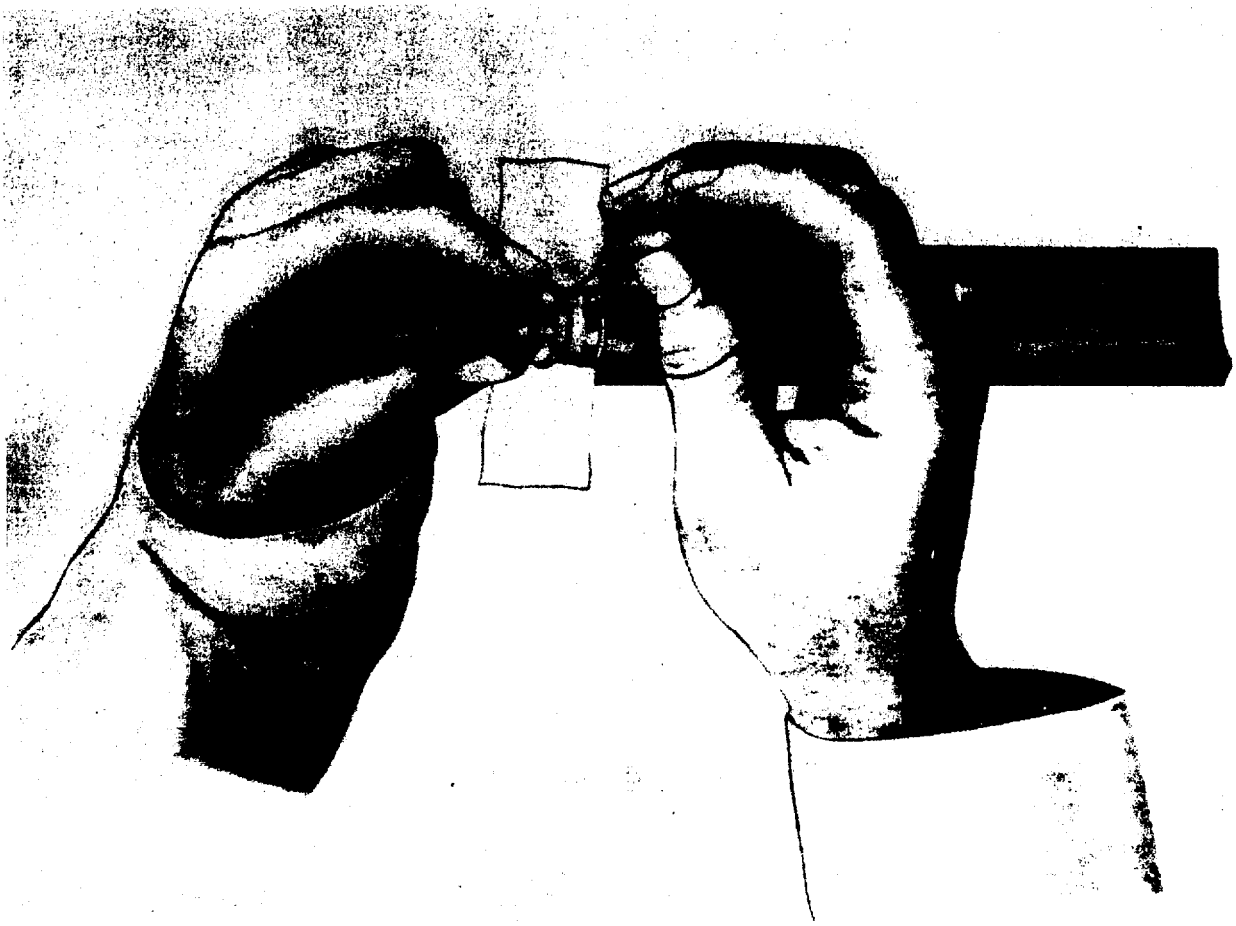


Figure 3-5. Setting Balancing Arbor Indicator Bushing.

3-9. 7A050 **KIT ADAPTER CONES, BUSHINGS, AND SPACERS.**

3-10. unpacking. **Opening the 7A050 kit case makes all kit components directly accessible without further unpacking.**

3-11. Handling. **Surfaces of adapter cones, bushings, and spacers are precision finished. Exercise care in handling these parts so as to protect them against accidental nicks, burrs, abrasion, or corrosion. For lubrication instructions to be observed prior to each application, refer to section V**

3-12. PROPELLER ADAPTER KIT 7A052. (See figure 1-14.)

3-13. Unpacking. **The storage case for propeller adapter kit 7A052 is MI designed that opening of the hinged cover provides direct, independent accessibility to all kit components without further unpacking.**

3-14. Handling. **Surfaces of the various propeller adapter kit components are precision finished. Exercise care in handling these components to protect them against accidental nicks, burrs, or abrasion especially when installing or removing the heavier counterweights from the storage case. These adapters and weights are also factory balanced and any detrimental damage will affect the application. For lubrication instructions to be observed prior to each application, refer to section V.**

3-15. PROPELLER SPINNER BALANCING ADAPTER KIT *7A055.* **(See figure 1-15.)**

3-16. Unpacking. **Releasing the trunk-type latches and opening the hinged cover exposes the kit components consisting of a large diameter adapter assembly and a small positioning adapter.**

3-17. Handling. **Adapters are precision finished and balanced. Avoid excessive or rough handling so as not to cause accidental damage or contamination. Nicks, burrs, or corrosion are detrimental. Refer to section V for appropriate lubrication instructions prior to use.**

NOTE

Usually the part no. 7HEL053 balancing kit and the 7HEL051, 7HEL052, 7HEL054, 7HEL055, and 7HEL056 supplementary adapter kits are purchased individually by most military contracts. In some instances, however, a master kit, part no. 7HEL050, is procured containing the six kits mentioned above. To cover this latter possibility, instructions are provided below for the unpacking of the 7HEL050 kit.

3-18. 7HEL050 KIT, HELICOPTER COMPONENTS BALANCING, TRACKING, AND ALIGNING. (See figure 3-6.)

3-19. Unpacking. Open **outer storage and shipping case by unscrewing six bolts in the two front side rails and removing front cover. Removal** *of* **this cover exposes the six kits, part no. 7HEL051 thru part no. 7HEL056, which are stored in separate, appropriate shelves and compartments within the shipping cane. (See figure 3-6.) Interim storage of front cover during use of the 7HEL050 kit is provided for by holes in the rear ride rails through which the six front cover attaching bolts can be inserted to secure front cover against back of storage and shipping case. The pullout panel in top of case can be used as handbook reference surface, while top surface of case provider convenient work table for selection and assembly of adapter components.**

3-20. The respective kits virually may be identified by the red stencilled number and nameplate affixed thereon. Each kit may be **removed by grabbing the leather handle and pulling the kit case from its compartment.**

Figure 3-6. 7HEL050 Kit Storage and Shipping Case with Front Panel Removed to Expose Sub-kits.

3-21. TAIL ROTOR BALANCING KIT 7HEL051. (See figure 1-16.)

3-22. Unpacking. Releasing the trunk-type latches and raising the hinged top will expose the components of this kit. Upon raising the hinged cover, visually examine the large adapter assembly to. made sure the eight phenolic blocks and the remainder of the kit components are undamaged.

3-23. Handling. Exercise care in the handling and use of the adapter assembly because of the susceptibility of damage and breakage of the phenolic positioning blocks. Avoid careless or indifferent handling of any part.

3-24. TAIL ROTOR AND FAN BALANCING KIT 7HEL052. (See figure 1-17.)

3-25. Unpacking. As with the TA050 and 7A052 kit shipping cases, the 7HEL052 shipping box is normallybanded prior to shipment. If used, cut the metal bands and remove nails securing the single piece plywood top. Lift out the kit storage case and store the shipping box for possible future use.

3-26. Handling. Releasing the trunk-type latches and raising the hinged top exposes the contents of this kit consisting of a large crisscrossed type of adapter assembly, cones and sleeves. The adapter assembly incorporates a phenolic block at the end of each leg. Make sure the blocks are undamaged and handle the adapter assembly with care to avoid possible future damage. The adapter hub, the cones and sleeves shall be protected from accidental nicks, scratches. burrs or other detrimental discrepancies.

3-27. SMALL PARTS BALANCING KIT 7HEL053. (See figure 1-18.)

3-28. Unpacking. Releasing the two trunk-type latches and raising the hinged cover provides access to all components of this kit. Since the kit details provide for a multitude of applications, to minimize loss and possible damage, it is suggested only those parts actually required for the specific balance application involved be removed from the storage case. The packing layout glued to the inside of the top cover will help identify and locate parts. All parts shall be returned to their proper locations in the storage case after use and preservation.

3-29. SMALL BALANCING ARBOR, PAR?' NO. 2516.

3-30. Remove small balancing arbor (22, figure 1-18) from its cradle in the kit storage case by lifting the exposed end of the arbor and carefully pulling it out of the tilting support tube. Preparation of this arbor for use differs from that of the larger Part no. 2259 arbor as explained below.

WARNING

Cleaning may be toxic. Use in well-ventilated area. Avoid prolonged inhalation of fumes or direct contact with skin. Do not use solvent near open flame or in area where very high temperatures prevail.

CAUTION

In handling the small arbor, particular care shall be exercised to avoid all impact or excessive downward pressure on the suspension rod.

a. Carefully clean all residual oil and preservative compound from the arbor assembly using solvent, Specification P-D-680, or equivalent.

b. As shipped, the top end of the small arbor is sealed by an internal, spring-loaded seal located on the suspension rod under the indicator bushing. In addition to preventing loss of dash-pot oil, this seal also supports the suspension rod in a fixed position in the arbor during shipment. To unseal the spring loaded seal and free the suspension rod for normal operation, push the indicator bushing downward, against light spring tension, so that its bottom surface clears the black indicator disc by approximately 0.003 inch. (For use of paper spacing shims, see figure 3-5). Lock indicator bushing in this position with indicator bushing set screw, using hex wrench provided in the 7HEL053 kit. Remove paper shims and check to insure indicator bushing moves freely.

NOTE

Review paragraph 3-8 for care and precautions to be observed when handling balancing arbor assemblies.

3-31. MAIN ROTOR BALANCING KIT 7HEL054. (See figure 1-19.)

3-32. Unpacking. Accessibility is gained to all components of this kit after the releasing of latches and raising of the hinged cover. All kit details are adequately preserved and securely recessed into appropriate compartments of the storage case.

3-33. Handling. Many of the kit components are factory balanced and all are precision finished. Exercise extreme care in handling and usage of the parts. Nicks, scratches, burrs, raised edges and contamination shall be avoided. Store parts in the kit case when not in use.

3-34. FAN TRACK AND CONCENTRICITY CHECKING KIT 7HEL055. (See figure 1-20.)

Releasing the trunk-type latches and raising the hinged top cover provides accessibility to the three components of this kit as identified by the packing layout on the inside of the cover. Both the plate and adapter are precision machined and balanced at the factory and care shall be taken to protect these parts from damage. The indicator assembly shall be handled as any other precision gage and shall not be immersed in any solvent or other fluids.

3-35. OPTICAL TRAMMELING KIT 7HEL056. (See figure 1-21.)

Release the trunk-type latches and raise the hinged top cover to provide access to the kit components. Identify parts by means of the packing layout. Particular care shall he exercised in removing and handling the scope assemblies. Avoid dropping or otherwise damaging the scopes), scope support assembly or the target assembly. Do not immerse the optical trammeling scopes in solvent or any other fluid.

3-36. MAIN ROTOR BALANCING KIT 7HELO61. (See figure 1-22.)

The gage, yoke assembly and adapter are easily removed from their recesses in the kit storage case once the latches are released and the binged cover is raid. Handle kit details carefully so as to protect them from surface damage that would prove to he detrimental. The yoke assembly and adapter are precision balanced at the factory and disturbance of this balance shall be avoided.

3-37. TAIL ROTOR BALANCE POSITIONING KIT 7HEL065 AND AA4920-8503. (See figure 1-23 and figure 1-23A).

Opening the hinged cover, after releasing the trunk-top latches, reveals eleven sets of matched bar pairs and two post assemblies. A decal strip, packing layout, and electric etched serial numbers on the parts identify the respective bar pairs. DO not interchange bars. Keep them in matched pairs (by serial number) and always return them to their proper part number slot in the attache-type storage case. Avoid any damage to the bars, especially to the precision machined ends.

3-38. MAIN ROTOR HUB BALANCING KIT 7HELO66. (See figure 1-24.)

By releasing the trunk-type latcher and raising the hinged top cover, accessibility is gained to the components of this kit. The yoke assembly and adapter are factory balanced and precision machined. Handle parts carefully to protect them from nicks, burrs and other detrimental surface damage. Return parts to storage case when not in me.

3-39. MAIN AND TAIL ROTOR HUB AND BLADE BALANCING ADAPTER KIT 7HEL069. (See figure 1-25).

Releasing the trunk-type latcher and opening the hinged top cover, exposes the contents of thin kit consisting of a yoke assembly, lock assemblies, spacers and adapters. All parts are precision finished and the yoke assembly also is factory balanced. In handling parts, care shall be taken to protect them from surface damage. Parts shall be retained in the storage case to avoid loss or damage.

3-40. MAIN ROTOR BALANCING ADAPTER KIT 7HEL354. (See figure 1-26.)

Opening the hinged cover after releasing bunk-type latches, reveals a plug assembly, sleeve and a bushing as one complete assembly recessed in the storage cane cradle. All puts are precision machined and the plug assembly is precision balanced also. Burrs, raised edges, sharp nicks, etc., are particularly undesirable and shall be avoided by careful handling of parts.

NOTE

A cool, dry, safe storage area shall be provided for storing all kit storage cases to minimize damage and deterioration of cases and parts.

3-41. DEPRESERVATION.

WARNING

Cleaning may be toxic. Use in well-ventilated area. Avoid prolonged inhalation of fumes or direct contact with skin. Do not use solvent near open flame or in area where very high temperatures prevail.

3-42. Prior to shipment by the manufacturer, all areas of kit components susceptible to corrosive attack are carefully cleaned and then coated with a Specified soft-film preservative compound in accordance with specifications. The applied preservative material is readily removed by washing the parts in clean mineral spirit solvent, Federal Specification P-D-680, and wiping with clean lint-free cloths or cleanring paper tissues. Avoid fingerprint stains by handling parts with clean, lint-free cloths after the thorough cleaning.

CAUTION

Immersion of detail parts in a vapor degreaser or heated cleaning solvents is not recommended, since nonmetallic assembly details may be adversely affected. Never immerse balancing arbors in a vapor degreaser or heated cleaning solvents, since arbor's internal assembly may be adversely affected and do not immerse the dial indicator (7HEL055 kit) or the optical trammeling scopes (7HELO56, kit) in cleaning solvents or other fluids.

3-43. Following depreservation, if parts are to be used in a balance application, leave them dry and clean. If parts are not to be used immediately, apply a light film of preservative oil, Specification MIL-L-6085 to steel surfaces; particularly to unplated piloting surfaces. Minimize parts handling. Prior to actual usage, wipe dry and clean the mated parts.

3-44. STORAGE OR SHIPMENT.

3-45. Interim Storage-active Kit Use.

a. Use cleansing tissues and/or lint-free cloths to clean parts. Make sure parts are thoroughly clean and free of contamination or fingerprint stains.

b. Apply a light coat of preservative oil Specification MIL-L-6085 to all ferrous parts, especially to unplated piloting surfaces.

c. Return all kit components to their proper locations in their respective hardwood storage cases. Refer to the packing layout installed on the inside of each case cover for location and identification information.

d. Store 7A050 and 7HELO53 kit cases containing unsealed balance arbors on end so that arbors will be in an upright position (rod end of arbor toward ceiling to prevent loss of dash-pot oil.

3-46. Preparation of Kitted Parts for Inactive Storage or Shipment.

3-47. In addition to paragraph 3-45, steps a and b. observe the following procedures.

a. Install a locally fabricated circular gasket seal under the indicator bushing of the 7A050 balancing arbor as follows:

(1) Loosen indicator bushing setscrew and remove indicator bushing from suspension rod.

(2) Install circular gasket over suspension rod so that gasket covers black indicator disc.

(3) Reinstall and lock indicator bushing tightly on top of gasket..

b. Seal center opening around 7A050 arbor suspension rod. directly above indicator bushing, by wrapping tightly with suitable tape.

c. Seal upper end of small 7HEFL053 balancing arbor by loosening indicator bushing setscrew and allowing internal seal spring to push indicator hushing upward.

d. Dial indicator (7HEL055 kit). Enclose dial indicator in moisture-resistant paper or plastic film. Seal enclosure with tape.

e. Enclose individual hardwood kit cases in suitable protective wood packing or shipping case. Use of original shipping containers, if available, is recommended.

f. 7HEL050 Kit assembly. Install sub kits in their individual compartments in the 7HEL050 kit storage and shipping case (figure 3-6), with red stencils outward and in upright position. Reinstall 7HEL050 kit front cover, using six side-rail bolts supplied with kit.

SECTION IV

OPERATION INSTRUCTIONS

4-1. GENERAL

4-2. The operation instructions included in this section cover detailed written procedures and usage of the components for the 7A050 and 7HEL053 balance kits in conjunction with components of the adapter kits (as required) listed in table l-l. Written procedures are supplemented with appropriate application sketches for complete explanations of all operations.

4-3. Before attempting to perform the operations described in this section, make certain the general principles of operation of the balancing arbors are understood as described in sections I and VII.

4-4. For permissable unbalance, tracking, or alignment tolerances, refer to applicable propeller or helicopter maintenance manuals. A complete manual listing is provided in appendix A. Adhere to the manual instructions concerning the method of correcting for conditions of unbalance exceeding the permissable tolerance. Use only the specified corrective weights and do not exceed the maximum number. Attach and secure all weights properly.

4-5. Since most operations require the use of the 7A050 work stand and hoist structure, assemble these components as described in section III.

4-6. certain of the balance kit components are used in many of the balance check operations described throughout this section IV. To minimize repetition of instructions regarding their use and operation, genera1 information is included below and these instructions shall apply at all times.

4-7. Quick-disconnect Couplings. The quick-disconnect coupling (10, figure 1-13), normally assembled to the 3/16-inch diameter suspension cable, is ready for use when removed from the balancing kit storage case. Install coupling or balancing arbor by placing open end of coupling socket over end of arbor suspension rod, and pressing straight downward on top end of coupling assembly, against moderate spring resistance, until a definite click is felt and heard. (See view A, figure 4-1.) This is the locked position of the coupling.

CAUTION

Avoid imparting excessive downward or sidewise pressure on arbor suspension rod, as damage to the flexible suspension element within the arbor may result. Should the coupling fail to en gage with moderate downward pressure, inspect coupling and suspension rod end for foreign matter which might cause interference. Parts must be clean.

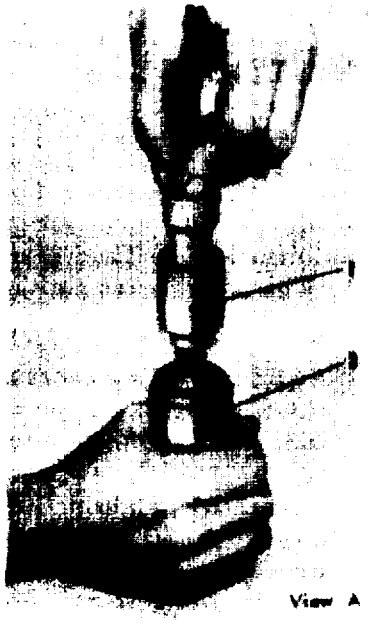
4-8. Before disengaging the coupling, be certain there is no load (suspended assembly) on the coupling and that the arbor is held so that it will not drop. Disengage coupling as follows:

a. Hold the arbor by the knurled section with one hand and press straight downward on the coupling sleeve with the other hand. (See view B, figure 4-1.)

b. Release coupling sleeve and lift disengaged coupling off arbor suspension rod.

CAUTION

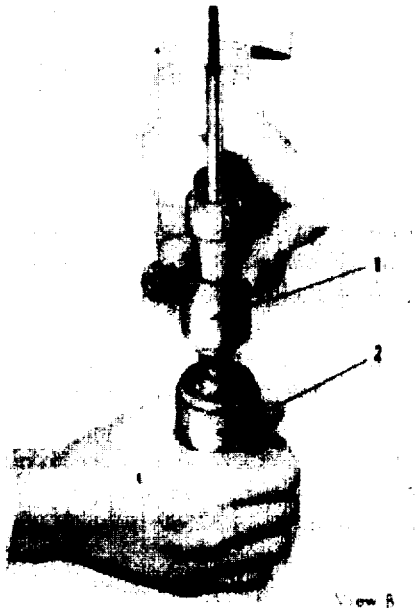
When installing or removing quick-disconnect coupling from small balancing arbor, part no. 2516 (7HEL053 kit), grasp upper suspension rod and decoupler assembly only, so as to prevent excessive compression load of the sensitive suspension element. (See views C and D, figure 4-1.)



VIEW A

Installing Quick-disconnect Coupling on Balancing Arbor, Part No. 2259 (7A050 kit)

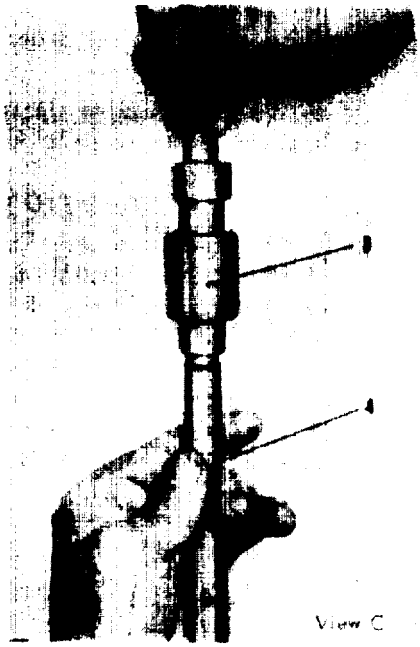
1. Coupling
2. Arbor



VIEW B

Removing Quick-disconnect Coupling from Balancing Arbor Part No. 2259 (7A050 kit)

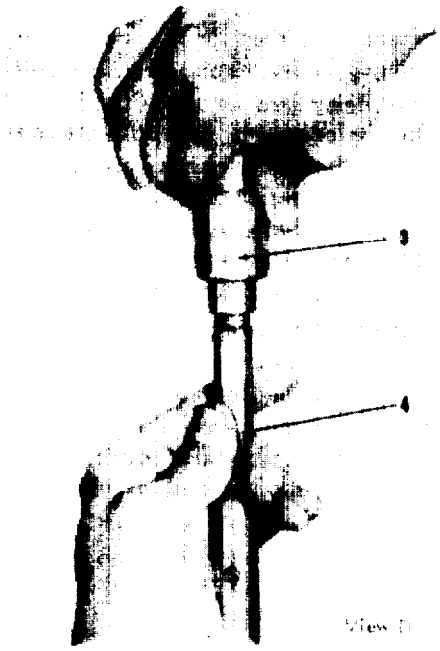
1. Coupling
2. Arbor



VIEW C

Installing Quick-disconnect Coupling on Balancing Arbor, Part No. 2516 (7HEL053 kit)

3. Coupling
4. Arbor



VIEW D

Removing Quick-disconnect Coupling from Balancing Arbor Part No. 2516 (7HEL053 kit)

3. Coupling
4. Arbor

Figure 4-1. Installing and Removing Quick-disconnect Couplings.

4-9. Hydraulic Pump Assembly. (See figure 4-2.) The hydraulic pump assembly contains hydraulic fluid and is ready for use when removed from the balancing kit storage case and installed on the hoist arm structure of the stand assembly. Operation is as follows:

a. To raise (hoist) a suspended load, turn the pump valve (5) counterclockwise to the limit of its travel. This closes the ram bypass and directs pressure to the ram cylinder. Actuate the pump handle (3) to raise the ram piston (6) to desired level within the piston's normal travel of approximately 1½ inches.

CAUTION

Upward travel of the ram piston is limited by a piston stop washer and retaining ring (1). With the ram piston against this stop, further actuation of the pressure pump will result in a build-up of internal pressure which may cause damage to the load indicating gage (8) or to internal pump parts. Never operate the pump beyond an indicated load of 800 pounds.

b. To lower a suspended load, turn the pump valve clockwise to gradually open the ram bypass and unload the ram piston. For more rapid descent, the valve may be turned clockwise as desired up to the limit of its travel.

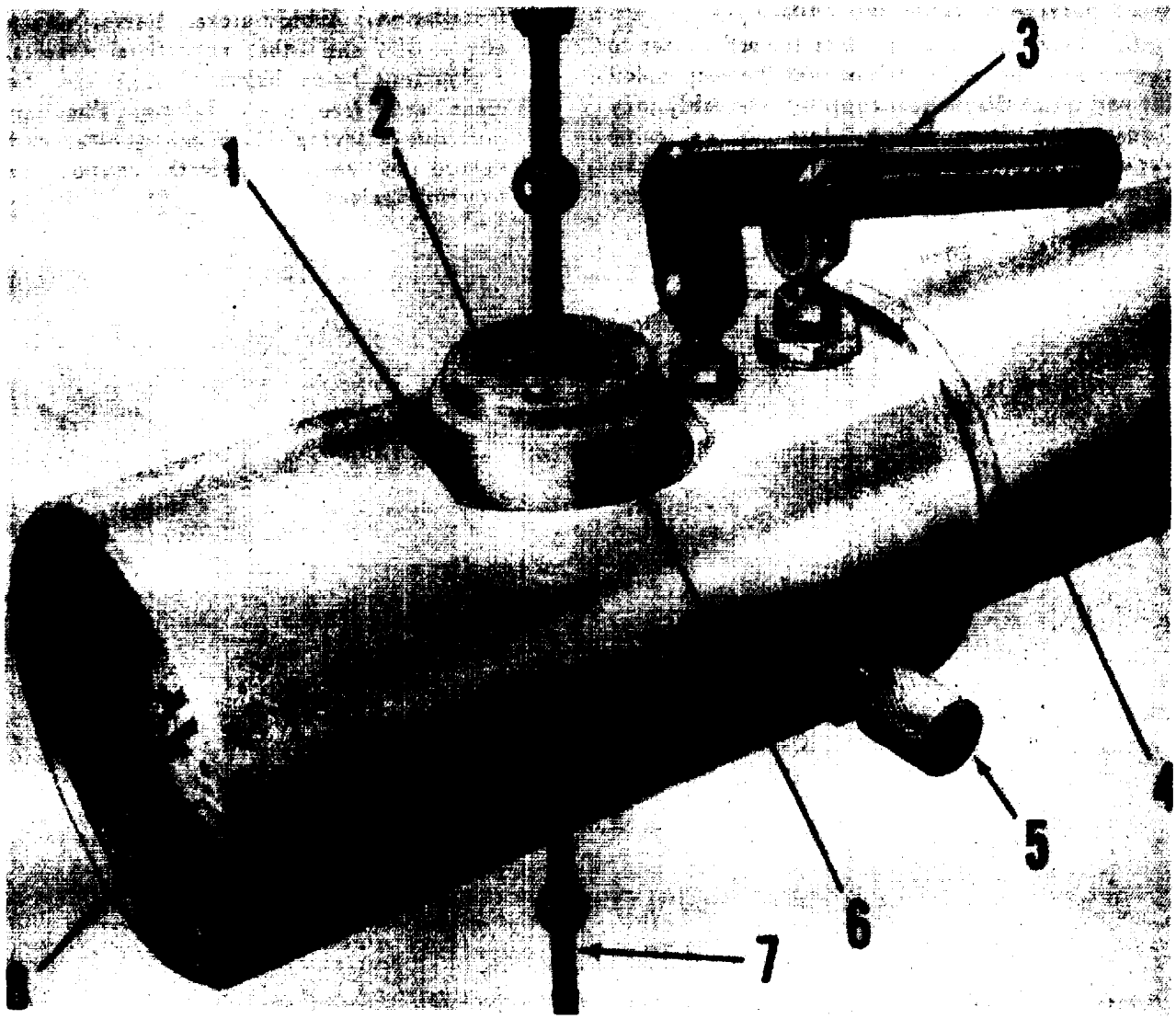


Figure 4-2. Hydraulic Pump Assembly.

Key to figure 4-2:

1. Piston stop washer and retaining ring
2. Pump lifting plate
3. Pump handle
4. Pump positioning screw
5. Pump valve
6. Ram piston
7. 3 / 16.Inch cable assembly
8. Load indicating gage

4-10. Suspension Cables. Install 3 / 16.inch suspension cable (13, figure 1-13) in ram piston (6, figure 4-2) of hydraulic pump assembly as follows:

a. Insert ball end of cable upward through center hole in the ram piston guide. Position pump lifting plate (2, figure 4-2) sidewire to permit free upward passage of cable and balls.

b. Move pump lifting plate toward center to engage one of the cable balls so that the suspension cable and quick-disconnect coupling assembly may be suspended from lifting plate. Make cable engagement with ram piston in full down position. Engagement of lowest possible cable ball will insure adequate hoisting of balance load within range of ram piston travel.

CAUTION

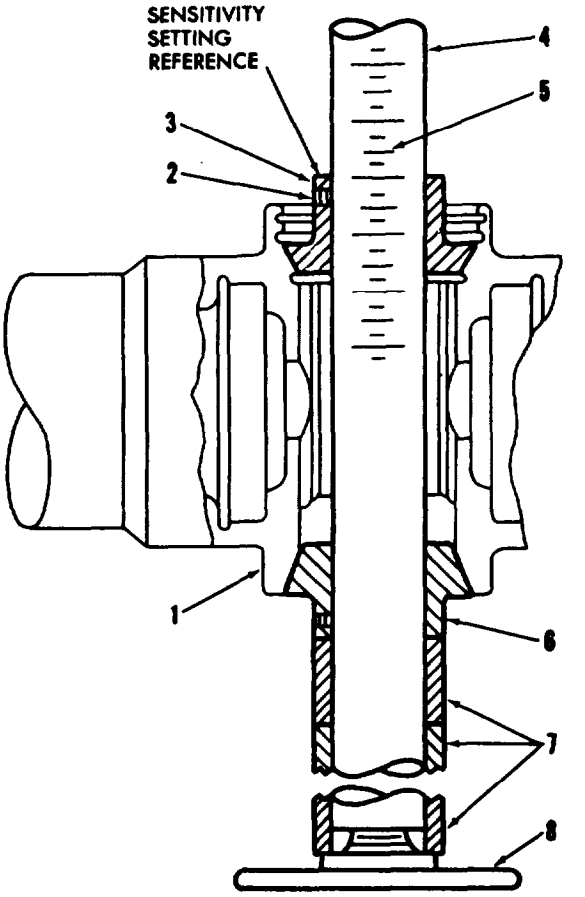
Do not exceed load limits engraved on load indicating gage (8, figure 4-2) of hydraulic pump for either 1 / 16-inch or 3 / 16-inch suspension cable. General use of the 3 / 16-inch cable is recommended so as to avoid inadvertent overloading of the 1 / 16.inch cable.

4-11. PROPELLER BALANCING APPLICATIONS.

NOTE

All kit components provide for close-tolerance slip fits. Clean all mating surfaces thoroughly before each kit component installation. Avoid nicks, burrs, sharp edges, dirt and other superficial defects. Equipment being balanced shall also be clean and free from defects. The importance of having all equipment clean and devoid of surface defects cannot be overemphasized.

Figure 4-3. Typical Method of Aligning Proper Sensitivity Setting.



1. **Propeller assembly**
2. **Front cone set screw**
3. **Front cone (7A050 kit)**
4. **Balancing arbor (2259, 7A050 kit)**
5. **Arbor scale**
6. **Rear cone (7A050 kit)**
7. **Spacers (7A050 kit)**
8. **Hand wheel (2215, 7A050 kit)**

Figure 4-4. Typical Balancer Installation - Double-cone Propeller Hub-and Blade Assemblies.

4-12. HAMILTON STANDARD PROPELLERS.

4-13. Models 2D30, and 231140 - Hub and Blades Only. (See figure 4-4, Typical).

a. Set all blades of propeller assembly to name pitch angle in accordance with instructions in applicable manual. (Refer to appendix A).

NOTE

Pitch settings must not be disturbed during the following balance operations.

b. Center propeller assembly (1), with front side of propeller upward, on stand table assembly (1, figure 1-13).

CAUTION

Block or hold round propeller hub barrel of two-blade assemblies to prevent propeller assembly from rolling off stand.

c. Select applicable SAE size front cone, part no. 2206 when balancing propeller 2D30, (3, figure 4-4) or part no. 2208 when balancing propeller 23D40, (3, figure 4-4) and install cone, hub upward, on balancing arbor (4) so that top surface of cone hub aligns on arbor scale (5) with 11½ inch position when balancing the 2D30 propeller, or the 11¼ inch position when balancing the 23D40 propeller. Lock cone securely in this position by tightening front cone setscrew (2) with 1/8 inch hex wrench (8, Figure 1-13).

d. Install arbor and cone assembly downward into propeller hub, seating cone in propeller front cone seat.

e. Install applicable SAE size rear cone part no. 2205 when balancing propeller 2D30, (6, figure 4-4), or part no. 2207 when balancing propeller 23D40, (6, figure 4-4), hub downward, over lower end of arbor, and push cone upward into propeller rear cone seat, Do not lock rear cone setscrew. Hold cone in place.

f. Install spacer part no. 2203 (7) on lower end of arbor. Install hand wheel (8) in bottom end of arbor, and tighten wheel to clamp cones securely in propeller hub cone seats.

g. Install 3 / 16-inch suspension cable (13, figure 1-13) and quick-disconnect coupling (10) assembly on suspension rod at top end of arbor, and engage suspension cable in lifting plate of hydraulic pump assembly.

h. Hoist entire assembly approximately ¼ inch off work stand. Check to insure that the suspended assembly is free from interference with work stand or other objects, and note the balance condition indicated by the black indicator disc at the top end of the arbor.

i. For balance tolerance and application of balance corrections, refer to applicable manual. (Refer to appendix A).

NOTE

Should interference occur between hand wheel (8, figure 4-4) and inside diameter of work stand, make and install ¾-inch (approximate dimension) wood blocks under the two work stand legs so as to center the suspended arbor in relation to the work stand.

4-14. Model, 2D30 with Cylinder and Counterweights. (See figure 4-5).

a. Set blades of propeller assembly (1) as near to flat pitch as possible. Adjust cylinder position so as to be visually centered and in line with propeller hub bore.

b. Center propeller assembly (1), with cylinder and counterweights upward, on stand table assembly (1, figure 1-13).

CAUTION

Hold or block propeller hub barrel to prevent propeller assembly from rolling off stand table assembly.

c. Select part no. 2206 front cone (2, figure 4-5); insert cone, hub upward, under propeller cylinder; and place cone in front cone seat of propeller hub.

d. Install lower end of balancing arbor (6) downward through propeller cylinder and pilot bore of front cone (2) so that top surface of cone hub aligns with the 11-1/8 inch position on arbor scale (8).

e. Install part no. 2205 rear cone (10, figure 4-5), hub downward, over lower end of balancing arbor (6), and push cone upward into propeller rear cone seat. Hold cone in place.

f. Install part no. 2203, spacer (11), on lower end of balancing arbor (6). Install hand wheel (12) in bottom end of arbor, and tighten wheel to clamp cones securely in propeller hub cone seats.

g. Install part no. 2224 bottom cylinder cone (9), hub upward, over top end of balancing arbor (6), and seat cone firmly in bottom end of propeller cylinder. Move cylinder as required to make certain that cone is centrally seated. Lock cone securely in this position by tightening bottom cylinder cone setscrew (4) with 1/8-inch hex wrench. (8, figure 1-13) modified as shown in figure 4-5 inset.

h. Install part no. 2207 top cylinder cone (7, figure 4-5), hub upward, over top end of balancing arbor (6), and seat cone firmly in top end of propeller cylinder. Move cylinder as required to make certain that cone is centrally seated. Lock cone securely in this position by tightening top cylinder cone setscrew (5) with 1/8-inch hex wrench (8, figure 1-13).

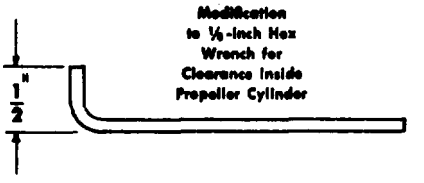
i. Install 3 / 16-inch suspension cable (13, figure 1-13) and quick-disconnect coupling (10) assembly on suspension rod at top end of arbor, and engage suspension cable in lifting plate of hydraulic pump assembly.

j. Hoist entire assembly approximately ¼ inch off work stand. Check to insure that hand wheel (12, figure 4-5) does not make contact with inside surface of work stand casting, and note the balance condition indicated by the black indicator disc at the top end of the arbor.

NOTE

Insertion of ¾-inch wood blocks under two legs of work stand may be necessary to free hand wheel from interference with work stand casting.

k. For balance tolerance and application of balance corrections, refer to applicable manual. (Refer to appendix A).



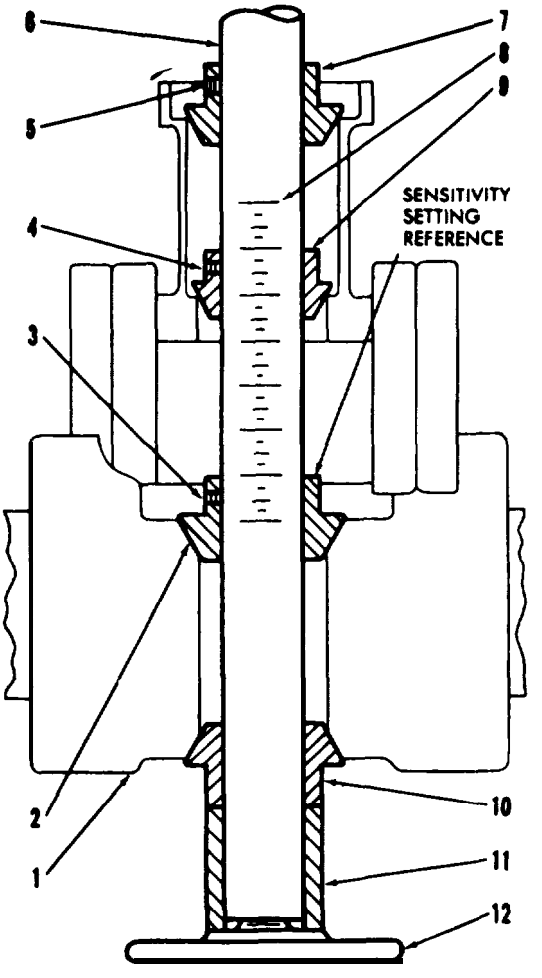


Figure 4-5. Typical Balancer Installation - Propeller Assemblies witb Cylinders and Counterweights.

Key to figure 4-5:

1. Propeller assembly
2. Front Cone (2206, 7A050 kit)
3. Front cone set screw
4. Bottom cylinder cone set screw
5. Top cone set screw
6. Arbor (2259, 7A050 kit)
7. Top cylinder cone (2207, 7A050 kit)
8. Arbor scale
9. Bottom cylinder cone (2224, 7A050 kit)
10. Rear cone (2205, 74050 kit)
11. Spacer (2203. 71050 kit)
12. Hand wheel (2215, 7A050 kit)

All data on page 4-8 deleted.

4-17. Model 23D40, with Dome Assembly.

(See figure 4-6).

a. Arrange auxiliary supports (saw horses or equivalent for propeller blade shanks on floor under suitable shop hoist.

b. Place propeller assembly (2), rear ride of propeller upward, on blade shank supports so that both upper and lower surfaces of propeller hub are accessible.

c. Remove dome assembly (1) from propeller hub.

d. Install part no. 2207 rear cone (3), hub upward, on balancing arbor (4). Align top surface of cone hub with the 14½ inch position on arbor scale (5). Lock cone firmly in this position by tightening rear cone setscrew (6) with 1/8-inch hex wrench (8, figure 1-13).

e. Install arbor downward through propeller hub, seating rear cone (3, figure 4-6) in propeller rear cone seat.

f. Install part no. 2208 front cone (7) hub downward, over lower end of arbor, seating cone in propeller front cone seat. Do not lock front cone setscrew. Hold cone in place.

g. Install applicable spacers part no. 2202 and 2204, (8), on lower end of arbor.

h. Install screw plug (9) in bottom of arbor, and tighten plug to clamp cones firmly into propeller cone seats.

i. Install dome assembly (1) (with piston sleeve removed in case of 22D30 assembly) over lower end of balancing arbor; and secure dome assembly temporarily by hand tightening dome retaining nut.

j. Install "quickie" coupling (11, figure 1-13) of alternate hoist eye assembly (12) on end ball of 3 / 16-inch suspension cable (13) and quick-disconnect coupling (10) assembly. Engage coupling eye with suitable shop hoist. Install quick-disconnect coupling on arbor suspension rod.

k. Hoist entire assembly approximately ¼ inch off blade shank supports. Check to insure that the suspended assembly is free from interference with blade shank supports and other objects, and note the balance condition indicated by the black indicator disc at the top end of the arbor.

l. For balance tolerance and application of balance corrections, refer to applicable manual. (Refer to appendix A).

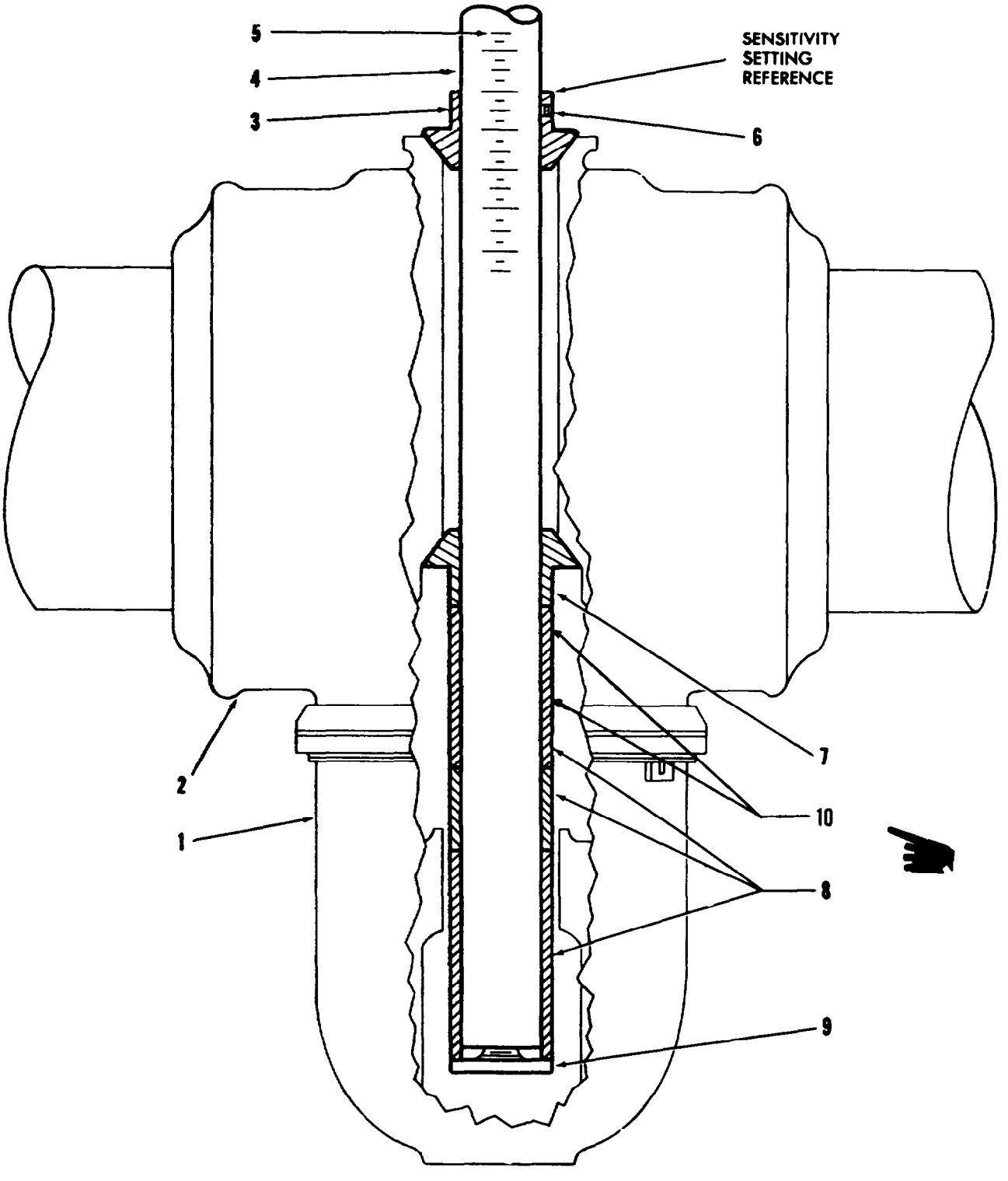


Figure 4-6. Typical Balancer Installation - Double-cone Propeller Assemblies – Shaft Nut and Front Cone Removed but Dome Assemblies Installed.

Key to figure 4-6:
1. Dome assembly
2. Propeller assembly
3. Rear cone (7A050 kit)
4. Balancing arbor (2259, 7A050 kit)
5. Arbor scale
6. Rear cone set screw
7. Front cone (7A050 kit)
8. Spacers (7A050 kit) as required
9. Screw plug (2435, 7A052 kit)
10. Bushings (7A050 kit) as required

4-18. Model 53C51 with Dome Assembly. (See figure 4-6).

NOTE

Assembly shall not include dome cap, oil transfer tube, low pitch stop assembly, or pitch lock assembly.

a. Arrange three auxiliary supports (saw horses or equivalent) for blade shanks of propeller assembly (2) on floor under suitable shop hoist.

b. Place propeller assembly, rear side of propeller upward, on blade shank supports so that both upper and lower surfaces of propeller hub are accessible.

c. Remove dome assembly (1) from propeller hub.

d. Instill rear cone (3), part no. 2228 (7A050 kit), hub upward, on balancing arbor (4) so that upper surface of cone hub aligns with 20-inch position on arbor scale (5).

NOTE

The 20-inch position is 1 inch above upper end of etched scale.

e. Lock rear cone (3) securely in this position by tightening rear cone setscrew (6) with 1/8 inch hex wrench.

f. Install arbor downward through propeller hub, seating rear cone (3, figure 4-6) in rear cone seat.

g. Install front cone (7), part no. 2208 (7A050 kit), hub downward, over lower end of arbor. Hold in position.

h. Install bushing, part no. 2210 (7A050 kit), and bushing, part no. 2211 (7A050 kit), over lower end of arbor. Do not lock bushing setscrews. Hold bushings in position.

i. Install the following spacers (8) in sequence over lower end of arbor: Part no. 2202, 2203, and 2204 (7A050 kit). If necessary, additional spacer part no. 2201, may be used.

j. Install screw plug (9) in lower end of arbor, and tighten plug to clamp cones firmly into propeller cone seats.

k. Install dome assembly (1) over lower end of balancing arbor, and secure dome temporarily by hand tightening of dome retaining nut.

l. Install "quickie" coupling (11, figure 1-13) of alternate hoist eye assembly (12) on end ball of 3 / 16-inch suspension cable (13) and quick-disconnect coupling (10) assembly. Engage coupling eye with suitable shop hoist. Install quick-disconnect coupling on arbor suspension rod.

m. Hoist entire assembly approximately ¼ inch off blade shank supports. Check to insure that the suspended assembly is free from interference with blade shank supports and other objects, and note the balance condition indicated by the black indicator disc at the top end of the arbor.

n. For balance tolerance and application of balance corrections, refer to applicable aircraft maintenance manual.

4-19. Model 53C51 Spinner assembly (See figure 1-12, typical).

NOTE

Since this spinner assembly cannot be accommodated on the 7A050 work stand and hoist assembly, the larger half of the 7A050 case assembly, on the floor with its felt tray upward, is suggested as a convenient resting place for the spinner assembly during installation and removal of the balancing adapters. Use of available standard shop hoist rather than the 7A050 hoist, is recommended in this instance for suspension of the balancing assembly.

a. Install part no. 2582 adapter (7A055 kit) hub upward, on lower end of part no. 2259 balancing arbor (7A050 kit) so that top surface of its hub aligns with the 1 ¼ inch position on arbor scale. Lock adapter in this position on arbor with adapter set screw, using 1/8 inch hex wrench (7A050, 7A055 kits).

b. Holding spinner front nut with commercial ¾ inch socket wrench (not supplied), screw part no. 2582 adapter all the way into spinner front nut until flange of the adapter bottoms firmly on spinner front support. Do not overtighten.

c. Install part no. 2227 and 2228 cones (7A050 kit) over top end of arbor and seat them firmly against hub of 2582 adapter. These cones serve as counterweights to properly position the center of gravity of the balancing assembly.

d. Install part no. 2753 adapter (7A055 kit), hub downward over top end of arbor and push downward until its grooved ring engages the circle of positioning dowels in the rear face of the spinner assembly. Insure the adapter is firmly bottomed on the dowel screws.

e. Install 2266 quick-disconnect coupling (7A050 kit) with 2264 cable (7A050 kit) on arbor suspension rod. Couple 2261 eye assembly to end ball of cable assembly using 2260-1 "quickie" coupling (7A050 kit). Engage hoist eye with shop hoist and suspend entire assembly free of interference. Note balance indication at top of arbor.

f. For balance tolerances and application of balance corrections, refer to applicable propeller maintenance handbook. (Refer to appendix A).

4-20. HARTZELL PROPELLERS.

4-21. Models HC83X20, HC93Z20, - Piston and Feathering Spring Removed. (See figure 4-10).

a. Center propeller assembly (1), with front cylinder upward, on stand table assembly (1, figure 1-13).

b. Engage installing tool (7) in part no. 2453 adapter (2) as shown in figure 4-10. Insert adapter upward through bottom of propeller hub, and screw threaded end firmly into propeller shaft nut. Disengage and remove installing tool from adapter.

c. Install rear bushing (4), knurled hub upward, on balancing arbor (8) so that top surface of bushing aligns with the 13¼ inch position on arbor scale (6) when balancing the HC93Z20 propeller, or the 13-3/4 inch position on arbor scale (8) when balancing the HC83X20 propeller. Lock bushing securely in this position by tightening bushing setscrew (5) with 1/8 inch hex wrench (8, figure 1-13).

d. Install balancing arbor (8, figure 4-10) downward through propeller shaft nut and adapter, seating rear bushing (4) on propeller shaft nut.

e. Install part no. 2223 rear cone (11), hub downward, over lower end of arbor. Hold in place.

f. Install part no. 2203 spacer (12). Hold spacers and cone.

g. Install hand wheel (13) in lower end of arbor, and tighten wheel to clamp rear cone (11) firmly into propeller cone seat.

h. Install plate (9), hub upward, over top end of arbor. Align plate pitch positioning pins, as applicable, with propeller blade pitch arms, and secure plate temporarily by inserting propeller pitch arm link screws through plate pins and propeller pitch arms.

i. Position blade pitch in desired range, and lock plate (9) on arbor by tightening plate setscrew with 1/8-inch hex wrench (8, figure 1-13).

j. Install wedges (3, figure 4-10) between propeller hub and blade butts. (See figure 4-7). Insert wedges consistently from leading edge aider of blades to insure symmetrical distribution of weight, and tap wedges lightly to make certain that play in blade bearings is taken up in a radially outward direction.

k. Install 3 / 16-inch suspension cable (13, figure 1-13) and quick disconnect coupling (10) assembly on suepension rod at top end of arbor, and engage suspension cable in lifting plate of hydraulic pump assembly.

l. Hoist entire assembly approximately ¼ inch off work stand. Check to insure that the suspended assembly is free from interference with work stand and other objects, and note balance condition indicated by the black indicator disc at the top end of the arbor.

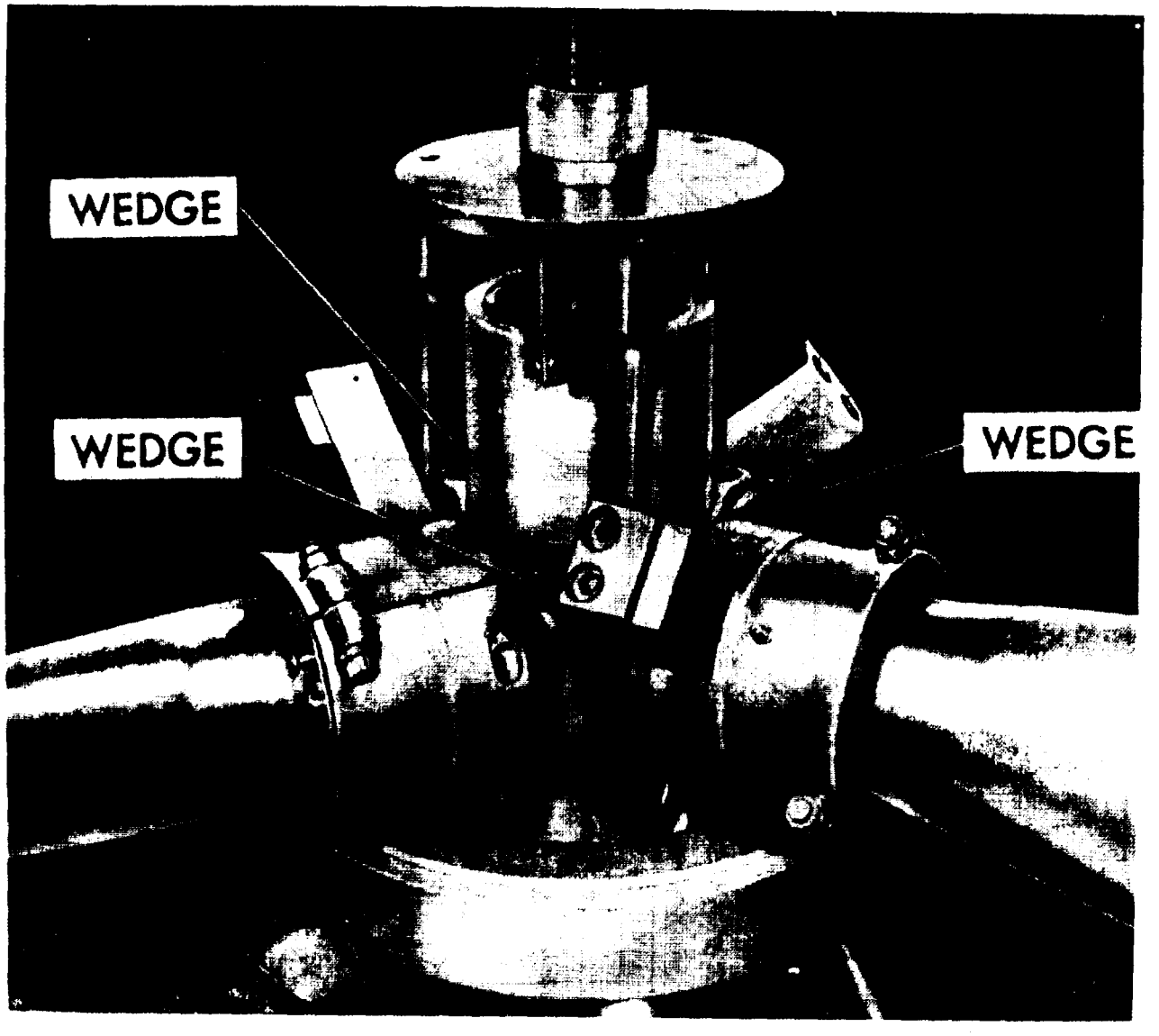


Figure 4-7. Typical Use of Wedges to Load Propeller Blade Bearings Radially Outward.

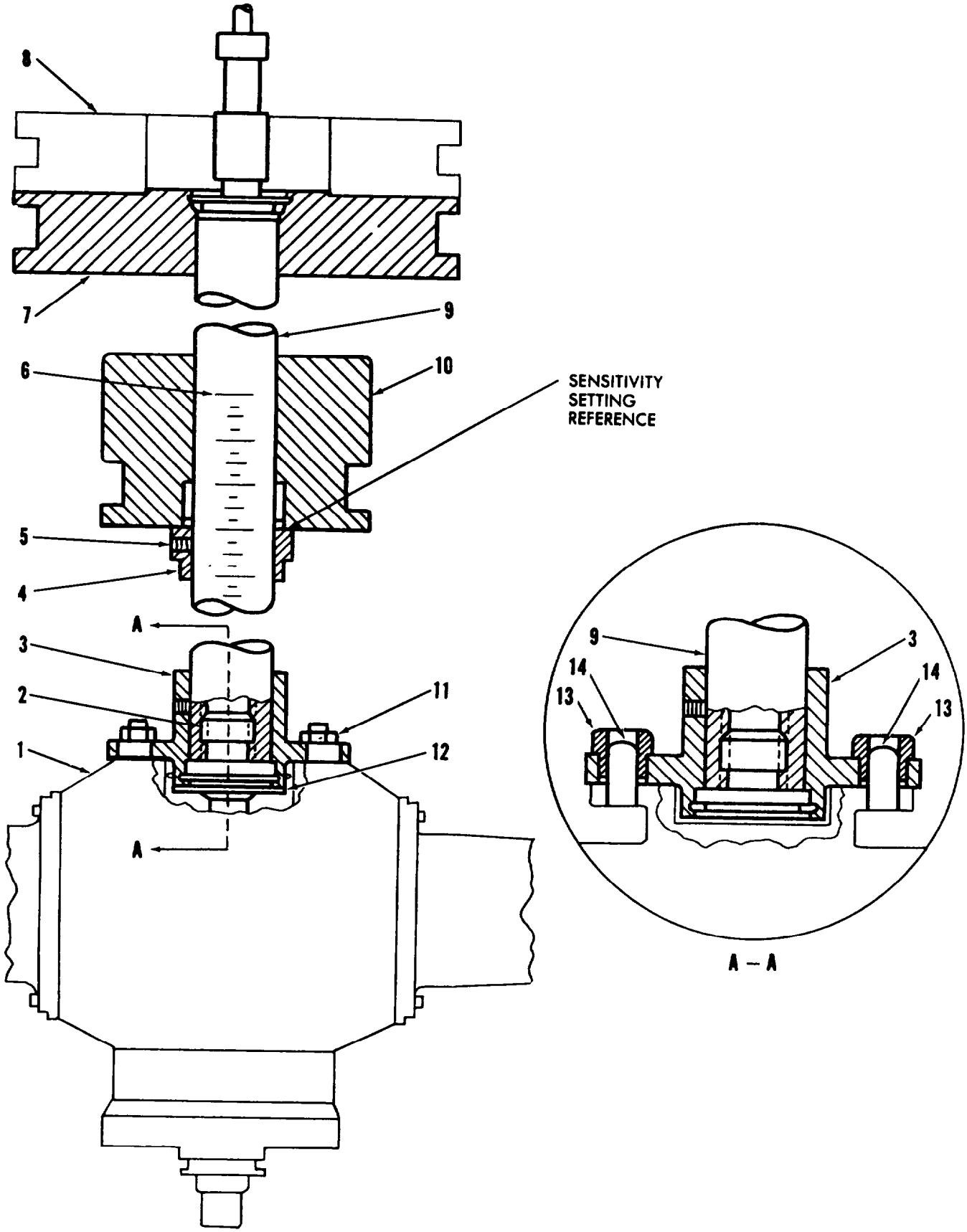


Figure 4-8. Typical Balancer Installation – Flange-mounted Propeller Assemblies Having no Center Hole for Installation of Balancing Arbor through Hub.

Key to figure 4-8:

1. Propeller assembly
2. Screw plug (2435, 7A052 kit)
3. Flange adapter (2433, 7A052 kit)
4. Rear bushing (2210, 7A050 kit)
5. Bushing set screw
6. Arbor scale
7. Weight assembly (2432, 7A052 kit)
8. Counterweight (2450, 7A052)
9. Balancing arbor (2259, 7A050 kit)
10. Adjustable weight (2434, 7A052 kit)
11. Propeller flange attaching nuts
12. Adapter pilot for propellers piloting in center bore
13. Dowel pilot bushing (2451, 7A052 kit) for propellers piloting on dowels instead of center bore
14. Propeller hub dowel

Figure 4-9. Deleted.

m. For balance tolerance and application of balance corrections, refer to applicable propeller manual. (Refer to appendix A.)

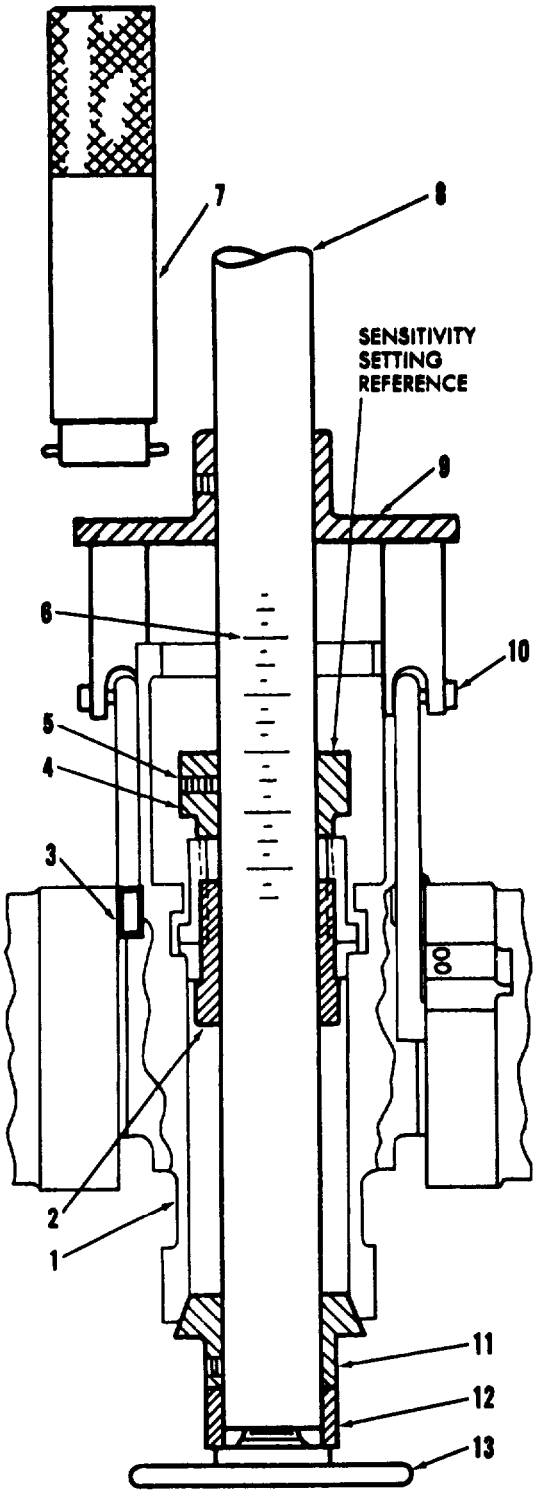


Figure 4-10. Typical Blancer Installation - Single-cone, Splined Hub Assemblies with Shaft Nuts Enclosed in Hub, Utilizing Pitch Positioning Plate.

Key to figure 4-10:

1. Propeller assembly
2. Adapter (2453, 7A052 kit)
3 Wedge (2247, 7A052 kit)
4. Rear bushing (2210, 7A050 kit)
5. Bushing ret screw
6. Arbor scale
7. Installing tool (2452 7A052 kit)
8. Balancing arbor (2259, 7A050 kit)
9. Plate (2455, 7A052 kit)
10. Pitch arm link screw
11. Rear cone (2223, 7A050 kit)
12. Spacers (2203, 7A050 kit)
13. Hand wheel (2215, 7A050 kit)

4.22. Balancing Hartzell Flange-mounted Turbo. propellers Reversing Type-Model HC-B3TN-3 Typical. (See figure 4-11.)

NOTE

Supplemental components not provided in normal adapter kits are required to accomplish instructions included below. These parts consist of: part no. 2769, Tube; part no. 2792, Base Plate: part no. 2793, Stand Adapter Plate; and part no. 2816, Flange Adapter Assembly. See table 1-1.

a. Remove piston and feathering spring assembly, if installed, from the propeller. Assemble TA050 work stand and hoist assembly using part no. 2769 tube assembly in lieu of part no. 2288 tube (no. 4) provided in 7A050 kit.

b. Insure prop flange and pilot bore as well as mating surfaces of the 2816 adapter (3) are completely clean. Install pilot of adapter (3) in prop flange bore. Check to insure adapter flange seats squarely against prop flange. Retain with two prop flange bolts, 180° apart.

c. Place 2793 plate (15) centrally on 7A050 stand table; place plate (14) centrally on top of plate (15). Set propeller with flange adapter downward, on top of part no. 2792 plate (14) and visually align inside bore of adapter (3) with bore of plate (14).

d. Install bushing (8), hub downward, on arbor (9) so that top surface of bushing aligns with 13.inch position on arbor scale. Lock bushing securely in this position with bushing set screw.

e. Install arbor downward through prop hub,

adapter (3) and plate (14) until hub of bushing (8) comes to rest at bottom of prop cylinder.

f. Install spacer (2) over bottom end of arbor, nsuring that top of spacer passes through slot in plate (15), to contact plate (14). Install handwheel (1) in bottom of arbor and tighten to clamp balancing assembly together.

g. Install plate hub upward, over top end of arbor. Align plate pitch positioning pins, as applicable, with propeller blade pitch arms, and secure plate temporarily by inserting propeller pitch arm link screws through plate pins and pitch arms.

h. Position blade pitch in desired range, and lock plate on arbor by tightening plate set screw with 1/8-inch hex wrench (8, figure l-13).

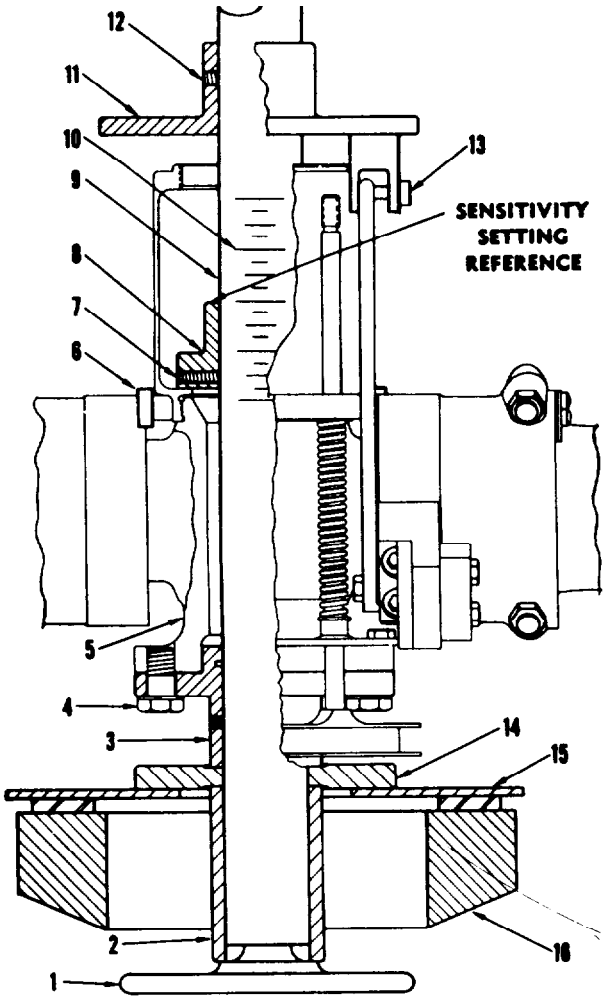
i. Install wedges (6, figure 4-11) between propeller hub and blade butts. (See figure 4-7). Insert wedges consistently from leading edge sides of blades to insure symmetrical distribution of weight, and tap wedges lightly to make certain that play in blade bearings is forced radially outward.

j. Hoist balancing assembly approximately 1/4 inch off plate (15) and remove plate (15) from stand table. Check to insure balancing assembly is suspended free of interference with stand or adjacent objects. Observe balance indication at top of arbor.

NOTE

Re-install plate (15) on stand table before lowering balancing assembly onto stand.

k. For balance tolerance and installation of balance corrections, refer to applicable propeller manual.



1. Handwheel (2215, 7A050 kit)
2. Spacer (2204, 7A050 kit)
3. Flange adapter (2816)
4. Propeller flange bolts
5. Propeller assembly
6. Wedge (2247, 7A052 kit)
7. Bushing setscrew
8. Bushing (2210, 7A050 kit)
9. Arbor (2259, 7A050 kit)
10. Arbor scale
11. Plate assembly (2455, 7A052 kit)
12. Plate set screw
13. Pitch arm link screw
14. Plate (2792)
15. Plate (2793)
16. Stand table

Figure 4-11. Balancing Hartzell Flange-mounted Turbo Propellers - Reversing Type (HC-B3TN-3).

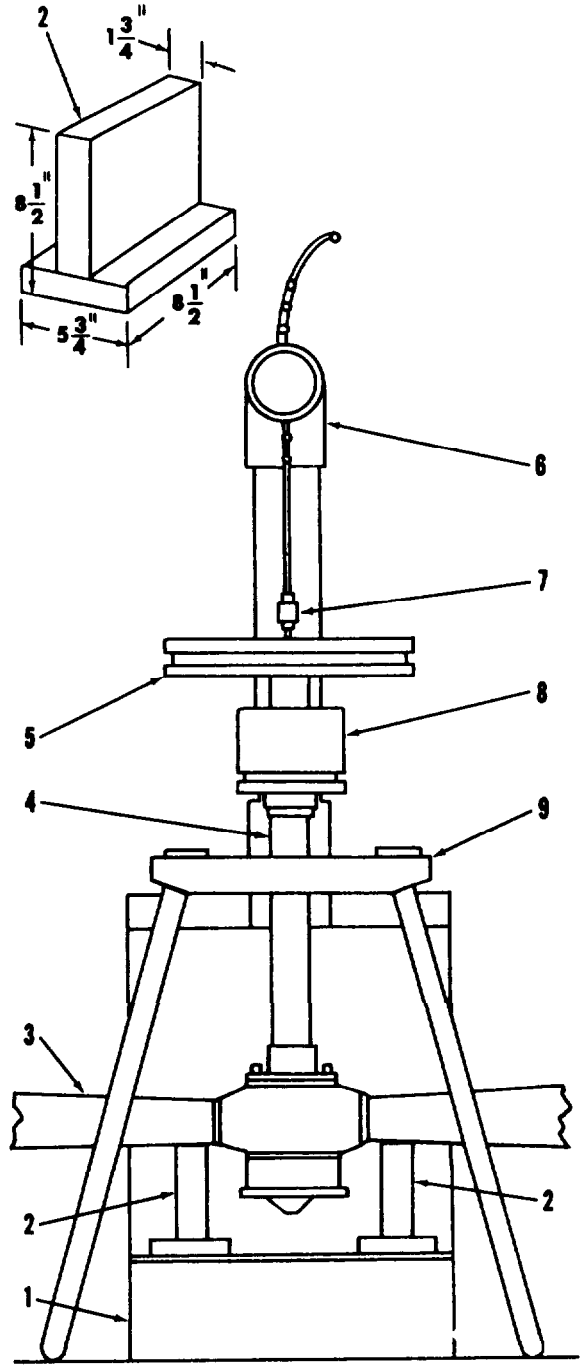


Figure 4-12. Typical Support Arrangement - underslung Suspended Propeller Assembly.

Key to figure 4-12:

1. 7A050 Kit storage case (bottom half)
2. Auxiliary support blocks
3. Propeller assembly
4. Balancing arbor
5. Weight assembly
6. Hydraulic hoist
7. Quick-disconnect coupling and suspension cable
8. Adjustable weight
9. Work stand

4-23. MC CAULEY PROPELLERS.

4-24. Model lA200, and One Piece Fixed Pitch. (See figure 4-13.)

a. Center plate (1) on stand table assembly (1, figure 1-13).

b. Center propeller assembly (2, figure 4-13), with camber (curved surface of the blade) downward on plate (1).

NOTE

The blade face is the blade surface adjacent to the aircraft; the flat side of the blade that can be seen by standing behind the aircraft. The blade back (camber) is the curved surface of the blade that can be seen by standing in front of the aircraft.

c. Install bushing (3), knurled hub upward, on balancing arbor (5) so that top surface of bushing aligns with the 14-inch position on arbor scale (6). Secure bushing in this position by tightening bushing set screw (4) with 1/8 inch-hex wrench (8, figure 1-13).

d. Install arbor downward through propeller hub and plate (1), seating pilot diameter of bushing (3) firmly into center bore of propeller hub.

e. Install spacers (7), as shown in figure 4-13 over lower end of arbor. Hold spacers in place.

f. Install hand wheel (8) in bottom end of arbor, and tighten wheel to clamp parts securely together.

g. Install suspension cable (13, figure l-13) and quick-disconnect coupling (10, figure l-13) assembly on suspension rod at top end of arbor, and engage suspension cable in lifting plate of hydraulic pump.

h. Hoist entire assembly approximately 1/4 inch off work stand. Check to insure that the suspended assembly is free from interference with work stand and other objects, and note balance condition indicated by the black indicator disc at the top end of the arbor.

i. For balance tolerance and application of balance corrections, refer to applicable propeller manual. (Refer to appendix A.)

Key to figure 4-13 :

1. Plate (2209, 7A050 kit)
2. Propeller assembly
3. Rear bushing (2210, 7A050 kit)
4. Bushing setscrew
5. Arbor (2259, 7A050 kit)
6. Arbor scale
7. Spacers (2201, 2202, 2203, 2204, 7A050 kit)
8. Handwheel (2215, 7A050 kit)

Figure 4-13. Typical Balancer Installation - Fixed Pitch, Flange-mounted Propellers.

4-25. Model 2A36 - (Complete Assembly. (See figure 4-8.)

a. Install screw plug (2) and retaining ring in flange adapter (3).

b. Install flange adapter (3) on flange of propeller assembly (1), with adapter pilot diameter seated in center pilot bore (12) of propeller mounting flange. Secure adapter with two propeller flange attaching nuts or bolts (11), as applicable, 180 degrees apart.

c. Place two auxiliary support blocks (2, figure 4-12) on felt tray of 7A050 kit case underneath work stand, as shown in figure 4-12.

d. Walk propeller through and under work stand, and center propeller hub under work stand with blade shanks resting on auxiliary support-blocks.

e. Install rear hushing (4, figure 4-8), knurled hub upward, on balancing arbor (9) so that top surface of bushing aligns with the 16 inch position on arbor scale (6). Lock bushing securely in this position by tightening bushing setscrew (5) with l/8 inch hex wrench (8, figure 1-13).

f. Install arbor downward through work stand casting and into flange adapter (3, figure 4-8). Screw arbor onto screw plug (2) until firmly bottomed in flange adapter (3).

g. Install adjustable weight (10), grooved end downward, over top of balancing arbor, seating weight on top surface of rear bushing (4).

h. Install weight assembly (7). retaining ring upward, making certain it is fully seated on top end of arbor. Counterweight (8, figure 4-8) is not used in this application.

i. Install 3/16-inch suspension cable (13, figure 1-13) and quick-disconnect coupling (10) assembly on suspension rod at top end of arbor, and engage suspension cable in lifting plate of hydraulic pump assembly.

j. Hoist entire assembly approximately 1/4 inch off auxiliary support blocks. Check to insure that the suspended assembly is free from interference with blocks, work stand, and other objects, and note the balance condition indicated by the black indicator disc at the top end of the arbor.

k. For balance tolerance and application of balance corrections, refer to applicable propeller manual. (Refer to appendix A.)

4-26. SESENICH PROPELLERS.

4-27. Model M-76-One Piece Fired Pitch

(See figure 4-13.)

a. Center plate (1) on stand table assembly (1, figure 1-13).

b. Center propeller assembly (2, figure 4-13, front face downward on plate (1).

c. Install rear bushing (3), knurled hub upward, on balancing arbor (5) so that top surface of bushing aligns with 15-inch line on arbor scale (6). Secure bushing in this position by tightening bushing setscrew (4) with l/8-inch hex wrench (8, figure 1-13).

d. Install arbor downward through propeller hub and plate (1, figure 4-13, seating pilot diameter of rear bushing (3) firmly into center bore of propeller hub.

e. Install all four spacers (7), over lower end of arbor. Hold in place.

f. Install hand wheel (8) in bottom end of arbor, and tighten wheel to clamp parts securely together.

g. Install 3/16-inch suspension cable (13, figure 1-13) and quick-disconnect coupling (10) assembly on suspension rod at top end of arbor, and engage suspension cable in lifting plate of hydraulic pump assembly.

h. Hoist entire assembly approximately 1/4 inch off work stand. Check to insure that the suspended assembly is free from interference with work stand and other objects, and note balance condition indicated by the black indicator disc at the top end of the arbor.

i. For balance tolerance and application of balance corrections, refer to applicable propeller manual.

4-28. HELICOPTER APPLICATIONS.

NOTE

All kit components provide for close tolerance slip fits. Clean all mating surfaces thoroughly before each kit component installation. Avoid nicks, burrs, sharp edges, dirt and other superficial defects. Equipment being balanced shall also be clean and free from defects. The importance of having all equipment clean and devoid of surface defects cannot be over-emphasized.

4-29. BELL HELICOPTERS.

4-30. OH-13 and TH-13 Helicopters.

4-31. OH-13 and TH-13 Engine Fan Assembly Balance Check. (See figure 4-14.)

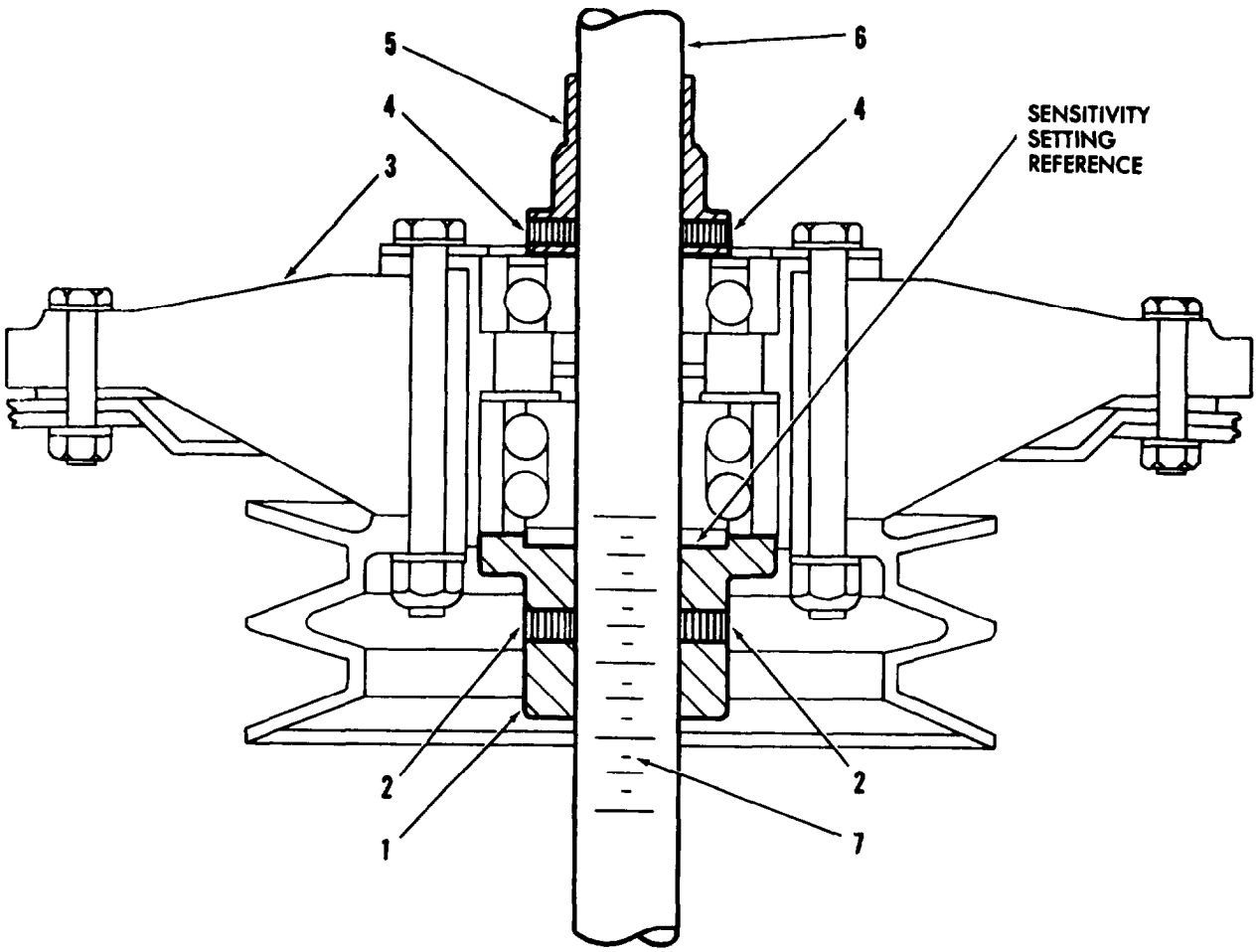
a. Install pilot bushing (1), flange upward, on balancing arbor (6) so that inner top surface of bushing aligns with 63/4 inch position on arbor scale (7). Lock bushing in this position by moderate and uniform tightening of two bushing setscrews (2), using 3/32-inch hex wrench (2, figure l-18).

b. Carefully install engine fan assembly (3, figure 4-14), pulleys downward, over top end of arbor. Insure that flange of pilot bushing (l) enters fan hub bearing sleeve and seats squarely on outer race of fan hub bearing.

c. Install sleeve (5), flange downward, over top end of balancing arbor, and seat firmly on top surface of fan hub bearing inner race. Lock sleeve in this position by moderate and uniform tightening of two sleeve setscrews (4), using 3/32-inch hex wrench (2, figure 1-18).

d. Install quick-disconnect coupling (7HEL053 or 7A050 kit) on arbor suspension coupler, and suspend entire assembly free of interference. Note balance condition indicated by black indicator disc at top end of the arbor.

e. For balance tolerance and application of balance corrections, refer to applicable helicopter manual. (Refer to appendix A.)



1. Pilot bushing (2533, 7HEL053 kit)
2. Pilot bushing setscrew
3. Engine fan assembly
4. Sleeve setscrew
5. Bushing (2530, 7HEL053 kit)
6. Balancing arbor 2516, 7HEL053 kit)
7. Arbor scale

Figure 4-14. Balancer Installation - OH-13 and TH-I3 Helicopter Engine Fan Assembly.

4-32. OH-13 and TH-13 Engine Fan Assembly Track and Concentricity Check. (See figure 4-15).

a. Clamp fixture assembly (2), recessed side downward, on surface plate (1) or other firm support surface.

b. Install pilot bushing (3), flange upward, on balancing arbor (8) so that bottom of bushing hub aligns approximately with P-inch position on arbor scale (9). Lock bushing in this position by moderate and uniform tightening of two pilot bushing setscrews (4), using 3/32-inch hex wrench (2, figure 1-18).

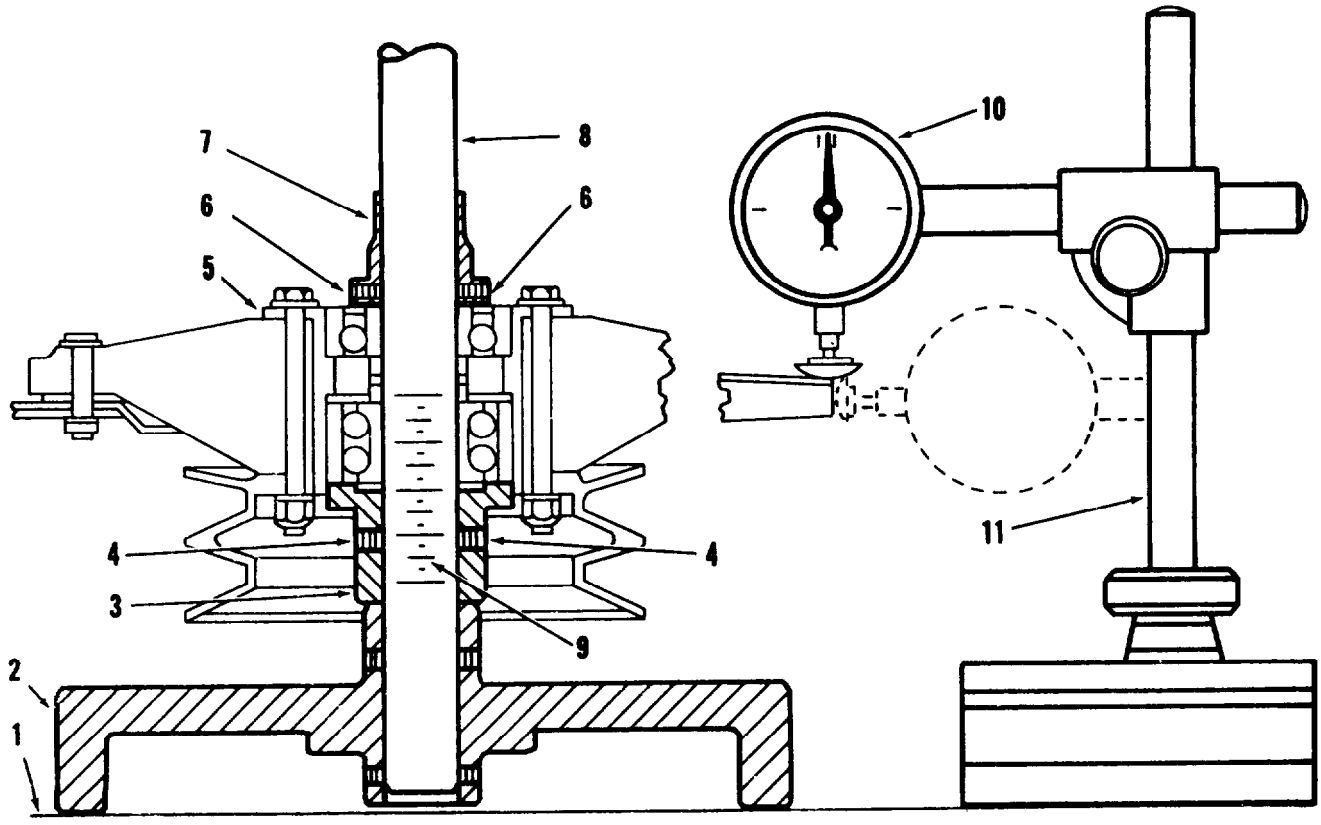
c. Install lower end of arbor in hub of fixture assembly (2, figure 4-15) so that bottom of pilot bushing (3) rests on top of fixture assembly hub. Do not lock fixture hub setscrews.

d. Carefully install engine fan assembly (5), pulleys downward, over top of arbor, insuring that pilot bushing (3) flange enters fan hub bearing sleeve and seats squarely on fan bearing outer race.

e. Install sleeve (7), flange downward, over top end of arbor, and seat firmly on inner race of fan bearing. Lock sleeve in this position by moderate and uniform tightening of two sleeve setscrews (6), using 3/32-inch hex wrench (2, figure 1-18).

f. Install 1/2 inch mushroom point on dial indicator (10, figure 4-15) and adjust height gage assembly (11) to read track or concentricity variations as required. Rotate fan to determine range of variations.

g. For track and concentricity tolerances and application of corrections, refer to applicable helicopter manual. (Refer to appendix A).



1. Surface plate
2. Fixture assembly (2532, 7HELO53 kit)
3. Pilot bushing (2533, 7HEL053 kit)
4. Pilot bushing Setscrew
5. Engine fan assembly
6. Sleeve setscrew
7. Bushing (2530, 7HEL053 kit)
8. Balancing arbor (2516, 7HEL053 kit)
9. Arbor scale
10. Dial indicator (7HEL055 kit)
11. Height gage assembly (7HEL055 kit)

Figure 4-15. Setup for OH-13 and TH-13 Helicopter Engine Fan Assembly Track and Concentricity Check.

4-33. OH-13 (Series E, G; Series H Through Serial No. 57-6244) and TH-13 Tail Rotor Hub and Blade Assembly Balance Check. (See figure 4-16).

a. Set fixture assembly (2), recessed side downward, on auxiliary support blocks (1) as shown. Screw stud ends of two post assemblies (3) into two diametrically opposite tapped holes (C, view Al in top surface of fixture. Using fingers only, insure that post assemblies are firmly seated on fixture.

b. Place one bushing (8), flange downward, central on top to fixture hub. Install tail rotor hub and blade assembly (4) over pilot diameter of bushing, insuring that hub seats firmly on flange of bushing and that blade shanks are clear of interference with post assemblies (3).

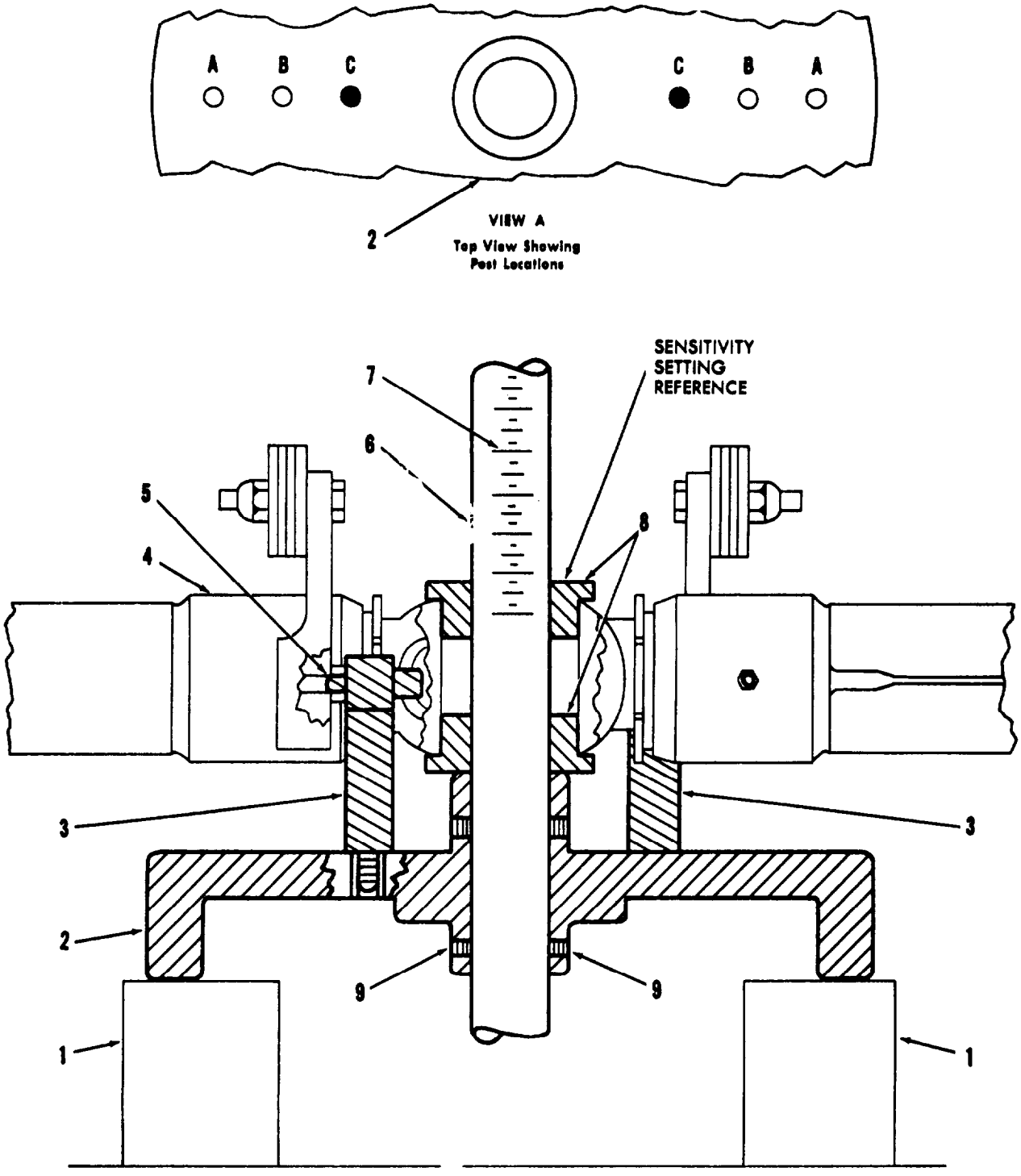
c. Install second bushing (8), flange upward, in top of rotor hub, seating bushing flange against top of rotor hub.

d. Insert lower end of balancing arbor (6) downward through two bushings (8) and hub of fixture assembly (2) until 71/4 inch position on arbor scale (7) aligns with top surface of upper bushing (8). Lock arbor in this position by moderate and uniform tightening of two lower fixture setscrews (9), using 3/32-inch hex wrench (2, figure 1-18).

e. Rotate swivel heads of post assemblies (3, figure 4-16), and rotate rotor hub on arbor until small ends of index pins enter rotor pitch arm bracket holes. Seat index pins and swivel heads readily outward against the rotor pitch arm brackets.

f. Install quick-disconnect coupling (7HEL053 or 7A050 kit) on arbor suspension coupler, and suspend entire assembly free of interference, and note the balance condition indicated by black indicator disc at top end of the arbor.

g. For balance tolerance and application of balance corrections, refer to applicable helicopter manual. (Refer to appendix A.)



1. Auxiliary support block
2. Fixture assembly (2532, 7HEL053 kit)
3. Post assembly (2539, 7HEL053) (2)
4. Tail rotor hub and blade assembly
5. Post assembly index pin
6. Balancing arbor (2516, 7HEL053 kit)
7. Arbor scale
8. Bushing (2528, 7HEL053) (2)
9. Lower fixture set screw

Figure 4-16, Blancer Installation - OH-13 (Series E, G; *Serial H through Series No. 57-6244) Helicopter Tail Rotor Hub and Blade Assembly.*

4-34. OH-13 (Series H, Serial NO. 58-1497 and Subsequent and Series S) Tail Rotor Hub and Blade Assembly Balance Check. (See figure 4-17.)

a. Set fixture assembly (2), recessed side downward, on auxiliary support blocks (1) as shown. Screw stud ends of two post assemblies (3) into two diametrically opposite tapped holes (B, view A) in top surface of fixture. Using fingers only, insure that post assemblies are firmly seated on fixture.

b. Place spacer (13) central on top of fixture assembly (2) hub.

c. Install pilot bushing (12), flange upward, on balancing arbor (8) so that its top surface aligns with 7-inch position on arbor scale (9). Lock bushing in this position by moderate and uniform tightening of two pilot bushing setscrews (11), using 3/32-inch hex wrench (2, figure 1-18).

d. Set tail rotor hub and blade assembly (4, figure 4-17) on fixture assembly (2) so that bottom (flat) surface of rotor hub trunnion rests on spacer (13), flat surface of rotor hub is upward, and rotor blade shanks are clear of post assemblies (3).

e. Insert lower end of arbor downward through rotor hub trunnion, spacer (13), and hub of fixture assembly (2). Press cone of pilot bushing (12) firmly into cone seat of rotor hub trunnion, and lock arbor in this position by moderate and uniform tightening of two lower fixture setscrews (14).

f. Rotate swivel heads of post assemblies (3), and rotate hub on arbor until small ends of post assembly index pins (5) enter rotor pitch arm bracket holes. Seat index pins and swivel heads radially outward against rotor pitch arm brackets.

g. Install part no. 2586 or 2531 plate (6) over top end of arbor, followed by bushing (7). with flange downward. The part no. 2586 is a miscellaneous component, and is not supplied in any kit included in this manual. Press bushing and plate firmly downward against flat top surface of rotor hub, and lock plate and bushing in this position by moderate and uniform tightening of two bushing setscrews (10).

h. Install quick-disconnect coupling (7HEL053 or 7A050 kit) on arbor suspension coupler, and suspend entire assembly free of interference. and note the balance condition indicated by the black indicator disc at top end of the arbor.

i. For balance tolerance and application of balance corrections, refer to applicable helicopter manual. (Refer to appendix .A.)

4-34A. OH-13 SERIES S AND TH-13T, TAIL ROTOR HUB AND BLADE ASSEMBLY BALANCE CHECK. (See figure 4-17A).

a. Set. fixture assembly (2), recessed side downward on stand assembly or auxiliary support block (1) as shown. Screw stud ends of two post assemblies (8) into two diametrically opposite tapped holes (A) in top surface of fixture. Using fingers only, insure that post assemblies are firmly seated on fixture.

b. Temporarily install balancing arbor (8) in fixture assembly (2) using set screw (12) to lock arbor in place. A sensitivity setting is not necessary at this time.

C. Install adapter (11) on arbor (8) with recessed portion of adapter downward to set on fixture assembly (2).

d. Install tail rotor hub and blade assembly on fixture assembly flat surface up. Adapter (11) is positioned against bottom side of trunnion with cambered sides between the trunnion sleeves.

e. Install plate (6) on flat surface of tail rotor hub and blade assembly.

f, Install bushing (7) with flange downward.

g. Rotate swivel heads of post assemblies (3) and rotorhub cuffs on arbor until small ends of index pins enter rotor pitch arm bracket holes from outboard side.

b. Push down On plate assembly (6) so flat surface of rotor hub is flush with plate. Loosen set screw on fixture assembly (2) and move arbor (8) up or down until a sensitivity setting of 7 inch position is aligned on arbor scale (9) with top surface of bushing (7). Tighten set screw (10). Press bushing and plate firmly downward against flat top surface of rotor hub and lock entire hub in position by moderate and uniform tightening of lower fixture set screws (12).

i. Install quick-disconnect coupling on arbor suspension coupler and suspend entire assembly free of interference, and note balance condition indicated by black indicator disc at top of arbor.

j. For balance tolerance and application of balance corrections, refer to applicable helicopter manual. (Refer to appendix A.)

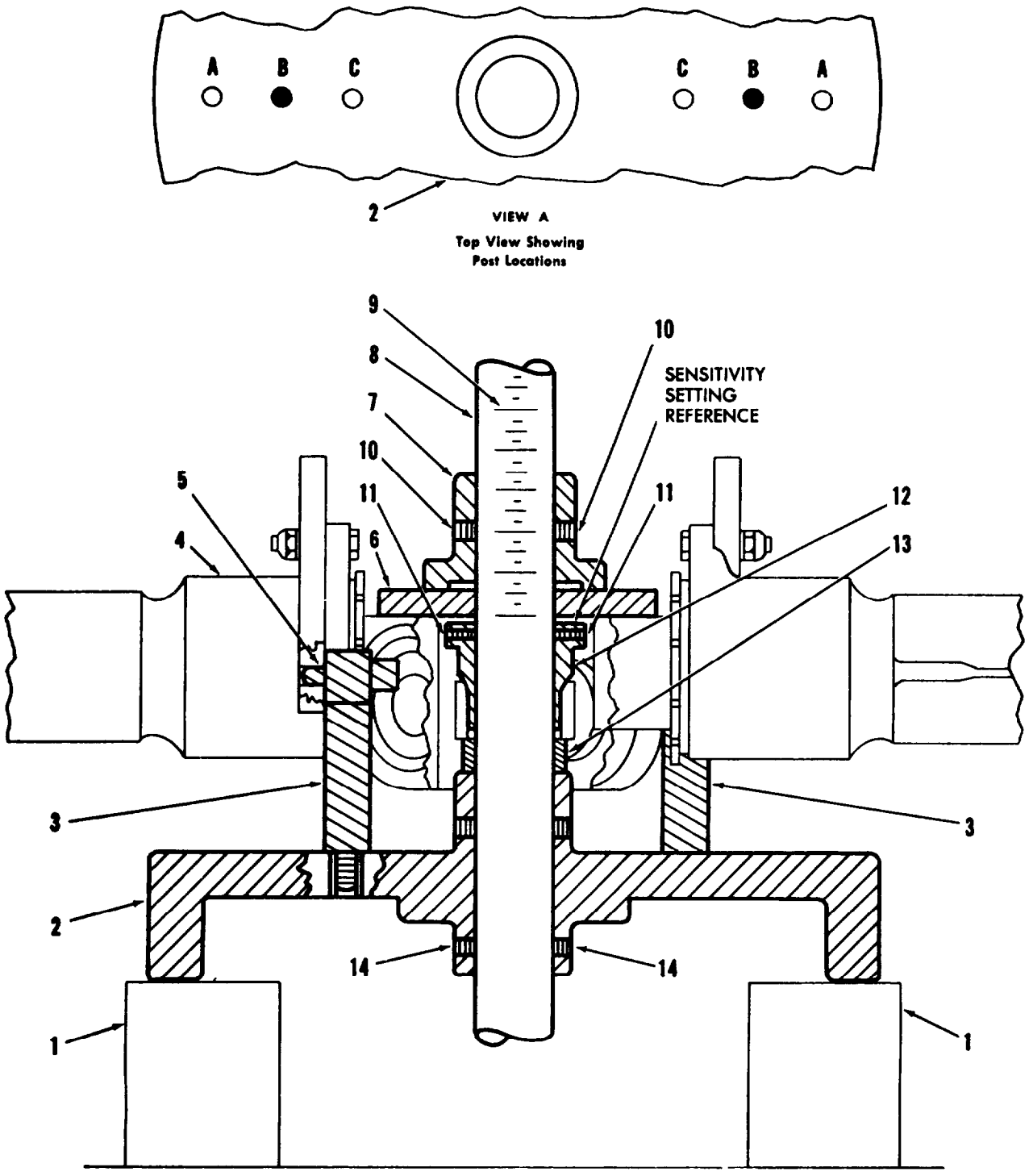


Figure 4-17. Balancer Installation - OH-13 (Series H, Serial No. 58-1497 and Subsequent) Helicopter Tail Rotor Hub and Blade Assembly.

Key to figure 4.17:

1. Auxiliary support block
2. Fixture assembly (2532, 7HEL053 kit)
3. Port assembly (2539, 7HEL053 kit) (2)
4. Tail rotor hub and blade assembly
5. Port assembly index pin
6. Plate (2586 or 2531, accessory part, 7HEL053 kit)
7. Bushing (2533, 7HEL053 kit)
8. Balancing Arbor (2516. 7HEL053 kit)
9. Arbor scale
10. Bushing setscrew
11. Pilot bushing setscrew
12. Pilot bushing (2530, 7HEL053 kit)
13. Spacer (2536, 7HEL053 kit)
14. Lower fixture setscrew

4-35. OH-13 and TH-13 Main Rotor Hub and Blade Assembly Balance Check. (See figure 4-18.)

NOTE

Additional hoist arm support height is required for thin balance check application. To provide this additional hoist arm height, substitute the miscellaneous component tube assembly, part no. 2769 in lieu of part no. 2288 tube provided in 7A050 kit.

a. Assemble hoist support structure using the part no. 2769 tube assembly (38″ length) in place of the vertical tube no. 4 (part no. 2288) shown in figure 3-3.

b. Center fixture (1), with sleeve (2) installed, on stand table assembly (1, figure 1-13).

c. Carefully lower rotor hub and blade assembly (3, figure 4-18) over top of fixture (1), guiding rotor hub trunnion spline inside diameter over sleeve (2). Make certain that base of rotor hub yoke seats squarely on fixture base.

d. Set blade pitch of rotor hub and blade assembly (3) approximately at zero position.

NOTE

Since pitch equalizer linkage insures symmetrical blade pitch variations, locking pitch arms is not required.

e. Install balancing arbor (4) through pilot bore of fixture (1).

f. Install 3/16-inch suspension cable (13, figure 1-13) and quick-disconnect coupling (10) assembly on suspension rod at top end of arbor, and engage suspension cable in lifting plate of hydraulic pump assembly.

g. Adjust suspended height of arbor so that top of fixture (1, figure 4-18) aligns with arbor scale (5) position as follows:

(1) Wood-blade rotor assemblies-14-3/4-inch position.

(2) Metal-blade rotor assemblies- 14-inch position.

h. Install spacers (6) on bottom end of arbor as follows :

(1) Wood-blade rotor assemblies-spacers, part no. 2202 and 2203 (7A050 kit).

(2) Metal-blade rotor assemblies-spacers, part no. 2202 and 2204 (7A050 kit).

i. Install hand wheel (26, figure 1-13) in bottom end of arbor, and tighten wheel to seat spacers (6, figure 4-18) firmly under base of fixture (1). Check to insure that sensitivity setting specified in step g has been maintained.

j. Hoist entire assembly approximately 1/4 inch off work stand. Check to insure that suspended assembly is free from interference with work stand and other objects, and note balance condition indicated by black indicator disc at top end of the arbor.

NOTE

The span of the rotor blades makes it essential that this balance check be performed in a draft-free area and that the movement of personnel in the area be held to a minimum.

k. For balance tolerances and application of balance corrections, refer to applicable helicopter manual. (Refer to appendix A.)

KEY to figure 4-17A:

1. Auxiliary support block
2. Fixture assembly (2532,7HEL053 kit)
3. Post assembly (2539, 7HEL053 kit)
4. Tail rotor hub and blade assembly
5. Post assembly index pin
6. Plate (2531, 7HEL053 kit)
7. Bushing (2533, 7HEL053 kit)
8. Balancing arbor (2516, 7HEL053 kit)
9. Arbor scale
10. Bushing setscrew
11. Adapter (2773, procure)
12. Lower fixture setscrew

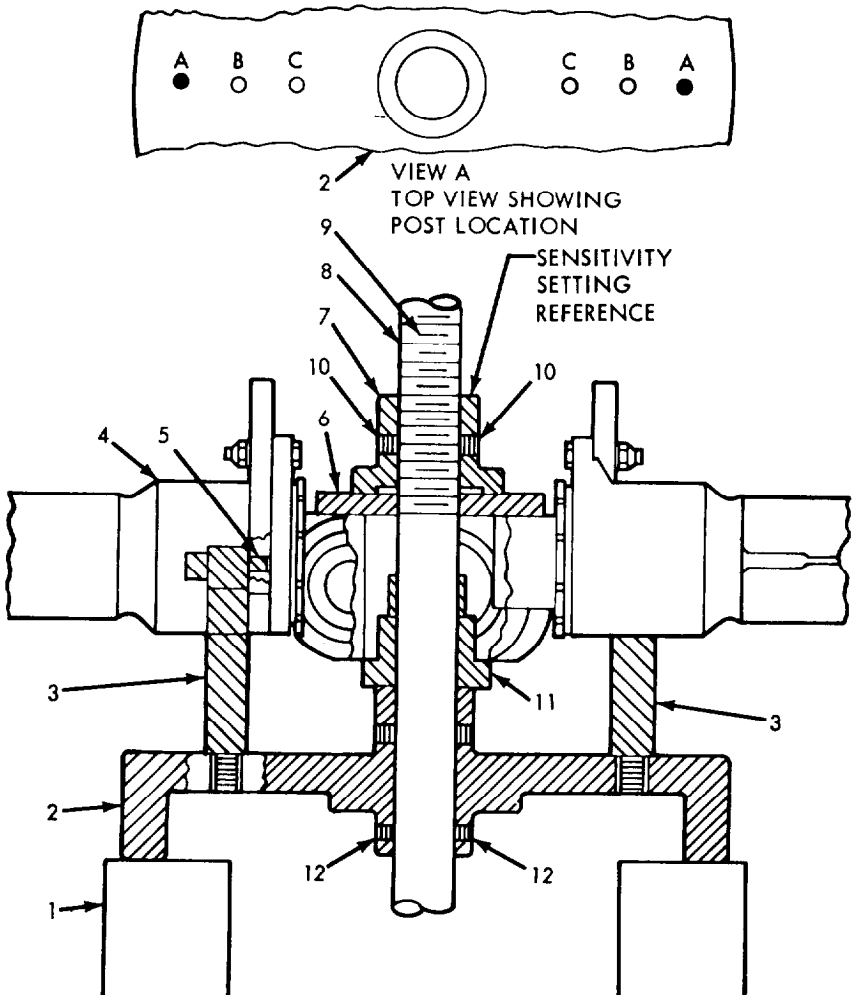
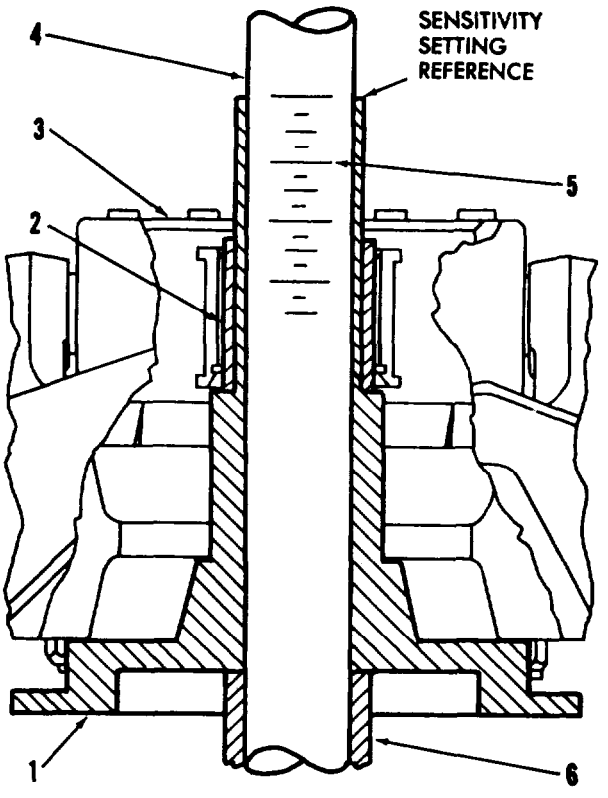


Figure 4-17A. Balancer Installation - OH-13 Series S and TH-13T Helicopter Tail Rotor Hub and Blade Assembly



Key to figure 4-18:

1. Fixture (2337, 7HEL054 kit)
2. Sleeve (2467, 7HEL054 kit)
3. Rotor hub and blade assembly
4. Balancing arbor (2259, 7A050 kit)
5. Arbor scale
6. Spacers (7A050 kit)

Figure 4-18. Balancer Installation - OH-13 and TH-13 Helicopter Main Rotor Hub and Blade Assembly.

4-36. UH-1 Helicopter.

4-37. UH-1 (Series A, B, D, F, H and N Typical Main Rotor Hub Assembly Balance Check (Except 540 Series Hub). (See figure 4-19.)

NOTE

Additional hoist arm support height is required for this balance application. To provide this additional arm height, use miscellaneous component tube assembly, part no. 2769 in lieu of the part no. 2288 vertical tube (no. 4) shown in figure 3-3.

a. Assemble the hoist support structure except use part no. 2769 tube assembly in place of the part no. 2288 tube.

b. Center fixture (1, figure 4-19) on stand table assembly (1, figure 1-13).

c. Install sleeve (2) over top of fixture (1) and seat sleeve on upper shoulder of fixture's central projection.

d. Install adapter (3), heavy end downward, over top of fixture (1) and seat on top of sleeve (2). Lock adapter in the position by tightening adapter set screw (4) using 1/8-inch hex wrench (7A050, 7HEL054, 7HEL061 kits).

e. Carefully lower rotor hub assembly (8) over fixture (1), aligning inside diameter of splined trunnion with piloting diameter of adapter (3), and insuring that cone surface of splined trunnion seats firmly on cone surface of adapter (3).

f. Install pitch positioning locks. These are available as manufacturer designed, Bell tool no. T101402. Install carefully, and adjust blade grips to symmetrical pitch positions. To accomplish this, place a bevel (bubble) protractor on flat top surface of rotor hub, across the grip pitch axis; adjust protractor to center the bubble. Transfer protractor, keeping it in same transverse position, to bottom inside surface of either blade grip fork and align protractor base with the transverse milled line in the fork surface. Adjust grip pitch only to recenter the protractor bubble. Transfer protractor, in same transverse position, to opposite grip fork and repeat grip pitch adjustment. Repeat grip pitch adjustment operation if necessary.

g. Using raw-hide or rubber mallet, tap heads of rotor blade retention bolts in radially outward direction to insure blade grips are fully seated in their radially outward positions.

h. Install yoke (5), legs downward, on arbor (6) and position so that top surface of its locking collar (sensitivity setting reference) aligns with arbor scale (7) listed below. Lock yoke (5) firmly in this position on arbor with its collar clamp screw. using 3/16-inch hex wrench (7HEL061 kit).

(1) UH-1A:
With Counterweights 15-1/2 inch

(2) UH-1B, D, F, H & N:
Without Counterweights 14-3/4 inch
With Counterweights 14-1/2 inch

i. Install arbor (6) downward through rotor trunnion and fixture (1) assembly, seating both yoke (5) legs firmly on flat top surface of rotor hub, in line with blade grip pitch axis.

j. For UH-1A, install part no. 2202 spacer (9) over lower end of arbor (6). For models UH-1B, D,

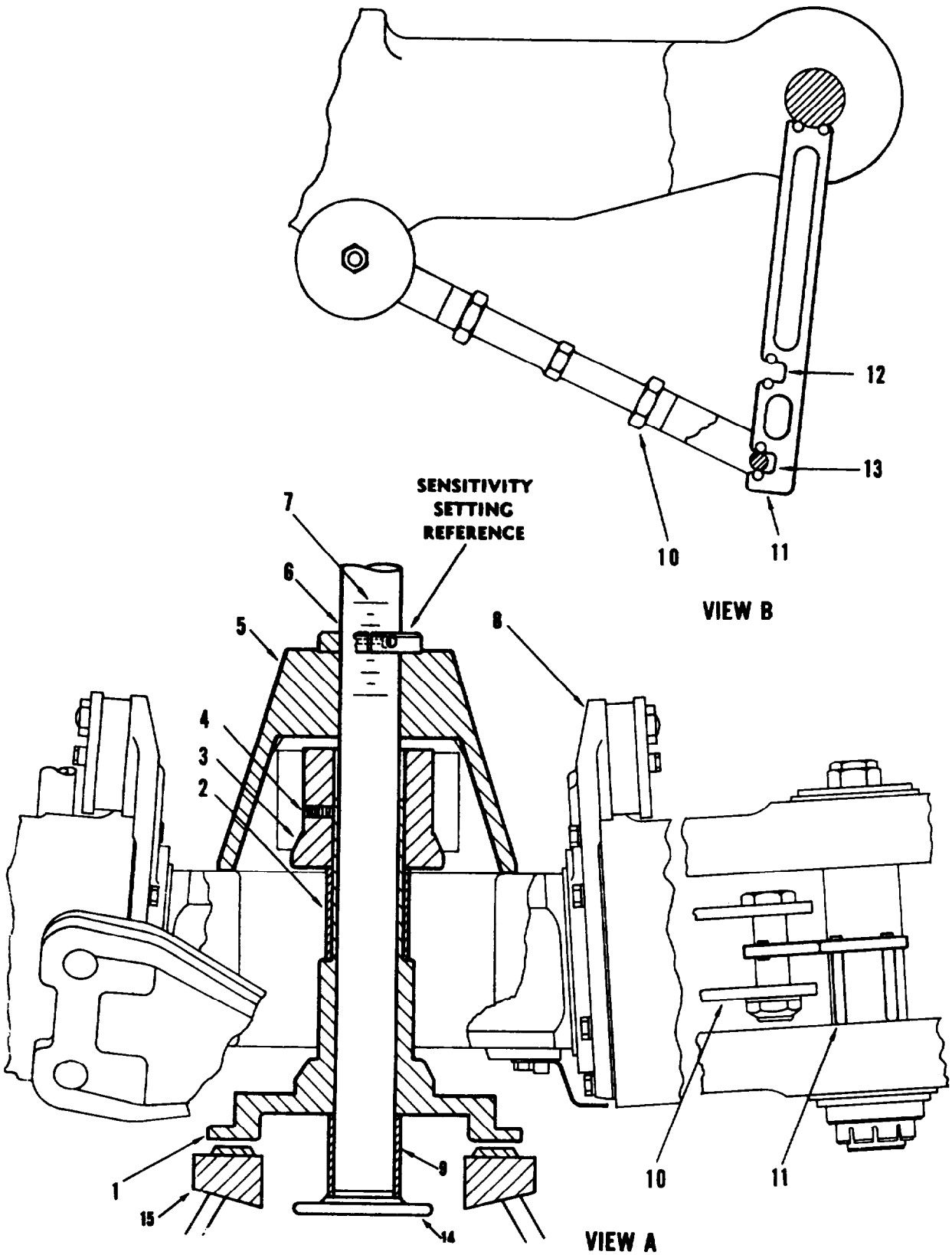


Figure 4-19. Balancer Installation - UH-1 (Series A, B, D, F, H, & N Typical) Helicopter Main Rotor Hub Assemblies (Except 540 Series Hub).

Key to figure 4-19:

1. Fixture (2337, 7HEL054 kit)
2. Sleeve (2467, 7HEL054 kit)
3. Adapter (2588, 7HEL061 kit)
4. Adapter setscrew
5. Yoke (2589, 7HEL061 kit)
6. Balancing arbor (2259, 7A050 kit)
7. Arbor scale
8. Rotor hub assembly
9. Spacer (7A050 kit) (2201 or 2202)
10. Drag strut
11. Drag strut positioning gage (2486, 7HEL061 kit)
12. Gage inner position
13. Gage outer position
14. Handwheel (2215, 7A050 kit)
15. Stand table (7A050)

F, H & N, install part no. 2201 spacer. Install hand wheel (14) in bottom end of arbor and tighten to clamp both legs of yoke (5) firmly against top surface of rotor hub.

k. Using gage (11) as shown, swing rotor hub drag struts to symmetrical angular positions. For UH-1A, use gage inner position 112); for UH-1B, D, F, H & N models, use gage outer position (13). Remove gage from rotor assembly during subsequent balance check.

l. Install quick-disconnect assembly with 3/16-inch cable (7A050 kit) on arbor (6) suspension rod and engage cable in lifting plate of hydraulic pump assembly (7A050 kit). Hoist entire assembly approximately ¼ inch off work stand. Check to insure that suspended assembly is free from interference with work stand and other objects, and note balance condition indicated by black indicator disc at top end of arbor.

NOTE

In order to insure that the part no. 2215 hand wheel suspends free of interference within the inside diameter of the stand table, it may be necessary to adjust the level of the stand assembly by installing suitable wood blocks or spacers under the two tubular stand legs.

m. For balance tolerance and application of balance correction, refer to applicable helicopter manual.

4-38. UH-1C, UH-1E, UH-1L, UH-1M, AH-1J, TH-1L, TH-1G, and AH-1G Main Rotor Hub Assembly (540 Series Hub) Balance Check. (See figure 4-20).

a. Assemble the hoist support structure by substituting the part no. 2769 tube assembly to provide additional vertical arm height in lieu of part no. 2288 tube (7A050 kit). The part no. 2769 tube is 38 inches long and is a supplementary miscellaneous detail that is not available in the 7A050 kit.

b. Center fixture (1, figure 4-20) on stand table assembly (16, figure 4-20).

c. Install adapter (2, figure 4-20), heavy end downward, over top of fixture (1) and seat on upper shoulder of fixture central projection. Lock adapter in this position by tightening adapter setscrew (3), using 1/8-inch hex wrench (7A050, 7HEL054, and 7HEL066 kits).

d. Insure that two grip positioning links (15), (Bell tool no. T101466), together with suitable eye bolts, are installed on the rotor to hold blade grips in symmetrical pitch positions. Arrangement of bolts, nuts, and washers used for attachement of these links should be identical on both sides.

e. Carefully lower rotor hub assembly (8) over fixture (1), aligning inside diameter of splined trunnion with piloting diameter of adapter (2), and insuring that cone surface of splined trunnion seats firmly on cone surface of adapter (2).

f. Install yoke (4), legs downward on balancing arbor (5) and position so that top surface of its locking collar (sensitivity setting reference, figure 4-20) aligns with 15-3/8-inch position on arbor scale (6). Lock yoke firmly in this position on arbor with its collar screws, using 3/16-inch hex wrench (7HEL066 kit).

g. Install arbor downward through rotor trunnion and fixture assembly. Seat legs of yoke in milled areas on top surfaces of hub yoke, central with scribed lines.

h. Position jacks (7) on the top surface of the rotor hub yoke so that their inboard ends bear against the central boss of the hub yoke, centered below the scribe lines mentioned in step g and their outboard ends hear centrally against the shoulders of the inboard bearing housings of the blade grip assemblies. Adjust jacks to provide uniform outward pressure sufficient to insure blade grips are seated in their full outward positions.

i. Install spacer (13) over lower end of arbor; install handwheel (14) in lower end of arbor and tighten to clamp both legs of yoke firmly against top surfaces of hub yoke.

j. Using gage (10) as shown, adjust rotor hub drag struts to symmetrical angular positons using gage outer position (12). Remove gage from rotor hub during subsequent balance check.

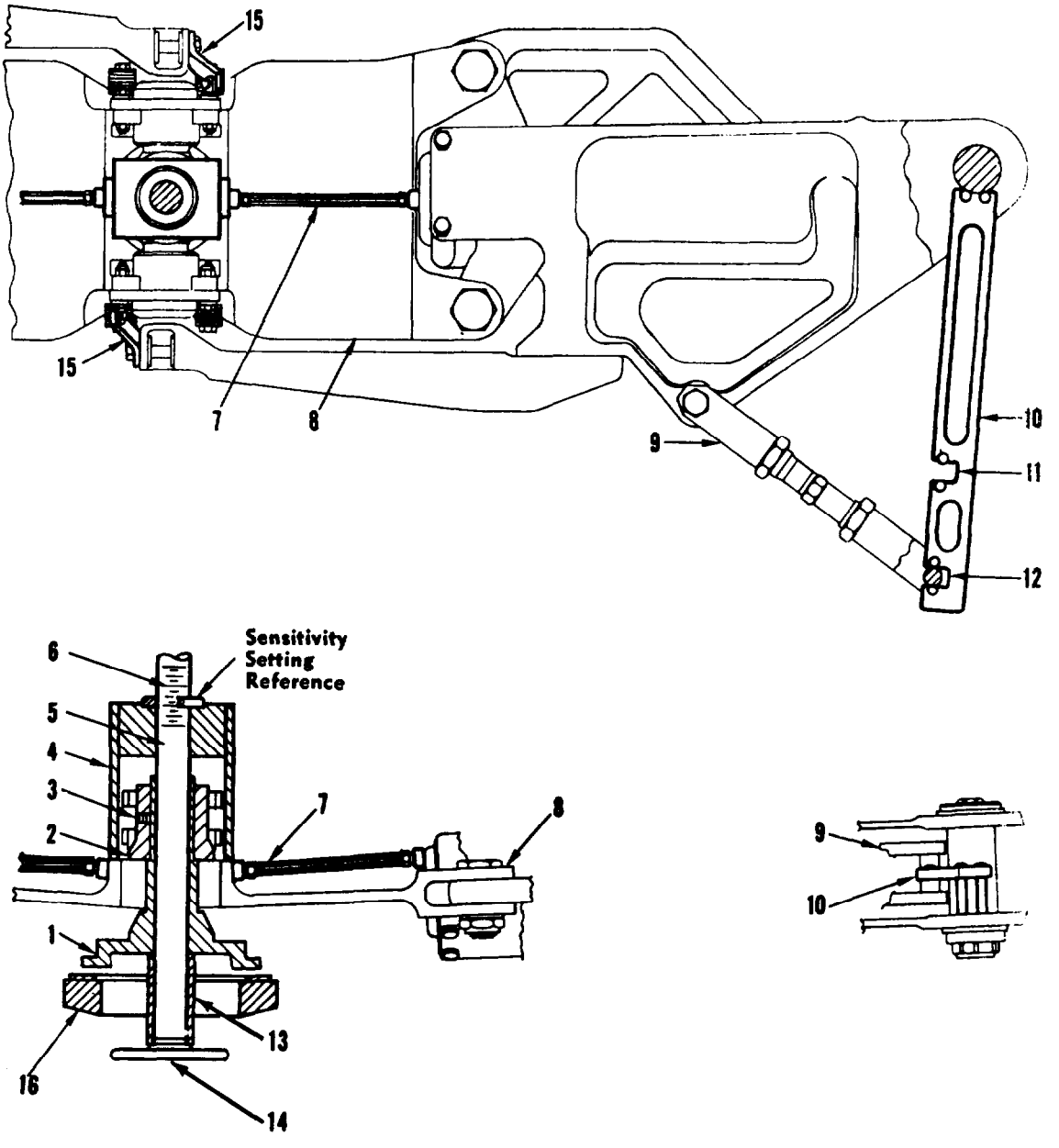
k. Install quick-disconnect assembly with 3/16-inch cable (7A050 kit) on arbor suspension rod and hoist balancing assembly approximately ¼ inch off work stand. Check to insure that suspended assembly is free from interference with work stand and adjacent objects, and note balance condition indicated at top end of arbor.

NOTE

In order to insure that hand wheel (14, figure 4-20) suspends free of interference within the inside diameter of the stand table, it may be necessary to adjust the level of the stand assembly by installing suitable blocks under the two tubular stand legs.

NOTE

For balance tolerance and application of balance corrections, refer to applicable helicopter manual.



1. Fixture (2337, 7HEL054 kit)
2. Adapter (2588, 7HEL066 kit)
3. Adapter setscrew
4. Yoke (2846, 7HEL066
5. Balancing arbor (2259, 7A050 kit)
6. Arbor scale
7. Jack (2865, 7HEL066 kit)
8. Rotor hub assembly
9. Drag brach
10. Gage (2486, 7HEL066 kit)
11. Gage inner position
12. Gage outer position
13. Spacer (2203, 7A050 kit)
14. Handwheel (2215, 7A050 kit)
15. Link-grip positioning (Bell no. T101466)
16. Stand table (7A050 kit)

Figure 4-20. Balancer Installation - UH-1C, UH-1E, UH-1L, UH-1M, AH-1J, TH-1G, TH-1L and AH-1G Helicopter Main Rotor Hub Assembly (540 Series Hub).

4-39. UH-1, (Series UH-1C, UH-1H, UH-1M, UH-1L, AH-1J, TH-1G, TH-1L and AH-1G Typical), Tail Rotor Hub and Blade Assemblies. (See figure 4-21).

a. Assemble the work stand and hoist support structure as described in section III.

b. Place the fixture (2), recessed side down, on the stand table (1) or suitable support blocks.

c. Prior to installing post assemblies (4), adjust movable index pins (14) of the positioning post assemblies to proper dimension as required by the rotor design configuration shown in view B of figure 4-21. Tighten the pin set screw (14) to maintain proper setting.

d. After adjusting post assemblies properly, thread the post assemblies (4) into two diametrically tapped holes of fixture (2), shown as holes A in top view of fixture (view C).

e. Locate the pilot bushing (11), large end down, centrally on top of fixture hub.

f. Remove or loosen nuts (16) from tail rotor blade attaching bolts (17). Drive bolts partially out of yoke assembly to obtain an approximate 9/32-inch gap under the bolt heads as shown in view A.

g. Set tail rotor on fixture (2) so that blade shanks clear posts (4); flat surface of hub is upward, and inside diameter of rotor splined trunnion fits over diameter of pilot bushing (11).

h. Install bushing (7), flange end downward on balancing arbor (8) so that top surface of bushing aligns with 7-¼″ or 7-3/8″ position on arbor scale (9) depending on the yoke configuration. Figure 4-22, illustrates the difference in yoke designs and it will be noted that the "Beefed-up" yoke with the half-moon cut-out portion at the bottom as shown in view A of figure 4-22, requires the 7-3/8" setting. View B, illustrates the yoke configuration requiring the 7-¼″ setting. Lock hushing in this position by moderate and uniform tightening of bushing set screws (10) using 3/32″ hex wrench (7HEL053 kit).

i. Place part no. 2586 plate (6) (accessory part) centrally on top surface of rotor hub as shown in top view of assembly. Insert lower end of balancing arbor (8) downward through plate (6), bushing (11) and hub of fixture (2). Seat assembly firmly together by pressing downward on bushing (7) and lock in this position by moderate and uniform tightening of two lower fixture set screws (12).

j. Rotate the rotor hub on fixture, positioning the index pins (14) of the two post assemblies (4) until the indexing diameters enter the pitch linkage holes in grip arms to their full depth.

k. From the matched sets of positioning bars (3), part no. 2940 thru 2950, (7HEL065 kit), select the pair (set), identified as having the lowest part number (2940). Make sure each bar bears the same matched pair serial number and the same part number. Trial install the matched set of bars (3), blocks upward, between opposite blade attachment bolts; contacting shanks underneath the bolt heads. Do not force bars onto the shanks of the bolts. If bars are too short, continue the trial installation using increasingly longer bar sets (identified by matched pair serial numbers and identical part numbers) as necessary until the longest matched pair that can be installed between the bolt shanks without force has been precisely established. Once this set and length have been determined, select the next higher part number bar pair, but make sure each bar also carries the same matched pair serial number. This is the matched pair bar set that shall be used during the balance operations. Be certain that the pair is identified correctly with a matched pair serial number and the same part number.

l. Carefully lift upward on both rotor blades at their tips simultaneously to produce increased span distance between the blade bolts; install the properly matched and identified pair of bars described and selected in paragraph k above. Then, release blade tips, allowing the bolt shanks to rest firmly upon the bar ends. Move bars precisely into final position by pressing upward to seat block section against rotor grip bushing face surface and inwardly to seat stop tang of bars against the bolt shanks. (See view D, figure 4-21). Investigate to make sure that the positioning post index sections are engaged in grip pitch arm holes and that the arbor (8) with bushing (7) is tight against the rotor hub.

m. Sight beneath the rotor hub across the positioning bar pair (3) to make sure they are in the same plane. Correct, if required, by readjusting the index section of each positioning post on its mounting rod an equal amount.

n. Install quick-disconnect coupling (7HEL053 kit or 7A050 kit) on arbor suspension coupler and suspend entire assembly free of interference. Note balance condition indicated by black indicator disc at top of balancing arbor.

o. For balance tolerance and application of balance corrections, refer to applicable helicopter manual.

p. When using Tail Rotor Balance Positioning Kit, AA4920-8503 follow the instructions of paragraphs a through o except use an arbor setting of 7-1/8″ or 7-1/4″ position on the arbor scale as follows: View A of figure 4-22 requires a 7-1/4″ setting and View B of figure 4-22 requires the 7-1/8″ setting.

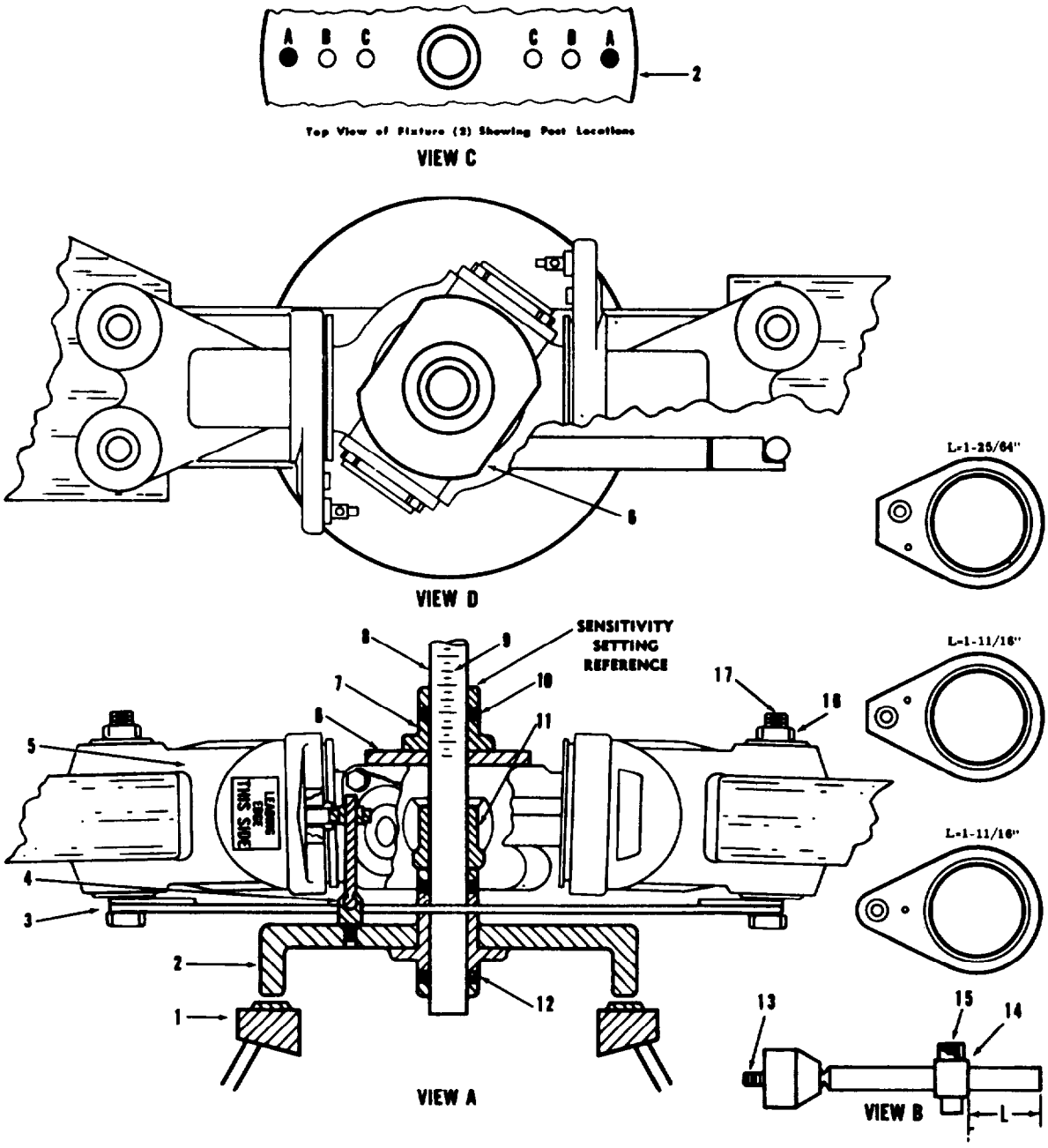
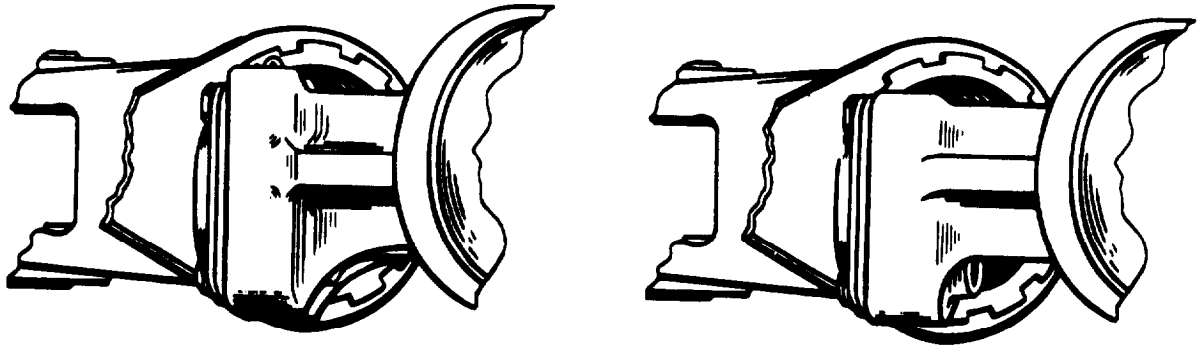


Figure 4-21. Balancer Installation - UH-1 (Series A, B, C, D, E end F and AH-1G Typical) UH-1H, M, L and AH-1J, TH-1J, and TH-1L Tail Rotor Hub and Blade Assemblies

Key to figure 4-21:
1. Stand table (7A050 kit)
2. Fixture assembly (2532, 7HEL053 kit)
3. Bar pair (11 sets) 2940 through 2950 (7HEL065 kit or AA4020-8508 kit)
4. Post assembly (2) (2080, 7HEL065 kit or AA4920-8508 kit)
5. Tail rotor hub and blade assembly
6. Plate (2586, procure)
7. Bushing (2533, 7HEL053 kit)
8. Balancing arbor (2516, 7HEL053 kit)
9. Arbor scale
10. Bushing ret screw
Il. Pilot bushing (2529, 7HEL053 kit)
12. Lower fixture set screw
13. Port thread
14. Movable index action
15. Index pin and set screw
16. Tail rotor attaching nuts
17. Tail rotor attaching bolts



VIEW A VIEW B

Figure 4-22. UH-1 and AH-1G Series Tail Rotor Yoke Configurations Identification for Proper Arbor Sensitivity Setting.

4-40. OH-58 Series Main Rotor Hub and Blade Assemblies Balance Check. (See figure 4-23).

a. Assemble the 7A050 kit work stand and hoist support structure, substituting pert no. 2769 tube assembly in place of the part no. 2288 tube assembly to provide the additional vertical height required for this application.

b. Place the fixture (2) centrally on the work stand (1).

c. Lower the adapter (3), large end down, over the top extension of the fixture (2).

d. Install pitch positioning locks (4) on the rotor assembly between the pitch arms and hub lower flange while the rotor is still mounted on the helicopter mast. Refer to view A of figure 4-23, and lightly tighten ring nut (5) securing hub clamp section (6) of locks and adjust blades to approximately flat pitch with the arm positioing ring nuts (7). Remove rotor assembly from the helicopter.

e. Carefully install the rotor assembly on the adapter (3) mounted on fixture (2), engaging trunnion bore over pilot diameter of adapter and seating firmly on cone surface.

f. Remove centrifugal tilt stop assembly from rotors incorporating this mechanism.

g. Observe oil level In grip and trunnion oil reservoir sight glasses. Fill as required in accordance with applicable helicopter maintenance manual.

h. Where not previously accomplished, install pitch positioning locks (4) on rotor assembly in accordance with instructions of stop d.

i. Position blade gripe to flat pitch and secure.

NOTE

Observe this operation in this step sequence only when rotor blade alignment is to be accomplished. Refer to applicable helicopter maintenance manual for blade alignments requirements and procedures.

(1) Place yoke (9) legs upward, centrally on the top surface of rotor trunnion.

(2) Place base of bubble protractor head on exposed surface of yoke and align at 90^{0} (across) to pitch axis. Adjust protractor to center bubble and lock.

(3) Transfer protractor, keeping it in the same transverse position, to the machined surface of a grip adjacent to its blade retention bolt and again align at 90^{0} to the pitch axis.

(4) Adjust and moderately tighten ring nuts (7) of pitch positioning lock (4) (installed in step d) to recenter bubble by positioning grip.

(5) Locate clamp block section (6) of lock to provide full length contact with rotor hub flange edge and moderately tighten clamping ring nut (5).

(6) Readjust grip pitch, if necessary, to maintain bubble in central position.

(7) Transfer protractor, keeping same transverse position, to like location and 90° alignment on opposite grip.

(8) Repeat pitch adjustment and clamping operations.

(9) Recheck bubble for central position on trunnion (yoke) reference again on initial grip.

NOTE

Following each blade sweep adjustment, recheck grip pitch settings and maintain at zero condition.

j. Install yoke (9), legs down, on arbor (10). Position to align yoke top flat surface (sensitivity setting reference) with the 15-1/8-inch scale location and secure by tightening set screws (11).

k. Install bushing (8), knurled section upward, on arbor (10) and position against lower surface of yoke body. Lightly tighten retaining set screw (12) to maintain position.

1. Install arbor, with assembled components, downward through rotor trunnion engaging adapter (3) and fixture (2). Position legs to align with blade pitch axis and seat on top surface of rotor hub.

m. Place rotor blades in their radially outward position. Lift both blades at their tips evenly to approach the precone angle. Maintain an outward load on each blade while slowly allowing them to return to their initial hub supported condition.

n. Loosen set screw (12) of bushing (8) and seat bushing taper firmly in rotor trunnion bore. Do not retighten bushing set screw at this time.

o. Screw handwheel (13) into lower end of arbor and moderately tighten to seat yoke legs against hub surface. Maintain alignment of yoke legs along pitch axis and seat of bushing taper into trunnion bore.

p. Tighten bushing ret screw (12) to maintain position.

q. Position blade gripe to flat pitch and secure. Refer to instructions contained in step i, except place protractor base on top flat surface of yoke (9) for adjustment of bubble to indicate central.

r. Attach 2266 quick disconnect coupling. with 2264 cable (7A050 kit) to arbor. Engage cable ball into lifting plate of stand hoist.

s. Hoist assembly approximately ¼-inch above stand table, stabilize movements, and observe balance indicated by black disc in top surface of arbor shaft. Check to insure balance indications are not affected by interferences from the stand, air drafts or movement of nearby personnel.

t. For balance tolerance and methods for correction, refer to applicable helicopter maintenance manual.

CAUTION

Forces generated during wrenching operations required for blade sweep balance adjustment can damage the balance indicating and adaptering equipment. Prior to and after accomplishing each adjustment, observe the following process steps.

u. Release hoist, allowing the support fixture (2) to rest on stand table (1).

v. Loosen set screw (12) securing bushing (8) to arbor (10).

w. Loosen handwheel (13) at base of arbor (10) a minimum of 5 turns.

NOTE

Blade sweep adjustment operations may now be safely made; however, restrain rotor tilt and forces applied to pitch positioning locks (4) by pitch arms. Following the adjustment continue procedure as outlined below.

x. Repeat step m to radially reposition blades.

y. Insure bushing (8) is seated firmly in rotor trunnion bore. Do not tighten its locking set screw.

z. Retighten handwheel (13) to seat yoke legs (9) against hub surface. Maintain alignment of yoke legs along pitch axis and the seat of bushing taper into the trunnion bore.

aa. Tighten bushing set screw (12) to maintain position.

ab. Check blade grip positioning and return to flat pitch, if required.

ac. Repeat hoist operation, stabilize and observe balance indication.

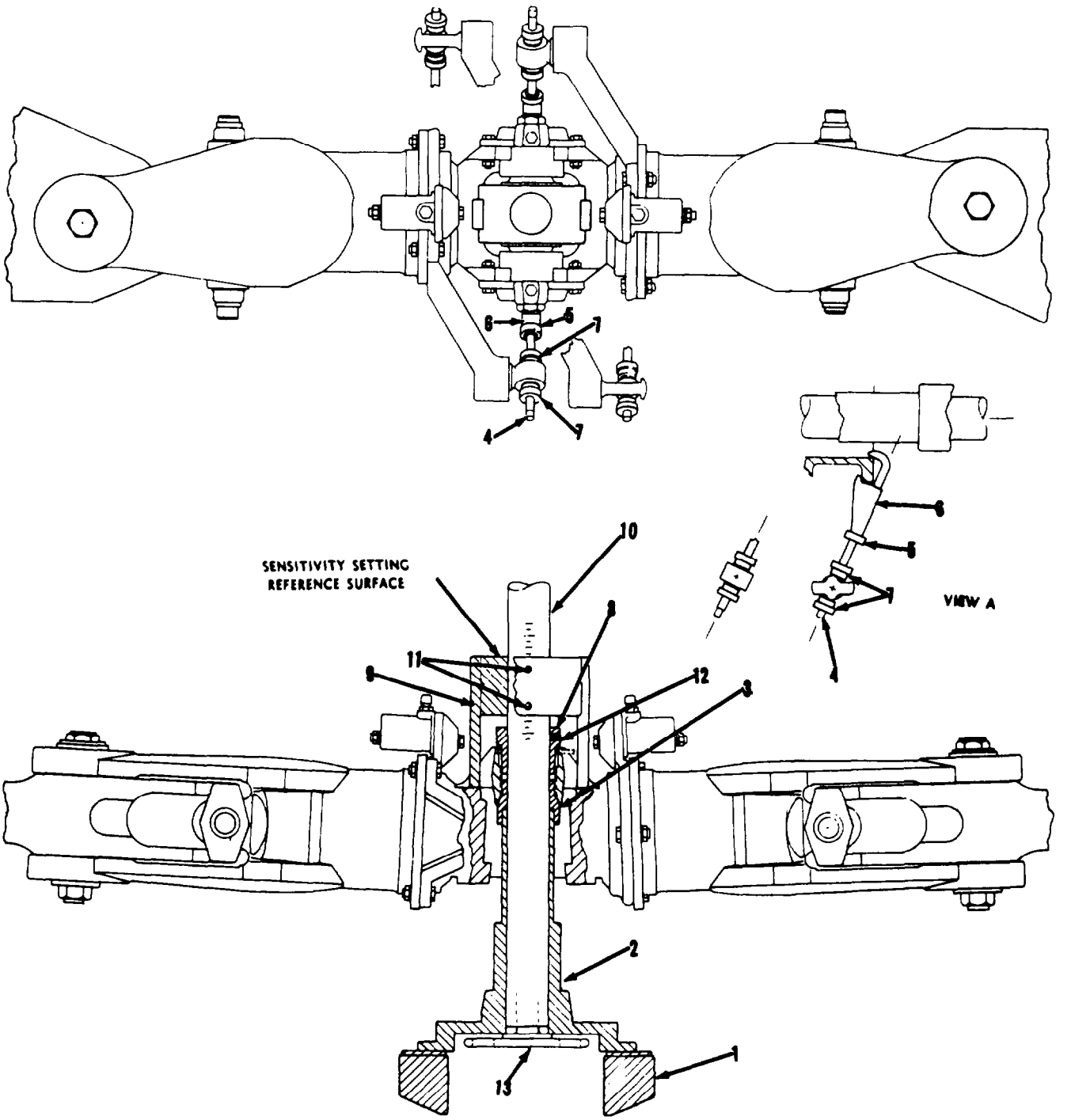


Figure 4-23. Balancer Installation - OH-58 Series Main Rotor Hub and Blade Assemblies (Typical).

Key to figure 4-23:

1. Stand table (7A050)
2. Fixture (2337, 7HEL054)
3. Adapter (2775, 7HEL069)
4. Lock (3035, 7HEL069) (2)
5. Ring nut. 3035 Lock
6. Clamp section, 3035 lock
7. Ring nut, 3035 lock
8. Bushing (2777, 7HEL069
9. Yoke (2780, 7HEL069)
10. Arbor (2259, 7A050)
11. Set screws, 2780 yoke
12. Set screw, 2777 bushing
13. Handwheel (2215, 7A050)

4-41. OH-58 Series Tail Rotor Hub and Blade Assemblies Balance Check. (See figure 4-24.)

a. Assemble 7A050 work stand and hoist support structure as shown in figure 3-3.

b. Place fixture (2), recessed side downward, centrally on work stand table (1).

c. Assemble spacer (13) to threaded end of two post assemblies (3). Install assembled units into tapped holes A, view A, of fixture (2). Use fingers only to tighten.

d. Place adapter (4), large end downward, over hub extension of fixture (2).

e. Position tail rotor assembly to place static stop (machined) surface of yoke section upward and index to locate trunnion bearing restrictions adjacent to flat sides of adapter. Engage trunnion bore with pilot diameter and install to seat upon adapter shoulder (4).

f. Place plate (5) centrally (accessory part P / N 2586 may be substituted) on top surface of rotor hub.

g. Install bushing (6) on arbor (7) with its flanged end downward. Position to align its top surface (sensitivity setting reference) with the 8-¾-inch arbor scale location for rotors incorporating flyweight ring type pitch horns or 9-½-inch location for non-weighted horns. Secure by tightening the two bushing set screws (8) evenly.

h. Install arbor, with bushing, downward thru plate on rotor hub, adapter and fixture. Seat tightly against plate and rotor hub. Tighten 2 lower set screws 19) of fixture hub evenly to maintain clamping pressure.

i. Position rotor assembly and adjust blade pitch to locate pitch horn studs (10) adjacent to post assemblies (3) below their indexing pin sections (12). Rotate upper section (11) of posts to position knurled length of index pin (12) above pitch horn studs. Readjust pitch of blades to seat studs upward against extending index pin knurled section, see view B, of figure 4-24.

j. Attach 2266 quick disconnect coupling with 2264 cable (7A050 kit) to 2516 arbor. Engage cable ball into lifting plate of stand hoist.

k. Hoist assembly approximately ¼ inch above stand table; stabilize movements, and observe balance indicated by black disc in top surface of arbor shaft. Check to insure balance indications are not affected by interferences from the stand, air drafts or movement of nearby personnel.

l. For balance tolerances, method of correction and other assembly requirements, refer to applicable helicopter maintenance manual.

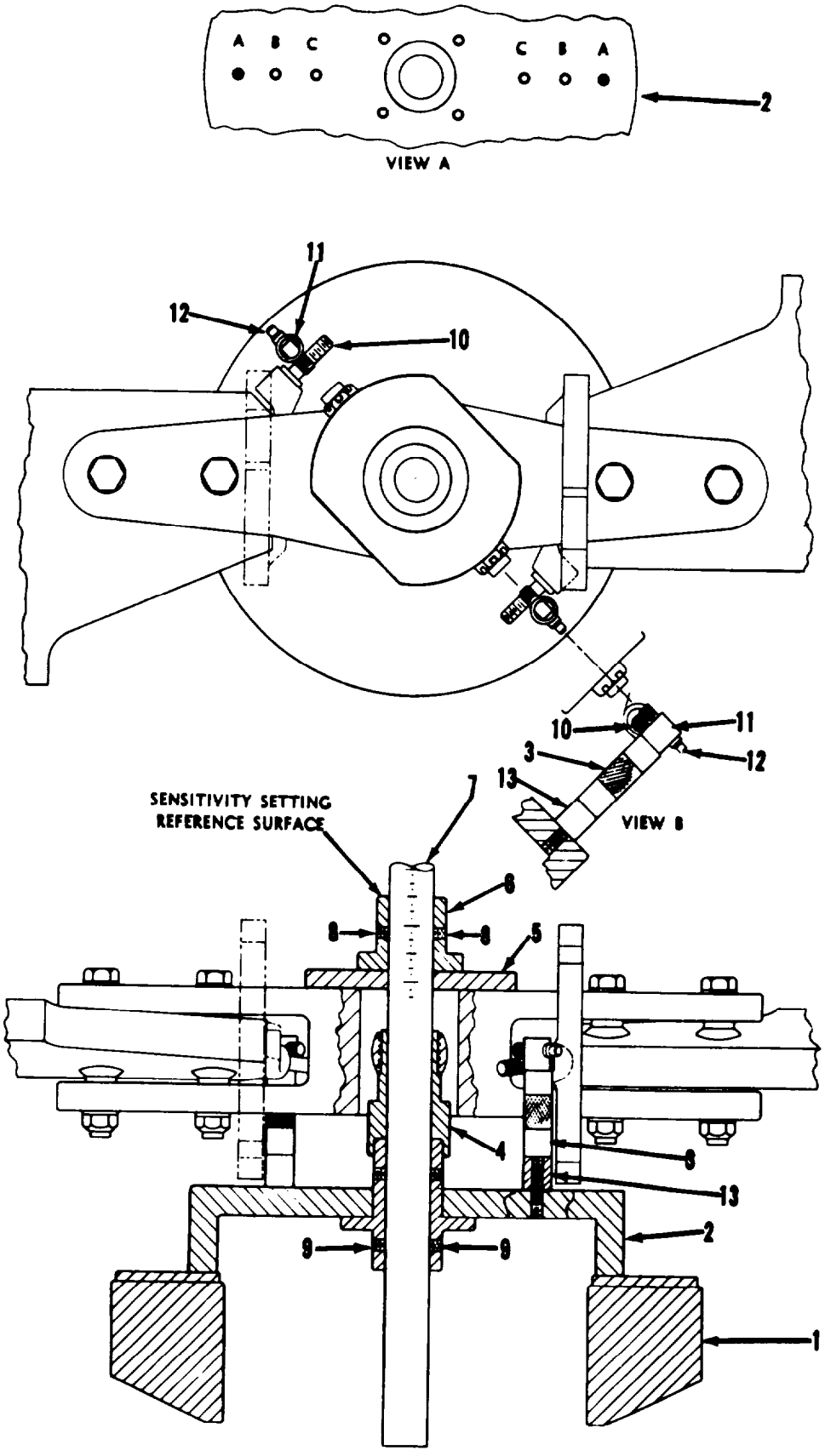


Figure 4-24. Balancer Installation - OH-58 Series Tail Rotor Hub and Blade Assemblies (Typical)

Key to figure 4-24:

1. Stand table (7A050)
2. Fixture (2532, 7HEL053)
3. Post assembly (2) (2539, 7HEL053)
4. Adapter (30771, 7HEL069)
5. Plate (2531, 7HEL053 or 2586 (Accessory part)
6. Bushing (2533, 7HEL053)
7. Arbor (2516, 7HEL053)
8. Set screws, 2533 bushing
9. Set screws, 2533 fixture hub
10. Studs, pitch horn
11. Section, upper, 2539 post
12. Indexing pin, 2539 post
13. Spacer (2) (3063, 7HEL069)

4.42. FAIRCHILD HILLER HELICOPTERS.

4-43. OH-23 Helicopter.

4-44. OH-23 Engine Fan Assemblies Balance Check. (See figure 4-25).

a. Select applicable extension pilot plug as follows: use extension pilot plug (1) for fan assemblies prior to OH-23 series D (view A); use extension pilot plug (13) for OH-23 series D, F, and G fan assemblies (view B).

b. Assemble applicable extension pilot plug in coupling (11) against coupling internal stop pine (5) as shown. Secure plug with two lower coupling setscrews (4), using 3 / 32-inch hex wrench (2, figure 1-18).

c. Insert extension pilot plug through hub of engine fan assembly (3, figure 4-25) from flat side of fan assembly.

d. Install collar (12) over projecting end of extension pilot plug as follows: for fan assemblies prior to OH-23 series D, install collar with flat end toward fan assembly (view A); for OH-23 series D, F, and G fan assemblies, install collar with cone end toward fan assembly (view B). Seat collar and extension pilot plug firmly against sides of fan assembly hub, and lock in position with collar setscrew (2), using 3 / 32-inch hex wrench (2, figure 1-18).

e. Insert lower end of balancing arbor (9, figure 4-25) in open end of coupling (11), bottoming arbor against coupling internal stop pins (5). Lock arbor securely in this position by moderate and uniform tightening of two upper coupling setscrews (6), using 3 / 32-inch hex wrench.

f. Install counterweight (10, figure 4-25), hub upward, over upper end of arbor assembly. Position counterweight so that top surface of hub aligns on arbor scale (8) as follows:

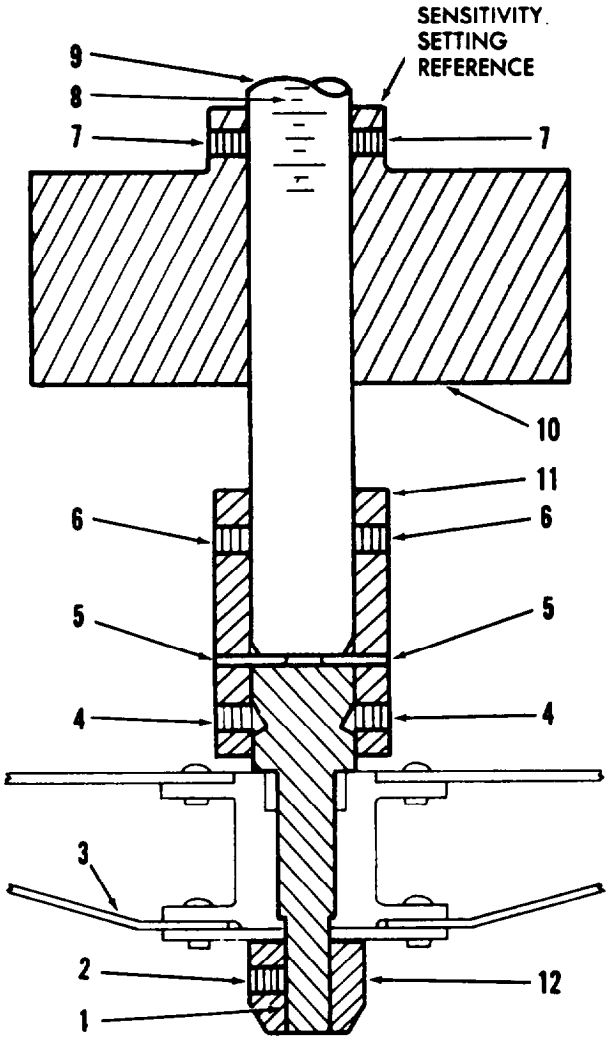
(1) OH-23 fan assemblies prior to series D-10-inch position.

(2) OH-23 fan assemblies series D, F, and G-10¼-inch position.

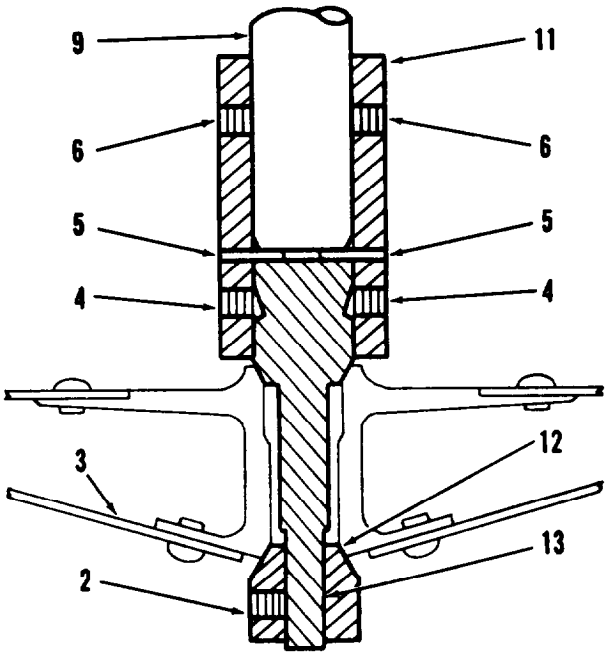
g. Lock counterweight in this position by moderate and uniform tightening of two counterweight setscrew (7), using 3 / 32-inch hex wrench (2, figure 1-8).

h. Install quick-disconnect coupling (7HEL053 or 7A050 kit) on arbor suspension coupler, and suspend entire assembly free of interference. Note balance condition indicated by black indicator disc at top of arbor.

i. For balance tolerance and application of balance corrections, refer to applicable helicopter manual. (Refer to appendix A.)



VIEW A
OH-23 (Prior to Series D) Engine Fan Assembly



VIEW B
OH-23 (Series D, F, and G) Engine Fan Assembly

1. Extension pilot plug (2525, 7HEL053 kit)
2. Collar set screw
3. Engine fan assembly
4. Lower coupling set
5. Coupling stop pin
6. Upper coupling set screw
7. Counterweight set screw
8. Arbor scale
9. Balancing Arbor (2516, 7HEL053 kit)
10. Counterweight (2523, 7HEL053 kit)
11. Coupling (2524, 7HEL053 kit)
12. Collar (2527, 7HEL053 kit)
13. Extension pilot plug (2526, 7HEL053 kit)

Figure 4-25. Balancer Installation - OH-23 Helicopter Engine Fan Assembly.

4-45. OH-23 Engine Fan Assemblies Track and Concentricity Check. (See figure 4-26).

a. Select applicable extension pilot plug as follows: use extension pilot plug (11) for fan assemblies prior to OH-23 series D (view A); use extension pilot plug (15) for OH-23 series D, F, and G fan assemblies (view B).

b. Assemble applicable extension pilot plug in coupling (6) against coupling stop pins (7) as shown. Secure plug with two upper coupling setscrews (8) at extension pilot plug end of coupling, using 3 / 32-inch hex wrench (2, figure 1-18).

c. Insert extension pilot plug through hub of engine fan assembly (9, figure 4-26) from flat side of fan assembly.

d. Install collar (10) over projecting end of extension pilot plug as follows: for fan assemblies prior to OH-23 series D, install collar with flat end toward fan assembly (view A); for OH-23 series D, F, and G fan assemblies, install collar with cone end toward fan assembly (view B). Seat collar and extension pilot plug firmly against sides of fan assembly hub, and lock in position with collar setscrew (12), using 3 / 32-inch hex wrench (2, figure 1-18).

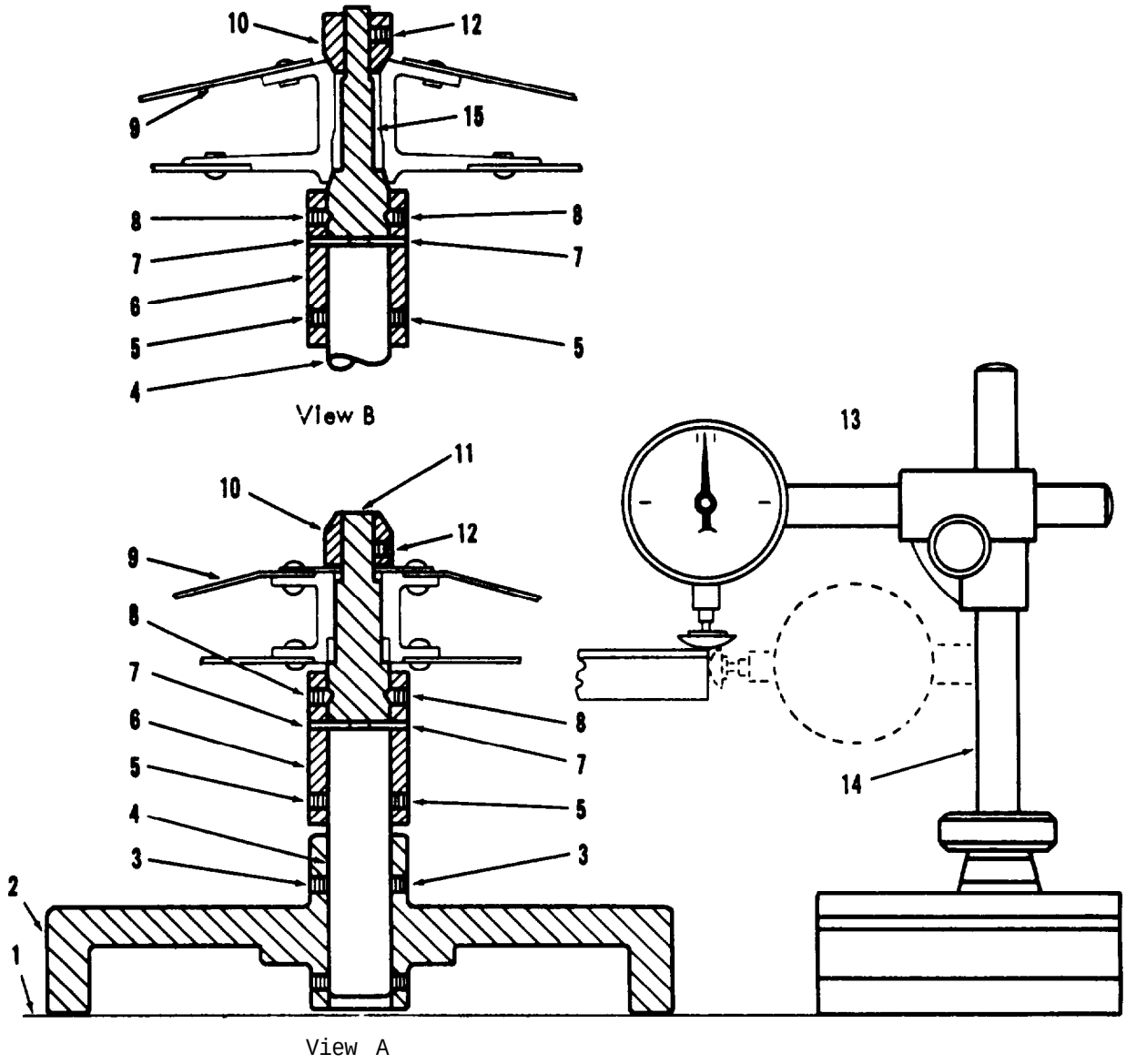
e. Clamp fixture assembly (2, figure 4-26), recessed side downward, on surface plate (1) or other firm support surface.

f. Install plug (4) in hub of fixture assembly (2) so that approximately 1¾ inches of plug projects above top of hub. Lock plug securely in this position with two upper fixture setscrews (3), using 3 / 32-inch hex wrench (2, figure 1-18).

g. Install open end of coupling (6, figure 4-26) (attached to fan assembly) over plug (4), bottoming plug against coupling stop pins (7). Do not lock coupling lower setscrews.

h. Install ½ inch mushroom point on dial indicator (13), and adjust height gage assembly (14) to read track or concentricity variations as required. Rotate fan assembly to determine range of variations.

i. For track and concentricity tolerances and application of corrections, refer to applicable helicopter manual. (Refer to appendix A).



VIEW B
OH-23 (Series D, F and G) Engine Fan Assembly

VIEW A
OH-23 (Prior to Series D) Engine Fan Assembly

1. Surface plate
2. Fixture assembly (2532, 7HEL053 kit)
3. Upper fixture set screw
4. Plug (2338, 7HEL053 kit)
5. Lower coupling set screw
6. Coupling (2524, 7HEL053 kit)
7. Coupling stop pin
8. Upper coupling set screw
9. Engine fan assembly
10. Collar (2527, 7HEL053 kit)
11. Extension pilot plug (2525, 7HEL053 kit)
12. Collar set screw
13. Dial indicator (7HEL055 kit)
14. Height gage assembly (7HEL055 kit)
15. Extension pilot plug (2526, 7HEL053 kit)

Figure 4-26. Setup for OH-23 Helicopter Engine Fan Assembly Track and Concentricity Check.

4-46. OH.23 (Prior to Series D) Tail Rotor Complete Assembly Balance Check. (See figure 4 27.)

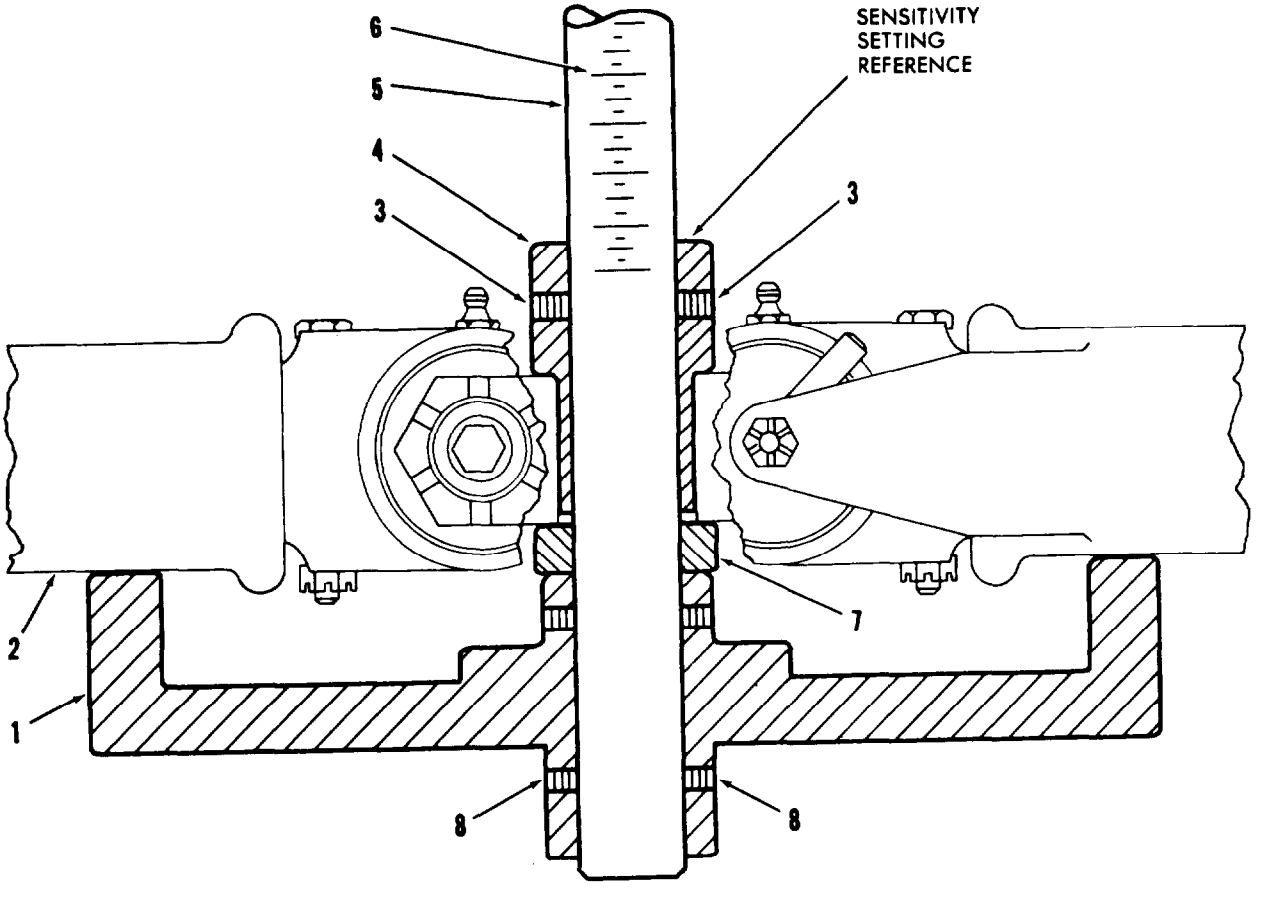
a. Install sleeve (4), hub upward, on balancing arbor (5) so that top of sleeve hub aligns with 7¼-inch position on arbor scale (6). Lock sleeve in this position by moderate and uniform tightening of two sleeve setscrews (3), using 3 / 32-inch hex wrench (2, figure 1-18).

b. Insert lower end of arbor and pilot of sleeve (4) through hub splines of tail rotor assembly (2) insuring that sleeve hub seats firmly against rotor hub.

c. Install spacer (7) and fixture assembly (1), recessed aide upward, over lower end of arbor. Press downward on sleeve (4) and upward on fixture assembly (1) to seat all components firmly together. Lock components in this position by moderate and uniform tightening of lower fixture setscrews (8).

d. Install quick-disconnect coupling (7HEL053 or 7A050 kit) on arbor suspension coupler, and suspend entire assembly free of interference. Position pitch arm ball ends (if installed) against centers of slot ends; keep them symmetrically positioned during balancing operation, and note the balance condition indicated by black indicator disc at top end of the arbor.

e. For balance tolerance and application of balance corrections refer to applicable helicopter manual. (Refer to appendix A).



1. Fixture assembly (2532, 7HEL053 kit)
2. Tail rotor assembly
3. Sleeve setscrew
4. Sleeve (2329, 7HEL053 kit)
5. Balancing arbor (2516, 7HELO53 kit)
6. Arbor scale
7. Spacer (2534, 7HEL053 kit)
8. Lower fixture setscrews

Figure 4-27. Balancer Installation - OH-23 (Prior to Series D) Helicopter Tail Rotor Complete Assembly.

4-47. OH-23 (Series D, F, and, G) Tail Rotor Hub and Yoke Assembly Balance Check. (See figure 4-28.)

a. Set fixture assembly (2), recessed side up, on suitable auxiliary support block (1).

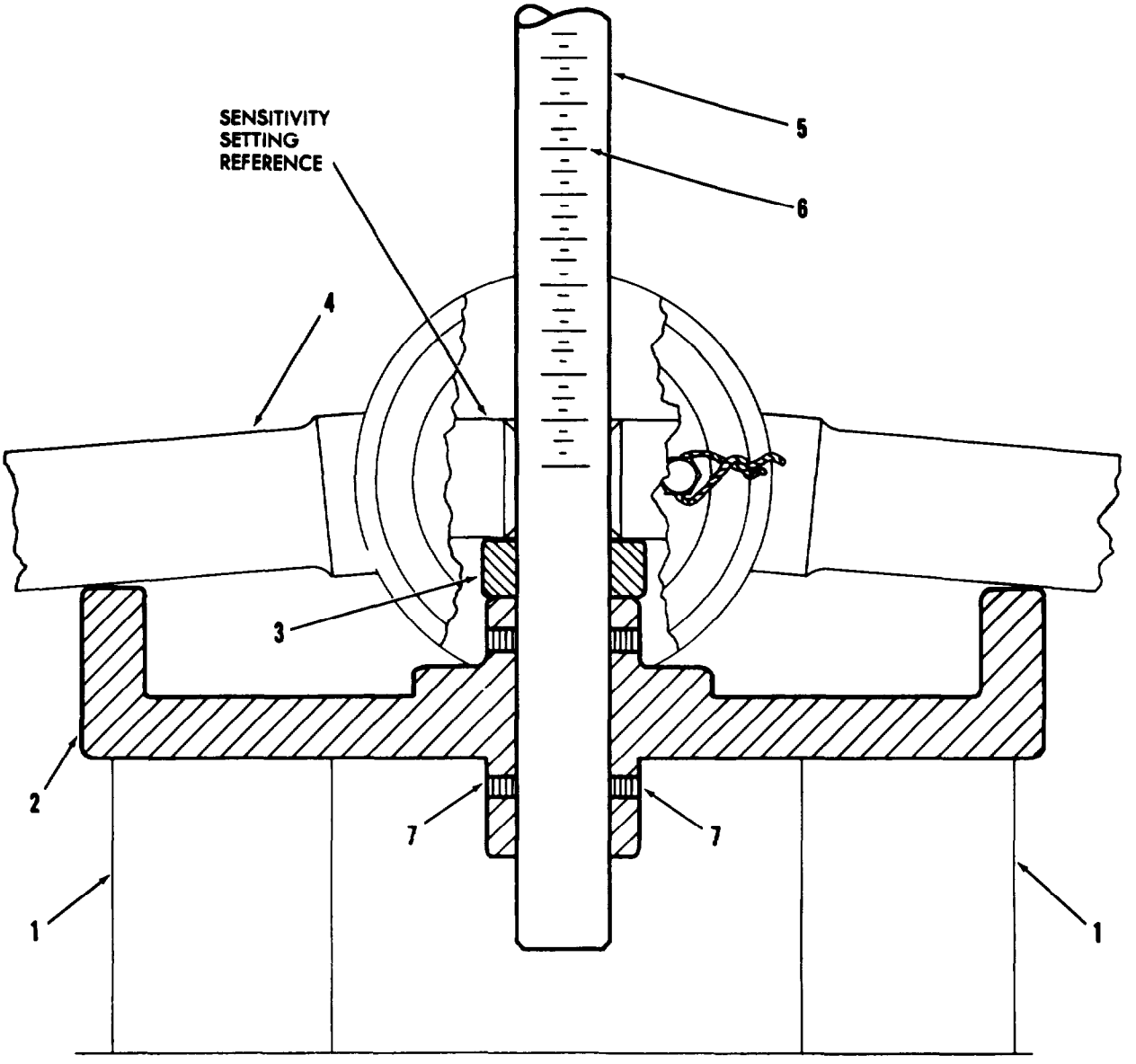
b. Place spacer (3) central on top of fixture assembly 12) hub.

c. Set tail rotor hub and yoke assembly (4) central on spacer (3), with hub shafts resting on rim of fixture assembly (2).

d. Insert lower end of balancing arbor (5) downward through rotor hub splines, spacer (3), and fixture assembly (2) hub until 7 5/8-inch position on arbor scale (6) aligns with top surface of rotor splined hub. Lock arbor in this position by moderate and uniform tightening of two lower fixture setscrews (7), using 3 / 32-inch hex wrench (2, figure 1-18).

e. Install quick-disconnect coupling (7HEL053 or 7A050 kit) on arbor suspension coupler, and suspend entire assembly free of interference, and note the balance condition indicated by black indicator disc at top end of the arbor.

f. For balance tolerance and application of balance corrections refer to applicable helicopter manual. (Refer to appendix A).



1. Auxiliary Support block
2. Fixture assembly (2532, 7HEL053 kit)
3. Spacer (2535, 7HEL053 kit)
4. Tail rotor hub and yoke assembly
5. Balancing arbor (2516, 7HEL053 kit)
6. Arbor scale
7. Lower fixture setscrew

Figure 4-28. Balancer Installation - OH-23 (Series D, F and G) Helicopter Tail Rotor Hub and Yoke Assembly.

4-48. OH-23 (Series D, F, And G) Tail Rotor Complete Assembly Balance Check. (See figure 4-29).

NOTE

The following procedure may be used in cases where selective matching of used or required rotor blades with new replacement blade is required. For prior balancing of rotor hub and yoke assembly only, refer to paragraph 4-47.

a. Set fixture assembly (2), recessed aide up on suitable auxiliary support block (1).

b. Place spacer (3) central on top of fixutre assembly (2) hub.

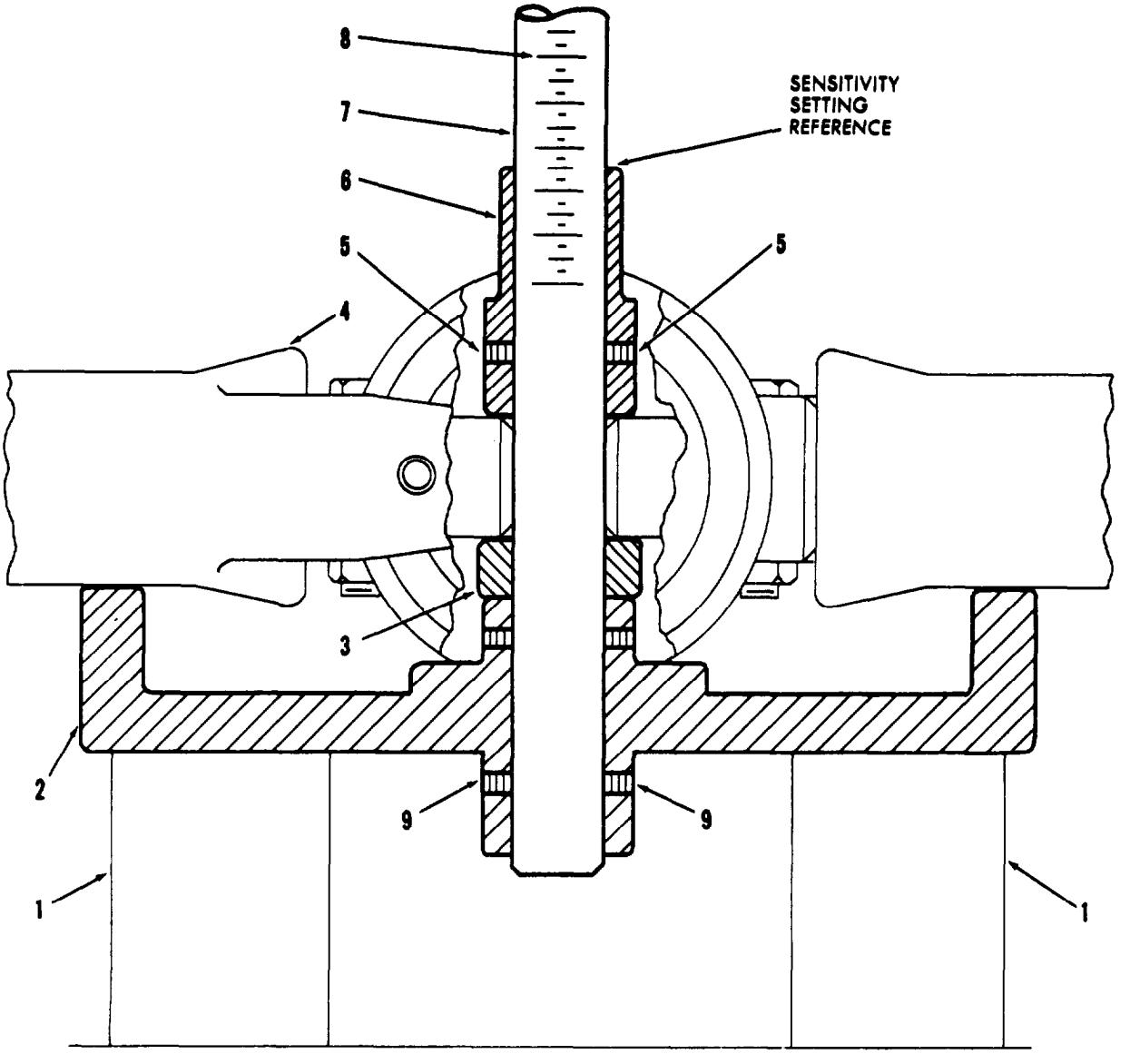
c. Set tail rotor assembly (4) approximately central on fixture assembly.

d. Install sleeve (6), hub downward, on balancing arbor (7), aligning top of sleeve with 8-inch position on arbor scale (8). Lock sleeve in this position by moderate and uniform tightening of two sleeve setscrews (5), using 3 / 32-inch hex wrench (2, figure 1-18).

e. Insert lower end of arbor downward through rotor hub splines, spacer (3, figure 4-29) and fixture assembly (2), pressing all components firmly together. Lock components in this position by moderate and uniform tightening of two lower fixture setscrews (9), using 3 / 32-inch hex wrench (2, figure 1-18).

f. Install quick-disconnect coupling (7HEL053 or 7A050 kit) on arbor suspension coupler, and suspend entire assembly free of interference. Position rotor pitch arm ball ends vertically downward and keep them symmetrically positioned during balance checks, and note the balance condition indicated by black indicator disc at top end of the arbor.

g. For balance tolerance and application of balance corrections, refer to applicable helicopter manual. (Refer to appendix A.)



1. Auxiliary support block
2. Fixture assembly (2532, 7HEL053 kit)
3. Spacer (2535, 7HEL053 kit)
4. Tail rotor assembly
5. Sleeve setscrew
6. Sleeve (2329, 7HEL053 kit)
7. Balancing arbor (2516, 7HEL053 kit)
8. Arbor scale
9. Lower fixture setscrew

Figure 4-29. Balancer Installation - OH-23 (Series D, F, and G) Helicopter Tail Rotor Complete Assembly.

4-49. OH-23 Main Rotor Head and Control Rotor Assembly Balance Check. (See figure 4-30.)

a. Center fixture (1) on stand table assembly (1, figure 1-13).

b. Carefully lower rotor assembly (2, figure 4-30), with drag struts removed, over fixture (1) so that upper diameter of fixture enters inside diameter of hub splined trunnion. Make certain that base of rotor hub seats squarely on base of fixture.

NOTE

Rotor forks must be locked in symmetrical positions, using arm assemblies, blade leveling, FSN 4920-509-5193. Refer to applicable helicopter manual (Refer to appendix A).

c. Install balancing arbor (3) downward through fixture pilot hole.

d. Install 3 / 16-inch suspension cable (13, figure 1-13) and quick-disconnect coupling (10) assembly on suspension rod at top end of arbor, and engage suspension cable in lifting plate of hydraulic pump assembly.

e. Adjust suspended height of arbor so that 14-¼-inch position on arbor scale (4, figure 4-30) aligns with top surface of fixture (1).

f. Install spacers (5), part no. 2202 and 2203 (7A050 kit), on bottom end of arbor.

g. Install hand wheel (26, figure 1-13) in bottom end of arbor, and tighten wheel to seat spacers (5, figure 4-30) under base of fixture (1). Check to insure that sensitivity setting specified in step e has been maintained.

h. Hoist entire assembly approximately ¼-inch off work stand. Check to insure that suspended assembly is free from interference with work stand and other objects, and note the balance condition indicated by black indicator disc at top end of the arbor.

i. For balance tolerance and application of balance corrections, refer to applicable helicopter manual. (Refer to appendix A.)

4-50. OH-23 Main Rotor Head and Blade Assembly Balance Check. (See figure 4-30).

a. Assemble the hoist support structure as shown in figure 3-3 except use part no. 2769 tube assembly to provide the additional vertical arm height in place of the no. 4 vertical tube (part no. 2288) supplied in the 7A050 kit.

b. Center fixture (1) on stand table assembly (1, figure 1-13).

c. Carefully lower rotor assembly (2, figure 4-30) over fixture (1) so that upper diameter of fixture enters inside diameter of hub splined trunnion. Make certain that base of rotor hub seats squarely on base of fixture.

NOTE

Rotor forks must be locked in symmetrical position, using arm assembly, blade leveling, FSN 4920-509-5193. Refer to applicable helicopter manual. (Refer to appendix A).

d. Install balancing arbor (3) downward through fixture pilot hole.

e. Install 3 / 16-inch suspension cable (13, figure 1-13) and quick-disconnect coupling (10) assembly on suspension rod at top end of arbor, and engage suspension cable in lifting plate of hydraulic pump assembly.

f. Adjust suspended height of arbor so that top surface of fixture (1, figure 4-30) aligns with arbor scale (4) as follows:

(1) Wood-blade rotor assemblies- 11-¾-inch position.

(2) Metal-blade rotor assemblies-9-½-inch position.

g. Install spacers (5) on bottom end of arbor as follows :

(1) Wood-blade rotor assemblies-part no. 2203 (7A050 kit).

(2) Metal-blade rotor assemblies-part no. 2201 (7A050 kit).

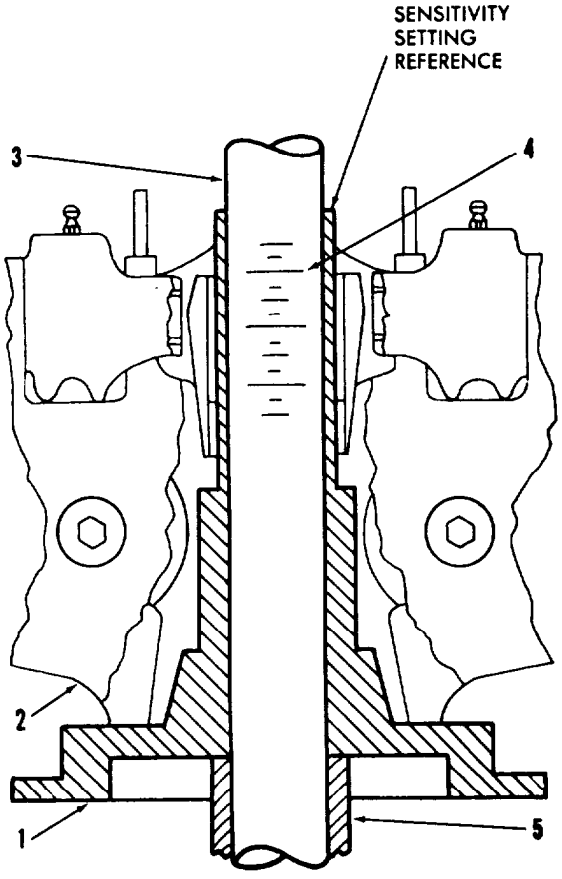
h. Install hand wheel (26, figure 1-13) in bottom end of arbor, and tighten wheel to seat spacer (5, figure 4-30) under base of fixture (1). Check to insure that sensitivity setting specified in step f has been maintained.

i. Hoist entire assembly approximately ¼ inch off work stand. Check to insure that suspended assembly is free from interference with work stand and other objects, and note the balance condition indicated by black indicator disc at top end of arbor.

NOTE

The span of the rotor blades makes it essential that this balance check be performed in a draft-free area and that the movement of personnel in the area be held to a minimum.

i. For balance tolerance and application of balance corrections, refer to applicable helicopter manual (Refer to appendix A).



1. Fixture (2337, 7HEL054 kit)
2. Rotor assembly
3. Balancing arbor (2259, 7A050 kit)
4. Arbor scale
5. Spacer (7A050 kit)

Figure 4,-30. Balancer Installation - OH-23 Helicopter Main Rotor Head and Control Rotor Assembly.

4-51. SIKORSKY HELICOPTERS,

4-52. UH-19 Helicopter.

4-53. UH-19 (Except Series C) Engine Fan Assembly Balance Check. (See figure 4-31.

a. Center engine fan assembly (1), with shroud upward, on stand table assembly (1, figure 1-13).

b. Install cone (2, figure 4-31) hub upward, on balancing arbor (3) so that top surface of cone hub aligns with 12-½-inch position on arbor scale (4). Secure cone in this position by tightening cone setscrew (5) with t/s-inch hex wrench (8, figure 1-13).

C. Install arbor downward through fan assembly hub, seating bottom surface of cone (2, figure 4-31) in approximate center and on top of the fan assembly hub.

d. Install plate (6), hub downward, over bottom end of arbor. Seat pilot lip on top surface of plate firmly and squarely over pilot diameter on bottom surface of fan assembly hub. Do not tighten plate hub setscrew.

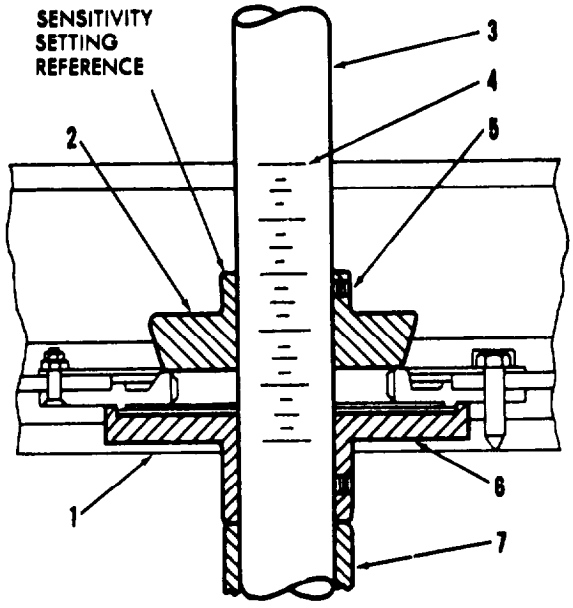
e. Install spacers (7) on arbor under plate (6) hub.

f. Install hand wheel (26, figure 1-13) in bottom of arbor, and tighten wheel to clamp spacers, plate fan assembly hub, and top cone securely together.

g. Install 3 / 16-inch suspension cable (13) and quick-disconnect coupling (10) assembly on suspension rod at top end of arbor, and engage suspension cable in lifting plate of hydraulic pump assembly.

h. Hoist entire assembly approximately ¼ inch off work stand. Check to insure that suspended assembly is free from interference with work stand and other objects, and note the balance condition indicated by black indicator disc at top end of the arbor.

i. For balance tolerance and application of balance corrections, refer to applicable helicopter manual. (Refer to appendix A.)



1. Engine fan assembly
2. Cone (2228, 7A050 kit)
3. Arbor (2259, 7A050 kit)
4. Arbor scale
5. Cone setscrew
6. Plate (2342, 7HEL055 kit)
7. Spacer (2202, 2203, & 2204, 7A050 kit)

Figure 4-31. Balancer Installation - UH-19 Helicopter Engine Fan Assembly.

4-54. UH-19 (Series C) Engine Fan Assembly Balance Check. (See figure 4-31).

a. Set engine fan assembly (1), hub extension downward, central on stand table assembly (1, figure 1-13).

b. With fan assembly in this position, try alternately fitting cones, part no. 2207 and 2208 (7A050 kit), in top cone seat of fan assembly. Select cone that fits cone seat and install this cone, hub upward, on balancing arbor (3, figure 4-31) so that its top surface aligns with 11 ½ inch position on arbor scale (4). Lock cone firmly in this position with cone setscrews, using 1/8 inch hex wrench (8, figure 1-13).

c. Install arbor downward through fan assembly hub, seating cone in top cone seat of fan assembly.

d. Install adapter (8, figure 1-14), slotted hub upward, over lower end of arbor so that its cone surface engages bottom cone seat of fan assembly. Install spacers (7, figure 4-31), followed by hand wheel (26, figure 1-13), on bottom of arbor and tighten to clamp cones firmly in fan cone seats.

e. Install quick-disconnect coupling (10, figure 1-13) to arbor suspension rod and hoist entire assembly approximately ¼ inch off work stand. Check to insure suspended assembly is free of interference with work stand or adjacent objects, and note the balance condition indicated by black indicator disc at top end of the arbor.

f. For balance tolerance and application of balance corrections, refer to applicable helicopter manual. (Refer to appendix A).

4-55. UH-19 Engine Fan Assembly Track and Concentricity Check. (See figure 4-32).

a. Set base (2) on surface plate (1) or other firm and level support surface. Bolt or clamp base securely to support surface.

b. Install lower end of balancing arbor (3) in base (2) pilot hole. Make certain that arbor is firmly bottomed and free to rotate in base.

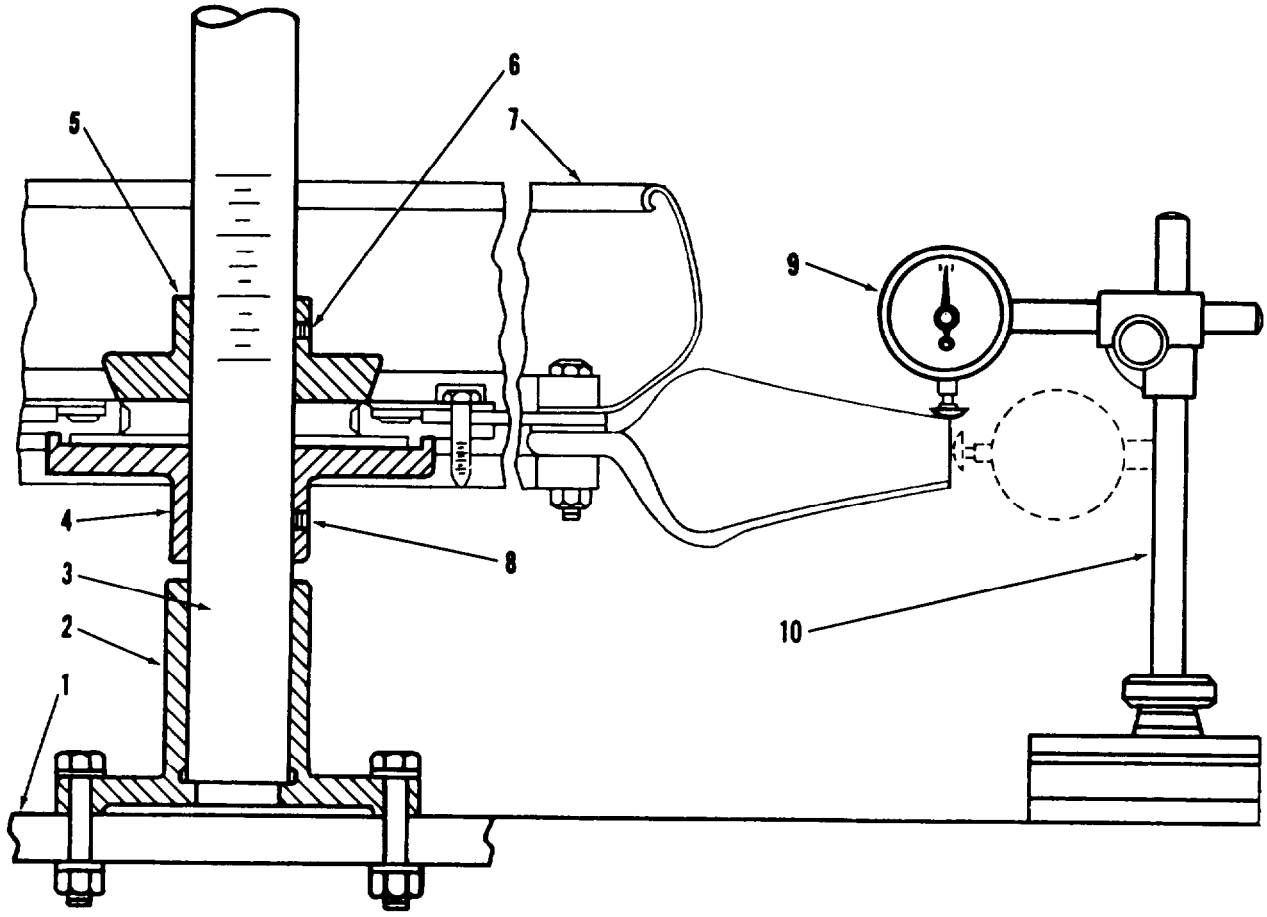
c. Install plate (4), hub downward, on arbor so that bottom of the plate hub clears top of base (2) by approximately ¼ inch. Secure plate in this position by tightening plate setscrew (8) with 1/8 inch hex wrench (8. figure 1-13).

d. Install engine fan assembly 17, figure 4-32), shroud unward. on plate (4). Check to insure that fan assembly hub pilot diameter seats firmly and squarely inside plate pilot lip.

e. Install cone (5), hub upward, over top of arbor. Press cone (5) firmly against top of fan assembly hub, and secure cone in this position by tightening cone setscrew (6) with l/8 inch hex wrench (8, figure 1-13).

f. Install 1/2 inch mushroom point on dial indicator (9, figure 4-32), and adjust height gage assembly (10) to read track of concentricity variations as required. Rotate fan and arbor assembly to determine range of variations.

g. For track and concentricity tolerances and application of corrections, refer to applicable helicopter manual. (Refer to appendix A).



1. Surface plate
2. Base (2341, 7HEL055 kit)
3. Balancing arbor (2259, 7A050 kit)
4. Plate (2342, 7HEL055 kit)
5. Cone (2228, 7A050 kit)
6. Cone setscrew
7. Engine fan assembly
8. Plate setscrew
9. Dial indicator (7HEL055 kit)
10. Height gage assembly (7HEL055 kit)

Figure 4-32. Setup for UH-19 Helicopter Engine Fan Assembly Track and Concentricity Check.

4-56. UH-19 Tail Rotor Hub and Blade Assembly Balance Check-105-inch-diameter Configuration with Movable Counterweights. (See figure 4-33).

a. Insert lower end of balancing arbor (6) into piloting hub of adapter assembly (1). Align top of adapter assembly hub with 6¾ inch position on arbor scale (7). Lock arbor securely in this position by moderate and uniform tightening of two adapter setscrews (4), using 3/ 32-inch hex wrench (2, figure 1-18).

b. Insert sleeve (9, figure 4-33) into tail rotor counterweight support spacer, and install spacer between rotor hub trunnion and bottom surface of counterweight support.

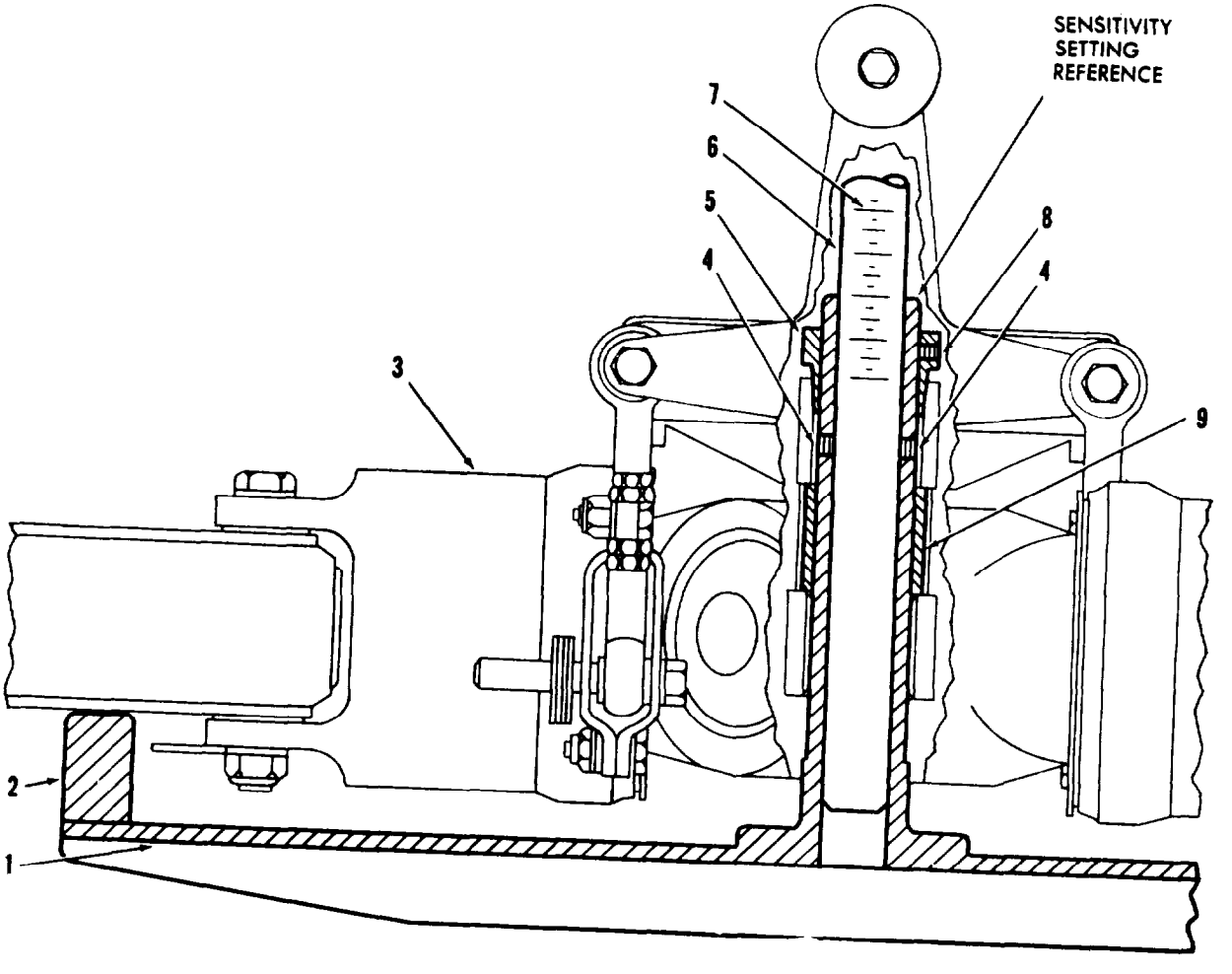
c. Carefully lower tail rotor hub and flange assembly (3), spacer, and counterweigh: support over arbor and adapter piloting hub. Align blades with adapter support blocks (2), and insure that weight of rotor assembly rests squarely on support blocks.

d. Install bushing (5) over arbor and adapter hub. Press tapered pilot on this bushing lightly into upper counterbore of counterweight support, and lock bushing securely in this position by moderate and uniform tightening of two bushing setscrews (8), using 3 / 32-inch hex wrench (2, figure 1-18).

e. Push pitch control bracket bolts, part no. AN-4-21A, radially outward with heads seated against blade pitch brackets. Insure that these bolts remain in this position throughout balancing operation.

f. Install quick-disconnect coupling (7HEL053 or 7A050 kit) on arbor suspension coupler, and suspend entire assembly free from interference, and note the balance condition indicated by black indicator disc at top end of the arbor.

g. For balance tolerance and application of balance corrections, refer to applicable helicopter manual. (Refer to appendix A).



1. Adapter assembly (2522, 7HEL053 kit)
2. Adapter support block
3. Tail rotor hub and blade assembly
4. Adapter setcrew
5. Bushing (2355, 7HEL053 kit)
6. Balancing arbor (2516, 7HELO53 kit)
7. Arbor scale
8. Bushing setscrew
9. Sleeve (2356, 7HEL053 kit)

Figure 4-33. Balancer Installation - UH-19 Helicopter Tail Rotor Hub and Blade Assembly - 105-inch-diameter Configuration with Movable Counterweights.

4-57. CH-34 Helicopter.

4-58. CH-34 Engine Fan Assembly Balance Check. (See figure 4-34).

a. Assemble hoist support (2, 3, 4, 5, and 9, figure 1-13) with no. 4 and no. 5 elbows in outer most positions on no. 2 and no. 6 tubes so as to provide radial clearance for engine fan assembly.

b. Center engine fan assembly (1, figure 4-34), with shroud (if installed) upward, on stand, on stand table assembly (1, figure 1-13).

c. Install cone (2, figure 4-34), part no. 2227 (7A050 kit), hub upward, on balancing arbor (4) so that top of cone hub aligns with 13¾ inch position (shrouded fans), 13-7 / 8-inch position (unshrouded fans) on arbor scale (5). Lock cone setscrew (3) with 1/8 inch hex wrench (8, figure 1-13).

d. Insert balancing arbor (4, figure 4-34) downward through fan hub until cone (2) contacts upper cone seat of fan hub.

e. Install cone (6), part no. 2228 (7A050 kit), upward on bottom of balancing arbor (4), making certain that cone seats firmly in bottom cone seat of fan hub.

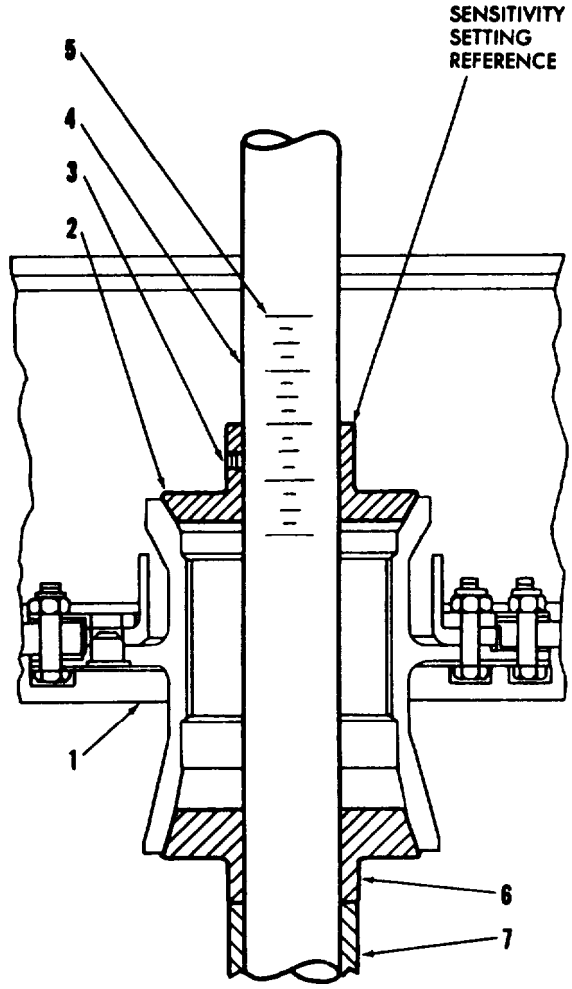
f. Install spacers (7), part no. 2202 and 2204 (7A050 kit), on balancing arbor (4) under cone (6) hub.

g. Install hand wheel (26, figure 1-13) in bottom end of arbor, and tighten wheel to clamp spacers, bottom cone, fan hub, and top cone securely together.

h. Install 3 / 16-inch suspension cable (13, figure 1-13) and quick-disconnect coupling (10) assembly on suspension rod at top end of arbor, and engage suspension cable in lifting plate of hydraulic pump assembly.

i. Hoist entire assembly approximately ¼ inch off work stand. Check to insure that suspended assembly is free from interference with work stand and other objects, and note the balance condition indicated by black indicator disc at top end of the arbor.

j. For balance tolerance and application of balance corrections, refer to applicable helicopter manual. (Refer to appendix A).



1. Engine fan assembly
2. Cone
3. Cone set screw
4. Arbor (2259, 7A050 kit)
5. Arbor scale
6. Cone
7. Spacer

Figure 4-34. Typical Balancer Installation -CH-34 and CH-37 Helicopter Engine Fan Assemblies.

4-59. CH-34 Engine Fan Assembly Track and Concentricity Check. (See figure 4-35).

a. Set base (2) on surface plate (1) or other firm and level support surface. Bolt or clamp base securely to support surface.

b. Install lower end of balancing arbor (3) in base (2) pilot hole. Make certain that arbor is firmly bottomed and free to rotate in base.

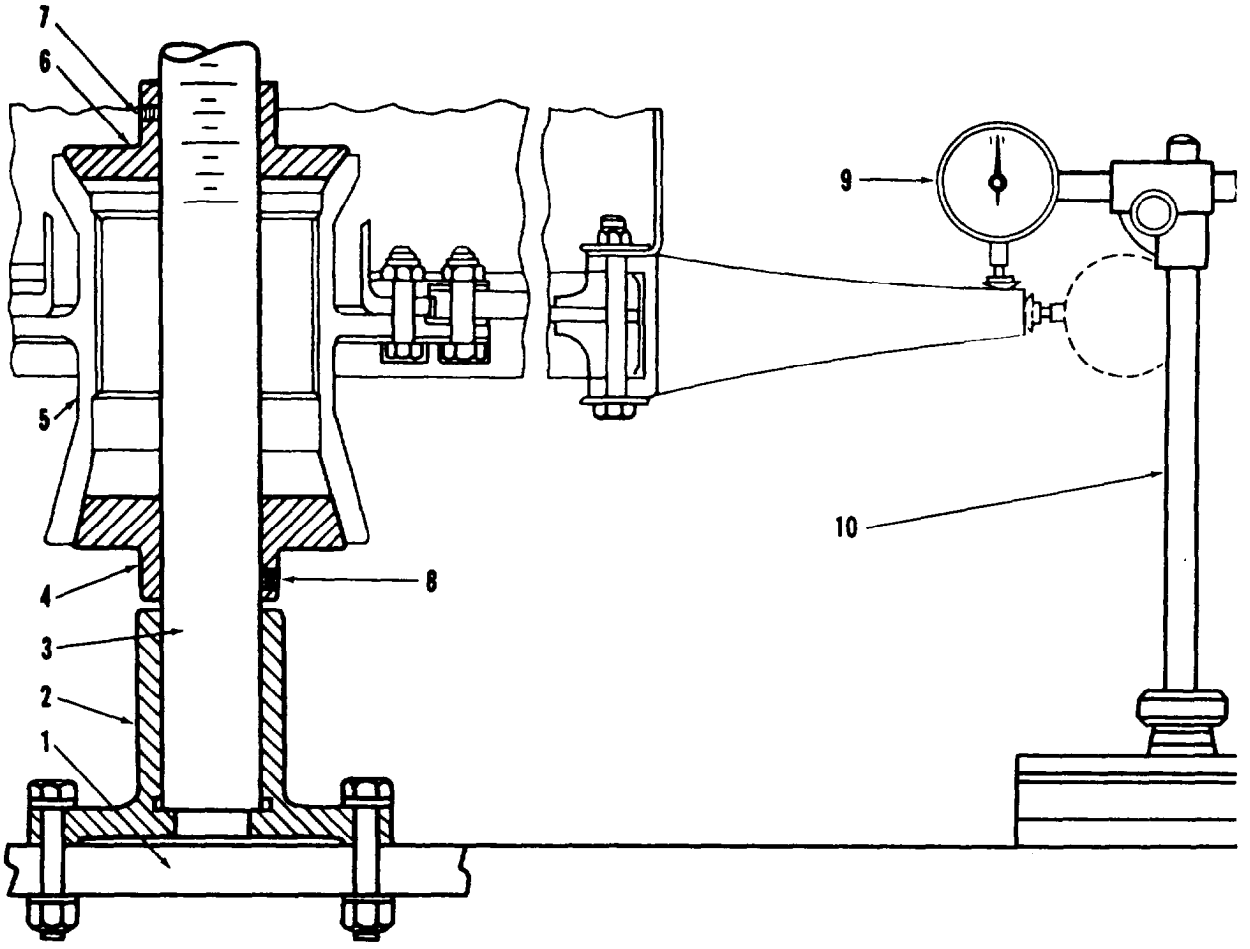
c. Install cone (4), part no. 2228 (7A050 kit), hub downward, on balancing arbor (3) so that bottom of cone hub clears top of base (2) by approximately ¼ inch. Secure cone in this position by tightening cone setscrew (8) with 1/8-inch hex wrench (8, figure 1-13).

d. Install engine fan assembly (5, figure 4-35), with shroud upward, over balancing arbor (3). Seat fan assembly hub squarely on cone 14) seat.

e. Install cone (6), part no. 2227 (7A050 kit), hub upward, over arbor, and seat cone firmly in top cone seat of fan assembly hub. Secure cone in this position by tightening cone setscrew (7) with 1/8 inch hex wrench (8, figure 1-13).

f. Install ½ inch mushroom point on dial indicator (9, figure 4-35), and adjust height gage assembly (10) to read track or concentricity variations as required. Rotate fan and arbor assembly to determine range of variations.

g. For track and concentricity tolerances and application of corrections, refer to applicable helicopter manual. (Refer to appendix A).



1. Surface plate
2. Base (2341, 7HEL055 kit)
3. Balancing arbor (2259, 7A050 kit)
4. Cone
5. Engine fan assembly
6. Cone
7. Cone setscrew
8. Cone setscrew
9. Dial indicator (7HEL055 kit)
10. Height gage assembly (7HEL055 kit)

Figure 4-35. Typical Setup for CH-34 and CH-37 Helicopter Engine Fan Assemblies Track and Concentricity Check.

4-60. CH-34 Tail Rotor Counterweight Assembly Balance Check. (See figure 4-36).

a. Center adapter plate assembly (1), with plate hub projection upward, on stand table assembly (1, figure 1-13).

b. Place spacer (2) on top of adapter plate assembly (1) hub with inside chamfer of spacer upward.

c. Center flat face of tail rotor counterweight assembly (3) hub on spacer (2).

d. Install bushing (4), with pilot end downward, on balancing arbor (6) so that top surface of bushing aligns with 12-inch position on arbor scale (7). Secure bushing in this position by tightening bushing setscrew (5) with 1/8-inch hex wrench (8, figure 1-13).

e. Insert lower end of balancing arbor (6, figure 4-36) downward through tail rotor counterweight assembly (3) hub, spacer (2), and adapter plate assembly (1) hub, pushing arbor all the way down until tapered pilot on bushing (4) seats firmly into counterbore of counterweight assembly hub.

f. Install spacers (9) on lower end of balancing arbor (6). Install hand wheel (26, figure 1-13) in bottom end of arbor, and tighten to clamp assembly firmly together.

g. Rotate counterweight assembly so that turnbuckles align vertically with adapter plate clevis blocks (8, figure 4-36) and counterweights are positioned counter clockwise from their respective clevis blocks.

h. Insert ball ends of turnbuckles in slots of clevis blocks, and install four bolts, part no. AN4-13A, through clevis locks, with bolt heads toward outside edge of adapter plate assembly (1). Align turnbuckles approximately parallel with balancing arbor (6).

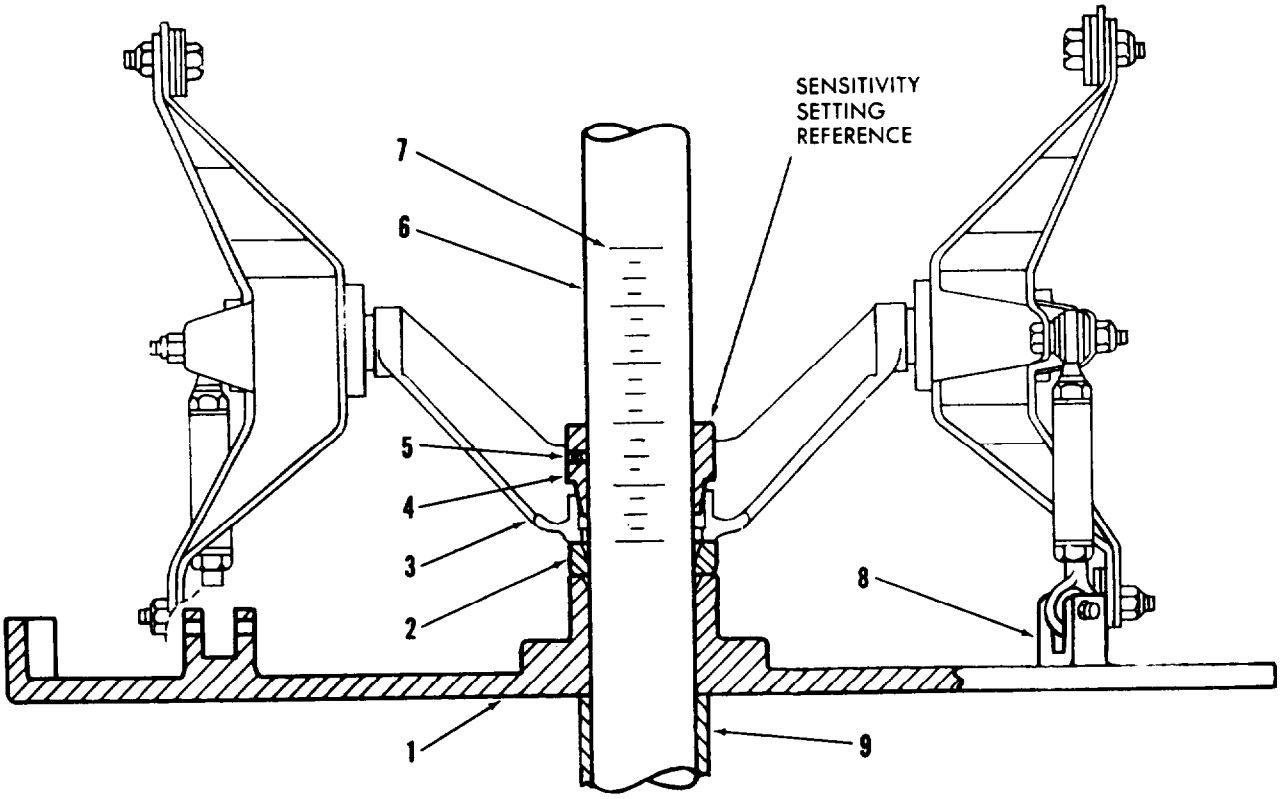
NOTE

Installation of nuts on bolts, part no. AN4-13A, is not essential, but check frequently to make certain that bolts do not shift position in clevis blocks during balance checking operations.

i. Install 3 / 16-inch suspension cable (13, figure 1-13) and quick-disconnect coupling (10) assembly on suspension rod at top of arbor, and engage suspension cable in lifting plate of hydraulic pump assembly.

j. Hoist entire assembly approximately ¼ inch off work stand. Check to insure that suspended assembly is free from interference with work stand and other objects, and note balance condition indicated by black indicator disc at top end of the arbor.

k. For balance tolerance and application of balance corrections, refer to applicable helicopter manual. (Refer to appendix A).



1. Adapter plate assembly (2238, 7HEL051 kit)
2. Spacer (2246, 7HEL051 kit)
3. Tail rotor counterweight assembly
4. Bushing (2242, 7HEL051 kit)
5. Bushing setscrew
6. Balancing arbor (2259, 7A050 kit)
7. Arbor scale
8. Adapter plate clevis Block
9. Spacer (2201, 2203, and 2204. 7A050 kit)

Figure 4-36. Balancer Installation - CH-34 Helicopter Tail Rotor Counterweight Assembly.

4-61. CH-34 Tail Rotor Hub and Blade Assembly Balance Check. (See figure 4-37).

a. Center adapter plate assembly (1), with plate hub projection upward, on stand table assembly (1, figure 1-13).

b. Place recessed side of tail rotor hub and blade assembly (3, figure 4-37) over plate assembly hub, with rotor hub grease fittings downward, and position blades so that heads of blade attaching bolts fall inside clearance cutouts in blade support blocks (2).

c. Install bushing (4), with small diameter downward, on balancing arbor (6) so that top surface of bushing aligns with 11-inch position on arbor scale (7). Secure bushing in this position by

tightening bushing setscrew (5) with 1/8-inch hex wrench (8, figure 1-13).

d. To facilitate rotor hub and plate alignment, raise rotor blade grips off plate support blocks. Insert lower end of balancing arbor (6, figure 4-37) downward through tail rotor hub and blade assembly (3) and plate assembly hub, pushing downward until lower end of bushing (4), rotor hub, and plate hub are seated firmly together. Reposition rotor blade grips central on plate support blocks.

e. Install spacers (9) over lower end of arbor.

f. Install hand wheel (26, figure 1-13) in bottom end of arbor, and tighten to clamp assembly firmly together.

g. Using rawhide or rubber mallet, tap shoulder of each blade hinge, adjacent to square head of hinge bolt, so as to position blade chordwise in direction of its trailing edge. Then insert two wedges (8, figure 4-37), symmetrically spaced across blade centerline, into each blade hinge. (See view at A.) Seat wedges firmly by pressing with thumb.

h. Install 3 / 16-inch suspension cable (13, figure 1-13) and quick-disconnect coupling (10) assembly on suspension rod at top end of arbor, and engage suspension cable in lifting plate of hydraulic pump assembly.

i. Hoist entire assembly approximately 1/4 inch off work stand. Check to insure that suspended assembly is free from interference with work stand and other objects and note the balance condition indicated by black indicator disc at top end of the arbor.

j. For balance tolerance and application of balance corrections, refer to applicable helicopter manual. (Refer to appendix A).

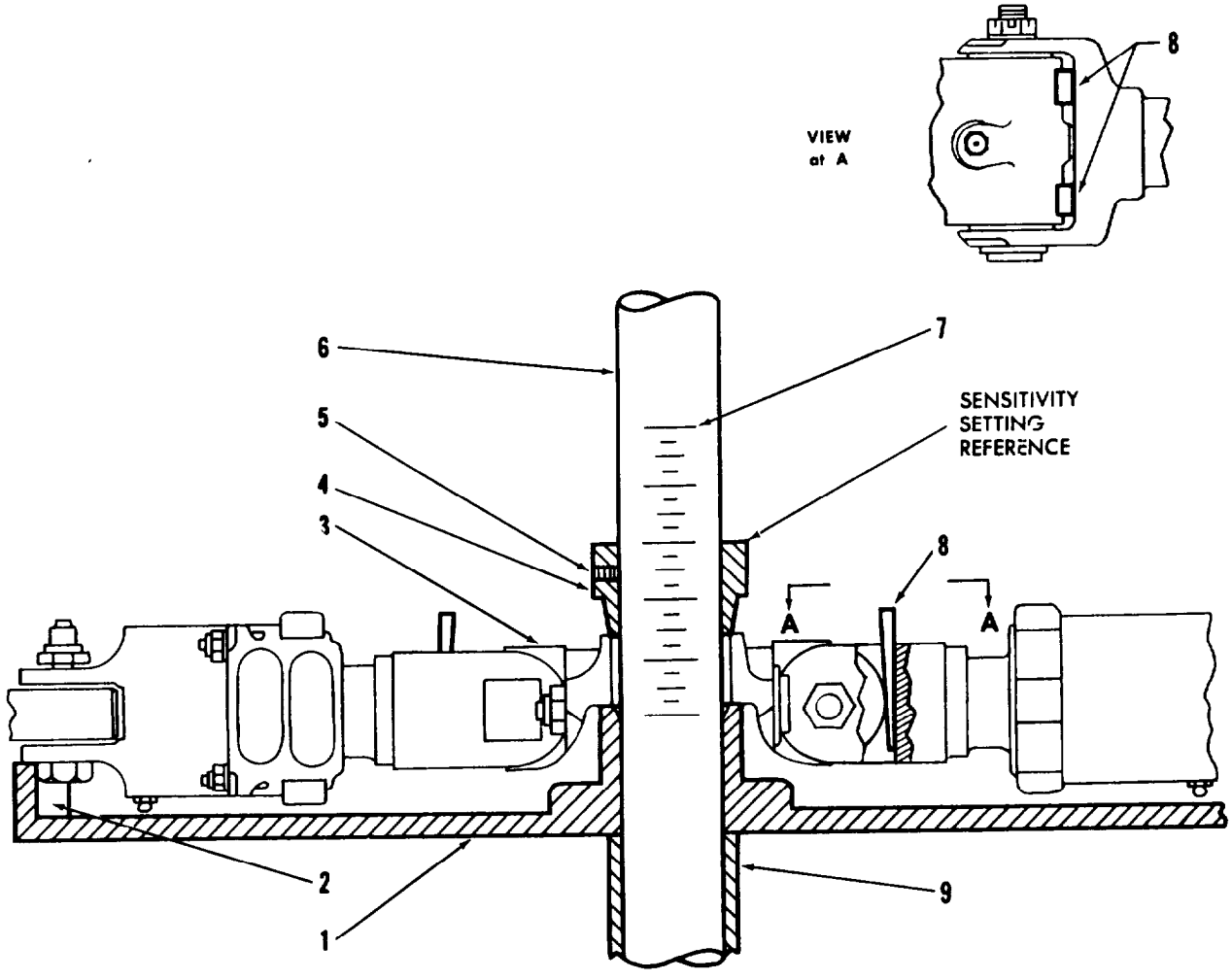


Figure 4-37. Balancer Installation - CH-34 Helicopter Tail Rotor Hub and Blade Assembly.

Key to figure 4-37:
1. Adapter plate assembly (2238, 7HEL051 kit)
2. Blade support blocks
3. Tail rotor hub and blade assembly
4. Bushing (2242, 7HEL051 kit)
5. Bushing setscrew
6. Balancing arbor (2259, 7A050 kit)
7. Arbor scale
8. Wedge (2247, 7HEL051 kit)
9. Spacers (2203 and 2204, 7A050 kit)

4-62. CH-3 7 Helicopter.

4-63. CH-37 Engine Fan Assembly Balance Check, (See figure 4-34).

a. Center engine fan assembly (11, with hub extension upward, on stand table assembly (1, figure 1-13).

b. Install cone (2, figure 4-34), part no. 2296 (7HELO52 kit), hub upward, on balancing arbor (4) so that top of cone hub aligns with 16½-inch position on arbor scale (5). Secure cone in this position by tightening cone setscrew (3) with 1/8-inch hex wrench (8, figure 1-13).

c. Insert balancing arbor (4, figure 4-34) downward through fan hub, seating cone (2) in upper cone seat of hub.

d. Install cone (6), part no. 2297 (7HEL052 kit), hub downward, on lower end of balancing arbor (4), making certain that cone seats firmly in bottom cone seat of fan hub.

e. Install spacers (7), part no. 2203, and 2204 (7A050 kit), on balancing arbor (4) under cone (6) hub.

f. Install hand wheel (26, figure 1-13) bottom end of arbor, and tighten wheel to clamp spacers, cones, and fan hub securely together.

g. Install suspension cable (13, figure 1-13) and quick disconnect coupling (10) assembly on suspension rod at top end of arbor, and engage suepension cable in lifting plate of hydraulic pump assembly.

h. Hoist entire assembly approximately ¼ inch off work stand. Check to insure that suspended assembly is free from interference with work stand and other objects, and note the balance condition indicated by black indicator disc at top end of the arbor.

i. For balance tolerance and application of balance corrections refer to applicable helicopter manual. (Refer to appendix A).

4-64. CH-37 Engine Fan Assembly Track and Concentricity Check. (See figure 4-35).

a. Set base (2) on surface plate (1) or other firm support surface. Bolt or clamp base securely to support surface.

b. Install lower end of balancing arbor (3) in base (2) pilot hole. Make certain that arbor is firmly bottomed and free to rotate in base.

c. Install cone (4), part no. 2297 (7HEL052 kit), hub downward on balancing arbor (3) so that bottom of one hub clears top of base (2) by approximately ¼ inch. Secure cone in this position by tightening cone setscrew (8) with 1/8-inch hex wrench (8, figure 1-13).

d. Install engine fan assembly (5, figure 4-35), with hub extension upward, over balancing arbor (3). Seat fan assembly hub squarely on cone (4) seat.

e. Install cone (6), part no. 2296 (7HEL052 kit), hub upward, over arbor, and seat cone firmly in top cone seat of fan assembly hub. Secure cone in this position by tightening cone setscrew (7) with 1/8-inch hex wrench (8, figure 1-13).

f, Install 1/2-inch mushroom point on dial indicator (9, figure 4-35), and adjust height gage assembly (10) to read track or concentricity variations as required. Rotate fan and arbor assembly to determine range of variations.

g. For track and concentricity tolerances and application of corrections refer to applicable helicopter manual. (Refer to appendix A).

4-65. CH-37 Tail Rotor Assembly Optical Trammeling and Balance Check.

4-66. Optical Trammeling. (See figure 4-38).

a. Install ¾-inch-thick wood block on floor under each of the tubular legs of stand table assembly (1, figure 1-13). Do not assemble overhead hoist structure at this time.

b. Center fixture assembly (15, figure 4-38) with blade support blocks upward on stand table assembly.

c. Carefully lower tail rotor assembly (2) onto fixture assembly (15), aligning blades with fixture support blocks (1), studs with clearance holes in fixture arms, and bottom rotor cone seat with fixture hub, Insure that blade cuffs rest squarely on blade support blocks and that rotor hub is fully seated on fixture hub cone. Disconnect pitch control linkages at blade cuffs, and turn rotor pitch control rocker arms so that their inner ends are in the full upward position. (See view A). Disconnect four tail rotor dampers at adjustment end only.

d. Install scope support assembly (3) over top of balancing arbor (11), insuring definite bottoming on end of arbor. Secure scope support assembly in this position by tightening scope

support assembly setscrew (4) with 1/8-inch hex wrench (8, figure 1-13).

NOTE

Zero position of scope support index plate (10, figure 4-38) lies directly above scope support assembly setscrew (4). If scope support index pin (5) is not in this position, lift index pin and rotate scope support assembly on index plate until index pin can be engaged in index plate directly over scope support assembly setscrew. (See view A).

e. Apply light grease or heavy oil to surface of rotor hub upper cone seat, and install balancing arbor (11) downward through rotor hub and fixture assembly (15) pilot hole, seating lower end of scope support assembly (3) firmly into rotor hub top cone. Install bushing (12), knurled hub upward, over lower end of arbor, seating bushing against bottom surface of fixture assembly (15). Do not lock bushing setscrew.

f. Install spacers (13) over lower end of arbor, and install hand wheel (14) in bottom end of arbor. Do not fully tighten hand wheel at this time.

g. Install scope (7), part no. 2420 (7HEL056 kit), through scope wheel (8). Adjust scope eyepiece (6) to bring scope cross-hairs into sharpest focus. Tilt scope wheel (8) and rotate scope support ant! arbor assembly to align intersection of scope cross-hairs on exact center of crossed-line intersection on top surface of any one of the four rotor lag hinge caps. (See view A). Slide scope (7) in scope wheel (8) to bring this target into sharpest focus, and lock scope in this position with scope lock screw (9). Recheck alignment of scope cross-hair intersection on intersection of hinge cap crossed lines, and adjust as required.

h. Tighten hand wheel (14) in bottom end of arbor to clamp spacers (13), fixture assembly (15) hub, rotor hub, and scope support assembly (3) firmly together.

NOTE

To prevent misalignement of scope with rotor huh, it is essential that no rotation between these parts be permitted during the remainder of the blade alignment operation.

i. Recheck alignment of cross-hairs on target. If necessary, loosen hand wheel (14) to adjust cross-hair alignment; always be sure hand wheel is firmly tightened before proceeding.

i. Install target assembly (17) on tip of rotor blade in line with scope by holding two target assembly gage pins (16) across leading edge of rotor blade and snapping spring-loaded roller across trailing edge of rotor blade. (See views B and D). Gage pins should align with inboard edge of blade tip cap, with body of target assembly parallel to inboard edge of blade tip cap.

k. Remove scope (7) from scope wheel (8). Install scope (7), part no. 2421 (7HEL056 kit). and adjust eyepiece to bring cross-hairs into sharpest focus. Tilt scope wheel (8) in vertical plane to align cross-hairs on body of target assembly (17) at rotor bade tip. Shift blade tip chordwise by gentle hand tapping as required to bring alignment target (18) into visual field of scope. Slide scope (7) in scope wheel (8) to bring alignment target (18) into sharpest focus, and lock scope in this position with scope lock screw (9). Bring blade into final precise alignment by hand tapping of blade tip and/or tilt scope wheel slightly to bring point of intersection of scope cross-hairs (19) within innermost circle of alignment target (18).

NOTE

To prevent faulty indications, do not disturb position of this blade during remainder of trammeling and balance checking operation.

l. Adjust damper assembly between the two trammeled blades so that, in neutral position, its attaching bolt hole aligns precisely with attaching bracket hole of the trammeled blade. Install damper bolt, with original washers, being careful not to disturb position of either trammeled blade.

m. Repeat steps h, i, j, k, and l to align remaining two rotor blades, and install damper bolts.

n. Repeat steps h, i, j, and k, recheck alignment of all rotor blades to make certain no shift has occurred during trammeling operations or installation of damper bolts.

NOTE

Blades must remain in their trammeled positions throughout subsequent balancing operation. If position of blades is inadvertently disturbed, repeat entire trammeling operation before proceeding with balance check.

o. Remove scope (7) from scope wheel 13). Remove hand wheel (14), spacers (13), and bushing (12). Remove balancing arbor (11) and scope support assembly (3) from fixture assembly (15) and rotor hub. Remove scope support assembly (3) from balancing arbor (11). Remove target assembly (17) from rotor blade.

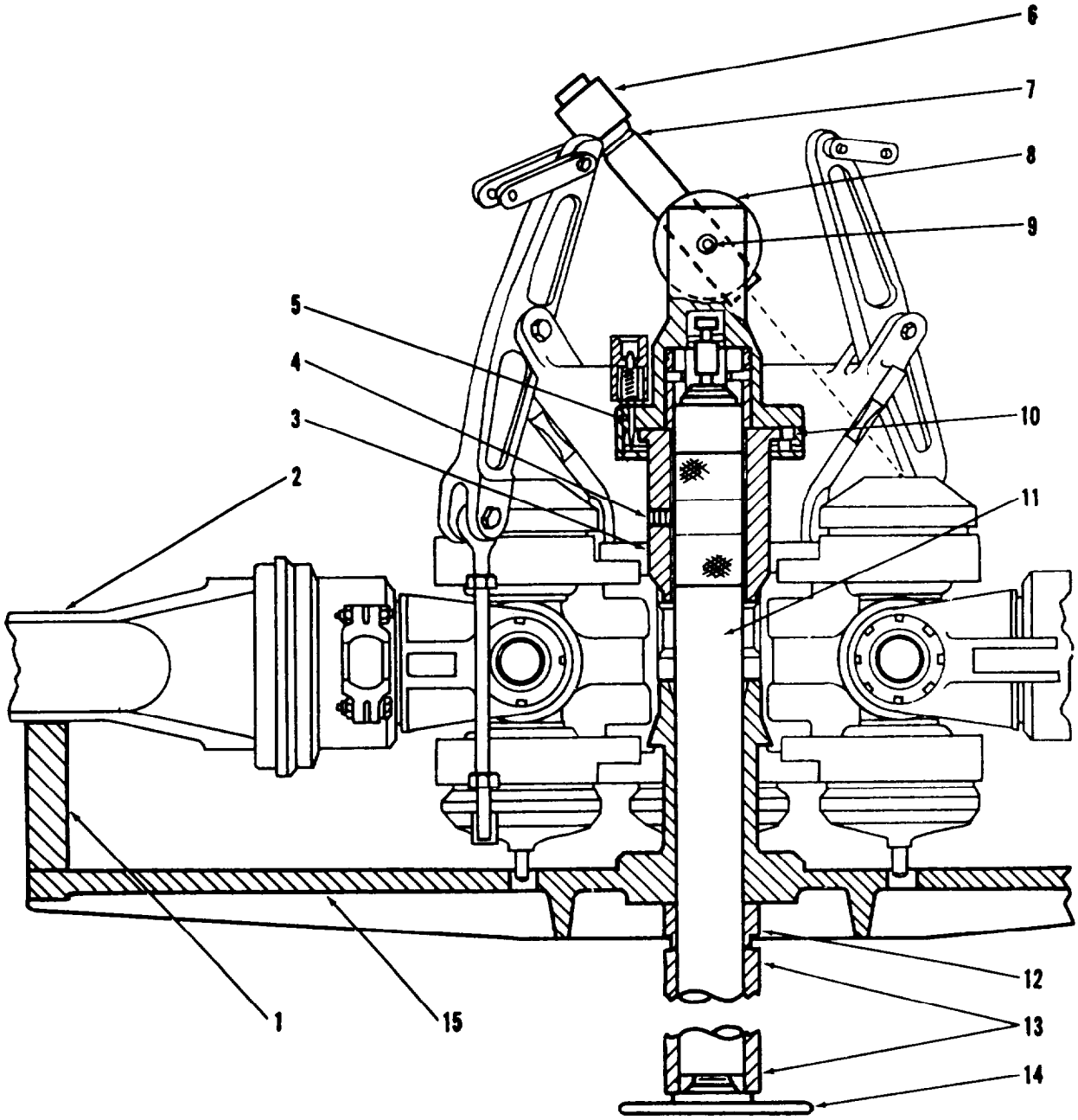


Figure 4-38. Setup for Optical Trammeling of CH-37 Helicopter Tail Rotor Assembly (Sheet 1 of 2).

Key to figure 4-38:

1. Fixture support block
2. Tail rotor assembly
3. Scope support assembly (2400, 7HEL056 kit)
4. Scope support assembly setscrew
5. Scope support index pin
6. Scope eyepiece
7. Scope
8. Scope wheel
9. Scope lock screw
10. Scope support index plate
11. Balancing arbor (2259, 7A050 kit)
12. Bushing (2211, 7A050 kit)
13. Spacers (2201, 2202, 2203, and 2204, 7A050 kit)
14. Hand wheel (2215, 7A050 kit)
15. Fixture assembly (2319, 7HEL052 kit)
16. Target assembly gage pin
17. Target assembly (2475, 7HEL056 kit)
18. Alignment target
19. Scope cross-hairs
20. Blade tip cap inboard edge
21. Roller

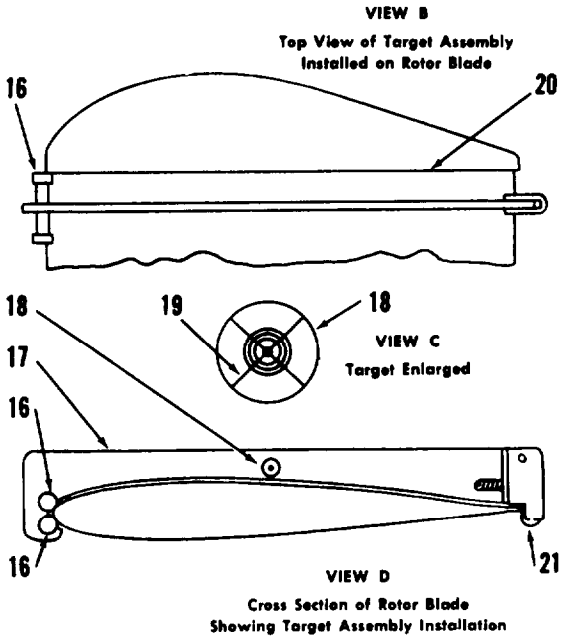


Figure 4-38. Setup for Optical Trammeling of CH-37 Helicopter Tail Rotor Assembly (Sheet 2 of 2).

4-67. CH-37 Tail Rotor Assembly Balance Check. (See figure 4-39).

a. Assemble stand table and hoist support structure as shown in figure 3-3 except substitute part no. 2769 longer tube in place of the no. 4 vertical tube (2288) to provide the additional arm height required for this application.

b. Install cone (1, figure 4-39), hub upward, on balancing arbor (4) so that top surface of cone hub aligns with 12-¾-inch position on arbor scale (5). Secure cone in this position by tightening cone setscrew (2) with 1/8-inch hex wrench (8, figure 1-13).

c. Install balancing arbor (4, figure 4-39) downward through hub of tail rotor assembly (6) and hub of fixture assembly (8). seating cone firmly in rotor assembly hub top cone seat.

d. Position rotor hub pitch change beams so that their inner ends rest against sides of balancing arbor (4) with links vertical against sides of arbor. Install suitable heavy elastic band (3) or O-ring around links to hold links and pitch change beams in this position during balance check.

e. Install spacer (9) on lower end of balancing arbor (4). Install hand wheel (26, figure 1-13) in bottom of arbor, and tighten wheel to clamp spacer, (9, figure 4-391, fixture assembly (8), rotor assembly hub, and top cone (1) firmly together.

f. Install 3 / 16-inch suspension cable (13, figure 1-131 and quick-disconnect coupling (10) assembly on arbor suspension rod end, engage suspension cable in lifting plate of hydraulic pump assembly, and hoist entire assembly approximately ¼ inch off work stand. Check to insure that suspended assembly is free from interference with work stand or other objects. Observe balance condition indicated by black indicator disc at top end of arbor, and apply balance corrections to rotor assembly as required.

NOTE

Due to blade span of this rotor assembly, stability of balance indication is dependent on complete absence of moving air currents. Balance check should be performed in completely draft-free area, and movement of personnel in this area should be restricted to a minimum during the balance checking operation.

g. For balance tolerance and application of balance corrections, refer to applicable helicopter manual. (Refer to appendix A).

h. Following addition of rotor balance corrections, carefully lower balanced assembly onto work stand. Remove quick-disconnect coupling from arbor suspension rod. Rotate the part no. 2769 tube approximately 30 degrees to swing hoist structure away and provide working clearance. Remove elastic band (3, figure 4-39) from balancing arbor (41. Remove hand wheel (26, figure 1-13) and spacer (9, figure 4-39) from lower end of arbor. Lift arbor and cone assembly out of fixture assembly hub.

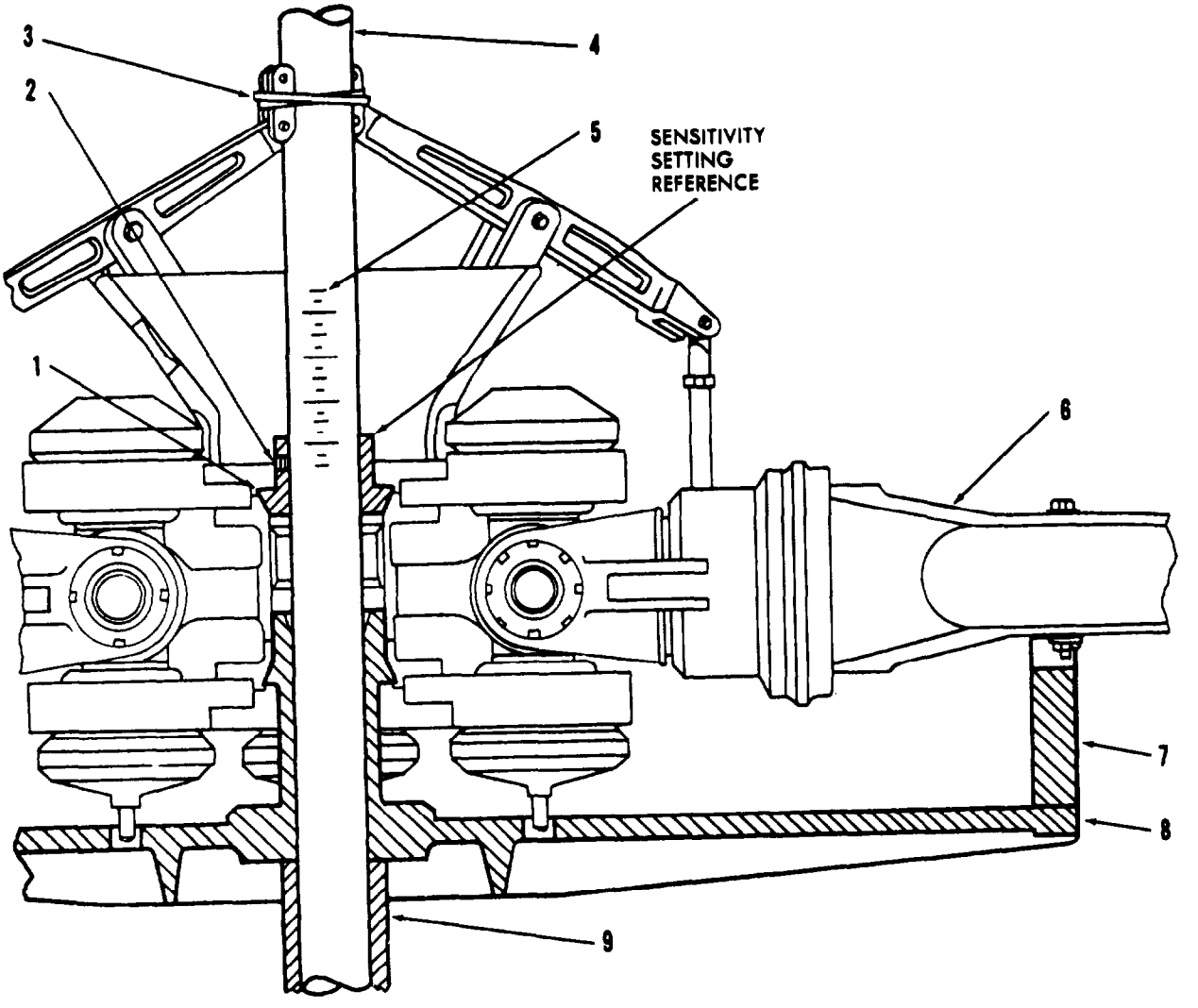
i. In order to verify that the rotor blades actually were in the proper trammeled position during addition of rotor balance correction, reinstall scope support assembly (3, figure 4-38), as instructed in paragraph 4-66, steps d and e. Install target assembly (17) on any blade, and install scope (7), part no. 2421 (7HEL056 kit), in scope wheel (8). Align scope cross-hairs (19) on alignment target (18) by tilting scope and rotating arbor in rotor hub. Do not shift position of blade.

j. With scope cross-hairs aligned in smallest target circle, lock balancing arbor (11) and scope support assembly (3) to rotor hub with hand wheel (141.

k. Carefully transfer target assembly (17) to next adjacent blade and reindex scope support assembly (3) to next 90-degree position in scope support index plate (10). By tilting scope wheel (8) only in vertical plane, intersection of scope cross-hairs (19) should fall within smallest circle of alignment target (18).

l. Repeat step k to check alignment of remaining two rotor blades.

m. Should steps i, j, k, and l indicate that blades, after balancing, are still in their correct 90-degree relationship, balance of the rotor may be considered satisfactory. Should this check indicate blade position was disturbed during or prior to addition of balance corrections, realign blades 90 degrees apart and recheck rotor assembly balance.



1. Cone (2206, 7A050 kit)
2. Cone setscrew
3. Elastic band
4. Balancing arbor (2259. 7A050 kit)
5. Arbor scale
6. Tail rotor assembly
7. Fixture support block
8. Fixture assembly (2319, 7HEL052 kit)
9. Spacer (2203, 7A050 kit)

Figure 4-39. Balancer Installation - CH-37 Helicopter Tail Rotor Assembly.

4-68. VERTOL HELICOPTERS.

4-69. CH-47 Rotor Head Assembly Balance Check. (See figure 4-40).

a. Center plug (1), with bushing (2) installed, on stand table assembly (1, figure 1-13).

b. Install sleeve (3, figure 4-40) as shown. Lock sleeve firmly in position with sleeve setscrew (4), using 1/8-inch hex wrench (8, figure 1-13).

c. Carefully lower rotor head assembly so that splined hub of rotor assembly fits over outside

diameter of sleeve (3, figure 4-40). Insure that rotor hub seats firmly on shoulder of sleeve or base of plug (1) as applicable. Allow rotor arms to rest against droop stops. Position pitch bearing housings in flat position.

d. Install balancing arbor (6) downward through center bore of bushing (2). Install quick-disconnect coupling (10, figure 1-13) with 3 / 16-inch suspension cable (13) on arbor suspension rod. Install alternate hoist eye assembly (12) with "quickie" coupling (11) on end ball of suspension cable, and attach alternate hoist eye assembly to suitable shop hoist (not supplied).

NOTE

Since weight of the rotor head assembly exceeds recommended limits for the 7A050 kit hoist arm structure, use of this hoist arm with its hydraulic pump assembly is not recommended in balancing of the rotor head assembly.

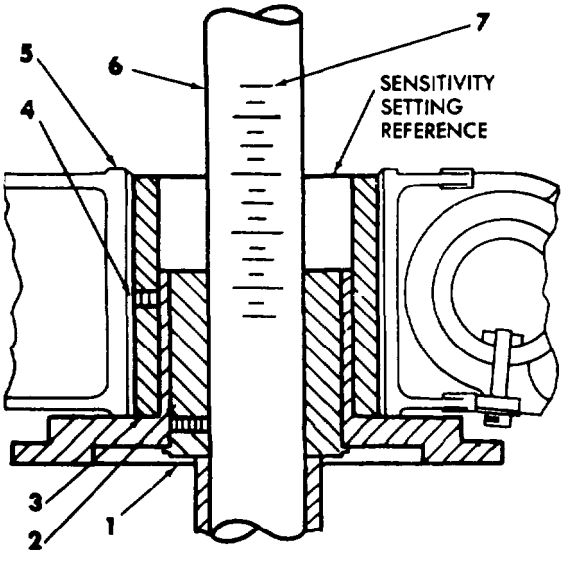
e. Adjust suspended height of balancing arbor (6, figure 4-40) so that 7-inch position on arbor scale (7) aligns with top surface of sleeve (3).

f. Install hand wheel (26, figure 1-13) in bottom end of arbor, insuring that it seats firmly against bottom of bushing (2, figure 4-40). Hoist entire assembly approximately ¼ inch off work stand. Check to insure that suspended assembly is free from interference with work stand and other objects, and note balance condition.

CAUTION

In using available shop hoist for suspending rotor head assembly, care should be exercised to avoid excessive acceleration loading (jerking) of the arbor suspension rod.

g. For balance tolerances and application of balance corrections, refer to applicable helicopter manual. (Refer to appendix A).



1. Plug (2250, 7HEL054 and 7HEL354 kits)
2. Bushing (2463, 7HEL054 and 7HEL354 kits)
3. Sleeve (2484, 7HEL354 kit)
4. Sleeve setscrew
5. Rotor hub assembly
6. Balancing arbor (2259, 7A050 kit)
7. Arbor scale

Figure 4-40. Balancer Installation - CH-47 Helicopter Rotor Head Assembly.

SECTION V

PERIODIC INSPECTION, MAINTENANCE, AND LUBRICATION

5-1. INSPECTION.

5-2. General. Inspection of the equipment described in this manual at regularly scheduled intervals is not required. However, the following inspections should be performed each time the equipment is removed from storage and prepared for use.

5-3. Balance Arbors. Visually examine all surfaces of the arbor for detrimental physical damage such as burrs, nicks, dents, scratches or corrosion. If any arbor is reportedly discrepant and/ or is suspected of having been damaged wherein the internal suspension element has been bent or deformed, a serviceability check of the arbor shall be accomplished. First, inspect for possible binding of the indicator bushing and correct for this condition, if necessary. Appropriate indicator bushing instructions are provided in paragraph 3-7. Check the oil in the arbor to make sure it is clean, fluid, and authorized. Drain unsatisfactory oil; clean and refill arbor, if required, as described in paragraph 5-21. If an arbor has been stored on its side (horizontally) for a considerable length of time, particularly at low temperature, eccentric balance indications may be due to improper distribution and / or congealing of the dash-pot oil. This condition shall be corrected by suspending the arbor at room temperature until the oil becomes fluid and uniformly distributed. If it is necessary to verify the correct alignment and condition of the arbor's internal suspension element, adhere to the following instructions.

CAUTION

Do not attempt to disassemble or repair balancing arbors. Except for adjustment of indicator bushings (refer to paragraph 3-7) and removal of oil filler screws (refer to paragraph 5-21), these arbors are permanent assemblies, and any disassembly by using activities will result in critical damage requiring factory repair. Refer to section VI, troubleshooting, for correction of abnormal symptons, permitted by field activities during the balance check of balance arbor assemblies.

a. Part no. 2259 arbor. Suspend cleaned, bare arbor to be checked using the 1 / 16″ cable (2262) and the quick-disconnect coupling (2266). Install and secure the rear cone (2228), collar up, at the extreme top end of the suspended arbor. Stabilize the suspended assembly. Eliminate its tendency to revolve or swing. Free the suspended assembly from any obstruction or interference. After the suspended assembly has stabilized, note the indicator bushing position in relation to the black indicator disc. An arbor that indicates balance eccentricity to the point of tangency illustrated in view C, figure 1-28, is acceptable end completely serviceable. However, overlapping circles are an indication that the arbor is out-of-balance beyond acceptable limits (providing indicator bushing interference, dash-pot oil, and cable discrepancy possibilities have been eliminated). See view D, figure 1-28.

NOTE

Cables shall be straight, without kinks or twists. Suspension cables incorporating a swaged shank junction at the coupling end may introduce errors due to a bent swaged connection. To check if a cable is satisfactory revolve it 180^0 and observe whether the unbalance indicated, if present, approximately follows the rotated cable or remains in a constant location. If the unbalance indication follows the rotated position of the cable, the cable is damaged or the swaged section is bent. The cable shell be replaced or repaired satisfactorily before proceeding with the balance check of the arbor.

b. Part no. 2516 arbor. First check the suspected arbor for possible indicator bushing binding or dash-pot oil discrepancies as described in paragraph 5-3 above. If necessary, check the alignment of the internal suspension element by adhering to the following instructions. Suspend the cleaned, bare arbor to be checked using the eye assembly (23871, or a suspension cable (2262 or 2264), in combination with the quick-disconnect coupling (2266), available in the 7A050 kit. Install the counterweight (2523), small collar up, on the arbor so that the top of the counterweight collar is in line with the 9¾ inch scale mark on the arbor. Tighten the set screw to retain the counterweight on the arbor. Because of the design of the 2516 arbor

cable, discrepancies have no affect on the balance indications. Stabilize the suspended assembly and note the indicator bushing position in relation to the black indicator disc. An arbor that exhibits balance eccentricity to the point of tangency illustrated in view C, figure 1-28, is acceptable and completely serviceable. However, overlapping circles as shown in view D, figure 1-28, are an indication that the arbor is out-of-balance beyond acceptable limits (providing indicator bushing interference and dashpot oil descrepancy possibility have been eliminated). Out-of-balance arbors shall be removed from service and forwarded to the manufacturer for repair.

5-4. Adapter, Yoke and Fixture Assemblies. Visually check all surfaces for nicks, burrs, scratches or corrosion; particularly, make sure pilot and mating surfaces are free of surface defects. If necessary, check snug slip fit of an assembly in question on the balancing arbor (mating surfaces shall be thoroughly cleaned). If an assembly is suspect due to tampering or inadvertent damage, accomplish a routine balance check of the assembly on a serviceable arbor assembly. All adapter, yoke and fixture assemblies are precisely balanced by the manufacturer prior to shipment and should retain thin precise balance unless parts are misused. Refer to section VII for increasing the sensitivity setting (vertical height) of the adapter, yoke or fixture assembly on the arbor, if a balance check is being made.

5-5. Cones, Bushings, Spacers, Etc. Make sure all parts are free of superficial surface defects such as burrs, nicks, scratches and corrosion, especially at the pilot and mating surfaces.

5-6. Quick-Disconnect Couplings. Install coupling on suspension rod end and check for freedom of action and positive locking. Check release action. (Refer to section IV for operation). If binding or interference is found, carefully inspect assembly for possible foreign matter. (For corrective instructions, refer to paragraph 5-16).

5-7. Suspension Cables. Visually check cables for fraying, kinks, mutilation, and security of swaged fittings.

5-8. Hydraulic Pump Assembly. With pump in horizontal position, check for proper functioning. (Refer to section IV for operation). If malfunction of assembly is indicated, check reservoir fluid level. (Refer to paragraph 5-22).

5-9. Stand and Hoist Structure. Visually check stand and hoist structure for free fits of all mating parts. If interference is found check for mutilation or deformation of affected parts. Check wood case for splits, cracks, or loosening of component parts. Visible deflection of hoist structure under load is normal and should not be interpreted as incipient failure.

5-10. Dial Indicator (7HEL055 Kit). Check indicator and mounting stand parts for mutilation or corrosion. Check stand assembly for proper functioning and security of indicator positioning. Check indicator head for smoothness and continuity of indicating action.

5-11. Scope Support Assembly (7HEL056 Kit). Visually check scope support assembly for mutilation or corrosion. Raise index pin and check rotation of scope support on index plate for smoothness and security. Check indexing action of index pin in 0-, 90-, 120-, 180-, 240-, and 270-degree positions. Insert scope in scope wheel and check tilting action of scope wheel for smoothness and security. Check locking action of scope lock screw.

5-12. Alignment Scopes (7HEL056 Kit). Visually check for mutilation or corrosion. Check fits in scope wheel for smoothness and security. Visually check lenses for cleanliness, mutilation, and security of mounting.

5-13. MAINTENANCE.

5-14. General. Careful preservation of precision-finished piloting surfaces of kit components against corrosive attack or accidental surface damage constitutes the most effective preventive maintenance.

5-15. Correction of Minor Mutilation or Corrosion. Local stoning and polishing of arbor and adapter piloting surface, to remove raised portions of minor nicks, dents, burro, or scratches may be performed in most cases without seriously affecting accuracy of piloting fits. Complete blending out of larger nicks and dents or removal of large areas of corrosion having a perceptible depth is not recommended. Individual parts that require more than correct ion of minor mutilation or corrosion should be returned to next higher echelon for inspection and evaluation.

WARNING

Cleaning may be toxic. Use in well-ventilated area. Avoid prolonged inhalation of fumes or direct contact with skin. Do not, use solvent near open flame or in area where very high temperatures prevail.

5-16. Quick-disconnect Couplings (7A050 and 7HEL053 Kits). Binding or erratic action of the quickdisconnect coupling due to presence of dirt or chips may usually be corrected by agitation of the complete coupling assembly while immersed in solvent, Specification P-D-680, or equivalent. Following such immersion, allow assembly to drain for 15 minutes, then immerse complete assembly in a medium lubricating oil, Military Specification

MIL-L-6085, to insure lubrication of internal parts. Again allow assembly to drain and wipe excess oil from outside surfaces.

5-17. Dial Indicator (7HEl055 Kit). Local repair of this unit is not recommended. If malfunction of the dial indicator occurs, send to

qualified instrument repair shop or return to manufacturer for overhaul.

5-18. Optical Alignment System (7HEL056 Kit). Local repair of this unit is not recommended. If malfunction of the scope support assembly or the scopes should occur, return the complete 7HEL056 kit to the manufacturer for overhaul.

5.19. LUBRICATION.

5-20. General. Immediately prior to each application of kit components, carefully wipe all external and internal mating surfaces of arbors and adapter components with lint-free cloth or paper cleanring tissue to remove old oil and accumulations of fine dust or other foreign matter. Seizing of cones, bushings, adapterr, etc., on balance arbors is almost invariably caused by fine particles of dirt or other foreign matter. Thoroughly cleaned mating surfaces will facilitate installation of close-fitting parts and will help insure satisfactory balance.

5-21. Addition of Damping Oil to Balancing Arbors. Should excessive oscillation of balance indications develop due to inadvertent loss of arbor dash-pot oil, or should change of dash-pot oil or oil level become necessary, proceed as follows:

a. Balancing arbor, part no. 2259 (7A050 kit). Remove the two filler hole screws located in knurled section of arbor and, with arbor in upright position, fill arbor to filler hole level with OE/HDO-50 oil, Military Specification MIL-L-2104. (See figure 5-1). Use only the specified oil and viscosity in this arbor assembly. To insure that small air spaces inside arbor are completely filled, repeat this operation two or three timer at intervals of 10 minutes. To drain arbor dash-pot chamber, lay arbor on its side and allow oil to drain through one of the open filler screw holes. Always reinstall filler hole screws following completion of draining or refilling operation.

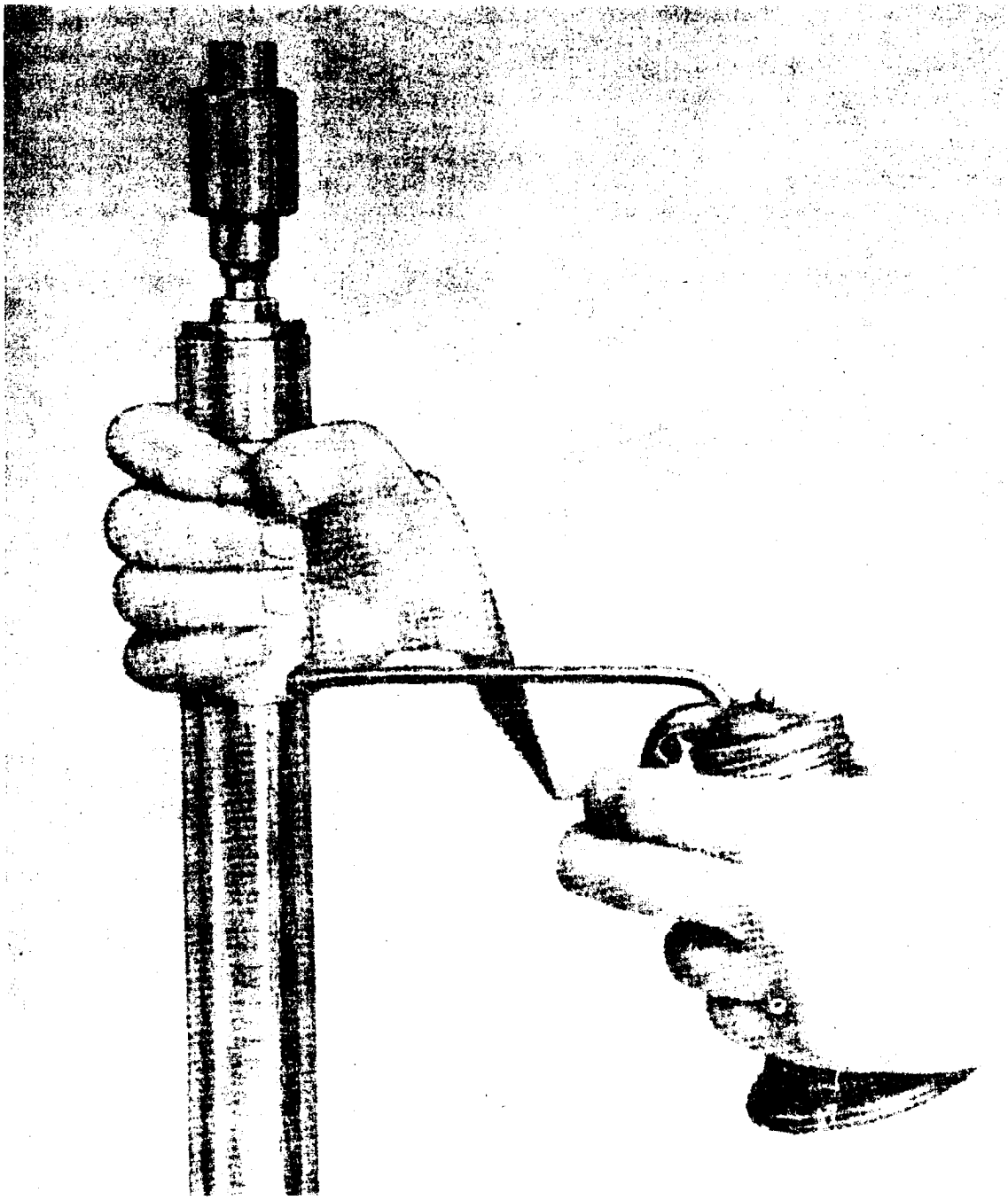


Figure 5-1. Adding Damping Oil to Balancing Arbor.

b. Balancing arbor. part no. 2516 (7HEL053 kit). Use light mineral oil only in dash-pot of this arbor. Do not use other than light mineral oil in this arbor assembly. One oil hole is located in aide of arbor approximately 1-11/16-inches below indicator bushing; another is located in opposite side approximately 2-½ inches from lower end of arbor. To fill arbor, remove both oil hole screws, using 1/16-inch hex wrench (7HEL053 kit). Using positive-pressure, pump-action oil can, pump oil into lower arbor oil hole until oil appears at level of upper arbor oil hole. Reinstall lower and upper filler hole screws. If positive-pressure-type can is not available, arbor dash-pot may be filled through

upper hole only, leaving lower screw installed in arbor. In this case, repeat filling operation two or three times at IO-minute intervals to insure small air spaces are completely filled. Always insure that filler hole screws are carefully reinstalled following filling or draining operation.

5-22. Refilling Hydraulic Pump Reservoir.

a. Remove pump positioning screw in end of no. 6 hoist support tube, and remove pump assembly from tube.

b. Stand pump assembly on gage end, and remove center screw from reservoir cover plate. Remove cover retaining ring.

c. Replace center screw with no. 10-32 screw (not furnished) having sufficient length to serve as a puller handle, and remove reservoir cover plate.

d. Press ram piston in to its full bottomed position (refer to section IV for operating instructions), and observe fluid level in reservoir, with pump standing on gage end. Fluid level, with ram fully bottomed, should be 1-1/4 to 1-3/8 inch below top edge of fluid reservoir. (See figure 5-2). If necessary, refill to this level, using petroleum base hydraulic fluid, Military Specification MIL-H-5606.

e. Before reinstalling reservoir cover, pump ram piston to its full outward position and press it back to its full bottomed position several times. Observe return flow of fluid into reservoir for bubbles which would indicate entrapped air in system. Repeat this process until no bubbles are observed.

f. Reinstall reservoir cover, insuring that AN6230-3 seal is in proper position in cover groove. Reinstall cover screw, insuring that its AN6227-3 seal is in proper position. Reinstall pump assembly in no. 6 hoist support tube, and lock in position with pump positioning screw.

NOTE

Operation of the pump with the assembly standing on the reservoir end will result in pumping air into the ramp pressure system and consequent malfunction. Should this occur, repeat steps b through f.

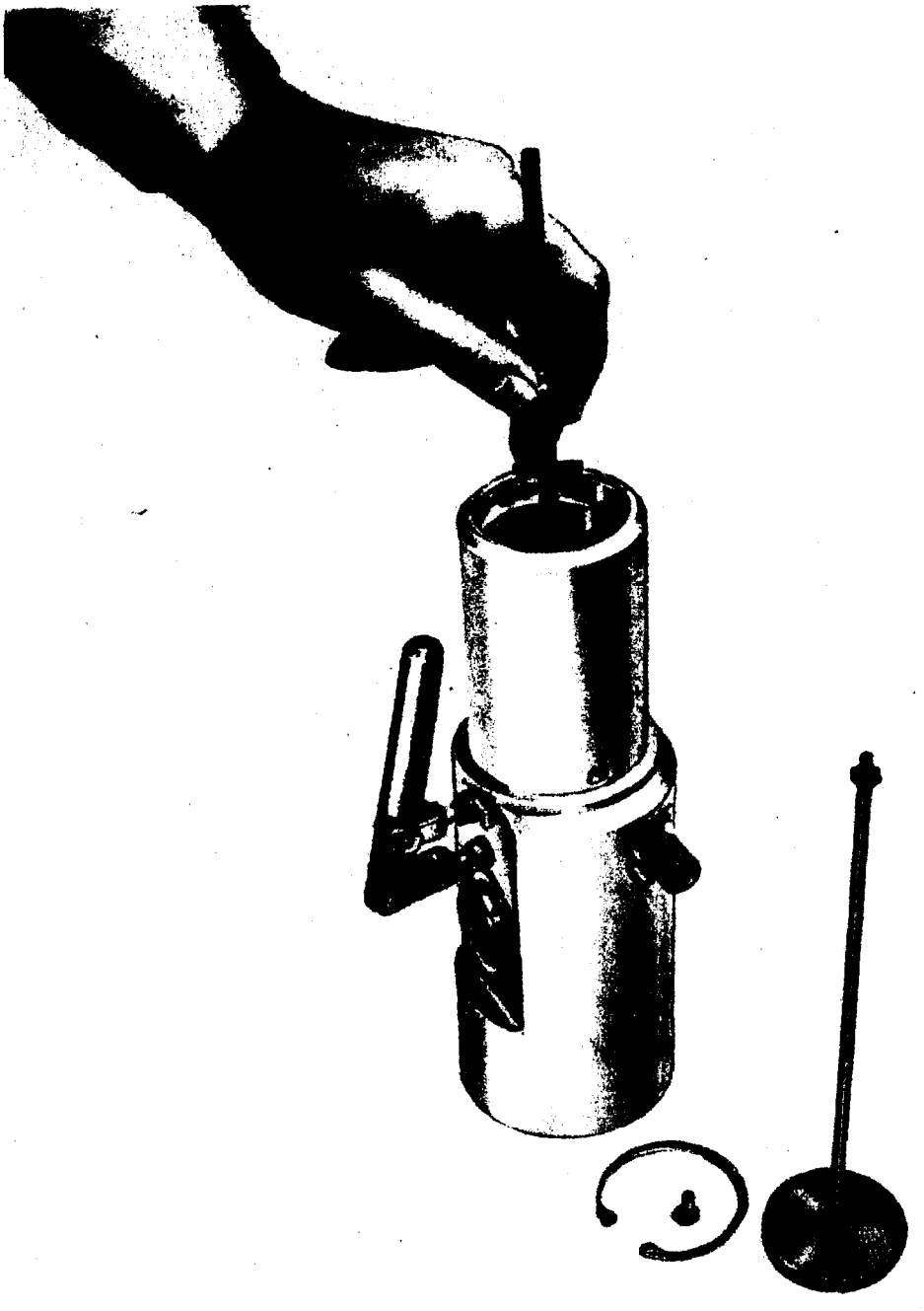


Figure 5-2. Checking Fluid Level in Reservoir of Hydraulic Pump Assembly.

SECTION VI

TROUBLESHOOTING

TROUBLE	PROBABLE CAUSE	REMEDY
Balancing arbor lacks sensitivity.	Sensitivity setting incorrect.	Increase sensitivity. (Refer to section VII for calibration procedure).
Balancing arbor remains tilted. Indicator cannot be centralized.	Physical interference with arbor or suspended mass.	Check to insure arbor and balancing assembly are suspended free of interference.
	Sensitivity setting incorrect balancer unstable.	Reduce sensitivity. (Refer to section VII for calibration procedure).
Balancer indicator seems to catch or lock in various positions.	Interference between indicator bushing and top end or arbor.	Loosen indicator bushing and raise to provide 0.002 to 0.003-inch clearance. Re-set bushing set screw. (Refer to section III).
Balancer oscillates excessively.	Air currents disturbing balancing assembly.	Isolate from air disturbance.
	Loss of dash-pot oil. Dash-pot oil viscosity too low.	Re-fill arbor fluid reservoir. (Refer to section V).
Balancing arbor response is too slow.	Dash-pot oil too cold or viscosity too high.	Refer to section V.
Balance indications inconsistent.	Cones or other adapters improperly seated.	Check for security of mounting, nicks, or foreign matter on adapter or balancing assembly mating surfaces. (Refer to section VI.
	Shifting of balancing assembly parts.	Check for movement of assembly parts. Insure consistent positioning of moveable parts.

SECTION VII

SENSITIVITY ADJUSTMENT

7-1. GENERAL.

7-2. Sensitivity adjustment, as applicable to suspension balancers, is the process of determining the correct sensitivity setting for individual suspension balancer applications. User personnel are capable of and need to make only limited sensitivity adjustments due to the very nature of the equipment involved. Personnel of all levels can determine the correct sensitivity setting for an unlisted assembly in accordance with paragraph 7-16. Ordinarily, however, operators will merely use the calibration values stated in the applicable propeller or helicopter maintenance manual.

7-3. MEASUREMENT OF STATIC UNBALANCE FORCES.

7-4. Relative magnitude of static unbalance forces is most generally expressed in ounce-inch units. An ounce-inch is the amount of unbalance (tilting force) produced by a weight of one ounce acting at an off-set distance of one inch from the line of suspension or other effective pivot point. (See figure 7-1).

7-5. In view A, unbalance force is zero because the weight of the rigid horizontal bar is equally distributed on either side of the pivot point. In view B, addition of a weight, "w" at a distance "d" from pivot point introduces a tilting force, "m", expressed numerically as "w" (number of ounces) times "d" (number of inches) in the general formula :

$$m = w \times d$$

Substituting typical values :

$$m = 2 \text{ (ounces)} \times 6 \text{ (inches)}$$

$$m = 12 \text{ ounces-inches}$$

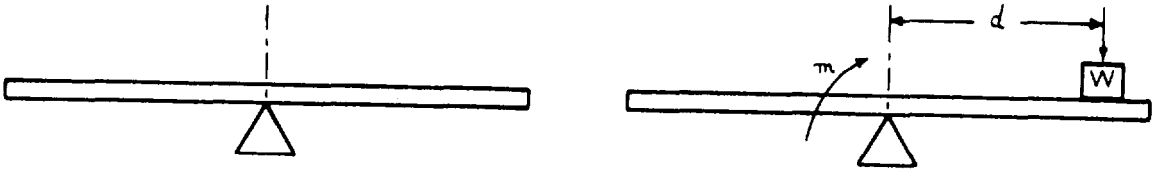


Figure 7-1. Balance Versus Unbalance Condition.

7-6. It is evident that the amount of unbalance force will remain the same if the typical values shown are reversed. That is, a weight of 6 ounces at a distance of 2 inches produces the same amount of tilting force as a weight of 2 ounces at a distance of 6 inches. Similarly, any other combination, such as 4 ounces x 3 inches, whose product is the same, will produce the same magnitude of tilting force. In comparing amounts of unbalance, the product of w x d is always the significant figure. It follows, naturally, that a 2-ounce weight at a distance of 12 inches will produce twice as much tilting force as the same 2-ounce weight at a distance of 6 inches.

7-7. If, as sometimes happens, weights are expressed in pounds instead of ounces, the products will be in pound-inches instead of ounce-inches. While the operation of the general formula is identical in either case, it must be remembered that one pound-inch represents 16 times as much tilting force as one ounce-inch. Similarly, since one ounce equals 28 grams (approximately), one ounce-inch represents 28 times as much tilting force as one gram-inch. These units must, of course, be converted to ounce-inches before their tilting force can be directly compared with other tilting forces expressed in ounce-inches.

7-8. BALANCE TOLERANCE.

7-9. Balance tolerance is the amount of unbalance established as the maximum that can be tolerated in specific propeller or helicopter components. The specified balance tolerance means, in effect, that the assembly need not be perfectly balanced, which would be an ideal but impractical condition. Since, however, the balance tolerance does limit the amount of unbalance which can be tolerated, 'a method is needed to determine whether the amount of unbalance actually present in a specific assembly is smaller or greater than this limiting amount. (Refer to paragraph 7-12).

7-10. Static balance tolerance for the specific assembly being balanced is usually specified in the applicable maintenance or overhaul instructions for the assembly. (Refer to appendix A). The static balance tolerance may be expressed directly in ounce-inch units; it may also, however, be expressed in several other ways, any of which can be converted to ounce-inch units for easy measurement and direction comparison. For example, propeller balance tolerances are sometimes expressed as "0.001 inch x propeller weight." Since 0.001 is already in inches, it can be substituted directly for d in the general formula, m = w x d. If the weight of the propeller, in ounces, is substituted for w in the formula, the product will be the propeller balance tolerance in ounce-inches. Example: Propeller weight = 200 pounds (3,200 ounces). Propeller balance tolerance = 0.001 x propeller weight. Substituting specific values in general formula m= w x d:

m = 3,200 (ounces x 0.001 (inch)

m = 3.20 ounce-inches = propeller balance tolerance.

7-11. In other cases, the balance tolerance may not be expressed in any numerical units at all, but directly in terms of a specific part (Example: AN-XXX washer) at a specific location on the assembly. Since, in these cases, the weight (w) of the specified part is constant and its location on the assembly (d) is also constant, the limiting amount of permissible unbalance is controlled just as effectively as if the balance tolerance had been expressed in ounce-inch units. If, for comparison purposes, it is desired to express such a balance tolerance in terms of ounce-inches, it is only necessary to multiply. the weight of the specified part (in ounces) by its distance (in inches) from the effective pivot point.

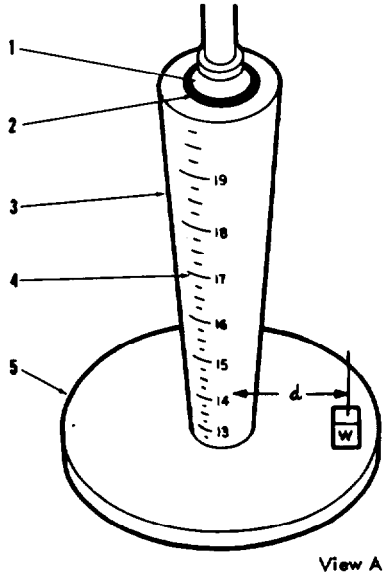
7-12. "GO - NO GO" BALANCE INDICATIONS.

7-13. Sensitivity of the suspension balancers can be readily adjusted so that a specific deflection of the black indicator disc with respect to the indicator bushing (tangency of the indicator circles) will occur when the limiting amount of permissible

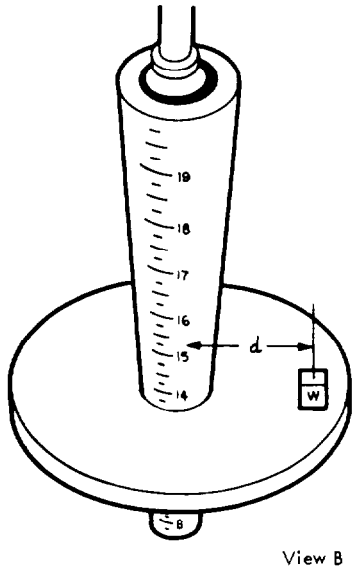
unbalance is present in the assembly being checked. (See figure 7-2). Once this setting has been established, subsequent similar assemblies, using the same setting, are directly indicated as "inside" or "outside" balance tolerance limits by the relative position of the indicator circles. This feature eliminates the need for any calculations by the operator; when the indicator bushing circle is anywhere inside the black indicator disc circle, the indicated unbalance is smaller than the balance tolerance limit.

7.14. EFFECT OF VERTICAL HEIGHT SETTING ON SENSITIVITY OF UNBALANCE INDICATION. (See figure 7-2).

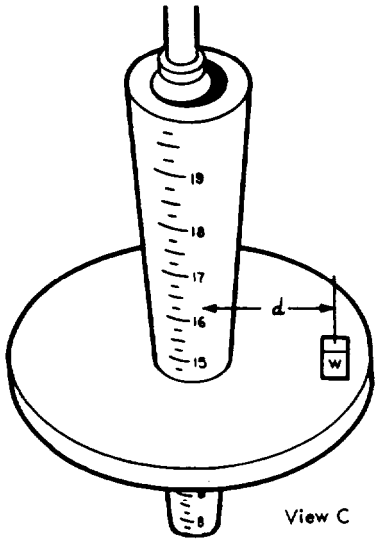
7-15. The bare disc in all four views of figure 7-2 represents the same balanced mass. The small unbalance force, introduced by addition of weight w at distance d, is the same in all four views and represents the maximum permissible unbalance for the assembly. In view A, with the disc mounted at the lower end of the arbor, balance sensitivity is too low to provide a visible indication of the small unbalance force. In view B, mounting the disc higher on the arbor increases sensitivity so that a visible indication of the small unbalance force is observed. By mounting the disc still higher on the arbor, sensitivity is further increased until the indicator bushing circle becomes tangent with the indicator disc circle, as in view C. This is correct sensitivity for the assembly (balance tolerance = w x d). In view D, mounting the disc still higher on the arbor results in an excessive degree of sensitivity, or actual instability.



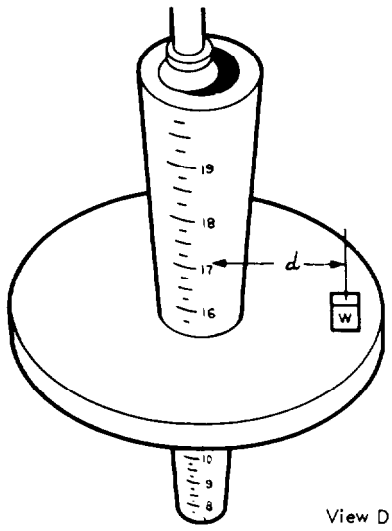
VIEW A
NO VISIBLE, RESPONSE
(VERY LOW SENSITIVITY)



VIEW B
SMALL RESPONSE
(LOW SENSITIVITY)



VIEW C
TANGENT RESPONSE
(CORRECT SENSITIVITY)



VIEW D
OVERLAPPING RESPONSE
(EXCESSIVE SENSITIVITY)

1. Indicator bushing
2. Indicator disc
3. Balancing arbor
4. Arbor scale
5. Assembly being balance checked wd. allowable tolerance

Figure 7-2. Effect of Sensitivity Setting on Balance Indications.

7-16. DETERMINATION OF CORRECT SENSITIVITY.

7-17. The listed arbor sensitivity setting for a given assembly may be verified in the following manner:

a. Mount propeller or blade on the arbor in accordance with the instructions applying to the individual assembly.

b. Position piloting adapters on arbor at the listed sensitivity setting in accordance with applicable instructions.

c. Install quick-disconnect coupling; hoist arbor and balancing assembly approximately 1/4 inch off work stand or other support. Check to insure that suspended assembly if free from interference with stand or other objects.

d. Observe stabilized balance indication and add temporary weights, as required, to centralize balance indication. If balance indication cannot be centralized, too high a CG position on the arbor (instability) is indicated. Try lower positions of the assembly on the arbor until the balance indication can be centralized by addition of temporary weights.

e. Once the centralized indication is established, add to the assembly a measured am amount of unbalance (w x d) equal to the balance tolerance. Addition of this amount of unbalance should cause the centralized balance indication to shift until the black indicator disc circle becomes tangent with the indicator bushing circle. If this occurs, sensitivity setting is satisfactory.

NOTE

Static balance tolerance for the specific assembly being balanced is usually specified in the applicable maintenance or overhaul instructions for the assembly. (Refer to appendix A).

f. If the indicator deflection from the centralized position, caused by addition of the balance tolerance, w x d, is less than the tangency point of the two circles, insufficient sensitivity is indicated; repeat the procedures above with assembly mounted higher on the arbor. Conversely, if the introduction of the balance tolerance, w x d, causes displacement of the balance indication beyond the tangency point of the two circles, sensitivity is too great and the assembly should be repositioned lower on the arbor.

APPENDIX A
REFERENCES

A-1. DICTIONARIES OF TERMS AND DEFINITIONS.

A-2. Reference Dictionaries of Terms and Definitions are as Follows:

a. AR 310-25	Dictionary of United States Army Terms
b. AR 310-50	Authorized Abbreviations and Brevity Codes
c. FM 21-5	Military Training
d. FM 21-6	Techniques of Military Instructions
e. FM 21-30	Military Symbols

A-3. LUBRICATION.

A-4. Specifications for Damping Oil, Lubrication Oil, and Hydraulic Fluid are as Follows:

a. NSN9150-00-188-9864	Lubricating Oil, Heavy Duty-SAE #50 (Arbor P/N 2259 only)
b. NSN 6505-00-133-6000	Mineral Oil, Light (1 Quart Can)
c. MIL-H-5606	Hydraulic Fluid, Petroleum Base, Aircraft and (part no. 3382 only)
d. MIL-L-6085	Lubricating Oil

A-5. OPERATION AND MAINTENANCE REGULATIONS.

A-6. Regulations Pertaining to Operation and Maintenance is as Follows.

AR 750-5	Maintenance Responsibilities and Shop Operation

A-7. REFERENCE AIRCRAFT AND PROPELLER MAINTENANCE AND OVERHAUL MANUALS.

A-8. Applicable Technical Manuals are Listed in Tables A-1 and A-2.

A-9. PUBLICATION INDEXES.

A-10. Applicable Publications Indexed are as Follows:

DA PAM 25-30	Consolidated Index of Army Publications and Blank Forms
DA PAM 738-751	Functional Users Manual for the Army Maintenance Management System - (TAMMS-A)

Table A-1. Reference Technical Manuals - Propeller Manuals

PROPELLER MANUFACTURER	PROPELLER BASIC MODEL	USED ON AIRCRAFT	APPLICABLE TECHNICAL MANUAL	TECHNICAL MANUAL TITLE
Hamilton Standard	2D30	U-6A, RU-6A	TM 55-1510-203-35	DS, GS and Depot Manual
	23D40	U-1A, RU-1A	TM 55-1510-205-35	DS, GS and Depot Manual
	53C51	OV-1A, 1B, 1C	TM 55-1510-204-35	DS, GS and Depot Manual
	544086 Spinner Assembly	PV-1A, B, C	TM 55-1610-203-40	GS Maintenance Manual
Hartzell	HC83X20	U-9B, U-9C	TM-1-1L-26B-2	Maintenance Instructions USAF Series L26B and L26C Aircraft
	HC93Z20	U-8D, F, G, RU-8	TM 55-1610-206-40	GS Maintenance Manual
	HC-B3TN-3B	U-21A, RU-21A, G, C, D, E	TM 55-1610-219-40 TM 55-1610-219-40	GS Maintenance Manual
McCauley	1A200	O-1A, O-1E, TO-1A, TO-2E, O-1G	TM 55-1610-205-50	Depot Maintenance Manual
	2A36	O-1D, O-1F	TM 55-1610-204-50 WR 55-1610-106B	Depot Maintenance Manual
Sesenich	M76	U-7A, B	PA-18	Piper Parts Catalog PA-18 Super Cub

Table A-2. Reference Technical Manuals - Helicopter Manuals

HELICOPTER MANUFACTURER	HELICOPTER MODEL	HELICOPTER COMPONENTS	APPLICABLE TECHNICAL MANUAL	TECHNICAL MANUAL TITLE
Bell	AH-1G, TH-1G	Main & Tail Rotors	TM 55-1520-221-34	DS, GS and Depot Manual
	UH-1A	Main & Tail Rotors	TM 55-1520-218-35	DS, GS and Depot Manual
	UH-1B	Main & Tail Rotors	TM 55-1520-219-35	DS, GS, and Depot Manual
	UH-1C, UH-1M	Main & Tail Rotors	TM 55-1520-220-35	DS, GS, and Depot Manual
	UH-1D	Main & Tail Rotors	TM 55-1520-210-34	DS, GS, and Depot Manual
	UH-1H	Main & Tail Rotors	TM 55-1520-210-34	DS, GS, and Depot Manual
	OH-13E,G,H	Main & Tail Rotors, Engine Fan	TM 55-1520-224-35	DS, GS and Depot Manual
	TH-13T	Main & Tail Rotors, Engine Fan	TM 55-1520-226-35	DS, GS and Depot Manual
	13S	Main & Tail Rotors, Engine Fan	TM 55-1520-225-35	DS, GS and Depot Manual
	OH-58A	Main & Tail Rotors	TM 55-1520-228-35	DS, GS, and Depot Manual
Hiller	OH-23D, 23F, 23G	Main & Tail Rotors, Engine Fen	TM 55-1520-206-35	DS, GS, and Depot Manual
Sikorsky	UH-19C, 19D	Tail Rotor, Engine Fan	TM 55-1520-201-34	DS, and GS Manual
	CH-34,34C	Tail Rotor, Engine Fan	TM 55-1520-202-35	DS, GS and Depot Manual
	CH-37B	Tail Rotor, Engine Fan	TM 55-1520-203-35	DS, GS and Depot Manual
Vertol	CH-47A, 47B, 47C	Rotor Hub	TM 55-1520-209-35	DS, GS and Depot Manual
			TM 55-1520-227-35	DS, GS and Depot Manual

APPENDIX B

MAINTENANCE ALLOCATION CHART

B-1. PURPOSE.

The purpose of the maintenance allocation chart is to provide all activities with maintenance functions to be performed at each level of maintenance.

B-2. DEFINITIONS.

a. Column 1, Group Number. Column 1 lists group numbers, the purpose of which is to identify components, assemblies, subassemblies, and modules with the next higher assembly.

b. Column 2, Functional Group. Column 2 lists the noun names of components, assemblies, subassemblies, and modules on which maintenance is authorized.

c. Column 3, Maintenance Functions. Maintenance functions will be limited to and defined as follows:

(1) Inspect: To determine serviceablity of an item by comparing its physical, mechanical, and electrical characteristics with established standards.

(2) Test. To verify serviceablity and to detect electrical or mechanical failure by use of test equipment.

(3) Service. To clean, to preserve, to charge, and to add fuel, lubricants, cooling agents, and air. If it is desired that elements, such as painting and lubricating, be defined separately, they may be so listed.

(4) Adjust. To rectify to the extent necessary to bring into proper operating range.

(5) Align. To adjust specified variable elements of an item to bring to optimum performance.

(6) Calibrate. To determine the corrections to be made in the readings of instruments or test equipment used in precise measurement. Consists of the comparison of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared with the certified standard.

(7) Install. To set up for use in an operational environment such as an emplacement, site, or vehicle.

(8) Replace. To replace unserviceable items with serviceable assemblies, subassemblies, or parts.

(9) Repair. To restore an item to serviceable condition. This includes, but is not limited to, inspection, cleaning, preserving, adjusting, replacing, welding, riveting, and strengthening.

(10) Overhaul. To restore an item to a completely serviceable condition as prescribed by maintenance serviceability standards prepared and published for the specific item to be overhauled.

(11) Rebuild. To restore an item to a standard as nearly as possible to original or new condition in appearance, performance, and life expectancy. This is accomplished through complete disassembly of the item, inspection of all parts or components, repair or replacement of worn or unserviceable elements (items) using original manufacturing tolerances and specifications, and subsequent reassembly of the item.

(12) Symbols. The symbol O, F, H or D, placed in the appropriate column indicates the level responsible for performing that particular maintenance function. The symbol "%%" which applies to organizational maintenance indicates the particular maintenance function may be performed provided it is specifically authorized by the direct support maintenance officer. Use of the symbol will apply only to replacement of major assemblies and time-consuming operations which are within the capabilities of organization, but over which control by the commodity commands is considered essential. In no case will the direct support maintenance officer require the accomplishment of a "%%" maintenance function by an organization or unit, and in no case will a "%%" function authorize stockage of parts at organizational level.

d. Column 4, Tools and Equipment. This column will be used to specify, by code, those tools and test equipment required to perform the designated function.

e. Column 5, Remarks. Self-explanatory.

B-3. GENERAL.

a. A maintenance function assigned to a maintenance level, which for any reason is beyond its capability, becomes the responsibility of the next higher maintenance level.

b. The authority to perform a maintenance function does not constitute authority to requisition or otherwise secure necessary repair parts as specified in current supply directives.

B-4. DEVIATIONS.

a. Normally, there will be no deviations from the assigned maintenance level. In cases of operational necessity, a maintenance function assigned to a maintenance level may, on a one-time basis and at the request of the lower maintenance level, be authorized to the lower maintenance level by the maintenance officer of the level to which the function is assigned. The higher level of maintenance has the authority to determine:

(1) If the lower level is capable of performing the work.

(2) If the lower level will require assistance or technical supervision and on-site inspection.

(3) If the authorization will be granted.

b. The furnishing of special tools, equipment, and the like, required by the lower maintenance level to perform this function, will be the responsibility of the level to which the function is assigned.

B-5. ADDITIONAL INFORMATION.

a. Changes in the maintenance allocation chart will be bared on continuing evaluation and analysis by responsible personnel and on Maintenance Request Form, DA 2407 received from field activities.

b. All maintenance prescribed herein will be performed in accordance with applicable publications.

c. In any instance of conflict with current tool, end equipment lists or current supply manuals, this maintenance allocation chart will be the final authority, Each such instance should be promptly reported by Maintenance Request Form DA 2407.

MAINTENANCE ALLOCATION CHART
FOR
KITS, STATIC BALANCING

(1) Group No.	(2) Functional group	(3) Maintenance functions											(4) Tools and equipment	(5) Remarks
		A Inspect	B Test	C Service	D Adjust	E Align	F Calibrate	G Install	H Replace	I Repair	J Overhaul	K Rebuild		
	KITS, BALANCING AND ADAPTER	O	O	O	O				F	H 1				Note 1

NOTE 1: See para 5-13 page 5-2

APPENDIX C

REPAIR PARTS AND SPECIAL TOOLS LIST
(Current as of 26 October 1971)

Section I. INTRODUCTION

C-1. SCOPE.

This appendix lists the components required for the performance of direct and general support maintenance of the propeller balancing and adapter kits.

C-2. GENERAL.

This basic issue item, repair parts and special tools list is divided into the following sections:

a. Basic Issue Items - Section II. Not applicable.

b. Maintenance and Operating Supplies - Section III. Not applicable.

c. Prescribed Load Allowances - Section IV. Not applicable.

d. Repair Parts (ORG) - Section V. Not applicable.

e. Special Tools, Test and Support Equipment (ORG) - Section VI. Not applicable.

f. Repair Parts (DS/GS) - SectionVII. A list of components authorized for the performance of maintenance at the direct and general support levels in figure and item number sequence.

g. Special Tools, Test and Support Equipment (DS/GS) - Section VIII. Not applicable.

h. Federal Stock Number and Reference Number Index - Section IX. This section is divided as follows:

(1) A list of Federal stock numbers in ascending numerical sequence, cross-referenced to the illustration figure and item number.

(2) A list of reference numbers in ascending alphanumerical sequence cross-referenced to the manufacturer's Federal supply code and illustration figure and item number.

C-3. EXPLANATION OF COLUMNS.

The following provides an explanation of columns in the tabular lists in section VII.

a. Source, Maintenance and Recoverability Codes (SMR), Column 1.

(1) Source code. Indicates the selection status and source for the listed item. Source codes are:

Code	Explanation
P	Repair parts, special tools and test equipment supplied from the GSA/DSA or Army supply system and authorized for use at indicated maintenance categories.
P2	Repair parts, special tools and test equipment which are procured and stocked for insurance purposes because the combat or military essentiality of the end item dictates that a minimum quantity be available in the supply system.
P9	Assigned to items which are NSA design controlled: unique repair parts, special tools, test, measuring, and diagnostic equipment which are stocked and supplied by the Army COMSEC Logistic System and which are not subject to the provisions of AR 380-41.
P10	Assigned to items which are NSA design controlled: special tools, test, measuring, and diagnostic equipment for COMSEC support which are accountable under the provisions of AR 380-41 and which are stocked and supplied by the Army COMSEC Logistic System.
M	Repair parts, special tools and test equipment which are not procured or stocked as such in the supply system but are to be manufactured at indicated maintenance levels.
A	Assemblies which are not procured or stocked as such but are made up of two or more units. Such component units carry individual stock numbers and descriptions, are procured and stocked separately, and can be assembled to form the required assembly at indicated maintenance categories.
X	Parts and assemblies that are not procured or stocked because the failure rate is normally below that of the applicable end item or component. The failure of such part or assembly should result in requirement of the end item from the supply system.

Code	Explanation
XI	Repair parts which are not procured or stocked. The requirement for such items will be filled by the next higher assembly or component.
X2	Repair parts, special tools and test equipment which are not stocked and have no foreseen mortality. The indicated maintenance category requiring such repair parts will attempt to obtain the parts through cannibalization or salvage. The item may be requisitioned, with exception data, from the end item manager for immediate use.
G	Major assemblies that are procured with PEMA funds for initial issue only as exchange assemblies at DS and GS Level. These assemblies will not be stocked above DS and GS level or returned to depot supply level.

NOTE

Cannibalization or salvage may be used as a source of supply for any items source coded above except those coded X1 and aircraft support items as restriced by AR 700-42.

(2) Maintenance code. Indicates the lowest category of maintenance authorized to install the listed item. Maintenance codes are:

Code	Explanation
C	Crew/operator maintenance.
O	Organizational maintenance.
F	Direct support maintenance.
H	General support maintenance.

(3) Recoverability code. Indicates whether unserviceable items should be returned for recovery or salvage. Items not coded are nonrecoverable. Recoverability codes are:

Code	Explanation
R	Repair parts (assemblies and components), special tools and test equipment which are considered economically reparable at direct and general support maintenance levels. When the item is no longer economically reparable, it is normally disposed of at the GS level. When supply considerations dictate, some of these repair parts may be listed for automatic return to supply for depot level repair as set forth in AR 710-50. When so listed, they will be replaced by supply on an exchange basis.

Code	Explanation
S	Repair parts, special tools and test equipment, and assemblies which are economically reparable at DS and GS activities and which normally are furnished by supply on an exchange basis. When items are determined by a GSU to be uneconomically reparable, they will be evacuated to a depot for evaluation and analysis before final disposition.
T	High dollar value recoverable repair parts, special tools and test equipment which are subject to special handling and are issued on an exchange basis. Such items will be repaired or overhauled at depot maintenance activities only. No repair may be accomplished at lower levels.
U	Repair parts, special tools and test equipment specifically selected for salvage by reclamation units because of precious metal content, critical materials, high dollar value, or reusable casings or castings.

b. Federal Stock Number, Column 2. Indicates the Federal stock number assigned to the item and will be used for requisitioning purposes. Items source coded A, M, X1 or X2 are not assigned a Federal stock number.

c. Description, Column 3. Indicates the Federal item name and any additional description of the item required. The description column contains the following subcolumns.

(1) Reference number and manufacturer's code. Indicates a part number or other reference number for the listed item followed by the applicable five-digit Federal supply code for manufacturers (FSCM) in parentheses. The FSCM is used as an element in item identification to designate manufacturer or distributor or government agency etc., and is identified in SB 708-42.

(2) Usable on code. Not applicable.

d. Unit of Measure (U/M), Column 4. A two-character alphabetical abbreviation indicating the amount or quantity of the item upon which the allowances are based (e.g., FT, EA, PR).

e. Quantity Incorporated in Unit, Column 5. Indicates quantities required for one assembly only, including instances when similar assemblies are broken down together. A "V" appearing in this column in lieu of a quantity indicates that a definite quantity cannot be indicated (e.g., shims, spacers).

f. Thirty-day DS/GS Maintenance Allowance, Column 6.

(1) The allowance column is divided into three subcolumns. Indicated in each subcolumn is the total quantity of items authorized for the number of equipment supported. Items identified with an asterisk (*) in this column will be requisitioned initially on an "as required" basis for the maintenance mission at DS/GS levels. Requirements for repair parts stockage and for distribution to support units will be based on demand and determined in accordance with AR 711-16/AR 710-2.

(2) Determination of the total quantity of parts required for maintenance of more than 100 of these equipments can be accomplished by converting the equipment quantity to a decimal factor by placing a decimal point before the next to last digit of the number to indicate hundredths, and multiplying the decimal factor by the parts quantity authorized in the 51-100 allowance column. Example: authorized allowance for 51-100 equipments is 40; for 150 equipments, multiply 40 by 1.50, or 60 parts required

(3) The basis of issue for authorized special tools, test and support equipment is the number of end items of equipment supported.

g. One-year Allowance per 100 Equipments/Contingency Planning Purposes, Column 7. Not applicable.

h. Depot Maintenance Allowance per 100 Equipments, Column 8. Not applicable.

i. Illustration, Column 9. illustrations appear in the narrative portion of this manual. This column is divided as follows:

(1) Figure number, column 9a. Indicates the figure number of the illustration in which the item is shown.

(2) Item number, column 9b. Indicates the callout number to reference the item in the illustration.

C-4. SPECIAL INFORMATION.

Action codes indicated in the left-hand margin of the listing page denote the following:

N - Indicates an added item.
C - Indicates a change in data.
R - Indicates a change in FSN only.

C-5. HOW TO LOCATE REPAIR PARTS.

a. When Federal Stock Number or Reference Number is Unknown:

(1) First. Find the exploded view illustration of the assembly or subassembly to which the repair part belongs.

(2) Second. Identify the repair part on the illustration and note the illustration figure and item number of the repair part.

(3) Third. Using the repair parts listing, find the figure and item number listed in the illustration column.

b. When Federal Stock Number or Reference Number is Known:

(1) First. Using the index of Federal stock numbers and reference numbers, find the pertinent Federal stock number or reference number. This index is in ascending FSN sequence, followed by a list of reference numbers in ascending alphanumerical sequence, cross-referenced to the illustration figure number and item number.

(2) Second. Using the repair parts listing, find the figure and item number listed in the illustration column referenced in the index of Federal stock numbers and reference numbers.

	(1) SMR CODE	FEDERAL STOCK NUMBER	(3) DESCRIPTION REFERENCE NUMBER & MFR CODE			USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30-DAY DS 'GS MAINT ALW (a) 1-20	(b) 21-50	(c) 51-100	(7) 1-YR ALWPER 100 EQUIP :NTGCY	(8) DEPOT MAINT ALWPER 100 EQUIP	(9) ILLUSTRATION (a) FIG NO	(b) ITEM NO
		4920-708-3106	2420	(87065)	.SCOPE,ALIGNING NOTE 1		EA	1						1-21	1
		4920-708-3103	2421	(87065)	.SCOPE,ALIGNING NOTE 1		EA	1						1-21	2
		4920-708-8636	2475	(87065)	.TARGET ASSEMBLY NOTE 1		EA	1						1-21	4
		4920-708-3048	2400	(87065)	.SCOPE SUPPORT ASSEMBLY NOTE 1		EA	1						1-21	5
		4920-708-3105	2415	(87065)	.CASE ASSEMBLY NOTE 1		EA	1						1-21	6
		4920-536-8214	7HEL061	(87065)	TOOL KIT,BLADE BALANCING		EA							1-22	
	P--F--	4920-536-8215	2486	(87065)	.GAGE,BLADE BALANCING		EA	1	*	*	*			1-22	1
	P--F--	4920-536-8220	2605	(87065)	.CASE,BLADE BALANCING		EA	1	*	*	*			1-22	2
	P--F--	4920-536-8218	2588	(87065)	.ADAPTER,BLADE BALANCING		EA	1	*	*	*			1-22	3
	P--F--	4920-536-8219	2589	(87065)	.YOKE,BLADE BALANCING		EA	1	*	*	*			1-22	6
C		4920-937-9418	7HEL065	(87065)	ADAPTER,BALANCING RPL-BY 4920-168-9797									1-23	
C		4920-067-8174	2940	(87065)	.BAR,PAIR-BLADE POSITI0NING RPL-BY 4920-237-0729									1-23	1
C		4920-067-8176	2941	(87065)	.BAR,PAIR-BLADE POSITI0NING RPL-BY 4920-405-0490									1-23	2
C		4920-067-8175	2942	(87065)	.BAR,PAIR-BLADE POSITI0NING RPL-BY 4920-405-0489									1-23	3
C		4920-067-8173	2943	(87065)	.BAR,PAIR-BLADE POSITIONING RPL-BY 4920-444-2355									1-23	4
C		4920-067-8167	2944	(87065)	.BAR,PAIR-BLADE POSITIONING RPL-BY 4920-444-2347									1-23	5
C		4920-067-8172	2945	(87065)	.BAR,PAIR-BLADE POSITIONING RPL-BY 4920-241-9651									1-23	6
C		4920-067-8159	2946	(87065)	.BAR,PAIR-BLADE POSITIONING RPL-BY 4920-444-2348									1-23	7
C		4920-067-8160	2947	(87065)	.BAR,PAIR-BLADE POSITIONING RPL-BY 4920-159-9006									1-23	8
C		4920-067-8164	2948	(87065)	.BAR,PAIR-BLADE POSITIONING RPL-BY 4920-241-9649									1-23	9
C		4920-997-4724	2949	(87065)	.BAR,PAIR-BLADE POSITIONING RPL-BY 4920-428-6361									1-23	10
C		4920-067-8155	2950	(87065)	.BAR,PAIR-BLADE POSITIONING RPL-BY 4920-241-9650									1-23	11
C		4920-067-8177	2939	(87065)	.POST,PITCH POSITIONING RPL-BY 4920-168-9801									1-23	12
C		4920-067-8157	2938	(87065)	.CASE ASSEMBLY,KIT CARRIER RPL-BY P/N AA4920-8503-2938									1-23	13
N		4920-168-9797	AA4920-8503	(81996)	ADAPTER,BALANCING RPLS-- 4920-937-9418		EA							1-23	
N	P2-F--	4920-237-0729	AA4920-8503-2940	(81996)	.BAR,PAIR-BLADE POSITIONING RPLS-- 4920-067-8174 NOTE 1 USE UNTIL EXHAUSTED NO REPLACEMENT		EA	1	*	*	*			1-23	1

	(1) SMR CODE	FEDERAL STOCK NUMBER	(3) DESCRIPTION REFERENCE NUMBER & MFR CODE			USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30-DAY DS/GS MAINT ALW (a) 1-20	(b) 21-50	(c) 51-100	(7) 1-YR ALWPED 100 EQUIP CNTGCY	(8) DEPOT MAINT ALWPED 100 EQUIP	(9) ILLUSTRATION (a) FIG NO	(b) ITEM NO
N	P2-F--	4920-405-0490	AA4920-8503-2941	(81996)	.BAR,PAIR-BLADE POSITIONING RPLS-- 4920-067-8176		EA	1	*	*	*			1-23	2
N	P2-F--	4920-405-0489	AA4920-8503-2942	(81996)	.BAR,PAIR-BLADE POSITIONING RPLS-- 4920-067-8175		EA	1	*	*	*			1-23	3
N	P2-F--	4920-444-2355	AA4920-8503-2943	(81996)	.BAR,PAIR-BLADE POSITIONING RPLS-- 4920-067-8173		EA	1	*	*	*			1-23	4
N	P2-F--	4920-444-2347	AA4920-8503-2944	(81996)	.BAR,PAIR-BLADE POSITIONING RPLS-- 4920-067-8167		EA	1	*	*	*			1-23	5
N	P2-F--	4920-241-9651	AA4920-8503-2945	(81996)	.BAR,PAIR-BLADE POSITIONING RPLS-- 4920-067-8172		EA	1	*	*	*			1-23	6
N	P2-F--	4920-444-2348	AA4920-8503-2946	(81996)	.BAR,PAIR-BLADE POSITIONING RPLS-- 4920-067-8159		EA	1	*	*	*			1-23	7
N	P2-F--	4920-159-9006	AA4920-8503-2947	(81996)	.BAR,PAIR-BLADE POSITIONING RPLS-- 4920-067-8160		EA	1	*	*	*			1-23	8
N	P2-F--	4920-241-9649	AA4920-8503-2948	(81996)	.BAR,PAIR-BLADE POSITIONING RPLS-- 4920-067-8164		EA	1	*	*	*			1-23	9
N	P2-F--	4920-428-6361	AA4920-8503-2949	(81996)	.BAR,PAIR-BLADE POSITIONING RPLS-- 4920-997-4724		EA	1	*	*	*			1-23	10
N	P2-F--	4920-241-9650	AA4920-8503-2950	(81996)	.BAR,PAIR-BLADE POSITIONING RPLS-- 4920-067-8155		EA	1	*	*	*			1-23	11
N	P2-F--	4920-168-9801	AA4920-8503-2939	(81996)	.POST,PITCH POSITIONING RPLS-- 4920-067-8177		EA	2	*	*	*			1-23	12
N	X2-F--		AA4920-8503-2938	(81996)	.CASE ASSEMBLY,KIT CARRIER RPLS-- 4920-067-8157		EA	1						1-23	13
		4920-924-5708	7HEL066	(87065)	ADAPTER,BALANCING		EA							1-24	
	P--F--	4920-944-0753	2850	(87065)	.CASE ASSEMBLY		EA	1	*	*	*			1-24	1
	X2-F--		2846	(87065)	.YOKE,ROTOR HUB POSITION		EA	1						1-24	2
	P--F--	4920-536-8215	2486	(87065)	.GAGE,BLADE BALANCING		EA	1	*	*	*			1-24	3
	P--F--	4920-536-8218	2588	(87065)	.ADAPTER,BLADE BALANCING		EA	1	*	*	*			1-24	4
	P--F--	4920-944-0752	2865	(87065)	.JACK,GRIP POSITION		EA	2	*	*	*			1-24	5
		4920-111-3063	7HEL069	(87065)	TOOL KIT, BALANCING		EA							1-25	
	P--F--	5365-182-5553	3063	(87065)	.SPACER,EXTENSION		EA	2	*	*	*			1-25	1
	P--F--	4920-254-6589	3035	(87065)	.LOCK,POSITIONING		EA	2	*	*	*			1-25	2
	P--F--	4920-254-6598	2780	(87065)	.YOKE,POSITIONING		EA	1	*	*	*			1-25	3
	P--F--	4920-410-2470	3036	(87065)	.CASE,BALANCING KIT		EA	1	*	*	*			1-25	4
	P--F--	4920-254-6601	2777	(87065)	.BUSHING,POSITIONING		EA	1	*	*	*			1-25	5
	P--F--	4920-254-6603	2775	(87065)	.ADAPTER,BALANCING		EA	1	*	*	*			1-25	6
	P--F--	4920-157-0927	3077	(87065)	.ADAPTER,PIL0T,ROTOR		EA	1	*	*	*			1-25	7
		4920-755-6686	7HEL354	(87065)	ADAPTER,KIT,MAIN ROTOR		EA							1-26	
		4920-868-8405	2552	(87065)	.CASE,BALANCING KIT OBSOLETE NO REPLACEMENT			1						1-26	1
			2484	(87065)	.SLEEVE,BALANCING			1						1-26	2

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION REFERENCE NUMBER & MFR CODE			USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30-DAY DS/GS MAINT ALW (a) 1-20	(b) 21-50	(c) 51-100	(7) 1-YR ALWPER 100 EQUIP INTGCY	(8) DEPOT MAINT ALWPER 100 EQUIP	(9) ILLUSTRATION (a) FIG NO	(b) ITEM NO
		2250	(87065)	.PLUG ASSEMBLY			1						1-26	4
		2463	(87065)	.BUSHING			1						1-26	4
				MISCELLANEOUS PARTS										
P--F--	4920-021-7544	2769	(87065)	TUBE ASSEMBLY		EA	1	*	*	*			3-3	4
P--F--	4920-536-8217	2586	(87065)	PLATE,BLADE BALANCING		EA	1	*	*	*			4-17	6
P--F--	4920-932-7697	2816	(87065)	ADAPTER ASSEMBLY,FLANGE		EA	1	*	*	*			4-11	3
P--F--	4920-902-5110	2792	(87065)	PLATE,BASE		EA	1	*	*	*			4-11	14
P--F--	4920-902-5106	2793	(87065)	PLATE,STAND ADAPTER		EA	1	*	*	*			4-11	15

STOCK NUMBER	FIGURE NUMBER	ITEM NUMBER
3120-180-7328	1-14	3
3120-180-7329	1-14	
4920-021-7544	3-3	4
4920-067-8155	1-23	11
4920-067-8157	1-23	13
4920-067-8159	1-23	7
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4920-708-3115	1-18	8
4920-708-3116	1-18	14
4920-709-8636	1-21	4
4920-10-6668	1-13	23
4920-738-6788	1-15	
4920-755-6686	1-26	
4920-868-8404	1-26	2
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4920-868-8440	1-18	15
4920-868-8441	1-18	7
4920-868-8442	1-18	11
4920-869-6307	1-18	16
4920-902-5106	4-13	15
4920-902-5110	4-13	14
4920-924-5708	1-24	
4920-932-7697	4-13	3
4920-937-9418	1-23	
4920-944-0746	1-24	2
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AA4920-8503-2942	81996	1-23A	3
AA4920-8503-2943	81996	1-23A	4
AA4920-8503-2944	81996	1-23A	5
AA4920-8503-2945	81996	1-23A	6
AA4920-8503-2946	81996	1-23A	7
AA4920-8503-2947	81996	1-23A	8
AA4920-8503-2948	81996	1-23A	9
AA4920-8503-2949	81996	1-23A	10
AA4920-8503-2950	81996	1-23A	11
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2224	87065	1-13	22
2227	87065	1-13	22
2228	87065	1-13	17
2238	87065	1-16	3
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2247	87065	1-14	4
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REFERENCE NUMBER	MFG CODE	FIG NUMBER	ITEM NUMBER	REFERENCE NUMBER	MFG CODE	FIG NUMBER	ITEM NUMBER
2940	87065	1-23	1	7A050	87065	1-13	
2941	87065	1-23	2	7A052	87065	1-14	
2942	87065	1-23	3	7A055	87065	1-15	
2943	87065	1-23	4	7HEL051	87065	1-16	
2944	87065	1-23	5	7HEL052	87065	1-17	
2945	87065	1-23	6	7HEL053	87065	1-18	
2946	87065	1-23	7	7HEL054	87065	1-19	
2947	87065	1-23	8	7HEL055	87065	1-20	
2948	87065	1-23	9	7HEL056	87065	1-21	
2949	87065	1-23	10	7HEL061	87065	1-22	
2950	87065	1-23	11	7HEL065	87065	1-23	
3035	87065	1-25	2	7HEL066	87065	1-24	
3036	87065	1-25	4	7HEL069	87065	1-25	
3063	87065	1-25	1	7HEL354	87065	1-26	
3077	87065	1-25	7				

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