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TYPE 8

I. C. INSTRUCTION BOOK No. 62-A

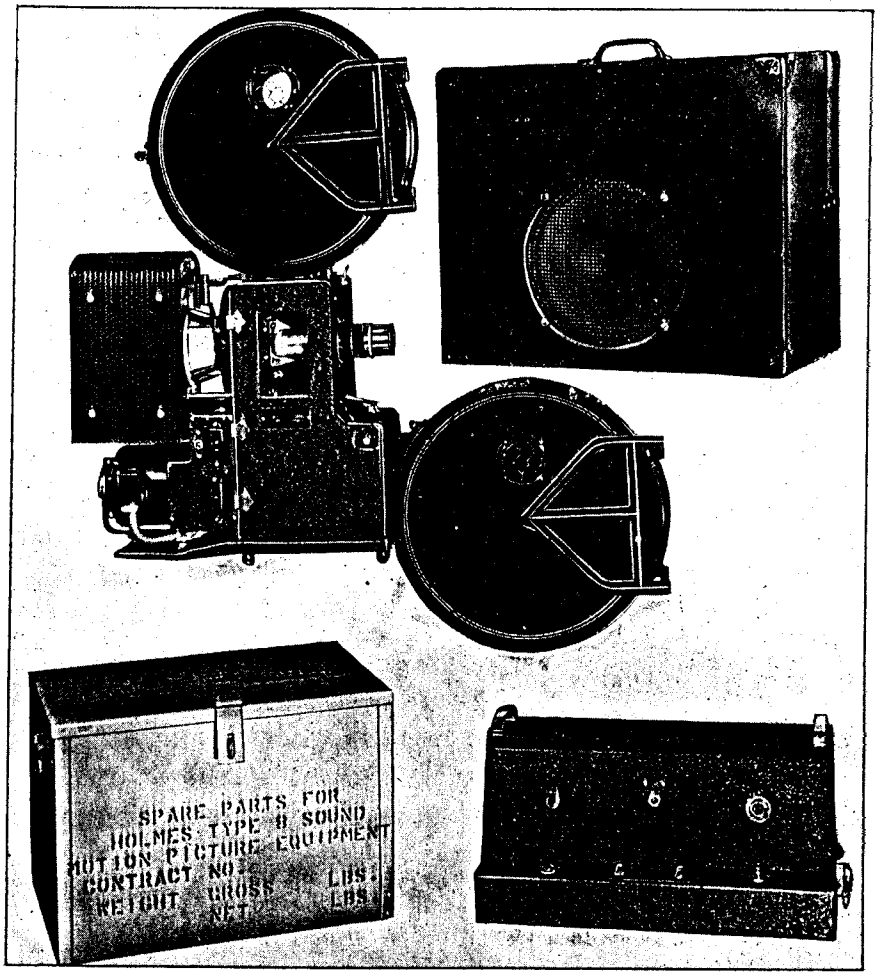
U. S. NAVY
35MM SOUND MOTION PICTURE EQUIPMENT

TYPE "D"

CONTRACT NO. NObs-20312

HOLMES PROJECTOR COMPANY
1815 Orchard Street, Chicago 14, Illinois

All inquiries about this projector and amplifier must bear the Type and Serial Number of the unit about which information is desired.



HOLMES 35mm TYPE 8 SOUND EQUIPMENT

NAVY TYPE "D"

GUARANTEE

The projector and associated parts are guaranteed against defective material and workmanship for a period of one year from date of shipment from the factory with the exception of Projection Lamps, Exciter Lamps and Photo Electric Cells.

The amplifier and speaker are guaranteed against defective material and workmanship for a period of 90 days from the date of shipment from the factory with the exception of Tubes, Pilot Lamps and Neon Lamps.

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U. S. NAVY
35MM SOUND MOTION PICTURE EQUIPMENT
TYPE "D"

UNPACKING

The standard Navy Type "D" equipment is packed in four cartons for Domestic shipment as follows: Projector in carton No. 1, Amplifier and Speaker in No. 2, Magazines, Reels, etc. in No. 3 and the Spare Parts Box in carton No. 4. A packing list is enclosed with each equiment designating the article, quantity and carton in which it is packed.

For Overseas shipment, the equipment is packed in four wooden boxes as follows: Projector in No. 1, Amplifier and Speaker in No. 2, Magazines, Reels, etc. in No. 3 and the Spare Parts Box in No. 4.

This equipment has been processed and packed in accordance with Navy Specification 39-P-21 (Int.). All precision metal spare parts have been protected with an approved rust-preventive compound, packaged and sealed to prevent the entrance of liquids. The projector and speaker case (in which the amplifier is stowed) are each packed in a carton which in turn is placed in a foil barrier from which the air has been exhausted. The same is true for the two cone and voice coil assemblies packed in the spare parts box. Sufficient dehydrating material has been inserted in the cartons to protect the contents from corrosion for 18 months. It is therefore imperative that the barriers remain unbroken until such time as the equipment is desired for operation.

All equipment was inspected carefully before it was packed and any damage discovered upon unpacking should be called to the attention of the transportation company immediately. Any obvious damage to the shipping containers should be noted on the delivery receipt at the time the shipment is accepted and a claim entered against the carrier. After delivery of the equipment to the transportation company, our responsibility ceases and any claim, therefore, must be made to the carrier.

SETTING UP THE EQUIPMENT

Secure a substantial stand as high as possible, preferably one 32" to 36" high, with a top approximately 24"x30". Place the projector on the stand so that the front rubber bumpers are within a 1/4" of the front edge **Illustration "A" Page 9.** Attach the top magazine, by inserting fire trap No. 9 **Illustration "E" page 21** in the rectangular opening in the top of the case, making sure the two steel dowel pins in the magazine bracket enter the two small holes in the top of the projector case. Securely tighten the large thumb screw which holds the magazine in place. Do not use pliers on this screw. Be sure that the machined base of the magazine bracket is firmly seated against the top of the projector case at all points.

Before attaching the lower magazine, place the takeup belt in the groove of the takeup pulley. Place fire trap No. 31 **Illustration "E" page 21** in the rectangular opening in the front of the projector case and position the magazine so that the dowel pins enter the proper holes. Tighten the thumb screw which holds the magazine in place, being sure the magazine bracket seats tightly against the projector case.

Remove the amplifier from the speaker case (See SPEAKER, page 11 for details) and set it on the stand behind the projector so that the controls are easily accessible, **Illustration "B" page 9.** The tubes are installed in the amplifier but remove the back cover and see that the tubes are tight in their respective sockets and that the shield cap is on the metal 6J7 tube. Replace cover and tighten securely.

The amplififer may also be set on a shelf underneath the projector facing out or mounted on brackets which may be secured to the bulkhead.

L25N AMPLIFIER

GENERAL

The instructions covered in this section refer to the general operating characteristics and servicing of the Type L25N sound motion picture amplifier supplied with the Holmes Type 8 (Navy Type D) 35mm portable motion picture projector.

The amplifier is mounted on a board which is held in position in the speaker-amplifier case by two sets of cleats as shown in **Illustration "D" page 13.** It is not necessary to remove this board for normal use or for any ordinary adjustments.

The L25N amplifier is a four stage, audio frequency amplifying device complete in itself which operates on 50 to 60 cycle A. C. (alternating current) at voltages from 105 to 125. See LINE VOLTAGE ADJUSTMENT, page 4 for adjustments to be made when operating on various line voltages. The purpose of the amplifier is to amplify the minute voltage changes, produced in the photo electric cell when the sound track is scanned by the light beam projected by the exciter lamp and sound lens, to the point where the resulting power is sufficient, when transduced by means of a loudspeaker, to produce audible sound at a suitably high level.

The amplifier supplies A. C. at the line frequency to the 4 ampere, 8.5 volt exciter lamp and 90 volts D. C. (polarizing voltage) to the photo electric cell both of which together with the sound lens are mounted in the projector. The amplifier and projector are connected together by suitable cables **Illustration "B" page 9**, the P.E.C. cable being made of coaxial cord, the shielding of which acts as the ground return.

The amplifier is composed of three stages of amplification arranged in the following sequence:

First Stage
Type 6J7 tube connected as a pentode, resistance coupled to
Second Stage
Type 6C5 tube operating as a triode, resistance coupled to
Third Stage
Type 6C5 tube operating as a driver, transformer coupled to
Fourth Stage
Two type 6L6GA tubes operating as beam power tetrodes and connected in push-pull, transformer coupled to the reproducer (speaker) unit.

The amplifier schematic wiring diagram and its spare parts list will be found on pages 85 and 87. A copy is also attached to the inside of the base cover of the amplifier itself.

TUBES

The amplifier is shipped with all tubes in place but before the unit is placed in operation, take off the louvred rear cover of the amplifier after removing the two knurled head screws which hold it in place. Make sure all tubes are pushed down tightly in their respective sockets. Remove the metal thimble-like grid terminal shield from the top of the 6J7 tube by pulling it straight up. Make sure that the grid clip is pushed down securely onto the grid terminal at the top of this tube and that the spring tension of the clip is sufficient to hold it securely in place. Replace the shield and press down firmly into position. This connection is extremely important for if it is broken, the sound output from the projector (s) or crystal microphone will not reach the grid of the first stage tube.

PHOTO CELL INPUT CONNECTIONS TO AMPLIFIER

The amplifier is provided with two input receptacles for two separate projectors. With this arrangement a single projector may be used by connecting it to either P.E.C. input. The connections for one projector are shown in **Illustration "B" Page 9**. If a second projector is used the connections should be made to the proper receptacles mounted in the other end of the amplifier. These P.E.C. input receptacles are designated by nameplates P.E.C. IN. - 1 and P.E.C. IN. - 2 attached to the amplifier and as S1 and S2 in the schematic diagram, page 87. When one projector only is used be sure that the P.E.C. input receptacle cap is screwed firmly in place on the receptacle at the opposite end of the amplifier in order to prevent picking up stray electrical disturbances. Use only low capacity coaxial cable to connect these receptacles to any type of input. The use of any other type of cord will result in excessive hum pickup because of the high impedance of the amplifier input.

Since the photo cell polarizing potential of 90 volts is carried by the center conductor with the woven shield acting as the ground return conductor it is doubly important that this shielding be continuous and unbroken. If it becomes broken or frayed at any point, wrap several turns of #20 or #22 B&S gauge copper wire over the break and solder both ends to the shielding with rosin core solder.

Too much emphasis cannot be placed on the use of rosin core solder in making repairs to any portion of the photo cell or amplifier circuits. There is no commercial soldering flux known, except rosin, which will not eventually corrode and cause endless trouble in circuits of this type.

The slotted shaft of the potentiometer mounted in the left end of the amplifier chassis and identified as P.E.C. ADJ. by its nameplate **Illustration "B" page 9** and by P1 in the schematic diagram page 87, may be rotated to adjust the photo cell polarizing voltage supplied through the photo cell input receptacle located beside it. When a single projector is being used this shaft should be turned clockwise to the limit of its travel and then turned counter-clockwise about 70 degrees. This adjustment was made before the amplifier left the factory.

When two projectors are used this potentiometer can be adjusted to raise or lower the volume of sound of the projector connected to the adjacent photo cell input receptacle above or below that of the other projector. By making this adjustment while running a feature picture the sound output of the two projectors can be equalized. Do not attempt to make this adjustment while running shorts or newsreels as the sound levels of these two types of films vary greatly. The sound level of a feature picture on the other hand is usually quite constant and an accurate balance may be obtained by careful adjustment of the above. Once adjusted in this manner the setting should be left strictly alone until it is determined that there really is a difference in the output level of the two projectors.

If the sound level cannot be raised by means of the preceding adjustment to match that of the second projector, switch photo cells or place a new photo cell in the projector attached to the adjustable input.

EXCITER LAMP CURRENT SUPPLY

Since the use of two projectors requires a source of exciter lamp current for each unit, an exciter lamp receptacle has been provided in each end of the amplifier chassis. These receptacles shown in **Illustration "B" Page 9** are designated as EXCITER 1 and EXCITER 2 by nameplates located immediately above them and are identified as S3 and S4 in the schematic diagram. Reference to this latter diagram reveals that the exciter current for both projectors comes from a single winding and is supplied to PROJECTOR 1 or PROJECTOR 2 by throwing switch SW1. This exciter changeover switch is shown in **Illustration "B" Page 9** and is designated by a nameplate 1 EXCITER 2. The figures refer to the corresponding numbers on the exciter lamp receptacles mounted in the ends of the amplifier chassis. As this arrangement permits current to be supplied to only one exciter lamp at a time it fulfills the requirements of a smooth, simple, foolproof sound changeover. When only one projector is used care must be exercised to see that the changeover switch is thrown to the side the number of which corresponds to the number on the nameplate over the exciter lamp receptacle which is being used.

This amplifier is designed to supply current to 4 ampere, 8.5 volt exciter lamps only. 4 ampere, 9 volt lamps can also be operated satisfactorily from this current source but lamps of higher amperage ratings should NEVER be used because of the excessive overloading of the transformer winding which will result.

DEFECTIVE TUBE INDICATOR

Mounted in the inclined portion of the front wall of the amplifier, to the right of the changeover switch is a neon lamp encircled by a nameplate marked DEFECTIVE 6L6G POWER TUBE. This neon lamp may flash faintly when the amplifier A.C. switch is turned on but with the amplifier in normal operation it will be dark. If either 6L6GA tube develops a short between the screen and a deflector plate, which is the most common occurrence in beam power tube failures, one plate of the neon lamp will glow brilliantly.

If the lamp does glow, change first one and then the other 6L6GA tube until the defective one is found. If this is not done immediately, the 6L6GA screen voltage dropping resistor may burn out.

This indicating lamp takes care of a condition in which the regular three ampere fuse will not give protection. Other types of power tube shorts do not cause the neon lamp to glow but evidence themselves by fuse blow-outs, no sound from the speaker or overheating of the rectifier tube so that failure of the neon lamp to glow is not always an indication that the 6L6GA tubes are operating properly.

The neon lamp may be replaced by pulling outward on the circular transparent cover and unscrewing lamp.

LINE VOLTAGE ADJUSTMENT

cover plate will disclose the line tap to which this lug should be attatched for operating. It is extremely important that the existing line voltage be ascertained accurately and that the movable lug be attached to the voltage tap corresponding to the line voltage or to a tap marked with a value higher than the existing line voltage. For example, if the line voltage is 110, place the lug on the 115 volt tap. If there is a large voltage variation, for example, between 113-118, it is advisable to attach the movable lug to a tap as high or higher than the highest voltage, in this case the 125 volt tap.

As stated before, this amplifier is designed for operation on 50-60 cycle, single phase, A.C. at voltages between 105 and 125. Do not attempt to operate on 25 or 40 cycle A.C. or D.C.

In the bottom cover of the amplifier is a small rectangular opening covered by a pivoted cover, accessible through a rectangular opening in the amplifier mounting board. Remove the screw holding this cover in place and pivot it 180 degrees. Note that the 3-contact terminal strip now exposed has attached to it a flexible wire terminating in a forked lug. Reference to the drawing on the movable

F U S E

The amplifier and speaker (when an A.C. speaker is used) are protected by a fuse mounted in the right end of the chassis **Illustration "B" page 9**. To remove the fuse, unscrew the threaded conical extractor engraved FUSE by turning same counterclockwise. When this extractor has been unscrewed until the threads are disengaged, the fuse and extractor may be pulled out with the fingers. Remove the fuse from its clip by pulling the two apart. A spare fuse will be found on the inner wall of the chassis, behind and above the 6J7 tube. The louvred back cover of the amplifier must be removed in order to get this fuse.

A pilot light located in the inclined front wall of the chassis will glow when the current is on. This pilot light will not burn if the fuse is blown.

A 3 ampere fuse is standard equipment. Note that this size fuse (3AG) is obtainable in current carrying capacities up to 30 amperes. It is extremely important that a fuse having a capacity no greater than 3 amperes be used. If the amplifier continually blows 3 ampere fuses there is something radically wrong and the necessary repairs or adjustments must be made before attempting to operate. Placing a fuse of greater than 3 amperes capacity in the amplifier eliminates the protection provided by a fuse of the proper capacity and may permit serious damage to occur.

AMPLIFIER CONTROLS

Main Volume Control

This control, identified by the designation VOLUME above its knob on the amplifier nameplate and as P2 in the schematic diagram, is a continuously variable potentiometer. Its resistance element has a semi-log taper giving practically constant changes in volume for equal increments of rotation. The sound level of the amplifier may be regulated by means of the main volume control regardless of the source of the input signal.

Tone Control

The tone control is identified by the designation TONE above its knob on the amplifier nameplate and as P3 in the schematic diagram. It is continuously variable and provides a means of gradually modifying the amplifier response characteristics from the fullest bass response, which is obtained when the knob pointer is on "1" of the dial, to accentuation of the higher frequencies and attenuation of the low frequencies which results when the pointer is on "10".

The tone control is used to adjust the frequency response of the entire sound system so that it produces the most desirable tone balance for the type of sound being reproduced. Thus when music is being played and a mellow tone is desired, the control is rotated to the point where those qualities it is desired to emphasize are brought out to the fullest advantage.

In the reproduction of sound from film the tone control is used mainly, however, to obtain maximum voice intelligibility and it thus offers a means of minimizing the effects of bad acoustic conditions and variable sound quality of the original recording or both.

For average speech and music reproduction a setting of "7" or "8" is normal. If bad acoustic conditions characterized by a long reverberation time or echo prevail, a setting of "9" or "10" may be necessary in which case the output volume should also be reduced to a minimum by means of the volume control. No hard and fast rule can apply and the best adjustment is that which gives the clearest speech reproduction or the most pleasing music.

Photo Cell Voltage Control

A complete description of this control will be found under PHOTO CELL INPUT CONNECTIONS TO AMPLIFIER, page 2.

Power Switch

The power switch shown in **Illustration "B" page 9** controls the current supply to the amplifier. When speaker equipment requiring 115 volts, 50-60 cycle A. C. is used, it is convenient to connect the speaker A. C. supply line to terminals 3 and 4 of the speaker output plug. The power supply for both amplifier and speaker is then controlled by the single switch.

ACCESSORY EQUIPMENT

Since the L25N amplifier is a high gain audio amplifier it can be used for amplifying the output from other audio signal generators, some of which are described in ensuing paragraphs.

Crystal Microphone or Crystal Phono Pickup

The input jack marked MICROPHONE, which is located in the left end of the amplifier chassis **Illustration "B" Page 9,** may be used with a crystal diaphram microphone, a crystal phonograph pickup or a high impedance (5000 ohms or higher) magnetic pickup.

Any phono pickup which is used should be provided with a separate voulme control which must be connected between the pickup and the input jack. In use, the main amplifier volume control should be set at "7" or "8" and the output volume thereafter regulated by manipulation of the phono volume control. This technique prevents overloading the amplifier tubes.

When using a microphone the volume may be adjusted by means of the main volume control of the amplifier.

Other types of microphones such as crystal sound cell, dynamic and high impedance velocity may be used successfully with the L25N amplifier provided the output of the unit used is not lower than —55DB. Microphones having an output lower than —55 DB may be used if the unit is held close to the speaker's lips.

Care must be used in connecting any of the preceding equipment to the amplifier, to see that the "hot" lead is connected to the tip of the plug which is inserted in the jack and that this lead is adequately shielded. The shielding must be connected to the sleeve of the plug which automatically grounds the shield when the plug is inserted in the jack. The usual method is to use a single conductor (stranded) shielded, low capacity cable. The wire becomes the "hot" lead and the shielding acts as the ground return. The length of the connecting cable, if operated as a high impedance line, is usually limited by attenuation and hum considerations to about 50 feet. If the cable has extremely low capacity and does not pass through any electrical fields, lengths as great as 100 feet may sometimes be used.

Low Impedance Magnetic Phono Pickup

Located in the front of the amplifier just beneath the pilot light is a jack marked "PHONO" which is provided for a phonograph pickup or other device having an output impedance of less than 2000 ohms. When using this jack a volume control should be placed in the circuit between the device and the amplifier and used to control the volume, leaving the amplifier volume control at a setting of "7" or "8".

The connecting cable used with a magnetic pickup may be either a two wire twisted pair (up to ten feet in length) or if shielded it may be practically any length. If the hum level is unduly high, try grounding the turntable motor frame and metal case of the phono unit to the shield of the connecting cable.

Note

When using any accessory equipment such as the foregoing while the amplifier is connected to the projector, throw the exiter changeover switch to the opposite position when one projector is being used. If two projectors are being used, disconnect the lighted exciter lamp by pulling the exciter lamp cord connector from the amplifier receptacle.

When the amplifier is not connected to the projector(s), screw P.E.C. input receptacle caps in position. This will shield the P.E.C. inputs and prevent external disturbances from being picked up.

AMPLIFIER CONSTANTS AND CHARACTERISTICS

Input Impedance: 231,000 ohms at 1000 C.P.S.

Output Impedance: 8 ohms. A 16 ohm tap is also brought out of the output transformer. See amplifier schematic for connections.

Gain: The total gain between photocell input and a connected 8 ohm resistance load is 102 DB at a frequency of 1000 C.P.S.

Power Output: 25 watts into an 8 ohm resistance load at an amplifier supply voltage of 117, 60 cycles (standard RMA test voltage)

Response: Flat within 1 DB between 70 and 8000 C. P. S.

POWER TRANSFORMER A. C. SECONDARY VOLTAGES

The following voltages were measured with an 1000 ohm per volt A. C. voltmeter. If a less sensitive meter is used the high voltage winding reading may be lower than the tabulated value depending on the sensitivity of the meter. Other voltages will not be affected appreciably.

High Voltage Winding — 530 volts measured between either 5U4G plate and ground under load.

Exciter Winding — 8.7 volts under a load of 4.0 amperes.

Amplifier Tube Heaters — 6.3 volts.

Rectifier Tube Heater — 5.0 volts.

VACUUM TUBE D. C. OPERATING VOLTAGES

The average normal operating voltages at the various vacuum tube socket terminals are listed herewith. As most voltmeters vary within the range of plus or minus 2 to 5 per cent of the actual value and since there is a somewhat greater variation in the amplifier component values, tube characteristics and line voltage the actual voltages measured will differ somewhat from those given in the following table.

The following values to ground were taken with the amplifier connected to a 117 volt, 60 cycle, A. C. line (Standard RMA test voltage). Note that one set of D. C. voltages has been taken with a 1000 ohm per volt meter while the other has been taken with a more sensitive 20,000 ohm per volt meter. Obviously the D. C. voltages actually measured in the field should be compared with the tabulated voltages obtained with a meter of comparable sensitivity.

	1000 ohms per volt	**20,000 ohms per volt**
First Stage Tube — 6J7		
Plate Voltage	153 on 750V scale	165 on 1000V scale
Plate Current	1.3 on 7.5MA scale	1.3 on 10MA scale
Screen Grid Voltage	61 on 750V scale	75 on 1000V scale
Cathode Bias Voltage	2.0 on 7.5V scale	2.4 on 10V scale
Second Stage Tube — 6C5		
Plate Voltage	195 on 750V scale	205 on 1000V scale
Plate Current	2.6 on 7.5MA scale	2.6 on 10MA scale
Cathode Bias Voltage	6.7 on 7.5V scale	7.8 on 10V scale
Third Stage Tube — 6C5		
Plate Voltage	300 on 750V scale	305 on 1000V scale
Plate Current	3.8 on 7.5MA scale	3.9 on 10MA scale
Cathode Bias Voltage	11.4 on 15V scale	12.3 on 50V scale
Output Stage — 6L6GA (Each Tube)		
Plate Voltage (P to K)	380 on 750V scale	380 on 1000V scale
Plate Current	43 to 70 on 250MA scale	43 to 70 on 250 MA scale
Screen Grid Voltage (Gs to K)	283 on 750V scale	286 on 1000V scale
Cathode Bias Voltage	23 on 150V scale	23 on 50V scale
Rectifier Tube — 5U4G		
Heater to ground	520 on 750V scale	520 on 1000V scale

VACUUM TUBE SUBSTITUTIONS

If tubes of the type originally furnished with the amplifier are not available, the following may be substituted with the results indicated:

First Stage Tube — 6J7

6K7 - This tube is directly replaceable but there will be a loss in gain of 6 to 10 DB, if such a substitution is made.

1603 & 1620 - These are essentially non-microphonic 6J7 tubes and may be substituted without any change in performance.

Second Stage Tube — 6C5

6J5 - This metal tube is directly replaceable with no change in amplifier performance.

6C5G - This glass tube is directly replaceable with no change in amplifier performance.

Third Stage Tube — 6C5

The same substitutions may be made for this tube as for the second stage 6C5 above.

Power Output Stage Tubes — 6L6GA

6L6 - This metal equivalent may be substituted

without any change in amplifier performance. Although the push-pull output stage will operate with only a single power tube in the circuit, it is not advisable that this practice be followed in case of the failure of one tube because the power output drops to 20 or 25 per cent of that obtainable with a pair of tubes while the voltage and current ratings of the remaining tubes are exceeded considerably.

RECTIFIER TUBE—5U4G

The following rectifier tubes may be used directly as temporary substitutes. They are listed in the order of preference.

5V4-G—This tube can be substituted permanently with practically no change in amplifier performance.

5T4—This tube may be used as a temporary substitute but should be replaced with a 5U4G as soon as possible.

5Y3—This tube should be used only in an emergency and should be replaced as soon as possible since it is overloaded approximately 15% with consequently lowered tube life.

MONITOR SPEAKER

Immediately above the fuse post is a bakelite twin jack engraved SPEAKER, **Illustration "B" page 9**, which is connected in parallel with the stage speaker circuit. If a monitor is required it should be connected to this twin jack by means of standard phone tips.

Either a pair of headphones or a speaker having an input impedance of 6 ohms to 16 ohms may be used as a monitor. If a speaker is used, an "L" or "T" pad of suitable resistance and having a power handling capacity of at least 10 watts should be inserted in the line between the monitor speaker and the twin jack as shown in the schematic AMPLIFIER AND SPEAKER CONNECTIONS, page 89, under the heading MONITOR SPEAKER CONNECTIONS. The use of either an "L" or a "T" pad minimizes the effect of monitor volume adjustment upon stage speaker volume which the use of a rheostat would introduce. In an emergency a 10 watt 125 ohm rheostat may be used to control the monitor speaker volume by inserting it in one of the monitor leads.

ELECTRICAL CONNECTIONS

Speaker Cable

Referring to **Illustration "B" page 9** insert the male plug, on the end of the speaker cable, in the female speaker receptacle which is mounted in the right end of the amplifier as shown. Note the plug is polarized with the housing having a slot which coacts with an internal projection on the receptacle housing. Screw the locking ring down tightly by hand which will prevent the plug from being pulled loose.

Photo Cell Cable

A shielded photo cell cable with female connections on each end is used to carry the direct current polarizing voltage from the amplifier to the photo cell. This cable also carries the very small signal voltage from the photo cell to the control grid of the first stage tube in the amplifier when the equipment is in operation. Connect one end of the cable to the male photo cell connection in either end of the amplifier as shown in **Illustration "B" page 9** and tighten same by hand.

Referring to **Illustration "E" page 21** remove screw cap No. 66A from male photo cell connection No. 66 and connect the other end of the cable to the above connection and tighten same securely by hand. Do not use pliers on these connections.

Exciter Lamp Cable

A two wire rubber covered exciter lamp cord carries the current from the amplifier to the 4 ampere 8.5 volt exciter lamp in the projector. One end of the cord is connected to a two prong male plug. Noting that this plug is polarized and can be put in only one way, insert it in the exciter lamp receptacle in one end of the amplifier as shown in **Illustration "B" page 9.** The other end of the cable terminates in a phone plug and is inserted in the jack located in the front end of the projector case near the takeup belt. Be sure to push both plugs into their respective receptacles as far as they will go. If the phone plug is not pushed all the way into the jack, the tip and sleeve will be shorted thus imposing an abnormal load on the power transformer with every likelihood of blowing out the amplifier fuse.

A. C. Connections

Plug female connector No. 1 **Illustration "E" page 21** into the control box receptacle and connect the other end of the cable to a source of 115 volt, 60 cycle, single phase, alternating current. The projector will not operate at the correct speed on current of any frequency other than 60 cycle. Do not attempt to operate it on 25, 40 or 50 cycle alternating current or on direct current.

Connect amplifier power cord to a source of 115 volt, 60 cycle alternating current.

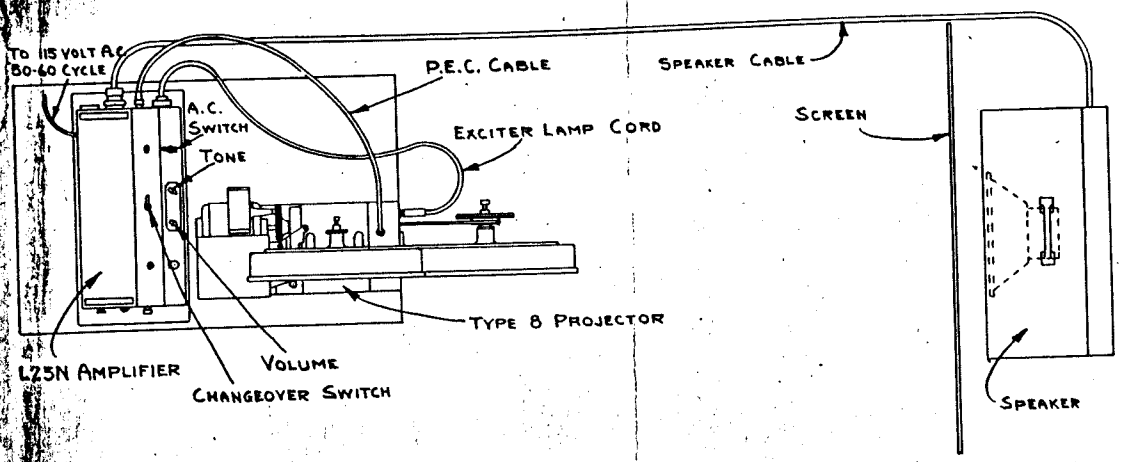


ILLUSTRATION "A"

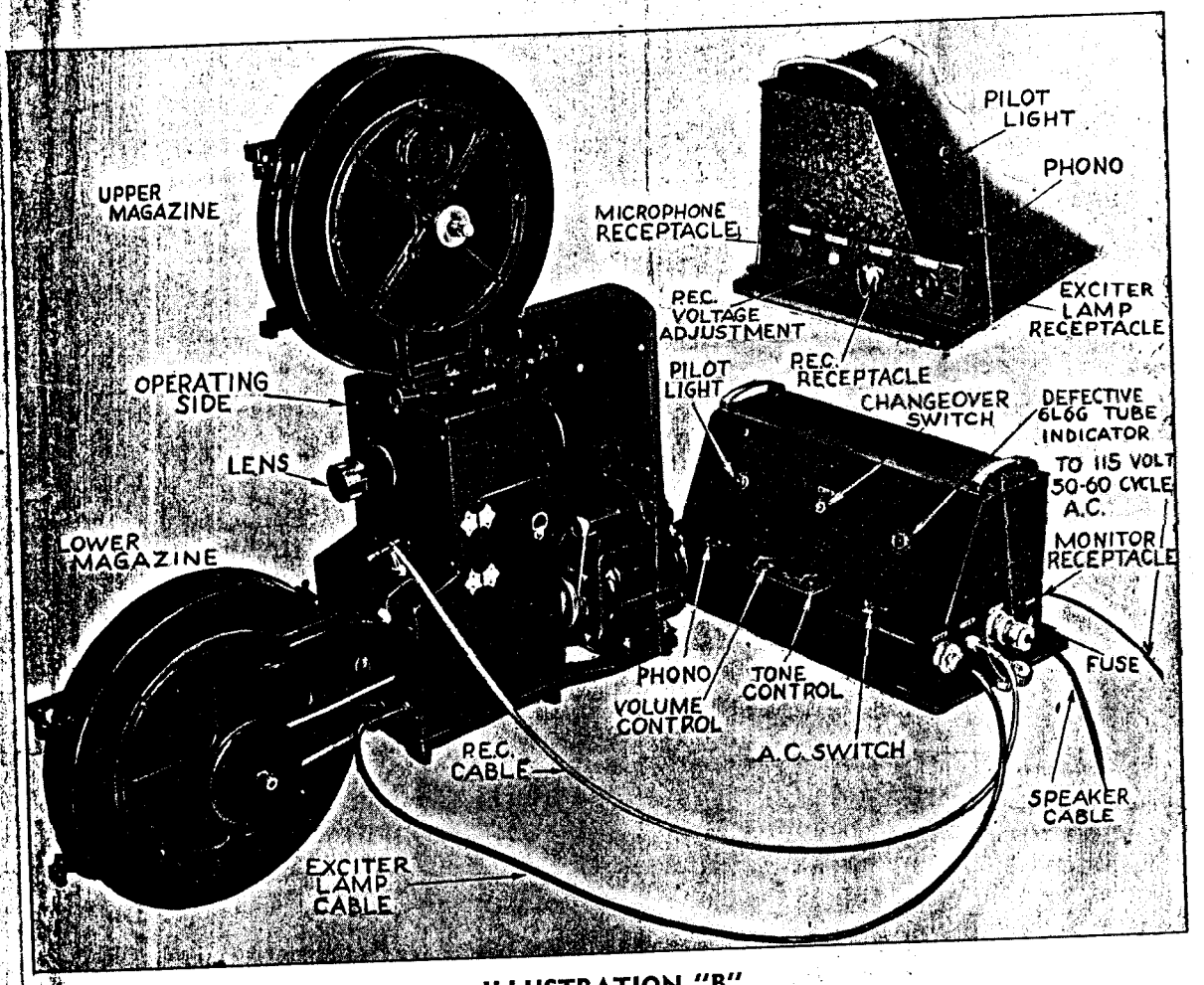


ILLUSTRATION "B"

A12PM (STAGE) SPEAKER

The reproducer furnished with the Type "D" equipment consists of a 12" permanent magnet speaker mounted in a plywood case in which the amplifier is also stowed when not in use as shown in **Illustration "D" Page 13.** The speaker cable is permanently attached to the speaker and when the equipment is being moved, it should be wound around the two cleats mounted on the inside of the door as shown. Be sure when wrapping the cable around these cleats that the plug is secured to a cleat or laced through the cable in such a manner that the plug cannot come in contact with the speaker cone and damage it. Instructions for connecting the stage speaker to the amplifier will be found under "SPEAKER CABLE" page 7.

This speaker has an input impedance of 8 ohms and a D. C. resistance of 6.8 ohms. Note that this input impedance matches exactly the output impedance of the amplifier, which is the ideal condition for minimum power loss and frequency discrimination. If another speaker must be substituted in an emergency, it will be found that speakers having an input impedance of from 4 ohms to 32 ohms may be used with but slight power loss and reasonable frequency distortion. Speaker wiring diagrams are shown under AMPLIFIER AND SPEAKER CONNECTIONS, page 89. A copy is also pasted to the inside cover of the amplifier.

For the best illusion possible with a single speaker, the unit should be behind the screen with its center about one third the screen height below the top of the screen and at the center of the horizontal dimension of the screen. This location, of course, is possible only when a perforated or sound screen is available. If a solid unperforated screen, canvas or other heavy material is used the speaker should be placed above or to one side of the screen. In any case, the speaker should be so tilted that its axis (an imaginary line through the center of the speaker and at right angles to the face of the speaker case) passes through the center of the area occupied by the audience. In general the speaker should be located high enough so each member of the audience has an unobstructed view of it or would have if the speaker were visible. This ensures direct sound radiation to each member of the audience within the angle of coverage of the speaker. Never place the speaker on the deck or floor while in use. If located on a stage characterized by a long reverberation or echo, a dimensioned sketch together with a full description of the difficulties involved should be sent to the manufacturer for an individual analysis of the problem.

Never cover the front of the speaker, while it is in use, with heavy cloth or other sound absorbent material as the quality of the sound reproduction will thereby be affected.

The speaker case door is hinged and removable and is held in its closed position by two drawbolts. When the speaker is in use and the door left ajar, the drawbolts will tend to vibrate at low frequencies so the best procedure is to remove the door and eliminate that possibility. The hinges are of split construction and to remove door, open same and lift upward.

While in use no metal or other loose objects should be allowed to come in contact with the speaker or the speaker case in order to prevent annoying vibrational rattles. The screws holding the speaker in its case should be snug at all times.

Although the speaker cone is water repellant it should not be allowed to become wet unnecessarily. Instructions for replacing the cone and voice coil assembly are contained in the section on page 49.

Referring to **Illustration "C" page 13** note the speaker case is so constructed that a groove is provided in each end near the bottom. When placing the amplifier in the speaker for transportation, as shown in **Illustration "D" page 13,** the amplifier mounting board is placed in the above grooves, with the inclined face of the amplifier towards the speaker, and pushed inward as far as it will go.

Make sure the amplifier A.C. supply cord is placed in the case so that it will not be pinched when the door is closed. Also be sure all amplifier receptacle caps are in position when the amplifier is pushed into place.

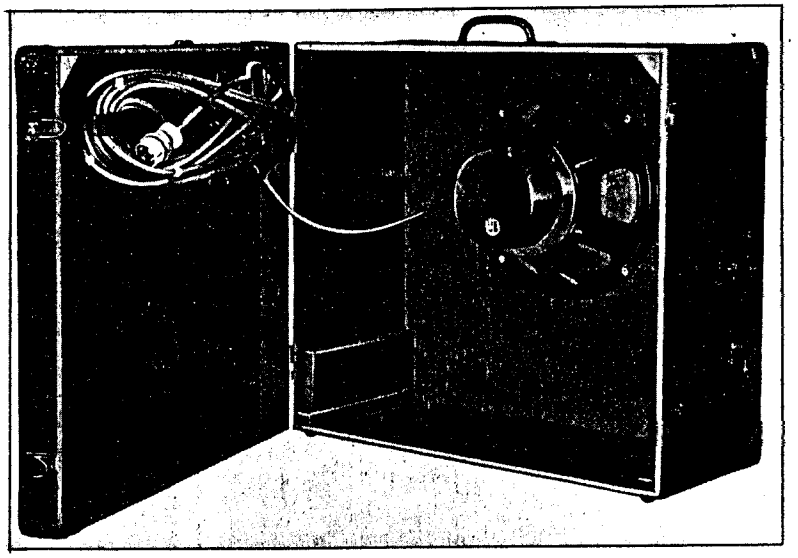


ILLUSTRATION "C"

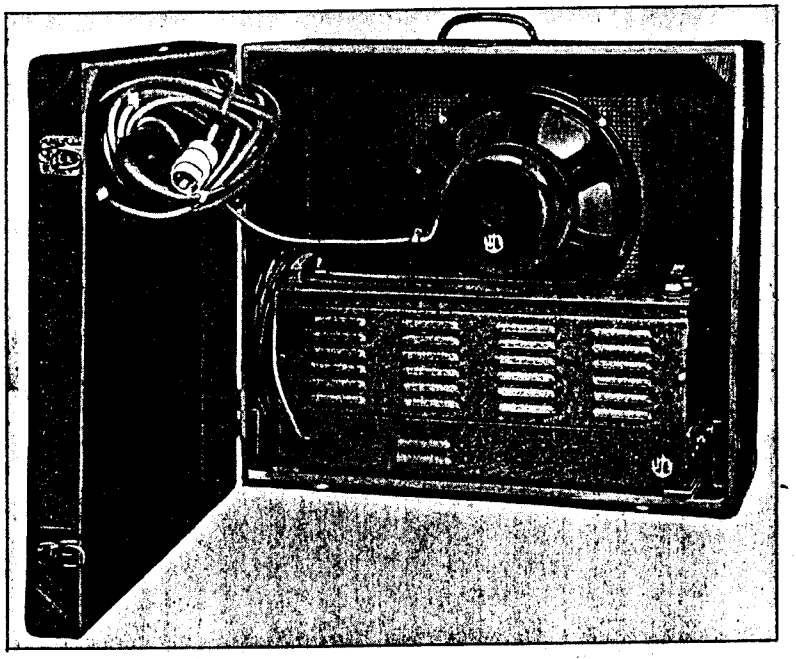


ILLUSTRATION "D"

35 mm FILM

General

35mm motion picture film is 1.378" wide by .006" thick and is manufactured in two different types. One has an acetate base and is known as "Safety Film" or "Non-Inflammable." The other type has a nitrate base and is highly inflammable. By far the greatest percentage of films shown will be of nitrate stock.

One side of the film has a photographic coating known as the emulsion or dull side while the other is bright and known as the "shiny" side. Along both edges of the film are sprocket holes which engage the teeth of the projector sprockets which revolve and impart motion to the film.

Picture and Sound Track

Printed on the film are rectangular pictures .631" high and .868" wide **Illustration "G" page 27** each picture being separated from the next by an .117" opaque black line, there being 16 pictures to the foot. The pictures are printed against one row of sprocket holes and between the other side of the pictures ond other row of sprocket holes lies the sound track .100" wide.There are 4 sets of sprocket holes to each picture. The film is projected at the rate of 24 pictures per second which corresponds to speed of 90 feet of film per minute.

Leader

Each reel of film has a **PROTECTIVE LEADER** of either transparent or raw stock, six to eight feet in length. Next comes the **IDENTIFICATION LEADER,** 18" long, containing the type of print, number of reel and title of picture. Following is the **SYNCHRONIZING LEADER** 13'3" long to where the actual picture starts. Three feet from the picture, the leader is marked with a large "3" and each foot down to twelve is marked with the corresponding footage numbers. The twelfth foot is marked with the word "Start" instead of number "12". The leader is used for threading and synchronizing projectors for changeovers if two machines are used. See **Dual Projector Operation, page 23.**

Trailer

At the end of the reel is an opaque **RUNOUT TRAILER** three feet in length. The next 1½ foot comprises the **IDENTIFICATION TRAILER** which contains "End of Reel", number of reel and title of picture. The last six or eight feet consists of either transparent or raw stock for the **PROTECTIVE TRAILER.**

Cues

The cues are circular opaque dots, printed in the upper right hand corner of four consecutive frames. These markings are for the purpose of indicating to the operator the proper time to perform the operations necessary to change the picture and sound from one machine to the other when two projectors are used. See **Dual Projector Operation** page 23.

Approximately 12½ feet from the end of the picture the **MOTOR CUE** appears. Seven seconds later (10¾ feet) the **CHANGEOVER CUE** appears. It is necessary that the operator pay close attention when the cues are to appear on the screen as their duration is only 1/6 of a second, indicating how easy it is to miss them.

TYPE 8 PROJECTOR

PROJECTION LAMP

This projector is equipped with a special, highly efficient light condensing system. In order to obtain the maximum efficiency from this system it is necessary to use a lamp having a C-13D (double) filament. If an ordinary lamp having a C-13 (single) filament is used,. only 60% of the light will result as compared to that obtained from the correct lamp.

The 1000 watt lamp is packed in one of the magazines. To install it, take out screw No. 7 **Illustration "E" Page 21** and remove lamphouse No. 80 by sliding it backwards.

The lamp is of the mogul prefocus type and the base is equipped with two projecting fins. The socket is also equipped with corresponding slots for the above fins. Note that one of the fins is longer than the other so that the lamp can be inserted only one way.

Place lamp base in socket so that the fins are in line with the corresponding slots, push downward and then turn lamp in a clockwise direction as far as it will go. This will lock the lamp in place as well as aligning it with the reflector and condenser. The socket has been accurately set at the factory before shipment and no readjustment should be necessary. When replacing lamphouse No. 80, make sure the round rods at the bottom of each side are inserted in the tracks provided for them on the lamphouse casting.

Six spare lamps are packed in the spare parts box and are listed as Item 11 on the spare parts list.

PRELIMINARY TEST

Before Any Film is Placed in Machine Make the Following Test:

Now that all electrical connections have been made, start projector by throwing "On", motor switch No. 2 **Illustration "E" Page 21**, located in the front of the control box and open dowser No. 33. Next throw projection lamp switch No. 3 also to the "On" position and a bright white image of the aperture will be projected on the screen. If the edges of the image are not sharp, or just a blur of light appears on the screen, move projection lens No. 35 back or forth until a fairly sharp outline appears then focus the lens by revolving the movable portion of lens jacket No. 34 in either direction until a sharp outline is obtained on the screen. The lens is now very close to the correct focus.

To increase the size of the picture, move the equipment farther away from the screen or to decrease the picture size, move the equipment closer to the screen. At a given distance from the screen, a longer focal length lens will decrease the picture size and a shorter focal length will increase its size. At whatever distance the machine is placed from the screen, always focus the lens before running any film in the projector.

Light threading lamp No. 75 **Illustration "E" page 21** by throwing "On" Threading Lamp Switch No. 4. Throw amplifier A. C. switch **Illustration "B" Page 9** to its "On" position. The red pilot light will light up indicating the amplifier is operating and exciter lamp No. 57 **Illustration "E" page 21** will light. If exciter lamp does not light, throw changeover switch **Illustration "B" Page 9** to its opposite position. Turn amplifier volume control to 6. Open sound gate No. 24 **Illustration "E" Page 21** by moving sound sprocket shoe No. 27 towards photo electric cell No. 40, where it is held in its open position by spring tension and move an opaque card up and down in front of sound aperture plate No. 25 to cut off the light entering photo electric cell No. 40.A staccato sound from the speaker indicates that the connections have been made properly and that the sound end of the equipment is in working order. Return amplifier volume control to "1".

If no noise is produced from the speaker when the above test is made, read the foregoing instructions carefully and recheck the connections step by step. Also see EXCITER LAMP, page 32.

Return both motor switch No. 2 and lamp switch No. 3 to their "Off" positions. Note that the lamp switch is dependent on the motor switch. The projector lamp may be turned "On" while the projector is running but will not light when the machine is still. This arrangement makes certain the lamp will not be on when the film is stationary in the machine. Although the projector is provided with an automatic fire shutter which closes when the projector slows down to a predetermined speed, the above method insures double protection against fire.

THREADING

Film is usually furnished wound on the reel with the beginning ready to thread and with the dull or emulsion side of the film outward, on either 1000' or 2000' reels.

Open projector door by pushing locking knob to the left. Open both magazines by pressing on the catches and swinging both doors outward to the right. When threading lamp No. 75 **Illustration "E" page 21** was turned on it also lighted framing lamp No. 36, concealed in the aperture mount cone. Straighten out clips No. 6 in both upper and lower magazine.

Take the full reel of film to be projected and note that it is equipped with a mounting hole and slot. Unwind about five feet of film from the reel and place it on the upper magazine reel shaft, lining up the slot in the reel with the round key on the reel shaft. Be sure there are no twists in the film and shove reel No. 8 in as far as it will go and snap clip No. 6 **Illustration "E" page 21** to the side so that it will rest at right angles to the shaft and hold the reel in position as shown.

When the film has been properly placed in the upper magazine, it should come off reel No. 8 in the direction shown, the dull or emulsion side must be towards lamphouse No. 80, the sound track must be on the side of the film nearest the operator and the picture must be upside down.

Before threading projector, open guide rollers Nos. 12, 19 and 29 by swinging them to the dotted position as indicated. Open picture gate No. 14 by pushing same to the right until spring catch No. 15 operates and holds it open. Press downward on intermittent sprocket shoe No. 18 to the dotted position as shown. Sound gate No. 24 has already been opened by pressing sound sprocket shoe No. 27 to the right as far as it will go. Press framing lever, which extends through the front of the projector case underneath lens jacket No. 34, downward as far as it will go which moves framing roller No. 16 to its extreme right position.

Carefully slip the film into fire trap No. 9 and down between feed sprocket No. 11 and stationary guide roller No. 10. Holding the film in this position with the right hand, grasp film about four inches below sprocket No. 11 with the left hand and place it over guide roller No. 12 in its dotted position. With left thumb and index finger, work film onto sprocket No. 11 until the sprocket teeth can be felt through the holes in the film with the index finger. Holding the film in this position, reach up with left middle finger and close guide roller No. 12 by pressing downward on it. Take up slack in film between sprocket No. 11 and reel No. 8 by twisting clip No. 6 clockwise.

Disregarding the loops at this time, continue film down through picture gate, in **front** of roller No. 16, around intermittent sprocket No. 17, behind shoe No. 18 in its dotted position, under roller No. 30, behind guide roller No. 19 in its dotted position, over takeup sprocket No. 20, under roller No. 21, over guide rollers No. 22, down through sound gate No. 24, around sound sprocket No. 26, over guide roller No. 29 in its dotted position, under holdback sprocket No. 28 and out through bottom magazine fire trap No. 31.

Note that when picture gate No. 14 is open, the picture aperture is illuminated by framing lamp No. 36. Also note that each picture on the film is separated from the next one by a wide black line known as the "frame line." The frame line on the leader is just the opposite, being indicated by a transparent line, the picture area being opaque.

Intermittent sprocket No. 17 should be locked, that is, it cannot be turned by hand. If movement is felt, open door in rear wall of projector and turn flywheel until sprocket is tight.

Grasp film with the left hand above rollers No. 13 and below intermittent sprocket No. 17 with the right hand. Move film up or down, as may be required, to secure a loop approximating the one shown in **Illustration "E" page 21** above rollers No. 13. Do not make it so large that it will rub the top of the case. Holding the film in place with the left hand, position it around sprocket No. 17. Looking at film through the open picture gate, the frame line will be readily apparent from the illumination through the picture aperture. The film should be so positioned at the picture aperture that the frame line appears near the bottom of said aperture. Move film on sprocket No. 17 to accomplish the above and close shoe No. 18. Seeing that the film is between guide rollers No. 13, pull upward on film with the left hand and holding it there, grasp the framing lever, extending through the front of the projector, with the right hand. Looking at the film in the gate, move framing lever upward until the frame line disappears and the aperture is covered with opaque film. Notice that if framing lever is raised too far, the frame line will appear at the top of the aperture. If this happens, push downward slightly on lever. Remember when performing the above operations to keep tension on the film at all times with the left hand. When film has been framed satisfactorily, pull outward on spring catch No. 15 with the thumb and gate No. 14 will close.

If intermittent sprocket was loose when framing, picture will be out of frame when projector is started.

Pull film taut between shoe No. 18 and roller No. 30 and place same over takeup sprocket No. 20 so that the teeth engage the holes in the film. Move film back over sprocket No. 20 not more than **5** and and not less than **3** sprocket holes, which will insure the proper loop between intermittent sprocket No. 17 and roller No. 30. Holding film on sprocket No. 20 with the index finger of the right hand, reach down with the thumb and close guide roller No. 19. If this loop is less than 3 sprocket holes, the film will tear due to the shortening of the loop just before the intermittent sprocket revolves. If the loop is more than 5 holes, the film will rub exciter lamp guard No. 58 and become scratched. After a little practice the size of this loop will come naturally but until that time, check loop by opening door in the back wall of the projector case and turning the flywheel a revolution or two clockwise. Note action of loop and if it becomes taut or rubs the guard, move film on sprocket No. 20 accordingly.

Grasp film between index finger and thumb of left hand between roller No. 21 and sound guide rollers No. 22. With the right hand, grasp film between index finger and thumb just below sound sprocket No. 26. With both hands, work film into sound gate No. 24 so that film lies between flanged guide rollers No. 22. In performing this operation, pull the film taut between the two hands and move it up and down a short distance, all the while working it into position. Keeping the film taut during the above assures it of being flat in the sound gate and eliminating the chance of it being held by the inner sound gate shoe. When film is finally positioned in sound gate, pull film tight with the right hand and engage the teeth of sprocket No. 26. Still keeping film taut between the two hands, back film upward **2** sprocket holes and again place it on sprocket No. 26 and then move both hands up and down in unision. This action will move the sound sprocket back and forth, if properly threaded, as well as indicating film is in place between guide rollers No. 22. Sliding the index finger of the right hand around under sprocket No. 26, at the same time feeling if teeth are extending through sprocket holes in film, reach over with right thumb and close sound gate No. 24 by pulling sound sprocket shoe No. 27 to the left. The two sprocket hole loop between sprocket No. 20 and guide rollers No. 22 is necessary for the proper operation of the sound sprocket and associated filtering unit, for without it, the filtering unit becomes unbalanced and its action nullified.

Spreading apart index and middle fingers of the left hand, place them underneath film and lift same up under holdback sprocket No. 28 so that the teeth engage the holes in the film. Reach over with the left thumb and close guide roller No. 29.

Leave a loop approximating the one shown but not large enough to rub adjusting screw No. 51 of the exciter lamp assembly. If this loop is too short, the filtering action of the sound sprocket will suffer. If this is the case, place the two fingers again under film and sprocket No. 28 and open guide roller No. 29. With left thumb, clamp film between it and left index finger and move film down off sprocket teeth, back a hole or two, up onto teeth again and close guide roller No. 29. Examine loop and move film again on holdback sprocket if necessary.

Place empty reel No. 32 on lower magazine shaft, line up slot in reel with round key on shaft, push reel in as far as it will go and snap clip No. 6 to hold reel in place. Slip end of film between reel and magazine and attach it to hub of reel. Carefully wind same up by rotating reel in a counter-clockwise direction as indicated by the arrow in the magazine. Just before the film is wound tight, make sure the film is not twisted or curled and work it between the magazine and reel. See that film is positioned in lower fire trap No. 31 and turn lower clip No. 6 in a counter-clockwise direction to take slack out of film.

CAUTION: The rough handling accorded the relatively weak 2000' reels now in commercial use results in badly bent reels. In many cases, film is sent out on reels which are dangerous to use. Such bent reels will not take up satisfactorily and the greatest care must be exercised not to use them as takeup reels. Only straight reels which run perfectly true should be used. Using a bent reel will likely mean that when the projector is started, the reel will catch on the side of the magazine and stop for an instant allowing slack to appear between holdback sprocket No. 28 and reel No. 32. Then as the reel gets up speed, the slack is taken up and the momentum of the reel snaps the film resulting in a shut-down before the show even begins.

Go back over the threading again and if correct, see that lamp switch No. 3 is "Off" and turn motor switch No. 2 "On" for an instant to see that film is propelled over all sprockets and that the loops remain their original sizes. Turn both clips No. 6 in the proper direction to take out any slack in the film and close both magazine doors.

OPERATING

Now that the projector is properly threaded, the equipment is ready to operate. Check and see that amplifier is "On" and that the volume control is turned down.

Open dowser No. 33 **Illustration "E" page 21** and start projector by throwing switch No. 2 "On" and as the leader has been threaded in the picture aperture, the projection lamp should not be turned on until all the leader has passed through or the numbers will flash on the screen.

The progress of the leader can be ascertained by looking through lens No. 35 towards framing lamp No. 36 and right after the number "3" appears, throw lamp switch No. 3 "On" and gradually turn up amplifier volume control until the desired degree of sound intensity is obtained.

Watch the titles on the screen and bring them into sharp focus by slightly rotating the knurled ring of lens jacket No. 34. Frame picture if necessary, by moving framing lever up or down as may be required. Throw threading switch No. 4 "Off" and close projector door.

At the end of the reel when "The End" appears, throw lamp switch No. 3 "Off" and turn amplifier volume control down. Let film run out of projector and turn same "Off".

In many feature pictures, after "The End" a list of characters appears together with music. If it is desired to show this additional film, as the list fades out, apply the above directions by turning lamp switch "Off", volume control down, etc.

When only one projector is used to run a feature, which is made up on three or four 2000' reels, it is necessary to stop at the end of each reel and rethread. When near the end of the first reel, watch for the round black dot **(see Cues under 35mm Film page 15)** which appears for an instant in the upper right hand corner of the picture. Another dot will appear in the same position approximately seven seconds after the first one. When the second dot appears, turn projector lamp "Off" and volume control down, let film run out of machine and turn same "Off".

Remove the now empty reel from the upper magazine and place it in the lower magazine. Place second full reel in upper magazine and thread projector. The film just run may be rewound as the show is going on but when so doing, glance at the picture every few moments and listen to the sound at all times.

When running colored pictures along with black and white prints, it will be noticed that when going from one to the other the picture will be slightly out of focus. Always be on the alert to refocus when such a condition arises.

"Important"

The primary duty of the operator is, of course, to operate the equipment in such a manner that a picture is projected onto the screen accompanied by the proper sound but the secondary items are just as important.

To the audience engrossed in the picture, such defects as the picture out of focus, sound too loud or too low, picture misframed, etc., immediately create a diversion thus interrupting their mood and concentration, nullifying the very purpose for which the picture was made.

It cannot be stressed too frequently that a good operator keeps watching his picture every few moments and at all times listens to his sound so that any changes may be compensated for immediately.

LOW TEMPERATURE OPERATION

The projector drive motor has two windings, one for starting and the other for running. Since acceleration of the mechanism from a standstill to the proper speed requires more than the ordinary running torque and for other reasons, the starting current is quite high.

When the current is turned on, both starting and running windings are actuated and the amature immediately starts to accelerate. When the proper speed is reached, a matter of a fraction of a second, a centrifrugal switch mounted on the armature operates to open the starting winding. By listening closely, the switch can be heard to operate and "kick" out at the proper speeed.

If the projector is allowed to become unreasonably cold, the starting winding will not accelerate the motor to the switch cutout speed and it will continue to run on the starting winding. Running the motor for longer than 15 seconds under these conditions may damage it seriously. The proper procedure, of course, is to raise the temperature of the motor and projector to room temperature or if the projection room is cold, it should be heated.

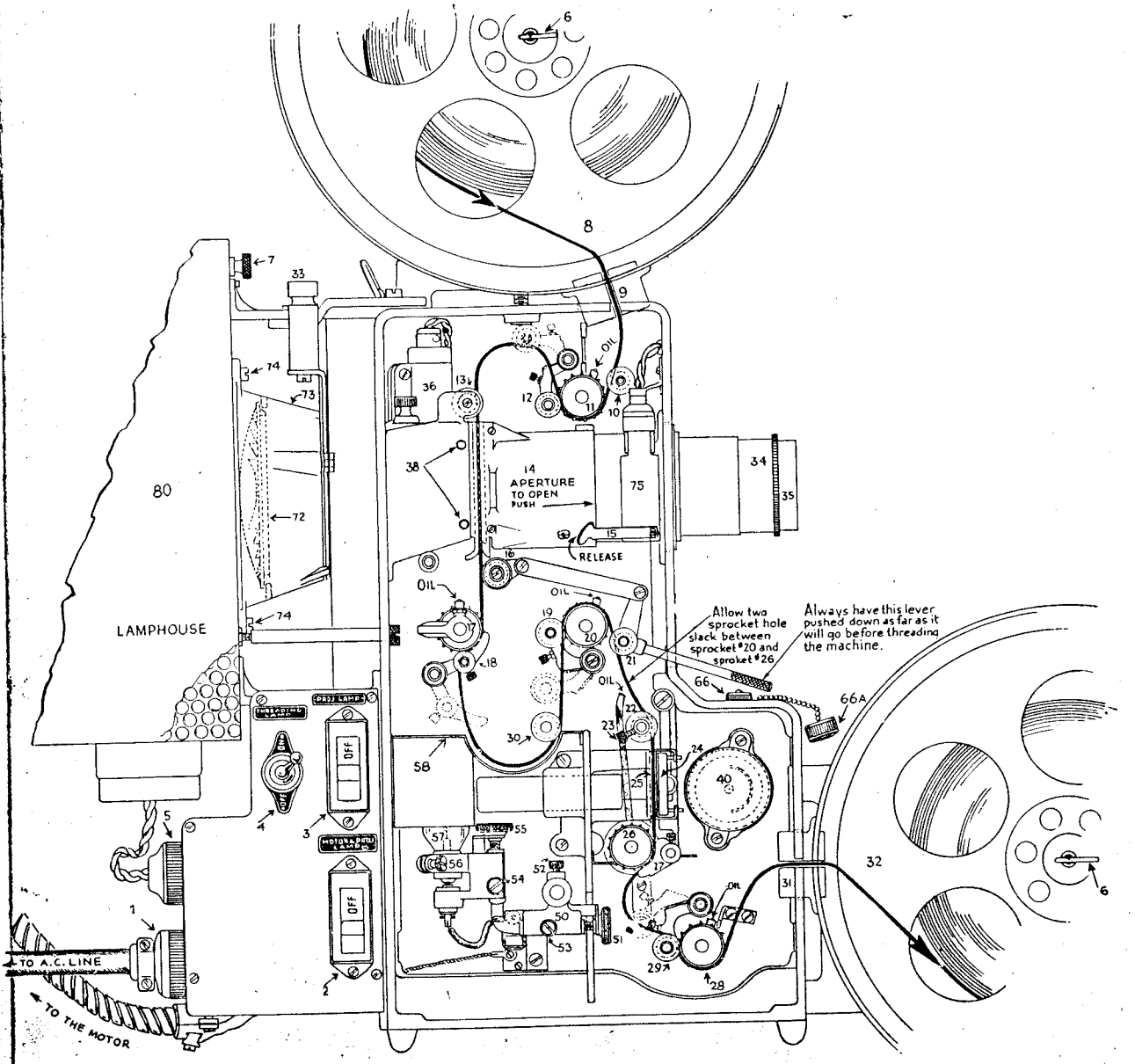


ILLUSTRATION "E"

THREADING

DUAL PROJECTOR OPERATION

It is important that the preceding instructions be read thoroughly before proceeding with the following.

General

As the film footage on exchange reels varies in running time from ten to twenty minutes, two projectors together with a single amplifying system may be used to present a picture without any interruptions, which is the case with a single machine.

While one machine is running, the other is threaded in a certain relationship so that at the proper moment, the idle machine is started and at a predetermined time later, the picture and sound are changed from one projector to the other.

Setting Up the Equipment

Two stands 32" to 36" high with tops approximately 12"x24" are necessary for the projectors and one of the same height with a top approximately 12"x24" for the amplifier.

Place both projectors within ¼" of the front edges of the stands and mount upper and lower magazines as described in the first two paragraphs under **SETTING UP THE EQUIPMENT** page 1. Separate the two stands so that there is approximately 34" between the two machines.

Place the smaller stand between the other two about even with the lower magazines so that the door of the left magazine can be opened and set the amplifier on it.

Electrical Connections

Connect the right projector to the right side of the amplifier as described under **ELECTRICAL CONNECTIONS,** page 7. Connect speaker as described under the same heading.

Connect left projector to left side of amplifier with second set of exciter lamp and P.E.C. cables. Insert second A.C. plug No. 1 **Illustration "E" page 21** into control box.

When equipment is to be permanently installed, blueprints can be furnished for conduit and wiring for the machines so that changeovers may be made through a switching arrangement mounted on the front wall of the booth below the observation port.

Preliminary Test

Follow instructions as outlined under **PRELIMINARY TEST page 16.**

Threading

Follow instructions as outlined under **THREADING, Page 16.**

Operating

Complete instructions for each machine are contained under **OPERATING, page 18,** with the exception of the **CHANGEOVER** which is described under the following heading.

Changeover

It will be recalled that under **35mm FILM,** page **15,** the standard exchange prints all have leader at the beginning of the reel with numerals marked on the film at every foot with two exceptions. The twelfth foot is marked "Start" instead of "12" and "1" and "2" are not printed so that the first number next to the picture is "3".

The following instructions should be put into operation before a show is run so that the operator will become proficient in making changeovers.

Thread machine No. 1 (left machine is No. 1, right machine No. 2) with a reel from a feature. Thread machine No. 2 so that "8" on the leader is close to aperture gate No. 14 **Illustration "E" page 21.** Remember the changeover cues take the form of black dots in the upper right hand corner of the screen.

When ½" layer of film is left on the upper reel of machine No. 1 (approximately one minute running time) take a position between the two projectors in such a manner that with the left hand on the switches in the control box of machine No. 1, the switches in the control box of machine No. 2 can be manipulated by reaching the right hand around the motor and under the lamphouse of machine No. 2. In this position the picture must be seen through the observation port.When the first (motor) cue appears, approximately 8½ seconds before the end of the reel, with the right hand throw motor switch of machine No. 2 "On" Immediately thereafter, raise the right hand a trifle and grasp the lamp switch. Place the left hand on the lamp switch of projector No. 1.

Seven seconds after the first cue, the second (changeover) cue will appear. At that moment, simultaneously throw lamp switch of machine No. 2 "On" and lamp switch of machine No. 1 "Off" and continue over with the left hand to the amplifier and throw changeover switch **Illustration "B" page 9** to the right to "2". Be instantly ready to turn amplifier volume control up or down and to frame picture in the event either is necessary.

As soon as the film in projector No. 1 has run out, stop machine, thread same with another reel and follow the above procedure on the next changeover.

The footage number threaded in the aperture depends on the acceleration of the motor and as this acceleration varies with different motors, the two projectors may have to be threaded with different numbers. However, after the number for each machine has been determined, it should be marked on the threading diagram on the inside of the projector door for the benefit of operators not familiar with the equipment.

Numbers flashing on the screen after the changeover indicates that less leader must be used when threading. For example, if "3" should flash on the screen, thread the machine the next time

with "7" at the aperture gate (bearing in mind that the machine was originally threaded with "8" at the gate.)

If just the opposite results and the changeover is made in the middle of a sentence or the continuity of the picture is interrupted, more leader must be used when threading. Thread projector with "9" at the aperture and make a changeover. If the above condition persists; try "10" and so on until a perfect changeover is made.

It is imperative that the clutch mechanisms on the lower magazines be properly adjusted at all times. The takeup belts also should not be allowed to become so loose that they slip on the takeup pulleys. During a changeover, the operator cannot always watch to see that the lower reel is taking up properly. See **Magazine Adjustments, page 30.**

REWINDING FILM

As the film is being run through the projector, it will be wound onto the takeup reel with the start of the picture at the hub of the reel. When the film has run out, therefore, it will be necessary to rewind the film on another empty reel to get the start of the picture on the outside of the reel where it was originally. A rewinding device is required for this operation.

A pair of hand rewinds consists of two elements or separate fixtures, one with a revolving spindle geared to a hand crank and the other with a stationary spindle on which the reel revolves. The fixtures should be clamped to the rewind table or shelf approximately 30" apart, so that the geared unit is on the right, and they should be so positioned that the film travels from one reel to the other in a straight line and particularly, the film should not strike the flanges of the reel.

The rewinding should be done at a uniform speed with just enough tension on the reel from which the film is traveling to keep it from over-running the reel on which the film is being wound. This is done to prevent the upper turns of the film from tightening up and slipping on the turns underneath which would scratch the emulsion causing streaks in the picture area as well as introducing extraneous noise through the sound track.

A pair of 2000' rewinds are packed in the spare parts box and are listed as Item 24 on the spare parts list. When ready to rewind, place an empty reel on the right hand (geared) fixture.

Remove the full reel from the projector and place in on the left hand fixture. It makes no difference whether the film comes off the top or the bottom of the reel. The important thing is that in either instance, the film must be carried straight across to the empty reel and fastened to the hub.

Due to the counter clockwise direction in which the film is wound onto the reel in the lower magazine **Illustration "E" page 21** the natural procedure is to remove the reel and holding it in the same relative position, place it on the left hand fixture. This will situate the film in such a manner that it will come off the top of the full reel **Illustration "F" Page 27** and will be wound onto the top of the empty reel with the dull or emulsion side up. Revolve the crank on the right hand fixture so that the empty reel will revolve in a clockwise direction. Rest the left hand lightly on the full reel to keep it from over-running the empty one.

Be sure to use an empty reel on the crank end the same size or larger than the full reel which is being rewound.

SPLICING FILM

Motion picture film is spliced by overlapping the ends of the film and cementing these portions together. The action of the film cement is such that it softens the celluloid base and when pressure is applied to the overlapping portions, they are welded rather than cemented together.

It is very important that all emulsion be scraped off the film where it overlaps. It should be borne in mind that the emulsion extends clear across one face of the film and that the film cement has no binding action on the emulsion but acts only on the celluloid base.

Splicer

A film patching block or splicer is packed in the spare parts box and listed as Item 23. Progressive steps in making a splice are shown in **Illustration "H" Page 27.** The logical place for the splicer is between the rewinds and for ease of operation, it should be screwed down to the rewind bench or shelf.

To place splicer in condition for operation, open left-hand clamp No. 1 by lifting same upward as shown in **Figure 1.** Raise right-hand top clamp No. 2 also as shown.

Take right-hand section of broken film No. 3 and with the **dull side up,** position film on locating pins No. 4 so that frame line No. 5 is **one** sprocket hole to the **left** of cutting edge No. 6 as shown. Hold film in place and close right-hand top clamp No. 2 by swinging same downward where it is locked in position by a spring catch. Raise film out of the way, to the position shown in **Figure 2,** by lifting upward on right-hand bottom clamp No. 7.

Referring to Figure 2, take left-hand section of broken film No. 8 and with the **dull side up,** place it on locating pins No. 9 so that frame line No. 10 is **one** sprocket hole to the **left** of cutting edge No. 6. Hold film in place and close left-hand clamp

No. 1. Swing right-hand clamp assembly (No. 2 and No. 7) downward as far as it will go and return it to the position shown in **Figure 2.** This action will cut both films to the required length.

Detach scraper No. 11 from its holder on the right side of the splicer. Position scraper on left-hand clamp No. 1, as shown in **Figure 3,** so that scraper blade contacts the visible portion of the film as shown at No. 12. The emulsion or dull coating is removed by moving scraper No. 11 back and forth. Care must be taken in scraping as excessive pressure will cause the blade to dig into the film which will rip out the sprocket holes. This is particularly true with old or brittle films. Continue scraping until the film at No. 12 is clear and transparent. The right-hand section No. 3 requires no scraping but should be free of oil or dirt.

Referring to **Figure 4,** remove applicator from film cement and spread an even coat of cement on surface No. 12. Quickly close right-hand clamp assembly by swinging same downward as far as it will go. This action positions both sections of film correctly with respect to each other. Allow cement to dry approximately 30 seconds (depending on type of cement used) and then open clamps No. 1 and No. 2 only. Wipe off excess cement and film is ready for operation.

HAND SPLICING

It may be necessary at some time to make a splice without benefit of a splicer. To make a splice by hand the following procedure should be adopted. All numbers refer to **Illustration "G" page 27,** with the emulsion side of the film up.

The same precautions must be taken as when using a splicer, namely - the film must be spliced in frame otherwise reframing will be necessary when the splice goes through the projector and unless the operator is watching the screen at that particular instant, the picture may go along out of frame for an indefinite length of time.

Note the frame lines on the film are positioned between the sprocket holes. Referring to the left hand strip of film (A), cut it in the frame line area approximately 1/32" to the right of sprocket hole No. 1 as indicated and remove all emulsion from the area bounded by a line 5/32" back from the end just cut.

On the right hand strip of film (B), locate sprocket hole No. 2 to the left of the frame line and cut the film 1/32" ahead (to the left) of this hole. The emulsion does not have to be removed from this strip as it overlaps the left hand one. Any oil or dirt should be wiped off the underneath or "shiny" side.

Place a straightedge, approximately 12" long, on a clean flat surface and lay the left hand strip of film (A), emulsion side up, on the flat surface against the straightedge. Apply an even coat of film cement to the area from which the emulsion was removed. Quickly place the right hand strip (B), emulsion side up, along the straightedge and on the cement coated area of the left hand film (A) so that the first sprocket holes of each strip, No. 1 and No. 2 coincide. Apply a strong even pressure on the lap just made for ten seconds or so (depending on the cement used) and then remove pressure and wipe off excess cement.

The straightedge should be used because if the two strips are not spliced properly, that is at an angle to each other, there is danger of the splice being torn apart as it goes over the sprockets.

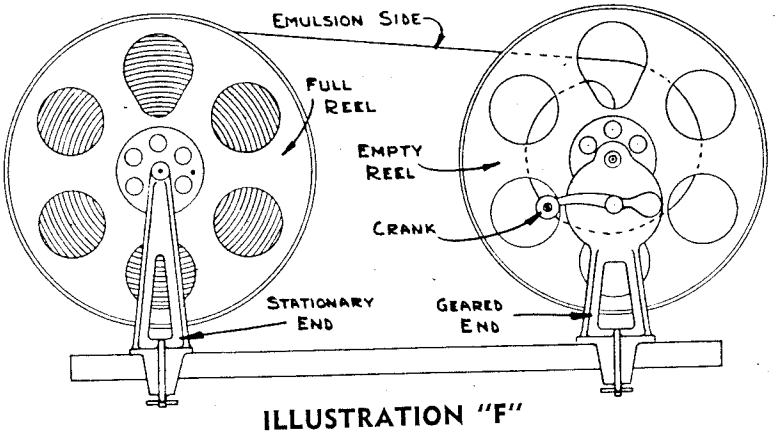


ILLUSTRATION "F"

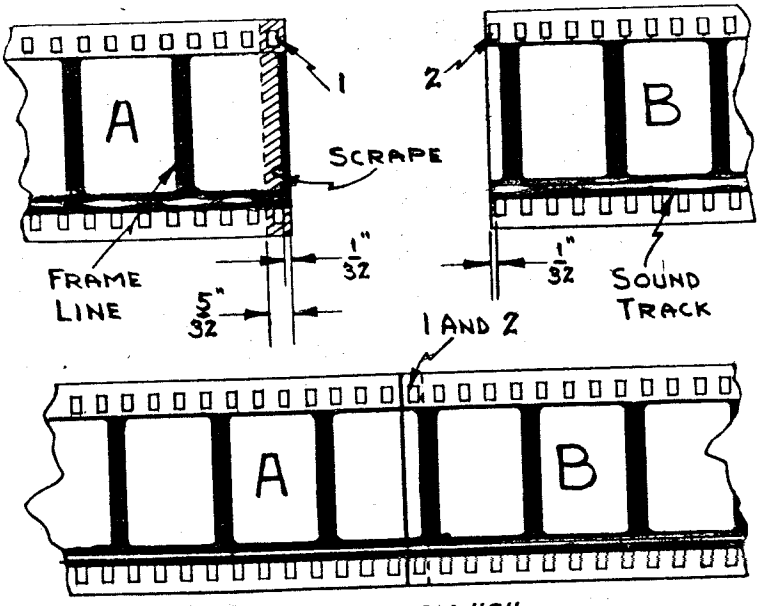


ILLUSTRATION "G"

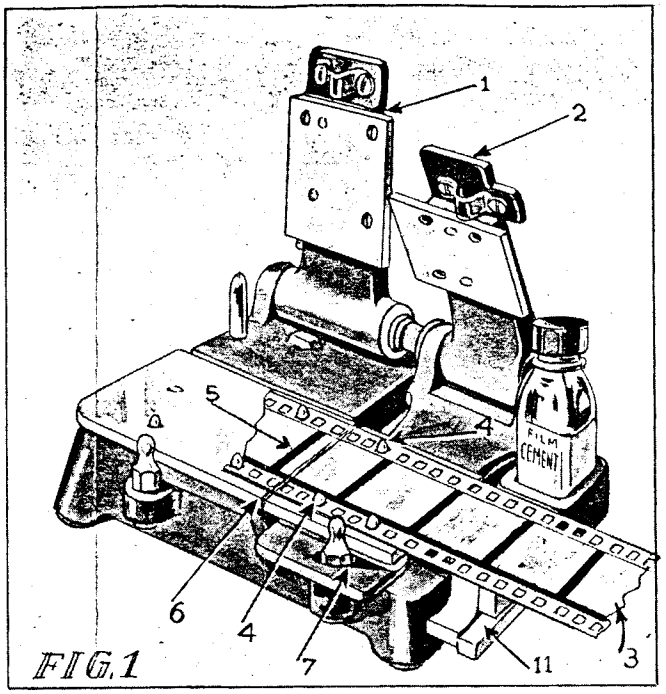


FIG. 1

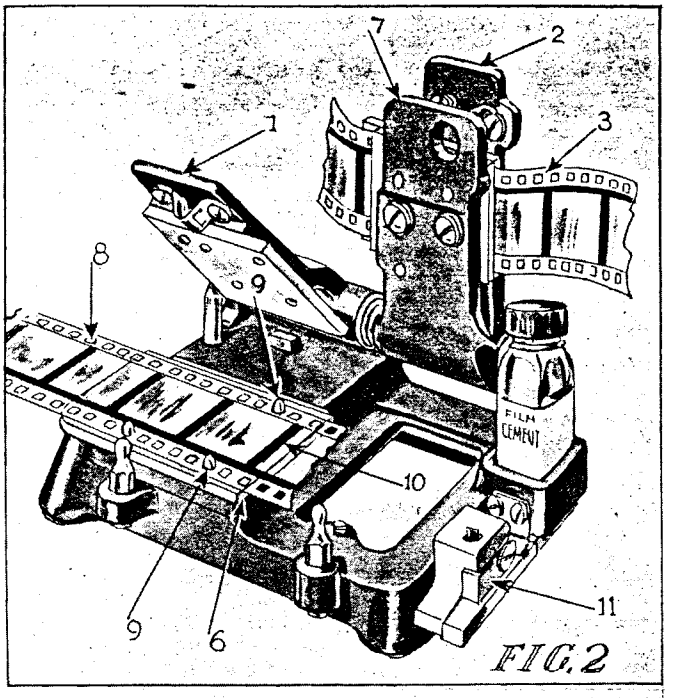


FIG. 2

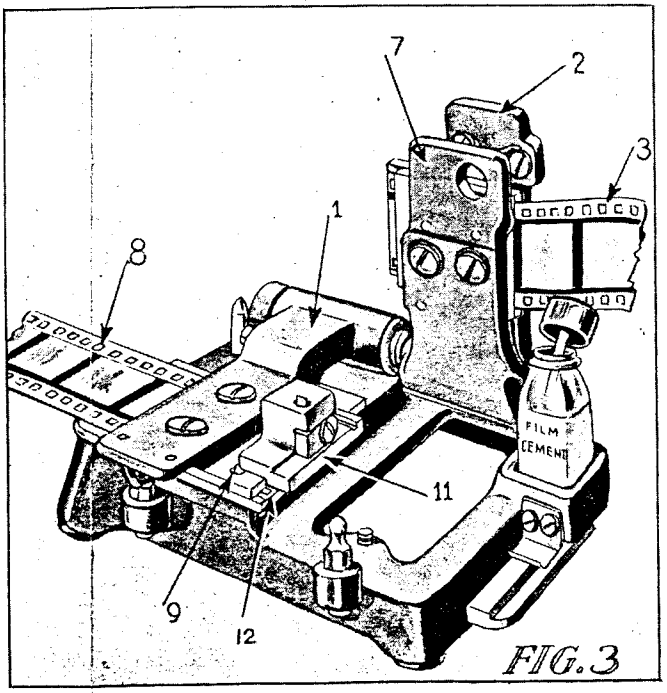


FIG. 3

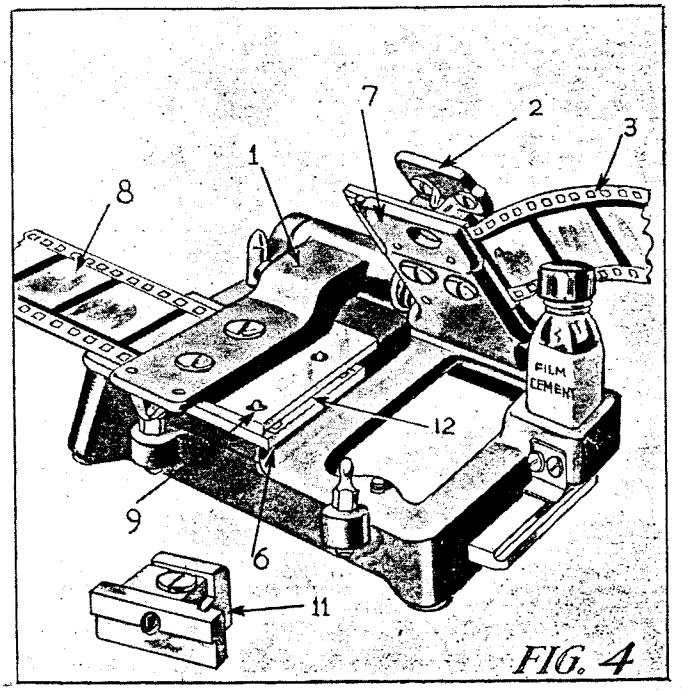


FIG. 4

ILLUSTRATION "H"

Pg 27

LUBRICATION

Oiling

All lubricating points on the projector are marked with red paint. An oil can is packed in the spare parts box as Item 22.

The projector mechanism is so designed that all gears and the intermittent movement are enclosed in a dust-proof and grease-tight housing. This housing is filled with sufficient special lubricant at the factory to last for approximately 200 hours of operation.

Six oiling points on the threading side of the projector are indicated by a red dot and shown in **Illustration "E" Page 21.** Intermittent sprocket No. 17 has two oil hole covers, one each in the front and rear bearing. Feed sprocket No. 11, takeup sprocket No. 20, and holdback sprocket No. 28 each have one. Sound sprocket No. 26 is reached through the oil tube, the opening of which is located just above guide rollers No. 22. Light oil such as SAE No 10 automobile engine oil should be used. A drop of oil should be placed in each of the above points before every show.

The following three oil points are located on the back of the projector:

The lamphouse blower bearings should be oiled with a drop of oil each time the projector is used. They are reached through an oil hole located in the blower housing bearing arm just to the right of the small blower pulley.

The upper magazine reel shaft should be oiled once every two weeks by placing a drop of oil in the oil hole located on top of the boss in which this shaft is positioned.

The lower magazine reel shaft runs on ball bearings which are packed with grease at the factory. They should not require lubrication for a year or more.

The takeup pulley (mounted on the reel shaft of the lower magazine) has an oil hole in its hub. Oil once every two weeks, taking care not to drop oil on the takeup belt.

The motor has two oil reservoirs (one in each end) packed with wool to retain the supply of lubricant for a period of 2000 to 3000 hours of normal service. These reservoirs are filled at the factory but before the equipment is operated, the two oil cups should be filled with SAE No. 10 lubricating oil. If too much oil is added, it will drain through the overflow holes so any excess should be wiped off the motor and base.

Every two months guide rollers Nos. 10, 12, 13, 30, 19, 21, 22, and 29 should be oiled. Note that the spacer of each assembly has a hole in it. Oil each with a few drops of light oil.

Greasing

After 200 hours of operation, remove the magazines, close the projector door and lay the projector down on its threading side. Remove the back wall, which is held in place with five screws. Three slotted head screw plugs, the heads of which are ½" in diameter and painted red, can now be seen in the back wall of the mechanism housing cover.

A carton containing a tube of grease and nozzle is packed in the spare parts box and is designated as Item 25 on the spare parts list. Attach the nozzle to the tube of grease and insert the tapered end of the nozzle in one of the above holes. Holding the nozzle firmly against the hole, squeeze the tube until the compartment is full. Do not try to force the grease in by excessive pressure on the tube. Hold a piece of cloth around the nozzle when removing it from the hole as the pressure inside the compartment will force some of the grease out and the cloth will absorb it. Continue in a like manner with the other two holes. Be sure and replace the plugs when through and tighten same securely.

Another grease hole plug, also painted red, is located in the side of the small rectangular gear box from which the main drive shaft extends. Grease should be introduced into this box also and the plug replaced.

MAINTENANCE

MAGAZINE ADJUSTMENTS

Upper Magazine

The upper magazine reel shaft is mounted in two brass bearings. Secured to the magazine bracket is a disc against which is pressed a felt fastened to another disc of the same diameter, the latter disc revolving with the shaft through the action of a key. Tension on the shaft is maintained by a spring and collar, the spring pressing one disc against the other creating a clutch effect.

The tension means are provided to insure the reel against overrunning when the projector is started as the resulting slack would break the film when the excess was again taken up.

Place a full 2000' reel in the upper magazine and thread the projector. Start the machine and turn it off immediately thereafter. If the upper reel has revolved after the machine has stopped, allowing excess film to appear between reel and fire trap, it indicates there is not enough tension on the shaft.

Loosen the screw in the collar, move collar in 1/8" and tighten screw securely. Turn motor on and off again and note if the above condition still persists. If it does, move collar in another 1/8" or until overrunning condition is remedied.

Do not use excessive pressure as not only will it wear out the film and feed sprocket quicker, but might also break a bad splice, resulting in a shutdown.

Lower Magazine

As the lower reel receives more and more film, the diameter upon which the film is wound gradually increases, causing the reel to revolve at a decreasing rate. The lower reel being driven by a belt from the projector, which runs at a constant speed, necessiates a clutch arrangement to take care of the variations in the speed of the reel as well as to keep a constant tension on the film so it will be wound on the reel smoothly and evenly.

The lower reel shaft is mounted on two ball bearings. Next to the magazine bracket is a large disc, having a pulley turned therein, driven by a belt from the projector and free to revolve on the reel shaft. Another disc of the same diameter is keyed to the reel shaft and has a felt cemented to its face, the felt surface acting against the face of the pulley disc. A spring, in conjunction with an adjusting collar, presses against the felt disc providing the tension means.

Over a period of time, the clutch felt may become worn and smooth causing too much slippage when the machine is started, which will result in a film breakage when the slack is suddenly taken up.

To properly adjust the tension of the lower reel, place a reel having a 5" diameter hub on the shaft. Position the reel so that one of the spokes is vertical. Secure a spring scale reading at least 36 ounces and place the hook around the vertical spoke of the reel down close to the hub. Holding the scale horizontally, turn motor on and read the pull in ounces. For correct adjustment, the scale should read between 18 and 20 ounces.

If the pull in ounces is below the above figures, turn motor off, loosen screw in collar, push collar in 1/8" and tighten screw securely. Check pull in ounces again and if still low, repeat the above until correct amount is registered.

Other causes of slow reel starting and loosely wound film are due to the takeup belt becoming stretched and/or saturated with oil or grease. If the belt is tight but is slipping due to it being oily, use a little belt dressing to remedy the condition.

If the belt has stretched, unbend one end of the belt hook and remove the belt from it. Draw belt tight, being sure it is on both projector and magazine pulleys, which will indicate how much is to be cut off. Cut excess off and punch a hole 3/16" from the end of the belt, approximately .067" in diameter or the hole may be drilled with a #51 drill. Insert belt hook in hole and bend hook over, clamping it down tight with a pair of pliers.

PROJECTION LAMP ADJUSTMENT

The projection lamp was accurately set at the factory for maximum output with a uniform field of intensity. If the equipment is moved around frequently and jarred, the lamp may be thrown out of adjustment. If a permanent dark area is noticeable on the screen or the general level of illumination is low, the lamp should be checked and adjusted if necessary. In the event the lamp has been in use for a long period of time, first install a new lamp (Item No. 11 on the spare parts list) and if no change is noted, proceed with the following instructions:

The center of the lamp filament should be on a line running through the center of the projection lens, condenser system and the reflector as shown in **Illustration "I" page 33.** The filament should also be parallel with the front of the lamphouse casting.

Make sure that the entire lamphouse is held rigid by tightening the knurled screw No. 88 **Illustration "M" Page 39** projecting through the back wall of the projector, near the intermittent sprocket, into the stay rod fastened to the lamphouse. The stay rod accurately positions the lamphouse relative to the projector.

As the lamp is of the prefocus type, any adjusting must be done with the socket. Remove lamphouse cover No. 80 **Illustration "E" page 21.** Note the socket holder is composed of two parts, the back half creating a clamping effect when the two screws are tightened. The front half is provided with a boss which in turn is supported in the lamphouse casting and is locked in position by two screws.

Check the lamp alignment by holding a straight edge in such a position that it coincides with the centers of the projection lens **Illustration "I" page 33,** condenser lens and the reflector. Sight along the edge and see if the center of the filament coincides with the straight edge. If not, loosen socket holder clamping screw and move lamp socket up or down until filament is centered.At the same time, if necessary, twist socket in holder until lamp filament is parallel with the front of the lamphouse casting. Tighten clamping screw when through. The accuracy of the adjustment can be checked by placing a sheet of paper against the front of the projection lens. The bright ball of light should be centered in the projection lens when the lamp is properly aligned.

The lamp should be positioned vertically and if it is tilted at an angle, loosen the two screws locking socket holder boss in lamphouse casting and move lamp accordingly. Tighten screws when through.

It will be noted that during the above adjustment the lampholder may be moved back and forth in a horizontal direction. Usually the holder will be in towards the front of the lamphouse as far as possible but if the low level illumination still persists, move holder out to see if illumination can be increased. If not, return holder to its original position.

If none of the above adjustments are of benefit the trouble probably lies in the reflector. Refer to **Reflector Adjustment** below.

REFLECTOR ADJUSTMENT

The primary purpose of the reflector is to collect the light emanating from the projector lamp and direct it into the condenser system. This action not only increases the total light output but also results in a more even distribution of light on the screen. Without the reflector, alternate bright and dark vertical lines will appear on the screen duplicating the incandescent coils of the projector lamp and the dark areas between the coils. The reflector is so adjusted that the image of the incandescent coils of the filament is directed at the dark areas on the screen creating an even field of light.

If necessary to adjust reflector, remove lamphouse cover No. 80 **Illustration "E" page 21.** The following instructions are based on the assumption that the projector lamp is correctly aligned as stated under **Projector Lamp Adjustment, page 30.**

The reflector is supported in its holder by three flat springs. The reflector base is secured to the lamphouse frame by two screws, the base being slotted, providing horizontal movement so that the reflector may be moved closer or farther away from the lamp. The reflector holder is mounted on a stud, the stud being pressed into the reflector base. This arrangement provides vertical movement for the reflector as well as rotation.

Select a small mirror approximately 2"x3" and hold it in place against the center of the condenser lens No. 72 **Illustration "E" page 21.** Position the head so that the left eye is alongside the reflector and note the size of the image of the lamp filament in the mirror. This image should be as nearly the size of the lamp filament as possible. If not, loosen the two reflector base screws and move base back or forth until the above condition is satisfied. Tighten the two screws when through.

Place the left eye alongside the reflector on its center line and looking into the mirror, note if the two images coincide. If one is higher or lower than the other, the reflector must be moved up or down accordingly. Note the reflector holder is secured to the reflector base by a screw. Loosen this screw and move reflector up or down, as required, until the two images are aligned vertically.

Next, place the left eye on top of the reflector on its center line and see if the two images are in line horizontally. If not, rotate reflector accordingly until the images are brought together. Place the eye alongside the reflector again and check the vertical alignment as it may have moved downward while being rotated. Tighten locking screw in reflector holder when through.

Although the left eye has been used as the basis for adjustments in the above, the right eye may be used equally well.

A check on the adjustment can be made by removing the projection lens and holding a white card or sheet of paper approximately ten inches in front of the projector. Referring to **Illustration "I" page 33,** the dark lines represent the image of the filament while the light lines indicate the image of the filament from the reflector. Actually, the image is not sharp as shown but is widely diffused.The above illustration indicates how the reflector is adjusted so as to superimpose the reflected incandescent coils of the filament on the dark areas. When the reflector is properly adjusted, an even field of light will appear on the card.

A spare reflector is packed in the spare parts box as Item 9.

EXCITER LAMP

The exciter lamp adjustment should be checked before each show with a white card as described in paragraphs five and six of this section.

Exciter lamps usually become too black for use before they burn out. When the black deposit inside the bulb becomes so heavy at the level of the filament that the oval spot (mentioned in paragraph six below) becomes yellow, it should be discarded. A white deposit on the inner surface of the bulb indicates an air leak and such a lamp should be replaced with a new one immediately.

To replace an exciter lamp (Item 7 on spare parts list), remove exciter lamp guard No. 58 **Illustration "E" page 21** by sliding it outward. Referring to **Illustration "J" page 33,** loosen knurled screw No. 52 and grasping casting No. 50, pull out entire exciter lamp assembly. Loosen screw No. 56 and rotating exciter lamp No. 57 slightly counter-clockwise, lift same out of the socket. Insert a new exciter lamp in the socket and push it downward until the two projecting pins in the lamp base clear the casting and then rotate the lamp slightly clockwise so that the filament is parallel with the long mounting hole in casting No. 50. Place casting No. 50 on support rod No. 68 projecting from the machine and slide entire assembly inward, making sure the angle blade on the casting slides between the two contact blades, one of which is shown as No. 69, mounted on the projector. This contact completes the electrical circuit for the lamp. Inspect lamp filament and see that it is parallel with the end of the sound lens as shown in **Illustration "K" page 33.** Rotate if necessary and tighten screw No. 56 **Illustration "J" page 33.** Do not tighten this screw too tight as excessive pressure will crack the lamp base, allowing air to leak into the bulb making it inoperative.

Turn exciter lamp on. Refer to the right hand view of **Illustration "K" page 33** which is a view taken just in front of the sound lens, looking towards the back of the sound aperture plate which is shown. The sound aperture plate is also indicated as No. 25 **Illustration "J" page 33.** Move exciter lamp casting No. 50 in or out as may be required until chevrons of light, indicated by the shaded areas on **Illustration "K" page 33,** on each side of the sound aperture are equal in intensity and size. Tighten screw No. 52.

Due to the slight differences in lamps, it usually will be necessary to move the exciter lamp up or down to compensate for these variations. The projector being moved around or jarred or the filament sagging slightly from age are other causes that may be remedied by the vertical adjustment of the lamp. Place or hold a white card against the opening in the photo electric cell housing No. 40 **Illustration "J" page 33.** Loosen locking screw No. 54 and move lamp up or down as may be required by rotating knurled screw No. 55 until a white, sharp edged image of light appears on the card. In other words, when the filament is lined up on the optical axis of the sound lens, the light image will be clear and sharp. Tighten screw No. 54.

The lamp filament is set at the factory the required distance from the sound lens but in the event the above white oval spot on the card is tinged with blue (indicating the lamp is too close to the sound lens) or the edges of the oval are yellow (lamp is too far away from sound lens) the lamp must be moved back or forth accordingly. To adjust, loosen locking screw No. 53 and rotate knurled screw No. 51 in the direction necessary to secure a white, uniform field of light on the card. Tighten screw No. 53. After this adjustment has been made, it may be necessary to again move the exciter lamp up or down a trifle. Remove the card from in front of the photo electric cell housing.

As a final test **(DO NOT MAKE THIS TEST DURING THE SHOW)** turn motor on and then amplifier volume control clear up to "10" and a loud steady hum will come from the speaker when the exciter lamp has been properly adjusted. A harsh, uneven sound from the speaker indicates the lamp is not properly set, so loosen screw No. 54 and rotate No. 55 in either direction until a steady even hum results. Be sure and tighten screw No. 54 when through.

The amplifier and sound system are designed for use with 4 ampere 8.5 volt exciter lamps. **DO NOT USE EXCITER LAMPS OF ANY OTHER RATING.**

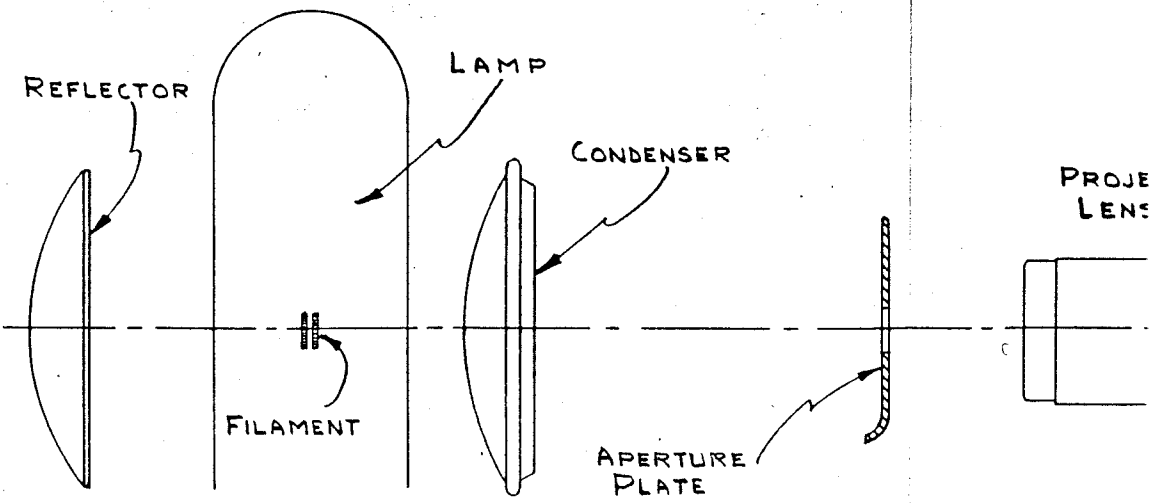
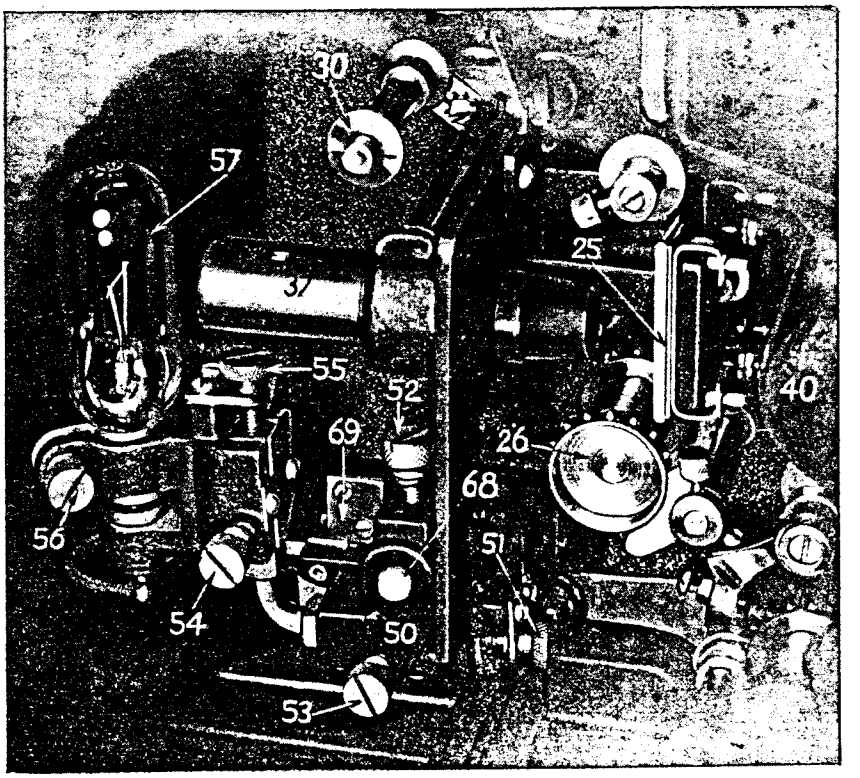


ILLUSTRATION "I"



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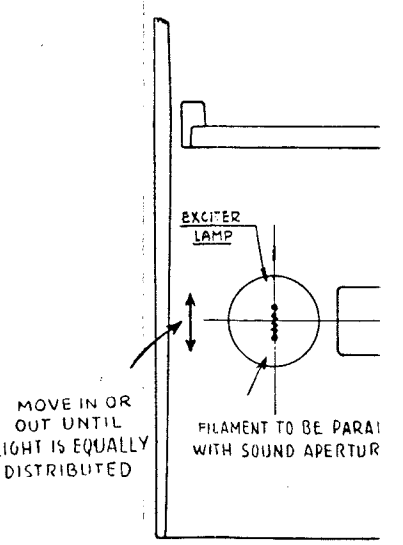

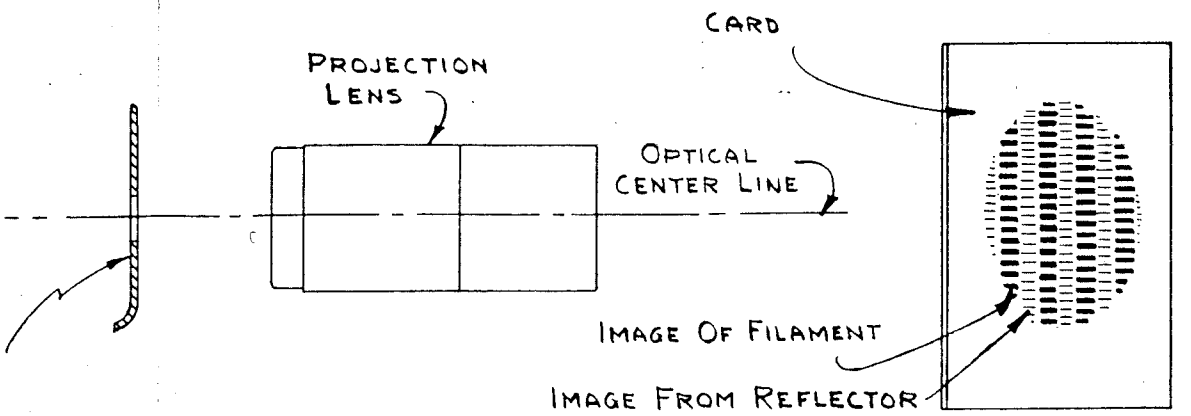

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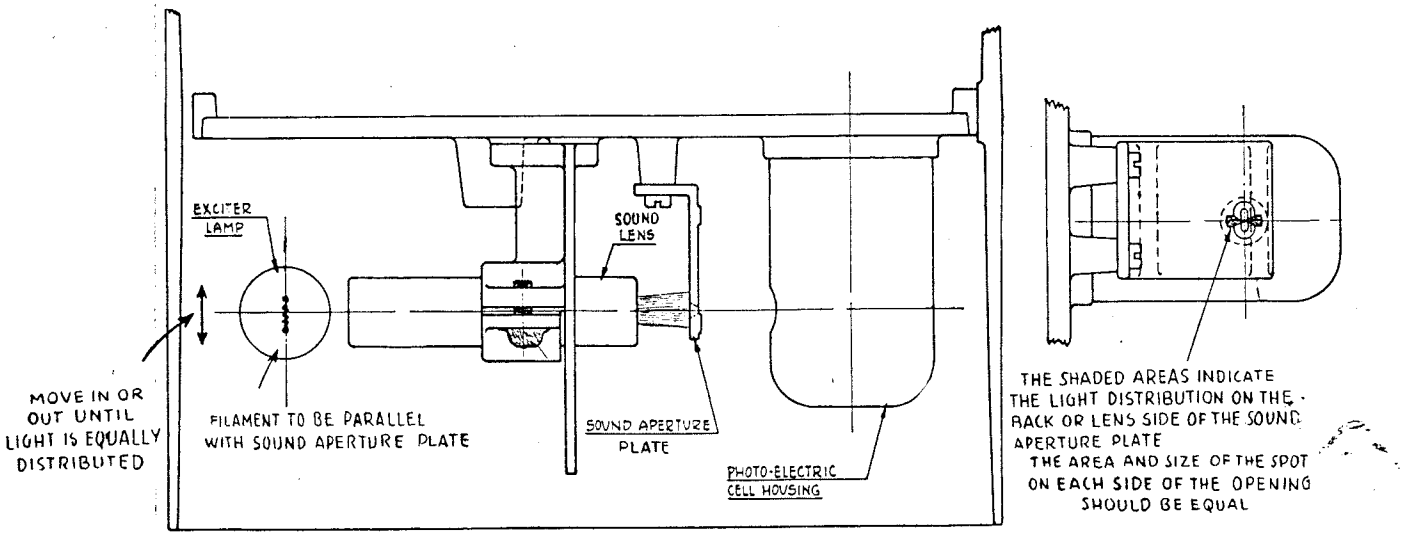


ILLUSTRATION "K"

SOUND LENS

Cleaning

The exposed surfaces of the glass elements of the sound lens should be cleaned every week with a soft camel's hair brush, a soft cloth or a new pipe cleaner. Care must be taken not to scratch the glass surfaces.

Great care also should be taken to prevent oil from coming in contact with the sound lens. Although this lens is effectively sealed against oil and dirt, the expansion and contraction of the metal tube caused by the heat from the exciter lamp, produces conditions which make a positive, permanent seal very difficult to obtain. Should the lens for any reason get oil in it, the field of light will be yellow when projected on a white card as described under **EXCITER LAMP page 32,** and no amount of adjustment will eliminate the color.

Adjustment

Should wear of the sound aperture plate necessitate its replacement or should the lens require resetting for any other reason, the entire assembly which consists of sound lens No. 37 **Illustration "L" page 39,** sound aperture plate No. 25, and the casting on which they are mounted, held to the main frame by three screws, should be removed and sent to the factory for repair if possible. The sound lens cannot be properly set except with a frequency film and meter.

If it is impossible to send the unit in for repair, and as sound lens No. 37 must be moved horizontally as well as rotated, it is next to impossible to adjust same without the aid of a special tool which can easily be made. Pliers should not be used on the lens barrel as not only is there a chance of squeezing it and throwing the slit out of alignment, but the sharp ridges left on the barrel may be so positioned that they will fall in the clamp area and when the clamp is tightened, the ridges may force the lens out of line.

To make the tool, select a piece of metal ¼" thick, 1¼" wide, and 4" long. ¾" from one end as the center, drill a ¾" diameter hole. From the opposite end, saw down the middle of the stock until the hole is reached, the slot being approximately 1/16" wide. An inch back from the hole on the ¼" surface, drill a hole with a #25 drill down to the slot. Tap the other half of the stock for a 6-32 screw. Insert a 6-32 screw 1" long, in the drilled hole and down into the tapped portion and screw same down. It can readily be seen that when the tool is placed on the sound lens and the screw tightened, a clamping action results which will not damage the lens.

Plug an A. C. meter or output meter into the monitor speaker receptacle of the amplifier **Illustration "B" page 9.** Due to the low voltage output of the amplifier, an A. C. voltmeter comparable to a rectifier type or vacuum tube voltmeter is usually used. Remove exciter lamp guard No. 58 **Illustration "L" page 39** and exciter lamp. Place the tool on sound lens No. 37, approximately ¼" from where the lens is clamped in the casting and tighten screw in tool. Replace exciter lamp assembly and adjust same properly as outlined under **EXCITER LAMP, page 32.** Break the seal covering the clamping screw in the casting and loosen same just enough so that the lens may be moved. Thread the projector with a loop of 8000 cycle or 9000 cycle film which may be purchased from the Academy of Motion Picture Arts and Sciences. Turn exciter lamp on.

Start projector and position meter so same may be seen while manipulating the lens tool. Turn amplifier volume control up until meter indicating pointer is approximately midway on the scale. The object of this arrangement is to secure the highest reading on the meter by adjusting the lens. Grasp the lens tool with both hands and watching the meter, move tool backward a trifle, keeping in mind that a few thousandths of an inch is all that is needed to bring the lens into focus. It will be found that when applying pressure to move the lens horizontally, a finer adjustment may be made by moving the tool up and down. It can readily be seen that if the lens clamping screw in the casting is too loose, the lens will not stay positioned when the pressure is removed.

Move the lens back or forth as may be required until the maximum reading of the meter is obtained. This procedure is tedious and requires patience as it sometimes takes as long as 15 minutes to make the correct adjustment. It cannot be stressed too frequently that this adjustment must be made in very small stages, otherwise the point of focus will be passed. The slit of light on the film must also be at right angles to sound aperture No. 45 so after the maximum reading is obtained on the meter, move tool up and down very slowly, which will rotate the lens until the best reading is again acquired Tighten lens clamping screw securely.

A check on the adjustment can be made by placing the thumb on aperture plate No. 25 (do not cover aperture No. 45) and pressing it towards and then away from the photo electric cell. If the lens is in correct focus, the meter indicator will drop both times. If the indicator moves up above the normal setting when plate No. 25 is forced towards the photo electric cell, lens No. 37 must be moved back. If the meter indicator moves up when plate No. 25 is forced away from the photo cell, lens No. 37 must be moved forward accordingly.

ALIGNING FILM IN SOUND APERTURE

General

The sound aperture guide rollers No. 22 **Illustration "L" page 39** have been accurately set at the factory with a standard buzz track film. Unless screw No. 23 loosens, readjustment should not be necessary until after many months of operation when the guide rollers become worn and new rollers are installed or a new spring is installed. Misalignment manifests itself in either 96 cycle sprocket hole hum or 24 cycle frame line noise.

If the above rollers do get out of adjustment though, they should be set with the aid of a buzz track film. If such a film is not available, thread projector with a standard film, turn exciter lamp on, loosen screw No. 23, and move the collar, in which it is threaded, in or out until neither the sprocket hole hum nor the frame line noise can be heard from the speaker. Tighten screw No. 23 when through. Do not force this screw as excessive pressure will twist it off in the collar. The above is a rough adjustment and the accurate buzz track film should be used as soon as possible thereafter.

Buzz Track Film

The Academy Research Council Standard Buzz Track consists of an .087" opaque-center track with a frequency of 300 cycles on the picture side of the track and a 1000 cycle tone recorded on the sprocket hole side. A 50' length (code number ABzT-1) can be purchased from the Research Council of the Academy of Motion Picture Arts and Sciences, 1217 Taft Building, Hollywood, 28, California.

To adjust rollers No. 22 with the buzz track, select approximately six feet of film and splice the ends together to make a loop. Remove the upper and lower magazines from the projector and thread projector with the loop. Turn exciter lamp on and start machine. Turn volume up and when the rollers are correctly positioned, no sound will be heard from the speaker. If the film is too far out, the 300 cycle tone will be heard, while if it is too far in, the 1000 cycle note will be heard. In any event, if either tone is heard from the speaker, loosen screw No. 23 and move rollers No. 22 in or out until neither tone is heard. Be sure and tighten screw No. 23 when through.

Over a long period of time, the sound guide roller spring may become weak, in which case the inner roller will not put sufficient pressure on the film allowing it to weave in the sound gate.

To install a new sound guide roller spring (Item 12 on the spare parts list), loosen screw No. 23 **Illustration "L" page 39** and remove collar, outer roller, spacer, inner roller and spring. Examine the two rollers and note that the only difference between the two is that the inner roller has a circular indentation in it for seating the spring. On the roller stud, place the new spring, inner roller, spacer, outer roller, and collar, and position the rollers as explained in the preceding paragraphs.

SOUND APERTURE

Sound aperture No. 45 in sound aperture plate No. 25 shown in **Illustration "L" page 39** is only ¼" high and .080" wide. This small opening oftentimes becomes clogged due to dirt or emulsion from the film. If the sound from the speaker suddenly becomes garbled or stops altogether, immediately look and see if this small aperture is closed, thus shutting off the light entering the photo electric cell.

Before every show, a ¼" from the end of a pipe cleaner, bend it at right angles and insert it in the sound aperture, from the back or sound lens side so there is no chance of scratching the sound lens, and work it up and down until the opening is clear. This, incidentally, might be one of the reasons for not obtaining a sharp outline of the oval spot described under paragraphs 5 and 6 of **EXCITER LAMP, page 32.**

Oil, emulsion, dirt, etc., also accumulate on the skids of the sound aperture plate as well as on the sound gate shoes. Bend a pipe cleaner in the middle and run it up and down several times in sound gate No. 24 to remove these deposits.

SOUND APERTURE GATE SHOE

Replacement

Two sound aperture gate shoes No. 39 **Illustration "L" page 39** are packed in the spare parts box and are listed as item 6. To install a new set of shoes, remove flathead screw and washer No. 41 and pull entire sound gate arm outward working it back and forth on its pivot at the same time. Note that each shoe is guided by two small rods No. 42 projecting through each end. Flat springs resting on each end supply the necessary pressure. Loosen the two nuts holding each spring and remove same. With a pair of pliers, unscrew rods No. 42 and remove them from the small casting in which they are mounted.

Reverse the above procedure when installing new shoes, leaving the four nuts loose. Replace sound gate arm on the stud. Note at the bottom of the arm, fastened to the main frame, is a spring for holding it in its open and closed positions. Press downward on this spring, push arm in and release

spring. Replace screw and washer No. 41 and tighten.

Insert a piece of film in the gate and close same so that the end of the film is just above sound sprocket No. 26. Grasp film a few inches above shoes No. 39 and move it up and down. This action should be smooth and free. If film buckles, loosen the four nuts a little. Next thread projector with a standard reel of film and run same with the sound on. If music and speech have a quavering throaty quality, there is not enough tension on the film. Give each set of nuts a turn or so until defect is remedied. Hold the bottom nut of each set and tighten top one securely.

PHOTO ELECTRIC CELL

Four spare photo electric cells are packed in the spare parts box and are listed as Item 5. To replace cell, remove cover No. 40 **Illustration "L" page 39** by loosening the two screws which hold it in position. Remove defective cell by pulling same outward. Note that the socket has two large and two small holes and that the cell base has corresponding prongs. Insert new cell in the socket and push it in as far as it will go. Replace cover No. 40 so that the opening in it is towards sound aperture plate No. 25 in order that the light from the exciter lamp may strike the photo cell. Insert the two screws in the cover flange and tighten them.

CAUTION: Photo electric cells are extremely sensitive to sunlight or strong artificial light so be careful that they are not exposed to such sources of illumination. 1P30 PHOTO TUBE

The photo cell has no filament and should not show any sign of illumination except the light beam which enters it. Should the cell glow with a blue light, it is a sign of ionization and the cell is either defective or the polarizing voltage is too high.

PICTURE APERTURE

The edges of the picture aperture should be cleaned before every show with a pipe cleaner, the end of which is bent at right angles. When running new film which has not been properly processed, emulsion may gather on the aperture plate skids and film tension skids. The formation of small emulsion deposits on these surfaces will result in increased film tension and the film in passing through the projector will be quite noisy. Oil, lint, and dirt from old film also accumulate on these surfaces. These accumulations may be easily removed by cleaning with a rag wet with alcohol, carbon tetrachloride or any other cleaning solvent.

The picture aperture plate No. 43 **Illustration "M" page 39** may be removed for inspection and cleaning. Move framing roller in as far as it will go, open picture gate No. 14 and remove the two long knurled head rods No. 38 by unscrewing them. Grasping the curved portion, extending below the aperture mount cone, between the thumb and forefinger of the right hand, move aperture plate towards lens No. 35 as far as it will go and then pull outward.

Before replacing the aperture plate, examine it and note the four lugs, each with a hole therein, projecting from the back. The long rods No. 38 passing through the above lugs, hold the aperture plate in position.

To replace plate, grasp the curved portion as before, between the thumb and forefinger of the right hand and work same into cone, lining the plate up so that the four lugs on the plate enter the four corresponding slots in the cone. When the plate is so positioned, slide the forefinger up the front of the plate to hold it while rods No. 38 are inserted. Tighten same enough to hold plate solid.

The size of the standard projector aperture for 35mm sound film is .600" x .825", which is the size in the aperture plate installed in the machine. Item 21 packed in the spare parts box is the aperture plate for silent film, the aperture in it being .679" x .906". When sound film was adopted, the sound track was placed along one side of the film and the width of the silent aperture was reduced so that the sound track would not show on the screen. The height was also reduced to retain the three to four aspect ratio.

FILM TENSION SKIDS

General

The necessary pressure applied to the film at the picture aperture to keep it flat on the aperture plate is accomplished through the medium of two long, flat springs No. 48 and No. 49 **Illustration "M" page 39,** known as the film tension skids. Referring to **Illustration "N" page 39,** the proper amount of pressure is controlled by a bar stop on each side of the gate, one of which is shown as No. 59.

One of the skid assemblies is pictured set out from the casting in **Illustration "N" page 39.** The assembly consists of the tension spring No. 48

fastened to support No. 60. Notice the support has a milled surface No. 61 for the purpose of eliminating light reflection, which means there is a right and left, necessitating the skid assemblies being in pairs. The assembly is set down into slot No. 62 and held in position by screw No. 64.

Replacement

Remove picture gate No. 14 from projector by removing the three screws extending through the front wall of the case into the tapped ears No. 65 **Illustration "N" page 39.** Loosen screws No. 64 and remove skid assemblies.

A pair of film tension skids are packed in the spare parts box and listed as Item 10. Note that one end of each spring No. 48 and No. 49 is ground to a smaller width than the rest. Select the assembly which, when placed in slot No. 62 and with the tapered end up, will have milled surface No. 61 in towards the center of the casting. Move assembly up so that the bottom of the spring is even with the bottom of the casting as shown at No. 67. Press support No. 60 down into slot as far as it will go and tighten screw No. 64.

APERTURE GUIDE ROLLER SPRING

Replacement

Item 2, packed in the spare parts box, consists of an aperture guide roller spring. Over a period of time this spring may become weak and will not perform its function properly, that is, of applying the right amount of pressure against inner roller No. 13 **Illustration "M" page 39.** This pressure is necessary as the inner roller forces the film against the outer roller, which acts as a guide, as well as preventing the film from weaving excessively. If side weave becomes noticeable (movement of picture back and forth across the screen) a new spring should be installed.

With a small screwdriver, unscrew threaded shaft No. 44 and holding guide rollers No. 13 in place, remove shaft. Keeping the two rollers pressed against the spacer between them, move the assembly slowly outward. As inner roller is about to move out past the casting, place finger over spring to keep same from flying away.

Examine the rollers and note they are identical with the exception that the inner roller has a circular recess for seating the spring.

Take the two rollers with the spacer between them and place the new spring in the recess of the inner roller. Place this assembly so that the outer roller rests on the thumb of the right hand and the index finger compresses the spring. Work assembly into position as shown, being careful the spring does not slip from beneath the finger. After assembly is in place, insert shaft No. 44 in casting, through assembly, and tighten same. Before installing shaft, place a few drops of light oil on it.

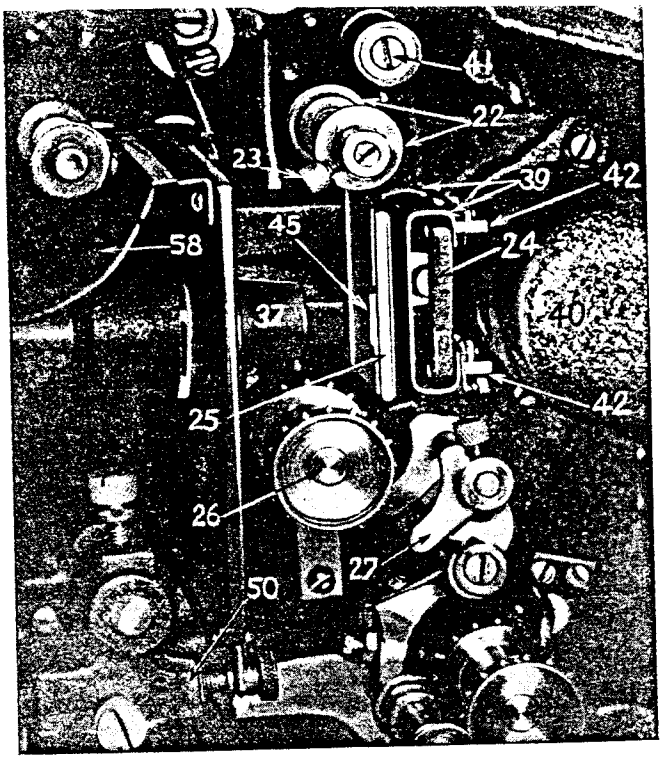


ILLUSTRATION "L"

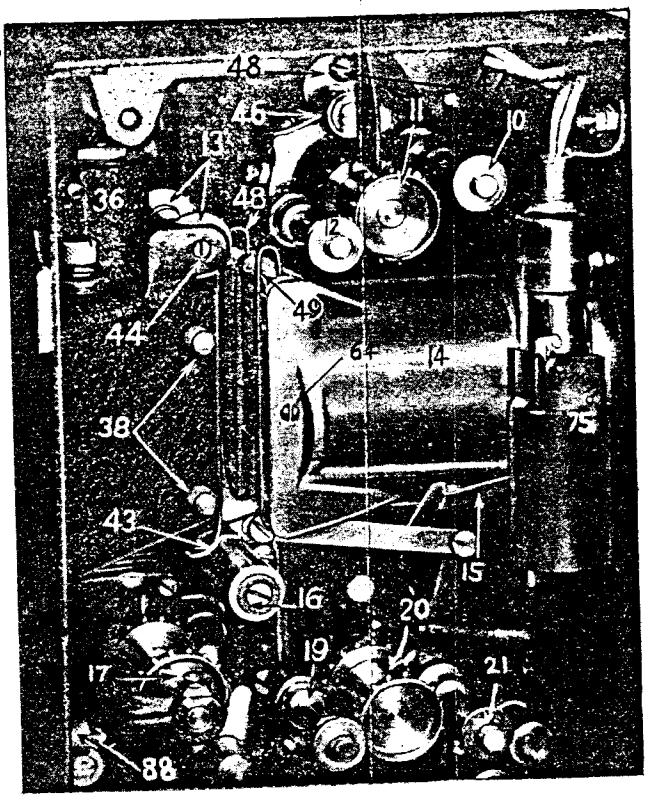
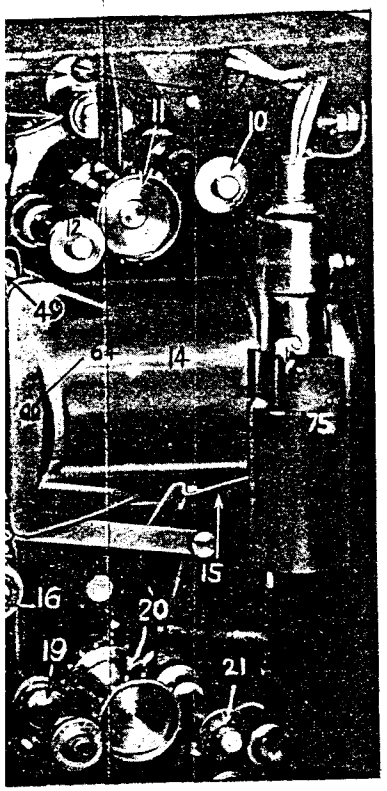
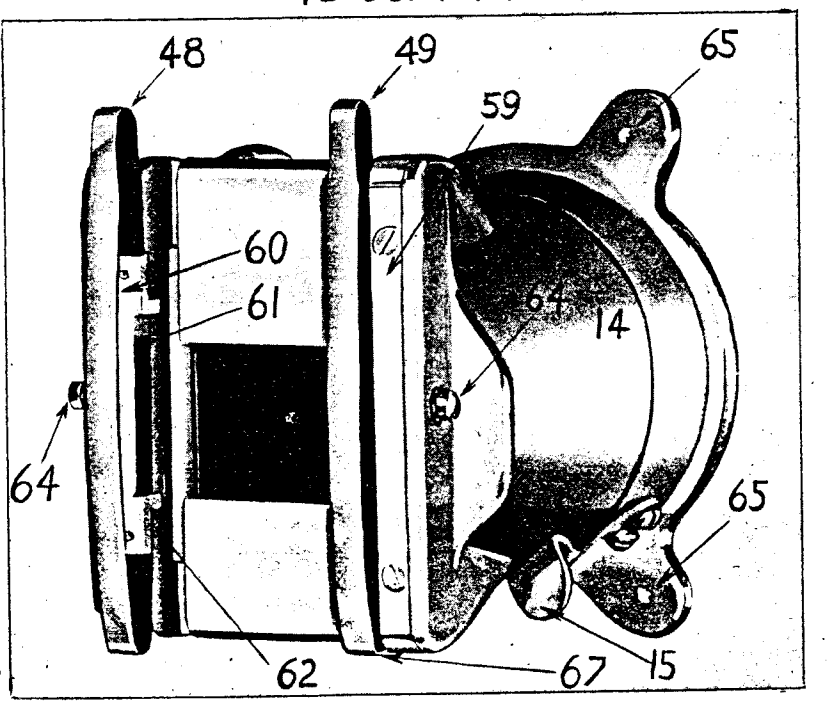


ILLUSTRATION "M"



JSTRATION "M"

ILLUSTRATION "N"



CLEANING

Reflector

Dirt and dust accumulating on the reflector cause a decided reduction in the screen illumination. At least once a month (more often in dry dusty countries) the reflector should be cleaned. Remove the lamphouse cover and projector lamp. Take a damp soft cloth and clean reflector thoroughly. Be sure not to get any water on the protective coating on the back. Dry thoroughly with a soft cloth when through.

In some instances it may be necessary to remove the reflector if the heat from the lamp has caused some substance to harden on it. Lift up one of the three supporting springs and remove the reflector.

To replace, position reflector in the indentations of two of the springs and lifting up on the third one, push reflector back and release spring. Make sure the reflector is held by the identations in all three supporting springs.

Condenser Lens

Condenser lens No. 72 **Illustration "E" Page 21** should be cleaned the same time as the reflector. It is held in position in the lamphouse frame by two right angle flat springs. Unscrew the two nuts holding these springs and remove same and take out condenser lens. Clean condenser with soap and water and dry thoroughly with a clean cloth.

When replacing condenser lens, the smooth convex side goes towards the lamp and the concave corrugated side towards the screen. Replace the two springs and tighten nuts securely.

An extra condenser is packed in the spare parts box as Item 8.

Projector

Every week the operator should go over the entire projector and clean off all dirt and oil accumulations. Take a clean cloth (preferably one dampened with carbon tetrachloride) and wipe off the oil and dirt from all sprockets and guide rollers. In particular, get the oil that accumulates on the back of the sprockets through the bearings as this oil gets on the film and collects dirt resulting in distortion of the screen image and sound reproduction. Remove exciter lamp guard No. 58 **Illustration "E" page 21** and clean same. Wipe off mechanism frame, aperture gate No. 14, sound unit, etc. Clean inside bottom of case and rollers in fire traps No. 9 and No. 31. Wipe off dust on outside of projector case, lamphouse, magazines, and excess oil on bottom of motor and base.

Picture Lens

At frequent intervals remove the picture lens and clean both the front and rear exposed glass elements with lens paper or a soft clean cloth, preferably one free of lint. Do not attempt to remove the lens elements from the barrel as the elements might be thrown out of focus which will necessitate shipment of lens to the factory for repairs.

STAR AND CAM ADJUSTMENT

General

The intermittent unit is constructed on the conventional Geneva Movement principle, consisting of a four-point star coacting with a circular cam. Refer to **Illustration "O" page 43** and **Illustration "P" page 43,** which is a simplified view of the star and cam. No. 70 is the star and No. 71 the star shaft to which intermittent sprocket is fastened; the cam is designated as No. 76 while No. 77 is the cam shaft and gear, driven by the vertical shaft. No. 78 illustrates the cam pin.

Referring now to **Illustration "P" page 43** star No. 70 has four slots No. 79. Cam No. 76 revolves in a counter-clockwise direction as shown by arrow. In the position shown, star No. 70 cannot revolve but is held tight due to the action of the cam. As the cam turns, pin No. 78 finally comes to a position where it is ready to enter slot No. 79. As pin No. 78 continues in its circular course, it enters farther into slot No. 79. It can be seen that as the pin travels in a circle it will turn star No. 70 due to the action of the pin against the sides of the slot, the cam being relieved in the area of the pin to allow the star to revolve. Note that as the pin turns the star and then leaves the slot, cam No. 76 again coacts with the next dwell of the star locking it in position. It will be seen that for every revolution of the cam, the star revolves ¼ of a revolution.

Adjustment

Over a period of time, due to the constant wear of the cam against the star, a small clearance will develop in the area indicated by No. 81 **Illustration "P" page 43.**

Referring now to **Illustrations "O" page 43** the star and sprocket unit is held in position by three screws No. 82. If the intermittent unit becomes noisy and the picture develops an abnormal jump, grasp intermittent sprocket No. 17 (with machine stopped) and try to rotate same back and forth, being sure, of course, that the unit is locked. If a

definite amount of "play" is felt, loosen the three screws No. 82 and move the star unit towards the cam, which will be towards the right, with just enough force to move the two together as too much pressure will cause them to bind. Tighten the three screws.

Try intermittent sprocket again and if all "play" is out, open door in back wall and turn flywheel. If flywheel is hard to revolve, it means the star is pressed too tightly against the cam and if projector is run under these conditions, not only will the star and cam tend to be thrown out of alignment but the entire train of gears will wear excessively. Remedy by loosening the three screws again and moving star back a trifle. A compromise can be reached wherein the flywheel may be turned normally without there being any "play" in the unit.

CAUTION: It is again stressed that all the above adjusting must be done when the unit is locked — that is, when the cam pin is **NOT** engaged with the slot in the star, otherwise the unit will be pounded to pieces when projector is started.

The tolerances to which this piece of mechanism is held is within .0002" so it can readily be seen that great care must be taken with any adjustment. Make certain that all three No. 82 screws are tight when through.

REMOVAL

If, for some reason, the star and cam are in such condition that they must be sent to the factory for repair, the entire unit as shown in **Illustration "Q" page 43** should be removed and sent in.

Remove back wall by taking out the five screws holding same to case. Loosen screw in rim of flywheel and turn flywheel so that the screw is facing downward as there is an extension rod between the screw and shaft. Remove flywheel, while holding one hand underneath it at the same time to catch any of the fire shutter friction shoes that may drop, and fibre fire shutter lift cup. Fastened to the mechanism frame is a bearing cap. Remove this cap by taking out the three screws holding same.

On the operating side of the projector, the entire unit is positioned on the mechanism frame by two dowel pins No. 84 and held by four screws, the clearance holes for which are shown as No. 85 **Illustration "O" page 43.** Remove these four screws and take unit out.

When replacing unit, insert same in opening in frame, line dowell pins up with their corresponding holes and press unit into place. Insert the four screws in holes No. 85 and tighten them securely.

Referring to the bearing cap, note there is a recess in it filled with a felt washer. Place cap on cam shaft being sure felt washer is in place, insert the three screws in cap and tighten them. Place fibre shutter lift cap on shoulder of bearing cap. Turn cam shaft so that milled flat No. 86 faces up. Place the four shutter friction shoes in position around the hub of the flywheel and lifting it up with locking screw in the rim facing down, place it on the cam shaft and shove it in as far as it will go, being sure all four friction shoes are held by the fire shutter lift cup. Revolve flywheel so that locking screw is facing upward and move flywheel back out just a trifle so that the hub will not rub on lift cup. Tighten locking screw in flywheel rim securely, making sure extension rod rests on milled flat No. 86.

CHANGING INTERMITTENT SPROCKET

After a year or so of constant use, the intermittent sprocket teeth may become "hooked." The teeth then will not enter the sprocket holes in the film properly but will enter with a sliding action that will not only cause an unsteady picture but will have a tendency to tear the film. The sprocket may be removed, reversed and used for a considerable length of time after which a new one should be installed.

To reverse the present sprocket or to install a new one, referring to **Illustration "Q" page 43,** loosen the three No. 82 screws and remove star unit from the projector. Remove screw No. 83 and holding intermittent sprocket No. 17, pull star and shaft out of bearings with a twisting movement. Wipe both ends of sprocket and reverse it. Place shaft in back bearing and push it forward until approximately 1/32" extends past bearing surface. Place the .015" thick washer on shaft and holding reversed or new sprocket in line with shaft, work shaft through sprocket bore with a twisting motion. Line clearance hole in sprocket up with tapped hole in shaft, insert screw No. 83 and tighten same securely. Replace star unit following instructions as outlined under **STAR AND CAM ADJUSTMENT,** page 41.

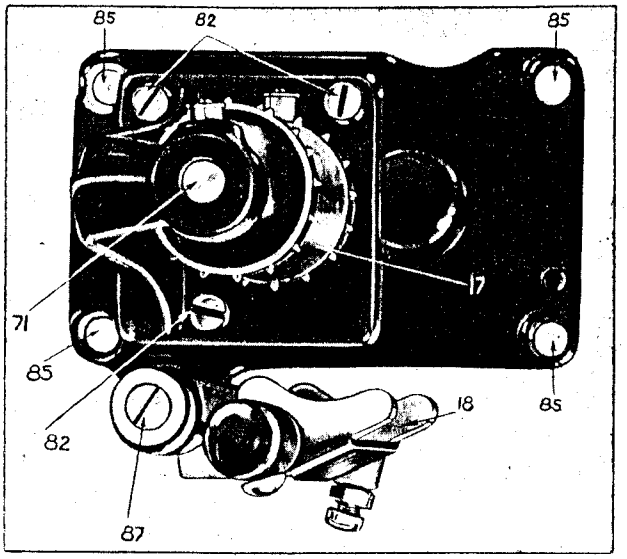


ILLUSTRATION "O"

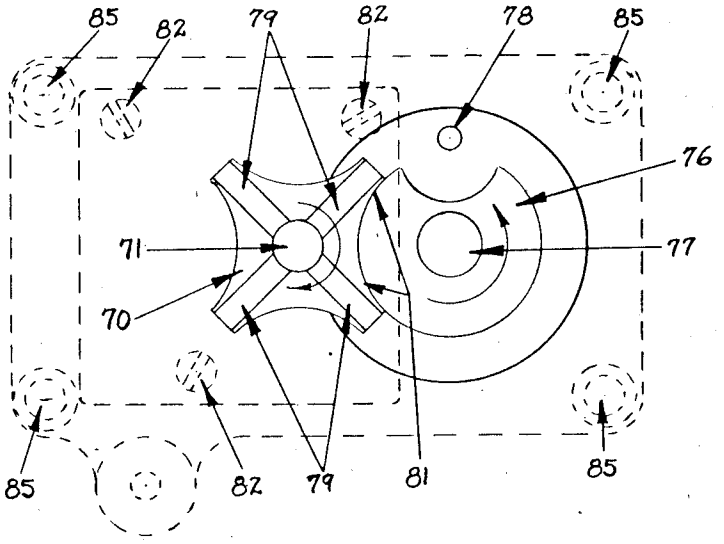


ILLUSTRATION "P"

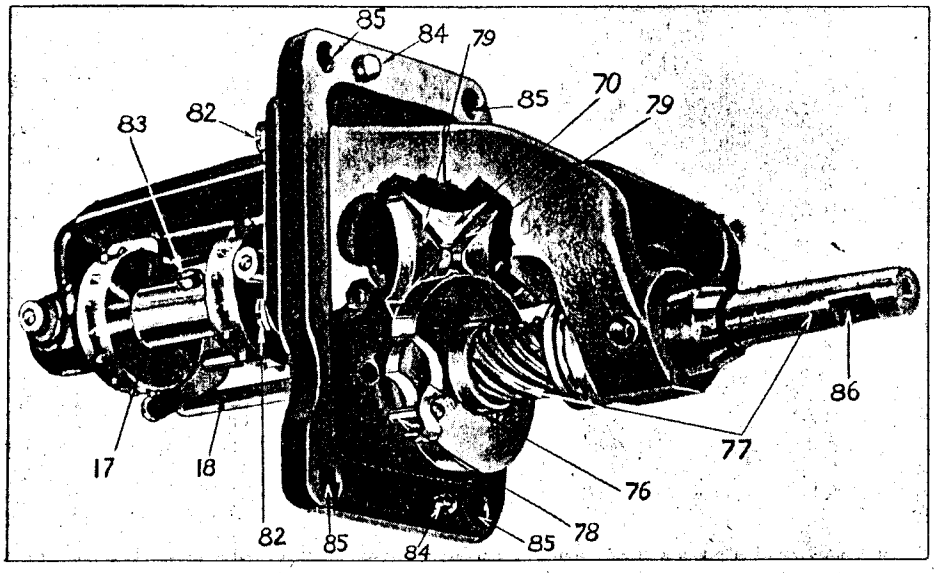


ILLUSTRATION "Q"

TIMING THE SHUTTER

The fundamental principle of motion pictures depends on the persistence of vision and the allusion of motion is accomplished by projecting the images of a number of differently positioned "still" pictures in rapid succession onto the screen at a rate of 24 pictures per second which is equivalent to 90 feet of film per minute for sound pictures.

The intermittent sprocket of the projector imparts movement to the film in such a manner that one picture is projected on the screen for 1/32 of a second, the film is moved down in 1/96th of a second, and the next picture then projected for 1/32 of a second, this cycle being repeated as long as the film is running in the machine.

During the 1/96 of a second period that the film is being moved down in the picture gate by the intermittent sprocket, the light must be shut off from the film, otherwise the picture on the screen will be blurred. It is the function of the shutter to cut off the light during this period.

"Travel Ghost" is most noticeable when titles are projected and is indicated by vertical streaks of light at the top or bottom of the letters or figures on the screen. This means that some light is getting past the shutter while the film is moving.

To remedy the above conditions, pull male plug No. 5 **Illustration "E" page 21** from its receptacle and remove the knurled screw No. 88 **Illustration "M" page 39** just in back of the intermittent sprocket, which secures the lamphouse stay rod to the projector case. A short arm projecting from the top of the lamphouse frame is fastened to the projector case by a slotted screw. Remove this screw and lift entire lamphouse upward and off its bottom pivot support.

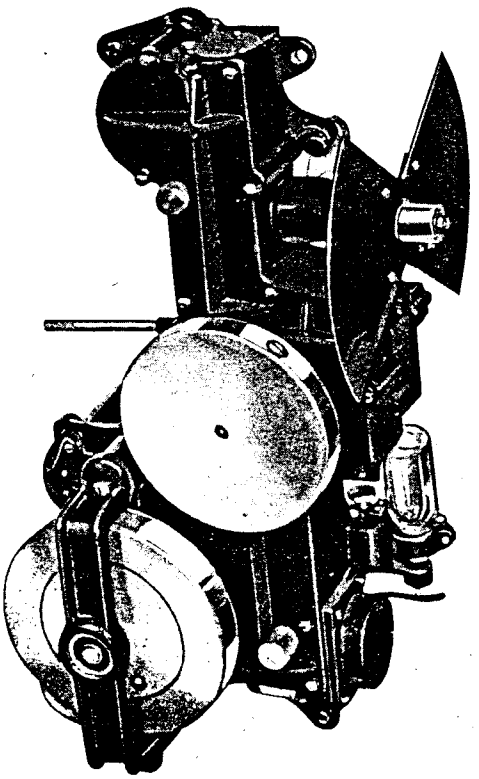
Enclosing the shutter is a circular metal guard. Remove this guard by unscrewing the four screws holding it to the case. Open the door in the back of the projector case and block fire shutter up by laying a long screwdriver over the shutter rod and the point under the mechanism frame, the weight of the screwdriver holding the shutter rod down. Standing in back of the projector and facing the shutter, grasp the flywheel through the rear door and turn it "top coming". This will revolve the sprockets in the proper direction and the shutter clockwise.

If "Travel Ghost" is evident at the top of titles, indicating the shutter is not closing soon enough, rotate the flywheel until the intermittent sprocket has **JUST** started to move (this may be felt by grasping the intermittent sprocket with the right hand). It will then be noted the shutter has not closed the rectangular opening in front of it as indicated by the clearance at the bottom.

Loosen the two set screws in the shutter hub (just enough so the shutter may be moved on the shaft) and holding the flywheel, push the shutter downward until the opening in front of it is closed. Tighten the two set screws securely. Revolve the flywheel until the intermittent sprocket has **JUST** stopped. The shutter blade should then be on the verge of uncovering the opening. In other words, the shutter blade should keep the front opening closed during the time the intermittent sprocket is moving.

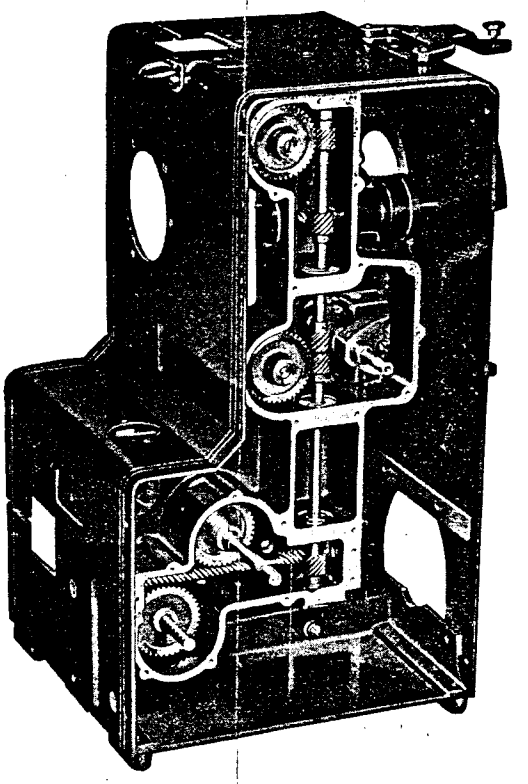
If "Ghost" is evident at the bottom of titles, indicating the shutter is opening too soon, loosen the shutter set screws, move the shutter up a trifle until the opening is closed and tighten screws securely.

Replace lamphouse arm on lower stud and replace slotted screw and tighten. Insert knurled screw through projector case and tighten same in lamphouse stay rod. Insert lamp plug No. 5 in its receptacle.



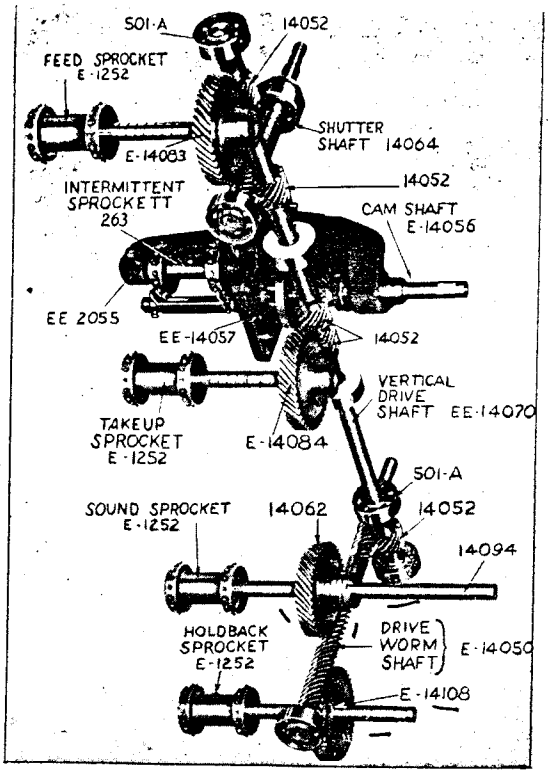
BACK VIEW OF MECHANISM
REMOVED FROM CASE

ILLUSTRATION "R"



GEAR TRAIN MECHANISM CASE

ILLUSTRATION "S"



PROECTION GEAR TRAIN

ILLUSTRATION "T"

INSTRUCTIONS FOR INSTALLING CONE AND VOICE COIL ASSEMBLY FOR A12PM SPEAKER

Each cone and voice coil assembly is packed in a separate carton in which a sufficient amount of desiccant has been placed to insure protection against corrosion for a period of 18 months. Each carton is sealed in a foil barrier and should not be removed until ready for use. Two assemblies are packed in the spare parts box as Item 20.

Unscrew the four nuts and lock washers securing the speaker, remove same from the case and lay it face down on a flat surface. Referring to **Illustration "U" page 51,** which is face up, note that two leads project from the cone, one of which is shown as No. 1. Unsolder these two leads from their respective lugs, which are fastened to speaker chassis No. 2, one of which is shown as No. 3, to which the speaker cable is attached.

Turn speaker over so it is face up as shown. With a sharp instrument, such as a razor blade, cut cone No. 4 clear around in the vicinity of the dotted line. Remove the three hexagon head screws and washers No. 5 which hold spider No. 6 in place and lift out the bottom part of the cone containing the voice coil. Immediately cover air gap No. 7 with scotch tape so that foreign particles cannot get into it.

Remove the four cardboard sectors No. 8 and upper part of cone No. 4 together with gasket No. 9 and clean chassis ledge No. 10 upon which they rested. Brush off the surface to which the scotch tape is attached.

Carefully remove the section holding the cone and voice coil assembly from the carton. Note the section is folded into two layers and taped on the end. Slit this tape and open section up. Remove inserted piece held in with tape and take out cone and voice coil together with gasket No. 9 which is fastened to the cardboard section. Remove the four sectors No. 8, tube of cement and dust cap No. 11 which are also taped to the section.

Spread an even coat of cement on ledge No. 10 of chassis No. 2 and place gasket No. 9 upon it, being sure the four holes in the gasket are in line with the four corresponding holes in the ledge. Press gasket down evenly all the way around. Spread another coat of cement evenly on the gasket.

Remove the scotch tape and place cone No. 4 in position so that the voice coil lies in gap No. 7 and the two leads No. 1 are directed towards lugs No. 3. Place the three screws and washers No. 5 in spider No. 6 and start them into frame No. 12 but do not tighten.

The voice coil must be centered around pole piece No. 13 as shown at No. 14. This may be accaccomplished by inserting three or four metal feelers, 1/8" wide, approximately two inches long and not over .005" thick, equidistant around pole piece No. 13 in space No. 14 which has been greatly exaggerated to show it clearly. If metal feelers are not available, take three pieces of film approximately two inches long and 5/8" wide, scrape all the emulsion off and insert them in space No. 14. Tighten the three screws No. 5 securely and press the outside edge of cone No. 4 gently down all the way around onto gasket No. 9, being sure the cone rests naturally on the gasket.

Apply a coat of cement to the four No. 8 sectors and lay them around on cone No. 4, making sure the indentation in each sector coincides with a hole in the chassis. Select a clean flat surface and place speaker face down for approximately 30 minutes, depending on the humidity, to allow the cement time to dry.

After the cement has dried, turn speaker face up again and remove the thickness gauges from space No. 14. Apply a coat of cement to the rim of dust cap No. 11 and press it firmly into place as shown. Solder leads No. 1 to their respective lugs No. 3.

Place speaker in case so that speaker cable strip No. 15 is to the left, **Illustration "D" page 13** and replace lock washers and nuts.

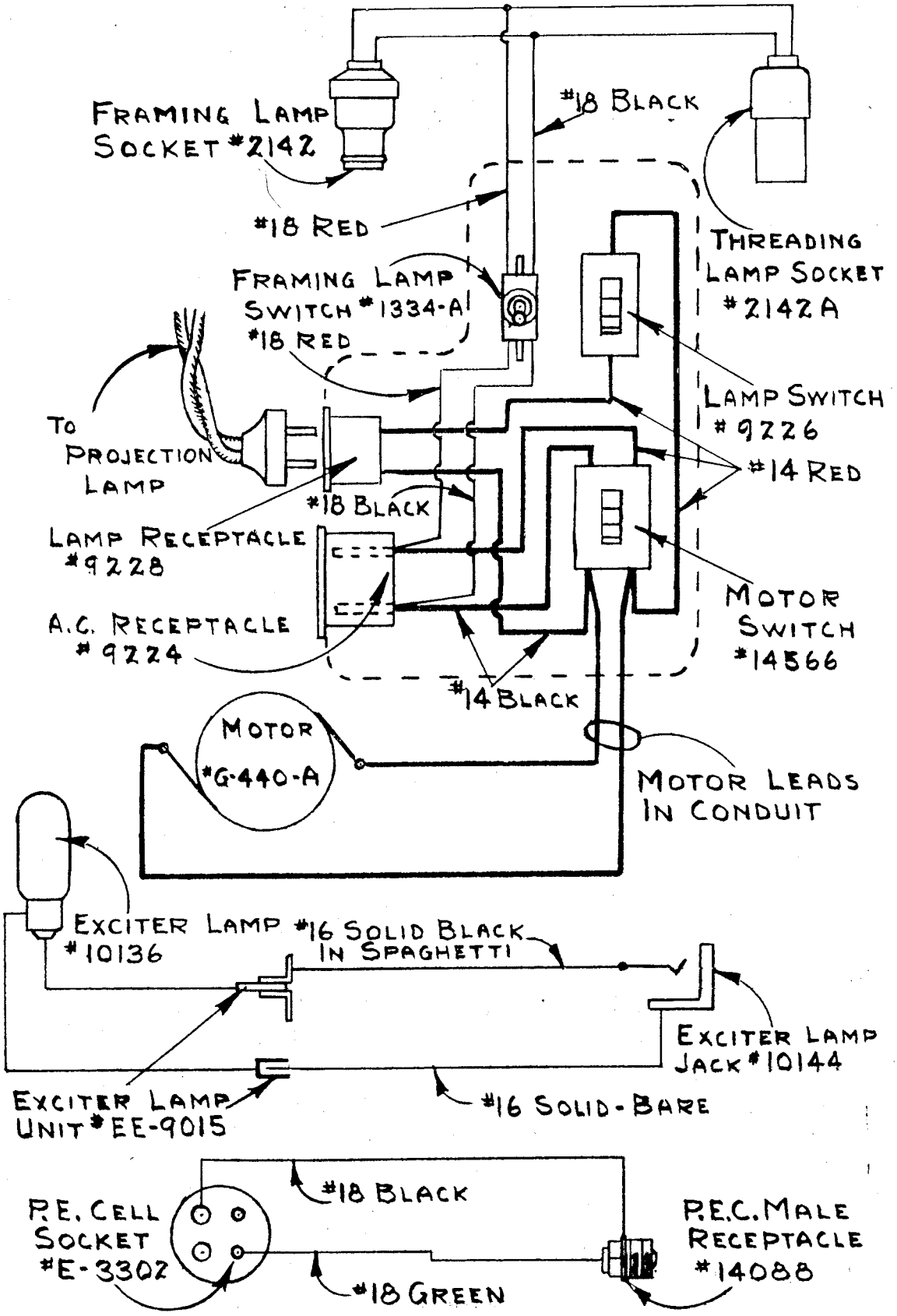
ILLUSTRATION "U"

POWER CONSUMPTION

UNIT	WATTS	AMPERES	POWER FACTOR
Projector			
Motor	203	2.67	66%
Lamp	1000	8.70	100%
Threading Lamp	15	.13	100%
Framing Lamp	6	.05	100%
Amplifier	150	1.30	95%
TOTAL	1374	12.85	

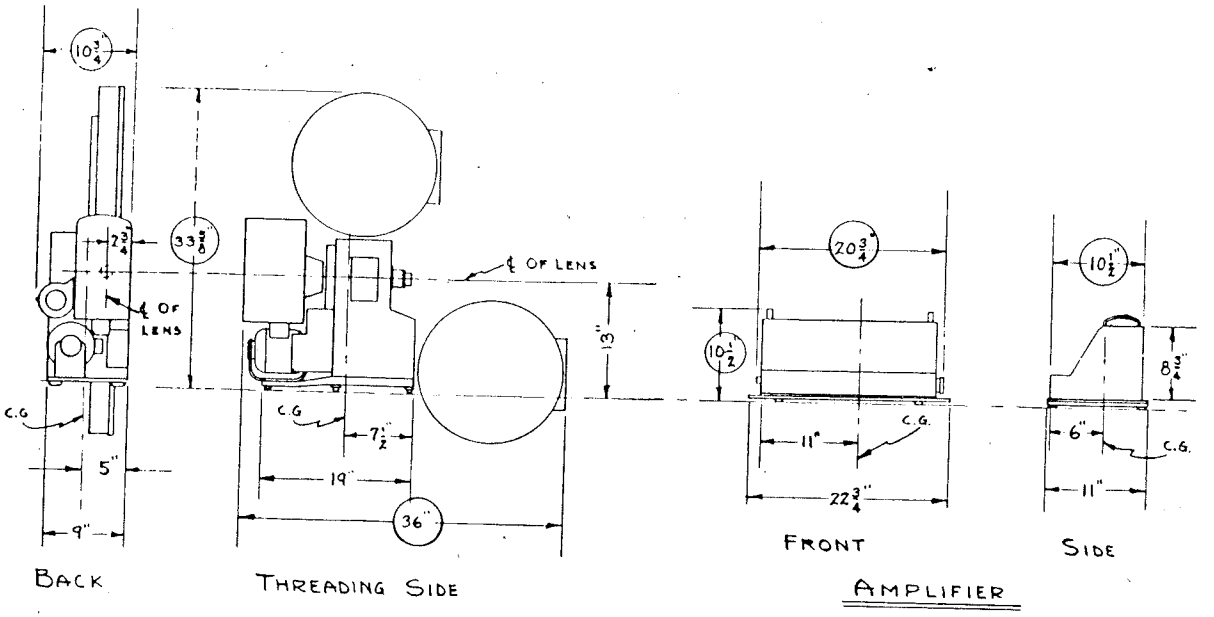
(Power Consumption in Watts Based on 115 Volts)

It should be noted that although the projector motor draws only 2.67 amperes or 203 watts at full load, the momentary starting current is approximately 20 amperes. The power supply line should therefore be sufficiently large to carry this starting current with a minimum voltage drop. Any extension cords other than that furnished with the projector should be of #14 B & S gauge wire or larger.



PROJECTOR WIRING SCHEMATIC

1P30
PHOTO TUBE
4-PIN BASE



BACK THREADING SIDE

FRONT SIDE

PROJECTOR & MAGAZINES

WEIGHT - 100#

PROJECTION LAMP - 1000 WATTS
THREADING LAMP - 15 WATTS
FRAMING LAMP - 6 WATTS

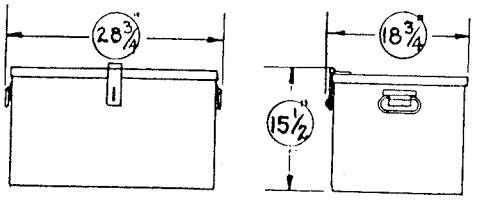
MOTOR DATA

115 VOLT, 60 CYCLE, SINGLE PHASE, A.C
1/8 H.P. 1725 R.P.M.
CURRENT - 2.67 AMPERES
STARTING CURRENT 20 AMPERES

AMPLIFIER

WEIGHT - 45#

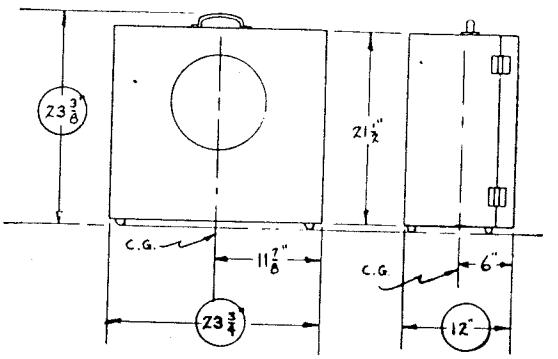
115 VOLT, 60 CYCLE, SINGLE PHASE.
A.C., 150 WATTS.



FRONT SIDE

SPARE PARTS BOX

WEIGHT GROSS - 89 #
WEIGHT NET - 44 #



FRONT SIDE

SPEAKER CASE

WEIGHT GROSS - 40#
WEIGHT NET - 20#

• NOTE •

C.G. - CENTER OF GRAVITY
(12") - OVERALL DIMENSIONS

WEIGHTS AND MEASUREMENTS

LIST OF SPARE PARTS AND TOOLS

(Reproduced from Manufacturer's Drawing No. ..... BuShs. No. .....)

Names and numbers of vessels .....

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Application ..... Appliance: Sound Motion Picture Equipment .....

U. S. Navy Contract No. NObs-20312 ..... Manufacturer: Holmes Projector Company .....

Item No.	Number of Sets	Number Per Set	Name of Part or Tool	Manufacturer's Data: Catalog or Serial Ordering Data	Manufacturer's Data: Manufacturer's Drawing and Piece Number: Piece	Manufacturer's Data: Manufacturer's Drawing and Piece Number: Drawing	BuShs. Drawing and Piece Number: Piece	BuShs. Drawing and Piece Number: Drawing
			SPARE PARTS FOR NAVY TYPE D PROJECTOR					
1	1	4	Sprocket Guide Roller Tension Spring	185				
2	1	1	Aperture Guide Roller Spring	395-A				
3	2	1	Framing Lamp	2144	36	E		
4	2	1	Threading Lamp	2144-A	75	E		
5	4	1	Photo Electric Cell, 1P30	3304				
6	1	2	Aperture Gate Shoe	10062	39	L		
7	6	1	Exciter Lamp, 8½ volts, 4 amperes	10136	57	E		
8	1	1	Fluted Condenser	10239	72	E		
9	1	1	Reflector	10261				
10	1	2	Film Tension Skid	10296-A	48	N		
11	6	1	1000 watt, 115 volt, Mogul Prefocus Base Lamp, C13D Filament	10325-D				
12	1	1	Sound Guide Roller Spring	10057				
			SPARE PARTS FOR L25N AMPLIFIER					
13	1	1	3 Ampere Fuse	9306-3	F	2705		
14	2	1	Pilot Lamp	8496	L1	2705		
16	2	2	6C5 Tube	—		2705		
17	2	1	6J7 Tube	—		2705		
18	2	2	6L6GA Tube	—		2705		
19	2	1	5U4G Tube	—		2705		
			SPARE PARTS FOR A12PM REPRODUCER					
20	2	1	Cone and Voice Coil Assembly with Tube of Cement	SA1880-22		U		
			ACCESSORIES					
21	1	1	Silent Aperture Plate	10270-B				
22	1	1	Oil Can	847				
23	1	1	Film Patching Block	14704-A		H		
24	1	1	2000' Film Rewinder	EE12123		F		
25	1	1	Tube of Grease	14700				
26	1	1	Pint of Film Cement	14702				
27	1	3	Cleaning Brushes					

Identification of appliance for which spare parts are intended

HOLMES NAVY TYPE D EQUIPMENT

When reordering always refer to serial number of projector and amplifier.

Number of sheets — 1 Sheet No. 1

NOTICE FOR NAVAL ACTIVITIES IN THE CONTINENTAL UNITED STATES

ORDERS FOR REPLACEMENT PARTS FOR PROJECTION EQUIPMENT NEEDING REPAIR

Should be sent to the nearest of the two following Navy Yards:

EAST COAST
SUPPLY OFFICER
NAVY YARD, BROOKLYN
NEW YORK
Telephone: CUMBERLAND 6-4500
EXT. 2242

WEST COAST
SUPPLY OFFICER
NAVY YARD, MARE ISLAND
CALIFORNIA
Telephone: VALLEJO 3-4511
EXT. 6239

Representative stocks of replacement parts for all motion picture and other types of projection equipment supplied by the Navy are carried at the two Navy Yards.

Bureau of Ships directive dated 14 June 1944 prohibits the manufacturers from filling replacement part orders from individual Naval Activities.

In submitting requests it is requested that the attached form be used.

NOTE: For 16 MM Sound Motion Picture Equipment, type H and 35 MM sound strip film type F, if trouble cannot be diagnosed contact the nearest Training Aids Library. If facilities are available for repair, order parts upon the recommendation of the library. If repair facilities are not available turn projector over to the library for repair.

For 35 MM Sound Motion Picture Equipments, D, A, B, & C order parts once trouble is diagnosed and if you have facilities to repair. If not turn inoperable projector into stock at the nearest Navy Yard and request a new one direct from the Bureau. The inoperable projector will be shipped to Navy Yard New York for repair and for reissue to another activity.

A small reserve of items such as lamps, tubes and belts frequently needed should be kept on hand. Mechanical parts should be ordered only when needed.

If parts are on order do not reorder. If the first order is reduced or cancelled, the activity will be notified.

Lenses should be requested only when breakage occurs and not carried as spares. If a lens is exchanged for size, return of original is requested.

REQUEST FOR SPARE PARTS FOR PROJECTION EQUIPMENT

Type: (F, H, or D, etc.)
Manufacturer's Name:
Model:
No. of Projectors concerned:

NOTE: This heading to be repeated for each make of projector for which ordering.

Serial No. of projectors on hand:
To be shipped to:

ITEM	NY STOCK NO.	DESCRIPTION OF ITEM	MFG. PART NO.	QTY. REQ.	QUANTITY ON ORDER NOT YET REC.	DATE OF ORDER	QUANTITY ON HAND

PLEASE DOUBLE SPACE BETWEEN ITEMS