

# COMMITTEE ACTIVITIES

## REPORT OF THE PROJECTION PRACTICE COMMITTEE\*

### SUBCOMMITTEE ON PROJECTION ROOM PLANNING

The following recommendations have been adopted, after an exhaustive study, by the entire committee and are submitted for adoption as standards. In following them the local code should in all cases be consulted for deviations from these standards. It is the aim of the Committee to bring them before the various agencies for revision and adoption. Three layouts have been adopted, marked A, B, and C, which were planned for flexibility, simplified construction, ease of operation, *etc.*, to be selected according to the size of theater and type of operation. The key to the symbols used on the plans is shown in Fig. 1, and the three plans are shown in Figs. 2, 3, and 4.

(1) *Projector Spacing*.—The distance between projectors shall be not less than  $4\frac{1}{2}$  feet nor more than 5 feet, measured between lens centers; for projection distances less than 100 feet, the spacing shall be 4 feet. When two projectors are used, they shall be equally spaced on either side of the center line of the auditorium. When three projectors are used, the center projector shall be placed on the center line of the auditorium.

(2) *Observation Ports*.—Observation ports shall be 12 inches wide and 14 inches high and the distance from the floor to the bottom of the openings shall be 48 inches. The bottom of the opening shall be splayed 15 degrees downward. In cases where the thickness of the projection room wall exceeds 12 inches, each side shall be splayed 15 degrees.

(3) *Projector Ports*.—Projector ports shall be 10 inches wide and 12 inches high (see Fig. 5). The bottom and sides of the openings shall be splayed in the same manner as observation ports. The

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distance from the floor to the bottom of the openings shall be in accordance with the table of projection angles as given in the accompanying plans for the layout of the projection room.

(4) *Other Openings.*—All other openings, such as those intended for effect projectors, double dissolvers or single spot lamps shall be 24 inches wide and 34 inches high. The distance from the floor to the bottom of the openings shall be 26 inches when the angle of projection is not greater than 20 degrees. For projection angles greater than 20 degrees, one inch shall be deducted from this value for each degree in excess of 20. The minimum spacing allowed between these openings shall be as shown on the plans for the projection room layout. The placing of these openings to the right or left of the projectors shall be optional and according to conditions.

(5) *Dimensions of Projection Room.*—The projection room shall have a minimum height of 10 feet and a maximum of 12 feet. The minimum depth of the room shall be 12 feet. The length of the projection room shall be governed by the amount and type of equipment, as shown on the plans. Consideration should always be given for probable future needs.

(6) *Front Wall.*—In all cases, the inside surface of the front wall of the projection room shall be smooth and without structural projections. Care shall be exercised in locating the hanging rods and columns in the front wall so as not to interfere with the proper location of the various openings.

(7) *Conduits.*—These shall in all cases be concealed, and all boxes shall be of the flush-mounting type.

(8) *Projection Arc Conduit.*—The size of conduits for projection arcs shall be as indicated on the plans. These sizes anticipate the need for future increased capacity, and should be adhered to in order to provide space for pulling in larger wires as needed.

(9) *Conduit for Sound Equipment.*—Conduit for sound equipment shall conform with the type of sound equipment to be installed. The manufacturers of such equipment should be consulted with regard to the proper layout of the sound system before proceeding with the installation.

(10) *Projection Room Lighting.*—An individual ceiling fixture with canopy switch shall be installed for each piece of equipment, and shall be placed in line parallel to the front wall at a distance not less than 18 inches or more than 24 inches from the front wall. The outlet connected to the emergency lighting system shall be

located in the ceiling midway between the extreme ends of the projection room, and 4 feet from the back wall. Small projection rooms shall be equipped with one reel light and large projection rooms with 2 such lights conveniently located.

(11) *Ventilation*.—A separate exhaust system of ample capacity shall be provided for the projection room and other adjacent rooms provided for projection equipment. All projection arcs, and arcs of other equipment as required, shall be connected into the ducts of the exhaust system, which should contain a blower type exhaust fan. There should also be a gravity vent in the main projection room, rheostat room, generator room, and sound equipment room, leading directly through the roof. The minimum size shall be 12 by 18 inches, maximum size 18 by 24 inches. They shall also be equipped with swivel cowls. A supply of fresh air shall be brought into the projection room, preferably at the floor level and at the extreme ends of the room, and shall be baffled to prevent direct drafts. In cases where the theater is equipped with a refrigerating system, the projection room system should be connected into the main duct of this system. A fan shall be provided of sufficient capacity to remove all smoke and gas in case of fire, and this fan should be so connected to the port shutter controls that its full capacity will be automatically made available upon dropping of the shutters.

(12) *Extra Rooms*.—A separate room shall be provided solely for the rheostat equipment. This room shall be provided with ventilating means as previously set forth. An additional and separate room, properly ventilated, shall be provided for the sound equipment.

(13) *Toilet and Wash Room*.—Hot and cold water, and other toilet facilities shall be installed and located convenient to the projection room. Suitable space shall also be provided for clothes lockers.

(14) *D-C. Supply for Arcs*.—Two generators or other sources of direct current shall be installed to insure continuous operation in case of breakdown.

(15) *Location of Arc Generators*.—Arc generators may be located in a room adjacent to the projection room, and the responsibility for their maintenance delegated to a projectionist. Where the generators are large, making it necessary to reënforce the structure carrying them, they may be placed in the basement, provided proper maintenance is assured. Where the generators are placed near the

projection room, this room shall be sound-proofed and the foundation for the generator arranged to thoroughly eliminate the noise and vibration of the generator.

(16) *Projection Port Shutters.*—(See Fig. 5.) These shall be constructed of not less than 16 gauge iron guides built up of iron flats, 2 inches wide and  $\frac{1}{8}$  inch thick, with spacers 1 inch wide and  $\frac{1}{4}$  inch thick for the shutter to slide in. The shutter shall be made of not less than 10 gauge iron, provided with leather bumpers on sill at the bottom to take up the shock when the shutter drops. Each port shutter shall be connected to a master rod by a string and ring attached to a pin on a master rod. The master rod is to be fastened securely to the front wall, approximately 18 inches below the ceiling. It should be provided with a sufficient number of bearings properly aligned to assure smooth operation, connected through pulleys and fusible links located over each projector and capable of being controlled at the exit so that it may instantly be tripped. All large openings in addition to the above shall be provided with an individual approved counterweight (see Fig. 6) which will permit the shutters to be easily opened and shall be controlled by the master rod. All observation ports shall be provided with metal guides to receive  $\frac{1}{4}$ -inch clear glass, this glass to be at an angle opposite to the projection angle and arranged to be easily removed for cleaning.

(17) *Projection Room Painting.*—A sufficient number of coats of paint shall be applied to assure a good coverage. Walls and doors shall be painted an olive green to the height of the door line. The walls above this line and the ceiling shall be painted buff. All painted surfaces shall be stippled to prevent reflections. All iron work on projection ports shall be covered with 2 coats of flat black paint. All other rooms shall be painted buff.

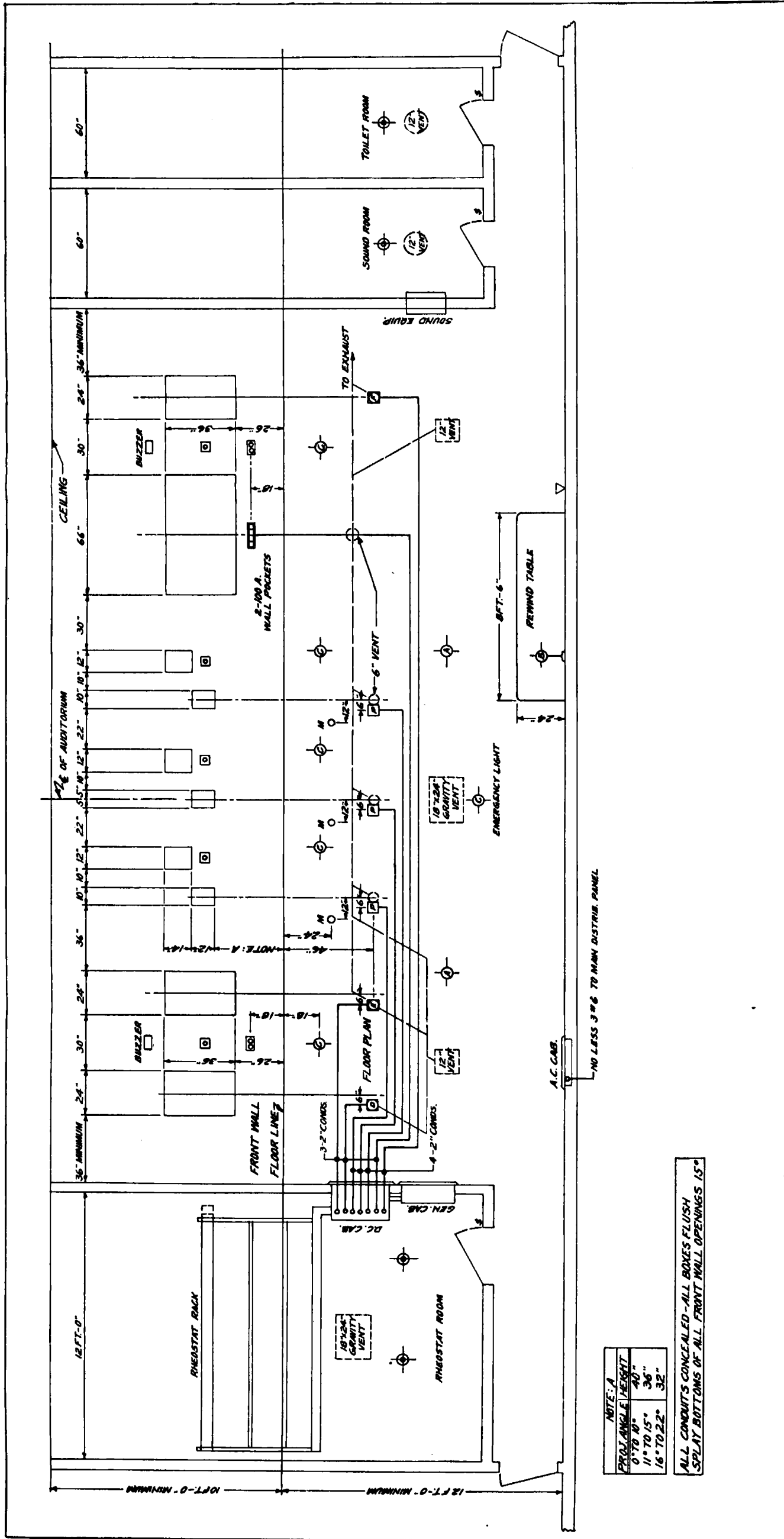
(18) *Projection Room Floor Covering.*—The floor of the projection room shall be covered with a good grade of "battleship" linoleum (brown or green) or rubber tile securely glued down. The floor covering should be laid before the equipment is installed. The floors of rooms adjacent to the projection room should be painted with a good grade of concrete paint.

(19) *Fire Extinguisher Equipment.*—The local fire department or safety commission should be consulted regarding the proper type, amount, and location of fire extinguishing equipment. In all cases there shall be adequate provision of such equipment.

- ⊖ CEILING OUTLET-REEL LIGHT
- ⊙ WALL BRACKET
- ⊖ CEILING OUTLET-CANOPY SWITCH TYPE
- ⊖ CEILING OUTLET
- ⊖ OUTLET IN FLOOR FOR DOUBLE DISSOLVER
- ⊖ OUTLET IN FLOOR FOR EFFECT MACHINE
- ⊖ OUTLET IN FLOOR FOR FLOOD LAMP
- ⊖ OUTLET IN FLOOR FOR PICTURE MACHINE
- ⊖ PUSH BUTTON
- ⊖ DOUBLE BASEBOARD RECEPTACLE
- ⊖ M.P.M. MOTOR OUTLET
- ⊖ HOUSE PHONE
- ⊖ WALL SWITCH FOR CEILING LIGHTS

WIRE SIZES		
Low Intensity	30 A.	No. 4
Reflector High Intensity	75 A.	No. 2
High Intensity	125 A.	No. 00
Super High Intensity	200 A.	200,000 C. M.

FIG. 1. Key of symbols for projection room layouts.



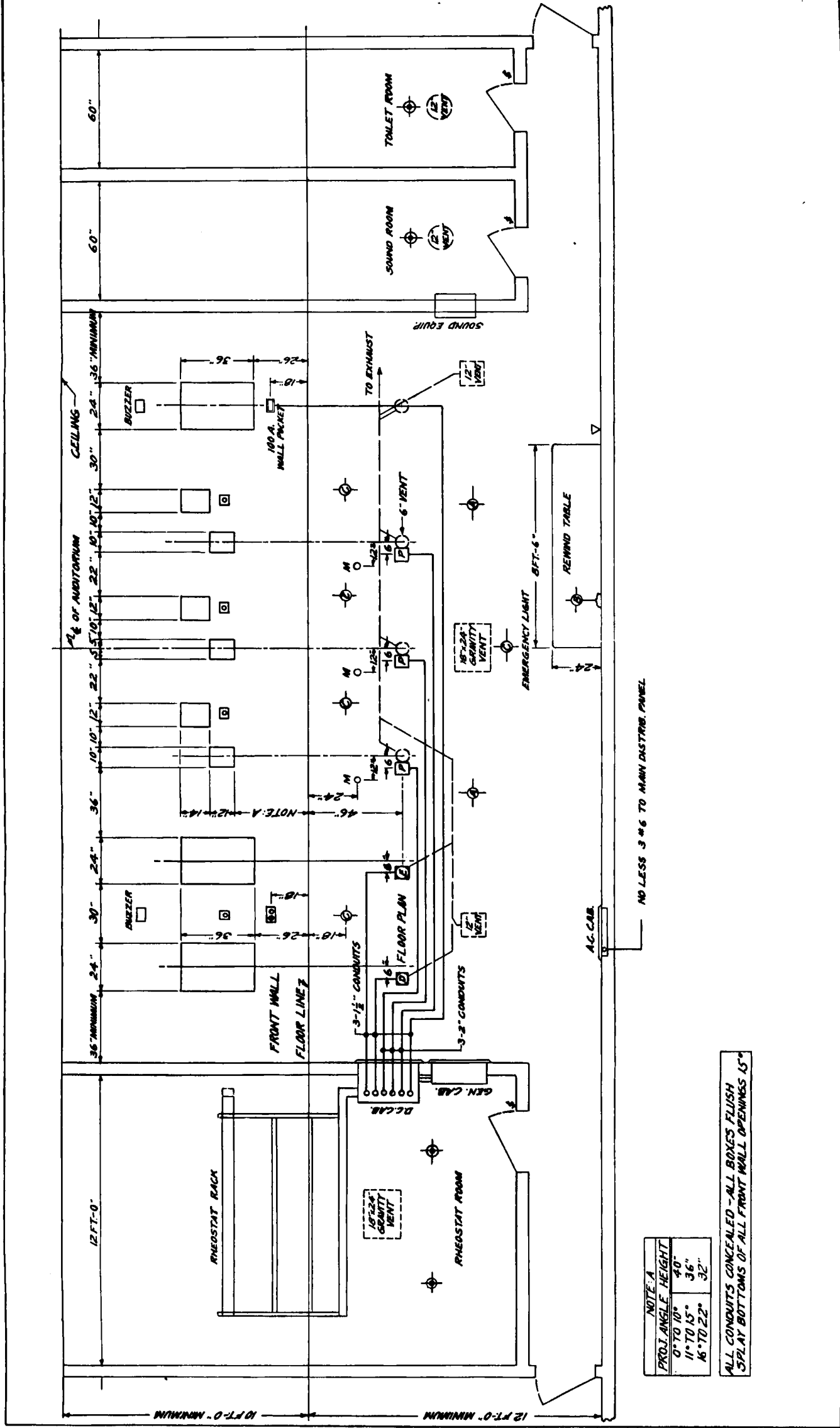
NOTE: A

PROJ. ANGLE	HEIGHT
0° TO 10°	40"
11° TO 15°	36"
16° TO 22°	32"

ALL CONDUITS CONCEALED - ALL BOXES FLUSH  
 SPLAY BOTTOMS OF ALL FRONT WALL OPENINGS 15°

NO LESS 3#6 TO MAIN DISTRIB. PANEL

FIG. 2. Projection room layout A.



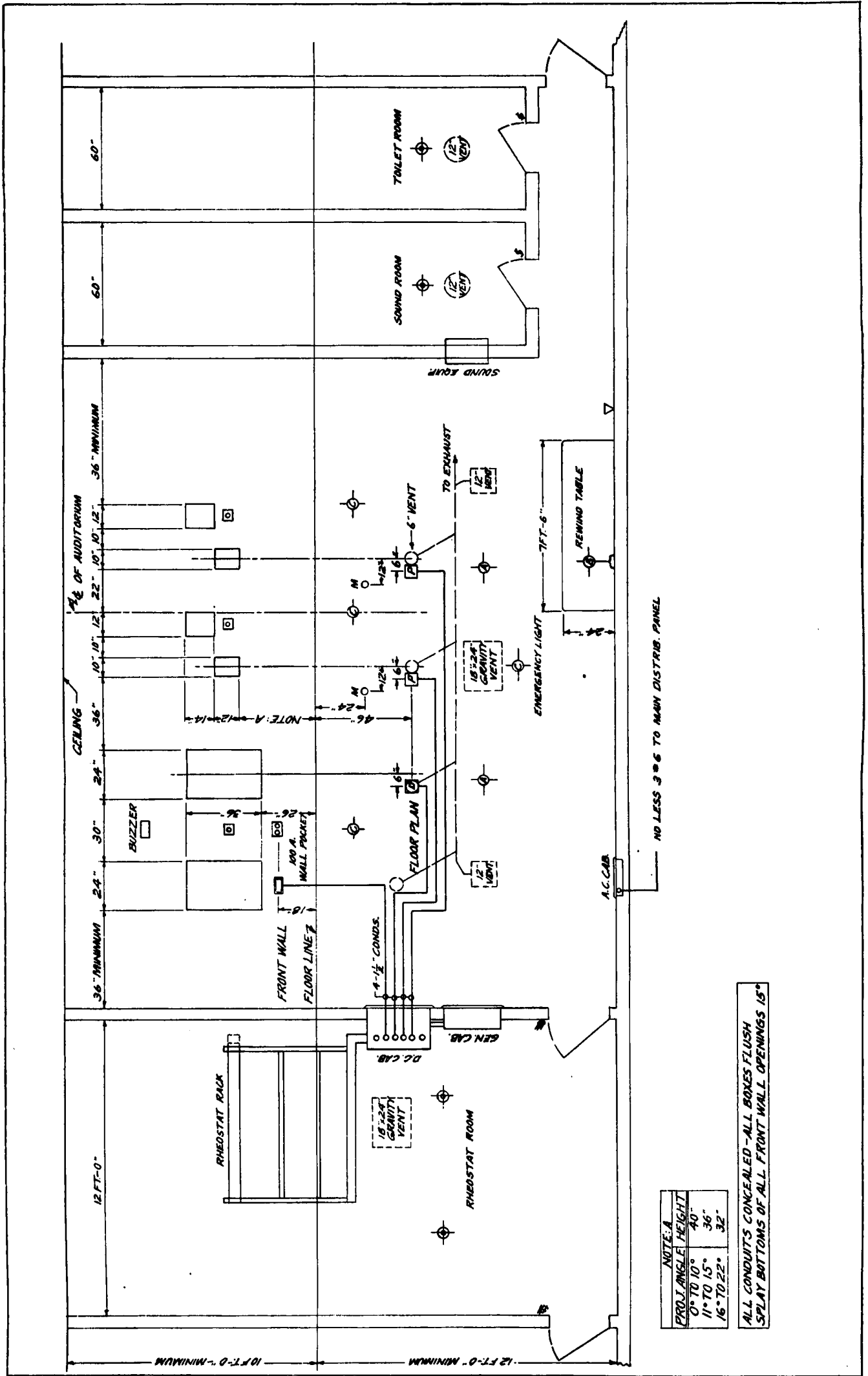
NOTE: A

PROJ. ANGLE	HEIGHT
0° TO 10°	40"
11° TO 15°	36"
16° TO 22°	32"

ALL CONDUITS CONCEALED - ALL BOXES FLUSH  
 SPLAY BOTTOMS OF ALL FRONT WALL OPENINGS 15"

NO LESS 3 #6 TO MAIN DISTRIB. PANEL

FIG. 3. Projection room layout B.



NOTE: A

PROJ. ANGLE	HEIGHT
0° TO 10°	40"
11° TO 15°	36"
16° TO 22°	32"

ALL CONDUITS CONCEALED - ALL BOXES FLUSH  
 SPLAY BOTTOMS OF ALL FRONT WALL OPENINGS 15°

NO LESS 3x6 TO MAIN DISTRIB. PANEL

FIG. 4. Projection room layout C.

(20) *Projection Room Construction.*—(a) The projection room shall be of fire-proof construction, and all walls exposed to the theater shall be of tile brick, gypsum, or any approved fire-resisting material. The walls of the projection room shall be not less than 6 inches thick and shall be covered inside and outside with a layer of plaster at least  $\frac{3}{4}$  inch thick. The inside walls and ceiling of the projection room shall be coated with an approved sound absorbing plaster. Projector ports should be blocked down after the projector is set to as small an opening as possible.

(b) The ceiling shall be of plaster or concrete suspended on metal lath, and the floor slab should be not less than 4 inches thick, having a 2-inch cinder fill above, and a 2-inch cement finish above the cinder fill.

(c) The walls of rooms adjacent to the projection room shall be not less than 4 inches thick, plastered inside and outside. Two exits shall be provided, one at each end of the projection room, in addition to stairways for entering the projection room. Under no circumstances may ladders be used for the projection room entrances.

(d) The doors shall be of the approved metal type, swinging outwardly from the projection room, and shall be provided with door checks or other approved door-closing devices.

(21) *Heating.*—Proper provisions shall be made for heating the projection room. The same facilities used for heating the theater should be extended to the projection room.

#### **SUBCOMMITTEE ON PROGRESS AND IMPROVEMENTS IN PROJECTOR DESIGN AND ACCESSORIES**

This Subcommittee was formed for the purpose of analyzing certain difficulties in connection with motion picture projection and sound reproducing equipment, and to suggest remedies therefor. The difficulties brought to this Subcommittee's attention were as follows:

- (1) inaccessibility of various parts of projectors;
- (2) scratching of film while in transit through the projector;
- (3) oil reaching the film during projection, due to leakage from various parts of the projector mechanism;
- (4) difficulty of replacing mechanism when used in connection with sound reproducing equipment.

(1) *Inaccessibility of Various Parts of the Projectors.*—This prob-



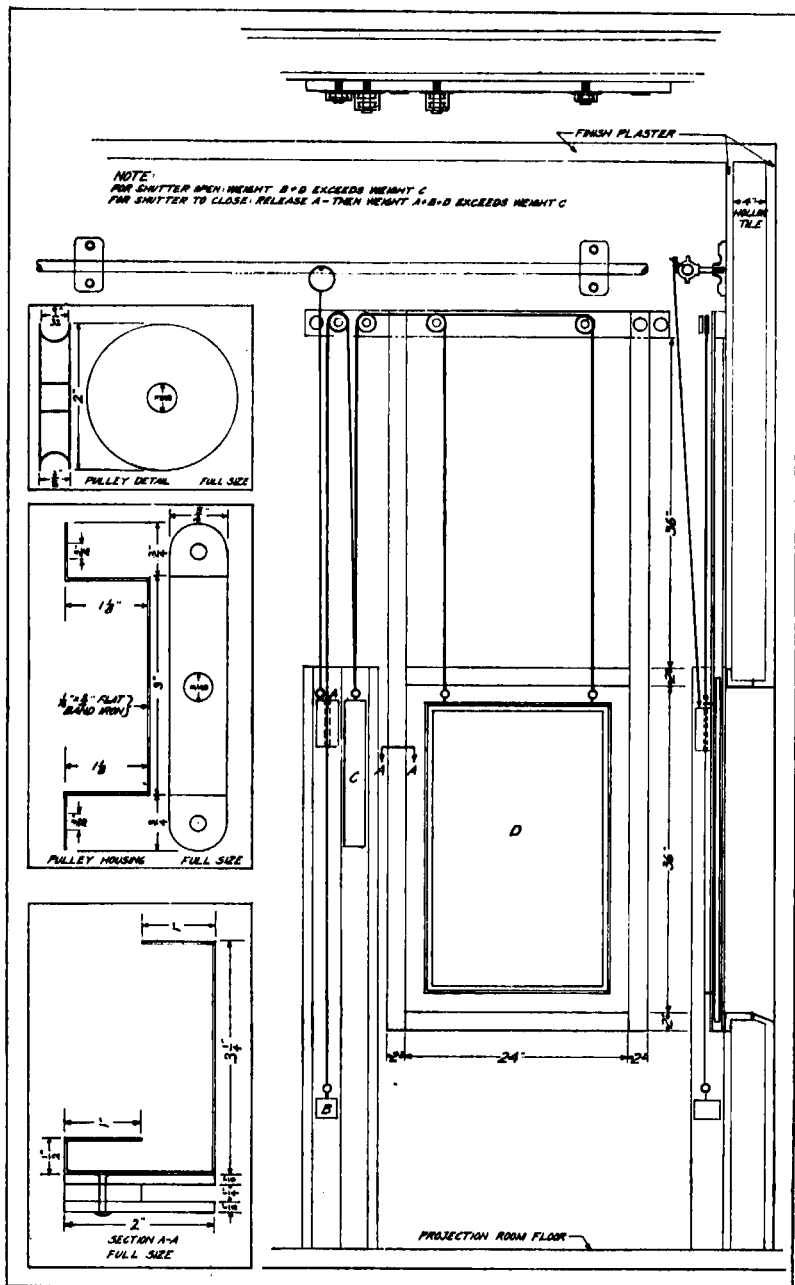


FIG. 6. Standard counterweight system for large size projection room port.

The suggestion was made that the tolerances existing between the magazine rollers be increased to such an extent that there is no possibility of film coming into contact with metal while passing through them. It was pointed out that as a fire prevention measure, the laboratories of the National Bureau of Fire Underwriters require definite dimensions maintained at these points. They allow sufficient leeway, however, so that if the film is not buckled, there is no possibility of its coming into contact with metal parts excepting at the sprocket holes. It was also pointed out that scratching of the film may occur when the projectionist allows the film actuating parts and film guides to become worn to such an extent that the clearance of a few thousandths of an inch is obliterated. It is obvious that these parts should be carefully watched and replaced when such wear occurs.

(3) *Oil Reaching Film during Projection, Due to Leakage from Various Parts of the Projector Mechanism.*—It was pointed out by the manufacturers of projectors that this difficulty was encountered only in the old types of equipment, and that improvements have been made for eliminating this. One of the worst offending assemblies which causes leakage of oil is the intermittent movement, which must normally be kept filled with oil to a certain level. Indicating sight gauges are placed in the oil boxes so that the projectionist may observe the height of the oil. In the old types of equipment, this sight glass was cemented into the casting. In time, the cement would disintegrate in places, allowing the oil to seep through. Also, in the old type movements, the shafts were designed without provision for carrying the oil back into the oil chamber when the bearings became slightly worn. These difficulties have been eliminated in the newer equipment, and the accompanying illustration shows how this has been accomplished. Section B, of Fig. 7, shows a view of the intermittent casing and at *A* are shown the new type oil sight glasses. Instead of cementing these glasses, threaded bosses have been provided, into which are first placed a washer, then the glass and another washer, and the entire assembly is tightened with a packing nut. Two such oil sights are provided and leakage at these points is entirely eliminated. The leakage of oil from other parts of the movement is prevented by felt washers under pressure as shown at *E* and *D* (Fig. 7). Oil is prevented from seeping through the bearing for the star wheel shaft *C* by a reverse groove cut in this shaft, which acts as a pump and carries oil seeping out of the inter-

mittent casing back into the case before it can reach the end of the bearing. These improvements can be assembled into existing projectors using this type of movement. It is only necessary that the movements be rebuilt in order to eliminate oil leakage from this source. The difficulty of oil leakage was also encountered in practically all the other shafts in the old types of projectors, but has

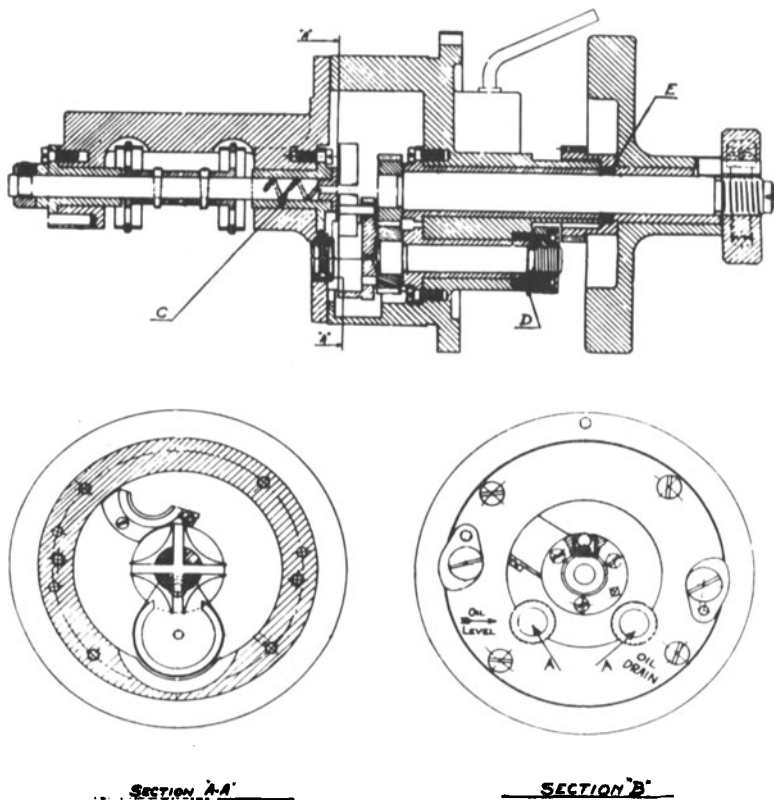


FIG. 7. Intermittent casing, showing location of oil sight glasses and methods of avoiding oil leakage.

been eliminated in the more modern equipment by cutting a reverse spiral curve in these shafts to carry the oil in the opposite direction to the side of the projection mechanism into which the film is threaded.

(4) *Difficulty of Replacing Mechanisms When Used in Connection with Sound Reproducing Equipment.*—This has been a very serious problem since the introduction of sound reproducing equipment

but it is mainly encountered in connection with what is known as the "D-Spec." attachment. This was the first attachment made, and consideration was not given at the time to the varying tolerances allowed by the manufacturers of the projector prior to the advent of sound film. It was not necessary to machine rough castings to which nothing was to be attached when projecting silent pictures,

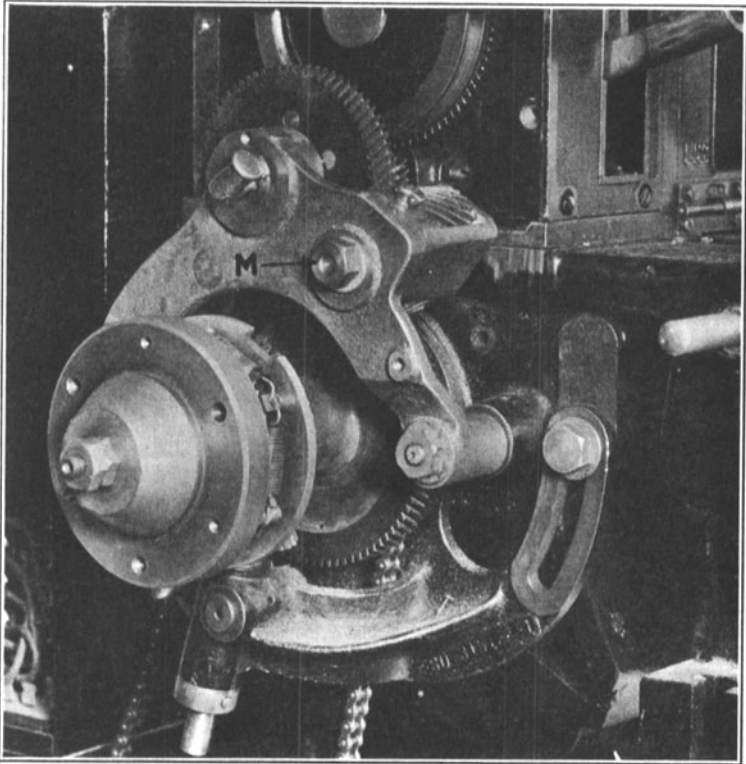


FIG. 8. New sound attachment for avoiding shimming.

but great difficulty was experienced when sound attachments were added to these unmachined surfaces. It became necessary to use shims varying from one-eighth of an inch to one-thousandth of an inch on the several corners of the mechanism in order to properly align the projector mechanism with the sound equipment drive.

Whenever a breakdown occurred during the running of a show,

several hours or more were required to adjust the mechanism. Since the majority of theaters in this country are equipped with only 2 sound-equipped projectors, a theater in which such a breakdown occurred would be left with only one projector to run the show until the other projector had been repaired. This, in turn, made it impossible to give an up-to-date and smoothly running performance.

The problem of solving this difficulty was put up to the manufacturers of both sound equipment and projectors, and an attachment was developed which eliminates the necessity for shimming.

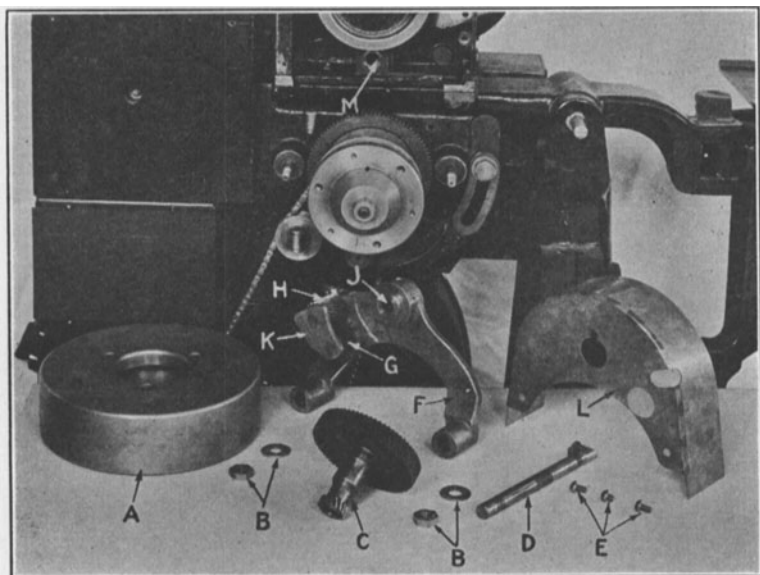


FIG. 9. New sound attachment dismantled.

This attachment is quite flexible and by its use the difficulty of replacing mechanisms on this old type of sound attachment was entirely surmounted, so much so that mechanisms may be readily changed within fifteen or twenty minutes.

Fig. 8 shows the new attachment. It is only necessary to remove the gear retaining yoke from existing D-Spec. attachments and replace it by the new yoke and idler gears shown in the illustration. This yoke is self-centered on the driving spindle for the projector mechanism and it is only necessary to insert the spindle in the bearing

and push it into the hole provided in the mechanism to receive it. The yoke is then securely locked on the frame of the sound attachment and the bracket carrying the idler gears is then adjusted to eliminate lost motion between the gear teeth and the driving unit. The idler gear bracket is then securely locked in place by means of lock nut *M*.

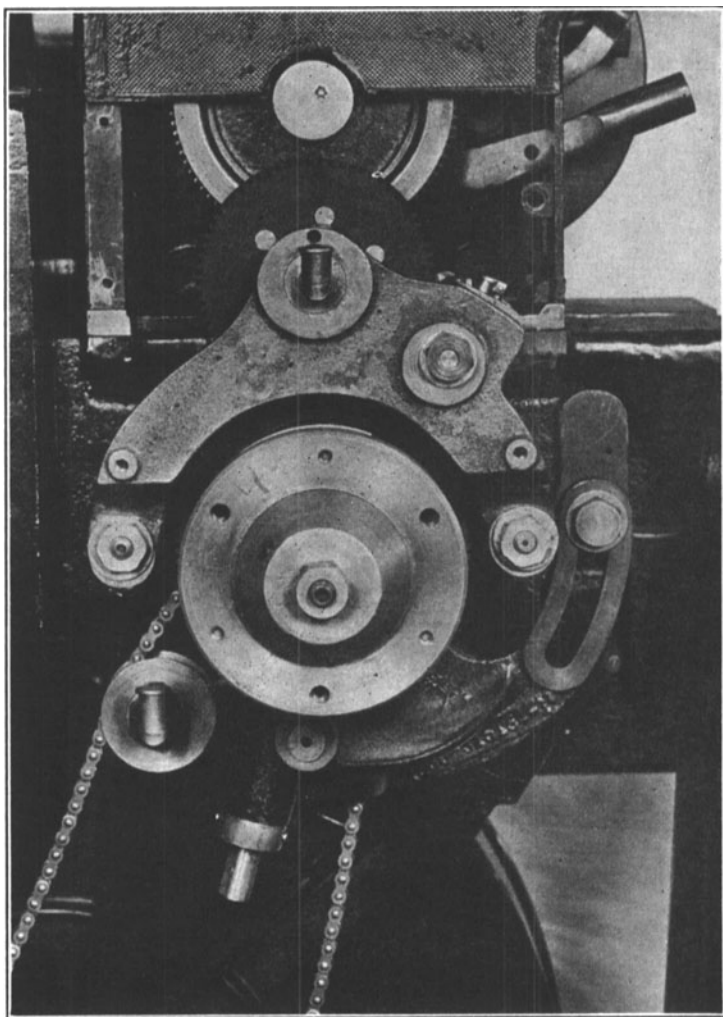


FIG. 10. Front view of the new sound attachment assembled on projector and sound unit without cover and flywheel.

Fig. 9 shows the assembly dismantled. At *A* is the flywheel which is always provided with the sound attachment; this is readily removed by taking out three screws. At *B* are the lock nut and washers for attaching the new yoke to the sound attachment; at *C* are the driving gears connecting the mechanism through the idler gears *G* and *H* to the main driving gear on the sound unit; at *D* is the spindle which slides into the hole *M* and upon which the assembly *C* revolves; at *E* are the three screws for attaching the protecting cover *L* after the unit is assembled; at *F* is the self-aligning yoke which carries the idler gear assembly; at *G* and *H* are the idler gears; at *J* is the adjustable bushing to take out end play in assembly *C*; and at *K* is the adjustable idler gear bracket.

Fig. 10 shows a front view of the attachment assembled to the projector and sound unit without the protecting cover and flywheel.

No shimming is required with this new attachment regardless of the age of the projector on which it is mounted, and it is felt by the Committee that this unit satisfactorily solves the problem of replacing mechanisms where the old type of sound attachment is used.

#### SUBCOMMITTEE ON MONITORING AND CONTROL OF SOUND IN THEATERS

In the report of the Projection and Sound Reproduction Committee, which was presented in abstract before the Society at Washington, and in full before the New York Section, June 12, 1930, there appeared a section on adjustment of volume levels and remote control. This report dealt principally with methods of controlling volume directly by an observer in the auditorium. As a matter of fact there are now devices on the market which permit such control. Whether the use of these devices has proved effective is not clear but the fact remains that there is a general urge to investigate fully the whole problem of volume control.

There are three distinct systems for providing volume control for theaters:

- (1) the method most generally in use which, to be effective, requires an observer in the audience who signals the projectionist for volume change;
- (2) the method described in the above report which provides actual control of volume by the observer in the audience;
- (3) a method which attempts to give to the projectionist some means of knowing what volume of sound is present in the auditorium, from which means he can adjust the volume from the projection booth.

Before discussing the advantages and disadvantages of these three methods, we may observe:

(a) The present monitor horn functions reasonably well for the purposes for which it was intended, namely, (i) means of checking the sound system before the start of a show and (ii) maintaining a running check of the system during its operation.

(b) It seems evident that from a theoretical standpoint the best location in which to hear the results obtained in the auditorium is in the audience itself. An observer placed in the audience hears just what the audience hears, can take into account the audience's reaction, and note the effect of the changing number of people, which in many houses materially affects the sound absorption, *etc.*

#### SYSTEM (1)

System (1) is based on the theory that the actual volume control should be handled by the projectionist, and further, that the proper place to judge volume is in the auditorium itself. This system, therefore, has two most desirable features. The disadvantages are:

(a) A slight time lag between the giving of a signal by an observer in the audience and the volume adjustment made by the projectionist.

(b) The increased expense of having an observer in the audience.

(c) A chance of carelessness on the part of the observer or on the part of the projectionist which will result in poor operation.

(d) The arrangement being described anticipates a rehearsal before the opening of the show. With the new release print in vogue, the need of such a rehearsal is less since the change-over cues are automatically indicated.

To refute these objections it might be said of (b) that a first-class house can well afford such an observer (who would be absolutely essential to system (2) which is to be described below), and furthermore, that a small house which could not afford an observer could probably not afford additional monitoring equipment unless it were very cheap. Additional equipment requires maintenance and usually the cheaper the equipment the greater the maintenance.

Item (c) anticipates carelessness on the part of the personnel but no matter what system is employed carelessness results in a poor show.

Item (d) is included under carelessness because if the manager is alert a rehearsal should be demanded even if only for sound cues.

**SYSTEM (2)**

System (2) indicates actual control of volume by the observer in the audience. This system has the advantage of reducing time lag to a minimum and permits the control to be handled in the audience, which is the best position for such observations. The disadvantages are again, the additional expense in providing an observer and the absolute necessity that this observer must always be present, for if he is not, the entire method is not workable. It might further be observed that the man in the audience must have knowledge of the capabilities of the system itself, otherwise he may overload the amplifiers in attempting to override audience noise during periods of applause or laughter. The best arrangement of this system calls for remote control of the fader because if the audience control is simply an auxiliary to the fader in the projection room it produces additional loss in the amplifier system which may be disastrous if perchance the amplifier system gain is only sufficient to meet normal operating conditions. There is, furthermore, a tendency toward split responsibility, which is not ideal.

**SYSTEM (3)**

System (3) anticipates that the projectionist may have some means of knowing what is taking place in the auditorium, so that he may have entire control of volume adjustments. Any such system will obviously be more elaborate and costly than either of the other two systems described, and whether it will be more effective and usable is doubtful.

There are several methods proposed to accomplish system (3):

(a) One system provides a microphone, or several scattered microphones, connected to an amplifier and then to a loud speaker located in the projection room.

The advantages are claimed to be that with a microphone in the audience the sound from the horns can be picked up and the projectionist can then know what sound is being received in the auditorium. In other words, the projectionist's ear has in a sense been extended into the auditorium proper.

It must be remembered, however, that it will be necessary to calibrate very carefully the over-all gain of the amplifier system so that the sound in the projection room will definitely indicate whether the volume in the house is lower or higher than it should be. If anything goes wrong with the equipment so that the over-all gain is

changed, the results obtained in the monitor horn will not indicate the true condition. Furthermore, the microphone will not completely reflect the effect caused by the changing number in the audience. Any effect from noise in the projection room which now hampers good hearing with the present monitor would also apply even to a greater extent to the proposed system.

(b) A second method proposed makes use of a microphone or several scattered microphones in the auditorium connected through an amplifier into a volume indicator.

The advantage here would be that a visual indication is presented to the projectionist which would not in any way be affected by the noise in the projection room.

There are several disadvantages. To make the system effective there should be an optimum point of operation indicated on the meter of the volume indicator with maximum and minimum points shown, above or below which the sound should never be allowed to go. The difficulties in designing such a meter and accompanying circuit are extreme. Furthermore, noise picked up from the audience, such as laughter or applause, immediately indicates increased volume on the meter. In present-day projection rooms, which are fairly well sound-proofed, a projectionist might conceivably react in such cases by believing that the sound volume through the horns is too loud and, as a result, he may reduce the gain of the amplifier system when it really should be raised. Again, a very careful calibration would have to be made in order that the indicator would give a reading of true conditions. If any of the constants of the circuit should change, an incorrect indication would result, with corresponding improper sound volume in the house. Likewise in this case, as under item (a), the microphone will not definitely take into consideration changes in the number of persons in the audience.

(c) A third method has been suggested, using a headset instead of the loud speaker in the projection room. This has such obvious disadvantages from an operation standpoint that there is no need for discussion.

#### CONCLUSIONS

It is the opinion of the Committee, that:

- (1) the proper and best place for observance of volume is in the auditorium among the audience;
- (2) any manually operated volume control system requires

that the observer be trained to judge proper volume in the auditorium;

(3) there is not at the present time any mechanical or electrical device which will give to the projectionists any satisfactory means of judging volume;

(4) with the observer stationed in the auditorium it should be recognized that the responsibility of the projectionist in controlling volume is only to react to the observer's signals promptly and diligently;

(5) until some other means not now apparent are provided, the present system of volume control, as now installed in the majority of theaters, is the most satisfactory. This system provides signaling means for the use of an observer in the auditorium to inform the projectionist when to raise or lower volume and assumes a competent observer and painstaking projectionist, which are requisites for a good performance in any and all cases;

(6) it is of the utmost importance that the manager be made to realize that the responsibility for obtaining good sound reproduction is primarily his own responsibility. He must provide at all times a trained observer, whether it be himself or someone appointed for that purpose. He must educate himself to know whether the sound system is working properly and that the projectionists are responding to the signals of the observer;

(7) regardless of where the volume control mechanism is operated it would be advantageous that the projectionist be able to hear what is taking place in the auditorium. It is urged that efforts be continued to make such means possible.

#### SUBCOMMITTEE ON PROJECTION ROOM ROUTINE AND MAINTENANCE

(1) With the introduction of sound apparatus into the theaters, the responsibilities of the projectionist have been greatly increased. The theater owner's investment also has risen proportionately. It is to the mutual interest of both owner and projectionist that the fullest measure of value be extracted from each and every item of equipment (consistent, of course, with the quality of the performance, which must always be the first consideration).

(2) The Committee feels that a detailed account of each and every item of work performed by the projectionist will not be of much practical value as such details vary greatly with each in-

stallation and type of performance. The Committee, however, desires to outline a general system of routine which will illustrate the close attention required for the proper functioning of equipment and for the perfect presentation of sound film entertainment.

(3) A printed form should be provided for the projectionists' daily report. This form should include space for entering each film or other subject included in the performance, and blank columns for entering the starting time of each subject on every performance. It should include the names of the projectionists on duty, with the starting and finishing time opposite each name. Spaces for reports as to the condition of film, the condition of equipment, supplies needed, supplies received, irregularities and imperfections of performances should be provided, in addition to space for records of vacuum tubes put in service or removed and the number of hours of use at time of removal.

(4) This form may be made in duplicate, one being retained in the projection room and the other being sent to the manager.

(5) It is fully as important to retain a record of the projection room as it is with every other branch of the business. By keeping this daily record accurately, both manager and projectionist can readily determine conditions of equipment and supplies. In many cases they are thus able to eliminate waste.

(6) Projectionists should report each day, sufficiently in advance of the scheduled opening time of the performance, to make the necessary horn and other tests of projection and sound equipment; to ascertain if batteries are in proper condition; observe meter readings; check projectors for equal volume; remove from charge such batteries as are intended for immediate use at least one-half hour prior to such use; and observe condition of vacuum tubes.

(7) They should consult the schedule of performances, noting particularly any deviation from previous schedules; consult the bulletin board for information or cues left by other members of the projection staff; clean interior of lamps, arc contacts, reflectors, condensers, objective lenses, and fader; and examine arc leads for corrosion and test connections for tightness.

(8) They should lubricate the projectors and let them run for several minutes, noting whether they maintain an even speed of ninety feet per minute; stop projectors, clean film trap, sprockets, and fire rollers, and wipe excess oil from bearings to prevent accumulating oil on film; check projector mechanisms for proper tension

of take-up and film tension pads, for proper clearances of pad rollers, fire valves, and film trap, and for tightness of all set screws of connectors.

(9) They should then check the exciting lamps for discoloration, condition of filament, and proper line-up; see that the sound optical system is free of oil; rewind and examine film. If new program, rewind and examine film prior to first showing, observe if change-over marks are properly placed and if any defect, such as oil accumulations, scratches, buckling, strained or broken sprocket holes are apparent. Such defects should be reported immediately.

(10) Such parts of projection and sound equipment as do not require daily cleaning, lubricating, or inspecting should have a designated day of the week assigned for receiving such attention.

(11) The procedure as outlined above, if properly carried out, will guard against film damage. Faulty adjustments or worn parts will cause film damage—a cause of great loss to the industry. Film in bad condition, faulty adjustments, or worn mechanisms create possibilities of film fire, with its attendant danger and financial loss.

(12) In projecting picture or effect, the projectionist should strive to avoid imposing any distraction on the audience which would serve to destroy the illusion, such as flickering light, shaking or moving the projected image.

(13) He should be constantly alert in maintaining even illumination, sharp focus, smooth change-overs, and proper timing of opening and closing of curtain. He should fade the picture or effect on and off gradually, to convey an agreeable and smooth effect to the audience.

(14) He should be stationed constantly at the projector while it is in operation, and should be promptly responsive to signals for adjustment of volume.

(15) Where the control of the curtain is not directly handled from the projection room, a pre-arranged system of warning and closing signals should be used. Such signals usually consist of a two-buzz warning to the stage which is acknowledged on a return buzzer. A one-buzz signal is given at the moment of opening or closing of curtains or changing screen masking for various-sized pictures.

(16) Film should be examined after each run and checked for loose splices and scratches, and if oil has accumulated on the film, it should be wiped off and the projectors checked immediately to

eliminate further scratching. Projectors also should be wiped dry of oil after each reel and checked for accumulations of emulsion from the film.

(17) Where more than one projectionist is on duty and when a projector has been threaded, the arc trimmed and fully prepared for the showing of each succeeding reel, the projectionist completing this work should step to the running projector and relieve the other projectionist, to allow him to check each detail of threading and trimming, noting that the proper reel has been placed in the projector. This routine of checking should be firmly established in the projection room as it has been the means of discovering faulty threading and incorrect reels in time to make corrections and avoid interruptions or film damage without making such errors evident to the audience.

(18) A minimum supply of spare parts should be determined upon. An accurate record of necessary spare parts and supplies should be kept by projectionists, and when items are used which reduce the amount below the minimum figure, such items should be reported in the "Supplies Needed" column of the projectionists' daily report.

(19) When ordering parts, the correct technical designation and catalog number should be given wherever possible in order to avoid error in delivery. Catalogs of main items of equipment should be filed in the projection room for reference. Parts subject to breakage, such as gears, vacuum tubes, and connectors, should be distinguished from parts which are subject to gradual wear, and additional precautions should be taken to provide against emergencies arising through such breakage.

(20) To provide against accidental breakage of spare vacuum tubes, they should be stored in their individual boxes. Tubes, as well as other spare parts, should be further protected by being placed in a large metal cabinet containing shelves and equipped with a lock and key. This manner of storing will facilitate a rapid inventory checking of spare parts.

(21) Proper attention should be given by the projectionists to the matter of maintaining the proper level of electrolyte in batteries. The avoidance of over-charging or over-discharging will result in a full useful life of the storage batteries and, conversely, a lack of such attention will result in a very greatly shortened life and consequent waste and expense for replacement.

(22) Where a generator is used in place of batteries it will be necessary to inspect the commutator each day and wipe it off with cheesecloth moistened slightly with vaseline. If this practice is regularly followed, the commutator should remain in condition for perfect sound reproduction.

(23) Exhibitors should acknowledge the good work of the projectionists in maintaining the equipment in the best condition and should be willing to institute new ideas and install new appliances which contribute to better performance or increased efficiency.

In conclusion, it is the belief of the Committee that every owner, manager, and projectionist should take cognizance of the fact that the projectionist is in a position to contribute measurably to the advancement of the industry. Every projectionist should manifest a desire to conduct his work so that optimum screen results are efficiently secured.

Systematizing the routine work in the projection room is highly important, for it is only by the orderly arrangement of the many complex details that:

- (1) thorough inspection, servicing, and checking of equipment can be made;
- (2) equitable working arrangements, discipline, and harmonious coöperation between projectionists can be had;
- (3) efficient results from projection and sound apparatus obtained;
- (4) smoothly conducted performances secured.

### PROJECTION PRACTICE COMMITTEE

HARRY RUBIN, *Chairman*

#### SUBCOMMITTEES

#### PROJECTION ROOM PLANNING AND LAYOUT

J. H. GOLDBERG, *Chairman*  
 J. J. HOPKINS  
 L. ISAAC  
 R. MIEHLING  
 L. M. TOWNSEND

#### PROGRESS AND IMPROVEMENT IN PROJECTOR DESIGN AND ACCESSORIES

H. GRIFFIN, *Chairman*  
 S. GLAUBER  
 J. J. HOPKINS  
 L. ISAAC

MONITORING AND CONTROL OF  
SOUND IN THEATERS

H. B. SANTEE, *Chairman*  
L. ISAAC  
R. MIEHLING  
F. H. RICHARDSON  
M. RUBEN  
L. TOWNSEND

PROJECTION ROOM ROUTINE  
AND MAINTENANCE

J. J. HOPKINS, *Chairman*  
L. ISAAC  
M. RUBEN  
R. H. McCULLOUGH  
S. GLAUBER

## MEMBERS OF COMMITTEE AT LARGE

T. C. BARROWS  
G. C. EDWARDS  
C. GREENE  
R. H. McCULLOUGH  
P. A. MCGUIRE

## DISCUSSION

MR. LINTON: I take this opportunity to extend my thanks to the Committee for the completeness and magnitude of the report. Projection practice varies in different types of theaters and with the kind of program put on. We have little control over this, and, for that reason, I am sure that this report will be of great interest to all projectionists.

PRESIDENT CRABTREE: What is the objection to wearing one earphone for judging the volume?

MR. GRIFFIN: There are so many extraneous noises that it is impossible to obtain satisfactory results with an earphone.

MR. C. GREENE: Several years ago I had the opportunity of examining the Mechau projectors which were at the Capitol Theater and when spinning them by hand I was particularly struck with the ease with which they turned and with the silence of their operation. A non-intermittent projector that would run as silently as that one did would be a great boon to a sound projection room. A pneumatic rubber earphone, sold for years by office supply houses, originally designed for the Bell Telephone receiver, will fit the majority of standard double head sets. It fits snugly at the side of the head around the ear and leaves the entire ear free and normal—not under pressure—and seals out a surprisingly large amount of extraneous noise.

MR. GRIFFIN: The occasional use of earphones involves no difficulty, but I do not believe any projectionist would like to wear them throughout the entire day. A type of headset which would exclude extraneous noise would also make it impossible for the projectionists to communicate with each other. The Committee feels that the desirability of using headphones is very doubtful.

MR. GREENE (communicated): Naturally, I do not expect headphones to be used continuously. However, I wear my cushioned set at the opening of each performance and entirely through each rehearsal with no discomfort.

PRESIDENT CRABTREE: Cannot a horn or baffle be placed close to the projectionist as he stands at his machine? By placing his ear close to the horn he may be able to obtain a measure of the volume.

MR. SANTEE: The main difficulty with the headset is the nuisance of the

cord attached to it and the danger of its becoming entangled in the moving machinery. There is already a horn connected to the output of the amplifier, which does not give the volume obtained in the auditorium but a measure of the volume coming from the system itself. I assume you refer to a horn connected to a microphone in the auditorium. It is very difficult to calibrate a system of that kind, as pointed out in the report. A variable quantity, in the form of an amplifier, is between the microphone and the loud speaker. The substitution of a tube of different characteristics would destroy a calibration and make it impossible to judge correctly the volume in the auditorium.

MR. HARCUS: It is the object of the studios to send out pictures which will not require cueing during the running of the show. This is being accomplished quite successfully by most producers, desired changes of volume being recorded into the sound track so that with uniform house conditions the show will run on one fader step. If the two projection machines are balanced for volume and quality, and the manager calls for changes of volume as the house fills and empties, ordinarily all the essential showmanship will be properly cared for. There are a few exceptions to this at the present time, such as in musical shows where songs should be played up a step or two above "normal," and in pictures where the effect of some spectacular scene is enhanced by momentarily raising the volume several steps.

MR. SANTEE: That is covered in the Report of the Sound Committee.

### REPORT OF THE SOUND COMMITTEE\*

The Sound Committee, in preparing this report, has confined itself mainly to a consideration of the status of present-day practices in sound recording and reproducing. Some study has also been given to the possibilities of standardization as well as to those items which might well be investigated further.

Where a practice has proved itself worthy of usage it is the plan of the Committee to recommend it for standardization to the Standards Committee of the Society. It is recognized that in an art so comparatively young as sound recording and reproducing, care must be taken against premature attempts at standardization. The progress of development is so rapid and the technic of recording and reproduction is undergoing adjustment so quickly that premature attempts at standardization might prove a hindrance rather than a help. On the other hand, the moment any phase of the art becomes stabilized, it should be presented at once as a matter worthy of standardization throughout the industry.

In this report the Committee intends to show a cross-sectional view of the newer and more important phases of sound recording

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\* Presented at the Spring, 1931, Meeting at Hollywood, Calif.

and reproducing. It is not intended that the material presented here shall encroach upon the activities of the Progress Committee although there may unavoidably be some slight duplication.

Neither the Committee nor the Society now has facilities to carry on investigations, but it can recommend what is of importance for further progress in the art. The Committee, therefore, feels it may be of considerable service in presenting to the Society and to the industry matters on which work should be done. Some of the items which have been suggested to the Committee as worthy of consideration have already received sufficient study to permit the formation of definite recommendations. In these cases, arguments for and against are presented and the Committee's conclusions submitted.

### *Part I*

#### STATUS REPORT

*Directional Sound Detectors.*—A directional sound detector comprises a device in which the efficiency of response is a function of the angle between the direction of incident sound and a reference axis in the system which coincides with the direction from which it is desired to receive the sound.

In general, there are two principles used in directional sound detectors, one amplifies the sounds desired by concentrating them and the other avoids or suppresses the unwanted sounds. Horn and reflector types employ both principles. The ribbon microphone and absorptive baffle make use of only the second.

*Horns.*—Horns have been long used in conjunction with various types of sound reception apparatus, but have not been used for high-quality pick-up due to the difficulty of obtaining a good frequency characteristic in spite of the apparent efficiency of this type of unit.

*Reflectors.*—The use of reflectors for the reception and focusing of sound is well known. In order to receive sound pressure variations over a wide frequency range, it is necessary to use a reflector having large dimensions. Within practical limits of size, a reflector is likely to have a characteristic which will be better at the high end of the frequency scale than at the low end, although compensation for this effect can be applied.

*Combination of Horn and Reflector.*—It is possible to combine the horn and reflector principles in a device which has a fairly good resultant frequency response. The directional properties, however,

as limited by the design of a horn and a reflector, may not be uniform with frequency.

The directional characteristics of these devices have been found useful in eliminating undesired sounds and noises, particularly where the sound which it is desired to pick up is weak. The effectiveness has been greater for outdoor work where there is no reflected sound than for use in studios where reverberation is encountered.

*Ribbon Microphone.*—A properly designed ribbon microphone may be made very directional. Its directional characteristic is practically independent of frequency because of its dimensions, and, by virtue of its directional effect, increases the distance from which acceptable sound may be picked up, in spite of the fact that it receives a relatively small amount of energy due to its size. It is also particularly effective in reducing unwanted sounds, such as camera noises and the like.

*Absorptive Baffle.*—It has been found possible to design an absorptive baffle for a microphone in such a way that any sound coming from a direction not included in the throat angle of this absorptive structure will reach the diaphragm at a very much reduced intensity. This structure, while fairly large in dimensions in order to obtain the necessary absorption, is not dependent entirely upon the wavelength of the lowest frequency for its minimum dimension since the wave front remains practically undisturbed. This arrangement, of course, is no more efficient than the microphone would be without the absorptive device but its sharp selectivity of the direction from which it effectively receives sound makes it appear promising.

#### CAMERA SILENCING DEVICES

Silencing of cameras became necessary with the advent of talking pictures. While the ideal method would be to use a silent camera, until such perfection is attained, it is necessary to place the existing cameras in some form of silencing box. This, in the first place, took the form of a camera booth large enough to house one or more cameras and the cameramen. Being extremely cumbersome and heavy, it was in some cases very difficult to place on a set and of necessity soon gave way to handier methods.

During this preliminary stage, much thought and work went into the methods of camera maintenance which resulted in their being brought to a higher state of mechanical perfection than had

ever before been attempted in the industry. It was also found that the commonly used means of interconnecting the camera and the camera drive motor by a flexible shaft was a great source of noise. This camera drive was a development of talking picture equipment which the weight of the early motors made necessary, as it was not practical to hang much weight on the camera structure.

At this period each studio investigated camera silencing in its own way. By a process of experimentation and elimination, the present-day devices were evolved. They are by no means ideal and are being continually changed and improved. The generally accepted opinion is, of course, that the ultimate solution of this problem will depend on the development of a silent camera which it will not be necessary to enclose.

In camera booths, the natural development was along the lines adopted by most studios (with a few exceptions), that is, an individual camera enclosing box which, in its early stages, was simply a wooden framework covered with various sound insulating materials. This did not silence the camera sufficiently to permit its use within fifteen or twenty feet of a microphone and it was soon replaced by more efficient designs. It is unnecessary to follow the various stages of this development, but from a survey of the present-day equipment it is easy to see that it is simply an elaboration of this silencing box.

The new camera silencing devices became known as "blimps" or "bungalows." In the majority of cases the bungalow was made to contain the drive motor as well as the camera. Some of the studios adopted a form of drive motor which was mounted directly on the camera; others retained the flexible shaft but enclosed it inside the bungalow. One or two of the studios made separate bungalows for the motor and the camera, and covered the flexible shaft with heavy layers of sound insulating material.

The Fox Movietone Studios adopted as standard a camera bag composed of rubberized cloth, kapoc floss, and other soft insulating materials, fastened by means of zippers and snaps. The lens and finder protrude through the bag.

With the adoption of the heavy bungalow covered camera, a very much stronger and more rigid camera-tripod became necessary. The bungalows used by Warner Brothers and United Artists are light enough to mount on the standard tripod. Most of the other studios adopted either a tripod which was developed by Metro-

Goldwyn-Mayer in collaboration with Pathé, or else an adaptation of this, used in conjunction with a standard tripod for rigidity.

The Academy of Motion Picture Arts and Sciences, under date of May 14, 1930, published through their Technical Digest Service, Report No. 3 of the Producers-Technicians Committee relating to camera silencing. This report gives in detail a complete résumé of all such devices in use at that time. It includes information on the insulating value in decibels, the methods of construction, materials used, and the distance that a microphone can be used from the camera.

#### NOISELESS RECORDING METHODS

The noiseless method of recording on film, announced at the end of 1930, appears to be receiving general acceptance throughout the industry. RCA Photophone has described two methods of effecting noiseless recording on variable width track. One of these displaces the zero line on the track in such a manner that the clear portion is only just wide enough to carry the modulation. This is subject to the disadvantage that weaving in the projector may cut off some of the weaker sounds. The second method uses a movable shutter during the recording which causes the clear part of the sound track to become blackened in those portions which are not employed to carry the modulation.

The Western Electric Company has announced a noiseless recording system which is applied to their variable density method. The density of the sound track is increased during the intervals in which the sound volume is low, and is decreased according to the envelope of the sound currents in such a manner that the film is always just able to accommodate the required modulation.

The Fox organization has devised a means for flashing lamp variable density recording, in which the intensity of the lamp is reduced during the intervals of low sound amplitude, the intensity being altered during the process of recording.

A number of independent makers of sound equipment, most of whom are using the flashing lamp, have announced attachments to their equipment which produce essentially similar effects.

The reduction of noise is accomplished during the actual recording by an attachment to the recording system, and, in general, involves no change in recording or processing technic. The amount of noise reduction which is being employed in most studios at the present time is of the order of 10 db.

## SET AND STUDIO ACOUSTICS—THEATER ACOUSTICS

Extensive investigations have been made by many interested in the factors concerned in set and studio acoustics and theater acoustics. In some cases these studies have been made with recently developed instruments, permitting more accurate results than those previously obtained by aural methods. Several factors have been discovered by such means, some of which have contributed to the development of a more general formula for the computation of the time of reverberation. The application of this formula, which has been published by Dr. C. F. Eyring, of the Bell Telephone Laboratories, is of particular value in set and studio work, where average absorption coefficients are comparatively high. Important studies of the effect of relative humidity on sound absorption are being made.

The necessity for consideration of the reverberation existing throughout the frequency spectrum is now well appreciated. Whereas many enclosures had in the past been acoustically treated, giving consideration only to the reverberation at 512 cycles, experience in many of these cases indicates the necessity for obtaining suitable balance between the reverberation at the low and high ends of the frequency spectrum relative to that in the central portions of the range. It is becoming the practice to adjust theaters and recording studios to have times of reverberation throughout the frequency spectrum such as will give definite rates of decay for sounds of equal loudness. With the application of suitable accurate instruments for the measurement of reverberation times, studies have been made of the relative effects of connected volumes, which have an important bearing on complex auditoriums, as well as on recording sets on large stages. Further study, by instrumental means, has indicated the effect of direct reflections to be of importance and requiring consideration in the design of auditoriums, in addition to the consideration given the reverberation time.

The importance of maintaining a very low noise level has been extended to cover not only the studio, but the theater. This has become more necessary with the development of recording methods insuring a lower background level in the sound picture. Attention must be given to the transmission of noise from the projection room into the theater, from the ventilating systems, from sources external to the auditorium, and to miscellaneous noise sources within the auditorium.

More information is available upon the acoustic power required

to provide satisfactory sound volume in an auditorium. It is, therefore, possible to predict more accurately what effect the introduction of absorbing material into an auditorium will have upon the sound volume and, where necessary, upon the electrical requirements of the system.

Many improvements have been noted in existing commercial materials and a large number of new materials suitable for studio and theater use have been developed and introduced in the past year. This has considerably widened the field for obtaining materials having the desired acoustic characteristics for the particular application and which will be more readily acceptable from the standpoints of architectural appearance, fire hazard, and cost.

#### PRESERVATION OF SOUND PRINTS

The Committee has been fortunate in receiving from a firm prominent in the film industry the results of tests, conducted over a period of two years, of processes which purport to preserve motion picture film. The method used in these tests was to prepare loops of film, half of which were processed and half unprocessed, both sections being taken from the same reel or roll. These loops were projected 300 times, with examination at 100, 200, and 300 runnings, on a specially prepared projection machine, which caused as little wear as possible.

The processes tested were such as lacquer, surface hardening, whole surface waxing, chemical impregnation, liquid edge waxing, *etc.*

The noticeable effect of the processes investigated was that the film became seasoned more quickly, so that during the first few times of projection, the emulsion did not collect on the shoes and tracks of the projection machine as is often the case with green emulsion.

There was also indication from this set of tests that liquid edge waxing provides comparable protection. Once past this initial period, however, it was not evident that the processes provided any material improvement in giving greater lasting qualities to the film.

#### TALKING MOTION PICTURE EQUIPMENT FOR HOME USE

In recent years several talking motion picture equipments have been developed and offered for sale for home use. Practically all of these equipments use a 16 mm. projector with either a flexible shaft or geared connection to a synchronous turntable for disk repro-

duction of sound. All the devices examined, except one, project 24 pictures per second and employ a turntable driven at  $33\frac{1}{3}$  rpm. This one exception projects 16 pictures per second and the projector and turntable are driven by electrically interlocked motors. In order to maintain synchronism with the  $33\frac{1}{3}$  rpm. turntable, every third frame is removed in printing from the negative to the positive.

At the present time 16 mm. films synchronized with sound are difficult to obtain and are expensive. If an extended library of films were available, it is probable that a larger demand would appear for home talking movies. To date, the supply of films is extremely limited and these films are available only in the larger centers, requiring personal application to obtain them and personal return. This mitigates against very extended use of these films and is a serious detriment toward obtaining a large market for the reproducing equipment in the home.

#### TALKING MOTION PICTURE EQUIPMENT FOR NON-THEATRICAL USES

Considerable demand is apparent for talking motion picture equipment for non-theatrical uses, this equipment to be used either for advertising purposes, instruction work, in schools, churches, *etc.* Equipment for this purpose is built by all the leading talking motion picture apparatus manufacturers. The trend seems to be toward a 35 mm. film with sound on the film, although some equipment has been built with the idea of using 16 mm. film and a synchronized disk, which permits a picture of sufficient size and brilliance of illumination for small audiences. Libraries are being developed which will undoubtedly stimulate the exploitation of such equipment.

#### SOUND EQUIPMENT IN THEATERS

On January 1, 1931, there were reported to be in the United States 13,515 theaters equipped for sound reproduction and 8209 theaters unequipped. It might, therefore, appear that during the period of sound equipment installations only about 63 per cent were completed. Many of the theaters now running silent, however, are unprofitable houses which may never be able to afford sound equipment. With the decreasing number of silent picture releases, these theaters may be forced to close. It follows, then, that the installation period is well over 63 per cent completed. Perhaps 80 per cent would not be too high a figure.

It may be considered that the industry is passing out of the in-

stallation period and is now entering a period of stability in operation and of refinement. The novelty value of sound has passed with every indication that sound has become as necessary a factor in the theater as is the picture on the screen.

The first problem of theater projection is obviously to keep a picture on the screen and to maintain sound from the horns. It so happens that statistics from Electrical Research Products, Inc., are available, which show the ratio of emergency calls to theater installations in the United States over a period of time. In December, 1928, with roughly a thousand theaters equipped, the ratio of emergency calls per week to theaters in service was about 0.185. In December, 1929, with 3300 theaters equipped, the ratio had fallen to about 0.05. In December, 1930, when nearly 5000 theaters were equipped, the ratio was as low as 0.022. This decrease in emergency calls is caused by improvements in design and manufacture, and to proper and continued maintenance of the equipment. It is logical to believe that the operating troubles experienced with other reputable systems follow somewhat the same general course. It is consequently obvious that the first requirement of sound projection, namely, consistent and reliable operation, has been achieved. The quality of sound now focuses our attention.

Poor theater acoustics constitutes one of the most serious causes of poor sound reproduction in theaters. Acoustic analyses have been made in a large number of theaters and corrections of the conditions have been made in some cases. It often happens that the theaters less able financially to make the correction need it most. It has been proved in so many cases that improved acoustic conditions result in increased box-office returns that the expense of the change has been thoroughly justified. It is believed and hoped that more theaters can avail themselves of this improved condition not only for their own salvation but to give to the public all the benefits of the improved products which could not otherwise be realized.

There has probably been a healthy although unconscious competition between the studio and the theater in striving toward higher quality. Such improvements as better reproducers for disk records, finer optical systems, and smoother mechanical features for film reproduction, along with other general advances applicable to both methods, have raised the standards of the theater equipment to the point where they are capable of handling good quality recordings.

Improved technic in the studios, resulting from such factors as study of stage and set acoustics, microphone placement, better knowledge of re-recording methods, and more exact control of film processing, have made it possible for the studios to show a tremendous improvement in the quality of the recorded product.

The gradual extension of the frequency range has been a material contribution to this improved quality but efforts toward a greater range should be and are being continued.

### *Part II*

#### ITEMS FOR FURTHER INVESTIGATION

##### PREFERRED SOUND TRACK SIZE AND LOCATION

The considerations which dictate the preferred sound track size and location are twofold—first, engineering, and, second, economic. For the present the second of these dominates. Engineering considerations tend to favor an increase in sound track width over the present track, although such an increase cannot be carried on indefinitely without encountering further engineering difficulties.

A number of locations for the sound track differing from the present have been proposed. The majority of these offer little to be gained from an engineering standpoint. Their effect is mainly to permit a change in the present picture size, and the principal difficulty standing in the way is an economic one. Until it has been possible to make a further engineering study of this problem, it would appear to be undesirable to disturb the producers' and theater owners' efforts to stabilize their economic positions by the introduction of equipment necessary to effect a relatively slight engineering or artistic improvement.

##### SOUND FROM SEPARATE FILM

At the time when sound recording and reproducing was just getting a start, the need for double film was felt rather strongly. Some difficulty was experienced in the proper processing of both sound and picture on the same film, and, in addition, the theater reproduction apparatus was less effective than it is today. At that time the industry was often able to obtain better than normal results by using the double film.

At present the situation is quite different. Theater reproduction apparatus has been greatly improved, and, moreover, a large part of the available theaters have been provided with sound ap-

paratus at considerable cost. To supersede this apparatus or to modify it in any way would represent a substantial increase in cost to the theater and would present an economic problem which should not even be proposed unless substantial advantages are to be derived from the change.

Separate sound film installations would permit:

- (1) control of sound film independent of the picture;
- (2) separate handling of the release print in processing;
- (3) wider sound track;
- (4) higher running speed for sound track.

There are no data existing to show that these improvements warrant an expensive change. In the first place, it is no longer considered a serious handicap to the sound record that in variable density records a negative development must be accommodated to the processing of the composite print. By proper choice of conditions, satisfactory results can be obtained differing only in volume from what might be obtained with the separate sound film. Noise reduction technic applied to the composite sound record is adequate for practical theater requirements.

Secondly, studio and laboratory technic has found practical solutions of most of the problems of development of picture and sound records on the same film, in positive form. This did not always seem feasible, but present results indicate no particular handicap. As a matter of fact, the positive control enforced by sound requirements has produced a general improvement in average picture print quality in many cases.

Somewhat the same reasoning applies to the wide sound track. With the track twice as wide as at present, an improvement of the order of three db. in signal-to-noise ratio should be obtained, with no change in quality. This improvement is scarcely sufficient to justify a large change in theater apparatus, in the light of noise reduction studies which are at present under way.

The case of high running speed for the sound track has advantages since the greater the speed of the track the greater the ease of recording high frequencies. There should certainly be no difficulty, however, in recording frequencies up to 6000 or 7000 cycles on existing film stock running at the present standard speed. The present recording and reproducing equipment, at least with modifications and improvements which will be made as the art progresses, should be capable of recording and reproducing this frequency

range. It would, therefore, seem wise to exert efforts to obtain good, clear reproduction with present facilities rather than to introduce additional means for extended range at this time. Ultimately the state of the art may warrant the recording and reproduction of very high frequencies in the audible range but it is not believed that the time is opportune to consider costly changes toward this until full advantage is taken of present equipment.

An important economic phase of the handling of film is the mechanism of release through the exchanges. Handling and shipping problems are such that the extra cost and complication of handling a separate medium for sound is almost prohibitive. Moreover, the problem of maintaining synchronism must be admitted. No numbering system, however complete, can be as satisfactory in this respect as to have the picture and sound records unalterably tied together on the same film. Even at present, the producers annually furnish thousands of feet of short replacements to take care of inadvertent or deliberate changes of a print in the exchange or theater to accommodate a particular situation. It has never been possible, thus far, to prevent such changes being made. Obviously, it would be very much harder to handle this phase of the problem on a double medium basis.

In the light of this brief analysis, it is the Committee's definite recommendation that the Society should take a stand in favor of improvements known to be possible in the present standard composite picture and sound print.

#### VOLUME CONTROL IN RECORDING

In the recording of sound for audible pictures, the volume range of the sound record is defined on the upper side by the overload point for the sound track and the cutover point for the disk, and on the lower side by the masking effect of the inherent noises in the sound record, known as ground noise or surface noise. This volume range was originally in the neighborhood of 30 db. and there was little choice between film and disk. As pointed out elsewhere in this report, the adoption of noiseless recording systems has increased the volume range on the film record by approximately 10 db.

In order to obtain a satisfactory ratio between the sound and noise level it was the custom in the past to raise the level of the weaker passages and lower the level of the louder passages at the time the record was made and to furnish the theaters with cue sheets

directing the projectionists to lower or raise the sound level at these points by amounts specified in the cue sheet. In practice, this has not proved entirely successful, as the projectionist's attention has been so largely occupied by other matters that he has been unable to properly follow the instructions given in the cue sheet. It has been found practicable to record the sound on the film at the levels at which it is intended to be reproduced in the theater. The cue sheet is, therefore, being abandoned. Consideration is being given to marking on the beginning of each reel in appropriate fashion the relative levels at which the reels should be reproduced.

The Committee will give further consideration to this important problem but suggests at this time that the trend be continued toward recording the sound at the proper levels.

#### FILM DEVELOPMENT

During the past year, radical changes have taken place in film developing. Almost universally, the use of machines for release prints has become standard practice. The developing of picture and sound negatives by machine has become almost general, as the results of machine development have proved to be superior in obtaining uniformity and freedom from mechanical injury. A matter that requires further study is the composition and maintenance of the chemical bath.

Although information is available to permit the proper development of sound film, and devices for controlling and checking the methods are at hand, the full use of such facilities is not yet being made. A uniform and consistently good product can only be obtained by constantly employing such instruments as a means of checking the results.

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H. C. SILENT  
R. V. TERRY  
S. K. WOLF

H. B. SANTEE, *Chairman*