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INSTALLATION, ADJUSTMENT, AND LUBRICATION

OF THE

# MOTIOGRAPH SH-7500 SOUNDHEAD

**PARTS SUPPLIER:**

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# Motigraph 35 m.m. Motion Picture Sound and Projection Equipment

## MOTIGRAPH - MIRROPHONIC SOUND SYSTEMS

### MIRROPHONIC DELUXE

#### SH-7500 ROTARY STABILIZER REPRODUCER

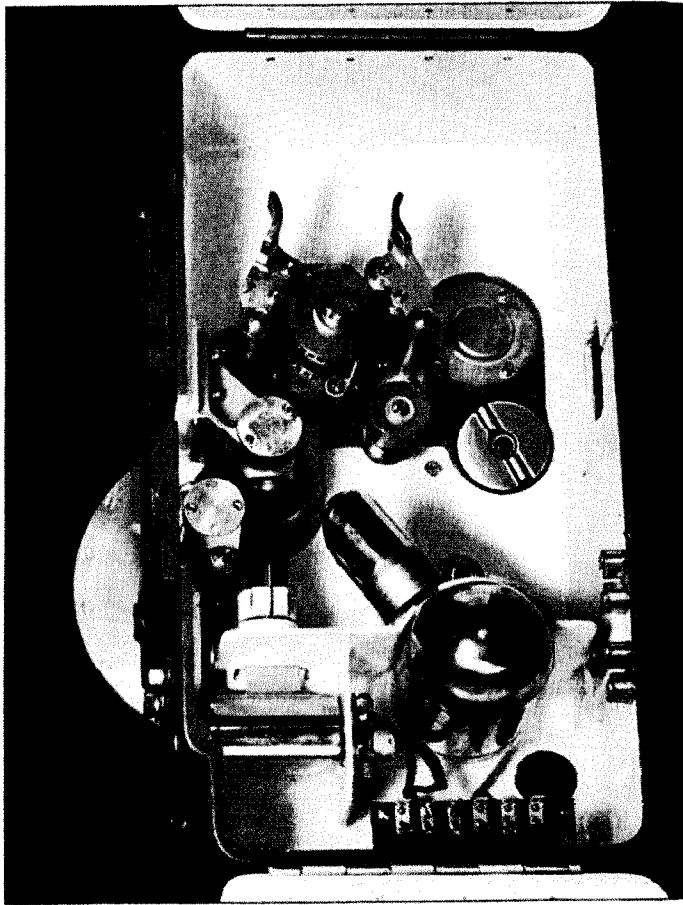
The Mirrophonic De Luxe Reproducer is standard in the Motigraph-Mirrophonic line.

Among the important features is the use of only one large precision machined 32-tooth sprocket which runs at half the speed of the conventional sound head sprocket. The lesser r.p.m. of this sprocket tends to pull the film over the stabilizer evenly, giving smoother action, eliminating possible film vibration and providing protection against flutter. This single sprocket makes for extreme simplicity of threading and results in an exceptionally roomy sound head.

The impedance roller is designed to give proper compliance of the film around the stabilizer drum under all conditions of film shrinkage.

The rotary stabilizer, with its enclosed flywheel operating in a specially developed liquid, imparts to the travel of the film a remarkable steadiness and results in a flutter content well below any other reproducer available.

The sprocket and guide roller, the shafts and the four sturdy extra-wide gears are machined with exacting precision of workmanship. All shafts operate on ball-bearings. This assures long life and the acme of silent operation so necessary to the reproduction of true, living sound.



Mirrophonic De Luxe SH-7500 Rotary Stabilizer Reproducer, featuring the two principles of maximum simplicity and accessibility, is based on designs of Western Electric Company and is built by Motigraph.

MOTIOGRAPH - MIRROPHONIC  
SOUND SYSTEMS

EQUIPMENT BULLETIN E-107 (8-15-45)

REPRODUCER, SH-7500

(Note: This issue replaces issue of 9-10-41, its Addendum No. 1 of 1-7-42, and parts list WE-7551-2 of 9-10-41, all of which are now incorporated into the present issue.)

1. ASSOCIATED DRAWINGS AND PHOTOGRAPHS

Drawing	WE-7521	Assembly
List	WE-7522	Stock List
Photo	WE-7553	Drive Side Assembly with Motiograph Models AA, K, and Simplex-type projector mechanisms.
Photo	WE-7550	Drive Side Assembly with Model HK (and older Motiograph) projector mechanisms.

2. DESCRIPTION

(2-a) The reproducer consists of a double wall main casting to support its various shafts and other components, a motor support bracket bolted to the drive side of the main casting, and doors to close the exciter lamp and film compartments which form the operating side of the main casting. Exterior surfaces are finished in wrinkle gray lacquer; interior surfaces of the exciter lamp and film compartments are finished in smooth white lacquer.

The rear portion of the main casting is a bracket for attaching the reproducer to the supporting pedestal. A machined groove and adapter plate in the upper side provide facilities for attaching standard projector mechanisms to the reproducer. Support pads are provided on the under surface of the main casting for attaching standard lower magazines.

(2-b) The side-mounted motor drives the reproducer directly through a flexible coupling. Heavy counter shafts running in ball bearings and carrying suitable steel pinions and bakelite gears transfer power to the reproducer's sound sprocket, its takeup drive pulley, and by means of a silent link chain drive, to the projector mechanism. All shafts operate in a horizontal position, regardless of projection angle, thus eliminating any need for thrust bearings.

(2-c) The film movement stabilizing system is of the "rotary stabilizer" or "kinetic scanner" type. There are three major components, the impedance drum assembly, impedance roller assembly, and the rotary stabilizer proper. The drum assembly consists of a heavy shaft supported in the drum by ball bearings; the inner end extends into the reproducer film compartment and carries a smooth-faced roller to support the film in the correct optical plane for sound track scanning. The outer end on the drive side of the reproducer carries the rotary stabilizer assembly. The impedance roller assembly consists of a small swinging bracket carrying a felt-faced, flanged guide roller to hold the film on the impedance drum roller and to guide it laterally. The rotary stabilizer is a hollow shell enclosing a heavy inner ball-bearing mounted flywheel. The shell is rigidly fastened to the impedance drum shaft and hence rotates with it. Force to rotate the inner flywheel is transmitted to it via a viscous liquid filling the space between the flywheel and the shell.

Film from the projector mechanism lower feed sprocket passes counterclockwise around the impedance drum roller and on to the reproducer's sprocket.

In operation, there is a small amount of slack film on each side of the scanning point. These slack film loops, in combination with the inertia of the whole rotating assembly, effectively prevent such motional disturbances as those produced by sprocket teeth entering and leaving film perforations from reaching the scanning point. Very steady film motion at the scanning point is assured by the simple flywheel effect of the complete rotating assembly plus the stabilizing action provided by the viscous-damped compound flywheel, or "rotary stabilizer."

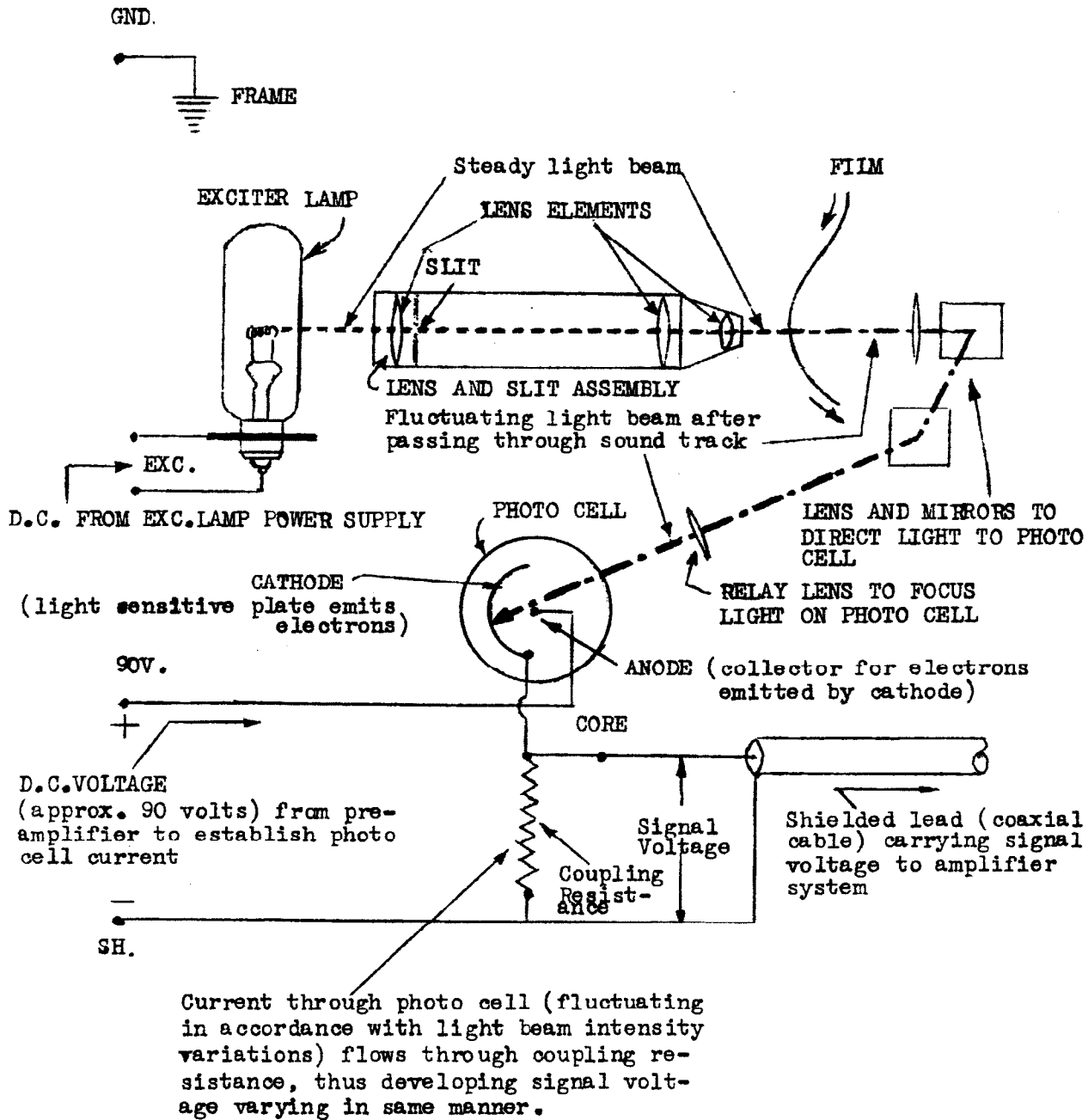


FIGURE 1.

The reproducer sprocket is twice the diameter of conventional sprockets and rotates at half the usual speed. This aids in the stabilizing action, reduces both film and sprocket wear, and permits the sprocket to be used both as a sound sprocket to pull film through the reproducer and as a holdback sprocket. Double pad rollers, top and bottom, securely hold the film in place on the sprocket.

The optical system consists of a 9 volt, 4 ampere prefocus base exciter lamp, a slit and lens tube assembly for producing the very thin, intense beam of light required at the scanning point, and a lens-mirror bracket assembly to collect the light after it passes through the film sound track and direct it to the photocell mounted below the exciter lamp. A small relay lens just above the photocell permits the location of light spot on the cell cathode plate surface to be adjusted so the beam clears the cell anode wire.

A combination optical and schematic diagram of the reproducer appears in Fig. 1. Terminal points in the electrical circuit are marked to correspond to the designations on the reproducer's terminal strip.

### 3. CHARACTERISTICS AND COMPONENTS

(3a) The bracket forming the rear part of the reproducer main casting is the same in design as the similar portion of Western Electric 206 and 208 type reproducers, and hence fits the same pedestal soundhead supports ("pedestal arms") as these reproducers. The following list shows the supports required to associate the SH-7500 Reproducer with various common pedestals. The supports must be obtained by the customer from the pedestal manufacturer in all cases except that of existing common Simplex-type 3 and 5 point pedestals. For these, Motiograph has available and supplies upon order with the reproducer a suitable support arm to replace the "flat foot" type arm normally part of these pedestals.

<u>PEDESTAL</u>	<u>REQUIRED SOUNDHEAD SUPPORT</u>
Motiograph type HU	None. Reproducer fits pedestal directly.
Motiograph type K	Motiograph PS-1475 Bracket
Motiograph type S	Motiograph PS-1475 Bracket
Simplex type L, 3 and 5 point (new)	Simplex A-169-L Pedestal Arm
Simplex types M and R	Simplex A-170-L Pedestal Arm
Super Simplex type	Simplex S-1184-L S.H. Support
Simplex S I type	Simplex S-1184-L S.H. Support
Century type L	Century S-6184-L S.H. Support
Century types C-D and Imp.5 point	Century S-6184-L S.H. Support
Century deluxe type	Century S-6184-L S.H. Support
Brenkert type EX-10	Brenkert #2185 Bracket
Brenkert type EX-12	Brenkert #2187 Bracket
Ballantyne "Soundmaster"	Ballantyne #S-303 Bracket

(3-b) Projector mechanisms having base designs similar to those of the Motiograph AA, and Simplex type machines, mount directly to the reproducer adapter plate with the screws furnished with the projector mechanism. Other Motiograph mechanisms such as Models K, HK, HU, H and F require an additional adapter plate casting, Motiograph part number CS-1445. These are not part of the reproducer, but are ordinarily included in reproducer shipments when it is known in advance that they are needed.

(3-c) Two types of projector mechanism drives are available for the SH7500 Reproducer. Photograph WE-7553 shows the arrangement used with Motiograph types AA and K mechanisms and with all mechanisms driven in the same manner as Simplex, Brenkert and Century machines. For older Motiograph mechanisms, such as the types HK, HU, H and F, the driving arrangement shown in photograph WE-7550 is required. The mechanism drive components are not part of the reproducer proper, but are usually included in reproducer shipments when the type required is known in advance.

(3-d-1) The lower magazine takeup drive pulley of the SH-7500 Reproducer is further toward the drive side of the reproducer than the usual take-up drive pulleys in projector mechanisms and in some other sound reproducers. To properly align the takeup belt it is therefore necessary to replace the pulley on the takeup with one having a longer hub.

(3-d-2) For existing Motiograph type K and type HU lower magazines the installed takeup assembly should be replaced with a Motiograph type TU-725 (prior to 1945, TU-716) Takeup Assembly, which has both a longer hub pulley and a longer shaft. New magazines shipped with reproducers will ordinarily have the correct takeups installed as received.

(3-d-3) Simplex type magazines usually have either takeups with a leather friction disc or takeups of the old Powers type having hard faced fibre friction clutches. The former type is modified for use with SH-7500 Reproducers by replacing the existing takeup pulley with a Motiograph SH-2669 Pulley having a longer hub, and by replacing the original tension spring with a Motiograph SH-2727 Tension Spring, which is somewhat shorter. To modify the latter type (Simplex W-29 or W-30) the existing pulley must be replaced by a Western Electric ASL-13817 Pulley. These are obtainable from Motiograph.

(3-d-4) When the type of takeup modification parts required is known in advance, they will usually be included with the reproducers. Belts will ordinarily run even though there is considerable misalignment, so lack of the proper modification parts need not necessarily hold up operation of the reproducer.

(3-e) The SH-7500 Reproducer is designed to reproduce standard movietone sound track positioned and dimensioned in accordance with the April 2, 1938, "Recommendations on Theatre Sound Reproducing Equipment" of the Research Council, Academy of Motion Picture Arts and Sciences, and the reproducer's characteristics and performance conform to these recommendations so far as they apply to the reproduction of standard movietone track and to reproducers alone.

(3-f) The SH-7500 Reproducer is normally supplied as a component of Motiograph-Microphonic Sound Systems, and its characteristics are properly matched to those of other system components. For comments regarding the use of the reproducer with other types of sound equipment refer to section (4-1).

(3-g) The SH-7500 Reproducer completely assembled with motor bracket and drives is approximately 20 inches deep, 9 inches high, and 16 inches long, and weighs 150 pounds. Reproducers to be supplied after September, 1945, have major castings of aluminum, rather than cast iron, and hence will weigh approximately 100 pounds.

(3-h) SH-7500 Reproducers are equipped with drive motors and gears suitable for operation on 115 volt, 60 cycle, single phase power supply circuits. SH-7501 Reproducers have 115 volt, 50 cycle, single phase motors and drive gears suitable to accommodate their lower rotational speed. Drive gear designs are also available to accommodate 1200 rpm synchronous and interlock motors for certain specialized uses.

#### 4. INSTALLATION

(4-a) "Item" numbers in the following instructions are those shown on Assembly Drawing WE-7521 and Stock List WE-7522.

(4-b) Carefully unpack the reproducer, checking packing material thoroughly for small packages of loose parts. Do not remove the metal shipping guard over the impedance drum shaft until the reproducer is mounted on the projector pedestal. Clean all machined surfaces protected by anti-corrosion grease and clean out all particles of loose packing material. Remove the Item 116 Adapter Plate from the top of the reproducer by taking out its fastening screws, Item 97, and carefully inspect the reproducer gear compartment for dirt and other foreign matter; turn the gears over by hand to make certain teeth are clean and that the gears turn freely.

(4-c) Check the pedestal mounting adapter (if required) and projector mechanism drive components to see that they are suitable for the pedestal and mechanism to be used. Also check the lower magazine takeup and if suitable modification parts are on hand, make the modifications outlined in section (3-d).

(4-d) Mount the reproducer on the pedestal soundhead support using Items 93, 94, 95 and 96 Screws and Washers. With some types of supports it may be impossible to use all four Item 95 Screws, but as many as are accessible should be used. Remove and return to Motiograph for credit the shipping guard over the impedance drum shaft. Save screws and washers for mounting motor bracket. In the film compartment, remove the screws or nuts fastening the Item 33 Lens Mirror Assembly and place the Assembly temporarily in a safe location. Loosen the Item 26 Retaining Clip above Item 38 Impedance Drum Assembly; swing it 90 degrees to clear Item 38 and retighten its fastening screw. Carefully withdraw the drum assembly from the reproducer taking care to place no undue strain upon its shaft bearings; place the drum assembly likewise in a safe location temporarily.

(4-e) Motor brackets and motors with new reproducers are usually shipped assembled and aligned since these operations are performed during final testing. Such assemblies are chalk marked to indicate to which reproducer of a pair they belong. Before fastening the motor and bracket assembly to the reproducer frame, slip the Item 91 Motor Coupling on the motor shaft. Then place the bracket assembly in position, at the same time slipping the coupling over the reproducer drive shaft, and fasten it securely in place with Items 100 and 101 Screws and Washers. If alignment has not been disturbed during shipping and handling, it should be possible to freely slip the motor coupling back and forth on the two shafts. If this cannot be done the motor must be re-aligned as outlined in section (5-f). When alignment is satisfactory, lock the coupling in place with its set screws, taking care to seat the screws on the shaft flats. It is advisable, if possible, to make temporary or permanent connections to the motor lead wires at this point so that it may be operated to see that it runs without excessive vibration and that the reproducer gears operate quietly and smoothly after being thoroughly oiled.

(4-f) Mount the lower magazine to the reproducer with the Item 99 special undercut Screws and Item 96 Washers and with the Item 92 Oil Pan between magazine and reproducer. Before final tightening of the screws, align the magazine fire trap rollers with the reproducer film slot and with the axis of the Item 59 Idler Roller. If the undercut mounting screws do not provide sufficient adjustment



range, it may be necessary to enlarge or slot the fire trap roller assembly mounting screw holes in the magazine assembly, or file out the opening in the bottom of the reproducer through which the assembly projects into the reproducer film compartment. Experience has shown that magazine roller assemblies are frequently very poorly located in the magazine body with respect to the magazine spider mounting holes.

(4-g) Install Item 128 Takeup Belt Idler Assembly on the reproducer using Item 97 Screws and tighten it in the minimum belt tension position. Place the Item 115 Takeup Belt over the reproducer and magazine takeup pulleys and cut it to a length which will give a fair amount of tension (new belts stretch considerably), and then splice the ends together with the clip provided. The splice should be hammered smooth to prevent it from catching in the pulleys and idlers.

(4-h-1) As was mentioned in section (3-b), Motiograph AA projector mechanisms and all mechanisms having the same base design as Simplex mechanisms, mount directly on the Item 116 Adapter Plate using the screws supplied with the mechanisms. All except the Motiograph AA require Item 117 Oil Shield and Item 137 Gasket between mechanism base and adapter plate to prevent oil from dripping into the reproducer film compartment. Holes for the mechanism mounting screws in the plate are somewhat oversized to permit the mechanism to be shifted slightly for exact alignment of its film path with that of the reproducer. Steel film is excellent for this purpose if it is available, but satisfactory alignment can usually be secured using ordinary film, or by means of straight edge measurements using the machined operating side reproducer casting edge as a reference surface. Tighten the mechanism fastening screws securely after aligning and checking the film path.

(4-h-2) All Motiograph mechanisms except Model AA require a Motiograph CS-1445 Mechanism Plate (Item 163) between the mechanism base and the reproducer adapter plate, Item 116. It provides for additional fastening screws and serves as an oil shield. Fasten this plate to Item 116 with Item 161 Screws but do not completely tighten the screws; place the assembly on the reproducer and loosely insert Item 97 Screws through the accessible holes in Item 116 into their tapped holes in the reproducer casting. Then shift the Item 163 Mechanism Plate as required to align the hole in its operating side front corner with the corresponding hole in the top front corner of the reproducer film compartment; the drive side edges of the two plates must also be parallel. When these conditions are fulfilled, remove the plates from the reproducer and firmly tighten the Item 161 screws holding them together.

(4-i-1) As was outlined in section (3-c), reproducers for use with Motiograph AA, K and all projector mechanisms driven in the Simplex manner have mechanism drive facilities as shown in Photograph WE-7553. The drive chain idler assembly, Item 129, is removed for shipment, but the drive chain sprocket, (Item 111) is left in place.

It is convenient to install the Item 144 Mechanism Drive Assembly in the projector mechanism before placing the mechanism on the reproducer. In most older mechanisms its pilot shaft is locked into a hole extending through to the operating side of the mechanism by means of a setscrew seating on the shaft flat. In some very old mechanisms the hole does not go through, and hence must be bored out to permit installation of the drive's oil cup from the operating side. The oil cup, with its lock nut, is threaded into the shaft end from this side by turning the shaft with a screwdriver from the drive side end. The slot is parallel to the shaft flat to facilitate seating of the lock set screw on the flat. Before tightening the screw, position the shaft to allow a few thousandths end play in the sprocket and pinion assembly portion of the drive. When the drive is locked in place, turn the oil cup to an upright position and tighten its lock nut.

Motiograph K mechanisms are provided with an adjustment to raise or lower the drive gear train so as to obtain correct mesh with drive gears of certain older types of reproducers. The adjustment consists of two screws set into the mechanism base casting just below the left rear half door. The one nearest the center frame is tapped into the base casting and pushes down against the gear train casting. The large headed screw next to it is a clearance fit in the base casting, but is tapped into the gear train casting. Thus by tightening one screw and loosening the other, the gear train casting can be raised or lowered as desired. With both screws tight, the casting is rigidly locked, and of course must be so during operation of the projector mechanism. Since the Item 144 Drive is carried by the gear train casting, this adjustment affects the amount of chain slack; it should be set initially, with the chain idler Item 129 in minimum chain tension position, so the chain tension is correct. The idler may then be used to compensate for wear.

The Motiograph AA projector mechanism, and one or two other currently manufactured mechanisms, have a "socket" type drive arrangement into which the entire drive unit is locked. The pilot shaft and the sprocket and pinion assembly both rotate with this "socket" and hence need not be separately lubricated since there is no relative motion between them. Instructions for locking the drive unit in place are supplied with the mechanisms.

With the drive unit installed in the projector mechanism the assembly may be placed on the reproducer. For mechanisms mounting directly on the adapter plate, the drive chain may be put in place on its sprockets by sliding the plate forward in its slot sufficiently. Motiograph K mechanisms are pushed forward on their adapter plates while the drive chain is put in place. After returning the mechanism to its normal position, install the chain idler Item 129 and adjust it so the chain runs smoothly without whipping, and so that the bakelite idler roller touches the chain with just sufficient force to insure rotation of the roller. Sprocket alignment should be checked with a straight edge; reposition Item 111 Drive Sprocket on its shaft if necessary.

(4-i-2) For older Motiograph mechanisms driven from the left front corner, the drive components shown in Photograph WE-7550 are required. The bakelite gear Item 148 and the Item 150 Bracket are left in place after final reproducer tests, but the Sprocket and Gear Assembly, Item 147, and the Item 151 Shaft are removed for shipment. The special Chain Idler Bracket Assembly, Item 174, is also usually shipped separately.

To assemble the drive components first replace the existing gear or sprocket on the existing mechanism drive shaft with the Item 152 Sprocket supplied. Place Item 153 Chain over the sprocket and hang Item 147 Sprocket and Gear in the chain loop. Install Item 174 Idler Assembly in minimum tension position and then fasten the mechanism to its Adapter Plate, Item 163, (must be Motiograph part CS-1445) with the regular mounting screws. Insert Item 151 through Item 147 into Item 150 Bracket and lock it in place; a shoulder on the shaft provides for correct end play. If Item 150 Bracket has not been disturbed since final reproducer testing the gear mesh will be correct. If the bracket has been moved or if the drive components are being assembled for the first time, adjust the bracket position for minimum gear backlash consistent with quiet operation and so that chain tension is under control of its idler assembly. The tension should be sufficient to insure rotation of the bakelite idler roller and smooth chain travel without binding or whipping.

(4-j) Check the Impedance Drum Assembly, Item 38, for free rotation of its shaft and film drum member. There should be no sign of binding or sticking and no more than the just perceptible end play characteristic in single row ball bearings. If the shaft binds or sticks, try tapping the shaft lightly at the film drum end with the wooden handle of a screw driver; the rear bearing is a slip fit in the housing to allow for shaft expansion or contraction due to

temperature changes, and the tapping will usually seat the bearing correctly for minimum bearing loading.

Remove the tape which holds the shaft spacers in place over their Woodruff key during shipment. Try the Item 90 Rotary Stabilizer on the shaft to see that there is no binding due to dirt or burrs in its shaft hole. Then, holding the drum assembly in one hand, partially insert it into its hole in the reproducer center wall, lifting the impedance roller meanwhile with the other hand to clear the drum. When the shaft end appears on the drive side of the reproducer, place the stabilizer in line with it and gently work the drum assembly to its seat, at the same time inserting its shaft through the stabilizer. Lock the drum in place with its retaining clip, and lightly tighten the stabilizer retaining nut on the shaft end, taking care that the tongues on the shaft collar enter the corresponding notches in the stabilizer hub. Restore Item 33 Lens-Mirror Assembly to its seat at the top of the reproducer film compartment after checking it for lens and mirror cleanliness (Refer to sections (5-a) and (6-b) for adjustment and cleaning instructions).

The impedance drum shaft and associated stabilizer, the film drum, and the impedance roller, which bears on and is driven by the film drum, should all rotate very freely and should have a long coast-down time after being brought to approximately film speed by hand. It should be possible to feel the inertia of the heavy inner flywheel of the stabilizer resisting suddenly applied hand turning force to the outer shell, and once in motion, the rotational energy of the inner flywheel should restart the shell via the coupling and damping fluid if the shell is momentarily stopped by hand. This restarting or "pickup" effect is not as prominent, however, as in some earlier designed and much lighter rotary stabilizers, since the magnitude of the coupling and damping action must be properly proportioned to the weight of the rotating members in the film motion stabilizing system.

(4-k) Attach the rear guard assembly, Item 118 or 173 and see that there is no interference with any rotating reproducer component. In the case of Item 173, the auxiliary chain guard must be positioned over the chain with the oil cup for the Item 151 shaft passing through the clearance hole in the guard. The auxiliary guard may need to be adjusted slightly on the main guard casting to provide adequate clearances.

(4-l) Install conduit and wiring to the reproducer in accordance with sound system diagrams. Motor starting current under normal load conditions is 15-18 amperes, so switches in the motor circuit should be of at least 20 ampere rating.

As was stated in section (3-f), the SH-7500 Reproducer is normally supplied as a component of Motiograph-Microphonic Sound Systems; the photocell circuit includes a 2 megohm coupling resistor mounted on the terminal strip. Other amplifier systems having this coupling resistor in the amplifier input circuit may be connected to the reproducer by connecting the input coaxial cable to the reproducer "90 V" and "CORE" terminals, which are respectively the photocell anode and cathode leads. Note, however, that the cable core must go to the "90 V" terminal, and the cable shield to the "CORE" terminal in this arrangement for correct cell polarization.

All Motiograph-Microphonic Systems include a power unit for supplying reproducer exciter lamps with direct current. The 9 volt, 4 ampere lamps of SH-7500 Reproducers associated with systems having no such power unit may be operated on alternating current from stepdown transformers of suitable rating, though reproduced sound quality will be inferior due to the resulting hum. If AC excitation must be used, somewhat better signal-to-hum level, at roughly the same output level, may be obtained by substituting 10 volt,  $7\frac{1}{2}$  ampere lamps operated at approximately  $5\text{-}3\frac{3}{4}$  amperes. The improvement is due to the heat storing action of the heavier filament in the 10 volt,  $7\frac{1}{2}$  ampere lamp. "BXA"

(4-m) Install the reproducer exciter lamp and photocell in their sockets.

Rotate the lamp until the locking eyelets in its prefocus ring drop over the socket locating pins; press downward on the lamp and turn it clockwise to lock it in the socket. Lamps are most easily removed, particularly when they are hot, by first prying the ventilating cap out of its hole in the reproducer housing over the lamp. Press downward on the lamp through this hole with a cloth protected finger, and turn counter-clockwise the relatively cool lower part of the lamp bulb with the opposite hand to unlock the lamp from the socket. Removing the ventilating cap also gives additional clearance for the lamp bulb during installation or removal.

After installing the photocell in its socket, replace the cover, taking care that the locating slot in the cover edge is over the locating pin in the cover base so as to properly align the light aperture.

## 5. ADJUSTMENTS AND OPERATION

(5-a) Turn on the exciter lamp power supply and check the path of the light beam from the lens tube, Item 41, through the lens mirror assembly, Item 33 and the relay lens assembly on the photocell bracket to the cathode (the cylindrical plate) of the photocell. A small white card held inside the film drum should show the light field coming through the lens tube with the bright filament image approximately centered up and down in the field. The lens in the Item 33 lens-mirror assembly shrinks the field to a narrow beam again, and in combination with the two mirrors, focuses this beam as an image of the lens tube slit on the relay lens just above the photocell. The front mirror is mounted in a plug which can be rotated as required to center the image on the relay lens, and the image is brought to focus by moving the entire lens-mirror assembly forward or backward as required in its mounting groove in the inside top surface of the reproducer frame casting.

The relay, or "collector", lens provides a means for locating the light beam to the photocell cathode so that it does not strike the cell anode wire enroute. The beam is small and interference with the anode wire would cause loss of output signal level, and possible distortion from variable area type recordings. Photocell anode wires vary considerably in position, so the adjustment must be made whenever a cell is installed or replaced. It is made by loosening the two screws which fasten the relay lens bracket to the main bracket; the bracket has large clearance holes so it may be positioned as required. After positioning the light spot on the cell cathode, recheck the centering of the slit image on the relay lens, using a small card or paper held immediately in front of it, and adjust the plug-mounted mirror in Item 33 if necessary. With the photocell cover in place, slide the paper or card over its light aperture opening and see that the light beam properly clears the edges of the opening. There must be no interference anywhere along the light beam path and the light spot on the photocell cathode should be clear and distinct.

(5-b) Turn on the sound system amplifiers and speakers and check for sound output from the reproducer by interrupting the light beam with a finger or card. Heavy thumps should be audible from the speakers and with the amplifier gain or volume control at maximum setting it should be possible to hear the characteristic "rush" or hiss of the photocell action under the influence of the light beam. With the gain up, tap the exciter lamp and the photocell to make certain they have no internal bad connections.

(5-c) Lubricate the reproducer (see section 6-a) and thread sound film into the machine. The film path through the reproducer is exceedingly simple; from the projector mechanism lower feed sprocket the film passes counter-clockwise around the film drum (emulsion side toward light beam) and thence over the top of the large sound sprocket. Pull the film up tight and then back it off

to allow a minimum of one sprocket hole slack and a maximum of two holes slack. Close the upper sprocket pad roller assembly and see that film is properly seated on the sprocket teeth and between the flanges of the impedance roller. Allow a three-finger loop at the right of the sound sprocket, thread the film back along the bottom of the sprocket and over the film idler roller (Item 59) into the lower magazine. Close the lower sprocket pad roller assembly and check for film seating on the sprocket and for absence of any slack film in the lower magazine.

(5-d) Start the machine and observe the action of the film as it passes over the idler roller Item 59. If an initial loop of any appreciable size forms at this point, increase the takeup clutch tension until the tendency just disappears. The tension must be sufficient to overcome the inertia of the reel almost instantly and this requirement, particularly in certain clutch designs, is inconsistent with tension adjustments based on gauge or feel tests. The takeup drive belt must obviously be free from slippage and there must be no binding of the reel shaft and no interference between reel and magazine if the tension adjustment is to be properly made.

(5-e) Observe film passage through the reproducer. Slack film loops on either side of the scanning point should be reasonably steady and the sprocket pad rollers should revolve freely during passage of film splices; outer pad rollers will usually revolve continuously since film contacts them over a considerable arc. Any sticking of rollers, excessive mechanical noise, or undue disturbance of film loops should be investigated and corrected if possible. Disturbances of the upper film loop may be due to poor alignment between projector and reproducer, badly hooked teeth on projector lower feed sprocket, or dirt on, or damaged impedance roller surfaces.

(5-f) Lateral adjustment of the impedance roller assembly ("guide roller") for correct alignment of sound track and light beam may be checked with standard buzz-track film if desired but it is much easier and sufficiently accurate to observe the alignment visually by placing the head at the front of the reproducer and looking at the track itself as the beam passes through it. If adjustment is necessary, loosen the lock screw in the center of the knurled adjusting nut on the roller bracket shaft and turn the nut clockwise to move the film inward to eliminate noise pickup due to the beam striking sprocket holes or counter clockwise to take out noise resulting from light striking picture frame lines.

(5-g) The double pad roller brackets for the sound sprocket are adjusted for lateral alignment of their roller flanges with the sprocket in the same manner as the impedance roller bracket. Clearance should be equal on each side. Roller film contacting shoulders should clear the sprocket by two film thicknesses. If adjustment is required, loosen the locking screws (Item 141) for the stud base several turns and loosen the mounting screws (Item 68) enough to permit movement of the stud. Place two thicknesses of film on the sprocket and press the entire bracket assembly and rollers down against it while the mounting screws are retightened. Then tighten the cone-shouldered locking screws little by little against the lock stud to rigidly anchor the assembly in place, taking care that they do not disturb the adjustment.

(5-h) The reproducer motor bracket incorporates several adjustments for exactly aligning the motor shaft with the reproducer drive shaft. The lateral adjusting screws (Item 120) are reached by removing the bracket cover plate (Item 156). The vertical adjusting screws (Item 126) are tapped into lugs at the bottom edge of the bracket and bear against the edge of the motor cradle. For adjustment, the nuts (Item 124), which hold the cradle to the lateral adjusting screws, must be slightly loosened to permit the screws to turn and to allow vertical movement under the influence of the Item 126 screws and adjusting screw locknuts must be backed off several turns. Make the best possible alignment

visually and thoroughly tighten the clamps holding the resilient motor mountings in the cradle. Using the motor coupling as an aligning tool, then adjust the screws until the coupling slides freely over both shafts. Tighten the adjusting screw locknuts and the Item 124 nuts and recheck the adjustment. When the coupling is free with all nuts tightened, align the coupling set screws with the shaft flats and securely tighten them and replace the Item 156 cover.

With correct alignment the motor will operate with virtually no vibration. Considerable misalignment can be present, however, with little effect on reproducer performance due to the use of the soft molded rubber coupling. Its flexibility also permits the motor to be removed during service operations by undoing its cradle clamps and if the resilient mountings are not too badly swollen from excessive motor oiling, the motor can be replaced in its cradle without necessitating realignment. If desired, the entire motor bracket assembly may be removed from the reproducer without disturbing the rotary stabilizer because two of its mounting holes are slotted and the other is tapped for the third mounting screw. Ordinarily, however, it is simpler to first remove the stabilizer and impedance drum in the manner outlined in section (4-d).

## 6. MAINTENANCE

(6-a) Lubrication of the SH-7500 Reproducer is very simple since most of the rotating members are equipped with ball bearings requiring no additional lubrication during the bearing life. Daily, or before each period of operation, apply Motiograph Mechanism Oil to the following points; wipe off any excess:

- Oil holes in the sprocket pad rollers.
- Sides of projector mechanism drive chain idler roller.
- Sides of takeup belt idler rollers.
- The oil tubes which carry oil to the drive gears.
- Oil cups and gears associated with projector mechanism drives.

Once per week of normal operation apply Motiograph Mechanism Oil to the following points:

- The mechanism drive chain.
- Oil holes in impedance roller and pad roller bracket arms.
- Item 59 film idler roller (its Oilite bushing needs only infrequent lubrication).

Once per six to eight months of normal operation, oil the motor bearings with a good grade of light automobile oil. Take care that only sufficient oil to saturate the wool packing is applied, for excessive oiling will cause rapid deterioration of the resilient mountings and of the starting switch inside the motor.

(6-b) Keep the reproducer clean. Wipe away all excess oil, dirt, and dust before they have a chance to affect operation. It is particularly important to keep all glass surfaces in the optical system free from oil or dust films, for they may cause low output signal level and distortion of the reproduced sound. If oily or dirty film is being run, the front lens of the lens tube may need daily, or even more frequent, cleaning and at least once a week all glass surfaces should be cleaned and polished with a soft, lint-free cloth or with lens cleaning tissue.

Great care must be exercised in cleaning the rhodium plated, first-surface mirrors in the Item 33 lens-mirror assembly. Since the plating, or "silvering" is on the surface facing the light, it may easily be damaged if any sharp implement is used during cleaning. The surface may also be tarnished or damaged by solvents such as acetone, alcohol, carbon tetrachloride, etc. If oil

collects in the assembly due to leakage from the projector mechanism above the reproducer, the assembly may be removed and washed thoroughly in gasoline. After complete drying, polish the mirrors and replace assembly in the reproducer; check and adjust as outlined in section (5-a).

(6-c) At least once a month of normal operation, and after replacing exciter lamps or photocells, check all optical system adjustments as outlined in section (5-a) and make any necessary corrections. Exciter lamps should be replaced when their bulbs blacken sufficiently to cause loss of output signal level or when their filaments show the "glazed" appearance which indicates impending burnout. Photocells usually have very long lives if they are not subjected to excessively high temperatures or mechanical damage. They should be replaced if their sensitivity falls to the point where reproducer outputs cannot be balanced or if they become noisy due to deterioration of internal connections.

(6-d) The Lens Tube (Item 41) is properly adjusted for maximum high frequency response during final reproducer testing and, except in the event of extremely rough handling of the reproducer during shipment and installation, or in the event of accidental damage, there should be no need for readjustment until the time for general reproducer overhaul comes. Operators are cautioned not to disturb the adjustment since special equipment not generally available in the projection room is required to properly make it.

If transmission tests ("frequency response runs") on the sound system indicate that the high frequency response is below normal, readjustment is in order. The essential equipment consists of a loop of 7000-9000 cycle frequency film, an indicating device such as an output meter connected to the sound system output terminals via a cable long enough to permit it to be placed near the reproducer, and some kind of a tool to grasp the lens tube. Most service engineers carry a circular clamp-type wrench for the latter purpose but cloth protected pliers will do in an emergency.

Tighten the photocell bracket mounting screws securely and adjust the stud and nut securing the front of the bracket so the light beam from the lens tube clears the end of the film drum by about a thirty second of an inch. If the corprene vibration isolation washers are deteriorated they should be replaced. Remove the sealing compound over the lens tube lock screw and loosen the screw until the lens tube is free. Thread the frequency film into the machine and pull it tight by hand over the film drum in its normal position. Position the lens tube by visual observation so the beam of light on the film sound track is as fine as possible and so that its length is perpendicular to the track axis, in other words, so the beam extends as nearly as can be visually observed straight across the track. Tighten the lock screw just enough to hold the lens tube not quite rigidly in this position.

Install the adjusting wrench on the lens tube (or use pliers) and start the film loop running. Align the sound track with the light beam as outlined in section (5-f). Adjust the output meter scale switch and the system gain control to give a low meter reading. If the lens tube is anywhere near the correct position, it should be possible to hear the reproduced frequency, or tone, in the projection room monitor speaker and having the monitor on full is helpful during the adjusting operation. As a matter of fact, in an emergency, lens tubes can be adjusted for reasonably satisfactory high frequency response without auxiliary equipment by positioning them to produce the maximum possible "s" sounds in reproduced speech aurally observed from the monitor speaker or in headphones connected to the amplifier output circuit.

The meter-frequency film adjusting procedure consists of very carefully moving the lens tube toward or away from the film, at the same time rotating it slightly one way or the other, to produce the best possible light beam focus

and azimuthal alignment on the moving sound track as evidenced by maximum meter indication. Go through the peak several times to make certain of the setting and then tighten the lock screw securely. It may be sealed with any suitable cement, if desired, to prevent unauthorized adjustments.

Transmission tests, using multi-frequency test films, are the best check on correct lens tube settings, but crisp, clear speech reproduction and natural sounding reproduction of incidental noises and sound effects are likewise an indication of satisfactory adjustment since they are the result of adequate system high frequency response.

(6-e) All film contacting roller surfaces and the sprocket surfaces should be kept free from dirt and film wax or emulsion accumulations. A stiff brush, such as a toothbrush, dampened with carbon-tetrachloride may be used for this purpose. The felt center section of the impedance roller may be cleaned with a cloth dampened with this solvent; move the cloth against the felt nap. Wipe oil from the rubber motor coupling and resilient motor mountings frequently.

(6-f) When the felt section of the impedance roller wears nearly to the point where film touches the shoulders of the steel sections it must be replaced. In early reproducer production the felt sections are not generally field replaceable, for the steel and felt sections were gauged in sets. Later impedance roller assemblies (identified by a "V" on the outer bearing retainer cap) have separately gauged components to permit such replacement. For the earlier type, Motiograph maintains a stock of reconditioned assemblies which are supplied through Motiograph dealers on a repair-exchange basis; they consist of only the swinging bracket portion of the major assembly (Item 32) and may be ordered as "SH-7045 Impedance Roller Assembly".

The impedance roller assembly is a fairly delicate piece of mechanism and there is hence considerable justification for returning even the "V" type to the factory when overhaul becomes necessary. The same consideration applies to the impedance drum assembly (Item 38) and obviously also to the rotary stabilizer assembly (Item 90) since it is a sealed unit.

(6-g) Experience has shown that the SH-2526 Lens Tube (Item 41) is virtually immune to the oil leakage common in earlier designs of such units due to the effective sealing. No attempt to disassemble this item should be made in the field. In the event of accidental damage or proved inferior performance, replacement units are available from Motiograph and from Motiograph dealers on a repair-exchange basis based on actual reconditioning costs.

## 7. REPLACEMENT PARTS

(7-a) All major assemblies and numerous individual components may be identified by reference to the assembly drawing, WE-7521 and the associated stock list, WE-7522. The stock list gives Motiograph part numbers and names or ordering information for each item listed. Unlisted components may be ordered by referring them to a listed item; for example, "Idler Pulley for SH-7014 Takeup Belt Idler Assembly."

(7-b) Some assemblies are available from Motiograph and from Motiograph dealers on a repair-exchange basis as was mentioned in sections (6-f) and (6-g). All components are ordinarily available from stock. Spares for such items as exciter lamps and photocells should obviously be on hand at each installation, and it is also advisable to have on hand at least one SH-2522 Motor Coupling (Item 91) since projector mechanism bind-ups may cause coupling damage. Less frequently needed, but desirable components to have on hand, are Item 183 (SH-2599) and Item 188 (SH-2603) Mirrors.



(7-o) Occasionally needed and field replaceable components of some major assemblies are listed in the following tabulation.

SH-7030 MECHANISM DRIVE ASSEMBLY (ITEM 144)

SH-2678 Drive Chain Sprocket  
SH-2687 Mechanism Drive Pinion  
SH-2688 Shaft  
SH-2741 Oil Cup (for Motiograph Model K Mechanisms)  
SH-2706 Oil Cup (for Simplex type Mechanisms)  
SH-2708 Oil Cup Locknut

Note: A few early SH-7500 Reproducers had SH-7028 Mechanism Drive Assemblies instead of SH-7030 assemblies. They are identified by spiral grooves in the shaft. The SH-2688 Shaft of the SH-7030 Assembly has a single, straight oil groove. Parts of SH-7028 are identical to those in SH-7030 Assemblies except that the shaft is part number SH-2681 and the drive pinion is part number SH-2684.

SH-7002 PHOTOCCELL BRACKET ASSEMBLY (ITEM 31)

SH-25<sup>5</sup>58 Exciter Lamp Socket  
SH-2560 Exciter Lamp Socket Insulating Washer  
SH-2562 Exciter Lamp Socket Insulating Bushing  
SH-2723 Exciter Lamp Contact Stud  
SH-2563 Exciter Lamp Connection Terminal  
SH-2564 Photocell Socket  
SH-2572 Lens (Lens B)  
SH-2571 Lens Retaining Ring  
SH-2573 Lens Bracket Light Hood

SH-7012 TERMINAL STRIP ASSEMBLY (ITEM 37)

SH-2642 2 meg. Coupling Resistor

SH-7005 AND SH-7006 PAD ROLLER ASSEMBLIES (ITEMS 34 AND 35)

SH-2604 Arm Casting (Upper)  
SH-2613 Arm Casting (Lower)  
SH-7023 Pivot and Stud Assembly (Upper)  
SH-7025 Pivot and Stud Assembly (Lower)  
SH-2582 Adjusting Nut  
SH-2605 Detent Spring  
SH-2730 Pad Roller  
SH-2606 Pad Roller Shaft  
7/32" Dia. Steel Ball Bearing (Detent Ball)  
8-32 x 1/4" Allen Cup Point Set Screw (for SH-2606 Shafts)  
8-32 x 5/8" Oval H.I.M.S., N.P. (Lock Screw for SH-2582 Nut)

SH-7003 IMPEDANCE ROLLER ASSEMBLY (ITEM 32)

SH-2583 Impedance Roller (Rear Section)  
SH-2584 Impedance Roller (Front Section)  
SH-7021 Cushion Roller Assembly (Felt Section)

Note: The above items are field replaceable only in "V" type assemblies - refer to section (6-f).

SH-2578 Impedance Roller Shaft  
SH-2592 Impedance Roller Bearing  
SH-2587 Impedance Roller Shaft Key

SH-2586 Impedance Roller Shaft Spacer  
SH-2589 Impedance Roller Tension Spring  
SH-2582 Adjusting Nut  
8-32 x 5/8" Oval H.I.M.S., N.P. (Lock Screw for SH-2582 Nut)

SH-2673 MOTOR (ITEM 134)

SH-2759 Terminal Block (Includes Starting Switch Contacts)  
SH-2770 Starting Switch Tension Spring  
SH-2771 Starting Switch Mechanism  
SH-2768 Thermal Overload Protection Device  
PS-1606 Resilient Mounting Ring  
SH-2772 Oil Cup (Straight)  
SH-2773 Oil Cup (Angle)  
SH-2774 Cradle Latch  
SH-2775 Bearing

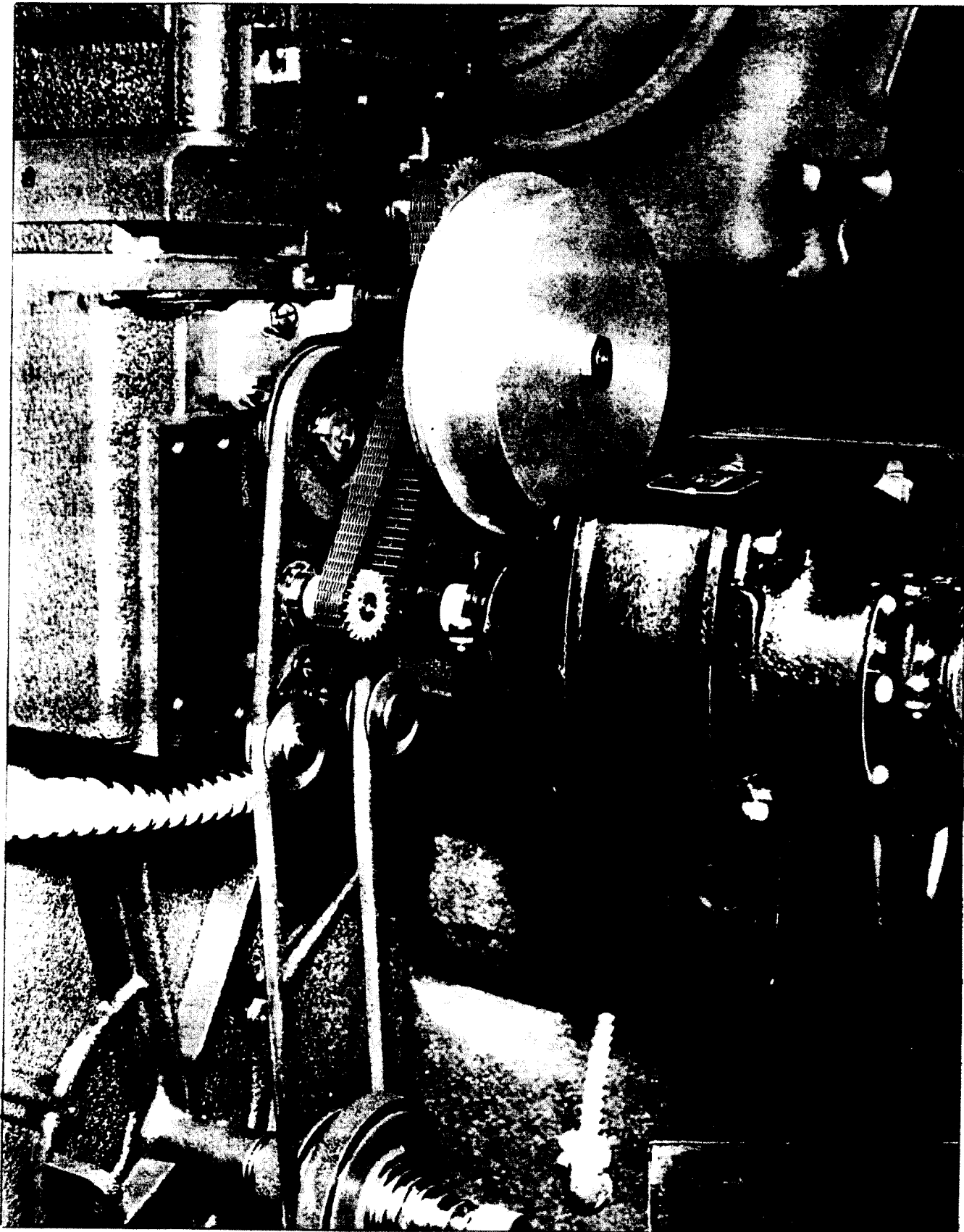
Note: Order components, other than those listed, by description and give "Reference Number" stamped on motor nameplate. SH-2618 Motors for operation on 50 cycle current are identical to SH-2673 Motors except that starting switch tension springs are part number SH-2776 instead of SH-2770.

M O T I O G R A P H

4431 West Lake Street .

Chicago 24, Illinois

Note: Mono and/or stereo solar cells are available from Wolk, Inc. or Kelmar Systems by ordering through your local theater equipment dealer or supplier.



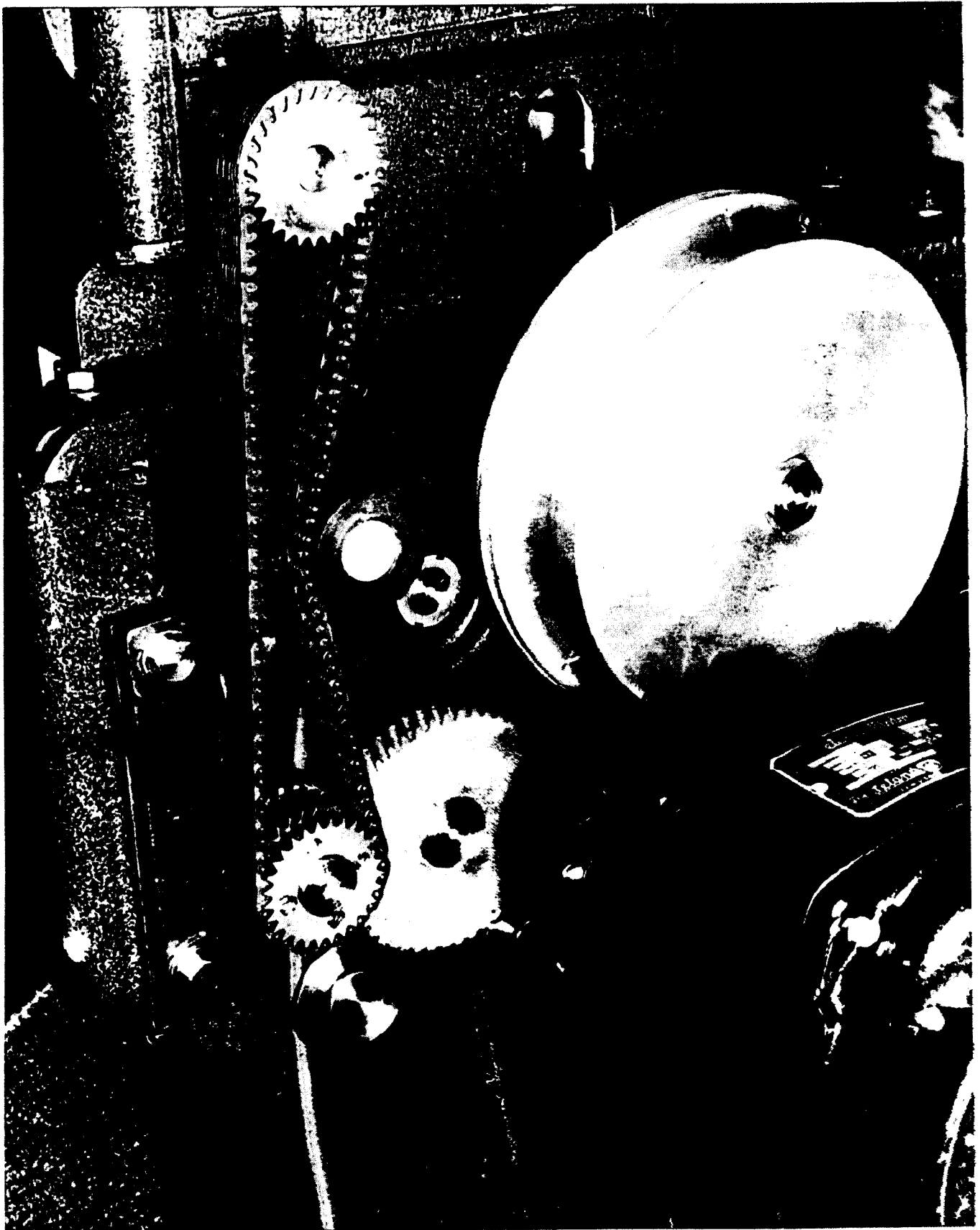
**SH-7500 REPRODUCER**

**DRIVE SIDE ASSEMBLY WITH MODEL K AND SIMPLEX TYPE PROJ. MECH.**

**DWG. WE-7553-1**

**AND "AA"**

**10-25-45**



SH-7500 REPRODUCER

DRIVE SIDE ASSEMBLY WITH MODEL HK PROJ. MECH.

MOTIOPHOTOGRAPH,  
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DWG. WE-7550-1  
7-10-40