Film-Tech

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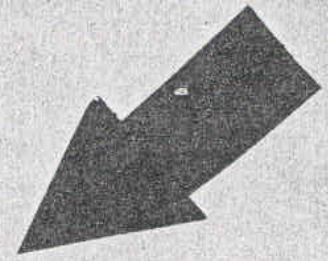


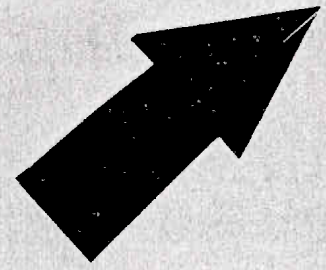
HERE IS WHAT MR. RICHARD F. WALSH, INTERNATIONAL PRESIDENT OF THE I. A. T. S. E. & M. P. M. O:, SAYS—

"We want to pay a special tribute to the Cameron Publishing Company, publishers of the Cameron Handbook for Projectionists, who are now celebrating their 32nd year of publishing books for projectionists, for their cooperation with our members down through these many years.

"Good books are of invaluable aid to both novice and experienced projectionists. No man ever lived who knew as much as he ought to know. When any man reaches a point where he imagines he has all the knowledge he should have, it is a certain indication of his need of it.

"I hope that this new anniversary publication will be as successful as the ones that you have published in the past. I know that the Cameron books have been and will continue to be a great help to members of our craft."

THE CAMERON BOOKS HAVE HAD THE ENDORSEMENT OF THE I. A. T. S. E. & M. P. M. M. O. FOR 26 YEARS!



Since in the final analysis the quality of sound reproduction is largely dependent upon the technique which the projectionist brings to bear upon his functions, his role in the new scheme of things has become an increasingly important one. The public, educated through past experience, has come to appreciate this fact, and its patronage is extended accordingly. The question, "Does the house have good sound reproduction?" assumes only slightly less importance than the star of the picture, or the picture itself, and its reaction to the question, therefore, has a definite economic significance for the projectionist. His value, and indeed his very survival in the business, is predicted upon this ability to turn out consistently smooth reproduction, unmarred by breakdowns or irregularities in the recording. The latter phase requires some sense of artistic appreciation; the former, a comprehensive knowledge of the technical requirements of his equipment, and careful attention to its proper upkeep.

As in other fields, the development of an adequate technique begins with the very ordinary details of routine operation. These must first be reduced to a strict science for in these details the artistry of presentation will have its roots. A procedure is here outlined which may serve as a useful guide to projectionists in the standardization of their daily routine; an orderly method of checking the sound equipment is outlined; and certain troubles which may possibly occur during operation are listed, together with their remedies. Some hints whereby the projectionist may enhance his value through skillful covering up of the defiriencies of the recordings are also given. The installation treated is assumed to be one having both film and disc reproduction.

The projection machines should be thoroughly cleaned of film dust, oil, etc. Special care should be taken to keep the sound gate always clean and smooth, and to prevent dirt from piling up on the rollers in the soundhead. Even a small particle of hardened film on the gate or rollers will cause an unevenness in the progression of the film, which may introduce a chatter into the sound reproduction. After cleaning the machines, thoroughly clean and polish the illuminating lamp and the lens system; the former with a soft, clean cloth, the latter never with anything else but lens tissue, which is especially made for this purpose and will not scratch the lenses or leave lint on them. Examine and clean all openings in aperture plate and tension pad. Dirt or dust on any of these components may result in insufficient illumination with subsequent loss of volume.

LAMP FOCUS

After cleaning has been finished, illuminating lamps of both projectors should be checked to see that they are focussed properly. Vibration of the machine is apt to knock the lamp slightly out of adjustment in the course of a day's run. Also with age, the lamp filament has a tendency to sag, which, of course, changes its line-up with relation to the slit in the lens system; this must be carefully guarded against. Another effect of aging is to blacken the walls of the lamps, resulting in insufficient light getting to the photoelectric cell, even though the lamp is run at its proper rating. For this reason, whenever a lamp becomes noticeably discolored, it should be replaced by a new one.

Any of the conditions mentioned will result in a decrease in volume of the sound, and quality also may be affected.

To adjust the lamp properly, its holding screw is loosened, and the lamp is then turned until its filament is straight with relation to the axis of the lens tube. Keeping this adjustment, the lamp is moved up or down until the filament image is centered exactly on the slit in the lens tube, as observed through the window usually provided for this purpose. Where this arrangement does not obtain, a small piece of white paper may be inserted ahead of the photoelectric cell, so as to center the light upon it. When the filament image is properly centered on the slit in the lens tube, the brightest light will be obtained on this miniature screen. It will be necessary to remove the light gate to the photoelectric cell for this purpose; the paper, or card, is held up against the opening which goes to the photoelectric cell. The light should be observed for shadows at the edges, and if these are observed, the lamp should be moved sidewise, or vertically, as the case may be, until they disappear. In no case should the lamp focus, which is pre-set by the manufacturer, be disturbed. When lining-up has been completed, clean the lamps thoroughly once more to remove dirt or oil from fingers, which may have been deposited on their walls during handling.

AMPLIFER CHECK

The amplifiers are next thrown on and permitted to warm up for a few seconds; in this procedure it should be made standard practice to always throw on the filament switch first before the plate switch is thrown. In shutting down, the reverse procedure should be followed, i. e., plate circuit disconnected first, then the filament circuit. This prevents sudden large surges of electron emission with subsequent damage to tubes.

Meters should be carefully checked to determine whether circuits are normal; particular care should be taken with the plate current reading, as this is in thousandths of an ampere, and even slight deviations from normal are relatively important.

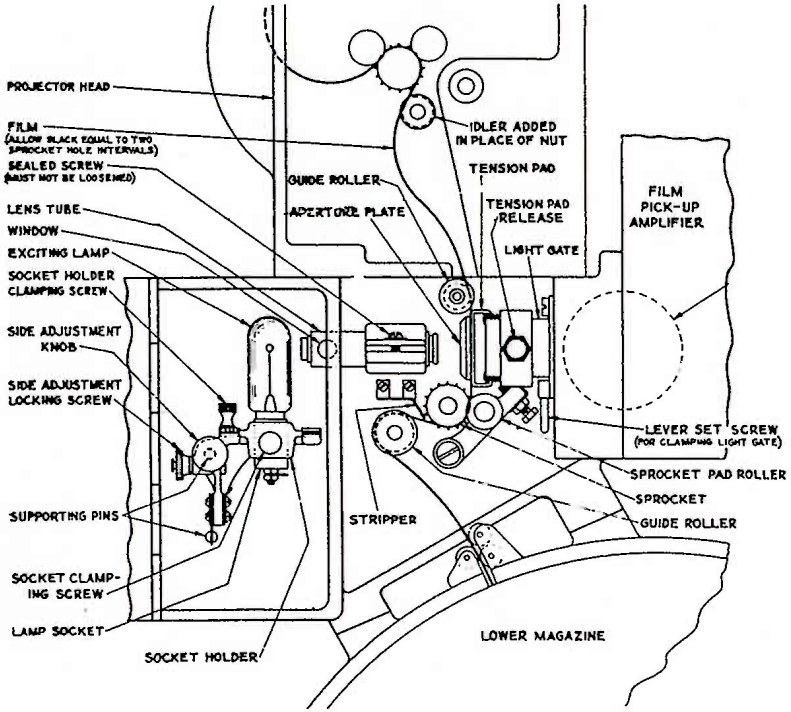
It is an excellent practice to keep a daily log, and thus have an accurate check-up on these readings. After making this check, the system is set up for normal reproduction.

Several test records of good quality—both film and disc—should be kept on hand for the purpose of establishing the daily criterion of performance. The film records need only be a couple of hundred feet long, while the discs can be somewhat longer, if desired, since their cost is about the same regardless of length of recording. The most desirable records for this purpose will be simple vocal solos with violin or piano obligato. For convenience, duplicates should be available so that the projectionist can cut back and forth between his two machines so as to ascertain relative balance in volume, and check possible differences in quality of the respective outputs.

The volume control or fader—if this serves the dual purpose—is always set at the same point each day for this test, and the volume is regulated so that the sound can just be comfortably heard at the rear of the empty house. The projectionist should make this check himself while his assistant runs the machines, or where this is not practicable, he should have a competent observer, perhaps the house manager or owner, assist him.

It is important that the same individual makes the test each day; otherwise it is not of much value. The reason for setting the volume at the lowest possible level, is that

any dropping off from this level will be much more apparent to the ear, than if a larger ratio of sound obtained; the output of the monitoring horn in the booth may serve as an additional check during this test.



Some installations are not provided with adequate checking facilities. If the equipment does not include meters for checking the individual plate currents of the tubes—especially the rectifier tubes—the projectionist will do well to have a reliable radio serviceman come in once a week to take these readings. A log should be kept of the readings, and when any tube falls off from normal reading it should be replaced. This precaution may prevent a number of breakdowns during the performance, and the expense of such service is negligible.

The headphones mentioned for testing circuits are sometimes supplied by the manufacturer of the sound equipment. If they are not, an ordinary pair of radio telephones of 2000 ohms resistance or better will suffice. Solder a 6 inch length of hard drawn copper wire of about No. 8 gauge to each cord terminal; these make a convenient pair of picks for getting across amplifier terminals which may not be easily accessible otherwise. The ends of the picks may be filed down to points, and the picks covered with a length of cambric "spaghetti" for insulation.

A spare photoelectric cell which has been tested in circuit should be kept on hand; it is also desirable to have available a spare disc reproducing unit for quick replacement in case of trouble. Several spare exciter lamps should also be on hand. These may be pre-set during the projectionist's off time by correctly positioning them for the best light, then marking a scratch on their bases which coincides with a reference mark scratched on the lamp collar holder in the projection machine. In case of a burn-out during operation, one of these lamps can be quickly installed without going through the process of lining up and adjusting for correct position.

It should not be necessary to mention the safeguard of having spare fuses available in each fuse box. Fuses have a habit of blowing just when there are not spares available, resulting in unnecessary delay in getting back into operation. The habit of coppering the fuse socket is exceedingly bad practice, and may result in serious damage to the equipment.

A convenient test lamp for the purpose of quickly checking fuses is made of an old socket to which are attached two short lengths of fairly stiff insulated wire; a 25- or 50-watt lamp is the only additional equipment required. Bridging across the fused line—ahead of and behind the fuses—will indicate at once the presence of an open fuse by failure of the lamp to light. Other equipment which the projectionist should have in the booth are an electric soldering iron, several pairs of wiremen's pliers, and several size screwdrivers; these inexpensive tools may prove invaluable to the equipment.

REFINEMENTS OF OPERATION

As mentioned previously, the projectionist's duties do not end with the proper maintenance of equipment; he is responsible also to a large degree for the artistic rendition of the sound accompaniment. Theoretically, this is entirely taken care of in the recording, but unfortunately, under present production methods, the theory does not always square with practice.

In a good many cases abrupt differences in sound level are encountered when changing reels; again, when the closeup of an individual player is shown, quite often the sound level is not increased proportionately, with the result that the closeup illusion is destroyed. Sometimes when some loud, terrifying noise is intended to accompany the action, the relatively small difference in recording levels allowed enfeebles the effect; one hears loud, raucous con-

versation, commands, shouts, then a supposedly huge explosion goes off with only a slightly louder "pop." The result is ludicrous. Equally bad are such effects as footsteps approaching along a gravel path which sound like a herd of pachyderms trampling down a forest of young bamboo, in comparison to the dialogue level.

CUE SHEETS AND MONITORING

Admittedly these are faults of recording which should have been corrected at the source, but with the producers in a rush to catch up with belated release schedules, such irregularities in the sound accompaniment are often condoned. It is up to the projectionist then to smooth these out as much as possible before passing them along to the audience. Careful rehearsal of each new picture is necessary to ascertain where gain manipulation will help the sound, and cue sheets showing these changes in fader settings should be prepared. In order to function intelligently in these manipulations, however, the projectionist must be provided with an adequate monitoring horn in the booth.

It is the writer's experience that in a large percentage of sound installations, the entire purpose of the monitoring horn is nullified, by having it run at too low a level. The primary purpose of this piece of equipment is to act as the criterion of quality and volume of the sound in the house; usually it serves only to indicate that the amplifier in the booth is operative, and to no other purpose. If the monitor is run so low that the noise from the projectors override it, then obviously it will be difficult to detect differences in volume—even fairly large differences—which may occur during the performance.

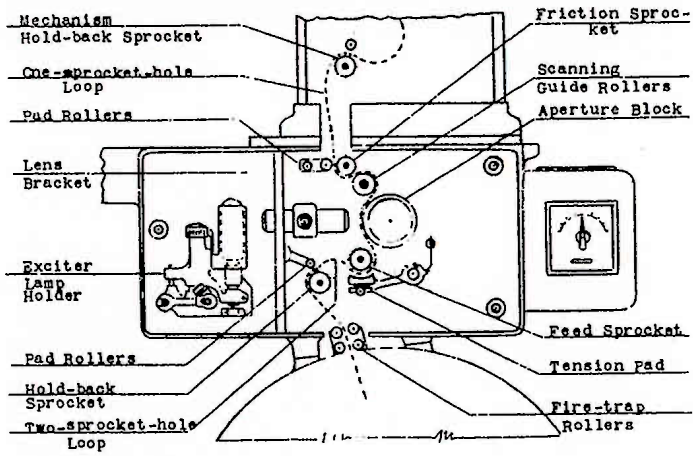
It may be argued that the rehearsals suggested should afford the projectionist an adequate basis for his manipulations, but when such changes must be made on a cue word, it is difficult, if not impossible, to time them accurately when working blind in this manner. The monitor level should be adjusted so that it can be comfortably heard above the noise of the projectors; it should not, of course, be so loud that it will be heard outside of the booth.

The horn should be of the same type used in the house and should have reasonable fidelity of tone. Too much stress cannot be laid upon this matter of suitable monitoring facilities; without them the projectionist is almost entirely isolated from the performance, and cannot be expected to do justice to its artistic requirements. If there is such a lack, it is usually because he has failed to appreciate his dependence upon facilities for smoother rendition of the show. Certainly the average exhibitor will take steps to provide such equipment, when its importance is pointed out to him.

VOLUME LEVEL

One other matter which bears in the same direction, is the tendency to feed excess volume into the house. Probaby more performances are spoiled through the bad reverberation and echo effects introduced thereby, than by any other single factor. The projectionist should fix a level for house conditions of half to full occupancy, and a lower level for empty to half-full house. The sound at these levels should just be comfortably heard throughout the body of the house under both conditions; if anything, the errors should be made on the side of too little, rather than too much volume. The proper amount can, with practice, usually be accurately gauged on the basis of the empty-house rehearsal of each production.

The mistake should not be made of trying to compensate for a few rows of seats in a bad area of the house where the sound is weak, by boosting up the volume to an extent where it interferes with the enjoyment of the patrons in the rest of the house. This is another very common error of practice. In such cases the problem is one of proper sound distribution, and a sound engineer should



be called in to remedy the difficulty.

In all the projectionist will realize that his skill in presentation of the performance is fully as important as that of the technicians who make the picture; in fact, he must be on his toes continually to guard against their errors of omission and commission. This phase of his work will lessen gradually perhaps, as the technique of the recording art is improved. But in the present state of affairs a

large share of the responsibility for maintaining consistently smooth performances is his. To do complete justice to his job, he should have some grasp of the physics of light and sound, and should cultivate the sense of perspective which will enable him to judge the levels of sound necessary to reproduce the proper dramatic effects. The intelligent projectionist will, through study and correct practice, so equip himself. The improvement in his technique of presentation will be reflected in the added popularity of his theatre. Far-sighted theatre owners will not be long in recognizing this asset, and rewarding it accordingly.

BALANCING SOUND PROJECTORS

It is quite possible to have both projectors in first class condition yet both so out of balance that the entertainment is second rate. Assuming that the machines were correctly and carefullly matched at installation they still require frequent testing, for conditions sometimes alter in so short a space of time as a few hours.

When are two sound projectors balanced? Often the reply to this question states when they each give equal volumes from the stage horns. This is true only to a limited extent for there are many points to be considered besides volume.

The prime essentials that must be the same are: (1) volume; (2) quality; (3) speed.

Each one of these items includes both film and disc methods of reproduction. Secondary points which are almost equal in importance are: (4) scratch; (5) surface noise; (6) pickup amplifier tube response; (7) ground noise; (8) photoelectric cells.

The true balancing of machines for volume is not so simple a matter as it may seem at first. A rough ear-test by the monitor will certainly indicate to within a few fader steps the matching but this is not good enough for first rate results.

Before any check for volume is made such projector should be thoroughly tested to ascertain:

(a) That both exciting lamps are in good condition; are carrying precisely the same current (checking the ammeter for zero error) and are both in exact focus.
(b) Both light gates should be cleaned and the lens should be polished.
(c) Photoelectric cells should be in good condition with clean windows.
(d) Plate batteries should not differ in voltage more than two volts.
(e) Pickup amplifier tubes should be carrying precisely the same filament current and give the same emission as checked for in the main amplifiers.
(f) Grid leaks should have clean connections.
(g) All film-disc changeover switches and rheostats should be clean and noiseless in operation except for the usual clean "plop" as they pass from one contact to another. There should be nothing gritty in their action.
(h) Pickups should be tracking properly and have the same drift and be fitted with two new needles of the same type.
(i) Both machines should be thoroughly run in before the test is started.

MATCHING FILM

It is quite common practice to match film by the hiss from the photoelectric cells. This is satisfactory so long as one knows by experience that the cells themselves give the same type of sound. In other words if the volume of the hiss is the same it may be assumed with fair certainty that the machines are matched. On the other hand if the hiss of one is louder than the hiss of the other further tests should be carried out.

If the fader is equipped with a rapid changeover key it will be found very useful to use this instead of the main knob which takes appreciable time to swing from one side to the other.

Two test films must be used. To have only one is almost useless for the ear cannot retain a record of sound intensity for more than a fraction of a second.

The only true way of making a correct balance in volume between both machines on film and disc is to have four copies of the same subject, two on film and two on disc. Then, whichever way the fader is thrown, and whichever way the transfer switch is pushed, the same sound should come over the stage horns.

After the machines have been threaded they should be started simultaneously. To effect this, cord may be connected to the switch of the far machine for it is imperative that one hand set them off. Two persons are bound to make the movement out of phase. As mentioned previously the machines should be thoroughly run-in before the test. The reason for this is that before the oil has been warmed up, experience shows that one machine is almost certain to be

slightly tighter in the bearings than the other, and thus will get out of step.

CHECKING VOLUME

An observer in the hall is often used for checking volume. This is all right so long as the telephone signals are not misunderstood. A better way is to listen from one of the ports which should have the glass removed for the purpose. If the nonsychronous set is near the booth this often affords a very good point of vantage for the observation of tests.

When the volume is matched the quality may still be at variance. An experienced ear will soon detect any difference in frequency response. A common source of trouble is a thin coating of grease over the focusing tube. Tests show that this will greatly reduce the high-frequency response.

Again, faulty tubes or badly matched tubes will sometimes give equal volume but quite different quality. On occasion photoelectric cells behave in a similar manner.

The speed of both projectors must be exactly the same. This may appear a curious statement when most of the better class sets are so governed that speed fluctuation is almost impossible. But the degree of similarity required in speed is extraordinarily high—so high in fact that an ordinary tachometer or revolution counter is useless for testing.

The ear of the ordinary observer will not be offended if the disc runs at thirty revolutions per minute instead of thirty-three and one-third. But at changeovers the thing is different. If the projector thrown in runs the smallest percentage lower in speed than that cut out the whole effect falls flat for the space of a minute or so until the ear becomes accustomed to the new key.

The only satisfactory practical method of checking machine speeds is by use of constant-frequency discs. Reproducers should be set on the same note and the fader operated. The sensitivity of this test it phenomenal and is increased if the power to the motor is cut on and off so as to give a rising and then a falling note.

TROUBLE CHART------PROJECTION.

TROUBLE	PROBABLE CAUSE	REMEDY
NO POWER AT PROJECTOR.	Open switch, blown fuse, no source of supply from mains. Trouble at generator.	Locate trouble by inspextion. See Trouble chart on Generators.
CONTINUED BREAKING OF CONDENSERS.	Condensers in mounts too tight, sudden draft from fan while condensers are hot.	Move position of fan. Loosen condenser mounts.
POWER AT PROJECTOR BUT MOTOR WONT START.	See trouble chart on motors.	See trouble chart on motors
TRAVEL GHOST ON SCREEN.	Light shutter out of time.	Retime shutter.
IN-AND-OUT OF FOCUS EFFECT ON SCREEN.	Objective lens loose in its mount.	Tighten projection lens in mount.
DISTORTION OF PICTURE ON SCREEN.	See trouble chart on screens	See trouble chart on screen
TAKE-UP REEL NOT ACTING PROPERLY.	Incorrect tension on driving belt, or friction discs. Take-up reel in poor condition.	Adjust tension. Replace reel.
OVERHEATING OF MOTOR.	See trouble chart on motors.	See trouble chart on motors
UNSTEADY PICTURE ON SCREEN.	Incorrect tension in film gate. Dirt on film runners or on intermittent sprocket. Film in poor condition. Loss of lower film loop. Badly worn sprockets.	Correct tension. Remove dirt, probably hard emulsion, from film guides. In doing this use a soft metal so that guides will not be scratched. Report condition of film. Replace loop. Replace worn sprockets.
UNEVEN ILLUMINATION OF PICTURE ON SCREEN.	Poor light and uneven light may be caused by a great number of things--screen in dirty condition, screen streaked, dirty lenses, especially the objective lens,-optical train--arc,condensers, objective lens etc, not being in alignment. Spluttering of carbons in arc lamp. Carbons not properly set, or fed.	Locate trouble by inspection. See trouble charts on Arc-lamps--Screens.
CONTINUED BLOWING OF BOOTH FUSES.	Dead short or heavy ground, probably in lamp house.	Use test lamp or test set to locate.
OVERHEATING OF LEADS AND CONDUCTORS.	Wires overloaded.	Locate trouble by inspection and testing.
SPARKING AT MOTOR ON PROJECTOR.	See trouble chart on motors.	See trouble chart on motors
ARC REFUSES TO LIGHT ALTHOUGH TEST-LAMP SHOWS POWER AT ARC.	See trouble chart on arc-lamps.	See trouble chart on arcs.
INSUFFICIENT VOLTAGE WHEN USING GENERATOR.	See trouble chart on generators.	See trouble chart on generators.
TAKE-UP SLIPPING.	Due to excess oil or incorrect tension.	Wipe off all excess oil. Adjust tension.

TROUBLE CHART----SCREENS.

TROUBLE.	PROBABLE CAUSE	REMEDY
DISTORTION.	This may be caused by a great number of things, or a combination of two or more of them. Using the wrong type screen for the size and shape of theater. Hanging the screen incorrectly. Generally caused by placing the projector high in the balcony so that the rays of light hit the screen at too great an angle.	Call in a reliable supply dealer, who will be pleased to give you information regarding the best type of screen for use under the circumstances. If due to the projector being too high in relation to the screen, the only way to overcome distortion is to change the location of projection room. Where the distortion is only evident from the seats on the extreme sides of the theater, this may be lessened by setting back the screen if this is possible.
PICTURE APPEARS TO BE BRIGHT IN FRONT SEATS OF THEATER BUT LESS BRILLIANT THE FARTHER AWAY THE OBSERVER IS FROM THE SCREEN.	Probably due to the use of a matte type screen.	Trouble may be remedied by substituting a reflective or directive type screen. Get advise from supply dealer. However do not install a directive type screen where the projection angles greater than 20 degrees, nor if the theater is a wide one.
LOSS OF REFLECTIVE QUALITIES.	May be due to dirt on the screen surface. Screen may be of the diffusiving type rather than the reflective type and may have been specially recommended for that type of theater.	If dirty clean (see below)
LOSS OF SOUND CONDUCTING QUALITIES.	Probably due to the "pores" of the screen becomming clogged with dirt.	Requires cleaning (see below)
LOSS OF PHOTOGRAPHIC CONTRASTS.	Caused by light other than that from the projector reaching the screen.	Lights in the auditorium should be so shaded that none of the rays reach the screen. It is also advisable to place a border of some dark material around the screen.
DIRTY SCREEN.	All screens will in the course of time gather dirt, some types will soil much quicker than others, while if a screen is tilted to try and overcome distortion, that screen will naturally gather more dirt and dust than one not so tilted.	Use a soft brush and brush the screen surface frequently, making sure that the brush is thoroughly clean. Brush in one direction only, preferably across the entire surface. It is well to use the brush on the back of the screen as well. Do not attempt to brush the surface of a beaded screen.

CARE OF EQUIPMENT

A regular periodic examination of all projection and sound equipment is the best way to keep it in good running order, and to lengthen it's period of usefulness.

This is also the best way to insure against sudden breakdowns, and will greatly assist in getting the maximum results from the equipment.

So that no part of the installation will be overlooked, it is suggested that a certain day each week be set aside for the check-up, and that the examination should be made by using the instructions below.

PROJECTION EQUIPMENT

SPROCKETS. Check for badly worn teeth, see that all sprockets are properly aligned, check for "backlash," see that they are securely mounted.

FILM IDLERS. Check for correct tension, see that they freely rotate, and that they are free from dirt and film emulsion.

MAGAZINES. Check to see that the magazines are in alignment with path of film travel, so that there is no undue tension on the film. Check spindle to see that this is not bent or unduly worn. Inspect valve and trap, see that these are clean, check rollers, see that these rotate freely, see that the valve is securely fastned to magazine. Check the film reels to see that film will run off and on these without undue friction. Tighten all screws. Check tension.

TAKE-UP. Check for proper tension on disc or driving belt or chain. Check for excess oil and dirt. Examine condition of belts.

MECHANISM. See that the "head" is securely fastened to the projector stand, and that it is aligned with lamphouse.

FRAMING DEVICE. Check to see that this is in working order and that the tension is correct.

FILM GATE. Check the film runners for proper tension, remove any film emulsion on runners. Examine runners for excessive wear. Clean aperture plate and aperture, remove all dirt and film scraps from behind film gate aperture plate. Check automatic light shutter.

INTERMITTENT MOVEMENT. See that movement is correctly timed. Check oil bath or oil plunger. Check

to see that both contains proper amount of oil. Check movement for backlash. Check to see sprocket is in correct alignment with path of film travel. Check teeth on sprocket.

OBJECTIVE LENS. See that the lens surfaces are clean and free from finger marks. Check to see that you are using "matched lenses." Check to see lens is correctly and securely set in mount. See that lens mount is secure and free from vibration.

ROTATING SHUTTER. Check to see that shutter is correctly timed. Check shutter shaft to see that this is not bent and that it rotates freely. Check for backlash.

GEARS. Check these for excessive wear, see that all gears mesh without binding, check for backlash.

LUBRICATION. Remember wherever there is friction there must be lubrication, check all oiling parts on projector. Wipe off all excess oil. Do not lubricate while machine is in motion. Lubricate pad rollers and gears. Do not over lubricate, and keep oil off all surfaces that do not require it.

FIRE SHUTTER. Inspect mechanism of fire shutters for correct operation.

SYNCHRONIZING MARKS. Check these marks on the intermediate gear, on the vertical shaft gear and on the intermittent movement flywheel to see that they are all in their correct operating relation.

MAKING REPLACEMENTS. When installing new parts like sprockets or intermittents, etc., first carefully read the directions, which will be found in Cameron's Motion Picture Projection.

PRECAUTIONS. Do not turn projector head by shutter shaft, this is apt to damage the gears, use the flywheel.

When projector is not in use, leave all pad rollers, lateral guide roller and film gate OPEN, this will help avoid "flat" spots and weaking of the film gate tension. Use a cloth to cover the head of the projector when sweeping up the floor of projector booth. Dust getting onto your gears and other working parts will greatly lessen the life of your equipment.

ARC LAMP

LAMP HOUSE. Check for carbon dust and stubs. See that lamphouse is clean and that all parts calling for lubrication are oiled or greased.

WIRING CONNECTIONS. Go over all connections, especially those leads that are located wherever heat is generated. Examine condition of all lug terminals, and the insulated bushings through which the leads pass.

ARC FEED MOTOR. Check for proper feeding speed. Overheating. See that the motor runs without binding.

ARC FEED CONTACTS. Check for dust and dirt. Check to see if they are "pitted" or corroded.

BRUSHES. Check to see if these need renewing, see that they make proper contact and that the brush tension is correct.

CARBON CONTACTS. Check for dirt, especially carbon dust, see that they are not worn or "pitted." Keep surfaces as smooth as possible.

ARC FEED MECHANISM. Check for dirt and see that mechanism is lubricated.

CARBON FEED ADJUSTMENT. Check to see that this adjustment is set so that carbons are fed at correct speed. Check for dirt and carbon dust.

OPTICAL TRAIN. In the lamp house this train may be considered to be made up of the source of light, the reflector (if used) and the condensers. Check to see that these elements are in correct focal alignment. In making this check up, it would be as well to consider the complete optical train, to the above, add the gate aperture and the objective lens — all these elements must be correctly positioned to obtain maximum screen results without waste of electricity.

CONDENSERS. Check to see that these are of correct size and combination. See that they are not mounted too tightly in mounts. Check to see that surface facing arc is not pitted. Check to see that no direct draught of air can reach condensers.

PROPER SPACING. Check to see that spacing between arc, reflector and condensers is correct. See that both lateral and vertical adjustments are properly set.

CLUTCH ON FEEDING ADJUSTMENT. See that this is acting properly so that carbons are being fed at a steady, even and correct speed.

CARBONS. Check to see that proper sizes are being used for amount of amperage being used. Check to see carbons are perfectly dry. Check to see that your supply of carbons is sufficient for immediate use.

LUBRICATION. Lubricate all moving parts inside lamphouse SLIGHTLY, do not overoil. The arc control motor bearings should be oiled once a week with a

FEW DROPS of oil, over oiling here will cause you trouble. The arc control commutator should be cleaned once a month, by wiping with a clean rag with a little vaseline.

EXHAUST DAMPERS. These should be cleaned of all carbon ash and dust once a month.

BURNING AT CORRECT CAPACITY. Suprex arcs should not be operated at less than the rated capacity, this will lead to trouble.

REFLECTORS. Check the surface to see that it is not badly pitted, that reflector is correctly positioned. Check for correct focal length. Reflectors used in Suprex type lamps gather a white scum, and this scum can cut down some 25% of your light. The reflectors should be cleaned with Bon Ami every day prior to the show. Use an old razor blade to remove the particles that are pitting the surface of the reflector. Remember that all light must reach your screen by way of the reflector, and that it is MOST IMPORTANT to see that the reflector is kept clean at all times.

SOUND HEAD. Check sound output from both projectors to see that volume is about equal. Check for any foreign noises. Check sound output for quality. Check output volume. Thoroughly clean the sound track in the sound head. Check to see that the exciting lamp, photoelectric cell and slit are in perfect alignment. See that lamp is properly focused. Check exciting lamp for normal meter reading. See that glass bulb is not discolored and that filament is not sagging. Check pads for tension. Check photoelectric cell for normal meter reading. See that cell is correctly mounted. Clean sprockets and check for excessive wear. Check all electrical connections see that these are all secure and making good electrical contact. Wipe off all excess oil, keep oil off all glass surfaces. See that clearance between pad and pad rollers and the sprockets is equal to two thicknesses of film. Check position of film strippers. Check the lateral guide rollers. Check and clean the sound take-off mechanism.

FADER. Check contacts to see that they are clean and that good electrical contact is made. Check for correct fader setting. Check wire connections. Check the operation of the relay contacts by manually operating each relay slowly. The relays should make contact on one side before breaking contact on the other. See that relay armature is positive in its closing and opening action, energize the relay coil with a 5000 ohm resistor temporarily in series with it. The armature should close instntly and remain closed until the coil is de-energized, then the spring action of the contact blades should return the armature to its normal open position.

MONITOR SPEAKER. Check connections, see that the speaker is correctly positioned. Check for volume level and quality sound output.

AMPLIFIERS. Check all meters to see that circuits are normal. Check condition of all tubes. Check tube prongs, see that same are clean and free from oil or grease. Check the tube sockets, see that the tube prongs and socket springs make good electrical contact. Go over all wiring, see that all connections are secure, check condition of terminal lugs. Check wiring for overheating. Check amplifiers for normal volume output. Check amplifiers for quality sound output. Check for foreign noises. Check socket voltages, and make sure that tubes of correct rating are being used. Remember two millivolts read on the test meter equals one milliampere of plate current. Examine all carbon type resistors for breaks. Examine wire-wound resistors for breaks, and to see that they are making good electrical contact. Check transformers for overheating. In replacing transformers, care must be used to see that maximum shielding is obtained. Check over the wiring diagram of the amplifiers you use, so that you can easily trace out the various circuits.

SPEAKERS. Check over the position of speakers and baffles, see that these have not been thrown off their proper position. Check wiring connections. Check for internal mispoling. Check for external mispoling. Check to see that speakers are securely mounted, especially where they are continually being moved as in theaters giving stage shows, etc. Remember that where there is more than one speaker being used on stage that all the speakers must be "in phase." Check for quality sound output. Check for volume output. Check field supply. Check condition of stage cables.

SPROCKETS, ETC. Check the condition of the sprockets, idlers and film pads, using the same procedure as already given for the projector head.

TUBES. Some tubes used in amplifiers require a pre-heating. See that the manufacturers directions are followed. Operate all vacuum tubes in keeping with the instructions supplied by the manufacturer. The life of the tube depends upon your cooperation and abiding by these instructions.

GENERATORS

Check wiring for overheating, this either shows overload or that wiring is not large enough, check to see manufacturers suggestions regarding wiring.

Check to see that generator is free from vibration, caused either by insecure foundation, or bent shaft, or rubbing together of pole pieces.

Check alignment of motor and generator, see that couplings are secure.

Keep commutator clean, see that brushes make good electrical contact.

Lubricate as per the directions of manufacturer.

Keep all abrasive dust and dirt from all moving parts of generator, cover the generator with a protective cloth while sweeping the floor.

When trouble shows up in generator, look up the pages covering the servicing of generators in Cameron's handbook.

LENSES

Keep surfaces of all lenses clean, and free from finger marks. See that the lens is secure in its mount and free from vibration. See that mount is secure and free from vibration. Use only a good quality lens tissue cleaner so that glass surfaces will not be scratched.

SCREENS

Dirt on the screen will prevent maximum sound reproduction and will greatly cut down the amount of reflected light.

Every month brush the surface of the screen with a soft, long-haired brush, and do not use this brush for any other purpose. Keep the hair of the brush covered when not in use. In brushing, brush one way only, and apply very little pressure. Watch the results so that the surface of the screen is not marked.

Keep the stage floor clean, so that dust is not started on its way to the screen surface each time the stage curtains are opened or closed, and see that these curtains do not "swipe" the screen in opening or closing.

If a vacuum cleaner is used on the screen, make sure that the nozzle does not make contact with the screen's surface, it should be held an inch or two away from the screen to avoid marking it.

PROJECTOR RECTIFIERS

Copper Oxide rectifiers should always be operated at the correct recommended rating.

Periodic inspection should be made to see that the cooling fan is in good operating condition, and that all bearings are properly lubricated.

LUBRICATION

The intermittent requires no individual lubrication. It is fully automatically lubricated from the rotary lubricator which is constantly being supplied with oil from the reservoir.

CHANGING SPROCKET INTERMITTENT

Remove the quarter panel X-1005, Figure 2, relieve film stripper X-1959 by removing screw P-1000 and swinging sub-casting X-1903 toward the rear of projector Figs 2 and 3.

Back out the left hand threaded sprocket retaining screw X1-1109 about a quarter of an inch by turning to the right.

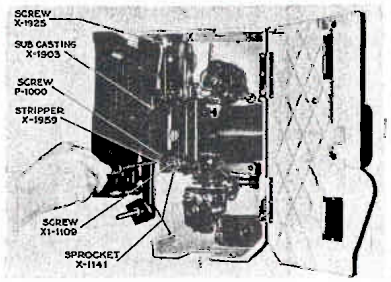


Figure 2.

Place the middle and forefinger of the right hand one on either side of the sprocket behing the outer flange and the thumb on the head of the screw. By pulling on the sprocket with the fingers and pushing inward on the head of the screw with the thumb, the sprocket will loosen from the shaft and come out as far as the screw head. See Fig 3. Remove screw X1-1109 and slide sprocket from shaft.

In replacing, make sure that the locking lugs on locking plate X1-1108 fit into the slots on the end of the shaft before screw X1-1109 is tightened firmly
Do not use extreme pressure as this is unnecessary.

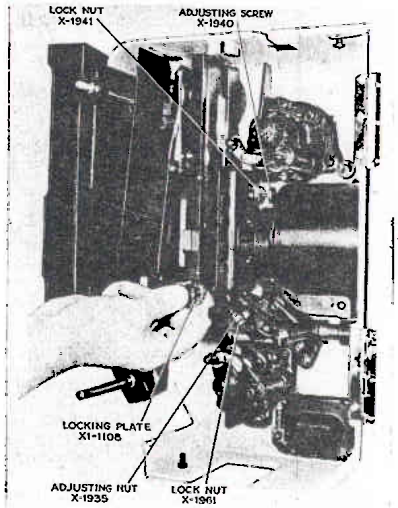


Figure 3

REMOVING INTERMITTENT

Remove intermittent sprocket. Remove gear side cover X-1002, and gasket, X-1003. Loosen the locknut P-154, and back off screw X1-1112, releasing the steel clamp, X1-1111, which holds the intermittent assembly in place. See Fig 4.
Move the steel clamp upward about ¼ inch by placing a screwdriver under screw X1-1112 and lifting. At the same time grasp the intermittent with the right hand as shown in diagram and pull it forward with a slight twisting motion.

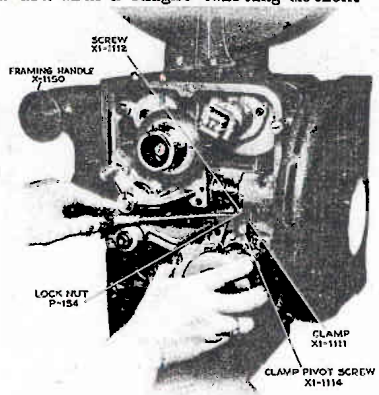


Figure 4

After pulling the intermittent movement slightly forward the steel clamp X1-1111 can be released and the intermittent completely removed by pulling forward with a slight twisting motion and at the same time rocking the framing knob X-1150

REPLACING INTERMITTENT

Hold up the steel clamp X1-1111 and insert the outer sleeve of the intermittent assembly into its main frame bearing. Make sure that the hole in the yoke arm X-1114 engages with the intermittent aligning pin X-1174. Diagram 3.
Grasp the intermittent flywheel X-1128 and exert a slight inward pressure while rocking the flywheel until the intermittent drive gear meshes with the gear X-1714, and the locking key, X-1135, contacts the main frame or enters its key way in the main frame mounting bearing.

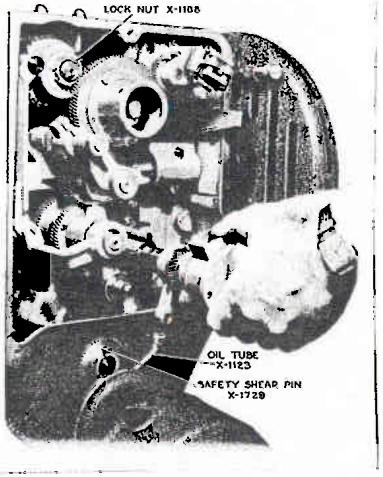


Figure 5

BRENKERT BX-40 & BX-80 PROJECTORS

REPLACING INTERMITTENT Continued

If the key does not enter its bearing, a slight rocking of the framing knob, X-1150, while exerting an inward pressure on the intermittent assembly will cause the key to engage.

Tighten the screw X1-1112, in the spring clamp X1-1111, until a slight back pressure is felt on the screw driver, and then lock screw back in position with lock nut, P-154.

Replace gear side cover and gasket. Make sure that both the gasket and the surface of the projector case are wiped free of oil and dirt. Replace the intermittent sprocket. Replace the quarter panel.

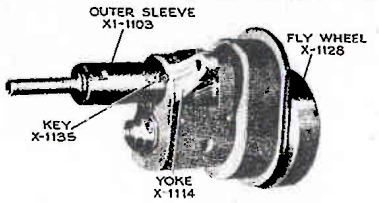


Figure 6

REMOVING LOWER SPROCKET ASSEMBLY

Remove film stripper X-1219, by removing the two screws P1035 Remove the three mounting screws, P-1000, which hold the assembly to the main frame.

Grasp the under side of the sprocket X-1207, and pad roller bracket X-1215, and exert up and down, and sideward pressure to free assembly from the main frame. Pull out assembly.

REMOVING LOWER SPROCKET

Relieve film stripper X-1219, Fig 4, by removing the front, and loosening the rear screws P-1035.

Remove the left hand thread screw, X-1231, by turning to the right.

Hold pad rollers X-1222, away from teeth of sprocket, and pull the sprocket from the shaft by hand.

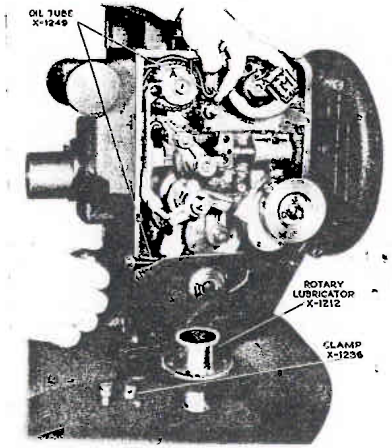


Figure 7

PAD ROLLER ADJUSTMENT

To alter the pressure of the tension spring, X-1221, the pad roller assembly must be removed by backing out screw X-1217, Fig 4, and carefully bending the spring as desired.

Proper clearance between pad rollers and sprocket has been adjusted at the factory by means of hardened stop screw, P-1039, and lock nut P-155.

Should it become necessary to readjust this, three thicknesses of standard film can be used as a guage.

REMOVING PAD ROLLER

To remove pad rollers, X-1222, first remove screw, P-63, and then lift locking key plate X-1225.

By pulling on studs X-1223 and X-1224, the rollers will drop out. Clean with a tooth brush or other small brush. Use Carbona, Kerosene or Naphtha.

Wipe dry and replace by reversing the procedure. Make sure that the locking plate, X-1225, fits into the slots in shaft X-1223 and X-1224, Fig 4.

REMOVING UPPER SPROCKET ASSEMBLY

Remove the cover from the drive side of projector.

Remove the gear assembly, X-1212, by first removing the slotted cap nut X-1011, Fig 5, when removing this gear make sure that the Woodruff key, P-1079, is in an upward position, other wise it might fall out and drop into the oil reservoir.

The position of the key should be determined, after the slotted cap nut, X-1011 has been removed, by checking the position of the key slot in gear hub, X-1212, Fig 5.

If the key is not in an upward position turn the complete mechanism manually by either the motor handwheel or the flywheel.

Do not attempt to turn the mechanism by using the flywheel on the intermittent movement.

Remove the screw, P-78, and clamp, X-1236, Fig 5, which hold the oil tube, X-1294, in place. Take care not to drop them into the projector.

Remove the film stripper, X-1220, by removing the two screws P-1035.

Remove the three mounting screws, P-1000 which hold the sprocket assembly to the main frame.

Grasp the underside of the sprocket, and pad roller bracket, and exert alternate up, and down and sideway pressure to free the assembly casting from the main frame.

In replacing this unit, the reverse procedure as outlined above should be followed.

For instructions on the removal of sprocket, or the removal, cleaning and adjustment of the pad rollers, refer to other chart.

Under no conditions should excessive force be employed in carrying out these instructions.

Great care should be exercised to see that the parts are in no way damaged during the operations.

BRENKERT BX-40 & BX-80 PROJECTORS

SHUTTER SHAFT UNITS

Details of construction and assembly are shown in Figure 6, for BX-40 and in Figure 7, for BX-80.

The BX-80 shutter is a double disc type, rotating in opposition, that cuts the light beam in the center of the picture frame aperture. This produces a better defined picture and it passes more light to the screen.

SHUTTER ADJUSTMENT BX-80

An adjusting stud, X-1433, is located in the upper center housing on the operating side of the projector. This is the only adjustment that is necessary in the shutter shaft assembly. Figures 6 & 7. It is used to remove travel ghost that might have occurred when shutters were timed by hand.

The adjustment allows 6 degrees shutter movement either way when adjusting screw is exactly in the center of travel.

SHUTTER BLADE TIMING

The only time this adjustment should be necessary is after the intermittent assembly has been removed and replaced.

Remove the quarter panel and the shutter housing, X-1007 Fig 1, Set the slotted adjusting stud X-1433, at the center of its travel.

Refer to Figure 7, and note that the two shutter blades are mounted on flanged hubs, X-1418 and X-1421 of different diameters. The inner blade, X-1450A is mounted on the larger hub, and the outer blade, X-1450B, on the smaller hub.

Do not disturb the set screws, X-1429 which hold the shutter hubs to their respective shafts. The shutters cannot be timed in this manner due to fixed counterseats in each shaft.

Rotate the projector mechanism manually until the intermittent sprocket justs starts its pull-down motion.

Loosen the screws P-1036 and P-1032, one turn each so that the blades can be moved indepently on their hubs without disturbing the intermittent setting or moving the mechanism. Looking at the rear of projector the inner shutter blade (the one with the large hub) moves in a counterclockwise direction and should be rotated in that direction until it divides the aperture plate opening in half.

Tighten the two screws, P-1032. If they cannot be reached rotate the outer shutter blade until they come in view. Move the outer shutter blade (the one with the small hub) in a clockwise direction until the lower edge of the shutter blade coincides with the top edge of the inner shutter blade. See Fig 7.

Tighten the two screws, P-1036 in the outer hub.

Check this adjustment by turning mechanism by hand several times and notice whether the edges of the inner and outer shutter blades are meeting exactly in the center of the aperture as the intermittent sprocket starts its pulldown movement. If this occurs then the shutters are correctly timed.

If a slight"travel ghost" appears when the picture is projected it can be removed by turning the adjusting screw X-1433, clockwise if travel ghost is moving upward, or counterclockwise if moving downward.

Replace shutter housing and quarter panel.

Should the shutter blades be accidentally bent at any time, they can be quickly removed and replaced by means of the set screws X-1429, without disturbing the timing.

REMOVAL FILM TRAP DOOR ASSEMBLY	Open the film trap door, remove the knurled fastening nut at the top and bottom of the door. Install the replaing Film Trap Door.
SHORT TENSION PAD REPLACEMENT	Remove the film trap door. Remove the four film trap door casing fastening screws and seperate the casting and door plate. Remove the top tension pad fastening screw, bushing, spiral spring, spiral spring retainer and the tension pad. Install the replacing pad and reassemble with the fastening screw. Reassemble the film trap door and reinstall in the projector.
LONG TENSION PAD ASSEMBLY REPLACEMENT	Remove the film trap door. Remove the four casting fastening screws and seperate the casting and door plate. Remove the two tension Pad fastening screws, tension bushings, spiral springs, spiral spring retainers and the tension pad assembly. Install the replacing pad assembly and reassemble with the fastening screws. Reassemble the film trap door and reinstall in the projector after checking the positioning of the film tension pad adjusting arm.
FILM TENSION PAD ADJUSTING ARM REPLACEMENT	Remove the film trap door. Remove the four film trap door casting fastening screws and seperate the casting and door plate. Loosen the upper tension adjusting arm pivot screw and lock nut and remove the film tension adjusting arm. Install the replacing arm and reassemble. Adjust the arm pivot screws so that the fork at each end of the arm is centered with respect to its associated tension pad fastening screw and tighten the lock nut. Set the film tension knob in extreme counterclockwise position. Each of the forks on the arm should just contact the associated film tension pad bushing. Form the forks carefully, if required, to obtain the desired positioning. Reinstall film trap door in the projector, check for picture steadiness and set the film tension knob as required.
INTERMITTENT TENSION SHOE REPLACEMENT	Remove the film trap door. Remove the intermittent tension shoe fastening screw, tension shoe and positioning plate. Replace parts as required, and reassemble. The word "Front" on the tension shoe must be visible after the door is installed. Reinstall the film trap door and align the Intermittent tension shoe and intermittent sprocket.
INTERMITTENT TENSION SHOE INTERMITTENT SPROCKET ALIGNMENT	Place a straight edge across the outboard face of the intermittent sprocket and the outer face of the tension shoe. Loosen the tension shoe fastening screw and slide the tension shoe as required for exact alignment.
FILM TRAP DOOR OPERATING LEVER ADJUSTMENT	The film trap door should close positively when the latch is released. If movement of the operating lever in a counterclockwise direction further closes the film trap door, additional spring tension on the operating lever should be obtained as follows; Remove the projection lens. Remove the film trap door.

FILM TRAP DOOR Continued	Insert a pin in one of the holes in the spring tension collar on the operating lever shaft and loosen the locking screw in the bottom of the operating lever assembly bracket. Rotate the collar clockwise by means of the pin, until the next succeeding hole in engaged by the locking screw as it is tightened. Install the film trap door and check closure. Repeat the adjustment procedure until proper tension is obtained.
FILM TENSION CONTROL ASSEMBLY REPLACEMENT	Remove the film trap door. Remove the tension adjusting screw in the bottom of the film trap door casting. Carefully retain the spring and ball bearing that are in the tapped hole in the casting. Remove the film tension control cam and knob retainer plate fastening screw, retainer plate and knob. Peplace parts as required, reassemble and adjust.
FILM TENSION CONTROL ASSEMBLY ADJUSTMENT	Turn the tension adjusting screw in the bottom of the film trap door casting, as required, to obtain positive detent action in all positions with smooth and free rotation of the film tension knob.
FILM TRAP ASSEMBLY REMOVAL	Remove the film trap door. Loosen the single captive film trap fastening screw, remove the film trap and make sure that the contacting surface on the main frame and the film trap are clean. Slide the replacing film trap in so that it registers with the two dowel pins on the main frame, depressing the fire shutter reset button at the same time, and tighten the captive screw securely. Operate the reset button a few times to make sure that the fire shutter is working properly. Check the alignment of the film trap guide edge and the intermittent sprocket.
FILM TRAP GUIDE ROLLER REPLACEMENT	Remove the film trap. Loosen the two guide roller pivot set screws at the rear of the film trap casting. Slide the two guide roller pivots out of the casting and remove the guide rollers and spring. Replace parts as required, reassemble and align. Reinstall the film trap.
FILM TRAP GUIDE REPLACEMENT	Remove the film trap. Remove the six guide fastening screws and the guides. Replace guides, reassemble and align. Reinstall the film trap.
HEAT SHIELD REPLACEMENT	Remove the film trap. Remove the three heat shield assembly fastening screws and the assembly. Replace parts, reassemble and reinstall the film trap.
FILM TRAP GUIDE AND GUIDE ROLLER ALIGNMENT	Place a straight edge along the Guide edge of the film guide and extend to the fixed roller above. Loosen the two guide roller pivot set screws and slide the guide roller pivots as required, until the film guide surface of the fixed roller is in exact alingment with the guide edge of the film guide. Tighten the pivot locking screws and check alignment

FIRE SHUTTER ADJUSTMENT	Remove the sop sight box. With the fire shutter closed and against its stop on the rear of the film trap, loosen the two fire shutter operating arm adjusment plate fastening screws, and adjust the operating arm adjustment plate so that it just clears the top of the fire shutter operating rod. Tighten the two fastening screws. Remove the gear compartment cover. Hold the governor in its operating position manually. Loosen the fire shutter adjusting collar fastening screw, and rotate the adjusting collar until the bottom of the fire shutter just clears the top of the picture aperture, then tighten the fastening screw. Check the operation of the fire shutter by holding the Governor in operating position and releasing. Readjust if necessary. Depree the fire shutter reset button to check its operation, then reassemble.
HEAT BAFFLE REPLACEMENT	Remove the spot sight box. Remove the heat baffle fastening screws from the rear or intermediate baffle, as required, and the baffle. Replace parts and reassemble.
INTERMITTENT ASSEMBLY	Open film trap door, Turn the framing knob to extreme counter-clockwise position. Set the shutter adjusting knob in mid-position. Set the knob correctly. Remove the gear compartment cover and be sure that no foreign material is deposited in the compartment while the cover is off. Rotate the vertical shaft, until the intermittent drive gear fastening screw is accessible. Remove the screw and slide the gear downward. Loosen the two intermittent retaining clamp fastening screw on the framing cam and rotate the clamps to clear the intermittent case. Withdraw the intermittent assembly from the gear compartment taking care not to strike the intermittent oil feed tube just above the intermittent case. When Simplex X-L projectors are installed in a Drive-In Theaters, the intermittent oil feed tube should be removed. Slide the replacing intermittent assembly into position as the keyway in the case is aligned with the key in the framing cam. Rotate the intermittent retaining clamps to retain the intermittent and tighten the fastening screws securely, Reinstall the Intermittent Oil feed tube in Drive-In theater installations. Remove the spot sight box, then depress the fire shutter reset button so that the fire shutter clears the Picture aperture and time the shutter. Align the intermittent sprocket with the film guide edge. When these adjustments are made, the instructions should be thoroughly understood by the projectionist before the job is started. We suggest that the instructions be read through prior to beginning the work.

SIMPLEX X-L PROJECTOR

TIMING	Rotate the shutter counterclockwise (from rear of projector) until its leading edge is exactly in line with the upper edge of the picture aperture (Aperture just completely blocked) Rotate the intermittent flywheel so that the intermittent sprocket turns clockwise until one of the four index lines on the outboard bearing collar is in alignment with the index line on the outboard bearing casting. Continue to rotate the flywheel in the same direction until the intermittent sprocket just begins to move. Reverse the rotation of the flywheel until the sprocket stops then turn the flywheel counterclockwise until the start of rotation of the sprocket is felt. Continue to rotate the flywheel until the precise point, at which the sprocket is about to move is obtained and retain that setting. Raise the intermittent drive gear and rotate tooth by tooth until it meshes with the intermittent driven gear and at the same time the mounting hole in the drive gear and in the shaft are in alignment. Do not rotate the vertical shaft or intermittent drive gear.
INTERMITTENT SPROCKET REPLACEMENT	Remove the film trap door and the film trap. Turn the framing knob clockwise until the stripper fastening screw is accessible. Remove the screw and the stripper. Turn the projector so that one of the index lines on the outboard bearing collar is in alignment with the index line on the outboard bearing casting and retain the setting. Remove the intermittent sprocket fastening screw and nut. Loosen the two outboard bearing thrust collar fastening screws and the bracket. Remove the intermittent sprocket. Slide the replacing sprocket on the shaft, being sure that the "Simplex" trademark is direct reading when viewed from the outboard end of the shaft. Position the outboard bearing bracket with the two fastening screws finger tight. Adjust the bracket, as required so that the bearing is precisely centered with respect to the intermittent shaft and tighten the fastening screws. Fasten the intermittent sprocket to the shaft with the fastening screws and nut. Slide the outboard collar on the shaft with one of its index lines in alignment with the index line on the outboard bearing casting. Pull the sprocket forward and at the same time, press the Collar inward to avoid end play. Tighten collar fastening screws securely and check for just perceptible end play. Reinstall the film trap and align film trap guide edge and intermittent sprocket. Reinstall film trap door, align the film tension shoe with the intermittent sprocket if necessary. Do not try and force new parts into position. If the work is done correctly all the parts will fit without the use of excessive force.

SIMPLEX X-L PROJECTOR

UPPER FEED SPROCKET ASSEMBLY.	Remove the four feed sprocket assembly fastening screws and withdraw the assembly as a unit from the film compartment. Reinstall the assembly with the four fastening screws finger tight. Position the assembly so that there is just a slight back lash between the meshing gears. The four mounting holes in the assembly bracket are sufficiently oversize to permit this adjustment. Tighten the fastening screws securely. Check back lash and readjust if necessary.
UPPER FEED SPROCKET REPLACEMENT	Remove one feed sprocket stripper fastening screw, loosen the other and rotate the stripper to clear the sprocket. Open the pad rollers. Remove the hexagonal sprocket fastening screw on the outboard end of the feed sprocket shaft and slide the sprocket from the shaft. Slide the replacing sprocket on the shaft with the key pin and keyway in alignment and secure with the sprocket fastening screw. Insert the stripper fastening screw and tighten both screws.
UPPER FEED SPROCKET PAD ROLLER ASSEMBLY	remove the feed sprocket assembly as a unit. Open the pad rollers, compress the actuating spring on the sprocket assembly so that the small hole in the forked spring guide is accessible and pass a pin (paper clip will do) through the hole to relieve the spring tension. Remove the pad roller assembly fastening screw and pad roller or rollers as required. Replace parts as necessary, reassemble and remove the pin. Position the pad roller arm adjusting screw on the sprocket assembly casting, so thatm with two thicknesses of film between the sprocket and pad rollers, both pad rollers just rotate. Be sure that the adjusting screw lock nut is then tightened securely. Reinstall the sprocket assembly and adjust for back lash.
Shutter Replacement	Remove the spot sight box. Loosen the two swivel mounting pin fastening screws on the dowser and withdraw the flexible shaft from the hole in this pin. Remove the five rear cover fastening screws and the cover. Loosen the two shutter clamping screws and remove the shutter. Set the shutter adjusting knob at mid-position. Turn the projector by hand, in the direction of normal rotation, until one of the four index lines on the intermittent outboard bearing collar is in alignment with the index line on the outboard bearing bracket. Continue to turn the projector in the same direction until the intermittent sprocket stops, then turn in the other direction until the start of rotation of the sprocket is seen. Continue to turn the projector until the precise point, at which the sprocket is about to move, is obtained. Slide the replacing shutter on the shaft to the shaft bearing, set so that its leading edge (counterclockwise rotation from the rear of the projector) is exactly in line with the upper edge of the picture aperture. Tighten two screws.

BRENKERT BX-60 PROJECTOR

CORRECT POSITION OF TENSION SPRING	Loosen the two screws which attach locking cam to the gate operating link. Force the locking arm to its extreme forward position toward the front of the main case. Snug up the two screws which attach the locking cam to the gate operating link. Close the gate and tap the locking cam and operating link to its extreme downward position. Tighten the two screws and replace lens mount.
REMOVING TENSION SPRING HOLDING SHAFT.	Remove the film pressure pad retaining plate. Remove the 4 screws which attach the springs to the shaft. Drive out the pin which attaches the arm to the shaft. Drive out the pin which holds the shaft in the gate easting. When replacing the shaft, make sure that it revolves freely in its mounting holes.
ADJUSTMENT OF SPROCKET PAD	Adjust the split cap nut on the intermittent sprocket pad for the quietest running of film. The normal adjustment for this pad is to screw the split cap nut on the threaded stud until the top of the nut is flush with the end of the stud. It should not be necessary to change this adjustment after it is once set.
REMOVAL OF PICTURE APERTURE	The picture aperture plate can be removed by pulling it toward the rear of the projector and then straight out of its housing. When replacing this aperture it will simply be necessary to move the light shield toward the rear of the mechanism and simply slide the picture aperture into position.
MAIN DRIVE GEAR UNIT	The main drive gear unit couples the gear train in the projector mechanism to the soundhead. To remove the complete drive assembly, proceed as follows; Drain the oil from the projector mechanism. Remove the oil cover. Remove the intermittent unit. Remove the gear cluster. Remove the intermediate drive gear and shaft. Rotate the drive gear assembly until the small end of the taper pin is pointing upward and then drive it out. Pull out the main drive shaft and the gear. The gear will then be free and can be removed. To remove the bronze bearing, remove the three screws and pry the bushing loose.
CLEANING.	Keeping the projector mechanism clean is one of the best ways of assuring highest quality projection. The interior of the film compartment is large and roomy, ample space is provided between all units to facilitate rapid and thorough cleaning. The projector mechanism should be cleaned daily, before the show starts. A clean rag and a small brush is all that is needed. Keep the film trap and the gate assembly clean and free from all dirt and film emulsion, care should be taken when cleaning between the film guide rollers and the film trap main casting to remove all dirt and foreign matter which may prevent their operating freely. Failure of the inner roller to turn when the film is passing through the trap may result in it becoming cut by the edges of the film.

TIMING SHUTTERS Double Shutters.	Remove the quarter panel, the rear shutter blade housing, and the front shutter housing. Remove the brass plug from the front shutter support casting and using the special manual shutter timing tool, set the hand timing screw at the center of its travel. Release the shutter blades in their flanges by loosening the screws so that each shutter blade can be turned in its flange without the shutter shaft turning. Turn the projector over slowly by hand until the intermittent sprocket justs starts to move. Move the front and rear shutters in their flanges, being careful not to turn the shutter shaft, until the upper edge of the rear and front blades exactly cut across the center of the picture aperture and projection lens respectively. Tighten the screws in the shutter blade flanges. Be careful that the shutter blade does not move in its flange or the shutter shaft turn when tightening these screws. Replace the front and rear shutter guards and the quarter panel. Project a picture on the screen, preferably one with titles, and check carefully for any trace of travel ghost. If a little amount of travel ghost is noticed on top of the picture turn the hand timing adjusting tool to the right. If noticed on the bottom, turn the screw to the left. If the travel ghost cannot be eliminated by adjusting the hand timing tool it will be necessary to retime the shutters again. Remove the tool and replace the plug in the front shutter shaft support casting.
OIL PUMP	Whenever the oil is changed the oil filter screen in the gage retaining housing should be removed and cleaned. This can be done as follows; Remove the cover from the oil pump by first removing the screws. Remove the bronze screen from the bottom of the pump and clean thoroughly with kerosene. Insert the screen in its housing in the cover and replace the cover on the oil pump. Make sure that the gasket is in good condition and attached properly to the cover when it is replaced; otherwise an oil leak may develop.
LATERAL GUIDE ROLLER ASSEMBLY	The lateral film guide roller assembly can be removed very easily without removing the complete film trap assembly from the main frame, by following the procedure below; Remove the quarter panel and shutter guard. Loosen the screw which clamps the guide roller center pin and pull the center pin out of its bearing. Remove the guide roller assembly from the film trap casting.
REPLACING FILM SLIDE STRIPS	Remove the film trap from the main frame. Remove the eight screws which attach the slide strips and film guides to the film trap casting. Install the new film slide strips and the film guides, snug up the attaching screws only but do not tighten them. Press the inner film guide firmly against the locating pins and tighten all four attaching screws evenly, making sure that the film guide does not move away from the locating pins. Insert the film guide adjusting gage between the film guides. Press the outer film guide snugly against the side of the gage and then tighten all four attaching screws evenly.

BRENKERT BX-60 PROJECTOR

UPPER FILM SPROCKET UNIT	Remove the cover from the gear side of the projector. Remove the oil distributor from the upper sprocket drive gear. Remove the upper sprocket drive gear assembly by loosening the two Allen set screws which attach it to the sprocket shaft. Remove the screw and clamp which attaches oil tube to the main casting. Take care not to drop these small parts into the oil reservoir. Remove the film stripper on the film side of the mechanism by removing the two screws. Remove the three mounting screws which hold the sprocket assembly to the main frame. Grasp the under side of the sprocket and pad roller bracket exert an alternate upward and sidway pressure to free the assembly from the main frame. Pull the unit out of the frame.
REMOVING PAD ROLLER BRACKET	The upper pad roller bracket assembly can be removed as a complete unit by removing the retaining screw and pulling the bracket assembly off its mounting stud. The pad rollers and the pad roller shafts can be removed from the bracket by removing the screw, turning the shaft in a clockwise direction and then pulling it from the bracket. The shaft can then be pulled out of the bracket and the pad roller will then be free from the bracket.
TIMING SHUTTER (Single Shutter)	Remove the quarter panel and the rear shutter blade housing. Remove the brass plug from front shutter support casting, and using the special manual shutter timing tool, set the hand timing screw at the center of its travel. Release the shutter blade in its flange by loosening screws so that the shutter blade can be turned in its flange. Turn the projector over slowly by hand until the intermittent sprocket justs starts to move. Move the rear shutter in its flange, being careful not to turn the shutter shaft, until the upper edge of the shutter blade cuts the upper right corner of the picture aperture when looking across the edge of the shutter from the rear of the mechanism. Hold the automatic fire shutter in its upward position when setting the blade. Tighten the screws in the shutter blade flange and replace the shutter guard and quarter panel. Project a picture on the screen preferably one with titles, and check carefully for any trace of travel ghost. If a slight amount of travel ghost is noticed on the bottom of the picture, turn the shutter timing tool to the left; if noticed at the top, turn the screw to the right until the travel ghost disappears. If the travel ghost cannot be eliminated using the hand timing tool, it will be necessary to retime the shutters again. Remove the tool and replace the plug in the front shutter shaft support casting.
REMOVAL OF LENS MOUNT	Remove the lens clamping screw in the film compartment. Remove the four screws which attach the lens mount to the front of the main frame. Remove the lens mount by lifting it through its mounting hole in the front of the main frame.
FRICTION ADJUSTMENT ON FOCUSING SCREW	The friction on the focusing screw is adjusted by means of the clamping screw. Tighten this screw until the desired tension is obtained when turning the focusing knob.
IDLER GEAR ASSEMBLY	To remove idler gear assembly, loosen the screw at the rear of the projector main frame case and pull the assembly out

ADJUSTING FRAMING ARM AND GEAR SECTOR

Remove the retaining ring from the framing arm casting. Pull the framing arm and gear sector assembly from its casing until it disengages with the framing gear. Turn the framing knob counterclockwise until the collar on the timing screw is about 1/8-inch from the main housing casting. Swing the framing arm and gear sector clockwise until it hits the stop pin closest to the front of the mechanism.

Mesh the framing gear sector with the framing worm gear, and make sure that the gear sector is kept as close as possible to the pin. Attach the retaining ring to the framing arm casting. Turn the framing knob to make sure that the framing arm assembly can be moved from one stop to the other. Make sure that this assembly hits the stop pin at each end of its excursion and that when the framing knob is turned to its maximum counterclockwise position the collar is approximately 1/8-inch from the front of the main frame casting.

LOWER FILM SPROCKET UNIT

Remove the film stripper and locking spring. Remove the three mounting screws which hold the assembly to the main frame. Grasp the under side of the sprocket and pad roller bracket and exert alternately an up and down and sideward pressure so as to free the assembly from the main frame. Pull the assembly from the main frame.

REPLACING LOWER SPROCKET ASSEMBLY

Clean the mounting surface on the center frame of the main case and sprocket assembly and apply a thin film of "Titeseal" to both of these surfaces. This is to prevent oil leaks. Insert the gear end of the assembly into the locating hole in the center frame so that the drive gears mesh properly.

Align the three mounting holes in the sprocket assembly with the three tapped mounting holes in the center frame and then press the assembly firmly into position. Apply a thin film of "Titeseal" to the threads of the three mounting screws and then screw them evenly and firmly into their holes. Replace the film stripper and spring.

REMOVING THE PAD ROLLER BRACKET ASSEMBLY

The lower pad roller bracket assembly can be removed as a complete unit simply by removing the retaining screw and pulling the bracket assembly off of its mounting stud.
The pad rollers and the pad roller shafts can be removed by removing the screw, turning the shaft assembly in a counterclockwise direction and pulling it out of the bracket. The shaft can then be pulled out of the bracket.

PAD ROLLER ADJUSTMENT

Loosen the nut on the pad roller bracket. Move the pad roller bracket to its open position and wrap three thicknesses of film around the sprocket so that the sprocket teeth engage correctly with the sprocket holes in the film.

Close the pad roller bracket against the periphery of the sprocket and adjust the screw on the pad roller bracket until the pad rollers barely come in contact with the film. The pad rollers should be far enough away from the periphery of the sprocket so that they do not touch two thicknesses of film and barely touch the film when three thicknesses are used.

REMOVING LOWER FEED SPROCKET

Move the film stripper away from the sprocket by removing the front screw and loosening the rear screw.

Move the pad rollers bracket to its open position.

Remove the sprocket retaining screw. This screw has a left-hand thread and must be turned to the right to remove it.

Pull the sprocket off of its shaft.

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REMOVAL OF INTERMITTENT SPROCKET.

To remove the sprocket proceed as follows:
Remove the quarter panel. Bend the film stripper away from the sprocket. Turn the projector over manually to make sure that the intermittent is in its locked position. Back out the left hand threaded retaining screw about quarter of an inch by turning it to the right.

Place the middle and the forefinger of the right hand on opposite sides of the sprocket hub behing the outer flange, and the thumb against the sprocket retaining screw. By pulling on the sprocket with the fingers and pushing inward on the head of the screw with the thumb, the sprocket will loosen from the shaft and come out as far as the screw.

Remove the screw and pull the sprocket from the shaft.

REMOVING COMPLETE INTERMITTENT

Remove the intermittent sprocket as shown above. Remove the gear cover. Loosen the lock nut and the back oof the screw releasing the steel clamp which locks the intermittent in position.

Lift the steel clamp out of its casting with the left hand; using the right hand, pry the intermittent loose with a screwdriver placed so that it is resting on the main gear assembly shaft with the blade pushing the intermittent out.

When the intermittent is loose in its holding casting, swing it clockwise so that the lower casting clears the main frame and then pull it directly out.

REPLACING INTERMITTENT

Lift the steel clamp upward out of its casting. Insert the sprocket shaft housing in the intermittent holding casting; make sure that the hole in the yoke arm engages with the intermittent aligning pin.

Press the intermittent into its casting until the main casting of the intermittent unit is directly against its holding casting. Press the steel clamp downward so that it drops into the retaining slot in the intermittent sleeve/ Tighten the screw in the steel clamp and lock in place with the nut.

Replace gear side cover and gasket. Make sure that both the gasket and the surface on the main case are wiped free of all dirt and oil. Replace the intermittent sprocket and bend the film stripper back into proper place. Retime the light shutter Replace the quarter panel.

ADJUSTING SPROCKET SHAFT END-THRUST

Remove the intermittent from the projector mechanism. Remove the oil scoop assembly. Loosen the Allen screw in the star wheel shaft thrust collar. This collar can be reached by inserting a 3/32 inch Allen wrench through the round hole in the intermittent sprocket sleeve.

Hold the star wheel tightly against the face of its bushing while at the same time pressing the thrust collar against the face of the bushing. Tighten the Allen screw in the thrust bearing. Replace the intermittent in the mechanism and retime the shutters.

ADJUSTING CAM SHAFT END-THRUST

Remove the intermittent unit from the mechanism. Loosen the two Allen head screws attaching the steel gear to the cam shaft Set the intermittent unit on its flywheel and tap the face of the gear snugly against its thrust bearing using a drift punch. Tighten the two Allen set screws attaching the steel gear to the cam shaft.

Turn the intermittent over manually several times to make sure that there is no binding. Replace the intermittent and retime the shutters.

INSERTING INTERMITTENT MOVEMENT

Make sure that the case of the movement is clean, and that the surface of the synchronizing cam into which it fits, C Plate 105, is also clean. Oil both lightly as a precaution against rust. The procedure to be followed will differ slightly, according to whether the movement to be installed is a new one or an old one that is to be replaced.

INSTALLING NEW INTERMITTENT

Take off its flywheel. Slide the movement into place from the operating side, lining up the guide lines B, Plate 105, so the guide lines on the movement to be installed and the guide lines on the framing cam coincide perfectly. Push the movement home when the small dowel pin in the framing cam will match up with the hole in the movement prodived to receive it. Be careful to see that flywheel gear and large micarta gear are properly meshed while performing this operation.

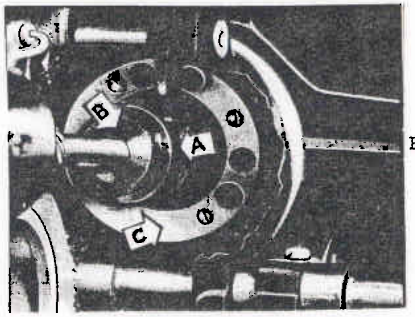

PLATE 102

REPLACING OLD INTERMITTENT

A movement that has been taken from the mechanism and is to be replaced, is slid part way into the synchronizing cam. Line up the guide lines roughly, deferring accurate alignment until later. At the operating side look for an "O" mark on the intermittent gear hub, and a corresponding "O" mark or dot on the micarta gear that meshes with the intermittent gear.

Rotate both gears until the teeth indicated by these "O" marks are in contact with each other. Now push the movement all the way into the synchronizing cam.

Leaving the gears at the drive side properly meshed, as indicated by the "O" marks, return to the operating side and rotate the movement in the cam until the guide lines are perfectly matched and push the movement home.

INSERTING INTERMITTENT MOVEMENT

The movement is now ready to lock in place. This is done by means of the wedge-shaped clamps on the driving side, all three of which are swung down into the slots provided for them on the intermittent casting.

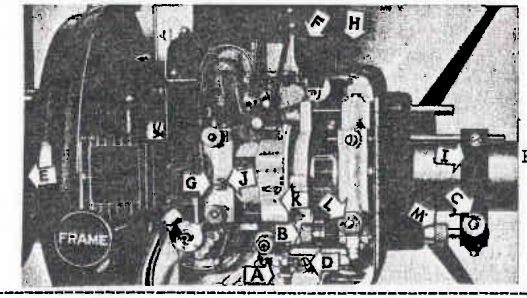

PLATE 103

INSERTING INTERMITTENT MOVEMENT. Continued

The holding screws are then tightened. The flywheel is replaced on the intermittent shaft, the key in the flywheel fitting into the guide groove on the shaft. The flywheel clamping screws A, are tightened evenly. The rear casting of the housing, the film gate, film trap and spot sight box are now replaced. In the case of a new movement it is still necessary to "time" the shutters. It is as well, even when replacing an old movement to check the shutter to see that it is correctly "timed".

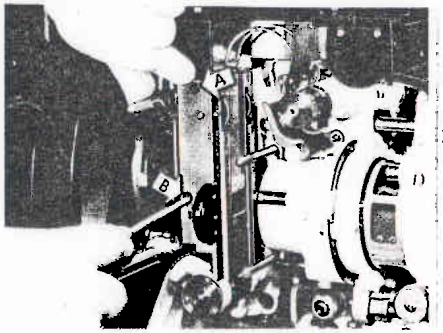

PLATE 104

TIMING THE SHUTTERS

Loosen shutter adjusting slide fastening screw. Turn the shutter adjusting knob at the front of the projector, under the exterior lens collar, until the shutter synchronizing device lock screw D, Plate 103, is in approximately central position in its slot. Remove the aperture plate.
Loosen the lens collar locking knobs C, Plate 103, and remove the lens and air deflector slide E, Plate 103, then loosen both clamps on both front and rear shutters, leaving the shutters free to turn on their shafts. Remove the spot sight box.

Insert the shutter aligning barrel in the lens holder with the knurled screw toward the front shutter. Lock it in place with the lens collar locking screws. Insert the shutter aligning shaft in the aligning barrel with the grooves toward the front shutter, lifting the fire shutter out of the way and being care ful not to strike the aligned shaft against either front or rear shutter blades.

Line up the narrow grove in the shaft, the one nearest the front of the shaft, with the front of the aligning barrel. When this is done, and the knurled screw is tightened down, the lower end of that screw will enter the wider of the two grooves on the shaft, holding the shaft in place, but leaving it free to rotate even when the knurled screw has been tighted.

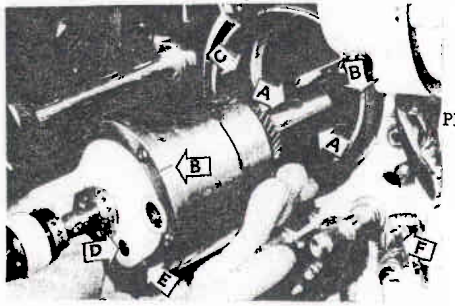

PLATE 105

TIMING THE SHUTTERS Continued

Rotate the shaft until its flat extension faces downward. Set the movement in its locked position by turning motor flywheel. Take the intermittent indicator and hold it vertically with the diamond-shaped end upward. Slip the diamond over the axis of the intermittent sprocket shaft, which protudes beyond the double bearing arm.

Turn the mechanism over by hand, in the normal direction, very slowly, watching the lower end of the intermittent indicator. Stop when the indicator just commences to move.

Grasp the rear shutter by its hub clamp, and turn it until the edge of one blade, either blade, comes up against the flat extension of the shutter aligning rod. Be sure that the shutter is free so as not to turn the mechanism. While turning the shutter knob, push it toward the projector, to assure that it will remain clear of the shutter guard. Lock the shutter in this position.

Turn the front shutter assembly similarly until the edge of either blade comes up against the flat extension of the aligning rod, making sure the shutter remains centered with reference to its guard, so it will not rub. Lock the front shutter in position.

Remove the shutter aligning devices from the lens holder and remove the intermittent indicator. Replace the aperture plate, spot sight box and lens, and refocus the lens. A slight readjustment may be necessary to eliminate travel ghost.

TAKING OUT INTERMITTENT MOVEMENT

Remove the spot sight box, film gate and film trap. Remove right back drum cover, which is just below the film trap. This casting is held by three kurled thrum screws, two along the bottom edge, half way up the inner edge is the other. When these thumb screws have been loosened, draw the casting toward you.

At the non-operating side, loosen the clamping screws in the outer rim of the intermittent flywheel, then remove the flywheel by drawing it off the shaft. Now refer to A, Plate 106, three wedgeshaped clamps hold the movement, and in turn are held by three screws, one of which is in contact with the screwdriver in Plate 106. Loosen all three screws till the clamps swing freely. It is not necessary to remove any gears.

The third screw, hidden in Plate 106, behind the intermittent gear, can be exposed by operating the framing knob.

Swing the three clamps clear of the movement, relock the screws tightly to prevent the clamps dropping back into their previous position. Returning to the operating side, set the gate opening lever in open position, lift the fire shutter, and draw the movement toward you as shown in Plate 105.

REPLACING THE UPPER FEED SPROCKET

Take out the spot sight box, the gate and film trap.

Ten with a short screwdriver, reach through the hole in the upper sprocket shoe and remove the fastening screw from the sprocket hub.

The gear and shaft can then be drawn out from the driving side. Be careful not to lose the thrust washer. The sprocket is lifted clear and the shaft is slid back into place through the hub of the new sprocket. The fastening screw is then replaced. While this screw is being tightened down, the gear and sprocket are pressed toward each other to leave approximately .002 inch end play. Replace the gate, trap and box.

SIMPLEX E-7 PROJECTOR

REPLACING LOWER FEED SPROCKET

Remove the housing casting below the film trap.

With a short screwdriver, loosen the screw that holds the upper stripper stud in the main frame casting, tilt the stripper out of the way.

Remove the fastening screw in the sprocket hub, and draw the sprocket off the shaft. The new sprocket should be slipped all the way in, leaving only approximately .002 inch end play, and the fastening screw made tight with the sprocket in this position.

The shaft may be pushed in from the non-operating side through a hole in the large main drive gear. The stripper is tilted back into place, care being taken to see that it just clears the sprocket hub and its fastening screw.

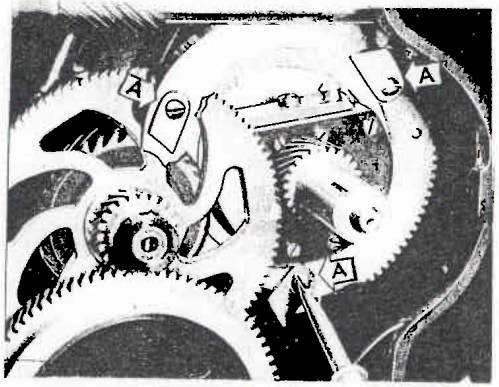

PLATE 106

REPLACING THE LOWER SPROCKET PAD ROLLER

Loosen the lower sprocket and roller arm stud screw F Plate 105 and draw screw and stud toward you. The pad roller arm can then be taken out.

Loosen the holding screw of the shaft of the roller to be removed, after which the shaft, with its roller, can be drawn out of the arm. Insert the shaft in the new roller and replace in the arm. Allow the roller about .005 inch play, and tighten the shaft holding screw. Replace the arm in the mechanism and restore the arm stud and the holding screw.
At the top right of the arm will be found a hexagonal bolt and lock nut. Adjust these for exactly two thicknesses of film clearance between sprocket and the left roller.

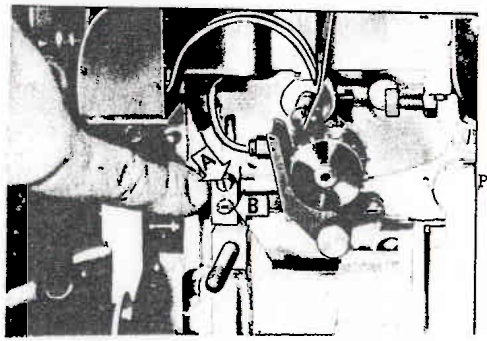

PLATE 107

CHANGING THE INTERMITTENT SPROCKET

The sound drive should first be disengaged, and the projector turned over by the front shutter knob, to note the "feel" of the mechanism, for comparison when the job is completed.

Remove the film gate, the film trap and the housing casting just under the film trap.

The screw under the right hand oil sight of the movement is then taken out, and the oil drained into absorbing material. Oil that reaches the mechanism should be wiped off.

The four screws in the same circumference are then removed, after which the double bearing sprocket arm can be drawn out. This must be done with extreme care to avoid striking the star wheel as it leaves the intermittent casing. The gasket between the arm and casing must be preserved undamaged, or replaced with a new one.

The fastening screw in the sprocket hub is then removed, and the star wheel and its shaft, is drawn out of the double bearing arm. Lift the sprocket out of the arm, and replace it with a new one. Slide the star wheel shaft back into position.

This is done very gently, with a slight twisting motion, no tools are used to drive the shaft. If the fit is snug, the shaft may be lubricated with a drop of oil. When the screw holes are lined up, the fastening screw is replaced in the sprocket hub, but before it is tightened down, the sprocket and the star are pressed toward each other until there is no perceptible end play, but rotation is still perfectly free. Replace gasket.

The double bearing arm is now held in the left hand, the fingers of the right hand resting against the sprocket. In this way, and with due care to avoid striking the star, the star wheel is brought gently against the cam. The left hand now rotates the double bearing arm carefully, until a locating hole in its casting engages a corresponding locating pin in the frame of the movement.

Pin and hole are kept in approximate contact while the fingers of the right hand rotate the sprocket very slowly until they feel the star engage the cam radius. The arm is then gently brought home into position. The locating pin and hole, star and cam, engaging simultaneously.

With the arm in place, the five screws are restored and tightened evenly. They are then loosened again to allow the arm to shift downward on its own weight, then the screws are tightened again.

The projector is now again turned over by the front shutter knob to determine whether there is the slightest trace of binding between the star and cam. Unless this action is perfect the five screws are loosened, the arm moved slightly, and the screws retightened. This process is repeated as many times as found necessary until the action is perfect.

The intermittent oil reservoir is then re-filled, the gate, the trap and the housing replaced.

Before attempting any of these operations we suggest that the projectionist read through the instructions from start to finish, so that he will better know just what procedure to follow during the operations.

Use great care in handling all parts to insure against damage.

SIMPLEX E-7 PROJECTOR

REPLACING SHUTTER GEAR

Before undertaking the work in the projection room, read this chart through, and make sure that there is room enough in front of the projector mechanism to perform the required operations. If there is not, the projector must be removed from the pedestal and the work done on the bench.

In the following order, remove these parts. Front shutter shaft knob. Front half of front shutter guard. Shutter. Rear half of the guard. Shutter adjusting knob holding screw. Shutter adjusting knob. Drive side door stop slide screw, which disconnects the stop slide from door.

Remove the two nickel-plated screws at the top of the front shutter ball bearing housing, and draw the housing toward you, removing it from the mechanism. Loosen the exterior lens collar holding screws and draw off the exterior lens collar.

Take out all screws that face you when looking at the front of the mechanism, except for the following; hinge screws, two small screws at the top just left of threading lamp toggle switch, three black machine screws placed close together toward the drive side of the base casting. None of these screws should be removed. All others, seven in all, should be removed.

Both doors are then opened, and the entire front of the housing with the doors and the front shutter spider, is then drawn forward and removed. The front bearing casting, is now removed by taking out the four screws that hold it. Turn the framing handle on non-operating side, counter-clockwise as far as it will go. Force back spring retaining collar, being careful not to release the spring suddenly. Draw off synchronizing spring.

At the non-operating side, take out the sliding sleeve guide screw, push the sliding sleeve forward in the sliding sleeve support casting, until it protrudes slightly at the front. Grasping the sliding sleeve where it protrudes from its support casting, rotate it clockwise $\frac{1}{4}$ turn. Rotate the shutter shaft until the keyway at the rear of the shutter gear points upward. The sliding sleeve can now be drawn out and removed, and will take the shutter gear assembly with it.

There is a Woodruff key which fits into the keyway in the shutter shaft. Make sure this key is not lost during the operation. The remainder of the work is done on the shutter gear assembly, and not at the projector. Take out the three screws that hold the ball bearing retaining plate, and remove that plate. Remove the shutter gear, ball bearing and lock nut assembly from the sliding sleeve.

Remove the lock nut fastening screw and take the lock nut off the gear, slip the gear out of the ball bearing. The new gear is installed by reversal of these operations.
Be sure to re-stake the fastening screw in the ball bearing lock nut. The Woodruff key must be properly seated in the shutter shaft when the sliding sleeve assembly is replaced. The sliding sleeve assembly must slip freely on the shutter shaft.

Do not replace the front of the housing until the shutter shaft has been found to run smoothly.

If it does not rotate freely the front bearing casting may have to be reseated by loosening the four screws, shifting it slightly, and reseating.

Repeat the procedure until perfect alignment is obtained, then re-time the shutters

SIMPLEX E-7 PROJECTOR

REPLACING MAIN INTERMITTENT GEAR STUDS	Take off the gear. Insert a punch into the oil hole on non-operating side of the mechanism and at the operating side loosen and remove the stud self-locking nut or film protecting stud, with a suitable wrench. The stud can now be drawn out from the driving side. Oil the new stud and restore operation. In the case of the removal of the intermittent drive gear assembly stud, time the shutters as described on another chart.
REPLACING GATE TOP TENSION PAD	Take out the gate and remove the small screw at the center of the retaining screw. Remove the round knurled nut, the pad tension adjusting nut, and the spiral spring. Slip off the tension pad. Slip on the new one, restore the spring, knurled nut and adjusting spring.
REPLACING INTERMITTENT SPROCKET SHOE	Take out the gate and remove the small screw at the center of the bottom spiral spring, the sprocket shoe tension retaining screw. Remove the knurled nut, and the spiral spring. Slip off the shoe and replace, restoring the spring, the knurled nut, and adjusting screw. Adjust the tension.
ADJUSTMENT OF FIRE SHUTTER	Remove spot sight box. Look down between the rear of the mechanism and the rear shutter guard to locate the fire shutter lift pin fastening screw. This is a black screw, the lowest that can be seen. Loosen it. At the non-operating side of the mechanism, look in past the governor to locate the fire shutter lifting pin, a steel pin about 1/8 inch in diameter which engages the slot that raises the fire shutter. Lift this pin as high as possible, making sure that it remains in the slot. Hold it in that position and re-tighten the fastening screw. Run the projector without film, and try to push the fire shutter down by hand without using too much force. If it can be made to drop, the adjustment was not properly made, and must be repeated.
ADJUSTMENT IF FIRE SHUTTER JAMS.	Remove the spot sight box. Just above the top of the fire shutter on the film trap there is a small stud on the film trap casting. The top of the fire shutter in raised position, should not quite touch this stud, but should clear it about 1/32 of an inch. Loosen the fire shutter raising lever adjusting bushing lock screw, about $\frac{1}{4}$ turn, no more. Do not take out this screw Now adjust the shutter height by turning the fire shutter raising lever adjusting bushing. Turning this bushing clockwise raises the shutter, turning it counter-clockwise lowers the shutter. Turn down the lock screw when the proper adjustment is obtained.
ADJUSTMENT IF FIRE SHUTTER FAILS TO TRIP	The fire shutter trip should be operated manually from time to time to make sure the shutter is working properly. If it does not, take out the spot sight box and the film trap, Remove the shutter lever guard holding screw and take off the shutter lever guard. Shutter mechanism can now be cleaned with kerosene to remove gummed oil.

MOTIOGRAPH "AA" PROJECTOR

DRIVE GEARS	How the drive gears are released from their mounting studs by removing the bearing retainer caps, is illustrated in Plate M-226. The unit design of the projector, plus the fact that all components are either self-aligning or are dowelled or pinned in their proper positions, makes it possible to completely disassemble the machine down to unit subassemblies for inspection or cleaning, and then put it back together in an elapsed time under two hours and if necessary, without removing the housing from its position on the sound reproducer.
LIGHTING AND WIRING	The projector is provided with two auxiliary interior lights. The irregularly shaped structure in the upper corner of the film compartment houses a lamp for general illumination of the projector interior, with an on-off toggle switch at the lower edge of the housing. The flat contour of the housing mounts a glass shield to protect the lamp, and as an extra safeguard in the event of accidental lamp breakage. The second light is within the shutter enclosure below the secondary framing aperture. This aperture is slightly above and to the rear of the upper guide rollers. The lamp socket is carried by a plug-type support inserted from the drive side of the center frame.
FRAMING APERTURE	The framing aperture has a glass shield to prevent the entrance of dirt, and is equipped with two registry pins. The linear relationship between these pins, the secondary aperture and the actual picture aperture is such that when the film is on the pins and is properly framed in the secondary aperture, it is likewise correctly framed at the picture aperture. There is thus no need to engage in awkward contortions to see the picture aperture during the threading of the film, and framing can be checked at any time prior to starting the projector merely by bending the upper film loop back over the framing aperture.
ELECTRICAL CHANGEOVER	The electrcal changeover device is of a generally standard construction, although the special model for the AA projector includes thermostatic protection for the operating coils and is arranged to make use of the projectors internal changeover wiring, as well as its built-in changeover shutter, which operates in an extra set of guides before the automatic fire shutter in the light path.
INTERMITTENT MOVEMENT	The intermittent movement is basically of the conventional 90 degree Geneva type and incorporates a number of original design features. The tension shoe assembly for holding the film in place on the sprocket is mounted directly on the movement case. Outboard ball bearings for both the sprocket, or star-shaft, and for the cam shaft are provided. The movement case design and the mounting arrangements in the projector are such as to permit the entire movement to be quickly and easily removed from the operating side of the machine without disturbing any other components except the movement balance wheel. The cam shaft is directly driven from the main projector gear train, and carries on its outboard end a balance wheel of sufficient diameter and weight to have adequate inertia to effectively equalize the pulsating torque requirements of the intermittent action. Reference to the illustrations will show how easily and quickly the projector head may be serviced.

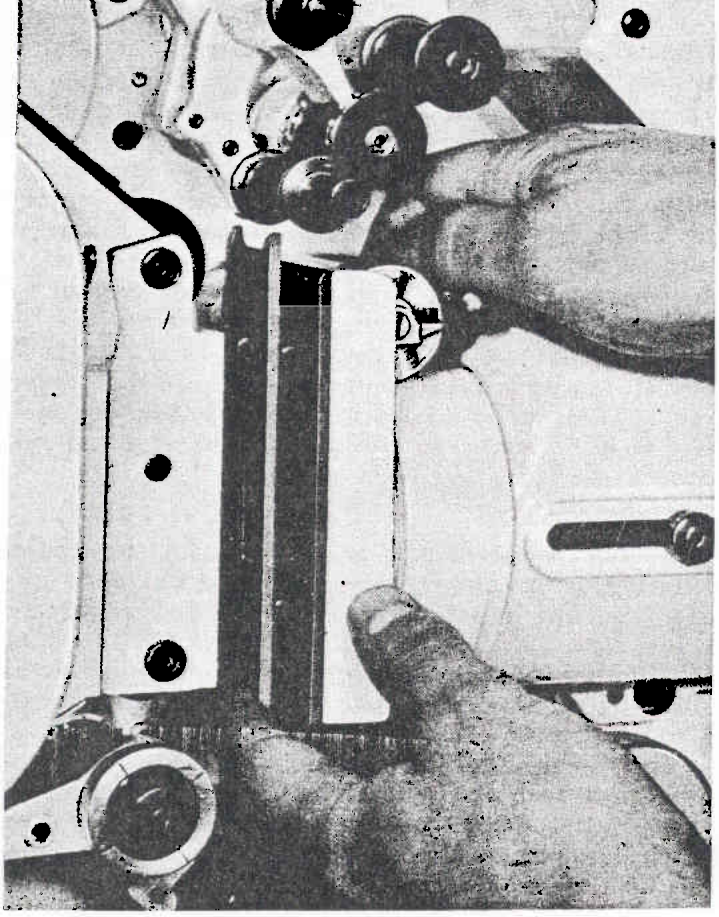

PLATE M-220

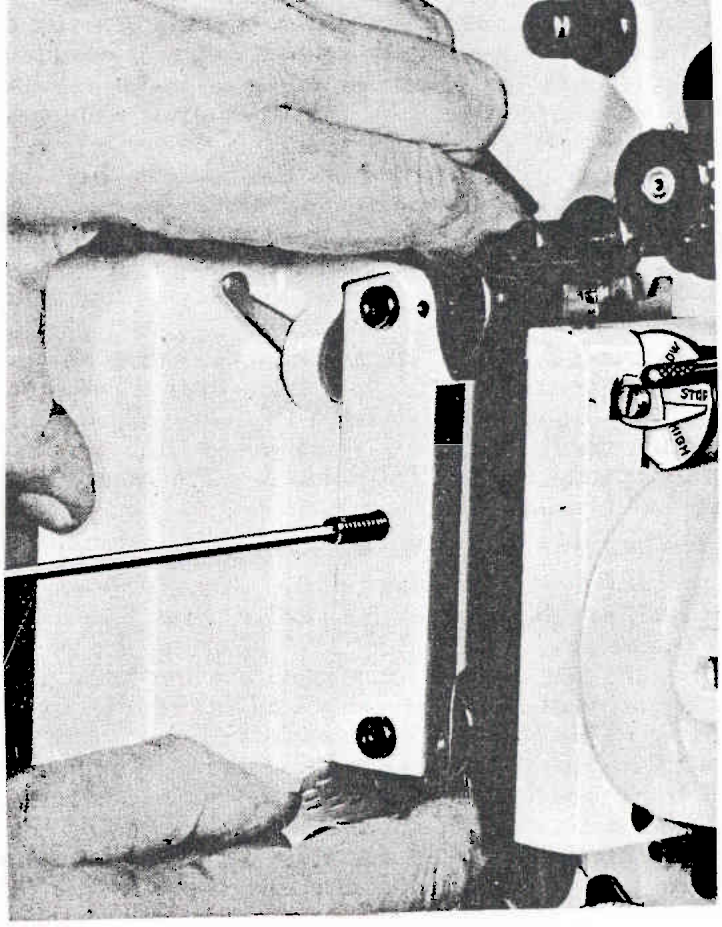

PLATE M-221

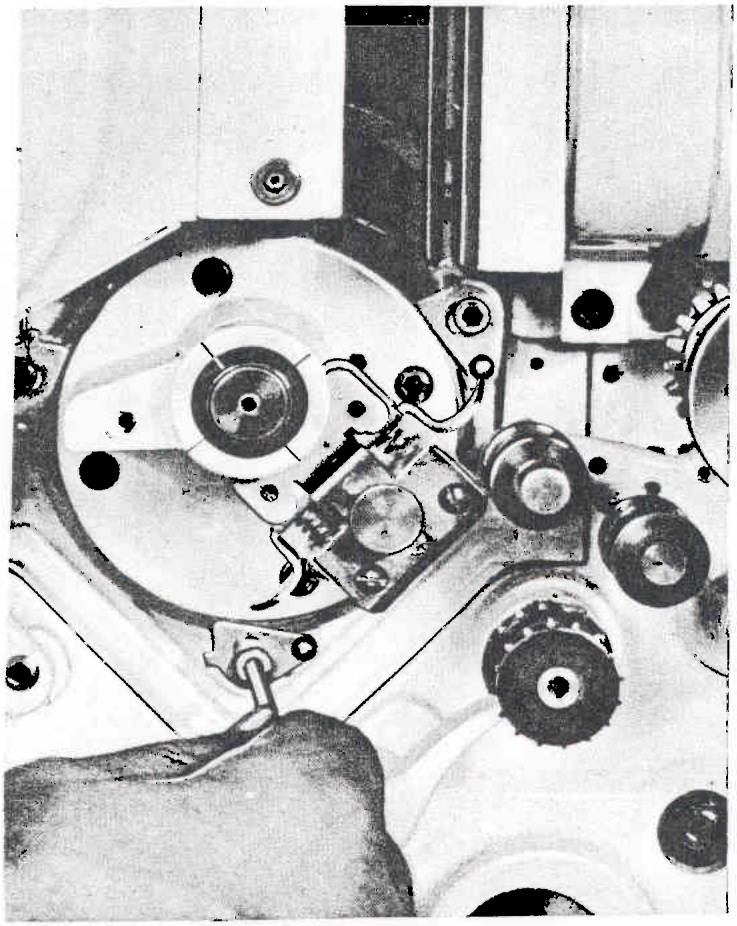

PLATE M-223

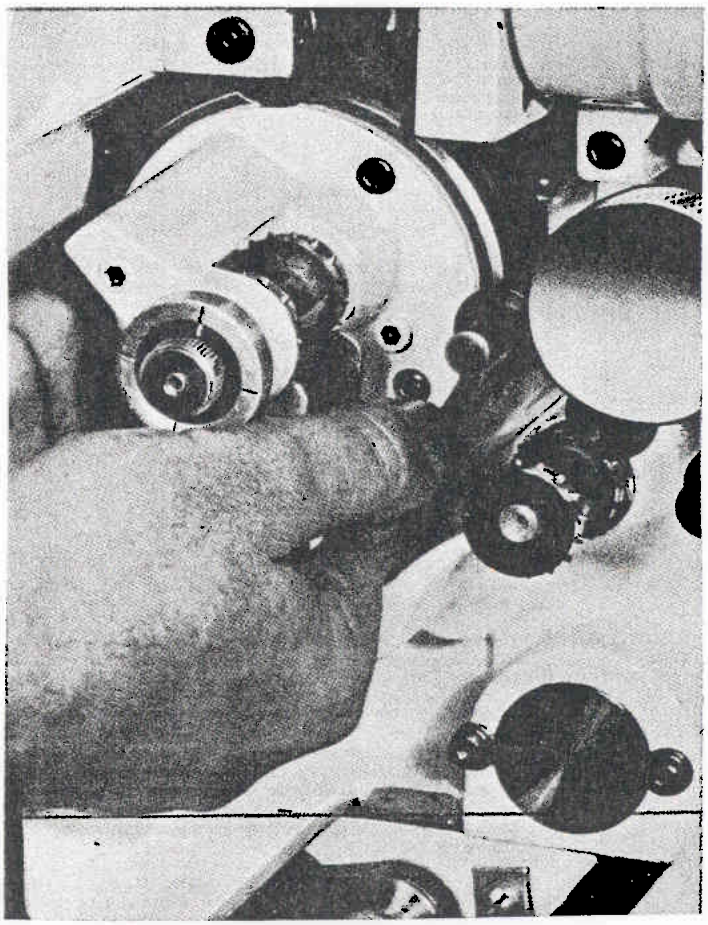

PLATE M-224

CLEANING TENSION SHOE UNIT

The tension shoe unit is revoved for cleaning by pulling backward the plunger of the gunlock mechanism in the gate body to release the mounting studs as the unit is pushed upward out of engagement.

This is shown in Plate M-220.

It is even more easily replaced by entering the studs in their slots and pushing the unit downward until their locks snap shut.

REMOVING TRACK AND APERTURE UNIT

Plate M-221 illustrates the operation of removing the track and aperture unit by backing out the single, long, cone-point socket head screw which anchors it to the support casting.

INTERMITTENT

Plate M-222 shows how the latches, or clamps, for the intermittent movement are opened and Plate M-223 indicates how the movement is rotated a quarter turn to disengage it from the gear train and align the clearance notch for the lower film guide rollers.

This Plate also presents a clear view of the secondary illuminated framing aperture and shows just to the left of the upper guide roller the lever for manually lifting the fire shutter.

Plate M-224 is a seperate view of the intermittent movement with the sprocket, stripper and outboard bearing disassembled.

This Plate M-224, illustrates perhaps more clearly than Plate 212 the constructional details on the operating side of the movement.

RETIMING SHUTTER

The retiming of the shutter, after replacing the intermittent movement is illustrated in Plate M-225.

The machine is turned over by hand to the point where the movement's cam pin just engages a star slot as evidenced by the alignment of the markings on the sprocket shaft locking collar and on the position indicator cap surrounding it.

The inner shutter rotor is locked to its drive shaft by a cone-type clutch which is released by loosening the socket screw in the center of the bearing cap just above the framing control as shown in the figure.

The rotor is then turned by hand through the lamphouse cone until a wrench or rod inserted through a small hole in the housing under the bearings drop into a drilled reference hole in the end of the shutter rotor, after which the clutch screw is retightened.

An exactly similar operation is then performed for the outer shutter rotor from the drive side of the projector, except that in this instance the clutch screw is located in the center of the drive gear for this rotor and the opening for the aligning tool is placed in a small boss on the center frame just below the drive gear.

The complete operation takes only a minute and since the cone clutches permit exact positioning of the shutter rotors, shutter rotor timing with respect to each other is necessarily quite accurate.

Small errors in timing between shutter and movement occasioned by imperfections in the initial positioning of the movement may of course be compensated during operation with the continuously variable shutter timing control at front of the projector.

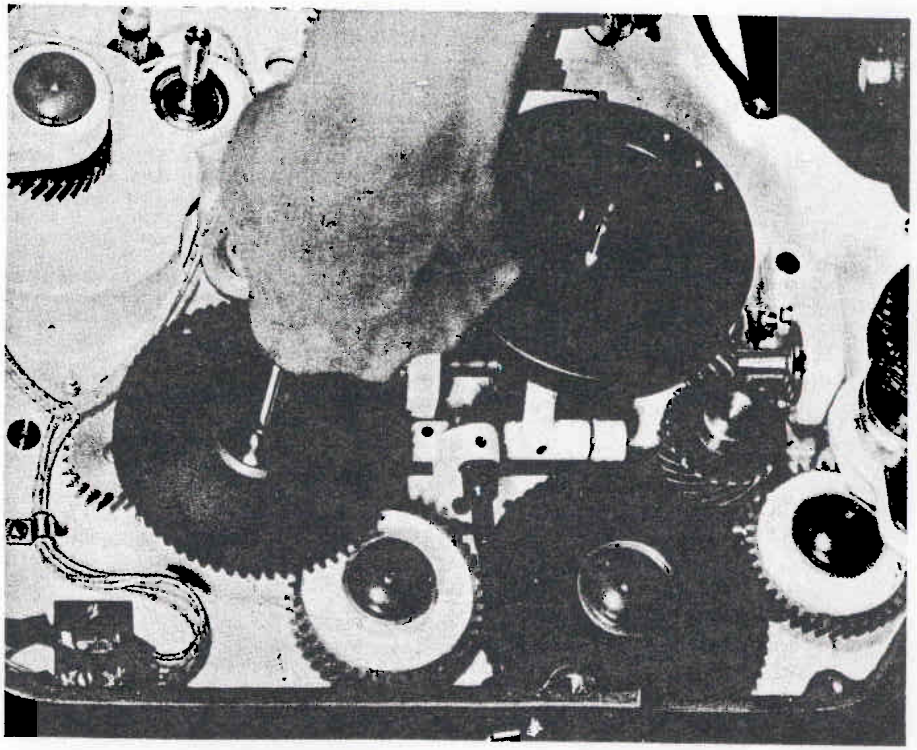

PLATE M-226

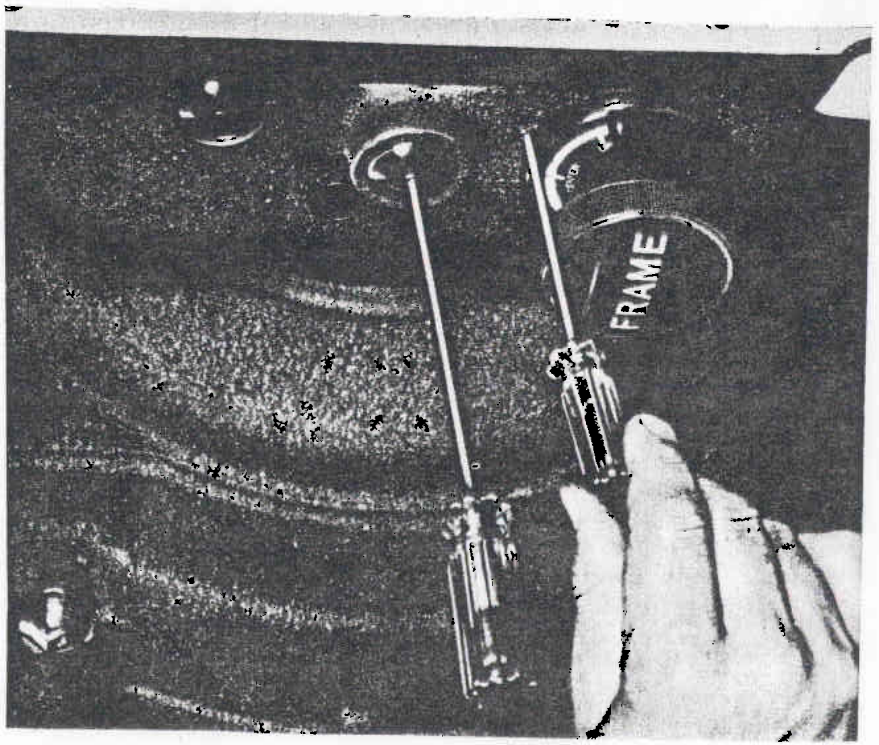

PLATE M-225

MOTIOGRAPH "AA" PROJECTOR

THE SHUTTER	The twin rotor double rear shutter of the "AA" projector features an entirely new design. It has been recognized that for best picture definition and maximum light efficiency, the shutter rotors should cut the light beam simultaneously from top to bottom as close as possible to the aperture and preferably in approximately the same vertical plane so as to preserve symmetry in the opening and closing actions. The shutter consists of two concentrically mounted cylindrical rotors turing in opposite directions transversely to the light beam immediately in front of the picture aperture. The master or cutting blades of the rotors cut the light beam in planes less than one-eigth of an inch apart, and only two inches from the aperture. As the light is thus symmetrically interrupted at its narrowest possible diameter, the opening and closing actions are unusually rapid and smooth, with corresponding improvement in both picture definition and projector light efficiency. The rotors turn in ball bearings, and have narrow balancing blades opposite the working blades and integral cooling fins to circulate cool air over their bearings and over the picture aperture. They are individually balanced dynamically so that the complete shutter operates with virtually no vibration. This is partly due to the fact that the shutter driving torque is adequately isolated from the pulsating torque at the intermittent movement drive points by the latter's relatively heavy balance wheel, and by the cushioning effect of the intervening gear meshes. Due to the basically high light elliciency of the shutter design, it has been possible to make the working blades of the rotors of such angular width as to allow for a very liberal margin of safety in the matter of travel ghost effects due to lost motion between the shutter and intermittent. In the design of the shutter, clearance has been allowed for the cone of light from proposed f:2.0 arc lamp optical systems using 16 inch reflectors. The shutter rotors are carefully machined from aluminum alloy castings, and are fully reinforced to prevent warping and breakage.
FIRE SHUTTER & VENTILATING SYSTEM	Centrifugal actuators for fire shutters should turn at relatively high speeds for positive operation without excessive dimensions. The projector design combines the fire shutter actuator with a blower of really adequate capacity to properly cool the shutter and aperture. The combination blower and actuator is located in an enclosure above the shutter compartment of the projector. It draws clean room temperature air inward through the vents in projector housing under the shutter, under the track and aperture unit, and upward over the shutter and across the aperture. The heated air is exhausted through a vent grill at the top of the mechanism. The shutter and aperture are thus located within a forced draft chute with the light opening being closed off as far as air currents are concerned by the currents produced by the rotating shutter.

SOUND PROJECTORS---16 m.m.

TROUBLE	PROBABLE CAUSE
NO SOUND DIAL, THREADING AND EXCITER LAMPS LIGHT	Speaker cable not connected, or broken leads in speaker cable.
NO SOUND DIAL AND THREADING LAMPS LIGHT, EXCITER LAMP DOES NOT LIGHT	Burned out exciter lamp.----- Tubes in wrong sockets. Defective 5Z4 or 6V6 tubes.
LOW VOLUME AND DISTORTION	Low line voltage. (Below 100 volts) Weak 5Z4 rectifier tube. 6V6 tube out of socket. Defective 6V6 tube. Speaker cables plugs not inserted all the way into the jacks.
PITCH OF SOUND TOO HIGH OR TOO LOW	Speed switch in silent speed position. Governor requires adjustment.
POPPING NOISE FROM SPEAKER WHEN OPERATING WITHOUT FILM	Photo-electric cell adjustment turned too far in clockwise direction.
POPPING NOISE WHEN OPERATING WITH FILM	Dirt on edge of sound drum. Lower guideway improperly adjusted.
RINGING NOISES FROM SPEAKER WHEN PROJECTOR VOLUME CONTROL IS AT LOW VOLUME POSITION	Defective photo-electric cell. Defective 6J7 tube.
RINGING NOISES FROM SPEAKER WHEN PROJECTOR VOLUME CONTROL IS SET AT HIGH VOLUME POSITION.	Defective exciter lamp.
CRACKLING NOISE FROM SPEAKER.	Dirty motor brushes.---Dirty governor slip rings or loose connection in the amplifier.
MOTOR DOES NOT RUN AND PROJECTOR LAMP DOES NOT LIGHT.	No electrical power.
MOTOR RUNS, MECHANISM DOES NOT RUN.	Clutch knob turned to maximum clockwise position. Drive belt off drive pulley. Drive pulley loose on motor shaft. Slipping drive clutch.
VERTICAL COLOR BANDS ON SCREEN	Defective projection lamp. Projection lamp out of adjustment.
WHINING NOISES FROM PROJECTOR	Foreign object in fan. Fan loose on motor shaft.
NO SOUND. DIAL AND THREADING LAMPS DO NOT LIGHT.	Burned out fuse.
FILM SPILLS OFF OF FEED REEL.	Dirty clutch on feed reel spindle assembly.
LOSS OF FILM LOOPS	Gate not correctly threaded.---Damaged film---Intermittent requires adjustment---Pressure shoe not properly seated in aperture plate.
PROJECTOR JUMPS FOCUS	Picture out of focus when photographed. Warped film. Projection lens elements loose in mount. Pressure shoe not seating properly.
SOFT FOCUS	Dirty lens.
PROJECTOR FAILS TO TAKE-UP FILM	Belt shifter in maximum counter-clockwise position. Take-up reel are in 400 foot position when using 1600 foot reel. Bent or stretched take-up belt.

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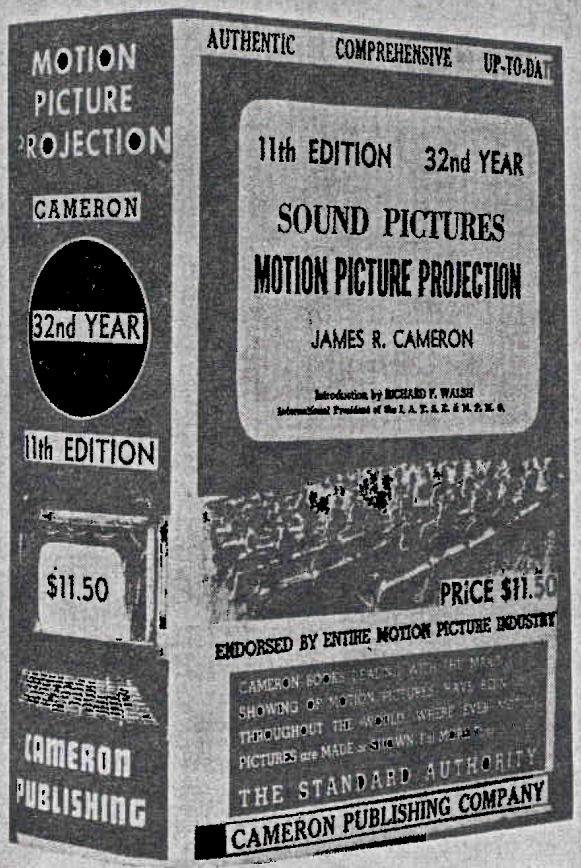

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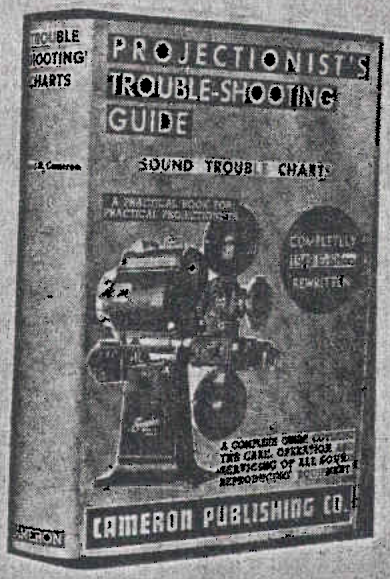

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