MOTION PICTURE PRESENTATION MANUAL

THE BRITISH KINEMATOGRAPH SOCIETY

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INCORPORATED 1946

Secretary
J. W. DUFFIELD-HARDING

BRITISH KINEMATOGRAPH SOCIETY

164 SHAFTESBURY AVENUE, LONDON, W.C.2. TEMple Bar 8915/6

THE PRESENTATION MANUAL

The final presentation of entertainment films to the public depends entirely on the projectionist himself and the apparatus at his disposal.

We in the B.K.S. knew that some of the complaints of bad presentation were due to matters outside the scope of the projectionist - such things as faulty production, processing, print maintenance and so on. An All-Industry Committee for the Improvement of Screen Presentation was formed, each of the organisations naming its own representative. The Committee consisted of the following:-

R.J.T. Brown	Chairman
W.G. Altria	Trade Press
Stuart Black	Association of Independent Cinemas
Gordon Craig	B.K.S. Film Production Division
A.E. Ellis	B.K.S. Theatre Division
R. Ellis	Film Laboratory Association
G.E. Fielding	C.E.A. and Associated British Cinemas Ltd.
H.S. Hind	Association of Specialised Film Producers
T.W. Howard	B.F.P.A. and F.B.F.M.
L. Knopp	Cinematograph Exhibitors' Association
T. Lever	N.A.T.K.E.
P. Pilgrim	Granada Theatres Ltd.
L.F. Rider	Kinematograph Renters' Society
S.B. Swingler	Circuits Management Association Ltd.
L. Ward	A.C.T.T.
R. Pulman	Secretary

After working for more than a year a Report was produced, calling attention to the reasons for faulty screen presentation in every stage from studio to cinema. In addition the Committee decided to produce this Manual to be given free to every Cinema in the Country.

THE MANUAL IS INTENDED FOR THE USE OF THE PROJECTIONIST BUT REMAINS THE PROPERTY OF THE CINEMA TO WHICH IT IS PRESENTED.

We know it will be useful to you and you can be quite sure that every Company which has sponsored data sheets is as keen as we are to help you. Do not hesitate to seek their advice or ours if you have presentation problems.

R. J. T. Brown

R.J.T. BROWN - PRESIDENT

THE RANK ORGANISATION LIMITED

38 SOUTH STREET · LONDON · W.I

TELEPHONE: MAYFAIR 7454

JD/BS

R. J. T. Brown, Esq.,
British Kinematograph Society,
164 Shaftesbury Avenue,
London, W.C.2.

Dear Mr. Brown,

Showmanship and consistent service to the public have never been more vital to our industry than they are today.

Your Committee's "Manual of Good Presentation" will help to maintain the highest standards at the immediate point of contact with the patrons, and I am sure that all producers, distributors and exhibitors will welcome it as I do. The great quality of presentation which has become possible through modern technical advances makes this a timely contribution to the industry, and I wish it every success.

Yours sincerely,

John Davis

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30th November, 1961.

R.J.T. Brown, Esq.,
President,
British Kinematograph Society,
164, Shaftesbury Avenue,
London, W.C.2.

Dear Mr. Brown,

I should like to congratulate you and your colleagues in the B.K.S. on the extremely valuable contribution which you have made to the Film Industry through your 'MANUAL OF GOOD PRESENTATION IN CINEMAS'.

Today, when the Industry is facing a strong challenge from other entertainment media, anything which is calculated to enhance the presentation of films to our patrons must be regarded as being of major importance.

I am sure that every projectionist will be quick to recognise the merit of the new Manual and the amount of sheer hard work and skill which has gone into its compilation.

I feel that your reward will come through the close attention it will receive from projectionists, who I am sure will be quick to avail themselves of the practical information it contains.

In complimenting you, I would like to urge every projectionist who has the interests of our Industry at heart, to familiarise himself with the mine of information and practical knowledge offered by the Manual.

Yours sincerely,

D.J. GOODLATTE

Issued by the PICTURE PRESENTATION COMMITTEE of the
BRITISH KINEMATOGRAPH SOCIETY

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DATA SHEET No. 1 – Issued by the PICTURE PRESENTATION COMMITTEE of the BRITISH KINEMATOGRAPH SOCIETY

Sponsored by the B.K.S. PICTURE PRESENTATION COMMITTEE

How Presentation Affects You – The Projectionist

GOOD PRESENTATION MEANS BETTER BUSINESS and better business means a better future for you.

You are the key men when it comes to the matter of good presentation, and skilful and unobtrusive operation of the equipment is a most important factor in the maintenance of consistently high standards of motion-picture presentation.

That brings you—the Projectionist—right into the picture—as it were—for you can make or mar the presentation of the motion-picture and in so doing make or mar your own future.

Operational perfection is of the greatest importance and calls for the full use of your skill and sense of showmanship. It is fully within your power to add to or detract from the final result, and so much effort is put into the making of a film that final interpretation cannot be ignored.

You are the man into whose capable hands quite a few people place the result of their crafts and labours, not to mention considerable finance, in the justifiable expectation that you will present their product in the best possible way to the paying customers.

We all know that good motion-pictures are the first essential requirement to success and, after all, nobody sets out to make a bad film. We need good films, just as anybody in business needs good articles to sell. Good presentation without good pictures will not bring in any paying customers.

Conversely, it may be said with truth that indifferent presentation of a mediocre picture may well be the last straw that breaks the patron's habit—the habit of going to the cinema.

Don't underestimate the importance of consistently good presentation—it runs closely second to the provision of good films.

Don't underestimate the part that you play in the provision of consistently good presentation. Without this important factor the paying customer is not coming back for more.

It is the outside presentation, designed to get the customer inside, that gets the plaudits and it is dangerous to assume that we have the right kind of inside presentation to keep them inside. Remember—you can't kid all of the public all of the time.

Good presentation of films should be to you " doing what comes naturally " but indifference is always waiting to creep in silently, so, just because you do the same job day in and day out, don't lose sight of the undoubted fact that on your skill and attention alone, rests the excellence of the " show."

Remember that your audience is changing all the time and each has the right to expect—in fact has paid for the right to expect—a good show.

You are a showman, just as much as you are a Projectionist, and you have your particular brand of showmanship, just as the Manager of your cinema has his.

To you, as well as to everybody else in the Industry, the only person of real importance is the paying customer. He or she pays your wages and we all live on continued patronage.

Cinemas vary in shape and size, in the excellence of their equipment and furnishings and, therefore, in the scope that they offer you—the Projectionist.

Nobody can do something with nothing, but many Projectionists can do a lot with a little. Fundamentals remain the same, irrespective of size and condition.

Nobody is going to pay more than once to view a film that is out of focus, where the screen illumination is dull and inconsistent, where this and that goes wrong.

The presentation of motion-pictures is essentially an optical illusion and the entertainment value lies in persuading the viewers to " participate " in the story and action. Bad presentation draws the customer's attention forcibly to the illusory nature of the entertainment and thereby spoils it for him or her.

The Projectionist of today might well claim membership of the magic circle for every day he throws on his screen one of the greatest of all magical tricks.

The projection of a giant picture from that tiny film transparency, the high degree of mechanical precision involved, the amazing optics used in the immense magnification and many other factors are a wonder in themselves. Don't lose sight of these facts and let familiarity breed contempt.

Your part in the showing of a film may be a hidden one but it is by no means a passive one. There is no glamour attached to your job, there is no direct contact with the customers, but it is your work that they come to see and, when you make a mistake, it becomes painfully obvious to them as they sit watching the show that you are putting over to them.

The presentation of a motion-picture is a team effort and the team is only as strong as its weakest member, and you—the Projectionist—are entrusted with the final climax.

The Industry must have consistently good presentation in order to stay in business and in order to be successful in business.

Can you doubt that your future is involved ? GOOD PRESENTATION MEANS BETTER BUSINESS AND BETTER BUSINESS IS BETTER FOR YOU.

DATA SHEET No. 2 – Issued by the PICTURE PRESENTATION COMMITTEE of the BRITISH KINEMATOGRAPH SOCIETY

Sponsored by the B.K.S. PICTURE PRESENTATION COMMITTEE

How to Get Good Presentation and How To Keep It

No matter what your status as a cinema projectionist, no matter whether you like your job or don't, no matter whether you are in it as a career or until you can find something better, the job for which you get paid is that of presenting motion-pictures to the paying customers.

To most projectionists, there is no need to emphasise the importance—the absolutely vital importance—of good picture and sound presentation, so we only have to explain why to the man who does not give value for money or just does not know. However, even to those projectionists who always put up a good show, a reminder will do no harm, so we have collected together as much information as possible and present it to you here. It is not new information and most of it comes from books and papers that have been written by the acknowledged experts and practising projectionists of our Industry.

You will have noted that we have given this Data Sheet the title of " How to Get Good Presentation and How to Keep It ". Of course, there is no easy automatic way of getting good presentation. It is a matter of painstaking attention to detail, and so is the question of keeping Good Presentation. That's even harder, for enthusiasm can be created but, maintaining it over a long period of time, or even for ever, is quite another matter and needs grim determination or, better still, the creation of a habit—this time a good one—which it will be difficult to break.

Many of us realise that Good Presentation is a business essential and accept that fact, but, for those who do not, let's spend a moment in an endeavour to make them realise this fact.

Common sense will tell you that, if people do not go to cinemas and pay to see motion-pictures, there soon won't be any cinemas and, therefore, no cinema projectionists will be required either. That is the first fundamental fact.

People pay to go to the cinemas to be entertained and they expect value for their money or they will not come back for more. That is the second fundamental fact.

The money that passes through the Pay Box pays your wages and ours. That is the third fundamental fact.

There is a shortage of films and, therefore, of good films for cinemas. That is the fourth fundamental fact.

You show the goods that we sell to the public and, therefore, in your hands rests the ability to present them in an attractive light or to do the opposite. That is the fifth fundamental fact.

You are paid to do this job to the best of your ability and it is in your own interest, whichever way you look at it, to do the job consistently well. That is the sixth fundamental fact.

You are a technical salesman and showman, just as much as anybody else handling the film, and you are at the end of the line in the place where everybody else but you has done their stuff. That is the seventh fundamental fact.

To be successful in business, you must improve and progress all the time. If the film is not up to much, if the copy is not up to much, if your equipment is not up to scratch, that is not your responsibility. Don't drop your standards of presentation. We want to bring everybody else up to your standard if you will only set a high standard. That is the eighth fundamental fact.

Learn from the other fellow—watch the other fellow and outdo the other fellow. That is the ninth fundamental fact.

Better Presentation means Better Business and it is Better Business that is better for all of us. You do your part—its your plain duty—it ought to be your wish—its certainly your job. That is the tenth commandment.

Having dealt with the human factor—for without success in that direction the rest goes for naught—let's examine the physical features.

People pay to see the film and we, of course, know that it is the film they come to see, not the Projectionist or for that matter his projection.

Let's be frank and say that what they have a right to expect is a picture that is clear, bright, steady and unblemished.

Four simple words, but how very much can be written around them.

Although the public likes and dislikes are impossible to forecast, one thing we do know with certainty is that successful motion-picture presentation, and by successful we mean business and not technical, is an intangible combination of a lot of factors, each one of which has an important part to play in creating the overall atmosphere that makes the entertainment sought after.

Nobody expects the customer to be able to analyse his or her dissatisfaction or, for that matter, their satisfaction with the entertainment they have paid for. Nobody expects them to pinpoint the faults, except the obvious ones.

So now let us analyse the act of motion-picture presentation and examine those many items that go to make up the satisfactory whole.

High standards of projection and sound reproduction must be given first consideration, although presentation as a whole obviously goes much deeper and involves other important factors such as patron comfort and emotional stimulation. Accurate determination of the suitability of grades of equip-

ment for particular auditoria also has a distinct bearing on the ultimate screen results.

Ignoring the purely technical point of view, what really constitutes the fundamentals of good picture presentation from a patron's eye view ?

1. Clear vision of the entire picture area from every seat.
2. Uninterrupted continuity.
3. Adequate and consistent screen illumination and brightness.
4. Acceptable picture steadiness.
5. Unobtrusive operation of the equipment.
6. Sharp and consistent focus.

Viewing Conditions

The first item, that of clear vision, is somewhat elementary and more a matter of careful planning than anything else, but it is still the first fundamental step in good motion-picture presentation. Obviously, no patron can really enjoy viewing a picture area, part of which is obscured by the head, if not the shoulders, of another person seated within the visual angle subtended by the picture.

Good viewing conditions also require compliance with the Eyestrain Regulations in relationship of picture size to seating layout. Distortion, both in viewing angles and projection angles, must be kept to an absolute minimum. Clear viewing should also be easy viewing with regard to the amount of head elevation or sideways movement necessary.

It is not the Projectionist's responsibility to determine seating layout, but he should know something about *all* the items that affect presentation.

Uninterrupted Continuity

Nothing is so surely fatal to good presentation as programme interruptions. The entertainment is completely spoilt and the continuity lost. No further remarks are needed here. Motion-picture entertainment is fundamentally an optical illusion—break the spell and you lose the effect.

Adequate and Consistent Screen Illumination and Brightness

This, of course, depends on the total light output available from the motion-picture projectors as well as the operation of the equipment and the state of the screen and is, therefore, not completely under the control of the Projectionist—except that it may be less than normal owing to maladjustment of the equipment.

Much has been written on screen illumination and screen brightness and is dealt with on other Data Sheets, so it will be sufficient here to recommend that screen brightness should be within the limits of British Standard No. 1404. This recommendation will assure " sparkling " picture quality and considerably help both film production technicians and the laboratory technicians in their efforts to give our customers maximum clarity, contrast and pictorial beauty in release prints.

While operating at levels below the standard can result in dull and uninteresting picture presentation, it should be remembered also that to exceed the B.S.I. recommendation can also be undesirable in that it may result in " washing out " certain prints and produce scintillation and flicker which cause visual discomfort.

Acceptable Picture Steadiness

A picture image that is unsteady, whether it be vertical jumping or horizontal weaving or a combination of both, is not conducive to good picture presentation. This is entirely a matter of condition of projection equipment and the servicing and maintenance of such equipment.

Immediately anything other than transient unsteadiness is observed, steps should be taken to correct the matter, whether it be a simple matter of sprocket replacement or some more complicated fault that means calling in the service engineer or equipment manufacturer's engineer.

Unobtrusive Operation

Operational perfection is of paramount importance and it calls for the full use of the Projectionist's skill and sense of showmanship in presentation.

It obviously lies within the power of every Projectionist to add to or detract from the final result, into which the brains and experience of a band of technical and artistic experts in every phase of film production have merged to produce what might well be one of the finest scenic and artistic presentations in the motion picture field.

So much effort is put into the making of a motion-picture that final interpretation becomes the climax. Here the inherent skill of the Projectionist makes itself felt, for, in many ways, he can help to turn what might be only a passable motion-picture into enhanced entertainment value.

Consistency of screen illumination rates first place among those matters under direct control of the Projectionist.

Screen illumination that flickers, is unsteady or shows signs of uneven colour, the " blue " or " brown " corners that result from incorrect arc focusing or maladjustment of the optical system, immediately remind the patrons of the illusory nature of the entertainment being experienced and spoil their enjoyment accordingly.

Proper distribution of the light intensity across the screen is another factor under the control of the projectionist and one which, when properly adjusted, adds its own contribution to perfection in presentation.

The other important factor under this heading is the question of timing. A keen sense of timing on the part of the Projectionist is part of showmanship in presentation and gives that necessary polish to the finished product. Careful and split-second timing of screen tabs against titles and ends of films, timing of main tabs, house and stage lighting all add lustre to the whole effect of good picture presentation.

DATA SHEET No. 3 – Issued by the PICTURE PRESENTATION COMMITTEE of the BRITISH KINEMATOGRAPH SOCIETY

Sponsored by the B.K.S. PICTURE PRESENTATION COMMITTEE

How to Get Good Presentation and How To Keep It—*continued*

Sharp and Consistent Focus

Nothing is more annoying than a picture image that is just " off-focus." Sometimes this is, of course, the picture itself and cannot be corrected, but, in the vast majority of cases, it is just a matter of inattention.

Make sure that you are not at fault in the matter and, if your projection room is so far from the screen as to make it difficult to obtain really sharp focus, then use a pair of binoculars or some other type of focusing aid.

Make sure that your lenses are in good condition, clean and unmarked, and, if they will not give sharp screen definition, get them replaced or repaired. Adjust focus gently. Use a piece of film, that you know to be good, for frequent test checks.

Inconsistent focus is also very damaging to presentation and this, again, can be due to inattention or not checking focus at beginnings of reels or at changes from colour to black-and-white, or vice versa.

Inconsistent focus can also be a matter of the in-and-out-of-focus that occurs with buckled films or projection conditions where the gate heat is excessive.

While you can, perhaps, do only a limited amount to minimise the effect caused by buckled films, you should do all you can and, where gate heat is excessive, call in the service engineers who may be able to suggest an alternative set of projection conditions whereby you get as much screen light but with less gate heat.

Sharp and consistent focus is a very important factor in good presentation. It demands your constant vigilance and, where you cannot cope, that of the experts available to you through the service organisations and equipment manufacturers. Do not fail in this vital matter. Remember that sharply focused detail gives good clarity.

The Screen

Screen surfaces are designed to suit different shapes and dimensions of auditoria and seating layouts and a prerequisite of good presentation lies in the correct choice of the most suitable screen surface and its maintenance in good condition.

Consult the Data Sheets on Screens for detailed information and do not under-rate the major importance of the part that the screen plays in the presentation chain.

Your patrons sit for hours looking at the screen and, to turn a phrase, the screen should always be " Inconspicuous by its presence."

Any uneven deterioration or patches will show up on sky scenes and particularly on a pan shot, thus drawing the patrons' attention forcibly to the screen itself instead of to the picture image.

Apart from the six fundamental issues discussed, there are some other and obvious items that only need brief reference here, as they are dealt with in detail in other Data Sheets in this Manual.

Projector and Film Care

Modern motion-picture projectors give a picture image that is amazingly steady, considering the large linear magnification of the tiny film frame, and it is only when the projector (film-mechanism) needs repair or replacement of worn parts that picture unsteadiness becomes detectable to the normal cinema patron.

Transient movements caused by joins or poor print condition are generally not observed by the audience, unless repeated often, but any permanent weave or jump should be corrected at once.

Film care is another matter that needs constant attention. Scratches, " rope marks," sprocket marking and poor joins all tend to remind the patron of the mechanical nature of the entertainment and can utterly spoil outstanding photography and sound recording.

Change-overs are a potential source of programme discontinuity. They should be invisible and inaudible and, except for the occasional knowing dot-watcher in the audience, they should pass undetected.

There is just no excuse for a poor change-over, even when the release print is in poor condition, lacks standard change-over dots or is mutilated by the trade marks of incompetents.

Unless there is definite discontinuity or badly cut dialogue, the patrons will not notice a good change-over and good change-overs constitute one of the hall-marks of good Projectionists and good presentation.

Lighting

Light has always attracted mankind and the psychological effect of light is of great importance in " presentation " as a whole. Skilful use of this medium will do much to attract

the patron to the cinema and to maintain the cheerful and exciting atmosphere that is most desirable. There are times and places when its effect should be startling, and others when it should efface its own individuality in silent and inconspicuous service.

There are two Data Sheets in the Manual on all aspects of the Lighting Atmosphere.

Heating and Ventilation

This is another most important item in the comfort aspect of presentation and fully covered in other Data Sheets. Warmth, fresh air and no draughts contribute enormously to the presentation atmosphere.

Furnishings

Patrons spend a long time seated in the auditorium and, while it is hoped that during the major portion of that time they are blissfully unconscious of their surroundings, there are times when they can become acutely conscious of seating discomfort.

Adequate seat spacing is a factor in comfort and in enabling reasonable ease of movement between rows and, while maximum spacing may limit seating capacity, it is now more than ever an important factor.

Considerable investigation has been carried out into the characteristics of the human body when seated which has ensured the availability of a range of seats covering the maximum comfort related to cost.

Seating layout and seat staggering are also very important in allowing a full view of a picture while sitting in the most comfortable position.

Carpeting in the cinema is a further factor adding considerably to the feeling of comfort on the part of the patron. This aspect of presentation has been covered in a Data Sheet in another part of this Manual.

The decorative treatment of the auditorium, foyers, etc., also has a definite influence on the presentation atmosphere, and the fact that there is a distinct appeal to the feminine part of the audience should not be lost sight of. The scrupulous cleanliness of toilets is another vital factor to be taken into consideration.

One of the mixed blessings of the exhibition side of the Industry is wet weather, for, while it brings in extra patronage, it also brings in water and mud, both enemies of a clean and cheerful atmosphere. Everything that can be done to ensure an immediate feeling of warmth and comfort to patrons entering from cold and wet weather should certainly be given priority of attention. The entrance foyer or vestibule is the part of the cinema most affected and suitable mats and flooring can do much in the way of removing grit from the shoes of the incoming patrons and to disperse the water that is shed fom shoes and clothing.

While, for many reasons, opinion varies considerably on the type of flooring most suitable and desirable for the needs of the cinema vestibule and foyers, the certainty is that in these days there is a wide choice of suitable materials coupled with an infinite variety of designs and colours.

Structure

There should be little need to stress the important part that the actual structure of the cinema plays in catering for the comfort and enjoyment of customers.

Good design and carefully planned layout of the building, which is, in itself, a complicated structure of considerable value, go far towards the aim of providing good entertainment in the right surroundings.

Cleanliness and Maintenance

While not directly concerned with picture presentation, cleanliness and maintenance have a considerable indirect effect upon other items, and their neglect can rapidly undermine the ability to provide good presentation.

Obvious cleanliness goes a long way to promote comfort and to create a good impression on patrons visiting a particular cinema for the first time.

Cleanliness also helps to maintain the furnishings and decoration in good condition, thus enhancing the appearance of the auditorium and foyers.

It would not be reasonable to neglect reference to maintenance of structure, furnishings and equipment as having an indirect but very definite bearing on patron comfort and enjoyment of good picture presentation.

Prevention has always been better than cure and, while there is merit in the correction of a fault in the minimum time, it would have been so much better if the fault had never occurred and the presentation been unspoiled.

In many cases over three hours of motion-picture entertainment are provided for our customers and, if they are to be encouraged to turn always to motion-pictures for entertainment, then they must be comfortably seated and warm so that they leave the cinema with a sense of satisfaction, relaxation and complete enjoyment, not with a feeling of frustration through experiencing petty annoyances and minor irritations.

While your job as a Projectionist does not cover all the closely interwoven items that go to make up the whole—good presentation—yours is the major contribution and, if you do your bit properly with an enthusiasm born of a desire to further your own interests, the rest of the team will be encouraged to do their part equally well. There are many facets to good picture presentation—a hundred and one items that must all receive due consideration and not be dismissed as trivial. The line of least resistance is so tempting but, unless the full number of pieces in the jigsaw puzzle are placed correctly in position, the picture remains incompleted.

There is a vast gulf between the cinema where motion-picture presentation is clear and sparkling and the cinema where presentation is marred by a dull, off-focus picture. The cinemagoing public may not be aware of the causes lying behind presentation of the latter kind or, for that matter, the constant painstaking work that results in good presentation. They have to suffer or go elsewhere for their entertainment, a step that they are increasingly taking.

Good presentation leads to good business and good business is good for you.

Consult the individual Data Sheets giving detailed information on each of the various items discussed briefly above.

DATA SHEET No. 4 – Issued by the PICTURE PRESENTATION COMMITTEE
of the BRITISH KINEMATOGRAPH SOCIETY

Sponsored by the B.K.S. PICTURE PRESENTATION COMMITTEE

Factors Affecting Apparent Picture Size

You, Mr. Projectionist, have possibly thought at times that the picture on your screen looks rather small, as seen from your point of view at the back of the auditorium. The patrons in the front row, perhaps switching their gaze rapidly from side to side in order to follow some fast action, would be only too eager to disagree with you. The foregoing statement holds good in all theatres, both large and small. Where, then, is the correct viewpoint for your picture ?

It is our purpose in this article to discuss the apparent size of the screen in its relation to the audience in the theatre.

Let us start by stating the matter in a nutshell. Perfect vision and perfect perspective are obtained from a seat on the centre line of the theatre which is so placed that the screen subtends an angle to the eye equal to that subtended by the scene to the camera lens when the picture was photographed. In case that statement, right and proper though it is, seems a little indigestible, we shall try to explain it in more everyday language.

The sight lines of the sides of the live action, as seen by the camera lens, are contained within a certain angle. With the standard 50 mm. camera lens this angle is about 24°. To obtain correct vision in the theatre, the observer should be at such a distance from the screen that his sight lines to the sides of the picture enclose an angle of 24°, equal to that originally seen by the camera.

We have used the terms " perfect vision " and " correct vision ". At this stage it is as well to define just what we mean by these expressions. How can a six-foot man look right on the screen if he is obviously shown as twenty feet tall ? To find the answer to this we must go back to the live-action scene as it appeared before the camera, when our six-foot friend was, perhaps about 20 feet from the lens. You can probably visualise how big a man should seem to you at 20 ft. If you are the right distance from the screen, then the magnified image should fall into its proper perspective and appear to you to be just as the man himself would appear at 20 feet from you.

One thing should be clearly understood at this stage. The 24° angle is the angle between the sight lines *from the observer's eye to the sides of the screen.* It has no connection with the spread of the light rays from the projector lens.

If a piece of stiff wire is sharply bent to an angle of 24°, it can be used as a simple sighting device to find approximately where in your theatre is the right seat for correct vision in good perspective. The correct viewing distance works out at about 2½ picture widths from the centre of the screen, assuming that a normal non-anamorphic picture is being shown. For the increased width of a CinemaScope or similar picture, the distance is equal to 1½ screen widths. The next thing is to consider how this point of correct vision fits into your theatre. If your screen is too small, then the ideal seat will be too far forward and, conversely, if your picture is too large, the rear seats will be favoured. Here we have to consider how we can give the best value for money to the audience.

A balance must be struck between the needs of the front row patrons who have paid the lowest price anyway, and the back row patrons who are not necessarily interested in the picture, even though they have bought dearer seats. As an all-round average, correct vision should be found about two-thirds of the distance from the front row to the back. This may be thought to favour the back of the house rather at the expense of the front. True enough, but remember that the presence of a balcony will, in general, tend towards a greater audience mass at the back. In any case, one sells the dearer seats because something better is offered, and the more of these dearer seats there are occupied, the better it is for *your* prosperity.

After reading the foregoing, the camera-minded projectionist may well wonder how this reasoning can stand up when wide angle or telephoto lenses are used. Surely the whole argument collapses ?

Strictly speaking, yes ! In practice, however, the 50 mm. camera lens is the standard general purpose lens and it is much more used than any other focal length. For this reason it still remains as a good basis on which to establish the relationship between screen size and auditorium.

There are other factors which influence the apparent size and shape of the screen but, in a correctly designed and furnished theatre, they should be of little significance. Many cinemas have been converted from former music halls and are provided with a balcony and a gallery. In order to provide adequate sight lines to the stage from the highest seats, the proscenium arch is often higher than it is wide. A screen of aspect ratio 2.35 will often seem depressingly lacking in height when crowned by such a cavernous and pointless proscenium. Rebuilding the proscenium is usually out of the question so recourse should be made to the use of a draped pelmet to fill the empty space.

On the other hand, the sides of the picture may be cramped by the proscenium pillars or by stage boxes, useless though they may be in the cinema. Here again, much may be done to improve matters by using anti-proscenium drapes carrying the line of the screen into the auditorium.

Strictly speaking, these are aesthetic matters which assume importance only when the screen and proscenium are illuminated other than by the picture. If the auditorium is correctly lit during the showing of the film with the very minimum of stray light on the screen, the contrast of the picture will be enhanced and the obtrusive features should be little noticed. Further improvement will result from the use of dark hues in the decor of the proscenium area.

The audience comes to the theatre to see films you have to offer. Their interest in the auditorium is secondary, but it can be sustained by the intelligent use of colour lighting between films. Do not be misled by the look of the screen with the house lights up. Our purpose is to consider the right size of screen *for the showing of pictures.*

If you are interested to check optimum screen width for your own theatre, the procedure is as follows:—

(a) Select a point in the theatre centre line about two thirds back from the front row.

(b) Measure the distance from this point to the screen.

(c) Calculate your screen width as 40% of this distance. This will give you a width for all non anamorphic 35 mm. films.

(d) For the optimum CinemaScope width, multiply by 1.75.

(e) The height of the picture is, of course, calculated by dividing the width by the aspect ratio of the picture.

You have now arrived at the picture sizes in which the truest perspective and the maximum sense of audience participation will be achieved. In an industry too often preoccupied with superlatives, it is as well to remember that the biggest is not necessarily the best. Were it so, then the dearest seats would be in the front row, where the *apparent* size is greater.

DATA SHEET No. 5 – Issued by the PICTURE PRESENTATION COMMITTEE of the BRITISH KINEMATOGRAPH SOCIETY

Sponsored by the NATIONAL JOINT APPRENTICESHIP COUNCIL of the C.E.A. and N.A.T. and K.E.

Training of Cinema Projectionists

The wide range of technical subjects dealt with in this Manual illustrates the necessity for the provision of an adequate system of training for those who wish to find a career in the cinematograph industry.

For this purpose an Apprenticeship Scheme has been established.

It is administered by a National Joint Apprenticeship Council composed of equal numbers of representatives of the Cinematograph Exhibitors' Association and the National Association of Theatrical and Kine Employees with Assessors from the Ministry of Labour and the Ministry of Education.

Whilst the National Council lays down a general standard of training, it is the Zonal Committees, through the Local Committees that administer the scheme throughout its operation and thus satisfy themselves that apprentices are being trained in accordance with the terms of the Scheme. In this regard the educational authorities throughout the country ensure that training at their technical colleges is in conformity with the syllabus prepared by the National Council.

The Zonal Committees and the Local Committees maintain a very close contact with the educational authorities in their respective areas and also with the Youth Employment Officers.

Apprentices normally join the Scheme between the ages of fifteen and eighteen years, but in special cases older entrants may be accepted.

In all cases a probationary period of six months is served and during this time either party may terminate the probation on giving not less than fourteen days' notice. On satisfactorily passing through the probationary period, this period is included in the term of apprenticeship which is four years.

On completion of the probationary period a standard form of indenture is completed by the apprentice and the employer and the apprenticeship is registered by the Local Joint Apprenticeship Committee.

During the apprenticeship, the apprentices undergo a course of practical training to standards determined by the National Joint Apprenticeship Council. The apprentice is taught how to handle and maintain the various types of equipment in projection rooms and the care and maintenance of the many different kinds of auxiliary equipment that is installed in cinemas. He is also taught the general maintenance of the electrical installations, stage lighting equipment, and how to project motion pictures on to the screen so as to provide the maximum of efficiency in the presentation of the exhibition.

The apprentice is also required to take a course in further education, and wherever facilities are available time is given by the employer during working hours for the apprentice to attend these classes without loss of wages.

The course of further education is initially a refresher course on elementary mathematics and science, but quickly deals with the technical and scientific aspects of cinematography, i.e., electricity and magnetism, heat, light and sound, etc., as concerns the cinema.

Where it is desired, an apprentice can be transferred from one cinema to another or from one employer to another with the consent of the Local Joint Committee in order to widen the apprentice's training and experience.

On the satisfactory completion of the apprenticeship, the indentures are endorsed by the employer and by the Chairman of the Local Joint Committee, whereupon the apprentice can regard himself as a fully qualified projectionist able to command employment in any projection room in the country.

Geographically, small units are involved on a fairly even spread throughout the country, with greater density in the larger towns and cities. Wherever possible, technical classes have been organised and located at central points. In country areas where long distances have precluded the setting up of classes, instruction by Correspondence Course has been substituted.

SYLLABUS FOR PRACTICAL TRAINING

Films

The apprentice is taught how to: receive films; differentiate between old and new stock, and types of film; spool up, check splices; make splices, examine for faults; rewind; report film damage; decide what damage can, and what damage cannot, be repaired; make up a programme and subsequently take down a programme; spool off, pack and despatch; understand the information contained in the protective leaders; clean films. He is taught the care and maintenance of rewinders and rewinding room equipment; the importance of cleanliness on the rewinding bench, in the spool bins and in the rewinding room generally; the care, maintenance and checking of spools; the Statutory Regulations and any special conditions of licence relevant to rewinding rooms.

Projection Room

Arcs: The apprentice is taught how to: clean, maintain and, where necessary, lubricate arc equipment; operate and

clean dowsers; remove, clean and replace and adjust mirrors; care for and trim carbons and to strike and control the arc; manipulate all controls and finally to switch off. He is taught how to clean arc flues; inspect and maintain in good condition connections of cables and the general maintenance of the lamp house.

Projectors: The apprentice is taught how to: clean and apply local lubrication as may be required; open film gate, clean and inspect; remove and replace aperture plates; clean, maintain and, where necessary, lubricate intermittent sprocket movement, rollers and fire trap bearings; open up sound head, clean and inspect; fit spools; lace up; rack; start and stop the projector.

The apprentice will be capable of inspecting, removing and re-fitting sprockets, intermittent movement and gate, including the adjustment of the gate tension. He will have knowledge of the causes and means of prevention of film damage. He will be conversant with and able to give general maintenance to driving motors; to take-up drives; to inspect and maintain in good condition shafts, chains, gears and similar methods of drives for mechanisms. He will be able to inspect and maintain shutters, including phasing, and to maintain air, water and oil cooling arrangements for gates.

He is taught the care and maintenance of lenses, methods of mounting and positioning and of controlling the focus. How to align the arc lamps, the carbon arc, the mechanism and lens system and, subsequently, how to carry out checks on the alignment.

Sound Equipment

The apprentice is taught how to: switch on; understand the significance of indicator instruments; remove and replace exciter lamps, including their alignment and focusing. He is taught the care and cleaning of photo-electric cells and magnetic heads and he will be able to locate the position of faulty valves and to replace them; be fully conversant with all controls, change-over devices, etc.

Arc Supplies

The apprentice will have knowledge of the care and maintenance of generators, metal rectifiers and arc rectifiers. He is taught: how to switch on; the care and maintenance of cooling fans; the cleaning and maintenance of switches; the checking and tightening of connections; cleaning and checking lubrication, where necessary; the care and maintenance of commutators; the checking, removal, replacement and bedding of brush gear and the general maintenance and cleaning of generator switchgear.

Auxiliary Equipment

The apprentice is taught the care and maintenance and methods of operation, where necessary, of fire shutters, non-sync. equipment, slide lantern, spots, floods and effects machines and associated resistances. He is taught the care and maintenance of, and how to use, the fire-fighting equipment installed in the projection room.

General

The apprentice is taught the methods of control and protection of the safety devices incorporated in, and the general maintenance of, electrical installations; to understand the principles of and the maintenance of safety lighting and general lighting systems. He is instructed in the types of stage lighting, methods of control, the care and maintenance of dips, battens, floodlights and spots. He is taught the maintenance and care of curtain and masking controllers with their associated gear; the care and maintenance of all electrical equipment associated with the heating and ventilation plants, and will know how to clean the spray-jets and filters of plenum plants or similar.

He is taught the method of control of neon and fluorescent lighting systems and the safety precautions that have to be taken in connection therewith.

He will be conversant with the Statutory Regulations regarding projection rooms, projection equipment, lighting systems and electrical installations, etc., and also with any special conditions of licence imposed upon the cinema in which he works.

Presentation

Finally, the apprentice is taught the general principles of good picture presentation, i.e., how to present a programme in the most satisfactory and attractive manner, both technically and artistically.

SYLLABUS FOR THE FURTHER EDUCATION OF APPRENTICES

Calculations

1*st year:* This period will be devoted to a revision of arithmetic, simple mensuration and algebra.

2*nd year:* Will be devoted to an extension of the first year's work and an introduction to the more simple forms of algebra associated with projection and electrical engineering.

English

1*st year:* Will be devoted to revision of school work and will train apprentices freely to express themselves in writing letters and reports.

DATA SHEET No. 6 – Issued by the PICTURE PRESENTATION COMMITTEE of the BRITISH KINEMATOGRAPH SOCIETY

Sponsored by the NATIONAL JOINT APPRENTICESHIP COUNCIL of the C.E.A. and N.A.T. and K.E.

Training of Cinema Projectionists—*continued*

Physics

1*st year:* This will also largely be a revision of school work in heat, light and mechanics.

The course in mechanics will deal with the transmission of motion and power as found in projectors and other equipment in cinemas.

Heat will be treated as it affects heating and ventilation plants in cinemas.

Light will receive an elementary treatment of various light sources, such as metal filament, discharge tube and arc lamps.

2*nd year:* Will be devoted to a revision and extension of the first year's work.

In the course on heat consideration will be given to measurement of heat outputs, deficiencies and further problems in ventilation and air-conditioning. In the course on light further consideration will be given to mirrors, condensers, projection and anamorphic lens used in projection equipment and in simple calculations associated with illumination and reflection of screens. An introduction will be given to elementary principles of sound and reproduction equipment.

Electrical Engineering

2*nd year:* An introduction to the elementary principles of electricity and magnetism, including methods of measuring electrical pressure and current.

3*rd year:* Elementary treatment of generators and motors and testing installations and an introduction to the I.E.E. and Home Office Regulations for the electrical installations in cinemas.

4*th year:* A revision and extension of the third year's work, including a treatment of valves, amplifiers and magnetic reproducing equipment used in cinemas.

Projection

1*st year:* Film leaders and threading of film in gate.
Introduction to projector mechanisms; intermittent motion and sprockets, etc.
Introduction to Statutory Regulations regarding projectors and projection rooms.

2*nd year:* Types of film; film dimensions; film wear and damage.
Further treatment of projector mechanisms; alignment and wear; film damage consequent upon misalignment and wear.

Further treatment of Statutory Regulations regarding projectors and projection rooms.

3*rd year:* General description of processing of film; film shrinkage; behaviour of film under various conditions of temperature and humidity.

Detailed consideration of projector mechanisms, including optical and magnetic sound heads.

Consideration of Statutory Regulations regarding sound equipment, repairs and colour equipment.

4*th year:* Consideration of screens—types, reflectances, maintenance, including masking control, etc.
Motion picture presentation—elements of artistic presentation of exhibitions, use of colour.

Whilst the National Joint Apprenticeship Council is firmly of the opinion that the best means of giving instruction is at technical classes, and this opinion is supported by the Ministry of Education, to meet the difficulties of apprentices in outlying cinemas a Correspondence Course has been devised. The lessons have been prepared by Dr. Leslie Knopp, M.B.E., Ph.D., M.Sc., F.R.P.S., F.R.S.A., F.I.E.S., Technical Adviser to the Cinematograph Exhibitors' Association, and will last for the full period of the Apprenticeship. The Assessor from the Ministry of Education agrees the syllabus as complying with the standards required and has accepted the form of instruction as a reasonable alternative to attendance at technical classes.

Agreement has been reached in principle by the National Council that examinations be held and that such examinations be optional and available to all apprentices. The Royal Society of Arts has offered to arrange these examinations by providing the necessary question papers, arranging for the marking of the worked scrips and the issue of certificates. There will be two examinations—an intermediate towards the end of the second year of the Course, and a final on completion.

The members of the Examination Committee are representatives of central and Local Education Authorities, Teachers' Associations, professional bodies and business organisations—and it is on their composite advice that the examinations are founded.

For further information application may be made to the Joint Secretaries, National Joint Apprenticeship Council, Cinematograph Exhibitors' Association of Gt. Britain & Ireland, 164, Shaftesbury Avenue, London, W.C.2, or to the Joint Zonal Secretaries responsible for the area indicated in the following schedule:—

ZONAL SECRETARIES

ZONE 2. NORTH-EAST ZONE

Northern Branch Yorkshire Branch Hull Branch Sheffield Branch	W. MORDUE, Midland Chambers, 17, Westgate Road, Newcastle-upon-Tyne, 1.	S. JACKSON, N.A.T.K.E., 2, Ellison Place, Newcastle-on-Tyne, 1.

ZONE 3. NORTH-WEST ZONE

North Western Branch West Lancs Branch Manchester & District Branch	S. DALLOW, Lloyds Bank Buildings, 11-13, Victoria Street, Liverpool, 2.	P. McGRATH, N.A.T.K.E., Room 12, 6, Norton Street, Liverpool, 3.

ZONE 4. MIDLAND ZONE

Birmingham Branch Leicester Branch Notts & Derby Branch North Staffs Branch	R. G. WATCHORN, Central House, 75, New Street, Birmingham, 2.	A. V. WOOD, N.A.T.K.E., Room 12, 38, John Bright Street, Birmingham, 1.

ZONE 5. EAST ANGLIA ZONE

Eastern Counties Branch North Lincs Branch Southern Midlands Branch	ARNOLD F. KENT, 71, The Close, Norwich.	F. H. WOODS, N.A.T.K.E., 20, Bedford Street, Strand, London, W.C.2

ZONE 6. LONDON & HOME COUNTIES ZONE

London & Home Counties Branch	ARTHUR TAYLOR, 164, Shaftesbury Avenue, London, W.C.2.	F. H. WOODS, N.A.T.K.E., 20, Bedford Street, London, W.C.2.

ZONE 7. SOUTHERN ZONE

Sussex Branch Hants & East Dorset Branch Portsmouth & Isle of Wight Branch	ARTHUR TAYLOR, 164, Shaftesbury Avenue, London, W.C.2.	J. STUBBERFIELD, N.A.T.K.E., 198, Terminus Road, Eastbourne.

ZONE 8. SOUTH WALES ZONE

South Wales Branch	W. J. FOOKS, 3, Park Place, Cardiff.	G. DAVIES, N.A.T.K.E., 50, Charles Street, Cardiff.

ZONE 9. SOUTH-WEST ZONE

Bristol Branch Devon & Cornwall Branch	S. W. SAVERY, 16, John Street, Bristol, 1.	R. PRESLAND, 60, St. Aidans Road, St. George, Bristol, 5.

SCOTLAND. In Scotland an independent scheme is operated and enquiries may be sent to:—

J. M. TURNER, Gordon Chambers, 90, Mitchell Street, Glasgow, C.1.	W. M. BROWN, N.A.T.K.E., 103, Bath Street, Glasgow, C.2.

DATA SHEET No. 7 – Issued by the PICTURE PRESENTATION COMMITTEE of the BRITISH KINEMATOGRAPH SOCIETY

Sponsored by the BRITISH STANDARDS INSTITUTION

How British Standards Help You

The cinematograph industry could not exist if the high cost of film production could not be met by providing many copies for showing in cinema theatres, not only in the country producing the film, but throughout the world.

Such widespread exhibition can only be achieved if there is precise uniformity in the dimensions of the negative film and the release prints, and in all of the equipment used to process them and project them.

In the studios, replacement lamps must have the same light output and colour characteristics as those they replace; spotlights must be interchangeable in the many sockets, and there must be interchangeability of the plugs in the socket outlets through which they are connected to the main supply.

The processing laboratories could not operate the very complex procedures involved in bringing together into one master negative the many separate picture negatives and sound records which go to make the whole, and so produce the necessary release prints, without films which are uniform to a high degree of accuracy, and without a general agreement on the characteristics to be used for the original sound recordings and for reproduction. Also there must be an agreement on the density and contrast of release prints, and a standard to which the first prints may be assessed in the review rooms, so that release prints from different laboratories will appear uniformly bright when projected in the cinema.

The projectionist would be utterly baffled unless all films were precisely of the same width, had the same size perforations, and had those perforations and the picture image precisely positioned in relation to each other and to the edge of the film; he could hardly be happy if the sound track varied in width and in placement, and he would not find life very easy if leaders were all different, if his spools had different sized centre holes, if his carbons varied so much in size that they would not fit in the jaws, or if his replacement exciter lamp would not go into its holder, or had its filament at a different height to the scanning slit.

All concerned with the industry could not work without anxiety unless they knew that the safety of " safety " film was strictly controlled, nor would the audience be easy in their minds if uniform EXIT signs and a minimum level of auditorium lighting were not provided.

That everything runs so smoothly is due to the continuous work of the national standardizing bodies in the various film producing countries; in the United Kingdom this body is the British Standards Institution. These organizations enable the raw stock manufacturers, film producers, film laboratories, and the manufacturers of all equipment for studios, laboratories, and cinema theatres, to meet and agree amongst themselves as to the dimensions and qualities to which they will work. The outcome of their work is published in the form of " British Standards " which are available to all who are interested. A list of some of those which have been published is given below. Many more are in course of preparation, and revisions of the existing standards are made from time to time so that they may always be up to date in an industry which is continually progressing.

Because films pass from country to country, and are shown all over the world, there must not only be agreement in any one country, but all countries must agree on these essential standards. The United Kingdom, through the British Standards Institution, takes an active part in the work of the Technical Committee on Cinematography of the International Organization for Standardization (ISO) which exists to bring about this world agreement.

BRITISH STANDARDS RELATING TO 35 mm. CINEMA EXHIBITION

MOTION PICTURE FILM

B.S.		
677: Part 1:	1958	35 mm. motion picture film (relates to dimensions of raw stock).
850:	1955	Definition of cinematograph " safety " film.
1492:	1948	35 mm. cinematograph release prints.

EQUIPMENT FOR PROJECTION

586:	1953	Photo-electric cells of the emission type for sound film apparatus.
1015:	1942	Exciter lamps for 35 mm. projectors.
1522:	1960	Schedule of projector lamps.
1587:	1949	Film spool for 2,000 ft. 35 mm. release prints.
1590:	1949	Lenses for 35 mm. cinematograph projectors.
1793:	1952	Audio-frequency transformers for cinematograph equipment.

1964:	1953	Tolerances on diameters for carbons for projection arcs and stage arcs. (Confirmed, 1959).
1967:	1953	Dimensions of sprockets for 35 mm. cinematograph projectors.

TESTING

1985:	1953	Test films for 35 mm. cinematograph projectors.
1988:	1953	Measurement of frequency variation in sound recording and reproduction.
2829:	1957	35 mm. magnetic sound recording azimuth alignment test films.
3154:	1959	Frequency characteristics for magnetic sound recording on film.

CINEMAS

1404:	1953	Screen luminance (brightness) for the projection of 35 mm. film.
1778:	1951	15 amp. three-pin plugs, socket-outlets and connectors for theatre and cinema stage use for circuits up to 250 volts. (Confirmed, 1955.)
2560:	1954	Exit signs for cinemas, theatres and places of public entertainment.
2784:	1956	Aspect ratios for 35 mm. motion picture films.
CP1007:	1955	Maintained lighting for cinemas.

INTERFERENCE SUPPRESSION AND SAFETY REQUIREMENTS

415:	1957	Safety requirements for radio or other electronic apparatus.
613:	1955	Components and filter units for radio interference suppression.
CP1006:	1955	General aspects of radio interference suppression.

GLOSSARIES

205: Part 6:	1943	Section 8 of the glossary of terms used in electrical engineering—lighting and heating.
233:	1953	Glossary of terms used in illumination and photometry.
661:	1955	Glossary of acoustical terms.

MISCELLANEOUS

1479:	1948	Memorandum on the use of sound level meters.
1568:	1960	Magnetic tape sound recording and reproduction.
1927:	1953	Dimensions of circular cone diaphragm loudspeakers.
1928:	1960	Gramophone records and reproducing equipment.
BS1917:	1952	Film strip and lantern slides.

IN COURSE OF PREPARATION

Cans and transit cases for 35 mm. film.
Colour filters for stage lighting.
Density and contrast range and colour grading of release prints.
Rewinders.
Revision of B.S.1404, Screen Luminance.

BRITISH STANDARDS INSTITUTION
2, Park Street, London, W.1.

DATA SHEET No. 8 – Issued by the PICTURE PRESENTATION COMMITTEE of the BRITISH KINEMATOGRAPH SOCIETY

Sponsored by AEI SOUND EQUIPMENT Ltd., R.C.A. (Gt. Britain) Ltd., WESTREX Co., Ltd., and the G.B-KALEE DIVISION OF RANK PRECISION INDUSTRIES Ltd.

The Economics of Equipment Replacement

In considering this subject one must of necessity be guided by facts and figures.

It is false economy to buy inferior goods or performance merely because they are cheaper.

With these thoughts in mind let us consider the effect on running costs and more especially the receipts at the box-office, of trying to sell to the cinemagoer a third rate show. This naturally starts outside, because if the cinema itself looks inviting the customer is half way to the box-office. However, people do not continue to be influenced by the wrappings of the box, they are more interested in what is inside—in other words, the END PRODUCT.

They want to see a good picture, properly projected, a good light, good sound, and last but not least to have a comfortable seat in a comfortable temperature.

That is what they have paid good money to obtain and they have every right to expect it: if they are not satisfied that they have received value for money, then you don't see them so often or perhaps never again. Many people, not only exhibitors, are too prone to tell themselves that they cannot afford this or that, but in these days when it is not too difficult to avail oneself of extended payments or bank facilities one *cannot* afford not to give and have the best.

The old days when inferior standards were accepted by certain audiences have gone for ever. In order to achieve the standard of presentation demanded by patrons today, suitable modern equipment is needed and the wise exhibitor will continually bear in mind the need for a far-sighted programme of equipment replacement in order to achieve this objective over a long period.

To a certain extent this consideration will be reflected in the initial choice of equipment. Flexibility is essential so that part modernisations can be accomplished and provision can be made for adapting the equipment to new methods that may be devised.

One of the first considerations in respect of an initial investment and in a replacement programme is the question of tax reliefs. This subject is by no means clear cut and the expert advice of an accountant is strongly recommended. Broadly speaking, the tax reliefs fall into two classes:—

(a) reliefs on capital expenditure, including investment allowance, initial allowance and annual reliefs.

(b) charges that can be made against revenue.

There must be a considerable number of cinemas today that are still using sound equipment installed in 1929/30, projectors that are just about holding together, screens that are so old that, with the constant resurfacing they have received, could probably support themselves.

Such a state of affairs is absolute false economy. People in their homes today get enjoyment from high quality modern amplifiers in either their radiograms or TV sets and they expect the same high standard or better at the cinema.

These are competitive times and unless we keep abreast of them we shall discourage not encourage the man in the street to become a regular picturegoer.

Now how do we put our house in order? Let us start with the sound system. The fact is that the reproduction you are now getting from an equipment which could be over 30 years old, even though it has been properly maintained, cannot be compared with modern standards since it is not capable of reproducing faithfully all that is recorded on the film and your customers naturally are using their modern sound equipment at home as a comparison.

By modernising an old equipment or better still by replacing it you will immediately experience a saving in the cost of repairs and replacements, whether you purchase outright or lease it, simply because the maintenance of the modern equipment is less costly.

The projector is the next vital link in the chain and unless it provides a steady picture on the screen it should either be factory reconditioned or at least thoroughly overhauled.

Depending upon its age and condition it may well be more economical to replace it with an up-to-date machine.

Perhaps both the sound system and the projectors are in really good shape and properly maintained, yet the show is not all that it should be, probably because the light is poor due to inefficient arcs or a screen which has long since passed its prime.

A screen which has been constantly resurfaced will be the cause of bad sound reproduction because the perforations will have become blocked. Higher carbon and electricity charges will be involved if the screen is not periodically resurfaced and replaced when the perforations begin to close up.

These are all obvious faults which could either individually or worse still collectively, ruin the presentation of a film and, if allowed to continue, can ultimately lead to a serious fall off in box-office receipts.

From the foregoing it appears that there is an obvious advantage in making equipment replacements in any highly profitable year, but as no one can see into the future and forecast the profitable years a wiser policy is to adopt a steady programme of replacement. The economic life of each different type of equipment in use in the cinema should be estimated from past experience, and sufficient funds should be reserved each year to ensure that there is enough available at the end of the useful life, whatever that may be, to enable a replacement to be made. In this fashion expenditure can be budgeted in advance and the whole operation conducted on a businesslike and conservative footing, rather than on the basis of sudden inspiration.

We therefore see that running a cinema successfully is not just something that happens; it is the result of good management.

The successful manager sees to it that his cinema is properly equipped, he is the man who likes his patrons to see the cleanliness and attractiveness of his theatre, rather than keep them in semi-darkness because he has something to hide.

Presentation today is the greater part of the battle, and the only way to combat the attractions of competitive entertainment is persistently to keep your picture presentation equipment in good working order, both sound and vision.

A good picture, good sound, good light and a comfortable seat in a comfortable temperature are all complementary to each other but if any one of these falls short of the patron's expectations then he is a dissatisfied customer. Rarely does he tell you this, he just does not come to your cinema in future, but goes elsewhere or finds some other form of entertainment.

The economics of equipment replacement are therefore simple of solution, whether it be cinema, theatre or dance hall. Give the customer what he wants, give him value for money and he will come again. In his opinion, his money is as good as the product he wishes to buy, which in this case is entertainment, but he will not continue his support unless he is put into the frame of mind whereby he automatically says to himself (and wife or girl friend), " Lets go to the X cinema —they always put on a good show ".

DATA SHEET No. 9 – Issued by the PICTURE PRESENTATION COMMITTEE of the BRITISH KINEMATOGRAPH SOCIETY

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The Advantages of Service/Maintenance

What is SERVICE/MAINTENANCE?

To the Cinema Industry that ubiquitous word "SERVICE" means "work to satisfy a need," and it may be thought that "MAINTENANCE" is just another word for service. In this business, however, the true meaning of Maintenance is "to keep in good condition."

It must be acknowledged that these two words have to some extent merged their individual meanings when used in relation to projection and sound equipment, and one may often be said when the other is meant. They are indeed so intimately coupled as to be almost synonymous.

The presentation of motion pictures in the modern cinema is, itself, a form of service of undeniable public importance and considerable extent. It is therefore clearly desirable in the interests of the Public as the consumer, the Exhibitor as retailer and the Film Producer as manufacturer, to establish and maintain certain standards in film presentation, this being the commodity or product.

In the practical interpretation of this philosophy as applicable to sound and projection equipment the main objectives of SERVICE/MAINTENANCE are:

1. To preserve the highest possible standards of sound reproduction and picture quality.
2. To ensure optimum equipment reliability and continuity of performance.
3. To provide prompt attention, expert diagnosis and effective remedial action in the event of equipment breakdown.
4. To encourage and facilitate the introduction of modifications and adjustments to sound and projection equipment which will reflect, within practicable limits, improvements and changes in picture and sound recording techniques.

Since the advent of talking pictures in 1928 the continuity of organisation and effort provided by the manufacturers and suppliers of sound and projection equipment towards the successful achievement of these fundamental objectives has been, and still is, one of the highlights of the Industry.

Coupled with high standards of equipment operation and showmanship by cinema projection personnel the Public is thereby assured of good picture and sound quality and uninterrupted performances, the Exhibitors' box-office worries due to equipment failure are reduced to the minimum and the Film Producer can be certain that the equipment will be in such condition that his product can be shown to the best possible advantage.

SERVICE/MAINTENANCE is thus a form of insurance, at a very modest premium, designed primarily to protect the interests of the Public and the Cinema Exhibitor as customer and supplier, and to guard against the financial and prestige losses which must occur if the standard of the product is allowed to fall.

The advantages of such insurance and the four basic objectives of SERVICE/MAINTENANCE having been broadly outlined, the practical aspects of the subject may now be considered in more detail.

1. *Sound and Picture Quality.* Those concerned with the design, development, manufacture and installation of modern projection and sound reproduction equipment invariably accept and conscientiously observe the various criteria formulated mainly by themselves and universally established through the medium of such bodies as the S.M.P.T.E. and the B.S.I. In this way agreed performance standards may be achieved within the limits imposed by such factors as auditorium acoustics, film processing, etc.

   Subsequently, regular periodical routine servicing by trained and experienced engineers, coupled with conscientious day to day equipment cleaning and inspection by projection staff will maintain top quality of picture and sound.

   Progressive and insidious deterioration which will otherwise, by almost imperceptible degrees, inevitably and seriously impair performance standards, will be arrested before it can start.

   Modern methods of testing and checking electronic and electro-mechanical apparatus will ensure that such vital performance criteria as frequency response, audio power output, noise level, screen illumination, sound distribution, etc. etc. are held at the desired levels and that imperfections are promptly observed and efficiently eliminated.

2. *Reliability.* Equally important is the need for regular servicing in conformity with a carefully conceived and consistently applied pattern of inspection and testing as a means of securing maximum reliability. This may be described as preventive or precautionary service—the correction of a fault before it exists—to anticipate, by processes of checking and deduction, what might happen tomorrow and eliminate the possibility before it can become a reality.

   The Service Engineers' routine will identify the valve which next week could have caused a loss of sound, the electrolytic capacitor which is about to fail, or the sprocket which might cause costly film damage. These things rarely occur but they do happen occasionally and prevention is better than cure.

3. *Emergency Service.* Although cinema equipment service is designed mainly to anticipate and prevent trouble occurring it must be acknowledged that the equipment does not exist which cannot and will not go wrong—sometimes. Therefore, it is a no less vital responsibility of any organisation offering such a service to make adequate provision for rapid and efficient attention in the event of an emergency.

   Apart from the simple practical aspect of this important function, that unique tradition peculiar to the entertainment world, namely " the show must go on," is particularly significant in the cinema industry, and every Company having equipment maintenance obligations is very conscious of, and therefore geared to satisfy, this need. For this as well as its less dramatic but no less vital day to day routines, the service organisation takes care to see that it is adequately and strategically staffed, that full transport and communication facilities are maintained, that its activities in this field are well supported by regionally dispersed stocks of spare parts, loan units and assemblies, by efficient workshop repair facilities and by a sound administration.

4. *Technical Progress.* Great advances have been made in the field of Cinematograph engineering and development during the thirty-three years since the screen found its voice, and the Industry is notable for a fine record of co-operation and liaison between the many and various organisations and individuals who are, directly or indirectly, concerned with the business of making and selling motion picture entertainment.

   Throughout these three decades of technical progess the servicing organisations have figured prominently and vigorously in the continuing search for perfection and in the practical implementation of design changes and improvements in sound and projection equipment. This pattern still prevails and service will continue to provide the essential link with changing techniques for the Exhibitor who wants to keep his equipment up to date.

It will be generally agreed that the entertainment value of the Motion Picture depends mainly on three things—the Story, the Treatment and the Stars. In which order this is not the place to judge. To the wise and the discriminating, however, there are many other factors, large and small, which can contribute to or detract from personal enjoyment and customer satisfaction. They know that the advantages of equipment SERVICE and MAINTENANCE may be summarised in six words—

BETTER PICTURES—BETTER SOUND—BETTER BOX-OFFICE

DATA SHEET No. 10 – Issued by the PICTURE PRESENTATION COMMITTEE of the BRITISH KINEMATOGRAPH SOCIETY

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Equipment Needs in Current Presentation Systems

Essentially of course this must comprise equipment for reproducing a picture—namely a projector and lamp; a means for reproducing sound—sound equipment and a power conversion unit for the lamp.

These, however, are only the basic elements and modern projection conditions involve many refinements to complete the high standard of picture presentation and sound reproduction current today. Projection-lenses and anamorphs with adequate means of pre-setting and focussing and easy removal are obvious examples.

Certain safety precautions are laid down by various Local Authorities, not only with regard to fire hazards but maintenance of emergency lighting systems, etc. Under these headings one immediately thinks of Fire Shutters with automatic release in the event of fire and battery operated emergency lighting systems.

The ancillaries to rewind and store the film—such as rewinders, spools, film cabinet, etc., are obvious.

A brief comment under the various headings outlined will perhaps be the best way of emphasising the main points for consideration in deciding " Equipment Needs in Current Presentation Systems."

Projector Mechanisms:

The 35 mm. film has, for many years, dominated the scene, but current thoughts indicate that 70 mm. film cannot be ignored and whilst projectors for dual 70/35 mm. are naturally more expensive than the model capable of handling only 35 mm. the advantage of a dual-purpose machine should be kept well in mind when consideration is being given to re-equipping an operating box.

With 35 mm. projectors the Penthouse soundheads for single or four-track magnetic reproduction, together with the optical soundheads, are usually units separate from the actual projector, although there is one current model of 35 mm. projector manufactured in this country which embodies the Optical soundhead as an integral part of the projector.

With 70 mm. however, the more usual Continental practice is established of combining the 6/4 track magnetic head and the optical sound head as an " in-built " part of the projector mechanism.

Sound Reproducer

The majority of cinemas in this country are equipped for Optical reproduction only, although many installed four-track magnetic in the early days of CinemaScope.

Later developments introduced the single track magnetic head and the subsequent use of the Mag-Optical prints and here again, depending upon the size and type of cinema, an early decision is usually made as to the extent of the reproducer equipment required.

Arc Lamp

A very wide choice is available here from the arc using a small High Intensity combination of carbons at 40/45 amperes to the requirements necessary for 70 mm. presentation where currents up to 135/140 amperes are employed.

Arc lamps can be divided mainly into two types, i.e., with a non-rotating positive carbon—the carbon feeding forward in the normal manner; or where higher current densities are available—with a rotating positive carbon.

Recent developments have introduced lanterns using Xenon and other gasses enclosed in a glass envelope and suitably excited, as an alternative to the carbon arc in the lower current ranges.

Rectifier

The choice of a rectifier is, of course, essentially tied up with the current to be used by the arc lamp, and a wide choice is available. Modern rectifiers are either mercury-bulb or metal-plate types and both give trouble-free service over many years of operation.

Anamorphic and Projection Lenses

The importance of first-class projection lenses cannot be over-emphasised. The greatest possible precautions are taken to ensure rock-steady projection, adequate illumination and first-class sound reproduction; yet on many occasions all this is spoilt by lack of picture definition.

Under modern projection conditions it is impossible to make do with old projection lenses and modern lenses with a speed of *f*1.8 or *f*1.9, together with a rigid lens mount with a fine focussing device, are essential.

Three types of anamorphic lenses are available: Cylindrical, Prismatic and Mirror.

Cylindrical have fixed expansion ratio but Prismatic can allow for a variable expansion ratio to suit any expansion ratio other than the 2:1 which is normal.

While Cylindrical anamorphs are often screwed directly to the backing lens, Prismatic anamorphs are invariably supported by a special bracket enabling the anamorph to be swung aside when not in use. Cylindrical anamorphs can be supported in this way also.

The Mirror anamorphic makes use of mirror lenses with a fixed expansion ratio of 2:1.

Lens pre-focussing rings, while a relatively minor item are very important in that they must ensure that every time the lens is replaced in the mount perfect positioning is achieved. This is necessary to make sure that the picture remains correctly focussed.

Spools, Film Storage Cabinets, Rewinders, etc.

Spools, film storage cabinets, rewinders, etc., are often relegated to a secondary role when considering projection equipment but a film can be irreparably damaged and presentation completely spoilt by the use of damaged or buckled spools, aggravated by obsolete rewinding and storage facilities.

The modern conception of these requirements is a combined unit comprising bench, rewinder, joiner, film storage and spool storage, etc.

Fire Shutters and Emergency Lighting

Fire Shutters are roughly divided into three main types, i.e., Standard, Counterweighted and Soundproof and normally a set comprises two projection and two observation ports.

The shutters are all cross-connected for emergency operation by a quick release device with an additional emergency release located outside the operating box.

The Counterweighted type of shutter allows for easier and more silent operation. Soundproof windows are essential where the rear row of seating is in very close proximity to the operating box to prevent any mechanical or other noise reaching the audience.

Emergency lighting equipment basically comprises a trickle charger with a series of accumulators to provide the emergency lighting facilities in the event of failure of the electricity mains. There is a wide variety of makes and types from which to choose including a self-contained Exit Box with its own accumulator and charger, the accumulator being continuously trickle charged from the mains supplying the normal lighting.

Slide and Spot Lanterns, Effects Lanterns

Mention must also be made of providing facilities for the projection of slides and for the provision of spotlights for stage use and for spotlighting the sales girls.

Basically any spot or slide lantern comprises a light source with a suitable optical system—the light source may be an arc lamp, a Xenon lamp or a Tungsten lamp. From the effects lantern a wide variety of effects is obtained by the addition of colour wheels, shutters, inserts, design slides, etc. A slide and an effects lantern can also be combined into one unit if required.

The ultimate choice depends again on the size and type of cinema and the scope needed but every consideration should be given to the installation of at least one effects lantern to provide for the final polish and touch of finesse which every projectionist-showman needs to round off better presentation.

This review has been confined to equipment found in the projection room and has not dealt with such other important items as the screen, etc. Consult other Data Sheets in this Manual for fuller details of individual items of equipment and consult the sponsors of this Data Sheet for your equipment needs for better presentation of current systems.

DATA SHEET No. 11 – Issued by the PICTURE PRESENTATION COMMITTEE of the BRITISH KINEMATOGRAPH SOCIETY

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The Motion-Picture Projector

The modern motion-picture projector is a very important, as well as a very expensive, piece of precision engineering deserving of the maximum care and intelligent operation.

It comprises a series of units brought together in a way that allows their efficient operation in inter-dependence, in spite of their individually complex and quite different natures.

The mechanical side of the projector is only one aspect for, apart from machinery, there is electrical equipment, electronic equipment, optical systems, thermo-electric devices, photo-electric devices and an high-powered carbon arc or a discharge lamp involved.

For the purposes of this general description, the motion-picture projector can conveniently be dealt with under the following sub-headings. These individual items are each dealt with in full detail elsewhere through Data Sheets in this Manual.

(*a*) The top spoolbox.

(*b*) The magnetic soundhead.

(*c*) The film-mechanism.

(*d*) The optical soundhead.

(*e*) The bottom spoolbox.

(*f*) The stand.

(*g*) The light source.

(*a*) *The Top Spoolbox.* This part of the motion-picture projector consists of a metal box into which the loaded spool of film is first inserted. The box has a central shaft to support the spool on which it rotates as the film is fed from the spool into the film-mechanism and soundheads. The spoolbox spindle is equipped with an adjustable friction device which holds the spool steady and prevents over-run due to momentum when the projector stops.

Where the film enters or leaves a spoolbox, generally through a slot, there is a narrow metal channel known as a fire trap and intended to prevent the passage of flame into the spoolbox should the film ignite. Since all film is now non-flam or safety type with slow-burning characteristics, there is little danger.

(*b*) *The Magnetic Soundhead.* Known as the penthouse soundhead, this piece of equipment is fitted underneath the top spoolbox and above the film-mechanism and consists of a series of tension rollers and other smoothing devices to ensure even and steady movement of the film over the multi-track magnetic heads.

(*c*) *The Film-Mechanism.* This is the section of the motion-picture projector which is concerned with the transport of the film through the picture gate, where an image of the film frame is projected to the cinema screen. The film-mechanism is certainly a piece of high grade precision machinery. It is, however, so constructed that it will operate satisfactorily under the most arduous conditions and during the long operating hours found in the average cinema.

Here we can break down again into sub-headings and consider the various items separately:

1. The take-off sprocket assembly.
2. The intermittent movement.
3. The shutter.
4. The picture gate.
5. The picture framing.
6. The take-up sprocket assembly.
7. The lens mounting.
8. The safety shutter and changeover device.

1. *The Take-off Sprocket Assembly.* This consists of a constantly driven film sprocket, sometimes called the top feed sprocket, which pulls the film off the top spool and feeds it to the picture gate and the intermittent sprocket. Associated with this sprocket is a system of guides and rollers intended to ensure that the film fits snugly on to the sprocket with its perforations meshing evenly with the sprocket teeth.

2. *The Intermittent Movement.* During the time that the picture image is being projected to the screen, the film must be held perfectly steady and accurately in place in the picture gate. It, therefore, becomes necessary to translate a continuous feed movement into an intermittent stop-and-start movement and this is accomplished by the intermittent, the true "heart" of the motion-picture projector.

The normal type of intermittent movement used in a 35mm. projector consists of a maltese cross and a cam with a striking pin. The cam is driven continuously and when the striking pin enters one of the slots of the maltese cross, the cross is turned one quarter of a revolution. Then the locking face of the cam slides over the curved surface of the maltese cross and during this time the intermittent sprocket, which is mounted on the shaft associated with the maltese cross, remains

stationary. The intermittent sprocket has 16 teeth and a quarter of a revolution involves four teeth which mesh with the four perforations of one film frame. On the end of the cam shaft there is a heavy flywheel to ensure smooth movement.

Since 24 picture frames are shown per second, the whole operation concerned with the stopping and starting of one picture frame must be 1/24th of a second. This period of time can be divided into 4/96ths of a second and during 1/96th of a second the film frame is moved away and the following film frame brought into position. It, therefore, follows that for 3/96ths of a second or 1/32nd of a second the film frame remains stationary in the picture gate while an image is projected to the cinema screen.

3. *The Shutter.* This is also a very important part of the film-mechanism. During the period of time required to move one film frame away and bring the following film frame into position (1/96th of a second) no light must reach the screen or there would be a picture defect. This would take the form of streaks of light known as " ghosting." The shutter is so arranged that it blocks off the light beam just as the film begins to move out of the picture gate and it opens the way again for the light beam to pass just as the next film frame comes to rest.

There is, however, a second function for the shutter. The projection of a motion-picture is an optical trick based on a defect of human vision. No true " motion " pictures are in fact shown, instead a rapid succession of still pictures is projected to the screen and persistence of vision serves to blend them into each other to produce the illusion of smoothly flowing motion-pictures. Bound up with persistence of vision is another defect of human vision known as flicker perception. The eye will perceive flicker if the light interruptions are 24 per second and so it becomes necessary to increase the number of light interruptions per second.

This is easily done by using the shutter to make a second light cut-off (1/96th of a second) during the time that the film frame is stationary in the picture gate (1/32nd of a second). This doubles the flicker frequency, bringing it up to 48 interruptions per second, which is above perception except for very bright pictures.

Shutters of various kinds are to be found. There are two bladed shutters of the disc type, single blade shutters of the disc type that rotate at twice normal speed, barrel shutters, dish shutters, etc., all having various advantages and various disadvantages in relation to light transmission and freedom from " ghosting."

4. *The Picture Gate.* This is generally a long metal channel through which the film is drawn while spring loaded runners press against the side margins of the film in order to hold it firmly and accurately in place. There are guide rollers at the entry to the gate channel and one section of the gate can be opened so that the film can be inserted in the channel.

An aperture, slightly smaller in opening than the area of one picture frame, is located in the picture gate and it is opposite this aperture that the film is stopped and held firmly and accurately while the image is projected to the cinema screen.

The intermittent sprocket is located directly at the exit from the gate and has its own assembly of guide shoes or rollers to keep the film in good contact with the sprocket.

The runners pressing on the film margins are generally capable of varying tension to suit the condition of the film or the projection conditions and to avoid unsteadiness while preventing damage to the perforation walls.

5. *The Picture Framing.* While the film can be threaded centrally in relation to the aperture, there is a need for up and down adjustment. The principle used today to effect this adjustment is the rotation of the whole intermittent movement by means of an external control, the rotation being around the centre of the maltese cross and sprocket, although the same purpose can be served by moving the intermittent movement vertically.

6. *The Take-Up Sprocket Assembly.* This consists of a constantly driven sprocket, sometimes known as the bottom feed sprocket, which feeds the film into the bottom spoolbox via the optical soundhead. Associated with this assembly is a system of guides and rollers intended to retain the film snugly on the sprocket with the perforations meshing evenly with the sprocket teeth.

Between the take-off sprocket and the entry to the picture gate and between the intermittent sprocket and the take-up sprocket there are two film " loops." These are necessary in order to allow for the stopping and starting of the film in the picture gate while the two sprockets rotate continuously. Thus the top " loop " is being enlarged while the film is stationary in the " gate " and the bottom " loop " is being made smaller, and they become equal in size again when the film is moving in the " gate."

7. *The Lens Mounting.* This is an integral part of the film-mechanism, although not directly concerned with the passage of film. It is needed, however, to hold the projection-lens in position so that the images of the individual frames may be projected to the screen. This mounting must accommodate various sizes and focal lengths of lenses in a solidly built, accurately aligned, smoothly adjustable assembly, located on the optical centre of the machine.

8. *The Safety Shutter and Changeover Device.* The light source transmits a considerable amount of heat to the film as well as light and while the film is rapidly moving through the light beam no harm is done to it, but should the projector stop and the film become stationary in the picture " gate " then the film would blister and smoulder, even though the film is " safety " or " non-flam." To prevent this a safety shutter is always incorporated, which is held open by a centrifugal device while the projector is running, but should it

stop, or even slow down to a considerable extent, this device allows the safety shutter to drop to protect the film.

The safety shutter or a similar shutter is also used to make the invisible changeovers from one projector to the other and back. The shutter may be connected to a solenoid or other electro-magnetic mechanism for remote control through a push-button or switch and by suitable interconnection the shutter on one projector can be opened at the exact instant that it is shut on the other projector and vice versa. There is also a variety of manually operated changeover devices available which achieve the same purpose.

(*d*) *The Optical Soundhead.* This is located below the film-mechanism and consists of a series of tension rollers and other damping devices to ensure even and steady movement of the film round the scanning drum between the exciter lamp and the photo-electric cell.

(*e*) *The Bottom Spoolbox.* This consists of a metal box into which an empty spool is inserted onto which the leader of the film is threaded. While the bottom spoolbox is similar to the top spoolbox in general appearance and has a shaft to support the spool, in this case the shaft is not free running. It is power driven by a chain or shaft from the projector motor or has its own motor. A heavier form of friction clutch is inserted between the drive and the spool shaft to compensate for the continually changing speed of spool rotation as the amount of film wound onto the spool increases.

(*f*) *The Stand.* The stand is generally a heavy cast pedestal on which the rest of the units making up a complete motion-picture projector are mounted together. The stand carries a beam on which the carbon-arclamp or discharge-lamp housing can be mounted and from which the bottom spoolbox can be hung.

The projector stand also has built into it, or in a separate box attached to it, the controls associated with the starting of the projector motor, the switching on of the exciter lamp and the picture and sound changeover. The controls for the projector-arclamp and its associated rectifier and the ammeter and voltmeter are also generally to be found on the projector stand.

The projector stand has to be so arranged that the part bearing the arclamp, film-mechanism, soundheads and spoolboxes can be tilted to throw the beam downwards to the screen, since projection rooms are generally built at the back of the circle well above the screen centre line. These projection rakes may vary from a few degrees upwards to as much as 30 degrees downwards.

(*g*) *The Light Source.* This may be a carbon-arclamp or a discharge lamp, but in each case the light source is contained in a lamphousing. This has to be mounted on the projector-stand so that the optical centre of the lamphousing is aligned accurately with the optical centre of the film-mechanism.

These are the items that go together to make up the modern motion-picture projector and they must not only fit together properly but they must work together efficiently in the cause of better picture and sound presentation.

Consult any of the sponsors of this Data Sheet for further information on motion-picture projectors and remember that BETTER PRESENTATION means BETTER BUSINESS.

DATA SHEET No. 12 – Issued by the PICTURE PRESENTATION COMMITTEE of the BRITISH KINEMATOGRAPH SOCIETY

Sponsored by THE FILM LABORATORY ASSOCIATION

The Birth of a Positive Release Print

The release print which comes to you for projection has had more loving care than you might credit. Whether the print is black-and-white or colour, the raw stock manufacturer has devoted years of research and development to perfect the base and the emulsions, the accuracy and precision of perforating, and still exercises tremendous care to ensure high standards of the raw material he delivers to the laboratories. You would be surprised at the amount of film which he makes which is scrapped if it fails to reach the proper standard of excellence.

This attitude of care and inspection is maintained in the laboratories. Quite apart from the work of the director, the cameraman, the cutter, the sound technicians in the making of the film all aimed at technical excellence as well as entertainment value, the laboratory exercises tremendous care to make sure that the actual release print is made to satisfy the producer, and that these standards are carefully maintained.

Let us see what happens in the actual manufacture of release prints such as are delivered to the theatre. We take for granted all the work that has been done in developing the picture negative, making daily rushes, cutting these rushes into final continuity, making dissolves, special effects and titles, all to the end of having a complete cut negative in release form. Let us take for granted, too, all the work that has been done in recording the sound and finally mixing it into a sound track made up in synchronism with the cut picture negative.

The first job whether it be colour or black-and-white is usually to make a protective master and eventually from the protective master duplicate negatives so that there is something to fall back on in the event of damage to the original. Any successful picture is certain to require several hundreds of release prints for the various territories and therefore it is extremely important that the negative is preserved free from defects to carry through the printing reqiurements for the various territories.

The black-and-white negative of a feature is graded or timed so that each scene has the appropriate density and the picture as a whole has a uniformity and a character suited to the mood of the picture. The sound, too, must be timed so that it prints at a proper level to get the best quality and volume of sound. In order that all prints shall receive the same scene-to-scene timing, laboratories make use of various devices to ensure that these changes take place at the appropriate time: one of the most modern types of printer to accomplish this end is a Bell & Howell Model "E" on which picture and sound are printed on the same printer and the negative runs backwards and forwards, producing at each pass through a new print. The density of each scene is controlled by a moving piece of film having different densities so arranged to run in synchronism with the negative so that at each scene a different amount of light is applied to the film so that a correct result is obtained. Practically all such black-and-white printing is done on a continuous printer; that is to say, the negative runs over a sprocket and with light projected through an aperture so that it passes through the negative and the positive running as a continuous sandwich around this sprocket. The sound is similarly printed on a sprocket and the greatest care must be exercised to be sure that these two films run smoothly together otherwise the quality of the sound would be impaired.

In order that the printer shall at all times produce identical results, control tests must be run on printers and again on the developers to ensure that everything is absolutely standard. This means, too, that the batch of positive stock being used must be carefully assessed for its speed and development time, again in order that standard results may be achieved. After printing, the film is passed through a continuous developer often running at quite high speeds of the order of 200 ft. a minute, and passed successively through a developing bath, fixing bath, washing and drying cabinets. The film is then inspected for picture and sound and checked to be sure that the sound is in correct synchronisation with the picture. Since laboratories are often printing more than one version of sound on a picture this point, too, must be checked to be sure that the right material is finally shipped to the distributor and thence to the theatre.

In making colour prints there is more than one process being used at different laboratories but the same general procedure takes place except that in the case of colour the light for each scene must be modified not only for amount but also for the actual colour impinging on the film. Only in this way can correct colour values be achieved and a smooth, well-graded print result. Here again testing of printers, developers and raw stock must receive careful and hourly attention and in most laboratories the baths being used are chemically analysed at frequent intervals in order to maintain absolute consistency.

Whether the film is colour or black-and-white it will, in the course of its developing and printing, run over a number of sprockets and literally hundreds of pulleys. It is obviously most important that in all these movements no marking of the film takes place which could give rise to rubs or scratches which could show on projection. Therefore each laboratory maintains well-trained maintenance staff who are constantly checking and cleaning and adjusting machines to make quite sure that films are correctly printed and developed, and this without any damage to sprocket-holes or the surface of the film.

Most films are edge waxed, often as an integral part of their processing procedure, so that the print will run smoothly and comfortably in any projection machine. Finally it is carefully packed and checked for the accuracy of the contents of the film can and shipped to the distributor for distribution to theatres. It is the constant aim of all laboratories to ensure that every foot of film of the many millions of feet of film they make shall be accurately printed so as to give a sharp, clear picture free from blemishes that will run smoothly on a projector, and with sound of high quality correctly positioned so that the sound, too, shall be satisfactorily produced under its conditions of use.

DATA SHEET No. 12 – Issued by the PICTURE PRESENTATION COMMITTEE of the BRITISH KINEMATOGRAPH SOCIETY

Sponsored by THE FILM LABORATORY ASSOCIATION

The Birth of a Positive Release Print

The release print which comes to you for projection has had more loving care than you might credit. Whether the print is black-and-white or colour, the raw stock manufacturer has devoted years of research and development to perfect the base and the emulsions, the accuracy and precision of perforating, and still exercises tremendous care to ensure high standards of the raw material he delivers to the laboratories. You would be surprised at the amount of film which he makes which is scrapped if it fails to reach the proper standard of excellence.

This attitude of care and inspection is maintained in the laboratories. Quite apart from the work of the director, the cameraman, the cutter, the sound technicians in the making of the film all aimed at technical excellence as well as entertainment value, the laboratory exercises tremendous care to make sure that the actual release print is made to satisfy the producer, and that these standards are carefully maintained.

Let us see what happens in the actual manufacture of release prints such as are delivered to the theatre. We take for granted all the work that has been done in developing the picture negative, making daily rushes, cutting these rushes into final continuity, making dissolves, special effects and titles, all to the end of having a complete cut negative in release form. Let us take for granted, too, all the work that has been done in recording the sound and finally mixing it into a sound track made up in synchronism with the cut picture negative.

The first job whether it be colour or black-and-white is usually to make a protective master and eventually from the protective master duplicate negatives so that there is something to fall back on in the event of damage to the original. Any successful picture is certain to require several hundreds of release prints for the various territories and therefore it is extremely important that the negative is preserved free from defects to carry through the printing reqiurements for the various territories.

The black-and-white negative of a feature is graded or timed so that each scene has the appropriate density and the picture as a whole has a uniformity and a character suited to the mood of the picture. The sound, too, must be timed so that it prints at a proper level to get the best quality and volume of sound. In order that all prints shall receive the same scene-to-scene timing, laboratories make use of various devices to ensure that these changes take place at the appropriate time: one of the most modern types of printer to accomplish this end is a Bell & Howell Model "E" on which picture and sound are printed on the same printer and the negative runs backwards and forwards, producing at each pass through a new print. The density of each scene is controlled by a moving piece of film having different densities so arranged to run in synchronism with the negative so that at each scene a different amount of light is applied to the film so that a correct result is obtained. Practically all such black-and-white printing is done on a continuous printer; that is to say, the negative runs over a sprocket and with light projected through an aperture so that it passes through the negative and the positive running as a continuous sandwich around this sprocket. The sound is similarly printed on a sprocket and the greatest care must be exercised to be sure that these two films run smoothly together otherwise the quality of the sound would be impaired.

In order that the printer shall at all times produce identical results, control tests must be run on printers and again on the developers to ensure that everything is absolutely standard. This means, too, that the batch of positive stock being used must be carefully assessed for its speed and development time, again in order that standard results may be achieved. After printing, the film is passed through a continuous developer often running at quite high speeds of the order of 200 ft. a minute, and passed successively through a developing bath, fixing bath, washing and drying cabinets. The film is then inspected for picture and sound and checked to be sure that the sound is in correct synchronisation with the picture. Since laboratories are often printing more than one version of sound on a picture this point, too, must be checked to be sure that the right material is finally shipped to the distributor and thence to the theatre.

In making colour prints there is more than one process being used at different laboratories but the same general procedure takes place except that in the case of colour the light for each scene must be modified not only for amount but also for the actual colour impinging on the film. Only in this way can correct colour values be achieved and a smooth, well-graded print result. Here again testing of printers, developers and raw stock must receive careful and hourly attention and in most laboratories the baths being used are chemically analysed at frequent intervals in order to maintain absolute consistency.

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Most films are edge waxed, often as an integral part of their processing procedure, so that the print will run smoothly and comfortably in any projection machine. Finally it is carefully packed and checked for the accuracy of the contents of the film can and shipped to the distributor for distribution to theatres. It is the constant aim of all laboratories to ensure that every foot of film of the many millions of feet of film they make shall be accurately printed so as to give a sharp, clear picture free from blemishes that will run smoothly on a projector, and with sound of high quality correctly positioned so that the sound, too, shall be satisfactorily produced under its conditions of use.

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Preventing Damage to Release Prints (1)

It is the aim of the renting side of the Industry to supply prints in first-class condition and in good time for the opening date for which the subject is booked.

Prints start life as new copies which will put on a faultless show. There are, unfortunately, many ways in which films become damaged and each such defect spoils the enjoyment envisaged for the public by the producer. Apart from accidental damage it would be simple to eliminate practically all of the types of damage films now suffer.

The Renters are anxious to have products placed on the screen so as to obtain the best possible results. In this direction both the Producer and the Renter are in the hands of the projectionists who are ultimately responsible for presentation. The Public expects a picture free of blemishes and with unimpaired sound. The way in which film is handled by its many users decides whether the public is satisfied or otherwise. The Renters do not claim to bring to your notice in its following comments anything startling or new. The matters dealt with are facts which have been written and spoken of many times in the past covering the causes and prevention of film damage.

Release prints

From its first run a print starts to deteriorate and the speed of deterioration depends on many factors which will be dealt with under their various headings. All Trade Organisations are combining in an effort to confine deterioration to fair wear and tear.

In general, reels of film delivered for screening are correctly packed, each in its own can properly labelled, with the clear spacing taped down to prevent damage to the leader. Small reels should not be placed into large cans—the less spare space in the can the better. This decreases the possibility of damage in transit. Clear spacing at the fronts and ends of reels is there to protect the Academy leader and the End of Part titles. The Standard leader is an integral part of a reel and matches " change over " cues at the end of the preceding reel, and upon its length and subsequent maintenance depends the success of " change overs " from one projector to another.

Should a film be received at a theatre without cue marks the projectionist should place his cues in the appropriate positions— the usual small circles or marks made with a coloured grease crayon, or better still, use a mechanical cue marker. Leaders are frequently damaged due to the " snatch " at the start of a projector; perforations are torn out and where this occurs the damaged perforations should be removed and a join made.

On account of the strain to which it is put, " V " cuts should never be made in a leader; " V " cuts weaken the film and make it tear much more easily. It is frequently found that leaders are deliberately removed from the front of reels and retained, possibly for use as a run in for Trailers and other materials supplied without leaders. Never remove and retain a leader. It will cause great inconvenience to the next user, particularly if the film concerned is crossed over direct.

Centre support

All reels of film require support of the centre, particularly the double reels. A plastic 2 inch centre as supplied by the stock manufacturers or a solid wooden bobbin under-cut to about 1 7/8ths inch is undoubtedly the best centre support. Without such support, reels dropped or carelessly handled in transit would suffer considerable damage of the inner convolutions due to impact. Recently it has become the habit of many projectionists to use either a split spool or a 2 inch bakelite bobbin on the take-up spindle at their last showing and to return the reels to the Renters without rewinding. In many instances the centre support is omitted. All reels should be correctly rewound and examined after the last showing so that the projectionist knows the condition of a film after he has finished his run. It is hoped that very soon all film will be supplied on the 2 inch core to B.S.677 Part 1 : 1958.

Rewinding

It is the practice in most Projection Rooms for rewinding to take place base side of the film uppermost. Scratching on the emulsion cannot be detected when films are rewound in this fashion, so all rewinding should be done with the emulsion side of the film uppermost. In many instances a whole copy and indeed a whole programme has suffered the same emulsion scratching throughout because the film had been rewound base side up, making it impossible to detect an emulsion scratch.

Where something on a projector is causing scratching, this should be noticed on rewinding the first reel damaged so that whatever is wrong can be rectified and thus prevent any further reels from suffering likewise.

Careless rewinding which leaves the edges proud and uneven can be responsible for the damage of long lengths of perforations, particularly if the edges stand higher in the tin than the depth of the tin; all reels should be plated off perfectly flat. Rewinding is not a job for a junior—this is an operation requiring skill. " Plating off " from spools after the last showing should be the responsibility of the " chief ", who should make sure the film is free from damage and is ready for immediate use whether it is being "crossed over " or returned to the Renter.

Remember,

1. Make sure your two rewind heads are perfectly aligned.
2. Rewind at moderate speed. Slow up towards the end so that the end does not flap.
3. Never leave slack film between the rewind heads and then take up with a jerk.
4. Loose rewinding causes abrasions but tightening a reel by pulling on the outside layer causes even more.
5. Stop several times at random and really examine both surfaces carefully.
6. Do not use a split spool on the last show, sending the film away unexamined.
7. If a spooled-off reel shows proud edges, never bang them down. Rewind the reel evenly.

Joins

Where joins are made in any part of a reel they should be perfectly made in all respects, the emulsion on the overlap should be completely removed and the base itself should be roughened to clear it of the binder layer so that the cement is applied to the base proper. The base side of the film to which the lap is to be joined should also be lightly scraped so that the base itself is exposed; the join should then be completed with an adequate cement under pressure, allowing a few seconds for the cement to act. The type of joint may vary but a full hole join is recommended. Imperfect joins are the main cause of breakdown during screening, and are also responsible for such serious defects as the film riding over the sprocket teeth and so tooth-marking the track and picture areas—such damage means re-printing.

Oil on films

Oil should never be allowed to get on to the film, as apart from impairing the quality of the picture on the screen, the film becomes very difficult to handle and particularly hard to wind flat and tight when being plated off. Oil is the usual cause of film not being wound flat and this can cause proud edges with the resultant damage that follows. The oil also picks up dirt particles and dust and retains it. A dry film with the proper hard wax coating remains clean very much longer.

Broken perforations

It is the practice of many projectionists where one perforation is split to put in a " V " cut. Although this weakens the edge of the film and makes it more liable to tear at this point, provided the " V " cut is properly made it will carry the film through the projector. " V " cuts however are not to be recommended, and for safety in projection a perfectly made join is preferable. Some projectionists make " V " cuts where two neighbouring perforations are damaged and this is a very dangerous practice and should never be resorted to. Where two perforations next to each other are damaged a join should *always* be made. And never make a " V " cut on a join.

Cleanliness

All parts of a projector should be kept scrupulously clean, particularly the film-path. Scratching, the main cause of emulsion damage is usually caused by some extraneous matter coming up against the film on its passage through the projector. More re-prints have to be made on account of heavily scratched emulsion than any other cause. If a projectionist is unfortunate enough to receive a badly scratched film, a report to the Renter concerned should be made immediately, so that the previous user can be traced and to make sure that what has caused the scratching is found and removed before further damage to other films is done.

Cleanliness counts

Make a fetish of it. Never touch film without cotton gloves or if this is not possible, without making certain that your hands are clean. You do not necessarily need the most up-to-date projection suite to be clean. Even a cupboard under the stairs can be kept spotless.

The hardest thing to overcome is to maintain your own standards when you receive film, transit cases and so on from someone not as particular as you are. Do not think your efforts wasted. We want to bring the other fellow up to your level, not you down to his.

Waxing or lubrication of film

It is the practice of most renters to have films waxed by the laboratory that does the film printing. This waxing should be sufficient to take the film through the projector on its first few runs without the shedding of emulsion from the perforation margin. It is, however, the practice of some projectionists to wax new films as a further safe-guard against emulsion piling up in the picture gate, and where this is done the lubricant should be applied with very great care so that there is not an excess of wax that is likely to spread across the sound track on to the picture. Paraffin wax should be applied very sparingly and in such a way that it keeps to the perforation edges only. Wax polish should not be used. Many waxes sold for furniture, etc., contain silicones which can cause image fading and other defects. The hard waxes of the Carnuba type used in the laboratories have been selected after much scientific investigation and are adequate and superior to anything the projectionist himself may fancy.

Wilful mutilation

The films should be returned after use in exactly the same condition as received. If this were a standard practice in every projection room and the necessary care taken by the first run operator onwards, damage would become almost non-existent and would make life very much easier for all who have to handle film. A little carelessness by many people can cause an accumulation of faults in a print after a relatively few runs

No one is perfect and accidents will happen.

When damage occurs it is always advisable for the projectionist responsible to report what has happened immediately to the Renter. This allows the Renter in the first place to see that the copy is not crossed over in a damaged condition to another exhibitor, and also allows adequate time for reprints to be made where necessary. If damage occurs of which the Renter is not aware the print can be crossed over to another exhibitor who, most unfairly, is prevented from putting on a good show.

Speedy and frank co-operation with the Film Renter is to be commended. Such a policy pays handsome dividends in the end.

Bad packing

When a film is ready for returning after the last performance, great care should be taken that it is properly canned in its right tin with the lids put on securely. The transit case should be securely closed. Please do not use the transit case as a receptacle for film cuttings, cigarette ends and various other material that is unwanted in the projection room. Keep the inside of a transit case absolutely clean so that there is no possibility of dirt or extraneous matter eventually coming in contact with the film itself.

The " condition " of a film, i.e. scratching, jumps in continuity, strained and split perforations, bad joins—is the result of treatment received in projection rooms. Projectionists have the remedy in their own hands—greater care in handling by all those concerned would soon become a " chain reaction " and each projectionist would be receiving material, even on direct cross over, that would be trouble free and would make possible Better Presentation.

Here then are some reminders:

1. Never let a reel of film with a large unsupported centre space flop about on a spooling plate hub or rewinder spindle.
2. Never overload a spool so that outside layers of film can fall off.
3. Rewind and examine every foot of film before re-using no matter how good it may look.
4. Keep a log book of titles, copy numbers and condition reel by reel, as received and as sent out again.
5. Report " damage as received " to your Manager so that he takes appropriate action immediately.
6. Check that there is 8 ft. of protective film and a Standard Leader on every film received.
7. Check every join for reliability.
8. Never use a bent or untrue running spool.
9. When examining hold the film with the hand below the film, emulsion up, and do not cup the film.
10. Don't make " V " cuts, make a good join.
11. Avoid removing leaders, but if it is really unavoidable, put them carefully aside and rejoin them in place before sending the film back.
12. Never allow films to trail on bench or floor.
13. Where no bands are provided to protect the outside layer, tape it down to prevent it loosening the reel in transit.
14. If you use the silver foil patches necessary in semi-automatic equipment make sure they are removed before despatch. They are easy to remove and intended to be removed.
15. Make sure the centre is properly in place before despatch.
16. Make sure each roll is in its correct can.

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Preventing Damage to Release Prints (2)

Now for the other side of film handling, the mechanical handling that is done by the motion-picture projector. The positive release print spends most of its life being run through quite a complicated mechanism, stopped and started 24 times each second and subjected to tremendous heat. There are many ways that the positive release print can be damaged during its passage through the film mechanism and sound heads and the only way to minimise the wear and tear and eliminate the unnecessary damage is to make sure that the equipment is working properly. Adequate and regular service, the timely replacement of wearing parts, strict cleanliness, and a thorough knowledge of the equipment and its weaknesses are the keynotes for the avoidance of projector induced film damage.

The majority of breakdowns of film during screening are caused by excessive gate tension. During tests carried out the breakdowns due to such troubles were *ten times* more frequent with a gate tension of 30 ounces than with a tension of 8 ounces. The recommended value is between 8 and 14 ounces.

There is not enough room here to describe them all but there is room to remind ourselves of the points to watch.

1. *Fire Trap Rollers.* The first point of contact with the film; watch for collection of dirt or oily matter. Watch for rollers developing flat spots. Wash out the bearings with spirit and re-oil occasionally.

2. *Signalling Devices and Pulse Pick-Off Rollers.* Check for binding or wear.

3. *Guide Rollers.* Watch alignment with sprocket. Check for ridges. Watch tension springs. Check the bearings as in 1.

4. *Sprocket Pad Rollers or Idlers.* Check for correct spacing from sprocket. Too little will cause rubbing, too much will cause a run-off. Clean and lubricate the shafts periodically.

5. *Gate Tension.* The degree of tension on the film in the gate is of vital importance and should be variable. Test in the recognised manner with a short length of film and a spring balance, and keep to the recommended average tension of 8 to 14 ounces, but observe any recommendations made by the projector manufacturer.

6. *Tension on Top Spoolbox Shaft.* Enough, but not too much. Avoid a jerky film feed but be sure on the other hand that you do not apply enough tension to cause perforation straining of the last few feet of film.

7. *Intermittent Film Guide or Shoe.* A part that causes a lot of film damage if not watched very carefully. See that you do not " spring " the shoe and that the guide or shoe is seated correctly with proper clearance when a gate is replaced.

8. *Sprockets.* A great deal of damage is due to faulty sprockets. Examine for wear and undercutting of teeth. Watch for damage to teeth. Make sure that your projectors are fitted with the so-called " Foxhole " sprockets for Mag-optical and Stereo release prints. Much unsteadiness in projection is caused by dirty intermittent sprocket teeth. Make sure that they are really clean and free from emulsion deposit at the roots of the teeth.

9. *Take-Up Tension.* Very important indeed. Excessive tension will strain perforations at the trailing edges. This can clearly be distinguished from leading edge damage caused by excessive gate or take-off tension.

By no means a complete list but a review of the major causes of projector film-damage. There will be other weak points peculiar to your particular installation. Know your projectors inside out and bring into use your skill as a projectionist whose job is to know just how to get film through the projectors without anything other than fair wear and tear.

Now for a few points that cannot be classified with the mechanical causes of film damage.

1. *Buckled Film.* Film having what is known as positive curl, with emulsion concave, or negative curl, with emulsion convex, where the curl is excessive, is likely to suffer abrasion through coming into contact with a

machine surface. Such surfaces, rollers, etc., are relieved on modern projectors but on older machines the offending surface should be relieved if necessary, but this is really a job for a skilled mechanic. File marks will probably do more damage than the original surface if they are left as a result of unskilful work.

2. *Print Sticking.* Some recently processed or new prints retain a considerable amount of moisture, and when the film passes through the gate the heat softens the gelatine which can be deposited in the gate. The gelatine then dries to a hardened state and can cause deep rubbing or perforation straining. Watch out and be ready to apply a wax lubricant very sparingly to the extreme edges of the film.

3. *Oil.* Don't get oil on the film at any time or under any circumstances. Apart from the fact that it collects grit and dust which then scratches film, the presentation is completely spoilt by the film of oil on the picture area causing varying definition.

4. *Film Loops.* Oversize loops increase the danger of abrasion due to the film coming into contact with machine surfaces.

5. *Overheating.* With the demand for larger and larger picture sizes, more high-powered arcs are in use and the need to filter out the injurious heat rays from the light beam has increased. Film can be very easily damaged through an excess of heat. Embossing and discolouration are serious enough but when buckling and blistering occur then film is being damaged unnecessarily. The former spoils the presentation through the continual in-and-out-of-focus effect and the latter through actual physical damage.

6. *Condensation.* Beware of condensation during the winter months. Moisture that has collected on cold machine parts overnight can seriously damage film if the exposed machine surfaces are not carefully wiped down and dried out. Warm up is the action needed.

7. *Lacing the Projector.* This is where a lot of small scratching can be done and the cumulative effect of many times results in visible damage. Always get your lacing checked by another projectionist. Always clean the complete film path before lacing. Check spool-boxes for slack film.

We might to advantage finish off this review of unnecessary film damage by giving a short list of the technical terms used to identify film damage of one kind or another. In reporting film damage it is very important to be clear on the kind of damage and the position in relation to the film stock. These notes may help to avoid misunderstandings and thereby assist our common aim of presenting to our paying public films in good condition and unblemished.

1. *Scratching.* May be on either surface and can be broken down into several well-identified types. (See 6, 7 and 8.)

2. *Abrasion.* Sometimes known as " rub marking." Generally caused by the film surface rubbing on some machine surface, and can be on base or emulsion surface.

3. *Centre Splitting.* Speaks for itself and is generally caused during rewinding by " cupping " the film with emulsion excessively convex. Generally found when prints have dried out too much. Keep a tray of water under your radiators in cold weather to keep humidity at a reasonable level.

4. *Perforation Damage.* Generally known as " straining." Damage to perforation walls that may cause a complete breakdown or even strip off a long section of the outside edge of the film. Caused by excessive tension before or after a sprocket. At the first sign of such damage, check take-off and take-up tension and gate cleanliness and pressure.

5. *" V " Cutting.* Sometimes known as edge notching. Cutting a " V " into a damaged perforation edge or damaged film edge. Even if used in an emergency a proper join should be made as soon as possible.

6. *Cross Abrasions.* The scratches resulting from contact of the entire film surface with the spool flange. Such scratches characteristically run diagonally across the film from one edge to the other.

7. *Short Horizontal Scratches.* On either surface and generally caused by contact of the film with the floor or a dirty rewind bench.

8. *Cinch Scratches.* Short lengthwise scratches caused by attempting to tighten reel by pulling on the outside layer.

9. *" S " Bends or " Pleats."* An even more severe result of pulling on the outside layer to tighten the reel.

10. *Buckle.* This is caused by evaporation of moisture or solvent from film edges due to storage conditions and can be either temporary or permanent.

11. *Edgeweave or Flute.* The opposite of buckle, the edges being elongated. Can be temporary on both edges under certain storage conditions or permanent on one edge under conditions of a thickness differential across the width of the stock.

12. *Twist.* An undulation extending to the centre of the film and alternating from one edge to the other. A condition caused by loose winding of new prints.

13. *Curl.* Positive curl with the emulsion concave and negative curl with the emulsion convex. Caused by changes in the moisture content of the emulsion layer.

14. *Spoking.* Caused by the loose winding of film with a high degree of curl. Temporary state can be cured by firm film winding.

15. *Embossing.* A deformation causing the frame to stand out in relief due to expansion caused by excessive heat in the gate.

So we come to the end of our review of how to handle delicate motion-picture film, and how to avoid anything but genuine and normal wear and tear while it is in your temporary possession.

Please remember that the film you handle is our stock-in-trade—the goods that we sell—and the customers are not going to continue to buy them if they are shoddy or presented to

them in a dirty manner. You have a very serious responsibility to many people throughout the Industry and your success in presentation means their success too.

If you are a first-run projectionist your responsibility is even greater for once damage starts it can be rapidly accelerated as the film progresses down the line from week to week. On the other hand receipt of a print in sparkling condition by a projectionist on third run is an encouragement to him to keep it in that condition.

We realise, just as well as you, that the elimination of film damage and the assurance that every print will be sent to you with inherently good definition, good colour, good contrast, and good sound, is a matter for all parts of the Industry, and that your effort is only one of many and without similar efforts by all others, will fail.

Take our assurance that all sides of the Industry are combined and determined to reach this goal.

Please do your part and thereby ensure BETTER PRESENTATION which means BETTER BUSINESS.

Any of the sponsors of this Data Sheet will be pleased to help you with any problems relating to their films.

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That Join should not be the Weak Link

Joining motion-picture film is of such great importance as to merit special and constant attention. Whether carried out in the theatre, the laboratory or under the distributor's inspection, that join could easily be the weak link that can spoil your picture presentation.

Apart from the adverse effect on presentation, a large amount of film is ruined by poor joining. Joins that are over width, stiff, buckled, or out of alignment are always liable to run off sprockets with resultant further damage to the film through run-off marking, straining or actual physical break-down.

Furthermore, perforations in the vicinity of bad joins are invariably strained and may even have broken down walls.

All reels of film contain joins; in older reels joins are more numerous—each join is a potential "Weak Link" in the chain of projection. Perfectly made joins will withstand the rigours of projection and rewinding indefinitely—imperfect joins will eventually come apart either in the rewinding process or on the projector.

Hand made joining of the tri-acetate base (NON-FLAM) cannot produce satisfactory results, and this method of joining is thoroughly condemned. A first class modern joining machine must be part of the standard equipment in the projection suite.

Where joins are made they should be perfectly made in all respects, the emulsion on the overlapping part of the join should be cleared completely from the base and the base itself should be lightly roughened to clear it of the binder or adhesive so that the cement is applied to the base proper. The base side of the film to which the lap is to be joined should also be lightly scraped so that the base itself is exposed. This ensures that base is joined to base and also removes any dirt, wax or oil and creates a stronger join. Joins become necessary mostly where broken or strained perforations have to be removed and occasionally due to accidental breaking of film. Joins are far, far more reliable than "V" cuts. A "V" cut should never be made on an existing join that has become split and should never be used instead of a join where two perforations next to each other are broken.

Let us ensure good joining by reiterating 11 golden rules.

1. *Use of Mechanical Joiner.* There are many types available, from the automatic scraper de-luxe model to the very simple and not too efficient cheaper machine. The more expensive machine is cheaper in the long run as it saves considerable time per join and makes a perfect join in all ways.

   Splicers (joining machines) should at all times be kept scrupulously clean and all movable parts lubricated. After making a splice, all dust and film scrapings and surplus film cement should be wiped off the splicer—leaving the machine clean and dry in readiness for the making of the next join.

   When moving parts become worn they should be replaced; worn parts create maladjustments which in turn can produce faulty joins out of correct alignment. Film scrapings often adhere to the film itself during the joining operation, so lightly dust the film with a soft cloth to remove this extraneous matter, which, if left adhering to film, will look like huge black spots on the screen.

2. *Use Proper Film Cement.* No matter how well the film is prepared for joining, the join cannot be completed without an adequate cement—make sure that the cement you use is fresh and of the correct type. There are several excellent cements available for you to choose from.

3. *Preserve Your Film Cement.* Use only a small quantity at a time, replace often and always replace the cork or stopper tightly immediately after use. The more volatile constituents evaporate more quickly than the remainder. Evaporation means deterioration and that leads to mutilation.

4. *Cut in Rack.* Always make certain in preparing to make a join, that you cut so that the join, when made, is "in rack" and completes a full "frame"—it is always worth a double check to ensure the "one hole" scraped lap is in fact a true frame-lap overlap.

5. *Scrape Accurately.* A good joining machine will cut the film exactly for the lap and frame involved but the scraping is left to the person concerned to decide the right amount to remove.

6. *Scrape Thoroughly.* All the emulsion and the binder layer must be removed from one end and the other should be cleaned of all oil and dirt—cement will not act upon emulsion, oil, wax or dirt. In the case of a film bearing emulsion on both sides, all emulsion and binder layer must be removed from both ends.

7. *Apply Film Cement Properly.* A sufficient but not excessive quantity in one stroke of the brush—hard to judge at first but easy after experience.

8. *Apply Proper Pressure.* Immediately cement has been applied, pressure is required to complete the join. Pressure ensures absence of air bubbles between the films being joined and also presses out any surplus unwanted cement.

9. *Apply the Pressure Long Enough.* In most mechanical joiners the required pressure is supplied automatically by the closing down of the machine. Keep the join under pressure for at least 20 seconds.

10. *Blooping of Optical Joins.* Joins made on a precision joining machine do not as a rule require blooping, but where blooping is considered necessary an elongated triangle with its peak pointing to the inner edge of the track is permissible, but every care must be taken to avoid the blooping ink getting on to the picture itself.

11. *Cleanliness.* Every time you scrape a lap you produce thousands of small particles of emulsion dust and base dust. The utmost care is necessary to keep bench and joiner clean and free from dust. Film becomes charged with static electricity when rubbed with a cloth and all these small dust particles are attracted to the film.

Motion-picture film is composed of three layers—the relatively thick base material, and the two thinner layers, the emulsion and the "binder." The binder layer binds the emulsion to the base and it can be easily forgotten. This must be completely removed from the base (and so must the emulsion) or the join will be useless, rapidly falling apart. A good join is as strong—sometimes stronger—than the unjoined base.

Types of joins vary but the $\frac{1}{8}$ in. full-hole join covering one perforation is the one that carries the confidence of most projectionists and is recommended.

When joining Magnetic or Mag-Optical prints it is recommended that a 3/32 inch join between perforations is used. It is *most* important that a non-magnetic joiner is used and that the overlap be as shown in figure (*a*) in order that the edge of the lap shall not damage the pole faces of the magnetic heads.

In many instances the cause of poor joins is blamed on the film cement being used or even on the characteristics of the film itself but the real cause is neglect of attention to the basic rules on joining—just don't let that join be the weak link in your presentation chain.

The Technical Managers of the Film Distributors sponsoring these Data Sheets are always willing to help you with technical advice. Consult them for they are vitally concerned to have their product presented to the public in the best possible manner.

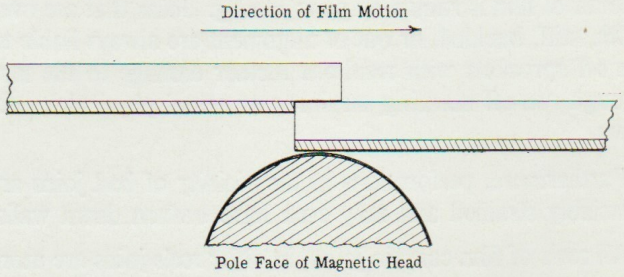

Fig. (a)

DATA SHEET No. 16 – Issued by the PICTURE PRESENTATION COMMITTEE of the BRITISH KINEMATOGRAPH SOCIETY

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ANGLO-AMALGAMATED FILM DISTRIBUTORS LIMITED
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The Waxing and Treatment of Films

Waxing

The rudiments of film processing are generally known to most projectionists. These cover printing, which is a dry process, followed by the immersion in baths for developing, fixing and washing, during which process the film becomes thoroughly wet. As all the moisture is not removed from the gelatine emulsion in the drying process, there is no doubt whatever that normal film as it comes off the end of the laboratory machine is not really ready to stand up to the hard wear of release projection, even if it has been subjected to a hardening treatment such as a formalin bath or a chrome alum type of bath.

Most laboratories therefore wax the perforation area or even wax the whole surface. This is necessary to prevent the soft emulsion when subjected to the heat of the Picture Gate from becoming tacky and shedding on to the gate runners causing the " Pile-up " which scores the perforation margins and strains perforations.

Apart from the early runs, waxing is important throughout the life of a film. A reel of untreated film for instance, if forced into a cone and then flattened, will show the usual horizontal cinch marks and if loosely wound and then tightened by pulling on the outside turns, will show longitudinal short scratches or cinch marks.

This condition is made worse by using oil or sticky wax. Moreover films maltreated in this way are almost impossible to wind flat and many " proud " edges will be found in such rolls. *Ninety per cent of edge damaged film is found to be oily.* Oil also produces mottle on the film surface giving the effect of unstable sharpness on the screen.

The use of machine oils, floor waxes and similar commercial lubricants is the worst thing to do. Many of these oils contain fatty acids and many of the polishes contain silicones both of which can affect image colour (even in black and white film).

Much work has been done on film lubrication and there seems no doubt that the best method is to apply either Johnson's Wax WM-169C (obtainable from S. C. Johnson & Sons Ltd., West Drayton, Middlesex) or " Ozokarite " Wax (obtainable from Harrington Bros. Ltd., 4 Oliver's Yard, 53a City Road, London, E.C.1.). Both waxes are applied by dissolving in carbon tetrachloride as an 0.1% solution (the exact percentage depends on the method and speed of application).

If such a wax is applied to the whole surface proud layers slip back in line without damage and cinch marks do not occur; a hard glassy surface results which is resistant to wear and to dust adhesion and is easy to handle.

Projectionists are advised not to resort to " do it yourself " waxing. If an emergency does arise a little paraffin wax applied to the perforations can be used—but this wax flakes and soon causes a very dirty copy. Report any such difficulty to your Renter.

Cleaning Film

Frequently, films become saturated with oil and other greases.

Cleaning is best left to the Renters who have at their disposal the services of laboratories that specialise in film cleaning.

Sometimes over-waxing is responsible for wax spreading on to the picture surfaces, and this as well as any other type of oil or grease will hold dirt and dust which if not removed from the surfaces of the film will have a disastrous effect on the screen. There are only a few ways of cleaning film adequately. The best method is with a properly designed cleaning machine where the film is immersed in the cleaning liquid with soft hair brushes revolving in the liquid against both sides of the film. By this method the soft bristles are able to remove dirt, grit or grease that has become embedded in scratches on either the base or emulsion.

If, however, a projectionist receives a really oily or dirty copy which he must use for a show, he needs to deal with the situation immediately. This requires cleaning by hand, and the procedure here is to moisten a very soft lint-free cloth or rayon plush cloth moistened with carbon tetrachloride, which is held in the hand in such a way that both sides of the film come into contact with the moistened material. Winding during this process should be very much slower than usual. (On account of the toxicity of carbon tetrachloride, there should be ample ventilation in the winding room.) Use good

quality fluid, free from the sulphur derivatives, which can give the emulsion a brownish tone.

It is essential that the cloth used is quite clean and free from any dirt, grit or dust as dirty material could quite easily cause a series of scratches. Also if the material is held too tightly against the sides of the film, the pressure even with clean material could cause shallow scratches to appear.

Never run the film through a dry cloth—this will only spread the oil on the film and cause scratches through grit picked up in the cloth.

Whilst the above method is quite effective as a means of cleaning by hand, it is essential to point out that cleaning of this type applies to normal *optical prints only* and under *no circumstances* should this method be used for prints with magnetic or magoptical tracks, as the carbon tetrachloride could find its way beneath the striping and cause it to lift.

The cleaning of film is a process requiring considerable care and should not be attempted by the unskilled.

If a copy is received in a seriously oily or dirty condition, report it to your Renter immediately.

DATA SHEET No. 17 – Issued by the PICTURE PRESENTATION COMMITTEE of the BRITISH KINEMATOGRAPH SOCIETY

Sponsored by ROBERT RIGBY LIMITED

Your Needs in Film Handling Equipment

FILM HANDLING EQUIPMENT can and does vary greatly, some theatres having elaborate and costly equipment others having the complete opposite, but throughout there are certain basic pieces of equipment common to all. Certainly common to all is the problem of avoiding film damage. No equipment has yet been designed which will avoid damaging the film if wrongly used and maintained.

Before dealing with the basic equipment let us briefly enumerate the basic causes of damage occurring in the projection room in relation to the film handling equipment, all of which can be avoided, and which can be summed up in three simple words—" CLEANLINESS—CARE—COMMON SENSE."

Damage occurs to film with:—

(1) DIRT—Dirty hands while examining prints—try to wear cotton gloves.

(2) DAMAGED SPOOLS—No film can stand up to these—most spools if not too badly damaged can be straightened. If very badly damaged throw them away, or return them to the manufacturers for repair.

(3) BADLY ALIGNED REWINDERS—Whatever you do, unless the rewinders are aligned properly, damage to the film will occur.

(4) REWINDING TOO FAST—No good can come to the film if it is rewound at breakneck speed; even so film can be rewound quickly and safely if care is taken to ensure a fast and constant take-up. Sudden stopping and starting at fast speeds soon damages the print.

Bearing these points in mind let us turn to the basic equipment:—

(a) A REWINDER—normally one end idle and one end geared, a little oil applied to the lubrication points periodically will keep the rewinder at its best.

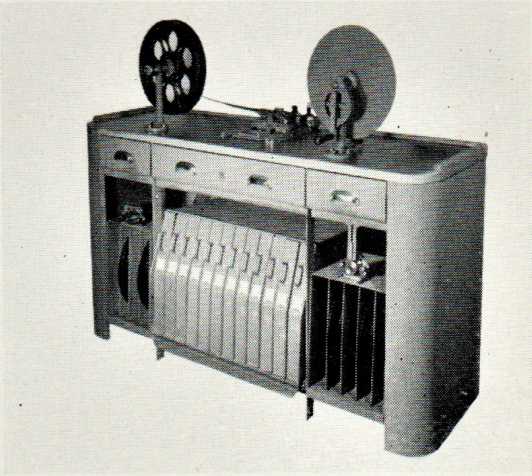
(b) A SPLICER—A block to trim the film and accurately register it prior to applying film cement. This should always be kept scrupulously clean. Always clear any excess cement off after splicing, see that the cutting and trimming surfaces are kept sharp.

(c) FILM CEMENT—Don't let film cement get stale otherwise bad splices will result.

(d) FILM STORAGE CABINETS—These should take the spooled-up programme and each compartment should be able to be easily marked with the part numbers.

(e) A BENCH for mounting the rewinder and inspecting the film. This should always be kept clean and tidy.

Today's Film Handling Equipment makes the task of projectionists much easier. Modern-styled, compact, all-metal rewind benches are used. These have plastic tops and incorporate all the equipment mentioned above. They also include other refinements; with this type of bench cleanliness is no problem.



The latest type of REWINDERS enable unspooled film to be spooled up at the beginning of a week's programme, and spooled off at the end. This is achieved by means of a plate fitted with a $\frac{3}{4}$-in. boss able to take the film directly, or with an adaptor to take film wound on plastic cores. In conjunction with the plate a film keep is used which stops the film from running off. Both plate and keep are interchangeable between geared and idling ends.

The latest hand SPLICERS now have a built-in preset scraper. This obviates the use of files, razor blades, penknives, etc. These splicers are dry splicers and do not need to have the emulsion wet prior to scraping.

On the modern Rewind Benches a FILM WAXER is provided for automatically edge-waxing green prints during rewinding. A hard type of wax is used which is put on the perforation area. This softens when passing through the projector gate and provides perfect lubrication. Also available is a FILM MEASURER comprising a sprocket geared to a counter which gives an instant check on the footage of any

film. On the modern rewind table both these pieces of equipment automatically line up with the film path between the rewinders. This is essential to prevent film damage.

A cabinet for storing up to 12 2,000 ft. reels fits underneath this bench, and drawer space and other spool storage space is also incorporated, thus giving compact and versatile facilities.

Cueing film can be done by using a Cue Dot Marker which automatically registers the film prior to scribing it. A special tool is provided for scribing four rings to the B.S.I. standard without damaging the film. Using this type of machine avoids the mutilation which can and does occur using other methods.

Keeping all this equipment in good running order is easy, all that has to be done is to lubricate the moving parts periodically and keep the rest of it perfectly clean.

Whatever the technique, whether it be CinemaScope, Todd-AO, Cinerama, 3-D, etc., the film handling equipment in the projection box remains basically the same. With larger size film, rewinders are available to take up to 25 in. diameter spools, splicers to take the wider film, and storage cabinets to take the bigger spools.

Whatever new innovations come into the projection box the basic essentials remain, and the cardinal rules still apply—CLEANLINESS—CARE—COMMON SENSE.

DATA SHEET No. 18 – Issued by the PICTURE PRESENTATION COMMITTEE of the BRITISH KINEMATOGRAPH SOCIETY

Sponsored by the B.K.S. PICTURE PRESENTATION COMMITTEE

The Positive Release Print in Colour

Colour has a very important effect on our lives—it stimulates the emotions, can cause pleasure or depression, the sensations of warmth or cold, act as a warning of danger or a guide to safety, consequently we have learnt to associate certain colours with certain matters.

In motion-picture entertainment colour also plays a very important part and is used to stimulate a feeling of excitement and well-being. In normal life vivid colours are not predominant and, of course, there are two schools of thought as to whether colour in motion-pictures should be portrayed faithfully as in real life or accentuated in order to stimulate the emotions and provide a needed contrast to a relatively drab existence, which after all is the purpose of motion-picture entertainment.

The science of colour is somewhat complex and perhaps even at this time an accurate description is very difficult to set down and even more difficult to grasp with complete understanding.

A short summary of facts that have a bearing on the ultimate presentation of a motion-picture on the cinema screen is a better way of dealing with the subject here and reference can be made to many books and technical articles by those who want to go further in detail.

We know that " white " light is actually a specific combination of certain colours which together form the visible spectrum and that these individual colours may easily be separated and recombined.

The " visible " spectrum is composed of violet, blue, green, yellow, orange and red in that order and combination of these colours in varying proportions produces a nearly inexhaustible range of hues.

In the presentation of a motion-picture, you have a positive release print in which the colours are in the form of dyes, and the nature of the projection light source and the intensity of the illumination can make or break the presentation colour-wise. Even the surface characteristics of the screen and its light reflecting properties have some bearing on the ultimate result which the patron sees. In preparing a colour release print great care is taken to make the print of such quality that the colours will show to best advantage under average projection light source.

There are two main colour film systems, the additive and subtractive, but the additive system fails because it is not possible under present circumstances to get enough light through the system to give adequate screen illumination for the large picture sizes of today. Consequently no additive systems are in commercial use.

Subtractive processes on the other hand utilise a normal type of release print with coloured film frames and projection of such a print becomes as simple as the projection of black-and-white print. Eastman Color, Anscocolor, Technicolor, Agfacolor, Gevacolor, Ferraniacolor and Sovcolor are all familiar names to a Projectionist and are all examples of subtractive processes. All these systems, with the exception of Technicolor, obtain their dye images by use of " colour couplers " in the emulsion. Technicolor dye images are produced by a transfer of the dyes from matrix films by the imbibition process.

Colour films with dye images have different projection characteristics from black-and-white prints in terms of heat absorption. The silver image of black-and-white film absorbs the visible light more than it does infra red. This means for example while a black-and-white film may absorb most infra red heat rays in its densest portions, colour prints will mostly transmit them, the result being a cooler film with less tendency to focus troubles through buckling.

In all other respects colour prints may be regarded as behaving similarly to black-and-white, but adherence to recommended screen brightness levels is even more important for prints in colour than in black-and-white. Too high a screen brightness results in a washed-out appearance to the colours: on the other hand if the brightness is too low the colours look " sooty " and degraded.

Colour is one of the great advantages that we have over other competitive systems of motion-pictures and market research has indicated that the public know this fact and express their preference by going to see such films in larger numbers.

To press our advantage, we need consistently good presentation of colour films.

DATA SHEET No. 19 – Issued by the PICTURE PRESENTATION COMMITTEE of the BRITISH KINEMATOGRAPH SOCIETY

Sponsored by the BRITISH ARC LAMP CARBON MANUFACTURERS' ASSOCIATION

Light–The Life Force of Picture Presentation

The light which is projected into the auditorium is one of the vital factors in cinema presentation. Its intensity, colour and stability establish picture quality and unless these factors are properly obtained and maintained the whole artistry embodied in the film being projected can be lost as far as the patron is concerned.

Although in the last few years other light sources have made their appearance in the cinema, the carbon arc is still firmly established as the source of light for 35 mm. cinema projection in the modern manner.

Today, with the development of large wide screen techniques it is more than ever essential that every part of the projection equipment is kept in the peak of condition.

The paths which light rays have to travel are rather tortuous before the radiant energy which leaves the crater of the arc finally reaches the retina of a patron's eye. If we study this path of light it gives us some guidance as to maintaining the standard of performance required today.

The Carbon Arc Light Source

Most arcs in use today are supplied with Direct Current, the crater produced on the end of the positive carbon being used as the source of light. From this crater, radiation is emitted of great intensity and with a colour similar to sunlight.

Provided the arc gap and electrical supply are maintained constant the candlepower of the light source will remain consistent throughout the life of the carbon. This reproducibility of the carbon arc is a well known property and at one time was considered as a standard source of light intensity.

There are, however, factors which can influence this consistency, mainly maladjusted arc gaps and the electrical supply to the arc.

The modern arc lamp is designed to burn the carbons correctly with a minimum of attention. If automatic feeds are functioning correctly and are properly adjusted the arc will run with virtually no attention.

Once positive and negative feed rates are adjusted to suit the burning conditions of the arc, negligible adjustment of manual controls should be required if the electrical supply to the arc remains constant.

If continuous fiddling with the knobs is necessary, attention should be paid to the alignment of carbon holders and feed guides, slipping clutches, too coarse adjustment of controls, erratic motor feed, possibly due to faulty potentiometer control.

All rectifiers should have a fine control around the normal working conditions of the arc to enable corrections to be applied to mains voltage variations.

The Mirror

The light from the crater is focused to the film aperture in most arc lamps by an elliptical mirror, which can be tilted in two planes. Once set in correct alignment this should rarely need adjustment, except after cleaning or mirror replacement.

The surface of the mirror at which some light losses occur should be maintained clean—see separate instructions on this. The mirror has two distinct foci, at one is maintained the positive crater—the film aperture is at the longer focus.

It is essential that the positive crater is maintained at its focal point. See that the arc image card line indicating the positive position coincides with the correct focal position, otherwise blue or brown screen light will be obtained with attendant light losses.

The Flicker Shutter

At this point approximately 50% of the light is lost. This is a function of flicker shutter design—there is no control over this.

The Film Aperture

Here again light losses occur due to covering a rectangular aperture with a circular spot of light. The introduction of wide screen apertures with cropped gates have made these losses greater.

The Projection Lens

Further light losses are inevitable at the lens and anamorphic attachments. These are a function of lens design and are beyond control.

The Porthole Glass

Loss of light of the order of 12% usually occurs at the porthole glass. This can be made worse if allowed to get dirty with dust deposits.

Atmospheric Absorption

Fog and smoke in the auditorium seriously influence the brightness of the picture. Full advantage of arc flexibility should be taken and the arc run at a higher current to offset these losses when they occur.

Screen Reflectivity

At the screen the light produced by the projector is converted to a sensation of brightness to the patron. However powerful the projector the screen surface has the final say as to what the customer sees. The general use of metallised screen surfaces has given additional problems to the projection engineer and because of the variation in reflectivity with angle of view it has become necessary to curve the screen to give a better uniformity of brightness from side to centre.

What we are aiming to do

Light loss under one of the above headings is bad enough, but when two or more light losses are added together the total loss can do great harm to your picture presentation. From the foregoing considerations of the light path it is clear that in a number of instances it is possible to exercise some control over the ultimate screen brightness and constant checking and scrupulous cleanliness of all glass surfaces will help in this direction.

In 1947 the British Standards Institution established the limits of screen brightness for 35 mm. film projection. This was established at between 8 and 16 foot-lamberts at the centre of the screen as observed from any seat in the auditorium.

There is no simple way to check screen brightness without special instruments. Service engineers have this equipment and are prepared to make the necessary measurements.

Take advantage of this service. Get British-Standards-conscious. Aim to achieve the standard and then aim to maintain it.

DATA SHEET No. 20 – Issued by the PICTURE PRESENTATION COMMITTEE of the BRITISH KINEMATOGRAPH SOCIETY

Sponsored by the BRITISH ARC LAMP CARBON MANUFACTURERS ASSOCIATION

Projector Light Outputs

The Picture Presentation Committee requested us to provide tables of projector light outputs from D.C. High Intensity Carbons and approximate Burning Rates as a rough guide to indicate what can be expected.

The figures quoted in the following tables have necessarily been obtained under controlled laboratory conditions and without taking into account the light loss of the film-mechanism shutter. They are therefore given as an indication of what can be expected by way of light output from arc-lamps of the orthodox straight-arc and rotating-positive types under *virtually ideal conditions*.

In practical theatre operation there are many factors which will lower these ideal figures and in any case you have to make an immediate reduction to one-half to allow for the rotating film-mechanism shutter which is always operating when light readings are taken in cinemas.

The lens used on the test figures was a surface-coated type with an " f " value of 1.9 and the type and speed of your own lens may seriously reduce the figures applicable to your cinema. So may the condition of lenses, porthole glasses and a host of other items.

The figures therefore must be considered only as a guide as was the intention of the Presentation Committee.

CARBONS		BURNING CONDITIONS		APPROXIMATE BURNING RATE IN. PER HOUR		SCREEN LUMENS
Positive	Negative	Amps	Arc Volts	Pos.	Neg.	f1.9 Bloomed
COPPER COVERED						
6 mm. LINK CA	5 mm. LINK NC	30	31	6.	4.125	8,150
		35	34	9.	4.375	8,650
		40	37	13.25	4.5	10,400
6 mm. LINK CC	5 mm. LINK NC	35	32	8.	4.375	7,120
		40	35	11.5	4.5	9,800
		45	38	15.25	4.625	11,100
7 mm. LINK CA	6 mm. LINK NC	40	34/5	7.75	3.25	9,200
		45	37	10.75	3.5	11,750
		50	39/40	15.25	3.75	13,950
7 mm. LINK CC	6 mm. LINK NC	45	33/4	8.	3.5	10,600
		50	36/7	10.75	3.75	12,750
		55	38/9	14.75	4.	15,080
8 mm. LINK CA	7 mm. LINK NC	50	39/40	7.5	2.875	12,250
		55	41/2	10.	3.	14,450
		60	44	12.5	3.25	16,750
		65	46	16.5	3.5	18,400
8 mm. LINK CC	7 mm. LINK NC	55	40	8.5	3.	13,100
		60	41	10.5	3.25	15,100
		65	43	13.25	3.5	16,800
		70	45	16.25	3.75	18,600
8 mm. LINK CD	7 mm. LINK NC	70	44/5	11.	3.25	18,400
		75	46/7	13.25	3.625	21,100
		80	48/9	18.	4.	23,000
9 mm. LINK CA	7 mm. LINK NC	60	41	8.5	3.25	13,500
		65	43	10.5	3.5	15,000
		70	47/8	15.	3.75	18,200
9 mm. LINK CC	8 mm. LINK NC	70	45	10.	3.	15,900
		75	47	12.25	3.125	18,150
		80	50	14.75	3.25	20,100

CARBONS		BURNING CONDITIONS		APPROXIMATE BURNING RATE IN. PER HOUR		SCREEN LUMENS
Positive	Negative	Amps	Arc Volts	Pos.	Neg.	f1.9 Bloomed
UNCOPPERED ROTATING						
9 mm. LINK BC	8 mm. LINK NC	75	49	11.25	2.75	16,000
		80	51	13.	3.	18,500
		85	53	15.5	3.25	19,500
10 mm. LINK BC	9 mm. LINK NC	85	52	8.75	3.	18,000
		90	54	10.5	3.125	19,000
		95	56	13.5	3.25	21,000
		100	58	16.5	3.375	23,000
11 mm. LINK BC	9 mm. LINK NC	100	57	11.5	2.5	19,000
		105	59	12.75	2.625	20,500
		110	61	14.5	2.75	23,000
		115	62	18.	3.	26,000
9 mm. LINK BD	8 mm. LINK NC	80	52/3	9.5	3.	16,500
		85	54/5	11.75	3.125	19,000
		90	56	13.75	3.25	20,500
		95	57	16.5	3.375	22,000
10 mm. LINK BD	9 mm. LINK NC	100	56	11.	2.5	20,500
		105	58	14.25	2.625	21,500
		110	60	17.	2.75	24,000
		115	62	19.75	3.	26,000
11 mm. LINK BD	9 mm. LINK ND	115	54	11.	3.	22,000
		120	56	13.5	3.25	25,500
		125	58	15.75	3.25	27,000
		130	60	19.	3.5	29,000
13.6 mm. LINK BD	11 mm. LINK NC	130	62	6.5	2.125	19,000
		135	64	8.	2.25	20,500
		140	66	10.	2.375	22,000
		145	68	11.5	2.625	24,000
		150	70	13.	2.75	26,500
		160	72	16.	3.	29,000

DATA SHEET No. 21 – Issued by the PICTURE PRESENTATION COMMITTEE of the BRITISH KINEMATOGRAPH SOCIETY

Sponsored by the BRITISH ARC LAMP CARBON MANUFACTURERS' ASSOCIATION

The Carbon-Arc Light Source– The Correct Trim and the Correct Gap

These two items are of the utmost importance in obtaining that better film presentation which the carbon arc can provide.

The Correct Gap

As is already well known, it is essential to burn a carbon arc on a D.C. supply which contains some form of ballast resistance in the circuit.

The reason for this is that if we measure the resistance of any arc at different currents we find that as the current increases so the arc resistance decreases. This would mean that if we attempted to run an arc at, say, 40 volts from a supply of 40 volts, any slight change in the arc due to feeding or disturbance of the flame by draughts would cause the current to either increase beyond the limits of the carbon electrodes or decrease rapidly so that the arc is extinguished.

This disturbing effect is removed if the electric supply contains some form of ballast, e.g. a series resistance in circuit with a supply of higher voltage than the arc voltage.

The simplest arrangement of this is illustrated in Fig. 1 showing a 60 ampere arc burning at 40 arc volts from a 70 volt D.C. supply through a ballast resistance. The volt drop across the ballast resistance must be 30 volts as the sum of this voltage and the arc voltage must equal the original line voltage. Applying Ohms law which states current $= \frac{\text{voltage}}{\text{resistance}}$ we can calculate that the arc resistance is $\frac{2}{3}$ Ohms and the ballast resistance 3/7 Ohms.

This simple circuit arrangement can be reproduced with unit type rectifiers in which the ballasting is produced in other ways, but as the performance of the arc is controlled in the same manner, as if it were run in series with a resistance, this discussion still applies.

Now the arc resistance not only depends on the current flowing through it, but also on the arc gap between the positive and negative electrodes and to some extent on the magnetic control of the arc lamp.

The wider the arc gap the higher the arc voltage at the same current. Little or no magnetic control on the flame tends to produce more overlapping of the flame round the top of the positive carbon giving a lower arc voltage and correspondingly lower resistance. Conversely, the less the flame overlaps the higher the arc voltage and arc resistance becomes. These magnetic control effects are, however, rather small in comparison with the changes produced by variations in arc gap which can influence the arc voltage by several volts.

It should be realised here that the arc establishes its own resistance at a given current so that provided the electrical supply voltage and its associated ballasting is sufficient to maintain the arc, the arc voltage will be the same in a particular lamp at the same current and arc gap irrespective of the line voltage. It simply means, referring to Fig. 1, that the higher the line voltage the greater the volt drop in the ballast resistance, the arc voltage remaining the same.

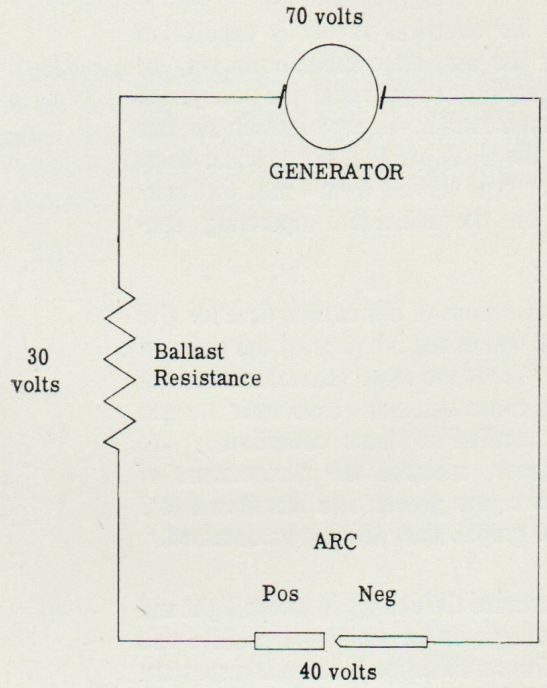


Fig. 1

Naturally if the current is to remain the same, a higher ballast resistance would be necessary for a higher line voltage, and conversely, a lower line voltage requires a smaller ballast resistance.

The relation between line voltage and arc voltage, however, does affect the electrical conditions at the arc when the arc gap is changed.

Obviously for a low line voltage the variation of arc resistance by changing the arc gap must produce a more violent change in electrical conditions at the arc since the percentage change of total resistance in the circuit would be more with the lower ballast resistance than for a high line voltage with correspondingly higher ballast.

This means that for equivalent low line voltages the striking current would be high and the arc is likely to become extinguished quicker if the arc gap is too wide. However, with a suitably responsive automatic feed mechanism on the arc lamp a satisfactory performance of the arc can be maintained with an improvement in electrical running costs as less energy is dissipated in the ballast. The variation of the ammeter and arc voltmeter pointers during the burning of the arc under these low line voltage conditions are more noticeable, although no serious effect on the screen light is evident.

For high line voltages with more ballasting in the circuit the arc current does not vary so violently with small arc gap changes, but of course there is a greater electrical loss in the ballast. The striking current is lower and the arc may be run at a wider gap without becoming extinguished. It has been observed that the tendency for an underloaded arc to "surge," i.e., the Beck effect at the crater is periodically lost, is more likely to occur with a high line voltage system than a low one.

Provided the electrical supply is capable of maintaining the arc, all combinations may be burned at varying arc gaps and arc voltages at the same current, and in our experience in markets throughout the world we find our product being burned at arc gaps varying from 4 mm. to 8 mm. depending on the individual operating conditions.

In the publications of our carbon data we give performance figures for arc gaps of the order of 6 to 7 mm. These are more general methods of burning and most arc lamps have their arc gap indications marked to these conditions. We have, of course, explored the performance of carbons at arc gaps greater and less than 6 to 7 mm. and the graphs show the results obtained.

Fig. 2 illustrates the change in screen light and positive burning rate for an 8 mm. positive and 7 mm. negative combination burning at a constant amperage at varying arc gaps. The change in light output from the smallest to the largest gap is some 12 per cent., a corresponding increase in positive burning rate also being found as the gap increases.

Naturally as the arc gap is increased the longer arc flame becomes more influenced by draughts in the lamphouse, while at the short gap the obscuration of the crater by the negative point becomes more apparent. At the shorter gap, carbide deposits on the negative tip also become more noticeable.

Under these conditions of test the burning rate of the negative carbon also increases slightly with the arc gap, but this increase is small enough to be ignored in practice.

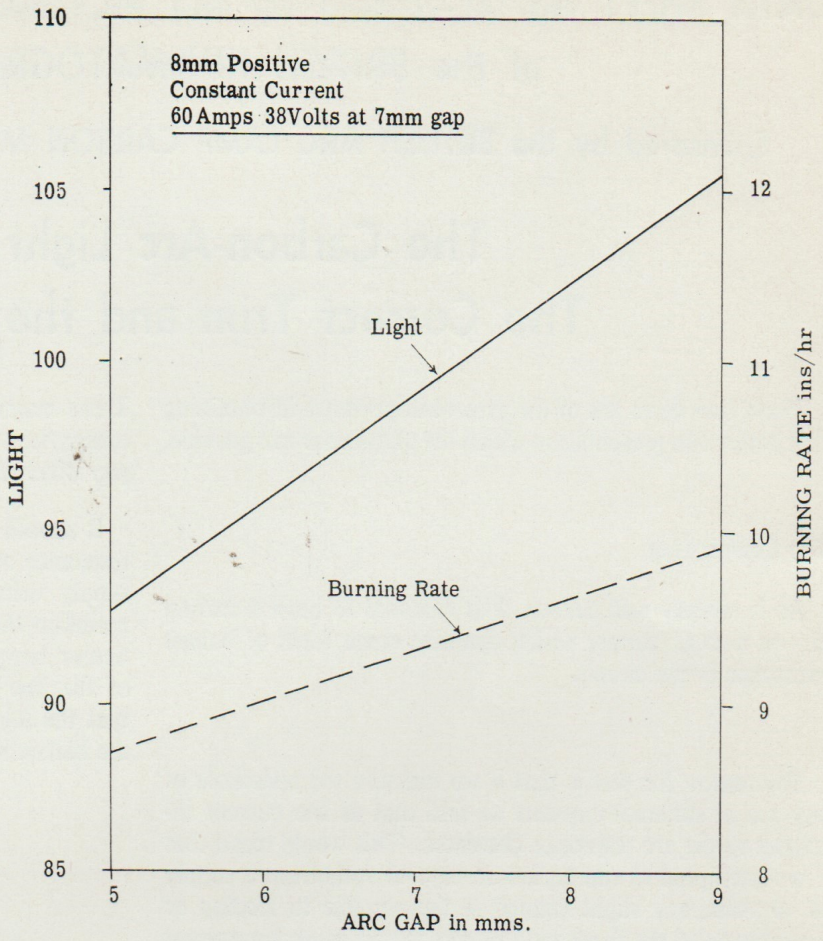


Fig. 2

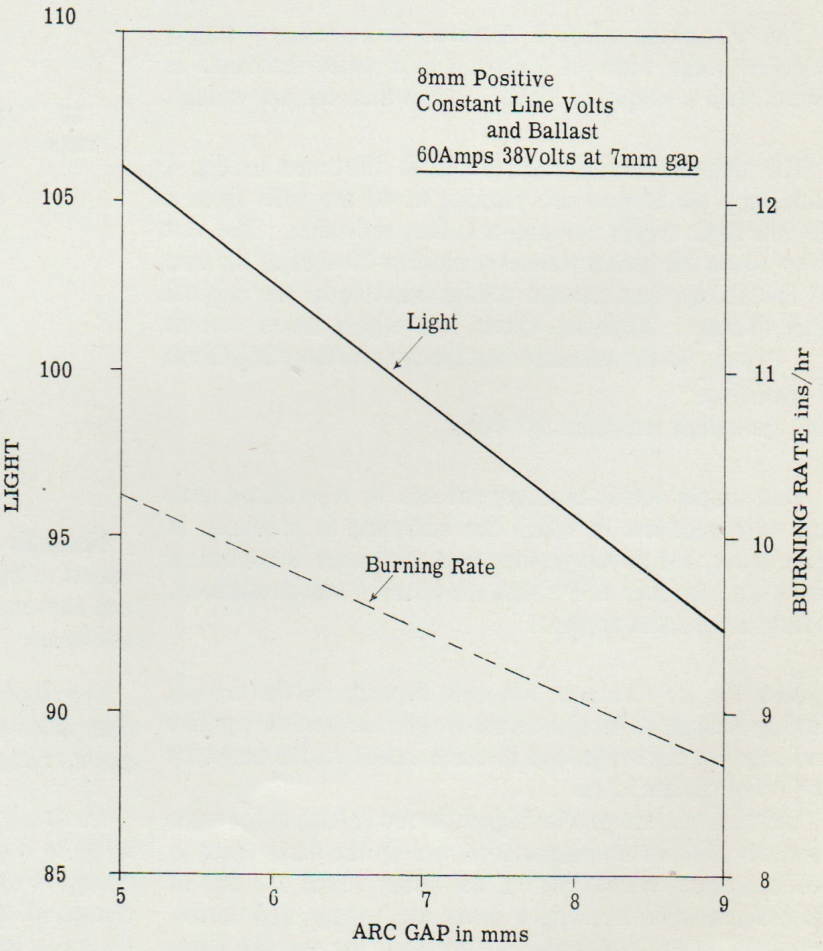


Fig. 3

It is apparent from the curves illustrated that, at a constant current, an increase in arc gap gives a measurable increase in screen light and positive carbon burning rate, which may be attributed to the increase in wattage at the arc. Bearing in mind the general stability of the arc, the normally used arc gap of 7 mm. is a reasonable choice giving some 5 per cent. less light than the wide gap with a correspondingly small reduction in positive burning rate and a more stable flame formation.

Fig. 3 illustrates the variations in the positive burning rate and screen light from the same combination of carbons when the ballast resistance and supply voltage remain constant. These conditions are such that as the arc gap is shortened the current rises and the arc voltage is reduced—and vice versa. The wattage at the arc remains approximately the same at the different arc gaps.

Starting from the 7 mm. gap it is evident that closing the arc to a 5 mm. gap increases the light by some 6 per cent., while at the same time the positive burning rate is increased by the same amount. As the gap is increased from 7 mm. to 9 mm. a fall in screen light of some 8 per cent. is observed with a corresponding reduction in positive burning rate and a greater susceptibility of the arc flame to draughts.

Correct Trim

Morganite projection carbons are produced to cover current ranges from 10 to 160 amperes within which are trims of carbons capable of servicing every set of operating conditions required by projectionists in the United Kingdom. In order to obtain optimum satisfaction from the carbons it is essential to select that trim which ideally matches the conditions available and the requirements needed.

It is our firm opinion confirmed over many years of experience that carbons should never be operated at the extreme limits of recommended current ranges. It is advisable to burn them nearer to the middle of the range. This will then take care of voltage variations to which the incoming supply is prone. It also gives that reserve for additional light which is extremely useful when there are smoke-laden or foggy atmospheres or, should the current become reduced due to incoming supply variations the carbons would still be comfortably within their safe current rating.

Initially the choice of trim should be made to give adequate brightness or luminance of the screen. This, of course, depends on the light falling on the screen, the size of the picture and the reflective properties of the screen surface. The final choice, however, depends on the current available and the general ease of handling the trim.

The carbon manufacturer's literature gives guidance regarding the selection of suitable combinations of carbons, and further, there are available the services of qualified engineers to give advice and personal attention where the correct trim is in doubt.

DATA SHEET No. 22 – Issued by the PICTURE PRESENTATION COMMITTEE of the BRITISH KINEMATOGRAPH SOCIETY

Sponsored by the BRITISH ARC LAMP CARBON MANUFACTURERS' ASSOCIATION

'Carbon Electrodes and Operating Conditions'

Carbon electrodes have many applications apart from their use in cinematograph film projection. For example, they are employed in arc lamps for plan reproduction, photographic studio lighting, photo-printing, film studio lighting, therapeutic treatment and spectrographic purposes to name but a few.

For each of these applications carbons are produced to specific formulations so that they serve the particular purpose intended. And for projectionists to obtain that satisfaction in use for which the carbons were designed they should be operated within the manufacturer's recommended conditions.

The basic requirements of a light source for cinematograph film projection may be summarised as follows:—

(a) High source brightness.

(b) Symmetry of brightness over the area which is utilised optically.

(c) Reproducibility of light emission from day to day.

(d) Satisfactory spectral emission for the projection of colour films.

All these requirements are obtained from the carbon arc, provided the carbons are correctly operated. A schedule of operating conditions is shown below.

High Intensity

D.C. Copper Covered Positive

	Diameter	*Amperes*	*Arc Volts*
Link CA: A copper covered carbon having a core impregnated with rare earths, providing a high light output in limited electrical conditions.	6 mm.	30–40	27/34
	7 mm.	40–50	32/40
	8 mm.	50–65	38/46
	9 mm.	60–70	40/44
	10 mm.	70–85	42/50
	11 mm.	80–90	46/56
Link CC: A positive designed for high current densities. Gives an exceptionally high light output with a low rate of burning. Normally operates at five amperes higher than Link CA grade.	6 mm.	35–45	31/37
	7 mm.	45–55	34/39
	8 mm.	55–70	41/46
	9 mm.	70–80	41/46
	10 mm.	80–90	48/52
	11 mm.	85–95	48/58
	12 mm.	90–100	50/60
Link CD: Is a grade of positive specially produced for use in the modern high powered mirror arcs.	8 mm.	70–85	44/50
	9 mm.	80–95	48/54
	10 mm.	95–110	50/56

D.C. Plain Rotating Positive

	Diameter	*Amperes*	*Arc Volts*
Link BC: A positive employed in lamps where the electrical contact is close to the crater of the carbon. Is the standard positive of this class.	9 mm.	75–85	49/53
	10 mm.	85–100	52/58
	11 mm.	100–115	57/62
Link BD: A rotating positive carbon having a shell and core designed to carry higher currents than Link BC grade.	9 mm.	80–95	52/57
	10 mm.	100–115	56/62
	11 mm.	115–130	54/60
	13.6 mm.	130–160	62/72

D.C. Copper Covered Negative

Link NC: A copper covered negative, the standard for use with most grades of D.C. high intensity positive carbons.	5 mm.	30–45
	6 mm.	40–55
	6.5 mm.	50–60
	7 mm.	55–70
	8 mm.	75–95
	9 mm.	100–115
	10 mm.	125–135
	11 mm.	130–150
Link ND: A negative carbon made to withstand the high current loadings demanded by the arc lamps employed in Todd-AO, Cinerama, Drive-in and other forms of panoramic film presentation.	8 mm.	95–110
	9 mm.	115–130
	11 mm.	130–160

High Intensity A.C. Carbons

Link AC: The standard high intensity carbon for use on A.C. lamps. Copper covered and designed for stability, low burning rate, wide current range and high light output.	7 mm.	55–70	21/24
	8 mm.	70–90	23/27
	9 mm.	90–100	24/27

Low Intensity

Link LP: Is a plain positive carbon having a smooth shell with a soft squirted core giving a good steady light at a very low rate of burning.

Low Intensity—*continued*	*Diameter*	*Amperes*	*Arc Volts*
Link LQ: A negative carbon with a plain shell and a copper covered core.	10 mm. Pos. / 7 mm. Neg.	10–20	48/52
	12 mm. Pos. / 8 mm. Neg.	15–30	48/52
	14 mm. Pos. / 9 mm. Neg.	25–40	48/52

Stage and Spot Lighting

			Approx.
Link OWF: A white flame carbon having a clean hard shell of high conductivity and a core impregnated with rare earths to give a white light of perfect colour balance and high emission efficiency on A.C. supply.	14 mm.	30–40	40
	16 mm.	40–50	40
	18 mm.	50–60	40
	20 mm.	60–70	40
	22 mm.	70–80	45
	25 mm.	80–85	45
Link SP: A cored uncoppered positive carbon specially designed for use in D.C. Spotlights and Stage Arcs.	14 mm.	25–35	48/52
	16 mm.	35–45	48/52
	18 mm.	45–55	48/52
	20 mm.	55–65	48/52
	22 mm.	65–75	48/52
	25 mm.	75–85	48/52
Link SC: A negative carbon, cored and copper covered to be used in combination with the Link SP positive at high current densities on D.C.	10 mm.	45–65	
	11 mm.	60–75	
	12 mm.	70–85	
Link SQ: Is a negative with a plain shell and a copper core, used with the SP positive for all normal D.C. stage lighting and spotlighting work.	9 mm.	25–35	
	10 mm.	35–45	
	11 mm.	40–50	
	12 mm.	45–55	
	14 mm.	55–65	

Operating Precautions

Keep Your Carbons Dry

A great deal of care and attention is taken by the manufacturers to ensure that carbons leave their factory dry. One of the main reasons for enclosing carbons in polythene bags before packing is to achieve this end. However, carbons will absorb moisture if stored in a damp place and spluttering at the arc will result. The practice of some projectionists of laying a few carbons in the lamphouse or on top of radiators before burning is to be commended. It is also a good practice to use carbons in rotation, i.e., finish old stocks before starting on the new. Carbons are not perishable and even if they should become damp, when dried out they will be as good as before.

Give Your Trim Time to Burn In.

For a short period after striking the arc on a new trim, materials are fed into the arc stream at a rate faster than normal. As a result small particles of soot or solids can be thrown from the crater area. Where a dowser can be used this helps to keep these particles off the mirror and after a few seconds when the carbons have settled in, it can be raised. In some cases semi-automation devices render this form of protection impossible and striking is also carried out on full load very successfully.

Avoid Carbon Breakage

Some clamping devices are such that too firm a pressure on the clamping area will crack the carbon under the copper coating. These cracks can become escape areas for the crater gases when the arc burns the copper away and uneven screen light is the result.

Dropping a copper-covered carbon on a hard surfaced floor may cause a breakage in the carbon which is not discovered until the protective copper is burned away at the arc.

Carbons are robust enough to stand up to normal handling and it is only abnormal treatment which results in carbon breakages—handle your carbons with care.

Keep Carbon Holders Clean

Carbon holders must be kept clean and their contact with the carbons firm. Frequent and careful attention should be given to ensure that holders are free of all effects of corrosion or burning so that smooth, firm contact of the area is maintained. Defective contacts between carbon and holder can be a cause of local heating, spindling or arc instability.

Likewise, it is essential that feed rollers in rotating positive type arc lamps be kept clean and in good condition to ensure steady and accurate rotation of the positive to maintain a symmetrical crater and prevent improper feeding.

Burn your carbons within the recommended current ranges listed and they will serve you well.

DATA SHEET No. 23 – Issued by the PICTURE PRESENTATION COMMITTEE
of the BRITISH KINEMATOGRAPH SOCIETY
Sponsored by AEI SOUND EQUIPMENT LTD., MOLE-RICHARDSON (ENGLAND) LTD., and the
G.B.-KALEE DIVISION of RANK PRECISION INDUSTRIES LIMITED

The Xenon and Discharge Light Sources

The Xenon Arc discharge, in the compact form required for film projection, is essentially a high current low voltage arc and there are two main types at present in use, the three electrode, of British design, and the two electrode, of both Continental and British design.

The Xenon lamp forms an important advance towards automation, as once set initially no adjustments are required and there is virtually no maintenance other than changing lamps at long intervals.

Since the Xenon Lamp is a sealed-off device with rigid fixing of the electrodes in a quartz bulb, it is not practicable to strike the arc in the usual way by touching the electrodes together and then withdrawing them once the arc has formed, as is done with carbons.

Instead, it is necessary to ionise the Xenon gas between the electrodes to form a conducting path to allow the discharge to pass.

The Xenon gas filling of the bulb is at a pressure of several atmospheres (in order to obtain adequate brightness), so that it is necessary to provide a high voltage between the electrodes in order to ionise the gas and allow the arc to strike, and this high voltage has to be removed immediately the arc has struck.

For a two electrode lamp, where the Xenon has to be ionised over the whole length of the gap between the electrodes, this high voltage is of the order of 40,000 volts, while for the three electrode lamp with its much smaller starting gap, the voltage is around 5,000 volts.

This starting voltage is provided by the starting unit in the form of high voltage pulses from specially designed equipment which is normally very reliable.

Under no circumstances should the projectionist interfere with the pulse starting gear.

The Two-electrode Xenon Lamp

The two electrode Xenon lamp can only be run very nearly vertically, whereas the three electrode British lamp will run in any position and, in particular, will run horizontally.

The main reason for this is that it is impractical to start a two electrode lamp in any but the vertical position, as it either will not strike at all or the arc will extinguish immediately after striking in a large percentage of cases.

The Three-electrode Xenon Lamp

On the other hand, the three electrode lamp is able to be run in any position, including horizontal, as it has an extra electrode—the probe—used for starting purposes only, with a very small gap between it and the cathode so that the probe arc will strike every time.

Once the probe arc is struck, this ionises the Xenon in the main gap and the latter then strikes, and as soon as it does so, a relay in the starter unit is operated which cuts out the probe arc and the high voltage pulse.

Optical Requirements

The light from the Xenon lamp does not, as with a carbon arc, come from a crater in the positive electrode, but from the arc itself, being mainly concentrated in a "cathode spot" near the negative electrode, although the rest of the arc flame does contribute some usable proportion of the total light.

For this reason the optical systems used with the Xenon differ in detail from those used in carbon arcs as the magnification and collection angle required are not the same.

With a horizontal burning Xenon lamp, it is possible to use a single mirror and as the light is produced in more than a hemisphere, the mirror is arranged to envelop the arc, resulting in a deep mirror.

The single mirror system has the advantages of giving a symmetrical light distribution on the screen and of requiring only the two normal mirror adjustments—horizontal and vertical.

Replacement Adjustments

Since the arc is on the mirror axis and has an appreciable length, the resulting image at the gate will have considerable depth along the axis, and since the arc is not uniform, this will result in variation in light distribution across the screen as the lamp is moved along the axis for focusing.

The total light to the screen does not vary by more than a few per cent over a range of positions near focus and the best focus position is one which gives a side to centre ratio of 60% or a little better.

A rough and ready rule which will be found useful if a lamp has to be changed quickly is to find the position of maximum peakiness of light in the centre of the screen and then move the lamp *AWAY* from the mirror by one half turn of the focusing screw.

It is unwise to leave the lamp in the maximum peaky position for long as it is possible to cause slight damage to a very dark film by so doing.

In any case, once the lamp is correctly set up and focused, it is NOT necessary to touch either focusing or mirror controls throughout the life of the lamp and this applies to either the two or the three electrode lamp.

For this reason, these controls are not brought outside the lantern, as is done with carbon arcs.

Precautions

The Xenon Lamp is filled with Xenon gas at a pressure of about four atmospheres (three electrode) or about six or eight atmospheres (two electrode) and the pressure increases by a factor of about two-and-a-half when the lamp is hot. (One atmosphere represents 15 lb. to the square inch.)

For this reason, it must always be operated in an enclosed lamphouse and interlocks must be fitted to the lamphouse to cut off power supplies when the lamphouse door is opened.

When handling or changing the lamp, it should always be kept in its protective covering of canvas or plastic unit, which also serves the secondary purpose of keeping the bulb clean. Goggles should always be worn when looking at an exposed bulb—i.e., when putting on the safety cover.

The bulb should never he handled direct—the natural oils of the fingers, unless carefully removed before operation of the lamp—may be burnt in and impair the transparency of the fused silica envelope and thus shorten the effective life of the lamp. (If any such marks are made they can be removed by carefully cleaning with a detergent in water, followed by alcohol—surgical spirit—which should be allowed to evaporate.)

Adjustments for Vertical Two-electrode Lamps

The two electrode Xenon lamp, which must run vertically, uses a double mirror system.

The rear mirror is an ellipsoidal similar to that used in a carbon arc and the front mirror is a spherical mirror used close to the lamp and its function is to return the forward emitted light from the lamp (which would otherwise be lost) back through the bulb on to the rear mirror.

The rear mirror has the normal horizontal and vertical controls, but as the front spherical mirror must be aligned to the optical projection axis and in addition must accurately superimpose the arc image on the actual arc, three controls for this mirror are required and in addition provision must be made for adjusting the height of the lamp so that the correct part of the arc is on the optical axis.

The lining up procedure for the vertical Xenon Lamp is thus more elaborate than that of a single mirror horizontal lamp, but once aligned the adjustments should hold for the life of the lamp.

In either case, the lining up procedure will be given in the Instruction Book provided by the lantern manufacturers. Xenon Lamps at present in use range in rating from 1 kilowatt to 2 kilowatts, but more powerful lamps ranging up to 3 kilowatts, which will all be of the two electrode vertical burning type, will be in use in the near future.

Care of Mirrors

Since the Xenon Lamp is an enclosed arc, there are no arc fumes or metallic droplets to damage the surface of the mirrors.

Mirrors will, however, eventually deteriorate, due to heat on the reflecting surface, but since the front face of the mirror is not pitted, a re-silvered mirror will be in all respects as good as a new one, always provided that there are no cracks.

Power Supplies

The Xenon Lamp requires a D.C. supply with not more than 5% r.m.s. *current* ripple, otherwise the useful lamp life is likely to be shortened by the formation of pips on the electrodes, which lead to instability.

In general, this is taken care of on installation either by the supply of a specially designed rectifier or by suitable additional smoothing filters on an existing rectifier, if this will supply the necessary current.

The Pulsed Discharge Lamp

The pulsed discharge lamp consists of a quartz tube, $3\frac{1}{8}$ inches long and pencil thin at only 7/32nd of an inch diameter. This type of discharge lamp is driven by a pulsating direct current of 72 impulses per second or three impulses per film frame. Under working conditions the pulsed discharge lamp is contained in a fully sealed holder in which it is surrounded by a flow of cooling water.

Power Supplies

The pulsed discharge lamp is fed from a pulsator unit, which is similar to a small rectifier and can be loaded up to 800 watts. The average life of the very inexpensive lamp is 33 hours under full load. At lower loads the life is very considerably extended.

Optical Requirements

Since the lamp is very small and may be placed without danger in the immediate vicinity of the film gate, the optical system can be similarly small and consists of a cylindrical reflector about $\frac{7}{16}$ of an inch by $\frac{3}{8}$ of an inch and two small lenses, which accounts for the high side-to-centre ratio of screen illumination.

Replacement Adjustments

Because of the relatively short life of the pulsed discharge lamp, projectors using the lamp are fitted with a turret containing two lamps, an arrangement which is possible due to the very small size of the pulsed lamp. When one lamp fails the other swings into position automatically and without more than a momentary black-out on the screen. Lamp replacement, which is very simple, can then be effected at convenience.

In common with Xenon, the pulsed lamp offers an important step towards projection automation, giving consistent light output and the facility of ease in switching on and off.

In procuring consistent presentation of a high standard, discharge lamps offer consistent illumination coupled with many other advantages. Consult the sponsors of this Data Sheet for further technical details.

DATA SHEET No. 24 – Issued by the PICTURE PRESENTATION COMMITTEE of the BRITISH KINEMATOGRAPH SOCIETY

Sponsored by AEI SOUND EQUIPMENT LTD., R.C.A. (GREAT BRITAIN) LTD., WESTREX CO. LTD., and the G.B.-KALEE DIVISION of RANK PRECISION INDUSTRIES LIMITED

Projectors and Arclamps—Care and Maintenance

There are many different makes and models of projector mechanism in use today. Whereas these may differ in a number of characteristics, such as physical appearance, or the way the drive is transmitted from one part of the machine to another and so on, they all do the same job and in a very similar manner.

No piece of running machinery, however well designed and made, can maintain a high standard of performance unless regular attention is paid to its cleanliness, lubrication and proper adjustment, and the cinema projector is no exception to the rule.

It should be the aim of every projectionist to present his audience with as flawless a show as is possible with the apparatus and skill at his disposal. At the same time, he should take all precautions to ensure that the film entrusted to him is returned to the renter, when finished with, in no worse condition than when first received.

To attain these most desirable ends, it is essential that proper maintenance and observation of his projection equipment is carried out regularly. Accordingly he should endeavour to establish a routine in this matter that will ensure the protection of all these interests.

In this Data Sheet it is proposed to cover the maintenance of projectors and arclamps, drawing special attention to one or two salient features, in the hope that this will be of some value to projectionists generally.

The first consideration must be in respect of the film path; this includes all parts of the mechanism which transport and actually come into contact with the film when in motion.

These can be summarised as follows:

The top spoolbox and firetrap, with spindle assembly.

The top sprocket and roller assembly.

The projection gate, pressure pads and aperture plate.

The intermittent sprocket and shoe.

The lower-line sprocket and roller assembly.

Any guide or entry roller assembly to the soundhead which may be mounted as part of the projector.

The lower spoolbox, firetrap and take-up assembly.

It should be mentioned that many sound servicing contracts include the responsibility for maintenance of the last named items above, but it is undoubtedly the moral responsibility of the projectionist to see that these parts are kept clean and in proper adjustment.

The top spoolbox take-off spindle is usually mounted in a long sleeve bearing, and it should be removed about once a week, the bearing cleaned, inspected and a spot or two of fresh oil applied through the oiling hole, seeing it come through the bearing. Wipe the old oil from the spindle and the clutch disc, lubricate lightly and re-assemble with the necessary tension to check spool overrun without strain.

Similar treatment should be given to the lower spoolbox take-up assembly, together with the take-up drive, whether belt or chain driven. The old idea, which is still subscribed to by some projectionists, of leaving the take-up strictly alone " while it is working O.K." does not pay dividends in the long run, but often leads to sudden failure of a component, when it is then, frequently, too badly worn to be capable of any adjustment. The better way is, of course, to learn to understand the correct condition and tension required, and to keep it that way by regular attention. It can be stated in principle that the correct tension required is that which will take up a full spool of film with neither slip nor strain. Get the guidance of your service engineer. A word of warning: most spoolbox spindle assemblies include a locating device such as one or more Woodruffe keys; take care not to drop or mislay these, and avoid damaging them when dismantling or assembling.

All film runners, such as the projection gate fixed runners, interior runners of many firetraps, etc., should be kept free of any deposits and preferably should be wiped after every reel. Watch for wear resulting in the distortion of contours.

The film projection gate pressure pads, or skates, must be watched for worn contours and should always be adjusted to the minimum tension necessary to ensure a steady picture with the particular film stock in use at the time.

Regarding roller assemblies, it is only necessary to offer the following advice:

Keep all rollers free to rotate with a light touch from the moving film.

Do not allow any roller to develop " flats " or other surface distortions.

Never allow emulsion from the film to build-up on the roller surfaces or flanges.

Film retaining roller assemblies should be adjusted so that there is exactly two film thicknesses space between the retaining roller and its associated sprocket. The method used for adjustment is usually obvious. The film lateral guide half-rollers at the top of the projection gate must especially be watched for undue wear,

and care should be taken that they are always adjusted correctly to perform the function for which they are designed. In the usual arrangement, the outside half-roller is a controlled position roller, which must be set to guide the film correctly into the gate in its proper path. The inside half-roller is controlled laterally by a coil spring and should keep a light pressure on the other film edge.

All sprockets should be cleaned and examined regularly. A special sprocket brush, or a good stiff tooth-brush, should be used to keep the spaces between the teeth free of emulsion. In the case of the intermittent sprocket, see that the gate sprocket shoe is correctly adjusted to give two film thicknesses clearance from the sprocket film surfaces; never allow the shoe to press against the sprocket.

The method of lubrication adopted for film projector mechanisms usually comes under one of the two headings below:

(a) Hand charged gravity feed systems.

(b) Automatic oil-pump distribution of oil.

The first named classification frequently employs a pipe system to convey the oil to each point requiring lubrication. This system is fed either from a common reservoir situated at the top of the mechanism frame, or from a number of separate oil cups conveniently situated for their purpose. When separate oiling points are provided it is suggested:

A few drops of oil in each bearing daily.

A few drops on any vertical or horizontal shaft daily, taking care that lubrication is provided to any actuating movement which has to travel on any shaft.

Move the framing adjustment up and down a few times whilst oiling.

With the framing adjustment at the centre position, see that the intermittent unit is filled with oil to the correct level on the gauge usually provided.

The type of mechanism requiring manual lubrication is generally fitted with an easily removable rear cover or door, making possible the frequent inspection of the interior.

Regarding the pump-type mechanism (b), providing that the oiling system is clear and the oil level maintained correctly, the lubrication of all parts of the system should be carried out quite automatically. The oil in the pump and sump area should be drained off and fresh oil provided at regular intervals. Filler and drain plugs are provided to facilitate this work. The frequency with which this oil change is necessary is dependent mainly on running hours, but it is suggested that a routine is established and kept, based closely on the recommendations of the manufacturer.

Many pump-type mechanisms are fitted with both fine metallic gauze filters and magnetic filters, the functions of which are to remove all foreign matter from the oil, the magnets collecting any small particles of iron or steel. Whenever an oil change is made these filters should be removed and cleaned, taking care to see that all metal particles are removed from the small magnets, where these exist.

Exceptional wear and tear of parts of the mechanism drive can often be detected at an early stage by intelligent examination of the condition of oil, when it is drained-off, and inspection of particles in the filters.

When replacing covers, drain or filler plugs, etc., on this type of mechanism make sure that all gaskets, oil seals, washers, etc., are replaced correctly and are undamaged.

A more recent arrival in the projector mechanism field is the type employing so-called self-lubricating bearings, which require only such little attention as the makers suggest. The actual oiling on this type of machine is usually restricted to a few points, for daily attention, where the special type bearing is not justified.

If it is necessary at any time, to remove or replace any gear or other part of the projector mechanism, other than the normal parts that have to be removed for regular cleaning and servicing, it is very advisable to obtain and follow the specialised instructions of the manufacturer. Most suppliers will quote for work that is beyond the scope or experience of the projectionist, and will provide skilled engineers to carry this out.

The adaptation gear is considered as part of the projector equipment, so remember to keep an eye on the condition of this.

All projector mechanisms incorporate an automatic fire shutter, which is usually operated by the action of a governor system; this must be kept free and clear of obstruction. Where an electrical changeover system is incorporated, the actuating linkage will require regular attention.

It should be stressed that, whenever a projectionist takes over a new or strange projection equipment, he should make an early point of acquainting himself fully with both sides of his machines, as the understanding and proper maintenance is as important as the operation of them.

It is quite as important to maintain a high standard of cleanliness and efficiency in the soundhead, and many of the fore-going observations are equally applicable to the components of the film path therein. Particular care must be taken, however, not to interfere with the adjustments of the optical systems in optical soundheads.

When cleaning magnetic soundheads, on no account should the position or adjustment of the magnetic scanning heads be interfered with. It must also be emphasised that all tools used in, or in the vicinity of, the magnetic soundheads should be properly de-magnetised, or be of non-magnetic materials.

The care of lenses used on projection apparatus is dealt with elsewhere in this book, so has not been touched upon here.

Lastly, as is the case in the use of all types of running machinery, there are a few important and necessary " don'ts " to which it is felt essential to draw attention.

Never, repeat *never*, attempt to wipe down or touch a machine with a duster or other rag whilst the machine is running. A surprisingly large number of projector mechanisms have come to grief as a result of the wrapping-up of a duster in the drive or sprockets, invariably resulting from obvious neglect of this precaution.

Very few projectionists have the necessary skill to make it safe for them to attempt any work or adjustment to the internals of the intermittent unit of a film projector. In any case, hardly any theatres are equipped with the necessary facilities for carrying out such work to the fine limits demanded. Therefore, the advice is, *DON'T*, under any circumstances, open up or tamper with this piece of precision apparatus. In the event of maladjustment or failure of an intermittent unit, get into immediate touch with the nearest branch or agent of the manufacturer, who will make early arrangements for the repair or replacement of the part.

The practice of over-oiling a projector mechanism can be nearly as dangerous to the proper performance of the equipment as under-oiling, though in a different way. Excess oil has an almost uncanny way of infiltrating into every part of the soundhead, especially the optical assembly, into the windings of the projector drive motor, and a great deal of the machine wiring may become impregnated with it. It needs little use of the imagination to visualise the probable results of the effects of such occurrences. Therefore, always oil with discretion and always immediately remove any excess oil.

DATA SHEET No. 25 – Issued by the PICTURE PRESENTATION COMMITTEE of the BRITISH KINEMATOGRAPH SOCIETY

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Projectors and Arclamps–Care and Maintenance–*continued*

Arclamps

There are also many different makes and models of projection arclamps in use but, in effect, they are all similar in basic principles and matters concerning their care and maintenance are, in general, common to all of them.

All projection arclamps are built round two major items, the carbon-arc itself and the optical system that collects the light from the carbon crater and directs it on to the film-mechanism gate. The care and maintenance of that vitally important item, the arclamp mirror, has a section all to itself in this Manual.

Eliminating the optical system, we are left with two classifications of components, the mechanical and the electrical.

A carbon-arclamp burns up carbon electrodes and, since carbon itself is a somewhat dirty substance, even when partially covered with copper, one can expect to find it clogging the working parts of the arclamp, leaving a film of carbon ash to be dealt with every time the arc is burnt. Because of the properties of carbon and the fact that any copper coating will be melted into blobs of molten copper, it is very essential that all working parts should be kept free and clean, *and this means daily attention.*

Lubrication can be a problem because of the intense heat that is generated inside the lamphouse and special heat-resisting lubricants have been developed for use therein. Most modern arclamps have the additional protection of having their working parts completely shielded and thereby allowing the successful use of a grease or oil of heavy consistency.

Arclamp ventilation is a very important matter in respect of care and maintenance. The bad effect of poor ventilation and draughts on arclamp mirrors has been dealt with elsewhere in this Manual, but there is another point to remember. Poor ventilation and draughts can also affect the arc itself, causing unsteady burning conditions with screen illumination that flickers and varies in intensity.

Do not block up holes in the lamphouse that are intended for intake of air, and make certain from time to time that arc flues are cleared of accumulated ash. Where a damper is fitted inside the flue outlet of the lamphousing, use this to regulate the flow of air to produce a steadily burning arc.

Modern lamphouses are made with a double "skin," so arranged that a current of air is continually circulated to cool off the outer casing. Make certain that this ventilation system is kept clean and clear and that the motor and fan are properly maintained.

Most arclamps incorporate a magnetic flame control which may be a permanent magnet or a wound electro-magnet. The positioning of a magnet of this kind is critical if steady burning is to be achieved. Keep the pole pieces clean and check occasionally that nothing has worked loose to allow the magnet to get slightly out of position with detrimental effect on arc steadiness.

Check the arc imaging device for tightness so that it always throws an image of the arc on to the ground glass screen or card with accuracy. Do not let movement give you false information, make a regular check using the arc focusing movement, watching the screen for peak light and checking back to see if the arc image is on the guide lines.

When we come to examine the electrical requirements to see how we can give good maintenance, the first thing that suggests itself is the electrical contact between the carbon electrodes and the "jaws" or "contacts." These must be kept clean and smooth so they may grip the carbons over a good and even bearing surface. Follow the arclamp maker's instructions to the letter. This point is especially important in regard to "contacts" that have to feed current continuously to positive carbons that rotate steadily while burning.

Alignment of these current-carrying "jaws" and "contacts" is also a matter to watch and correct where necessary, otherwise a local arc will be set up between the carbon or its copper coating and the jaw and this will "pit" the jaw and may well cause the carbon to overheat and burn in the wrong place. Pitted jaws are useless since the deterioration becomes additive.

Some of the rotating-positive types of arclamp have silver contacts. Never use a file or emery paper on contacts of this type, use a good metal polish instead.

Remember that firm contact pressure is critically important if you are to avoid "pitting." Do not, however, put too much strain on the feeding mechanism, causing the carbon to stick and feed unevenly.

Because the carbon "jaws" or "contacts" must move along as the carbons burn away and are fed together by the feed motors, certain electrical leads are made flexible, either by means of laminated copper strip or a flexible copper cable which is generally sheathed in asbestos. Give regular inspection to these leads and watch out for signs of burning or perishing in order that immediate replacement can be made preventing a breakdown of your show.

Remember that the basic rules in dealing with the maintenance of electrical contacts are BRIGHT AND TIGHT.

Since the two carbons carry opposite poles of a Direct Current supply of electrical energy, they must be insulated from each other and from the lamphouse which is, itself,

earthed. All insulation bushes, washers and packing pieces should be examined regularly and kept free of carbon dust that will allow an electrical leakage or even an eventual "short."

Some arclamps are fitted with their own ammeter. It is very important that this should give you a true reading of the current passing through the arc. Arrange for an occasional check against another ammeter known to be accurate.

Don't neglect the working lamp used to illuminate the interior of the lamphouse. It will soon become covered with carbon dust and needs a regular clean and its contacts checked.

The terminal blocks to which the cables are connected should also be kept clean and all contacts tight and bright.

Keep spare fuses handy in case of feed motor failure.

Where you have water-cooled "jaws" or "contacts," keep all water connections tight and watertight. Check these water connections regularly.

Give the water circulators proper and regular maintenance. Each circulator will have a fan, a motor, a radiator, and a storage tank. Give all these items regular attention or they will let you down at a crucial moment. Don't leave the tank uncovered. Clean out the tank regularly and remove any dust and dirt. Use distilled water if possible to avoid scaling. When using water mains, check that the pressure is adequate and the flow constant over running hours.

Empty the copper drip tray regularly and burnish it so that copper particles will not weld to it.

Some modern projection arclamps incorporate an automatic focus control which operates to maintain the position of the positive carbon crater constantly in correct relation to the distance required from the arclamp mirror. This is generally effected by deflecting an image of the positive crater on to a thermo-electric or a photo-electric relay.

Naturally such a device is sensitive and needs careful maintenance in accordance with the maker's instructions in order to make certain that the crater image always falls in the correct position on the detector unit.

Most of the mechanical maintenance needed by the carbon-arc is a matter of common sense, remembering that, whereas most mechanical parts run at slightly higher than room temperature, those working in the arclamp are subject to intense heat.

Manual feeding of the carbons is sometimes effected by clutches interposed in the drives from the feed motors. Look after these clutches and so avoid jerky carbon movement.

The tilting movements, up and down and side to side, of the arclamp mirror are accomplished by threaded shafts brought out to knobs external to the lamphouse. Check these controls regularly, oil sparingly and make certain that the movement is slow and even.

The raising and lowering movements for the negative carbon and the movement controlling the feeding ratio between positive and negative carbons need regular attention and careful lubrication.

Where a manual striking device is fitted, this is generally of the scissors type. Regularly check the force with which the carbons touch in striking the arc, adjust the limiting device so that they just touch gently as otherwise the positive crater will be broken and the screen illumination affected while the crater re-forms. Similar maintenance is required where there is a solenoid striking device.

The dowser arrangements constitute an important part of the lamphouse. Make sure that the movement is kept free and clean and, where there is linkage with a mirror protector, regularly check on this mechanism. The renewal of any burnt or distorted blades will avoid unnecessary trouble.

Feed motors, of which sometimes there are two, and blower motors need the same maintenance as any other fractional horsepower motors and this is dealt with elsewhere in this Manual.

Your projection arclamps constitute an important part of the presentation chain. They house the source of your screen illumination. Without regular and correct maintenance, you cannot expect to have bright and consistent screen illumination.

Consult the sponsors of this Data Sheet on your projection arclamp problems and remember—BETTER PRESENTATION means BETTER BUSINESS.

DATA SHEET No. 26 – Issued by the PICTURE PRESENTATION COMMITTEE of the BRITISH KINEMATOGRAPH SOCIETY

Sponsored by J. FRANK BROCKLISS Ltd., AEI SOUND EQUIPMENT Ltd., and the G.B-KALEE DIVISION OF RANK PRECISION INDUSTRIES Limited

Arclamp Mirrors, Care and Maintenance

The mirrors in your arclamps represent an important link in the chain that leads to Good Picture Presentation.

Avoid the premature deterioration or damage caused by the items listed below.

Look after them in the way set out below.

This action on your part will make sure that they are not the weak link in your chain.

Remember that *Good Presentation Pays.*

Avoid these Causes of Damage and Premature Deterioration

(1) Make sure you always have the right mirrors for your particular arclamp. They must be suitable in diameter, curvature and focal length. The design constants are usually stencilled on the back of the mirror in terms of major and minor set-up distances. Replacement mirrors must always have the same figures and any divergence is likely to result in a serious loss of light.

(2) Make sure that the mirror holder is so maintained that the arrangements to allow expansion and contraction of the mirror are not interfered with. Mirrors get very hot and must be able to expand, otherwise they will crack.

(3) Make sure that you keep as much heat away from the mirror as possible. Bad lamphouse ventilation shortens their life—ventilation systems should be of a generous size and be cleaned out occasionally.

(4) On steep negative projection rakes, the top of the mirror may overhang the arc tail flame which can cause deterioration at the top of the mirror. Steps should be taken to deal with this problem where necessary through adjustment of the magnetic flame control and/or other means.

(5) Mirrors on which the silvering has deteriorated and become clouded absorb light instead of reflecting it and may overheat and crack. They should be replaced just as soon as such deterioration exceeds say 10% of the total area. Mirrors can be re-silvered but for obvious reasons this work and transit is at owner's risk so such mirrors should be carefully packed and be free from cracks.

(6) On modern arclamps, mirror pitting, which is due to incandescent particles shot from the carbon crater on to the mirror surface, is no longer a problem because of the relatively large diameter and the relatively long working distances, but any mirror that shows serious signs of pitting should be replaced as this means loss of light.

(7) Dichroic mirrors having special coatings that allow transmission of heat through the mirror while still reflecting light are now coming into use. Naturally such coatings are susceptible to damage—being extremely thin—and so mirrors of this kind need extra care in handling, especially if the coating is on the inside of the mirror.

(8) Make sure that the mirror dowser is in good condition and in place before striking the arc. If the arc is struck without this protection there is a likelihood that the projection of particles from the carbons may cause the mirror to fracture.

(9) Whether burning in carbons or testing your equipment, *never* run for any length of time at a low current. Under such conditions soot is formed and, as the tail flame is not then under proper control, a soot patch may be deposited on the mirror. If full current is then applied, a spot of intense local heat will be developed in the glass which may crack in a very short space of time.

(10) Make sure that the mirror is not subjected to any cool draught or sudden change in temperature when it is hot. Otherwise there is a possibility that the mirror will crack even if it is of the so-called heat-resisting type.

(11) Take care when fitting carbons that metal carbon holders do not knock against the mirror.

(12) Metal mirrors are particularly susceptible to distortion in handling and in spite of their apparent sturdiness should be treated very carefully in this respect.

(13) Make sure that spare mirrors are stored in a damp-free atmosphere and that any packing material is dry. Moisture in any form eventually affects the silvering of the mirror.

How to Clean and Maintain Your Arclamp Mirrors in Good Condition

(1) The arclamp mirror is an important optical component and needs to be kept absolutely clean at all times, otherwise it will not do its job properly.

(2) Great care should be taken when removing the mirror from its holder to ensure that no damage to the silvering occurs around the edge or around the hole through which the negative carbon protrudes.

(3) When removed for cleaning the convex surface of the mirror should be placed on a felt pad on a table or stood on its edge on a felt pad for cleaning in this upright position.

(4) Where possible it is recommended that mirrors should be cleaned without removal from the mounting and without the back being handled.

(5) For the best results daily cleaning is essential and in any case not less than twice per week. This is in addition to the wipe over that should take place after every reel. Regular cleaning will help to minimise the adverse effect that the heat stream from the arc has on the mirror surface.

(6) To clean a GLASS MIRROR proceed as follows:

(a) The face of the mirror should be carefully wiped with a soft, clean and dry cloth. This will remove soot and fume deposits and small carbon spots which if allowed to remain and accumulate will cause a loss of light.

(b) Using a good quality cotton wool, and removing a layer of wool as it becomes dirty, apply one of the proprietary mirror, optical or window cleaners of the " whitening " type.

(c) Never use too much of the cleaning fluid as it may penetrate between the glass and the protective covering and affect the silvering. Never get the back of the mirror wet under any circumstances.

(d) Allow to dry and then polish off with the clean, soft and dry cloth.

(e) If the deposit is difficult to remove use careful polishing with fine steel wool type 00. Great care is needed not to scratch the surface of the mirror.

(f) Small carbon spots that prove to be stubborn can be removed by the rapid sweep of a flexible razor blade over the surface. Again be careful not to scratch the mirror surface.

(g) If in doubt, use the cleaning fluid recommended by your mirror supplier.

(7) To clean a METAL MIRROR proceed as follows:

(a) Metal mirrors are generally anodised aluminium, rhodium or chromium plated, are unbreakable and not affected by " pitting " from the carbons.

(b) The reflecting surface is, however, on the front and therefore unprotected.

(c) Take great care not to scratch the surface either with carbon holders, harsh cleaning abrasives or in any other way.

(d) Lightly wipe off all dust with a clean, soft and dry cloth.

(e) Apply a high grade silver polish. Never use brass or chromium cleaners, they will damage the reflecting surface of the mirror.

(f) Trouble may be experienced through a deposit caused by the arc fumes. This bloom may be removed with jeweller's rouge and water and some " elbow grease." If the mirrors are anodised aluminium the rouge should be " mercury-free."

(g) Don't force an oversize mirror into the holder. It will distort or bend with resulting loss of light on the screen.

ALL MIRRORS SHOULD GIVE GOOD SERVICE IF HANDLED CAREFULLY, BUT NO MIRROR, HOWEVER GOOD, CAN BE EXPECTED TO DO JUSTICE TO YOUR PRESENTATION IF CHIPPED THROUGH BEING ALLOWED TO COME INTO CONTACT WITH THE MOVING PARTS OF THE ARCLAMP OR IF IT IS NOT CLEANED PROPERLY OR IF THE SILVERING HAS DETERIORATED.

REMEMBER—GOOD PRESENTATION PAYS.

DATA SHEET No. 27 – Issued by the PICTURE PRESENTATION COMMITTEE of the BRITISH KINEMATOGRAPH SOCIETY

Sponsored by KERSHAW WORKS (LEEDS DIVISION) and TAYLOR, TAYLOR and HOBSON DIVISION of RANK PRECISION INDUSTRIES LIMITED

Focus on Projection-Lenses

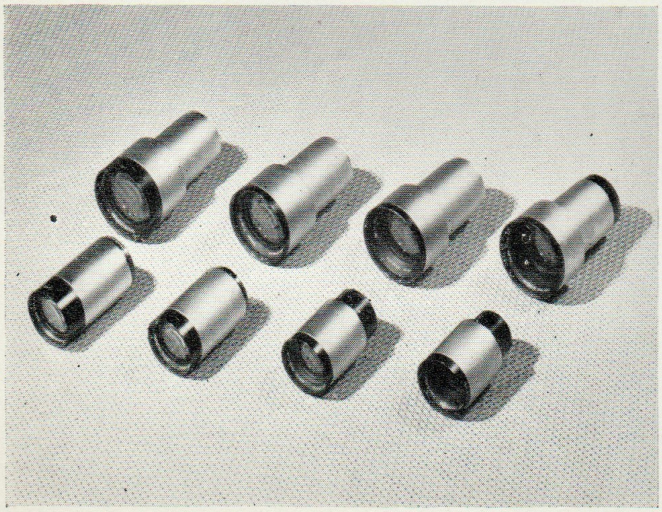
The projection-lenses used in the cinema of today are perhaps the most important part of the picture presentation equipment. Although generally small in size, they are items of extremely high quality and in many cases of high cost.

To convert the small 35 mm. transparency into the large Wide Screen picture image so that it is viewed on the vast cinema screen of today and to carry out that enlargement, an area magnification of perhaps as much as 500,000 times is no mean feat in itself. To effect that enlargement in perfect focus to the very edges of the screen without introducing any distortion and with an absolutely faithful transfer of the minutest detail and the whole range of colours, is a gigantic undertaking needing up-to-date and efficient optics.

In thousands of cinemas this is being done every day by those seemingly simple and inanimate objects, the projection-lenses. They deserve respect, they should be handled with care and given the chance to perform their function under the best of conditions.

This Data Sheet has not been written with the intention of delving into the complexities of lens design. It is intended rather to remind you of the basic functions of a projection-lens, to highlight some of the lens properties and by recounting some brief history to bring you up to date.

The obvious starting point when selecting a lens is the focal length. This is always clearly marked on the lens barrel in inches and fractions or decimal parts of an inch and also in millimetres. In addition the name of the manufacturer, the trade name given to the particular range and the serial number are also recorded. Sometimes there is also an " f " number which will be dealt with later.



The available focal lengths of any range of lenses are generally in steps of one quarter of an inch from 2 in. up to 6 in., although focal lengths shorter than 2 in. or longer than 6 in. may also be available.

The next factor is the " throw," which is the distance from the lens to the centre of the screen and varies greatly, perhaps between 50 ft. and 200 ft., from cinema to cinema.

We know that the film-mechanism aperture width is – 0.825 in. for Wide Screen and 0.839 in. for CinemaScope, and finally the size of picture that is required will also be known. These three known factors enable the correct focal length of lens to be calculated as under:

$$\frac{\text{Throw (in feet) x aperture width (in inches)}}{\text{Picture width (in feet)}} = \text{focal length (in inches)}$$

In the case of CinemaScope we take only half of the picture width because the anamorphic lens doubles the width of the picture, thus:

$$\frac{\text{Throw (in feet) x aperture width (in inches)}}{\frac{1}{2}\text{ Picture width (in feet)}} = \text{focal length (in inches)}$$

It is clear that knowing any three of the four factors the fourth can be determined by the simplest mathematics.

The " f " value, sometimes found marked on the lens, really concerns the size of the lens aperture, but it can be taken as a very rough indication of the amount of light transmitted compared with other " f " values. This is roughly in proportion to the " square " of the " f " value and so an f1.8 lens passes about 20% more light than an f2.0 lens.

Fuller information regarding " f " and " t " values, depth of focus, the composition of lenses, the types of glass used, the aberrations of a lens and many other more technical aspects are discussed in the various books that have been written about motion-picture presentation.

In the days when there was only one picture shape and that picture was less than half the area of the picture sizes of today, the requirements in respect of projection-lenses were far less exacting. Today we have to be near perfection under vastly more difficult circumstances and the attainment of perfection is always costly.

In the early 1950's with the advent of the Wide Screen formats and the increasingly greater use of colour, two new

ranges of projection-lenses were designed and brought into use. These were known as the " Vutal " range covering from 2 in. F. to 3¾ in. F. and the " Fultal " range covering from 4 in. F. to 5¾ in. F. Both of these new designs had larger apertures and included the use of more types of glass material, enabling the designer to choose different curves and thicknesses. These factors, combined with the knowledge gained from earlier ranges and the surface-coating of all glass-to-air surfaces, produced a high quality lens.

One employed five glasses and the other six, against the four glasses of earlier designs. Design, knowledge and technique coupled with advanced use of the glass material itself to an extent quite unknown in previous years thus combined to satisfy more readily the meticulous demands made by the lens designer. By using methods of inspection and production, whereby batches of glasses could be produced in the various component shops with tolerances controlled to a very high degree, a finished product that was amongst the foremost projection-lenses in the Industry became available.

The basic requirements of a projection-lens can be stated as the ability to transmit the maximum amount of light, to illuminate evenly the screen area and to provide a projected image that is as free as possible from spherical aberration, field curvature, astigmatism, distortion and chromatic aberration, since all these defects tend to produce " soft " or " fuzzy " picture images.

The optical design of any lens is of prime importance and as these designs became more complex so was the designer given more opportunity to reduce the residual aberrations within the system by use of the corrective power of the additional glasses. In addition the newer techniques in testing methods and equipment enable the production staff to work to closer tolerances in all stages, thereby reducing the margin of error in all components, metal and glass.

The designer, by using glasses of varying composition, can, by varying the number of elements involved, by thicknesses, by curvatures and separations, arrive at a formula which corrects these aberrations, thus ensuring sharp picture images.

In 1959, to meet the demand for still greater perfection, a completely new range of projection-lenses was designed embodying even further advances in design, better use of the glass material and improved production and inspection; the result was the " Afotal " range.

A limited number of these extremely fine lenses has been produced and is in use in many of the largest cinemas in this country. The system employs seven glasses, has an aperture of f1.8 or f1.9, and produces an even screen illumination with an almost complete absence of residual aberrations.

Finally, your lens is a highly pr ced product of superlative performance—it should always receive the attention it deserves.

DATA SHEET No. 28 – Issued by the PICTURE PRESENTATION COMMITTEE of the BRITISH KINEMATOGRAPH SOCIETY

Sponsored by KERSHAW WORKS (LEEDS DIVISION) and TAYLOR, TAYLOR and HOBSON DIVISION of RANK PRECISION INDUSTRIES LIMITED

Projection-Lenses, Care and Maintenance

It should be understood that the surfaces of the glasses comprising a lens have been very carefully polished so that all surface pits or scratches have been removed to produce the highest standards of optical performance. Any scratch, however small, scatters light and impairs the definition that the lens is capable of giving. It will therefore follow that if the surface of a lens is covered with a network of fine scratches picture image definition can be ruined.

The introduction of surface-coating of projection-lenses has not altered the recommended methods of lens cleaning, but the penalty for neglect, careless cleaning or mistreatment has become infinitely more serious. The surface-coating may be about 4 millionths of an inch in thickness and while tough it can be rapidly ruined by abrasion. Coated lenses should therefore be treated with the same high degree of care that all highly polished glass surfaces require.

Under no circumstances allow abrasives to come into contact with projection-lens surfaces.

Dirt and especially grease on the surface of a projection-lens also impairs the definition and a finger-print on a lens will soften the focus in no uncertain manner. It is very important that finger-prints are removed at the first available opportunity, otherwise a permanent stain may appear which can only be removed by repolishing. Therefore, always keep the lens free from dust and finger markings.

Generally speaking only cleaning of the external lens surfaces should be undertaken by the projectionist and the following routine should be adopted.

Lenses should be cleaned at least once every day before the commencement of the performance and examined at the end of the day's run to make sure that no grease or oil is left overnight on the lens surface.

To clean a lens first remove the surface dust from the glass surfaces. Do not wipe the dust off as this would produce minute scratches. The RIGHT way is to brush off the dust with a soft camel-hair brush with the lens surfaces held downwards so that the dust will fall away. Keep the brush clean and in an airtight container. If it becomes greasy, clean it in ether and allow it to dry at room temperature.

Secondly, wipe carefully and very gently with a piece of clean, soft, cotton pocket handkerchief or a similar material that is soft but free from lint particles.

Thirdly, remove grease spots, if any are present, by means of a drop of methylated spirit on a separate piece of the cleaning material. It is VERY IMPORTANT that the spirit should be applied very sparingly because it may penetrate into the lens cells. DON'T USE IT AT ALL unless absolutely necessary. Very greasy deposits may need an initial application of a tiny spot of benzine and then treatment with methylated spirits.

If grease spots have had to be removed, give the lens a final wipe over with the piece of clean handkerchief: CAREFULLY AND GENTLY. An added precaution is to use the camel-hair brush again to remove any possible particles of lint.

Once again, only use the smallest amount of methylated spirit. If any penetrates into the cell bore it will certainly attack the edge black of the lens and result in increased internal reflections and loss of image contrast.

NEVER use cleaning powders or preparations intended for cleaning porthole glasses or arclamp mirrors because in spite of manufacturers' assurances such preparations almost certainly contain materials likely to cause abrasion to lens surfaces and surface-coatings.

A projection-lens should never be dismantled because the lens components, glass and metal, are machined to such fine tolerances that the correct fitting of a glass into the metal cell and the pairing of a number of cells one to another requires instruments of a special nature. If the final assembly, as passed by the Inspection Department, is disturbed, there can be no guarantee that the optimum lens performance is attained.

From illustrations you will know that in a number of lenses there are two glasses which to the eye appear to be identical in thickness and curvature. In fact they probably differ slightly and if such a lens is dismantled it would be quite easy to reassemble the glasses incorrectly, either back to front or even in the wrong cell completely. This would then give an imperfect picture image in some form or another. Another danger is that two such glasses incorrectly assembled might foul each other resulting in flawed glasses, which in the older types of projection-lens could not be replaced.

From the above it should be obvious that you cannot change cells and glasses between two lenses even of the same type and focal length. Each cell and metal component is

unobtrusively marked with an indent and is selected to produce the finished lens.

Remember also that the lens-coating is only a few millionths of an inch thick and any attempt to touch these surfaces may do untold harm.

For repair or adjustment send the lens back to the manufacturer or a qualified lens repairer who will have the knowledge, the facilities and the special tools.

If the edge black on a glass appears to have deteriorated send it away for attention, don't try to effect a repair yourself. Avoid twisting the glasses in the cells when handling or cleaning as this could result in an untrue image. Do not follow the practice of roughly focusing the lens by rotating it in the lens holder—use the focusing adjustment on the lens mount. DON'T DROP IT.

To minimise the deposit of dust and perhaps prevent finger marks always cover your projection-lenses when they are not in use. Use the lens caps provided or make your own.

It is a good idea to keep your lens cleaning materials in an airtight container; they should never be used for any other purpose.

Your projection-lenses are precision instruments born of the skill of craftsmen and mathematicians. It is certainly only through their perfection that Wide Screen and Cinema-Scope and Wide Film presentations "live" on the cinema screen. To magnify that tiny film frame a matter of 500,000 times with faithful transfer of every minute detail and the full range of colours is a very wonderful achievement.

Respect their important function in the presentation chain and treat them with the care they so richly deserve. They are literally your **SHOW** and your presentation depends on them.

Follow the hints and tips given above, use the cleaning routine described and you will then keep your projection-lenses working at high efficiency throughout the life of the projectors in which they are used.

For any further information consult the firms sponsoring this Data Sheet.

DATA SHEET No. 29 – Issued by the PICTURE PRESENTATION COMMITTEE of the BRITISH KINEMATOGRAPH SOCIETY

Sponsored by THE 20th CENTURY-FOX FILM Company Ltd.

Anamorphic and Backing Lenses

ANAMORPHIC ATTACHMENTS

Anamorphic attachments are of three types, each having its own characteristics which influence the choice for any given situation.

(a) Cylindrical type :

Most of these conform to the original Bausch and Lomb pattern which is made under licence in many parts of the world. They have a transmission factor of up to 92%, good chromatic correction and show an excellent uniformity of expansion factor across the full width of the screen. In theatres with a steep projection angle, centre sagging of horizontals may be a disturbing factor and for this reason their use should be limited to projection angles of not more than 10-12 degree, assuming a vertical screen.

(b) Prismatic type :

This type is easier to manufacture than the cylindrical attachment but, owing to the thickness of the glass in the prisms—which may be up to five in number, the transmission is of the order of only 70%. Where short focus backing lenses are used, the resulting wide angle of divergence of the light beam may be more than the attachment can handle, resulting in a pronounced light loss at the sides of the picture. In general, this type of attachment is best used in situations where the focal length of the backing lens is not less than four inches.

Many prismatic attachments show a lack of uniformity in expansion factor across the width of the screen. The result might be that a wheel or other circular object would assume the shape of a vertical or horizontal ellipse in different parts of the screen, and other shapes would be distorted in a similar manner. The prismatic attachment is, however, the only type which can be manufactured so as to provide a variable expansion factor, but, so far, this facility has not been required in this country.

(c) Mirror Type :

These attachments have a good transmission factor, approaching that of the cylindrical type, and are capable of giving an excellent picture. They have one particular advantage over the other types in that they may be deliberately misaligned to correct for centre sag and can be used satisfactorily with projection angles of up to 30 degrees.

A disadvantage of this type is the downward displacement of the emerging light beam by some five inches, which entails the projectors being raised by a like amount in order to utilize an existing port. The surface-silvered mirrors, thinly quartz-coated for protection, are exposed to dust and arc bloom and need frequent and careful cleaning. This imposes a degree of wear and tear on the mirrors and limits their working life. Nevertheless, even when they are quite heavily scratched, a good picture can still be obtained although there will be some loss of contrast due to light scatter.

Note :

Small anamorphic attachments designed for use with 16 mm. projectors have been suggested as suitable for use with 35 mm. film. Such attachments while being quite satisfactory for use with the smaller film format, are incapable of accepting and transmitting efficiently the wider light-beam of the 35 mm. projector. In such circumstances the light transmission might be as low as 50 per cent. and their use under these conditions should be avoided.

Backing Lenses

In many theatres the backing lens was found to be the largest contributory factor to poor picture presentation.

The four-element Petzval type of lens was developed to quite a high standard and was adequate for the coverage of the Academy aperture of .825 in. by .600 in. The larger aperture of the usual anamorphic print, coupled with the horizontal magnification revealed the limitations of this class of lens in respect of definition and colour fringing at the sides of the picture.

For first-class projection under all conditions, a modern six-element lens of good quality is an essential pre-requisite.

Deterioration of Lenses :

Up to about 20 years ago projection lenses could be regarded as permanent assets which were subject to little depreciation, provided sufficient care was exercised in cleaning the external surfaces. Today's lenses, although vastly improved in performance, do not stand up to years of continuous usage without attention to the interior surfaces.

The use of higher powered illuminants, coupled with the increasing prevalence of colour prints, results in the passage of much more heat through the lenses and the temperature

cycle of heating and cooling is much greater than it used to be. It is neither feasible nor desirable to seal the lenses hermetically, so " breathing " must take place as the contained air is heated while showing and cooled while at rest. In the cooling part of the cycle, air from the projection room is drawn in and, with it, the finer particles of arc bloom and dust from the atmosphere.

Another form of deterioration is the formation of a milky deposit on surfaces of the lens components, probably resulting from an electrostatic charge being set up. If the lens is opened up, it may be found that the deposit yields to normal cleaning procedure, but in many cases it is necessary to return the lens to the manufacturer for repolishing and coating.

Mention should be made of an apparent deterioration in the form of an arc mirror image which may appear on the surfaces of the projection lenses. It is caused by some change in the nature of the lens coating as a result of heat. Although clearly visible by reflected light, it cannot be seen by transmitted light and its effect on picture quality is negligible.

Cleaning of Lenses

Dust should be removed from the external faces of lenses with a camel hair brush and finger marks or other grease-bound deposits by the use of a proprietary lens cleaning solution. The instructions of the manufacturers should be closely followed. In no cases should a silicone-treated cleaning cloth or spirit in any form be used for cleaning lenses.

DATA SHEET No. 31 – Issued by the PICTURE PRESENTATION COMMITTEE of the BRITISH KINEMATOGRAPH SOCIETY

Sponsored by ANDREW SMITH HARKNESS LIMITED and the PERFORATED FRONT PROJECTION SCREEN CO. LTD.

The Screen – a Vital Factor in Presentation

The screen in your cinema is perhaps the most important factor in the motion-picture presentation chain for it is on that cinema screen that the final motion-picture image is formed.

Nothing in the presentation chain must draw attention to the essentially illusory nature of the entertainment and so the screen itself must remain invisible. The screen must therefore have a perfectly homogeneous surface and be completely free from blemishes or patchiness and must have invisible seams.

Is it because of the screen's self-effacement that it is often given the least consideration of all the items making up the presentation chain ?

If your screen is dirty, yellowed by age, or has blemishes or patches, then the whole concept of good motion-picture presentation is ruined and all the efforts from studio to cinema are brought to nought.

Screen deterioration through tar contamination

Screens start to deteriorate immediately they are installed because of the smoking that takes place in the auditorium during public performances. This causes a very insidious form of tar contamination on the screen surface and it is inevitable that after a period of service any screen will cease to give satisfactory results in reflecting enough projection light.

Importance of regular screen replacement

Regular replacement of screens has everything to commend it except for the cost involved, and it is an absolute necessity if you are to maintain consistently high standards of motion-picture presentation.

Without the development work that resulted in better screen surfaces, it would have been impossible to provide such very large Wide Screen and CinemaScope pictures and still retain good standards of screen brightness and presentation.

The mere fact that such presentation systems demand a size of screen which, in many cases, is as much as twice the area of the old, has put a false perspective on the cost involved in the regular replacement programme.

Modern high-efficiency screens are not cheap but the wise exhibitor will consider the screen as a semi-consumable item of the greatest importance to the business interests of his cinema, and budget accordingly.

The cost of regular replacement, looked at on the basis of so much per seat per annum against the revenue of that seat is insignificant when one realises that the excellence of your motion-picture presentation depends entirely on the state of your screen.

When to replace your screen

How does one arrive at knowing when the screen has deteriorated to such an extent as to necessitate replacement ? This is a rather difficult problem because economic considerations dictate that you do not replace the screen before this step is absolutely necessary and presentation considerations make it equally necessary that you should not retain a screen in use when it is giving indifferent presentation to the detriment of your business.

The deterioration due to tar contamination is slow and even and it is sometimes very difficult for a person working in a particular cinema to judge just how serious the deterioration is at any period of time. Some simple means of comparison is needed.

Comparison with a piece of white blotting paper is a rough guide but better still a piece of new screen material. Make a test at monthly intervals after the screen has been in use for nine months. When the difference between the deteriorated screen and the test piece is quite marked then you can be sure that your picture presentation is being adversely affected. A yellowish tint to the " whites " in a black-and-white film, a lack of sparkle, dull colours, are all signs of screen deterioration beyond a reasonable degree.

The right surface for your auditorium shape

Most cinemas today either use the modern " silver " screen or the so-called " pearl ".

To meet the demands of the larger screens for Wide Screen and CinemaScope presentation the original " silver " screen, which was almost a direct reflector, was modified in that the screen surface reflection characteristics were " controlled " to some extent by various methods. The resultant surface

reflected much more light than the older " flat white " and reflected that light into the seating areas instead of all over the walls and ceiling as well.

The so-called " pearl " screen surface was later developed to overcome some deficiencies of the modified " silver " screen. While it is " white " in appearance, something like the older " flat white ", it has a semi-specular surface which is controllable to give greater light reflection into the seating areas. The complexity of this type of surface makes it almost impossible to respray it on site.

The " silver " screen is more suitable for the long narrow auditorium while the " pearl " will cover the shorter wider auditorium.

Full details of screen surfaces, curves of light distribution and other technical information can be obtained directly from the screen manufacturers who have sponsored this Data Sheet.

REMEMBER THAT A GOOD SCREEN IS INCONSPICUOUS BY ITS PRESENCE AND GIVES BETTER PICTURE PRESENTATION LEADING TO BETTER BUSINESS.

DATA SHEET No. 32 – Issued by the PICTURE PRESENTATION COMMITTEE of the BRITISH KINEMATOGRAPH SOCIETY

Sponsored by ANDREW SMITH HARKNESS LIMITED and the PERFORATED FRONT PROJECTION SCREEN CO. LTD.

The Screen – Its Care and Maintenance

Once a new screen has been installed in a cinema auditorium it becomes vulnerable to various factors each of which will in time cause it to deteriorate, giving poor picture presentation, or to become obvious as a screen through damage or blemish.

This Data Sheet is intended to give you some simple rules on the care and maintenance of screen surfaces and hints on the best way of keeping screens in good condition throughout their useful life.

Tar contamination

The most serious enemy to cinema screens is the tar contamination that results from the smoking taking place in the auditorium. This is in many cases accentuated by inefficient or wrongly designed ventilation plant.

Under normal conditions this form of deterioration spreads evenly over the uncovered parts of the screen and thereby causes a steady decrease, day by day, in the amount of projection light being reflected back to the audience, thus lowering the standard of picture presentation.

This kind of deterioration also causes a change in the colour of the screen surface which has a bad effect on picture presentation especially when colour films are being shown.

The speed at which this deterioration takes place is determined mainly by local conditions, such as the inherent cleanliness of the locality, the efficiency and location of the ventilation plant, the proper " backing " of the rear surface of the screen, the number of capacities per week, etc.

This tar contamination is very insidious and has defied the continual efforts of the screen manufacturers to find any complete solution. Modern screens are more resistant to tar contamination but the practice of smoking has increased and screens are larger so this advantage has been almost cancelled out.

Without prohibitively expensive equipment, costing infinitely more than regular screen replacement, this problem of tar contamination has to be faced.

Such contamination is relatively slow and it is sometimes very difficult for a person working in a particular cinema to know just how much a screen has deteriorated over a period of time.

Screen tilt

Many screens are tilted slightly from the vertical, generally leaning slightly backwards, in order to provide the best light distribution over circle and stalls; many screens are also curved.

Tilted screens are even more susceptible to staining than vertically standing screens.

Staining may occur through water dropping from a leak in the roof over the stage or through oil or grease that has dropped from a curtain track or from equipment on the grid.

The screen tilt also tends to encourage the deposit of more dust on the screen surface than would be the case if the screen was standing vertically.

Physical damage

While the screen material is quite strong and will not easily tear, the great expanse of screen is necessarily susceptible to accidental or deliberate damage and the actual screen surface can easily be marred.

Accidents will happen and work on ladders or even with vacuum cleaners near to the screen is a hazard. Work on speaker assemblies or masking controls behind the screen can also be dangerous and result in a hole or dent in the screen.

There is also the question of deliberate damage caused by missiles, ice cream, etc., thrown or otherwise projected at the screen surface by the audience.

Uneven deterioration

Even deterioration of a screen surface is an unobtrusive menace but uneven deterioration renders the screen immediately useless for it reveals the screen itself and thereby destroys the motion-picture illusion, completely spoiling the presentation.

This uneven deterioration is generally caused by draughts,

openings in the screen " backing ", by leaving the variable masking closed for a long period of time and other factors.

Before installation of a new screen

1. Carefully examine the backstage area.
2. Repair any leakages in the roof—make watertight and weatherproof.
3. Seal all openings likely to cause draughts.
4. Clean stage area to remove dirt and dust from walls, floor and ceiling.

Don't forget that water must not be allowed to drip on to the new screen and that backstage draughts will cause air currents to pass through and across the screen area with the possible danger of uneven deterioration.

A rough method of testing for draughts is to project a light on to the screen from a projector or spot arc lamp after closing all auditorium doors and then watch the behaviour of smoke trails from a lighted cigarette. Make several tests when the wind is in different directions.

Check your Plenum plant, if one is installed, to make sure it is operating properly. Backstage exhaust fans can cause rapid screen deterioration.

On installation of a new screen

The new screen should be properly " backed " by wool serge or fireproof felt. Where possible the entire screen frame should be totally enclosed at the back, fitting the material closely around the speaker assemblies. This precaution will help to prevent uneven deterioration brought about by the passage of dust and fume-laden air through the screen perforations.

During the life of your screen

At the end of the day's performances always open the top and sides of the variable masking to the full extent. This will prevent unequal deterioration of the exposed screen surface.

Brush the screen surface periodically with a special screen cleaning brush but always in one direction only—from top to bottom. Undue pressure or a scrubbing motion must be avoided as burnishing may occur which would alter the reflection characteristic of the screen.

Special screen cleaning brushes are obtainable from your Supply House. These do not have any metal projections or allow the wood stock or handle to come into contact with the screen surface. Keep this special brush clean and dry and use it only for screen brushing. Keep the brush covered when not in use—use a polythene bag.

The frequency of brushing depends upon a number of local factors. In some situations this should be once a week while in others once a month is sufficient.

Under conditions of the greatest possible care you can vacuum clean the screen surface if a clean soft-hair brush tool without projections is used. It cannot be over emphasised that vacuum cleaning a screen should only be undertaken by senior staff as the brush and tubing is unwieldy and damage to the screen surface could easily occur.

Keep the screen frame area and backstage clean and vacuum clean the masking regularly and very carefully.

DATA SHEET No. 33 – Issued by the PICTURE PRESENTATION COMMITTEE
of the BRITISH KINEMATOGRAPH SOCIETY

Sponsored by ANDREW SMITH HARKNESS LIMITED and the
PERFORATED FRONT PROJECTION SCREEN CO. LTD.

The Screen – Its Care and Maintenance – *continued*

Screen lacing

Adjust the screen lacing during the first month of installation of a new screen and thereafter check every six months. Even tension over the whole screen is the aim. Take care that excessive side tension on curved screens does not distort the screen shape in the vertical.

Take care in servicing variable masking

When checking control cables on the variable masking equipment or curtain controls in order to adjust slack cables, make sure that no oil or grease or even dirt falls on the screen surface. Splashes and spots of oil will ruin the screen surface. Never over oil bobbins and pulleys.

Emergency action

Should oil, grease or ice cream stains appear on the screen surface *immediate* action should be taken as follows:

(a) Using clean cotton wool or paper tissue moistened with white spirit, the contaminated area should be cleansed, taking great care not to spread the patch. It is important that *pure white spirit* only should be used or the vynil surface will be disturbed. The spirit must be free from paraffin (some turps substitute is white spirit but frequently has had paraffin added). No other kind of paint solvent should be used.

(b) When the grease etc., has been removed the area may be gently washed with *toilet soap and water*—here again the cotton wool or paper tissue must only be moistened or the affected area will become enlarged. All traces of soap must finally be removed with great care.

(c) If the blemish has been caused by dirty water (rainwater leaking through the backstage roof) only *toilet soap and water* need be used. Never use a harsh domestic washing soap.

(d) If the screen has been in use for some time before the accident occurs and is therefore already stained with nicotine tar, then an attempt should be made to leave a uniformly stained surface as otherwise the clean patch may well show up more than the dirty patch.

(e) The sooner the above steps are taken the greater the chance of success. Keep to the above instructions otherwise the stain may well spread or become worse than if you had left it alone.

Follow all the above instructions, hints and tips carefully and you will get the maximum useful life out of your cinema screen and thereby enable it to play its important part in better picture presentation.

A great amount of care is shown by the screen manufacturers in providing you with new screens having no visible seams and new screen surfaces without blemish or patchiness of any kind.

It is therefore to your advantage to maintain your screen in good condition for otherwise your standard of picture presentation falls and in one way or another you lose customers.

Don't let it be your cinema screen that receives the least consideration among all the items that make up the picture presentation chain from light source to the audience and keep in mind the important fact that it is the screen on which the audience view the motion-picture.

UNDERSTAND THE THINGS THAT CAN CAUSE YOUR SCREEN TO DETERIORATE AND YOU OPEN THE WAY TO PREVENTING UNDUE DETERIORATION. A CLEAN SCREEN IN GOOD CONDITION REFLECTS A GOOD PICTURE AND THAT MEANS BETTER PICTURE PRESENTATION LEADING TO BETTER BUSINESS.

For any further information that you may require consult the screen manufacturers sponsoring this Data Sheet.

DATA SHEET No. 34 – Issued by the PICTURE PRESENTATION COMMITTEE of the BRITISH KINEMATOGRAPH SOCIETY

Sponsored by the BRITISH ARC LAMP CARBON MANUFACTURERS' ASSOCIATION

Screen Illumination and Brightness

The brightness or luminance of the projected image of the film is of fundamental importance to the patron, as this is one of the factors which enables the screen to be viewed in comfort.

Upper and lower limits of luminance of the screen have been established in many countries.

The British Standard of 8-16 foot-lamberts at the centre of the screen, as viewed from any seat, with no film in the gate, was established in 1947, and applies only to matt white screens.

Other countries have established values of a similar order but sometimes expressed in different photometric units.

Photometric Units

Fundamentally the brightness or luminance of a surface depends on the intensity of illumination falling on it together with the reflective properties of the surface in the direction of viewing.

These facts naturally apply to the viewing of a cinema screen. The reflective properties of the screen and the illumination we project on it are the basic factors which determine the picture quality to a patron.

In the days of the matt white screen, photometry was relatively simple, but with the introduction of the selectively reflecting metallised screen the problem has become more involved.

There are only three fundamental units of light measurement which are generally applied to the cinema.

(1) *The Lumen* is the unit of *quantity* of light. It is often used to describe the light output of a projector, the figures quoted giving a guide to the size of screen which can be adequately illuminated. If a certain illumination falls on, say, one square foot of surface it will obviously give a brighter appearance than if it were spread over, say, a square yard. The unit used to describe illumination with respect to the area on which it falls is the foot-candle.

(2) *The Foot-Candle* is the commonly used unit of incident light and is defined as the level of illumination when *one lumen* falls on *one square foot of surface*. Our real interest, however, is the amount of light reflected and this is quoted in foot-lamberts.

(3) *The Foot-Lambert* is the unit used here and in the U.S.A. to describe the brightness or luminance of a surface. It can be defined as the brightness of a perfect reflecting matt white surface when illuminated to an intensity of one foot-candle. This surface would have the same brightness when viewed from any angle and would be reflecting back all the light it receives. The apparent reflectivity of a surface is defined as:

$$\frac{\text{Brightness (Foot-Lamberts)}}{\text{Illumination (Foot-Candles)}}$$

so that the perfect matt white surface has a constant apparent reflectivity of 1.

In practice a matt white surface has not as high a reflectivity as this and for a new matt cinema screen the apparent reflectivity is of the order of 0.8 for most angles of viewing.

The general formula connecting Reflectivity, Brightness and Illumination is:

$$\underset{\text{(Foot-Candles)}}{\text{Brightness or Luminance}} = \underset{\text{(Foot-Candles)}}{\text{Illumination}} \times \underset{\text{Reflectivity}}{\text{Apparent}}$$

Specular Screen Surfaces

The Metallised screens in common use today are not uniform in their reflectivity at all angles of viewing and, indeed, behave more like a mirror in that the greatest reflectivity to a ray of light is in the direction of the specular reflection, i.e., where angle of reflection = angle of incidence.

This means that at some angles of viewing the *apparent reflectivity* can be greater than 1 and the brightness of such a surface at certain viewing angles for the same illumination would be much higher than that of a matt screen which uniformly diffuses the light in all directions.

It is for this reason that the metallised screen has had general use, as it has enabled the presentation of larger screens to the public at a satisfactory luminance for the same illumination from the projector-arclamp.

front stalls seats a similar effect to a lesser degree is sometimes observable from the projection room.

Care should be taken not to try to correct this condition by a vertical mirror tilt of the arclamp or the main body of the audience could well be viewing a screen more out of vertical symmetry than it appears from the projection room.

Types of metallised screens

From Figure 1 it will be observed that beyond an angle of about 30 degrees the metallised screen has less apparent reflectivity than the matt screen shown as a dotted curve. With this type of screen, the brightness falls from seats off the centre line and this type of screen is more suitable for the long narrow type of auditorium. A screen surface of the

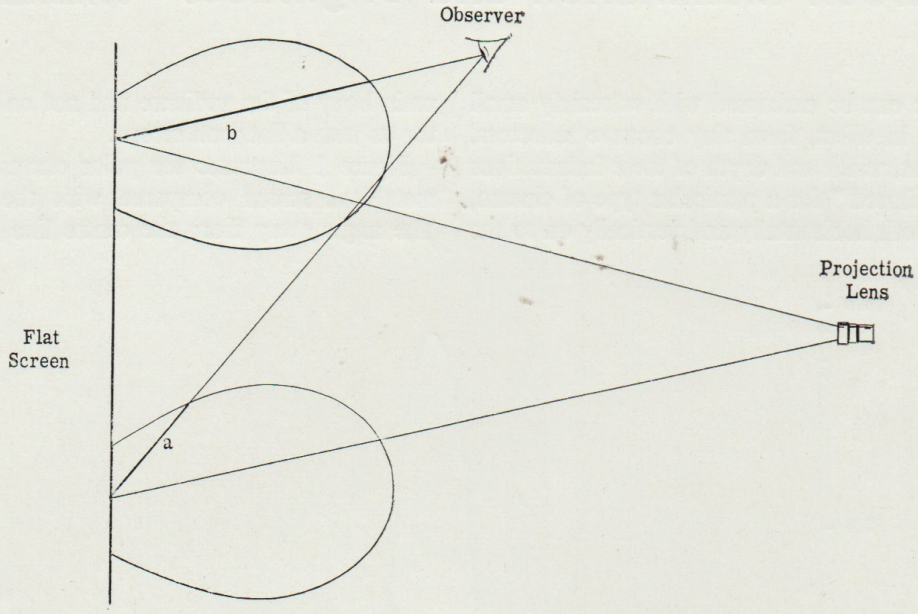


Fig. 2

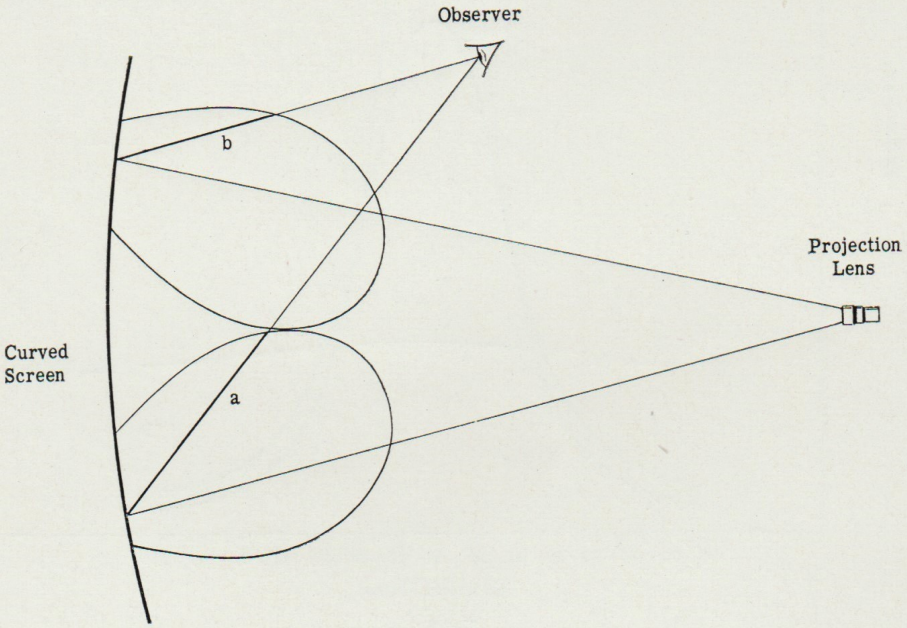


Fig 3

Screen tilt

As already mentioned, the metallised screen has a mirror-like characteristic so that the maximum reflectivity and brightness is observed along the angle of reflection—the angle of incidence of the projected light on the screen.

Consequently, this position of maximum brightness is governed by the rake of the projector and the tilt of the screen.

As the projection rake is fixed, the screen tilt should be adjusted to throw the maximum reflectivity towards the main audience mass and not, as can happen, principally towards the front half of the stalls seats.

Type " B " having a more modest reflectivity is more suitable for the average shaped auditorium, the fall off in reflectivity not being so prominent when one views the screen from the side seats.

It should be realised that any position of viewing in the auditorium which subtends an angle greater than 30 degrees with the line of maximum reflectivity will inevitably have a screen brightness lower than that of a new matt screen.

Consequently, if a satisfactory screen luminance is to be obtained at these angles the luminance in the direction of maximum reflectivity should be at or near to that of the maximum British Standard of 16 foot-lamberts.

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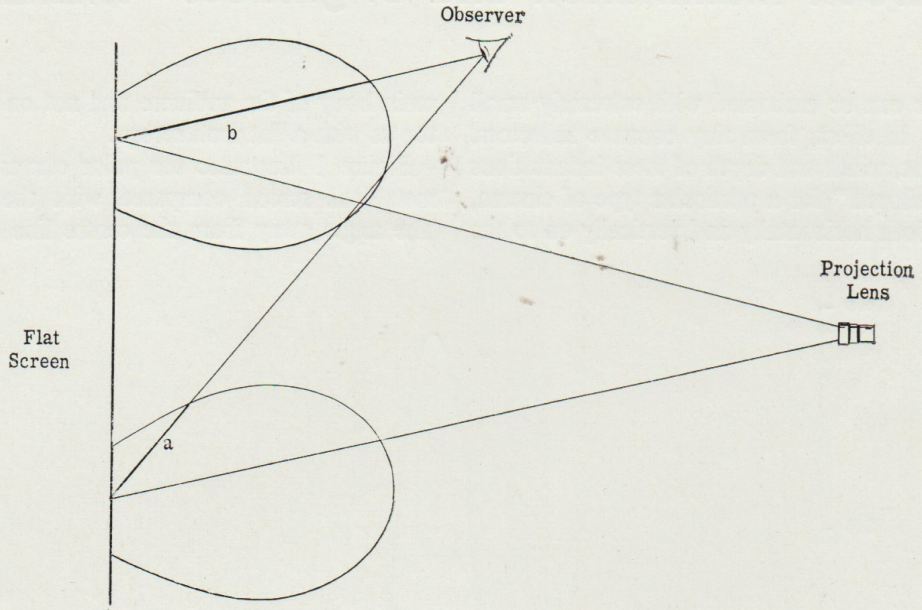
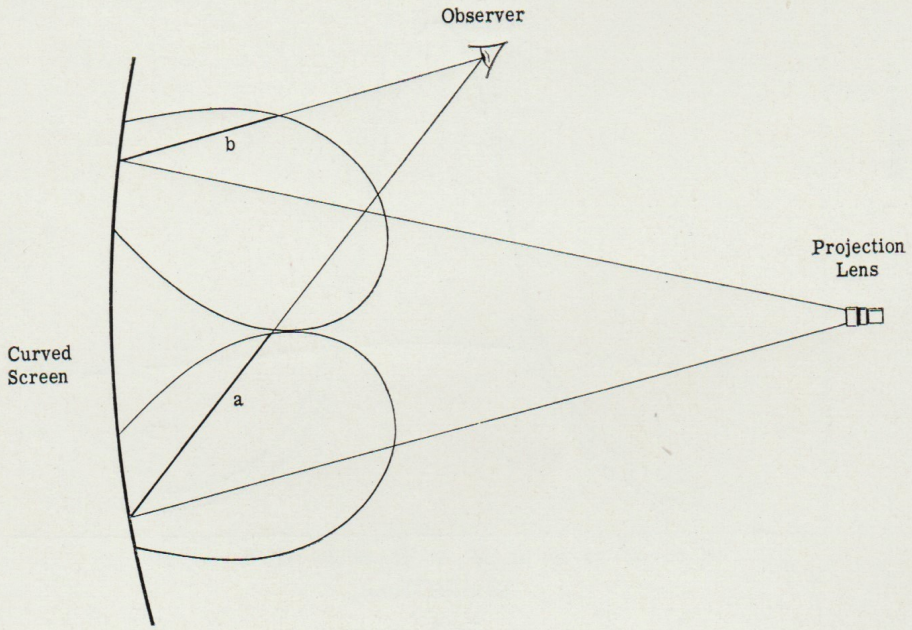


Fig. 2



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DATA SHEET No. 36 – Issued by the PICTURE PRESENTATION COMMITTEE of the BRITISH KINEMATOGRAPH SOCIETY

Sponsored by ANDREW SMITH HARKNESS LIMITED

Screen Frames and Variable Masking, Curvature, Tilt and Mobility

The screen end of the cinema is obviously a very important part of the building as it houses the screen on which the audience watch their motion-picture entertainment.

We know that the screen should be " inconspicuous by its presence " but what is not so generally known is the part played by the screen frame on which the screen must be mounted and held in close optical alignment to the motion-picture projectors and the way in which variable screen curvature and tilt are accommodated, masking altered to suit the aspect ratios of the various presentation systems, and the whole frame made mobile when required.

Screen frames are constructed of tubular steel and they must have the utmost rigidity for optical reasons. Considerable strength is also required in order that the screen can be laced tightly at top and bottom to lessen the tendency to a vertical convex curvature that results from any other than a very light pull at the sides of a curved screen. In fact the screen frame, housing as it does the screen on which the ultimate picture image is formed must be soundly constructed in every way, for suspension of as much as 2,000 square feet of plastic base so that the surface is completely free from ripple or creases is in itself a task of considerable magnitude.

Naturally the screen frame must not only be located centrally within the proscenium opening but also its edges must be the same distance from the mean between the two projectors in order to attain best picture focus.

This sometimes presents some difficulties in that the projectors themselves are not always centrally disposed to the proscenium opening or the screen position and in such cases the best possible compromise has to be effected—fortunately in all these cases there is some slight usable tolerance.

Variable masking

Once upon a time the picture format was at one standard —the 4 x 3 or in more modern terms the 1.33 : 1 aspect ratio. The format varied to some slight degree from cinema to cinema because of the extra height of picture added by the vertical elongation of the picture on heavy downward rakes, but in such cases the masking was always static and could therefore be given a clean cut edge.

The introduction of CinemaScope and thereafter of various other presentation systems made it necessary to allow for a mounting number of aspect ratios, 1.33 : 1, 1.66 : 1, 1.75 : 1, 1.85 : 1, 2.0 : 1, 2.35 : 1, 2.55 : 1 and so some form of variable masking became necessary.

The principle on which this variable masking worked was already established in the magnascopic masking used many years ago. The difference was that modern demands needed independent control of the top masking as against the combination of the two sides. In this country a static bottom masking line was adopted to be common to all presentation systems and many cinemas also adopted a common picture height or top line where only CinemaScope and Wide Screen presentations were in use. In these cases the sides merely opened out or closed in as required.

Variable masking systems differ slightly in design but they consist essentially of:

(a) Top and bottom tracks each side for the side masking.

(b) Side tracks at the top for the top masking.

(c) A metal leading edge for each side, top and bottom.

(d) A festoon type suspension for the top leading edge.

(e) A system of pulleys and guides.

(f) Flexible steel wires.

(g) One or two motor driven winding drums with two or more variable switching limits.

(h) Duplicated push-button control boxes.

By operating suitable push-buttons in the projection room the projectionist can vary the position of his masking to limits already set to give any particular aspect ratio at any width or height within the dimensional limits of the screen frame. By using the " stop " push-button he can also vary the relationship between sides and top at will.

This equipment is, of course, operating every day to suit the programme make-up and since mechanical operations are continually involved, and wires are liable to stretch and fray, some service maintenance is required.

These hints and tips on maintenance will enable you to get the best out of your variable masking, avoid breakdown and maintain a clean cut edge to the picture.

First, it is essential that all cables are inspected for fraying and wear at least once every three months and all pulleys should be examined to make sure that they run quite freely.

Don't use oil for lubrication—many screens have been ruined by this practice—in fact don't use oil on the curtain tracks either. Lubrication should be carried out by very careful and sparing application of grease.

Troubles that occur after installation or when cables have been renewed recently are generally traced to cable stretch, so for at least a period of two months after such work a weekly check should be made and any signs of slackness taken up.

Slackness will also affect the stop positions so limit switches on the controllers should be adjusted. Proceed as follows—(1) check rotation of motor, (2) when correct rotation is determined then wind to WIDE by hand, (3) set the WIDE limit striker (usually the outside one), (4) check rotation again, (5) wind by hand to CinemaScope position and set limit striker, (6) repeat for STANDARD.

Attention to the black masking material is needed regularly especially to the reefed top masking. Although dirt will not necessarily show against the black material, regular vacuum cleaning will keep it clean and assist the masking to function properly. Take great care, however, and don't hurry the job for the sake of the screen.

Screen curvature

The horizontal barrels on which the actual screen is laced are generally curved in a concave direction. This curvature can vary from 2 ft. in 40 ft. of width to 10 ft. in 50 ft. of width or even more.

Although such curvature, especially of the heavy depth, is generally a matter of the requirements of the promoter of a particular presentation system to enhance the audience participation through a " wrap-round " effect, the primary reason is to even out the light distribution across the screen in those viewing positions that are at one side of the auditorium. A flat white screen using a diffusive material is quite satisfactory on a flat screen frame but one of the modern specular screen surfaces on a flat screen frame would give the audience seated off centre a brighter picture at the edge nearest to them and then a progressive falling-off in brightness across the screen to the furthest corner. On the other hand, a matt white screen laced on a curved frame has no ill effect.

This curvature, if one can determine a degree of curvature which will suit all the presentation systems to be projected, and this is fortunately possible in most cases, can be built into the outer structure of the screen frame.

The screen frame manufacturers are quite used to making tailor-made screen frames to fit into awkwardly constructed stage space and the flexibility of tubular construction lends itself to such special considerations.

Screen frames in which screen curvature can be varied at will, either by motorised control or hand winding, are rather a special and elaborate construction problem, but several are in use in cinemas in this country where Wide Screen presentations, Cinerama, Cinemiracle, or other specialised road-show presentations are interspersed at times with normal 35-mm. CinemaScope and Wide Screen.

Screen frame tilt

In order to compensate somewhat for the heavy downward rakes familiar in many cinemas and to get a level picture brilliancy from stalls and circle seating areas, it is usual to introduce some backward tilt to the screen frame. For practical reasons and considerations of space this tilt is limited to a few degrees. This compromise is arrived at to prevent too much tilt causing trouble with the variable masking gear and excessive collection of dust on the screen surface especially if the surface is somewhat rough in order to attain high diffusion.

This screen tilt can be built into the outer screen frame construction so that the frame itself would stand solidly on the floor or it can be obtained by physically tilting the frame backwards and securing it in that position by dead lines from the grid or ceiling of the stage or by supports let into the rear wall.

Screen frame mobility

Many cinemas are fitted with a fully equipped stage and in these cases some means is required to remove the screen frame for stage presentations.

In other cases there is the need to move the screen frame backwards several feet in order to allow limited space for small stage presentations. In fully equipped cinemas it is sometimes possible to " fly " the whole screen frame away by lifting it on steel cables with the assistance of counterweighting to the grid. Otherwise the whole frame is generally moved on tracks and wheels to the rear of the stage.

Both these sets of circumstances demand a specially reinforced construction of the screen frame to allow it to be moved without any " whip " or bending and special arrangements to make certain that the screen frame can be located easily and accurately in its original position time and time again.

Ante-proscenium structures

In the desire to give larger pictures it often becomes necessary to erect a structure to carry the large screen which has to be placed within the auditorium directly across the original proscenium arch. Here the screen manufacturer's skill comes into its own in the design and manufacture of a complete structure carrying not only the screen and variable masking but also the curtains and their tracks, any pelmets, dress legs and even lighting if this is required as well as the forestage structure leading up to the picture bottom line. All this specially made to dimensions and shapes to suit the individual architectural features of any particular auditorium.

In the chain of expensive equipment from the studio to the final cinema presentation, the only thing on view to the public is the picture on the screen and its immediate surroundings. To achieve the presentation you desire the screen must be supported properly and securely. The sponsors of this Data Sheet will be glad to offer you advice on any problem you may have, modifications you may wish to make, or replanning that you intend to carry out.

DATA SHEET No. 38 – Issued by the PICTURE PRESENTATION COMMITTEE of the BRITISH KINEMATOGRAPH SOCIETY

Sponsored by CROMPTON PARKINSON LIMITED and THE ELECTRIC CONSTRUCTION COMPANY LIMITED

Maintenance of Electric Motors

Extracted by permission of the author, J. L. Watts Esq., A.M.I.E.E, from an article appearing in 'Distribution of Electricity.'

Modern industrial processes are very dependent on electric power and it is important that the maintenance of motors should be designed to avoid their breaking down—not merely to repair machines after failure.

Developing defects on electric motors frequently show certain indications. Any unusual symptoms noticed by the operating staff should be reported to the maintenance staff, and it is most desirable that each item be inspected periodically and any necessary preventative maintenance work carried out in good time.

Care of Motor Bearings

In most types of motors the bearings are the only parts which are subject to normal wear, and this should be minimised by careful lubrication. A small quantity of grease may be added once a year to ball or roller bearings which are fitted with lubricators, taking care to avoid foreign matter being introduced at the same time. Every few years it is a good plan to wash the old grease out of the bearings with warmed, light mineral oil, afterwards repacking the housings about 60% full of new grease. Lubricating grease having a high melting temperature should be used in ball or roller bearings which are in a hot position. Overheating of a ball or roller bearing usually indicates that excessive grease has been forced into the bearing.

It is necessary that a sleeve bearing be lubricated with an adequate amount of clean oil of the correct grade. Points at which faults may occur are indicated in Fig. 1.

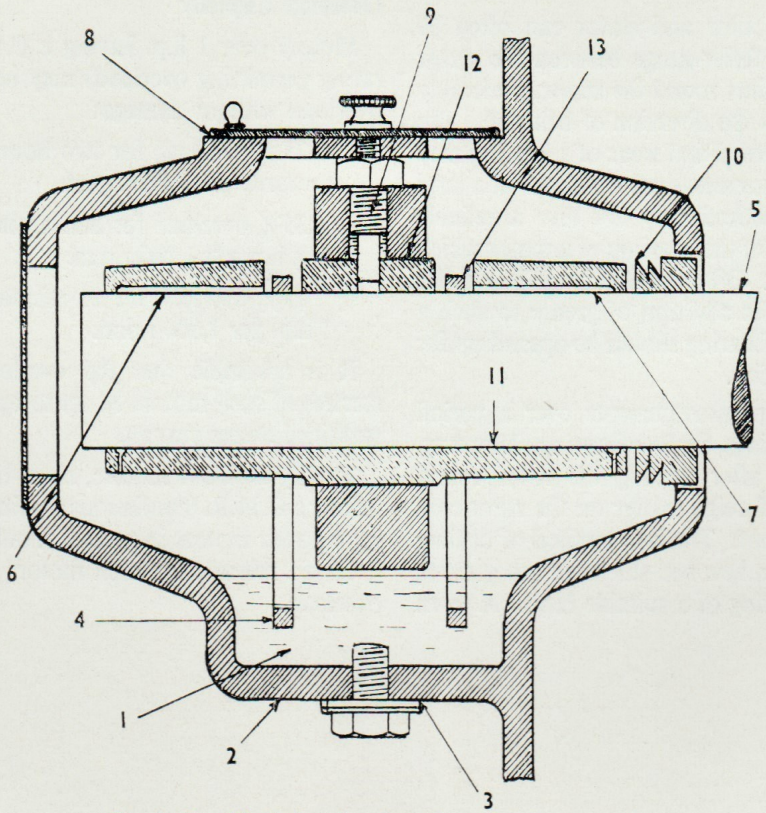

Fig. 1. Possible fault points in a ring-oiled sleeve bearing.

1. Insufficient, wrong grade, or dirty oil. 2. Cracked oil-well. 3. Loose drain-plug or oil-gauge. 4. Oil-ring out of true or parted at the joint. 5. Excessive belt tension or shaft out of line. 6. Bent shaft, scored shaft or bearing. 7. Choked oil-groove or drain. 8. Badly fitting cover allowing entry of dirt. 9. Securing bolt slack. 10. Oil thrower too small or too blunt. 11. Worn bearing or shaft. 12. Bearing loose in housing. 13. Dirt causing oil-ring to stick.

Overheating of a sleeve bearing may occur if the oil grooves and/or gutters become choked by foreign matter so that the heated oil cannot escape freely from the bearing surfaces. Small motors having sleeve bearings which are packed round with wool yarn may require a few drops of oil every few months, at which time a check should be made that the yarn is being held in contact with the shaft or bearing. If the lubrication is neglected the yarn may become hard in time, and it should then be renewed. Small motors which are fitted with oil-retaining sintered bearings may require a few drops of light oil every six months if they are in constant use.

The temperature of each bearing should be checked periodically by hand, at the same time observing whether oil-rings are carrying clean oil to the shaft. The oil content of a yarn packed bearing housing can usually be estimated by pressing the blade of a thin screwdriver into the yarn. Other causes of bearing trouble are excessive backlash in gearing, excessive belt tension, or a direct-coupled motor being out of line with the driven shaft.

Treatment of Worn Bearings

Since the radial air gap clearance between the rotor and stator of a small motor may be no more than a few thousandths of an inch, it is important that a worn bearing should be renewed in good time to avoid risk of the serious damage which might result from the rotor being allowed to rub on the stator. The amount of wear in a bearing can sometimes be estimated by placing a finger in contact with the shaft and bearing housing whilst the shaft is levered up in the bearing. It may be possible to measure the wear in a sleeve bearing directly by inserting a feeler-gauge between the shaft and bearing.

The clearance between a rotor and stator can often be measured by passing a long feeler-gauge between the stator and rotor at three or four points round the stator, preferably at the top and bottom and in the direction of belt pull. The measurements should be recorded and wear of a bearing may be indicated if different measurements are obtained on a later occasion. However, this method may not give a reliable indication of wear on the top of the bearings of a motor which drives through a vertical belt. Often a defective ball or roller bearing becomes noisy. If the addition of grease to such a bearing fails to silence it, the bearing should be opened up for early examination and attention.

Variation of radial air-gap measurements over a period may indicate wear of the bearings, shaft or housing. However, if the measurements differ after turning the rotor round somewhat, the cause may be foreign matter on the rotor core or the motor shaft may be bent. The best method of dealing with a worn housing is to fit a new end-shield, or the housing may be bored out for the fitting of a suitable bush. A worn shaft may be built up by metal deposition, or by welding on new metal, and machining to size, although it is often more practicable to fit a complete new rotor to a small motor. Normally, the inner race of a ball or roller bearing should be a press fit on the shaft, and the outer race a push fit in the housing. Ball-bearing motors should be stored in a place where there is no vibration, as vibration is liable to cause stationary indentation.

If a motor appears to be too hot, it may be advisable to measure the temperature of the various accessible parts by means of an alcohol thermometer, parts of the bulb which are not in contact with the tested surface being covered with a pad of felt or similar material. It is not possible to measure the maximum temperature, which will be in the interior of the windings.

Overheating is often due to lack of ventilation owing to an accumulation of foreign matter on or in the motor. Overheating may also result from fitting a motor in a confined space, a hot position, or a hot-air pocket. Adequate ventilators should be provided in such positions.

Overheating may also be caused by mechanical overload. This may be indicated if the motor currents in each line are equal but exceed the full-load values marked on the name-plate. If the current is not marked on the machine, reference should be made to a table of approximate full-load currents of typical motors. The full-load current of a motor of given type and horsepower may be taken as inversely proportional to the rated voltage. However, if the voltage also is low, a motor will take more than its rated current to develop its rated horsepower, and thus may overheat due to low voltage.

Overload Capacity

Motors over 1 h.p. having a C.R.P.O. rating (continuous rating permitting overload) may be capable of the following overload without damage:

25% overload for two hours for sizes of 10 h.p. and upwards per 1,000 r.p.m.

25% overload for half an hour for sizes from 10 h.p. to 4 h.p. per 1,000 r.p.m.

25% overload for 15 minutes for sizes from 4 h.p. to 1 h.p. per 1,000 r.p.m.

It is advisable that the overload releases fitted in the starters of such motors be set to operate in the event of 25% sustained excess current.

Totally-enclosed motors, short-time rated motors, motors having a C.M.R. (continuous maximum rating), and fractional horsepower motors in general should not be overloaded. The overload releases for such motors should be set about 10% overload.

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Sponsored by CROMPTON PARKINSON LIMITED and THE ELECTRIC CONSTRUCTION COMPANY LIMITED

Maintenance of Electric Motors—*continued*

Faulty Connections

A motor may overheat with normal current in each phase, and normal voltages on the supply side of the starter and good ventilation, if the starting operation has not been completed, or if the motor is wrongly connected. In this case the voltage applied to parts of the motor will be less than normal. The protective devices of a starter should be maintained so that it returns to the off position if the motor is not properly started. The same effects may be obtained if stator windings of a motor are connected in star when they should be in delta, or a dual-voltage motor is run on the lower voltage with the windings connected in series instead of parallel.

A motor may take a high current and overheat, possibly even on reduced load, if the supply voltage is high. This may also happen if stator windings of a 3-phase motor are connected in delta when they should be in star, or if a dual-voltage motor is run on the higher voltage with its windings connected in parallel instead of in series.

Overheating of a polyphase motor is often due to an open circuit in one supply line causing single-phasing. In this case the line currents to the motor will not be the same in each phase.

Faulty Windings

Unequal line currents with normal voltages may also indicate an open circuit in the stator circuit of a motor, an earth fault on the motor circuit, or a short-circuit. An earth fault is due to failure of insulation between conductors and the metal casing, and may be confirmed by use of a test-lamp or an insulation-resistance test set. A short-circuit is due to

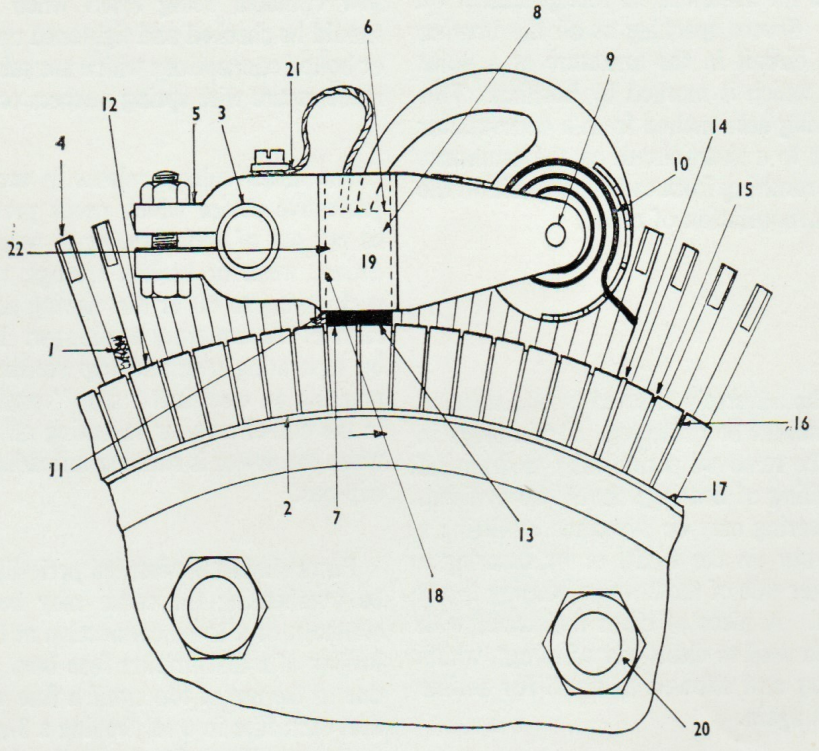

Fig. 2. Brush holder and part of commutator indicating location of possible defects.

1. Dirt or conducting matter between commutator risers. 2. Oil or dirt on mica V-ring of commutator. 3. Foreign matter on brush-holder insulation. 4. Solder melted from commutator connections. 5. Brush holder loose. 6. Brush sticking in holder. 7. Brush worn down to pigtail connection. 8. Brush worn out of range of pressure finger. 9. Sticking pressure finger. 10. Weak or broken pressure spring. 11. Dirt accumulated against brush. 12. Rough, burnt, grooved, or blackened commutator. 13. Brush not properly bedded to commutator surface. 14. Projecting intersegment micas. 15. Dirt or carbon dust on intersegment micas. 16. Carbonized intersegment micas. 17. Rotted or broken string binder on mica V-ring. 18. Excessive brush clearance. 19. Wrong grade of brush. 20. Loose clamping nuts. 21. Loose or broken pigtail connection. 22. Wrong brush position.

failure of insulation between conductors. This generally results in smoking, with burning, discoloration or embrittlement of the insulation, necessitating rewinding.

Brush Gear and Collecting Gear

Brushes should be kept free in their holders with adequate pressure, usually about 2 lb./sq. in. of contact area. They should be well bedded to the surface of the commutator or slip-rings, and insulating parts must be kept clean; a small paint brush is useful for this purpose. Intersegment micas of a commutator should not be allowed to project above the surface of the copper. They may be recessed about 1/32nd in. below the copper but it is essential that such recesses be kept clean: a bone scraper may be used for this. Dirty slip-rings or commutator may be cleaned with fine glasspaper. If they are grooved or untrue, it may be necessary to skim or grind them up, when the amount of metal removed should merely be that necessary to restore the surface. Reference may be made to Fig. 2 for other matters which may need attention.

Sparking at brushes may be due to their being in the wrong position, overload, an electrical fault, incorrect brush pressure, sticking brush, worn brush, faulty contact surface, or vibration. A ring of sparking around a commutator may indicate a short-circuit in the armature, or foreign matter on the intersegment micas. Severe sparking at all the brushes often indicates an open circuit in the armature at a point connected to a segment which is marked by burning. This may be due to solder having been melted from a commutator riser, as might occur due to a short-circuit on the armature, or a partial short-circuit resulting from carbon deposit on the intersegment micas, or carbonisation of micas.

Motor Windings

Motor windings may be adversely affected by moisture or oil, against which they should be protected. Drain-plugs in enclosed motors should be removed periodically to drain off any condensate. Over-oiling of bearings should be avoided. Leakage of oil from a bearing may be overcome by fitting a new and better oil thrower on the shaft, or by securing a leather washer on the inner side of the bearing housing to act as a gland for the shaft. A piece of cloth moistened with petroleum solvent may be used to clean oily windings, which should then be wiped dry and allowed to stand for a time before being switched on again.

Periodical Insulation Testing is Desirable

Every six months or so the insulation resistance of each motor circuit should be tested by means of an insulation-resistance test set, such as a " Megger." The circuit should be isolated from the supply and the test set applied between conductors and metal casing, with the starter closed. Tests may also be made between phases of a 3-phase motor used with a star-delta starter, when the starter is in the off position. It may, however, be necessary to hold the starter mid-way between start and run, and/or interrupt the circuit of the undervoltage release coil by separating overload contact in this circuit or by other means.

Secondary circuits, such as the rotor circuit of a slip-ring or repulsion-type of motor, should also be tested. In most cases it will be necessary to raise the brushes of repulsion-type motors in order to test the rotor. Liability to failure may be indicated by falling insulation resistance. In general, it is advisable that the cause of any test result below about 0.5 megohm be investigated, by disconnecting the various parts of the machine or circuit for individual tests. Careful inspection of the part responsible for the low-test result will usually reveal the cause; the remedy may merely involve cleaning or renewal of a small piece of insulation, but this may avoid a major breakdown. If all parts of a motor have low-insulation resistances the cause is usually dampness. The motor should then be dried out and the windings afterwards varnished.

Control Gear

Motor failures often originate in control-gear defects. This gear should be kept clean, with the correct oil level in oil-immersed gear. Contacts should be examined periodically, the contact surfaces being kept clean with adequate pressure, new contacts being fitted when necessary. Connections should be checked and tightened up if necessary. All screwed or bolted connections which are subject to vibration should be made secure with spring washers or locknuts.

The under-voltage release in each starter is an important protective device which needs periodical checking. It may be put out of action owing to wear, rust, dirt, lack of lubrication, weak or broken springs, rough contacts, or it may stick owing to oil or dirt having accumulated on the contact faces of the armature or plunger. It is best to test this device by separating overload trip contacts in series with the coil, pressing an electrical " stop " push-button switch connected in the coil-circuit, or switching off at the isolator, preferably when the motor is running unloaded. The starter should then trip out.

Fuses should be checked periodically. If they are found to be overheating the cause may be dirty or badly adjusted contacts, or a loose connection at the fuse wire, cable, or the busbar of a distribution fuse box. Overheating may also be due to the use of too small a fuse wire. It is most important that each fuse in a set feeding a 3-phase motor should be the same size. If one fuse is smaller than the other two, this may melt during starting, or at a momentary overload, and allow the motor to remain running with an open-circuited line.

The use of correct sizes of fuses, correct setting of overload releases, and efficient earthing are essential safeguards against the risk of electric shock or fire in the event of failure of insulation. Periodical tests should be made of the impedance of the earthing circuits to ensure this is low enough to provide proper protection, and the earthing system should be inspected from time to time to make sure that all connections are sound.

DATA SHEET No. 40 – Issued by the PICTURE PRESENTATION COMMITTEE of the BRITISH KINEMATOGRAPH SOCIETY

Sponsored by MORGAN'S SLIDES LIMITED and ROBERT RIGBY LIMITED

Give That Slide Equally Good Presentation

The projected slide, which is the only rational means of making an emergency announcement, is another link in the chain that leads to GOOD PROGRAMME PRESENTATION. The slide also has an important place in advertising and general announcements. It can be inserted into the programme almost immediately when required and the full use of slides during interval time keeps audience attention on the screen.

Remember that advertising pays in more ways than one—but advertising too demands good presentation.

British Standard No. 1917 issued in 1952 sets out in detail in Section Five the dimensional tolerances, projection area and preferred method of position indication.

Slides are obtainable packed in boxes of twelve from the accessory dealers or directly from the manufacturers.

Those intended for emergency announcements have a patented ruled area on the surface so arranged that the writing will conform to the screen area—this guide makes it possible to keep the wording straight and of consistent height, thus allowing good presentation. They have a matt grey surface which is easily cut with a scriber or any pointed object.

Slides can also be obtained with pictorial or geometric designs thereon, in either black-and-white or colour, to give pleasing effects that can be used on many occasions. With a colour wheel attached to the slide projector an endless variety of moving effects can be obtained.

When designing, selecting or ordering special slides consult the slide maker. The aspect ratio of your screen can easily be reproduced on the slide and your slide maker will be pleased to have this information as it helps him considerably to make a suitably arranged slide for you. With lenses of the correct focal length a more proportionate and pleasing effect can be obtained rather than the " postage stamp " size slide image often seen on today's large screens.

On projection throws with steep rakes inform your slide maker of the angle involved. He can then design the layout of the slide to minimise any " keystone " effect by avoiding the use of long vertical lines especially when such lines are near to the edge of the slide.

Photographic emulsion type slides should be stored in a warm dry atmosphere and if possible the slides should be warmed up before projection. This helps to avoid moisture in the emulsion condensing during projection which can occur when the slides are new and perhaps " green ".

Size and composition of the subject matter for a slide should be carefully planned. Brevity of " copy " is of paramount importance—fine lines and small type should be avoided.

Always remember to clean regularly all slides and slide projection equipment as only clean and well maintained components will give good presentation.

Unlike the film projector, a slide projector seldom has reflector optics, but nevertheless deterioration of picture is due to:

1. Poor lamphouse ventilation.
2. Clouded and fumed condenser-lenses.
3. Discoloured condenser-lenses due to overheating.
4. Clouded projection-lens.
5. Carbon misalignment.
6. Incorrect focusing of crater in relation to condenser-lens.
7. Pitted condenser-lenses due to particles from carbons.

Cleaning of condenser-lenses regularly ensures maximum efficiency from the slide projector. Always use great care in removing mounting and lenses from the lamphouse and ensure that lenses are refitted in the correct position. Lenses should be laid on a felt pad and embedded particles from the carbons removed with a flexible razor blade, using a rapid sweeping motion over the surface. Take care not to scratch the polished surfaces.

Apply over the surface a " whitening " type of cleaner, rubbing well where fume deposits are noted. Allow cleaner to dry and then polish off with a clean dry cloth.

Slide projection-lenses, provided they are not the " coated " or " bloomed " type, should be cleaned periodically as follows. Carefully remove lenses and spacers from mounting and lay on a felt pad, making sure to keep them in the order in which they were removed. Apply a " whitening " cleaner sparingly, being very careful not to allow any liquid near the joins of " cemented " lens combinations. Polish with a clean dry cloth, then remount the lenses and spacers in the correct order.

Where condenser or projection lenses are held in position by screwed retaining rings, do not screw these up completely tight but release by about one twentieth of a turn to allow for expansion.

Slide projection-lenses that are " bloomed " should be cleaned in accordance with information given elsewhere in this Manual.

Slide projectors using projector-lamps instead of carbon arcs as the illuminants should have their lamps, and reflectors, cleaned regularly.

The stationary position of the slide and its carrier in the light beam necessitates an allowance being made for expansion due to the heat of the beam, so slides and carriers should always be free running in their guides.

During recent years a number of types of heat filters have been used in slide projectors to divert a large proportion of beam heat from the slide and the cleaning and maintenance of these filters should be carried out in accordance with the manufacturer's instructions.

Consult the sponsors of this Data Sheet for any further information you may require and GIVE THAT SLIDE EQUALLY GOOD PRESENTATION.

DATA SHEET No. 41 – Issued by the PICTURE PRESENTATION COMMITTEE of the BRITISH KINEMATOGRAPH SOCIETY

Sponsored by ELECTRIC CONSTRUCTION CO. LTD., HACKBRIDGE AND HEWITTIC ELECTRIC CO. LTD., G.B-KALEE DIVISION of RANK PRECISION INDUSTRIES LTD., and WESTINGHOUSE BRAKE AND SIGNAL CO. LTD.

Power Supplies and Rectification

All types of light sources for 35 mm and 70 mm motion-picture presentation require a DIRECT CURRENT electrical power supply, generally of a voltage quite different from that of the commercial electrical supply. Although there are a few districts still in this country where the commercial supply is DIRECT CURRENT the vast majority of cinemas are served with an ALTERNATING CURRENT supply which must be converted to DIRECT CURRENT for the carbon-arc or Xenon lamp.

Carbon-arcs vary in their current requirements from around 50 amperes to as high as 180 amperes and their arc voltages also vary from 30 to 75 while Xenon lamps require from 23 to 90 amperes at arc voltages of from 20 to 35.

The normal electrical supply into a cinema is 415 volts 3 phase 50 cycles ALTERNATING CURRENT from which a 240 volt single phase 50 cycle ALTERNATING CURRENT is derived for lighting circuits.

Some form of power conversion is therefore required and this generally takes the form of a so-called " rectifier " as opposed to the motor-generator set, which is also a " rectifier " in the strictest sense but embodies rotating machinery and is generally only found where a DIRECT CURRENT electrical supply is the only service available for power requirements.

There are several types of " static " rectifier,

(a) the mercury-arc or cold cathode.

(b) the thermionic or hot cathode.

(c) the metal.

Metal rectifiers may be further subdivided into:

(1) the Copper-Oxide.

(2) the Selenium.

(3) the Germanium.

(4) the Silicon.

All these different types of rectifier are dealt with individually through Data Sheets elsewhere in this Manual and so is the care and maintenance of rotating electrical machinery which therefore covers the motor-generator set.

If the carbon-arc is connected directly to a source of DIRECT CURRENT power there would be trouble because the carbon-arc has a " negative temperature coefficient " which means that as the temperature rises, so the resistance decreases and therefore the current increases. This increasing current creates a higher temperature and so a vicious circle is formed and the current continues to increase until the fuses or circuit-breakers overload and operate to isolate the circuit from further harm.

Therefore some safety device must be used and this is partly the function of the " ballast " resistance which is connected in series with the carbon-arc and which also serves to control the current delivered to the carbon-arc by the paralleling of resistance sections.

It is usual to arrange for the DIRECT CURRENT supply from the power conversion unit or rectifier to have an output voltage of around 100 where ballast resistances are still used although from the point of view of efficiency, i.e., economy, lower output voltages of down to 70 are to be found. The danger here is that any mains voltage variation tends to give a considerable current change in the arc and may result in unsteadiness which is to be avoided in the cause of consistent screen illumination.

With modern rectifiers the necessary ballasting circuit is built into the rectifier unit.

The modern system is to have an individual rectifier unit for each arclamp which is only switched on when the carbon-arc is to be " struck " rather than a single large power unit feeding its output into busbars from which current is taken by each arclamp through a ballast resistance.

Another step in the direction of higher electrical efficiency or conversion efficiency is the introduction of a " twin " rectifier unit that may use only one transformer and one six-arm mercury-arc bulb to feed two separate arclamps. This economy measure becomes possible through the routine twenty minutes on and twenty minutes off that is a characteristic of motion-picture projection together with the fact that the double load required on changeover is only necessary for a few minutes at a time; the mercury-arc rectifier having a good overload characteristic.

Mercury-arc and hot-cathode operation

The operation of both mercury-arc and hot-cathode rectifiers is based on the following.

The flow of current in a vacuum (which is normally an almost perfect insulator) is made possible by the emission of electrons from an incandescent body which is placed in the vacuum. The insertion of such an incandescent body renders the vacuum a conductor but only in one direction; only currents that are directed from the incandescent body can pass through the vacuum.

The incandescent body emits electrons and this emission only takes place at high temperatures so that the electrons —negatively charged particles—may be considered as a form of electric vapour which is projected with great force from a highly heated body in the same way that water vapour escapes from boiling water. The vacuum actually enhances the emission and facilitates the movement of the electrons as if the extraction of the air had removed all resistance to their movement.

Current cannot flow unless particles are emitted from the cathode—the incandescent body—and it is quite immaterial in what manner the cathode is heated: the current flowing across the vacuum can itself be used to make the cathode incandescent, or a heated filament may be used in the rectifier. In using the current itself to heat the cathode—the way in which a mercury-arc rectifier works—it is necessary to have some " starting " device to temporarily heat the cathode, a method known as " ignition."

In the mercury-arc rectifier the cathode is a pool of mercury and the passage of the operating current through the mercury gives rise to the formation of a brilliantly incandescent " cathode spot " which attains a temperature of as high as 3,000° C. thereby providing the " incandescent body."

Since the emitted particles are negatively charged it naturally follows that a current can only flow in the external circuit and through the vacuum if the anode or anodes are positively charged.

Therefore, if an ALTERNATING CURRENT is connected to the mercury-arc rectifier, only half the current wave is conducted; during the remaining half cycle no current flows through the external circuit.

Mercury-arc rectifiers generally contain from two to six anode arms. The negatively charged particles are then attracted to that anode which is at the highest potential from which alone current flows but only during such time as its potential is higher than that of the other anodes. Hence the anodes in turn supply current into the cathode which can be finally smoothed into a DIRECT CURRENT supply.

The mercury and its vapour assist in reducing the overall voltage drop and in automatically renewing the cathode.

Initial ignition can be accomplished in a variety of ways, some known as " pinch " and " tilt " but the most widely known being the system which uses a magnetically operated " dipper arm " which dips into the mercury pool and in springing out " strikes " an arc which is then sustained through two small auxiliary anodes located near to the mercury pool and thereby maintains the " cathode spot "—the incandescent body—while no load is being taken through the main anode arms.

Mercury-Arc Rectifier Units

The usual type of mercury-arc rectifier unit consists of:

(*a*) the mains transformer.

(*b*) the mercury-arc rectifier bulb or bulbs.

(*c*) the smoothing choke or chokes.

(*d*) the carbon-arc ballast circuit.

(*e*) the control gear.

The ALTERNATING CURRENT of the electrical supply is fed into the primary winding of the mains transformer, which has several secondary windings, including the feeds to the ignition circuit, the cooling fan and the control gear.

The main secondary winding feeds the anodes of the mercury-arc rectifier bulb.

DIRECT CURRENT is obtained between the centre point of the transformer's main secondary winding and the cathode pool in the mercury-arc rectifier bulb and this DIRECT CURRENT output is smoothed by cathode smoothing chokes which reduce the ripple.

The carbon-arc ballasting circuit may comprise ALTERNATING CURRENT chokes or other means of offsetting the negative temperature coefficient of the carbon-arc such as high reactance transformer windings.

Hot-Cathode Rectifier Units

The hot-cathode rectifier consists of a mains transformer used in conjunction with a set of hot-cathode rectifier valves, generally two, three, four or six. The main transformer secondary windings are arranged to give the requisite anode voltages and suitable voltage to the filament cathode, usually of a very low voltage and high relative current, say 2.0 volts 70 amperes.

The hot-cathode rectifier valves are connected in different parallel combinations to suit the output required and the degree of rectification required.

It is, of course, necessary to allow for pre-heating of the cathode filament before switching on the main anode current, and interlocked switches meet this requirement.

Each hot-cathode valve carries two anodes and is therefore a full wave rectifier.

Here again, the ballasting arrangements necessary for the successful operation of carbon-arcs may be an integral part of the rectifier unit itself.

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Power Supplies and Rectification—*continued*

Metal Rectifier Operation

The " metal " and " semi-conductor " rectifiers depend on an electronic action which is difficult to describe without entering into an involved and highly theoretical discussion of the physical properties. It suffices here to state that in the conducting direction the voltage drop across a junction is extremely low, while in the non-conducting or blocking direction the resistance of the junction becomes extremely high. Thus, like a gate, the junction opens the ALTERNATING CURRENT circuit 50 times a second when the half cycle is of one polarity and closes the ALTERNATING CURRENT circuit when the half cycle is of the opposite polarity allowing pulses of unidirectional current.

Metal Rectifier Units

The normal " metal " rectifier unit consists of:

(*a*) the mains transformer.

(*b*) the series-parallel arrangement of rectifier plates or junctions.

(*c*) the carbon-arc ballast circuit.

(*d*) the control gear.

The connections and use of these items are fundamentally similar to any other type of rectifier unit such as the mercury-arc or hot-cathode rectifier.

The COPPER-OXIDE type of " metal " rectifier consists of copper having a suitable layer of oxide formed on it and having a connection both to the copper and to the outer surface of the oxide. The property of such a combination is that, while it permits current to flow readily through the oxide to the copper, it has an extremely high resistance in the opposite direction. The action of the rectifier is electronic, no chemical change whatever occurring in the constituent elements.

Copper discs were originally used and later copper plates which can be built up into combinations covering a wide range of voltages and current.

The SELENIUM type of " metal " rectifier consists of a layer of selenium formed on a steel plate and sprayed with a thin layer of a special alloy containing tin and cadmium. Current will flow readily from the selenium to the alloy film but is restricted in the opposite direction.

The GERMANIUM rectifier unit is a little different in that some years ago it was discovered that an excellent rectifier could be prepared upon semi-conducting germanium and today power rectifiers are prepared by a process of diffusing indium into mono-crystalline germanium.

Germanium is a metal which is extracted from coal or zinc deposits and refined to a high degree of purity and the resultant metallic material is pulled into a single crystal. This single crystal is specially cut to form small wafers and by heat treatment an indium button is welded on to and diffused into the germanium wafer.

The SILICON rectifier is obtained by refining the metal—silicon is obtained from silica (sand)—to a high degree of purity, drawing it into large mono-crystals and cutting it into wafers.

A thin plate of aluminium is then bonded to and diffused into the silicon wafer and the junction between the aluminium and the silicon wafer forms the rectifier.

A rectifier may be considered as a differential resistor, offering a low value of resistance in the conducting or forward direction and a very high resistance in the non-conducting or reverse direction. The reverse characteristic determines the ALTERNATING CURRENT voltage the rectifier can safely withstand which, depending on the rectifier circuit chosen, determines the DIRECT CURRENT output voltage. It may be necessary to use several rectifier elements in series if a high DIRECT CURRENT voltage is required.

The forward resistance determines the current rating and several rectifier elements in parallel may be required for heavy current outputs.

The selenium-compound type of rectifier has an improved forward characteristic and reverse stability over the original selenium rectifiers and has replaced the copper-oxide type for the medium power requirements of carbon-arcs as being smaller, cheaper and more efficient.

Four main types of metal rectifiers and semi-conductors are therefore available and out of these selenium is usually employed although for the larger arclamps silicon has certain advantages and so has germanium.

Copper-oxide rectifiers have been used in cinemas for many years and recently a new type has been introduced which has a substantially higher reverse resistance without any sacrifice in the notably low forward resistance.

Selenium developments over the years have tended towards improvements in stability allowing operation at higher temperatures as well as a much longer and more stable life under normal operating conditions. Selenium rectifiers are used in many cinemas as power supply for both carbon-arc and Xenon lamps.

Germanium and silicon rectifier units are now used in a variety of applications and the final choice as to which type to use is very much a matter of examination of the relative forward characteristics, reverse characteristics, temperature characteristics and the effect on life, voltage and current overload capacity, voltage rating and efficiency in relation to the work for which the rectifier is intended.

The power supply unit is a very important item in the motion-picture presentation chain, for on its reliability, efficiency and rectification properties, depend the screen illumination, its consistency and freedom from fault. Refer to the appropriate Data Sheets for information on care and maintenance of each type and consult the sponsors of this Data Sheet on any problems regarding the provision of DIRECT CURRENT for your carbon-arcs and Xenon lamps.

DATA SHEET No. 43 – Issued by the PICTURE PRESENTATION COMMITTEE of the BRITISH KINEMATOGRAPH SOCIETY

Sponsored by AEI SOUND EQUIPMENT Ltd., G.B-KALEE DIVISION OF RANK PRECISION INDUSTRIES Ltd., STANDARD TELEPHONES AND CABLES Ltd., and WESTINGHOUSE BRAKE AND SIGNAL Co., Ltd.

Metal Rectifiers, Care and Maintenance

A survey of a cross-section of cinemas today would probably show that the majority of the present-day cinema arc supplies are one or other of the following types:

1. The glass-bulb mercury arc rectifier, with associated transformer and smoothing, and either choke-controlled or requiring external ballast resistances.

2. The metal rectifier with its smoothing circuit and often including inbuilt ballast or control systems, which result in automatic provision of the correct arc voltage at the correct arc current within the scope of the range of any particular rectifier unit.

Metal rectifiers are of two types, the earlier copper-oxide rectifier, and the more recent selenium rectifier, while it is probable that units of even more advanced design may soon become available.

The care and maintenance of cinema arc metal rectifier units generally is the subject of this article, and the matter of a maintenance routine which it is advisable to follow in respect of any specific rectifier unit is, of course, one that is dependent to a great extent upon the situation, type, period and frequency of use of the rectifier and to various other peculiarities which may apply in that situation.

This makes it impossible to establish satisfactorily hard and fast rules, but it is considered that a resume of the requisite environment, causes of possible deterioration, and the effects to be guarded against when using arc rectifiers will be helpful to projectionists in determining a maintenance procedure which will suit that particular set of conditions.

It must be emphasised that no attempt should be made to carry out work on any rectifier unit unless it is isolated from the mains, preferably with the main fuses for the circuit in the possession of the person carrying out the work.

A feature that is common to all cinema arc metal rectifiers is that in the course of operation heat is generated and adequate ventilation is an essential. Some types of rectifiers are fitted with a cooling fan to assist in circulation of air around the rectifying element. In the case of selenium rectifiers the maximum ambient temperature at which they should be allowed to operate is usually clearly defined, and it is important for their proper performance that this figure is not exceeded. Whilst dealing with ventilation it must be stated that the presence of dust, often abrasive, and the deposit of foreign matter on electrical contacts and switchgear, or accumulation of the like upon the elements between the cooling fins of the rectifier, can only prove harmful, and could cause serious trouble.

All the foregoing points must be given consideration when choosing a position to house the rectifier.

Different makes and types of rectifiers can, and do, differ quite widely in certain physical respects, but they are often remarkably similar so far as electrical switching and contacts are concerned.

All circuits carrying alternating currents (a.c.) are subjected, under working conditions, to physical stresses as a result of vibrations set up at the frequency of the mains supply, normally 50 cycles per second in this country. Over a period of working this can cause set screws, nuts, terminal screws and the like to work loose on their threads. The particular ones to be watched are those securing the a.c. supply mains to the unit, fuse holder and fuse carrier connections in the a.c. circuit, and also any contactors which may be in use for the remote control of the rectifier unit.

The direct current (d.c.) connections, associated with the output of the rectifier to the arc circuit, should also be checked with some regularity for satisfactory contact. It must be borne in mind that the d.c. current carried in this circuit is frequently of the order of 55-65 amperes, whilst in some of the larger cinemas considerably greater demands are made. Although the conductors provided in the rectifier unit will be of generous proportions, the prolonged use of large currents of this type can result in some rise in temperature.

This rise occurs in conductors, and between joints and connections and some expansion occurs. When the rectifier is switched off, or is not delivering current, contraction occurs. This process over a period results in loose joints or connections, and accordingly unwanted resistance is introduced into the circuit. The effect of this will be apparent when it is considered that at a d.c. current of 60 amperes, the introduction of as small an amount of extra resistance as one tenth of an ohm will result in a drop of 6 volts across the area of poor contact causing that increased resistance. The dissipation of this 6 volts across the poor contact will cause considerable local heating-up at the contact and probable burning and " pitting " of the metal. This, in turn, will cause greater heating and more resistance, thus setting up a " vicious circle " of deterioration.

Another cause of increase in contact resistance is oxidization of the metal surfaces involved in a joint or connection, which will also result in the same burning and "pitting" at the affected contacts.

Loss of resilience of the contacts of switches, or springs of relays and contactors, will also tend to cause similar troubles. In this case re-setting or replacement of the affected parts may be necessary. This work, if carried out by the projectionist, should be done with great care.

Where burning or " pitting " has already occurred, or is occurring, the affected surfaces should be carefully cleaned bright and free of pits with the assistance of a suitable abrasive such as a fine-grade carborundum stone or carborundum paper, used with discretion. If, however, a small spring loaded contact, such as is found on relays or contactors, is affected by " pitting " it is inadvisable to use anything more abrasive than the specially prepared paper known as " wet or dry " paper, which can be purchased from any good hardware or tool store, and must be used dry. In every case steps should be taken to see that all trace of abrasive and metal dust is carefully cleaned away from all contacts and moving parts.

All nuts, set screws, and other terminations should be periodically checked to see that they have not become loose, or are causing poor contact through any other cause. If requiring tightening, use good well-fitting screw-drivers and spanners, and do not use excess force or leverage. If some other cause is present, then consider carefully and apply the remedy that appears correct before further damage or deterioration can result.

If there is a cooling fan present in the unit, remember to check both its electrical connections and lubrication occasionally.

Periodically blow out the dust from between the plates of metal rectifiers. A vacuum cleaner with the nozzle " blowing " will be found useful for this purpose.

If a rectifier unit is situated in an operating enclosure, carefully wipe clean at regular intervals to avoid accumulation of carbon deposit on the components.

In fact, as a general rule, a clean rectifier must be better and more efficient than a dirty one.

All fuses should be periodically inspected and if in poor condition replaced, whether of the " rewirable " or cartridge type.

Always apply to the manufacturers in respect of work on the rectifier requiring professional handling, or when any information is required about the equipment.

Lastly, any electrical apparatus used in connection with projection equipment should be checked occasionally to see that the " earthing " of the unit remains satisfactory.

DATA SHEET No. 44 – Issued by the PICTURE PRESENTATION COMMITTEE
of the BRITISH KINEMATOGRAPH SOCIETY

Sponsored by THE ELECTRIC CONSTRUCTION COMPANY LTD. and
HACKBRIDGE AND HEWITTIC ELECTRIC CO. LTD.

Mercury-Arc Rectifiers, Care and Maintenance

General

The simple and purely static nature of a mercury arc rectifier enables it to operate satisfactorily for long periods with the minimum attention.

To ensure reliable and trouble-free service, it is important that adequate ventilation is provided in the room where the equipment is required for service. Ventilating grills are provided on the rectifier cubicle to ensure that an adequate circulation of air passes through the equipment and on no account should these ventilating grills be covered up or restricted in any way.

Upon switching on the A.C. supply to the rectifier transformer the bulb strikes up and remains running on its exciters. As soon as the D.C. switch or circuit breaker is closed the rectifier will pick up the connected load.

Sometimes in cold weather the bulb may restrike several times before settling down to run steadily on its excitation circuit. This does not necessarily indicate that something is wrong or the bulb is deteriorating. If some load can be applied the bulb will soon warm up and run steadily.

Having put the rectifier on load it remains only to adjust the voltage to suit requirements and to see that the equipment is not overloaded beyond its proper rating.

MAINTENANCE AND ADJUSTMENTS

Cleaning

Dusting or cleaning the interior of the cubicle should not be regarded as a routine operation, under normally clean conditions, as a reasonable amount of dust will not impair operation. If it is desired at any time to give the plant a clean *no attempt should be made to clean the bulb*. There is a risk of a rag catching one of the bulb clips and the sudden wrench may fracture the seal. It is advisable therefore to confine the cleaning to terminal boards and the components in the lower part of the cubicle.

Starting and Excitation Circuit

The function of the starting and excitation circuit is to get the bulb into a state of readiness to take load as and when required. Once the bulb is operating on its excitation circuit the starting feature is isolated by a double pole relay.

In the range of mercury arc rectifiers with the excitation omitted, the bulb strikes up load immediately the carbons in the projection arc lamp are fed together.

Upon switching on the A.C. supply to the equipment there should be a voltage across the starter coil which should immediately cause the starting electrode on the bulb itself to make contact with the mercury. Immediately contact is made it should spring back and in the process of doing so draw an arc, thus ionising the mercury to enable the auxiliary exciter anodes to fire or in the case where there is no exciter circuit for the main anodes to pick up load.

For the circuit to function correctly it is important that:

(*a*) The starting electrode on the bulb is approximately $\frac{1}{8}$ in. above the surface of the mercury. Provision is made for adjusting the angle of the bulb with respect to the vertical in order to obtain the correct gap setting and this simply involves slacking off a wing nut which secures the bulb cradle to its fixing bracket in the cubicle. This adjustment should only be made when the equipment is isolated from the A.C. supply.

(*b*) The contacts on the auxiliary double pole relay should be closed and making good contact when the equipment is isolated from the A.C. supply. Occasionally, say once a year the contacts on this relay should be cleaned with a fine emery cloth.

Cooling Fan Motor

A cooling fan is sometimes found necessary in order to enable a particular size bulb to deal with the required output rating. The cooling fan where provided is driven by a totally enclosed low voltage induction motor. The motor runs in ball bearings packed with grease. The bearings should be regreased once a year with Price's Belmoline R.B. or equivalent soda base grease, care being taken to prevent the entry of dirt. It is advisable to clean the motor before removing the grease cups. After ten years running the motor should be dismantled and the bearings and housings thoroughly cleaned and repacked with grease.

Tracing Faults

In spite of the simplicity and reliability of the mercury arc rectifier there may come a time when for some reason or other a bulb fails to strike up or operate satisfactorily. The reason for this failure may be due to something simple like a loose connection or a blown fuse, and the projectionist will require to know the quickest way to locate the trouble and restore the rectifier to service. It is recommended that the following general procedure should be adopted.

Visual Examination

First of all make a visual examination for signs of excessive heating or damage to insulation at any point. Also check for loose connections or a fuse not properly located in its holder.

A thorough check should be made of all main circuit fuses both on the incoming and outgoing sides of the rectifier equipment and also any other fuses which may be in series with these but external to the rectifier cubicle.

Assuming that all phases of the A.C. power supply are healthy and at normal voltage and that all adjustments have been correctly carried out the trouble should be investigated in the following manner.

1. Starting and excitation circuit.
2. Main circuit.
3. The bulb itself.

1. Starting and Excitation Circuit

(*a*) If, after switching on the A.C. supply, the electrode comes in contact with the mercury and stays there, check the auxiliary fuses associated with this circuit after reference to the manufacturers diagram.

(*b*) If the starting electrode repeatedly makes and breaks with the mercury pool, producing a bluish spark at each break, check the auxiliary fuses as directed in paragraph (*a*) above.

(*c*) If the electrode is not pulled down into the mercury this would indicate a fault in the starting coil, that is the small coil attached to the starting electrode arm on the bulb. The nature of the fault could be of a high resistance due to a broken connection or alternatively due to shorted turns. The normal resistance of the coil when in sound electrical order is 7 ohms. If when checking the coil this resistance value measures something appreciably higher, a high resistance or open circuit fault is indicated. If on the other hand, the resistance measures something appreciably lower than 7 ohms the fault would be due to shorted turns. A replacement coil should be obtained from the manufacturers.

2. Main Circuit

Failure of the bulb to pick up load although it is running quite healthily on its excitation circuit would indicate that a main circuit fuse is blown either on the A.C. or D.C. side of the equipment. Alternatively a main connection may have come adrift or possibly a high resistance fault developed due to a loose connection.

When examining the main circuit the following points should be borne in mind:

(*a*) There can be no glow in the main anode arms until an external load is connected to the output terminals.

(*b*) Those bulbs which do not have an excitation circuit will not strike up until an external load is connected.

3. The Bulb

The bulb is unlikely to give trouble except as a result of gross overloading, overheating or mechanical damage to a seal.

If, after having examined the equipment on the lines indicated above and the cause of the trouble has not been located, the manufacturers should be consulted.

Remember that your Rectifiers constitute an important part of the PRESENTATION chain and look after them in accordance with the information given above.

Consult the sponsors of this DATA SHEET in case of difficulty and for further information on your Mercury-Arc rectifiers.

DATA SHEET No. 46 – Issued by the PICTURE PRESENTATION COMMITTEE of the BRITISH KINEMATOGRAPH SOCIETY

Sponsored by ALLIANCE ELECTRICAL Co., Ltd., ELECTRA (Birmingham) Ltd., GRETTON WARD Ltd., and TROUGHTON AND YOUNG Ltd.

Your Electrical Installation

The operation of every cinema depends on the reliability of the electrical installation in the same way as that in every other industry. With care and a little thought, this installation can easily be maintained in a state of high efficiency and complete reliability.

" The Show Must Go On " is one of the traditions of the cinema. Despite this axiom and the fact that poor maintenance will cause unnecessary breakdowns, the electrical installation is often greatly abused. The Chief Projectionist as the technician in charge of the cinema, can do his part in ensuring a long and trouble free life for the installation and its vital equipment.

The first essential is to know the main details of the electrical supply. If it is A.C., the standard medium pressure supply is 415 volts, 3 phase, 50 cycles, 4 wire, but since all parts of the country have not yet been able to changeover to the accepted standard, voltages still vary throughout the country, your cinema may be connected to a single phase supply. There are also a few D.C. supplies still operating. Circuits for lighting and for small appliances will usually be found to be within the range 200/240 volts single phase, but where a 3 phase supply is provided, the electricity board will usually require that the 3 phase load of the whole cinema is balanced over the 3 phases, bearing in mind the varying diversity factors applicable to cinema operation.

Their requirement that all 3 phase switchgear be marked with the voltage and an indication as to what main or submain is controlled not only assists when annual installation tests are made but also easily and clearly locates a faulty service when fuses blow.

Metering

Please refer to Data Sheet No. 63, " *Electricity Supply.* "

Know Your Electrical Installation

Time is well spent in preparing a log of all fuseboards and switchgear and in ensuring that all fuseways are properly and clearly marked to indicate the location of the points served, the wattage of lamps or details of miscellaneous gear, total load per circuit or fuseway and size of fusewire required.

It is also a great advantage to find out the routes of conduit runs and other information useful to your Electrical Contractor. This will save him time and save you cost.

The so-called " temporary plug or point " even though installed in all good faith and with the best of intentions, becomes a danger to the installation. Carried out with makeshift materials and a little " know-how " it works and then it becomes semi-permanent. Once started, this practice tends to spread throughout the cinema, with subsequent overheating of fuses, and in many cases, involving connectors, missing conduit box lids, and poorly made joints.

Be a Good Chief Projectionist not a Poor Electrician and when any new points are required call in a competent Electrical Contractor. In this way the extra wiring will be installed in the approved manner, in keeping with the rest of the installation—safe and reliable.

This does not imply that the electrical installation is not your responsibility. There are many ways in which you can help to maintain the installation in good working order.

Lighting

Lighting may conveniently be divided into four categories:
(1) External Lighting.
(2) Decorative Lighting.
(3) Primary Maintained or Management Lighting.
(4) Secondary Maintained or Safety Lighting.

(1) Canopy lighting and signs should be inspected prior to the opening of the cinema for the exterior appearance is of great importance. It is the first thing that the patron sees —the first link in the presentation chain.

(2) Will include the main auditorium lighting, stage lighting and any spot or flood lighting for curtains or proscenium, the latter generally controlled from the projection room by motor or hand operated dimmers.

(3) All areas where it is necessary to maintain permanent illumination during the time that the cinema is open to the public will be fed from this source. Exit boxes and directional signs and lighting points in auditorium, toilets, foyers, exit passages, etc., are dealt with here. The general level of illumination will vary according to decoration and architectural features and the use to which the area is put.

(4) The importance of the Secondary Maintained or Safety Lighting led to the issue by the British Standards Institution, in conjunction with the Institution of Electrical Engineers, of a British Standard Code of Practice, CP.1007:1955, in which there are 27 pages of information on this very important subject.

" The Cinematograph (Safety) Regulations, 1955, Statutory Instrument 1955 No. 1129 " contain a requirement that means of illumination adequate to enable the public to see their way out of the premises without assistance from the general lighting shall be provided in the auditorium and all other parts of the building to which the public are admitted, in all passages, courts, ramps and stairways to which the public have access and which lead from the auditorium to outside the premises and for the illumination of all notices indicating exits from any part of the premises to which the public are admitted. This illumination, known as safety lighting, has to be kept on at all times when the public are in the premises except in those parts of the premises which are adequately lit by daylight. The lighting serving this purpose is required to be derived from a source other than that which supplies the general lighting of the premises except in so far as the provision of a system using a changeover switch in conjunction with a trickle-charged battery supply, or a floating battery system, is permitted.

It is a general regulation that all secondary lighting should be switched on and checked prior to the public being admitted.

All batteries should be in a fully charged condition every day and be capable of carrying their full lighting load for at least three hours. Therefore, if a battery is discharged or even partially discharged during the day before—it must be brought up to a fully charged condition before the next public performance.

The Safety Lighting batteries initially installed by the manufacturers have a capacity large enough to deal with the number of safety lighting points installed when the cinema is built or the battery is installed, and the charger supplied is suitable for the characteristics of the battery. No increase should therefore be made in the lamp wattages on the safety lighting circuit unless it is certain that the battery has a sufficient capacity to carry the increased load for the full period of time demanded by the Statutory Regulations. Since the voltage of the safety lighting may vary between 12 volts and 240 volts, it is highly desirable that the lampholders connected to safety lighting points be of a type other than those in use on the normal mains lighting installation to prevent low voltage lamps being inserted into a high voltage lampholder.

DATA SHEET No. 47 – Issued by the PICTURE PRESENTATION COMMITTEE of the BRITISH KINEMATOGRAPH SOCIETY

Sponsored by ALLIANCE ELECTRICAL Co., Ltd., ELECTRA (Birmingham) Ltd., GRETTON WARD Ltd., and TROUGHTON AND YOUNG Ltd.

Your Electrical Installation—*continued*

Lamps

Ensure that the correct voltage and wattage lamps are used to replace ones that have failed. It is surprising how easily the total wattage of a circuit reaches the stage of overheating fuses merely because of the substitution by 60 watt lamps of a circuit designed for 40 watt lamps.

Change lamps systematically and whole sections at a time by keeping a check on burning hours. The average lamp life is 1,000 hours provided it is burning cap uppermost, and the efficiency beyond 1,000 hours falls rapidly to an uneconomic level. A lot of heartache and contortions needed to change lamps in some cornices and fittings and the trouble of setting up ladders, can be saved by a systematic programme of replacement. To check that lamps do burn for approximately 1,000 hours, it is a simple matter to mark the date of the installation on the lamp cap, as manufacturers will replace premature failures under guarantee.

Fuses

A spare pair of fuse bridges ready wired and kept adjacent to a fuseboard or switchfuse can save time, trouble and panic when a fuse fails. The blown fuse can then be repaired at your convenience and without causing a blackout on a vital circuit.

When ordering fuse wire, it is preferable not to ask for " 15 amp ", " 30 amp ", etc., since suppliers sometimes have varying ideas as to what wire gauge should be used. It is better to order the correct wire gauge given in the Manufacturer's instructions, or, where this is not provided, to select the correct gauge of tinned copper wire from the following table:—

Table 3 I.E.E. Regulations—13th Edition

Current Rating of Fuse	*Standard Wire Gauge*
5 amp.	35
10 amp.	29
15 amp.	25
29 amp.	21
45 amp.	18
65 amp.	17
102 amp.	14

The above table represents the approximate continuous carrying capacity of each gauge of tinned copper wire tabulated, without overheating. The value at which the fuse will blow is approximately twice the continuous carrying capacity. Whilst the fuse will carry a small overload for a short time, it will deteriorate quickly and will blow usually at a most inconvenient time.

Moreover, a relatively small overload can be serious in that not only does it cause the fuse wire eventually to blow, but the heat generated may seriously impair the copper contacts of the fuse bridge and of the switchgear. It is good practice to change fuse wires in rewirable fuse bridges at least once a year. Fuse wire left in service year after year tends to oxidise. This weakens the fuse and it eventually ruptures and, of course, this generally happens just when the show is in progress. WHY LET IT HAPPEN TO YOU.

Faults

Examine and tighten all cable clamping screws in switchfuses and fuseboards and look for loose fitting fuse bridges at least once every three months. A perfectly good switchfuse or fuseboard can easily be rendered completely useless in a very short time through overheating, generally due to loose terminals.

In enclosed lighting fittings such as bulkhead fittings where a certain amount of heat is always generated, it is good practice to use rock asbestos flexibles or other heat resisting flexibles such as silicone rubber which, since it does not absorb water or moisture, will not be prone to give low " megger " readings due to dampness. The extra cost and trouble of installation of such flexibles is well worth while in view of the trouble-free operation they give, with negligible maintenance costs.

External lighting fittings must always be a possible source of trouble in their exposure to the weather. Make a regular examination often. Make sure that all box lids have a good rubber gasket and that none of these are perished. External conduits and boxes should be painted regularly—don't wait until they show signs of rusting. Don't allow faulty or broken fixings or saddles to let the conduits sag or more and more will give up the unequal struggle with the strain. Check all well glass fittings to make sure that the sealing gasket is tight and sound and that all clamping screws are tight. Change any lampholder showing signs of corrosion and always keep spare glasses ready to make an immediate replacement.

When a minor constructional alteration is made, make sure that no vital conduit inspection boxes are covered up and thereby forgotten. Insist that such a box shall receive special attention otherwise the time will come when cables need renewing and the conduit run may have to be abandoned and re-run entirely at considerable and unnecessary cost.

Don't rely on the fact that you know where the box was.

You may not be there when it comes to it.

Mains voltage can be a lethal weapon, and the importance is stressed again (although you already know it) of ensuring that all flexibles to portable appliances are sound and that such appliances are securely earthed.

You have a responsibility to your staff and others in the cinema who do not have your knowledge. Don't take it for granted that a three-pin plug is earthed—check and make sure.

When re-flexing E.S. lampholders make certain that the live conductor is always attached to the centre contact.

Keep a book record of motors, starters and major plant items and use it also as a maintenance record.

Observe manufacturer's instructions—they know—for they made the item and they want repeat orders so you can rely on their advice.

Call in your Electrical Contractor when you need electrical work done and when he is working at your cinema use this golden opportunity to record on paper the layout of old and new conduit runs, the position of inspection boxes, etc.

Consult the Electrical Contractors sponsoring these Data Sheets—they are the specialists in cinema work.

DATA SHEET No. 48 – Issued by the PICTURE PRESENTATION COMMITTEE of the BRITISH KINEMATOGRAPH SOCIETY

Sponsored by CHLORIDE BATTERIES LTD., PRITCHETT AND GOLD AND E.P.S. CO. LTD., D.P. BATTERY CO. LTD., and OLDHAM AND SON LIMITED

Secondary Lighting Batteries, Care and Maintenance

This Data Sheet refers to Batteries of the "Stationary" type having pure lead (Plante) positive plates.

Two different systems are in general use:

(a) *Trickle Charging* with automatic changeover contactor and "Quick Charge".

(b) *Floating* distinguished by absence of an automatic changeover contactor.

The operation of the control gear, should be in accordance with the makers' instructions.

(a) *Trickle Charge Operation.* Keep the battery on trickle charge continuously (24 hours every day). The battery must be fully charged before leaving it on trickle charge. The trickle charge rate is given approximately by the makers but must be adjusted as found necessary. *Too much trickle charge* is indicated by gassing of the plates, even to a moderate degree and by the need for frequent topping up. To remedy, decrease the trickle charge rate a little at a time until the symptoms disappear.

Too little trickle charge is shown by the specific gravity of the electrolyte in the "pilot cell" being generally below the fully charged value, and by the pale appearance of the plates. Correctly trickle-charged plates show a marked contrast between positives which should be a rich even brown and the negatives which should be clear light grey. Remedy for too little charge—give a quick charge and then return to trickle charge at a rate increased a little at a time until the symptoms disappear.

(b) *Floating Operation.* The object of floating is to adjust the output voltage of the Rectifier or Motor Generator, so that the battery is prevented from discharging into the load. If this is only just achieved (about 2.08 volts per cell) the battery is in the same state as it would be if left disconnected and it will slowly lose capacity by self-discharge. Adjust the output so that the centre zero ammeter reads zero or a fraction on the charge side of zero. If the rectifier is a simple manually controlled one, the floating condition will be upset from time to time by variations in the load and/or the mains input voltage, resulting in periods of slight discharge and slight charge. The output control should therefore be adjusted from time to time to suit average conditions. As the amount of trickle charge (if any) going through the battery cannot be readily measured, the voltage while floating is used as a guide to the frequency with which freshening charges are needed.

Floating at around 2.08 volts per cell (100 volts for 48 cells) necessitates giving a freshening charge once a week even though no actual discharge has taken place.

If a higher floating voltage is adopted (take care to avoid too high a voltage on the lamps) freshening charges may be required less frequently. If the rectifier is automatically compensated for changes of load current, and perhaps for mains voltage variations, the floating voltage will have been pre-set and there will be no need to make adjustments to maintain the floating condition. In such cases the need for freshening charges will occur less often than with manually-controlled floating rectifiers and will depend upon the floating voltage, and any period during which the whole installation is switched off.

When to charge. As soon as possible after any emergency or test discharge and whenever the battery is found to have lost 5-10% of its capacity as judged by the hydrometer readings, with due correction for temperature, a charge should be given. Freshening charges should also be given, as recommended above, to floating batteries, but correctly trickle charged batteries need charging only after actual discharges. When periodical test discharges are required by the Local Authority, the recharge after such test can take the place of one of the periodical freshening charges. Always have the charge on when topping up the cells (see "Topping Up"). Momentary discharges to test for correct working of contactors, lights, etc., do not call for a charge. The state of charge of the battery is best determined by the specific gravity of the electrolyte, measured at least in the pilot cell and periodically in all cells. Each different size and type of cell has its own number of points drop of specific gravity in the course of a 3-hour discharge, so to judge when the battery is say 10% discharged involves knowledge of the points drop in a full discharge. When this figure is required it can always be obtained from the battery makers. In general 3 to 4 points drop (.003 to .004 in specific gravity as read on the hydrometer) indicates that the battery is 10% discharged. With the new stationary cells of the high performance types now available, the corresponding drop will be around 7 points (.007).

As this is only a small difference when reading the hydrometer, care must be taken to avoid errors (see Correction for Temperature). In the course of its life the battery may lose a little acid by spilling when

taking hydrometer readings and by chemical combination with the sediment at the bottom of the cells. Thus the fully charged gravity may be a little less than when new. All hydrometer readings therefore should be compared with the maximum reading at the end of the most recent full charge.

It is necessary to raise the voltage of floating battery chargers in order to give a charge. As floating batteries are directly connected to the secondary lighting this would overload the lamps. Floating batteries can therefore only be charged when the lights are not required. Trickle charged batteries with automatic contactors can be charged without affecting the voltage on the lights.

How to charge. The makers' directions must be followed in operating switches and control of charge current. The full load output of the D.C. source (usually a rectifier) must not be exceeded. In the event that a maker's instruction card is not available, the following will serve as a close guide for determining the correct charging currents.

Batteries can be charged successfully over a considerable range of currents but the recommended procedure is to start the charge at about 14% of the 10-hour capacity of the battery and to reduce this to not more than 7% of the capacity as soon as the cells gas vigorously which will be when the cell voltage reaches 2.3 volts. For the rest of the charge the 7% figure must not be exceeded.

Example. The initial charging current for a battery of 100 ampere-hour capacity at the 10-hour discharge rate will be 14% of 100=14 amperes. The reduced charging current will be 7% of 100=7 amperes.

The whole charge can be given at the lower rate throughout and many rectifiers will not give more than this amount. The 7% charge rate is suitable for freshening charges. Continue the charge until the specific gravity and voltage have ceased to rise and have remained constant for one hour. This length of time is purposely kept to a minimum to avoid undue wear on the plates of batteries charged once a week and specific gravity is usually measured in the pilot cell only. There may therefore be odd cells in the battery which are behind the others. The above charge should therefore be continued every fourth charge, particularly with floating batteries, until the readings have been constant for 3 hours. All cells should gas freely towards the end of a charge. Any cell that does not gas or is late in gassing, should be examined and the cause found and cured. Loose material may be lodged between plates. Sediment may have been allowed to build up until it touches the plates. When corrected the cell may need additional charging to bring it back to full charge and healthy appearance.

Length of Charge. This will depend on the state of charge of the battery when charging begins, upon the charge current used, and upon the purpose of the charge. After a full discharge at the 3-hour rate, and using the starting and finishing rates as described, it may take 8 hours. A routine weekly freshening charge may only take 2 or 3 hours. In all cases the end of charge must be judged by the readings and signs described above.

Correction of hydrometer readings for temperature. Before comparing any two readings correct both for temperature. For every 2½° F. that the temperature in the pilot cell is *above* 60° F. *add* 1 point (.001) to the hydrometer reading. For every 2½° F. that the temperature in the pilot cell is *below* 60° F. *subtract* 1 point (.001) from the hydrometer reading.

Records. Keep records, preferably in the printed record book available from battery makers. Records are invaluable in assessing the condition of the battery.

Pilot Cell. Select a cell about in the middle of the battery. Readings in this cell will be representative and will show the state of charge of the battery as a whole.

Topping Up. Batteries lose water by evaporation and by gassing. Therefore add water only, to restore the level. Do this frequently in the pilot cell so that specific gravity readings are not falsified by varying levels. Use pure distilled water, or water that has been approved for use in batteries. Always have the charge on when topping up, to help mix the water and acid. The plates should be gassing.

IMPORTANT. Never add acid to any cell except on advice from the makers.

Routine Matters. Keep the battery clean and dry. Keep the intercell connections free from corrosion, covered with petroleum jelly (Vaseline) and firmly tightened up. Use the cable sockets provided for all end-of-row connections. Keep vent plugs in position to protect from the entrance of dust or any other impurity.

Have sediment removed in plenty of time before plates become weak and difficult to handle.

Never allow smoking or a naked flame in the battery room.

DATA SHEET No. 49 – Issued by the PICTURE PRESENTATION COMMITTEE of the BRITISH KINEMATOGRAPH SOCIETY

Sponsored by H. W. DUTTON LTD., THE FREEMAN HEATING CO. LTD., J. B. JACKSON AND PARTNERS LTD., THOMAS McDOWELL LTD., SMEATON AND SONS LTD., and NORMAN TURNER LTD.

Operation and Maintenance of Heating Equipment

During recent years the price of fuel has risen to such an extent that it is necessary to extract the last ounce of energy from every pound of fuel used.

Making patrons sit in cold theatres is no solution to the problem, for far more would be lost in box office takings than would be saved in fuel costs. If attention is paid to detail, a substantial reduction in the fuel bill can be achieved without lowering the standards of patrons' comfort, but when it comes to getting the last few degrees of efficiency from the last ounce of fuel, it is well to remember that every theatre has its own special problems, and general rules must be supplemented by local knowledge of each situation.

This data sheet will give general guidance on maintaining plant efficiently and effectively to ensure the maximum comfort for patrons at the minimum of cost. This can, of course, only be achieved by a close study of the recommendations, by putting them into practice, and continuing to do so throughout the heating season.

The obvious things to do are as follows:

On starting up at the beginning of the heating season:

1. Make sure the system is full of water. The altitude gauge on the boiler will indicate whether it is; if not, check that water will flow into the feed and expansion tank and that the boiler isolating valves are open. Remember that the feed and expansion tank only supplies make up water to an already filled system and if after the system has been filled, the water continues to run freely into the tank, this will indicate a leak somewhere.

2. Check that the circulating pump (if any) is working.

3. Check that all radiators and heater banks are vented and free of air. This may require several tours of the system before they are entirely free.

4. 1. The boiler flues and fire box should be clean.

   2. The ashpit should be clean.

   3. Open ashpit and flue dampers.

   4. Start circulating pump. Look at the altitude gauge while doing so and if the pump is working properly you will see the needle move a degree or so.

   5. Light a small fire in the fire box of the boiler and note that the size of the fire should be only gradually increased.

   6. When well alight add more fuel and spread the fire evenly over the fire bars.

7. Build up level of fire to a depth of about 9 inches

8. Control the rate of burning by adjusting the ashpit door and flue dampers. Use the least possible draught but never close the dampers to the extent that fumes escape from the boiler into the boiler-house.

9. To find the most suitable damper setting for any required water flow temperature, experiment must be made but remember that temperature is always relative to other conditions and while it may be possible quite easily to obtain a water flow temperature of 160° F. with a good fire on a day when it is dry and with an outside temperature of 50° F. will not be quite so easy when the outside temperature has dropped to 40° F. Thus, experiment is necessary.

10. Do *not* force the boiler and never try to raise the temperature of the water too quickly.

11. Do not rake or disturb the fire unnecessarily.

12. Do not raise the temperature of the water more than the conditions warrant. The following table is a rough guide:

Outside Shade Temperature	50	45	40	35	30
Flow Temperature	140	145	150	165	180

The flow temperature of a sectional boiler should not, as a general rule, be allowed to fall below 140° F, as under some conditions, condensation may attack the boiler flueways and cause corrosion. It is particularly important to build up from experience a chart for each individual theatre, as each theatre will vary according to local conditions (see item 8).

13. The water temperature should be raised in time to warm the theatre before the patrons are admitted. Even so the boilers should be lit or opened up if banked down overnight as late as possible to avoid waste of fuel.

5. It is essential that when warming the theatre prior to opening, that all doors should be closed and the extract fan should be off. After house opening, the constant opening of doors may reduce the auditorium temperature. During the afternoon performances the extract fan need not be used if the atmosphere is clear. " Attention to doors " is just as important as " attention to boilers." The manager and floor staff will obviously co-operate in this respect.

Although it is desirable that cleaners on their arrival should open all theatre doors to let in fresh air, this rule should be varied in conditions of fog or extreme cold when doors should be kept closed.

No doubt managers would make arrangements with the head cleaner that this variation to standard practice should be observed. When outside temperature drops to 35 degrees at the time the theatre closes, the following action should be taken:

(*a*) Circulator pumps should be kept running all night.

(*b*) Coke-burning boilers should be banked up last thing.

(*c*) The following morning, after heavy frost, all supply tanks, etc., must be examined.

6. In foggy conditions the use of the extract fans should be restricted to prevent the ingress of fog. At the same time, the auditorium temperature should be maintained as high as possible short of causing discomfort to patrons, but at no time however should the boiler temperature exceed 180° F. During mild Autumn conditions, it is very easy to overheat a theatre, and strict attention to flow temperature and thermostat settings is necessary to achieve comfortable conditions. Boilers should be lit as late as possible, flow temperatures should be kept as low as possible and boilers should be shut down as early as possible—consistent with maintaining comfortable conditions in the theatre. When the heating plant is in use, keep the inner set of main foyer doors closed. It is desirable to keep front main doors of theatres open but discretion should be used and if the temperature in the foyer drops below a comfortable level, while the temperature in the auditorium is 65° F., front doors should be closed.

7. Check the air valves on radiators and heater banks for air locks. Do not have radiators on where heat is not required. In severe cold weather however, radiators should not be shut off completely in any part of the building where there is risk of them being damaged by frost.

8. Record outside, inside and flow temperatures when the plant is running, so that it is *known* what flow temperature is required to maintain comfortable conditions for any given outside temperature. Dampers should be adjusted to give the required flow temperature and also to ensure that enough air is entering the boiler to give smokeless combustion. As the auditorium fills up, it will be found that the flow temperature can be reduced —if good business is expected, ensure beforehand that the theatre does not become overheated. Be alert for a sudden drop in temperature in the evening, particularly in Spring and Autumn, so that the water temperature can be increased before the theatre becomes uncomfortably cold.
Where several boilers are installed, shut down one or two boilers as early as possible, consistent with need to maintain the same comfort for the patrons who arrive at opening time and those who see the feature through for the last time.

Do not keep the job a secret, but discuss methods employed and problems encountered with your assistants on the correct handling of the boilers and fans under all conditions.

DATA SHEET No. 50 – Issued by the PICTURE PRESENTATION COMMITTEE of the BRITISH KINEMATOGRAPH SOCIETY

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Operation and Maintenance of Heating Equipment—*continued*

9. *Multiple Boiler Installations.* When a theatre is equipped with more than one central heating boiler, it is economical to use one boiler only when the load is within the rating of the boiler. As soon as it is necessary to force or overload the boiler, it is more economical to light up a second boiler, even though it means feeding two fires. When the conditions are such that two or more hand-fired boilers have to be used:
   1. One boiler only should be banked up overnight and the other should be allowed to burn itself out.
   2. On the following morning, the boiler which has been allowed to go out should be thoroughly cleared and relighted whilst the fire in the boiler which was banked up should be cleaned in the normal way (see section 10) and should again be put on load.
   3. By banking only one boiler at night and by alternating the boilers to be banked each night, each boiler will be thoroughly cleared every other day, and more comfortable conditions will be held in the auditorium during the last hour or two of the last performance.

10. *Fire Cleaning.*
   1. Fire should be cleaned first thing in the morning and again before overnight banking. With some fuels and high rates of burning it may sometimes be necessary to clean at shorter intervals.
   2. After any unattended period and especially after overnight banking, DO NOT OPEN THE FIRING DOOR UNTIL THE FLUE DAMPER HAS BEEN FULLY OPEN FOR SOME MINUTES. Failure to do this may cause unburnt gases to explode.
   3. Set dampers and let the fire burn down to a medium thickness.
   4. Adjust the flue damper to carry fumes away during cleaning and keep ashpit door closed while fire-door is open.
   5. Clean each side of the fire in turn. Move the good fuel to one side, remove the exposed clinker and ash, move the good fuel back to the clean half and repeat the operation for the other side.
   6. Remove ashes from the ashpit and recover unburnt fuel.
   7. Do not let ashes and clinker lie against the boiler as this may cause severe corrosion.

11. *Boilers Not in Use.*
   1. When a boiler is taken out of service at the end of the heating season or for any prolonged period, the loose firebars should be removed and all unburnt fuel, ash and clinker cleared away and the flueways, etc., well cleaned and left free from soot. The dampers and ashpit, firing and flue doors should be left open to allow air to circulate, unless the boiler is connected to a common flue to which other boilers *in service* are connected, in which case the dampers and doors must be kept closed to maintain draught.
   2. Do not empty the system except when it is out of commission in frosty weather.
   3. Never burn waste paper or rubbish in any boiler—WHETHER IT IS IN SERVICE OR NOT.

12. *Breakdown.* In the event of a serious water leakage in any part of the system, the following steps should be immediately taken:
   1. Draw boiler fire.
   2. Shut off stop-cock (or valve) at tank. When stop-cock not fitted, tie up ball valve.
   3. Drain out system.
   4. If the circulating pump stops through electricity failure or other cause, the fire must be drawn, if necessary to prevent the water temperature exceeding 180° F.

13. *Precautions During Frosty Weather.*
   1. Boiler fires should be maintained at night and at weekends and the circulating pump (if any) kept running.
   2. Keep all radiator control valves open and, where provided, close fresh air inlets behind radiators.
   3. DO NOT relight fire if it dies out during unattended period until it has been checked beyond doubt that no part of the system (including the open vent pipe) is frozen.

14. *General Precautions.*
   1. CLEAN the boiler smoke flue passages and smoke box AT LEAST TWICE A WEEK.
   2. *DO NOT draw water from a heating boiler or any other part of the system.*

3. Look for, and if found, prevent air-in-leakages by stopping up any cracks which may occur at boiler foundations, joints of the flue-pipe sections, etc. See that ashpit, firing and cleaning doors are a good fit.

4. Any dampness in ashpit or other signs of water leakage should be dealt with immediately as they often indicate the start of more serious trouble.

5. Periodically check system for accumulation of air in radiators and pipes and release through air cocks.

6. Periodically check feed and expansion tanks. If water is continually running in from the ball valve this denotes a leak on the system.

7. Use the correct stoking tools and keep them in good condition.

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Operation and Maintenance of Ventilation Equipment

The importance of comfort to theatre patrons cannot be over-emphasised; comfort is a combination of several factors, foremost of which is equable heating with good ventilation.

Heating and ventilating is a highly specialised branch of mechanical engineering, but the main principles and lines of operation are reasonably simple and can be readily understood by the layman.

Ventilation is essential for three main reasons:

(*a*) To prevent unduly high concentration of carbon dioxide and moisture, and depletion of the oxygen content of the air.

(*b*) To prevent concentration of bacteria-carrying particles.

(*c*) To prevent undue concentration of body odours.

Efficient ventilation is dependent upon air changes but the temperature of air, its direction and velocity must be controlled.

Air movement can cause discomfort, especially if it is at floor level. Even a slightly lower temperature at low level will cause a feeling of chill.

Air control is extremely difficult in theatres where the extract is the only mechanical means; in these circumstances consideration must be given to the many deficiencies of this method if even a moderate degree of comfort is to be obtained. Comfort means clean air without draughts.

Equipment varies considerably from theatre to theatre, but can be classified into two main systems:

1. Ventilation by mechanical extract only with heating by hot water radiators.
2. Plenum mechanical fresh air intake and mechanical extract with (often) auxiliary heating by hot water radiators.

Theatres ventilated by mechanical extract only.

These are generally the older type of theatre; in winter, heating throughout is achieved by means of radiators and pipe coils and ventilation by means of extract fans. The shortcomings of this type of installation are readily apparent and the patron's comfort is not really assured. Air will be drawn into the auditorium from outside, usually via cracks beneath doors, through open doors, etc., and discomfort to occupants is bound to occur at all points of ingress, though careful curtaining and screening can often minimise these nuisances. Even where special grilles in walls (often behind radiators) are fitted, the cold draught effect is usually so severe to nearby seats, that the grilles are often permanently sealed up. The more such openings are sealed, the more draught exclusion strips that are fitted to exit doors, the worse the ventilation will become, since the very success of the use of an extract fan depends on the amount of air it can move and over a period it cannot push more air out of the auditorium than it draws in through grilles and doors, etc.—its function is not to create a vacuum. The choice seems to be cold draughts on the one hand or "fug" on the other. Neither provide the real comfort that will bring discriminating patrons back time after time.

A temperature of about 66° F. has generally been considered a suitable standard for warmth when sitting for long periods, but although a reasonable temperature is essential, there are other factors which affect the warmth and comfort of the individual.

The Plenum System of Heating and Ventilating.

This sets out to overcome the deficiencies of the previous type of system. It consists of a mechanical fresh air intake as well as the mechanical extract system. It is arranged such that in cold winter weather the incoming air can be warmed prior to its admission to the theatre, and in addition, there is usually provision for cleaning by a water air washer or filters. It is the modern method and is capable of giving all desired results when properly designed and when properly operated and maintained.

Some Licensing Authorities specify that a plenum plant must be designed to provide a supply of fresh air into an auditorium at the rate of 1,000 cubic feet of air per hour per person.

Intake air is drawn from outside by a fan and made to pass through either an air washer or a filter battery and thence through heaters, after which it is delivered into the auditorum via ducts terminating in delivery grilles. Vitiated air is taken out by the extract fans through grilles situated at the opposite end of the theatre; the quantity of air handled by the extract fan is usually some 25% less than the quantity supplied by the intake fan and the purpose of designing the plant this way is to provide a slight air pressure within the auditorium (and sometimes the entrance suites as well), thus creating an outward air movement instead of an inward one. The theory behind this is quite simple and sound but the success of its operation depends on careful maintenance of the entire plant and intelligent operation.

To maintain the atmosphere clear in a theatre and prevent undue vitiation, the rate of ventilation has to be some four to six times greater than in an average sitting-room, shop or office. To achieve this, the air movement rate will also be some four to six times as fast, and unless the air temperature is

correct, this high rate of ventilation is almost bound to cause discomfort. The " correct " temperature is dependent on the outside temperature and weather conditions and upon theatre attendance.

The demand then on plenum plant both in air volume and the amount of heat required prior to the admission of the warm air to the auditorium varies considerably, due to the external air temperature and the number of occupants in the theatre. The external temperature factor is quite obvious: the effect of a widely differing occupancy is perhaps not so readily understood.

The human body—even sitting down enjoying a cinema programme—throws off an appreciable amount of heat; without quoting tedious figures the following will illustrate the point. . . . A full theatre on a cold day could require approximately 40% less heat input from the plant to maintain an internal temperature of 65° F. than when the same theatre was empty. It could also be said that the body heat given off by a " full house " is the equivalent to the output of a fair sized boiler, and it will be seen that in summer time inside temperature of an auditorium must of necessity be rather higher than the outside shade temperature, unless some form of cooling equipment (refrigeration) is installed to operate in conjunction with the plenum fresh air intake plant. It is for this reason and because refrigeration plants are not usually installed that during the summer warm spells the fresh air intake plant should be run at top speed to ensure maximum rate of ventilation.

Installations vary so greatly that no attempt will be made to suggest how even a typical plant should be operated. Instead a few notes generally applicable to most installations will be given, several of which may assist to ensure that best results are obtained.

Temperature of intake air (winter running) at delivery grilles should be slightly higher than the required auditorium temperature, say 78/80° F. A good " target " temperature for the auditorium is 67/68° F. plus or minus 2° F., which provides a good degree of comfort but great care is needed to bring an auditorium temperature down by introducing relatively cold air, as discomfort to patrons seated near fresh air delivery grilles will almost certainly result. Prevention is (still) better than cure and the " answer " is not to allow the internal temperature to rise above 68° F., and this really means that the two variables must to some extent be anticipated. Allowance must be made for the house to pass from (say) one-third full at 5.0 p.m. to (say) three-quarters full at 6.30 p.m., and at the same time some reasonable allowance should be made for a change of outside temperature. It is agreed that weather forecasting is at best a tricky business, but it is in fact not as difficult as it at first seems to calculate—a 5°, 7° or sometimes 10° temperature drop after sundown, according to the local geography, etc. If there was a 5° drop on Sunday and a 6° drop on Monday, between 4.0 p.m. and 7.0 p.m., the chances are there will be a similar drop on the Tuesday too—all other things being equal.

If an installation is fitted with automatic thermostatic controls, then check that they are intelligently adjusted and that they do carry out the functions intended.

Remember that poor boiler management and dirty fires and flues can reduce the effective output of a boiler plant by as much as 50%. Whether boiler firing is by coke, coal, gas or oil, cleanliness is always essential. The checking of gas and oil firing installations may be a specialist's job, but if boilers are arranged for hand firing, results will depend directly on the standard of stoking.

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Operation and Maintenance of Ventilation Equipment—*continued*

Maintenance of fan, air washer and heater battery equipment is obviously of paramount importance, and all these items should be given frequent and regular attention. Heaters must be kept clean, otherwise not only will the incoming air not get properly warmed, but the volume of air will be seriously reduced with the result that less heat will be passed to the theatre. The " balance " between fresh air and extract will at once be upset (if heaters are allowed to get fouled by dirt and dust) and the slight positive pressure mentioned earlier will give way to a definite negative pressure with the shortcomings of a building with extract plant only. Occasionally fans (somehow) come to be running in the wrong direction; this sometimes happens after electrical re-wiring or electric motor repairs and usually when there is a three phase supply. The remedy is simple and the changing over of a pair of leads will give the right direction of rotation. A cased fan running the wrong way will usually give only 40-45% of its normal output—enough to make a normally comfortable theatre a cold and unattractive one—very often for no apparent reason !

Dampers (like the handless " lock shield " valves on HW Radiators) are provided to enable an installation to be set up and balanced, and such setting up is undoubtedly a specialist's job. Once set, neither should be interfered with for any reason —balancing on a large installation is a very long and laborious operation. The closing of a few dampers can ruin hours of careful work and incidentally give rise to more complaints of draughts in a system than they can cure.

Where a modern type plenum or warm air plant is installed, it is recommended that periodically a check be made to ensure that the combined effect of the simultaneous operation of the intake and extract fans does in fact give a pressure effect in the auditorium. Such a test is simply carried out by closing all doors and setting all fans in operation; smoke from a cigarette with an exit door ajar should easily indicate an inward or outward air flow (a test of this nature should not be carried out if the doors are located in an exposed position, and there is a very strong wind). If the air movement is persistently inwards, then heater batteries, air washer eliminator plates, etc., should be suspect, and a detailed examination made for obstruction. A forgotten fog blanket or blocked heater batteries would, of course, easily account for a very appreciable air volume fall-off, and the obstructions should be removed immediately.

A common nuisance is cold air sweeping forward into the auditorium from the stage area, and this is often so severe that the lower part of stage drapes stand out towards the footlight. Causes of this might be an ill-fitting stage lantern light, or badly fitting roof, allowing air to be blown into the upper part of the stage . . . badly fitting scene dock doors or shutters . . . pass-doors, etc., left open or even wedged open, all contribute to this effect. Being an unoccupied area, hot water radiators are sometimes misguidedly turned off in the interests of fuel economy. This is clearly wrong, and generally is a very false form of economy. Indeed, it is important to ensure that all stage heating is working efficiently—the covering of radiators by disused equipment, drapes, etc., etc., is to be discouraged. The radiators were placed there to do a job of work, and they should certainly be allowed to do just that—warm up the stage area !

Some of the larger type theatres with large stages may have, in addition to radiators at floor level, hot-water pipes or coils suspended at high level—perhaps, 25 or 35 feet up on the rear wall, and it is well worth while checking that these, too, are functioning as intended and in particular that they are suitably arranged for the venting off of air which might otherwise restrict water circulation.

In conclusion, it should be remembered that the whole of the heating and ventilating plant will only give the best results if kept in good clean condition and is intelligently operated. It is a vital part of any theatre, but because it is largely " behind the scenes " it should not be thought it is any less important than those features of the building that are more in the public's eye.

DATA SHEET No. 53 – Issued by the PICTURE PRESENTATION COMMITTEE of the BRITISH KINEMATOGRAPH SOCIETY

Sponsored by the CARPET MANUFACTURING CO. LTD., CARPET TRADES LTD., JOHN CROSSLEY AND SONS LTD., T. F. FIRTH AND SONS LTD., and S. J. STOCKWELL AND CO. (CARPETS) LTD.

Patron Comfort – On the Carpet

Patron comfort is without doubt a very important factor within the framework that makes motion-picture presentation an entertainment worth seeking.

Not many years ago, one of the major attractions of the cinema was the luxurious surroundings. The lush carpeting, the decor and the lighting created atmosphere and the general air of an occasion—an exciting incursion into another world.

A feeling of luxury and well-being was engendered when the entering patrons, often tired and depressed, felt their feet ride buoyantly on the softness of a rich and thick carpet.

Now living standards are so much higher and the patrons of today take for granted this feeling of luxuriousness under their feet which they are used to at home and naturally expect to find elsewhere. Only when this feeling is missing are they brought down to earth with a subconscious distaste.

Carpets have always been a sign of luxury since the magic carpets of Turkey, India and Persia. Here the carpet has stood for comfort and affluence ever since the time when the revocation of the Edict of Nantes drove French craftsmen across the channel to Bristol, Axminster and other places in South-West England.

The industry soon spread to Glasgow, Kidderminster and the Yorkshire towns and now there are a multitude of designs, colours and types of carpet, all with their own particular appeal and suitability for various uses.

Patrons experience a feeling of warmth and comfort when their feet are resting on an all-wool carpet and this has a psychological effect on the patron's attitude to the entertainment offered. Moreover, a good carpet helps to keep out draughts, another important point in considering the comfort of patrons.

A reasonably thick carpet has valuable acoustic properties.

It is particularly desirable to have carpet where patrons walk, in the aisles and between the rows of seats, for the distraction caused by footsteps on uncarpeted areas can be annoying, as it militates against audience participation in the story being unfolded on the screen.

In choosing a carpet it is very important to buy one of a high quality because of the very hard wear to which it will be subjected in the cinema, mostly in the same places such as in the aisles and between the seats. Here money is well spent and the initial outlay well justified by the length of life and, more important still, by the continued " fresh " look of the carpet itself.

An all-wool or worsted carpet is probably the best buy, as nothing has the same resilience as wool and, consequently, there will be the minimum of pressure marks.

Although there is a certain amount of resilience in the pile of the newer nylon carpets, and they can be expected to stand up to hard wear, they have one disadvantage for specialised cinema use—the tendency of nylon to disintegrate under conditions of extreme heat. For example, when burning cigarette ends are dropped on them, with the result that black beads are formed at the top of the tuft. This may be somewhat unsightly, but a repair can be made by sewing in tufts.

Good carpets offer an advantage with regard to design. There are literally hundreds of designs to choose from, in addition to which carpet firms, such as those sponsoring this Data Sheet, will always be willing to produce special designs for individual cinemas incorporating monograms, local features or a motif to tie up with an existing decor, as part of their very comprehensive contract service.

Carpet should always be laid over a good quality underlay, whether rubber, rubber and felt, or one of the orthodox underfelts. This not only makes the carpet feel even more luxurious to the tread but will protect it and make it wear even longer.

Density of pile surface is very important to a fabric's wearing properties and since the part of the carpet that has to resist wear is the pile yarn and a carpet is a structural product, it is materially aided by being adequately supported by strong backing materials which form the foundation of any carpet.

Carpet has a long wearing life. A typical example in a cinema is twelve years, during which time one hundred million people walked on it.

A good carpet is worth looking after, so here are some hints and tips on maintenance and cleaning which will repay observance.

Sometimes a new carpet will show signs of " fluffing ". The fact that a vacuum cleaner picks up what appears to be a large amount of fluff from a new carpet is not by any means serious. Some loose short fibres are bound to work their way up to the surface. The loss of this fluff does not damage the carpet in any way and the amount lost during the life of the carpet is infinitesimal and in no way lessens its life.

Once in a while " sprouting " takes place and these threads noticed protruding above the surface of the pile should be clipped level with a pair of scissors.

However often and carefully a carpet is cleaned in a cinema there is a certainty that a degree of soil is absorbed which may cause a slight change in the carpet's appearance. Professional dry cleaning will restore the original appearance.

Many spots and stains can be removed easily with carbon-tetrachloride or a soapless lather cleaner. Dampen the spot carefully and then dab with a clean absorbent cloth. Stains caused by the spilling of soft drinks require the application of fresh, clean, cold water. Rub with the pile, never against it.

Burn holes caused by lighted cigarette ends can easily be repaired by sewing in new tufts, where the material, which will not burn with a flame, has smouldered and charred.

Daily use of a vacuum cleaner in the most used areas will help to remove dirt and grit (it is not always realised that dirt can cut the pile of a carpet)—the enemies of carpet wear. A soft bristled broom may be used but with a light touch and with the pile.

All areas should be vacuum cleaned once or twice a week not only to remove dirt and grit but as an added precaution against moth eggs and forms of insect life which thrive on animal fibres although trouble from those causes is unlikely as all reliable manufacturers moth-proof their carpets automatically.

Periodic care should include any needed repairs plus professional cleaning once a year and perhaps brightening the pile surface through the use of an organic solvent.

Treat your carpet properly and it will see you through thick and thin. Remember that there are many types of carpets as well as many colours and patterns and you would be well advised to consult one or more of the sponsors of this Data Sheet on your carpeting problems. They will gladly advise you on the best kind and type of carpet for the service you desire and their ranges are almost inexhaustible.

DATA SHEET No. 54 – Issued by the PICTURE PRESENTATION COMMITTEE of the BRITISH KINEMATOGRAPH SOCIETY

Sponsored by the GAUMONT-KALEE SEATING DIVISION OF RANK PRECISION INDUSTRIES LTD.

Seating – Comfort and Maintenance

The necessity of providing comfortable seating for Cinema patrons has never been of more importance than it is today when the Exhibitor, facing the hard facts of Television competition, has to literally " pull " the patron from the comfort of his own chair by his own fireside.

Comparisons with regard to seating comfort are, therefore, likely to be more stringent today than ever before.

The provision and fixing of Cinema chairs together with their maintenance should be fully understood by the theatre staff but once installed maintenance is generally of a straightforward nature to ensure that the chairs remain rigidly fixed and of course free from cuts and tears in material and confections or chewing gum which may adhere to the covering material.

The specialist firm supplying the seating will, in most cases, carry out the actual installation after a seating layout, showing the position of the new chairs, has been approved by the local Council.

In respect of the actual installation of the chairs this can be briefly broken down under the following sub-headings:—

Fixing:

If chairs are to be fixed to a wooden floor normal wood screws are used, usually four screws per standard 1½ in. x 10. These screws should be regularly checked for tightness; a long handled Yankee screw-driver is the best tool for this purpose.

If chairs are to be fixed to a concrete floor it is important to see that the Rawlbolt grips in the concrete and not just in the surface screed; drilling and inserting the plugs is work of a specialised nature unless these can be inset at the time the floor is " floated " in. Alternatively, where a concrete floor is involved wood fillets can be inserted at the time the floor is laid so that the normal type of fixing with wooden screw can be obtained.

Fixing the Seat and Back:

Again all screws securing these items should be regularly checked for tightness and a smaller type of ratchet screwdriver is the best tool.

The seat back of, say, 18 in. or 20 in. depth is secured to the casting with three screws to each side of the back frame. The screws in this case are usually 1 in. x 9.

In respect of the seat bottom a longer screw is used (1¼ in. x 9), the seat bottom normally having screwed to its underside a saddle bracket securely fixed to the solid wood frame and which in turn swivels on a pin cast in to the side of the standard. Rubber buffers are normally fitted to the bracket, the modern tendency being for these to be of an " H " shape formation, and it is important to ensure that these are replaced as they wear.

Armpads and Ashtrays:

The armpads are normally fitted before the standard is fixed to the floor, by means of three 1 in. x 9 screws. The armpads are either of dome type, scroll type, or with top section upholstered with sponge rubber.

Ashtrays are normally fitted in the " V " provided by the junction of the curve of two backs where they join and are of various types, either fixed or with a tipping action, and are fitted with small wood screws.

Whilst the foregoing deals with the main points involved in the installation, by far the most important item from the Exhibitor's viewpoint is of course adequate maintenance to ensure that the chairs are kept in good condition, clean and attractive. This generally falls under the following main headings:—

Backs:

These are generally the least subject to damage and what does occur is usually of a destructive nature, such as deliberate slashing.

Maintenance can generally be carried out on site if the material can be drawn together and sewn, but failing that the only alternative is for the back to be replaced from spares kept for the purpose. The damaged back can then be returned to the manufacturers for renovation.

Seat Bottoms:

The upholstered seat bottoms are subject to the hardest wear and the greatest damage. Here, again, damage is caused by malicious slashing with a knife or by the adherence of sticky sweets or chewing gum. Practically all 12/16 spring seat bottoms embody a mattress mesh top with the spring unit substantially anchored to a metal " web," but more and

more the modern tendency is to use a " Dunlopillo " seat unit in place of a spring unit.

It is possible to completely renovate a seat bottom on site by skilled labour, with a completely new top cover and if necessary by replacing the hair/flock/fibre used to provide the actual padding. Alternatively, the damaged seat bottom can be returned to the manufacturers for renovation.

Under normal conditions chairs last for many years if regularly cared for, and the removal of dust by a vacuum cleaner should always be a regular feature of care and maintenance. The abrasive action of dust and dirt considerably shortens the life of all materials.

A few general hints in respect of maintenance may be useful:

Dust and Dirt:

This is always a problem in large buildings and particularly so in cinemas, either through transfer from patrons' clothing or due to the entrance of dust and dirt from exit doors (very often adjoining car parks) which are opened during the time the cinema is not operational. Only constant attention regularly by a powerful vacuum cleaner can successfully eliminate this menace.

Water:

The use of water in cleaning wooden floors must be with considerable restraint as excess water finds its way under linoleum or round the base of casting, and ultimately rots the floor and rusts the fixing screws. The same also applies in respect of the use of bolts when fixing to concrete.

Floor condition:

Apart from the adverse effect of excessive water as mentioned above, poor ventilation under the floor can be a considerable danger.

Provision in this respect is usually made by means of airbricks and it is important to see that these are kept quite clear.

Whilst all the foregoing has dealt with the most common type of theatre chair installed, namely with cast iron standard, there is of course the well-known " Ambassador " all-metal chair which utilises a metal " seat pan " and back into which a specially formed Dunlopillo seat unit is fitted.

With this type of chair, as also with the " Consul " and " Diplomat " versions, the standard can be adjusted to suit any type of normal rake, by a simple screw adjustment, but with the older type of cast iron standards the rake has to be calculated in advance and the back legs shortened accordingly to fit the angle of inclination of the floor.

DATA SHEET No. 55 – Issued by the PICTURE PRESENTATION COMMITTEE of the BRITISH KINEMATOGRAPH SOCIETY

Sponsored by F. H. PRIDE Limited

Patron Comfort–The Lighting Atmosphere

To-day's new cinemas embrace all the modern techniques of lighting and equipment, both for the exterior and interior of the buildings. The established cinema has undergone, and still is undergoing, modernisation, both in decor and lighting treatment, to keep them in a competitive position. All the new light sources, new materials and metal finishes available for lighting, together with the skill with which they are applied, give a wide field in design. This section presents suggestions and information for general guidance.

The exterior lighting of the cinema should be so designed as to assist in the selling of its programme to the public; this calls for attention to good design and brilliantly illuminated elevations, and in some cases movement and sparkle. Large canopies with vertical signs illuminated by fluorescent lamps, and a great use of Perspex as diffuser panels with interchangeable metal or coloured Perspex letters on the face, are the modern trend.

The soffit is illuminated by means of recessed silver mirror lamps in suitably designed downlighters, or fluorescent lamps in Perspex panels with recessed reflector boxes, so arranged to form a pattern directing attention towards the entrance.

Exterior colour lighting can be carried out by floodlights with coloured filters, and the changing colour effect controlled by motorised cycle dimmers. In some recent instances colour change lighting to exteriors has been successfully applied with the use of cold cathode tubes. This method produces colourful backgrounds for the brilliantly illuminated frontal areas.

Lighting for the front of house—the vestibule, entrance hall and inner foyers—plays an important part by providing the first point of contact with the interior, and should be impressive. Fine examples can be seen in many of to-day's cinemas in this country, making use of colour treatments of high reflection value on large surfaces, and lighting fittings specially designed to suit the decor, so arranged to give equal high illumination over the area.

Secondary lighting can be accommodated in the design of the fittings, but must be positioned to give equal illumination below.

Sales kiosks are of utmost importance and should be highly illuminated, but with lighting sources so arranged as not to cause undue heat build-up where confectionery is displayed. The background display area can be lit by fluorescent tubes, and downlighters on the front upper area to give concentrated light on the frontal part of the kiosk.

Side wall and display lighting can be carried out by the introduction of a decorative metal trough, which can be perforated to give sparkle, and be illuminated from the rear with fluorescent lamps equally placed so as to give an unbroken line of light. This type of lighting not only gives added interest, but also illuminates the displays and the star pictures.

Stalls and circle foyer lighting treatment usually has a reduced intensity level of lighting, as it is the last part of the front of house as one approaches the auditorium, and thus assists the eyes to adjust themselves before entering.

Lighting in the foyer can be carried out by suitably designed lighting fittings to give sparkle with pleasing soft background lighting, such as spun metal dome reflectors with a light source centrally placed, and enclosed in a glass (or glass and metal diffuser) with a perforated design. Large wall areas in foyers can give added interest if wall brackets to match the lighting fittings are introduced. These brackets could accommodate the secondary lighting.

Soft background effects can be achieved also by utilising the curtain areas and installing fluorescent lamps in a pelmet, which can be part of the lighting trough, perforated to give sparkle, whilst the main source of light is reflected down the curtain face, as well as to the upper part of the ceiling and cove. It is of course necessary to use the correct colour lamp to suit the colour of the curtain.

The tendency to-day in lighting an auditorium is to provide an architectural feature, which will suit the modern treatments and plain surfaces of the auditorium. Decorative lighting should be so designed to lead the eye to the focal point, which is the proscenium.

The type of lighting now introduced into many new and modernised cinemas includes indirect lighting troughs, using metal troughing with 25/40 watt lamps from 4 in. to 9 in. centres, or battens to accommodate 2 ft. 20 watt or 4 ft. 40 watt fluorescent lamps. However, this last method has its limitations and is more costly, because it requires more elaborate dimming arrangements and the control gear.

Such indirect lighting is incorporated with suitable decorative fittings, which can be positioned suitably to the design lay-out to give life and sparkle to the darker areas in other parts of the ceiling. The under-circle ceiling lighting fittings should be so designed as to be well out of the sight line of patrons.

Modern types of lighting fittings require little maintenance, and the trend to-day is the use of a limited amount of glassware, usually in the form of contemporary type shades embodied in tubular style fittings, suitable for a lamp range of 25 to 40 watts.

It is general practice to construct such fittings to withstand heavy handling, and all internal wiring is brought out to

suitable terminal blocks to facilitate easy connecting.

Where secondary lighting is incorporated into any fitting, the wiring should be completely self-contained, and sealed off from the primary supply. The modern method is to have primary and secondary lighting cones fitted into the ceiling, positioned to illuminate the seating and gangway areas evenly.

Lighting fittings installed at high levels have to be maintained, and some provision in the form of self-sustaining winches must be provided for raising and lowering the fittings, to give complete access. Secondary fixing arrangements must also be provided.

An alternative application for house lighting, especially where auditoriums are modernised by the introduction of new colour and wide proscenium curtain treatment, is the use of recessed or semi-recessed types of decorative down-lighters, which can be maintained from inside the main ceiling. Such units are designed to give both sparkle and soft reflected light by the introduction of colour anodising of the reflectors, designed to give the required lighting coverage in coloured light without the use of filters or coloured lamps. The light source is obscured by a glass diffuser, suitably arranged in the soffit of the unit. The periphery of the fitting below ceiling level may be perforated, and if desired, fitted with crystal glass shapes to give additional sparkle.

DATA SHEET No. 56 – Issued by the PICTURE PRESENTATION COMMITTEE of the BRITISH KINEMATOGRAPH SOCIETY

Sponsored by F. H. PRIDE Limited

Patron Comfort–The Lighting Atmosphere–*continued*

The advent of the wide screen has meant the provision of additional forms of lighting for the front of house and stage. The desired effects can be obtained by the introduction of directional downlighters, so arranged to illuminate the curtain face and front portion of the auditorium, or by means of a bank of front-of-house spots, situated at the front of the circle.

However, where possible the installation of footlights provides the best results, and with the use of dimmers (either hand-operated or motor-driven) a great variety of colour change and control can be obtained.

The lighting equipment for maintained and secondary lighting in the auditorium has been designed and standardised to meet all requirements of the Cinematograph Safety Regulations, and the Code of Practice of the British Standards Institute.

The primary (or management) lighting and secondary (or safety) lighting is covered by equipment such as recessed conical downlighters, which are generally fitted with B.C. holders for maintained lighting, and Edison screw holders for secondary lighting. The units are fitted with diffusers or louvres so as to obviate distraction.

There are downlighters which have adjustment to the lamp and at the base a masking plate, so that the width of the beam can be definitely adjusted to suit the area which it is to illuminate, thus obviating side spill on to the side walls.

Exit boxes are designed and standardised in accordance with B.S. No. 2560, and these are also fitted with B.C. and E.S. lampholders for the primary and secondary supplies. In most cases the boxes are fitted to the wall face, the base of the box having a glazed soffit which is recessed into the bottom, so that the light source is out of view from the seating area but at the same time additional lighting is given to the exit gangway. The cleaners' lights are also of standard equipment, designed to accommodate 100 to 500 watt lamps, and in each case the filament centre of the lamp is just below the ceiling face, thus enabling complete efficiency from the light source.

Many of the visual effects given by both stage and various forms of decorative lighting depend to a great extent on the standard of control equipment installed. A costly and involved lighting system achieves little unless the control system can be easily operated to give desired effects.

The use of dimmer control switchboards plays an important part in this function and the layout, and design of these units can be so arranged for easy operation to give various effects.

Different types of dimmers are in use today, each type being used in different circumstances and depending to some extent on the sum allowed for a particular installation.

(1) Radial Lever Type Dimmers

This type of unit comprises a series of coils or wound formers contained in a framework. The ends of each coil or former are brought out to two panels usually fitted with 80 or 100 contacts, between which a contact brush travels round in an arc, pivoted from top of the dimmer frame. The radial type of dimmer is particularly suitable for mounting at the back of board and can be easily arranged in rows for individual or collective control. It is widely used, and has proved most efficient and suitable in many cinemas for a considerable number of years. In this type of dimmer, as in the slider type, the brushes are self-lubricating, and very little maintenance is required apart from regular cleaning and inspection.

(2) Slider Type Dimmers

This is a comparatively inexpensive form of dimmer, and is suitable for small loads ranging up to the region of 15 amps. " Quick break " switches can be fitted at the dim end to prevent arcing. Being of the resistance type of unit, a slider dimmer is not suitable for a varying load, and will function best at the particular loading for which it is wound.

(3) Auto-Transformer Dimmer

This type of unit is usually of a toroidal shape and serves the same purpose as a tapped auto-transformer. The results are achieved by allowing a brush to run over the windings, thus controlling the voltage supplied to lamps. The obvious advantage of this type of dimmer is the wide range over which it can be used, from a few watts up to the full load for which it is designed. It is not suitable for overloads, and its rated current must not be exceeded.

(4) Saturable Reactor Type Dimmer

In this type of equipment the load is connected in series with the A.C. winding of the reactor, which also incorporates another winding fed with a D.C. supply through a suitable rectifier. The D.C. current is controlled by a small type of variable resistance. For this type of equipment it is necessary to accommodate some form of contactor control in the load lines, in order to ensure quick " On " and " Off " control when required.

This type of equipment is suitable for remote control installations, the variable resistances being housed with switches, etc., in a control panel of small dimensions, while the reactors are mounted in suitable racks sited in a convenient location.

DATA SHEET No. 57 – Issued by the PICTURE PRESENTATION COMMITTEE of the BRITISH KINEMATOGRAPH SOCIETY

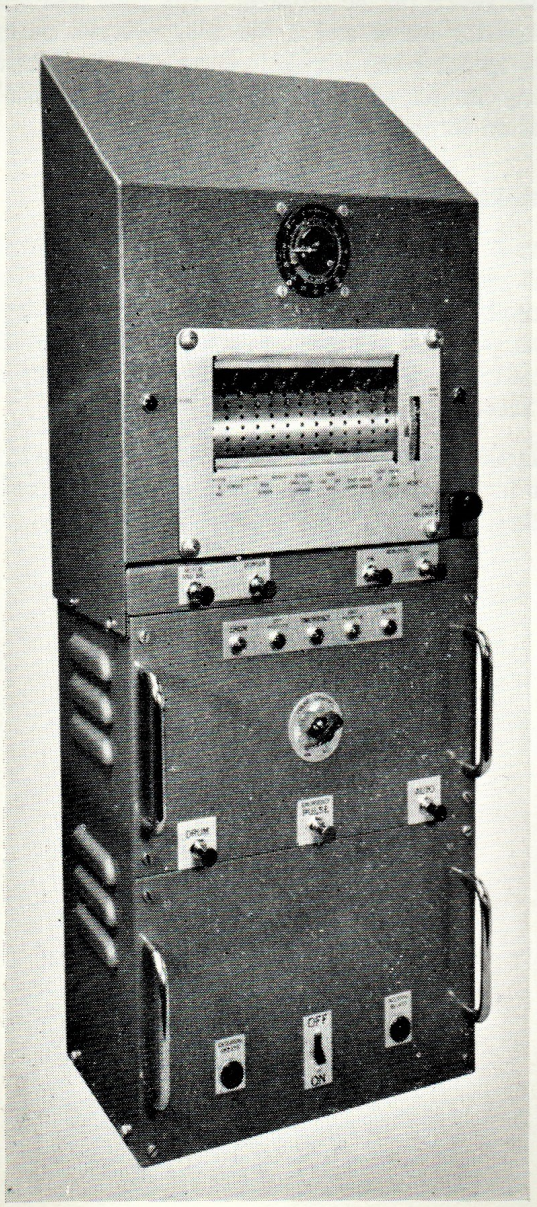
Sponsored by the G.B-KALEE DIVISION OF RANK PRECISION INDUSTRIES LTD.

Projectomatic – How and Why

Projectomatic automatic control equipment means better film presentation—taking the drudgery out of the Projectionist's job, leaving him free to concentrate on the finer points of presentation and on general supervision.

Projectomatic also enables him to leave the projection room for short periods of time to check personally screen illumination and sound quality and volume in the auditorium—tasks which demand the attention of a skilled Projectionist.

With the introduction of the new techniques in picture production and the very high standard of presentation necessary with large screen presentation, additional equipment is called for both in the projection room and at the stage end of the cinema.



The split-second timing of Projectomatic enables the Chief Projectionist to rely on the maximum efficiency in performance from the whole of the complex equipment associated with picture and sound presentation.

Thus by perfect presentation and smooth running, Projectomatic ensures good showmanship.

Projectomatic will operate all leading makes of Sound Reproducers, Projectors, Arclamps as well as the new Xenon lamp. It is approved in the United Kingdom for use with the Gaumont-Kalee, B.T.H. (A.E.I.), R.C.A., and Westrex equipments.

Projectomatic carries the approval of the Home Office, and Licensing Authorities have been advised that the new Model " O " Projectomatic complies with the Cinematograph (Safety) Regulations 1958.

Projectomatic equipment consists of a control cabinet and a number of relay units, each performing one or more operations which would otherwise be carried out by the Projectionist. Every switch which is normally used by the Projectionist in presenting motion-pictures is bridged by one of these relays, connected in such a manner that, should it fail to function, the switch can be operated manually in the normal way.

The following is a brief technical explanation of the operation of Projectomatic. For fuller detail consult the published literature or apply to the sponsors of this Data Sheet.

Control Unit

The control unit consists of three removable units—(a) the Drum Unit, (b) the Auto Unit and (c) the Power Supply Unit, which is designed for operation on A.C. mains 200/250 volts, 40/100 cycles.

Drum Unit

The drum unit contains a metal cylinder with 650 holes arranged in 50 horizontal lines of 13 holes. Pins can be placed in these holes in a predetermined sequence. The drum can be rotated by hand or electrically through an impulse motor. Arranged across the top of the drum are 13 micro-switches. The operating arms of these switches are so arranged that, when the drum rotates, the heads of the inserted pins lift the arm, operate the switch and set in motion the action it is desired to perform, i.e., a pin placed in a hole in the vertical line under the heading " Screen Curtains Open "

will open the screen curtains when the pin, due to rotation of the drum, arrives under the micro-switch operating arm.

Eleven of the micro-switches are used to control external operations. One other is designated " On Drum Pulse " and is used to control the rotation of the drum. The remaining micro-switch is designated " On Auto " and is used to take control from the drum, such as when the feature is running and only automatic changeovers are required.

The Drum can also be made to rotate one step when a mark on the film made by a special self-adhesive silver foil passes over the pick-off roller which is mounted on each projector.

Auto-changeovers are effected by placing three of these marks at the end of each reel of film. The first of these starts a control function and sounds a warning buzzer. The second mark starts the incoming projector and arc, while the third mark operates the actual changeover of picture and sound, and sets up the sequence ready for the next changeover.

To cause the control unit to revert back to Drum operation only one mark is placed on the end of the reel of film. Switching back again to Auto changeovers is effected by setting a pin in the appropriate hole in the vertical line under " On Auto."

A further roller fitted to each projector serves as an emergency stop if the film breaks or the projector speed falls below about half-speed, switching off the projector and arc.

Other points of interest are, (a) the striking of the arc is effected by either inserting fusable pellets between the carbons or using a solenoid striking unit, (b) all sequences can be controlled by one emergency push button should a fault develop, ensuring that the presentation remains uninterrupted, (c) the drum is automatically isolated while on Auto to facilitate setting-up, (d) in case of emergency the projectors can be stopped from either projector position by means of a push button, (e) indicator lamps show which of the circuits are in operation, (f) provision is made for control of footlights through a saturable reactor if motorised control is not in use, (g) sound changeover is controlled through a relay in the same way as the light dowser, and (h) the Drum Mode can easily be converted to comply with the Home Office Regulations (1530) by the addition of various relay units.

Projectomatic Model " O "

This equipment is designed specially to meet the Home Office Regulations (1530) and provides for auto-changeovers only, no external functions or control of non-synchronous sound being provided for. The same method of film marking, pick-off rollers, stop rollers and arc striking, as for the Drum Model, is used.

The safety features to comply with the new Regulations consist basically of a combination of the stop-rollers with two double-wound relays for each projector. One of these is associated with the arc voltage and the other with the projector motor supply voltage, the basic principle being that if two voltages are applied, one to each winding of a double-wound relay, and these voltages remain approximately the same, they will have a cancelling-out effect and the relay will not operate. If, however, either of these voltages ceases to be effective or vary outside predetermined limits, then the relay will operate.

In relation to the arc, should the carbons break or jam together, the arc voltage will rise or fall, the relay will operate and will switch off the projector. The same idea relates to the projector motor and if the relay operates an external battery-operated bell circuit is completed and alarm bells will ring continuously until reset by means of a push-button located on the front of the main control unit.

Information, Please

Should you already have Projectomatic in use at your cinema and require any advice or additional information, your nearest Sound Reproducer Service Depot will be pleased to assist you. If you are not equipped, the fullest detailed information is at your disposal from the sponsors of this Data Sheet.

PROJECTOMATIC, the original and proved automation system for the cinema, ensures smooth operation and better presentation.

DATA SHEET No. 58 – Issued by the PICTURE PRESENTATION COMMITTEE of the BRITISH KINEMATOGRAPH SOCIETY

Sponsored by J. FRANK BROCKLISS Ltd., and the G.B-KALEE DIVISION OF RANK PRECISION INDUSTRIES Ltd.

Wide Film Processes and 70mm. Projection

It is said that there is nothing new in this world of ours and perhaps this saying is most apt when applied to the Film Industry. We seem to have an infinite capacity for dipping into the past for a solution to the problems of our future.

Wide Film is a case in point, for how many years ago was it that we heard of the Paramount 65 mm. Magnafilm and the Fox Grandeur ?

There were various reasons why these Wide Film systems came to nought, but important among them is the technical reason that only on the large picture sizes of today does Wide Film really come into its own. It is a simple matter of supply and demand and the picture sizes of those halcyon days of long ago could be adequately served by the 35 mm. film frame.

It was the era of 1954/5 when cinemas all over the world were tumbling over themselves to make their projected picture sizes " high, wide and handsome ", when the proponents of this mad rush found themselves hoist with their own petard in that they could not say with truth, " bigger and better. "

The magnification or blow-up of the 35 mm. film frame necessitated by the Wide Screen proved in many cases to be beyond the capabilities of that relatively tiny film frame, and when one considers the magnification factors involved, very often 500,000 times in area, then it was indeed a miracle that the 35 mm. film frame stood up so well.

Granted that when print and projection conditions were near perfect, the resultant picture image was impressive in size and reasonably satisfactory in quality, but the margin of safety had gone and the happy combination of circumstances was the exception rather than the rule, and, like the little girl—" when she was bad she was horrid. "

This fact eventually led to a limitation in extension of picture size and in some cases an actual retrenchment when the grim consequences had been viewed.

When the technicians were given a short breathing space they immediately turned their energies to improving the ultimate picture image, firstly by improving the negative.

The obvious answer was a larger negative, not necessarily by an optical trick as in anamorphosis but actually by increasing the negative size, and VistaVision was the first process to start the ball rolling towards the Wide Film systems proper.

However, the father and mother of Wide Film systems is, of course, the famous TODD-A.O. system and it is perhaps surprising that the late Mike Todd contacted Dr. Brian O'Brien as early as 1952 regarding the possibility of creating a motion-picture system that would allow action to be photographed in a very wide angle, with one camera, on one strip of film, to be projected from a single machine, on a very large screen, with a quality so near perfect that the audience would become participants rather than passive spectators.

From this ambitious ideal and amazing foresight sprang TODD-A.O., a practical scientific system developed by the American Optical Company's engineers.

The first tests of the system were made in 1953, and Wide Film for both negative and positive played a large part in the creation of the superlative presentation results.

There can now be no possible doubt that if consistent motion-picture presentation of high-quality, high-fidelity picture images is the aim, then for picture sizes of 45 feet and upwards a Wide Film system is a necessity.

The picture area on 70 mm. film is nearly four times that of normal 35 mm. film and thus, when projected on very large screens, the magnification factor is greatly reduced and other deficiencies of the photographic film frame reduced in proportion, with the important result that the final picture image on the cinema screen is sharper, clearer and brighter. Incidentally, Wide Film also provides ample room for six magnetic sound tracks of good width and because of the five perforation pull down, increased film speed and other factors, the quality of sound reproduction matches the high quality of the picture, so contributing effectively to a near perfect presentation.

Coming back to VistaVision, a 35 mm. negative was used, but this was arranged to run horizontally through the camera at double the normal speed, and each film frame occupied eight perforations instead of four giving a frame size of 1.485 in. by 0.991 in. instead of 0.866 in. by 0.629 in. for the normal 35 mm. negative, allowing a striking gain in quality even with the reduction necessary to give a standard 35 mm. positive release print.

Since that time Technirama, which is described elsewhere in a Data Sheet in this Manual, has brought forth a 70 mm. Wide Film positive print from its famous and very versatile negative, which is also horizontal double-frame but having

the additional potential given by the addition of anamorphosis.

These positive prints are known as " Technirama-70 " and " Super-Technirama-70 " and are compatible in dimensions etc., with the 70 mm. print produced from Todd-A.O.

The next variation of Wide Film is known as " Camera-65, " which is a process using a Wide Film negative and positive but with anamorphic compression in taking and expansion in projection.

Now, we have " Panavision-70 " which seems to be a straightforward Wide Film negative and positive system.

All prints are compatible with the Todd-A.O. standard for projection but in the case of " Camera-65 " there is an added anamorphic lens.

The degree of projected picture quality naturally varies in accordance with technical considerations over the range of Wide Film systems, but with the best it is quite true to say that to ask for better screen results would indeed be gilding the lily and discernible only to the expert.

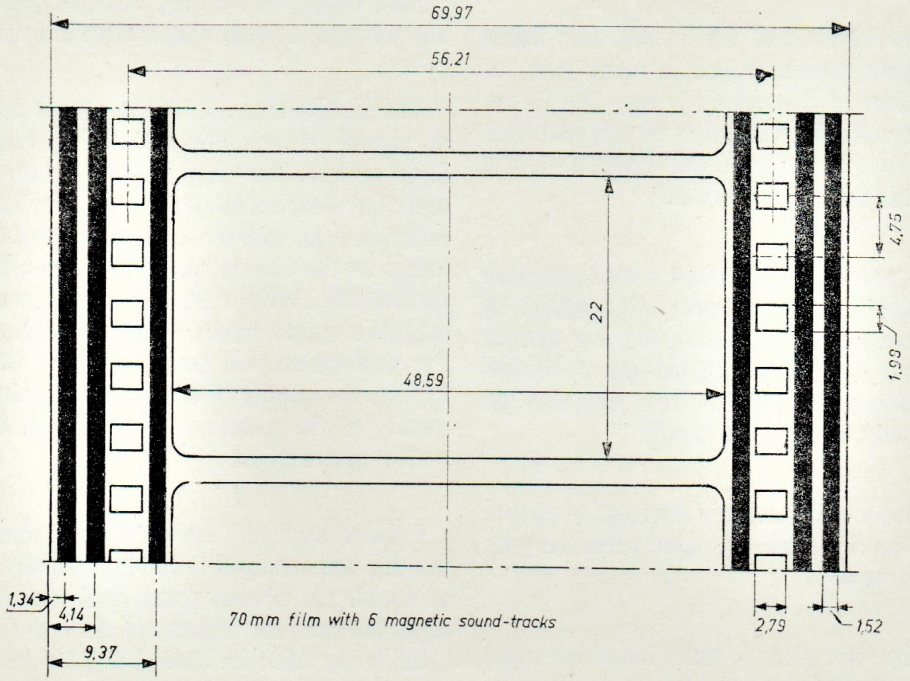
There are several 70 mm. Wide Film projectors available, all of which are also capable of normal 35 mm. projection. The Cinemeccanica " Victoria-X " and the Philips " DP.70 " are described elsewhere in Data Sheets in this Manual.

A final summary of statistics gathered from published data.

Common to all Wide Film systems 65 mm./70 mm. is the direction of film travel which is vertically downwards as with normal 35 mm., height to film frame which is equivalent to five perforations, sound tracks six by 0.059 in. and a choice of 30 frames or 24 frames per second.

For Todd-A.O., Panavision-70 and Super-Technirama-70 the projector aperture is 1.9114 in. by 0.8661 in., giving an aspect ratio of 2.2 : 1 but there is a certain amount of tolerance depending on the picture composition.

" Camera-65 " adds a projection anamorphic lens at 1.25 : 1 squeeze ratio, and apertures of from 1.910 in. by 0.865 in. for an aspect ratio of 2.7 : 1 to 1.6195 in. by 0.865 in. for an aspect ratio of 2.34 : 1 have been mentioned.



DATA SHEET No. 59 – Issued by the PICTURE PRESENTATION COMMITTEE of the BRITISH KINEMATOGRAPH SOCIETY

Sponsored by TECHNICOLOR Limited

Technirama

The Technirama process is based on a 35 mm. " double-frame " anamorphic picture photographed on colour negative film. The " double-frame " image is much the same as that produced by a 35 mm. " still " camera, the exact dimensions being as shown in the diagram. From this type of negative, all types of positive release print used in current presentation systems can be manufactured by Technicolor.

The negative image size makes the best use of an area bounded by eight perforations and arranged lengthwise on standard 35 mm. film, achieving more than twice the area used in normal 35 mm. photography. The additional use of a prismatic anamorphic system in photography with a compression ratio of $1\frac{1}{2}$: 1 allows for a picture format equivalent to an Aspect Ratio of 2.35 : 1.

The dimensions of the negative frame as well as the areas used for projection of the various types of positive release print are shown in the diagram.

Positive Release Prints

(A) Large-Area Prints for Road-Show Presentation

(1) **" Technirama-70."**

This type of print is completely compatible with prints of the TODD-A.O. 70 mm. Wide-Film presentation system and can be used on all types of 70 mm. projectors suitable for TODD-A.O.

A Non-Anamorphic image with an Aspect Ratio of 2.21 : 1 on 70 mm. Wide-Film positive stock carrying six magnetic tracks for stereophonic presentation.

(2) **" Technirama Double-Frame "**

This type of print is intended for projection on machines using 35 mm. film running horizontally. An 8-perforation frame size on 35 mm. film with a lateral anamorphic compression of 1.5 : 1 carrying three magnetic tracks for 4-channel stereophonic presentation and giving an Aspect Ratio of 2.35 : 1.

(B) Normal-Area Prints for General Release

(3) **" Technirama Anamorphic with Optical Track "**

This type of print is identical to all prints of the " CinemaScope " type, carrying a standard 35 mm. optical sound track. A 35 mm. film print with an anamorphic ratio of 2 : 1 giving an Aspect Ratio of 2.35 : 1.

(4) **" Technirama Wide-Screen with Optical Track "**

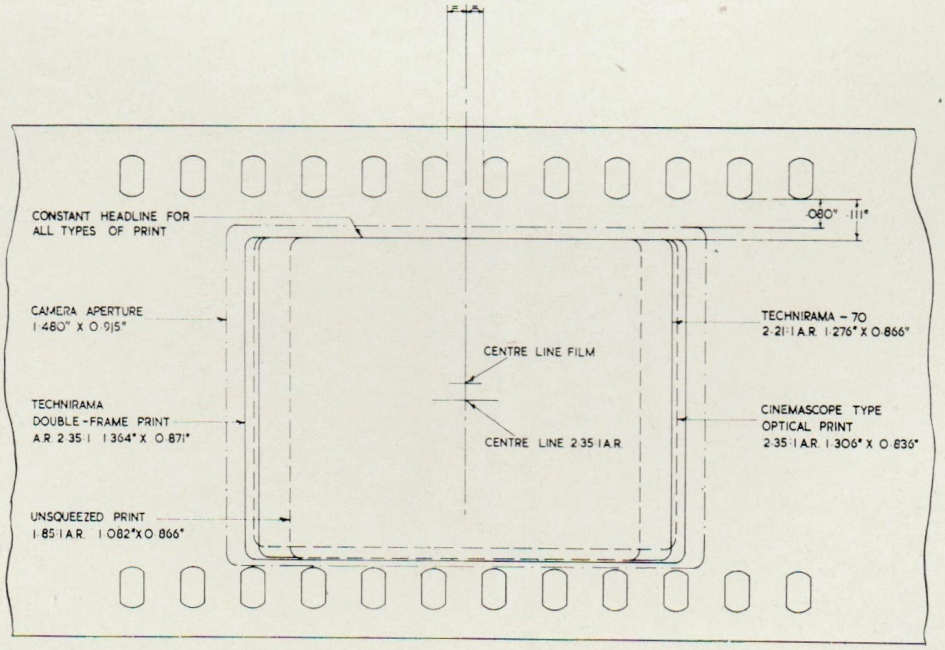
A normal Non-Anamorphic Wide-Screen print, " unsqueezed " and giving an Aspect Ratio of 1.85 : 1, carrying a standard 35 mm. optical sound track. Special prints of this type can also be obtained for an Aspect Ratio of 1.65 : 1 with standard 35 mm. optical sound track.

(C) Prints on 16 mm. Film

(5) A 16 mm. " CinemaScope " type print with optical sound track. An anamorphic ratio of 2 : 1 giving an Aspect Ratio of 2.6 : 1 with a standard 16 mm. optical sound track.

(6) A 16 mm. " Wide-Screen " normal " unsqueezed " print with optical sound track, giving an Aspect Ratio of 1.87 : 1.

Special prints of this type can also be obtained for an Aspect Ratio of 1.65 : 1 carrying a standard 16 mm. optical sound track.



TECHNIRAMA NEGATIVE AND AREAS OF IMAGE PROJECTED IN DERIVATIVE PRINTS.

DATA SHEET No. 60 – Issued by the PICTURE PRESENTATION COMMITTEE of the BRITISH KINEMATOGRAPH SOCIETY

Sponsored by J. FRANK BROCKLISS Limited

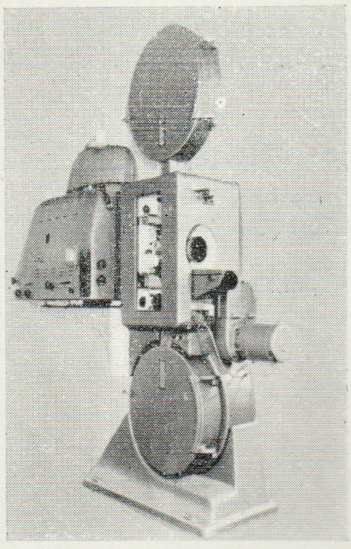
The Philips 35mm./70mm. Projection Equipment

In 1952/53 when the first work, on what was to become the TODD-AO Wide Film process, started in the Research Laboratories of the American Optical Company and when the MAGNA Corporation and the TODD-AO Corporation were formed it was to Philips Gloeilampenfabrieken-Eindhoven-Holland that they turned for the development, design and manufacture of a multi-purpose projector to handle 35 mm. and 70 mm. film in all the standard versions and all the sound reproduction systems associated therewith.

Philips, with their long-established reputation in the field of international cinematograph equipment, were thereby able to meet the highest requirements of ingenuity of invention, outstanding quality and absolute reliability.

The outcome was the Philips multi-purpose DP 70 projector now used in the overwhelming majority of cinemas wherever in the world the use of 70 mm. Wide Film processes has come into being.

The projector that fulfils the highest expectations of easy running, minimum maintenance, perfection in presentation and long life of film is described below.



Construction of the projector

Driving mechanism

The driving mechanism is very sturdy and at the same time very simple. The sprockets, the intermittent mechanism, the shutter and the take-up spool are driven by a stout vertical main spindle. This spindle is driven by a horizontal shaft, which also drives the spur-gear oil pump located in the base of the projector housing and hence is always below the oil level. All the gear-wheel transmissions and bearings are amply lubricated via an oil tube with tappings.

The horizontal driving shaft is coupled to a friction clutch, which provides a simple means of changing the speed from 30 frames/sec to 24 frames/sec and vice versa. The asynchronous motor is located on the drive housing which contains the two V-belts, their pulleys and the clutch used for the change-over from one speed to the other—simply by shifting the friction discs.

Intermittent mechanism

In principle, the intermittent mechanism of the DP 70 projector follows that of a normal 35 mm. Philips mechanism, but it is of much more robust construction. However, to keep the acceleration forces and therefore wear of the mechanism as low as possible, it is of the utmost importance that the Maltese cross and the intermittent sprocket be light.

For this reason aluminium was the most obvious material to use for the manufacture of sprockets. After many experiments, a special method was found for hardening the surface of the aluminium, and a life test proved that aluminium sprockets treated in this way compared very favourably with chrome-nickel sprockets.

Picture Gate

For good definition it is necessary that the distance between the film in the gate and the projection lens should not vary.

When a flat gate is used, 70 mm. film is liable to bend in a transverse direction and this cannot be remedied. For this reason, the DP 70 projector is equipped with a curved runner plate. The slight bend in a longitudinal direction gives the film a greater transversal stiffness.

Shutter

The DP 70 projector is equipped with a one-blade conical shutter with a very large diameter. At a film speed of 30 frames/sec the shutter rotates at a speed of 3,600 r.p.m. and at a film speed of 24 frames/sec at 2,800 r.p.m. The 70 mm. system is intended in the first place for the projection of very large pictures. Loss of light must therefore be avoided as much as possible. The conical shutter can be mounted close behind the mask, so that it intercepts the light beam where it is narrowest. This, in conjunction with the large diameter and the high speed, guarantees the smallest possible angle of interception and the highest efficiency.

Cooling

The high light-intensity and the great heat it generates require powerful and efficient cooling of both the film and the projector. For this reason, the plate on which the pressure strips are mounted is water-cooled.

The shutter of the DP 70 projector has been constructed as a powerful fan which sucks in the cold air from the rear of the projector and blows it against the film in the gate.

Lens holder

The 70 mm. film requires a very large optical system. The size of this system determines that of the lens holder. The lens is focused by means of the knob underneath the lens mount bracket over which the entire lens holder slides during focusing ; this adjustment is free of any backlash. An eccentric adapter tube and adapters with different internal diameters can be mounted into the lens holder to fit the lenses necessary for the different projection systems. For the projection of 35 mm. films the optical axis is shifted over the required distance by turning the eccentric adapter tube through 180°.

Sound heads

The sound heads, although built-in, form separate units. The sound head for the scanning of magnetic sound-tracks is located in the top right-hand part of the projector. The magnetic cluster, located between two sound drums of anti-magnetic material, is equipped with ten cores, viz. six for 70 mm. films and four for 35 mm. CinemaScope films.

The optical sound head, located at the bottom to the left, is used only for 35 mm. films. One of the most important characteristics of this sound head is that in the scanning system a 13.5 times enlarged picture of the sound-track is projected on to the scanning slit. This picture is visible through an observation window, so that the position of the sound-track with respect to the slit can easily be adjusted.

Light source

The shape of the projector and of the mounting table are such that any light source can be used, provided that its optical properties match the image size.

Spool boxes

Both spool boxes are provided with adjustable friction devices. The upper spool box is illuminated and equipped with time scales for the projection of both 70 and 35 mm. films.

The rollers in the fire traps have a large diameter so that even warped films can pass through without risk of damage.

The spools are suitable for 950 m. (3,100 ft.) of 70 mm. film.

Parts for modifying the projector

As it is not to be expected that a given theatre will show only 70 mm. films, it is necessary that the projectors can also be made suitable for running 35 mm. films.

The DP 70 projector is undoubtedly most universal in this respect. Films shot in any of the 35 mm. systems in practical use can be shown with this projector.

All the sprockets are provided with two sets of teeth ; the outer set is spaced for 70 mm. film and the inner set for 35 mm. film.

The parts which have to be replaced separately are :
the runner plate, two pad rollers, the pressure strips, the aperture plate and the lens.

The complete modification takes only a few minutes.

DATA SHEET No. 61 – Issued by the PICTURE PRESENTATION COMMITTEE of the BRITISH KINEMATOGRAPH SOCIETY

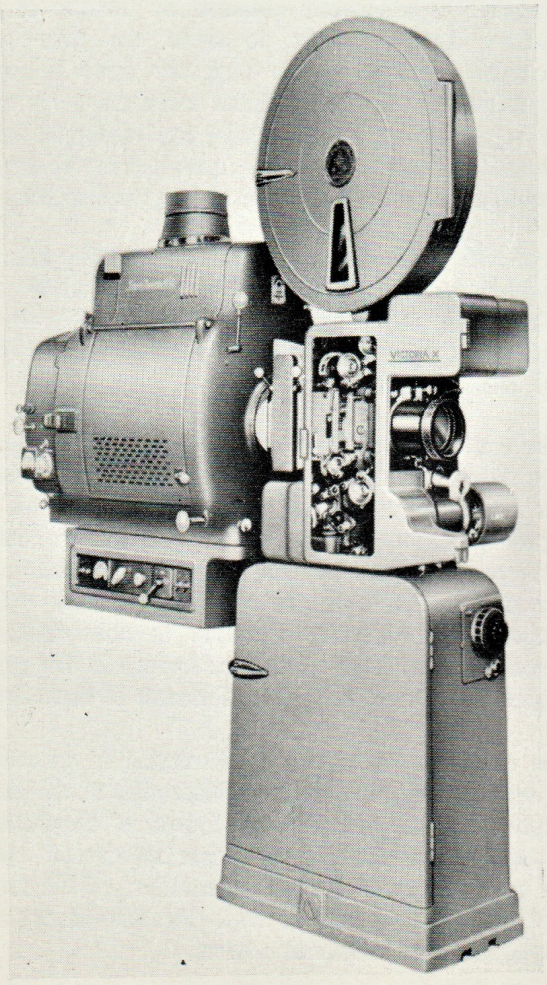
Sponsored by the G.B-KALEE DIVISION of RANK PRECISION INDUSTRIES LIMITED

Cinemeccanica "Victoria X" 35mm./70mm. All-Purpose Projector

Handled exclusively in Great Britain, and in many other parts of the world, by the G.B. Kalee Division of Rank Precision Industries, Ltd., the Cinemeccanica " Victoria X " All-Purpose Projector has been designed with the aim of obtaining the highly stable operating conditions demanded for 70 mm. film projection, whilst at the same time providing the normal facilities for running 35 mm. magnetic and optical prints.

Because inertia effects and film speed are both greater with 70 mm. film than with 35 mm. film the use of a very heavy projector stand is essential to reduce to an absolute minimum any mechanical vibration or instability.

The combined 35/70 mm. film projector mechanism is mounted on such a stand, the arc lamp being supported on a cantilever beam bolted to the rear of the stand. The inside of the wide base unit is used as the lower spoolbox on the operating side, and as housing for certain complementary equipment on the other side. This complementary equipment consists of the independent gate cooling fan, the independent take-up motor, the exciter lamp rectifier, the main terminal board and, where required, the magnetic pre-amplifier power supply.



The Victoria X mechanism is a well finished robust piece of engineering work. All the rotating parts of the mechanism have parallel axes, and to make full use of the special advantages of this a drum shutter is incorporated. Smooth, reliable and accurate operation has been obtained by the use of ellipsoidal cylindrical gearing, and the elimination of belt and similar drives.

Lubrication is effected by the use of a geared pump and a system of distribution pipes, and, to ensure that the oil is free of foreign particles of a harmful nature, both magnetic and mechanical filters are incorporated in the system. All oil is made to pass through these filters before being distributed through the pipes to the various bearings and gears.

The high efficiency barrel, or drum, shutter is driven through a special shock absorbent joint to ensure steady, rattle-free rotation. The framing control movement is linked through gears to the shutter to ensure compensation.

The liberally rated three-phase projector driving motor carries on its shaft the speed shift system, which can be set very easily by relative angular displacement of the two concentric knobs on the motor shaft in respect of the " frames per second " indicator marks on them. This gives the choice of either 24 or 30 frames per second projection rate, according to whether 35 mm. or 70 mm. film is to be projected. This speed change is accomplished by the use of two different gears, the correct one of which is selected and directly meshed with the mechanism driving gear, in accordance with the position of the two knobs on the shaft. This system of driving the projector is highly efficient.

The intermittent unit, which is a precision piece of work, is of the conventional and well proved Maltese Cross and Pin type, located in a long bearing and held in place by a set stud and secured by a nut. By removal of the intermittent sprocket and the above mentioned securing nut the movement is removable as one unit.

The framing adjustment, or racking movement as it is frequently called, consists of a crown and pinion movement. The crown gear is concentric to and locked with the intermittent unit housing, the whole assembly being arranged to rotate through a considerable arc. Coupled in mesh with the crown gear is a pinion secured on a shaft which is brought through the front of the mechanism and terminated in a large knob for " racking " control. The intermittent drive is interlocked by gears with the drum shutter driving shaft, thus, whilst up to two whole frames shift of rack can easily be obtained, the correct relative phasing of the shutter is ensured at any setting.

The need for provision in the design of the mechanism for quick interchange from 35 mm. to 70 mm. operation has been met by the double-profiling of all elements of the film path,

except the projection gate plate and pressure pads, which are easily changed for those of correct size and aperture. This double profiling is included on all firetraps, guide rollers, etc.

The three constant speed driven sprockets have two sets of teeth, the inner sprocket being 32 teeth and the outer sprocket of 40 teeth, this being an eight frame lap for either 35 mm. or 70 mm. films. This large diameter sprocket allows of low shaft speeds. The intermittent sprocket also has two sets of teeth (16 and 20 teeth respectively), is of light aluminium alloy hardened by oxidisation and of very low weight, being eminently suitable for the tremendous accelerations found in 70 mm. projection.

The sprocket pads each carry two roller systems, two half rollers in the centre matching the 35 mm. teeth ; and two half rollers, one on each side, matching the 70 mm. teeth. The roller systems are eccentrically mounted on a rotatable shaft carried by two side pressure levers. Rotation of the shaft through half a circle allows interchange from 35 mm. to 70 mm. operating position, or vice versa, setting the correct rollers against the appropriate sprocket teeth. There are four of these double roller pads, one each for the three constant speed sprockets and one for the intermittent sprocket. They are colour-marked to indicate the particular setting, either for 35 mm. or 70 mm., and when selection has been made can be locked at that setting by a securing screw.

Separate projection gates and pressure pads are supplied for 35 mm. and 70 mm. film respectively and it is necessary to fit the appropriate units when changing from one to the other. No tools are required for this and accurate positioning is predetermined.

The projection gate is of the traditional type. The film gate runners, which are linear in form throughout most of their length, are so profiled that they go through a small change of angle at about a quarter of the distance along their length resulting in a short curve at this point. Thus the film travels through the main part of the gate in a slightly different plane from that in which it entered.

The pressure pads, which are divided into two sections to conform with this gate profile, have adjustable tension designed to apply the pressure where needed and ensure that the film remains perfectly flat and without buckling when projected.

The film in the gate is cooled by a powerful fan with independent motor, mounted in the projector base. A textile filter ensures dust free cooling air being carried to the gate. The film gate can also be water cooled and use of the two cooling systems will ensure the minimum heat damage to the film, even when the most powerful light source is in use.

The spoolboxes are designed to accommodate a 5,000-ft. spool of film. The spool spindles in both top and lower spoolboxes are of $\frac{1}{2}''$ diameter in order to carry the heavy 70 mm. spools of film without strain, and positioning rings are provided to centre the narrower spools for 35 mm. operation. The spindles have double joints at the outer end to enable the two different width spools to be correctly accommodated.

The optical soundhead makes use of the popular pre-focused projected slit system of scanning the soundtrack, in conjunction with a Cinetron photo-electric cell. Wow and flutter are practically eliminated by the use of dash-pot damping of the spring controlled jockey roller. Flutter does not exceed 0.10%, which is considerably better than the established standards.

The magnetic soundhead is a separate assembly mounted on the front of the film mechanism. The film is pulled down from the top spoolbox by a driven sprocket which precedes the magnetic head, thus avoiding any flutter which might originate from the variations in film pull from the spool. Mechanical smoothing is assured by use of a system of nylon idler rollers, a drum with a heavy flywheel, and a dash-pot spring damper.

The same principle used on the roller pads of the mechanism has also been followed in the design of the roller pad for the magnetic soundhead drum. The magnetic cluster, consisting of 10 magnetic reproducing heads, is assembled on a circular base and divided into two groups ; one of four heads, set for 35 mm. film scanning and one of six heads, set correctly for the tracks on 70 mm. film. This arrangement allows of selection of channels by rotation of the assembly through 180°.

The magnetic heads are mounted very near to the drum, at a point where flutter is at a minimum. The resultant figures in respect of flutter content are of the same order as those obtained from the optical soundhead, i.e. better than 0.1% R.M.S.

The film take-up system used in the bottom spoolbox is very efficient, and proper control over the very wide range of loading called for, when both 35 mm. and 70 mm. film are to be handled, is adequately obtained by the use of an independent Torque motor to drive the take-up. No mechanical coupling to the projector drive is required. The tension with which the film is taken on to the spool is easily adjustable by use of a spring-loaded clutch plate, the compression of the spring being controlled by the turning of the compression nut on a thread on the spool spindle.

A control panel is mounted on the operating side of the lamphouse beam. This carries the projector starter switch, which provides " start " and " run " positions for the three-phase driving motor, giving smooth acceleration up to full speed without snatch.

The control panel also carries the optical soundhead exciter lamp switch, current control resistance, and ammeter ; the projector lacing light switch ; a switch which can provide remote control of the arc rectifier or generator; and a special " re-set " switch for control of a film break safety device, which can be supplied on order with this projector. The necessary terminals to accommodate the projector and arc-lamp wiring are housed in the projector stand, as is also a range of fuses for some of these circuits.

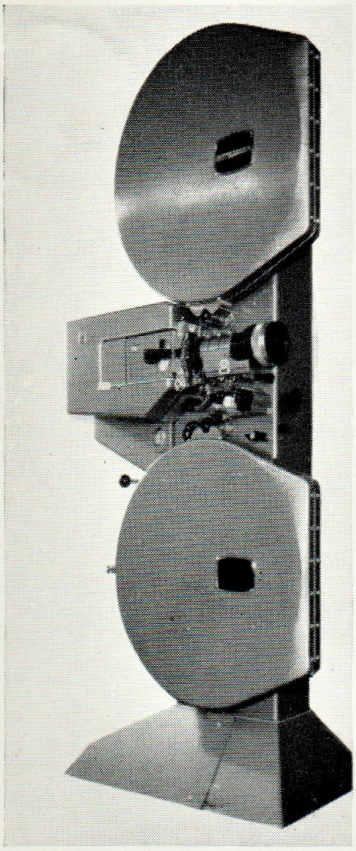
The change from 35 mm. to 70 mm. film operation, or vice versa, merely requires the replacement of the gate and pressure pads, the insertion or removal of the positioning rings in the spoolboxes, appropriate rotation of the four roller pads, of the drum pressure roller, of the magnetic cluster, and changing of the lens. This should not require much more than a minute to achieve.

DATA SHEET No. 62 – Issued by the PICTURE PRESENTATION COMMITTEE of the BRITISH KINEMATOGRAPH SOCIETY

Sponsored by J. FRANK BROCKLISS LIMITED

The Philips FP.20.S Pulsed Lamp Projection Equipment

Embodying the pulsed SPP.800 gas-discharge lamp, the Philips FP.20.S shutterless projector, described in brief detail below, represents a revolutionary development ideal for the automation age of motion-picture presentation.



Simplified design offers minimum maintenance, trouble-free operation and least possible attention with the option of remotely controlled focusing and framing and completely automatic changeovers. Single push-button starting of projector combined with light source, automatic change to standby lamp, simplified film lacing, and minimum lubrication are only some of the outstanding features of this remarkable projector.

The FP.20.S projector also offers a flicker-free picture presentation with constant brightness and an unbelievable uniformity to the very edges, minimum film heating, the elimination of the need for any special ventilation and reduced space requirements for installation. Large spoolboxes allow for over two hours' running with only one changeover.

The SPP.800 gas-discharge lamp consists of a quartz tube only $3\frac{1}{8}$ in. (80 mm.) long and pencil thin at only $\frac{7}{32}$ in. (5.6 mm.) diameter. The lamp is driven by a pulsating direct current of 72 impulses per second or three impulses per frame. Under working conditions the lamp is contained in a fully sealed holder in which it is surrounded by a flow of cooling water.

The SPP lamp is fed from a pulsator unit, which is similar to a small rectifier and may be installed in an adjoining room.

The lamp can be loaded up to 800W and the average life of this very inexpensive lamp is 33 hours under full load. At lower loads the life is considerably extended.

Since the lamp is small and may be placed without danger in the immediate vicinity of the film gate, the optical system can be similarly small, and consists of a cylindrical reflector about $\frac{7}{16}$ in. x $\frac{3}{8}$ in. (11 x 9 mm.) and two small lenses, which explains the exceptionally high side-to-centre ratio of screen illumination.

The special qualities of the SPP lamp greatly facilitate the work of the Projectionist. Its operation is confined to switching on and off and even this can be accomplished automatically by the film itself or a timing device. It does not produce any dust or noxious fumes and hence requires no ventilation, and total running costs for electrical supply and lamp replacement are low.

The skeleton of the projector consists of a rectangular sheet-steel housing. Its front panel is completely flat so that components to be subsequently fitted will not require any special alignment to ensure a smooth running of the film. Projection up to 15 degrees upward or 25 degrees downward is allowed for.

The driving mechanism is extremely simple, both sprockets being chain driven by slow running chains and chain wheels of synthetic material which is practically indestructible and ensures absolutely silent operation. The framing device requires no phase correction and hence no gear transmission for this purpose.

All the spindles and shafts run in sealed ball-bearings, requiring no lubrication, and all the guide rollers are made of self-lubricating material. The oil bath of the Maltese Cross is fully enclosed and easy to refill.

The projector is equipped with a curved gate, the film being guided by four ceramic rollers. The runner strips can easily be replaced, novotext, steel or velvet being available and the right and left strips are interchangeable, thus doubling their life.

The skate pressure is adjustable by one knob; a scale facilitates checking and re-adjustment. The aperture plates for different aspect ratios are inserted into a slit behind the gate, where they snap into their correct position and can be interchanged during projection.

The lens holder, which slides over a sturdy support fixed to the projector, takes lenses with a diameter of up to 2.25/32nds in. The fine focusing screw, in conjunction with a pressure spring, makes it possible to shift the lens without any backlash.

The lens holder complete with lens can be removed from its support in a single operation and replaced with another lens holder complete with lens for another aspect ratio.

Starting, changeover and stopping the projector are

effected with a single switch and as soon as the projector is up to sufficient speed, the lamp is switched on automatically. Motor and lamp are switched off together. An automatic film rupture switch is fitted which switches off both motor and lamp if the top loop becomes too large.

The projector is equipped with a turret fitted with two lamps. Normally the lower lamp is in operation. When it fails, the turret pivots *automatically* and the upper lamp takes its place. The defective lamp can be replaced and the turret turned up again *during projection*, thus re-establishing the automatic tandby for the lamp in operation.

To synchronise the action of the intermittent film movement with the current pulses for the lamp, a very simple device is used. Slots have been milled in the rim of the flywheel and each slot when passing a coil mounted on a permanent magnet, produces a voltage pulse which controls the current pulses for the lamp.

The projector can be fitted with a slide projection attachment, in which case the lamp turret is pulled backwards in the lamp housing by means of a lever which, at the same time, inserts a mirror system for deflecting the light from the pulsed lamp to the slide attachment.

DATA SHEET No. 63 – Issued by the PICTURE PRESENTATION COMMITTEE
of the BRITISH KINEMATOGRAPH SOCIETY

Sponsored by the ELECTRICITY COUNCIL

Electricity Supply

This section explains how electricity tariffs are constructed, and the points to be considered where a choice of tariffs is available. Electricity Boards will give advice to individual consumers on the choice of tariff, if required.

It also gives brief details on what to do if a power failure occurs.

1. There are twelve Electricity Boards operating over England and Wales, each responsible for their own finances. There are, therefore, inevitably, differences in the tariffs but they generally follow the same broad principles. The costs of supply fall into two main categories, fixed costs in the provision of generation and distribution equipment to cover the highest demand likely to be made on the supply and running costs the major part of which is the cost of the coal (or other fuel) used in the power station. For this reason tariffs are generally two-part in form, the aim being to collect most of the fixed costs in some form of fixed or demand charge and the running costs in a running charge per unit supplied.

2. For tariff purposes, consumers are divided into four broad classes: Domestic, Farm, Commercial and Industrial. There are generally two types of tariff available, as alternatives, to consumers in the " Commercial " class which includes cinemas. They are:

(a) Measured maximum demand (m.d.) tariffs with a demand charge and a low unit charge and

(b) Tariffs with an assessed initial charge followed by a low unit charge but not generally so low as in (a). These are generally for the smaller consumers where the expense of maximum demand metering is not warranted.

3. M.d. tariffs follow more closely the costs of supply and the type of tariff in (b) may not be available for large supplies. The m.d. tariffs to individual consumers have a demand charge based on the consumer's maximum demand over a given period—generally over a year because, although the consumer's demand may be less in summer than in winter, the plant has to be provided to meet the maximum load whenever it occurs. Consumers who use a large number of units in relation to their chargeable maximum demand, i.e., who have a high " load factor," will generally find the measured demand tariff more favourable than the tariff on an assessed basis. The more the consumer can level out his demand, the cheaper will the supply under that tariff become.

4. Consumers with a low consumption in relation to their maximum demand are likely to find the alternative tariff on an assessed basis more favourable. This is because, although their individual " load factors " are low, the Electricity Board takes into account the diversity in demand of these supplies. When taken collectively, these tariffs collect an amount each quarter from an assessed initial quota of units at a relatively high price per unit (or in a few areas, by means of an assessed fixed quarterly charge) after which all units are charged at a low rate. The assessment usually depends on the installed load of the consumer (although some Area Boards use other methods, e.g., a floor area basis). Most cinemas, especially smaller ones, will find this tariff appropriate, particularly where they are normally only open in the evening.

5. One difficulty which sometimes arises results from the use of heavy lighting loads at infrequent intervals for occasional stage shows. The assessment on an installed load tariff or the demand charge on a maximum demand tariff may be increased by this load and so appreciably affect the overall cost per unit, and it is well worth while discussing this matter with your Area Board to see if, by separate metering, suitable timing or perhaps some other means, these relatively heavy charges can be reduced.

6. Other means of ensuring maximum economy should be investigated. These may include:

(a) Alternative registration times on maximum demand tariffs. The maximum demand of a consumer is always calculated on the basis of twice the largest number of units taken in any half-hour of the registration time. This may be a month, a year, part or all of a day, winter or summer, etc. It may be possible for the cinema to plan their use of electricity so that the heaviest demands fall outside their registration period.

(b) Power factor correction. Examination of your tariff will show just what penalties exist for low power factor, and, by setting the capital cost of correction against the expected saving, the economic correction can be decided upon. Full correction to unity is rarely justified.

(c) Use of " Restricted-hour Tariffs " or special concessions for excess demands during periods of light load on the Board's system. Where part or all of the cinema is heated by electricity by storage methods, these specially low tariffs, for supplies used only at off-peak times, are of considerable advantage. Many buildings which previously relied on other methods of heating are now installing electric thermal-storage heaters which have proved to be a most effective and economic form of central heating.

Mains Faults and Failures

Much time can often be saved if mains and supply failures are correctly reported. The following information may be of help in minimising the delay in restoring power.

The projectionist should know:

(1) The correct telephone number to ring for day and night faults. This number is not necessarily that of the local District Office.

(2) The number and position of the points of supply to the cinema.

(3) Details of the emergency lighting equipment. He should also have available a comprehensive wiring diagram.

The Electricity Board will wish to know the extent of the failure thus:

(a) partial or complete on one or more phases at one point of supply;

(b) a complete point of supply;

(c) all points of supply (if more than one);

(d) if possible, neighbouring buildings, including street lamps and traffic signals.

The projectionist should not attempt to examine the Electricity Board's main fuses; he should isolate the Projection Room before leaving it.

DATA SHEET No. 64 – Issued by the PICTURE PRESENTATION COMMITTEE of the BRITISH KINEMATOGRAPH SOCIETY

Sponsored by THE GAS COUNCIL

Gas Supply

If an escape of gas is suspected, ventilate the room by opening all doors, windows, etc., and report to the local Gas Board at once; do not, on any account, attempt to trace an escape with a naked flame; make sure there are no naked flames or possible sources of sparks in the vicinity. Do not smoke or permit anyone else to do so near the suspected escape.

Gas appliances when fitted are normally set to give correct combustion, therefore regulating screws of gas and air supplies should only be adjusted by a trained experienced man.

If for any reason a main control cock, i.e. a cock controlling more than one appliance, is turned off, ensure that *all* appliances controlled by the main cock are each turned off by its *own* tap before turning on the main cock.

Flexible tubes should only be connected by means of properly fitted screwed connections, NOT by rubber sleeves or similar jointing pieces. Rings, etc., should never be hung up by the flexible tubes, and care should be taken to ensure that flames do not at any time play on the tubes.

Rooms where gas appliances having no flues are fitted should be ventilated at all times when the heaters are alight.

Many gas appliances are fitted with governors to ensure correct gas rate. Care should be taken not to cover the small hole in the casing of these governors through which the diaphragm breathes.

Secondary lighting and exit signs

Lighting fittings require cleaning regularly, usually about once every two weeks; this cleaning should be carried out with care.

Remove glasses where fitted and clean with a soft rag.

Remove mantles carefully; remember, these are very fragile, and place with hard top ring downwards.

Remove dust from injectors; this can usually be done by blowing gently through the air holes.

When reassembling remember that glasses should not be a tight fit in their galleries but should have room to expand.

Space heaters

Ensure that burners and air inlet holes on aerated (bunsen type) burners are free from fluff and dirt, the interior of heaters should be cleaned only with a soft brush—the burners should be covered when cleaning heater to prevent dirt from falling into them. Great care should be taken when cleaning neat flame (flat flame or luminous) type burners not to break steatite tips.

After cleaning, examine luminous type jets, and if tips are damaged resulting in incorrect flame, change broken jet before using heater—make sure flames are not making contact with any part of the heater.

Examine and check all connections from time to time, especially flexible connections, to make sure they are sound; if they are not, turn off control cock and report to local Board.

Keep exterior of heaters clean to prevent smell of burnt dust; clean and polish reflectors and glass doors or panels; do not use metal polish on reflectors. These can normally be cleaned by washing with soap and water and polishing with a soft clean rag.

If the heater has radiants (fuel) these should be replaced if broken, and any broken pieces which have fallen on the burner should be removed. When lighted, the inner blue cone of the aerated flame should not impinge on the radiant.

Instantaneous water heaters

Observe that pilot flame is correct length, i.e. that it warms any bi-metal or similar flame failure device and that it lights the main burner smoothly and without delay when the water control tap is turned on.

Adjusting screws should *not* be interfered with, as these are set to give correct combustion conditions.

If there are complaints of smell, other than gas, where an appliance having a down-draught diverter (baffle) fitted in the flue is fixed, test flue by firstly passing a lighted taper or match along the edge of the down-draught diverter-opening to the flue with the gas turned off—the flame should burn normally or tend to pull up the flue. Secondly, carry out the same operation with the heater fully alight. If the flue is blocked or obstructed, the flame will waver considerably and will probably go out; if this happens do not use appliance until the flue has been cleared.

Central plant

Gas fired central heating or hot water boilers should be periodically serviced by men trained for this work. Arrangements can usually be made with the local Gas Board.

Instructions for the correct procedure to be followed when lighting the boiler(s) should be prominently displayed close to the appliance(s) and this lighting procedure should always be adhered to strictly. Lighting instructions are frequently attached to the boiler and, where this is so, they should be kept clean and readable.

Gas flames within boilers should all be of approximately the same size and shape. If one or more burners are seen to

differ greatly from the others a broken or blocked burner is indicated and should receive attention, as, if left, it leads to " sooting " up of the appliance.

Flames of aerated (bunsen type) burners should have a clean blue cone in the centre. The flames should not be flabby, if they are, more primary air is required to prevent " sooting."

Automatic controls are so numerous and differ so much that it is not possible to cover them briefly. Each Engineer should familiarise himself with the control system of his particular plant and carry out periodic checks to ensure that all controls are working satisfactorily.

In the event of a boiler failing to shut down under automatic control, turn off boiler main control cock and report to Gas Board.

In the event of a boiler failing to light up, turn off main control, examine thermostats to ensure they are calling for heat, check that clock (time switch) has not stopped in the CLOSED position, then carry out lighting procedure. If boiler still fails to light, expert assistance should be sought.

Incinerators

Check periodically that gas to incinerators shuts off automatically after ignition period is completed. It is not normal for this to extend beyond the time taken for charge to ignite.

Catering equipment

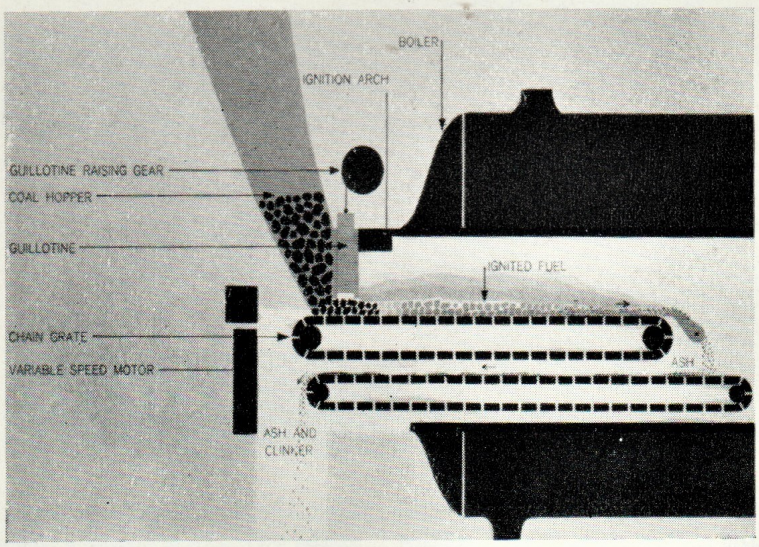
See section on " Care and Maintenance of Equipment " prepared for handbook on " Commercial Catering."

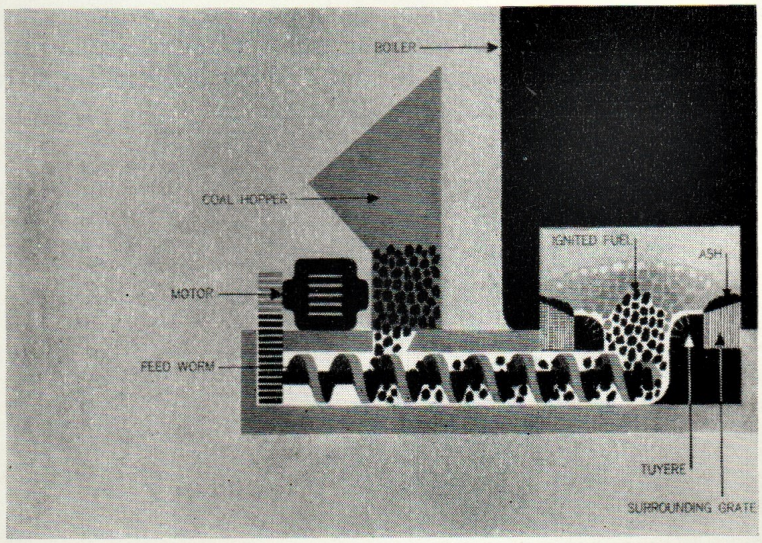
DATA SHEET No. 65 – Issued by the PICTURE PRESENTATION COMMITTEE
of the BRITISH KINEMATOGRAPH SOCIETY

Sponsored by the NATIONAL COAL BOARD

Solid Fuel Firing

To hand fire solid fuel boilers can be wasteful both of labour and of fuel while, to avoid smoke emission an inherently smokeless fuel must be used which is usually more expensive than bituminous coal. When quantities in the region of 100-150 tons of coal or coke are needed for the average sized cinema each year it is common sense to ensure that the fuel is burnt in the most efficient way. This means that some form of mechanical stoking must be applied. To a certain extent the choice of appliance may be influenced by the type of existing boiler but the most influential factor will be the maximum quantity of fuel which has to be burnt in order to keep the cinema at an equable temperature. Initial cost is, of course, most important, together with fuel availability and in view of all these considerations one of the more popular types of stoker chosen is the underfeed design. The fuel is fed either direct from a bunker to the boiler or from a hopper attached to the stoker itself by means of a worm which forces it up through the bottom of the fire retort inside the boiler. Volatiles driven off must pass through the ignited fuel bed thus eliminating smoke. This type of stoker operates under forced draught and lends itself to automatic control which proportions the coal feed and combustion air supply in relation to the heat demands made on the boiler. The underfeed stoker can be applied to boilers ranging in output from 100,000 Btu/hr. upwards, and has a maximum coal handling capacity of 750 lb./hr. This stoker functions most successfully with graded coals, not too strongly caking, with an upper size limit of 1 in.-2 in., depending on the pitch of the feed screw flight, and a maximum fines content not exceeding 20% through $\frac{1}{8}$ in. with an upper limit of 10% free moisture. The

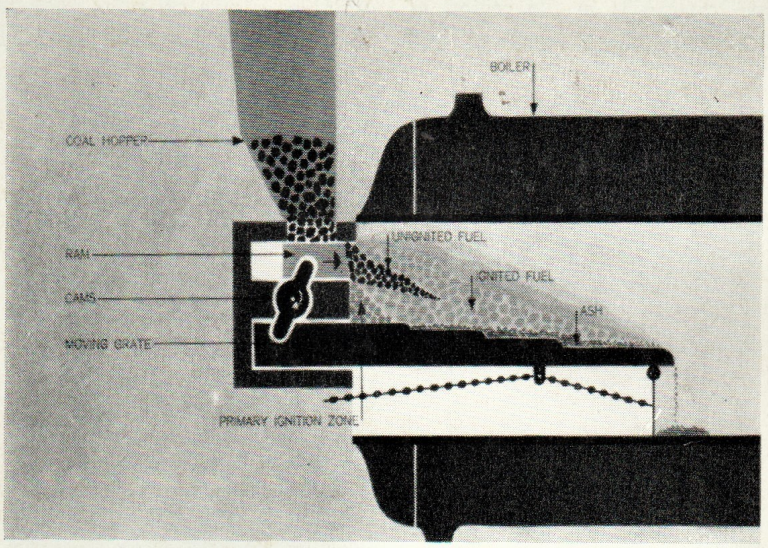




most common boiler to which it is fitted for cinema heating is, of course, the sectional type but the underfeed stoker is also widely used for vertical and horizontal single or two-flue shell boilers.

In the case of very large cinemas a shell boiler may well be in position fitted with either a chain grate or a low ram coking stoker. Until recently the chain grate stoker has only been applicable to the larger installations, but there are now smaller units which have been developed suitable for use with cast iron and steel sectional boilers. The stoker conveys the coal from a hopper in an even layer into the boiler on an endless belt made up of a series of links through which combustion air is blown. The ash falls off the back of the grate bars and the feeding of fresh coal from the front of the ram An efficient form of automatic control can easily be fitted which ensures precise regulation of the firing rate and draught. The upper size limit of fuel is 1in.-2 in. and the maximum free moisture limit about 12%, while the ash content should preferably not exceed 10%.

All the mechanical firing appliances described so far are smokefree when burning bituminous coal and can operate under automatic control with a minimum of attention. An alternative method is the gravity system which uses inherently smokeless fuels such as coke or more usually anthracite. Attendance necessary is reduced to a minimum and consists merely in removing the pieces of clinker and filling the hopper



and can be removed to the front manually, or by a mechanical ash conveyor. Fully automatic control systems are available for this type of stoker. Coals recommended for the chain grate stoker are treated and untreated smalls with a fines content of up to 40% through $\frac{1}{8}$ in., a free moisture content of 8-12% with lower and upper ash content limits of about 7-20% respectively.

The coking stoker, of the ram type, is applicable to shell-type boilers and feeds the coal on to the grate by means of a reciprocating ram fitted beneath the coal hopper. Once fed into the boiler the coal moves forward along the grate by a combination of the reciprocating movements of the grate which should preferably be done mechanically by some simple means such as a screw-type elevator.

Technical Advice

Attention is drawn to the comprehensive Technical Advisory Service now provided by the National Coal Board in all its regions which is freely available to engineers and those concerned with the heating side of the cinema. Advice will be given concerning the best type of appliance and the most economic type of suitable coal available in a particular district and on all problems relating to smokeless operation and the Clean Air Act.

DATA SHEET No. 75 — Issued by the PICTURE PRESENTATION COMMITTEE of the BRITISH KINEMATOGRAPH, SOUND AND TELEVISION SOCIETY

Sponsored by the MOTION PICTURE TECHNICAL ADVISORY COMMITTEE

Technical Data – Film, Lens and Aspect Ratios

Lens Formula : (1) $P = \frac{A \times T}{F}$ (2) $F = \frac{A \times T}{P}$ (3) $T = \frac{F \times P}{A}$

where P = Picture Width F = Focal Length of Lens T = Throw A = Aperture Width

Note 1. P in feet and T in feet go with F in inches and A in inches.
P in metres and T in metres go with F in millimetres and A in millimetres.

Note 2. P can just as well represent picture *height* but only if A represents aperture *height*.

Note 3. As the negative (downward) angle of the projector increases so the resultant picture height also increases and the picture sides tend to slope inwards — the well-known "keystone" effect. A guide to the extra height involved can be found by dividing the COSINE of the angle of rake into the normal picture height (5°=0.9962, 10°=0.9848, 15°=0.9659). The COSINE of any angle is readily available from a table of the functions of angles.

Conversion Table for Projection Lenses

45 mm. = 1.771 in.	72.0 mm. = 2.834 in.	95 mm. = 3.740 in.	135 mm. = 5.315 in.
50 mm. = 1.968 in.	75.0 mm. = 2.952 in.	100 mm. = 3.937 in.	140 mm. = 5.511 in.
55 mm. = 2.165 in.	77.0 mm. = 3.031 in.	105 mm. = 4.133 in.	145 mm. = 5.708 in.
57 mm. = 2.244 in.	80.0 mm. = 3.149 in.	110 mm. = 4.330 in.	150 mm. = 5.905 in.
60 mm. = 2.362 in.	85.0 mm. = 3.346 in.	115 mm. = 4.527 in.	155 mm. = 6.102 in.
62 mm. = 2.440 in.	87.5 mm. = 3.445 in.	120 mm. = 4.724 in.	160 mm. = 6.299 in.
65 mm. = 2.559 in.	90.0 mm. = 3.543 in.	125 mm. = 4.921 in.	165 mm. = 6.496 in.
70 mm. = 2.755 in.	91.0 mm. = 3.582 in.	130 mm. = 5.118 in.	170 mm. = 6.692 in.

2 in. = 50.80 mm.	3 in. = 76.20 mm.	4 in. = 101.60 mm.	5 in. = 127.00 mm.	6 in. = 152.40 mm.
2¼ in. = 57.15 mm.	3¼ in. = 82.55 mm.	4¼ in. = 107.95 mm.	5¼ in. = 133.35 mm.	6¼ in. = 158.75 mm.
2½ in. = 63.50 mm.	3½ in. = 88.90 mm.	4½ in. = 114.30 mm.	5½ in. = 139.70 mm.	6½ in. = 165.10 mm.
2¾ in. = 69.85 mm.	3¾ in. = 95.25 mm.	4¾ in. = 120.65 mm.	5¾ in. = 146.05 mm.	6¾ in. = 171.45 mm.

Lens Barrel Diameter Equivalents

52.29 mm. = 2.059 in.
70.56 mm. = 2.778 in.
70.61 mm. = 2.780 in.
70.64 mm. = 2.781 in.
79.38 mm. = 3.125 in.
101.60 mm. = 4.000 in.

Useful Conversion Factors

1 millimetre = 0.03937 in.
1 centimetre = 0.3937 in.
1 metre = 39.37 in., 3.82 ft., 1.09361 yd.
1 inch = 25.4 mm., 2.54 cm., 0.025 m.
1 foot = 304.8 mm., 30.48 cm., 0.304 m.
1 yard = 914.4 mm., 91.44 cm., 0.914 m.

Note. British Standard 350—1959 and 1962 Conversion Factors and Tables will give you an immediate and comprehensive reference.

Film	16 mm. = 0.629 in.		35 mm. = 1.378 in.		70 mm. = 2.756 in.	
Perforations per Frame	1	1	4	4	5	5
Frames per Foot	40	40	16	16	12.80	12.80
Perforations per Foot	40	40	64	64	64	64
Frames per Second	16	24	24	25	24	30
Feet per Minute	24	36	90	93.75	112.50	140.62
Metres per Minute	7.31	10.97	27.36	28.50	34.20	42.75

Projector Apertures

Silent	35 mm.	1.33:1	0.910 in. x 0.680 in.	23.11 mm. x 17.27 mm.
Academy Standard	35 mm.	1.375:1	0.825 in. x 0.600 in.	20.95 mm. x 15.25 mm.
Wide Screen	35 mm.	1.66:1	0.825 in. x 0.497 in.	20.95 mm. x 12.62 mm.
Wide Screen	35 mm.	1.75:1	0.825 in. x 0.472 in.	20.95 mm. x 11.99 mm.
Wide Screen	35 mm.	1.85:1	0.825 in. x 0.446 in.	20.95 mm. x 11.33 mm.
CinemaScope	35 mm.	2.34:1	0.839 in. x 0.715 in.	21.31 mm. x 18.16 mm. *
Wide Film or	70 mm.	2.20:1	1.913 in. x 0.868 in.	48.59 mm. x 22.00 mm.
	16 mm.	1.34:1	0.380 in. x 0.284 in.	9.65 mm. x 7.21 mm.

* Refers to Optical and Mag-Optical Prints only.

Dimensions for multi-track Magnetic CinemaScope	2.55:1	0.912 in. x 0.715 in.	23.16 mm. x 18.16 mm.

Note 1. Aperture Dimensions and Aspect Ratios apply only at Resultant Picture and 0° Projection Angle.

Film Perforation Dimensions

Type		Pitch	Dimensions
Bell and Howell	BH.	0.1866 in.	0.1100 in. x 0.0730 in.
Bell and Howell	BH.	0.1870 in.	0.1100 in. x 0.0730 in.
CinemaScope	CS.	0.1870 in.	0.0780 in. x 0.0730 in.
Dubray Howell	DH.	0.1870 in.	0.1100 in. x 0.0730 in.
Kodak Standard	KS.	0.1866 in.	0.1100 in. x 0.0780 in.
Kodak Standard	KS.	0.1870 in.	0.1100 in. x 0.0780 in.

Synchronisation Between Picture and Sound

Film	Type of Sound	Frames	Position
16 mm.	Optical Track	26	Ahead
16 mm.	Magnetic Track	28	Ahead
35 mm.	Optical Track	20	Ahead
35 mm.	Magnetic Track	28	Behind
70 mm.	Magnetic Track	24	Behind

Conversion of Lens Focal Length Using Common Picture Height

Lens Focal Length of	Multiply By	To Obtain
Standard		
1.375:1	0.786	WS.1.75:1
1.375:1	1.191	CS.2.34:1
1.375:1	1.443	WF.2.20:1
Wide Screen		
1.75:1	1.271	ST.1.37:1
1.75:1	1.515	CS.2.34:1
1.75:1	1.834	WF.2.20:1
CinemaScope		
2.34:1	0.660	WS.1.75:1
2.34:1	1.211	WF.2.20:1
Wide Film or 70 mm.		
2.20:1	0.545	WS.1.75:1
2.20:1	0.825	CS.2.34:1

Note. Some of the Dimensions given above are not yet the subject of British or American Standards and may vary slightly between authorities.