Film-Tech

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SUPPLEMENT

Method of Operating 3A-46 System

The method of operating this system is the same as described in this book, except for the following changed and supplementary information:

Disregard pages 9 - 13 inclusive, if the system has no storage batteries. The motor - generator set is started by simply closing the motor switch.

Disregard the directions for lubrication on page 17. A few drops of light machine oil are to be applied daily to the lubricating head just behind the fly-wheel. The idler rollers are not to be lubricated, as they have self-lubricating bearings.

In connection with the operation of the amplifiers, as covered on page 18, the following instructions govern the use of the 713-A Control Cabinet:

The current for each sound lamp and each 49-B Amplifier filament circuit is turned on by means of a toggle switch on the cabinet, marked "Power". There is one of these switches for the "Red" machine and one for the "White". Adjust the sound lamp currents, as indicated on the respective ammeters, by means of the rheostats. The closing of each "Power" switch also lights the "Ready" lamp behind the green bull's-eye associated with that switch. The current supply for each photo-electric cell is controlled by the switches on the cabinet marked "90V". Turning the output switch (either at the Control Cabinet or Control Unit) to either "red" or "white" connects the reproducer output from the corresponding machine through to the 46 Type Amplifier input and lights the corresponding red "Play" light.

Disregard the instructions given under the heading "Film Reproduction" on page 20, and substitute the following:

To set up a sound film ready for operation, with this equipment, proceed as follows:

(a) See that volume control on 713-A Control Cabinet is at normal operating position, and that output switch is at "Off".

(b) On projector head, place aperture sound track mask in position, and place framing lever in central position. Move projector mechanism by turning flywheel so that shutter cutoff blade is uppermost, lens is open and intermittent has just ceased moving. Thread projector mechanism with film in usual manner except be sure that loop between intermittent sprocket and lower sprocket of head is such that film loop is just in line with edge of head, as shown in Figure 11.

(c) Thread film through film reproducing mechanism in Sound Unit in the same manner as shown in Figure 11. In doing this allow for a slack of two sprocket tooth intervals between the lower sprocket of the projector head and the sound sprocket, and also between the sound and holdback sprockets in the Sound Unit.

(d) After properly locating film in Sound Unit; release tension pad, so that it bears on the film and holds it close up against aperture plate in front of 4-Type Aperture.

(e) On synchronized feature pictures, by starting and stopping the motor with the starting switch as much film as necessary may be run off to bring end of "Part No." leader approximately up to projector aperture.

Miscellaneous points on operation

(a) Leave volume control on 713-A Control Cabinet set at normal operating position (6 or 7) at all times. Use output switch for making sound change-over. Operate it <u>after</u> projector motor is up to speed and <u>before</u> the sound track on the film reaches the light gate.

(b) Leave <u>both</u> "Power" switches and <u>both</u> "90V" switches on the 713-A Control Cabinet closed at all times while running the show. It is unnecessary to ever turn them off except for adjustment or test.

(c) The film speed is fixed at 90 feet per minute by the motor design, and cannot be changed.

OPERATING INSTRUCTIONS

FOR

SYNCHRONOUS REPRODUCING EQUIPMENT

****

WESTERN ELECTRIC SOUND PROJECTOR SYSTEM

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For applications of the system to other purposes than synchronous reproduction, see the separate operating instructions covering such applications.

ISSUED BY

Electrical Research Products Incorporated

250 West 57th Street

New York, N. Y.

U.S.A.

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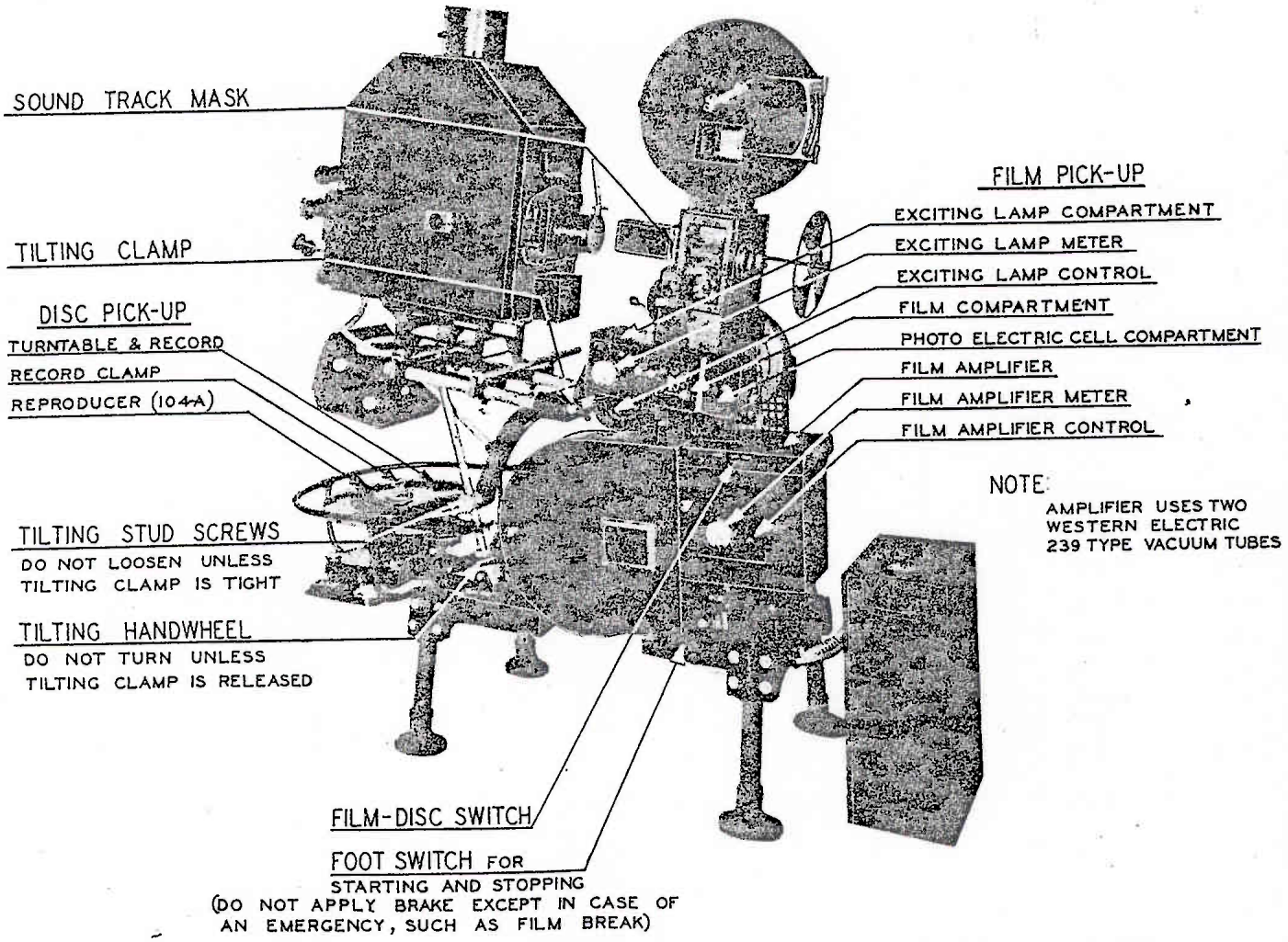
(8-30)

C O N T E N T S

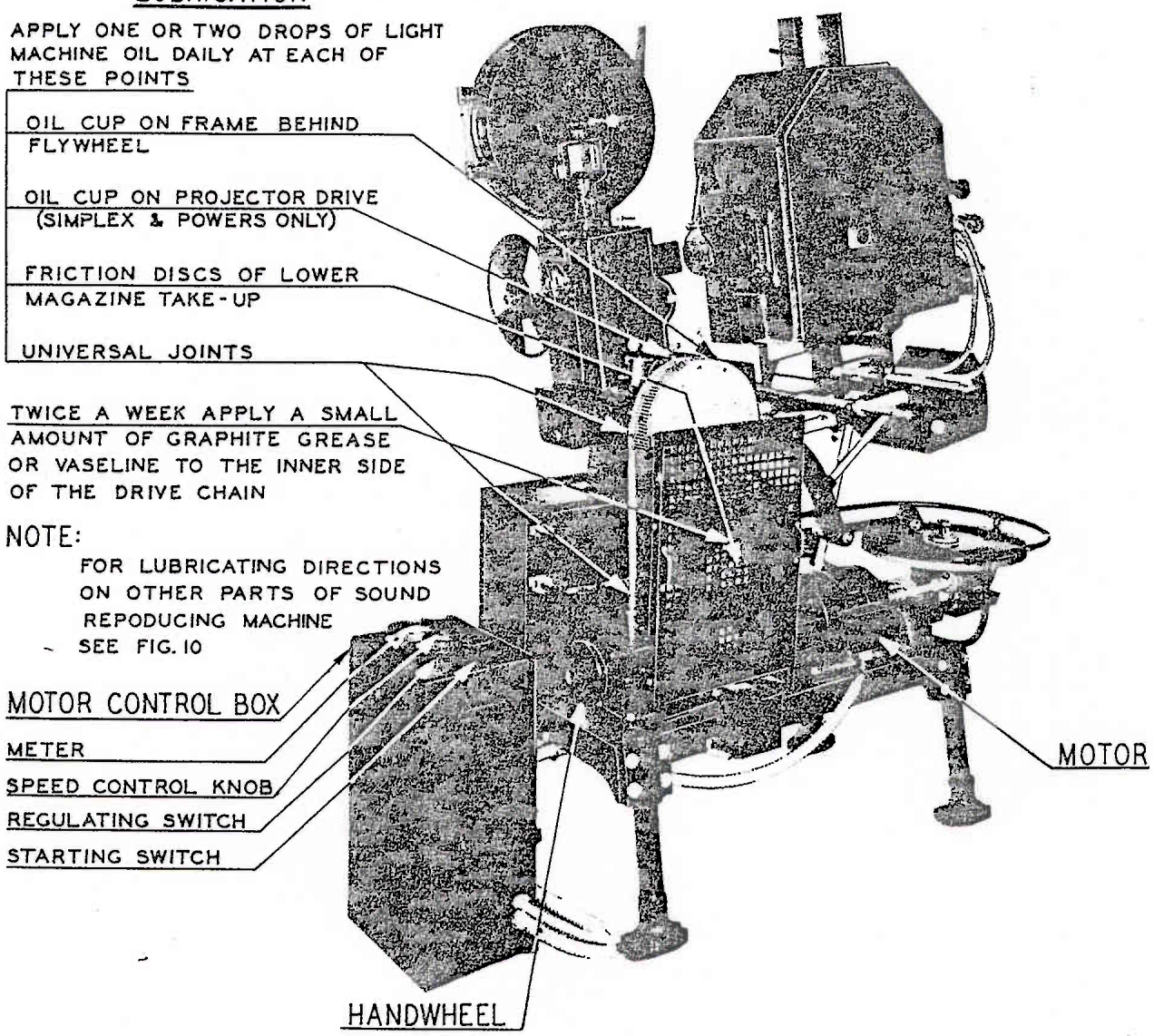
Issued as of December 1st, 1928.



PROJECTOR AND WESTERN ELECTRIC REPRODUCER SET

OPERATING SIDE

FIGURE 1



PROJECTOR AND WESTERN ELECTRIC REPRODUCER SET

DRIVING SIDE

FIGURE 2

General

It is essential to strictly follow these operating instructions in order to obtain satisfactory results and avoid apparatus trouble. Everything in this book should therefore be carefully studied and thoroughly understood. If anything in it is not clear to you, consult our representatives, who will be glad to explain.

Caution

It is of the greatest importance to observe strict cleanliness in the handling of the film and all parts of the equipment, as explained in detail later in these instructions.

Cases have occurred where persons having some radio experience have experimented with the equipment and made changes and substitutions. Not only is this expressly forbidden in the contract by which the equipment is leased to the theatre, but also there will almost certainly be serious ill effects on the quality of reproduction and the life of the equipment.

Purpose of the Equipment

The main purpose of this equipment is to reproduce speech, music or incidental sounds in connection with moving pictures in a manner so realistic that the effect is practically equivalent to having the speakers, artists or occurrences actually present, every sound being heard at the same moment that the action accompanying it is seen on the screen. A further use is to accompany feature pictures with specially recorded cued music and effects, known as a synchronized score, so that every scene has music and effects appropriate to it, and when the scene changes, any corresponding change in the character of the sound accompaniment is accurately and automatically made at the same moment. Hence the two applications mentioned are also collectively called synchronous reproduction.

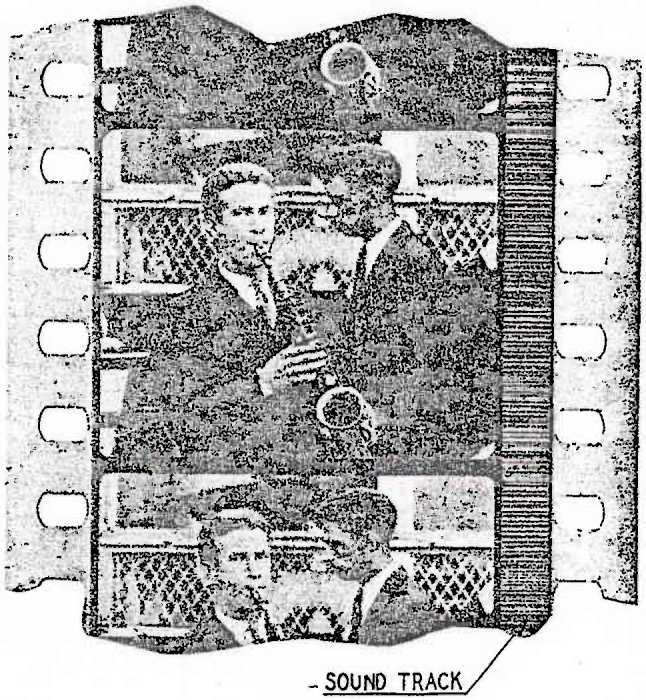
General Principles of the Equipment

Two methods of recording are employed. In one method, the sound record is on a disc similar to a phonograph record, and this is therefore called the disc method. It is used by Vitaphone. In the other method, the sound record is photographed on the film. This is called the film method. It is used by Movietone. A house can be equipped for showing productions made by either method or both, the only difference lying in the apparatus used at the projector.

The first step in synchronous reproduction is to generate a small electric current whose variations correspond to the sound waves forming the voice or music that was recorded. Depending on which of the two previously mentioned methods of recording was used, this current is obtained as follows (Figs.1 & 2):

(1) With the disc method, the current comes from an electrical reproducer playing on a disc record; these records are similar to the best types of phonograph record except that they are much larger and run at about half standard speed; this enables each record to play throughout a whole reel. The film used with the disc record, called a synchronized film, is similar to an ordinary film, except that one frame at the beginning is specially marked to give the starting point.

(2) With the film method, the sound record consists of a band about 1/8" wide, called the sound track, which runs down one side of the film and consists of microscopic lines (Fig.3). The spacing of these lines at each point depends on the pitch of the sound which was recorded at that moment. The difference in density of the lines depends on the loudness of



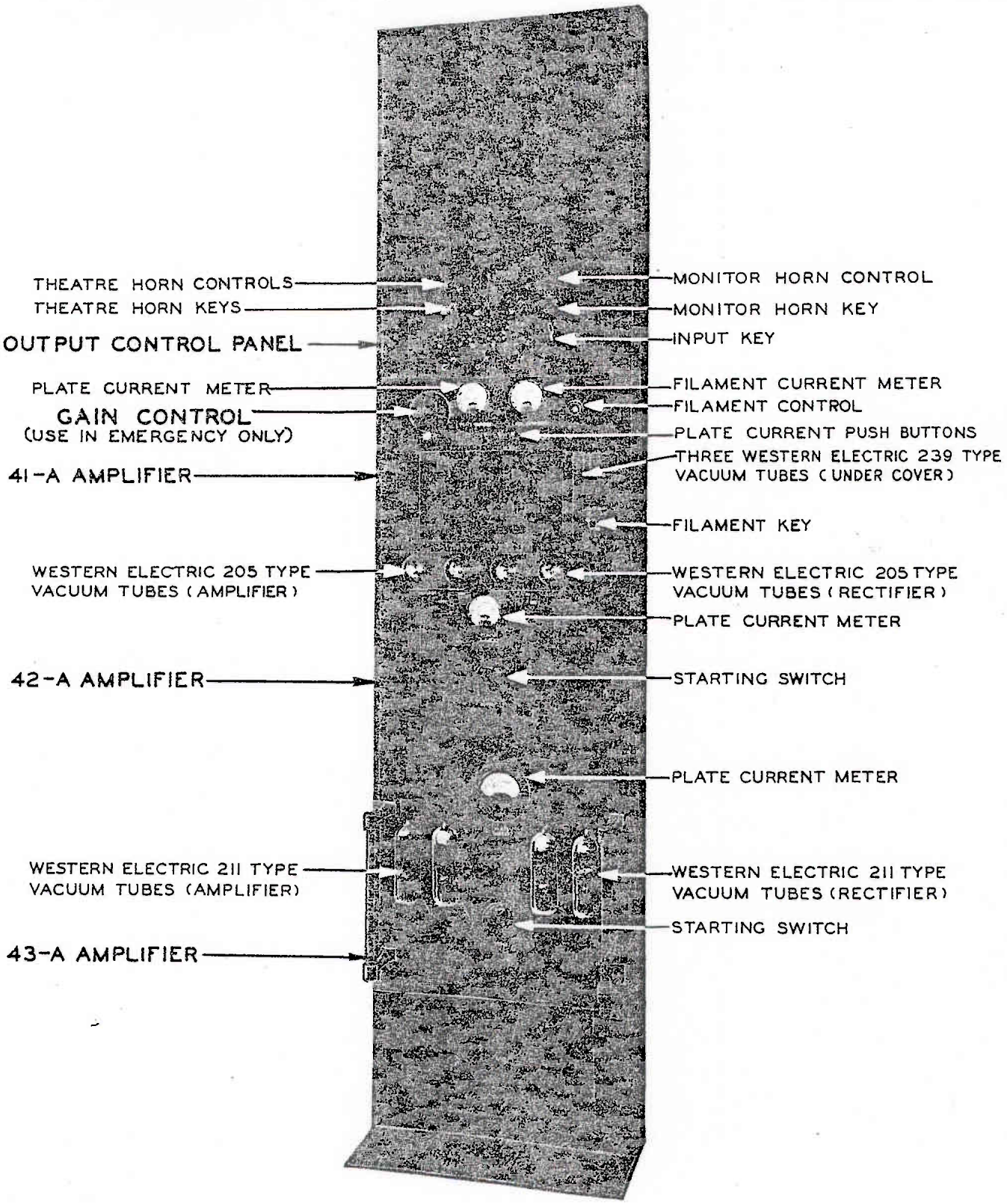
FILM WITH PHOTOGRAPHIC RECORDING
FIGURE-3

the sound - that is, the greater the contrast between light and dark lines, the louder the sound. Such a film is called a sound film, and is otherwise similar to an ordinary film. After leaving the lower sprocket of the projector head, the sound film enters the reproducing apparatus, where it passes over a sprocket that moves it along at constant speed. A narrow bright beam of light from a high intensity exciting lamp is focused on the sound track of the film through a system of lenses and a slit in an aperture plate. The light which has passed through the moving film will then vary in intensity according to the variations of the lines recorded on the sound track. This light falls on a photoelectric cell, which produces a small electric current whose variations correspond to the light, and therefore to the sound which was recorded.

The small current from the electrical reproducer or the photoelectric cell passes along to one or more vacuum tube amplifiers (Figs.4,5, & 5A) similar in principle to those used in the audio-frequency stages of radio sets; these amplifiers deliver a greatly magnified copy of this current. The current from the amplifiers is converted into sound by means of sound projectors consisting of receivers and horns (Fig. 6), located at the screen. Usually a special type of screen is employed, which reflects light well and enables a good picture to be obtained, but is practically transparent to sound waves. The horns are placed immediately behind the screen so that a perfect illusion that the sound is coming from the speaker or other source seen on the screen is obtained in all parts of the house. Obviously if the sound is not coming directly from the screen, the illusion is lost.

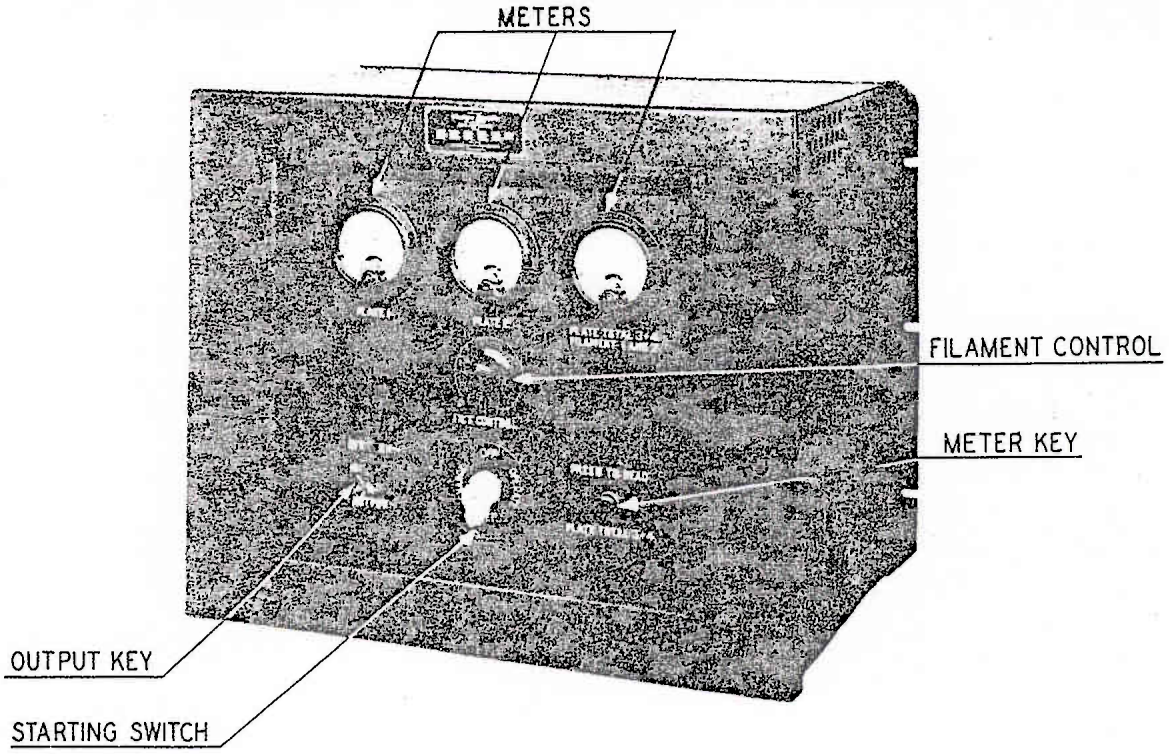
In the disc method, synchronism between sound and picture is assured by having the projector and the turntable carrying the record both driven by the same motor; hence if the film and record are started together they must necessarily keep in step throughout the remainder of the reel. In the film method the fact that the sound record is on the same film with the picture makes synchronism inherent provided that the film is set up with the proper loops to ensure that when a picture is at the picture aperture in the projector head, the accompanying portion of the sound track will be at the light aperture in the reproducing mechanism.

By using two projectors alternately, a continuous program can be run just as with ordinary pictures. This is accomplished by turning a knob on a device known as a fader (Fig. 7), at the same time that the changeover is made

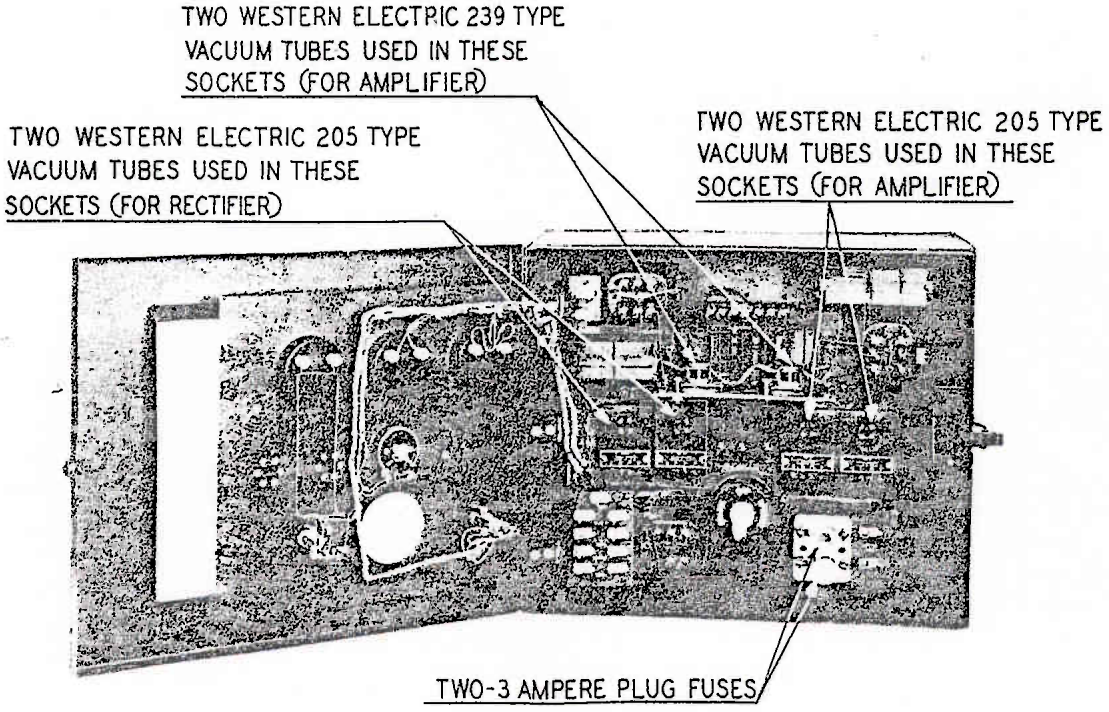


41-A, 42-A, AND 43-A AMPLIFIERS, AND OUTPUT CONTROL PANEL

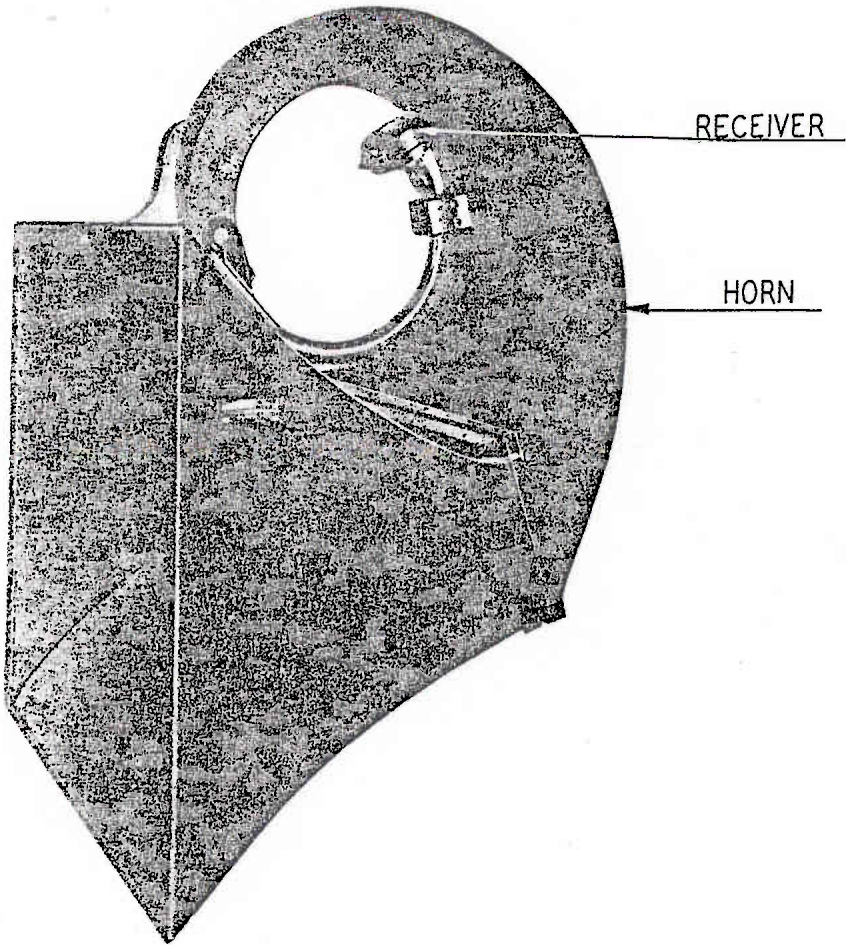
FIGURE 4



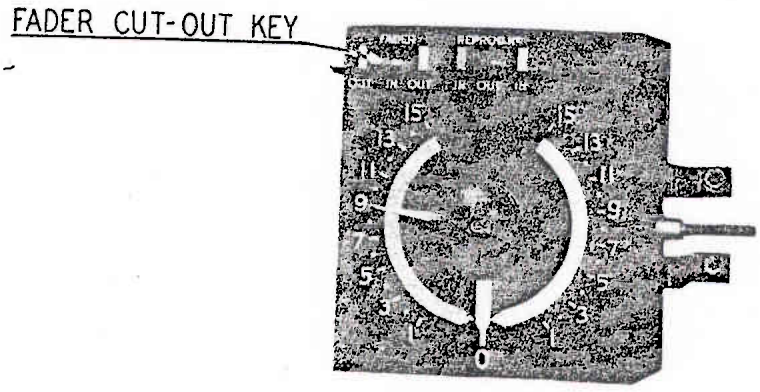
46-B AMPLIFIER
FRONT VIEW
FIGURE-5



46-B AMPLIFIER
INTERIOR VIEW
FIGURE-5A



SOUND PROJECTOR
FIGURE 6



FADER
FIGURE 7

from one reel to the next. At the end of each record or sound film, the music overlaps the opening notes of the next, so that with proper operation the audience is unaware of any change being made.

In ordinary moving picture projection, the film is usually shown at a faster speed than it was taken. However, this cannot be done with a synchronized film or a sound film, as the pitch would be changed and this would cause the voice or music to be distorted and spoiled. All synchronous subjects have therefore to be shown at exactly the same speed they were made, which is 90 ft. per minute. This speed is maintained automatically by means of a special type of motor and an electrical governing system contained in the motor control box. (Fig. 2)

To permit of running films other than synchronized numbers in the usual manner, means are provided on the motor control box for regulating the speed within the usual range employed in projection.

General Principles

The operation of the storage batteries is taken up first, because the equipment will not function successfully unless the batteries are properly handled.

In systems using the 1-FD type battery charging panel (Fig. 8), one set of storage batteries, called the H batteries, is used to supply magnetizing current to the receivers attached to the horns, and two other sets, F1 and F2, supply filament current for the amplifiers, exciting lamps, and indicating lights. The F1 and F2 sets are used alternately, one set being on charge while the other is supplying current. It is very important to always follow this practice, which is necessary in order to maintain the charge and ensure that adequate power will be available for every show.

In systems using the 40 type battery charging panel (Fig. 9), there are two sets of batteries, #1 and #2, supplying current for the horns, amplifier filaments, exciting lamps, and indicating lights. These two sets are used alternately, one set being on charge while the other is supplying current. It is very important to always follow this practice, which is necessary in order to maintain the charge and ensure that adequate power will be available for every show.

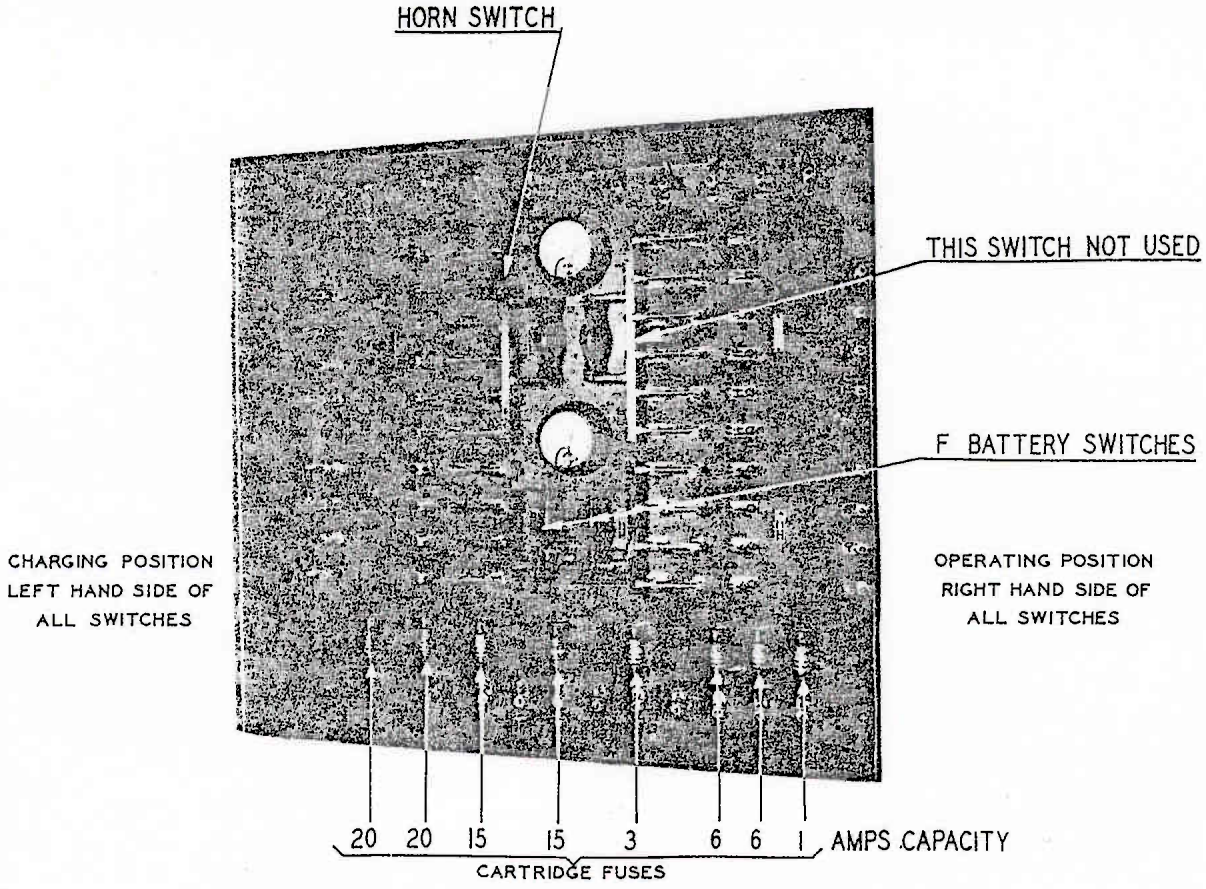
How long to run each set of batteries before putting it on charge will depend on the extent to which the equipment is used; furthermore, in the case of the 1-FD battery panel, the charging period may be different for the F sets as compared with the H set. This makes it impossible to lay down any general rule as to how long each set should run. It is therefore essential to use the hydrometer supplied with the batteries, to find out when each set needs charging, as explained below.

The charger is set by our engineer to give the proper charging rate, and this setting must not be changed except on his instructions. The charging switch of the AC charger may be kept on all the time, as the charger circuit is opened and closed by the switches on the battery panel.

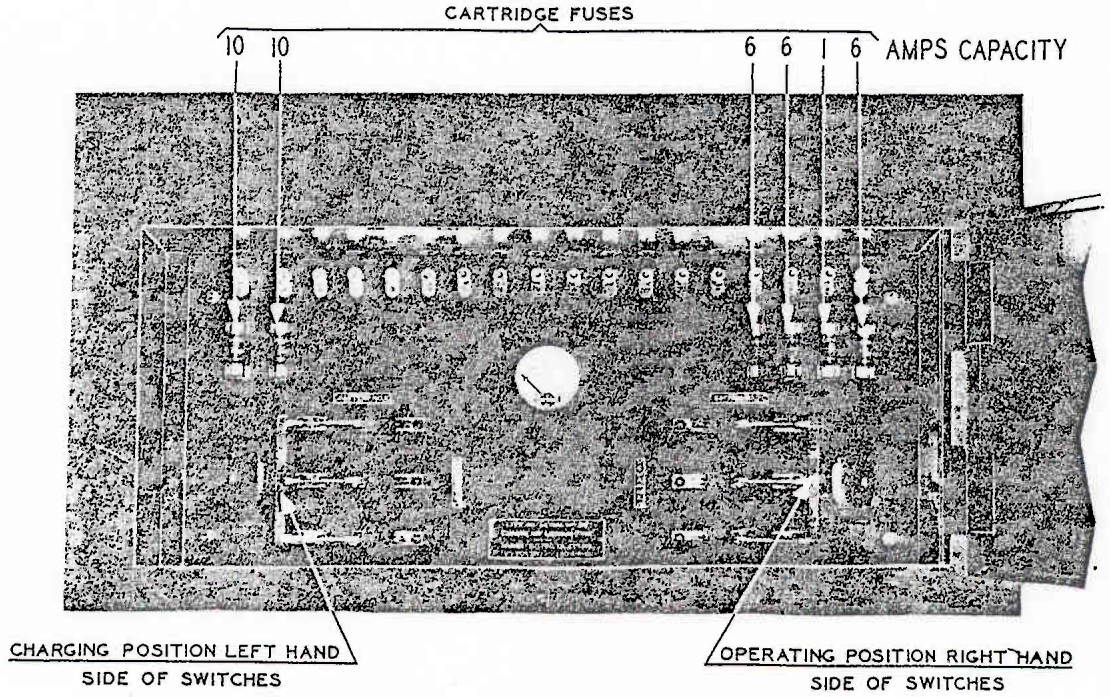
The meters mounted on the panel are primarily for use by our engineer in adjusting the charging rate, and ordinarily the projectionist does not need to read them.

Hydrometer

As a storage battery becomes discharged and loses its energy, there is a corresponding fall in the specific gravity of the acid - that is, the weight of the acid in comparison with the weight of an equal volume of pure distilled water. Knowing this figure for any battery, it is possible to tell at once whether or not it needs recharging. The hydrometer is an instrument for ascertaining the specific gravity of the acid in a battery-usually called for short the "battery gravity".



1-FD BATTERY PANEL
FIGURE 8



40 TYPE BATTERY PANEL
FIGURE 9

Battery Charging

(1) Check condition of batteries EVERY DAY with hydrometer. For this purpose, select one cell in each battery group for use as a pilot cell, and read gravity in each of these cells by removing filling cap and drawing enough acid into hydrometer barrel to lift float. After reading, replace all acid withdrawn and put cap back. Never measure the gravity just after adding water; wait until battery has been on charge long enough to stir up solution.

(2) Enter gravity readings on Battery Log Sheet we supply. This is very important in order that our engineer may have proper information to enable him to service the installation.

(3) As soon as gravity of pilot cells of any set in use has fallen to 1200, put this set on charge, as described on next page. NEVER let gravity get below 1190, as this shortens life of battery and has bad effect on operation of equipment. On the other hand, do not start charging above 1200, as batteries will then be worn out by too frequent charging.

(4) When gravity of set on charge has risen to between 1270 and 1285, take this set off charge.

(5) Our engineers adjust charging rate so that as a general rule, where there are two sets of batteries used and charged alternately, if one set is on charge while other is in use, set on charge will reach full charge value by the time set in use is down to 1200. If you find that it is often necessary to make period of charge longer than period of operation, report matter to our service engineer on his next visit.

(6) When equipment is not being used very much, acid gravity may not fall to charging point in a whole month. At such times, charge batteries every month.

(7) In connection with the use of the hydrometer, change the pilot cell every month so that all cells will be used in turn and loss of electrolyte through dripping, etc., will be equalized.

Operating 1-FD Type Battery Panel

To prepare for operation of equipment, proceed as follows:

(1) Set at "Operate" switch for "F" battery set which is to be used.

(2) Set at "Charge" switch for "F" battery set which is to be charged.

(3) Set at "Operate" the switch controlling the "H" batteries.

When finished operating, open all above switches, with the following exceptions:

(1) If additional charging as explained previously is needed for "F" battery set that has been on charge, keep the switch controlling this set at "Charge" until gravity reaches full charge value.

(2) If "H" batteries need charging, set switch controlling them at "Charge" and keep it there until gravity reaches full charge value.

Operating 40 Type Battery Panel

To prepare for operation of equipment, proceed as follows:

(1) Set at "Operate" switch for battery set which is to be used.

(2) Set at "Charge" switch for battery set which is to be charged.

When finished operating open both switches, unless additional charging as explained previously is needed for set that has been on charge, in which case keep the switch controlling this set at "Charge until the gravity reaches the full charge value.

Maintenance

If the storage batteries are to realize their full life and cause no trouble, they must have proper care and attention. The following points are for this reason very important.

Water

Never put anything into a storage battery except clean DISTILLED water. Keep this water in glass or earthenware receptacles, never metal ones.

Battery makers put a certain amount of acid, diluted with water, into each cell when new, and no more acid is needed. As the water evaporates, it must be replaced from time to time so that the solution keeps the plates completely covered.

EVERY WEEK, on the pilot cells, and EVERY TWO WEEKS on all the other cells, look at the acid level. To do this, remove the caps and use a flashlight to illuminate the cell interior. The acid level should be about a quarter of an inch above the top of the plates. It should never be allowed to get down to the top of the plates, and on the other hand, it should not touch the bottom end of the filling tube.

Add the necessary amount of water by running it in slowly just BEFORE charging. Batteries require more water in hot weather than in cold weather.

Distilled water may be obtained at any drug store or battery service station. It is best to buy it in large bottles of one gallon to five gallons capacity, and fill the cells either directly from the bottle through a rubber tube, or else by a special filling cup. Do not use a hydrometer for this purpose. If you are not already provided with such an arrangement, our service man will show you how to set up a distilled water bottle with glass tubing and rubber hose.

Cleanliness

Keep the outside of the battery dry and clean, not merely for the sake of appearance, but to obtain proper service.

If you are careless in using the hydrometer, and drip acid on the batteries, or if you leave the filling caps off and allow the fine acid spray, coming from the batteries when they are charging, to be deposited on the battery tops, you invite short circuits and noise in operation. A little acid mixed with dust from the air in the room will soon form an electrical leakage path on the battery top between terminals, which may give a lot of trouble. In any case once each week wipe off the battery tops and connectors with a rag moistened in a solution of baking soda in water, or a solution of household ammonia and water in equal parts. Be sure none of this liquid gets inside the batteries, so for the sake of safety dampen the cloth somewhere away from the batteries. After this cleaning, wipe off the battery tops with a rag dampened in water; finally, dry them off with a clean rag.

After cleaning, coat the battery terminals and connecting bars with the special non-oxide grease supplied. If any deposit has formed on the parts, scrape it off first.

Remember that even a very small particle of dirt getting into a cell may reduce its effeciency and its life. Therefore, ALWAYS KEEP THE FILLING CAPS SCREWED ON TIGHT, except when testing the gravity, or adding water. The little vent holes in the caps will take care of the gas given off in charging.

Miscellaneous

If for any reason the batteries are not in use, keep them fully charged and test their gravity and add water once a month.

Connections must be tight at all times. Occasionally check both the outside connections and the cross straps between cells, to ensure that they are tight and good connection is being made.

Never bring open lights or flames of any kind into the battery room.

Keep the battery room ventilated at all times.

Do not use the batteries right after charging, but allow about half an hour to elapse; otherwise the batteries will still be gassing and this will cause noises to be heard in the system.

Responsibility for Batteries

To ensure proper care of the storage batteries, one person should be given full responsibility for them, and should fill out the Battery Log Sheet we supply; no one else should touch them. If the projectionists work in two shifts, one man on each shift should be given responsibility for the batteries.

Cleaning Mechanism and Film

Strict cleanliness as regards both the film and the film pick-up mechanism (Fig. 10) is most important.

Dirt on the exciting lamp or on the lenses, or dirt clogging the openings in the aperture plate and tension pad, will lead to low volume and poor quality.

Dirt or emulsion accumulating on the film tracks of the aperture plate and tension pad may lead to scratching of the film.

Dirt on the sprocket in the film compartment may cause unsteady pitch in reproduction.

Dirt, dust, oil, fingermarks, scratches or sprocket-hole cracks on the film will cause noisy operation.

The film must therefore be kept in first-class condition, and the different parts mentioned must be cleaned AT LEAST ONCE EVERY DAY.

A pipe cleaner and tooth-brush should be used for cleaning the sprocket and tension pad. Dust and surplus oil should be wiped off with a dry cloth. Do not scrape the film tracks with a knife or abrasive in cleaning them. The film tracks must always be perfectly smooth and polished to the touch. Run the finger tip over them at least once daily to see that no rough spots are developing due to dirt or emulsion hardening on.

Film should be cleaned by drawing it gently through clean, soft, cloths. Do not use chemicals or "dope" on it.

Sprocket-hole cracks in the film can be avoided by not having excessive tension on it. Use no more tension than is necessary to get a clear picture at the highest projection speed used in the house.

Adjusting Film Exciting Lamp

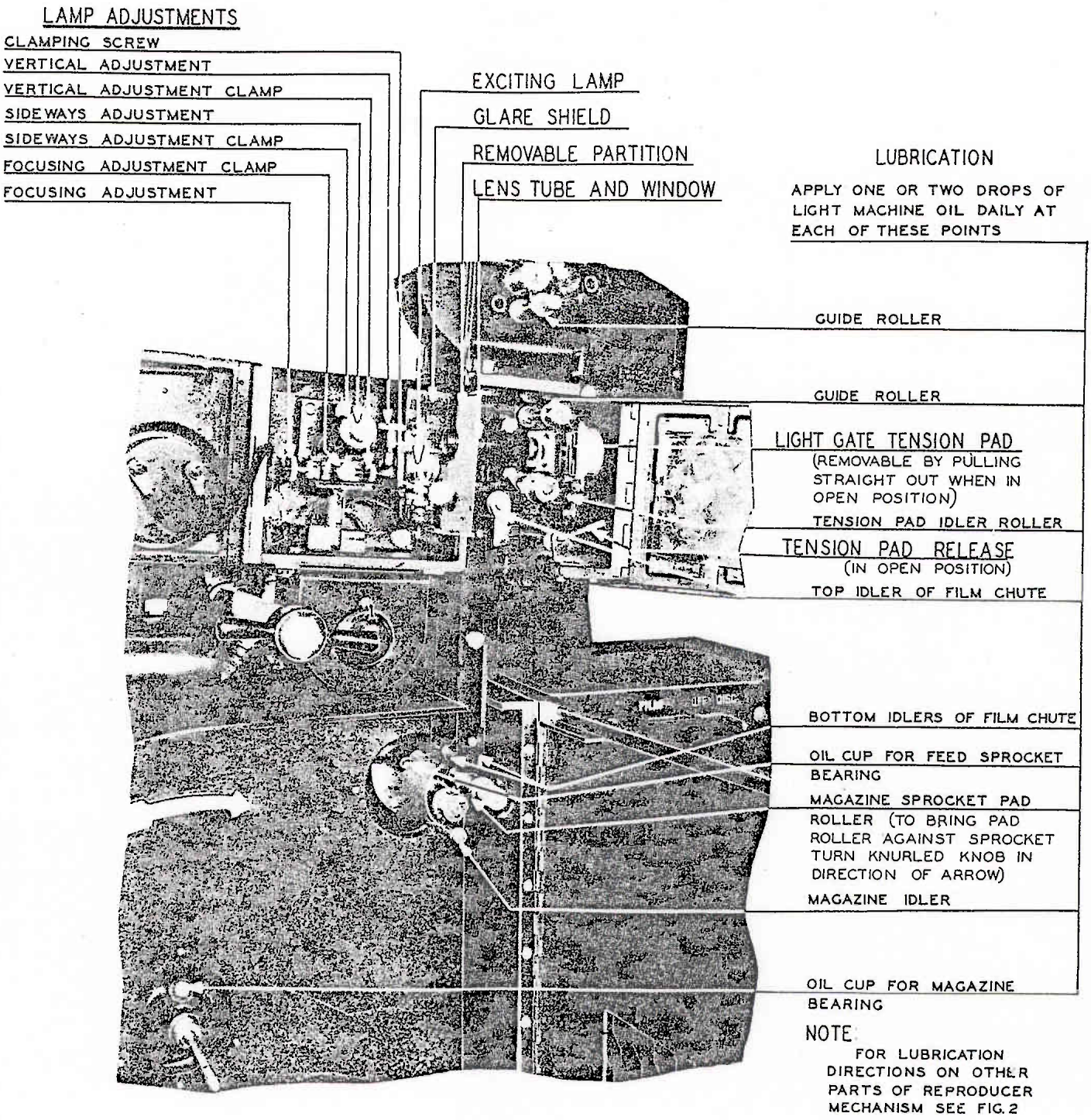
It is vitally important to have the exciting lamp of the film pick-up apparatus properly adjusted.

To light this lamp, set the film-disc switch (Fig. 1) on the front of the machine at "FILM". Then turn the control knob on the door of the exciting lamp compartment until the meter adjacent reads exactly 3.6 amperes. This value is important.

The object of this lamp is to produce a bright, clear illumination on the sound track of the film and on the photo-electric cell. The light from the lamp passes through the lens tube (Fig. 10). In the side of this tube will be seen a small round window. Take out the removable partition between the lamp compartment and the film compartment, and swing the glare shield in place over the lamp, to avoid dazzling the eyes. Light the lamp; then on looking through the window in the lens tube, a narrow horizontal slit will be seen inside the tube, at the right. The light falling on this slit should be bright and sharply focused, with the slit in the center. On removing the tension pad and holding a small white card or piece of paper in front of the aperture, an oval spot of light will be seen on the white surface. The edges of this spot will be soft and blurred, but otherwise it should be clear and uniform. There should not be shadows at the top or bottom or at the ends.

Check the two points just mentioned AT LEAST ONCE EVERY DAY. Whenever the illumination does not meet these requirements, adjust the lamp as will now be described.

The exciting lamp is mounted on a bracket (Fig. 10). This bracket in turn is mounted on two supporting pieces, which



EXCITING LAMP AND FILM COMPARTMENTS OF WESTERN ELECTRIC REPRODUCER SET

FIGURE 10

also serve to make contact for the lamp circuit. The bracket can be removed by simply pulling it sideways. Four adjustments for the exciting lamp are provided on this bracket, namely:

Clamping Adjustment

The lamp base is held in a socket which is clamped by means of a thumbscrew. At the bottom of the socket is a spring contact stud. The lamp base has a pin in the side, and the socket is slotted to clear this pin. When putting in a lamp, see that the clamp screw is loosened, then push the lamp down until the pin is out of the slot, and turn it so that the pin locks it in place, like a bayonet joint. The lamp must always have the filament perpendicular to the length of the lens tube, that is, parallel with the film. Except when putting in a new lamp, this adjustment should not need attention.

Vertical Adjustment

Loosen the clamping screw of this adjustment, then by means of the adjusting screw move the lamp bracket up or down as required until the light is vertically centered on the slit in the lens tube. Tighten clamping screw.

Sideways Adjustment

Loosen the clamping screw of this adjustment, then by means of the adjusting screw move the lamp bracket sideways so as to center the light on the slit horizontally. When trying to move bracket away from you, press steadily on the clamping screw at the same time; otherwise the bracket will not move. Finally tighten clamping screw.

Focusing Adjustment

Loosen the clamping screw of this adjustment, then turn the adjusting screw so as to get the sharpest possible focus of the light on the slit. Tighten clamping screw.

The filament image should now be bright and sharp and perfectly centered on the slit. Check the illumination in front of the aperture plate by means of the white card test. If the light spot shows any shadows at top or bottom or sides, move the lamp slightly up or down or sideways, as required, until these shadows disappear. Do not change the focus.

After an exciting lamp has been used considerably, the filament may show a tendency to sag. This has a bad effect on the volume, as the filament image no longer coincides with the slit. Another result of ageing that tends to cut down the volume is blackening of the lamp bulb, which reduces the amount of light emitted. Therefore, as soon as the filament begins to sag noticeably or the glass begins to darken, replace the lamp.

On account of the number of operations involved in adjusting the exciting lamp, and the possibility that one may have to be replaced during a show, it is very necessary to have some means of putting in a new lamp and operating it at a moment's notice. This can be done by setting up in the machine each spare lamp and bracket supplied, and making all bracket adjustments needed for proper operation.

As already explained, the bracket can be slipped bodily off the supporting parts without disturbing any adjustments; the spare lamp and bracket can therefore be removed and stored away ready for immediate use. If possible, keep the lamp in the bracket; otherwise, mark each lamp so to permit quick identification.

Lubrication of Mechanism

The mechanism should be lubricated regularly in the manner that will now be specified. Avoid lubricating at irregular intervals and avoid using more lubricant

than necessary. The excess lubricant does not last in the machine any longer than a moderate quantity; it simply runs off, clogs the mechanism, gets on the film, and spoils both the picture and the sound. Use only the lubricants supplied by us, which have been specially selected for their purpose.

Driving Side of Machine

Apply one or two drops of light machine oil daily to the following parts (Fig. 2):

Universal joints on vertical shaft.

Oil hole on upper gear box (projector drive gear box; with Simplex and Powers heads only).

Oil cup at right of flywheel.

Friction discs of lower magazine take-up (turn magazine reel by hand while doing this, to spread the oil).

Apply a small amount of graphite grease or vaseline twice a week to the inner side of the driving chain.

Once each week clean the take-up friction surfaces by removing the discs and wiping the friction surfaces with a rag soaked in clean oil.

Operating Side of Machine

Apply one or two drops of light machine oil daily to the following parts (Fig. 10):

Lowest guide roller in projection head.

Guide roller in film compartment (top roller).

Tension pad idler roller.

Top idler of film chute.

Bottom idlers of film chute.

Oil hole behind sprocket in lower magazine.

Pad roller in lower magazine.

Idler roller in lower magazine.

Oil hole behind take-up spindle in lower magazine.

No lubrication by the projectionist is required for any of our equipment, beyond that just specified.

The motor-generator used in case of DC supply is also self-lubricating. Our Service Department will give the apparatus any periodic care required in the matter of lubrication beyond what has already been directed.

In case any oil gets on one of the commutators by accident, wipe it off as soon as possible and clean out the slots between the bars with a wooden toothpick to remove any carbon.

Treat the projector head itself as instructed by the maker.

Starting Amplifier Equipment

When the 41-A, 42-A, or 43-A amplifiers (Fig. 4) are installed, proceed as follows:

(1) See that starting switches on 42-A and 43-A amplifiers are turned off and that horn safety switch is off.

If starting up during a show make sure that theatre horns are turned off by means of output control key on output control panel.

(2) See that storage batteries are switched on ready for use as covered in preceding section.

On DC supply, start motor generator.

See that power safety switch is closed.

(3) If using film reproduction, set film-disc switch at "Film", and turn control knob on amplifier door so that adjacent meter reads 270 milliamperes.

(4) On 42-A and 43-A amplifiers turn starting switch to "Fil".

(5) On 41-A amplifier, see that filament key is on, and adjust filament control so that filament meter reads 270 milliamperes.

(6) On 42-A and 43-A amplifiers, after allowing at least one minute to elapse since turning switch to "Fil", turn this switch to "Plate".

(7) On 41-A amplifier, press in turn the three buttons marked "Plate Current".

Meter marked "Plate" should read in each case not less than 1.35 nor more than 1.55 milliamperes.

(8) On 42-A and 43-A amplifiers, each meter pointer should be on red mark.

(9) Turn on horn safety switch.

When the amplifier installed is the 46-B (Fig. 5), proceed as follows:

(1) See that horn safety switch is off.

If starting up during a show, make sure that theatre horns are turned off, by means of output key on amplifier.

(2) See that storage batteries are switched on ready for use, as covered in preceding section.

On DC supply, start motor generator.

See that power safety switch is closed.

(3) If using film reproduction, set film-disc switch at "Film", and turn control knob on amplifier door so that adjacent meter reads 270 milliamperes.

(4) On 46-B amplifier, turn on starting switch, and adjust filament control so that right-hand meter reads 270 milliamperes.

(5) Check reading on left-hand meter on amplifier. It should be between 0.85 and 1.1 milliamperes. Reading on center meter should be between 1.3 and 1.6 milliamperes. Press meter key; right-hand meter should now read between 50 and 65 milliamperes.

(6) Turn on horn safety switch.

Testing Amplifier Equipment

Having started up the amplifier equipment as already described, test it as follows before every show in which it will be used:

(1) If both disc and film equipment is installed, switch in whichever is to be tested first, by means of the film-disc switch.

(2) Put pick-up equipment on one machine on turntable in circuit, by setting fader at point 9 on side to which this equipment is connected.

(3) If testing disc pick-up, rub needle of reproducer lightly with finger. This should be clearly heard in monitor horn.

(4) If testing film pick-up, see that lamp current is at value previously specified, and readjust if necessary. Now take out tension pad and move a card up and down across light spot. Every time this is done a click should be heard in the monitor horn. Finally, replace light gate.

(5) Move fader to other side and test that pick-up equipment in the same way.

(6) Bring fader to zero.

Shutting Down Amplifier Equipment

Proceed as follows, and always in the order given here:

(1) Turn off output key at Output Control Panel or at 46 Type Amplifier; then turn off horn safety switch.

(2) Turn off starting switches on 42-A and 43-A amplifiers.

(3) Turn off power safety switch. On DC supply, also shut down motor-generator set.

TURN OFF STARTING SWITCH ON 46 TYPE AMPLIFIER

(4) Set film-disc transfer switch at "Off" (if installation is equipped for film reproduction).

(5) Turn off storage batteries at battery panel.

Starting Mechanism and Testing System

EVERY DAY before the house opens test the theatre horns individually and at the same time check the operation of the projector and pick-up mechanism, as will be described in this section.

Regular daily testing is of great value and importance for the reason that a large proportion of failures and defects do not happen suddenly, but develop gradually, and hence can be detected and remedied before they become serious.

Keep a stock of two or three records or sound films especially for testing, independently of those used in the show. Piano, speech, and orchestra selections are the most suitable. At least

two copies of each record or two prints of each film are required.

After cleaning and lubricating the mechanism, checking the exciting lamp, and starting and testing the amplifier equipment, as previously described, start and test the mechanism and horns by proceeding as follows:

(1) Turn off all theatre horns and if installation has an output control panel (Fig. 4), providing an individual dial switch for each horn, set these controls at zero, that is, turned all the way to the right. Keep on monitor horn with control at usual setting.

(2) On fader, set pointer at zero.

If installation includes both film and disc reproduction, see that film-disc switch is set for type of pick-up which is to be tested.

(3) On the two machines, set up two copies of one of test records, or thread two prints of one of the test films, exactly as described in next section, "Setting Up".

(4) On each motor control box, see that regulator switch is set at "REG" and that starting switch is on.

(5) Set up operator's and observer's telephone sets. The Manager, or some one else qualified to judge whether reproduction through theatre horns is satisfactory, should now go into theatre and stay within easy reach of observer's telephone.

(6) Start first projector by raising foot switch on machine base (Fig. 1).

(7) Check reading of meter on control box. After machine is up to speed, reading should vary somewhere between 20 and 30 mils, on AC supply, or 40 and 60 mils, on DC supply.

(8) See that projector mechanism is running freely and that disc reproducer is tracking properly and has not jumped any grooves, and that film is passing through smoothly.

(9) Bring up fader pointer to one step below correct setting for record or sound film which is being played. Music or speech should now be heard from monitor horn.

(10) If the installation has an output control panel, turn all theatre horns on and then off again, one at a time. The observer, who ought to be near the stage, should listen to each horn in turn and check its operation. He should also be sure that the sound from each horn is clear, free of noise, and of full volume.

(11) Put on all horns, with fader at correct setting, and see that reproduction is satisfactory.

(12) If installation includes an emergency amplifier equipment, switch over to this equipment by means of key on system switching panel, and see that reproduction is satisfactory, using all horns. Then switch back to regular arrangement.

(13) Stop first machine by pressing down foot switch on machine base. With disc pick-up, put new needle in reproducer and set it back at starting point of record. With film pick-up, rewind film and set it back at starting point.

Now start both machines and compare outputs for volume and quality by switching from one pick-up to other on fader.

(14) Put fader on zero, stop machines, and put away test records or films.

If the above tests are satisfactory, the equipment is ready for operation.

Film Reproduction

To set up a sound film ready for operation, proceed as follows:

(1) See that fader is at zero and that film pick-up circuits are connected to it.

(2) On projector head, place aperture sound track mask in position.

(3) On projector, place framing lever in central position. Move projector mechanism by turning handwheel (Fig.2), so that shutter cut-off blade is uppermost, lens is open and intermittent has just ceased moving. Thread projector mechanism with film in usual manner except as follows:

3.1 For Simplex, be sure that loop between intermittent sprocket and lower sprocket of head, is such that film just comes in line with edge of head, as shown in Fig. 11.

3.2 For Motiograph, allow a tight "two finger" loop between intermittent sprocket and lower sprocket of head.

3.3 For Powers, thread above automatic loop-setter and allow a "two finger" loop.

3.4 If using a type of projector head other than one of the three makes just mentioned, allow a length of film equal to 19 1/3 frames, or 14 1/2", between center of picture aperture in the projector head, and center of light-gate aperture in reproducing machine. In other words, if the frame centered at projector aperture is called #1, then, counting downwards along film, middle of light-gate aperture should be one-third of a frame past center of #20. This gives perfect synchronism between sound and picture with all makes of heads, and is basis of rules for threading just given.

(4) Thread film through film reproducing mechanism exactly as shown in Fig. 11. In doing this, allow for slack, between lower sprocket of projector head and sprocket of film reproducing mechanism, a length of film equal to approximately two sprocket tooth intervals.

(5) After film has been properly located on reproducing machine sprocket, do not forget to release tension pad, so that it bears on film and holds it close up against aperture plate in front of lens tube, as shown in Fig. 11. Door cannot be shut unless tension pad is released. Also close the film chute cover so as to have the film completely enclosed in case of fire.

(6) On synchronized feature pictures, by starting and stopping motor with starting switch run off as much film as necessary to bring end of "Part No" leader approximately up to projector aperture. Avoid doing this to excess, as it tends to burn up the switch contacts.

Disc Reproduction

To set up the record and film ready for operation, proceed as follows:

(1) See that fader is at zero and that disc pick-up circuits are connected to it.

(2) See that reproducer is in its rest. Put in new needle.

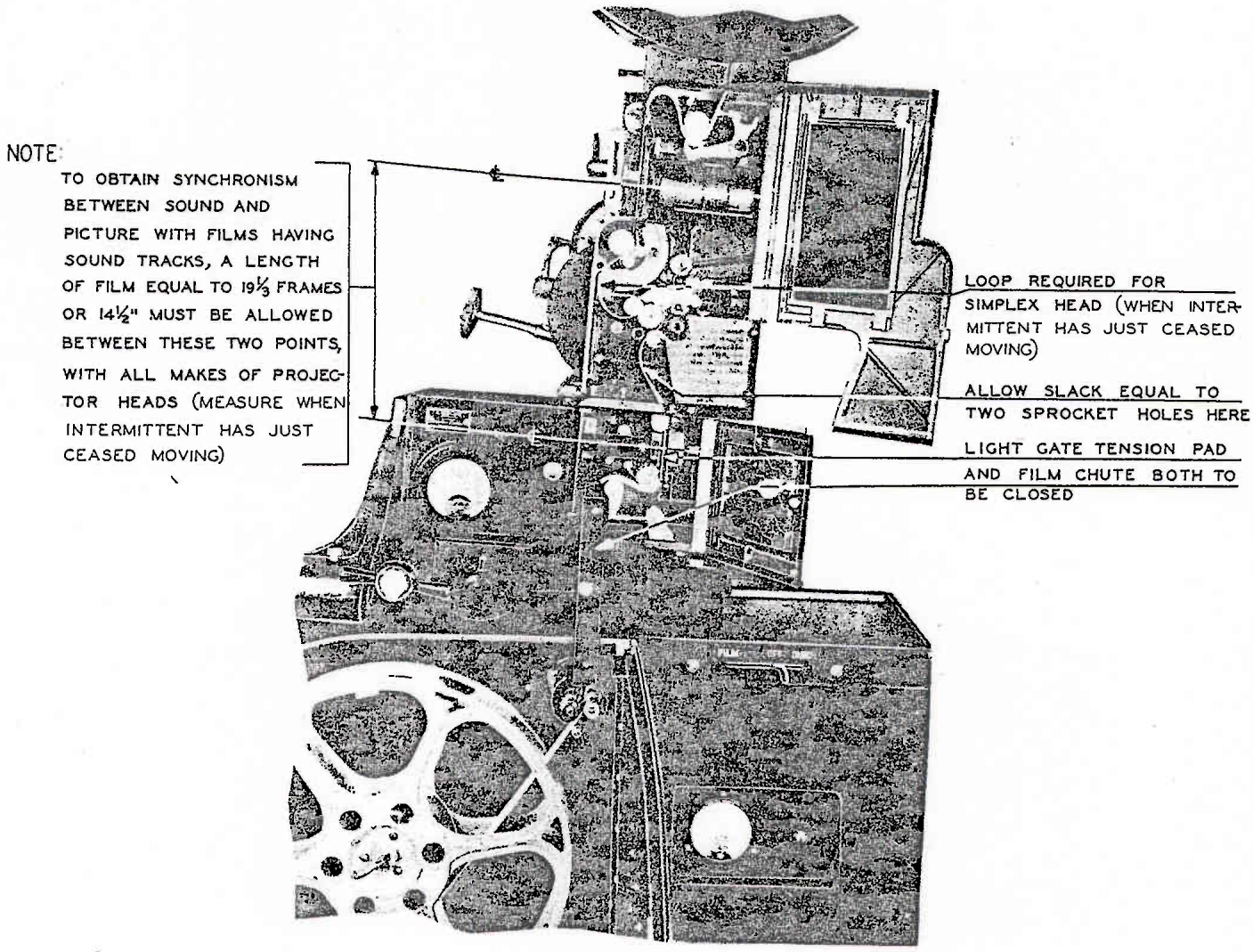
(3) Select film and record to be used, and be sure to check number on record against number on film. Mark record on label to show number of times used, counting this run.

(4) On projector, place framing lever in central position. Move projector mechanism by turning handwheel (Fig.2) so that shutter cut-off blade is uppermost, lens is open, and intermittent has just ceased moving. Thread projector and reproducing mechanism with film in same manner as just described for film reproduction, placing frame marked "START" directly in front of aperture.

On Simplex and Motiograph, this step is easier if you remember that when a frame is in front of the aperture, the lower edge of the aperture plate track will be between the eighth and ninth sprocket holes from the lower edge of the frame. Therefore, splice a white leader on the ninth hole from the "START" frame, and then when you line up this splice with the lower edge of the aperture plate track, "START" frame will be at the aperture, as shown in Fig. 12. On Powers, the gate is open when threading, so that there is no difficulty.

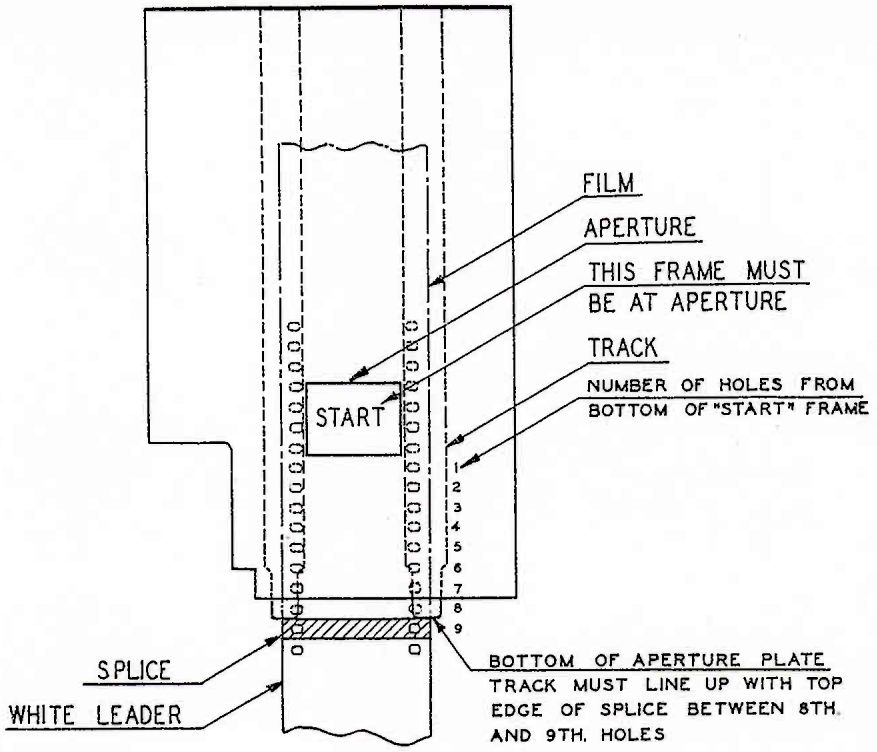
(5) Set up record on turntable as shown in Fig. 13. In doing this, following method must be strictly observed so as to avoid risk of imperfect synchronism or damage to records. Motor must never be turned when adjusting record on turntable:

5.1 Hold record with both hands and lay it on turntable so that starting arrow is at about the place where needle comes. Wipe off



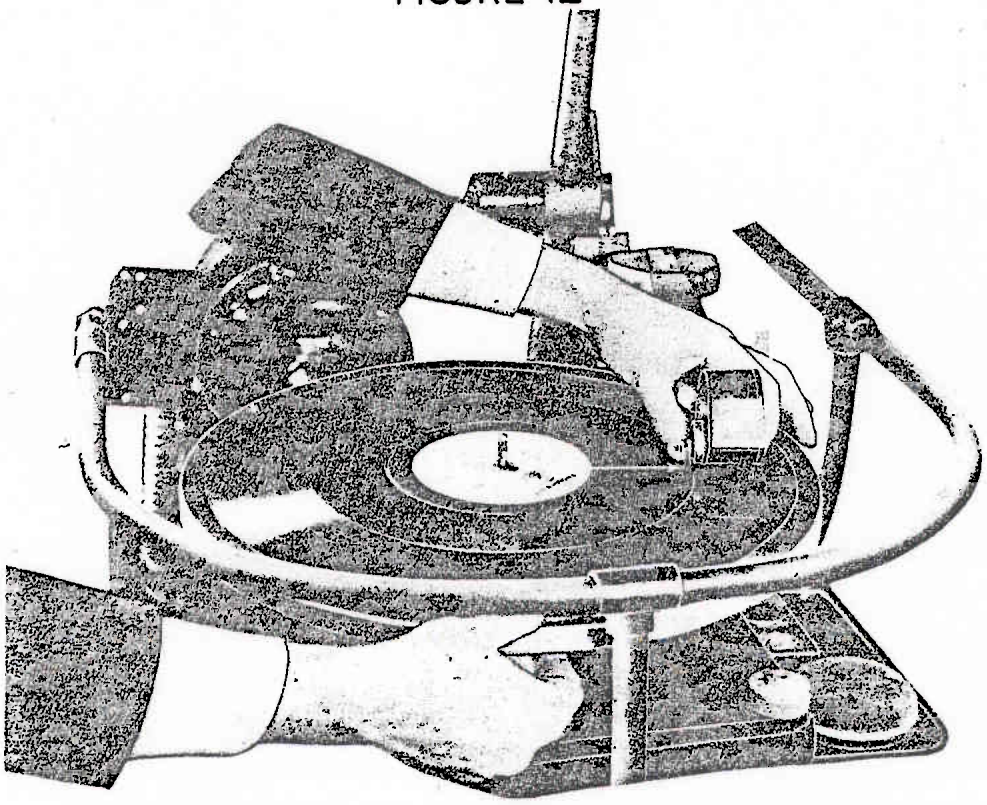
THREADING PROJECTOR AND WESTERN ELECTRIC REPRODUCER SET FOR FILM REPRODUCTION

FIGURE 11



SETTING UP FILM FOR DISC REPRODUCTION
(SIMPLEX AND MOTIOGRAPH HEADS)

FIGURE 12



METHOD OF SETTING RECORD AT STARTING POINT
ON WESTERN ELECTRIC REPRODUCER SET

FIGURE 13

record lightly with cleaner provided.

5.2 Pick up forward end of reproducer unit between thumb and forefinger of your left hand so that tips of thumb and finger project about 1/2" below bottom of unit.

5.3 Move unit over until needle point is above starting groove and rest tips of thumb and forefinger on record surface so as to hold needle point just off record.

5.4 Place your right hand with fingers resting lightly on underside of turntable, near edge, and thumb on top of record, near edge; hold turntable steady and by moving thumb turn record so that starting arrow comes exactly below needle point.

5.5 Lower needle down gently into starting groove at this point by slowly opening thumb and forefinger between which it is held. Do not push point into groove by sliding it sideways across uncut record surface, but lower it straight down. When it is in place rest fingers lightly on top of reproducer and gently press it towards each side to make sure needle point is in groove.

5.6 Put record clamp over center pin of turntable and press it down on record firmly, but not too heavily.

(6) Turn over mechanism by handwheel until turntable and record have revolved about half a turn. See that needle tracks properly on record and film travels free.

(7) On synchronized feature pictures, by starting and stopping motor with starting switch run off as much film as necessary to bring end of "Part No." leader approximately up to projector aperture. Avoid doing this to excess, as it tends to burn up the switch contacts.

Important

Never attempt to stop or slow up a projector equipped for disc reproduction by holding on to the turntable, as this may cause damage to the apparatus and spoil the synchronism for the subject that is being set up. The turntable coasts about four turns after the power is shut off.

Never remove record clamp, or put it on, while turntable is revolving.

Horn Controls

If the equipment has 12-A upper horns and 13-A lower horns, then after setting up the record or film as directed in the instructions immediately before this, adjust the horns for an A, B, or C setting, as required for the particular subject being shown (See "Rehearsing"). The following is the procedure required:

For an equipment using 41, 42, or 43 type amplifiers, which is provided with an output control panel (Fig. 4), the following table shows the steps on which the horn control dial switches on this panel must be placed to give the A, B, and C settings, respectively.

"A" Settings

Controls	1	2	3	4	5	6
Steps	...	...	...	...	...	...

"B" Settings

Controls	1	2	3	4	5	6
Steps	...	...	...	...	...	...

"C" Settings

Controls	1	2	3	4	5	6
Steps	...	...	...	...	...	...

(Our engineer will fill in these figures).

If the equipment employs a 46 type amplifier, horn setting is done by means of the horn control key, which is mounted on a wall cabinet. This key has two positions, marked "A or B" and "C". Use whichever is required.

Before giving in detail the steps to be followed in running the show, some general points will be touched on.

Before any public showing, all presentations should be rehearsed as covered in the next section, "Rehearsing".

The fader must always be kept at zero when the house is open, except when testing with all theatre horns turned off, or when voice or music is actually being reproduced, with the motor up to speed, as covered in detail in these instructions. This is necessary (a) to avoid the record surface noise or film noise being noticed (b) to prevent the possibility of noises being heard from the horns at times when the pick-up equipment is being handled (c) to preclude the voice or music being heard in distorted form when the motor is speeding up or slowing down, in case it has to be stopped during a reel from film breakage or other cause.

When making a change-over as described in detail in the instructions which follow, move the fader as smoothly as possible, and if you cannot make a complete change-over in one movement, stop AT ZERO for a fresh grip. Be careful not to overshoot the setting and then have to come back to it.

If the installation includes disc pick-up, always keep the reproducer in the rest except when a record is set up.

Under no circumstances is it permissible to run pictures with synchronized voice or music at any other speed than 90 ft. per minute - that is to say, when running such pictures the motor control box regulating switch must always be set at "REG", as already mentioned in these instructions, and never at "VAR". Any adjustment in the timing of the program by speeding up numbers or slowing them down must therefore be done elsewhere than in the synchronized reels.

So that the operator may have immediate and proper notification in case any part of the show is not coming over as it should, a member of the staff designated by the management, perhaps an usher, should remain in the theatre all through the performance. This observer should be competent to judge quality of reproduction, synchronism, etc.; he should be within reach of the observer's telephone and given responsibility for notifying the operator immediately anything goes wrong. He should also keep the operator informed as to how well the house is filled, so that the latter can adjust the volume if necessary. (See "Rehearsing").

Never make the monitor horn so loud that it can be heard outside the projection room; keep the volume up just enough to follow the sound after the numbers have started, and make it a little louder before cues.

Do not cut synchronized film or sound film except in case of breakage (See sections on "Troubles-During Show" and "Replacements-Splicing Film"). If it is found desirable to eliminate bows at the end of the film, use the douser. If there is insufficient leader to permit proper

threading of the film at starting, you may add more blank leader, provided, of course, it is added before the "START" mark. Leader must always be so added if it is found that the voice or music begins before the motor is fully up to speed.

If the machines are equipped with a safety device which stops the motor when the film has run through, then, with disc reproduction, in case the record does not end until some time after the finish of the film, this ending will be spoiled through the safety device shutting down the equipment, unless sufficient blank film is added at the end to keep this device from operating until the music is finished. Check this point during rehearsal and before running show make sure these blank lengths have been added to any reels that require them.

With subjects using disc reproduction a broken film is a more serious interruption than with ordinary subjects, on account of the need for synchronism between record and film, and with film reproduction, a break is also specially objectionable because it cuts off the music as well as the picture. Therefore, examine all synchronized films and sound films with extra care when rewinding, so as to catch tears before they develop into breaks. For this reason, rewind by hand and not by motor.

In film reproduction make especially sure that the film has been put in as good condition as possible and that the mechanism is clean, as covered previously under "Starting and Testing-Cleaning Film Reproducing Apparatus". Oil or grease from the projector or film pick-up mechanism is particularly liable to get on the first few feet of film.

Keep emergency films in containers unless they have to be used.

Synchronized films and sound films come treated ready for immediate use, and require no different care than ordinary films, except as just noted.

Keep all records in envelopes they come in, when not in use. Put each record in its envelope with the playing side next the felt, and facing you. Keep the records in correct order for the next show.

Synchronized Subjects

The process of running synchronized subjects, using either film or disc reproduction, is as follows:

(1) Follow out starting and testing procedure, and set up first two synchronized numbers on the two machines to be used, exactly as described in preceding sections.

(2) Strike arc on first projector in usual manner.

(3) When lamp is in operating condition and show is ready to proceed, start motor of first projector.

(4) When motor is up to speed open douser.

(5) Bring fader up SLOWLY so that it reaches correct setting just before voice or music begins. (This needs rehearsal).

Motor used in this equipment takes four or five seconds to speed up, because of heavy flywheel required. NEVER move fader from zero before motor has reached full speed, as this will completely spoil beginning of speech or music. If sound begins before motor has finished speeding up, add leader to film as required.

(6) For synchronized feature pictures, keep track of operation by listening to monitor and by watching screen for cues. Do not make monitor so loud it can be heard outside projection room. At cue "SM" as given on cue sheet, start motor on second machine. At cue "CO", operate change-over so as to switch picture from outgoing projector to incoming. As soon as voice or music from outgoing machine is finished, bring fader of this machine to zero and then up to proper setting for incoming machine in time to catch first note of music. (This needs rehearsal).

Stop outgoing machine, kill arc, and set up third film, and also third record, with disc method.

(7) For synchronized subjects other than feature pictures, keep track of operation by listening to monitor and watching pictures. As soon as last note of music or last word is heard, bring fader to zero, then fade out picture as soon as subject matter requires. Start second machine in same manner as already described for first machine. Proper instant for starting second machine so as to get right time interval between end of first subject and beginning of second, must be determined by rehearsal.

NEVER stop motor on any machine before fader has been brought to zero or switched to incoming machine, as otherwise end of speech or music will be spoiled.

Stop outgoing machine, kill arc, and set up for third subject.

(8) Continue process of switching from one machine to the other until show is completed.

(9) When synchronized presentations are finished shut down amplifier and power equipment as covered in previous sections. Put away films and records.

(10) When using film pick-up, after running each reel wipe off with a rag the light aperture and film tracks of aperture plate and tension pad in reproducing attachment, so as to guard against possibility of dirt accumulating and obstructing light beam or scratching film.

Non-Synchronized Subjects

When films without synchronized accompaniment are being used, and it is not desired to operate at the standard synchronized speed of 90 ft. per minute, throw the regulating switch on the motor control box to the "VAR" position and turn the control knob to regulate the speed as desired. The motor is started and stopped by the foot switch used in synchronized operation.

Use of Tilting Mechanism

If the house has both a front and a back screen, change the projection angle, in going from one screen to the other, by turning the tilting handwheel (Fig. 1). Upper and lower stop nuts are provided to check the movement of the handwheel when the correct angle is reached. Be sure to loosen the tilting clamp before turning the handwheel, and be sure to tighten it again when the angle has been changed.

If for any reason it is desired to change the tilt of the machine by a large amount, first see that the tilting clamp is tight, then loosen the two tilting stud setscrews (Fig. 1) which grip the tilting rod. Hold the rear of the lamp house bracket in one hand, loosen the tilting clamp with the other, and tilt the machine as desired. Then tignten clamp and setscrews.

Important - Use of Foot Brake

When the foot switch is pressed down lightly, it turns off the starting switch and stops the machine. If it is pressed down more heavily, against the resistance of the spring, it applies a brake to the motor flywheel. However, this braking feature is not to be used as a regular thing, as this is not necessary and would cause excessive wear. It is only to be used in emergencies, such as film breakage, when a quick stop is necessary to avoid damage.

In order to give a satisfactory performance with synchronized presentations, adequate rehearsal is necessary to cover the various points which will be listed.

The House Manager should be present at these rehearsals with an observer at the telephone set. The subjects should be run off in the same way as for an actual performance, as covered in the last section, "Running the Show". Time spent in careful rehearsing will be amply repaid in the perfection of the show, and the actual presence and interest of the house manager is indispensable.

Light effects and any special features of the forthcoming show should be considered and tried out in conjunction with the rehearsal procedure described here.

Note that, as previously mentioned, adjustments in the timing of numbers must be confined to parts of the program other than the synchronized reels; the latter must always be run at standard speed, with the regulating switch on the motor control box set at "REG".

The points to check are as follows:

(1) On first reel of each synchronized feature picture and on first of each group of short subjects shown, determine how soon after starting motor fader should be brought up to its full setting. It should be brought up slowly, taking two or three seconds, and should reach this point just before the voice or music begins. Add blank leader if necessary, as previously mentioned under "Running The Show".

(2) For remaining reels of a feature, determine how soon after change-over fader should be brought up to its full setting. Usually this will be immediately after change-over.

(3) For short subjects, determine how soon after end of voice or music accompanying each subject the picture should be faded out.

On second and following subjects, determine when motor of incoming machine should be started to allow proper time interval between subjects, and when fader should be brought up to its setting to catch incoming music.

(4) If using a safety device that stops motor when film has run through, see whether there are any reels where the film terminates before the end of the record is reached, and add blank film at end as required, as mentioned previously under "Running The Show".

(5) As previously mentioned, in houses where the upper horns are of the 12-A type and the lower horns of the 13-A type, and where an output control panel is used, with a separate control for each horn, three different types of combinations or settings of the upper and lower horns are used, and designated respectively by the letters "A", "B", and "C".

The "A" setting is for vocal and instrumental solos or speech and uses upper horns only or upper horns with some lower horn.

The "B" setting adds more lower horn to bring out effect of orchestral accompaniment.

The "C" setting is for orchestra alone and carries further result mentioned for the "B" setting.

The last page under "Setting Up" describes how to make these three settings in this theatre. Inasmuch as the settings are determined by careful tests of the house they should be followed without change. Other settings than recommended may throw system out of balance electrically and overload it or distort sound.

(6) As a matter of convenience, and in order to give the theatres the benefit of the opinion of the recording and engineering staffs, recommended fader and horn settings are frequently marked on records or films or given on cue sheets sent out with them. Our engineers so adjust the amplifiers that with a full house, and fader setting recommended, correct full house volume is obtained. With house only partially filled fader should be brought down one or two steps.

(7) Determine horn settings and empty house fader setting for each number, bearing in mind any recommendations marked on or accompanying record or film. Do this with care and in particular do

not permit too high a volume. Synchronized scores to feature pictures should be run at a volume appropriate to incidental music. Never make the volume so loud that it causes the needles to oscillate on the amplifier plate current meters. If this happens it is a sure sign of overloading and poor quality.

Speakers talking at a distance or in conversational tones should be reproduced with less volume than those speaking close or obviously talking loudly. Instrumental solos should have less volume than full orchestras (not accompanying), bands, etc. In news reels, street noises, locomotive whistles, etc., should be loud to give correct illusion.

(8) In certain records effect may be improved by bringing fader up or down a step at certain points in the picture, as just mentioned. Even the horn settings may occasionally be changed during a number as record changes from light or vocal effects, which are best reproduced by upper horns, to heavier orchestra music for which lower horns are brought out.

However, discretion must be used in not making too great or too frequent changes in horn and fader settings; each record is made under skilled musical and technical direction in such a manner that when it is reproduced the effect desired by composer, artist, and conductor will be obtained without any need for frequently changing settings while playing. If they are changed too much, therefore, proper effect will not be obtained.

(9) Having rehearsed show and determined all settings, curtain cues, etc. record them in the form of a cue card posted in the booth.

(10) In communicating with the operator by means of the telephone set it will be found handy to use the buzzer, with the following code:-

One buzz	-	Fader up one step
Two buzzes	-	Fader down one step
Three buzzes-		Answer over telephone.

General

If this equipment is properly maintained it should rarely give trouble in operation.

All the information given in this division has been carefully prepared on the basis of operating experience gained with large numbers of theatres, and you should make yourself familiar with it so that you can quickly locate and remedy troubles, and continue a program with the minimum of interruption if trouble arises during a show.

Remember that whenever the sound is not coming over as it should, the fader can be employed to cut it out until the trouble has been located and remedied. It is much better to do this than to continue the sound accompaniment when it is obviously bad. If the fader is properly handled all kinds of trouble may happen and be remedied by the projectionist without the audience noticing anything seriously amiss.

Whenever trouble occurs, use the emergency equipment or emergency set-up if one is provided, and endeavor to locate and remedy the difficulty, if possible, by following the instructions given here. If you are unable to do so, notify our nearest representative by telephone, telegraph, or registered mail. Do not attempt extensive repair or replacement work on the equipment, as this usually requires expert knowledge and we maintain service engineers who are quickly available for this purpose.

The installation has fuses at the following points:

Motor Control Box -
Two-10 amp. plug fuses on AC
Two-15 amp. plug fuses on DC

Battery Panels - See Illustrations.

Box for Film Dry Batteries -
1 amp. midget fuses.

Horn Cutout Box (Backstage)
3 amp. plug fuses.

46-A or 46-B Amplifier (if used)
Two-3 amp. plug fuses.

KS-5321 Motor Generator (used on DC only)
Generator-Two-10 ampere cartridge fuses
Motor (115 V.)-Two-20 ampere cartridge fuses.
Motor (230 V.)-Two-10 ampere cartridge fuses.
Voltmeter-Two 1/2 amp. midget type fuses.

Battery Charger (used on AC only)
Three-5 amp. plug fuses.

When one of the fuses burns out, replace it by a new fuse of the same type, as covered in the instructions which follow, but if it blows a second time, do not renew it until the cause of the trouble has been found and remedied.

Before removing the rear cover of any piece of amplifier equipment, be sure to turn off the power and keep it off till the cover is replaced. Also switch off the power on the battery switching and charging panel before replacing any fuses.

If all conditions appear normal, and still no sound is heard from the horns, and no relief is afforded by any of the procedures that will be described, the indications are that a break or short circuit exists somewhere in the sound circuit. In this case listen in with the headset along this circuit, starting at the disc or film pick-up with a record playing, and working

on towards the horns until the location of the fault is shown by coming to a spot beyond which nothing is heard. Be sure to use very little gain, as otherwise the headset will be overloaded and possibly damaged, and the quality will be spoiled. Use the same method to locate the source of noise or bad quality.

Use a battery and buzzer to test lines for opens or shorts, but NEVER to test amplifier or reproducer circuits, as this may upset the magnetic characteristics of the coils.

On some amplifiers two or more tubes are operated with their filaments in series; if one tube burns out, the others will then be extinguished. If two or more tubes go dark at once, therefore, it should be realized that only one has burnt out. This tube may be located by inspection, or the replacing tube can be tried in each socket in turn.

Troubles Occurring When Testing

Charger Not Functioning (AC Supply Only)

On charger used with AC supply, if a rectifier bulb does not light, its filament may be burned out. Also, a fuse on battery panel may have blown. Clean tube socket. If tube still does not light, replace it by one of spares supplied.

If tubes light but charger does not give output, a fuse inside charger may have blown.

Motor Does Not Start

(1) Is line switch on?

(2) Fuse may have blown in motor control box.

Reading on Motor Control Box Meter Not Within Specified Limits

If reading is to high, on AC, or too low, on DC, it indicates excessive friction at some point in mechanism. If this is not attended to immediately a bearing may freeze, rendering a projector temporarily useless. Stop machine and oil all bearings immediately abnormal reading is noted on meter, particularly any bearing that seems unduly hot. If trouble persists, notify our service man at once.

Motor Does Not Maintain Regulated Speed

Notify our service engineer at once.

Unsteady Pitch in Reproducing ("Flutter")

With film reproduction, there may be dirt on the sprocket in the film compartment of the attachment. If this cause does not exist, notify our service engineer at once.

Reproducer Not Tracking Properly

This occurs when needle jumps from groove. See that reproducer is not dragging on record (See "Replacements-Changing Reproducers") and that it is not hitting anything or otherwise being hindered from free movement. Put in new needle. Try new record. The swivel base on which the reproducer swings is mounted on a bracket, which in turn is clamped to the base by a bolt. See that the bracket is level and that the bolt has not loosened and allowed it to turn.

Excessive or Insufficient Plate Current.

If this is noticed on testing the amplifiers, replace the tube showing this condition by a spare.

When two or more tubes on an amplifier all show low plate current at the same time, try replacing the rectifier tubes on that amplifier (the 41-A amplifier uses the rectifier tubes on the 42-A amplifier). This may also be a sign of defective condensers (see paragraph #6 under heading "Volume Falls Off or Ceases").

No Sound From One Horn

(1) Fuse may have blown in cutout box back-stage.

(2) If fuse in cutout box has not blown, replace receiver as described under "Replacements-Changing Receivers".

Volume Falls Off or Ceases

(1) If system is a double one, having emergency amplifier equipment, cut in emergency amplifiers by means of key on system transfer panel. If this clears trouble, continue use of emergency amplifiers until our service engineer repairs or replaces defective regular amplifier, unless trouble can be cleared as will now be described.

(2) One of amplifier tubes may be burnt out. If so, replace with a new tube of same type.

(3) One horn may have short in line or winding through which sound current passes, thereby causing others to receive no power. Turn off all horns by means of keys on output control panel, or if these are not provided, then by means of switches in horn cutout box back-stage, and then try to locate bad receiver by turning horns on and off one at a time. They should all give volume except bad one. If defective receiver is found, replace by spare as described under "Replacements".

(4) Possibly fuses in horn supply circuit on battery panel have blown.

(5) Check reproducers by switching from one to the other on fader. If one is bad, replace as described under "Replacements". If neither gives any sound, check fader and circuit by means of headset, or as follows.

(6) In systems using 41, 42 and 43 type amplifiers, left-hand key at top of fader, called fader cut-out key (Fig. 7), can be used to cut out either side of fader circuit. If this key is thrown to left, (red) for example, reproducing equipment on "red" machine will be connected direct to amplifiers without going through "red" side of fader. Similarly when key is thrown to right (white) side, "white" machine is connected direct to amplifiers. To check whether trouble is due to defect in fader, try using cut-out key in this manner. If this eliminates trouble, use cut-out key for changeovers, instead of fader, until our service engineer can repair or replace latter. Regulate volume by means of gain control on 41-A amplifier.

(7) With film reproduction, exciting lamp may be out of focus or burnt out, or opening in photoelectric cell may be out of line with opening leading to film compartment. Position cell properly.

(8) If system uses one or more 43 type amplifiers, and plate current reading on one of these amplifiers is very low or is zero, probably a condenser has failed. A further indication of this is that plates of rectifier tubes of amplifier affected may begin to get red hot. Turn off power on this amplifier, by means of amplifier starting switch. Locate defective condenser as follows:

Remove front cover of amplifier. The condensers are connected in parallel in two groups, the first group containing C-2 to C-10 inclusive and the second group C-11 to C-19 inclusive. Unsolder connection coming from behind panel to lower terminal of C-2. Turn amplifier starting switch to "Plate". If plate meter reading is now normal, it shows bad condenser is in C-2 to C-10 group. Shut off switch. Restore connection on C-2, and unsolder connection between C-2 and C-3. Turn on switch. If meter reading still normal, it shows C-2 is good and bad condenser is in C-3 to C-10 group. Restore connection on C-3 and unsolder connection between C-3 and C-4; test again with switch and meter, and so on until a condenser is found which when connected causes meter reading to fall. This will be the bad condenser. Cut it out by connecting together directly the lower terminals of the two adjoining condensers, instead of making the connection through the lower terminal of the defective condenser.

If in the first place, when the connection coming from behind the panel is unsoldered from the lower terminal of C-2, this does not bring the meter reading back to normal, it shows that the defective condenser is in the C-11 to C-19 group. Then restore connection on C-2, unsolder connection between C-11 and C-12, and test for defective condenser as already described for C-2 to C-10 group.

(9) If all fuses are in good condition and all current and voltage readings normal, probably there is a ground, open circuit or short circuit somewhere in the system. Try to locate fault with headset, as described under "Troubles-General". Possibly a loose or grounded connection may be found, which can easily be repaired.

If system has no emergency amplifiers and includes one 43-A amplifier, and this is found to be defective, disconnect its "Input" and "Output" terminals (accessible by removing the back cover) and run system off 500 ohm "Output" terminals of 42-A amplifier. If system uses two 43-A amplifiers and one is found to be defective disconnect its "Input" and "Output" terminals. When cutting out an amplifier as just described the loss of power can be partly compensated for by running the fader higher, or raising the gain control dial on the 41-A amplifier one or two steps. Be careful not to impair quality by raising fader or gain so much as to overload amplifiers.

Poor Quality or Noisy Output

(1) See paragraph #1 under previous heading "Volume Falls Off or Ceases".

(2) One of amplifier or rectifier tubes may be burnt out. Replace with spare

of same type. For amplifier use, this must be a new tube.

(3) A receiver may be defective. Test horns one by one, as described in paragraph #3 under previous heading.

(4) Film may be scratched or dirty.

(5) A reproducer may be defective. Test reproducers as described in paragraph #5 under previous heading.

(6) Fader may be defective. Check as described in paragraph #6 under previous heading.

(7) One of amplifier tubes may be defective. Take a new tube and try it in place of each tube in turn until the noisy one is located.

(8) Storage batteries may be dirty on top. See that they are kept clean, as specified under "Running Storage Batteries".

Storage batteries may have been put in use too soon after charging, while still gassing. About half an hour is required for gassing to cease completely.

Storage battery connections may be loose. Keep them tight, as specified under "Running Storage Batteries".

(9) There may be poor ground or loose connection at some point in system. Examine connections and tighten any found loose. If trouble still unsolved, use headset as described under "Troubles-General", and if a defective 43-A amplifier is found, cut it out as described in paragraph #9 under previous heading.

Observer's Equipment Not Functioning

If not loud enough to enable observer and operator to hear each other, or if buzzer is weak or inoperative, make sure that switch on box is pulled out, and that batteries are in good condition. Replace batteries (open battery box by loosening screw in cover). If trouble not here, check line for shorts or opens.

Troubles Occurring During Show

Film Breaks (Film Reproduction)

As synchronism between pictures and sound is inherent in the film, no loss of synchronism is occasioned by a break. Therefore, deal with a broken sound film the same as with an ordinary film in the same circumstances, but in making splice be sure to follow directions given under "Replacements-Splicing Film".

Film Breaks (Disc Reproduction)

Douse light, turn fader to zero, and stop motor. The next step, as specified below, will depend on whether the break is above the intermittent or below it, and whether the sound only consists of a musical accompaniment and incidental effects, or whether there is speech, close-ups, etc., which make synchronism very important.

Splice broken films as described under "Replacements-Splicing Film".

Break Below Intermittent - All Cases.

Run down film needed for winding around take-up, by means of handwheel. Do not disturb film at aperture plate, or record and reproducer. Continue run, bringing fader to regular setting as soon as full speed is reached.

Synchronism will usually be maintained under these conditions. However, since audience will lose some of the subject, it is generally better in the case of short subjects not to wait for restarting as just described, but to continue performance immediately by showing next subject, which is set up on other machine. In meantime broken film can be repaired and shown again at conclusion of number which is running on other machine. If break was near end of reel it may not be worth while returning to subject.

Break Above Intermittent - With Speech or Other Sound Accompaniment Where Exact Synchronism is Essential.

In this case it is not possible to continue on broken film without losing synchronism, and there is therefore no option except to continue program with next reel, which is set up on other machine, or else cut out sound for remainder of this reel.

Break Above Intermittent - With Music or Other Sound Accompaniment Where Exact Synchronism is Not Essential.

Rethread and continue as previously described for break below intermittent. Synchronism is usually lost under these conditions, but this can be tolerated in an emergency, unless there is a direct cue in record, such as a knock, voice or cheers. In such a case, pass over cue with fader on zero.

Needle Jumps Groove

If the needle jumps back the sound will repeat, and may keep on repeating at every revolution of the record. If the needle jumps forward, the sound will be ahead of the picture. The procedure will depend on the character of the film and on where the jump occurs. Any record on which the needle has jumped must never be used again, and the reproducer should be checked as soon as possible, when covered under "Troubles When Testing - Reproducer Not Tracking Properly". Bring fader to zero immediately jump is noticed; the next procedure will depend on circumstances, as follows:

With Speech or Other Sound Accompaniment Where Exact Synchronism is Essential.

In this case it is not possible to continue without losing synchronism, and there is therefore no option except to continue program with next reel, which is set up on other machine, or else cut out sound for remainder of this reel.

With Music or Other Sound Accompaniment Where Exact Synchronism is Not Essential.

Keep projector running, and look over reproducer quickly to see if there is any visible cause for jump, such as reproducer body dragging on record, or reproducer hitting something that prevents it from moving freely. If so, remove obstacle or change reproducer (See "Replacements-Changing Reproducers"). This, of course, involves loss of accompaniment for remainder of reel.

If no cause for trouble is evident, then, if needle jumped back, change needle, move reproducer over to a position two or three grooves ahead of where it was when it jumped, and restore fader to its regular setting. If needle jumped forward, and if it now seems to be tracking properly, restore fader to regular setting.

Synchronism is lost when record is continued after needle has jumped, so in such cases if there are any direct cues in picture, such as knocks, voices, cheers, etc., fader must be put down to zero when passing over them.

Quality Goes Bad or Noisy
Volume Falls Off or Ceases

See recommendations already made under these headings in previous section "Troubles Occurring When Testing".

General

While projectionists are expected to follow the instructions previously given for dealing with equipment troubles, and to do simple repair work on the apparatus, such as soldering broken connections, replacing burnt out tubes or burnt out fuses, tightening loose parts, replacing defective parts by other parts supplied or recommended for the purpose by us, etc., they must never experiment with the equipment by changing circuits or substituting coils, condensers, etc., of other types, or by using records of types not authorized by us, as this might result in a situation constituting default of our contract with the theatre.

Keep all spare parts in a clean, dry place; be sure that the temperature is not above 80°, as this causes deterioration of the photo-electric cells.

Life of Vacuum Tubes

Vacuum tubes require replacement when any one of the three following conditions is noticed:

(1) When plate currents begin to fall below the minimum values specified earlier in this book. This, of course, applies only in cases where a meter is provided on the amplifier for the purpose of checking these currents. When two or more amplifier tubes begin to show low plate current at the same time, the fault probably does not lie with them but may be due to the rectifier tubes; therefore, try renewing the latter.

(2) When the tube begins to be noisy. This applies to amplifier tubes.

(3) When the filament shows one or more bright spots instead of glowing uniformly throughout its length.

Tubes that have once been used in a rectifier are unfit for use in amplifiers, as they are incapable of giving good quality. Therefore be sure to exercise care on this point in handling the stock of spare vacuum tubes.

Changing Receivers

If a defective receiver is found by application of the various tests described in these instructions, replace it by one of the spares we furnish. Be sure to connect each wire to the same terminal on the new receiver as it was connected to on the old one. All four receiver terminals are marked for this purpose. If a receiver is connected wrongly, the quality of the sound as heard in the house will be spoilt.

Never open receivers or attempt to repair them. Never operate a receiver without the horn, as this may damage it.

In installations having only one horn, if this horn is provided with a receiver switching device the spare receiver may be put in use by simply moving over the throat lever. The double-throw switch located in the stage cut-out box, which controlsthe sound circuit to the receivers, must also be thrown to the other position so as to connect in the spare receiver.

Changing Reproducers

If a defective reproducer is found by application of the various tests described in these instructions, replace it by one of the spares we furnish.

The base of the reproducer assembly (swivel, arm and reproducer unit) fits on a bracket attached to the turntable pedestal. This base is clamped to the bracket by means of a milled thumb-screw. When

this thumbscrew is loosened and the output leads disconnected from the connecting block, the whole reproducer assembly can be removed. The simplicity of this operation makes it the best method of changing reproducers quickly.

To change a 4-A reproducer unit, remove the two screws attaching the unit to the arm; you will see one of these screws at each side of the reproducer just behind the head. This leaves the unit loose except for the output leads; turn it over on its back, thereby exposing the terminal block, and remove the leads by loosening the binding screws that attach them to the terminal block. To put in a new 4-A unit, follow these operations in reverse order.

On no account open a 4-A reproducer unit or loosen any screws other than those mentioned, as it is filled with a special damping compound and will be ruined if this leaks out.

Never attempt to repair or adjust reproducers.

Before using a new reproducer during a show, test it by playing a record with it or listening across its terminals with the headset.

Changing Photo-Electric Cells

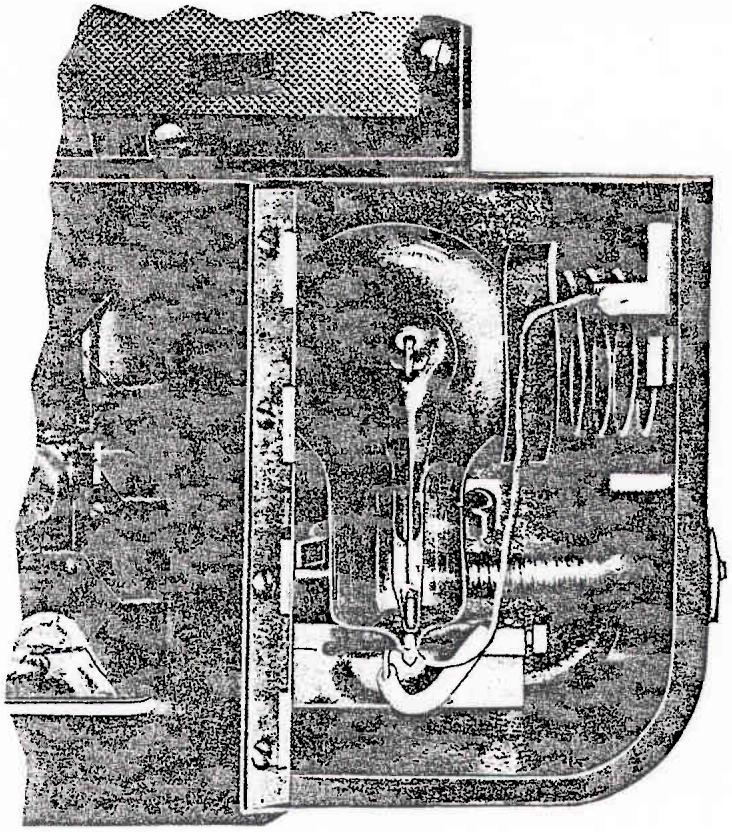
The correct position and connections for the photo-electric cell are shown in Fig. 14. Be sure to see, as previously mentioned, that the window in the cell lining is properly lined up with the opening in the partition separating the cell compartment and the film compartment.

Splicing Film - Disc Reproduction

Vitaphone film has 16 frames per foot, and each foot is numbered. Beginning with "0" at the starting mark, the 16th frame after the starting mark is marked #1. The 16th frame after #1 is marked #2, and so on throughout the print. There are, therefore, 15 frames without numbers between each pair of numbers. By this system, the position of every single frame in the reel is indicated. In synchronized features there are in addition other numbers on the margin of the film which indicate the scene numbers of the picture. These numbers can be distinguished from the footage numbers, because they have a dash at each side, as for instance " - 286 - ", the footage numbers themselves being simply "286", without the dash at either end. In cases where the scene and footage numbers conflict, the footage number is omitted, but is counted, and reference will have to be made to the next footage number in sequence.

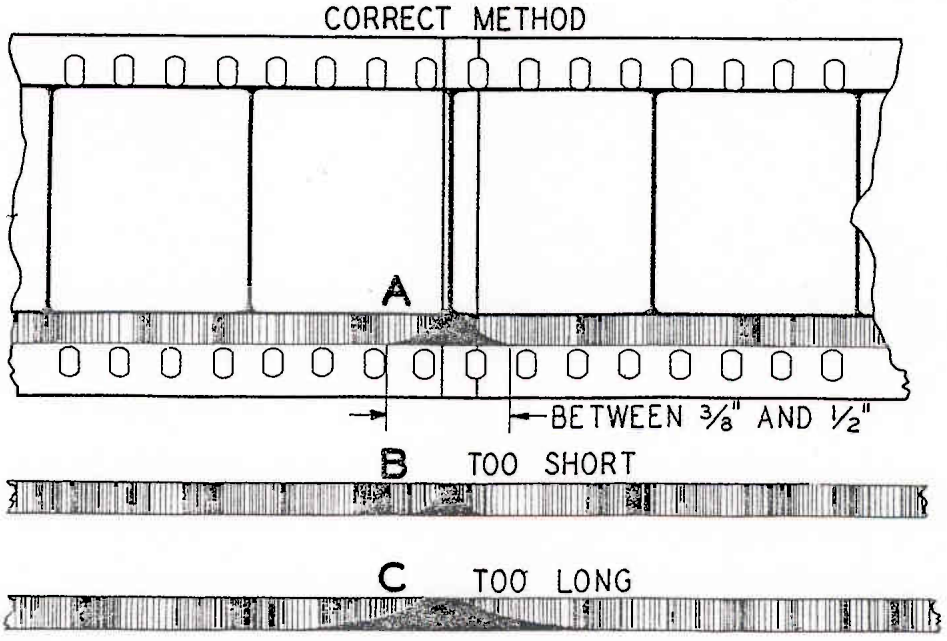
If a footage number does not appear at each 16th frame, continue counting until you reach the next number, when you should then have 31 frames between the two footage numbers.

With the numbering system described, it is easy to ascertain whether or not a print has the proper number of frames, by simply examining each splice and counting the footage numbers on each side. The two numbers should be consecutive and there should be 15 frames without numbers between them.



CORRECT POSITION AND CONNECTIONS FOR PHOTO-ELECTRIC CELL

FIGURE 14



SPLICING FILM WITH FILM TRACK

FIGURE 15

In case of a break in a film, make a patch by inserting black leader. Be sure that the number of frames of black leader inserted is exactly the same as the number of frames you take out of the film, plus the frames used for the patches. After putting in the black leader, be sure to check up and see that the numbers follow in sequence and that there are exactly 15 frames without numbers between each pair of footage numbers.

If any numbered frames are missing, or if the missing portion is more than one foot, you will have to check both sides of the break to the next number, and after making the splice, see that you do not forget the intervening numbered frames.

Splicing Film - Film Reproduction

In case film carrying a sound track becomes broken, cut out as few frames as possible when making the splice. A break in the sound track is usually even more noticeable to the audience than a break in the picture. However, do not go to the extreme of saving weak film that will cause trouble later.

A plain splice, no matter how carefully made, will cause a click to be heard from the sound projectors as it passes through the film reproducing attachment, because the two edges and the overlap disturb the uniformity of the sound track and produce the same effect as though noises had actually been recorded on the track. In dealing with film of this type, therefore, first make a splice in the usual manner and then paint over this splice in black, as shown at "A" in Fig. 15. The painted mark on the sound track should be roughly triangular in shape with a blunted apex and between 3/8" and 1/2" wide at the base. If the splice is painted in this manner it will be almost inaudible when passing through the reproducing attachment, as the change in the light intensity which it causes will be at a frequency below the audible range. If the mark is made too short, as shown in figure "B", the click will be very pronounced; if it is made too long, as in figure "C", there will not be a click but there will be a noticeable pause in the sound owing to so much of the sound track being obliterated.

For opaqueing splices, the use of Zapon Concentrated Black Lacquer #2002-2 is recommended. It is made by the Zapon Company, Stamford, Connecticut. When a thinner is necessary, Zapon thinner #20 is recommended. The lacquer should be applied to the shiny, or celluloid, side of the film and not to the emulsion side. It dries almost instantly, adheres tightly, and is much more satisfactory than India ink or other substances. If for any reason it should become necessary to remove it, a rag soaked in lacquer thinner will be effective.

Splices in the negative in making up subjects sent out by the producers are taken care of in the printing and may be observed by the triangular marks along the sound track near changes of scene.

Procedure for Replacing Western Electric Fiber Bevelled Gear Wolk Part # P-220741, RCA Stock # 29534

Replacing Fiber Bevelled Gear

On operating side, unscrew soundhead sprocket screw. Remove screw, three point washer, sprocket, and spacer washer.

On drive side, remove six screws to flywheel cover plate. Remove plate.

Unhook the two springs on the side of the bellows by first removing the spring ends that hook onto screws, and then remove the other end of the springs from the common hole near the center of the flywheel

On the other side of the bellows is a machine screw that holds the bellows to the flywheel shaft with a small piece of metal. Remove the small screw, split washer, and two nuts to free the flywheel shaft from the small piece of metal

Grab flywheel and pull gently out of machine.

In the center of the now exposed shaft that's still in the projector is a round piece of metal with four holes in it. Looking past this metal are six screws. To get to the six screws, the round piece of metal must be unscrewed from the shaft. Put two small screwdrivers into two of the four holes. Place a large screwdriver between them for leverage, and unscrew the metal from the shaft. Unscrew CLOCKWISE

After removing the round piece of metal, the six screws are now exposed.

Remove the fiber gear and three inches of outer shaft from the inner shaft that's still in the projector

Place on workbench and remove the six screws and their split washers. Separate the two pieces of metal that sandwiched the fiber gear. Now press the fiber gear off the short metal shaft. It's a tight fit. You can use a small trailer core between the fiber gear and table top and push gear over core, if necessary.

Replace with new fiber gear and re-assemble. Make sure holes in fiber gear align perfectly with screw holes, or it won't re-assemble. Fiber gear won't shift once it's on the shaft. If holes don't align, pull off and try again.

To replace entire flywheel assembly, see other side.

Revised March 1997