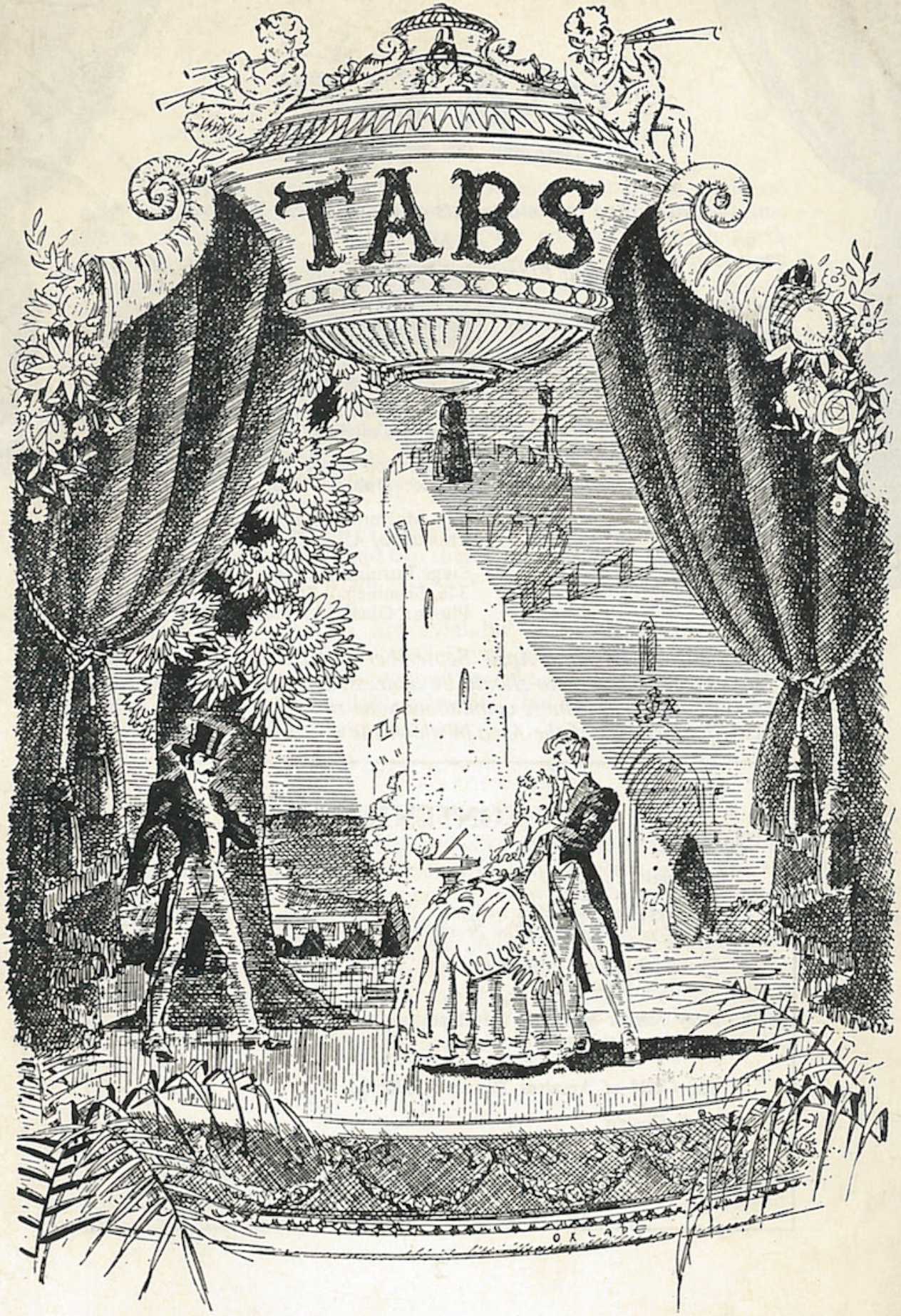

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TABS

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EDITORIAL

Marking the Colours

It is a time honoured custom back-stage to mark in chalk on each colour frame, the number of the colour medium it contains, when it is necessary, between scenes, for colours to be changed. This has helped a quick selection of the correct colour, a necessary precaution if the person responsible for the change is not able to identify the standard filters visually in the often unhelpful conditions back-stage. It leads to unfortunate error when an old chalk-mark is not substituted by a new one, which can easily happen in the chaos of a lighting rehearsal if the producer decides to change the colours originally selected.

An alternative, less liable to error, is to mark the colour filter itself. It is possible to do this by use of a " Chinagraph " crayon pencil, which is also useful for marking sheets of Cinemoid and Gelatine held in stock.

They can be marked at leisure, with the aid of a colour chart (supplied free on request) and can thereafter be easily selected during the heat of the battle, when mistakes cause frustrating delays and exhibitions of temperament.

These special pencils are available free of charge to TABS readers ordering Cinemoid or Gelatine, provided that their order so requests. These pencils cannot be sent separately through the post. They are only available provided that they can be wrapped up with an order for colour mediums.

* * *

A Man Of Many Parts

Few people can be better qualified to comment on stage lighting matters than Mr. George Devine, who contributes a book review on page 23 and a letter on page 21. As well as being an actor of considerable reputation he is also well known as a producer of both plays and opera. He not only lights all his own productions but has, on a number of occasions, fulfilled the same function for other producers. He lectured on stage lighting amongst other subjects at the Young Vic School, and before the war at the London Theatre Studio. In earlier days he was a prominent member of the O.U.D.S.

* * *

Binders for Tabs

Binders with stiff board covers are again available, each one holding about 15 issues. Price 6*s*. each, post free, from our Head Office, 29 King Street, London, W.C.2.

A Pat on the Back

We have liked to think that the Strand Electric overseas organization may, in some small measure, have contributed to the success of the recital tour undertaken by Dame Sybil Thorndike and Sir Lewis Casson, not only through our own branch in Melbourne, Australia, but also through the good offices of our friends and agents, Messrs. Joan & Russell Reid, of Wellington, N.Z. It was therefore with sincere delight that we received from our agents in India, The Crompton Engineering Co. (Madras) Limited, a copy of a letter which they had received from these good troupers. May we long have the pleasure of serving them both.

30th Jan. 1955

The Crompton Engineering Co. (Madras) Ltd.

Dear Mr. Sunderaraman,

We cannot leave Madras without thanking you most sincerely for carrying out so efficiently the lighting installations for our recitals here. Both you and your staff are worthy of your connexion with the Strand Electric Co., and we can give you no higher praise than that!

Yours sincerely,

Lewis Casson.

All good wishes to you—thank you. From **Sybil Thorndike.**

* * *

THE SET DESIGNED BY . . . ?

The following is reprinted by kind permission from "The Prompter"—journal of the Southampton Theatre Guild. The editor of "Tabs" would be interested to receive readers' comments on this somewhat controversial subject.

Most acting editions of the plays we present carry a photograph of the set used in the first London production. Still more have a plan of the set and nearly all the author's description of the scene as envisaged when the play was written.

How clearly should these matters be followed when we endeavour to present the play on a stage so much smaller and with so many fewer facilities than were originally available? May we legitimately break away from the original set with a light heart yet consider it irresponsible deliberately to change the script?

One thing that is never given in an acting edition is the scale of the plan provided. If it were we should find that the proscenium opening was considerably wider than we have ourselves available, so that slavish following of the plan is impossible. This being the case

we must scale down the wall flats, for a proportional reduction in the size of the doors and probably of the windows is not possible. Having done this the proportions of the set have been spoilt, and it may be that we should have been better off to discard the plan and design a suitable set for ourselves.

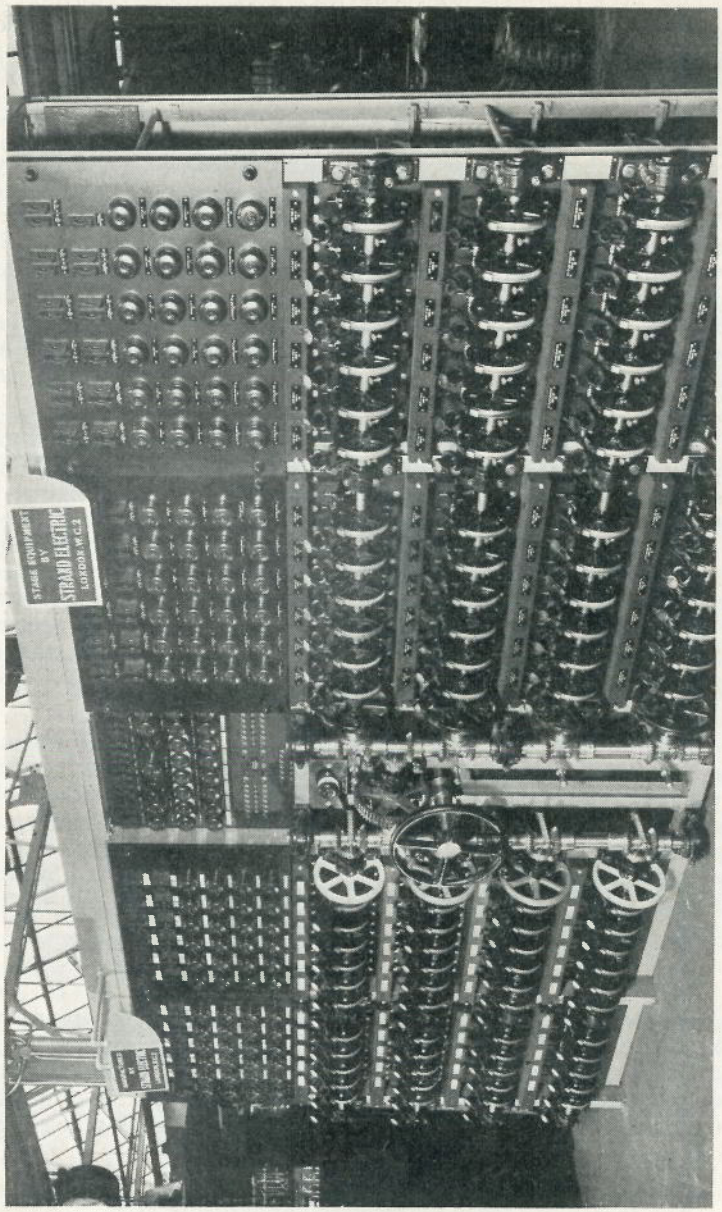
Nevertheless, if we accept the author's play as a good play, should we not accept the designer's set as a good set, the designer, be it remembered, being far more expert in his craft than we are? It is possible to follow the original with reasonable faith, and still have a pleasingly proportioned set with its main features as described. Our stages are, for the most part, not so small that a door, a fireplace and a window fill the entire space available, and cutting out the frills (with regret) we may still have the set as designed by the expert.

On the other hand, amateurs are often told that theirs is the field for experiment. Why not, therefore, adventure with something really new, on the principle that if a true copy of the original is impossible we will have no makeshifts? There is great satisfaction in the study of plans, books and illustrations with the object of designing the set—satisfaction in watching it grow in the workshop —and satisfaction in seeing it complete on the stage lit as it should be for the first time. Should it justify the favourable comment of those better qualified to judge than our friends and relations, that is ample reward for the many hours of work involved.

It is, however, no matter to be undertaken lightly and without good reason. A thorough knowledge of the mechanics of the play is essential and if the set depicts a room, it must be a reasonable room in which the characters in the play might reasonably be expected to be found. A "lounge-hall" with four doors and a staircase is hardly the setting for a winter evening scene however adequate the fire. Neither is a second door a likely feature in the average living room.

The design (particularly of the window) must be in accordance with the likely age of the house and there are many other features indicating period which should be considered. A Victorian room modernized in the 1920's and decorated in modern style 1954 will hardly carry conviction on the stage, and would be better with Victorian wallpaper, marble fireplace, finger plates, and all the other trappings of that period.

Yes, there is an awful lot of work and much to learn, and since it is impossible to please everybody all the time, someone won't like it, so why should we stick our necks out—or should we? L. C. E.



A modern 96-way Grand Master Theatre Switchboard.

TYPICAL LIGHTING PROBLEMS

The following which forms part of "Lighting the Stage" by P. Corry (Pitmans) is reprinted by permission of author and publisher. The book is reviewed on page 23 of this issue.

It is not at all desirable to be dogmatic about how particular lighting effects should be obtained or about which colours should be used for specific purposes. The designer has a wide range of choice. His choice will be influenced by his knowledge of the possibilities and limitations of his equipment and his experience of its use, but it will be determined primarily by something that is essentially personal. Call it intuition, inspiration, artistry, genius, or what you will, it is something that cannot be condensed into a golden rule. The artist is a law unto himself and "In framing an artist, art hath thus decreed, To make some good, but others to exceed."

To the person of limited experience it is probably useful to study the methods of others, and the following comments on a few common stage problems must be recognized as being merely guidance towards a method of approach and not as established definite procedure. In general, the suggestions are based on practical experience, but it is conceded that others of equal or greater experience would probably offer quite different advice. It must also be realized that the conditions in which the problems arise are rarely, if ever, identical. Stage lighting is something intangible; it is a quality of visibility, transforming that which is made visible. The subtle possibilities of transformation are limitless, but the designer must beware of the danger of treating light as a thing apart. In itself it does not create a stage picture: it reveals a significant picture if there is something to be revealed that can be made significant.

Selection of Colour Mediums

The colour filters in general use on the stage have become standardized by names and numbers. They normally consist of sheets of gelatine or a more durable plastic material which is usually known by a proprietary name such as "Cinemoid." Glass can be used but is not obtainable in the range of colours required, and many authorities frown on its use owing to the danger of breakage. The Cinemoid type of filter is fire-resistant and is, therefore, as satisfactory as glass for most purposes. The gelatine is cheaper to buy, but Cinemoid lasts longer without any appreciable fading. For short-period use the gelatine is an economy, but the longer life of the Cinemoid more than compensates for the greater cost, if the longer life is an advantage.

The following is a list of the colours available:

NUMERICAL ORDER

1. Yellow
2. Light Amber
3. Straw
4. Medium Amber
5. Orange
5A. Deep Orange
6. Red (Primary)
7. Light Rose
8. Deep Salmon
9. Light Salmon
10. Middle Rose
11. Dark Pink
12. Deep Rose
13. Magenta
14. Ruby
15. Peacock Blue
16. Blue-Green
17. Steel Blue
18. Light Blue
19. Dark Blue
20. Deep Blue (Primary)
21. Pea Green
22. Moss Green
23. Light Green
24. Dark Green
25. Purple
26. Mauve
29. Heavy Frost
30. Clear
31. Light Frost
32. Medium Blue
33. Deep Amber
34. Golden Amber
36. Pale Lavender
38. Pale Green
39. Primary Green
40. Pale Blue
41. Bright Blue
42. Pale Violet
48. Bright Rose
49. Canary
50. Pale Yellow
51. Gold Tint
52. Pale Gold
53. Pale Salmon
54. Pale Rose
55. Chocolate Tint
56. Pale Chocolate
60. Pale Grey

The suppliers of these colour mediums provide free samples of each in booklet form. The lighting designer or producer who does not possess these samples is handicapped needlessly. It is impossible to judge at all adequately the fine shades of difference merely by comparing the names. The filters should not be judged in daylight. They are best tested by allowing the light from a filament lamp to pass through them. With experience, one acquires certain favourite mediums used singly or combined in twos or threes, and there is a danger of overlooking others that might be more suitable for a particular purpose. By experiment it will be found that the use of two or three different colours in a single frame will often produce a more suitable effect than can be obtained from any of the single colours.

The chief difficulty occurs if, as is usually so, the colours must remain unchanged throughout a performance. The colours selected must then be capable of providing whatever changes are necessary by dimming and mixing. It is quite possible that in one production it is necessary to suggest both interior and exterior at dawn, full daylight, dark night, moonlight, lamplight, gaslight, candle-light, and so on. The flooding equipment, which includes battens and footlights, should include a selection of filters likely to give what are judged to be the most satisfactory variations. The primary colours will give the maximum choice of variations but, as already explained, their use involves the needless loss of considerable intensity. The flooding equipment, the purpose of which is to give the general, diffused lighting of the setting, will normally be so controlled that three (or probably four) separate circuits are available. If battens and footlights are included in the flooding equipment, the three circuits in the footlights and in each batten should be separate: it is a disadvantage if the individual colour circuits of two or three battens are looped together for dimmer control, as it does not follow that the mixture of colours from each batten should be identical.

The following is a group of alternative three-colour sections which are often used for the flooding of the acting area. If a fourth circuit is available, it is an advantage to have it free of colour and for a frosted or clear medium to be used. This circuit makes it possible to increase visibility while still preserving a paler version of the general tint required.

(*a*) Primaries: No. 6 Red; No. 39 Green; No. 19 Dark Blue (or two circuits of No. 20 Deep Blue).

(*b*) Alternative Primaries: No. 34 Golden Amber (double); No. 16 Blue-Green; No. 19 Dark Blue (or two circuits of No. 20 Deep Blue).

(*c*) No. 7 Light Rose; No. 36 Pale Lavender; No. 32 Medium Blue.

(*d*) No. 10 Middle Rose; No. 2 Light Amber; No. 40 Pale Blue.

(*e*) No. 11 Dark Pink; No. 52 Pale Gold; No. 18 Light Blue.

The selection of the particular combination that will best suit the colours in the setting and costumes and will flood the stage with light of the required warmth, coldness or intensity is a matter of individual choice. When all three circuits are on at full there will be maximum intensity of light with an overall tint determined by the dominant colour in the combination. In selection (*c*) the dominant colour would be Blue and the "full-up" lighting would be rather colder than from selection (*d*) in which the constituent colours are more evenly balanced. In each selection it will be seen that two of the colours can be combined to give a warmer tone than all three, or two can be combined to give a colder light. It is important to realize that the colours of the costumes and scenery will be negatived if those colours are not in the light that makes them visible. If each of the mediums selected allows all the primary colours to pass through in a more or less degree, it is safe to assume that any colour pigments used in the costumes and scenery will be able to reflect the name colour in a higher or lower degree of intensity if only one circuit is alight. For example, No. 11 Pink and No. 52 Gold both allow Red, Green and Blue light-waves to pass in differing proportions, but No. 18 Blue allows only Blue and Green to pass. Therefore, a red costume in light provided by the No. 18 Blue circuit will not appear to be red. If a proportion of either of the other two colours is added, the red costume will have light which it can reflect and its colour will register as red of an intensity varying according to the intensity of the additional light introduced.

It is dangerous to advise any particular combination of colours. The selection is one to be made with due regard to the mood and setting of the play produced. It should be clear, however, that a selection similar to (*e*) is of general utility in providing reasonable variation of tints for the diffused lighting. If the play is one that does not require any great change of light intensity, the object will probably be to obtain as much light as possible. It is usually important when playing comedy to keep the lighting bright, and a selection of the paler tints will probably be desirable.

The colour filters used with the spot, acting area and pageant lanterns must usually be of the pale tints. The main purpose of these lanterns is to light the actors to a higher intensity than that of the dispersed lighting. If the deeper colours are used for this purpose, the actors will appear unnatural and probably grotesque. In spectacular musical shows it is often desirable to have a lavish use of vivid colours, but in such productions realism may be justifiably sacrificed to colourful theatrical effect, and provided the result is pleasing, it matters little whether it is credible or no. In a musical comedy ballet, for instance, a riot of vividly contrasting colours can be much more attractive than a sedate selection of the pale tints that might be necessary if realism were the object.

In general, spotlights should have the paler colour filters. The spotlights are usually directed diagonally across the stage and as an actor should be lighted from opposite sides on any part of the stage, it is desirable that there shall be a difference of tints in the opposing spots. If the same tint is used from each side there is a tendency to flatten the features. If the lighting from one side is warm (say, 54 Pale Rose), a cold tint on the opposite side (say, 17 Steel Blue), will give the effect of shadow and emphasize the illusion of the " motive light " coming from the side that is warmly lighted. If the contrast between No. 54 and No. 17 is too great, a more subtle difference can be obtained by opposing No. 54 with, say, No. 52 Pale Gold.

It is important to choose carefully the colour mediums that are to be used for the lighting of the actors, whose make-up and appearance can be changed considerably by the light. Tints that have some proportion of each of the constituent primaries are usually better than the hues with only two constituent primaries. The amber and straw are devoid of blue, being obtained by combination of red and green only, and are inclined to be cold and harsh, whereas the gold and pale pink tints consist of all three primaries and are more pleasing in their effect on stage complexions. No. 36 Pale Lavender (formerly known as Surprise Pink) is a popular tint and can be used quite effectively in opposition to No. 51 Gold Tint or No. 54. No. 36, as may be judged from its name, has a more definite effect on the make-up than the No. 51 or No. 54. For this reason it must be used with discretion. It has had a certain vogue,

but when used undiluted with other colours lavender can play havoc with some costumes and make-up.

A word of warning must be uttered about the misuse of amber. It can completely ruin the appearance of costumes of delicate blues and greys and can be devastating to feminine make-up. The deeper the amber, the greater the devastation. It is often misused in flooding back-cloths, etc. An exterior cloth is usually strong in various shades of green and blue, and the effect of flooding it with amber is to present a very autumnal countryside instead of what was probably intended to be a sun-drenched pastoral scene in high summer. What is required is a light of maximum intensity with colour medium or mediums giving maximum value to the dominant colours on the back-cloth. No. 17 Steel Blue will give a much more satisfactory light on the cloth. On the other hand, if the effect of sunlight shining through window, doorway, arch, etc., is needed, the No. 17 Steel Blue will be unsuitable: No. 52 Gold will be much warmer in tone and therefore more appropriate.

The lighting of off-stage areas visible to the audience when doors are opened is frequently treated with less care than is desirable. It is usually an advantage to have a contrast of intensity and colour between such areas and the on-stage scene, but the contrast must not be too violent. If an actor leaves a brilliantly lighted stage through a doorway that reveals a gloomy darkness, there is likely to be a sudden loss of illusion unless the gloom is deliberate and credible. Not only does the backing to the door need suitable illumination, but actors making an entrance or exit must be adequately lighted. Any part of the stage that is seen by the audience is part of the acting area and must be given full consideration when equipment and colours are selected. The most popular method of lighting behind a door is to attach to the back of the flat what is known as a " length." This can be either a wooden batten on which lamps are fixed or a miniature compartment batten. The latter is preferable, as colour filters can be used and the double-sided length, if fixed above the door, will throw light on the backing and downwards on the actor, thus avoiding the creation of shadows as he enters or leaves the setting. In many cases the exclusive use of a length will not be sufficient, and spots or floods will also be needed.

Interior Scenes (Daylight)

In a realistic setting there will almost certainly be at least one window to provide an assumed source of light. If the scene has a ceiling, it is a great disadvantage to have the one window in the rear wall, as all the lighting must necessarily be from F.O.H., footlights, No. 1 Batten or perch positions. If the window is in a side wall and lighting is by spots and floods directed diagonally, the problem of achieving credible lighting is simpler. The light directed from the window side should be warmer in tone or of greater intensity, or both, than the light from the opposite side. If Gold or pale Pink

mediums are used for the warm tones and Steel Blue from the opposite side, the effect of light and shade will be quite credible without sacrificing visibility. If the Steel Blue is too cold, softer contrasts can be obtained by opposing Pale Gold and Pale Rose. It is also likely that a Light Frost added to the colour in the lanterns directed towards the supposed source of light will help. If rear wall windows are necessary, the advantages of using cut-down scenery, fully dealt with in Chapter VI, will be apparent, as it will then be possible to direct spot lighting towards front-stage. This lighting from behind the actors can add considerably to the interest and significance of the stage picture.

As far as possible the general lighting of the set should be greatest at floor level and gradually fade towards the top. Such lighting is justifiable as it concentrates the attention more at the level of the actors. If a ceiling is used, it is realistic to light the ceiling, but it is questionable practice theatrically. The main function of the stage ceiling is to mask the upper space without resort to borders, and if it is too strongly lighted, it becomes intrusive and provides too great a contrast with the scenery and stage. The ceiling rarely has any pictorial value, and the less the audience see of it the better. It should be as high above the proscenium opening as possible. The height of the flats used will determine the height of the ceiling, and if this height can be a few feet above the height of the proscenium opening, it is an advantage. There will be greater freedom for the positioning of the lighting units on the No. 1 Bar, and the ceiling itself will be less conspicuous. Another advantage of the cut-down scenery alternative is that all members of the audience receive the same stage picture. With ceiling or conventional borders, the occupants of the front seats have the full impact of either and the occupants of the rear seats escape both. This criticism of ceilings will be apostasy to many, but is submitted without apology. The designer must make his own choice.

The backing to the window and its lighting are vital to the whole setting. Both are sadly neglected at times. On the small stage this requirement can pose some difficult problems. What is seen through the window can often convey more to the audience than the rest of the setting, and the designer should see that adequate space is available, even though it might mean the sacrifice of a part of the acting area. Box-settings need not be too rigidly rectangular. By the insertion of a few returns or cutting a corner diagonally it is usually possible to avoid having a window within inches of the back wall, even on the tiny stage. There must be space enough to accommodate equipment by which the backing can be lighted at an intensity that will at least remove from the sky the shadow of the window thrown by the acting area lighting. It is always possible to make the window opaque by covering it with tracing cloth, or semi-opaque with gauze curtains, but this is a defeatist subterfuge that intrudes on the consciousness of the audience. In Galsworthy's *The Skin Game* the

play depends on the fact that there is a lovely view of the Centry, part of an adjoining estate, which should be seen through the window. The window and its backing are part of the play, and the producer should not accept a pathetic pretence that criss-cross shadows on the undulating plaster of the back wall are a fair representation of the sky above the Centry.

It is a frequent requirement that what is seen through the window shall indicate the time of day or season, or the weather that has affected the behaviour of the characters. The effect of a sunset seen through the window can be emotionally valuable; or a suggestion of strong sunlight streaming through may be important. Space must be made available for the lanterns that will be necessary to direct the intense beams at appropriate angles. If a window has a lace or gauze curtain, what is intended to represent a strong beam of sunlight is likely to appear as a very unreal patch of light. This can be remedied by using a Light Frost in the lantern. It is not necessary for the full chromatic splendour of a lurid sunset to be seen in the sky: it can often be better suggested by the colour and direction of the shafts of light striking the window frame and adjacent wall. This suggestion is unlikely to carry maximum conviction if the " window " is merely a two-dimensional aperture in a 3-ft. flat, embellished with " leaded lights " of insulating tape. It should have some reasonable resemblance to the type of window it is supposed to be.

Interior Scenes (Night)

The placing of apparent light sources is usually suggestive rather than faithfully realistic. Most actual domestic interiors have fittings suspended from the ceiling, but the majority of stage interiors rely on floor and table standards and wall-brackets, as they are more conveniently obtainable and easier to install. Period chandeliers are more frequently used than modern ceiling fittings, but both present real difficulties that cannot always be overcome satisfactorily. They are usually cumbersome and fragile and therefore difficult to transport, and their suspension is often quite a problem. If the setting has borders, the suspension is comparatively simple, provided the necessary pulleys can be fixed at a suitable height. The fitting is attached to a flexible steel cable or rope passing over a pulley fixed to the grid, and is raised and lowered as required. Borders used in conjunction with such fittings are likely to be incongruous on a small stage; a ceiling mask would be more convincing. In that case the cable would pass through a hole which would be screened by a decorative ceiling-rose. If there is a change of scene involved, the fitting of a chandelier to a ceiling during the change, without the usual facilities of a professional stage, is likely to deter most amateur stage managers. It is rarely, if ever, entirely satisfactory to use a three-ply cut-out painted to resemble a chandelier unless the painting is frankly stylized and in a setting that is not realistic.

The lack of a centrally suspended fitting is not important if the suggestion of " artificial " lighting is credibly made by standards or wall-brackets. Normally the fitting does not contribute anything to the general illumination. The lamp used should be of a low wattage. It is often an advantage if the lamp is tinted slightly. It is possible that light escaping through the top of the shade will spill on the ceiling or borders, in which case a piece of cardboard or other masking should be fitted to the shade.

The dispersed lighting should provide an overall colour and intensity appropriate to the type of artificial light supposed to be in use, e.g. torch, candle, oil-lamp, gas or electric. The choice of colours to be used is an individual one, but various alternatives are given later in this chapter. Most of the light sources mentioned are warm in tone and stronger in red and yellow than in blue and green. The filters must be considered not only in relation to the realistic quality, but also in relation to the colours of the scenery, furnishing, and costumes; what is even more important, the lighting must help to sustain the mood the actors are trying to create.

Spotlighting should give emphasis to the areas in the vicinity of the supposed light sources. It is of doubtful advantage to allow the actor to control the lighting of the fitting. The spotlighting giving the supporting light will be controlled from the switchboard, and it is better for the two to be synchronized there. This arrangement occasionally inflicts on the actor an uncomfortable wait with finger on switch, but this danger should be slight if there has been adequate rehearsal. In focusing the spotlights on the various areas of the stage care must be taken to ensure that the actors will be covered when standing. In spotting settees, armchairs and the like, this is particularly important, whether the scene represents day or night; there should never be any risk of the actor being brightly lit when sitting and in shadow immediately he stands.

The greatest difficulty is that of providing a convincing colour and intensity of light on the backing to the windows to indicate the outside conditions of a dark or moonlight night. On most amateur stages there is insufficient depth to avoid some spill of light from the acting area through the window on to the night " sky." The problem is solved if the window curtains can be drawn. If they cannot, the dark sky is best suggested by black drapes. If a foreground is required, a cut-out painted in dark colours is probably the best solution. If a moonlit sky is essential, the sky cloth or cyclorama should be masked as much as possible by the foreground cut-out, again painted to absorb as much light as possible. If, as is not improbable, the space available behind the back wall of the set is restricted to two or three feet, it is better to place the window in one of the side walls or across a corner to provide adequate space for the backing. In any case, the lighting on the acting area should be diverted away from the window as far as possible to ensure that the

minimum shall pass through. If sufficient spot lanterns are available, it is desirable to avoid using floods or battens because of their wider diffusion, but it is unlikely that all lighting can be kept away from the windows, which should be backed with a surface that reduces reflection to a minimum. It is preferable to avoid large plain areas painted in light colours. If the backing is painted in dark colours and of irregular design, the intrusion of light from the acting area will probably escape notice. If the same scene has to be used for daylight and night, it is sometimes worth while to have the window-backing for night painted specially to give the night effect.

It becomes only too obvious when setting and lighting such scenes that the importance of stage depth is little realized by many of those who plan stages. The portions of the stage outside the visible acting area are of vital importance. Any stage with a depth of less than 24 ft. is inadequate; 30 ft. is reasonable, but 40 ft. would not be excessive. When the stage depth is restricted the designer should adjust the depth and shape of the setting to provide off-stage space. This must adequately provide not only for the scenery that has to be placed there, but also for the correct siting of the equipment which provides suitable lighting of that scenery.

The following points are worth remembering when dealing with night scenes:

1. Any light on the stage should be shaded, or it will distract the attention and probably cause discomfort to the audience.
2. Real candles, lamps, torches, etc., are usually forbidden by the local authorities. Even if the authority responsible is not vigilant, the naked flames should not be used. They create a serious fire risk, and an accident could have disastrous results.
3. The supposed light from lamps, candles and torches should be brought gradually to full intensity when lit on-stage.

Gas Lighting

It is an advantage if a bracket is fitted with an actual gas-mantle to conceal the lamp. These mantles, obtainable in the tall shape for upward burning or the small type for inverted burning, are quite robust until the protective surface has been burnt off; a 15-watt pigmy lamp fits inside. This method has been successfully used with brackets, chandeliers, street lamps, etc. The pigmy lamp should be dipped in No. 17 Steel Blue lacquer and, when dry, a few drops of Amber lacquer complete the effect. For the spotlighting used in conjunction with the gas-fitting a mixture of No. 17 Steel Blue and No. 3 Straw gives an acceptable colour of light.

Oil-lamps

If it is possible to avoid moving the lamp about the stage and a cable can be concealed, the pigmy lamp can be used in this type of fitting also. Otherwise, it will be necessary to use a low-voltage lamp suitable for the battery that must be incorporated. The pigmy

lamp is preferable and, if it can be connected to the circuit feeding a supporting spotlight, the two can be faded in together. It is an advantage if a frosted globe is used. For tinting the stage light most of the paler ambers (Nos. 2, 3 and 4) are quite suitable.

Candles

The most popular stage-candle is the metal tube, suitably painted, concealing a torch battery; the torch lamp is obscured by a wisp of paper. These are not very convincing in the absence of a flickering flame, and whenever possible the light should have a shade.

Torches

As with candles, these are rarely convincing, with the result that some producers take a risk and use the real thing. The standard flambeau torch has become an acceptable stage convention in spite of its lack of conviction, but there is room for some experiment by an adventurous prop.-maker.

Exterior Scenes

The principles governing the lighting of exterior settings are not materially different from those dealt with in connection with interiors. The presumed light source is not so arbitrarily fixed by the scenery of an exterior. One appears to develop a subconscious preference for assuming the sun to be shining from either stage-right or stage-left, in which case it is more than likely one will be inclined to place the moon, when needed, on the opposite side. If, during a play, the same setting must be presented at different times of day—say morning and evening—it is obviously necessary to establish that east is opposite to west.

The lighting of exteriors has been dealt with to some extent in Chapter XI (Cyclorama Lighting), and this section must be regarded as supplementary, dealing with particular problems. The use of a cyclorama of some kind is now so general that for many of the effects examined its existence will be assumed.

Strong Sunlight

It was stressed in Chapter XI that a blue sky and intense lighting on the acting area give the most convincing suggestion. For the latter the acting area lanterns without any colour at all can be most useful. If one side of the stage can justify shadow, it will help to intensify the suggestion if a contrast is established by concentrating any lighting with colour to the side in shadow. The actors standing in the sunlight would be lit from above, without colour, and from the supposed direction of the sun also without colour; from the opposite side perhaps a No. 51 Gold Tint or No. 52 Pale Gold might be used. In the shadow the colour directed from the sunny side could be a double No. 51 or No. 52, and from the shady side No. 17 Steel Blue with No. 54 Pale Rose and a Light Frost, all three in one frame. The scenery opposite to the shadowed

side must be strongly lighted and an attempt should be made to have similar strong lighting directed down-stage from the rear. This back-lighting is particularly important to counteract the brightness contrast of the broad expanse of cyclorama. Diagonal lighting of the whole of the acting area is most necessary to avoid shadows being thrown on the cyclorama.

The lighting of the groundrow standing in front of the cyclorama can be very materially assisted if it is inclined slightly towards the cyclorama and light directed from above.

It is an advantage in all exterior scenes to have some three-dimensional objects such as trees, columns, balustrades, etc., so that one side can be strongly lighted to stress the suggestion of sunlight.

Sunless Daylight

The marked contrasts suggested for strong sunlight conditions must be avoided. An overcast sky cannot be effectively suggested by colour-lighting alone, although it is frequently attempted. If heavy clouds can be projected on the cyclorama, the result is likely to be more convincing. The intensity of light on the acting area will be reduced. Light Frost added to the colours in the spots will assist in spreading a more evenly distributed light.

Night Scenes

It is impossible to produce a credible dark night sky with colour-lighting alone. The most successful method is to project streaks of cloud from a slide (see following chapter). The projected clouds for night skies are invaluable, as there will often be sufficient light from the clouds to dispense with the need for any other light at all on the cyclorama, and the cloud projection will be at maximum efficiency. It may even be desirable to dim the intensity a little. The greatest trouble will be experienced in keeping stray light from the acting area away from the cyclorama. It is unwise to strive too hard for realism in night scenes as the actors are liable to be swallowed in a Stygian gloom. In the absence of moonlight it is important to avoid strong contrasts of light and shadow. The contrasts are required, but they must be softened, and there must be a sensitive control of overall intensity. This can be best obtained by practical experiment, using mainly multiples of No. 17 Steel Blue. Whenever a street lamp or other obvious light source can be introduced, the possibilities of emphatic lighting of important areas are quite exciting. In lighting any night scene the importance of contrast to visibility must be borne in mind; and the colour of the light which supplements the supposed light source introduced should be carefully chosen. Deep ambers and reds should usually be avoided as they will emphasize the blue in the rest of the lighting.

Moonlight and other exterior effects are dealt with in the following chapter.

BABY MIRROR SPOTLIGHT DEVELOPMENTS

When the Strand Pattern 23 Baby Mirror Spot was introduced a little over two years ago no one could have possibly envisaged the extraordinary popularity which it would immediately achieve. It had of course nearly everything in its favour. It was small (overall width 11 in., overall length 1 ft. 1 in.), light (6¾ lb.), and remarkably efficient. (The optical system gives about twice as much light as an ordinary stage spotlight of equivalent wattage.) Finally, as a result of the mass production methods employed, it was very reasonably priced.

Fig. 1. *Standard Pattern 23 Baby Mirror Spotlight.*

It is not surprising, therefore, that this lantern attracted the attention of copyists, but, as John Ruskin wisely remarked, "*There is hardly anything in the world that some man cannot make a little worse and sell a little cheaper. The people who consider price only are this man's lawful prey.*"

At the time of its introduction this Strand spotlight was described in some detail in TABS, Vol. 11, Nos. 1 and 2 (April and September 1953). In the former of these issues we also announced the arrival of a new type of projector lamp—the Class "T," which embodied the best features of the Class "A" and Class "B" type projector lamps, the high efficiency compact grid filament of the former, the "tiltability" of the latter, and a reasonable life. At the time this lamp was only available in the 500-watt size, and so, for stage purposes, including the Pattern 23 Mirror Spot, the 250-watt Class "B" projector held its own.

The arrival of the Pattern 23 Baby Mirror Spot was considerably delayed by the non-appearance of the Class "T" type of lamp in even a 500-watt size, as it had been designed with this type of lamp in mind. The 250-watt Class "B" lamp gave fairly adequate results, but it is good to be able to report that the recently available 250-watt Class "T" lamp has brought considerably improved results—a smoother and even brighter beam. (Incidentally, improved results may also be obtained by using the 250-watt Class "T" lamp in preference to 250-watt Class "B" in the ordinary 250-watt Pattern 45 Stage Spotlight.)

From every point of view the Strand Baby Mirror Spotlight seemed to be a "natural" for front of house work in small halls and theatres. It is not surprising therefore that there was shortly a requirement for some kind of remote colour change. Simultaneously the dance hall world showed a deep interest in this spotlight, but in many cases with the additional requirement of a continuously rotating motor-driven colour wheel. An accessory which, as it happens, will fulfil both functions equally well, has therefore been produced to fit either the standard or wide angle versions of the spotlight (Patterns 23 and 23W. *Not* the narrow angle, Pattern 23N).

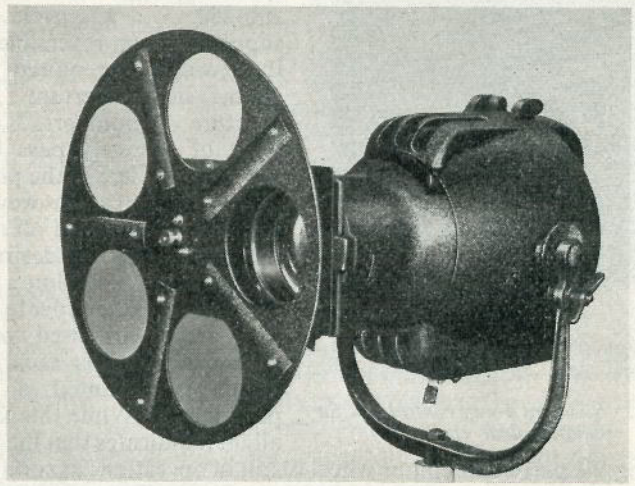


Fig. 2. *Colour change for 5 colours (or 4 colours and white).*

Seeing that such colour changing spotlights are frequently required to operate in quantities rather than singly, a series of control boxes have been made available containing respectively one, two, four, eight or twelve selector switches. These sheet metal boxes are for surface wall mounting and may be mounted adjacent to or remote from the spotlight or spotlights which they control. It should be understood, however, that they only control the circuit of the colour change motor, the spotlight lamp being switched and/or dimmed separately. Fig. 3 shows a standard four-way control box. One rotary switch is provided for each spotlight. Each such switch has six separate positions, five of these being serially numbered from 1 to 5. These numbers correspond with the five apertures on each colour wheel and provide the means of colour selection. The sixth position on each switch is marked C (i.e. continuous running).

When a switch is put to this position the colour wheel will continue to rotate at 4 r.p.m. until the switch is put to any one of the other five positions, when the colour wheel will take up this position and stop. When using this colour wheel as a colour change it should therefore be understood that unless one of the five apertures in the wheel is left blank it will not be possible to obtain white light. Furthermore, the A.C. motor, which is self-starting and suitable for 200/250 v., 50 cycle A.C. supply, is non-reversible. If, therefore, it is required to go from, say, aperture 2 to aperture 5, numbers 3 and 4 must of necessity pass before the spotlight lens in the process. The spotlight can, however, be dimmed or switched off during the process, but the desirability of arranging the colours as far as possible in the order in which they are to be used will be appreciated. Over each rotary switch is mounted a Neon pilot lamp. While this lamp is alight it indicates that the motor driving the particular colour wheel is still in operation; as soon as the colour change is completed the lamp automatically goes out. It will be understood that on any particular cue, one spotlight might be required to move one aperture whilst another might be required to move three or even four apertures. Individual motors may, therefore, be required to run for different lengths of time, hence the desirability of an indicator lamp for each motor circuit.

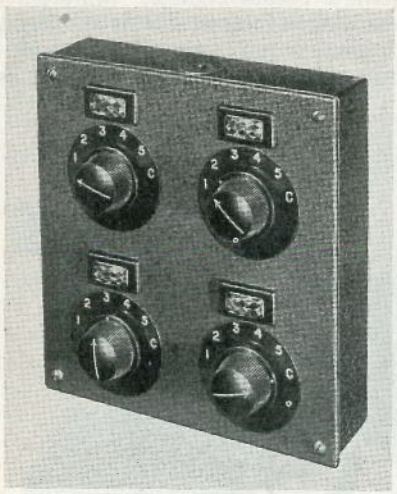


Fig. 3. *Standard 4-way control box for remote colour change.*

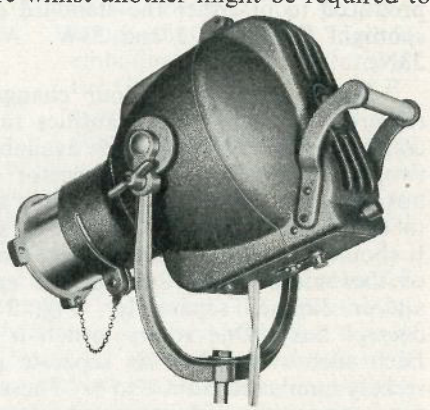


Fig. 4. *For cases where the spotlight is used for "following" artists, the lantern is now available fitted with a heat insulated handle at the rear.*

Whether used as a continuously rotating colour wheel or as a colour changer, the filter wheel rotates at four revolutions per minute, which means that the time taken to move from any one colour filter to that immediately adjoining it in the direction of rotation is about 3 seconds.

For theatrical purposes it will inevitably be necessary to change the colour on a number of these spotlights simultaneously "on cue." A master switch is therefore fitted to all control boxes handling more than four colour changers. When this master switch is in the "off" position, any of the selector switches may be moved to the required new position in advance of the cue and then when the master switch is closed the colour wheels will all move simultaneously as required. Where four or fewer selector switches are concerned, a master switch is not fitted, it being considered that it should be possible to manipulate this small number sufficiently quickly to produce a semblance of simultaneous action.

* * *

CORRESPONDENCE

To the Editor,
"Tabs."

DEAR SIR,—May I add a word to the discussion about "Who lights the set?" Firstly, although there was much sense in Mr. Wrench's article, I wish he had not titled it to imply that the set is a thing to be lit for its own sake. Surely "Who lights the stage?" would have been a happier title? Or, better still, "Who lights the play?"

Secondly, the answer, as always in such matters, must be that the most able person should do the lighting, provided that it is accepted that the producer is ultimately responsible for its co-ordination with the rest of the elements of the production. It is more or less customary for the producer (or a "lighting expert" on his behalf and at his side) to undertake the lighting with the designer present for constant consultation.

I cannot say I would agree to the American method of the designer having the "right" to do his own lighting because this implies a division of interests between the designer and the producer, and puts the stress too much on the decorative aspect of the production. For example, it is unlikely that the designer will know every position of every character in every scene, and the precise balance of light on the characters which the dramatic situation will demand from moment to moment.

The Craigian conception of the perfect "stage manager," as he calls it, being very rarely achieved, there is still no reason why the principle involved in that conception should not be aimed at.

Yours faithfully,

George Devine.

THE GUILD OF AMATEUR DRAMA PRODUCERS

The Guild of Amateur Drama Producers has recently celebrated its second anniversary. It was founded in 1952 by Mr. Edward Wilcox and a group of amateur producers, who had met on a Production Course given in 1950–52 by Mr. Alan Jefferson at Toynbee Hall. It was generally felt that an association of amateur producers as envisaged by Mr. Wilcox could do much to raise the standard of amateur production from both æsthetic and technical aspects, and also encourage active co-operation between amateur producers and those organizations concerned with the welfare of amateur drama.

The Guild is an entirely new venture, unique in this country. It is a non-profit-making organization, administered by a Management Committee elected yearly. Since its inauguration, membership has increased steadily, and now includes amateur producers from all over Britain. With headquarters in London, local branches of the Guild are being created as opportunity arises. Individual membership is divided into two classes: Associate Membership, which is open to anyone interested in the aims of the Guild, and full Membership, which is open to Associates who satisfy the Management Committee of their ability to further actively the work of the Guild. There is also another class of membership for societies who wish to become affiliated to the Guild.

The services of the Guild are available to all members. These include the panels of specialists and producers, and educational facilities. The panel of specialists comprises members who have specialized in various branches of the amateur theatre (e.g. make-up, lighting etc.), and who are available for advice or assistance on request. The panel of producers is formed from members prepared to undertake full-scale productions or otherwise assist societies requiring an experienced producer. This service is particularly appreciated, and calls upon it are consequently increasing, especially for producers for full-scale works in the London area.

The Guild's educational facilities include comprehensive yearly courses in production and stage management, which are very popular, and a programme of lectures, discussions and practical demonstrations by well-known personalities in the professional as well as the amateur theatre.

A quarterly magazine is also published by the Guild. The variety and scope of its contributions by members make lively reading, and reflect in general the vitality of the Guild.

Further information may be had on application to:
Mr. L. Johnson, 270 Conisborough Crescent, S.E.6.

BOOK REVIEW

Lighting the Stage: by **P. Corry.** *8vo. 157 pages text and 12 plates, fully cloth bound. Sir Isaac Pitman & Sons. 20/-*

Although Mr. Corry's book is addressed to the amateur, by his precepts it could well serve the professional. There is an amount of admonition and advice which bespeaks a lifetime of experience and contact with far from first-rate theatre, and this may irritate the reader who thinks he knows all the answers. I can assure this reader that if the professional theatre as a whole were to put into practice the principles of stage craftsmanship contained in this book the general standard of presentation would go up several notches. The book is called *Lighting the Stage*, which I find a good title. So many books on the subject are called *Stage Lighting*. Mr. Corry sees the job in its right perspective and not as a mysterious or miraculous process which is added to a production like candles on a birthday cake. He is an expert without being a crank.

Nevertheless the information, technical and artistic, is all basic, sound, comprehensive and essential (except, perhaps, for Pepper's Ghost!) for anyone, paid or unpaid, who wishes to master the craft of lighting the stage. And, as the author himself implies, the customary conduct of a lighting rehearsal is a hit or miss affair—"Try this, try that." This is not only a waste of time and money, but is shamefully inartistic, in whatever sort of theatre it takes place. The trouble is that lighting is rather "fun," and it seems very dull to know what you want and get it at once. Mr. Corry, quite rightly, will have none of this sort of fun, thinking that the mastery of such a medium of expression is much more fun than muddling through at the expense of other people's nerves and pockets.

Wasting time is an unpardonable offence in the theatre, where there is never enough time. I would be prepared to wager that more time is wasted on lighting than anything else. That is why everyone who has to light the stage should read and digest this book.

I find the author a bit astray on the questions of modern developments in stage forms, which he treats slightly scornfully. I think Mr. Corry must accept experiments with better grace, albeit he does tell us about the problems of the arena stage, and acknowledges the admissibility of every type of production. It is a pity he had not more to say about three-dimensional lighting and back-lighting (even in proscenium theatres) which is an essential part of advanced theatre practice. He thinks too much of pictures and not enough of space. Admittedly the "average" production of his readers is still likely to be in a box set, but it would be good to have

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Orders for the above book should be placed with booksellers or direct with the publishers. Not being in the book trade, Strand Electric are **not** *in a position to supply.*

had some more positive vision of the theatre of the future. The more entertainment is " framed "—cinema and T.V.—the more the theatre must return to its original three-dimensional (as in the open air) life.

This book has an excellent preamble by Tyrone Guthrie against pontificating in the theatre, laying down laws and imposing ways of doing things—of none of which the author of this book is guilty. Unfortunately, for me, this foreword is spoilt by a gross exaggeration for the sake of the argument. Dr. Guthrie, in his efforts to discredit the ignorant and herd-like admiration for the works of Stanislavski (in translation) which prevails today, implies total discredit of the works themselves: he gives them as an example of a " pretentious work of theory." This is not possible to accept. Because Stanislavski is a name that is grossly misused, I see no reason to imply that what he wrote was not an important contribution to the literature of the theatre, even in translation.

George Devine.

THE EARLY DEVELOPMENT OF THE CARBON ARC

By A. G. DUERDOTH, B.Sc., A.Inst.P., A.R.C.S.

Reprinted from " The Photo Arc " by kind permission of Chas. H. Champion & Co. Ltd., manufacturers of " Ship " carbons.

It is now nearly 150 years since the phenomenon of arc discharge of electricity was discovered. The credit goes to Sir Humphry Davy who, in 1807, demonstrated his achievement at the Royal Institution. The carbons he used were very crude, being cut from pieces of wood charcoal, and their highly porous nature resulted in a very rapid rate of consumption. Electrical generators were, of course, unknown in those days, so for his supply he used the great battery of the Royal Institution with its 2,000 voltaic cells. Nevertheless, he was able to achieve in his demonstration an arc about 4 in. long.

The arc had been struck but it appeared to remain a laboratory curiosity for many years before its potentialities became recognized and before serious efforts were made to prepare dense, homogeneous carbon rods for the purpose. Indeed, it was not until 1846 that the first patent was taken out covering the extrusion into rods of mixes consisting of pulverized coke and a sugar solution, the rods being baked at white heat. Porosity was still the prime defect and some attempt was made to reduce this by dipping the kilned carbons into a second sugar solution and rebaking them.

The same year saw the first installation of an arc lamp. This was the Duboscq lamp, which also operated from batteries, and was

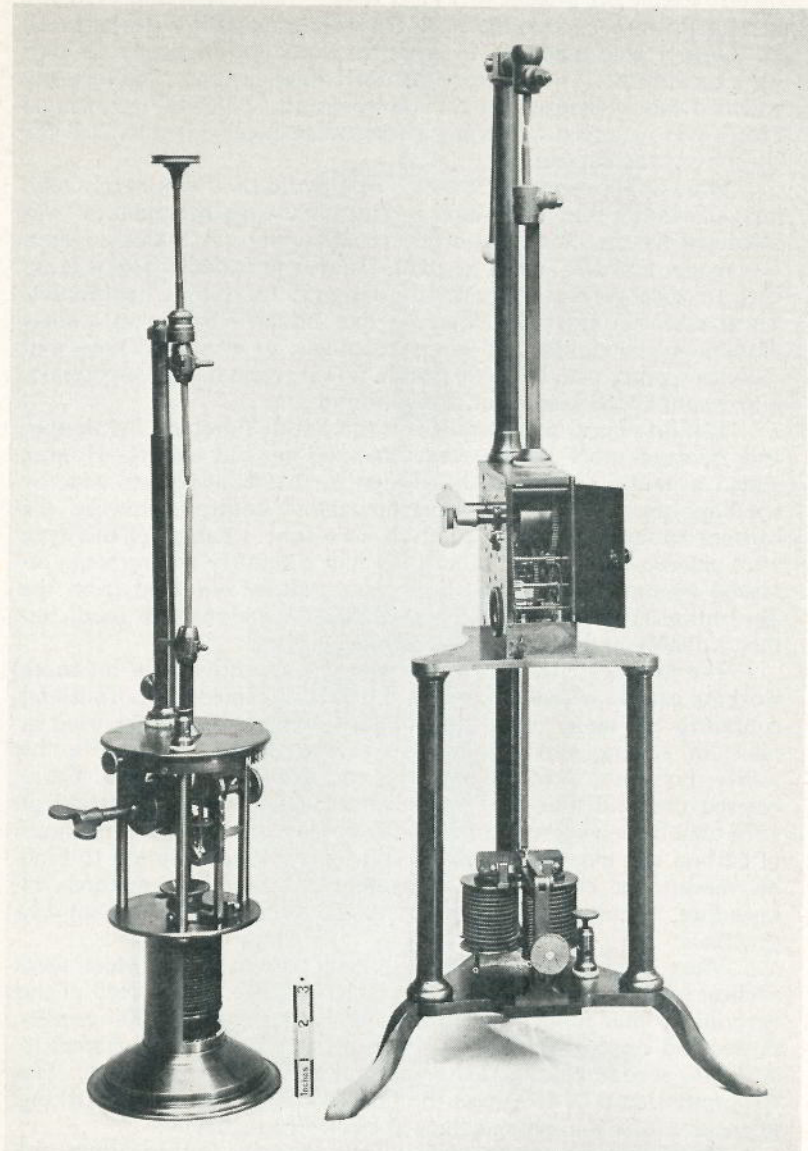

FIG. 1. *The Duboscq arc lamp of* 1846 *was used to illuminate a Paris opera and worked off giant batteries. Note the clockwork feed mechanism which even in those days made use of a solenoid to control the rate of feed. Crown copyright. From an exhibit in the Science Museum, South Kensington.*

used to illuminate a scene in a Paris opera. The lamp employed two identical carbons, arranged vertically and, even with this first lamp, an attempt was made to feed the carbons automatically as they were consumed. The value of the dcereasing current as the arc-gap widened was recognized for this purpose and a solenoid operating a detent was arranged to permit a clockwork mechanism to feed the carbons as the current fell.

Wide application of arc-lamps in a world that was largely relying on candles and oil lamps for its night-time illumination was restricted by the limitation of electrical supply. A major advance was made, however, when in 1850, Holmes introduced a new lamp with its own generator, primarily designed for use in lighthouses. These essential aids to navigation had hitherto been very poorly illuminated by candles, oil lamps, coal-gas, or even coal fires, and Holmes's lamp, with its 1,000 candle-power, must have been literally a highlight in the history of navigation at sea.

The first lamp was installed in the South Foreland lighthouse, and because most houses were manned by old sailors, Holmes added a nautical touch to his design in that adjustments were by windlass and pulleys, an electromagnetic control allowing the carbons to feed together 1/200th in. at a time. Lamps of this type were extensively used for more than half a century before being replaced by tungsten filament lamps. It will be observed from the illustration (Fig. 2) that carbons of square section were used, but this probably had no particular significance.

The arrival of the generator gave the incentive to a lot more work on carbon manufacture, but the rods remained too porous and contained too many impurities for satisfaction. Tars were tried in place of sugars, and lampblack was introduced to improve the purity, but costs were far too high and it was not until M. Carré entered the field that any real advance was made. His patent of 1874 may be considered to be the forerunner of all modern methods of carbon rod manufacture. He still used a sugar solution to bind his mixture of lampblack and ground coke, but his methods of kneading, extrusion and baking were the foundation of present-day practices.

More lamps were designed during that decade. Most used vertical trims with electromagnetic control of the gravity feed of the carbons, a later model, the Brush (1891), developing 2,000 candle-power and employing two pairs of carbons with an arrangement to strike the second pair as the first became consumed to its limit. The Crompton lamp of 1873 was the first to employ automatic striking of the arc, this also being achieved electromagnetically.

Identical carbons were customarily used for both positive and negative electrodes with the result that the positive burnt away at about twice the rate of the negative.

The first attempts to equalize burning rates were commercialized in 1876 under the name Jablochkoff Candles, after the designer.

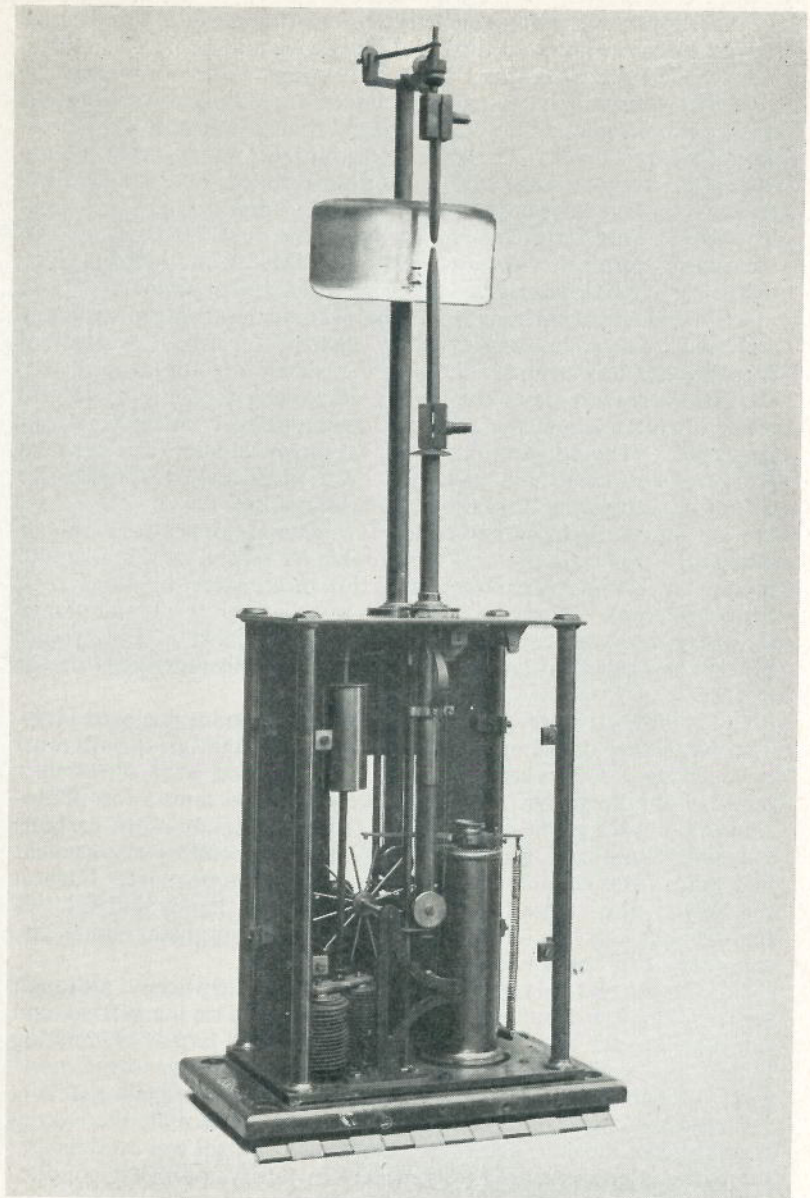

FIG. 2. *Holmes' first arc lamp for lighthouses combined its own generator. Installed in the S. Foreland Lighthouse in* 1850, *this* 1,000 *candle-power light represented a great advance on anything previously seen. Photograph by courtesy of the Director of the Science Museum, South Kensington.*

Two carbons were mounted vertically, but side by side, the positive having twice the cross-section of the negative and being enclosed in a porcelain tube with only the tip protruding. The purpose of the tube was, presumably, to prevent the arc travelling down the sides of the carbons and, as the electrodes shortened in length, the porcelain tube burnt away. The system was far from satisfactory, mainly due to the irregular edge of the tube that resulted, rendering the arc very erratic, but the candles were improved upon during the following year. This improvement involved the first recorded use of alternating currents with arc lamps and added a marked incentive to the early development of A.C. generators and supplies.

Two identical carbons were employed again arranged vertically and side by side, but separated by a strip of kaolin. A piece of carbon paste was arranged between the carbon tips for striking and, even in these early days, the idea of employing a copper-coating to reduce oxidation and the rate of consumption of the carbons was employed. The illustration (Fig. 7) shows a later arrangement (1882) of two such pairs mounted on a single base for successive operation and giving a total of 6 to 8 hours' life.

So far, arc-lighting had found few general applications outside industry. Domestic use was undesirable by reason of the heat and fumes, but 1881 saw the first installation of arc street lighting, using Siemens lamps. Many of the later installations were maintained until well into the twentieth century, indeed, those at Billingsgate Market and others at Hull were not replaced until shortly before the last war.

The next advance came in 1895 with the Jandus enclosed lamp. The containing of the arc within an almost airtight glass bulb must have brought the enhancement of the blue and near ultra-violet parts of the spectrum as with modern process lamps for photo-printing, but the prime object was to reduce oxidation of the carbons and so prolong their life. The Jandus lamp, operating at a current of 5 amps., was capable of burning for 150 hours or more. Carbon purity was of extreme importance for enclosed lamps and for this reason, such carbons had to be prepared from lampblack mixes, the ash content of cokes being too high.

Carbons had as yet been mainly of the solid variety, although some with soft mineralized cores had been placed on the market, and the value of such a core in stabilizing the arc and largely eliminating hissing was well recognized. Manufacturing difficulties were, however, still rampant and manufacturing companies were fast realizing the need for close control of all processes, in particular, the baking conditions of the extruded rods. Until such control was established, the carbons continued to vary widely in purity, porosity, conductivity and even size. A copper-coating in those days was recognized as an admission of inferior quality of the carbon itself. It is interesting to note that, although a major portion of the experimental and development work was carried out in this country, there was no

Fig. 3. Fig. 4. Fig. 5.

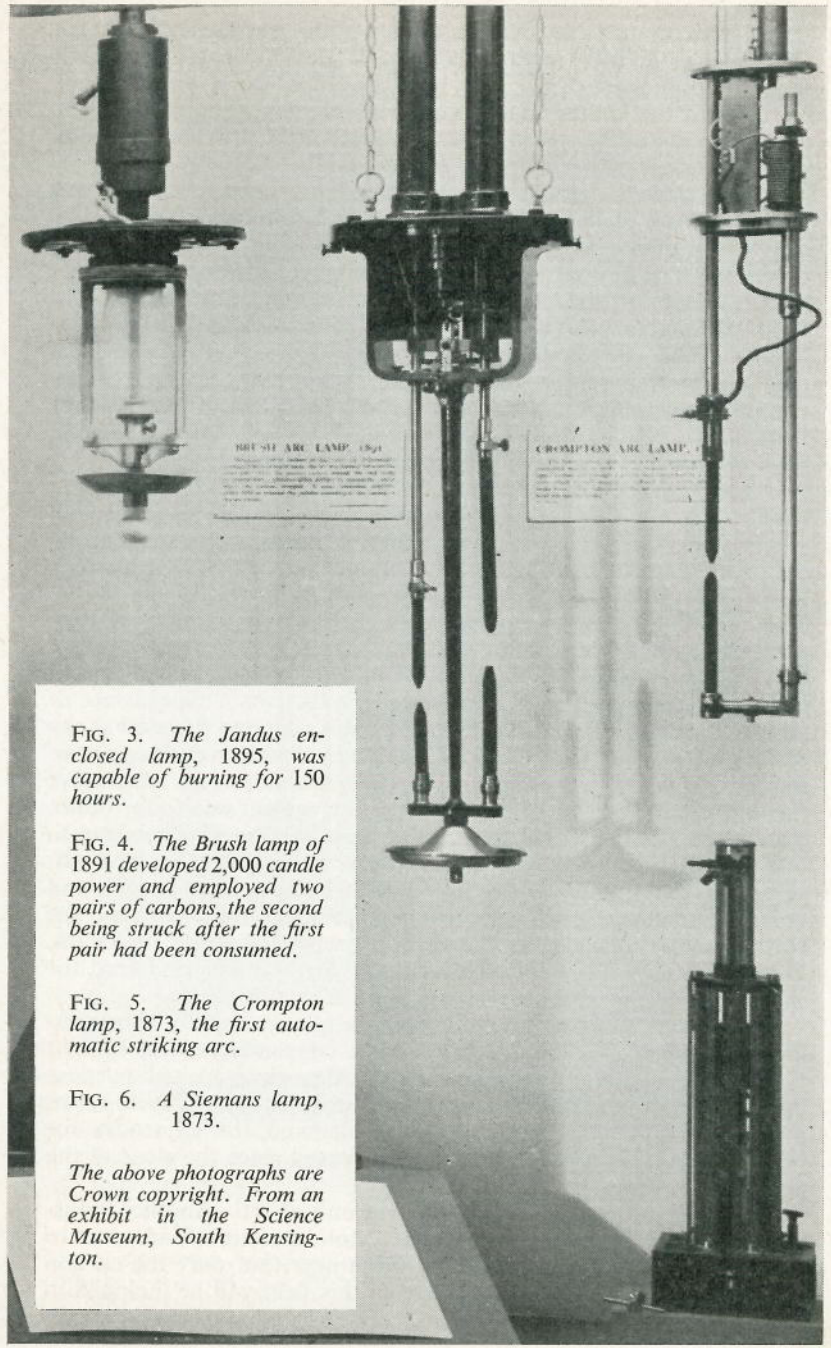

FIG. 3. *The Jandus enclosed lamp*, 1895, *was capable of burning for* 150 *hours.*

FIG. 4. *The Brush lamp of* 1891 *developed* 2,000 *candle power and employed two pairs of carbons, the second being struck after the first pair had been consumed.*

FIG. 5. *The Crompton lamp*, 1873, *the first automatic striking arc.*

FIG. 6. *A Siemans lamp*, 1873.

The above photographs are Crown copyright. From an exhibit in the Science Museum, South Kensington.

Fig. 6.

large-scale production for many years until the General Electric Company established their factory at Witton. Most of the early carbon production came from Germany and, to a lesser extent, France and the United States, i.e. those districts where the gas and petroleum industries were most advanced and provided a good supply and selection of suitable raw materials.

The scientists were not content, however, in merely improving manufacturing quality; the cry, so often heard nowadays, " How can we get more light? " appears to have started before 1900, and before the turn of the century cores containing salts to enhance light output had been the subject of experimentation. Impregnation of solid carbons was also tried, but loaded cores gave the greater satisfaction. The early findings were first publicized in 1902 and from then the development of the flame arc was rapid. Magnesia, lime and other calcium salts were widely used with an enhancement of the light output of the order of 50 per cent., but many other chemicals were tried giving a very wide range of flame colorations.

Many early cores were made in two layers. Both layers were of similar composition, i.e. containing light-enhancing salts, but whereas the outer core was of moderate hardness to concentrate sufficient material into it, the smaller inner core was considerably less dense and served to keep the arc centrally within the crater. The moulding of the two cores into one was only a matter of time and considerably simplified production.

The employment of higher currents with flame arcs resurrected the coppering of carbons to increase conductivity. One defect of copper coatings was that the copper did not melt and drop off as the carbon burnt away, but often projected as a sheath over the point of the carbon causing uneven and unsteady burning. An alternative method to improve the conductivity of the carbon was to introduce a metal core, usually in the form of a brass or zinc wire, running to one side of the main core, and because it was therefore well off-centre, it did not enter the arc itself. Elaborations were found necessary to ensure good electrical contact between the wire and the carbon holder and also to the carbon itself throughout its length. Production costs were increased but the method was preferred for some years to the external coating.

The days of the tungsten filament lamp were rapidly approaching, and with the advent of this far more convenient source of light the arc was gradually superseded for other than special purpose lighting, but manufacturers found a growing outlet for development work in carbon production with the demand for electrodes for electric furnace purposes which had increased since the close of the nineteenth century.

The lull in the arc-lighting side was only short. Another industry was becoming firmly established. Motion pictures had come to stay and with them a demand for brightness that only the carbon arc could satisfy. The development in this field will be included in

later articles. Further demands for arc-lighting were also arising for photographic purposes, but before closing this history of the first 150 years or so of the carbon arc, two more outstanding milestones must be mentioned.

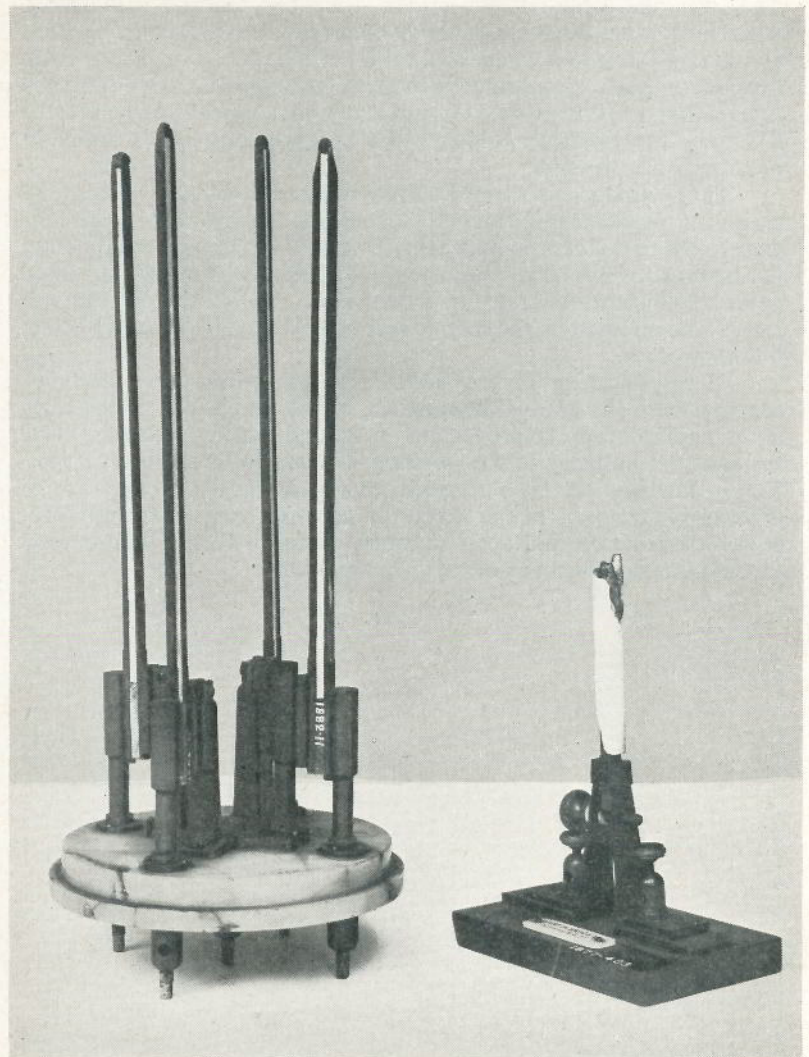

Fig. 7. **Fig. 8.**

FIG. 8 *is the famous Jablochkoff candle* (1876) *in which two carbons were arranged vertically, side by side with the positive in a porcelain tube. With the advent of A.C. generators an improved candle,* **Fig. 7**, *resulted in* 1882.
Crown copyright. From an exhibit in the Science Museum, South Kensington.

The introduction of the flame arc had led to a substantial increase in possible light output, but a new discovery was announced in 1910 from which modern developments had given brilliancies up to seven or more times as great as the best low intensity type of arc. This was the Beck effect, named after the German discoverer, whereby the employment of higher current densities with carbons containing loaded cores enabled an intense flame to be drawn from the core with a very substantial increase in brightness. No practical application of this is known until the first world war gave the Germans the incentive to introduce the high-powered searchlight based on this principle.

The second event was the employment of rare-earth metals, and cerium in particular, in the cores of flame carbons. The first reference to the use of cerium appears to be in 1912 in a paper read before the Institute of Electrical Engineers. At this stage, it merely appeared to be an efficient material for producing a very white light but was later to be adopted as the main constituent for white flame and high intensity cores.

The application of the Beck effect to cerium-cored carbons, together with the gradual elimination of the limitations of the early cores and a steady improvement in manufacturing methods, have brought the industry to the position it holds to-day, where, if perfection has not yet been reached, many thousands of arcs are in daily use in all parts of the world for purposes varying from microscope illumination and spectrographic research to the illumination of the mammoth screens of drive-in theatres.

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