Film-Tech

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the open door

to pictures of perfection

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BELL & HOWELL

Filmosound

179

16MM PROJECTORS

PROJECTION LAMPS:

DFY	1000W	25 HOURS
DFK	1000W	10 HOURS
DEJ	750 W	25 HOURS

EXCITER LAMP:

BRD	4 VOLT,	.75 AMP

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You have purchased a promise with your Filmo—a Bell & Howell promise of professional "movies" with amateur ease for years to come.

Behind this promise and your Filmo stand years of Bell & Howell research, tireless craftsmanship of engineers and workmen, and the finest materials made. To be sure you get the perfect pictures your Bell & Howell equipment is made to give, study the following pages carefully with your Filmo in front of you. Then, when you put it to work, you'll get matchless performance from your very first try.

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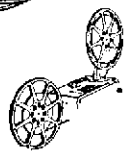
10 ACTIONS . . . of setup and operation

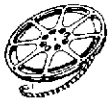
4 MINUTES . . . of pre-show time

for PICTURES OF PERFECTION


. . . Make electrical connections

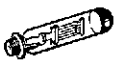

. . . Attach reel arms


. . . Set sound-silent switch


. . . Thread film


. . . Turn on amplifier


. . . Start film-moving mechanism


. . . Turn on lamp


. . . Focus lens


. . . Adjust volume


. . . and tone

Contents

Instructions for Operation and Maintenance of BELL & HOWELL FILMOSOUND AUDITORIUM Model 179-J

The information given in the following pages refers *specifically* to the Filmosound Model 179-J and *generally* to the Filmosound Models 179-H and -K. Differences in operation of the Models 179-H and -K are given on pages 33 through 39.

Setting Up

Positioning of Projection Units. Place the Filmosound at the rear of the room on a stand or table of a height which will permit projecting over the heads of the audience. Set up the projection screen, at the front of the room, according to the instructions accompanying the model to be used.

Unfasten two latches on rear door of power speaker and open door. Unsnap both fasteners of retaining band LE, Figure 1, and remove feed reel arm HR, Figure 1, and take-up reel arm JS, Figure 1, from carrying positions. Remove Y cord, speaker-to-projector cable, line cord and take-up reel from carrying positions. Carry the speaker, line cord, and speaker-to-projector cable to the front of the room. Place the speaker as nearly as possible at the center of the screen and above the floor, but not so high as to interfere with the picture. Locate the speaker at least 18 inches in front of any obstructing surface.

Electrical Connections — Speaker. With line switch ND, Figure 3, in the OFF position, insert female plug MG, Figure 2, of power speaker line cord into receptacle KR, Figure 2; plug other end of line cord into wall receptacle supplying 105- to 130-volt, 50- to 60-cycle alternating current. Connect plug AR, Figure 2, of speaker-to-projector cable to receptacle DP, Figure 2. For operation of power speaker on 115-volt direct current or 220-volt alternating current, see pages 17 and 18.

Draw cable out of slot in right side of case door and close door. Uncoil-

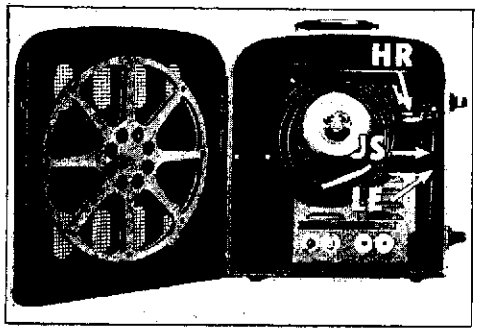


Figure 1

HR Feed reel arm
JS Take-up reel arm
LE Retaining band

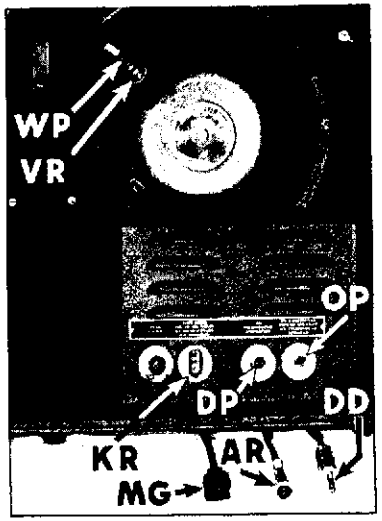


Figure 2

AR	**Female plug**
DD	**Extra speaker cable plug**
DP	**Receptacle**
JL	**Female receptacle**
KR	**Power supply receptacle**
MG	**Female plug**
OP	**Extra speaker jack**
VR	**Male plug**
WP	**Female plug**

ing speaker-to-projector cable as you walk toward projector, place cable where audience cannot trip over it. Figure 4a shows positions and connection of Filmosound and power speaker.

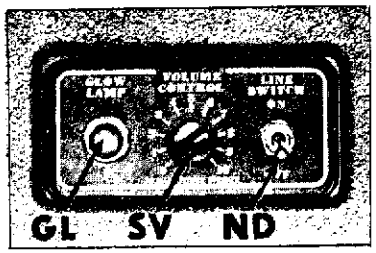
On those occasions when even greater sound volume is desired, add one or more extra power speakers. To connect two or more power speakers (see Figure 4b): Connect plug MG of second power speaker line cord to receptacle KR. Connect plug AR of speaker-to-speaker cable to receptacle DP. With connections for first power speaker made in the usual way, connect plug DD of speaker-to-speaker cable to jack OP on first speaker amplifier. Connect each additional power speaker to the one before it, using the speaker-to-speaker cable; since all connectors are polarized and speaker amplifier receptacles are clearly identified, connections can be made only correctly.

When desired, a regular speaker may be used with the power speaker or the power speaker itself may be used as a regular speaker. To use a regular speaker with the power speaker (see Figure 4c): Connect plug AR of speaker-to-speaker cable to receptacle VR of regular speaker. With connections for power speaker made in the usual way, connect plug DD of speaker-to-speaker cable to jack OP on power speaker amplifier. To use the power speaker as a regular speaker (see Figure 4d): Remove plug WP, Figure 2, from receptacle VR, Figure 2. Connect plug AR of speaker-to-projector cable to receptacle VR, Figure 2. No further electrical connections for speaker are necessary, since amplifier of speaker will not be used.

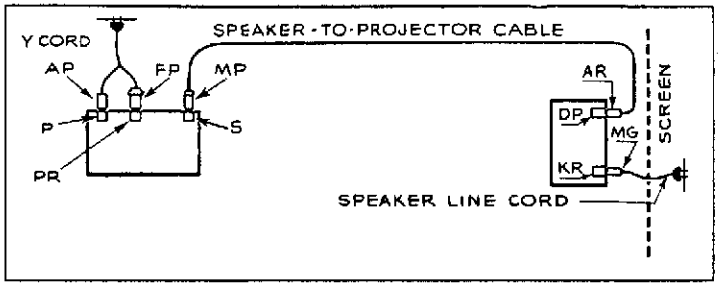
Electrical Connections — Projector. When speaker(s) has been set up and

Figure 3

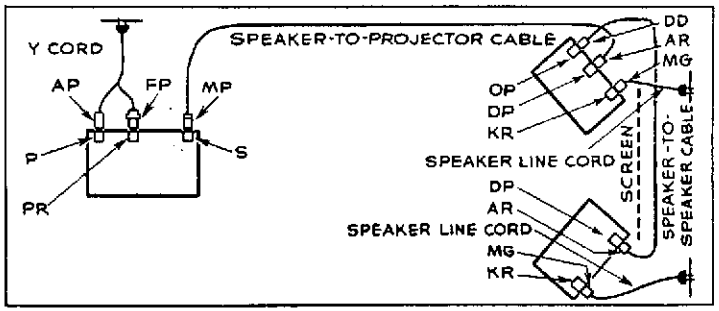
GL	**Glow lamp**
ND	**Line OFF-ON switch**
SV	**Volume control**



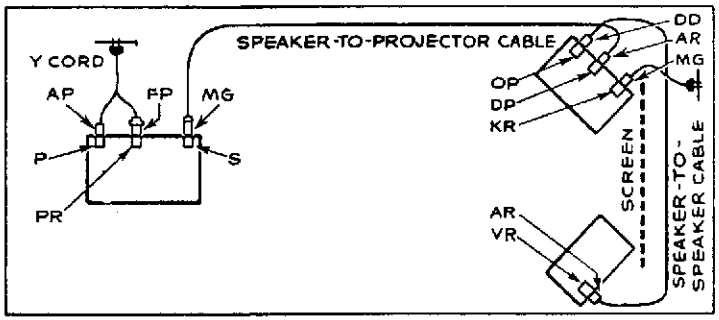
4a



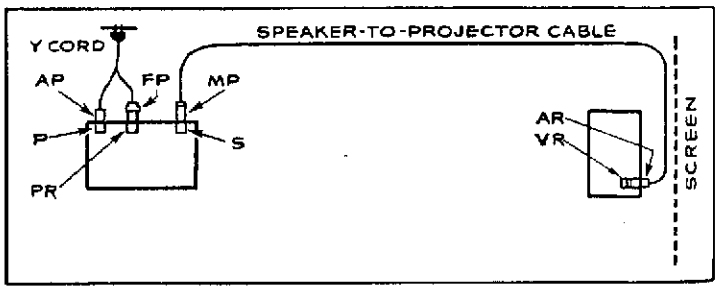
4b



4c



4d



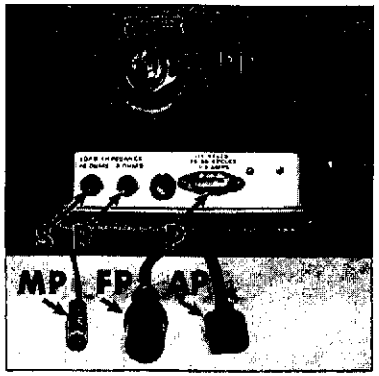


Figure 5

AP	**Female plug**
FP	**Female plug**
MP	**Male plug**
P	**Amplifier receptacle**
R	**8-ohms receptacle**
S	**16-ohms receptacle**
PR	**Projector receptacle**

connected, insert plug MP, Figure 5, of speaker-to-projector cable into 16-ohms receptacle S, Figure 5. With all controls on the Filmosound in the OFF position, insert plug FP (round plug of the Y cord), Figure 5, into projector receptacle PR, Figure 5. Insert plug AP (flat plug of Y cord), Figure 5, into amplifier receptacle P, Figure 5. Plug other end of Y cord into a wall or extension cord receptacle supplying *115-volt, 50- to 60-cycle alternating current.*

Since the Filmosound draws 11 amperes, it should be connected to a line fused at 15 amperes or more. If other appliances are connected on the same line and the total current drawn by appliances and Filmosound exceeds the rating of the fuse in that line, either connect Filmosound to another source, transfer some appliances to another line, or disconnect them while Filmosound is in use.

Preparing to Operate. Attach feed reel arm HR, Figure 6, at the top front of the projector case with the thumb screw on the inside of the case at that point. Attach take-up reel arm JS, Figure 6, at the upper rear of the projector case, using the thumb screw on the inside of the case at that position.

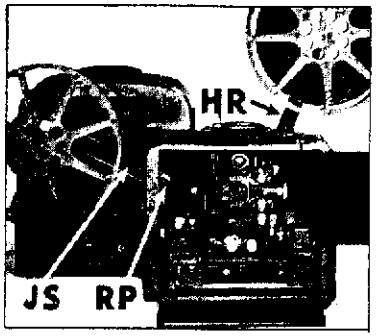
Loop the front spring belt, without a twist, over the feed reel arm pulley at the top of feed reel arm HR, Figure 6, on the side opposite the spindle. Loop rear spring belt, without a twist, from drive pulley RP, Figure 6, to take-up pulley Q, Figure 7.

Remove the projection lamp as instructed in the paragraph on "Projection Lamp Replacement" and check its voltage; if voltage of lamp does not match that of voltage to be used, replace the lamp with another of the correct voltage.

Set direction switch DS, Figure 8, at FORWARD; set sound-silent switch SS, Figure 8, at SOUND. If silent

Figure 6

HR	**Feed reel arm**
JS	**Take-up reel arm**
RP	**Take-up drive pulley**



film is to be projected, see paragraph on "Projecting Silent Film," page 15.

Open the small door in the case in front of the projection lens. Turn on projector switch PS, Figure 8, and lamp switch LS, Figure 8; turn clutch control X, Figure 8, to the extreme clockwise position. If the projector electrical connections have been correctly made, the film moving mechanism should now operate and a beam of light be projected on the screen.

Move the projector on its stand or table to such a position that the projected beam coincides with the screen. Tilt the projector up, if necessary, by turning tilt adjustment knob TN, Figure 8, in a clockwise direction.

If the projected image is larger than the screen, move the projector closer.

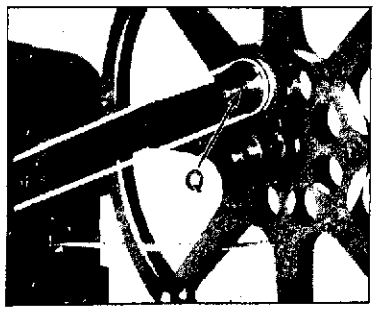
If the image is too small, move the projector farther from the screen.

If room size limits the throw, select the correct lens as indicated in the table of projected picture sizes on page 14.

With the projector operating and the lamp turned on, loosen lens locking screw LL, Figure 8, and slide the lens L, Figure 8, forward or backward in its carrier until the outlines of the aperture or frame are sharply defined. To further sharpen focus, revolve the lens first in one direction and then in the other. When the point of maximum sharpness is found, tighten lens locking screw LL, Figure 8, securely.

Figure 7

Q Take-up pulley



Place projector switch PS, Figure 8, in the OFF position. Set power speaker line switch ND, Figure 3, at ON. If the speaker electrical connections have been made correctly, glow lamp GL, Figure 3, will now light up to indicate that the amplifier is operating. Set volume control SV, Figure 3, midway between the 7 and 8 marks, for average acoustical conditions. The sound volume may now be controlled by the projector volume control. If more than one power speaker is being used, turn on each speaker and set the volume control as above.

Set amplifier switch G, Figure 8, at ON. Allow about one minute for the tubes to heat; then, move volume control V, Figure 8, in a clockwise direction until a hiss is heard in the speaker(s). At the same time a light should be seen from behind exciter lamp cover Z, Figure 8. If these conditions exist, electrical connections and other adjustments have been made correctly.

Since the power speaker volume control setting may require adjustment to give best coverage of the area, it is recommended that the Filmosound and power speaker(s) be set up and checked in advance of the actual showing.

At that time, with the Filmosound threaded with sound film and speaker and projector amplifiers operating,

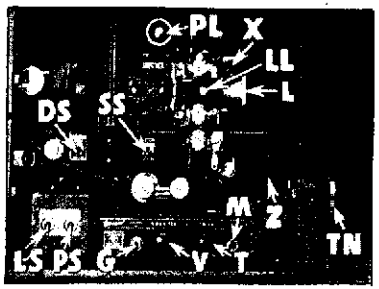


Figure 8

DS	Direction switch
G	Amplifier switch
L	Lens
LL	Lens locking screw
LS	Lamp switch
M	Microphone jack
PL	Pilot light
PS	Projector switch
SS	Sound-silent switch
T	Tone control
TN	Tilt adjustment knob
V	Volume control
X	Clutch control
Z	Exciter lamp compartment cover

the operator should check, by ear, the sound volume at various points in the room. If, with the speaker volume control set midway between the 7 and 8 marks and the projector volume control at or close to its minimum position, the sound volume is too great, set the speaker volume control at a lower point. Do not set the speaker volume control at a point lower than the 1 mark since the sound will then be almost inaudible even with the projector volume control at the maximum position. If, with the speaker volume control set midway between the 7 and 8 marks and the projector volume control at or close to its maximum position, the sound volume is not sufficient, set the speaker volume control at a higher point or the 10 position.

Once the best volume control setting of the speaker(s) has been found, adjustment of the projector volume control at the start of or during the show will handle any necessary compensation for acoustics altered by the presence of an audience.

When the projector has been set up and checked and the speaker volume adjusted, the Filmosound is ready for threading.

Threading the Film

With all projector and power speaker controls in the OFF position and clutch control X, Figure 8, turned to the extreme counter-clockwise position, place the first reel, or a practice reel, of film on the spindle of feed reel arm HR, Figure 6, and an empty reel on the spindle of take-up reel arm JS, Figure 6. Press each reel firmly on the spindle until the small retaining spring-balls lock the reels in position

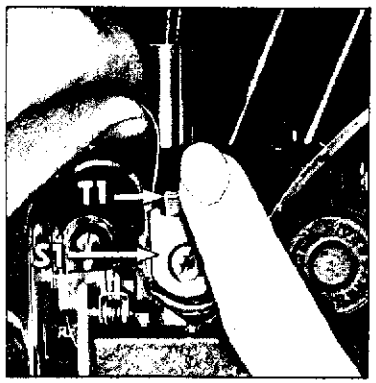


Figure 9

S1	Sprocket
T1	Sprocket tab

Figure 10

A	Gate lever
B	Hand setting knob

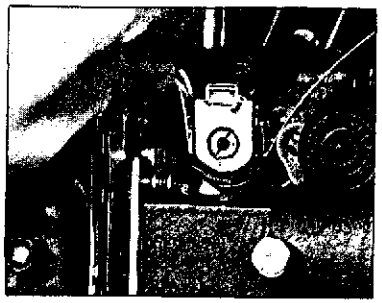


Figure 11

on the spindles. Pull off about four feet of leader film for threading.

NOTE: To provide illumination for threading film in a darkened room, pull pilot light cap PL, Figure 8, forward.

The film, if correctly wound, should feed from the front of the reel with the perforated edge toward the operator and the emulsion (dull) side out. (Exception: Duplicates from original reversal film, prints of 16mm negatives and Kodachrome films are wound and projected with emulsion side in.)

Slip the film into the slot at the base of feed reel arm HR, Figure 6, and between the two guide rollers. Lead the film over roller and below sprocket S1, Figure 9. Slide the film as far toward the machine as it will go. Holding the film snugly around the sprocket, press on tab T1, Figure 9, to open the guard. Pull gently on the film until the perforations seat over the sprocket teeth. Then release tab T1, locking the film on the sprocket.

Swing film gate lever A, Figure 10, upward to open the film gate. Form the first loop, following the outline on the side of the gear case, as shown in Figure 11. Pass the film through the channel behind the lens as in Figure 11, being certain that it is fully seated in this channel. Then close the film gate by pressing down film gate lever A, Figure 10, as far as it will go. Form the second loop, conforming to the outline on the gear case, and slip the film over sprocket S2, Figure 12. Slide the film as far toward the machine as it will go. Holding the film snugly around the sprocket, press on tab T2, Figure 12, to open the guard. Pull gently on the film until the perforations seat over the sprocket teeth. Then release tab T2, locking the film on the sprocket. Turn clutch control X, Figure 8, to the extreme clockwise position; then, turn hand setting knob B, Figure 10, several

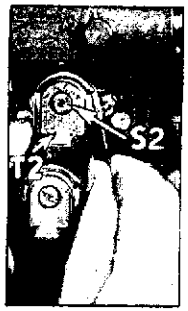


Figure 12

S2	Sprocket
T2	Sprocket tab

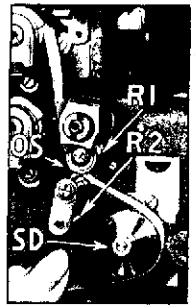


Figure 13

OS	Oscillatory Stabilizer
R1	Stabilizer roller
R2	Stabilizer roller
SD	Sound drum

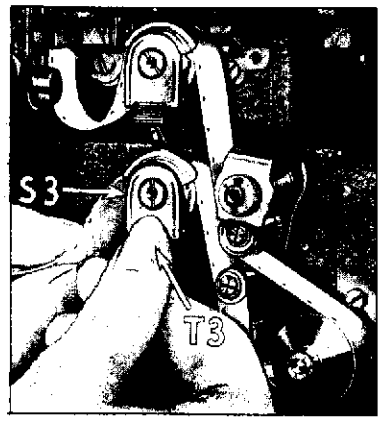
clockwise revolutions to engage the film with the shuttle teeth. Should the lower loop slide upward, open the gate and reset the loop to the outline on the gear case. Close the gate, and test the threading again by using the hand setting knob. Turn clutch control X, Figure 8, to the extreme counter-clockwise position.

Lead the film from under sprocket S2, Figure 12, under roller R1, Figure 13, around sound drum SD, Figure 13, under roller R2, Figure 13, and over sprocket S3, Figure 14. Press the film as far toward the projector as it will go, over the sprocket.

Pull down gently on the film as it passes over the sprocket until the Oscillatory Stabilizer OS, Figure 13, is moved to its extreme position by the tension on the film. Then, open the sprocket guard by pressing on tab T3, Figure 14. Free the film just sufficiently to permit the Oscillatory Stabilizer to pull it back to the first

Figure 14

S3 Sprocket
T3 Sprocket tab



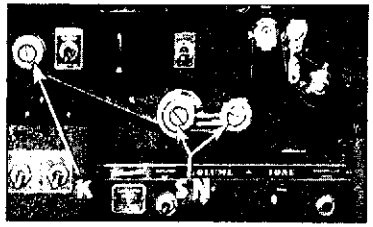


Figure 15

K Rear idler roller
SN Snubber

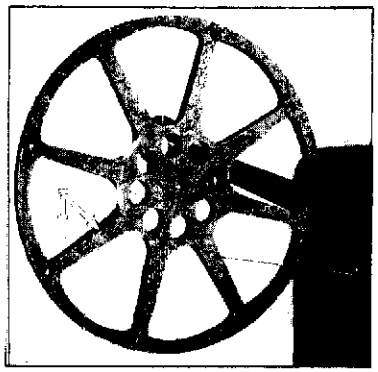
available set of perforations, and release tab T3 to lock film on sprocket. Pass the film under snubber SN and rear idler roller K, Figure 15, into the slot at the base of the take-up reel arm, and between the two guide rollers. Place the film around the bottom of the take-up reel I, Figure 16, and revolve reel to remove film slack.

No special precautions need be observed to synchronize the sound to the picture since adherence to the foregoing instructions will assure correct synchronization.

The mechanism on the take-up reel arm is a combination take-up and re-

Figure 16

I Take-up reel



wind device. Set it for take-up by pressing lever U, Figure 17, while the reel is on the spindle. No adjustment or compensation is necessary for various reel sizes, since the flat fabric belt between pulleys Q and Q1, Figure 17, provides complete and automatic compensation without any adjustments.

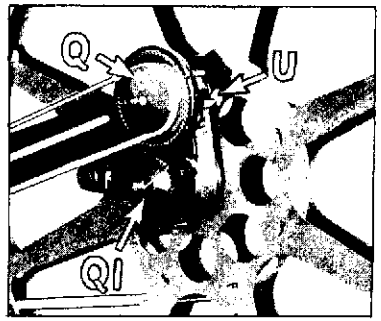


Figure 17

Q Take-up pulley
Q1 Spindle pulley
U Take-up lock lever

Before projecting, you must be able to answer "yes" to the following questions:

1. Have you read, and carefully followed, the preceding instructions?
2. Have you checked the aperture, removable gate shoe, and optical components to see if they need cleaning? (See pages 25-27.)
3. Are both film loops of the correct size?
4. Is the film properly engaged on sprockets S1, S2, and S3?
5. Have you tested the threading by turning the hand setting knob B or by *momentarily* turning on the motor?
6. Is the film gate closed?
7. Is the film properly started on take-up reel I, with all film slack removed?
8. Is the take-up reel arm mechanism set to *take up* film?
9. Is direction switch DS set at FORWARD?
10. Is sound-silent switch SS set for the type of film, sound or silent, to be projected?
11. Is the power supplied to Filmosound and power speaker 115-volt, 50- to 60-cycle alternating current? (Or have you correctly connected the polarity changers or converters for operation on direct current?)
12. If projecting sound film, are projector and speaker amplifier switches set at ON?
13. If using a microphone with silent film, is projector amplifier switch G set at ON?
14. Have you correctly adjusted the power speaker volume control setting?
15. Have you learned from the ensuing pages of this manual: How to use a microphone and turntable; how to use the still picture clutch and tone control; how to rewind film; how to operate the Filmosound in reverse?

(After you have become adept at threading the film through the mechanism, turn on projector and speaker amplifiers before threading. The amplifier tubes will then warm up to the proper operating temperature, so that sound projection can be started as soon as threading is completed.)

Projected Picture Sizes Obtained with Filmo Projection Lenses

LENS FOCAL LENGTH	DISTANCE IN FEET FROM SCREEN TO FILM														
16mm Projector	8′	10′	12′	15′	20′	25′	30′	35′	40′	45′	50′	60′	75′	100′	125′	150′
	WIDTH AND HEIGHT OF PICTURE															
	Upper Dimension is Width of Picture Lower Dimension is Height of Picture															
5/8″	4′9″ 3′6″	5′11″ 4′5″	7′2″ 5′4″	9′0″ 6′8″	12′0″ 8′11″											
3/4″	3′11″ 2′11″	4′11″ 3′8″	5′11″ 4′5″	7′6″ 5′7″	9′11″ 7′5″	12′6″ 9′3″										
1″	2′11″ 2′2″	3′8″ 2′9″	4′5″ 3′4″	5′7″ 4′2″	7′5″ 5′7″	9′4″ 6′11″	11′3″ 8′4″	13′1″ 9′9″								
1 1/2″	1′11″ 1′5″	2′5″ 1′10″	2′11″ 2′2″	3′8″ 2′9″	4′11″ 3′8″	6′2″ 4′7″	7′6″ 5′7″	8′9″ 6′6″	10′0″ 7′5″	11′3″ 8′4″	12′6″ 9′4″					
2″		1′10″ 1′4″	2′2″ 1′8″	2′9″ 2′1″	3′8″ 2′9″	4′8″ 3′5″	5′7″ 4′2″	6′6″ 4′10″	7′5″ 5′7″	8′5″ 6′3″	9′4″ 6′11″	11′3″ 8′4″	14′0″ 10′5″	18′9″ 13′11″	23′5″ 17′6″	28′2″ 21′0″
2 1/2″		1′5″ 1′1″	1′9″ 1′3″	2′2″ 1′8″	2′11″ 2′2″	3′8″ 2′9″	4′5″ 3′4″	5′3″ 3′11″	5′11″ 4′5″	6′8″ 5′0″	7′5″ 5′7″	9′0″ 6′8″	11′3″ 8′4″	15′0″ 11′2″	18′9″ 13′11″	22′6″ 16′9″
3″						3′1″ 2′3″	3′8″ 2′9″	4′4″ 3′3″	4′11″ 3′8″	5′7″ 4′2″	6′2″ 4′7″	7′5″ 5′7″	9′4″ 6′11″	12′6″ 9′3″	15′7″ 11′7″	18′9″ 14′0″
3 1/2″						2′7″ 1′11″	3′2″ 2′4″	3′8″ 2′9″	4′3″ 3′2″	4′9″ 3′7″	5′4″ 3′11″	6′5″ 4′9″	8′0″ 5′11″	10′8″ 7′11″	13′4″ 9′11″	16′1″ 12′0″
4″						2′3″ 1′8″	2′9″ 2′1″	3′3″ 2′5″	3′8″ 2′9″	4′2″ 3′1″	4′8″ 3′5″	5′7″ 4′2″	7′0″ 5′2″	9′4″ 6′11″	11′8″ 8′8″	14′0″ 10′5″

Operation

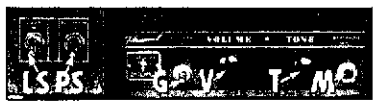
Projecting Sound Film. With projector and speaker amplifiers operating (or projector amplifier alone when using power speaker as regular speaker) and the volume control V, Figure 18, about one-quarter on, turn off pilot light PL, Figure 8, by pushing cap back and place projector switch PS, Figure 18, in the ON position. Immediately after the motor has started, place lamp switch LS, Figure 18, in the ON position and turn clutch control X, Figure 19, to extreme clockwise position.

With the projector operating and the lamp on, loosen lens locking screw LL, Figure 19, and slide lens L, Figure 19, forward or backward in its carrier until the outlines of the aperture or frame are sharply defined. To further sharpen focus, revolve the lens first in one direction and then in the other until the point of maximum sharpness is found. Lock lens in position by turning lens locking screw LL, Figure 19, in a clockwise direction until tight.

If the picture frame line shows on the screen, turn framer knob E, Figure 19, to make the frame line disappear. If framing moves the picture off the screen, readjust tilt adjustment knob TN, Figure 8.

Figure 18

G Amplifier switch
LS Lamp switch
M Microphone jack
PS Projector switch
T Tone control
V Volume control



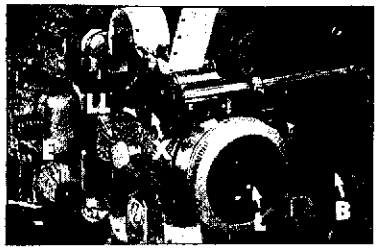


Figure 19

B Hand setting knob
E Framer control
L Lens
LL Lens locking screw
X Clutch control

The volume control V, Figure 18, operates similarly to volume controls on radio sets. Advance or retard it as necessary to produce the desired volume of sound. (See also the paragraphs on power speaker volume control setting, page 9.)

The tone control T, Figure 18, is also operated similarly to a tone control on a radio receiver. By means of this control, frequency range can be compensated for in accordance with the acoustical conditions under which the equipment is being used. At each showing set it for the most desirable reproduction.

Project the first reel, or the practice reel, in its entirety. Run it over again, as necessary, until you are thoroughly familiar with every phase of operation and threading.

As "The End" title appears on the screen, place lamp switch LS, Figure 18, in the OFF position and, as the end of the narration or music is reached, retard volume control V, Figure 18, until no sound is heard. Run the remaining trailer of film completely through the machine.

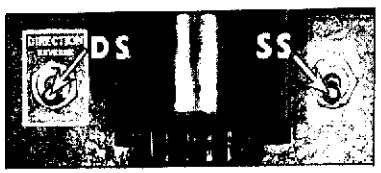
Projecting Silent Film. To project silent film, thread the machine in the usual way. Set sound-silent switch SS, Figure 20, at SILENT. Do not turn on projector or speaker amplifier unless oral comments are to be made through the speaker by means of a microphone, or musical accompaniment is to be reproduced by means of a turntable. Turn off pilot light. Set projector and lamp switches and adjust focus and framing as for sound film.

If using a microphone, adjust volume control V, Figure 18, until the most pleasing sound volume is attained. If using a B&H turntable, adjust turntable volume control for best results under existing acoustical conditions.

Still Picture Projection. To project a single film frame as a still picture, turn clutch control knob X, Figure 19, one full counter-clockwise revolution, which disengages the projector mechanism. If no picture appears on the screen, the closed section of the shutter is obscuring the light. Turn hand setting knob B, Figure 19, slightly to bring the open section of

Figure 20

DS Direction switch
SS Sound-silent switch



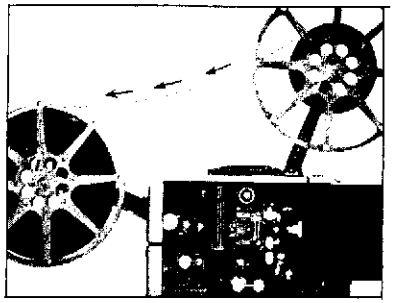


Figure 21

the shutter into correct position. Adjust the lens to focus the still picture; re-focus when motion is resumed.

Reversing. Retard volume control V, Figure 18, until the sound is inaudible. Stop the film by disengaging clutch control knob X, Figure 19, or by placing projector switch PS, Figure 18, in the OFF position. When the mechanism has stopped, set direction switch DS, Figure 20, at REVERSE. The lamp may be on or off, as desired.

NOTE: Always stop projector mechanism before changing film direction.

Rewinding. Remove the take-up reel, which has now received the entire film, and the empty feed reel from their spindles and interchange the two reels. Lead the end of the film over the top of the empty reel so that the film travel appears as in Figure 21. Press take-up lock lever U, Figure 17, and lift take-up reel as far as it will go to engage the rewind gears. Then, while still holding the reel in the lifted position, release pressure on lever U, to lock the assembly in rewind position. The take-up arm gears will then appear as in Figure 22.

Place direction switch DS, Figure 20, at FORWARD, place projector switch PS, Figure 18, in the ON position, disengage clutch control knob X, Figure 19, and allow the motor to run until all of the film has been rewound on the original reel.

Immediately after rewinding and before removing the loaded reel, press lever U, Figure 17, to restore the assembly to the take-up position.

When only a portion of a reel has been projected and must be rewound, unthread the projector and interchange the two reels. Then proceed with rewinding in the usual way.

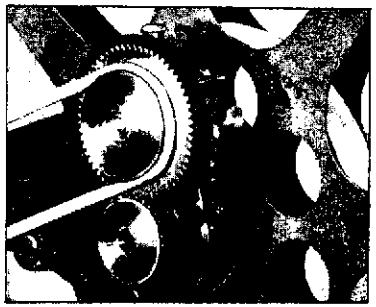
NOTE: No twisting, changing or removing of any belt is necessary when rewinding or taking up film.

Microphone. A high-grade crystal or high-impedance dynamic microphone may be used with your Filmosound. Slip the end of the microphone cable beneath the projector case into the opening between case and amplifier base, so that both case doors may be closed if desired.

Insert the microphone plug into jack M, Figure 18, and turn on projector and speaker amplifiers (or projector amplifier alone when using power speaker as a regular speaker); adjust the volume to the desired level

Figure 22

Gears on take-up arm locked in rewinding position



by means of projector volume control V, Figure 18. While the microphone remains connected to the Filmosound, the exciter lamp is automatically disconnected. Therefore, when the microphone is *not* in use, remove the microphone plug from jack M in order that sound from film may again be heard.

Phonograph Turntables or Transcription Players. Any phonograph turntable with a sapphire stylus, crystal pick-up, or a high-impedance magnetic pick-up arm may be used with the Filmosound provided that it has an independent volume control.

Set turntable volume control at the minimum position, insert turntable plug into jack M, Figure 18, and set projector volume control at the maximum position. Turn on projector and speaker amplifiers (or projector amplifier alone when using power speaker as a regular speaker). Adjust turntable volume control for the best results under existing acoustical conditions.

Polarity Changer. When a polarity changer is being used with the projector, plug the polarized flat arm of the Y cord into polarity changer receptacle W, Figure 23. Connect the male end of the Y cord to a current supply receptacle; either alternating or direct current may be supplied to the polarity changer through this cord *provided that current is 115-volt.* Plug the round arm of the cord into projector receptacle PR, Figure 23. The polarity changer is connected to the projector amplifier by a cable, one end of which is wired permanently into the polarity changer. Plug the other end, polarized flat plug VS, Figure 23, into amplifier receptacle P, Figure 23. When the above connections have been made, operation is the same as for Filmosounds not so equipped.

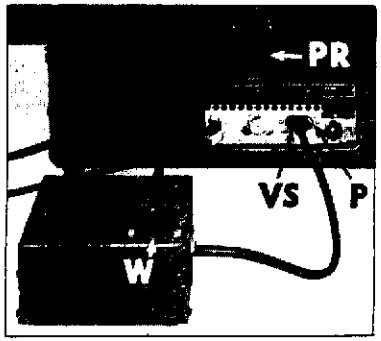


Figure 23

P Projector amplifier receptacle
PR Projector receptacle
VS Polarity changer plug
W Polarity changer receptacle

When a polarity changer is being used with the power speaker, insert the polarized flat plug VS, Figure 24, of the polarity changer cable into power speaker receptacle KR, Figure 24. Plug the polarized flat plug MG, Figure 24, of the power speaker line cord into polarity changer receptacle W, Figure 24; either alternating or direct current may be supplied to the polarity changer through this cord *provided that current is 115-volt.*

Operation on 115-volt Direct Current, without Polarity Changer. If the projector and/or power speaker amplifier is to be operated on direct current *without the use of a polarity changer(s)*, a DC to AC converter having a capacity of 100 watts is necessary for the operation of *each amplifier.* The film-moving mechanism will operate on either alternating or direct current without any changes.

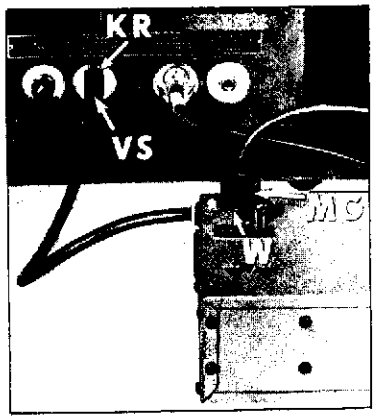


Figure 24

KR	**Power speaker receptacle**
MG	**Power speaker line cord plug**
VS	**Polarity changer plug**
W	**Polarity changer receptacle**

Connect the converter to the direct current outlet with a line cord. Connect the female end of a second line cord to projector receptacle PR, Figure 5, and the male end to one socket of the direct current outlet. Plug the male end of the Filmosound Y cord into the AC output of the converter and the flat arm AP, Figure 5, into amplifier receptacle P, Figure 5.

When using the power speaker amplifier, without polarity changer, on direct current, connect a second converter to the direct current outlet with a line cord. Connect the male end of the power speaker Y cord into the AC output of the converter and the flat arm of the Y cord into power speaker receptacle KR, Figure 2.

When correctly positioned and connected, the units will appear as in Figure 25. Operation is the same as for alternating current.

Operation on 220-volt, 50- to 60-cycle Alternating Current. When the Filmosound and/or its power speaker is to be operated on 220-volt alternating current, a 1500-watt, 220- to 115-volt transformer is required. Plug the 220-volt side of the transformer into the alternating current outlet. Connect the female ends (AP and FP, Figure 5) of the projector Y cord to the projector as for normal operation (see "Electrical Connections—Projector"). Connect power speaker line cord to speaker as for normal operation. Plug male ends of Y cord and speaker line cord into a double socket; plug double socket into 115-volt side of transformer. Operation is the same as for *115-volt alternating* current.

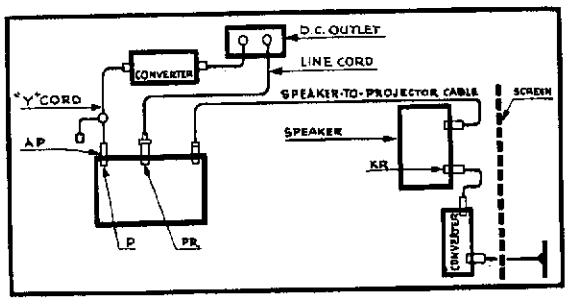


Figure 25
Arrangement and connection of Filmosound units without polarity changer for operation on 115-volt DC

Operation on 220-volt Direct Current. The Filmosound and/or power speaker may be operated on 220-volt, or varying, direct current by the addition of a special B&H 130-250 volt adjustable rheostat. Rheostat operating instructions are furnished with each unit.

Public Address System. To use the speaker and amplifier of your Filmosound, in conjunction with a microphone or turntable, as a public address system, remove the amplifier from the projector as instructed on page 29 under "Tube Replacement." Remove photocell PE, Figure 34, from the projector amplifier, place the B&H Amplifier Cover over the amplifier and fasten it to the amplifier base with the four screws which held the amplifier in the projector. Add the rubber feet supplied with each cover.

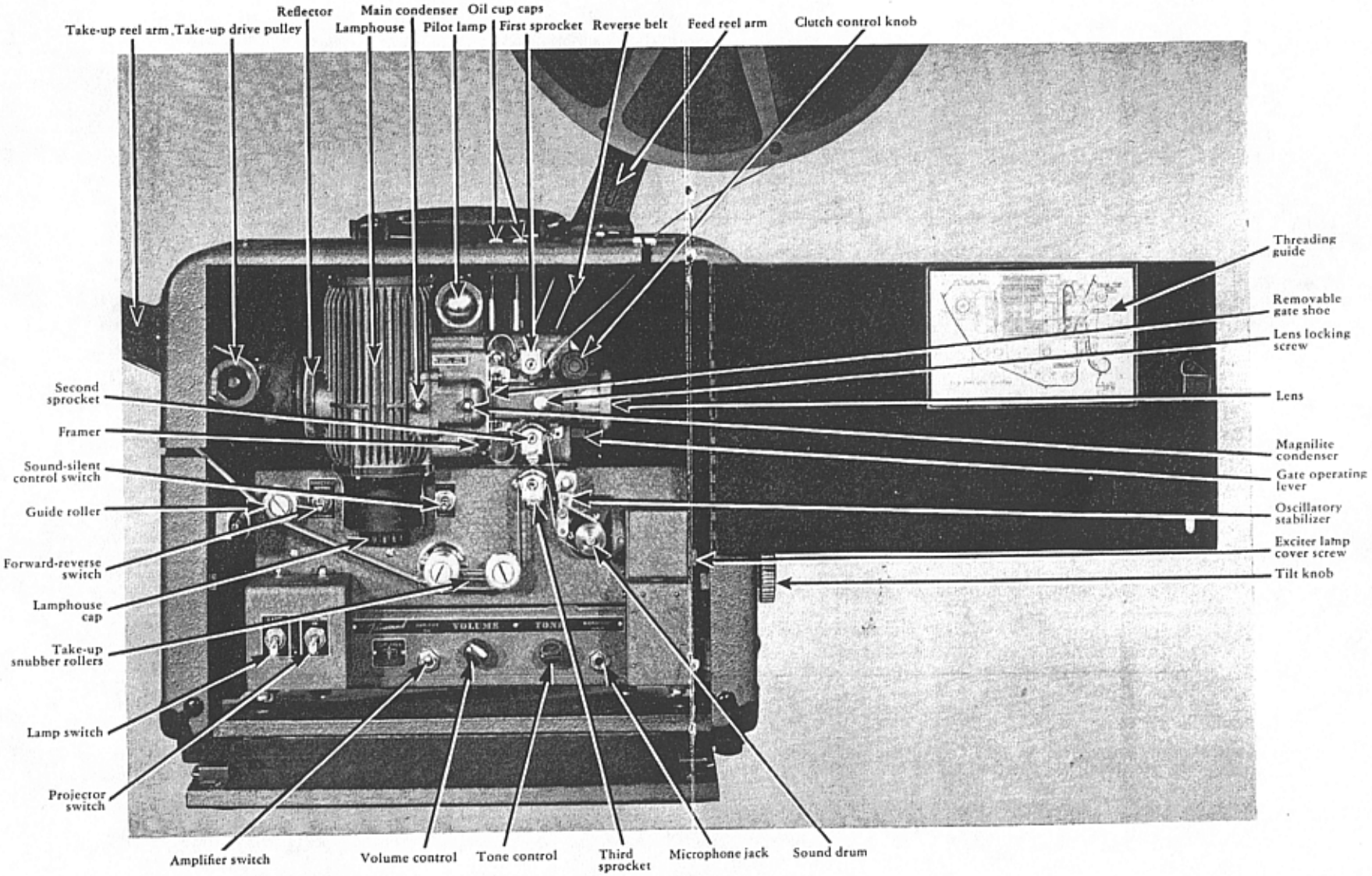
Connect speaker and microphone or turntable to projector amplifier in the usual way; connect projector and power speaker amplifiers (or projector amplifier alone when using power speaker as regular speaker) to power supply. Turn on projector and speaker amplifiers (or projector amplifier alone when using power speaker as a regular speaker). When using a microphone, adjust the sound to the most pleasing volume for the existing acoustical conditions by advancing or retarding the projector volume control. When using a turntable, connect the unit and adjust the sound volume as instructed on page 17 under "Phonograph Turntables or Transcription Players."

With either setup, it is recommended that the units be positioned and tested in advance of their use. It may be necessary at that time to adjust the tone control to eliminate frequency noises resulting from adverse acoustical conditions. Further slight adjustments of volume and tone control settings may be necessary when the program begins, since the presence of a large number of people will alter the acoustics somewhat, but the adjustments may be made without interrupting the program.

When the program is over, disconnect cables, remove amplifier cover, and return the photocell to position on the amplifier. Return amplifier to position in the projector; reconnect exciter lamp lead wire and tighten amplifier retaining screws securely.

Projection Defects and Remedies

Defect	Remedy
1. Filmosound will not operate.	1. a. Check to see that current supply cord is correctly connected to wall receptacle or extension cord outlet. b. Test current outlet with ordinary lamp or other device known to be in working order to see if current is supplied to outlet.


Take-up reel arm
Take-up drive pulley
Reflector
Lamphouse
Main condenser
Pilot lamp
Oil cup caps
First sprocket
Reverse belt
Feed reel arm
Clutch control knob
Threading guide
Removable gate shoe
Lens locking screw
Lens
Magnilite condenser
Gate operating lever
Oscillatory stabilizer
Exciter lamp cover screw
Tilt knob
Second sprocket
Framer
Sound-silent control switch
Guide roller
Forward-reverse switch
Lamphouse cap
Take-up snubber rollers
Lamp switch
Projector switch
Amplifier switch
Volume control
Tone control
Third sprocket
Microphone jack
Sound drum

2. Exciter lamp does not light and no sound is heard from speaker.	2. a. Check speaker cable connections at speaker and Filmosound. b. Check to see if projector amplifier switch is in the ON position. c. Check to see if fuse in projector amplifier is blown. d. Check to see that microphone plug has been removed from jack on Filmosound. e. Check to see that exciter lamp lead wire is connected. f. Check to see if exciter lamp is burned out. If so, replace lamp. g. Check to see that projector amplifier tubes are correctly seated in correct sockets. h. Replace projector amplifier tubes with a complete new set.
3. Exciter lamp lights but no sound is heard from speaker.	3. a. Advance volume control slightly. b. Check to see that power speaker has been connected to current supply and to Filmosound, or that power speaker has been correctly connected for use as a regular speaker and to Filmosound. c. Check to see that power speaker amplifier has been turned on and that speaker volume control has been set above the 0 position. d. Check to see if fuse in power speaker amplifier is blown. e. Check film threading. f. Check to see that grid clip is connected to cap on top of 6J7 tube in projector amplifier. g. Clean lens and mirror of sound optical system to remove dirt. h. Check position of exciter lamp damping shell. Opening in shell may not be opposite optical slit. i. Sound may be missing from film; to prove that defect lies in film and not with Filmosound, proceed as follows: Remove the film and turn on the amplifier. Turn volume control to maximum position. Pass a card swiftly back and forth between sound lens and sound drum. If a loud "thumping" noise is heard from the speaker, the Filmosound itself is operating properly and the sound is missing from the film. j. Replace projector amplifier tubes with a complete new set. k. Check to see that power speaker amplifier tubes are correctly positioned in correct sockets. l. Replace power speaker amplifier tubes with a complete new set.
4. Sound volume is not adequate.	4. a. Advance volume control toward maximum position. b. Change power speaker volume control setting. c. Check to see that line current supplied to projector and power speaker is of the correct voltage. d. Check to see if film is clean. Dirty or poorly made film will not give the full sound volume. e. Clean lens and mirror of sound optical system to remove any dirt or dust. f. Check exciter lamp. If defective, replace; if incorrectly positioned, remove and replace correctly, wiping off dirt or fingerprints.

	g. Replace tubes of projector and power speaker amplifiers with complete new sets.
5. Sound quality is unsatisfactory.	5. a. Check to see that sound-silent switch is set at SOUND. b. Check to see that amplifier is firmly fastened in projector. c. See other remedies given for defect No. 4 (see preceding page).
6. No picture appears on screen.	6. a. Open door in front of projection lens. b. Check to see that projector and lamp switches are in the ON position. c. Check to see that current supply cord is correctly connected at wall receptacle and Filmosound. d. Check to see if projection lamp is burned out. If so, replace with another of correct voltage.
7. Picture brilliance seems insufficient.	7. a. Check to see that all windows and other light sources are properly covered or extinguished. b. Check to see that current supply is of the correct voltage. c. Darken room until screened picture seems brighter. d. Clean projection lens, condensers, and reflector; remove any dirt from projection lamp. e. Check to see if projection lamp has become excessively blackened. Effective lamp life may terminate before lamp actually burns out. Replace lamp if necessary.

Maintenance

Projection Lamp Replacement. Your Filmosound is equipped with a lamp of the voltage common to most communities. The next lamp you buy should be rated at the voltage of your line current. Using a lamp at higher than its rated voltage gives increased brightness but shorter life; at lower than rated voltage, increased life but lower illumination.

To replace a projection lamp, with projector switch PS, Figure 18, in the OFF position, unscrew the cap at the bottom of the lamphouse and allow the burned-out lamp to slide out into the hand, as in Figure 26. If the lamp is being replaced during a show, be careful as the lamp slides down to grasp it by the relatively cool prealignment gauge ring. This operation should be performed quickly, since a moment or two after the lamp is disengaged from the socket, the prealignment gauge ring, acting as a cooling flange, becomes quite warm.

Insert the new lamp with the vertical tongue on the prealignment gauge ring toward the front of the projector and revolve it slightly one way or the other until the tongue settles into the prealignment gauge slot in the bottom of the lamphouse.

Replace the screw cap, making sure that it screws in squarely and tightly to lock the lamp in proper position.

Never attempt to change a lamp with the current on.

Since the lamp is designed to burn base down, the machine must not be turned upside down or laid on its side while the lamp is lighted.

Cleaning Optical and Film Handling Parts. At any time that seems necessary, clean: (1) projection lens, (2) removable gate shoe, (3) field flattener (if shoe is so equipped), (4) aperture, (5) film channel, (6) condensers, (7) lens and mirror of sound optical system, and (8) reflector.

To remove the projection lens L, Figure 27, for cleaning, loosen lens locking screw LL, Figure 27, and pull forward on the lens barrel. The front and rear elements are then accessible for cleaning. If only a slight amount of dust has accumulated, remove with

Figure 26
Lamp replacement

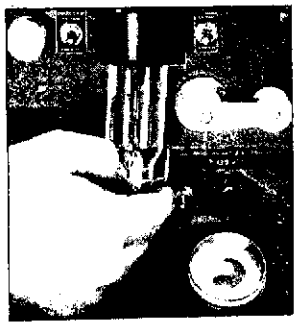
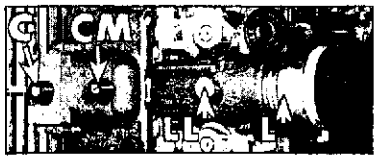


Figure 27

C Main condenser
CM Magnilite condenser
L Lens
LL Lens locking screw



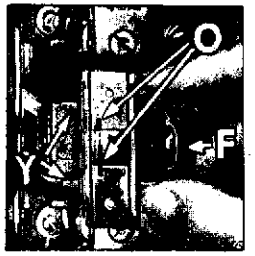


Figure 28

F Removable gate shoe frame
O Openings
Y Guides

Filmo lens cleaning tissue. If, however, fingerprints, oil, grease, or other accumulations of dirt are present, wipe B&H Lens Cleaning Fluid on the lens surfaces and follow with a thorough cleaning with lens cleaning tissue. *Use B&H Lens Cleaning Fluid only—use no other cleaning agent as it may damage the Filmocoted surfaces.*

While the lens is out of position, clean the removable gate shoe, field flattener (if shoe is so equipped), aperture, and film channel. To remove the gate shoe for cleaning, grasp the metal frame F, Figure 28, and withdraw. *Use no tools!* Clean and polish with a soft cloth. If dirt or emulsion has gathered and hardened on the shoe, remove by rubbing with a soft dampened cloth. To avoid scratching polished surface, *use no sharp tools.*

If the removable gate shoe is equipped with a field flattener (or optical element), clean the element in the same manner as the projection lens. *Do not remove the field flattener (or optical element) from the gate shoe.* Using the brush supplied with the projector, clean the small openings O, Figure 28, in the shoe, above and below the field flattener.

To clean the aperture, insert the brush supplied with the projector through the lens carrier and into the aperture, *being careful to stop forward motion of the brush at the first sign of contact with the safety shutter.* Slowly withdraw the brush, turning it in a clockwise and counter-clockwise direction to remove all dust and dirt.

Clean the film channel by opening the gate and inserting the brush into the channel in a vertical position. With the gate partially closed, move the brush up and down to remove all dirt and emulsion. *The machine must not be running.*

To return the removable gate shoe to position, place the guides Y, Figure 28, in the grooves formed by the metal plate attached to the back of the lens carrier and push the shoe inward. An audible click will be heard when the metal frame F, Figure 28, is correctly positioned.

Close film gate, return lens to position in carrier, and tighten lens locking screw LL, Figure 27, securely.

Remove the main condenser C, Figure 27, and the Magnilite condenser CM, Figure 27, from the projector for cleaning by pulling on the holder handle. Clean in the same manner as the lens and return to position.

To expose the lens and mirror of the sound optical system for cleaning, remove the exciter lamp compartment cover Z, Figure 8, as instructed in the paragraph, "Exciter Lamp Replacement." One face of the lens is exposed within the exciter lamp compartment and the other toward the sound drum; the mirror can be seen by looking down behind the sound drum from in front of and above the Filmosound. Clean both lens surfaces and the mirror with Filmo lens cleaning tissue wrapped around the end of a toothpick—*use no other materials. NEVER attempt to remove or adjust the lens of the sound optical system.*

To expose the reflector for cleaning, turn the holder BC. Figure 29,

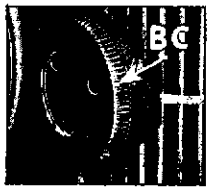


Figure 29

BC Reflector holder

counter-clockwise until it may be removed from the projector. Clean the reflector in the same manner as the projection lens and return holder to position; tighten securely. The reflector is factory-adjusted.

Projector Lubrication. Correct lubrication will assure long, trouble-free life of the Filmosound; lack of oil will result in serious damage.

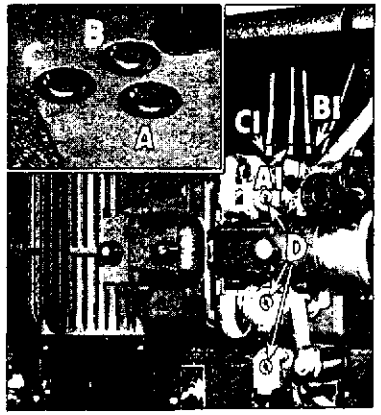


Figure 30

A B C Oil cup caps
A1 B1 C1 Matching oil cups
D Sprocket oil holes

The projector is properly lubricated when it leaves the factory.

For ease in lubrication as indicated in the chart below, your Filmosound is equipped with flexible tubes leading from oil cup caps A, B and C, Figure 30, on outside of projector case to oil cups A1, B1 and C1, Figure 30, on gear case assembly.

Lubrication Chart *(See Figure 30)*

	Silent Speed	*Sound Speed*
Oil Cup A1	One drop of Filmo Projector Oil after each 8 hours of operation.	One drop of Filmo Projector Oil after each 4 hours of operation.
Oil Cups B1 and C1	One drop of Filmo Projector Oil after each 32 hours of operation.	One drop of Filmo Projector Oil after each 16 hours of operation.
Oil Holes D	Saturate felt reservoirs every 6 months.	Saturate felt reservoirs every 3 months.

When preparing to remove projector from case, disconnect tubes by bending each tube toward you enough to permit pulling lower end out of oil cup. When projector has been returned to case, bend each tube as necessary to reinsert tube from oil cup cap A into oil cup A1, tube from B into B1, and tube from C into C1. To saturate the felt reservoirs within the sprocket shafts, disconnect the projector from the line current and speaker, and lay it on its side. Insert the tip of the Filmo oil can in the holes D, Figure 30, and squeeze the sides of the oil can 3 times.

After every 100 hours of use, remove thumb screw cap GG, Figure 31, and add Bell & Howell reel arm grease as necessary to grease cup EE, Figure 31. Replace cap and tighten securely. After every 100 hours of operation, place one drop of oil on shafts of snubber SN and roller K, Figure 15, and on the shafts of the rollers at base of each reel arm, where film enters and leaves projector case.

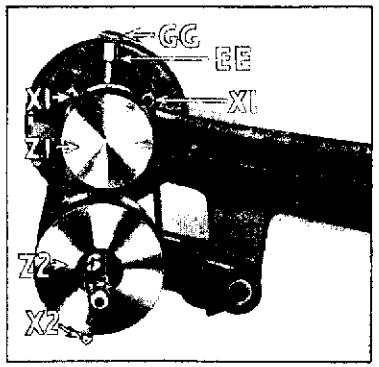
Spring Belt Replacement. To replace the belt on the feed reel arm HR, Figure 6, unhook the belt at the joining and draw it out of the projector and case. Insert one end of the new belt into the slot at the base of the feed reel arm and down into the feed drive pulley slot in the gear case. Push the belt into this slot until the end, having wound itself around the concealed pulley, reappears at the opposite edge of the slot. Pull the end up, lead it through the slot at the base of the feed reel arm, and hook the two ends together to form a continuous belt. Place the belt, without a twist, around the pulley on the feed reel arm.

To replace a spring belt on take-up reel arm JS, Figure 6, unhook the belt at the joining and draw it out of the projector and case. Insert one end of the new belt into the slot at the base of the take-up reel arm, place the belt around take-up drive pulley RP, Figure 6, and lead it out of the slot. Hook the two ends together to form a continuous belt and place the belt, without a twist, around pulley Q, Figure 17.

Fabric Take-up Belt Replacement. To replace a worn belt, with the take-up mechanism set to rewind film, remove the old belt by pulling it from over the two pulleys Z1 and Z2, Figure 31, and from under the three belt guide pins X1 and X2, Figure 31. *It is not necessary to disassemble the take-up mechanism to replace the belt.* Place the new belt over the upper pulley Z1, pressing it under the two upper guide pins X1, and place it around the lower pulley Z2 and

Figure 31

EE Grease cup
GG Thumb screw cap
X1 Upper belt guide pins
X2 Lower belt guide pin
Z1 Upper pulley
Z2 Lower pulley



under the lower belt guide pin X2. Set the take-up mechanism to take up film.

Exciter Lamp Replacement. The exciter lamp is beneath the three-sided metal cover Z, Figure 8. Unscrew the thumb nut which holds the cover in place, and remove the cover. Remove the metallic damping shell, which is in two parts held together by a spring belt, by pulling it up and off. Press the lamp down, turn it counter-clockwise slightly, and lift it out. Insert a new lamp, reversing the above procedure. Be sure when replacing the lamp to turn it as far to the right (clockwise) as it will go. The lamp will then be correctly aligned. Before the damping shell is replaced or the lamp lighted, wipe it (as a lens) to remove all finger marks. With the halves of the damping shell held as a unit by the small spring belt and with the opening in the shell side toward the optical slit, place the shell over the exciter lamp and press down gently. Adjust the shell's position until the line formed by the joining of the two halves is at a right angle to the sound head casting behind the lamp and the opening in shell is positioned at the level of the optical slit. Replace cover Z and tighten thumb nut securely.

Tube Replacement. All tubes should be tested at a B&H Authorized Service Station about once a month, if projector and power speaker are used frequently, and replaced if they are not up to standard. Gradual deterioration of the tubes before they actually stop functioning detracts from the amplifiers' effectiveness. A complete set of spare tubes should be carried with Filmosound and power speaker at all times.

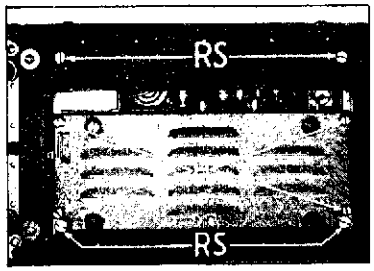


Figure 32

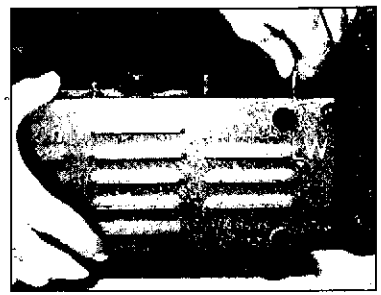
H Amplifier retaining screws
RS Projector retaining screws

If a defective tube in projector or power speaker amplifier is suspected, remove tubes and replace with a complete new set.

To replace tubes of projector amplifier, it is necessary to remove the amplifier from the Filmosound. To remove the amplifier, lay the projector on its side and, with a screw driver or a coin, remove the four screws H, Figure 32. Pull gently on lead wire LW, Figure 33, to disconnect the exciter lamp. Remove the amplifier by pulling straight out, being careful not to allow it to drop and damage the tubes.

Figure 33

LW Exciter lamp lead wire



Remove each tube, and replace it with another of the same type from the new set; the label on the tube will identify the tube type. Although tubes used in the Filmosound projector and power speaker may be obtained from most radio stores, it is advisable to use tubes tested by Bell & Howell and sold by your B&H dealer.

When all of the tubes have been replaced with new tubes and have been correctly seated in their sockets, replace the amplifier, reversing the removal procedure. *Be sure* to re-connect the exciter lamp lead wire LW, Figure 33.

NOTE: Before returning the amplifier to position, recheck the position of each tube and the connection of grid clip GC, Figure 34, on 6J7 tube.

To expose the amplifier (see Figure 35) of the power speaker for tube replacement, place one hand on either side of the amplifier cover, as shown in Figure 36, and pull forward on the cover until it slips from over the amplifier. It is not necessary to remove the amplifier from the speaker. Remove and replace the power speaker amplifier tubes in the same manner as for the projector amplifier tubes. When all of the tubes have been replaced with new tubes and have been correctly seated in their sockets, replace the amplifier cover, sliding the edges of the cover under the amplifier base plate. Press the cover firmly back into position.

Since only one of the tubes removed from either amplifier may be defective, have the complete set tested at a B&H Authorized Service Station.

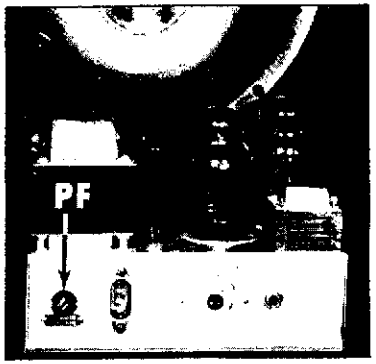


Figure 35
PF Fuse holder slot

Figure 34
GC Grid clip
PE Photocell

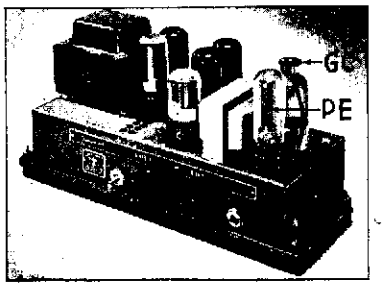
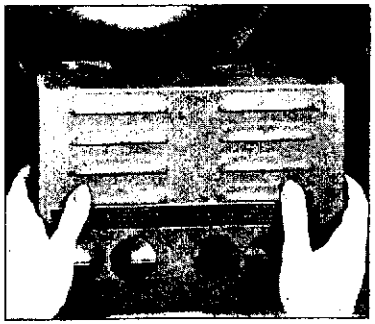


Figure 36
Removing cover of power speaker amplifier



The tubes found in good condition may be carried as spares; the tubes found defective should be replaced with new tubes of the same type in order to keep the spare set complete.

Fuse Replacement—Projector. A 2-ampere fuse is provided in the projector amplifier. Check it immediately if the exciter lamp fails to light. The fuse will burn out if direct current is fed into the amplifier supply receptacle.

To replace the fuse, disconnect the Filmosound line cord from the power source. Insert the edge of a coin into the slot FR, Figure 37, and turn coin in a counter-clockwise direction until the red portion of the fuse holder may be removed. Remove the fuse from the holder and replace it with another 2-ampere fuse; never use a fuse larger than the 2-ampere size.

Fuse Replacement—Power Speaker. A 3-ampere fuse is provided in the power speaker amplifier. Check it immediately if the glow lamp on speaker control panel fails to light or speaker does not operate. The fuse will burn out if direct current is fed into the amplifier supply receptacle.

To replace the fuse, disconnect the power speaker line cord from the power source. Insert the edge of a coin into the slot PF, Figure 35, and turn coin in a counter-clockwise direction until the red portion of the fuse holder may be removed. Remove the fuse from the holder and replace it with another 3-ampere fuse; never use a fuse larger than the 3-ampere size.

Glow Lamp Replacement. To replace glow lamp GL, Figure 3, unscrew the plastic shell; turn burned-out bulb counter-clockwise until it may be removed. Replace it with another ½-watt lamp (General Electric NE-51). Pressing lamp firmly into socket, turn clockwise as far as it will go. Replace plastic shell and tighten securely.

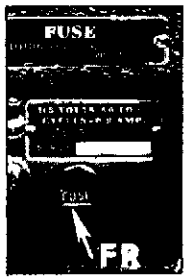
Pilot Light Replacement. To replace the pilot light, turn cap PL, Figure 8, in a counter-clockwise direction until it may be removed. Unscrew the burned-out lamp and replace it with another of the same voltage. Replace cap PL and tighten securely.

Removing the Projector from the Case. At any time it seems necessary to remove the projector from the case, proceed as follows:

Disconnect the line cord and speaker cable, remove the front and rear reel arms, and draw the two spring belts to the inside of the case. Disconnect the oil cup tubes as described in the paragraph on "Lubrication." Remove the amplifier from the projector as described in "Tube Replacement."

Lay the projector on its side and remove the four screws RS, Figure 32. Set the case on its feet. Pull the projector toward you, being sure that take-up drive pulley RP, Figure 6, clears the reel arm rack. Pull the front of the projector out of the case as in Figure 38.

Figure 37
FR Fuse holder slot



To replace, put the back of the projector into the case with the take-up drive pulley between the case and the reel arm rack. Push the front of the projector into position. Lay the projector on its side and replace the four screws RS, Figure 32. Replace the amplifier as described in "Tube Replacement." Re-connect the oil cup tubes as described in "Lubrication." Replace the reel arms, position the two spring belts, and make the electrical connections; the projector will then be ready for further use.

Figure 38

Special Instructions for Power Speaker or 12" Regular Speaker equipped with Cordomatic Speaker Cord Reel

If your power speaker or 12" regular speaker is equipped with a Cordomatic speaker cord reel, the speaker cable emerges from the case through the hole in the lower right side of the front panel. It is wound within the case on an automatic cable control reel.

Withdraw the cable from the speaker by exerting a steady, even pull, until the desired length has been reached. Release tension on the cable and allow it to rewind slightly until the locking mechanism holds it firmly in position. (Every other click of the ratchet mechanism will hold the reel.)

To rewind the speaker cable, disconnect the plug and pull (do not jerk) the cable until a click is heard, indicating that the locking mechanism has been released. Holding the plug, walk toward the speaker case, allowing the cable to wind compactly onto the reel within the speaker case. This insures longer wear, and, in addition, prevents the cable from winding up loosely and thereby bulking up and crowding the inside of the reel casing compartment before all of the cable has been taken up.

If, at any time, the rubber-covered cable becomes sticky, shake a generous amount of talcum powder into a soft cloth and allow the cable to pass through the cloth as it is being rewound.

Instructions for FILMOSOUND NEW ACADEMY Model 179-H

Operation of the Filmosound New Academy differs from that of the Filmosound Auditorium as follows:

Reel Arms. Open speaker case door; unsnap retaining bands NC and NR, Figure 39. Remove feed reel arm HR and take-up reel arm JS, Figure 39, from carrying positions. Remove Y cord and take-up reel from their carrying positions.

Electrical Connections — Speaker. When all necessary accessories have been removed from speaker case and it has been correctly positioned at the front of the room, remove plug CB, Figure 39, from receptacle MS, Figure 39.

Speaker cable is wound on reel N, Figure 39, and emerges through the hole in the lower right side of the front panel of the case. Holding plug on this end of speaker cable, withdraw the cable as you walk toward projector; place cable where audience cannot trip over it. Insert male plug MP, Figure 40, into 16-ohms receptacle S, Figure 40. Returning to speaker case, insert plug CB into receptacle MS, Figure 39, and close speaker case door.

When show is over, remove plug MP from receptacle S and plug CB from receptacle MS. Turning handle CH, Figure 39, in a clockwise direction, wind speaker cable evenly and compactly onto reel N.

Electrical Connections — Projector. Electrical connections for the Filmosound New Academy are the same as those for the Filmosound Auditorium with one exception: the New Academy can he connected to a power source supplying 115-volt, *25-cycle* alternating current, as well as 115-volt, *50- to 60-cycle* alternating current.

Preparing to Operate. Set up and check the Filmosound New Academy, following the instructions given on

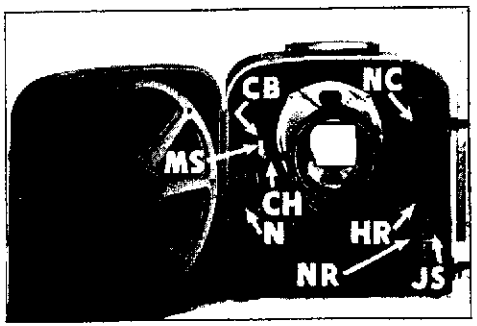


Figure 39

CB	Plug
CH	Handle
HR	Feed reel arm
JS	Take-up reel arm
MS	Receptacle
N	Speaker cord reel
NC	Retaining band
NR	Retaining band

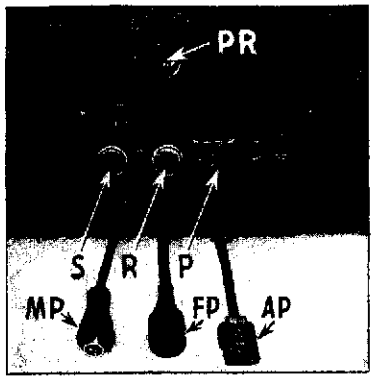


Figure 40

AP	**Female plug**
FP	**Female plug**
MP	**Male plug**
P	**Amplifier receptacle**
PR	**Projector receptacle**
R	**8-ohms receptacle**
S	**16-ohms receptacle**

page 8 under the above heading with two exceptions:

The controls on the front panel of the New Academy amplifier are slightly different in position; see Figure 41.

The New Academy speaker does not require a volume control setting; disregard these mentions.

Microphone. When using microphone with *silent* film, set sound-silent switch SS, Figure 41, at SILENT and insert microphone plug into jack M, Figure 41. Turn on Filmosound amplifier. Adjust the volume to the desired level by means of projector volume control. If there is a considerable lapse of time between broadcast comments, turn off the amplifier, to eliminate extraneous noises.

When commentary is over, turn off Filmosound amplifier and remove microphone plug from jack M.

When using microphone with *sound* film, before inserting plug into jack M, Figure 41, set sound-silent switch SS, Figure 41, at SILENT, to disconnect exciter lamp while microphone is in use. Adjust Filmosound volume control for best results under existing acoustical conditions.

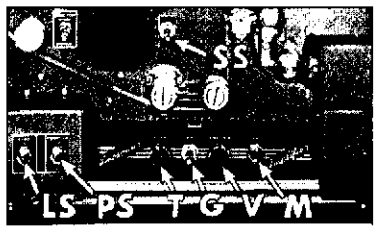
While it is possible to connect the microphone without disconnecting the exciter lamp, it is not possible to adjust the microphone volume without correspondingly affecting the film sound volume, since both are adjusted through the same control. It is, therefore, advisable to use the microphone as instructed above.

When microphone is *not* in use, remove plug from jack M and set sound-silent switch SS at SOUND in order that sound from film may again be heard.

Phonograph Turntables. When using phonograph turntable with silent film, with sound-silent switch SS, Figure 41, at SILENT and turntable volume control at minimum position, insert turntable plug into jack M, Figure 41. Set projector volume control at maximum position; set amplifier switch at ON and allow amplifier tubes to warm up. Then adjust turntable volume control for best results under existing acoustical conditions. When using phonograph turntable to provide background music for *sound* film, with turntable volume control set at minimum position, insert turntable plug into jack M. Adjust turntable volume control to desired sound level.

Figure 41

G	**Amplifier switch**
LS	**Lamp switch**
M	**Microphone jack**
PS	**Projector switch**
SS	**Sound-silent switch**
T	**Tone control**
V	**Volume control**

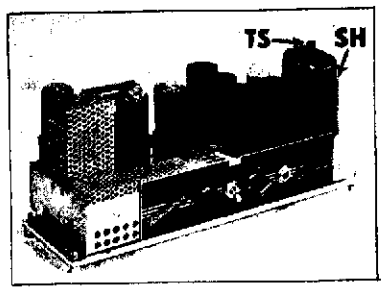


Polarity Changer. A polarity changer may *not* be used with the Filmosound New Academy. When it is necessary to operate the Filmosound amplifier on *direct* current, a DC to AC converter having a capacity of 100 watts must be used. At such times, follow the instructions given on page 17, under the heading, "Operation on 115-volt Direct Current, without Polarity Changer."

Public Address System. To expose photocell of Filmosound New Academy, remove the amplifier from projector in usual way; with Filmosound line cord disconnected, unscrew thumbscrew TS, Figure 42, and lift off shell SH, Figure 42. Remove photocell PE, Figure 43. Return shell to position, placing contact pins CO, Figure 43, on shell edge in holes PH, Figure 43, in amplifier chassis. Tighten thumbscrew TS to top of shell as firmly as possible *without the use of tools.*

Figure 42

SH	**Shell**
TS	**Thumb screw**



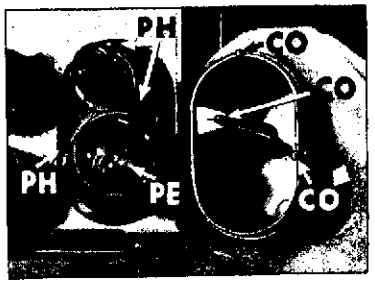


Figure 43

CO	**Contact pins**
PE	**Photocell**
PH	**Holes**

When program is over, return photocell to position, being sure to replace shell properly and to tighten firmly thumbscrew TS.

Projection Defects and Remedies. The remedies given for Filmosound Auditorium projection defects apply to the Filmosound New Academy with the following changes:

2. d.	Check to see that sound-silent switch is set at SOUND.
3. b., c., d., f., k., l.	Disregard.
3. m.	Photocell shell not firmly screwed down.
4. b.	Disregard.
4. c.	Check to see that line current supplied to projector is of the correct voltage.
4. g.	Replace amplifier tubes with a complete new set.

Tube Replacement. To replace the amplifier tubes, it is necessary to remove amplifier from Filmosound. To remove amplifier, lay the projector on its side and, with a screw driver or coin, remove four screws H, Figure 32. Pull amplifier out far enough to reach exciter lamp lead wire plug LP, Figure 44; remove plug from receptacle LR, Figure 44, before completely removing amplifier from projector.

Remove and replace tubes in the same manner as for the Filmosound Auditorium.

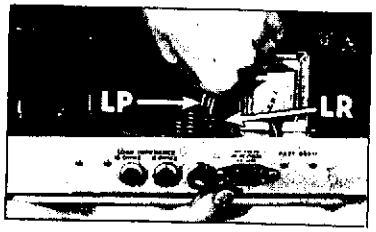
To expose the photocell, with Filmosound line cord disconnected, unscrew thumbscrew TS, Figure 42, and lift off shell SH, Figure 42. Remove photocell and replace with another. Return shell SH to position over photocell and first amplifier tube, placing contact pins CO, Figure 43, on shell edge in holes PH, Figure 43, in amplifier chassis. Tighten thumbscrew TS to top of shell as firmly as possible *without the use of tools.*

Fuse Replacement. A 1½-ampere fuse is provided in the Filmosound New Academy amplifier. Remove and replace it as instructed under "Fuse Replacement — Projector," page 31. Never use a fuse larger than the 1½-ampere size. Disregard paragraph on "Fuse Replacement—Power Speaker."

Maintenance — Speaker Cord. If, at any time, cord on hand-wound speaker cord reel becomes sticky, shake a generous amount of talcum powder into a soft cloth and pass the length of cord through cloth before rewinding.

Figure 44

LP **Lead wire plug**
LR **Receptacle**



Instructions for FILMOSOUND COMPACT Model 179-K

Operation of the Filmosound Compact differs from that of the Filmosound Auditorium as follows:

Positioning of Projection Units. Place the Filmosound at the rear of the room on a stand or table of a height which will permit projecting over the heads of the audience. Set up the projection screen, at the front of the room, according to the instructions accompanying the model to be used.

Open the upper door of the projector case, and then the lower door. The feed reel arm HR and take-up reel arm JS are transported as shown in Figure 45; the take-up reel I travels on the lower door; the Y cord is carried in the space before the projection lens. Remove the cords, reel arms, and all necessary accessories from their carrying positions in the case. Position reel arms and spring belts in the usual way.

The speaker is mounted on a door built into the far side of the projector case. It may be used in any one of three positions, as desired: within the case, in the position in which it travels; at a 90° angle to the case, by pulling the speaker door outward until it snaps into place at this angle; at the screen, by opening the speaker door and lifting it off the split hinges on which it is hung. See Figures 46a, b and c.

With the speaker positioned as desired, uncoil the necessary length of speaker cable from the storage brackets on the rear of the speaker; the storage brackets serve as a stand for the speaker when it is used apart from the projector case. Connect plug

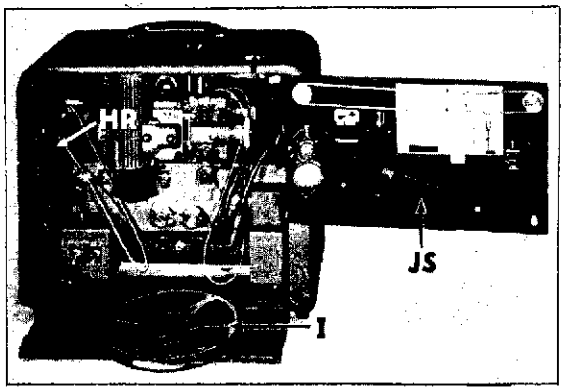


Figure 45

HR **Feed reel arm**
I **Take-up reel**
JS **Take-up reel arm**

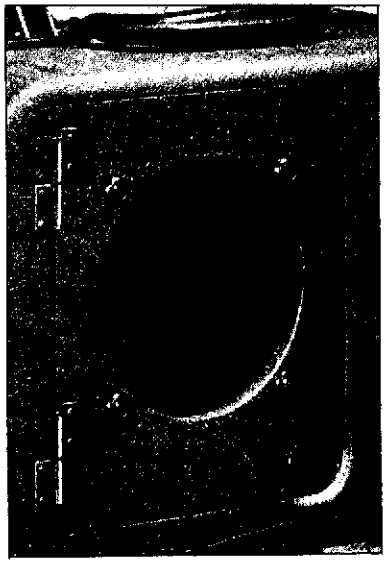


Figure 46a
Speaker used within case

Figure 46b
Speaker used at 90° angle to case
ML Storage brackets
MP Plug
S 8-ohms receptacle

MP, Figure 46b, of speaker cable to 8-ohms receptacle S, Figure 46b.

When show is over, remove plug MP from receptacle S and wind speaker cable evenly over brackets ML.

Electrical Connections — Projector. Electrical connections for the Filmosound Compact are the same as those for the Filmosound Auditorium with one exception: the Compact can be connected to a power source supplying 105- to 130-volt *25-cycle* alternating current as well as 105- to 130-volt *50- to 60-cycle* alternating current.

Preparing to Operate. Set up and check the Filmosound Compact, following the instructions given on page 8 under the above heading with two exceptions:

The controls on the front panel of the Compact amplifier are slightly different in position; see Figure 41.

The Compact speaker does not require a volume control setting; disregard these mentions.

Microphone. When using a microphone with the Filmosound Compact, follow the microphone instructions given for the New Academy on page 34 under the same heading.

Phonograph Turntables. When using a phonograph turntable with the Filmosound Compact, follow the instructions given for the New Academy under the above heading on page 34.

Polarity Changer. A polarity changer may *not* be used with the Filmosound Compact. When it is necessary to operate the Filmosound amplifier on *direct* current, a DC to AC converter having a capacity of 100 watts must be used. At such times, follow the instructions given on page 17, under the heading, "Operation on 115-volt Direct Current, without Polarity Changer."

Public Address System. To use the amplifier of the Filmosound Compact as part of a public address system, follow the instructions given for the New Academy under the above heading, on page 35. Remove the Compact speaker from the projector case.

Projection Defects and Remedies. The remedies given for Filmosound Auditorium projection defects apply to the Filmosound Compact with the following changes:

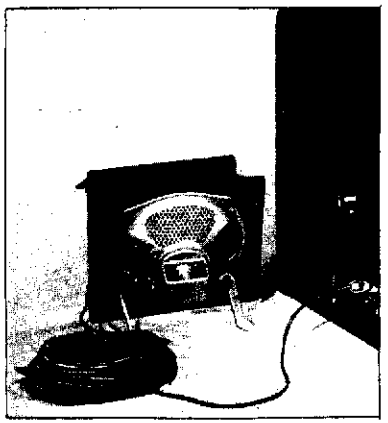
2. d.	Check to see that sound-silent switch is set at SOUND.
3. b., c., d., f., k., l.	Disregard.
3. m.	Photocell shell not firmly screwed down.
4. b.	Disregard.
4. c.	Check to see that line current supplied to projector is of the correct voltage.
4. g.	Replace amplifier tubes with a complete new set.

Tube Replacement. To replace the amplifier tubes of the Filmosound Compact, follow the instructions given for the New Academy under the above heading on page 36.

Fuse Replacement. A 1½-ampere fuse is provided in the Filmosound Compact amplifier. Remove and replace it as instructed under "Fuse Replacement — Projector," page 31. Never use a fuse larger than the 1½-ampere size. Disregard paragraph on "Fuse Replacement—Power Speaker."

Maintenance—Speaker Cord. If, at any time, cord sticks together during storage on brackets, shake a generous amount of talcum powder into a soft cloth and pass the length of cord through the cloth.

Figure 46c
Speaker removed from case



PROFESSIONAL SERVICING

Fine equipment that it is, your Bell & Howell camera and projector need only a minimum of expert care. You might think, because of their precision construction and efficient operation, that they need no servicing at all. *This is not true.* For, just as all fine equipment demands professional care, so Bell & Howell cameras and projectors must be serviced regularly to keep them in their original perfect condition.

The low service requirements of Bell & Howell equipment are due in part to excellent design, materials, and craftsmanship. Another reason for the long, trouble-free lives of B&H equipment lies in the fine service, advice, and operator training provided by B&H Special Representatives. Cue to your responsibility is the old saw, "An ounce of prevention is worth a pound of cure," for it's you who must see that your equipment gets the care it needs *before* it needs it.

To be sure this small but vital bit of service is correctly done, you will want to turn your equipment in to your local dealer to be taken to the nearest Authorized Service Station, Bell & Howell factory branch, or the B&H home plant in Chicago.

Many owners follow our suggestion that every projector, even though apparently in first-class condition, be serviced annually. The equipment is thoroughly cleaned, lubricated, and inspected. Any parts which show serious wear are replaced. Then, after careful testing, it is returned ready for another year of rigorous use. The cost of this preventive service is nominal, and results in dependable performance are more than satisfactory.

Supplement this yearly servicing with good, everyday care, proper storage and maintenance; the added appreciation of all who view your movies will be your reward.

SERVICE INSTRUCTIONS

FILMOSOUND PROJECTORS

finer products through imagination

Bell & Howell

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CHICAGO 45, ILLINOIS

PART NO. 70014

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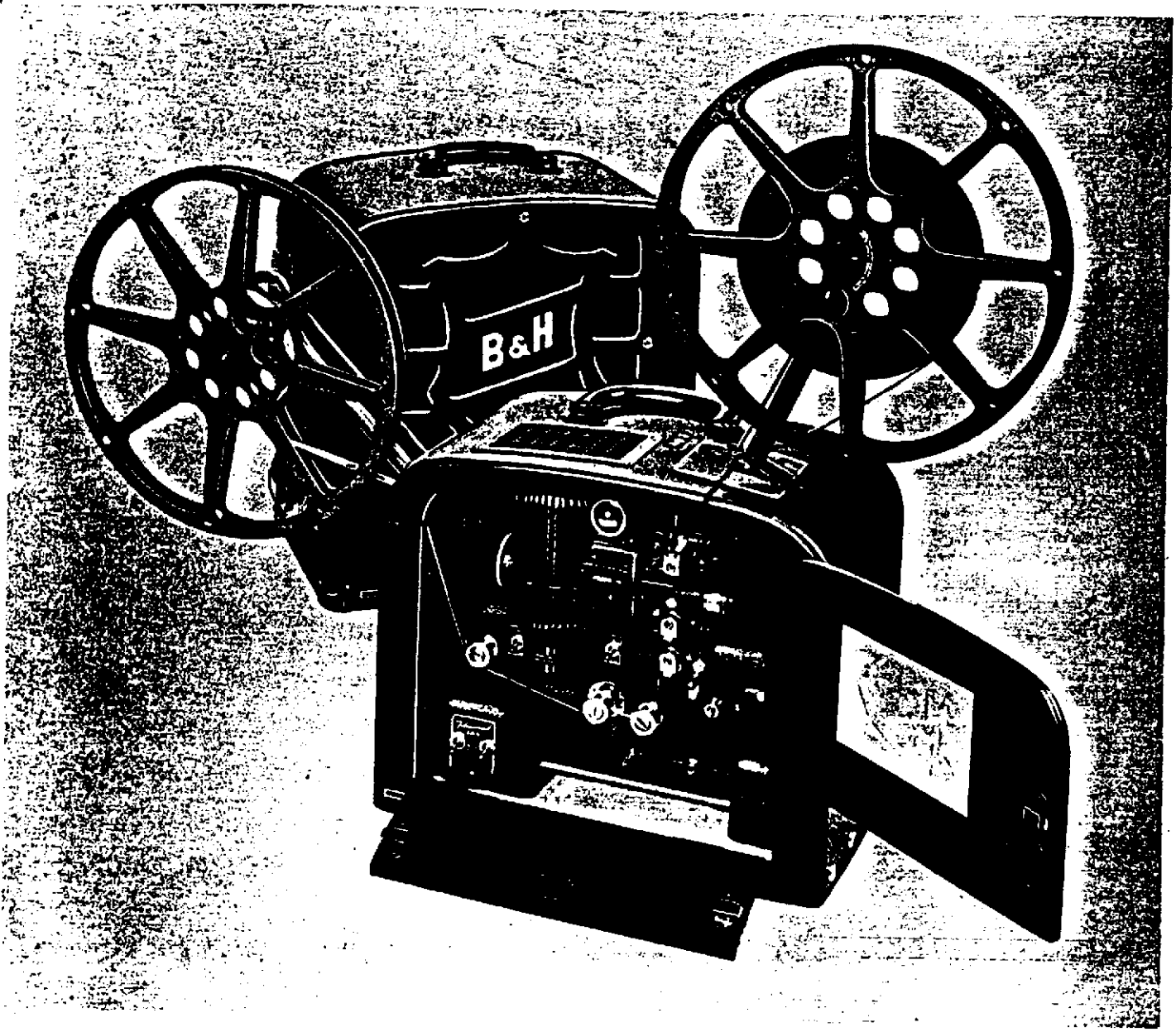

Figure A. Filmosound Projector (Design 185B)

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Introduction

GENERAL.

This manual contains service instructions and parts replacement information for all models of the Filmosound projector (Designs 179, 185, 285 and 385). The service instructions contained herein are based on the Design 185 projector; however, with few minor exceptions, the instructions will apply to other designs as well.

This manual sets forth, in a step by step procedure, the correct and approved method of disassembly, cleaning and repair, reassembly and adjustments. The probability of ever having to disassemble the entire projector is slight. However, we have gone into as much detail as possible and feel that a serviceman, in making certain definite repairs, can eliminate the steps not necessary to reach and correct the part in question.

Before attempting to disassemble the projector, and during the disassembly itself, it is well to observe and remember the manner in which it is already assembled and the job that each part is called upon to perform. It is suggested that after a part has been removed, the screw or screws that attached that part be replaced to prevent loss or mix up in the screws. There are many screws which have identical thread sizes but do vary in length, thus making it possible to replace a screw in the wrong place.

Read this manual through carefully before attempting any repairs. Also use this manual as a guide during the actual performance of the service work. The illustrations contained in this manual adequately show each part and their relationship to each other in the assembly of the projector. It need not be elaborated upon that the quality of the service work performed will depend, to a large extent, upon the ability and ingenuity of the person performing it.

LUBRICATION.

When lubricating the projector, it is essential that Bell & Howell projector oil and/or grease as supplied by Bell & Howell be used. These are lubricants that have been selected after extensive research especially for Bell & Howell projectors to insure perfect operation and long life. Under no circumstances should any other oil except Bell & Howell projector oil be used. If, however, Bell & Howell should not be available, we strongly recommend the use of the best grade of ball-bearing grease that is obtainable. It must be free from any dirt, grit or acids and should maintain its viscosity even after long usage.

The parts referred to in the following paragraphs will be followed, in parentheses, by one or several numbers. These numbers are the index numbers of the part or parts referred to. A view of the part can then be found by locating this index number within the figure referred to in the heading of the paragraph, or group of paragraphs. Exceptions to this rule are few and are noted as such within the parentheses.

IMPORTANT NOTICE.

This manual is subject to changes which may occur from time to time. Notice of such changes will be automatically forwarded to service stations for insertion in the manual. Insert revision pages at once and then place obsolete pages at the rear of the manual to refer to when repairing obsolete model projectors.

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SPECIAL SERVICE TOOLS.

The following special service tools are supplied by Bell & Howell for use on the Filmosound projectors. The tools are illustrated in figure B and the listing that follows is indexed to the illustration.

The number of each tool is stamped in the tool, with the exception of the small Bristo wrenches. When used properly, these tools will assure proper adjustment and trouble-free operation.

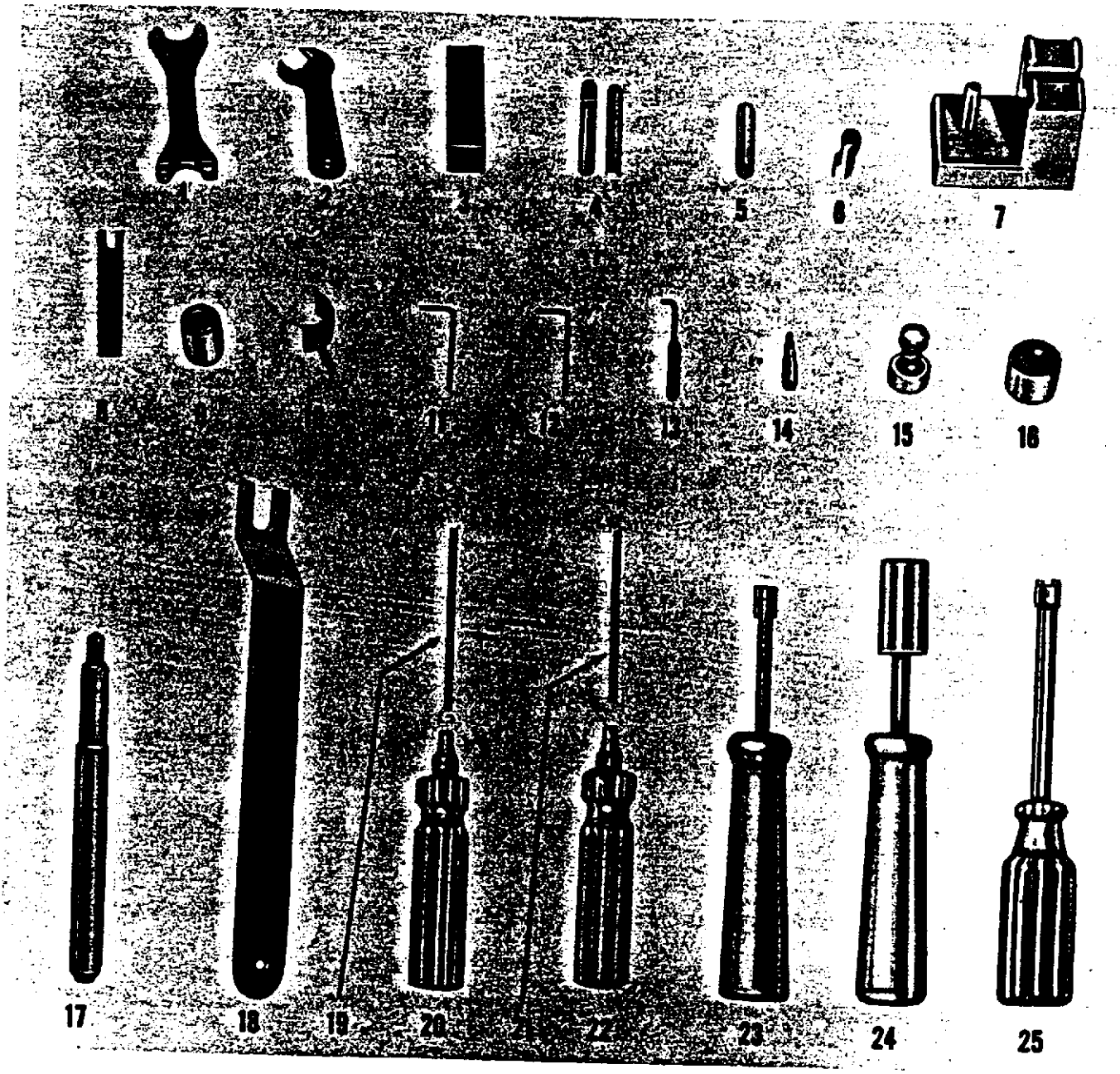

Figure B. Special Service Tools

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INDEX NO.	TOOL NO.	FUNCTION
1	ST-244-F1	Remove bearing in the fan housing
2	S-10309-F1	Adjust lens carrier assembly
3	S-4529-N3	Go-No-Go gage to check the height of shuttle teeth
4	S-4007-F14	Quills used to assemble the counter gear shaft and the shuttle shaft to gear case
5	S-4007-F5	Brass sleeve used in the reassembly of counter gear shaft and shuttle shaft to the gear case
6	Stock 1459	Clip to hold quills on shaft
7	S-4007-F11	Fixture used to assemble steel balls and felt to the shuttle shaft and counter gear shaft
8	S-15177-N4	Shim for adjusting gears
9	S-4007-F6	Sleeve used to assemble steel balls around shuttle shaft and counter gear shaft
10	S-15638-N6	Adjust clearance between film guides and sprockets
11	G-165-F3	Used for socket set screws
12	G-167-F3	No. 6 Bristo wrench for socket set screws
13	S-14986-X1	Bristo wrench for socket set screws
14	S-15177-F3	Cone for assembling sprockets to shafts
15	S-15177-N2	Adjust sprockets
16	S-15177-N1	Adjust sprocket shafts
17	S-14878-F1	Drift punch to remove bearings in gear case
18	S-10310-F2	Hold shuttle shaft when removing and assembling shutter
19	G-167-X2	No. 10 Bristo wrench for socket set screws
20	G-167-F1	Handle for No. 10 Bristo wrench
21	G-165-X2	No. 8 Bristo wrench for socket set screws
22	G-165-F1	Handle for No. 8 Bristo wrench
23	S-19028-F4	Clutch disassembly wrench
24	S-19028-F3	Clutch disassembly wrench
25	S-12264-F3	Spanner wrench for governor cap

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Disassembly Procedure

NOTE

The Design 185, Model B Filmosound projector was used as a basic model in the preparation of this manual. All other models are shown as a variation of the Design 185 B. Use a cleared working surface covered with a clean cloth to place the disassembled parts on when servicing the projector.

1. PROJECTOR, AMPLIFIER AND CASES. (See figure 1.)

a. On all models of the Filmosound, the projector (5) is held in the case with the fillister head screws (1), washers (2), rubber cushions (3) and spacers (4). On most all of the Design 185 models, the projector is removed through the bottom of the case while on all of the Design 179 models and the Design 185 A, the projector is removed through the door.

b. Unscrew the knurled head screws (6) and carefully remove the amplifier assembly (7) from the projector.

NOTE

Exciter lamp lead should be carefully disconnected from amplifier when removing from sound head.

c. The take-up arm (9) and the front reel arm (11) are stored either in the case assembly (8) or speaker (13). The film take-up spring belt (10) and front spring belt (12) can be removed by disconnecting the ends that are joined together and pulling them free of the projector case.

NOTE

In the disassembly and reassembly instructions, no mention is made of the wiring. It is strongly recommended that you mark each wire and its connecting point or points before removing the wire. Refer also to the projector schematics in figures H, J, K and L, being sure you select the correct schematic to correspond to the model projector being serviced.

1. PROJECTOR, AMPLIFIER AND CASES. (See figure 1.)

a. Remove the relay condenser (1), 45-50 mm condenser assembly (2) and projector lens (3) from the projector.

b. Unscrew the exciter lamp cover assembly (6). Remove the exciter lamp shield (4). Press down slightly on the exciter lamp (5) and with a twisting motion remove it from its socket.

c. On the Design 185, models B and C, the gear case, blower housing, motor, and governor is removed as a unit from the sound head (26) by unscrewing the two binding head screws (7) and the three fillister head screws (8). On all models of the Design 179 and the Design 185 A, remove the screws (7A), lock washers (7B) and hex nuts (8A). The mounting stud (8B) is screwed into the blower housing and it is not necessary to unscrew it.

d. Detach the gear case assembly (15) from the blower housing by removing the fillister head screw (9), clutch lever spring (10), fillister head screw (11), fillister head screws (12), guide rail (13) and washers (14). Separate the gear case (15) from the blower housing, being careful not to damage the teeth of the fiber counter gear (see figure 5, index 21), which may get caught on the thrust nut (see figure 8, index 1), if caution is not exercised. Note that when the gear case is assembled to the blower housing, the counter gear (see figure 5, index 21) engages the motor pinion (see figure 8, index 8).

e. Loosen the two headless set screws (16) and remove the pilot light unit assembly (17), being careful not to dislodge the contact block assembly (19) enough to cause the spring (18) to pop out and become lost. The contact block (19) is connected to the projector wiring system by means of two wires which will have to be unsoldered either at the contact block or at their terminals inside of the projector. In either case, mark the wires and the connection points.

f. Unscrew four fillister head screws (20), two fillister head screws (21) and separate the blower housing assembly (22) from the motor housing.

g. Unscrew the two fillister head screws (23) and remove the governor cap assembly (24) from the lamp house and motor assembly (25).

3. GEAR CASE ASSEMBLY, 1 of 3 ILLUSTRATIONS. (See figure 3.)

a. Remove the pressure plate assembly (1 through 7) from the rear of the lens carrier. Disassemble it by pressing in on the spring cup (1) and removing the spring cup and compression spring (2). Unscrew the fillister head screws (3) and separate the bushings (4), spacers (5), yoke (6) and pressure plate (7). Remove the rubber knob (8).

b. On the newer model projectors, unscrew the hex nut (9). Then partially unscrew the knob assembly (10), remove the retaining ring (11) and unscrew the knob assembly the rest of the way. The spacer (12)

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will drop out as the knob assembly is removed.

c. The older model projectors have the type of clutch linkage shown in the inset (13 through 17). Unscrew the knob assembly (15) and remove the lock nut (16). The mounting bracket (17) is attached with two of the oval head screws (18) that hold the front cover (19) on. The old-style front cover that is used with the clutch manipulator parts (13 through 17) is slightly different than the cover (19) used with the items indexed 9 through 12.

d. Before removing the front cover (19) note that there is a small pin in the plate (23) which engages the hole in the gate operating block (20). These two parts must be disengaged while the front cover is being removed. Remove the gate operating block (20).

e. Unscrew the fillister head screw (21) and remove the gate operating lever (22). Loosen the fillister head screw (23) and disassemble the plate and shaft assembly (24) and eccentric bushing (25). Unscrew the idler gear shaft (26) and remove the idler gear (27), eighteen steel balls (28), washer (29) and fillister head screw (30).

f. Loosen the pilot screw (31) and disengage the clutch lever stud (32) to remove the clutch lever linkage (33). When the clutch manipulator parts (13 through 17) shown in the inset are used, a slightly different clutch linkage (33) from the one shown is used. It does not connect directly to the knob assembly (15) but engages the clutch extension link (14) instead.

g. Remove the clutch plunger (34) from the Design 185, models B and C. Earlier model projectors have a clutch which does not require the use of a plunger.

4. GEAR CASE ASSEMBLY, 2 of 3 ILLUSTRATIONS. (See figure 4.)

a. Unscrew the fillister head screw (1) to remove the film stripper (2). Remove the other film stripper in the same manner.

b. Unscrew one fillister head screw (3) and remove a sprocket guard assembly (4), spring (5) and tension washer (6) from each sprocket shaft.

c. Use the Bristo wrench (see figure B, indexes 21 and 22) to loosen the headless set screws (7). Slide the sprocket assemblies (8) off the shafts, being careful not to damage the felt washers which are located inside the sprockets.

d. Unscrew the fillister head screws (9) and remove the film guides (10). Unscrew the pilot screws (11) to remove the lens carrier retainers (12). Slide the lens carrier assembly all the way out.

e. Unscrew the fillister head screw (13) to remove the ball retaining spring (14) and steel ball (15). Unscrew the fillister head screws (16) to remove the pressure plate adjustment nuts (17) and pressure plate carrier (18).

WARNING

Never try to remove the lens lock (19) from the lens carrier (20).

f. Note that the film tension clips (22) fit into a slot in the aperture plate. Unscrew the fillister head screws (21) to remove the upper and lower film tension clips (22) and the film gate thrust spring (23). The aperture plate (24) is now free to be removed. Remove the framer shaft and knob assembly (25).

g. Use the Bristo wrench (see figure B, indexes 19 and 20) to loosen the socket set screws (26). Turn the screws out far enough to clear the side of the flat in the end of the sprocket shafts (27). Remove the upper sprocket shaft (27). The washer (28), upper

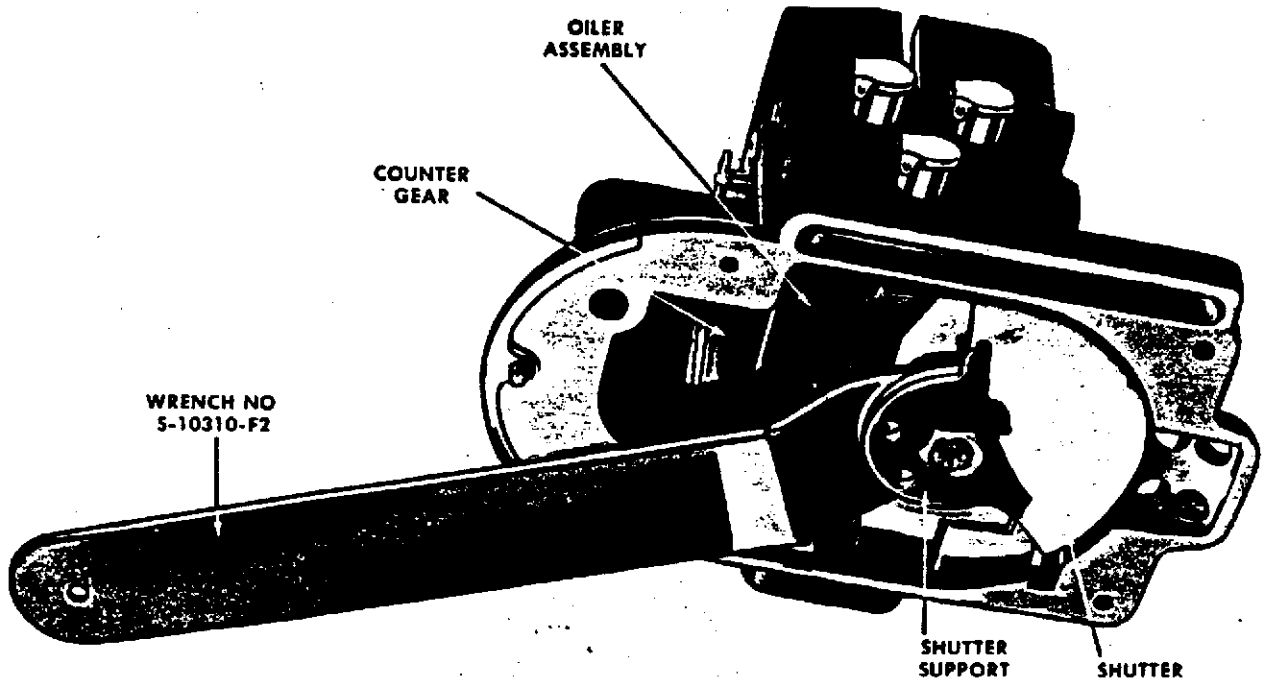

Figure C. Use of Tool No. S-10310-F2

gear (29) and spring washer (31) will come out as the shaft is removed. Remove the lower shaft in the same manner and catch another washer (28), the sprocket worm wheel assembly (30) and another spring washer (31) as they become loose.

5. GEAR CASE ASSEMBLY, 3 of 3 ILLUSTRATIONS. (See figure 5.)

a. Insert the wrench (see figure B, index 18) behind the shutter supports (2) as shown in figure C. The tool must engage the flat sides of the shuttle shaft (13). Then use a common open end wrench to remove the hex nut (1). Lift out the shutter supports (2) and the shutter (3). The oil baffle (4) and lubricator assembly (5) must be removed as a unit and should not be separated unless necessary. Do not remove the lubricator felt (6) unless necessary. Unscrew the special fillister head screws (7) to remove the double tooth shuttle (8) and dowel pins (9). If a replacement shuttle (8) is being ordered, be sure to order the correct class fit (either 1, 2, 3 or 4). The number that tells you what the class fit of the shuttle is will be found etched into the shuttle in the location indicated by the letter "A" in figure 5.

b. Before removing parts indexed 10 through 24, note the location of the steel balls (12, 14, 21 and 23).

NOTE

Every time the gear case is disassembled, the 60 steel balls that are removed should be destroyed and be replaced by 60 new steel balls in reassembly. The steel balls used by Bell & Howell are carefully graded and balls of different grades should not be mixed. When ordered in bottles of 1000 or more, the grade is indicated on the bottle. When ordered in lots of less than 1000, the balls are all of one grade and should not be mixed with any steel balls you already have on hand.

Loosen the two socket set screws (10). This can be done easily by inserting the Bristo wrench in through the hole located in the side of the gear case, directly under where the lens carrier assembles to the gear case. Remove the collar (11) and remove and discard the fifteen steel balls (12). From the rear of the gear case, remove the shuttle shaft (13). Remove and discard the fifteen steel balls (14). Remove the oil felt (15) from the shuttle shaft.

c. Loosen two set screws (16) and remove the worm drive extension (17). Loosen the set screws (18) and (19) and carefully remove the worm gear (20). Remove and discard the fifteen steel balls (21). Note that the set screw (18) has a flat point while the set screw (19) has a cone point which must engage the shallow, pointed slot in the counter gear shaft (22). From the back side of the gear case, remove the counter gear (22), fifteen steel balls (23) and the oil felt (24). Discard the steel balls (23).

d. Unscrew the flat head screw (25) to remove the spring clamp (26). Remove the oiler felt (27).

e. If it is necessary, the shaft bearings (28) can be removed by driving them out with the drift punch (see figure B, index 17) from inside of the gear case. There may or may not be one or more bearing shims (29) behind the collar of each bearing. These are placed there at the factory and the same amount of shims will have to be replaced on the same bearing in reassembly.

f. Unscrew the fillister head screw (30) to remove the oiler assembly (31).

g. There are two different types of oiler tubes used on Filmosound projectors. Either one of the two types can be used on any Filmosound projector and both types are illustrated in figure 5, indexed 32 through 37. The open type (index 32 through 34) requires the use of a flexible connecting tube to the projector case while the capped type (index 35 through 37) does not. These oiler tubes are a press fit in the gear case and should not be removed unless it is absolutely necessary.

6. PILOT LIGHT AND BLOWER HOUSING ASSEMBLY. (See figure 6.)

a. The pilot light assembly has already been removed as a unit in paragraph 2. The headless set screws (1) are used to attach the pilot light assembly to the blower housing and are shown here for reference only.

b. Unscrew the lamp housing (2) and lamp (3).

c. Unscrew the pilot screw (4), noting that the tip of the screw rides in the slot in the top of the socket tube (8). Remove the parts indexed 5 through 8 from the housing (9) as a unit. Unscrew the round nut (5) and remove the light socket (6) and friction spring (7) from the socket tube (8).

d. Carefully remove the safety shutter assembly (10). Unscrew the fillister head screws (11) to re-

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move the safety shutter guide (12).

NOTE

Extreme care should be maintained in the handling of the safety shutter both during disassembly and reassembly.

e. If necessary, the fastening studs (13) can be unscrewed. Unscrew the special fillister head screws (14) to remove the relay condenser spring retainer (15). Do not remove the set screw (16) from the blower housing (17). The set screw (16) is used only for the purpose of adjusting the safety shutter and unless this adjustment must be made, the screw should not be tampered with.

f. Disassemble the relay condenser assembly (18) by removing the retaining spring (19) and the condenser lens (20). Unscrew the round head screw (21) to remove the handle (22) from the holder (23).

7. GOVERNOR CAP ASSEMBLY. (See figure 7.)

a. There are two types of governor cap assemblies that can be used on any Filmosound projector. Figure 7 adequately illustrates both types. Items indexed 1 through 14 are common to both types. Items 15 through 22 can be used only on the type having the steel bearing balls (18 and 20) and items 23 through 31 can be used only on the type having the radial ball bearings (25 and 30). The housing (33) is, of necessity, different on the inside in order to accommodate the different type of bearing. The two types of governor caps can be distinguished between by comparing actual parts with those in figure 7. Single items that are not common to both types cannot be interchanged between types nor can all of the parts (not common to both) of one type be interchanged with all of the parts (not common to both) of the other type because the housing itself will accommodate only one of the two types.

b. Unscrew the special nut (1), using a spanner wrench to do so. Then unscrew the fillister head screw (2) and remove the radial bearing (3). Remove the worm shaft and drive blade (4) and felt washer (5). Use the special tool (see figure B, index 25) to unscrew truss head screw (6). Remove cover (7) and bronze washer (8). When doing so, however, be careful not to dislodge the spring (9) or steel balls (11). Note how the parts indexed 9 through 12 are assembled before removing the clutch cam (10). Then remove the spring (9), the clutch cam (10), the three steel balls (11) and the clutch ball retainer (12). Remove the rear take-up pulley (13), being careful not to lose any of the roller bearings (14). There are eighteen roller bearings.

c. Tap lightly on the bearing cap (15) and pull out. Loosen the two set screws (16) and carefully remove the bearing collar (17) and thirty-five steel balls (18). Tip the governor cap on its side and remove and disassemble the pulley shaft assembly (19), thirty-five more steel balls (20), the worm wheel (21) and the spring washer (22).

d. Finish disassembling the other type of governor cap by unscrewing the screw (23) and then removing the retaining washer (24), radial bearing (25) and worm wheel (26). Now reach inside of the governor cap and remove the retaining pin (27). Pull the shaft (28) out. Remove the retaining ring (29), radial bearing (30) and retaining ring (31).

e. The fillister head screw (32) is used to plug the grease packing hole in the governor cap (33).

FIGURE D DELETED

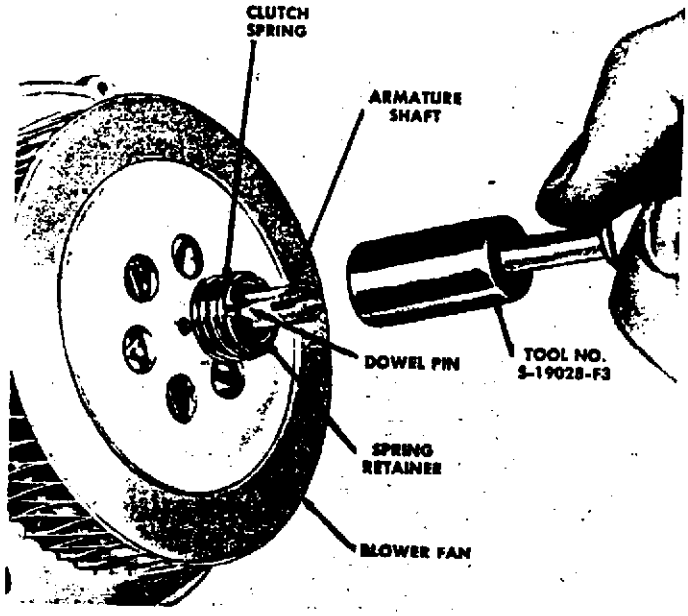

Figure E. Using Tool No. S-19028-F3

8. FAN, GOVERNOR AND MOTOR. (See figure 8.)

a. There are two types of clutch assemblies in use on Filmosound projectors. Parts indexed 1 through 10 in figure 8 make up the old-style clutch and parts indexed 11 through 18 make up the new-style clutch. The same type of clutch already on any particular projector will always have to be used on that particular projector because each type of clutch requires a different armature shaft. Also, the new-type clutch (11 through 18) requires the use of the clutch plunger (see figure 3, index 34) while the old-style clutch (1 through 10) does not.

b. Disassemble the old-style clutch as follows: Remove the spring and roller assembly (1). Note that each one of the rollers holds one of the clutch jaws (2) in place. Remove the clutch jaws (2) and operating pin (3). Unscrew the adjusting nut (4) from the armature shaft. Remove one motor pinion washer (5), the motor pinion (6), thirty-one roller bearings (7) and another motor pinion washer (5). Using tool No. S-19028-F3 (see figure B, index 24) as shown in figure E, push against the spring retainer (9) and remove the dowel pin (8). A straightened-out paper clip will facilitate the removal of the dowel pin. Remove the spring retainer (9) and spring (10).

c. Disassemble the new-style clutch as follows: Insert tool No. S-19028-F4 (see figure B, index 23) into the armature shaft and push back on the thrust washer (12) enough to disengage it from the thrust nut (11). Unscrew the thrust nut (11) and remove the tool and thrust washer (12). Remove one motor pinion washer (13), motor pinion (14), thirty-one roller bearings (15) and another pinion washer (13). Using tool No. S-19028-F3 (see figure B, index 24) as shown in figure E, push against the spring retainer (17) to remove the dowel pin (16). A straightened-out paper clip will facilitate the removal of the dowel pin. Remove the spring retainer (17) and spring (18).

d. On the opposite end of the armature shaft, loosen the two set screws (19) and remove the governor (20), but be careful not to lose the three governor brushes (21) which may pop out as the governor is removed.

e. Unscrew the fillister head screws (22) and remove the bearing retaining cap (23).

WARNING

As the hex nut (24) and washer (25) are removed, the armature shaft (37) will become loose and may slip forward. DO NOT allow the armature to slip forward because the armature windings may catch on the resistor clamp (41) and damage the armature windings.

Flatten out the ears on the locking washer (25) and remove the hex nut (24) by holding the blower fan (34) with one hand while unscrewing the hex nut (24). Remove the locking washer (25) and radial bearing (26).

f. Unscrew the brush caps (27) and remove the motor brush springs (28) and motor brushes (29).

g. Unscrew the fillister head screws (30) to remove the brush holder housing (31) and spacer (32).

h. Now unscrew the dowel screw (33) and remove the blower fan (34), star washer (35) and spacer (36).

i. From the opposite side of the motor housing remove the armature (37). Unscrew the field retaining nuts (38) and carefully remove the stator assembly (39). Unscrew the fillister head screw (40) to remove the resistor clamp (41) and resistor (42).

j. The retainer ring (43) can be unscrewed now with the use of special tool No. ST-a44-F1 (see figure B, index 1). Remove the radial bearing (44).

9. LAMP HOUSE GROUP. (See figure 9.)

a. There are two types of reflectors in use with Filmosound projectors. Remove the type of reflector (1 or 2) that is used. The reflector (1) is fabricated into one unit and cannot be disassembled. The reflector (2) is disassembled as follows: Unscrew the three reflector adjusting screws (3) from the mounting (4). Separate spring (5) from reflector (6).

b. Unscrew the fillister head screws (7) to remove the lamp house cap (8). Lift out the air-circulating tube (9).

c. Unscrew the lamp lock screw assembly (10). Remove the fillister head screws (11) to detach the terminal box assembly (12). Do not remove the heat conducting ring (13) unless necessary.

d. Unscrew the fillister head screw (14) to remove the condenser friction spring (15) from the lamp house and motor housing (16).

e. The condenser assembly (17), which was removed in paragraph 2, is disassembled by removing the lens retaining snap ring (18). When doing this, be careful the spring (20) does not release suddenly and cause possible damage to the lens (19). Remove the condenser lens (19), spacer spring (20) and condenser lens (21) from the condenser lens housing (22).

f. If possible, do not get the two condenser lenses mixed up. However, if they do get mixed up, they can be differentiated between when both lenses are placed side by side with the flat surfaces down on a white background. When looking straight down at the lenses, there will appear to be a circular reflection in each lens. However, the circle will be larger in one than in the other. The lens (19) which has the smaller part number will have the smaller reflection, while the lens (21) having the larger part number will have the larger reflection.

10. SOUND HEAD ASSEMBLY, 1 of 2 ILLUSTRATIONS. (See figure 10.)

a. Remove the retaining ring (1) to detach the knurled head screw (2) from the exciter lamp cover (3).

b. Before disassembling any part of the stabilizer, take careful note of how it is assembled.

c. On the Design 185 B and C projectors, loosen the set screw (4) and remove the cap (5) and washer (6). The washer (6) may or may not be used, but be sure to replace the same amount of washers in reassembly if any are removed now. Remove the complete stabilizer assembly from the shaft now. Unhook the spring (8) from the pin and separate the stabilizer into two units. Loosen the fillister head screw (7) to remove the torsion spring (8). This is a very small screw, so be careful not to lose it. Unscrew the fillister head screw (9) and disassemble the roller shaft (10), plain roller (11) and lower stabilizer arm (12). Remove the screw (13) and disassemble the roller stud (14), flanged roller (15) and stabilizer arm (16).

d. The stabilizer stud (17) and lock nut (18) are used

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on the Design 185 B and C projectors only.

e. On all Design 179 models and the Design 185 A, the stabilizer shown in the inset is used. Remove the complete assembly (19) by loosening the set screws in the knurled collar nut and slipping the assembly off the shaft. Do not attempt to disassemble this stabilizer. Unscrew the hex nut (20) from inside the sound head and remove the stabilizer stud (21) and plate and pin assembly (22).

f. Unscrew the fillister head screw (23) and remove the film stripper (24). Unscrew the special fillister head screw (25) and remove the sprocket guard (26), spring (27) and tension washer (28) from the sprocket shaft. Loosen set screw (29) and slide sprocket assembly (30), tension washer (31), spring washer (32) and spacer washer (33) off the shaft. Now loosen the set screw (34) enough to clear the flat in the sprocket shaft (35) and pull the shaft out. Once the shaft is removed, the washer (36) and sprocket driving gear (37) are free to be removed. Unscrew the fillister head screws (38) to remove the film guide (39).

g. Unscrew the fillister head screw (40) which has a hex nut (41) and cable clamp (42) on it inside the sound head. Then unscrew two remaining fillister head screws (43) and detach the snubber assembly (44 through 52). Unscrew the fillister head screw (44) and remove the snubber bearing (45) and torsion spring (46), noting how the torsion spring is assembled as you do so. Remove the snubber bearing plate (47). Unscrew the snubber studs (48), which will allow the spring retainer (49), hex nut (50), idler rollers (51) and snubber lever (52) to become disassembled.

h. Unscrew idler roller stud (53) and remove the spacer (54) and idler roller (55). On the older model projectors, the spacer (54) is not used and instead the hex nut (56) must be unscrewed to remove the idler roller.

i. On the Design 185 B and C projectors, unscrew the Phillips head screws (57) to remove the sound head brackets (58).

NOTE

On all Design 179 and the Design 185 A, the projector mounting brackets are secured to the projector case.

j. DO NOT remove or disturb the optical slit assembly (60) unless absolutely necessary. If it is necessary, remove the sealing wax on the set screw (59), loosen the set screw and remove the optical slit assembly (60).

11. SOUND HEAD ASSEMBLY, 2 of 2 ILLUSTRATIONS. (See figure 11.)

a. Unscrew the fillister head screws (1) and remove the bearing retaining cap (2), spring retainer (3) and compression spring (4).

b. On the front of the sound head remove the two short, fillister head screws (5), noting that one of them attaches the light control shield (6). Remove the third fillister head screw (7), which also attaches cable clamp (9) by means of the hex nut (8) screwed on to it.

WARNING

Extreme care must be taken when removing parts indexed 10 through 12. Follow directions below carefully. Do not allow the flange on the shaft (12) to strike the optical slit.

Carefully pull the shaft (12) partially out of the sound head. Then tilt the inner end of the shaft up so that the hex nut (10) and drum (11) can be removed. Carefully remove the shaft (12) from the sound head (19). Do not allow the flange of the shaft to strike the optical slit. Remove the radial bearing (13).

c. The Design 179 and 185 A projectors have an exciter lamp socket (15A through 15F) which can be disassembled. Unscrew the fillister head screw (15A) to remove the complete assembly. Then disassemble the jack lead assembly (15B), compression spring (15C), bakelite washer (15D), lamp socket shell (15E) and socket support (15F).

d. Unscrew the fillister head screws (16) and speed nuts (17) to remove the receptacle (18) from the sound head (19).

e. Unscrew the fillister head screw (20) and oval head screw (21) to remove the terminal cover assembly (22). Do not lose the type "J" speed nut (23). When removing the terminal cover assembly, note how the wires are packed underneath so that they may be neatly repacked in reassembly.

CAUTION

Be sure to mark every wire and its connecting point in such a manner that the proper wire terminal will be placed in its proper place when the sound head is reassembled.

f. Unscrew the oval head screws (24) to remove the terminal strip (25) and terminal strip insulator (26).

g. All of the Design 179 and the Design 185 A projectors have a different sound head from the Design 185 B and C projectors. This fact requires a different type of terminal cover (22A), the parts of which are shown in the inset. To remove, first unscrew the hex nuts (26A) and detach the washers (26B). Slip the terminal cover (22A) off the screws (26F) and remove the spacers (26C), two more hex nuts (26A), terminal strip (26D), spacers (26E) and two more hex nuts (26A).

h. Do not remove the resistor (27) or capacitor (28) unless necessary.

i. Unscrew the Phillips head screws (29) and remove the hermetically-sealed capacitor (30).

NOTE

Before removing any of the switches, mark each one so that the correct size switch will be reassembled in the correct circuit.

j. Unscrew the thin hex nuts (31, 34 and 38) to remove the LINE-LAMP name plate (32), FORWARD-REVERSE name plate (35) and SILENT-SOUND name plate (39). The line-lamp switches (33), forward-reverse switch (37), silent-sound switch (41) and switch locating discs (36 and 40) are easily removed.

12. AMPLIFIER. (See figure 12.)

a. Do not attempt to disassemble the amplifier beyond what is shown in figure 12. When replacing any tubes, be sure to remove and replace only one at a time to insure getting the correct tube back in the correct socket. Each tube is marked with its part number.

b. Remove the extractor fuse post center part (1) (includes the part of the fuse post mounted in amplifier) and 1-1/2 amp fuse (2). The cap (3) is merely unscrewed. Loosen the set screw (4) to remove the control knob (5). Unscrew the binding head sheet metal screws (6) to remove the base plate assembly (7). Unscrew the knurled head shaft in the cover assembly (8) to remove it from the amplifier assembly.

c. If a complete amplifier is being replaced, check the parts list carefully to insure ordering the correct replacement amplifier.

d. The diagrams shown in figures H, I, J and K are not the amplifier wiring diagrams but are merely the projector schematics. Refer to the amplifier wiring diagram manual for the proper amplifier wiring diagram.

13. PROJECTOR CASE. (See figure 13.)

a. Projector cases have varied with the different model projectors. Some projector cases do not have all of the parts shown in this manual exploded in the projector case illustration, but do have them elsewhere in the Filmosound equipment. In some instances, projector cases which do not incorporate everything as shown in this manual, may be adapted to include these items. However, case doors which are not already provided with means for storing the rear reel arm should not be tampered with in order to provide the means. It necessitates the drilling of a hole to accept part of the rear reel arm. The hole is necessary in order to allow the door to close completely when the rear reel arm is mounted in it. The door may be adapted to store all other items very easily, however. Check the projector case you are servicing, and bearing the above in mind, use the following instructions and parts list accordingly. Parts which are shown in this manual with the projector case, but which are actually located elsewhere on the Filmosound you are servicing, are exactly the same parts as shown here and may be ordered from the figure 13 parts list. Parts for replacement for the Design 179 projectors are listed in the figure 13 parts list under the same index number for the similar part used on the Design 185 projectors. For example, the part number for the rear reel arm holder on the Design 179 projectors will be found listed in the parts list under the index number 41, which in the illustration is the index number that calls out the rear reel arm holder for the Design 185 B.

b. The tilt knob mechanism (1 through 9) can be removed as a unit by turning on the hex shaft of the friction cup (8) in a clockwise direction. The tilt foot unit (10 through 13) will become free as the tilt knob mechanism becomes disengaged from it. The tilting knob (2) must be held by hand while using the wrench on the hex shaft, which has a left-hand thread.

c. The tilt knob mechanism (1 through 9) is shown as assembled in the inset in the lower right-hand corner of figure 13. Unscrew the hex nut (1) and remove the tilting knob (2) and bronze washer (3). Note how the spring (4) is assembled in the friction band (5) before removing them. Unscrew the pilot screw (6) and remove the tilting pinion (7). Then detach the friction cup (8) which has a left-hand thread and pinion washer (9 or 9A).

d. Unscrew the fillister head screw (10) to remove the split lock washer (11), tilting foot bar (12 or 12A) and tilt rack (13 or 13A).

e. On the front of the projector case, unscrew the four Phillips head screws (14 or 14A) to remove the countersunk washers (15 or 15A) and tilt bracket (16 or 16A).

f. On the older model cases, the parts 16B through 16F can be disassembled now. Unscrew the fillister head screws (16B) to remove the front projector mounting support (16C). Withdraw the screw and disassemble the washers (16D), rubber mountings (16E) and spacers (16F).

g. The foot bar (17) is detached from the rear of the case by unscrewing four Phillips head screws (which are identical to those used on the front (14). However, if the feed reel arm mounting bracket (17A) is used, a slightly longer Phillips head screw (14B) must be used in place of one of the screws (14).

h. A cutaway view of the older model cases is shown in the inset in the lower left-hand corner of figure 13. Unscrew the fillister head screws (17C) and disassemble the rear projector bracket (17B), washers (17D), rubber mountings (17E) and spacers (17F).

i. If necessary, remove the foot assemblies (18 or 18A) and split lock washers (19).

j. Unscrew the flat head screws (20) to remove the door pull plate (21 or 21A) and door pull (22). Unscrew the round head wood screws (23) to detach the door catch (24).

k. Remove the hex nuts (25), internal teeth lock washers (26) and plate washer (27). Grasp the handle and remove all of the handle parts as a unit. Then disassemble the handle posts (28 and 29), handle pins (30) and torsion spring (31). Note how the spring fits into the handle and also how it keeps the handle (32) down against the projector case and away from the grill. Remove the rear adapter plate (33).

l. Unscrew the Phillips binding head screws (34) to remove the bottom front arm plate (35) and the reel arm holder and pin assembly (36). Pull out the roller pin (37) to remove the roller assembly (38). All Design 185 projectors use the single roller (38) as illustrated while the Design 179 projectors use two small rollers (38D and 38E). The roller (38D) has a smaller flange on it than the roller (38E) and is located slightly forward and above the roller (38E) when it is correctly positioned in the reel arm holder. Consequently there are also two roller pins (37A and 37B) which one (38C) is slightly longer than the other (38B). These two pins are held in place with set screws (38A) which must be loosened to remove the roller pins and rollers.

m. Unscrew the Phillips binding head screws (39) to remove the inside rear arm plate (40) and rear arm holder and pin assembly (41). Remove the special screw (40A) and lock washer (40B). Pull out the roller pin (42) to remove the roller assembly (43). The same situation described immediately above for the front reel arm holder also holds true for the rear

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reel arm holder.

n. When the projector leaves the factory, the grill (44) is attached securely with rivets. However, should it become damaged and necessitate replacement, the special screws (45) and special nuts (46) should be used in place of the rivets.

o. The reel arm clip and block assembly (47) and the reel mounting block assembly (48 through 50) are nailed and glued to the case. The reel mounting post (49) is secured to the block and clip assembly (50) with the flat head screw (48) before gluing.

p. The aperture brush (51), spare fuses (52) and oil can (53) are easily removed. Unscrew the wood screws (54) to remove the oil can bracket (55).

q. Remove the screw (56) to detach the spare belt holder (57). Remove the flat head wood screw (58) and countersunk washer (59) to detach the reel arm strap (60).

r. The bullet catch (61) will have to be pried out. Remove the nails (62) to detach the catch strike (63).

s. On the models 179 K and 185 C, the speaker assembly (64) is mounted in the projector case. Refer to paragraph 16 for disassembly instructions and to figure 16 for an exploded view.

t. When ordering a replacement projector case, it will have to be ordered using the projector case assembly number and all of the items NOT wanted will have to be listed. These items will then be removed at Bell & Howell before the case is shipped out.

14. REAR REEL ARM. (See figure 14.)

a. Remove the fabric take-up belt (1). Unscrew the rewind drive gear (2) from the shaft of the take-up drive pulley assembly (3) by turning clockwise to loosen the left-hand thread. If necessary, wrap tape around the rewind drive gear (2) and drive pulley (3) so that they may be firmly grasped to unscrew one from the other. Remember that they have a left-hand thread. Be careful not to let the drive pulley (3) fall out. Now remove the take-up drive pulley (3) slowly, cupping hand around it to catch the plunger (4) and compression spring (5) which will pop out as the pulley is removed.

b. Carefully remove the spring (6). Unscrew the shoulder screw (7) to remove the rewind locklever (8). The knurled head screw (9) acts as a plug for the grease packing hole and is easily removed.

c. The bearing retainer ring (10) is press fitted in place and will have to be pried out if it ever becomes necessary to remove any of the sixteen roller bearings (11) from the rear reel arm (12).

d. Remove the socket set screws (13) (if used) and press out the shaft (14) to remove the take-up arm complete. Some models of the Filmosound do not use any set screws (13) while still others will have a fillister head screw.

e. Disassemble the take-up arm assembly complete by first unscrewing the fillister head screw (15) and removing the rewind gear (16). Then unscrew both the hex nut (17) and the bearing retaining ring (18). Remove the nineteen steel balls (19), take-up pulley assembly (20) and nineteen more steel balls (21) from the take-up arm assembly (22). Be careful not to lose any of the steel balls.

15. FRONT REEL ARM. (See figure 15.)

a. Unscrew the fillister head screw (1) and remove the cover (2) and bronze washer (3). Carefully remove the three steel balls (4), clutch cam (5) and clutch ball retainer (6).

b. Lift the roller bearings (7) and pulley (8) out together. Remove the shim washer or washers (9). Do not lose any as the same amount will have to be replaced in reassembly. Remove reel arm spindle washer (10). Carefully separate the split retaining washer (11) and work it up and off the shaft.

c. On the new model reel arms, separate washer (12), reel spindle (13) and washer (14). Unscrew the bearing retainer (15) to remove the bearing (16) from the front reel arm (17).

d. The parts for the older model reel arms that differ from the newer model are shown in the inset in figure 15. They are disassembled as follows:

e. Unscrew the screw cap (18) and the adjusting screw (19). Remove the compression spring (20) and one of the friction blocks (21). The reel spindle (13) goes in between the two friction blocks (21). When the reel spindle is removed, the other friction block (21) and friction block retainer (22) can be removed.

f. Unscrew the inner ball race (23) to remove the steel balls (24) from the reel arm (25). There are twenty steel balls (24) on each side of the reel arm.

16. 6-INCH LOUDSPEAKER. (See figure 16.)

a. Do not detach the cable and connector assembly (1) from the loudspeaker unless absolutely necessary. Remove the four Phillips head screws (2), two lock washers (5), speaker cable brackets (6), washers (7) and speaker (8).

b. Unscrew the round head wood screws (9) to remove speaker door clip (10) from speaker door (11).

17. SPEAKER CASE. (See figure 17.)

a. Remove the reel (1) from the inside of the door. The Y cord (2), 50 feet of cable (3) and line cord (4) are stored inside of speaker case.

b. Remove the nuts (5), screws (6) and washers (7) to detach the speaker (8) from the case.

c. Unscrew nuts (9) and remove the internal teeth lock washers (10) and lower handle plates (11). Remove the handle and its parts by pulling straight up. Disassemble the handle studs (12), handle pins (13), handle (14) and upper handle plates (15).

d. Unscrew the screw (16) to disassemble the reel mounting stud (17), internal teeth lock washer (18), washer (19) and countersunk washer (20) from the door of the carrying case assembly.

e. On speaker models having an amplifier, unscrew the round head screw (21) to remove the strain relief (22) and cable (23). To remove the amplifier assembly (26), unscrew the oval head screws (24) and remove the countersunk washers (25). The amplifier cover (26A) will become separated from the amplifier when the oval head screws (24) are removed.

f. If a cordomatic (32) is provided, detach by removing hex nuts (27), lock washers (28), flat washers (29), screws (30) and countersunk washers.

Cleaning and Repair

18. CLEANING.

OPTICAL PARTS: Clean the projection lens, both condensers, the reflector and the lens and mirror of sound optical system. The lens of the sound optical system is mounted in the boss on the sound head between the exciter lamp cover and the sound drum. (See figure 10, index 60.) The mirror of the sound optical system is located in the sound drum. (See figure 11, index 12.) The front and rear elements of the projection lens and sound optical lens should be cleaned. Do not attempt to take the lenses apart for any further cleaning. The cleaning should be done with either the Bell & Howell lens cleaning kit or Filmo lens cleaning tissue. If only a slight amount of dust has accumulated on the lenses, use lens cleaning tissue to remove the dust. If, however, any fingerprints, oil, grease or other accumulation of dirt is present, Bell & Howell Optikleen lens cleaning fluid should be wiped on the lens surfaces. Then clean thoroughly with lens cleaning tissue. Clean condenser lenses and reflector in the same manner.

FILM HANDLING PARTS: Film handling parts include aperture plate, gate shoe, sprockets and other surfaces over which the film must pass. All of these parts should be cleaned with a soft cloth. If any dirt has accumulated and hardened, dampen the soft cloth and rub the dirt off. Follow this with a polishing with a dry, soft cloth. Be very careful not to scratch the polished surface. If any emulsion has collected, remove it with a toothpick or an orange stick cut to a knife edge. Dirt that may have accumulated between the teeth of the sprocket wheels should be cleaned out with a small, soft brush or soft cloth. Clean the aperture opening with the aperture brush.

MECHANISM PARTS: Any part other than those already mentioned should be cleaned with carbon tetrachloride to remove old grease and lubricating oil. Dry thoroughly. The most ideal method of drying is with compressed air. However, this method is highly impractical in many instances. Therefore, dry with a clean cloth as much as possible and then allow parts to dry thoroughly in air.

19. REPAIR AND REPLACEMENT.

MECHANICAL PARTS: The reconditioning of parts for possible re-use in the projector is not practical. Parts which have been physically damaged must be replaced with new parts.

TUBES: All tubes should be tested and replaced if not up to standard. Be sure to replace correct tube in the correct socket. All tubes and sockets are adequately marked.

ELECTRICAL CORDS: If, at any time, you find the rubber coated cords are sticky, shake a generous amount of talcum powder into a soft cloth and then pass the entire length of cord through it. The stickiness is due to long periods of storage and may be especially prevalent where the cord has been tightly wound.

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Reassembly Procedure

20. SPEAKER CASE. (See figure 17.)

a. Insert the oval head screws (30) through the countersunk washers (31) and then through the side of the speaker case. Position the cordomatic (32) on the screws and attach firmly in place with the plain washers (29), lock washers (28) and hex nuts (27).
b. Position the amplifier (26) inside of the amplifier cover (26A) and place in the speaker case. Attach both with the countersunk washers (25) and oval head screws (24). Attach the cable (23) to the bottom of the speaker case with the strain relief (22) and round head wood screws (21).
c. Insert the screw (16) through the countersunk washer (20) and then through the door. From the inside of the door, place the washer (19) and lock washer (18) on the screw and then screw on the reel mounting stud (17).
d. Place the handle plates (15) in position on the case. Insert the pins (13) through the handle (14) and place a handle stud (12) on each end of the pins. Now insert the handle studs (12) through the handle plates (15) and the case. Attach the handle firmly to the case by means of the lower handle plates (11), lock washers (10) and hex nuts (9).
e. Attach the speaker (8) to the case by means of the four screws (6), countersunk washers (7) and elastic stop nuts (5). Replace the line cord (4), cable (3), Y-cord (2) and film reel (1) in the case.

21. 6-INCH LOUDSPEAKER. (See figure 16.)

a. Attach the door clip (10) to the door (11) with the round head wood screws (9).
b. Position the speaker (8) on the door (11) and attach it at the top with the oval head screws (2), countersunk washers (3), cable brackets (6), lock washers (5) and hex nuts (4). The lower half of the speaker is fastened in the same manner with the exception that the washer (7) replaces the cable brackets (6). Lay the assembled speaker door aside until reassembly of the projector case. See paragraph 24 for these instructions.

22. FRONT REEL ARM. (See figure 15.)

a. On the Design 179 reel arms, place a layer of B & H grease around the ball race on each side of the reel arm (25). Then place twenty steel balls (24) on each race and replace the inner ball race (23) over the balls. Then insert the friction block retainer (22) into the arm and one of the friction blocks (21) into the retainer.
b. Place the washer (14) on the reel spindle (13) and insert the spindle up through the arm. Make sure the spindle goes through friction block retainer (22) and that the one friction block (21) which is already inserted is behind the spindle.
c. Insert the other friction block (21) and the compression spring (20) into the retainer. Screw in the adjusting screw (19) and screw cap (18). The rest of the feed reel arm parts are identical to the Design 185 reel arm and are assembled in the same manner as outlined in subparagraph 22 f through i below.
d. On the Design 185 models, insert the bearing (16) into the reel arm (17) and screw in the bearing retainer (15).
e. Insert the reel spindle (13) up through the washer (14) and bearing (16).
f. On the projecting round shaft, replace the washer (13). Work the split retaining washer (11) down into position on the spindle. Be sure the split retaining washer engages the groove in the shaft. Replace the spindle washer (10) and the same amount of shim washers (9) that were removed in disassembly. Slip the pulley (8) on the shaft with the hollow side up. Insert eighteen roller bearings (8) between the pulley and the reel spindle and lubricate.
g. Place the clutch ball retainer (6) in the pulley with the ears up. Position the clutch cam (5) on the clutch ball retainer so that the ear on the inside diameter of the retainer (6) engages the curved slot in the clutch cam (5) and also so that the small end of each of the three cutouts in the outer diameter of the clutch cam (5) is in a counterclockwise direction from the larger end of each cutout.
h. Place a steel ball (4) into each of the three slots in the outside diameter of the clutch cam (5) and in between the two ears of the clutch ball retainer which project into the slots. Lubricate the balls lightly with B & H projector oil.
i. Replace the bronze washer (3) and clutch cover (2) and screw in the fillister head screw (1).

23. REAR REEL ARM. (See figure 14.)

a. Place a film of B & H grease on the shoulder inside the take-up pulley (20). Then place nineteen steel balls (21) in this film of grease. When placed in position properly, the nineteen steel balls will form a complete circle, with the last ball just touching the first. Carefully insert the take-up pulley (20) with the steel balls in place, up through the take-up arm (22). Where the shaft of the take-up pulley starts to project out from the take-up arm, there is a beveled shoulder in the take-up arm (22). Place a layer of B & H grease on this beveled shoulder and then position nineteen more steel balls (19) in this grease so that they also form a complete circle.
b. Very carefully screw the bearing retaining ring

(18) onto the shaft until the ring just touches the balls. Then back it off 1/4 turn to allow for free operation of all parts. Hold the shaft as steady as possible so as not to disturb the placement of the steel balls.

c. Screw the hex nut (17) on and position the rewind gear (16) on the take-up pulley shaft. All Design 179 models have a washer (noted in the parts list as 16A) which goes between the hex nut (17) and rewind gear (16). This washer is not used on the Design 185 projectors. Screw in the fillister head screw (15) to securely fasten these parts in place.

d. If the sixteen roller bearings (11) were removed, lubricate and replace them now. Press fit a new bearing retainer ring (10) in over the bearings.

e. Insert the compression spring (5) and plunger (4) into the rear reel arm (12) and while holding the spring and plunger in place with your finger slip the drive pulley (3) up into position so that it holds the spring and plunger in place. Because of the left-hand thread, screw the rewind drive gear (2) in a counterclockwise direction onto the end of the drive pulley shaft. If necessary, tape the gear and pulley to better secure the two together.

f. Attach the rewind locklever (8) to the rear reel arm with the shoulder screw (7). Hook the spring (6) between the small stud on the locklever and a small stud in the rear reel arm.

g. The hole into which the knurled head screw (9) goes should be packed with B & H grease before replacing the screw.

h. Place the take-up arm (22) in position on the rear reel arm (12) and insert the shaft (14). Screw in the screws (13). Some models use fillister head screws and others do not use any.

i. Slip the belt (1) over the two pulleys. Check the action of the locklever (8) to see that it will lock and disengage the two gears. A view of the two gears and locklever in the unlock position is in figure F.

24. PROJECTION CASE. (See figure 13.)

NOTE

All of the parts shown in the exploded view illustration may or may not be on the projector case you are servicing. Concern yourself only with those parts which do appear on the projector case you are servicing.

a. Replace the bullet catch (61). Using the flat head nails (62), replace the catch strike (63) in such a position that the bullet catch (61) will engage the catch strike.

b. Insert the flat head wood screw (58) through the countersunk washer (59), through the reel arm strap assembly (60), and screw it into the door. Attach the spare belt holders (57) to the door with the screws (56). The oil can bracket (55) is attached with two wood screws (54).

c. The oil can (53), spare fuses (52) and aperture brush (51) are easily slipped back into their proper place.

d. Attach the reel mounting post (49) to the block and clip assembly (50) with the flat head screw (48). The reel block assembly (48, 49 and 50) should be glued to the lower door as indicated in figure 13. If the small reel arm clip and blocks (47) were removed, they should be glued back on the projector case.

e. If the grill (44) is being replaced, attach it with the special screw (45) and special nut (46) as shown in figure 13.

f. The parts shown in figure 13, indexed 34 through 43 apply only to the Design 185 (all models) projectors. Similar functioning parts used on the Design 179 projectors are illustrated in the insets and explained in paragraph 24g immediately following this one. Position the roller (43) in the rear reel arm holder (41) and insert the roller pin (42). Position the rear reel arm holder (41) on the outside of the projector case and the inside rear arm plate (40) up against it on the inside, and secure the two together with the Phillips binding head screws (39). Assemble the front reel arm plates (34, 35, 36, 37 and 38) in exactly the same manner.

g. On the Design 179 projectors, each reel arm holder assembly has two rollers for the film. These are shown in the inset in the upper left-hand corner of figure 13. Note in each reel arm holder film passage there are two holes, one of which is forward and slightly above the other. Place the roller with the large flange (38F) in the bottom rear hole and with the flange toward the inside (or away from the film slot). Insert one of the short pivots (38C) through the holder and into the flanged end of the roller. Insert one of the longer pivots (38D) through the holder and into the other end of the roller. Secure both pins in place with the set screws (38A), which are slightly longer than the set screws (38B) used for the other roller pivots.

h. Position the small flange roller (38E) in line with the upper forward holes and with the flange toward the film slot, or outside. Insert a short pivot (38C) through the holder and into the flanged end of the

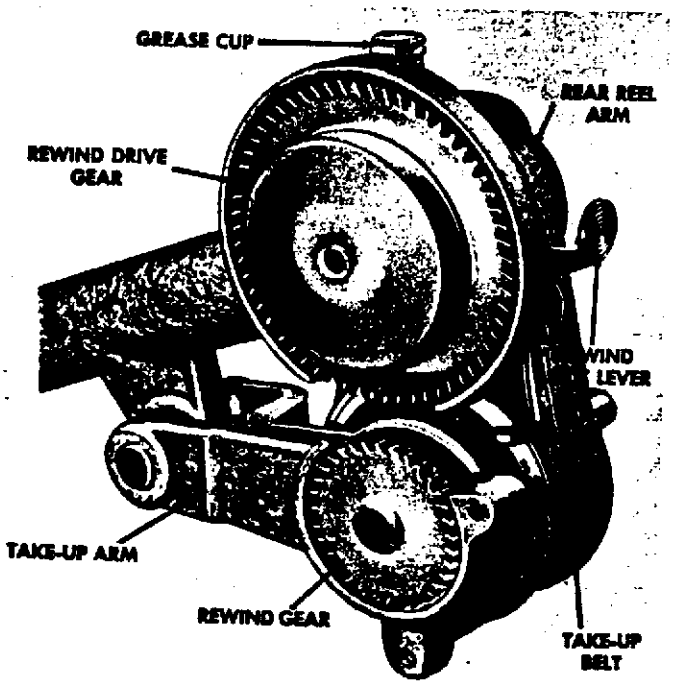

Figure F. Take-up Arm and Locklever

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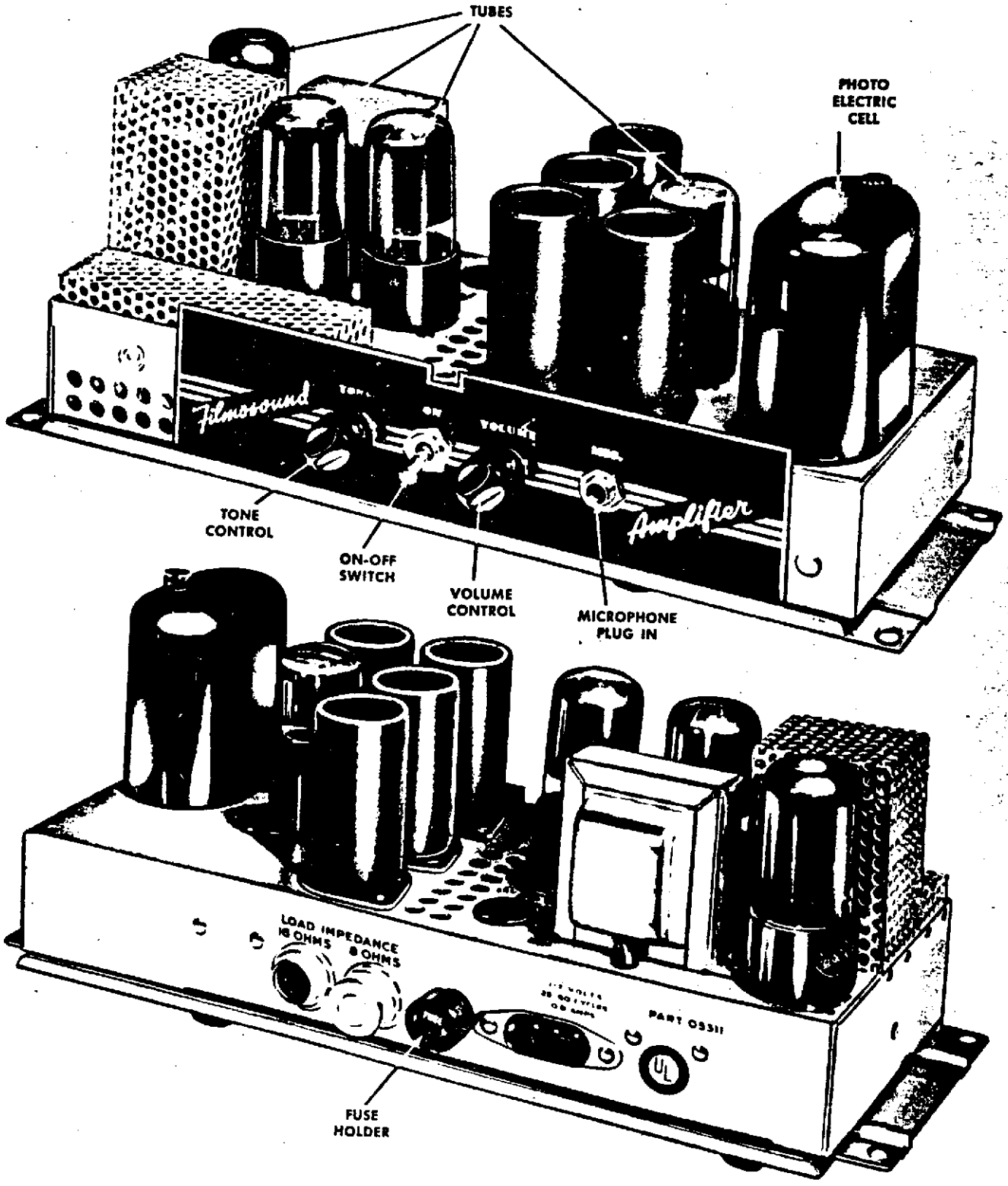

Figure G. Full View Illustration of Amplifier, Part No. 05311

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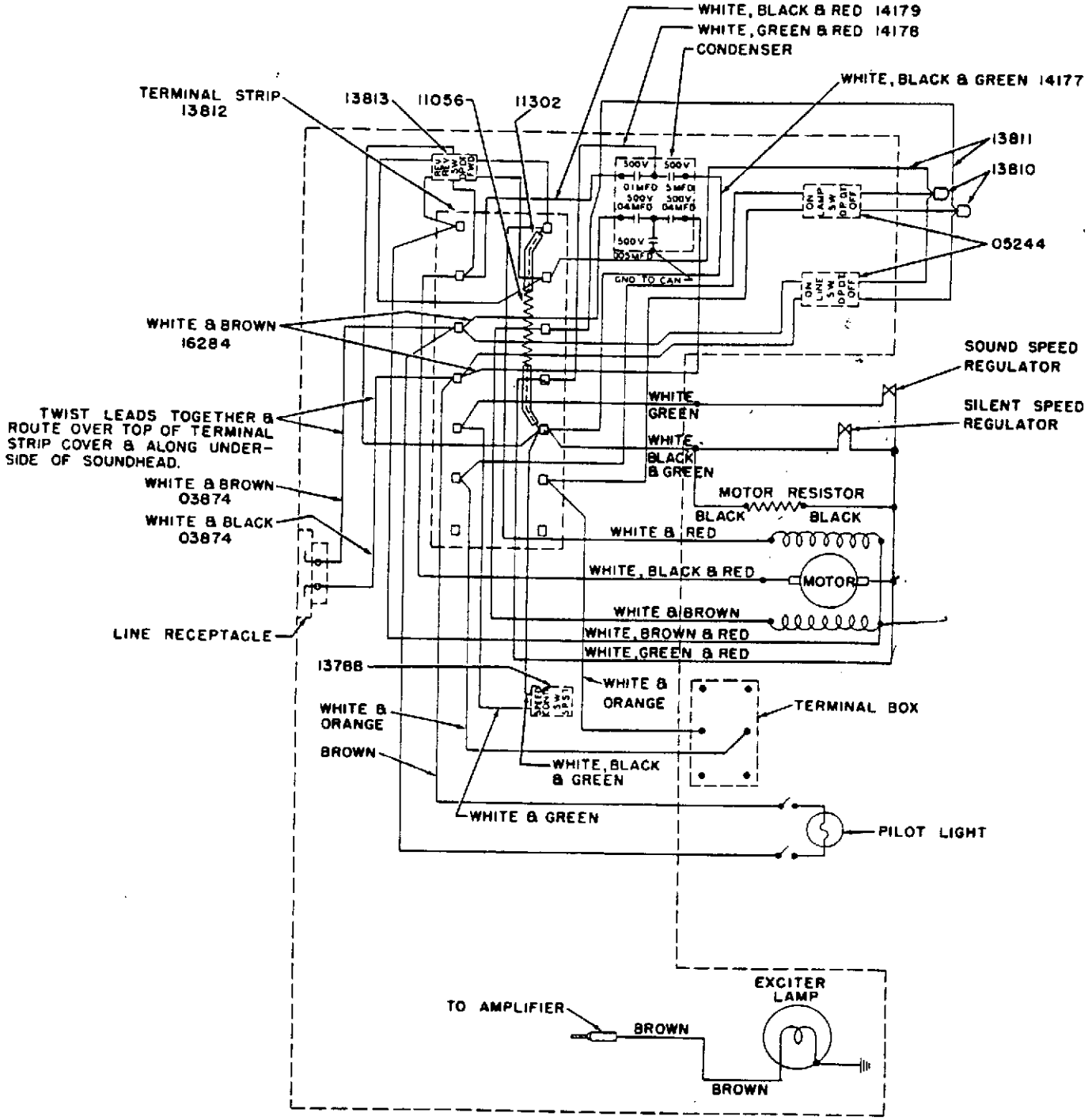

Figure H. Wiring Diagram for the Design 179, Models E and F Projectors

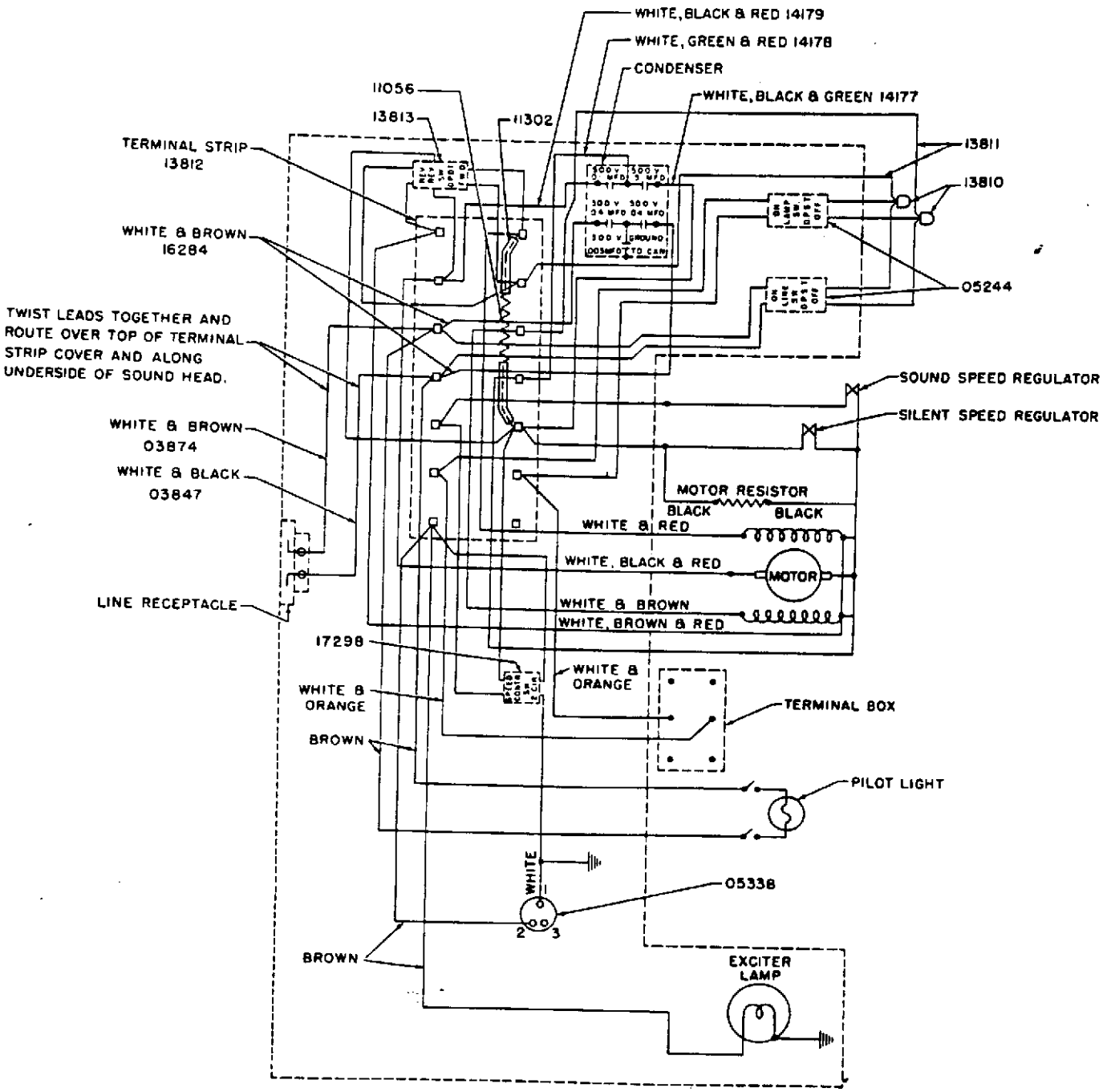

Figure I. Wiring Diagram for the Design 179, Models H, J and K Projectors

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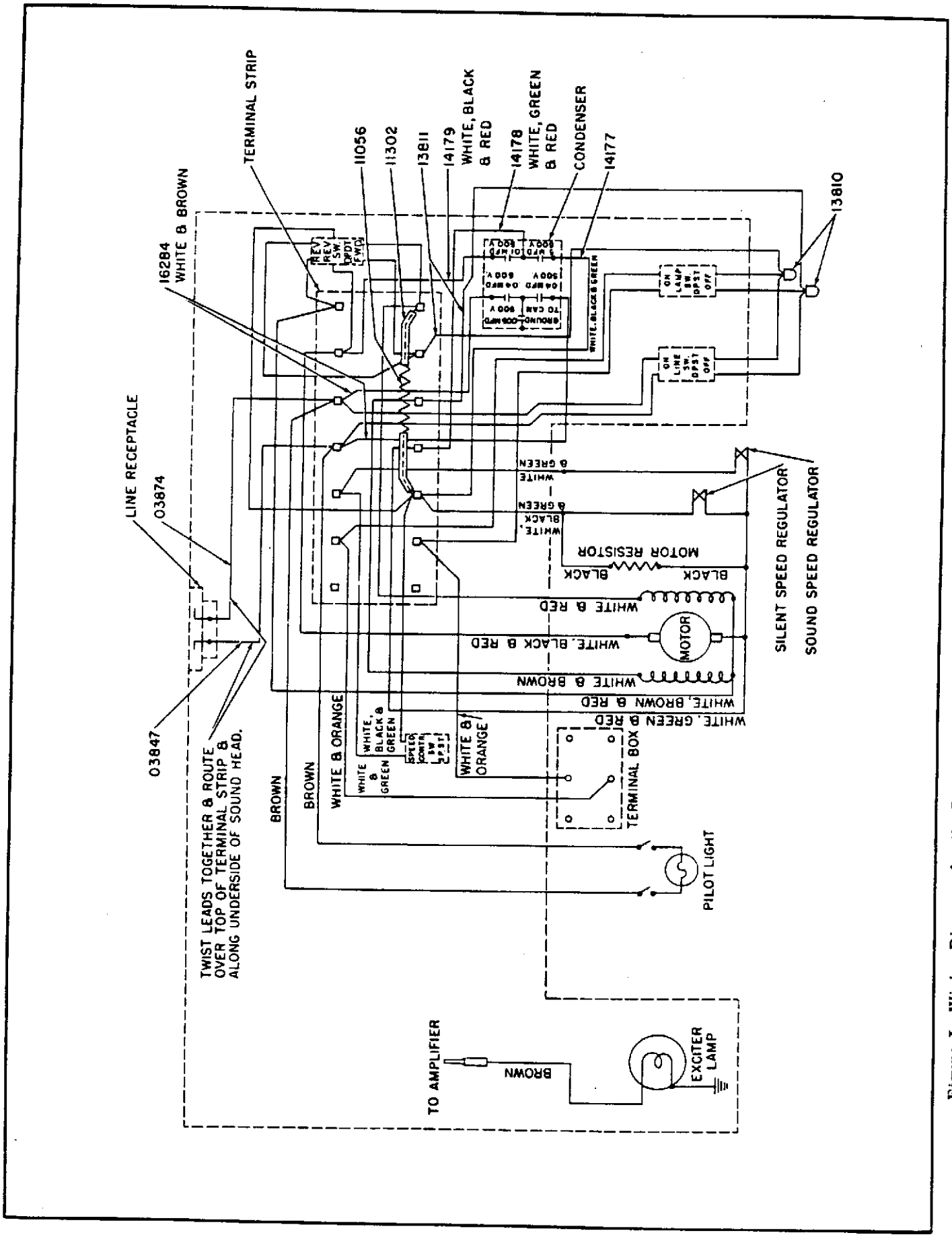

Figure J. Wiring Diagram for the Design 179, Models A, B, C, D and the Design 185, Model A Projectors

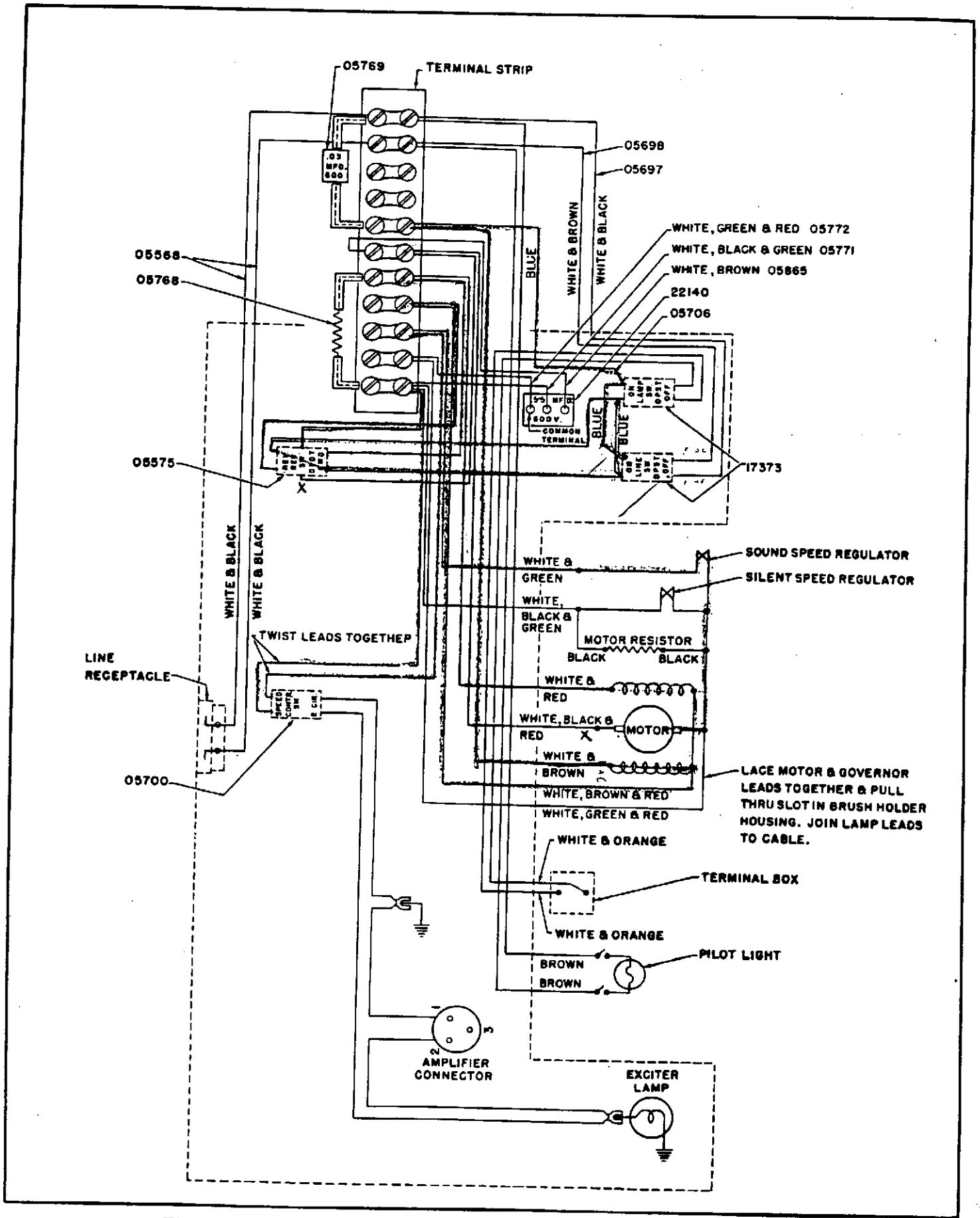

Figure K. Wiring Diagram for the Design 185, Models B and C Projectors

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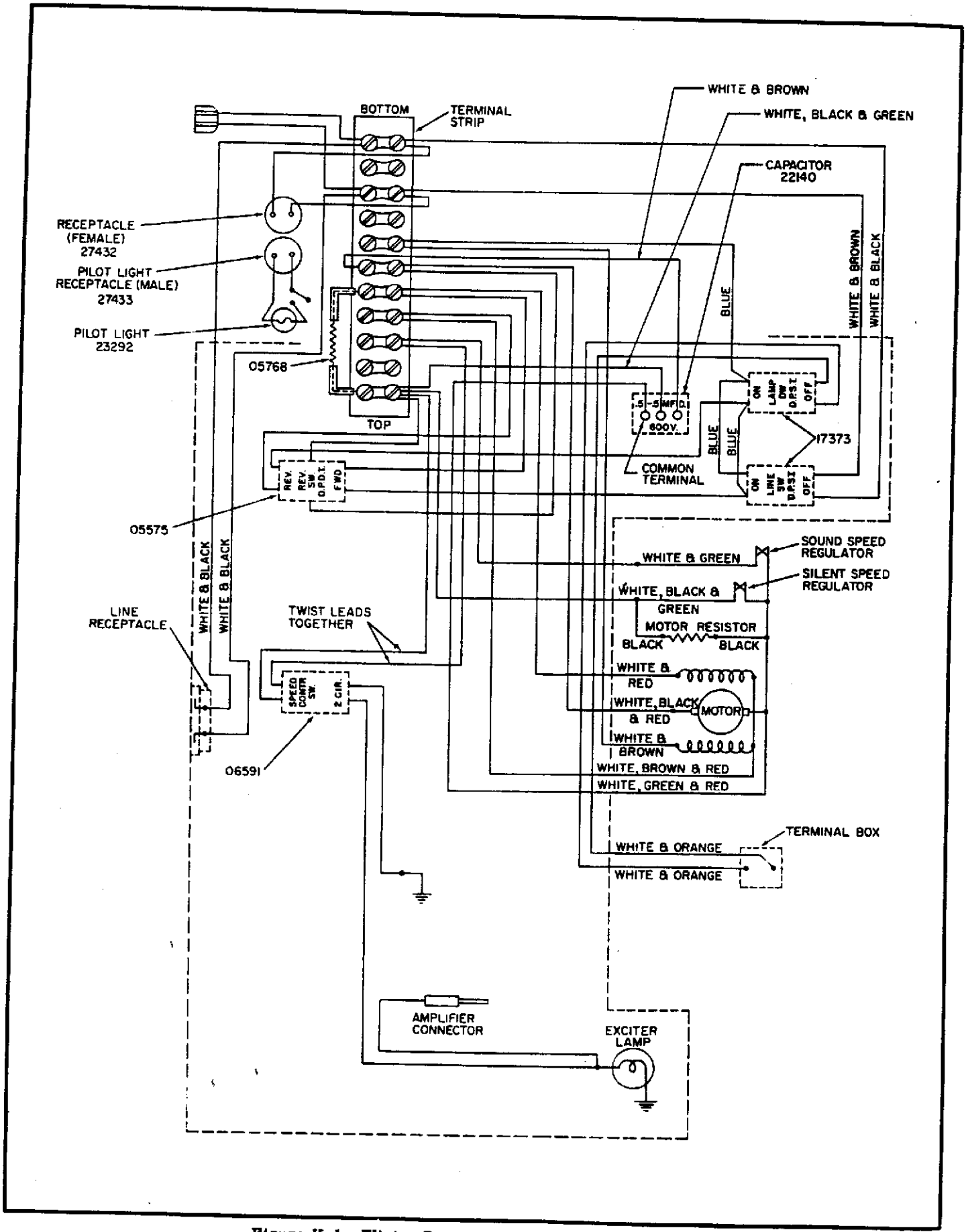

Figure K-1. Wiring Diagram for Design 285 Projector

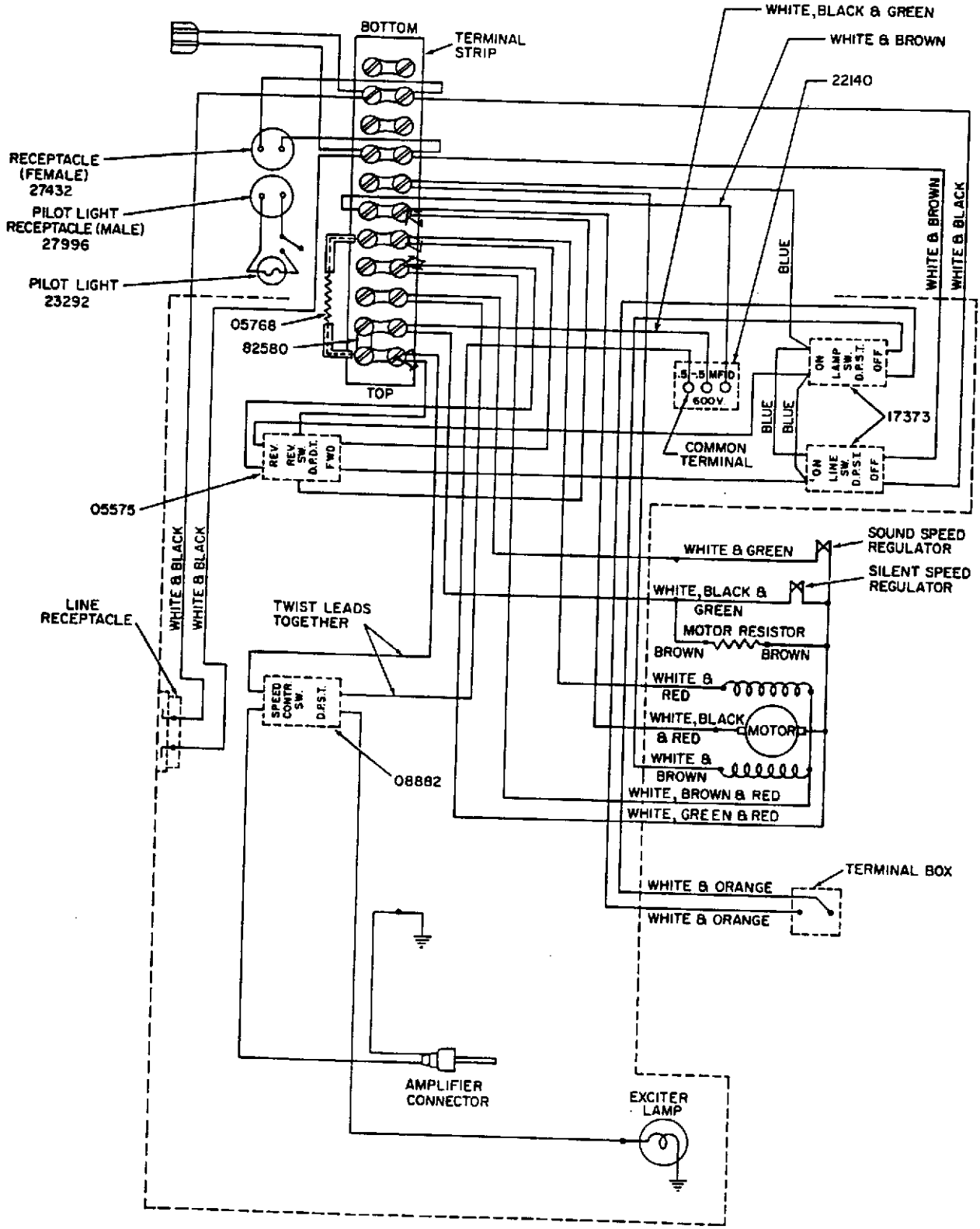

Figure K-2. Wiring Diagram for Design 385 Projector

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c. A view of part no. 05311 amplifier is in figure G.

NOTE

In the reassembly instructions that follow, no mention is made of the wiring connections. It is suggested that proper wiring connections be made as much as possible as the reassembly progresses. Refer to the schematics shown in figures H, I, J and K. These diagrams are projector wiring schematics only. Amplifier wiring diagrams will be found in the amplifier wiring diagrams manual.

26. SOUND HEAD ASSEMBLY, 2 of 2 ILLUSTRATIONS. (See figure 11.)

a. Place the switch locating disc (40) on the threaded portion of the SILENT-SOUND switch (41) (the smallest of the four switches) and insert the switch through the sound head (19) as shown by the dotted line in figure 11. The projecting tip on the switch locating disc (40) must engage the small hole just above the large hole for the switch in the sound head. On the outside of the sound head, position the SILENT-SOUND name plate (39) on the threaded portion of the switch and then screw on the thin hex nut (38).

b. The switch locating disc (36), the FORWARD-REVERSE switch (37) (second smallest of the four switches), the FORWARD-REVERSE name plate (35) and the thin hex nut (34) are assembled in exactly the same manner as outlined in subparagraph 26a above.

c. The largest size switches (33) are the LINE switch and the LAMP switch. Insert these through the sound head as indicated by the dotted line in figure 11. Position the LINE-LAMP name plate (32) on the sound head and screw on the thin hex nuts (31).

d. Position the hermetically sealed capacitor (30) on the inside of the sound head and just behind the LINE-LAMP SWITCHES. Secure it in place with two Phillips head screws (29).

e. This subparagraph and subparagraph f immediately following apply only to the Design 185 B and C projector sound heads. Replace the capacitor (28) and resistor (27) on the terminal strip now. Position the terminal strip insulation (26) and the terminal strip (25) on the inside of the sound head (19) about halfway between the sealed capacitor (30) and the rear of the sound head. Attach the terminal strip securely with the oval head screws (24), being sure to line up the holes marked with the letter A in figure 11.

f. Place the type "J" speed nut (23) on the terminal cover (22) as shown in figure 11. Position the terminal cover (22) in the sound head and attach it to the terminal strip with the fillister head screw (20) and to the sound head with the oval head screw (21).

g. The Design 179 projectors and the Design 185 A have a different sound head which requires a different method of mounting the terminal strip. The parts involved are shown in the inset near the center of figure 11. Insert two screws (26F) through the sound head. On the inside of the sound head, place a spacer (26E) on each screw. Then screw one hex nut (26A) on each screw. Now position the terminal strip (26D) on the screws. Screw another hex nut (26A) on each screw and follow this with the spacers (26C). Position the terminal cover (22A) on the screws and fasten these parts securely with the washers (26B) and the hex nuts (26A).

h. Position the receptacle (18) in the rear of the sound head (19) and securely fasten in place with the fillister head screws (16) and speed nuts (17).

i. On the Design 185 B and C sound heads, position the exciter lamp socket (15) in the sound head and secure it in place with the fillister head screws (14).

j. All Design 179 and the Design 185 A sound heads use a type of exciter lamp socket that can be disassembled. The parts are shown exploded in the inset in the lower left-hand corner of figure 11. Insert the jack lead assembly (15B) up through the compression spring (15C), through the bakelite washer (15D) and into the lamp socket shell (15E). Assemble all of these parts to the socket support (15F) and then insert them in place in the sound head. Secure them in place with the fillister head screw (15A), which screws in from the outside of the sound head. This type of exciter lamp socket requires an adjustment. A rough adjustment should be made now as outlined in subparagraph k immediately following. A more accurate adjustment can be made later with the use of sound as outlined in paragraph 45.

k. Place an exciter lamp in the socket. The lamp must be adjusted so that the lamp filament is parallel with the sound optical slit (see figure 10, index 60). To adjust, loosen the fillister head screw (15A) and move the entire socket assembly up or down as required until the filament of the exciter lamp lines up exactly with the inscribed filament line behind the exciter lamp. This can be done by sighting across the top of the filament. Tighten the fillister head screw (15A) and remove the exciter lamp to prevent breakage.

NOTE

Be very careful not to nick or damage in any way the flange on the sound drum (12) during the following reassembly procedure.

l. Insert the 6-mm radial bearing (13) into the recess in the rear of the sound head. Then carefully insert the sound drum (12) into the sound head. Tilt it just enough on the inside of the sound head to place the flywheel (11) on the end of it and then screw the hex nut (10) onto the end of the drum shaft as far as possible.

m. Hold the bearing (13) in place and carefully insert the end of the drum shaft into it. Through the bottom hole in the flange on the sound drum (12), insert the long fillister head screw (7) and secure it on the inside with the cable clamp (9) and hex nut (8).

n. Now insert the compression spring (4) and spring retainer (3) into the bearing retainer cap (2). Position the bearing retainer cap (2) over the bearing (13) and secure it in place with fillister head screws (1).

o. On the front of the sound head, screw in the other two sound drum attaching screws (5), and also attaching the light shield (6) with the screw that goes into the top hole in the sound drum flange.

27. SOUND HEAD ASSEMBLY, 1 of 2 ILLUSTRATIONS. (See figure 10.)

a. If the optical slit assembly (60) was removed, replace it and screw in the set screw (59). Note that one end of the optical slit has a slightly protruding mask. This end must face the sound drum. Do not seal the set screw in with sealing wax until proper adjustment of the optical slit assembly has been made, as outlined in paragraph 50.

b. Assemble the mounting brackets (58) to the sound head with the Phillips binding head screws (57). The brackets shown are for the Design 185 B and C projectors only. The brackets for the Design 179 and the 185 A projectors are already assembled in the projector case.

c. On the 185 B and C, insert the idler roller stud (53) through the idler roller (55) and spacer (54) and screw it into the sound head. On all Design 179 models and the Design 185 A, the hex nut (56) must be screwed on the idler roller stud to fasten the idler roller in place.

d. Insert one of the snubber studs (48) through one of the roller assemblies (51), through the snubber lever (52) and screw the hex nut (50) onto it. Insert the other snubber stud (48) through the other roller assembly (51), through the snubber lever (52) and screw it into the spring retainer (49), being sure the slot in the spring retainer engages the finger on the snubber lever. Slip the snubber bearing plate (47) over the spring retainer. Then place the torsion spring (46) over the shaft of the spring retainer and hook the front end of the spring into the recess on the back side of the spring retainer collar. Assemble snubber bearing (45) over the spring, being sure the terminal on the end of the spring engages the hole in the end of the snubber bearing. Screw the fillister head screw (44) into the end of the spring retainer as far as possible, but keep bearing plate (47) from being pinched under the bearing (45). The bearing plate must turn freely. Insert the snubber assembly into the sound head and screw in the two fillister head screws (43), being sure that the finger on the snubber lever (52) rides under the screw on the left. Insert the fillister head screw (40) in the bottom hole and attach the cable clamp (42) to it with the hex nut (41). Adjust the snubber assembly as outlined in subparagraphs 27e, f and g immediately following.

e. Note the position of the snubber assembly when it is at rest. Then note the position that the snubber assumes when film is being run through the projector. The tension on the snubber assembly must be such that it will not start to take effect until the snubber has moved about 1/16 of an inch from the "rest" position.

f. To adjust the snubber assembly, proceed as follows: Loosen the three attaching screws (40 and 43) and leave them loose while making the adjustment. Turn the bearing part of the snubber (see figure 10, index 45) that extends into the sound head in either direction as necessary to either increase or decrease the tension of the snubber torsion spring. Hold the bearing (45) in the desired position and at the same time tighten the three attaching screws (40 and 43). Check the action of the snubber. If tension is not felt when the snubber is about 1/16 of an inch out of the "rest" position, loosen the attaching screws and again adjust until the desired results are obtained.

g. When the condition just stated exists, it means that the torsion spring (46) is at rest when the snubber is in the "rest" position, but upon raising the snubber about 1/16 of an inch, the torsion spring begins to exert pressure on the snubber. As the snubber is raised further, the tension will build up strong enough to take care of all conditions.

h. A felt washer is located inside the sprocket (30). To avoid damaging it, use tool No. S-15177-F3 (see figure B, index 14). Saturate the felt washer with B & H oil. Insert the sprocket shaft (35) into the sound head, assembling the sprocket driving gear (37) and washer (36) to it as it passes through the pocket in the sound head. Tighten the set screw (34) against the flat surface of the shaft just enough to keep the shaft from turning but not so tight as to keep the shaft from being adjusted in or out. Slip spacer washer (33) and spring washer (32) onto the shaft and into the sound head. Assemble the film guide (39) to the sound head with the fillister head screws (38) at this time. Now place tool No. S-15177-N1 (see figure B, index 16) and tool No. S-15177-N2 (see figure B, index 15) on the sprocket shaft as shown in figure S. Screw the knurled head portion of the tool in as far as possible, thus drawing the shaft into the correct position. Tool No. S-15177-N1 should bear up tight against the film guide. Tighten set screw (34) securely at this time. Remove tools.

i. Slip tool No. S-15177-F3 (see figure B, index 14) onto the end of the sprocket shaft. Slide the sprocket (30) over the cone, onto the shaft and into the sound head. Remove the cone tool and again screw tool No. S-15177-N2 (see figure B, index 15) onto shaft. Tighten the two set screws (29). The sprocket, sprocket shaft and driving gear should now be positioned correctly. Remove tool from shaft.

j. Use tool No. S-15638-N6 (see figure B, index 10) to adjust the film guide clearance as follows: Loosen the screws (38) and insert the clearance tool between the sprocket and the film guide as shown in figure U. The tool will fit over the sprocket in only one way. Press the film guide down against the tool and tighten the screws (38). Remove the clearance gauge.

k. Fasten the film stripper (24) with the fillister head screw (23).

l. Insert tension washer (28) and spring (27) into the sprocket guard (26) and attach all of these parts to the sprocket shaft with the fillister head screw (25).

m. The stabilizer assembly for the Design 185 B and C is assembled as follows: (See paragraph 27r below for the Design 179 and 185 A stabilizer.) Screw stabilizer stud (17) through the lock nut (18) and into the sound head. Place the torsion spring (8) in place in the lower stabilizer arm (12) and secure it there with the fillister head screw (7). Insert the stud (10) through the plain roller (11), lower arm (12) and then screw the fillister head screw (9) into it. This completes what may be called the lower arm assembly.

n. Insert roller stud (14) through the flanged roller (15) and stabilizer arm (16) and then screw the fillister head screw (13) into it. Now twist the spring about one-half turn in a counterclockwise direction (looking at spring from the rear), or just enough to clear the flat bottom of the lower arm (12). Hold the spring in this position and at the same time slip the brass post which is located on the upper arm (16),

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through the lower arm (12) and spring (8). Hook the free end of the spring to the small, grooved post on the arm (16). The spring should now cause the lower arm to rotate in a clockwise direction as far as possible when looking at the stabilizer as it is shown in figure 10.

o. Install the stabilizer on the stud (17), forcing the lower arm assembly about one-half turn in a counterclockwise direction when doing so. After the stabilizer is fully in position on the stud, the lower arm should bear up against the post which is located in the sound head just below where the stabilizer stud (17) is screwed in.

p. Replace bronze washer (6) if any were removed in disassembly, the cap (5) and tighten the set screw (4). For adjustment of the stabilizer assembly, see paragraph 46.

q. Insert the knurled head screw (2) into the exciter lamp cover (3) and then place the retaining ring (1) on the screw to hold it in the cover.

r. This paragraph applies to the stabilizer assembly used on the Design 179 and 185 A projectors only. Insert the stabilizer stud (21) through the plate and pin assembly (22) and through the sound head. Attach it securely with the hex nut (20). Position the stabilizer assembly (19) on stud (21) and tighten the set screw which is located in the knurled collar on the upper front of the stabilizer assembly. For the adjustment of the stabilizer assembly as a unit, refer to paragraph 48. The detail and critical adjustments that are made within the stabilizer should never be attempted outside of the Bell & Howell plant. For this reason this style stabilizer (19) should never be disassembled.

28. LAMP HOUSE GROUP. (See figure 9.)

a. Replace the condenser lens (21), spacer spring (20), coated condenser lens (19) and retaining snap ring (18) in the condenser housing (22). In the event that the two condenser lenses are mixed up, refer to paragraph 9 for a method of determining which is which. Lay the condenser assembly (17) aside until projector is completely reassembled.

b. Attach the condenser friction spring (15) to the motor housing (16) with the fillister head screw (14).

c. If, for any reason, the heat conducting ring (13) was removed, re-cement it in place in the terminal box assembly (12). Position the terminal box (12) under the lamp house and fasten securely with the fillister head screws (11). Screw in the lamp lock screw assembly (10).

d. Slip the air-circulating tube (9) into the lamp house. Attach the lamp house cap (8) securely to the lamp house with the fillister head screws (7).

e. Some projectors may have the type of reflector (2) shown exploded in the inset. Assemble it as follows: Insert the grooved heads of the three reflector adjusting screws (3) into the three slots in the rear of the reflector mounting spring (5). Screw these screws into the reflector mounting (4). Place the reflector (6) on the spring and bend the three clamps of the spring over the edge of the reflector. The adjustment of this reflector will be found in paragraph 41.

f. The other type of reflector (1) is fabricated into one unit and is merely screwed into place. The adjustment for this reflector is the same as for the reflector (2) and will be found in paragraph 41.

29. FAN, GOVERNOR AND MOTOR. (See figure 8.)

a. Carefully place the resistor (42) inside of the resistor clamp (41) and secure the clamp to the inside front of the motor housing (45). Caution is advised so as not to damage the ceramic case around resistor.

b. Insert the 7-mm radial bearing (44) into the front of the motor housing and screw in the bearing retaining ring (43). Use tool No. ST-244-F1 (see figure B, index 1) to screw in and tighten the bearing retainer.

c. Carefully insert the stator assembly (39) into the motor housing and screw on the retaining nuts (38).

CAUTION

When assembling the armature (37), do NOT allow it to slip forward in the motor housing and come in contact with the resistor clamp (41). The result may be torn armature windings which would necessitate replacing the armature with a new one.

d. Carefully insert the armature (37) through the motor housing and allow just enough of the shaft to project through the front of the housing to permit the blower fan (34) to be assembled to it. Slip the spacer (36), armature spring washer (35) and blower fan (34) onto the shaft. The six points of the spring washer (35) should bear up against the six ribs of the blower fan, which are formed by the holes in the front surface of the fan. Align the hole in the hub of the blower fan up with the threaded hole in the armature shaft and screw in the dowel screw (33).

e. Slip the spacer (32) into the recess in the brush housing (31) and then position the brush housing on the back end of the armature shaft end up against the motor housing. Attach it securely with the fillister head screws (30).

f. Slip the 6-mm radial bearing (26) and the locking washer (25) onto the shaft and up against the brush housing. Screw the hex nut (24) onto the shaft as far as possible and then bend the ears of the locking washer (25) up against the sides of the hex nut. Position the bearing retaining cap (23) up against the brush housing and attach it in place with the fillister head screws (22).

g. Insert the motor brushes and springs (28 and 29) into the brush housing. Be sure that the curvature of the brushes matches the curvature of the armature. Screw in the motor brush caps (27).

h. Insert the three governor brushes (21) into the brush housing and slip the governor (20) onto the end of the armature shaft. Be sure the tips of the governor brushes are bearing flat against the governor rings, and that you can see about 1/16 inch of the governor brushes. Secure the governor to the shaft with the set screws (19).

i. This subparagraph applies only to the new style clutch shown in figure 8 as index items 11 through 18. Place the compression spring (18) and spring retainer (17) on the armature shaft. Use tool No. S-19028-F3 (see figure B, index 24) to compress the spring and retainer as shown in figure E and then insert the dowel pin (16). Slip a motor pinion washer (13) onto

the shaft. Insert thirty-one roller bearings (15) into the motor pinion (14). Place just enough B & H oil on these bearings to hold them in place when positioning the motor pinion on the shaft. Usually about one drop is sufficient. Place the motor pinion (14) on the shaft with the end into which the bearings were placed going on first. Slip another motor pinion washer (13) (when used) and the thrust washer (12) onto the shaft. Screw the thrust nut (11) onto the shaft as far as possible, with the slotted surface going on first. Then use tool No. S-19028-F4 (see figure B, index 23) to press the thrust washer (12) back as far as possible and at the same time screw the thrust nut (11) up against the thrust washer. Remove the tool and back the nut off just enough to allow the two ears on the thrust washer to drop into the nearest slots in the thrust nut (11). The motor pinion should now be positioned under a sufficient amount of force to prevent its slipping on the shaft when the projector is operating. However, should the motor pinion still slip, the compression spring (18) will have to be replaced. For correct adjustment of the clutch lever, see paragraph 43.

j. This subparagraph applies only to the old style clutch shown in figure 8 as index items 1 through 10. Place the compression spring (10) and spring retainer (9) on the armature shaft. Use tool No. S-19028-F3 (see figure B, index 24) to compress the spring and retainer as shown in figure E and then insert the dowel pin (8). Slip a motor pinion washer (5) onto the shaft. Insert thirty-one roller bearings (7) into the motor pinion (6). Place just enough B & H oil on the bearings to hold them in place when positioning the motor pinion on the shaft. Usually, about one drop is sufficient. Place the motor pinion (6) on the shaft with the end into which the bearings were placed going on first. Slip another motor pinion washer (5) (when used) onto the shaft. Screw the adjusting nut (4) onto the armature shaft as far as possible so that the motor pinion (6) and washers (5) are locked in place. Then back off the adjusting nut (4) from one to 1-1/4 turns, until the slots in the adjusting nut line up with the slots in the armature shaft. Under no circumstances should the adjusting nut be unscrewed more than 1-1/4 turns or less than one turn. Insert the clutch operating pin (3) into the shaft. Place the four clutch jaws (2) in the four slots of the adjusting nut (4) and hook the small end of the clutch jaws under the metal ring on the adjusting nut. Place the spring and roller assembly (1) over the clutch jaws so that each roller "straddles" one of the clutch jaws.

30. GOVERNOR CAP ASSEMBLY. (See figure 7.)

a. Before reassembling the governor cap assembly, identify the type you are servicing by comparing the actual parts with the illustration. Items indexed 1 through 14 are used on all types while items indexed 23 through 30 replace items indexed 15 through 22 on some. The main difference is the type of bearing used (either 20 or 30). Also, the governor cap (33) will accommodate one or the other but not both. Either complete governor cap assembly will work on any model Filmosound.

b. The type of governor cap assembly using items indexed 23 through 30 is assembled as follows: Lubricate the bearings before reassembling them. Insert the retaining ring (31), radial bearing (30) and retaining ring (29) into the bearing cap (33). Insert the shaft (28) through the radial bearing. Reach in from the opposite side of the governor cap and drop the retaining pin (27) into the hole provided for it in the shaft (28). Insert the worm wheel (26), radial bearing (25), retaining washer (24) and secure these parts in place with the truss head screw (23).

c. The type of governor cap assembly using items indexed 15 through 22 is assembled as follows: Place a layer of grease around the beveled shoulder on each end of the opening into which the shaft (19) will go. Insert the pulley shaft (19) through the worm wheel (21), through the spring washer (22) and partially into the governor cap (33). Now place thirty-five steel balls (20) on the beveled shoulder and between the worm wheel (21) and the collar on the shaft (19). If the steel balls are placed in position first, the worm wheel will displace the steel balls when it is installed and the steel balls will have to be repositioned again. Carefully insert the shaft (19) the rest of the way in and hold it in place, using tape if necessary. On the opposite side now place thirty-five more steel balls (18) in the layer of grease on the beveled shoulder. Carefully place the bearing collar (17) on the shaft and up against the steel balls. At this time check to be sure the slot in the worm wheel (21) is engaging the pin on the shaft (19). If not, rotate the shaft (19) and push in on the bearing collar (17) until the shaft engages the worm wheel. Tighten the two set screws (16). With a soft hammer, tap the bearing cap (15) into place.

d. Place eighteen roller bearings (14) around the inner diameter of the rear take-up pulley (13). Be sure to lubricate the bearings with B & H grease before reassembling them. Insert the clutch ball retainer (12) into the take-up pulley.

e. Position the clutch cam (10) on the shaft with the slot in the cam engaging the ear on the clutch ball retainer. When the clutch cam (10) has been placed properly, the small ends of the three cutouts in the outer edge will be in a clockwise direction from the large ends of the cutouts.

f. Insert the three steel balls (11) in between the ears on the outside diameter of the retainer and then place the compression spring (9) in the slot in the cam. Replace the bronze washer (8), reel drive clutch cover (7) and screw (6). Use special tool No. S-12264-F3 (see figure B, index 25) to screw in the screw (6).

g. Insert the worm shaft (4) through the felt washer (5) and governor cap (33). Place the radial bearing (3) on the other end and screw in the fillister head screw (2). Lubricate the radial bearing and pack the space between the bearing and the nut (1) with a liberal amount of B & H grease.

h. Screw on the special nut (1) using a pair of long nosed pliers to do it. Before screwing in the fillister head screw (32), pack the hole into which it goes with B & H grease.

31. RELAY CONDENSER ASSEMBLY. (See figure 6.)

a. Attach the handle (22) to the holder (23) with the round head screw (21). Insert the auxiliary lens (20) into holder and secure it in place with the lens re-

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taining spring (19).

b. Lay the relay condenser assembly (18) aside for insertion into the projector later on.

32. BLOWER HOUSING ASSEMBLY. (See figure 6.)

a. The set screw (16) is for the purpose of adjusting the safety shutter and should not be removed or turned unless the safety shutter requires an adjustment after reassembly. See paragraph 43 for this adjustment.

b. Attach the relay condenser spring retainer (15) to blower housing (17) with the special fillister head screws (14). Replace pilot light fastening studs (13).

c. Attach the safety shutter guide (12) to inside of the blower housing with fillister head screws (11). Carefully insert hooked lip of safety shutter (10) into the safety shutter guide. It would be wise to tape the safety shutter in place temporarily to prevent it from juggling around and causing possible damage to the hooked lip. Remove the tape when assembling the blower housing to the motor housing.

33. PILOT LIGHT ASSEMBLY. (See figure 6.)

a. Insert the light socket (6) through the socket tube (8) as shown in figure 6 and screw on the round nut (5). Place the friction spring (7) around the groove in the socket tube. Then insert these parts into the pilot light housing (9), pressing the spring (7) into the groove as it passes into the housing.

b. Turn the socket tube (8) until the slot in the top lines up with the hole into which the pilot screw (4) goes. Screw in the pilot screw.

c. Screw the lamp (3) into the socket and the guard (2) into the socket tube.

d. Lay the pilot light unit assembly aside for assembly to the blower housing later.

34. GEAR CASE ASSEMBLY, 3 of 3 ILLUSTRATIONS. (See figure 5.)

a. Replace the same type of oiler (32 through 37) into the same hole from which it was removed in disassembly. Replace the same amount of bearing shims (29) on each of the shaft bearings (28) that were removed in disassembly. Use the drift punch (see figure B, index 17) to drive the shaft bearings home in the gear case (41).

NOTE

Before replacing the shaft bearings (28), note that there is a hole drilled in the barrel of each one. These holes must line up with the ends of the hole that is provided in the gear case for the oiler felt (27), so that the ends of the oiler felt will continually lubricate the shuttle shaft (13) and counter gear shaft (22).

b. Saturate the oiler felt (27) with B & H oil. Replace the oiler felt (27) by inserting it into one of the shaft bearings and then forcing it into the hole that extends between the two shaft bearings. Attach the spring clamp (26) between the two shaft bearings with the flat head screw (25).

c. Saturate the oiler assembly (31) with B & H oil and attach it inside the gear case with the fillister head screw (30).

d. In order to reassembly shafts (22 and 13), bearings (23 and 14) and felts (24 and 15) correctly and easily, the following directions should be read and followed carefully. Figures L through P will help by illustrating the various steps.

e. Place the tool jig No. S-4007-F11 (see figure B, index 7) on the table in front of you. Slide the brass sleeve No. S-4007-F5 (see figure B, index 5) over the post on the jig. Now slide collar No. S-4007-F6 (see figure B, index 9) over the brass sleeve, being sure the cone surface of the collar is facing up. Place fifteen new steel balls (23) on the cone surface as shown in figure L. Do not grease the steel balls. Then place the counter gear and shaft assembly (22) inside the brass sleeve in the same manner as shown in figure M for the shuttle shaft. Slide the collar on which the steel balls are resting up along the brass sleeve and note the surface on the underside of the counter gear where the steel balls touch. Slide the collar back down, remove the counter gear and place a layer of B & H grease on the surface just noted. The grease will serve to hold the steel balls in place on the counter gear when the collar is finally removed. There should not be any grease on the surface of the steel balls where they touch the collar, because some or all of the steel balls will probably stick to the cone surface of the collar instead of to the counter gear when the collar is removed.

f. Replace the counter gear and shaft (22) in the

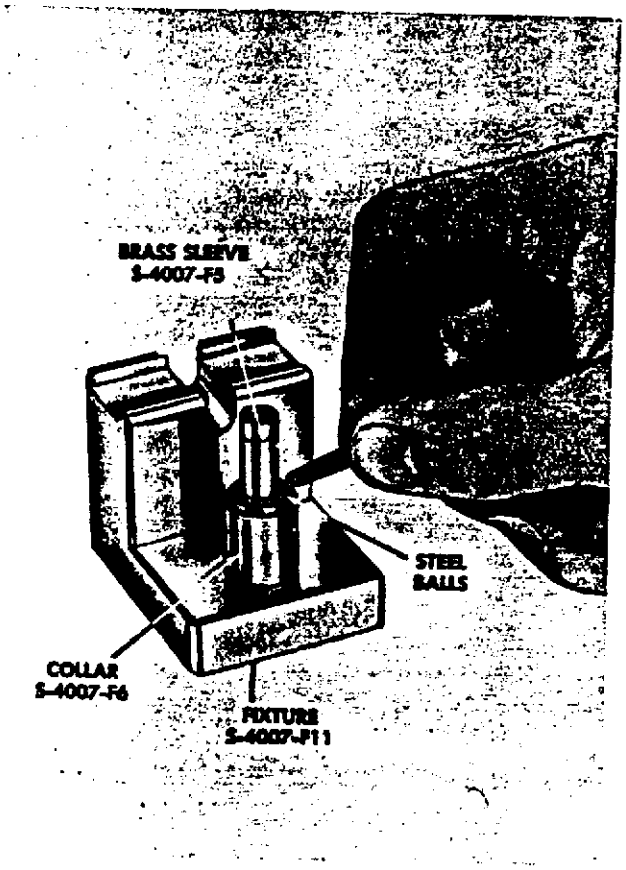

Figure L. Step 1, Reassembly of Counter Gear and Shuttle Shafts

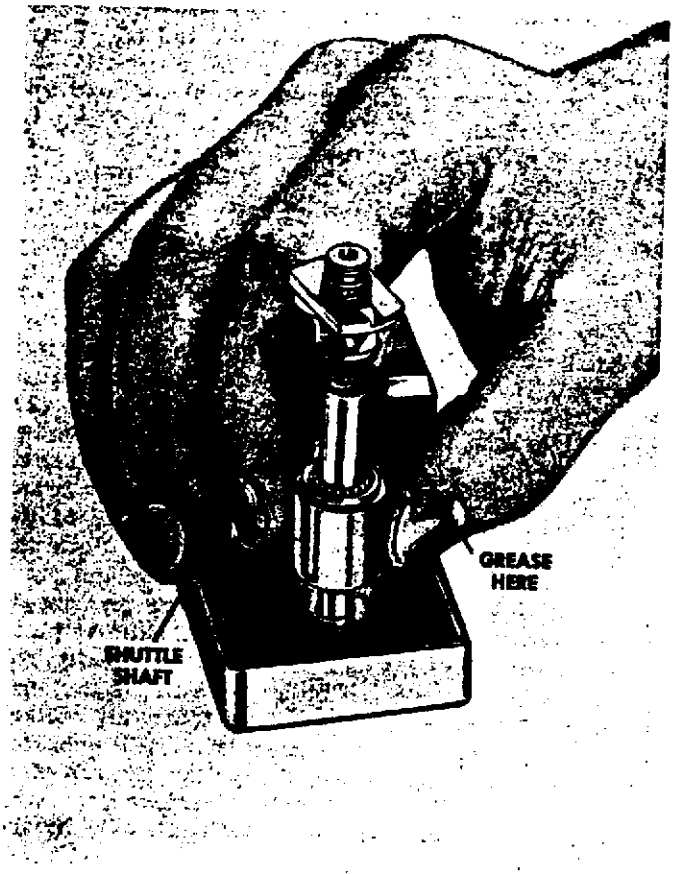

Figure M. Step 2, Reassembly of Counter Gear and Shuttle Shafts

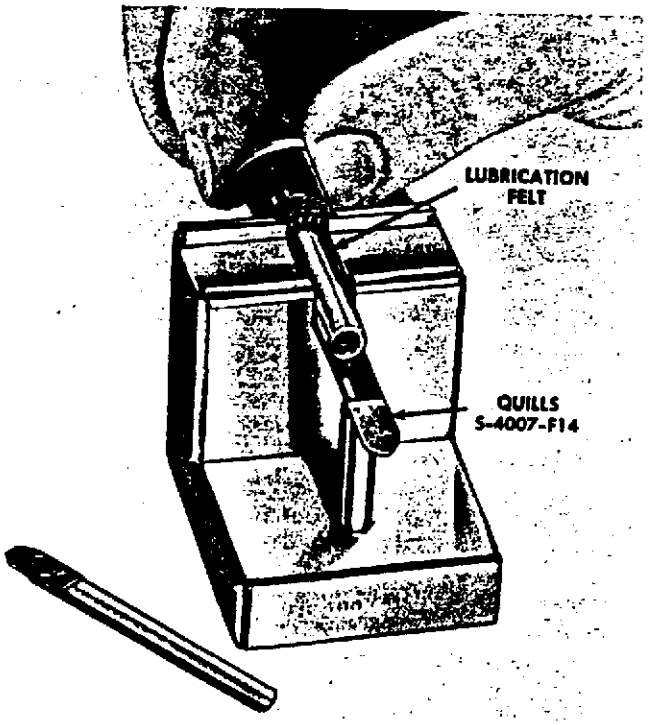

Figure N. Step 3, Reassembly of Counter Gear and Shuttle Shafts

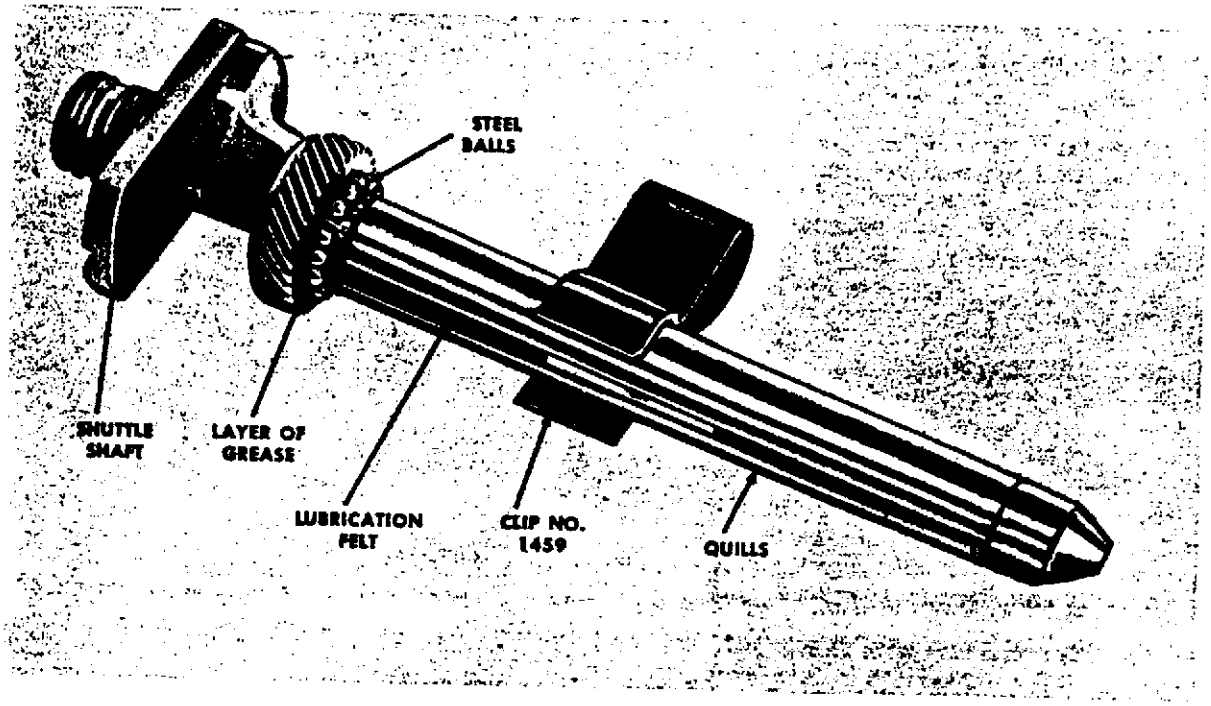

Figure O. Step 4, Reassembly of Counter Gear and Shuttle Shafts

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brass sleeve. Again slide the collar, with the steel balls on it, up along the brass sleeve until the steel balls become imbedded in the thin layer of grease. Slide the collar back down. All of the steel balls should now be in place around the counter gear shaft. Carefully remove and set aside the counter gear and shaft. Remove the brass sleeve and cone collar from the jig.

g. Take one of the quills No. S-4007-F14 (see figure B, index 4) and place it in the jig as shown in figure N. Now saturate the oil felt (24) with B & H oil and place it in the curvature of the quill in the jig. Carefully pick up the counter gear and place it in the jig so that the grooved portion of the shaft just below the bearings rests in the oil felt as shown in figure N. The steel balls should now be in the grooved shoulder on the rear surface of the jig. Place the other quill over the oil felt so that the two quills match to form a cylinder with the shaft and oil felt inside.

h. Hold the quills together by slipping on the clip, stock No. 1459 (see figure B, index 6). Remove the gear and special tools from the jig. Figure O, which uses the shuttle shaft as an example, shows the way it should look if the tools were used properly. Carefully insert the shaft, with quills and clip attached, into the correct bearing hole in the gear case, similar to the manner shown in figure P. Insert the quills into the bearing as far as possible, remove the clip and insert the quills the rest of the way. When the shaft is all the way in, reach inside the gear case, grasp the end of the quills and pull them all of the way through. The shaft, steel balls and oil felt are now in their correct position.

i. Hold the counter gear and shaft in place and insert fifteen new steel balls (21) around the shaft on the inside of the gear case. Slip the right-hand worm (20) onto the shaft as far as possible and turn it until one of the set screw holes lines up with the groove in the shaft. Screw the cone point set screw (19) into this hole and the flat point set screw (18) into the other hole. The counter gear and shaft should now be securely and correctly positioned and there should not be any end play present whatsoever.

j. Place the worm extension (17) on the shaft and up against the worm (20). Secure it to the shaft with the set screws (16).

k. The shuttle shaft (13), fifteen new steel balls (14) and oil felt (15) are assembled in exactly the same manner as described above for the counter gear. Figures L through P illustrate the procedure with the shuttle shaft used as an example. When assembling the shuttle shaft, be sure to line it up properly with the counter gear as shown in figure Q. The slot in the shuttle shaft serves as the index mark for the shuttle shaft. When the shuttle shaft is correctly positioned, hold the shaft in place and on the inside of the gear case, replace fifteen new steel balls (12), collar (11) (push on as far as possible) and two flat

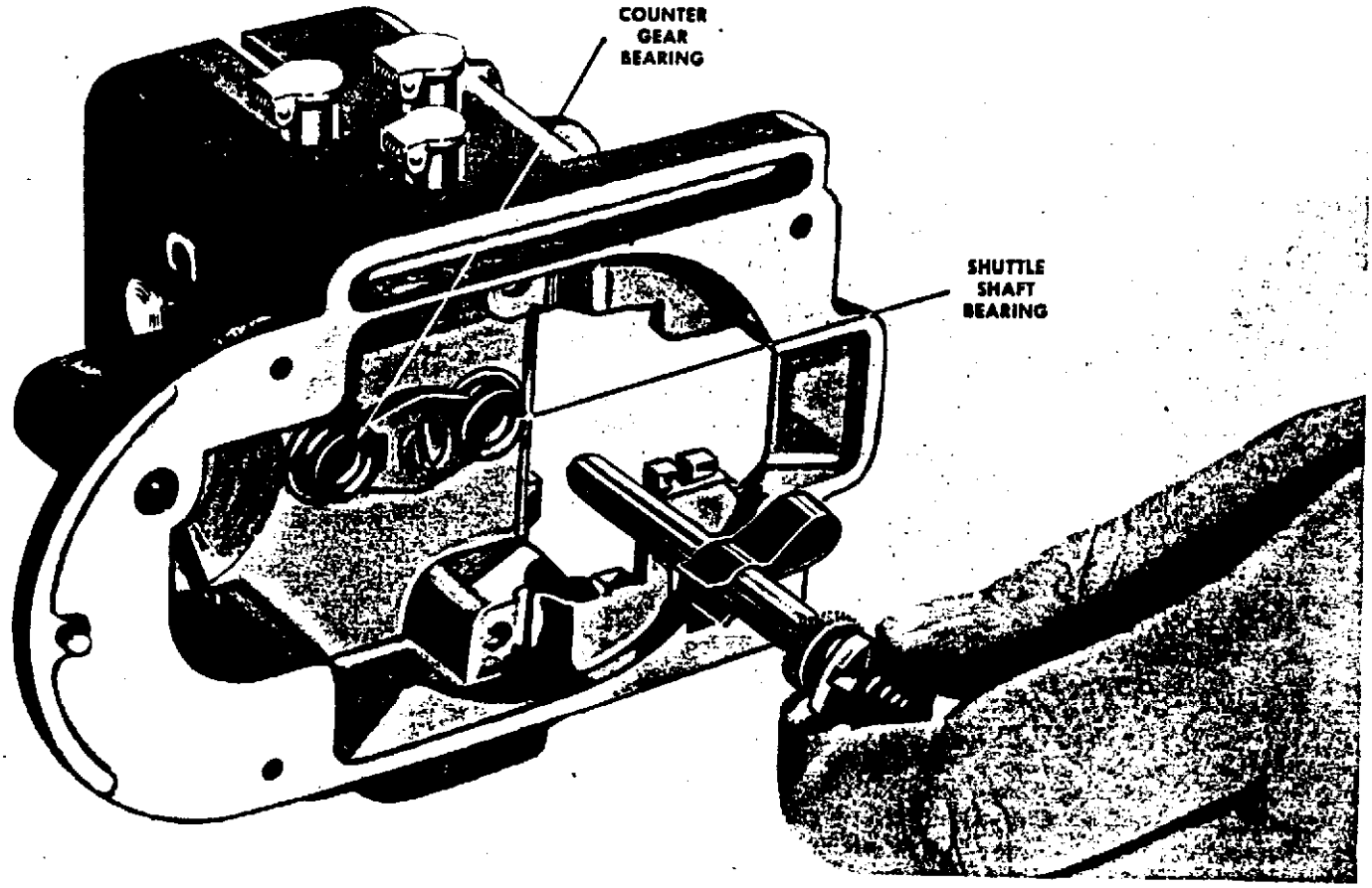

Figure P. Step 5, Reassembly of Counter Gear and Shuttle Shafts

point set screws (10). The teeth of the gear on the shuttle shaft should now be engaging the counter gear teeth and there should not be any end play present whatsoever. Also, the timing as indicated in figure Q should be exactly true.

l. Insert the dowel pins (9) into the double tooth shuttle (8) and position the shuttle on the rear of the gear case. Now push the dowel pins out until they butt against the gear case and secure them in this position with the special fillister head screws (7).

m. The shuttles are made in four types in order to assure greater ease in good fitting. Each shuttle is marked either 1, 2, 3 or 4 in the spot indicated by the letter A in figure 5. For replacement, a shuttle having the same number as the one removed usually should be used.

n. Assemble the two sections of the oiler assembly (4 and 5) together and saturate the felt (6) with B & H projector oil. Press the oiler assembly into place.

o. Place one of the shutter supports (2) on the shuttle shaft so that the small pin on the support (2) engages the timing slot in the shuttle shaft collar (13).

NOTE

Be sure the pin engages the slot. The shutter will not rotate and serious damage to the shutter will result if they are not engaged.

p. Position the shutter (3) on the shuttle shaft and on top of the shutter support (2). Place the second shutter support (2) on the shutter so that the small pin in it goes through the small hole in the shutter and into the first shutter support. Install hex nut (1). Use wrench No. S-10310-F2 (see figure B, index 18) as shown in figure C to engage the shuttle shaft collar and then draw the hex nut (1) on tight with an open end wrench. A view showing the rear of the gear case assembled is in figure R.

35. GEAR CASE ASSEMBLY, 2 of 3 ILLUSTRATIONS. (See figure 4.)

a. Insert the framer shaft and knob assembly (25) into the side of the gear case as shown in figure 4.

b. Place the gear case on its back and place the aperture plate (24) in position. Be sure that the framer knob and shaft assembly (25) is all the way in. The eccentric near the end of the framer shaft must engage the ears on the back of the aperture plate with a snug fit. It may be necessary to bend back the ears slightly to accomplish the snug fit.

c. Insert a fillister head screw (21) through the upper film tension clip (22), through the film gate thrust spring (23) and screw it into the hole in the gear case as shown in figure 4. The clip (22) must fit into the slot in the aperture plate. Attach the lower film tension clip in the same manner.

d. Now that the aperture is correctly positioned (be sure it is flat against the gear case), the height that the shuttle teeth project through the aperture plate can be checked.

e. The distance that the shuttle teeth should project above the surface of the aperture plate is 0.028 (±0.005) of an inch. GO-NO GO gage No. S-4529-N3 (see figure B, index 3) must be used to check this height.

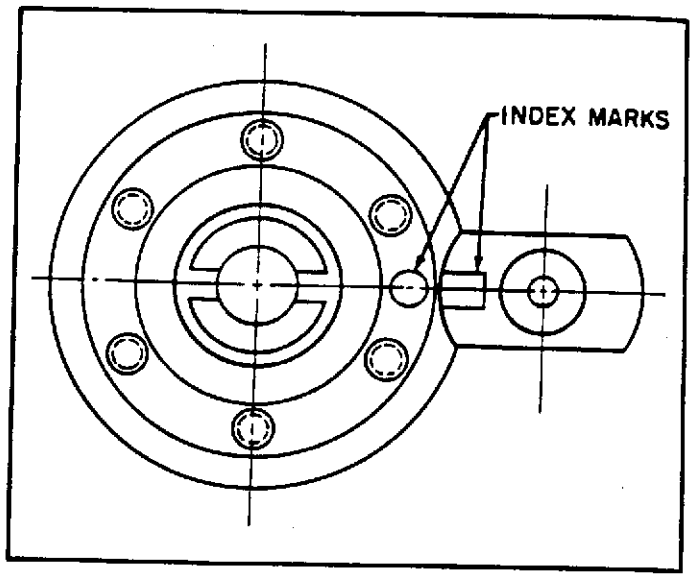

Figure Q. Alinement of Counter Gear and Shuttle Shaft

f. The shuttle cam should be revolved to the point where the shuttle teeth protrude farthest through the aperture plate. The gage is then placed on the rails of the aperture plate.

g. The 0.023 inch step in one end of the gage should strike the teeth and the 0.033 inch step in the other end of the gage should pass over the teeth. If the teeth come at any point between these two settings on the gage, they may be considered set for normal operation. The two heights mentioned are clearly marked on the side of the gage.

h. When the shuttle teeth do not project far enough through the aperture plate as determined by gaging, correction is made by disassembly of the counter gear (see figure 5, index 22) and its related parts. Then remove the bearing (see figure 5, index 28) and add shims (see figure 5, index 29) as necessary to

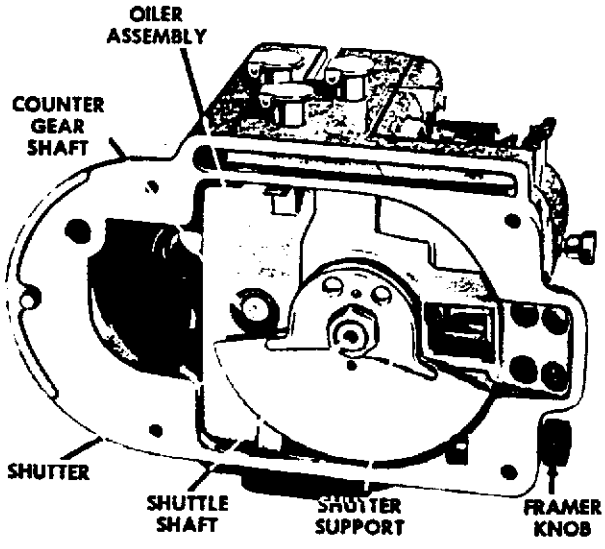

Figure R. Rear of Gear Case Assembled

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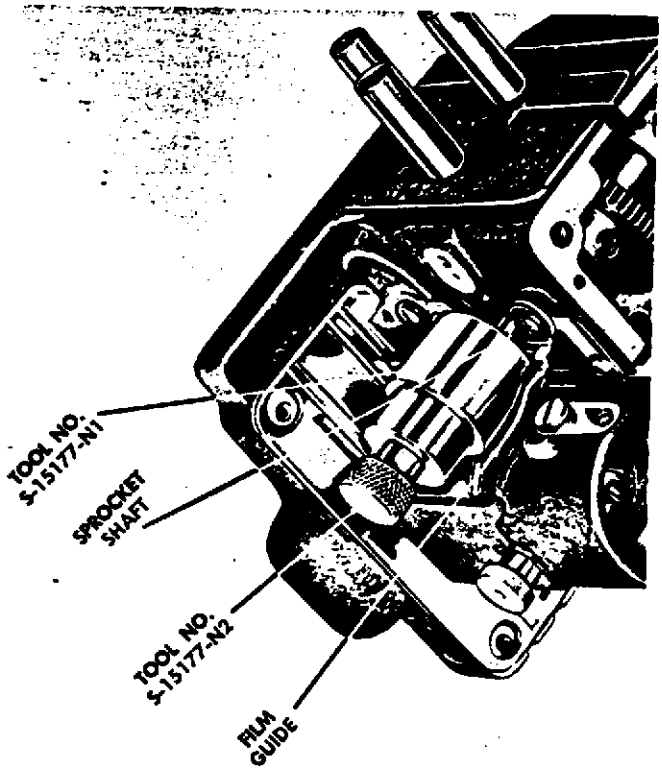

Figure S. Sprocket Shaft Adjustment

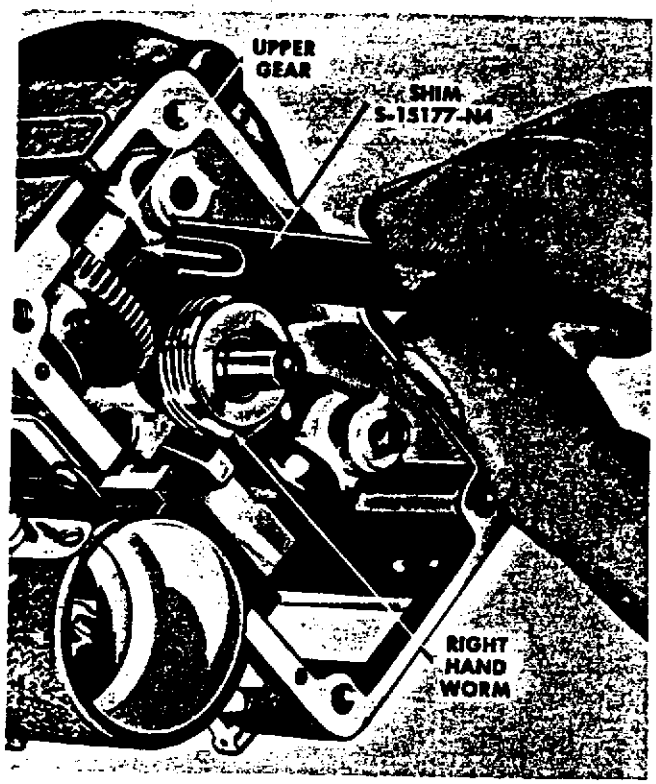

Figure T. Using Shim to Obtain Gear Clearance

bring shuttle teeth height out to fit in the GO-NO GO gage.

i. When the shuttle teeth project too far through the aperture plate, correction is made by using another shuttle or by stoning down the shuttle teeth. Avoid bending the shuttle to make a proper fit. Do not alter the grooves in which the shuttle dowel pins (see figure 5, index 9) lie. Make certain that the aperture plate is flat against the gear case when checking the shuttle teeth.

j. Replace the lens lock assembly (19) (if one was removed) in the lens carrier (20). Position the pressure plate carrier (18) on the rear of the lens carrier, insert the adjustment nuts (17) from the rear and screw the fillister head screws (16) into the adjustment nuts (17). Instructions for properly adjusting the pressure plate carrier (18) are given in paragraph 37d. Attach the steel ball (15) and ball retaining spring (14) to the lens carrier with the fillister head screw (13).

k. Slide the lens carrier assembly into position on the gear case and attach the two lens carrier retainers (12) with the pilot screws (11). The two lens carrier retainers should hold the lens carrier assembly on the gear case but still allow it to slide back and forth freely.

l. Now attach the two film guides (10) with the fillister head screws (9).

m. Insert the upper sprocket shaft (27) into the gear case, assembling the upper gear (29) and one of the washers (28) to it as it passes through the gear case. Then insert the lower sprocket shaft into the gear case, assembling the sprocket worm wheel assembly (30) and the other washer (28) to it as it passes through the gear case. Tighten both flat point set screws (26) against the flats located near the end of each shaft just enough to prevent the shafts from turning, but not enough to prevent the shafts from being adjusted in or out.

n. Place the sprocket shaft adjusting tools Nos. S-15177-N1 and S-15177-N2 (see figure B, index nos. 16 and 15) on the upper shaft as shown in figure S. Screw the knurled head of the tool into the sprocket shaft as far as possible and tighten the flat point set screw (26). Do the same thing with the lower sprocket shaft, tightening the other flat point set screw (26) when the shaft is properly adjusted. Remove the special tools.

o. Place a spring washer (31) on each shaft. Before reassembling the sprockets (8), saturate the felt washers which are located inside of the sprockets with B & H oil. Place sprocket cone No. S-15177-F3 (see figure B, index 14) on the end of the upper shaft. Slide one of the sprockets (8) over the cone and onto the shaft as far as possible. It must go inside the upper gear (29).

p. Remove the cone and again screw in the knurled head adjusting tool. Now insert shim No. S-15177-N4 (see figure B, index 8) between the gear and gear case as shown in figure T. Slide the upper gear (29) over against the shim and tighten the two set screws (7). The shim gives the correct amount of clearance (0.002 inch) between the gear and the gear case, while the knurled screw adjusting tool correctly positions the sprocket on the shaft. Both adjustments are securely held when set screws (7) are tightened. Remove the special tools.

q. Repeat the same procedure for lower sprocket. Slide sprocket over cone, remove cone and replace it with adjusting screw tool, insert shim, slide sprocket worm wheel against shim, tighten set screws (7) and remove tools.

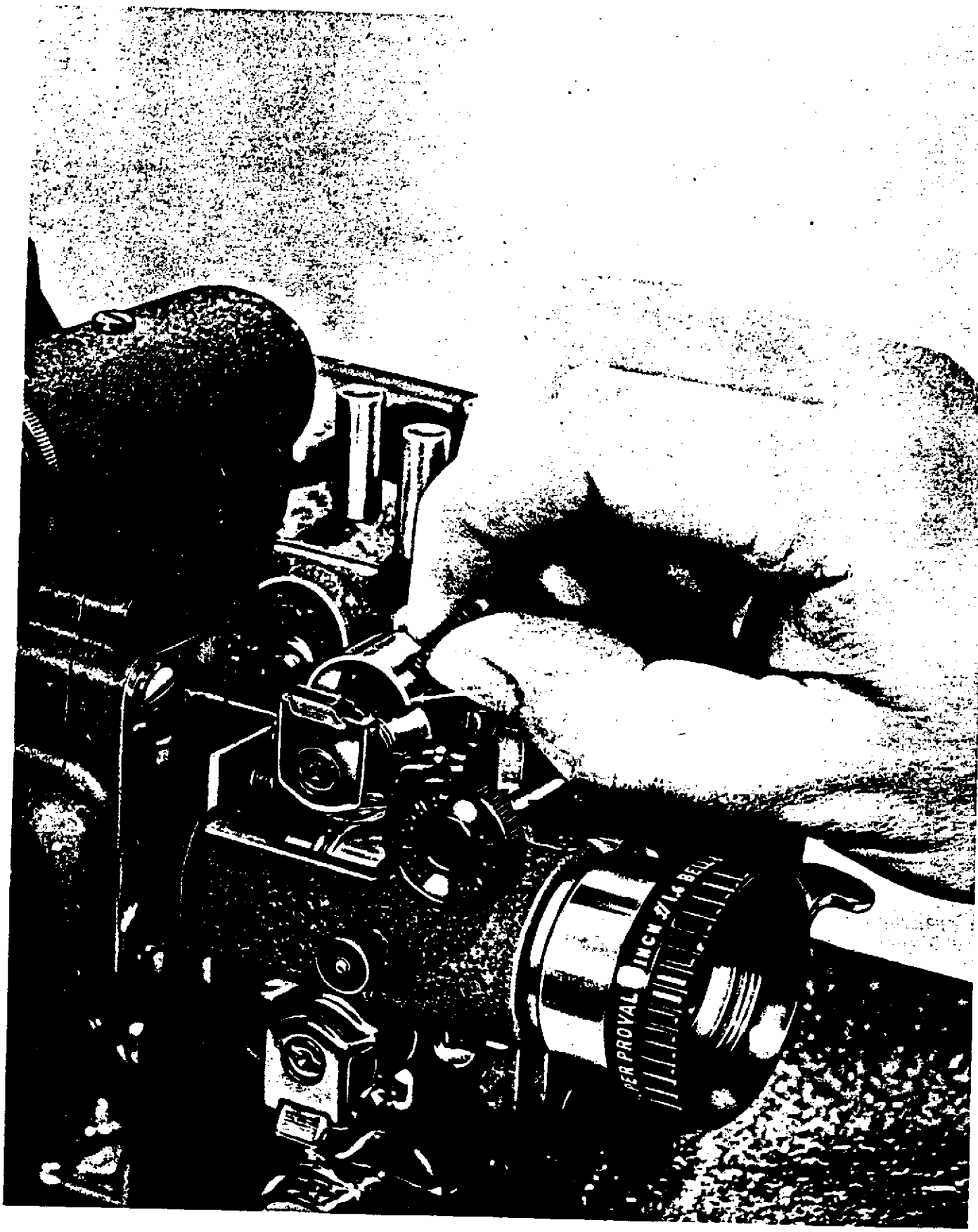

Figure U. Adjusting Film Clearance With Tool No. S-15638-N6

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r. It would be advisable at this time to adjust the film guides (10). Loosen the screws (9). Place the film guide adjusting tool No. S-15638-N6 (see figure B, index 10) on sprocket as shown in figure U. Slide the tool around the sprocket until it is between the film guide and the sprocket. Press the film guide against the tool and tighten the screws (9). Do the same with the lower film guide.

s. Insert a tension washer (6) and spring (5) into each sprocket guard (4) as shown in figure 4 and attach to the end of the sprocket shafts with the fillister head screws (3).

t. Attach the film strippers (2) with the fillister head screws (1).

u. Refer to Figure V for a view of the gear case interior assembled.

36. GEAR CASE ASSEMBLY, 1 of 3 ILLUSTRATIONS. (See figure 3.)

a. Insert clutch plunger (34) into the gear case if the new style clutch, which requires use of the plunger, is used on the projector you are servicing. Place the lower end of the clutch lever (33) into the slot just below the clutch plunger recess. Then insert the clutch lever stud (32) into the gear case so that it engages the hole in the lower tip of the clutch lever (33). Screw in the pilot screw (30).

b. Lubricate the washer (29) with a light coat of B & H grease and place it in position on the boss on the rear of the cover (19). Hold the cover in such a position that the boss and washer will lay flat in the horizontal plane. Lay the idler gear (27) in position on the washer. Use a pair of tweezers to place eighteen steel balls (28) around the inside diameter of the idler gear. Insert the idler gear shaft (26). Hold these parts together with your fingers, turn cover over and screw the fillister head screw (30) into the idler gear shaft (26). Draw the screw up tight.

c. Assemble the eccentric bushing (25), plate and shaft assembly (24), fillister head screw (21), gate operating lever (22) and fillister head screw (23) to the front of the cover as shown in figure 3.

d. Sparingly lubricate the gate operating block (20) and slip it into the slotted recess on the lens carrier assembly.

e. Carefully position the cover (19) on the gear case. The pin on the plate (24) must engage the hole in the gate operating block (20). This engagement is facilitated if the gate operating block is near the bottom of its slot. Manipulate the gate operating lever (22) slightly until the plate (24) engages the block (20). The cover (19) should now go into place on the gear case easily. Do not force it. If it does not drop into place easily, remove and try again. Attach the cover with the oval head screws (18).

f. On some models, the two top cover attaching screws are also used to attach the clutch manipulator assembly shown in the inset (13 through 17). Insert the knob assembly (15) through one side of the mounting bracket (17). Then screw the lock nut (16) onto the end of the shaft and insert the shaft through the other side of the mounting bracket. As the shaft emerges from the other side of the mounting bracket, screw it through the clutch extension and link assembly (14). The slot in the top link of the link assembly (14) must engage the small finger on the mounting bracket and the lock nut (16) must fit snugly into the mounting bracket. Connect the link assembly (14) to the clutch lever and linkage assembly.

g. Projectors having the new-style clutch manipulator are assembled as follows: Insert the knob assembly (10) through the boss on the left-hand side of the cover and then place the retaining ring (11) on the shaft. Insert the shaft through the right-hand boss, through the spacer (12) and screw it into the link of the clutch lever and linkage assembly (33). Screw the hex nut (9) onto the end of the shaft, drawing it up tight. Place the rubber knob (8) on the counter gear extension.

37. PRESSURE PLATE. (See figure 3.)

a. Insert the fillister head screw (3) through the spacer (5), bushing (4), pressure plate yoke (6) and screw it into the pressure plate (7).

b. Assemble the compression spring (2) and spring cup (1) between the head of the screw and the outer ear of the pressure plate yoke as shown in figure 3.

c. Attach the bottom half of the pressure plate yoke in the same manner. For adjustment of the pressure plate, see subparagraph 37d, immediately following. See figure W for a view of the gear case completely assembled.

d. Adjust the pressure plate for position and pressure as outlined immediately following:

e. POSITION: The outer edge of the pressure plate (7) is slotted in order to provide clearance for the shuttle teeth. Therefore, it is necessary that the pressure plate be correctly positioned.

f. Close the gate lever (22) so that the pressure plate (7) rests on the aperture plate. Sight along the film channel and at the same time turn the hand setting knob (8) so that the shuttle makes a full stroke. Watch the shuttle teeth carefully to see if the teeth are centered in the pressure plate slot during the full course of the teeth travel. If it is, no adjustment for position is necessary. If it is not, the adjustment can be made as follows:

g. Insert a screw driver through the lens carrier and loosen the two screws (see figure 4, index 16) just enough to be able to shift the pressure plate carrier (see figure 4, index 18) slightly to either the left or right as necessary to center the shuttle teeth in the pressure plate slot. When the correct adjustment is obtained, tighten the two screws (see figure 4, index 16).

h. PRESSURE: The pressure adjustment can be made only after the gear case has been assembled to the blower housing. Refer to paragraph 42 for this adjustment.

38. PROJECTOR ASSEMBLY. (See figure 2.)

a. Assemble the governor cap assembly (24) to the motor housing (25) with the fillister head screws (23). When doing so, however, be sure the pin on the worm shaft and drive blade assembly (see figure 7, index 4) engages the slot in the face of the governor (see figure 8, index 20).

b. Assemble the blower housing assembly (22) to the motor housing with the two fillister head screws (21) and four fillister head screws (20).

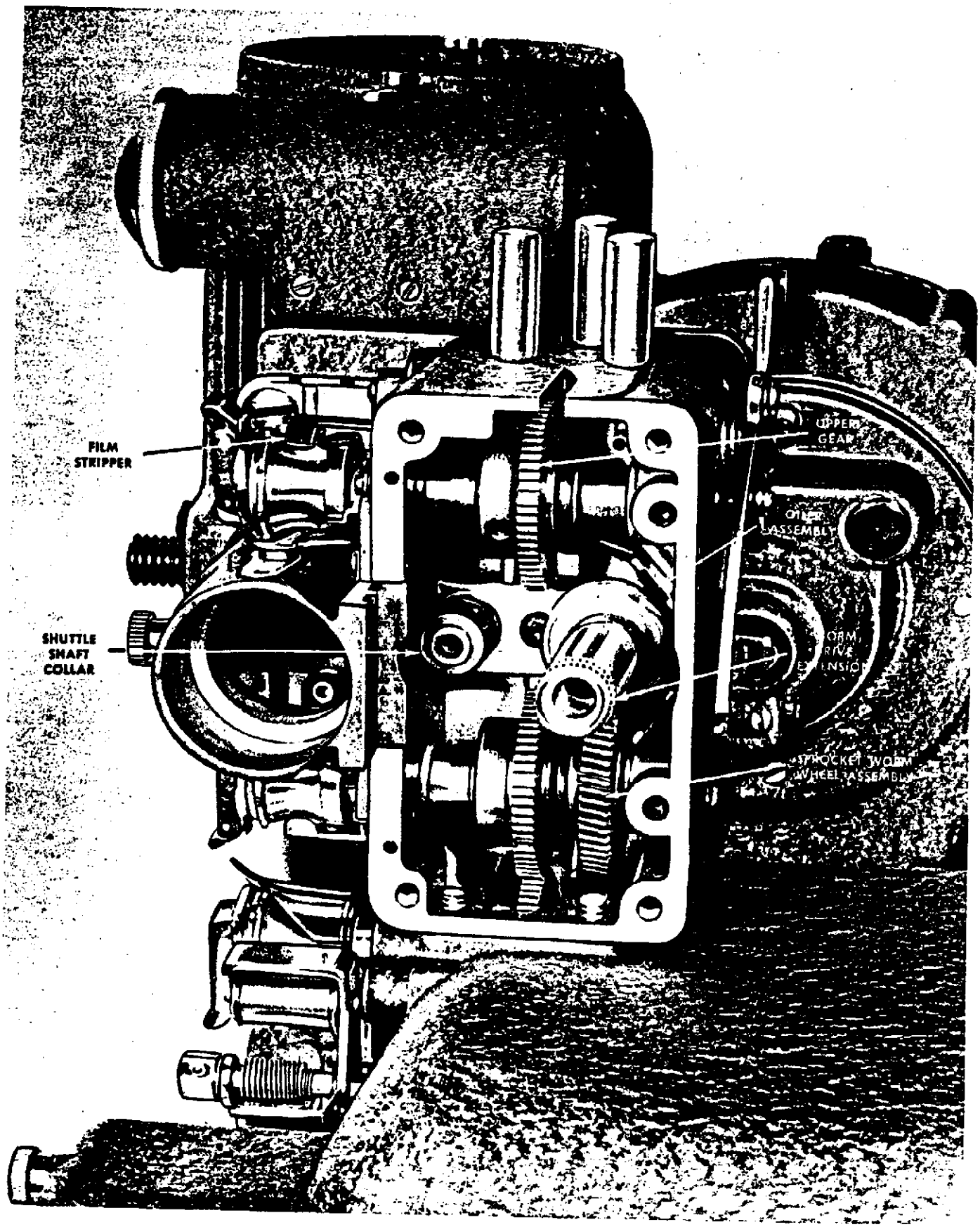

Figure V. Components Properly Reinstalled in Gear Case Interior

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c. The pilot light unit assembly (17) is assembled to the blower housing now. If the safety shutter was taped in place during reassembly to prevent damage to the safety shutter, remove the tape. Insert the contact block assembly (19) and spring (18) into the pilot light unit assembly. Hold these parts together and position the pilot light unit assembly (17) over the pilot light positioning studs on the blower housing and tighten the set screws (16). Be sure to pull the two wires from the contact block down through the blower housing so that they may be connected to their proper terminal inside the sound head.

d. When assembling the gear case (15) to the blower housing (22), take pains to make sure the clutch plunger (if used) enters the armature shaft and that the counter gear (see figure 5, index 22) meshes easily and properly with the motor pinion (see figure 8, index 6 or 14). Do not force the gear case into position.

e. On the back side and across the top of the gear case there is a horizontal channel. The projecting area around this channel should be painted with shellac just before assembling the gear case to the blower housing. The channel is the air passage to the safety shutter in the blower housing and the shellac makes the channel air tight.

f. Attach the gear case in the upper right-hand corner with the clutch lever spring (10) and fillister head screw (9). The clutch lever spring should be flat up against the vertical side of the gear case.

g. Attach the gear case in the lower right-hand corner with the fillister head screw (11).

h. Securely fasten the left-hand side of the gear case with the washers (14), guide rail (13) and fillis-

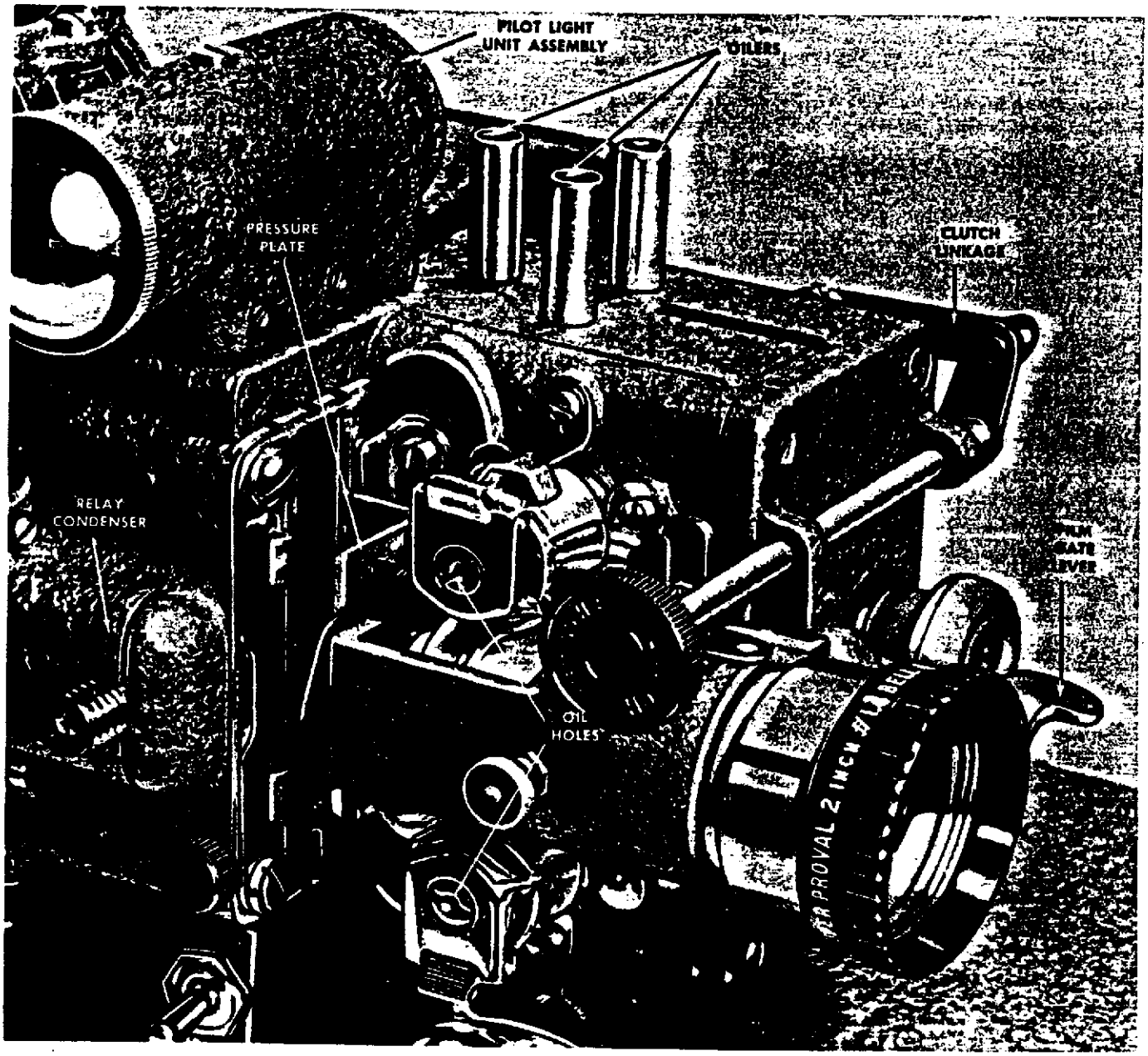

Figure W. Gear Case Completely Assembled Showing Points of Lubrication

ter head screws (12). The washers (14) fit into the holes in the aperture plate and go between the guide rail and gear case housing.

i. Now place the assembled gear case, blower housing, motor housing and governor cap assemblies in position on the sound head (26). On the Design 185 B and C projectors, the two binding head screws (7) and three fillister head screws (8) attach the assemblies to the sound head. On all Design 179 projectors and the Design 185 A, the lock washers (7B), screws (7A), mounting stud (8B) and two hex nuts (8A) are used to attach the assemblies to the sound head. The mounting stud (8B) is located in the underside of the blower housing, and one hex nut is used to support the weight of the motor while a second nut is used to secure the sound head to the stud.

j. Replace the exciter lamp (5) and exciter lamp shield (4). The small window in the shield must face directly into the optical slit. The Design 185 exciter lamps can be installed in only one position and need no adjustment. The Design 179 exciter lamps must be adjusted as outlined in paragraph 45. Replace the exciter lamp cover (6).

k. Replace projection lens (3), 45-50 mm condenser assembly (2) and relay condenser assembly (1).

NOTE

Before assembling the projector in the case, lubricate it at the points of lubrication shown in figure W and in accordance with the instructions given immediately following.

l. Lay the projector on its side and insert the tip of the oil can into the small hole in each sprocket shaft, including the one on the sound head. Squeeze the side of the can three times in each hole. Place the projector in an upright position and wipe off the excess oil. Then place one drop of oil in each of the three oilers located in the top of the gear case. If any of the felt reservoirs were saturated with oil during the reassembly, no more oil need be added at this time. Be sure to caution the customer to follow the lubrication instructions printed in the booklet he received with the projector. Add grease if necessary to the grease cup in the take-up arm by removing the knurled head screw shown in figure F.

39. AMPLIFIER ASSEMBLY. (See figure 1.)

a. Assemble the amplifier assembly (7) to the inside of the sound head on the projector assembly (5) with the knurled head screws (6).

b. Make all necessary connections to operate the projector.

c. Do not assemble the projector assembly in the case until the following adjustments have been made.

d. Neither of the two reel arms (9 and 11) are needed for the following adjustments.

NOTE

Before assembling the projector inside the case, make the following adjustments. Be sure all wires that were disconnected have been reconnected.

40. ADJUSTMENTS.

41. REFLECTOR.

a. Projectors having reflectors which are not fabricated into one piece are adjusted as follows:

b. Place the SOUND-SILENT switch in the SILENT position. Remove the projection lens. Place the projector five feet from a screen and turn it on.

c. With the reflector (see figure 9, index 2) screwed all the way in, adjust the reflector adjusting screws (see figure 9, index 3) until a clear and evenly illuminated picture of the lamp filaments appears on the screen.

d. Replace the projection lens.

42. PRESSURE PLATE.

a. The pressure plate position adjustment has already been explained in paragraphs 37d through 37g. The pressure adjustment is done as follows:

b. Refer to figure 3 for the index numbers used in this pressure adjustment outline.

c. The pressure adjustment can only be made after gear case has been securely fastened to blower housing and all four attaching screws securely tightened.

d. Close the lens carrier in towards the aperture plate by pushing down on gate operating lever (22). Loosen fillister head screw (23).

e. Use wrench No. S-10309-F1 (figure B, index 2) and turn on the hex head portion of eccentric bushing (25). Note that the lens carrier will move in and out slightly. Note also that when the pressure plate (7) is against the aperture plate, the compression springs (2) are compressed and the pressure plate yoke (6) is forced slightly away from the spacer (5).

f. When the space between the pressure plate yoke (6) and spacer (5) is approximately 0.002 of an inch, the adjustment is correct. Tighten fillister head screw (23) to lock the adjustment in.

g. Check adjustment after the fillister head screw has been tightened. If tightening of the fillister head screw has forced the pressure plate out of adjustment slightly, loosen and readjust, allowing enough to make up the difference caused by tightening the fillister head screw.

h. Either too little or too much pressure may result in an unsteadily projected picture or in failure of the intermittent mechanism to maintain the lower film loop. This adjustment must be accurate.

43. CLUTCH LEVER AND SAFETY SHUTTER ASSEMBLY. (See figure 3.)

a. The correct clutch lever (33) adjustment is essential for correct operation of the safety shutter (figure 6, index 10) because the safety shutter operates on a flow of air which is controlled by the clutch lever. The air enters the projector on the clutch lever side of the gear case.

b. To adjust properly, loosen pilot screw (31) and turn clutch lever stud (32) until the following conditions are obtained.

c. Operate the projector at either sound or silent speed and move the clutch lever back and forth by turning knob assembly (10 or 15). The safety shutter

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must close, or cover the aperture opening, before the clutch lever is pulled back far enough to stop the mechanism. Conversely, in releasing the clutch lever, the mechanism must start running before the safety shutter rises.

d. To facilitate the correct adjustment of the safety shutter, turn the set screw (figure 6, index 16) either in or out as may be required. This screw is located directly above the safety shutter and will control the flow of air to the safety shutter, thus making it rise or drop more quickly. When properly adjusted, seal set screw in place with wax.

CAUTION

It should be remembered that the pilot lamp contacts are alive when this adjustment is being made.

e. If there is any noise resulting from vibrations in the clutch mechanism, it can usually be corrected by a slight adjustment of the clutch lever stud (32). Be sure to tighten pilot screw (31) after adjustments have been made.

f. The clutch lever spring (figure 2, index 10) must hold the clutch lever snugly against the gear case and over the air hole.

44. SPROCKET SYNCHRONIZATION.

a. The sprockets are numbered in the order in which the film passes over them. The top sprocket on the gear case is number one, the bottom sprocket on the gear case is number two and the sprocket on the sound head is number three. Sprockets number two and three must be synchronized.

b. PROJECTORS HAVING NEW STYLE STABILIZER. (See figure 10, index 4 through 18.) There should be an eight degree difference between the sprocket teeth as shown in figure X.

c. This adjustment is easily made with the use of a special tool like the one shown in figure Y. The left-hand side of this figure gives the dimensions of the tool which can be easily made from any 1/16-inch stock of steel, aluminum or bakelite, whichever you might find in your shop.

d. For accuracy in locating the two slots, a steel scale should be used for layout and a Swiss pattern file used to make the slots. Knife file No. 2 is ideal.

e. This special tool is used to synchronize the second sprocket with the third sprocket.

f. Loosen the fillister head screw (see figure 10, index 25) and remove the sprocket guard (see figure 10, index 26). Pull out on the third sprocket until the sprocket can be turned freely by hand. When so doing, the sound sprocket gear in the sound head is disengaged from the second sprocket gear in the gear case.

g. Rotate the projector mechanism by hand (turn the rubber knob, figure 3, index 8) until one of the teeth on the second sprocket is in the vertical as shown in figure Y, with the center of the tooth lined up with the

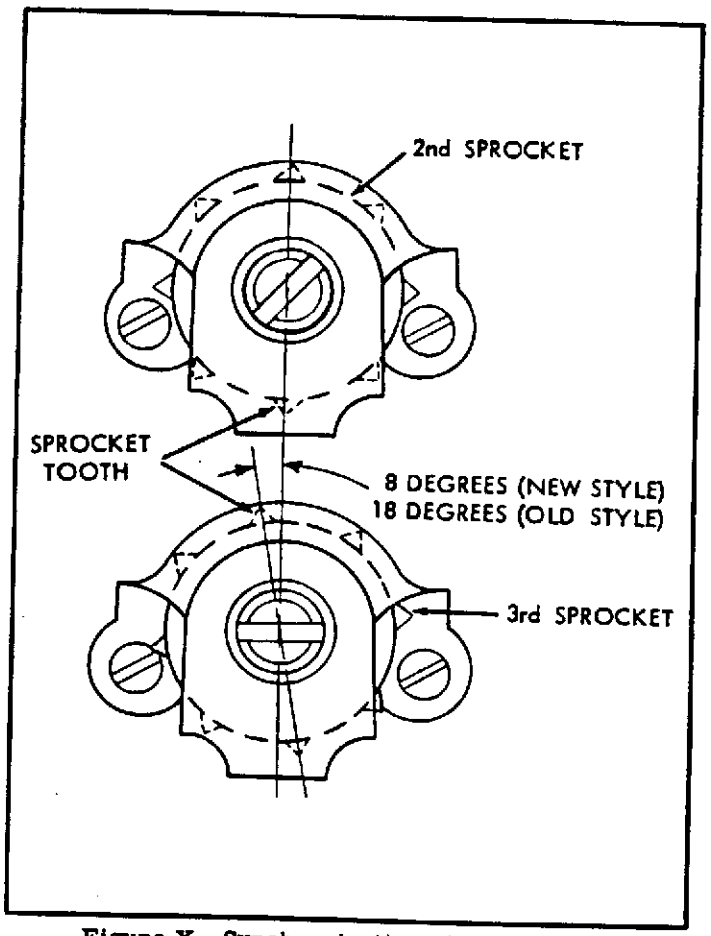

Figure X. Synchronization of the Second and Third Sprockets

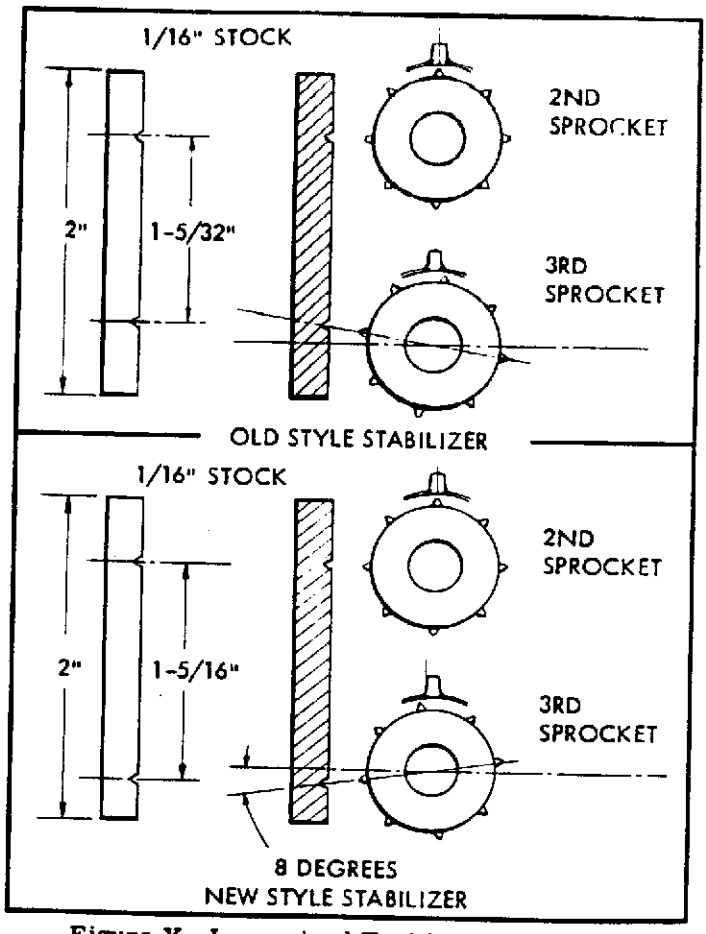

Figure Y. Improvised Tool Used for Synchronizing Second and Third Sprockets

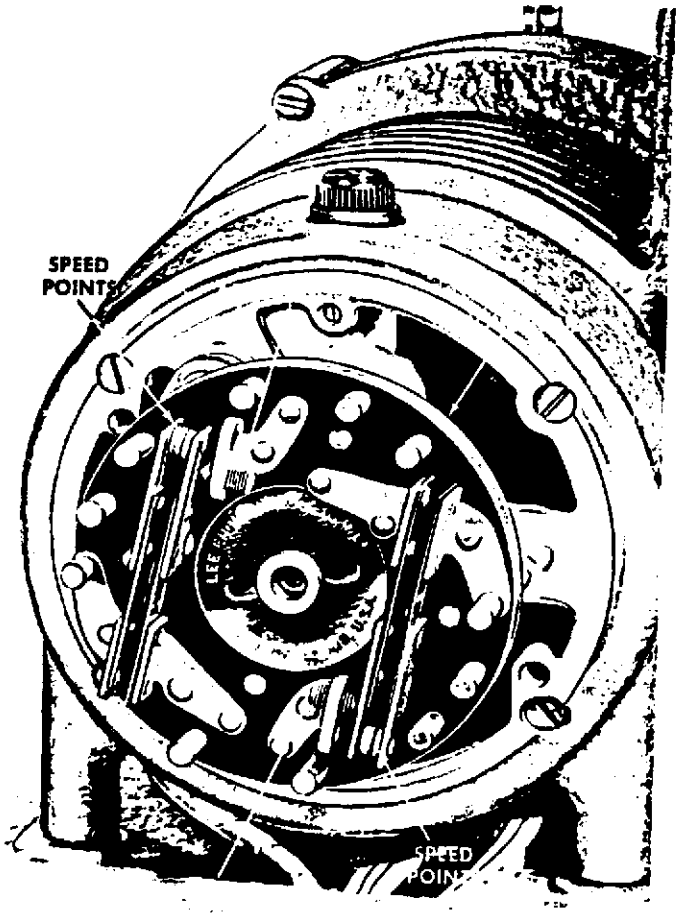

Figure Z. Adjusting Governor Speed

center of the tip of the film guide.

h. Note now that a pair of teeth are projecting in the horizontal. Place the upper slot of the gauge over one of the teeth in the horizontal and rotate the third sprocket until one of the teeth fit into the lower slot of the gauge.

i. With the gauge still on the teeth, push the third sprocket back into position.

j. Replace the sprocket guards over the sprockets as outlined in paragraph 35s.

k. PROJECTORS HAVING OLD STYLE STABILIZER. (See figure 10, index 19.) This adjustment requires a special tool like the one shown in figure Y for old style stabilizers.

l. Tool is made in the same manner as described in subparagraphs c and d above.

m. The actual adjustment is made in the same manner as described in subparagraphs f through j above.

45. EXCITER LAMP.

a. This adjustment applies only to those projectors having the type of exciter lamp shown in figure 11, indexed items 15A through 15F (all Design 179 models and the model 185A).

b. The rough positioning of the exciter has been explained in the reassembly instructions given in paragraph 26k.

c. The exciter lamp can be adjusted even more accurately if an audible test is made while sound is being reproduced. Move the socket up or down until the point of maximum sound volume is reached. Tighten the screw.

d. Remember the filament must be parallel with the optical slit. For example, if an imaginary line were drawn through the length of the filament and another imaginary line drawn from the sound drum through the length of the optical slit assembly, these two imaginary lines would be at right angles (90 degrees) to each other and would cross in the exact center of the exciter lamp filament. Notice the slit in the rear of the optical slit assembly. Under the above conditions, it is parallel to the filament.

e. Place the exciter lamp shield (see figure 2, index 4) over the exciter lamp so that the small window faces the optical slit. Replace the exciter lamp cover.

46. SPEED. (See figure Z.)

a. The speed adjustment is a critical one and must be very accurate to obtain satisfactory operation, especially with sound. There is only one accurate method of checking speed and that is with a tachometer.

b. Check the speed at the worm drive extension (figure 5, index 17). At the silent speed of 18 frames per second, the correct speed is 1080 rpm. At the sound speed of 24 frames per second, the correct speed is 1440 rpm. These two settings may have a variance of ±30 rpm.

c. In the event that a tachometer is not available, an alternate method may be used. This method is not as accurate as a tachometer and should not be used if a tachometer is available.

d. Make an endless film loop exactly 90 frames long (26-3/4 inches). At the silent speed of 18 frames per second, the loop will pass through the mechanism 12 times per minute. At the sound speed of 24 frames per second, the loop will pass through the mechanism exactly 16 times per minute. These speeds can be checked by counting the number of times the splice passes a predetermined point.

e. The speed is adjusted by means of the headless set screw located on each set of contact points on the governor. (See figure Z.) These contacts operate under a spring tension.

f. Note that one set of points has a weaker set of springs than the other set. The set of points with the stronger spring controls sound speed.

g. By turning the headless set screw to either increase or decrease the contact point gaps, the speed can be either decreased or increased. Adjust until the correct speed is obtained for both sound and silent.

47. STABILIZER ASSEMBLY, DESIGN 185, B and C MODELS.

a. The stabilizer assembly must be correctly adjusted to obtain the best sound reproduction.

b. Make an endless loop of "buzz track" sound film

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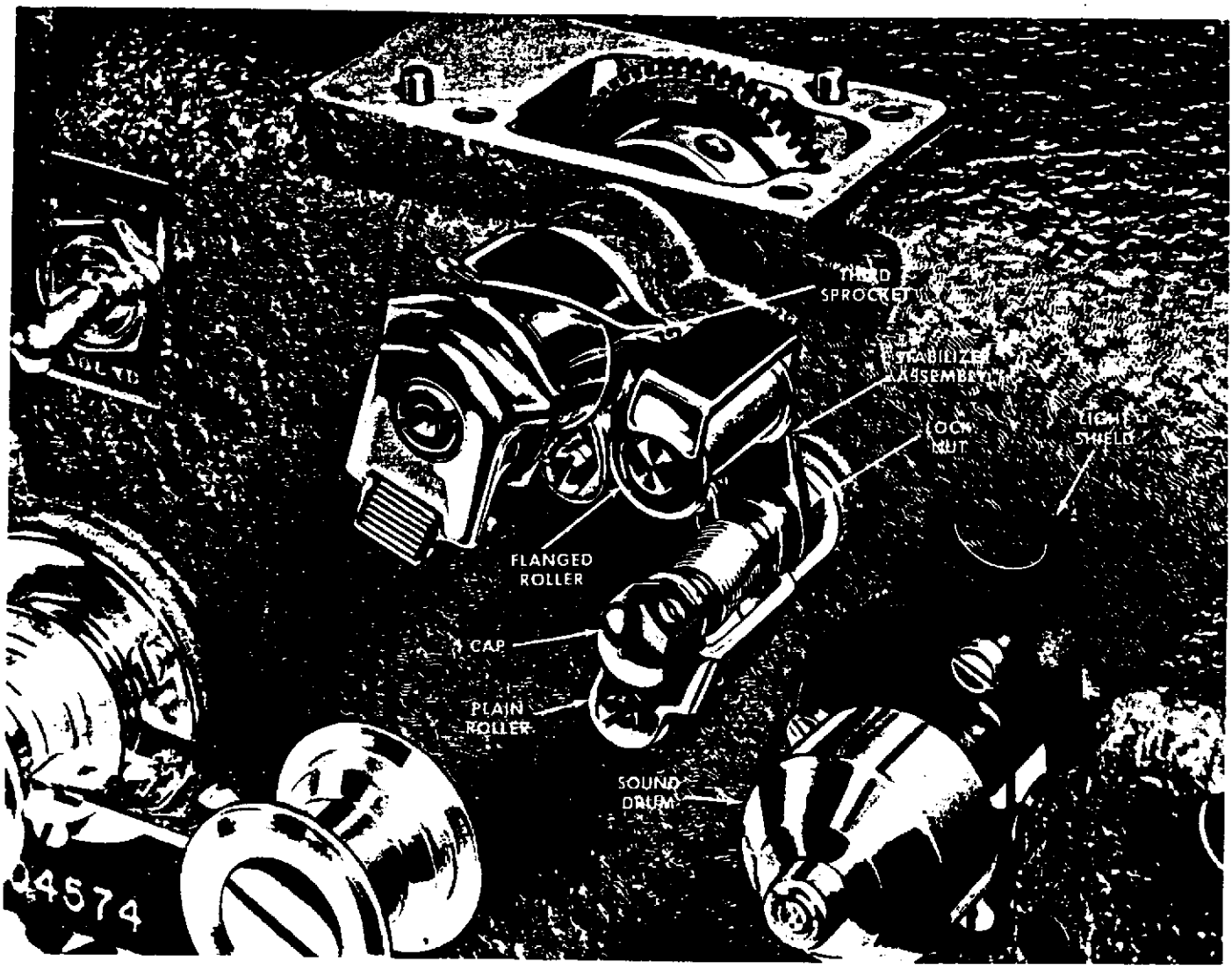

Figure AA. Stabilizer Assembly, Design 185 B and C Projectors

and thread it through the second sprocket, the stabilizer assembly, over the sound drum and through the third sprocket on the sound head.

c. Operate the projector with the amplifier and speaker on.

d. Loosen the set screw in the cap (see figure AA). Move the entire stabilizer assembly in or out as necessary, until the least amount of sound is audible from the "buzz track" film.

e. If necessary, spacers can be added to maintain the correct position of the stabilizer. If it is necessary that the stabilizer be moved away from the sound head, spacers (see figure 10, index 6) should be placed on the stud between the lock nut (see figure 10, index 18; also see figure AA) and the stabilizer assembly.

f. If it is necessary that the stabilizer assembly be moved closer to the sound head, and the cap (see figure 10, index 5; also see figure AA) will not go on far enough to eliminate all end play, the spacers (see figure 10, index 6) should be placed on the stud in the location shown in figure 10.

g. Be sure the lock nut (see figure 10, index 18; also see figure AA) is tight against the sound head and also that the set screw in the cap (see figure 10 index 5; also see figure AA) is tight once the adjustment is made. There should not be any end play (in or out) present.

h. Now start and stop the projector several times. Note the position of the plain roller on the bottom half of the stabilizer when the projector is inoperative and then note the position the roller assumes when the projector is operating. The time elapsed between starting the film through the projector and the plain roller to come to rest in its operating position should be in 2-1/2 seconds. If it is not, the torsion spring (see figure 10, index 8) must be replaced.

47. STABILIZER ASSEMBLY, ALL DESIGN 179 MODELS AND THE DESIGN 185 A.

a. The stabilizer assembly must be adjusted correctly to obtain the best sound reproduction.

b. To adjust the stabilizer assembly, make an endless loop of "buzz track" sound film and thread it through the second sprocket, the flanged roller of the stabilizer assembly, the sound drum, the plain roller

of the stabilizer assembly and the third sprocket on the sound head.

c. With the mechanism running and the amplifier and speaker turned on, the roller yoke and arm assembly should be positioned on the shaft on which it operates by moving it in or out, as necessary, until the least amount of sound is audible.

d. The "buzz track" sound film has a low frequency along one edge of the sound track and a high frequency along the other edge of the sound track. When the roller yoke and arm assembly is positioned so that it centers the sound track on the scanning beam, the minimum sound reproduction is audible.

e. In conjunction with this setting, another adjustment must be made. The tension of the spring must be adjusted so that the roller yoke and arm assembly comes to rest in its operating position in 2-1/2 seconds. Both of these adjustments are critical ones and are done as follows:

f. Loosen the two set screws in the knurled collar on the upper front of the stabilizer (see figure 10, index 19). Move the entire stabilizer assembly in or out, as required, on the shaft until the minimum sound reproduction is audible. Tighten the two set screws.

g. With the stabilizer thus positioned on the shaft, turn the projector off and on several times and check the operation of the plain roller at the bottom of the stabilizer. When the projector is turned on, it will shift position slightly as the film starts to pass over it. It must come to rest in its operating position in 2-1/2 seconds. If it does not, again loosen the two set screws and turn the knurled collar to change the tension on the spring as necessary until the roller yoke and arm assembly comes to rest in 2-1/2 seconds. Tighten the set screws. DO NOT lose the position adjustment when making tension adjustment.

h. Only by making these two critical adjustments correctly can the sound reproduction be absolutely faithful, since it depends upon the roller yoke and arm assembly functioning perfectly.

49. OPTICAL SLIT ASSEMBLY.

a. If the optical slit assembly (see figure 10, index 60) was removed or disturbed, it must be repositioned correctly to insure satisfactory sound reproduction. The adjustment of the stabilizer (paragraphs 47 or 48) must be done for correct slit scanning across the sound track before making any adjustment on the optical slit.

NOTE

This adjustment of the optical slit assembly must be done in a quiet location.

b. Thread the projector with a strip of 7000-cycle note test film.

c. Turn the amplifier switch on and set the VOLUME control approximately 1/3 of the way up.

d. Look at the optical slit assembly. Note that one end has two small screws in it. This is the end which must be toward the exciter lamp. Note also that the lens on each end is masked and that there is a rectangular slit cut in each mask. The long sides of the rectangle should be parallel with the horizontal.

e. Grasp the optical slit assembly on the exciter lamp side. DO NOT block the exciter lamp rays. Turn the projector switch to the ON position. Move the optical slit assembly forward and backward until the maximum volume is obtained. The long sides of the rectangular slit should still be parallel with the horizontal when the point of maximum volume is reached.

f. Tighten the set screw (see figure 10, index 59) immediately to lock the optical slit assembly in place. Be very careful not to change the setting of the optical slit when tightening the set screw. Seal the set screw in with sealing wax.

g. The optical slit adjustment is a VERY CRITICAL ONE. BE CAREFUL during adjustment.

h. Special tools for making the optical slit adjustment are available on special order.

50. PROJECTOR, CASE AND REEL ARMS. (See figure 1.)

a. The speaker case (13) is already assembled.

b. Return the front reel arm (11) and take-up reel arm (9) to their normal place of storage.

c. Insert one end of the spacers (4) into the rubber mountings (3) and then insert the other end of the spacer through the mounting brackets. Assemble another rubber mounting (3) to each spacer.

d. Older model projectors have the mounting brackets and rubber mountings assembled directly to the projector case.

e. Attach the projector assembly (5) to the inside of the case (8) with the washers (2) and fillister head screws (1). On the newer models, the projector is assembled to the case through the bottom of the case. Older models have a case which has a bottom built in and the projector will have to be assembled through the door.

f. If there are oiler tubes connecting the projector to the top of the case, connect these tubes now.

g. Insert the front reel arm spring belt (12) and take-up reel arm spring belt (10) into their respective positions and connect each into an endless loop. The front reel arm belt (12) goes through the arm holder, down into the gear case where it loops itself around and out again. The take-up belt (10) goes through the rear reel arm holder, loops around the take-up pulley on the governor cap and comes back out through the reel arm holder.

NOTE

Before returning the projector to the customer, read and comply with the instructions given under FINAL TEST immediately following to insure smooth and trouble-free operation for the customer.

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Final Test

51. GENERAL. It is important that the projector be carefully tested and that certain adjustments to various components be made upon the completion of any maintenance which has included any disassembly and reassembly. Besides the following specific adjustments, the final inspection of a repaired machine should include the running of a reel of film to observe picture steadiness, illumination, etc. and also the quality of sound reproduction.

52. FILM RUNNING TESTS

a. Make an 18-inch loop of new film, thread it through the mechanism with emulsion side to gate shoe and turn on the motor switch.
b. Allow it to run through the projector 250 times.
c. Remove the film and inspect it for scratches. If scratches are evident, they are probably caused by emulsion which has gathered on the pressure plate. Clean the pressure plate as described in paragraph 18 and repeat the test, using new film.
d. If scratches are again evident on the film, examine aperture plate and pressure plate for scratches. There must not be any scratches on either of the plates. Replace the plates if necessary.
e. Upon completion of reassembly and all necessary adjustments, a sound film should be run through the projector in order to check the mechanical and sound operation. Use a film known to be in good condition and possessing a good sound track.

53. FINAL INSPECTION. (See figure A8.)

a. Before returning the projector to the customer, make a run-down of the following items to be sure everything is in order.
b. Inspect and clean all lenses (para. 18).
c. Inspect all film handling parts (para. 18).
d. Check snubber adjustment (para. 27, step f).
e. Check height of shuttle teeth (para. 35, steps d through i).
f. Check film guides adjustment (para. 35, step r).
g. Check the shuttle teeth stroke (para. 37, steps e through g).
h. Check pressure plate adjustment (para. 37, 42).
i. Be sure all points of lubrication are properly taken care of (para. 38, step l).
j. Be sure reflector is adjusted (para. 41).
k. Check clutch lever and safety shutter operation (para. 43).
l. Check synchronization of sound sprocket with second sprocket (para. 44).
m. Check running speeds of projector (para. 46).
n. Check stabilizer adjustment (para. 47-48).
o. Check optical slit adjustment (para. 49).
p. Be sure film tests have been made (para. 52).
q. Check operation of reel arm pulleys and belts.
r. Be sure all screws and nuts are secure.
s. Be sure the amplifier and projector assembly attaching parts are secure.
t. Check operation of the tilt mechanism.

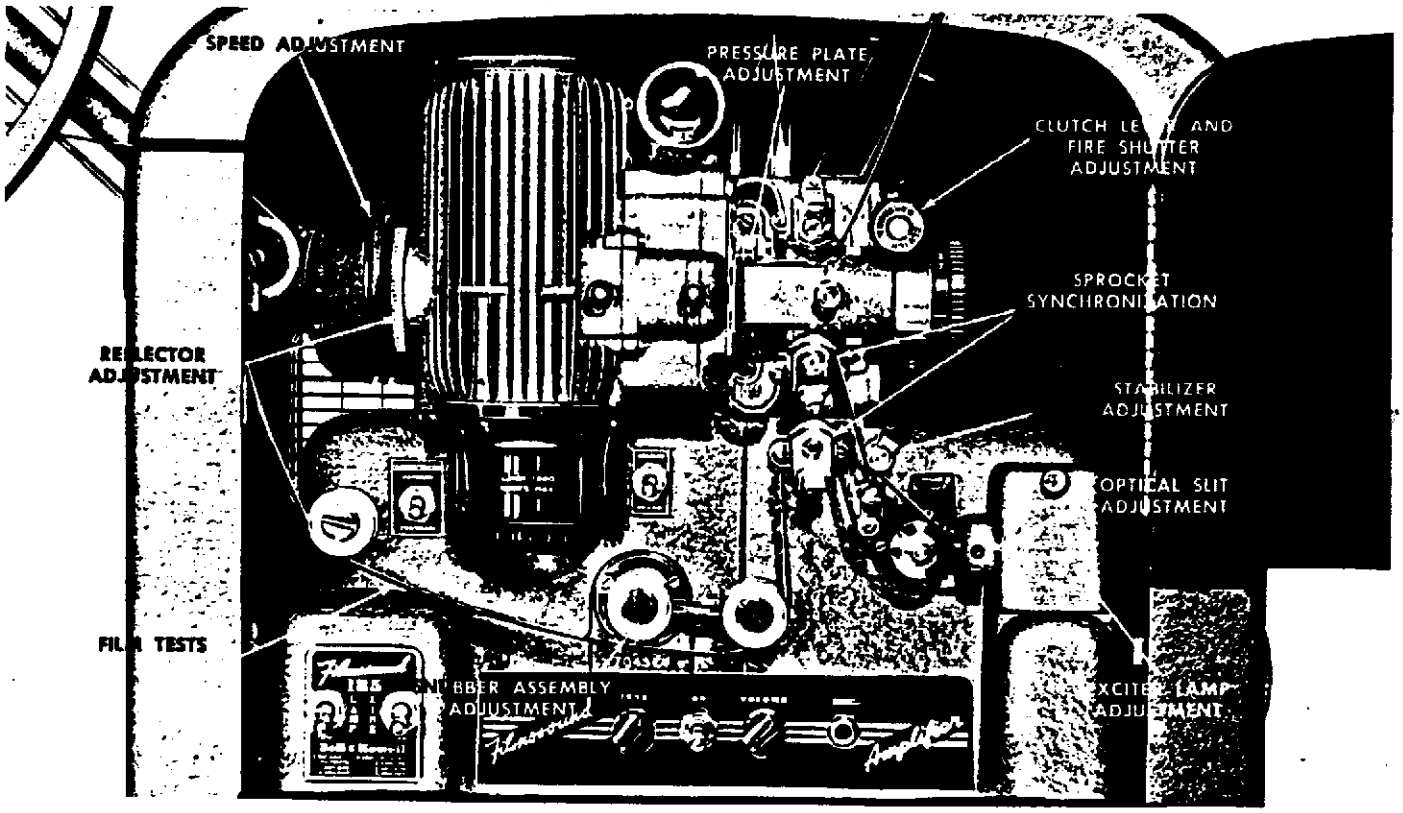

Figure AB. Final Inspections to be Performed

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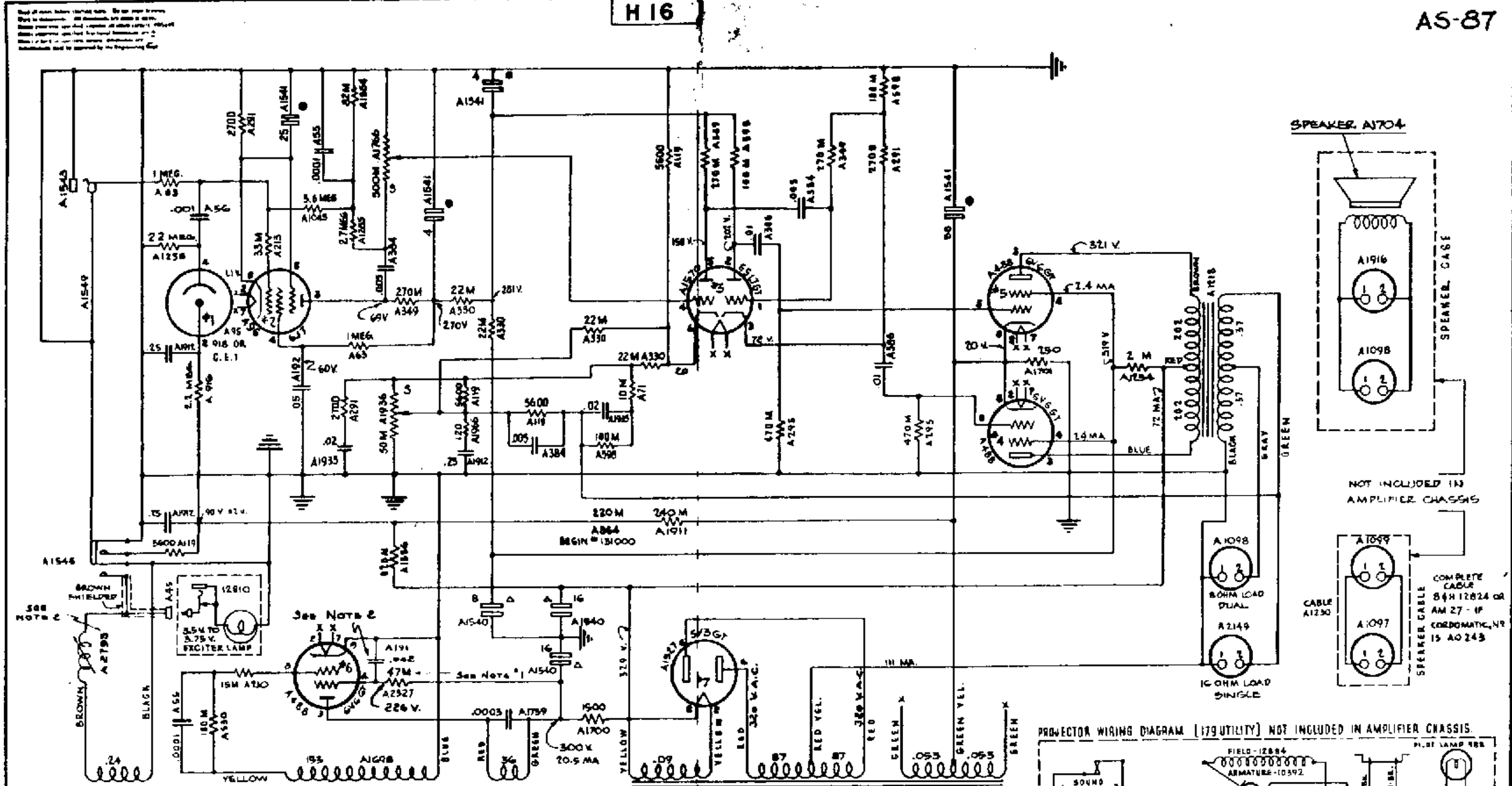
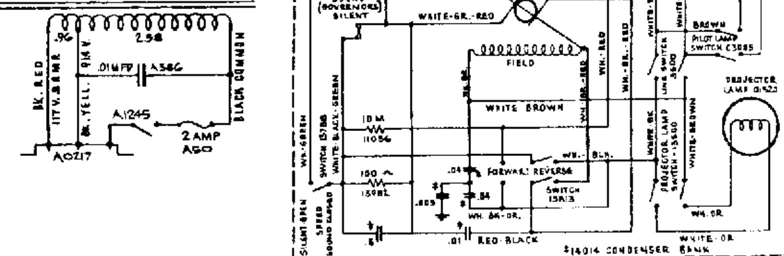




NOTES

1. Resistor May Be Modified To Allow For Output Voltage Variations In Transformer.
2. Variable Reactor A-2793 & Capacitor A-191 Notes Are Used In All Amplifiers After 146704.
3. Jack 12810 Has Been Removed.
4. D.C. Voltages Taken With 20000 Ohms Per Volt Metre & A.C. Voltages Taken With 1000 Ohms Per Volt Meter Readings Are Not Corrected For Shunting Effect.

WIRING COLOR CODE	
WHITE-GROUND	BROWN-SCREEN
YELLOW-CATHODE	BLUE-PLATE
RED-B+	BLACK-HEATER
GREEN-GRID	

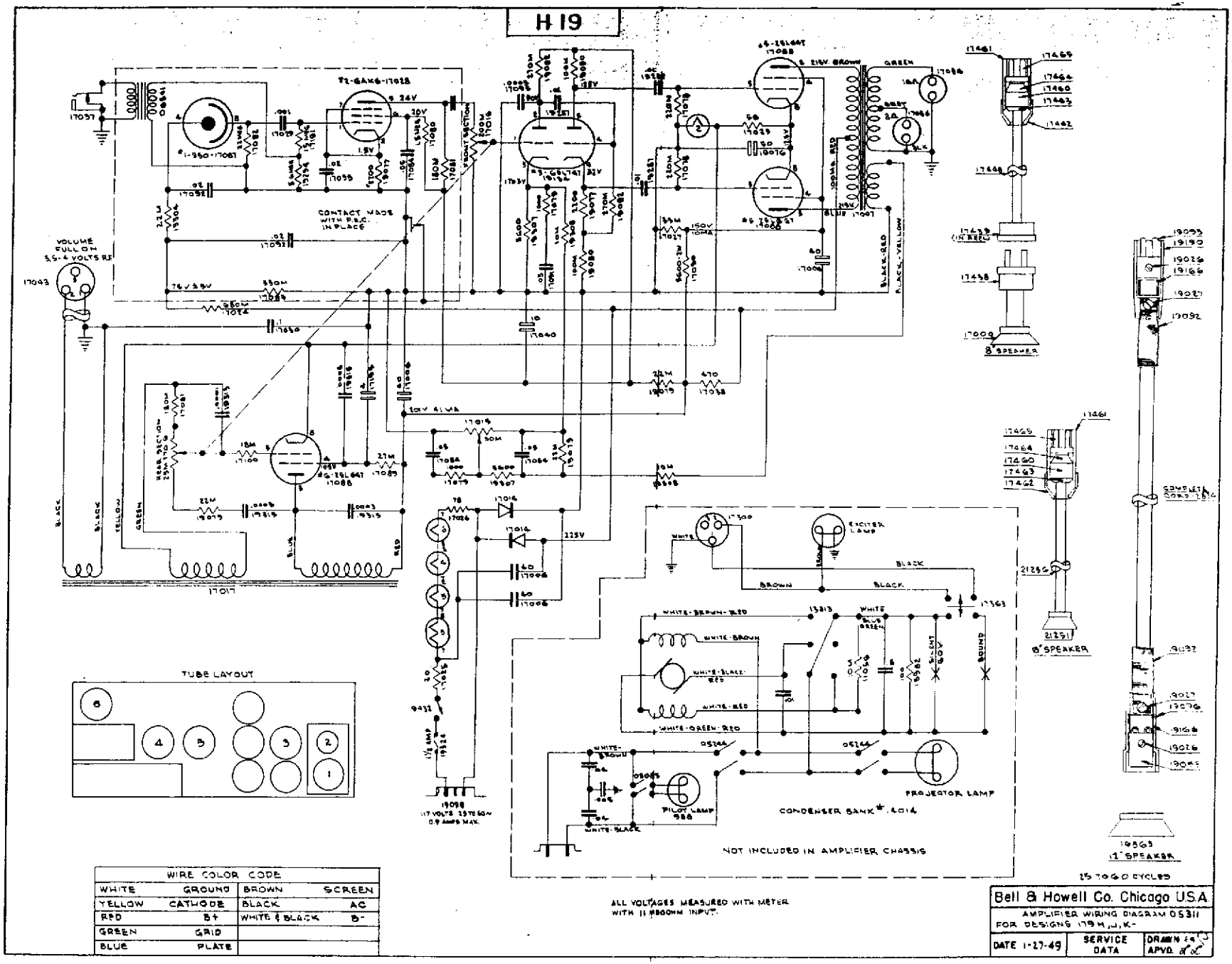
"5" INDICATES TERMINAL AT CLOCKWISE STOP. ALL VOLTAGE MEASURED WITH RESPECT TO CHASSIS AND TONE CONTROL BASS.
⊕△ INDICATES CAPACITORS IN BANK.

AS-87

FOR USE WITH AMPLIFIERS BEARING SERIAL NUMBERS 109003 TO 110002 & 114003 UP

SERVICE DATA
AMPLIFIER WIRING DIAGRAM
DESIGN 179 MODEL A - 60 CYCLE
FOR USE ONLY WITH AMPLIFIER PART No 14027 | 12-15-45

B+H 179 PROJECTOR AMPLIFIER 14027 MODEL A 12-15-45



Bell & Howell 179 Amp. Schematic Models H, J, K.