

FILM-TECH

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BOLEX S-221 SOUND PROJECTOR 16mm

Instructions for use

**www.cineinfo.co.uk
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EQUIPMENT

The S-221 projector is supplied with :

- one 1000 w. lamp (750 w. lamp supplied on request)
- one lens *
- one 2000 ft reel
- one power cord, length 13 ft, with 3 leads

as well as with the following accessories which will be found inside the lid of the case :

- one oilcan - one screwdriver - one brush - two spare fuses.

- * The S-221 projector is fitted with a standard-focus lens of focal length 50 mm. Two other focal length lenses are available :
- a 35 mm lens, intended for short projection distances;
 - a 70 mm lens, intended for long projection distances.

PAILLARD-BOLEX lenses are specially designed to produce pictures of maximum brilliance, sharpness and contrast.

The microphone, type D 11-Hi (Code : SOMIC), which can be supplied on request with 13 ft of cable, may also be stowed away inside the lid.

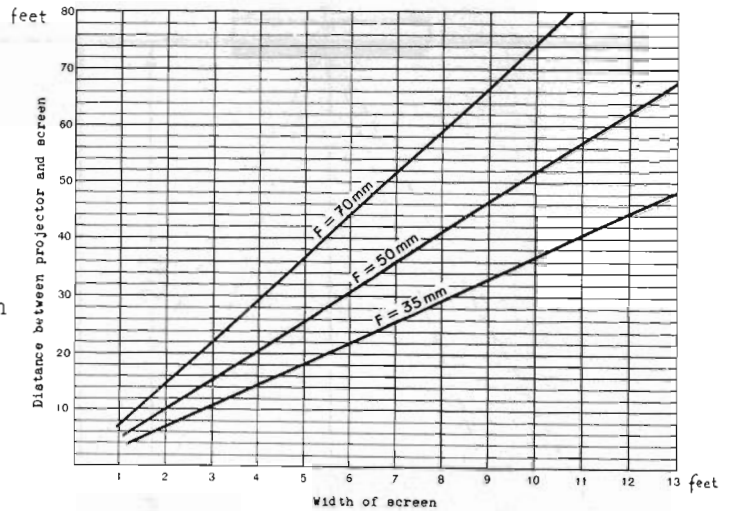
Use of the special carrying bag (Code : SOHOU), supplied on request, is strongly recommended, as this bag effectively protects the lined projector case. It also has room for two 2000 ft reels and their cartons.

IMPORTANT - Before using the projector, unscrew the back panel of the case in order to remove blocks and cushions from inside housing.

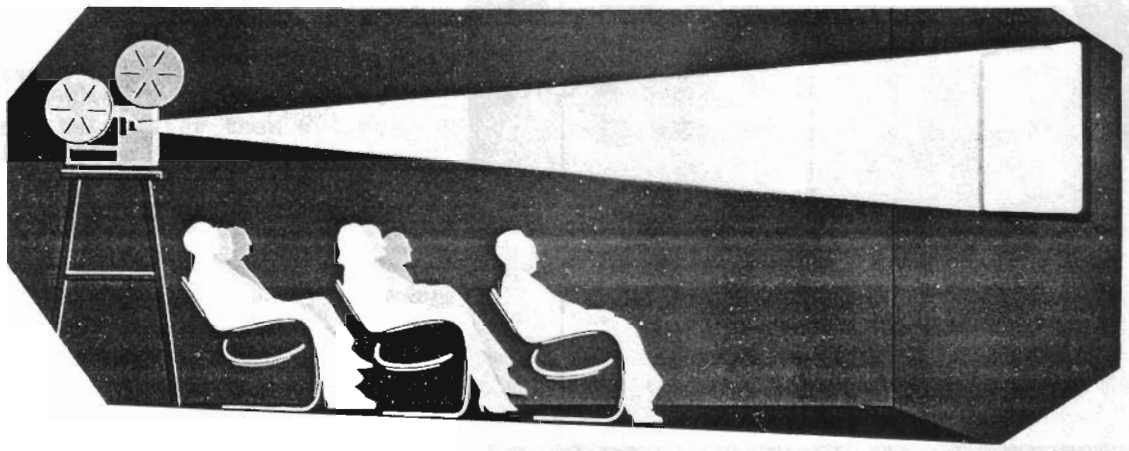
HOW TO GET THE MOST OUT OF YOUR
BOLEX S-221

- Arrangement of Projector and Screen

The distance from the screen depends on the size of the screen and on the focal length of the lens used. The diagram opposite shows the size of the picture produced on the screen when using projection lenses of focal length 35, 50 and 70 mm at various projection distances.

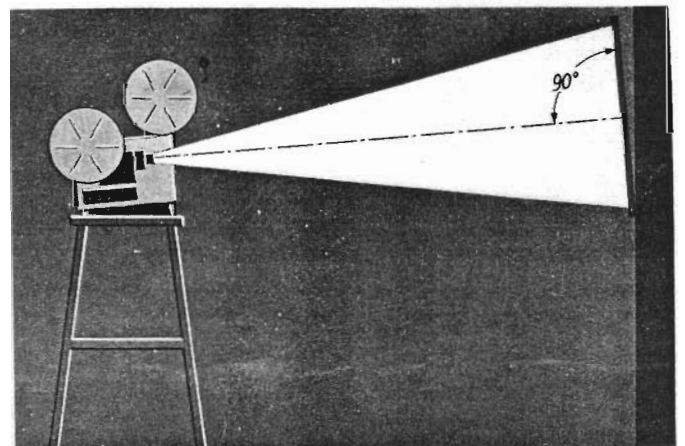


For example : For a 50 mm lens and a 6 ft screen the appropriate projection distance will be 30 ft.



Set the projector on a stand or table facing the screen, high enough so that the beam is projected over the heads of the audience.

Try to ensure that the screen is always set squarely in line with the projector, but if this is not possible the screen should be inclined slightly in the appropriate direction so that the beam strikes it perpendicularly. By doing this, picture distortion is avoided.



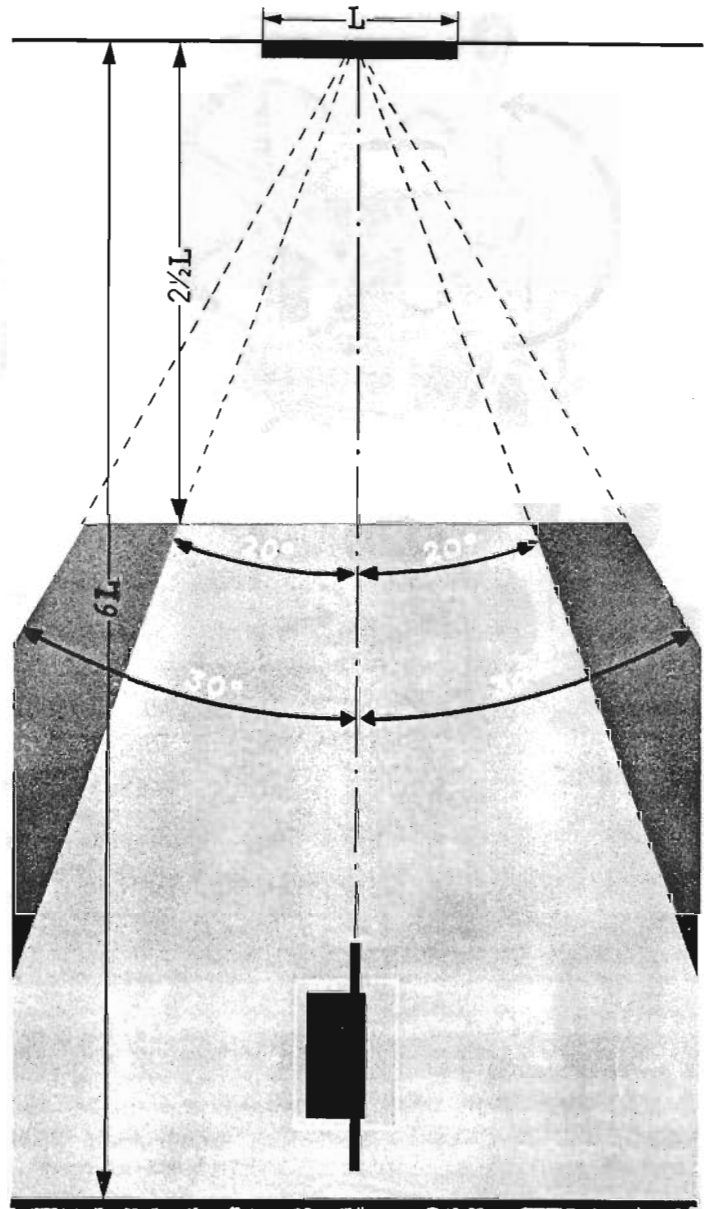
- Seating Arrangements

Projection conditions are good if the viewing angle is within :

- 30° - matt screen
- 20° - beaded screen.

The minimum acceptable distance between the first row of spectators and the screen may be estimated by multiplying the width of the screen by $2\frac{1}{2}$.

The distance between the screen and the row of seats furthest from it should not be greater than 6 times the width of the screen.

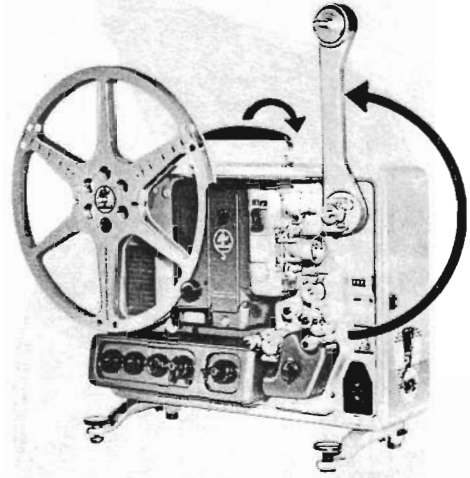
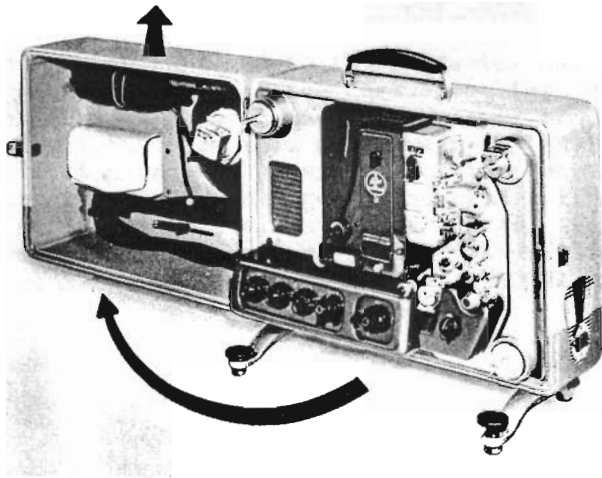


- Other Points

In order to obtain good picture contrast, particularly when showing colour films, it is advisable that films should only be projected in a fully darkened room. Flickers falling on the screen from an open fire in particular should be guarded against.

The Bolex S-221 projector will take either a 750-watt or a 1000-watt projection lamp. If the room used for projection is comparatively small, a 750-watt lamp will generally give sufficient illumination.

To change the projection lamp, see page 29.



SETTING UP THE PROJECTOR

- Open the case fully and lift the cover off its hinges.
- Raise the upper reel arm.
- Push down the handle.
- Make sure that the knob at the end of the take-up spindle is fully pushed in. Then fit the empty reel on the take-up spindle until it is behind the ball spring. Pull the knob towards you in order to lock the ball spring and to prevent the reel from falling off during the projection.


Notice : Reels with standard hub should be used :

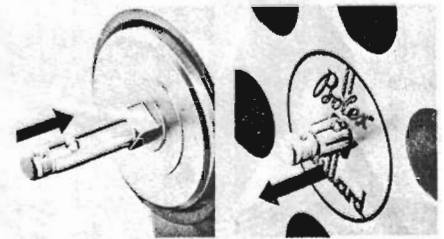
400 ft reel,	minimum diameter of the hub:	63 mm
800 ft reel,	" " " " "	90 mm
2000 ft reel,	" " " " "	115 mm

Important - The 50 or 100 ft reels coming back from the developing laboratory can be used only as feed reels. Reverse motion must be avoided (except for rewinding).

- Insert the lens into the lens-holder.

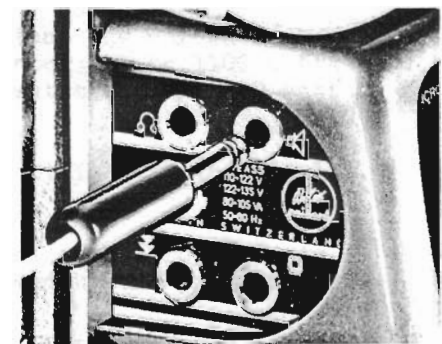
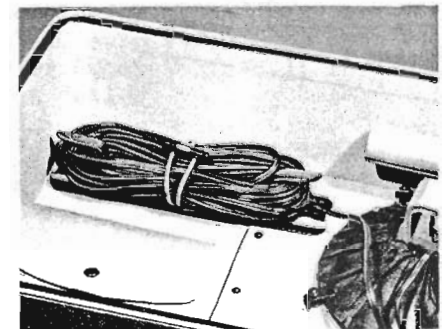
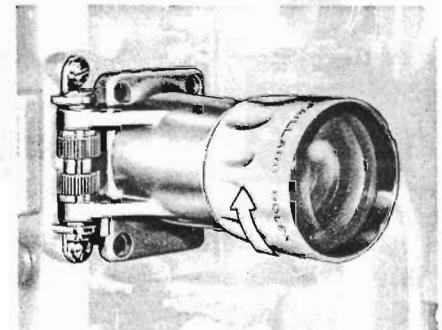
For Sound Projection with built-in Loudspeaker

- Remove the cable winder from the cover (by simply pulling it towards you).
- Unwind the loudspeaker cable and set the speaker beneath or beside the screen.
- Insert the jack of the loudspeaker cable fully into the jack marked  and situated on the side of the control panel.



unlocked

locked

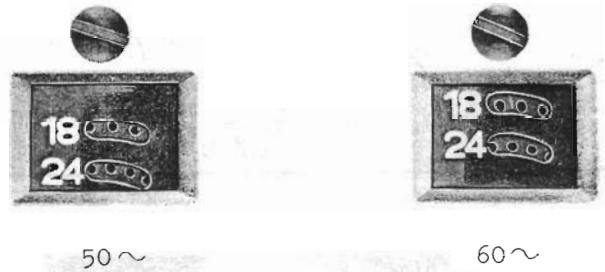


- Connection to the Electric Power Supply

The voltage supplied to the projector must be 110 to 135 volts. If the nominal voltage of the local main supply is either lower or higher than these values (between 90 and 295 volts, taking into consideration the over-voltage and undervoltage of the grid), it is necessary to use the Paillard-Bolex transformer T 11 (or another auxiliary transformer of equivalent power rating, i.e. 1350 VA).



The S-221 projector runs on AC current, 50 or 60 cycles/sec. If necessary, adjust the position of the cover of the stroboscope according to the figure shown opposite. To do this, loosen the screw situated above the stroboscope aperture (one turn at the utmost), move the cover (e.g. by means of a match) downwards for 50 cycles/sec. or upwards for 60 cycles/sec.; then tighten the screw again. Be careful not to press on the perforated disk of the stroboscope.



If only DC current is available, the projector can be used solely for silent projection unless a converter is added in order to provide the essential AC supply for running the amplifier (Power about 70 watts, voltage : 110-135 volts, 50 or 60 cycles/sec.); for information about connecting the converter, contact your Bolex dealer.

Warning - If the S-221 projector is used with DC current, do not switch on the amplifier (see page 9) in order to avoid blowing the fuse. (To replace the fuse, see page 30).

- Fuses

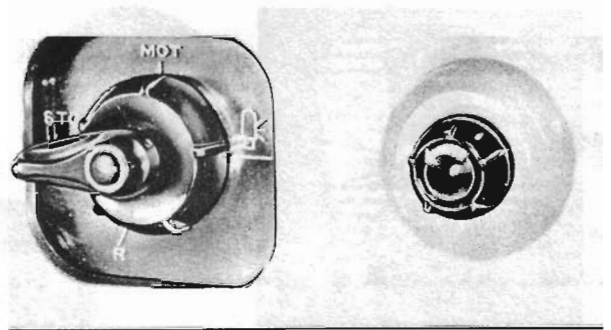
Check your house fuses to see if they are strong enough to stand the current taken by the projector. The maximum total power consumed by the projector can be 1100 watts when equipped with a 750 watt lamp; it climbs to about 1350 watts when a 1000 watt lamp is used.

The rating of the fuse must be at least equal to the figure obtained if the total power indicated above is divided by the supply voltage.

If other lamps or electric appliances are left switched on while the projector is running, then the power they use must be added to that consumed by the projector in calculating the fuse rating required.

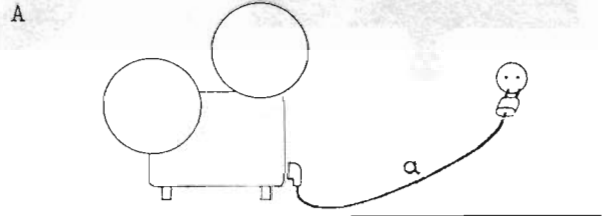
- Connecting up the Projector

1. Make sure that the main switch is set to STOP.
2. Turn the knob of the rheostat (which regulates the amount of current fed to the lamp) as far as it will go in the direction shown by the arrow.



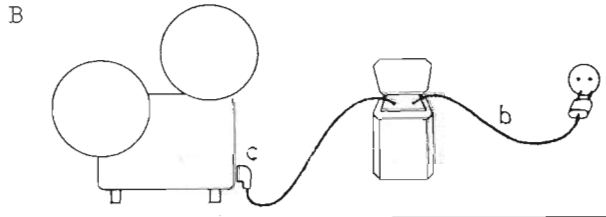
A. Main Voltage between 110 and 135 Volts

Withdraw the power cord (a) fitted under the lid and connect the projector directly to the power supply.

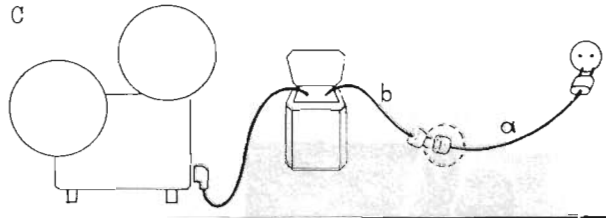


B. Main Voltage higher than 135 Volts or lower than 110 Volts

Use the Paillard-Bolex transformer T 11. Connect cable (b) of the transformer to the power supply and insert the plug (c) in the projector socket.

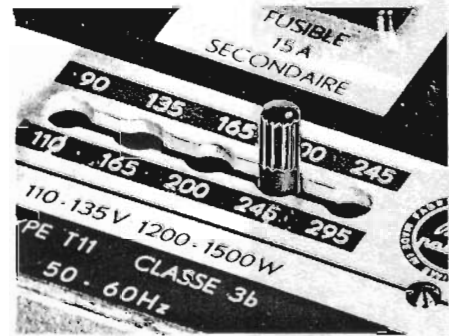


- C. If it is desired to use the power cord (a) as an extension cable, the bent plug on it must be removed and the cord connected to cable (b) on the transformer with an appropriate plug.



- To Set the Voltage Selector on the Bolex T 11 Transformer

Screw the plug into the hole opposite the voltage range covering the local main voltage. The maximum supply voltage of either range of the transformer is marked in red and the minimum voltage in blue.



- Power Supply to Amplifier

The amplifier has a voltage selector, the setting of which is necessary in order to obtain the maximum output and at the same time avoid possible overvoltages which cause the tubes to burn out prematurely.

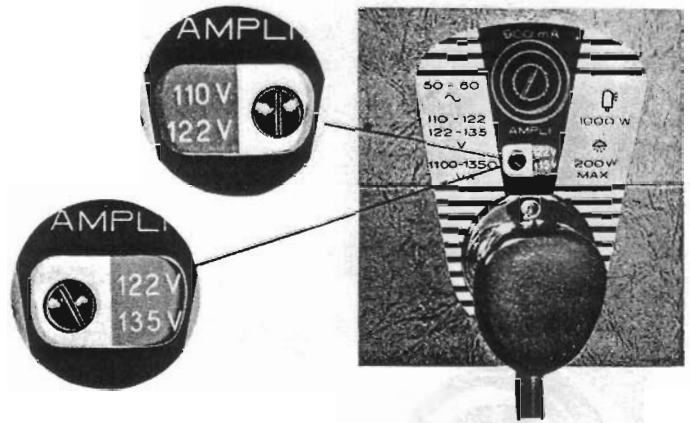
It is advisable to measure the voltage supplied to the amplifier by means of a voltmeter. Preferably use the Paillard-Bolex voltmeter (supplied on request) by connecting it to the room lighting outlet on the projector. In order to read the voltage, projection lamp must be switched off.



- Adjusting Voltage Selector on Amplifier

Set the selector :

- to the "blue" position if the voltage (main or transformer) is between 110 and 122 volts,
- to the "red" position if the voltage is subject to frequent changes or if the voltage (main or transformer) is between 122 and 135 volts.



If there is no voltmeter available to measure the exact voltage supplied to the projector by the transformer T 11, check the nominal main voltage (shown on the electricity meter or a bulb).

Ascertain whether the nominal voltage comes nearer to the minimum voltage (shown in blue) or the maximum voltage (red) of the voltage range chosen by means of the transformer plug.

Set the selector of the amplifier to the corresponding colour.

To adjust the voltage selector, unscrew the knob, pull it forward and slide it sideways until the desired colour is visible. Then screw the knob down again.

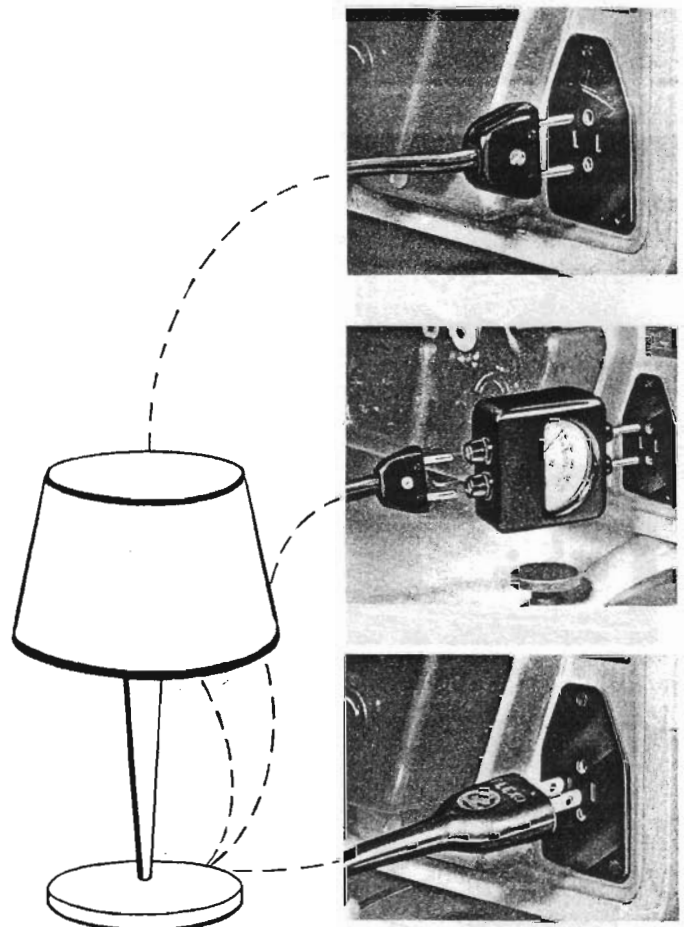
In case the supply voltage is not known precisely (no voltmeter available), it is best, for safety's sake, to set the selector to the "red" position.

- Connecting up Room Lamp

A room lamp can be plugged into the universal-type socket of the projector. This lamp is switched off automatically when the projection lamp is switched on and vice versa. The room lamp outlet has a socket for both European and American type plugs. Use a bulb of 110 to 130 volts, which is the voltage available with the universal-type socket. If the bulb is destined for a higher voltage, it will only supply a percentage of its potential output.

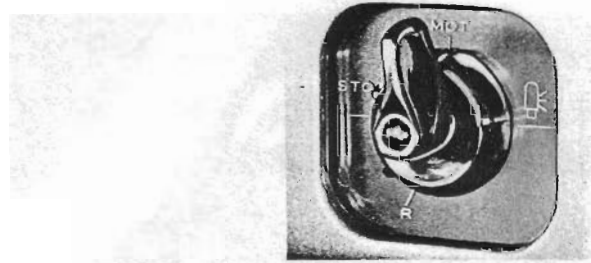
The power taken by the room lamp must not be more than :

- 200 watts if a 1000 watt projection lamp is used;
- 150 watts if a 750 watt projection lamp is used.



- Pre-loading Operations

- Turn the main switch to "MOT".



- Turn the speed selector knob (with an arrow) in order to obtain the desired projection speed.



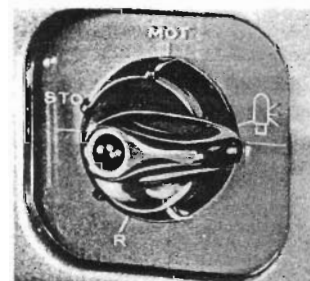
- Check the projection speed with the stroboscope:

The projector runs at a speed of 24 f.p.s. when the luminous dots on the inner circle of the stroboscope appear motionless.

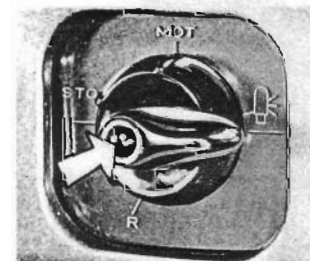
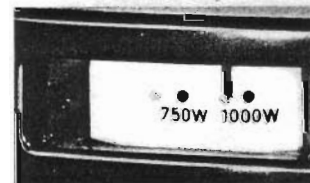
The projector runs at a speed of 18 f.p.s. when the luminous dots on the outer circle of the stroboscope appear motionless.

N.B. - By means of the speed selector it is also possible to select any projection speed between 16 and 25 frames per second, but in this case it is not possible to check the speed by the stroboscope.

- Switch to the position marked  .

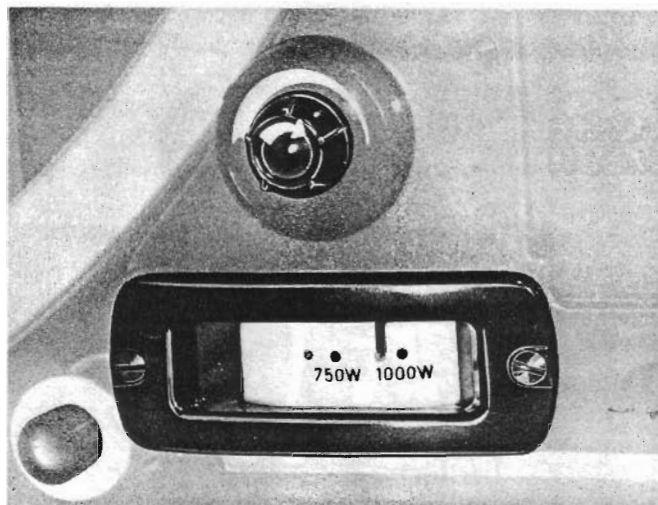


Warning - If, in spite of the resistance of the lamp rheostat, the pointer of the ammeter goes beyond the red or yellow dot or beyond that of a different colour corresponding to the particular nominal voltage of the lamp (see following page) - 750 w or 1000 w according to the type of lamp used - press immediately on the knob at the centre of the switch in order to stop the projector, for this indicates that the supply voltage fed to the projector is higher than 135 volts, and the lamp would be overloaded. In this case, use a transformer or, if one is already in operation, check the position of the voltage selector.



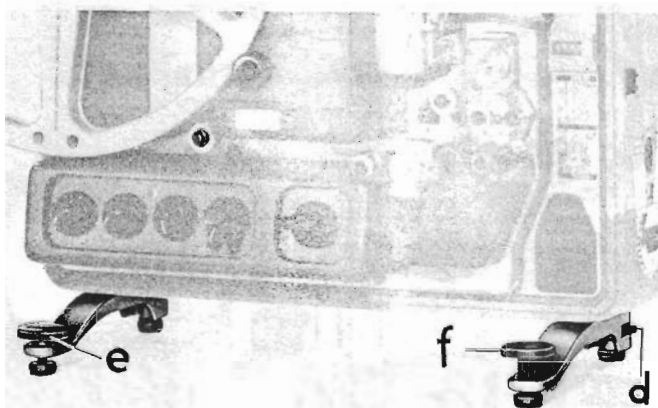
- Turn the knob of the rheostat slowly in the direction shown by the arrow until the pointer of the ammeter is facing the red dot (1000 w or 750 w, according to the type of lamp), or the yellow one when a 115 V lamp is being used instead of the commonly used 110 V lamp.

If possible, do not allow the pointer to exceed the appropriate red or yellow dot position, or otherwise the projection lamp will be overloaded and its life correspondingly shortened.



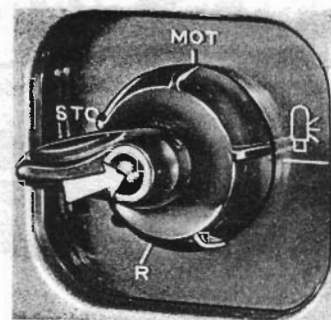
- Line up the projector until the projected beam of light covers the screen.

- To adjust height, turn milled knob (d).
- The image is levelled up and the projector made steady by turning knobs (e) and (f).



- Turn the switch back to the position STOP, by simply pressing on the centre of the switch.

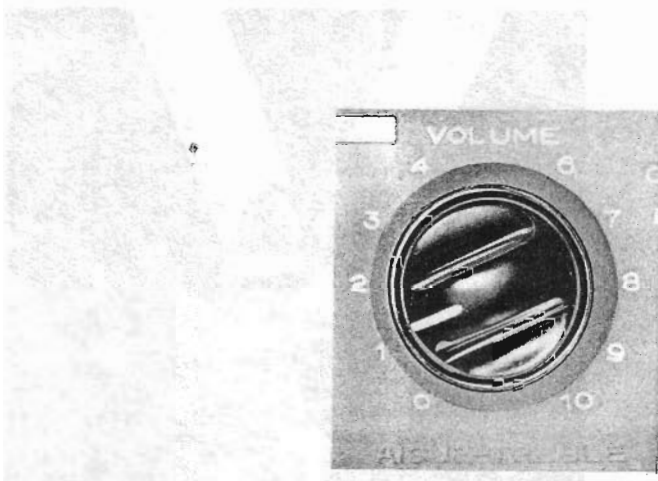
If you wish to stop the projector quickly, you can use the motor as a brake by setting the switch temporarily to the position "R" (reverse motion).



- If a Sound Film is to be shown

- Turn the control marked VOLUME to position "1" in order to switch on the amplifier. The control panel lamp will then light up.

The amplifier should not be run for more than one hour without switching on the motor, which provides the necessary ventilation.



LOADING THE PROJECTOR

The film threading diagrams on the front of the apparatus show the paths through which the film must be threaded for sound projection with optical track (diagram marked OPT) or with magnetic track (diagram marked MAGN). The path picked out in dots on the OPT diagram is used to thread silent film. (See illustrations, page 11 and 12).

- Place the full reel on the upper spool arm. Do not forget to lock it (see page 4).

The film must unwind in the direction shown by the arrow.

When a film with a single row of perforations is used, the perforations must be on the side nearest the operator.

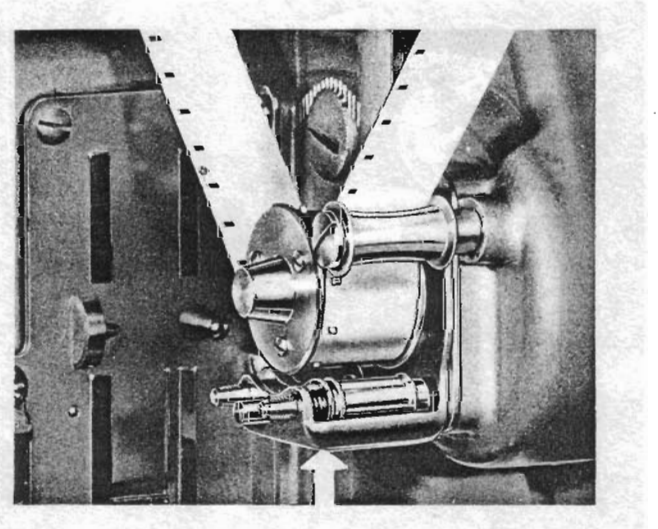
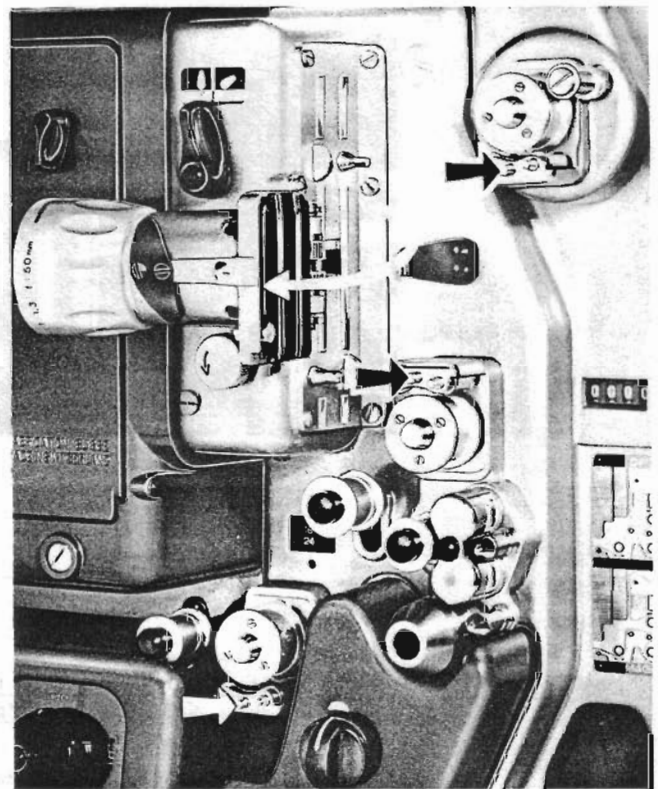
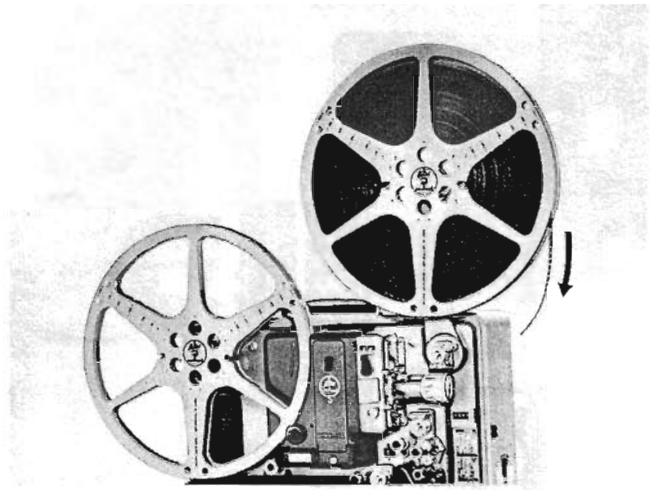
- Unwind about 5 feet of film (leader).

- Swing the lens-holder out in order to open the gate entirely.

- Open the film guides on the three sprockets by pressing on their respective buttons (see arrows).

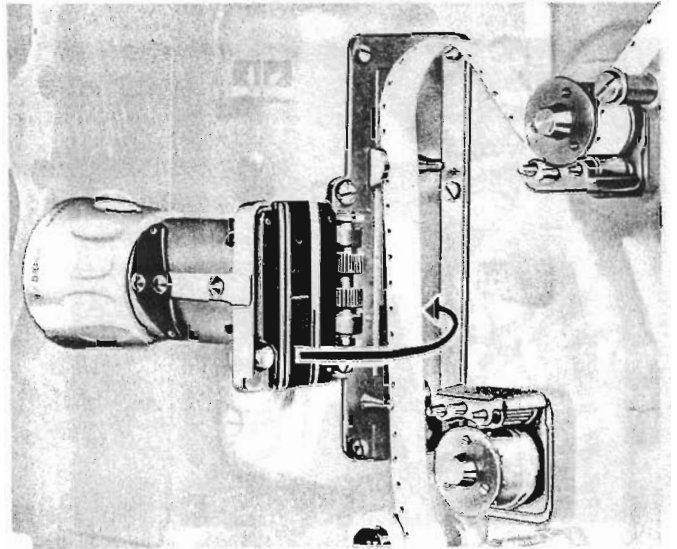
- Draw the film onto the entry roller and insert it between the upper sprocket and its film guide. Make sure that the sprocket teeth enter the perforations.

- Then simply press the guide down onto the film.

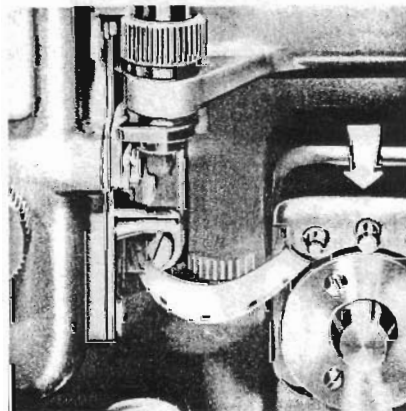


- LOADING THE PROJECTOR (cont.)

- Form the upper loop to coincide with the height of the engraved curve on the housing of the projector.
- Insert the film into the gate between the film guides.



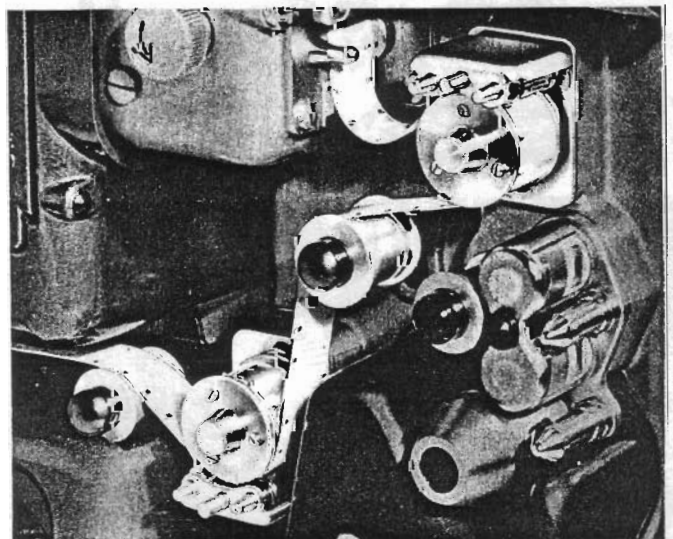
- Form the lower loop to coincide with the engraved curve on the housing of the projector.
- Insert the film on the middle sprocket, making certain that the teeth engage the perforations.
- Press the film-guide down against the film.
- Close the lens-holder with no regard to the position of the claw.



The path of the film between the middle and lower sprocket is different for a silent film and for a sound film with optical or magnetic track.

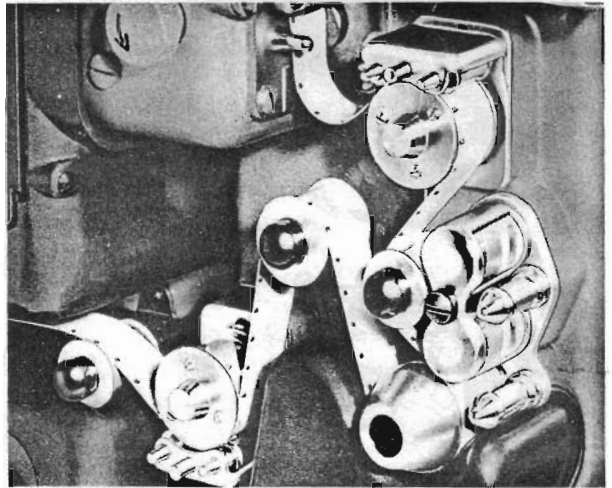
Carefully examine the following illustrations :

- a) Film path for silent projection.

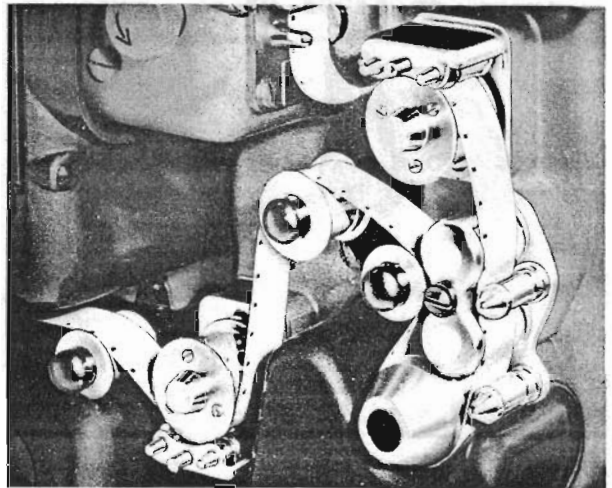


- LOADING THE PROJECTOR (cont.)

b) Film path for optical sound track.



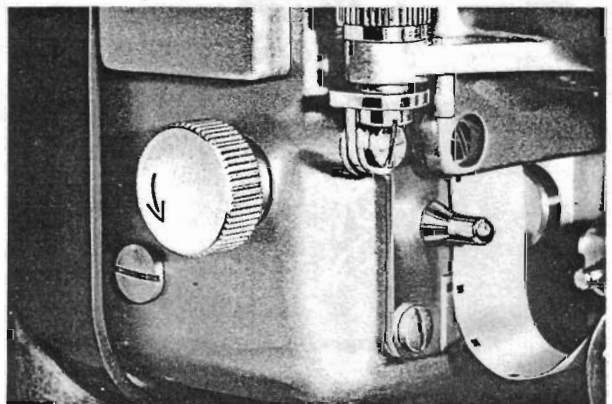
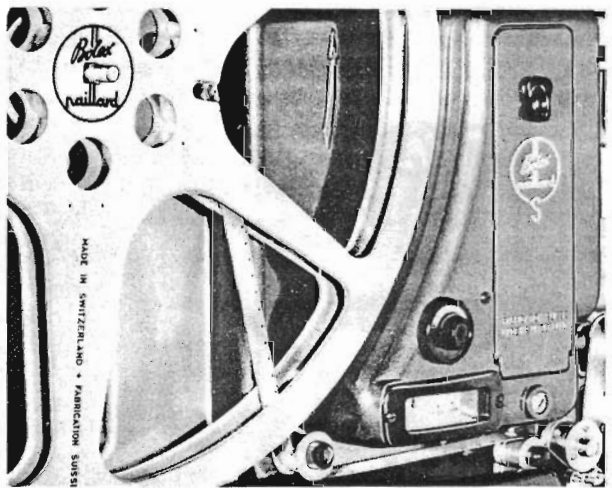
c) Film path for magnetic sound track (playback or recording)



- Thread the film on the lower sprocket, without attempting to pull it tight, and press the film-guide down against the film. If the teeth are properly engaged in the perforations, the sprocket guide can be closed with ease.
- Guide the film between the two exit rollers and insert its end in the slot in the core of the take-up reel. Tighten the film by turning the take-up reel in the direction shown by the arrow engraved on the projector housing.

Important - Check that the film-guides of all three sprockets are properly closed before starting the projector!

The milled knob, shown opposite, permits the mechanism to be run manually in either direction, in order to see that the film is properly driven.



OPERATING THE PROJECTOR

- Projection

- Set the main switch to MOT and check that the film is passing through the projector smoothly and winding onto the take-up reel.
- Switch on the projection lamp.
- Bring the picture into sharp focus by turning the lens slightly.
- If necessary, adjust the framing by turning the milled knob on the lens-holder.
- Adjust the variable shutter to 2 or 3 light interruptions per frame in order to obtain the most favourable results: maximum brilliance and minimum flicker.

Using 2 light interruptions per frame:

- projection at 24 f.p.s.
- big screen or screen with a low reflective surface
- film of average or darker-than-average density.

Using 3 light interruptions per frame:

- projection at less than 24 f.p.s.
- small screen or screen with a high reflective surface
- film of light density or projection of light sequences.

The shutter can be adjusted while the projector is running or stopped.

- Reverse Motion

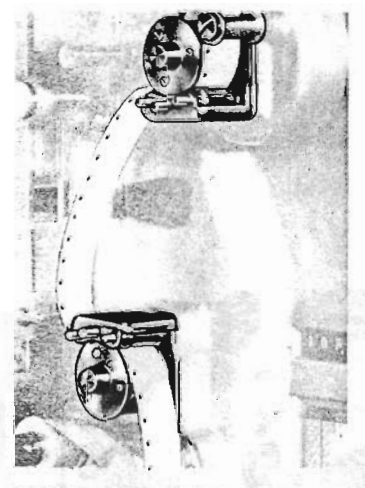
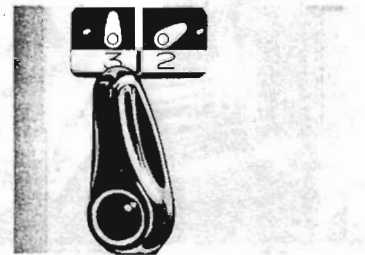
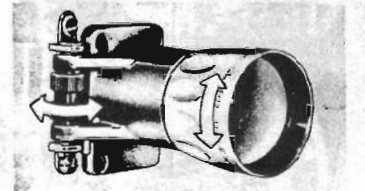
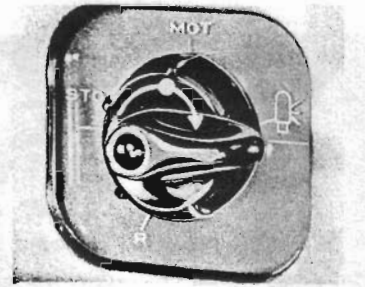
It is advisable to run the film in reverse with the filmgate open, especially when the film is fresh or the magnetic track is rough. To do this, open the lens-holder and the upper sprocket and tighten the film again so that it is threaded from the middle sprocket directly onto the upper sprocket; when running the film in reverse in this manner, the film does not touch the claw.

If the damper roller is not in its highest position, slacken the film in the sound head by turning the middle sprocket by hand.

- Turn the switch to position "R".

The projection lamp does not light when the projector runs in reverse motion.

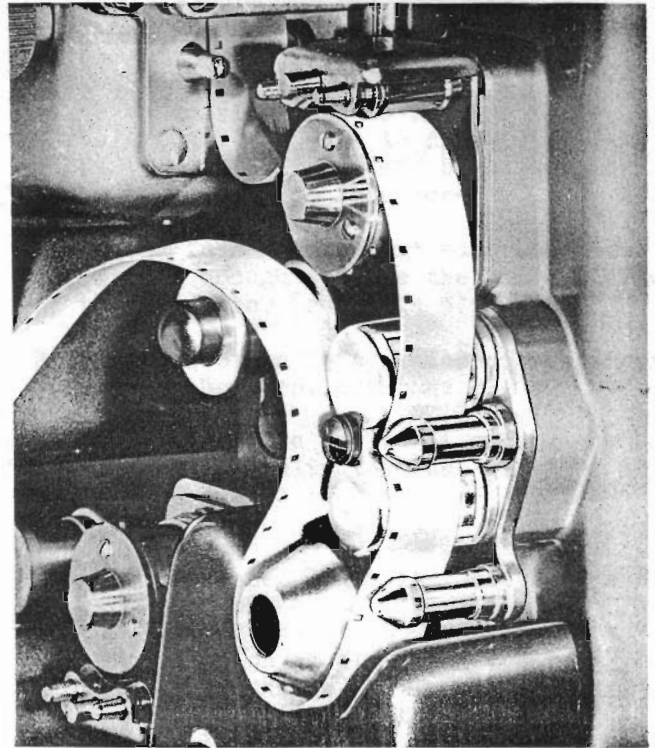
Before loading with a freshly developed black and white film, we advise you to run the projector for a few minutes with the projector lamp switched on. The purpose of this is to warm the film channel and the shutter, and thus prevent any condensation forming on the film gate or the rear element of the lens.



- Unloading

To remove the film when only part of it has run through the projector:

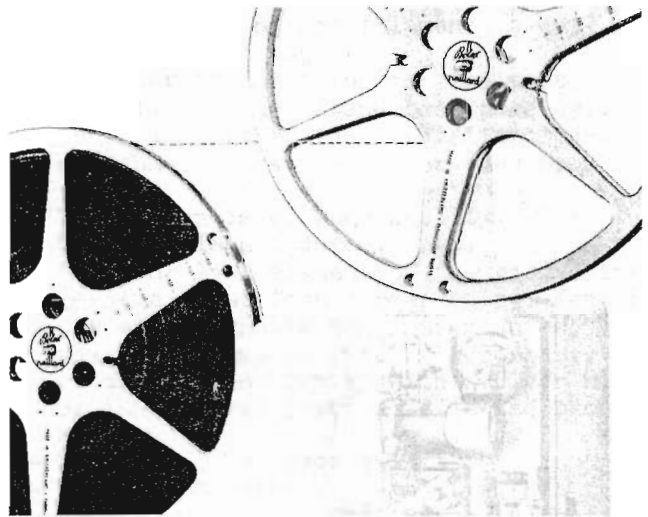
- Open the film guides of all three sprockets; to do this, press on the knob as indicated on page 10.
- Swing the lens-holder out to open the gate.
- Withdraw the film gently, beginning with the lower sprocket.



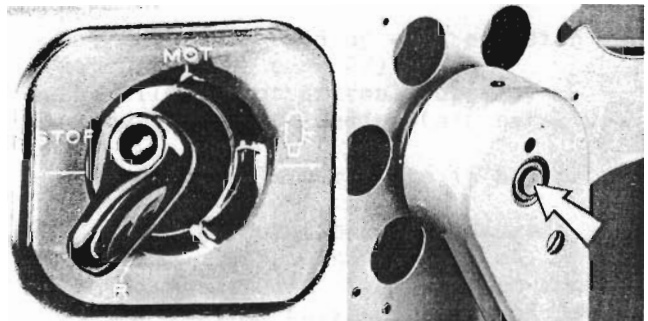
- Rewinding

It is not necessary to invert the reels when rewinding the film.

- Insert the end of the film in the slot in the core of the empty reel.



- Set the motor switch to "R".
- Press on the engaging knob, at the rear of the arm, to assure direct starting of the reel.
- When the film is rewound, move the switch back to STOP.
- Press on the knob at the end of the spool spindle to free the reel, (see page 4).



Observation - If you want to project the same reel a second time, press on the knob at the end of the spindle in order to declutch the reel; do not forget to pull the knob out again to lock the ballspring.

MINOR REPAIRS OF PROJECTOR

TROUBLE

The motor will not run, the stroboscope does not light, no current is reaching the projector.

The motor stops as soon as the switch is set to "lamp" on. The lamp does not light up.

The motor runs, but the lamp does not light up.

The motor and projection lamp both operate, but the control panel does not light up when the VOLUME control is switched on.

The control panel does not light up, although the amplifier works.

The screen is insufficiently lighted.

The pointer of the ammeter does not reach the red dot (1000 or 750 w depending on the type of lamp), when the rheostat knob is turned fully in a clockwise direction.

The screen is unevenly illuminated.

The pictures on the screen lack brilliance (poor contrast).

The pictures are occasionally unsteady.

The upper or the lower loop disappears.

PROBABLE CAUSES

- The house fuses have burnt out.
- The connection cord is faulty.
- The transformer cord is faulty.
- The transformer fuse has burnt out, or the selector plug is unscrewed.

The house fuses have burnt out, they are not strong enough to take the current drawn by the projector (see page 5).

Faulty projection lamp (filament burnt out). To change the lamp, see page 29.

The amplifier fuse has burnt out. Check the voltage with a voltmeter (see page 29) and change the fuse.

The control panel light is faulty. To change it, see page 30.

- The projection is dim (glass bulb blackened). Change the lamp.
- The supply voltage is too low. Check it with a voltmeter.

- The projection lamp filament is not centered (see page 29).
- The lamp is not turned in the proper direction on its stand (see page 29).
- There is dirt on the projection lens, the condenser or the reflector (see p. 27-28).

- The screen is of poor quality.
- The room is not dark enough.
- The rear lens element of the projection lens is moist from condensation. Keep the projector running for some minutes, while the lamp is lit. If necessary, clean the lens gently with a clean cloth or the special paper sold in the photo stores.
- The film is of poor quality.
- The film is dirty. Clean it with a special cleanser, obtainable in photo stores.

- The film is damaged or its quality is poor.
- The gate is gummed up with emulsion deposits (see page 27).
- The film is not driven properly, owing to faulty loading (see page 10).

- One of the film sprockets is not properly closed.
- The film perforations are damaged.
- The film has been badly spliced.
- The film has been tightened too much during loading between the sound drum and the lower sprocket, (see page 12).

PROJECTION OF OPTICAL SOUND PRINTS

- General

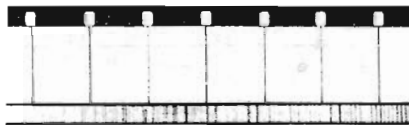
The S-221 projector is designed to take all types of 16 mm film with optical sound track :

- a) Original reversal prints and optical copies.
During loading, the emulsion faces the screen.
- b) Contact prints.
During loading, the emulsion faces the lamp.

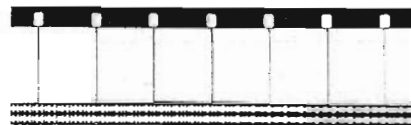
The emulsion can easily be distinguished from the base, as its surface appears duller.

The optical track can be either of variable density or variable area (simple or multiple (push/pull) track).

The variations in light intensity transmitted by the sound head to the photoelectric cell are converted into sound waves after amplification.



Variable density

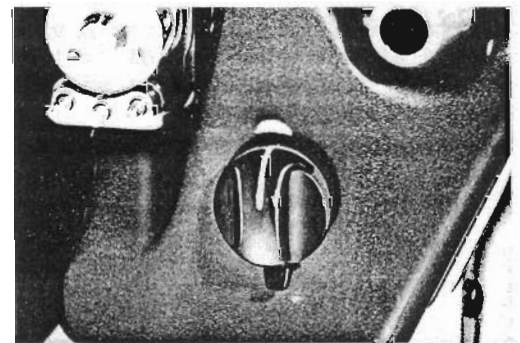


variable area

- Adjusting Fidelity of Reproduction

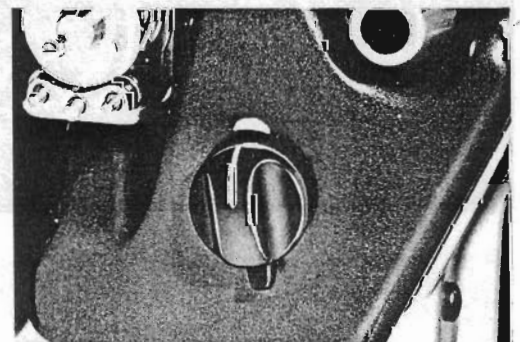
After loading, the sound track on the unperforated edge of the film can face either on the screen or lamp side, depending on whether the film is of the a) or b) type. For optimum sound reproduction, it is important to concentrate the light spot on the sound track, on the side of the emulsion. This is done by adjusting the Fidelity control knob.

The spot is properly adjusted for films with emulsion facing screen when the pointer of the Fidelity knob is more or less in the middle of the engraved white sector. If necessary, improve the adjustment when listening, for the maximum treble.

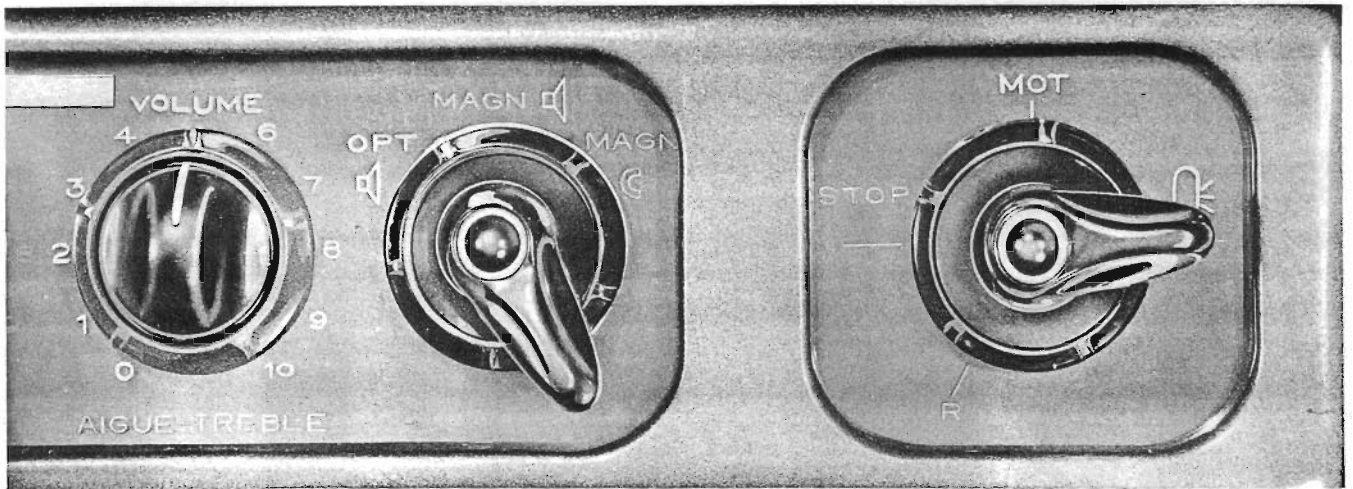


Position of Fidelity knob for type a) film - (emulsion facing screen).

When films with emulsion facing lamp are shown, turn the Fidelity knob gently towards the left from the previous position, until you obtain the maximum amount of treble.





Position of Fidelity knob for type b) film - (emulsion facing projection lamp).



- Projection

For optical sound reproduction, the projection rate must be set to 24 frames per second (check with stroboscope, see page 8).

- Set the fidelity control knob according to the type of film to be screened (see preceding page).
- Set the selector switch to OPT  . The exciter lamp of the optical soundhead will light up.
- Set the main operating switch to MOT and then to  (projection lamp on).
- Adjust the sound volume by means of the VOLUME control.

Remarks :

The amplifier can supply an output power of 15 watts (if it is run on its rated operating voltage).

Since the loudspeaker built into the projector takes only a maximum power of 6 watts, the sound volume should not be set beyond a certain level if this loudspeaker is used alone, in order to avoid distortion and even possible damage to the speaker.

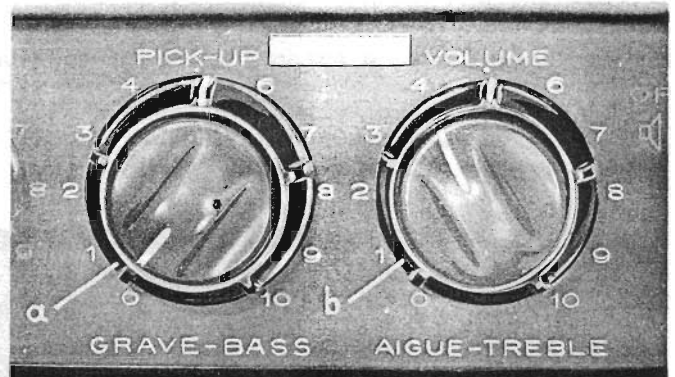
- Adjustment of Tone

- knob a (bass)
- knob b (treble)

As a general rule, the correct balance between bass and treble is obtained when the red markings on the tone control knobs are set about mid-way.

Some adjustment of tone is sometimes necessary, however, depending on the acoustics of the room, the quality of the recording and the characteristics of the loudspeaker used.


The bass and treble registers can be reinforced or reduced in strength by merely turning the corresponding tone control knob in the appropriate direction. Number "10" corresponds to the maximum amount of treble or bass available.



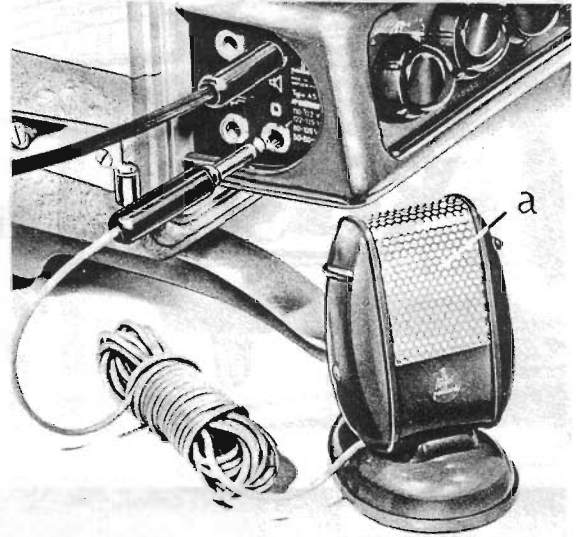
PUBLIC-ADDRESS SYSTEM

It is sometimes effective to use live narration while a film is shown, to add a musical background when the sound track carries speech only, or to dub in both music and speech when showing a silent film.

- Use of Microphone

Insert the microphone jack in the microphone input  on the rear of the projector. This is a high impedance input.

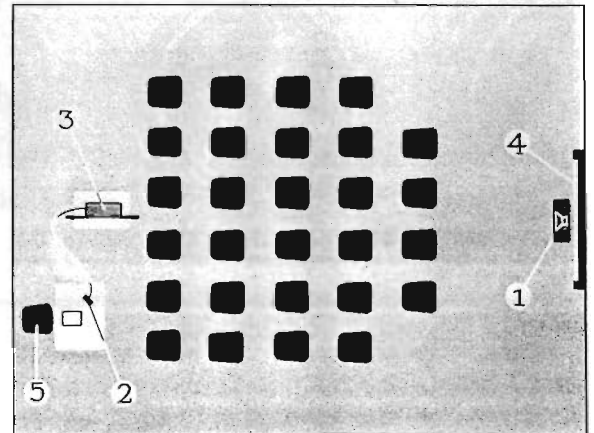
Use of the Paillard-Bolex microphone, supplied on request, is recommended. This uni-directional type microphone, the impedance of which is 50 k ohms, is especially effective when the commentary is spoken in the projection room itself. The risk of setting up an acoustical reaction between microphone and speaker can be minimized by refraining from turning the front (a) of the microphone towards the speaker. This microphone will not pick up noise from the projector if it is turned in a suitable direction.



Correct positioning of microphone with respect to loudspeaker and projector :

- 1 Loudspeaker
- 2 Microphone
- 3 Projector
- 4 Screen
- 5 Speaker - operator

A microphone of another make, either electric or magnetic type, with a minimum impedance of 40 k ohms, can also be used. It must be fitted with a jack similar to that fitted on the loudspeaker cable.



Adjustment of Speech Level


The sound background (film sound track) must be lowered by means of the VOLUME control knob before each spoken commentary, in order to insure the speech being heard clearly. Set the MICRO knob to the position of the VOLUME knob. By careful synchronization of both adjustments, it is possible to dissolve one channel into another with great smoothness.

Note - Some tests before the show will help the speaker to adjust the tone of his voice, find the proper distance from the microphone at which to speak and determine the correct position of the MICRO volume control so that his voice will be clearly heard by the entire audience.

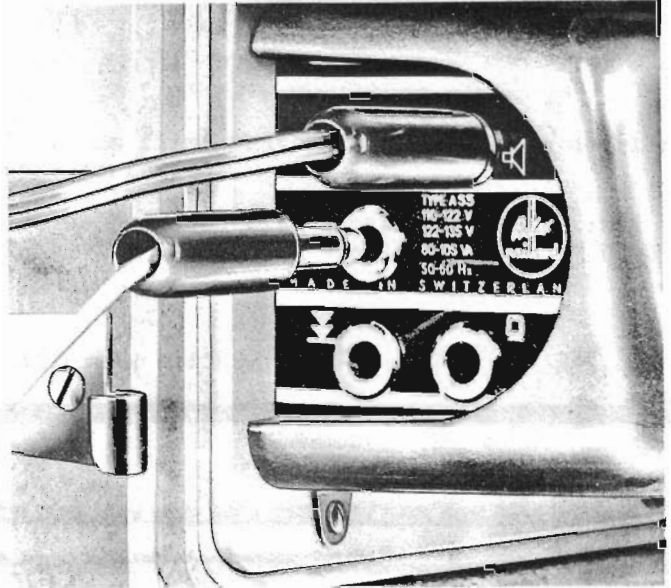


- Use of Record-Player or Tape Recorder

The cord of the instrument used must be fitted with a jack similar to that fitted on the loudspeaker connection cord.

Insert the jack in the phono input  at the rear of the projector.

This is a high impedance plug, suitable for any pick-up having a minimum impedance of 40 k ohms.



Adjustment of Sound Level



Turn the PICK-UP volume control knob in a clockwise direction until the sound is loud enough. The musical background must not hamper reproduction of speech, and it can be turned up gradually and slightly between the narration. (See advice on page 37).

The PICK-UP volume control is independent with respect to the main VOLUME control, which adjusts the volume level of sound from the sound track.



- If the Film is silent

- Spoken Commentary

- Turn the selector switch to MAGN  (At OPT , the exciter lamp of the optical head would burn unnecessarily).
- Set the MICRO control to "10" and adjust amplification by means of the VOLUME control.

- Mixing Sound (Speech and Music)

- Adjust the respective levels of speech and music by means of the VOLUME and PICK-UP controls, according to the effect sought.



MAGNETIC SOUND PROJECTION

- General

A magnetic sound track can be added to all 16 mm films that have already been developed, regardless whether they are single or double perforated.

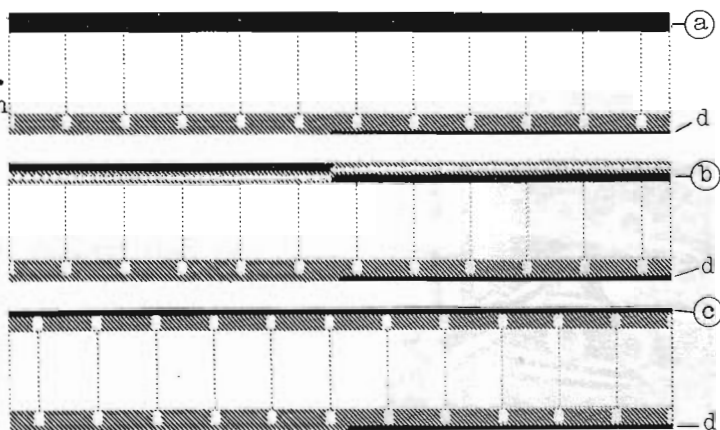
A film with an optical sound track can also be provided with a magnetic sound track in order to permit use of either track. Thus, for example, a single film can be used with sound tracks in two languages.

Magnetic sound tracks are made in three different widths :

- a) Full track (2,6 mm)
for films with single perforations.
It takes up the whole space between the pictures and the edge of the film.

- b) Half-track (1,3 mm)
added to half of area taken up by optical track, inner or outer side of films with single perforations.

- c) Quarter-track (0,8 mm)
used on films with perforations on both edges.





- d) There are films which have, besides the sound tracks a), b) or c), a "balance stripe" to keep them flat when wound onto large reels. This 0,8 mm track is not used for sound recording.

The S-221 projector may be used for recording and playback of all three types of magnetic tracks.

However, the finest sound quality is obtained by using a full track and a projection speed of 24 frames per second. (See page 39).

- Projection


After the projection speed is adjusted (check with the stroboscope, see page 8), load the projector according to diagram c) on page 12.




- Set the switch to MAGN .
- Set the main switch to MOT and then to  (lamp on).
- Adjust the sound level by means of the VOLUME control. (See note about amplification on page 35).
- Adjust tone as required. (See page 17).

MAGNETIC SOUND RECORDING

After the projector has been loaded according to diagram c), page 12, and the speed has been adjusted, follow these instructions for recording:

- Recording a Musical Background




When music is transcribed from a record-player or a tape recorder, the use of earphones for audio monitoring is desirable, since the speaker is disconnected when the selector switch is set to MAGN  .

- Set the first frame of the film (or of the part to which sound is to be added) in front of the projection aperture. Do this by running the projector in forward or reverse motion until the frame appears in the aperture, or simply drive the film manually by turning the knob on the film drive mechanism.
- Set the frame counter to 0000 by turning the milled knob.
- Run the projector backwards until the counter reads 9980 (or less). One unit corresponds to 10 frames. Do not forget to open the lens holder and to reduce the film loop (see page 13).
- Plug the record-player (or the tape recorder) into the socket at the rear of the projector  .
- If earphones are used for audio monitoring, connect them to the earphone jack  . (See page 23).
- For testing, set the selector switch temporarily to MAGN  (recording). This can only be done by pressing on the knob in the center of the selector switch.
- Without starting the projector, operate the record-player (or the tape recorder) and adjust the volume by means of the PICK-UP volume control, while checking the volume level by means of the magic band. The deviation of the branches indicating the sound modulation must be thoroughly watched. In the loudest parts the branches even may joint themselves, but superimposition must be avoided; otherwise, there would be saturation of the magnetic track, giving distorted reproduction.

The characteristics of the magnetic track depending on the make, the correct degree of illumination of the neon lamp can slightly vary.

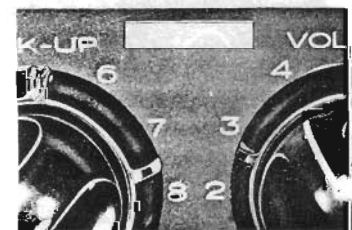
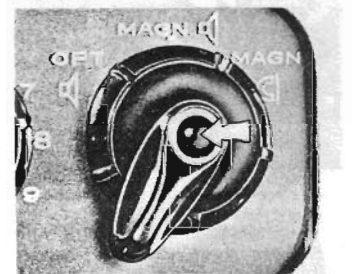
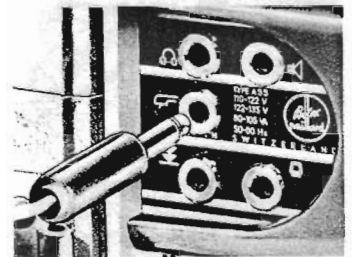
The earphones are useful for checking the music to be recorded and for making the necessary adjustments of tone and volume controls on the record-player or tape recorder. (See page 37).

Do not adjust the tone controls of the projector, as they have no effect on the recording.

- Set the main switch to MOT, or  (lamp on) if you want to watch the film during the recording.
- Note: Operating the switch from STOP to MOT or vice-versa makes the selector switch return automatically to MAGN  . This safety device prevents any unintentional erasing of the magnetic track.
- Check the frame counter; as soon as it registers 0000, set the selector switch quickly back to MAGN  and immediately start the phonograph record or the tape recorder.
- If necessary, the volume level can be corrected during recording by adjusting the PICK-UP control.

Carry out exactly the same operations if sound effects are to be recorded from a tape or a record.

For erasing, checking the quality of the recording and checking an unfinished recording, see page 23.

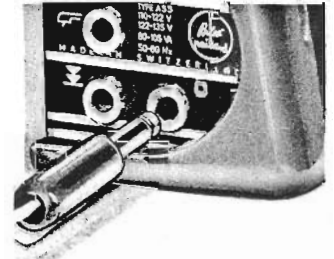


- Recording a Spoken Commentary

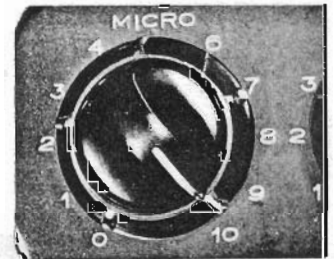
- Set the first frame of the film (or of the part to which sound is to be added) in front of the projection aperture. Do this by running the projector in forward or reverse motion until the frame appears in the aperture, or simply move the film manually by turning the knob on the film drive mechanism.
- Set the frame counter to 0000 by turning its milled knob.
- Run the projector backwards until the counter reads 9980 (or less). One unit corresponds to 10 frames. For safety measures, see page 13.

- Connect the microphone jack in the microphone input @ at the rear of the projector.

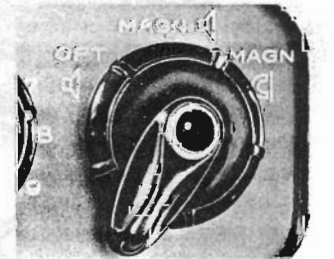
Disconnect the speaker plug, if the speaker is positioned anywhere near the microphone, in order to avoid an acoustic reaction or "howl".



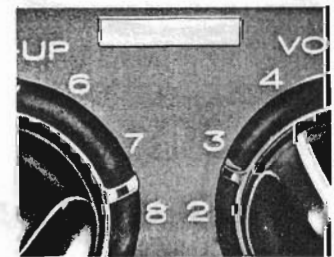
- Set the MICRO knob to "10".



- For testing, set the selector switch temporarily to MAGN (recording). This can only be done by pressing on the knob in the center of the selector switch.



Without running the projector, say a few words into the microphone, at the proper distance from the latter, keep your voice at its natural pitch, and adjust the amount of amplification by means of the VOLUME control. While doing so, check the recording level by means of the magic band. The deviation of the branches indicating the sound modulation must be thoroughly watched. In the loudest parts the branches even may joint themselves, but superimposition must be avoided; otherwise, there would be saturation of the magnetic track, giving distorted reproduction.



- Set the main switch to MOT, or Q (lamp on) if you want to watch the film while recording. Operating the switch from STOP to MOT or vice-versa makes the selector switch return automatically to MAGN Q . This safety device prevents any unintentional erasing of the magnetic track.
- Check the frame counter; as soon as it reads 0000, set the selector switch quickly back to MAGN Q and start speaking immediately.
- If necessary, the sound level can be corrected during recording by means of the VOLUME control.

The MICRO control knob must not be operated while sound is being recorded. The tone controls have no effect when the selector switch is set to MAGN Q (recording).

- Erasing

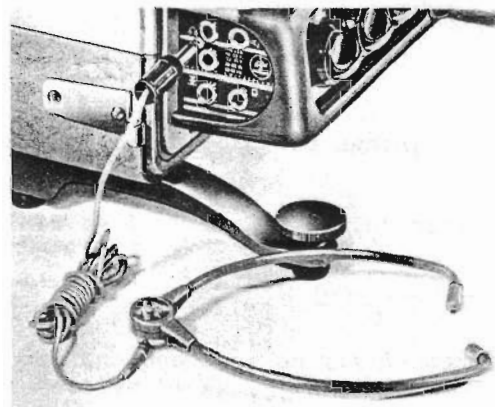
Since the magnetic sound track passes through the erasing head before reaching the recording head, any previous recording is automatically erased.

- Checking the Recording (Audio Monitoring)

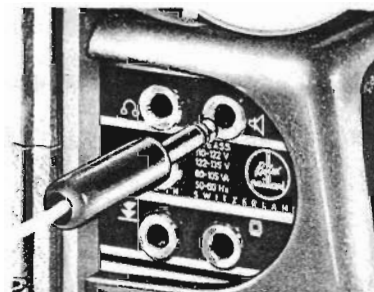
Earphones can be plugged into the earphone jack Q at the rear of the projector. (Impedance 1200 ohms).

The earphones, supplied on request (code: SOECO) are useful for checking a musical recording, making fades, recording narration, or when the speaker is in an adjoining room.

Earphones of another make can be used, provided they have an impedance of at least 50 ohms.







- Run the projector in reverse until the counter reads 9980 (or less). One unit corresponds to 10 frames. For safety measures, see page 13.
- Plug the speaker into the socket Q at the rear of the projector.
- Now run forward and listen to the recording just made (see page 20). If the recording is of good quality, continue where you left off.



- Sound Mixing

For mixing music and narration, perform the following operations :

- Set the first frame of the film (or of the part to which sound is to be added) in front of the projection aperture.
- Set the frame counter to 0000.
- Run the projector backwards until the counter reads 9980 (or less).
- Plug the record-player (or tape recorder) into the phone input .
- Plug the microphone into the microphone input  and turn the MICRO control to 10. The MICRO control knob must not be touched again while recording is in process.
- Plug the earphones into the earphone jack .
- Set the selector switch temporarily to MAGN  and make a test recording without running the projector.

The VOLUME control adjusts the amplification of the sound picked up by the microphone, and the PICK-UP control affects the volume of music input (check level by means of the magic band).



The use of earphones is essential in order to adjust the relative input of speech and music according to the effect required.

When the best positions for the VOLUME and PICK-UP controls have been noted, the recording can be made.


Note: If you have not recorded sound effects, they can often be produced and recorded through the microphone; for mixing, see preceding instructions.

- Re-recording of Unsatisfactory Passages

If parts of the sound track are not satisfactory and have to be recorded again, proceed as follows:

- Determine the beginning of the faulty passage, either by listening with the earphones or by checking the picture sequence.
- Set the frame counter to 0000.
- Depending on the type of correction needed (on music, on speech or on mixed sound), plug the record-player or microphone into their respective jacks.
If the microphone is used, disconnect the speaker plug and turn the MICRO control knob to 10.
- Make a test without running the projector (see pages 21 and 22).
- Run the projector backwards until the counter reads 9980 (or less).
- Set the main switch to MOT, or  (lamp on) if you want to watch the film.
- As soon as the frame counter indicates 0000, quickly turn the selector switch to MAGN  and start recording immediately.

Warning

As soon as the faulty passage has been re-recorded, set the selector switch quickly back to MAGN  (play back) in order to avoid erasing the rest of the recorded sound track.

ACCESSORY FOR THE SUPERIMPOSITION OF SOUND
(available on request) Code: SOSUR

With the help of this accessory, it is possible to superimpose additional speech, sound effects or music on a sound recording already made, either over a microphone or by connecting a turntable or a tape recorder to the projector.

The existing recording can be attenuated at will and in a desired proportion down to 60 - 70 % of its initial volume, which leaves about 30 to 40 % of its former record level. For fading-in narration, it is recommended to diminish the existing sound to this maximum value, in order to make the spoken commentary stand out clearly against background music or sound effects.

As long as the setting knob of the accessory is in position "0", the sound volume remains unchanged. When operating this knob in a clockwise direction, the existing record level is diminished progressively, which permits one to obtain "sound fades".

To facilitate the superimposition, the microphone can be unscrewed from its stand and fastened to the accessory.

Diminution of the existing record level,
no overplay

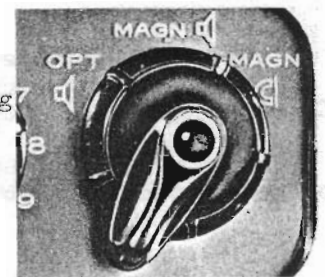
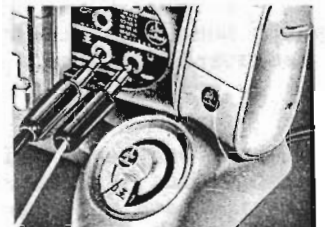
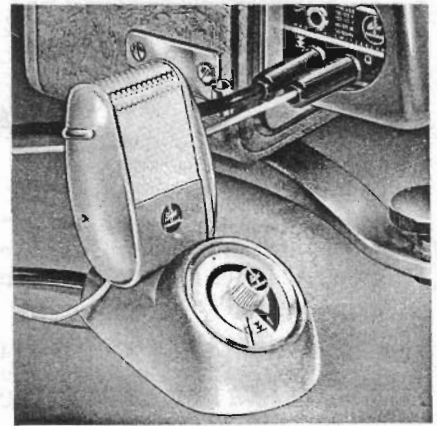
Recording of the sound to be superimposed

Overplay and fades of sound

Overplay procedure :

- Start with the recording of background sound (see page 21).
- Insert the jack of the accessory into the input ∇ , the setting knob of the accessory being in position "0".
- Connect the microphone to input \square , the turntable (or tape recorder) to input \curvearrowright .
- Limit the rotation of the button according to the desirable degree of erasure by rotating the transparent stop disc to the corresponding position. To set the most suitable effect of background erasure, you will find a reference scale under the disc which one may use as a help for setting the stop disc to a position found by some previous tests.
- Switch on the projector.
- Set the selector switch to MAGN \mathcal{C} .
- Adjust the desired sound volume by means of the control knobs MICRO and VOLUME or the PICK-UP knob, according to instructions given on page 21 and the following pages.
- Operate the setting knob of the accessory for superimposition in order to obtain the desired overplay.
- Do not forget to reset the knob to "0" at the end of the above operation.

Remark - By inserting the jack of the accessory into the input ∇ and by setting the control knob to "0", the circuit of the erasing head becomes inoperative. As long as this control knob is not operated, the film will pass without the risk of the magnetic track being affected.



MINOR REPAIRS OF THE SOUND SYSTEM

<u>NATURE OF BREAKDOWN</u>	<u>PARTS OF SYSTEM AFFECTED</u>	<u>PROBABLE CAUSES</u>
No sound at all.	All (exciter lamp will not light up).	- Amplifier fuse blown (see page 30). - The wiring has come loose at the amplifier connection plug (e) (see page 31).
	All (exciter lamp lights up).	- Faulty speaker or break in the speaker connection cable. - Faulty ECC83 = 12AX7 (I) tube.
	Optical sound reproduction (other channels in order).	- Exciter lamp burnt out (see page 30). - Faulty EL90 = 6AQ6 tube. - Faulty photoelectric cell (see page 30). - 7-prong plug (a) or shielded plug (c) not plugged in fully (see page 31).
	Magnetic sound reproduction.	- Faulty EF86 = 6267 (I) tube. - 7-prong plug (a), 4-prong plug (b) or shielded plug (d) not plugged in fully. (See page 31).
Sound weak or distorted.	All.	- Faulty EL84 = 6BQ5 (I or II) or ECC83 = 12AX7 (I or II) tubes. - Faulty speaker.
No sound or sound weak.	Optical sound reproduction and microphone (PA system) (reproduction from pick-up or tape recording is good).	- Faulty EF86 = 6267 (II) tube.
Sound weak.	Optical sound reproduction (other channels in order).	- Faulty photoelectric cell (see page 30). - Upper slit in optical sound head plugged up; it should be cleaned as described on page 29.
	Reproduction from pick-up or tape recorder.	- Pick-up has too low impedance or delivers insufficient output (such as magnetic pick-ups requiring preamplifier); try connecting it to the microphone input.
	Magnetic sound playback.	- Sound has been recorded at too low an input level or quality of magnetic sound track is poor (see pages 21 - 22 and 39). - Magnetic sound head is dirty and must be cleaned according to instructions on page 28.
Output power low.	All.	- Power supply voltage is too low (see page 6), check it with a voltmeter.
Lack of treble	Optical sound reproduction.	- Quality of optical sound track is poor. - Fidelity (slit control) knob is wrongly adjusted (see page 16).
Poor synchronization	Optical or magnetic sound reproduction.	- Lower loop too large; form the loop on a level with the engraved sign on the housing.

MINOR REPAIRS OF THE SOUND SYSTEM

NATURE OF BREAKDOWN

PARTS OF SYSTEM AFFECTED

PROBABLE CAUSES

Wow.

Optical and magnetic sound reproduction.

Magnetic playback.

- Film has been poorly spliced together.
- Emulsion deposits on sound drum, sprockets or rollers. Clean these elements (see page 28).
- Cover of optical sound head has been wrongly replaced and touches the film.
- Magnetic sound head is dirty; clean it according to instructions on page 28.

Hum.

Optical sound reproduction.

Magnetic playback

Reproduction with pick-up, tape recorder or microphone.

- Cover of optical sound head wrongly replaced.
- Power supply transformer placed too near projector.
- Improper shielding of leads connecting attachments to projector. Check that leads and shielding are properly connected to jacks.

Intermittent crackles or interference.

All.
Motor stopped.

All.
Only when motor is running.

- Bad contact in a plug or socket.
- Lamp in bad condition.
- Defective motor. See your Bolex franchised dealer.

Sound recording weak and distorted; magnetic track not completely erased.

Sound recording is weak and cannot be increased.

Sound is recorded with marked distortion on loud passages.

Microphone recordings marred by background noise (machinery in motion).

Magnetic sound recording.

- Faulty EL90 = 6AQ5 tube.
- Faulty EF86 = 6267 (II), ECC83 = 12AX7 or EL84 = 6BQ5 tubes.
- Sound is recorded at too high a level.
- Microphone has been set too near projector.

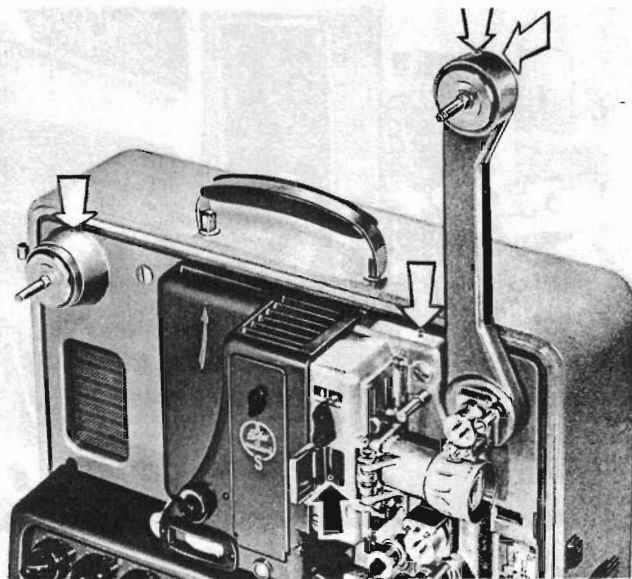
For instructions on changing the amplifier tubes, see pages 31 and 40. If changing the apparently faulty tube does not eliminate the trouble, consult your Bolex dealer.

This should also be done for any defects not listed in the above chart.

MAINTENANCE

- Lubrication

The lubricating system of the S-221 projector requires no special attention. All the operator need do is insert, after every 10 hours of operation, a few drops of fine oil (using the oiler supplied with the projector) in the lubricating holes marked in red.



- Cleaning

All the components of the optical system, as well as all parts of the projector that are in contact with the film, must be kept absolutely clean to guarantee faultless projection. Never do any cleaning while the projector is running!

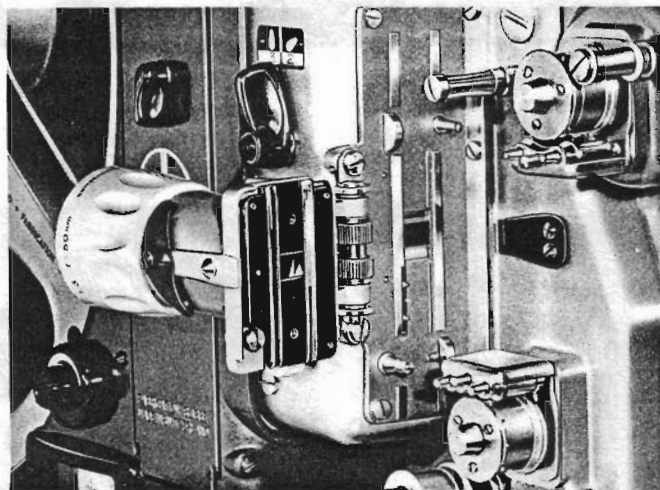
Lens

All glass surfaces that can be reached must be cleaned gently and carefully, using only the special tissue paper sold for this purpose in photo stores. Avoid rubbing the lenses constantly, since by doing so, you may damage their delicate anti-reflex coating. Never attempt to clean the lens surfaces with a damp cloth; if absolutely necessary, breathe slightly on them.

Pressure-Pad and Gate

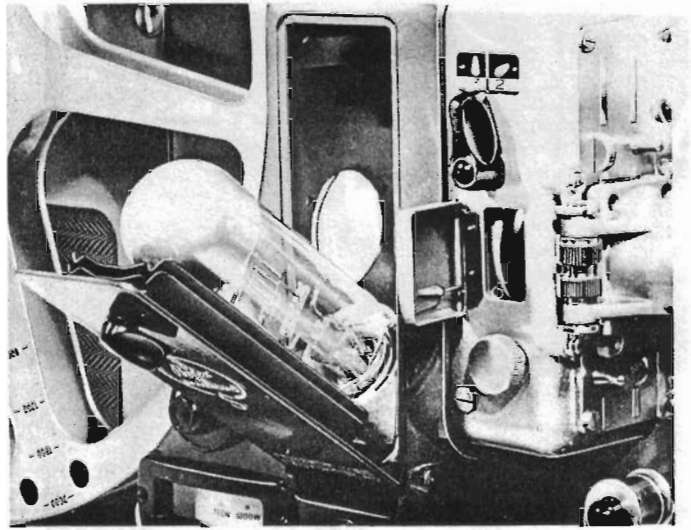
These parts must be inspected for cleanliness at regular intervals.

- Open the lens holder.
- Remove dust by means of the brush or a cloth; the edges of the aperture must be clean.
- Remove any deposits of emulsion; they may scratch the film and make the pictures seem unsteady on the screen. If necessary, retract the claw from the gate by slightly turning the knob that drives the projector mechanism.
- Never use a tool or other metallic object; you can use the micarta emulsion scraper supplied with the Bolex film splicer, or a small wooden stick or chip, the end of which is covered with a clean cloth.
- If the emulsion deposit is difficult to remove, rub with a slightly moistened cloth, and be careful to wipe the part dry again after cleaning.
- Deposits occur more frequently when fresh films are being screened.



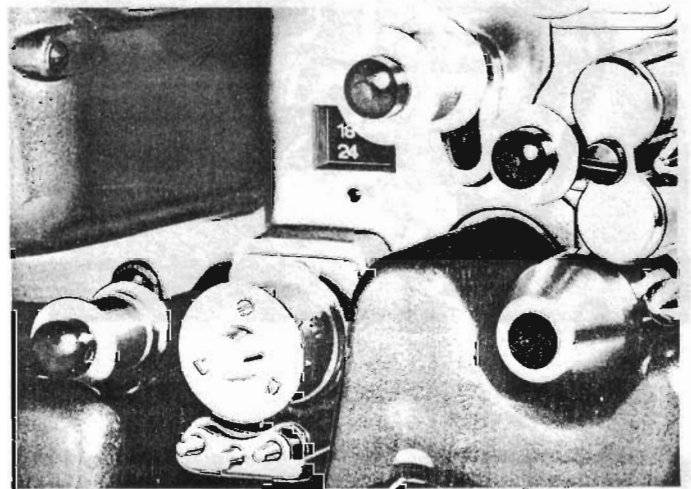
Condenser and Reflector

To reach the condenser lenses, open the panel under the shutter control knob as well as the projection lamp door and remove the projection lamp. (See following page).



Sprockets and Rollers

Any emulsion or dust deposited on the sprockets, rollers or film guides may cause wow causing speed variation and scratching of the film. While the projector has been designed to prevent these parts from making contact with the emulsion, and to keep the film in perfect condition, it is nevertheless very important to give these parts regular and thorough cleaning.



Sound Drum

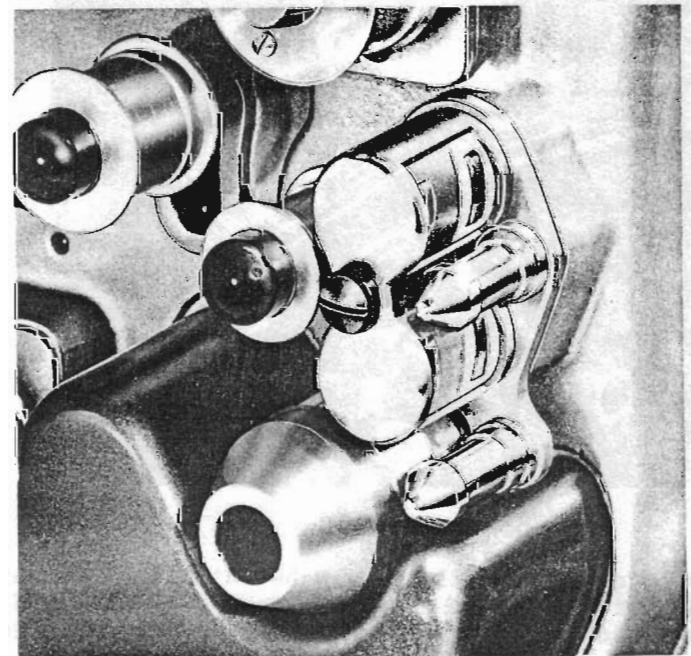
This component must be wiped over from time to time with a clean, smooth cloth that does not leave dust. Quality of sound reproduction suffers if particles of dust or emulsion are allowed to cling to the sound drum.

Magnetic Sound Heads

It is important to see that these parts are always kept clean. They can be dusted with the brush.

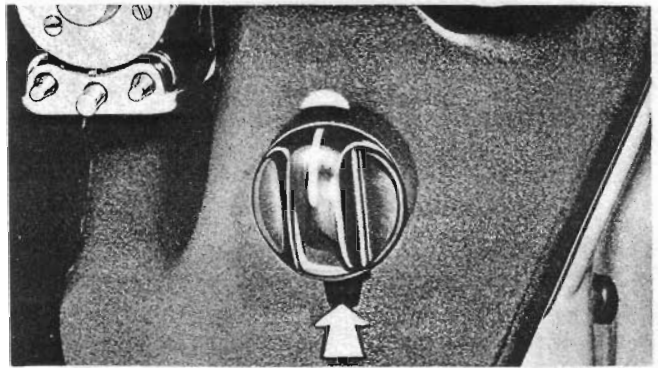
Never approach them with magnetized objects like speakers, screw drivers, magnets and so on.

If there are emulsion deposits, proceed as for the cleaning of the film gate (see preceding page).

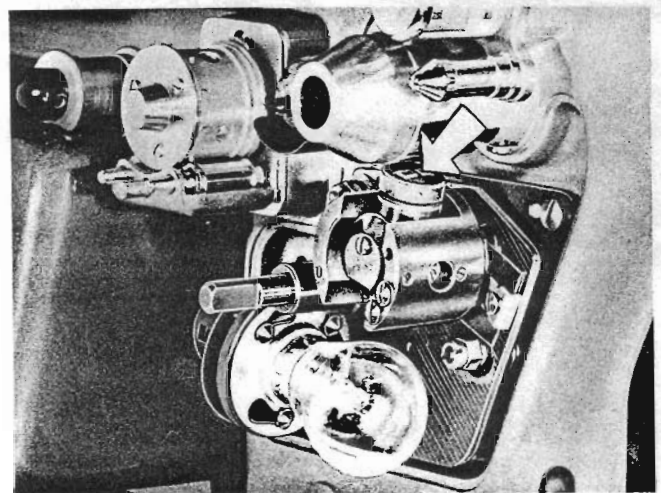


Optical Sound Head

- Cut off the power supply.
- Remove the fidelity (slit control) knob (unscrew the screw, then press on the end of the spring at side; at the same time pull the knob towards you).



- Remove the cover.
- Clean the sound head with a soft brush. The upper slot can be reached more easily if the control is turned so as to lower the optical unit. For cleaning use a soft cloth or special lens cleaning paper.
- Put back the cover and the control knob, the marking on which must be set as described on page 16.



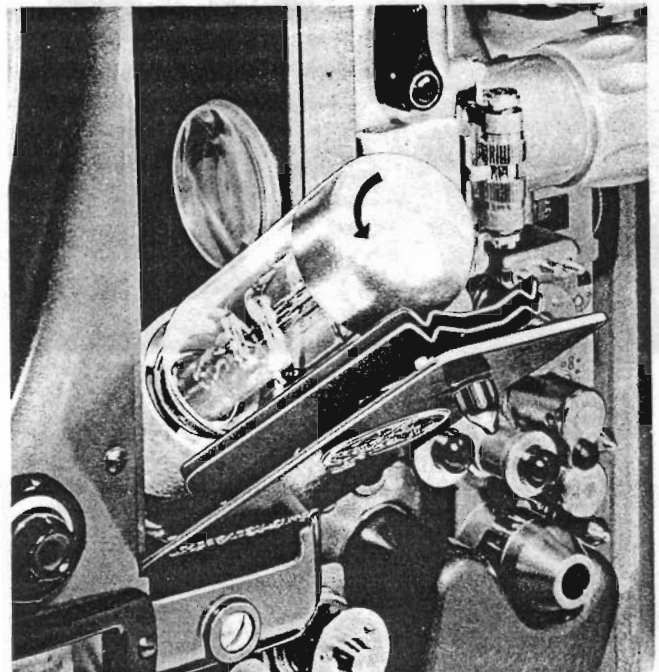
1000W TYPE A1/59
750W TYPE A1/9

- Replacing of the Projection Lamp (750 or 1000 w., 110 V.)

- Disconnect the projector.
- Open the panel.
- Press the lamp down fully in its socket, turn it one quarter of a turn (in the direction shown by the arrow) and remove it.
- Insert the new lamp (taking care to place the fins on the lamp base facing the corresponding openings in the socket).

The position of the lamp is correct when the fins are touching the stops in the sockets.

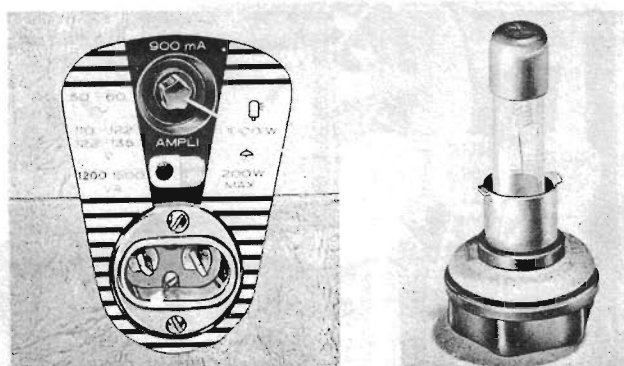
Note: Since the projection lamps are of standardized design, they can easily be changed and require no further adjustment.



However, if the screen appears to be unevenly illuminated without film in the projector, the projection lamp filament may be slightly off-center; correct this by turning the regulating screw under the panel slightly in one direction or the other, using a coin as a screw driver.

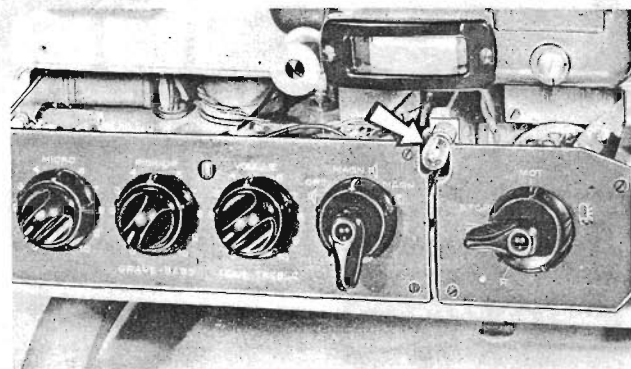
- Replacing the Amplifier Fuse (900 mA).

- Press on the bayonet type cover and turn it a quarter turn to release it from the socket.
- Remove the blown fuse and insert one of the spare fuses supplied with the projector.



- Replacing the Control Panel Lamp (6,3V - 0,3A).

- Disconnect the projector.
- To reach this lamp, unscrew the 6 screws at the edge of the control panel and remove the cover.



- Replacing the Exciter Lamp of the Optical Sound Head. (TYPE G 29)

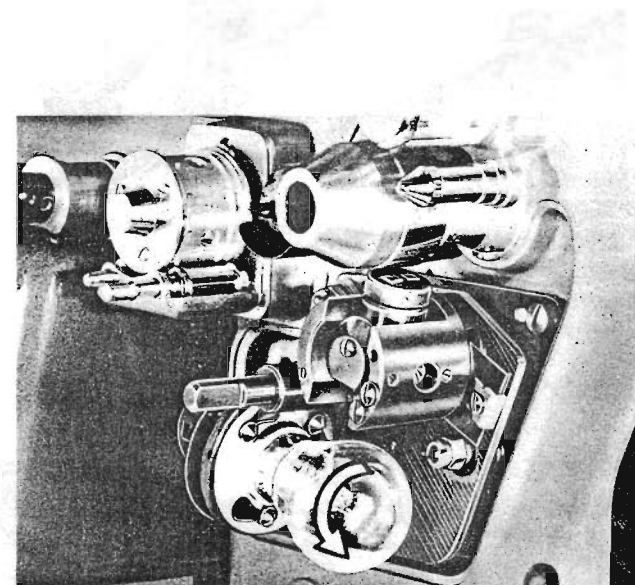
- Make certain that the amplifier is switched off.
- Remove the fidelity (slit control) knob and the cover (see preceding page).
- Turn the lamp in its socket in the direction shown by the arrow, so that the pins are facing the base.
- Remove the faulty lamp and insert a new one, reversing the above operations.

Since the lamp bases are of standardized design, centering is automatic and no adjustments are necessary.

The bulb must be perfectly clean (avoid finger prints).

Lamps of various makes can be used:

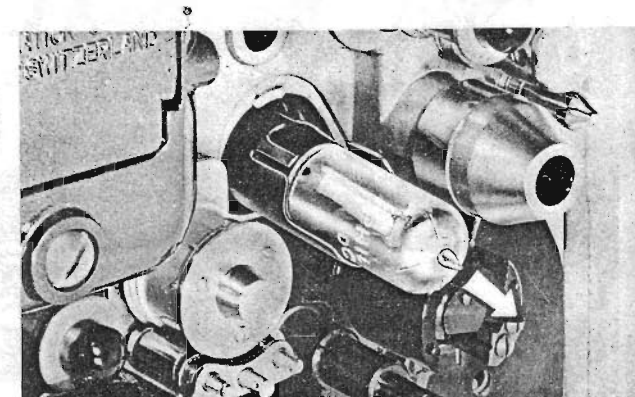
- G.E. No 75 A/S8SCP and G.E. BFX 4V
- Westinghouse 75 A/S8SCP
- Philips No 7253 C
- Radiant O,75A-4V - C6-T5-SC



- Replacing the Photoelectric Cell

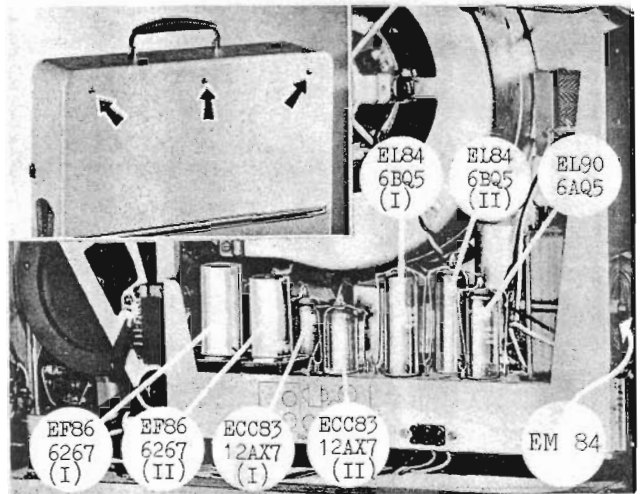
- Remove the fidelity (slit control) knob and the cover (see preceding page).
- Withdraw the cell from its socket by pulling it towards you.

The S-221 projector is equipped with a Philips No 90CG cell (cells of other makes cannot be used).



- Replacing the Amplifier Tubes

- First turn off the power supply to the projector.
- The amplifier tubes can be reached by unscrewing the 3 screws that fasten the back panel of the case. The tube types are shown opposite and on the diagram, page 40.
- The tube EM 84 (magic band) can be approached in the same way as the control panel lamp (see preceding page).

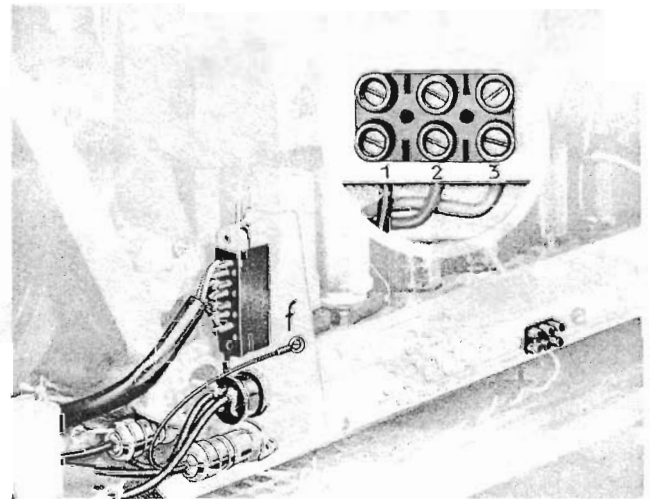


- Replacing the Amplifier

Should the amplifier fail and replacing the lamps be without result, consult your Bolex dealer. In case of absolute necessity, use spare amplifier.

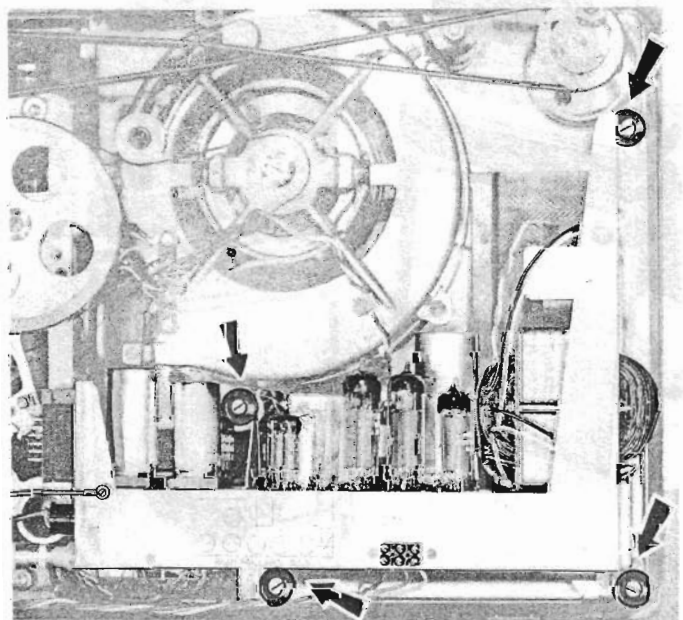
To remove the amplifier chassis from the projector, proceed as follows:

- Unscrew the 3 screws retaining the back panel of the case.
- Disconnect the two multiple-pin plugs (a and b) as well as the shielded plugs (c and d).
- Unscrew the 3 lower screws on the front terminal block (e).
- Unscrew fastening screw of the cable connecting lug (f).



1) black 2) blue 3) red

- Carefully remove the 4 screws that hold the amplifier.
- To insert the amplifier, carry out the above operations in reverse.



AUXILIARY LOUDSPEAKER BE-14 (15 WATTS)
 (Available as accessory) Code : SOCOF

This 12" loudspeaker takes the entire power output supplied by the amplifier (see page 17).

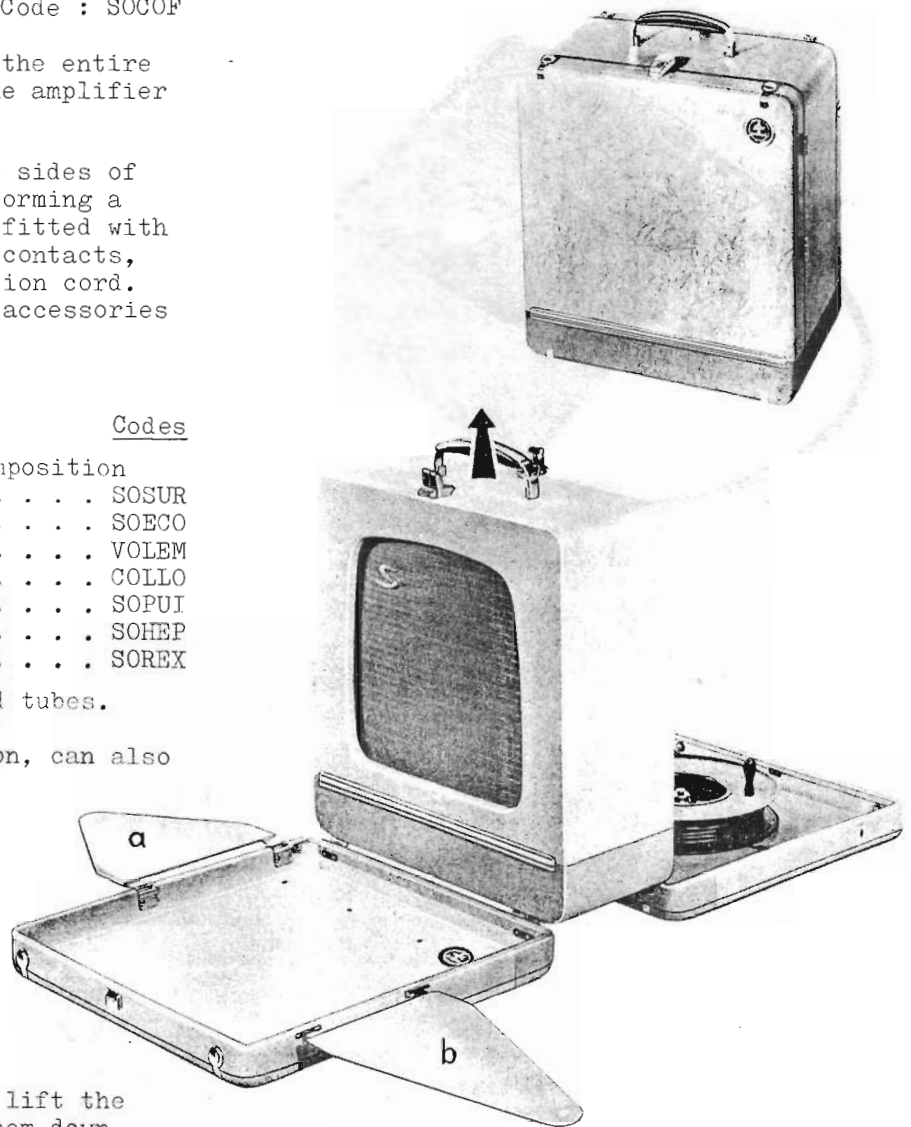
It is housed in a case, two sides of which can be folded down, forming a stand. One of the sides is fitted with a reel drum with permanent contacts, containing 50 ft of connection cord. There is space for various accessories such as:

Codes

- 1 accessory for the superimposition of sound SOSUR
- earphones SOECO
- 1 voltmeter VOLEM
- 1 splicer COLLO
- 1 speaker distributor box SOPUI
- 1 speaker extension cable SOHEP
- 1 power extension cord SOREX


and various spare lamps and tubes.

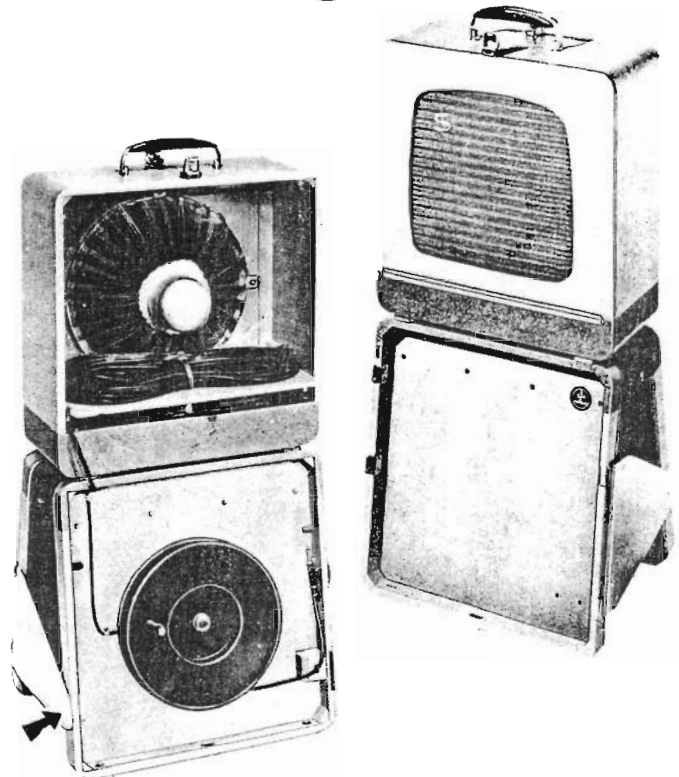
A 2000 ft reel in its carton, can also be placed on one side.



- Setting up

- Open the two sides and lift the case in order to let them down.
- Unfold panels (a and b) and fasten them on both sides by using pressure; in this position, they form a sturdy stand.

Place the speaker near the screen (see page 34), unwind the cord and insert its jack into the speaker output jack  at the control panel. The other end of the cable is permanently connected to the loudspeaker.



Note: The reel drum is fitted with a friction brake that can be tightened to prevent the cable from unwinding too freely or loosened to facilitate rewinding. The milled screw can also be used to lock the drum in position to prevent the cable from unwinding during transport.




SPEAKER DISTRIBUTOR BOX

(supplied with 12" speaker) Code : SOPUI

This accessory is used for connecting the two speakers when the projector is installed in a projection booth, allowing the built-in speaker to serve for monitoring purposes.





- Connecting the Box

- Connect the distributor box to the projector (speaker output  on the control panel).
- Connect the jack from the auxiliary (12") speaker to the socket under the sign  and the jack from the built-in speaker (8") to the socket under the sign  on the distributor box.

- Adjustment of Output to Speaker

The 6-position knob controls the distribution of power from the amplifier to the two speakers, as follows:

Extreme positions - output is supplied to a single speaker only, namely

- The auxiliary speaker (12") when the pointer is set on position 
- The built-in speaker (8") when the pointer is set on position  (*)

Intermediate positions - output is supplied to both speakers (*)

In this case, the power used by the built-in speaker (8") is taken from that supplied to the auxiliary speaker (12"). It is reduced progressively when the knob is turned from right to left.

(*) However, the maximum power that can be supplied to the built-in speaker via the distributor box is limited to 2,5 watts.

Note: The figures that identify the various positions of the control knob only relate to the direction of variation (the white surface indicates the amount of power supplied to the built-in speaker).

SOME HINTS FROM A SOUND ENGINEER

I. SOUND PROJECTION

- Acoustics of the Projection Room

Besides the suitability for motion picture screenings and the comfort it offers to the audience, the projection room must also have good acoustics. The best results will be obtained in a room in which reverberation has been suitably reduced. A certain degree of reverberation is nevertheless useful, since it tends to "liven up" the reproduction of the sound, especially of music.

Reverberation is produced by the mixing of the sound waves coming directly from the speaker and of those that have been reflected by floors, walls, ceiling etc. and which are heard as a mild echo.

Curtains of heavy material will do much to alter the acoustic characteristics of a room, to make them suitable and to prevent the occurrence of echoes that interfere with good reproduction. Panels of sound absorbent material can also be used with good results. Do not forget that an empty room has more pronounced reverberation than one that is filled to capacity.

- Arrangement of Projector and Speakers

The ideal solution is to install the projector in its own separate booth. In this case, the auxiliary speaker BE-14 (15 w.) is used in the auditorium, while the speaker placed in the projector lid is used by the operator for monitoring purposes, the speakers being regulated with the special speaker distributor box control. If this arrangement proves to be impractical, the projector may be set up in the auditorium, preferably behind the audience rather than in the middle of it, to avoid distraction of attention by the noise of the projector. The projector can also be set up in an adjoining room, provided there is a door or other opening conveniently located to permit projection from one room to the other.

When the projector is set up in the auditorium, either one or both speakers can be used. The main speaker is best placed as near as possible to the screen, beside or beneath it, but not too low.

The speaker BE-14 suits this purpose very well, since it is mounted on a stand. If a special perforated screen for sound projection is available, the loudspeaker may be placed directly behind and in the center of it, so that the sound will appear to come from the picture.

- Appropriate Sound Level

For comfortable listening, the level of sound from the speaker must be considerably louder than any other noises which may be heard at any point of the room (sound from the projector, people walking in passageway, etc.). The amount of power that must be fed to the speaker to produce an adequate sound output depends on the size of the projection room and also on its reverberation characteristics. With the Bolex BE-14 loudspeaker, the amount of audio-frequency output required from the amplifier in a room with little reverberation is about 1 watt per 100 m³.

Note: The above values are merely approximations; they should be used as a guide and the operator may even find it of advantage to depart from them in particular cases.

- Some Recommendations for the Operator

- Do not forget that the average audience is highly critical and that your skill will be compared to that of professional operators.
- Start setting up your equipment early, allowing yourself plenty of time to get everything ready and to carry out the necessary tests before the spectators begin to arrive.
- If you have to leave your equipment unattended for some time after installing it, check that the speakers are still connected and "live" for sound before beginning the show.
- Make sure that the fuses in the power supply circuit are strong enough to pass the current taken by the projector and auxiliary room lighting.
- Before the audience is seated, run a few feet of film on the projector to check picture and sound quality and make any adjustments that are necessary.
- Do not leave the VOLUME control turned up higher than position "2" or "3" when sound is not being used, as otherwise background noise from the amplifier will be heard in the speakers. Turn the volume up only at the start of the film, when the first image appears on the screen.
- When the audience is large, the acoustic properties of the hall are altered, making it necessary to increase the sound volume and sometimes to alter the tone, generally by increasing the treble control. These adjustments should be made gradually, so that the audience is not aware of it.
- At the end of the show, switch on the room lighting and switch off the projection lamp before the last foot of film has run through the projector, in order to avoid the audience being dazzled by an empty and brilliantly-lighted screen.

II. HOW TO ADD MAGNETIC SOUND TO A FILM

Much depends on the type of film to which sound is to be added: documentary, feature film, newsreel and so on. Depending on circumstances, the operator may have wide latitude or he may, on the contrary, have to closely follow the written script. The three elements from which any sound track is compiled - narration, music and miscellaneous sound effects - will have to be introduced in vastly different proportions, according to the kind of film involved.

- Documentary Films - Newsreels

In this category of film, music is used simply to sustain the general atmosphere, while the script is designed to introduce or explain the succeeding scenes. The operator should not attempt to record all the words spoken by the people seen on the screen, or he will find himself faced with some exceedingly difficult problems in synchronization. In general, the spoken commentary must be kept short and clear and must not seek merely to express the same thing as the image on the screen.

- Feature Films

Here, music and sound effects are wedded to the action in order to lend powerful aural distinction to certain scenes. The music must be chosen with special care, and its selection requires an intimate acquaintance with the idea behind the script. Sometimes musical passages are used to bridge the gap between two spoken sequences. Accenting certain selected passages (by slightly turning up the volume) helps to avoid monotony. If the musical theme used has a marked crescendo, care must be taken to prevent this from interfering with a spoken passage.

- Sound Effects

It is difficult to lay down any hard-and-fast rules applicable to sound effects, since the latter depend entirely on the character of the film involved. Broadly speaking, one can distinguish between synchronized and non-synchronized sound effects.

Non-synchronized sound effects (such as the whistling of the wind, noise of crowd) may be treated exactly like background music. They may be either recorded with a tape recorder when the scene is shot or imitated by using the special records that may be purchased.

The synchronized variety, such as those portraying the smashing of a glass, the slamming of a door and so on, entail a certain amount of skill on the part of the operator. They may be either produced artificially when the sound is dubbed in, or recorded on a tape recorder at the time the scene is shot and registered on the film, after it has been edited.

- Sound Editing

So that the film will appear harmonious and logical, the sound at any given moment must always match the pictures that it accompanies. After viewing the finished edited film, it is a good idea to draw up a script in which the timing of each scene is accurately noted, as has been done in the following example:

Title of Film		Reel No.			
Scene No	Subject	Sec-onds	Sound Sequence	Control Settings	Remarks
1	"X" films present:	5	Opening	"Pick-up"	
2	TITLE	5	music	on 7	
3	1st scene of film	10	Fade music gradually	"Pick-up" on 4	
		10	Speech with music in back-ground	"Micro" on 10 "Volume" on 6	
	etc.....				

RECORDING SOUND

- Pick-up and Records

If the record-player unit has a tone control, set it to the position giving maximum treble. The turntable speed must not be allowed to vary, and the records must be flat and not warped in any way. Long playing recordings are particularly recommended on account of their low background noise.

There is available a wide variety of recordings of background mood music for all occasions, and sound effects of all types. Most commercial recordings are subject, however, to copyrights (laws vary from one country to another) and can only be used for commercial purposes if the consent of the recording company is obtained.

- Tape Recorder

The recorder must be fitted with an adequate output socket permitting connection to the input circuit of the projector amplifier. If the output impedance is high, the cable connecting the unit to the projector amplifier must be carefully shielded in order to avoid buzzing noises. If the socket for the auxiliary speaker (low impedance) is used as output socket, no particular precaution is necessary.

Recording by placing the microphone in front of the speaker of the tape recorder is not usually conducive to good results and should be used only if it is desired to introduce special effects which were not present on the original sound track. A cathedral-like resonance effect or echo can be produced, for instance, if the recording is made in a large empty room with bare walls.

The volume and tone controls on the tape recorder should be set in the normal position for playback (the tone control set to give good treble response) and must not be touched during the recording process.

- Microphone

The D 11 microphone which we recommend is characterized by its high sensitivity and excellent response at all frequencies between 60 and 10,000 cycles per second, sturdy construction, small size and resistance to moisture. Omnidirectional type microphones are less suitable, because they pick up background noises. In order to avoid the recording of noises that would be detrimental to the sound quality, the microphone should not be set up too near the projector, but at a distance of several feet or, if possible, in an adjoining room with little reverberation. This arrangement requires the service of two persons: one who operates the projector and the amplifier as well as the auxiliary equipment (record-player, tape recorder), and the other who acts as a narrator.



- Narrator and Operator

The narrator should avoid speaking too close to the microphone, or the sound track may be saturated when his voice is raised. At a normal vocal level, the best distance is about 8". To prevent the consonants like "s" from reaching too high a level, the microphone should be held level with the chin, so that the breath does not strike directly against the sensitive membrane. In order to avoid disturbing noises from being recorded, manipulating the microphone during the recording as well as any movement of the connecting cord must be avoided. A stand or support for the microphone proves to be most useful; however, it should not communicate any sound vibration to the microphone.

The speaker must take care not to speak too fast, in a nervous manner or without normal pauses if he is reading a script.

If the projector and microphone are set up in the same room, the operator simply makes a sign to the narrator when it is time to start speaking; both are guided by the picture on the screen.

If the projector is installed in a separate booth or room alongside the auditorium, the operator signals to the narrator to start speaking by means of some electrical or other device (such as a battery-operated warning light). However, both should have a good view of the screen, without which proper synchronization of sound and image would be impossible.

Another more practical solution is to record the narration first on a tape recorder, and then to transfer it onto the film, with or without dubbed-in musical accompaniment. To dub in the music, the output from the tape recorder must be fed to the phono input jack  and that from the pick-up to the microphone input jack  on the projector.

In this case, only one person is needed to make the recording. If the sound consists of a mixed output from various channels, the operator must keep a check on the relative levels by monitoring the amplifier output with earphones, no matter which system of recording is used.

- Synchronization

More or less perfect synchronization is necessary according to the type of sound-track.

A simultaneous commentary reaches a sufficient degree of precision if it starts some frames after the beginning of the scene to which it refers and if it ends some frames or even some seconds before the end of the scene.

A text, however, which is spoken in lip synchronization must be synchronous to some tenths of a second. It is rather difficult to carry out such a synchronization without special equipment.

The simplest method and the most common one of making a recording is to follow the picture on the screen.

If the script is "tight" you should make use of the frame counter on the projector (1 unit per 10 frames, which can be easily read while the projector is running) or time the different sequences of the film

Another possibility consists in adding marks of special, self-sticking paper directly onto the film.

Quality of Recording

The quality of a magnetic sound recording depends on various factors, some of which, together with pertinent advice, are quoted below:

- Quality of Magnetic Track

The material used for the sound track (a first-class magnetic coating), its regular consistency, a smooth surface, a perfectly constant width and thickness of the sound track are very important in obtaining good results.

The tracks obtained by cementing a thin magnetic band onto the film are specially recommended. "Laminated", very smooth tracks are most suitable because they cause very little wear on the magnetic heads.

- Width of Magnetic Track

2,6 mm - Full-Track - Whenever possible, this track should be used, since it provides optimum sound quality, especially with regard to dynamics. The use of films with a single row of perforations is therefore highly recommended. In addition, films without splices (prints) give the best results.

1,3 mm - Half-Track - Since the sound energy produced when running a half-track is weaker than in the case of a full track, a greater amount of amplification must be used in order to obtain an equivalent amount of output from the speaker. As a result, the sound-to-noise ratio is not as good when narrow tracks are used.

0,8 mm - Quarter-Track - The factors quoted above apply even more to the quarter-track which should be used only in case of absolute necessity. (For instance, if the film has double perforations). Even in this case, it is preferable to have a print on single perforated film made to which a full magnetic track can be added. In addition, splices are eliminated in this way.

- Projection Speed

The fidelity of reproduction in the high frequencies, which are most important for a good musical quality, is proportional to the speed of the track over the magnetic heads.

Speed of 24 f.p.s. - This is the standard speed for all musical tracks, both optical and magnetic. Films shot at this speed lend themselves well to high-quality sound projection. Actually, the frequency range e.g. of a magnetic sound track goes from 50 to 10.000 c/s \pm 3 db.

Speed of 18 f.p.s. - Due to the slower running speed, the frequency range is less wide in the high frequencies and music cannot be registered with the same fidelity of sound as in the case of films shot at 24 f.p.s.; in most cases, however, quality is sufficient.

- Importance of Constant Speed

The result of variations of the projection speed is that the sound will appear to waver ("wow" effect). This is a phenomenon that does not affect speech very much, but the effect on musical recordings is much more noticeable. The following precautions must therefore be taken so that the projection speed remains constant:

- keep the sound heads and film drive parts on the projector perfectly clean (see pages 27 and 28);
- take care that any splices on the film are properly made.

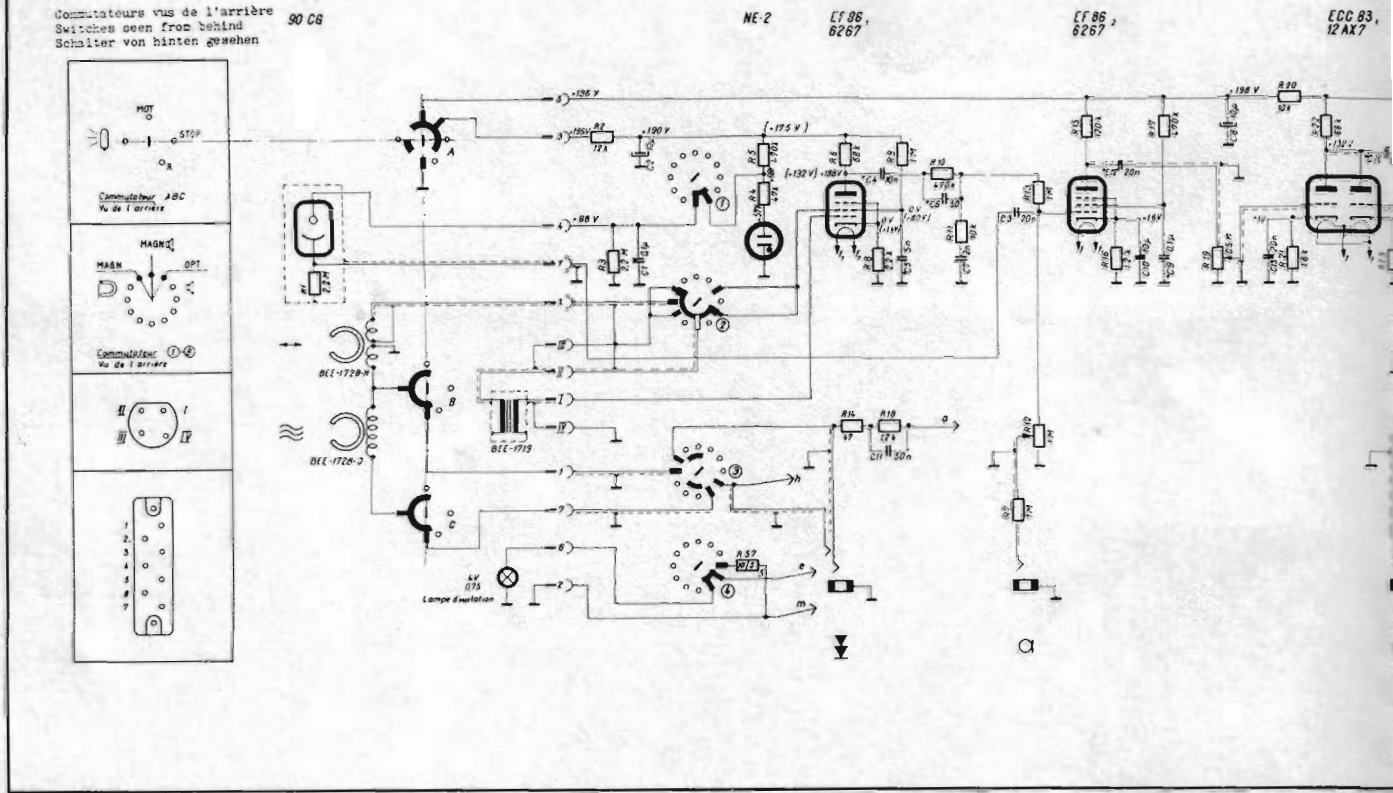
If, on beginning a recording, the stroboscope does not appear to be absolutely motionless, but seems to be moving slowly (about 1 period per second), this need not give cause for concern, since the difference in speed is very slight. An attempt to correct the speed would cause a change in the recording, and result in a "wow" effect when playing back. In such a case, the recording should be continued at the original speed.

Les valeurs indiquées entre parenthèses s'entendent pour fonctionnement sur position MAGN α .

The values in parentheses position MAGN α .

Tensions continues mesurées avec un instrument de 20000 Ω/V .

DC voltages measured with

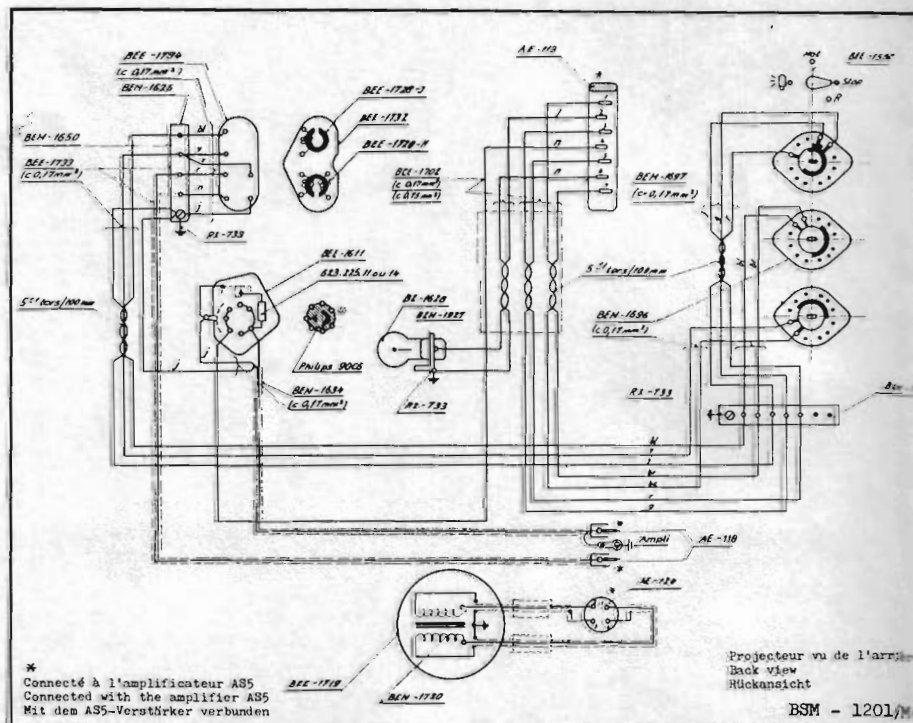


PLANS DE CABLES

Courant faible - Weak current - Schwachstrom

- bc = blanc - white - weiss
- bl = bleu - blue - blau
- br = brun - brown - braun
- g = gris - grey - grau
- j = jaune - yellow - gelb
- n = noir - black - schwarz
- r = rouge - red - rot
- v = vert - green - grün

- C 0,17 mm2 = câble, section 0,17 mm2
- C 0,75 mm2 = cable, section 0,75 mm2
- C 1,5 mm2 = Draht, Querschnitt 1,5 mm2



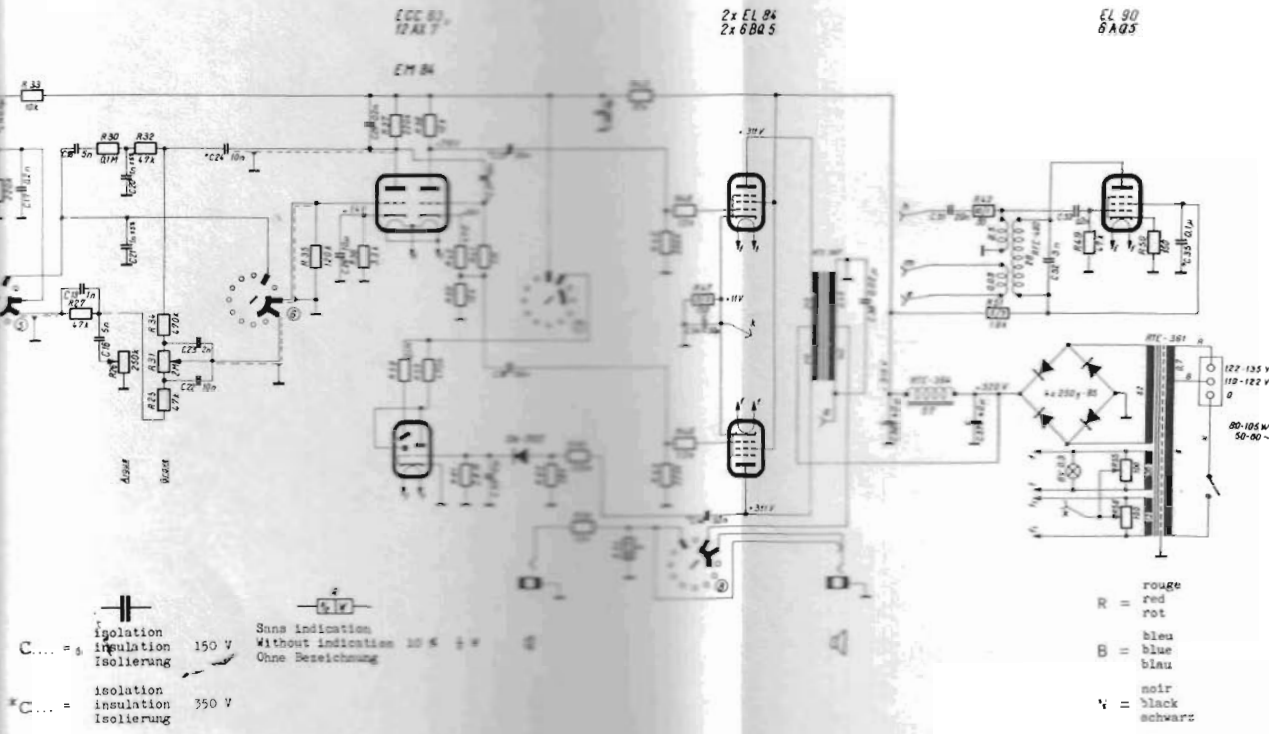
SCHALTBILD DES AS5 VERSTÄRKERS

to operation on

Die zwischen Klammern angeführten Werte verstehen sich für Betrieb auf Stellung MAGN d].

Instrument of 20000 Ω/V.

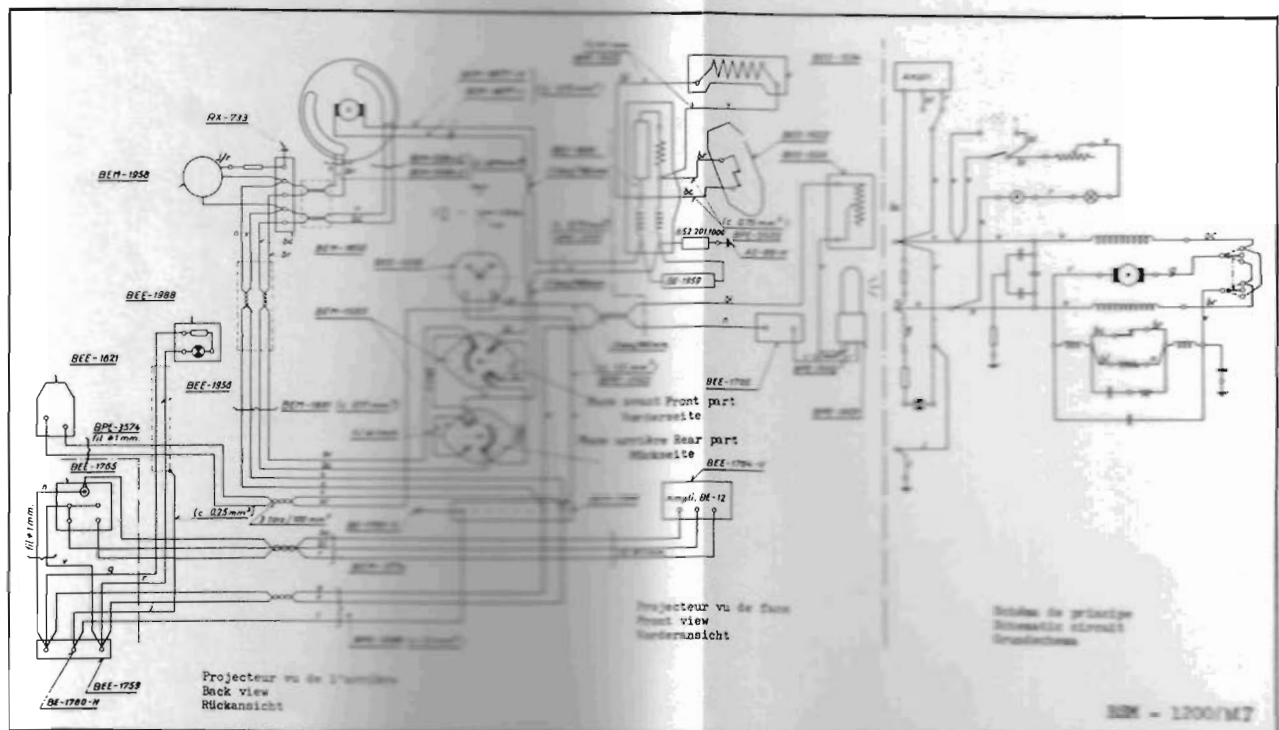
Gleichspannung mit einem Instrument von 20000 Ω/V gemessen.



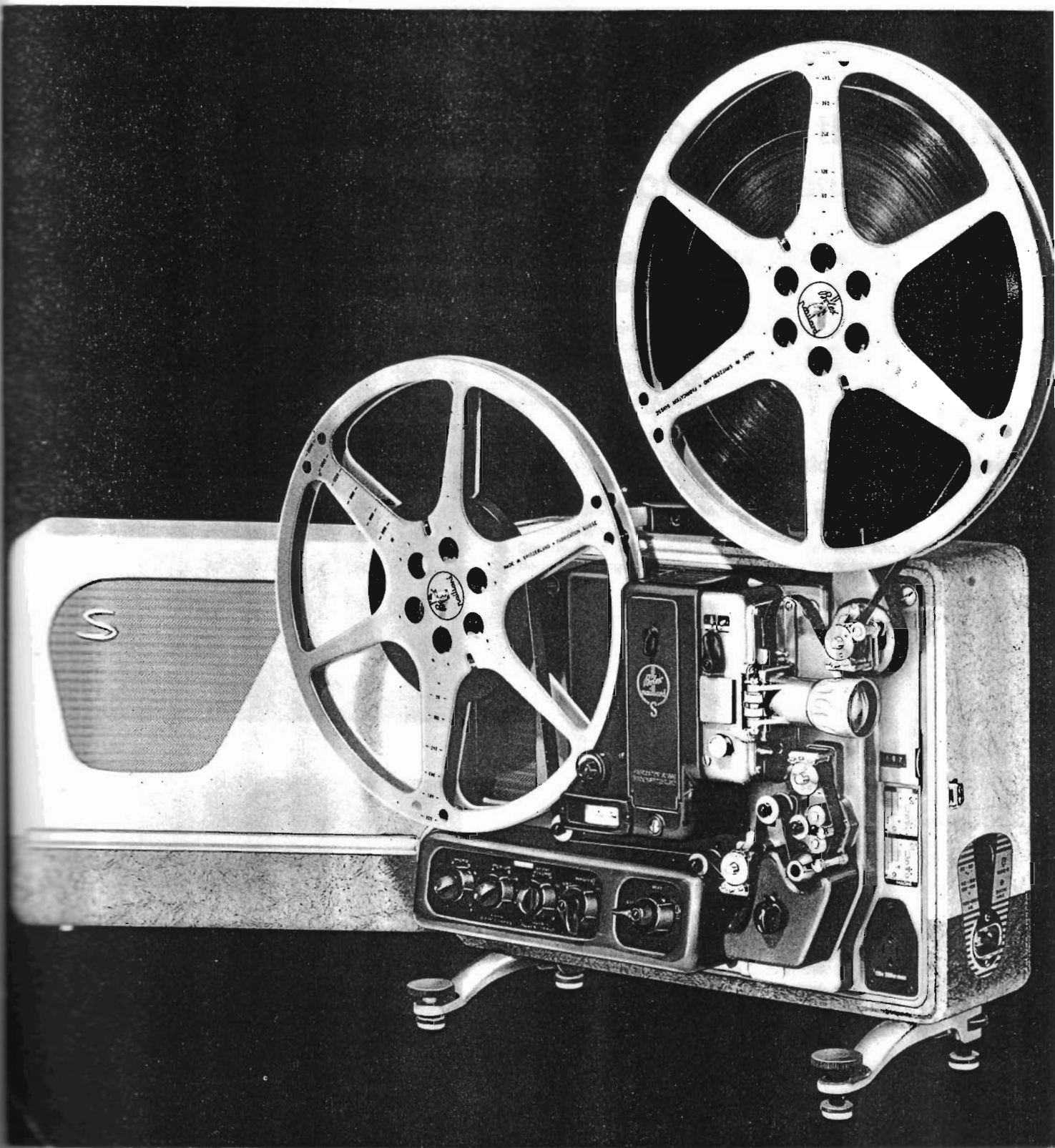
BS - 1133/M 11

WIRING DIAGRAMS - VERDRÄHTUNGSSCHEMATA

Courant fort - Power current - Starkstrom



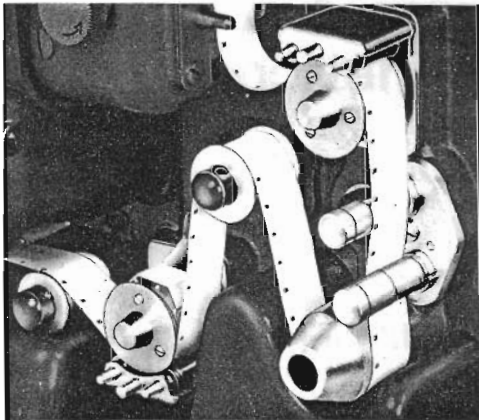
BSM - 1200/M 7



Two 16 mm sound projectors for the industry advanced amateurs and professionals

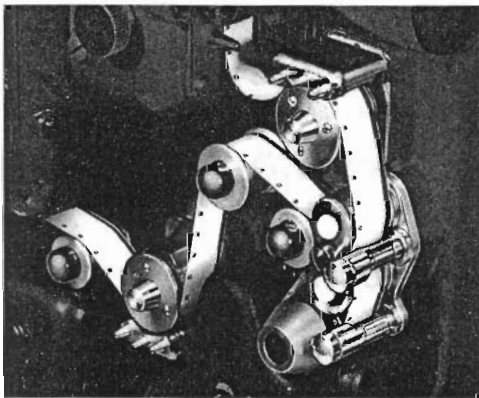
Optimum results — Utmost reliability Ease of operation

The quality and performance of the Bolex S-211 and S-221 sound projectors assure you of a completely faithful reproduction of both sound and picture. They are widely appreciated by professional movie-makers, knowledgeable amateurs and all users of audio-visual techniques, especially in the fields of industry, education and scientific research.



16 mm optical sound projector

- Projects silent films with single or double perforation.
- Projects films with an optical track.
- Can be used as a complete PA system for music and/or narration.
- Permits mixing of an optical sound track with live narration.



16 mm optical and magnetic sound projector

- Projects silent films with single or double perforation.
 - Projects films with an optical sound track.
 - Projects films with a magnetic sound track, single or double perforation.
 - Records, superimposes, mixes, erases magnetic track.
- Already a favorite on the world market this highly versatile projector offers in addition to top quality sound projection all the features required for professional sound recording.

ound because

**The Bolex Projectors
S-211 and S-221
offer you the five most
important features:**

- 1. Hi-Fidelity sound**
- 2. Superb image quality**
- 3. Utmost reliability**
- 4. Greatest film protection**
- 5. Ease of operation**

1. Hi-Fidelity sound because...

Sound heads, amplifier, loudspeaker and mechanical components were designed for each other as a unit, according to the most exacting specifications. Excellent sound quality is due to absolutely constant film movement assured by two massive, perfectly balanced flywheels.

a) Optical sound head. Its careful design yields a faithful reproduction of music, voice and sound effects.

- Frequency range : 50 to 7,000 c/s \pm 3 db.
- High precision scanner.
- Standard 4 V 0.75 amp. exciter lamp fed by 40,000 c/s high frequency current, which eliminates hum. The lamp is precentered and easy to change.
- Large photo-electric cell with elastic suspension, shielded against microphonic effects.
- Focusing knob keeps scanner beam at maximum efficiency, regardless of whether emulsion or base side of film faces sound head.
- Scanner shielded against stray light from valves and other light sources.

b) Amplifier. Of sturdy construction, it was designed specially with the use of a sound projector in mind (choice of first class materials, modern valves, silicium rectifiers). The wiring has to undergo careful testing and the performances are measured to meet exact specifications.

- Frequency range : 30-16,000 c/s, \pm 1 db.
- Audio power output : 15 watts, sufficient even for large auditoriums ;
audio power output 3% distortion : 12 watts.
- Voltage selector.
- Two high impedance inputs : 1) for microphone ; 2) for record-player, tape recorder or radio.
- Two independant input channel controls for mixing and transitional fades.
- Two output channels : 1) for loudspeaker (6 ohms) ; 2) for earphones (50 ohms).
- Volume control.
- Tone control for bass and treble respectively (response characteristic can thus be varied depending on the acoustical characteristics of the room where projection takes place).

— **Use of the amplifier as "Public Address" system.** Used in conjunction with a microphone, record-player or tape-recorder the amplifier-loudspeaker system can also serve as a public address system.

— **During projection :** to add commentary, background music and sound effects to a silent film, or to accompany the music track of a film with live narration ;

— **Without projection :** as a public address system.

c) Built-in loudspeaker. Permanently fitted into the projector cover.

- Output : 6 watts.
- Diameter : 8 inch.
- Supplied with 50 foot cable.

Magnetic sound features of the S-221 projector are described on page 10 "Additional Specification..."



Checking the sound quality of an S-221 projector electronically.

2. Superb image quality because...

Paillard engineers have found ingenious solutions to the four crucial problems that face every designer of projectors ; picture brightness, definition, steadiness of image and freedom from flicker.

- a) **The high picture brightness**, together with an even distribution of the light on the screen, was achieved by creating one of the finest optical-mechanical systems to be found in projectors. Its components are :
- Spherical reflector.
 - Condenser system consisting of three coated lenses.
 - Projector lens of high aperture.
 - Extremely rapid claw pull-down, reducing the moving time of the film.
 - Large diameter shutter, resulting in narrow shutter blades and extremely short shutter time.

- b) **Definition**, sharp and brilliant pictures are, of course, largely the responsibility of the lens.
- Paillard-Bolex projection lenses are fast and fully corrected. They carry the trade-mark "Hi-Fi" exclusively throughout the world and provide clear pictures from corner to corner with maximum contrast and faithful colour reproduction. (*)
 - Mechanical factors also contribute to the quality of the projected image, which is enhanced by the simple original design of the film guide and the precision with which film gate and aperture are machined and mounted. The film, therefore, cannot curl or warp.

- c) **Steadiness of image**, both vertical and horizontal, is the result of :
- High precision film guide system (permanently adjusted)
 - Claw mechanism machined to microscopic tolerances and permanently lubricated. Wear and tear to the mechanism is negligible.

- d) **Flicker is eliminated** with the built-in variable shutter, which by the touch of a button can be set for two or three blade positions, according to the power of the lamp, projection rate, image size, quality of screen and condition of the film. Shutter adjustment can be made regardless of whether projector is running or not.

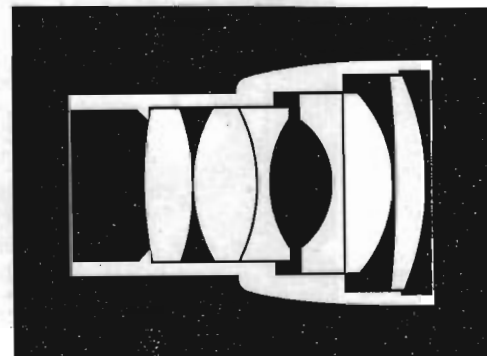
- *) Paillard-Bolex "Hi-Fi" projection lenses are available in three focal lengths :

35 mm f/1.3, code : SOPRO
50 mm f/1.3, code : SOCAN
70 mm f/1.6, code : SOSEP

Also available :

Astro-Kino IV 100 mm f/1.8, code : ASTON

Cross section of the Paillard-Bolex Hi-Fi 50 mm f/1.3 lens.

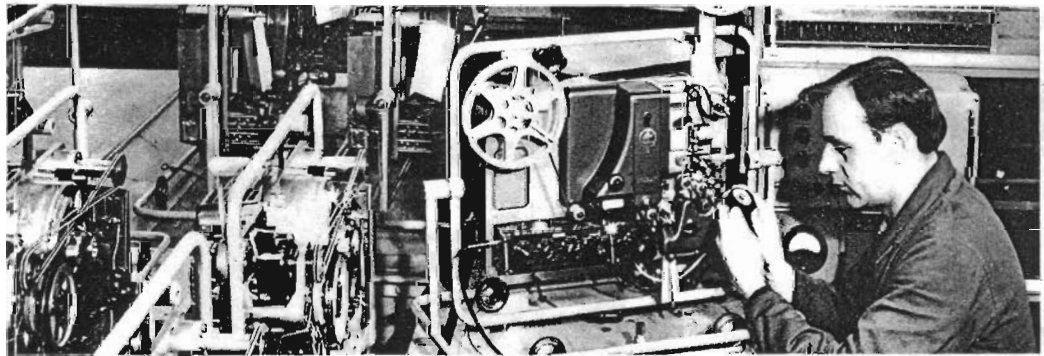


3. Utmost reliability because...

The sound projectors S-211 and S-221 show infinite care in every component, the observance of microscopic tolerances and a carefully planned design down to the minutest detail. Materials of chosen quality guarantee heavy duty performance. The main components are permanently adjusted. All projectors have to pass exhaustive tests during and after assembly.

Here are three specific, significant examples of care in production and main parts control :

- The film gate and pressure plate have to be corrected, machined, polished and mounted with the highest degree of accuracy justified by the limited depth of focus of fast projection lenses.
- The claw is made from extra-hard chrome-plated tempered steel. Its cam is milled to a tolerance of 0.0002" or one twelfth of the diameter of a hair. The claw is tested in the "life test" laboratory during a 1,000 hour test run at 24 f.p.s. representing almost 90 million claw movements. Examination must not reveal any trace of wear.
- Even greater precision, of an order of 0.00004" or one sixtieth of the diameter of a hair, is observed for certain parts of the magnetic sound head. All heads have to undergo final electrical testing of high standards.

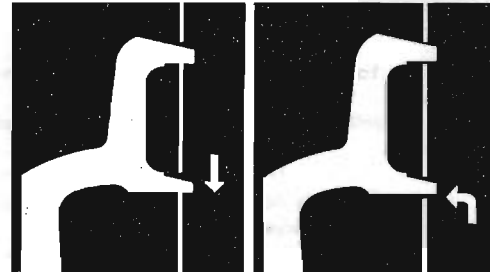


Assembly of the sound heads

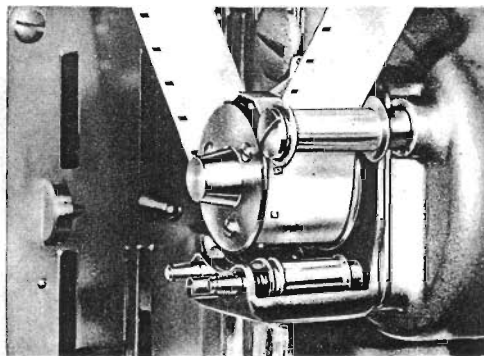
4. Greatest film protection because...

Films, especially originals, are valuable and often irreplaceable documents. With this in mind, Bolex engineers have developed numerous features designed to greatly lengthen the life of your film. Here are some of these features :

- Tension on film remains constant throughout projection – in forward, reverse and rewind – regardless of load on take-up reel.
- Sprockets and guide rollers touch neither frame nor sound track.
- Frame gate and pressure plate are highly polished and precisely positioned. Easy to clean.
- Claw mechanism is precision designed to protect film perforation.
- Optical sound drum is made from anti-magnetic stainless steel, machined with extreme accuracy and polished to a super-finish.
- Film, during run through projector, follows minimum of curves and loops.
- Moderate rewind speed protects film against damage due to excessive friction.



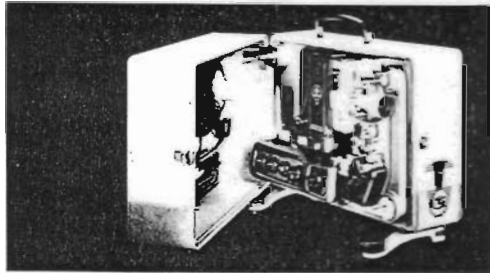
The claw is slightly raised before it leaves the perforation to make sure that it does not scratch against the edge of the perforations.



As an example every projector has to pass the following test : a heavily spliced test film is passed repeatedly through the projector, both forward and reverse, the film, on thorough inspection, should not show the slightest sign of damage, otherwise the projector will not be admitted for shipment.

One basic principle at Paillard-Bolex is safety combined with precision.

5. Ease of operation because...



The S-211 and S-221 are "compact" projection machines in a single "suit case". Although both projectors offer the latest in technical refinement their operation is easy and quiet.

a) Preparing the projector for use

- Cover containing the loudspeaker slides off easily.
- Only one reel arm to swing out.
- Positioning screws for vertical and horizontal adjustment are easily accessible.
- Special outlet for room lamp. Lamp is switched off automatically at start of projection, turned on automatically at end of projection.

b) Film threading becomes a matter of seconds

- Lens holder swings out completely, leaving film gate clear.
- Film is positioned automatically on claw when lens holder swings back to projection position.
- Threading film into sound head is equally easy. Tension on film is adjusted automatically.

c) Operating the projector

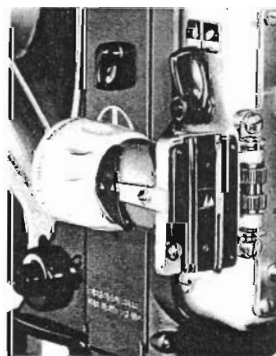
- For operating convenience all controls are grouped on one panel on same side of projector.
- Controls are illuminated.

d) Rewinding

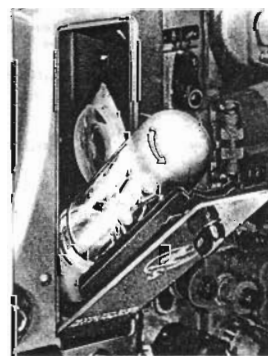
- Is done by switching the motor into reverse, i.e. without interchanging reels.

e) Maintenance presents no problems

- All main components are easily accessible.
- Centralized lubrication system keeps mechanism in prime working order.



Swing out lens holder for easy cleaning of film gate and aperture. Also greatly facilitates positioning of the film. Framing is conveniently regulated by a knurled knob which moves the frame.



Hinged door of lamp house carries projection lamp, which is thus easily changed. Rear surface of condenser also readily accessible for cleaning. Standard projection lamps : 110 volts/1,000 watts, code : BERSO ; 110 volts/750 watts, code : BENGÉ. Micrometric screw for centering lamp. Variable resistance for different voltages. Built-in ammeter to control lamp current.

General Specification of models S-211 and S-221

Dimensions	With cover closed : 20 1/2" x 11" x 16 1/4". With cover removed and reel arm in position (without reels) : 20 1/2" x 9 1/2" x 24 1/4". With cover removed and 2,000 ft. spool in position : 25" x 9 1/2" x 30 1/4".
Weight	55 lbs.
Finish	Two-tone grey enamel finish, metal parts in mat chrome.
Case	Covered with washable plastic cloth.
Power Supply	110-135 volts AC, 50-60 c/s (90 to 265 volts with transformer).
Motor	Series-wound high starting torque. Switch : Four position main switch (STOP, forward without lamp, forward with lamp, reverse without lamp). Automatic return to STOP by simple push button pressure.
Speeds	Variable speed from 16-25 f.p.s. Accurate stabilization by means of governor activated by electric impulses.
Stroboscope	Built-in stroboscope (illuminated) shows exact 18 or 24 f. p.s. speed. Adjustable to 50 or 60 c/s.
Spools	One 2,000 ft. steel reel is supplied with each projector.
Codes	Projector S-211 : SOTOP Projector S-221 : SONOR

Additional Specification especially for model S-221

Magnetic Sound Heads	Manufactured and aligned with extreme accuracy. Cannot damage the picture. Permanently positioned. Extremely wear resistant.
Sound Recording-Play-back Response	Frequency range : 50-10,000 c/s \pm 3 db. Takes full, half and quarter width tracks without special adjustment.
Erase Head	Operates on high frequency magnetic field. Situated next to recording head for easy spot erase.
Safety Device	Special safety device prevents accidental erasure.
Recording Level Controls	Visual by "magic eye" lamp. Audio monitoring by earphones.
Mixing and Transitional Fades	Recording level of the two input channels is controlled by two independent volume controls so that unit can be used for mixing and transitional fades.
Superimposition Unit	Special accessory is available for superimposition of sound effects and narration over previously recorded music for truly professional sound tracks.
Frame Counter	Built-in frame counter is an invaluable aid for recording or when a particular part of the sound track must be picked out quickly and accurately.
Film Path	Separate film paths for optical and magnetic tracks. Optical track cannot be damaged by magnetic heads

Accessories (available separately)

Note: Some of these accessories are supplied with the projector. See price list.



Auditorium Loudspeaker
12" diameter, 15 watts,
50 ft. cable on reel with
permanent contacts.
In handsome lined case.
Sides fold down to form
base. Storage space for
accessories.
Weight 28 1/2 lbs.
Code: SOCOF



Superimposition Unit
(for projector model
S-221 only)
Attenuates magnetic sound
recording and super-
imposes spoken
commentary, music or
sound effects.
Code: SOSUR



**Audio Power
Distributor**
Permits audio power
distribution to auditorium
loudspeaker and built-in
loudspeaker in any proportion
desired.
Code: SOPUI



Earphones
(for monitoring
recording)
Impedance: 50 ohms.
Double channel.
5 ft. cable and jack.
Code: SOECO



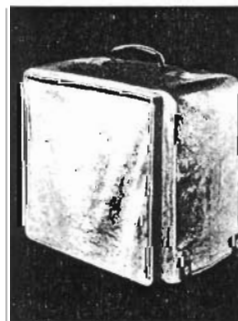
Transformer
Portable: in metal case
with carrying handle
Has 5 different inputs
from 90 to 260 volts, 50
to 60 c/s. Rated
power: 1350 VA. Safety
fuse. 5 ft. long leads.
Weight: 32 lbs.
Code: SOTRA



Reel
Of grey enamelled steel,
non-warping.
Codes:
2,000 ft. reel: BOSON,
same reel with carton:
BOBSI



Microphone
High-fidelity dynamic
microphone. Directional
13 ft. cable with jack.
Code: SOMIC



Travel Case
Of canvas with stiff
bottom. Insures perfect
protection of lined case.
Storage space for two
2,000 ft. reels with card-
board containers.
Code: SOHOU