VICTORIAN THEATRES & MUSIC HALLS
LONDON 1837-1901

At the pantomime: a comfortably-off Victorian family in a box, undated (Earl)

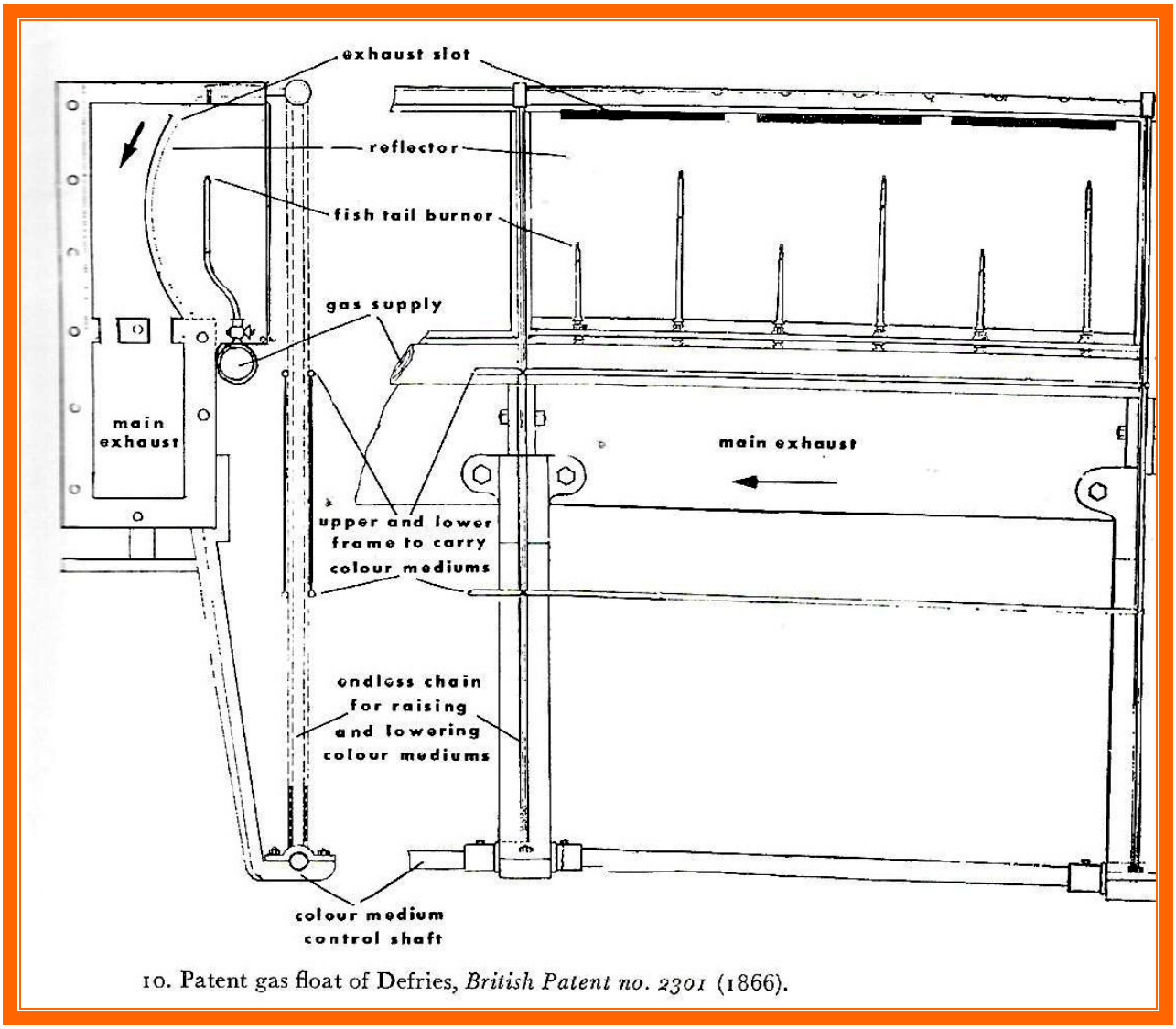
GAS LIGHTING
PART THREE

EXAMPLES & APPENDICES

EARLY ELECTRIC LIGHTING

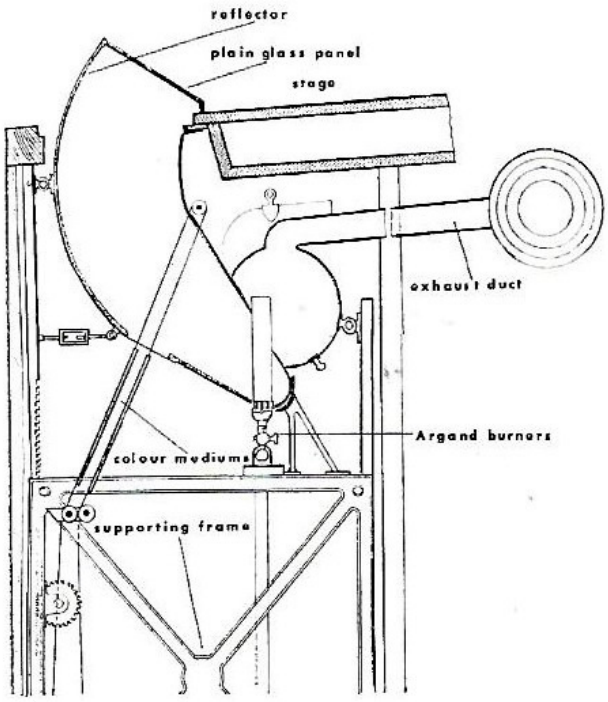
VICTORIAN THEATRES: EXAMPLES

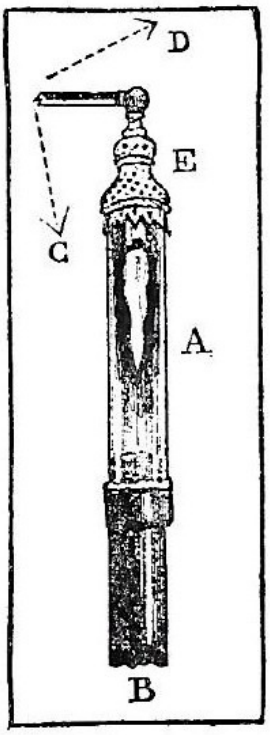
Diagrams are from "Theatre Lighting in the Victorian Age" by Terence Rees



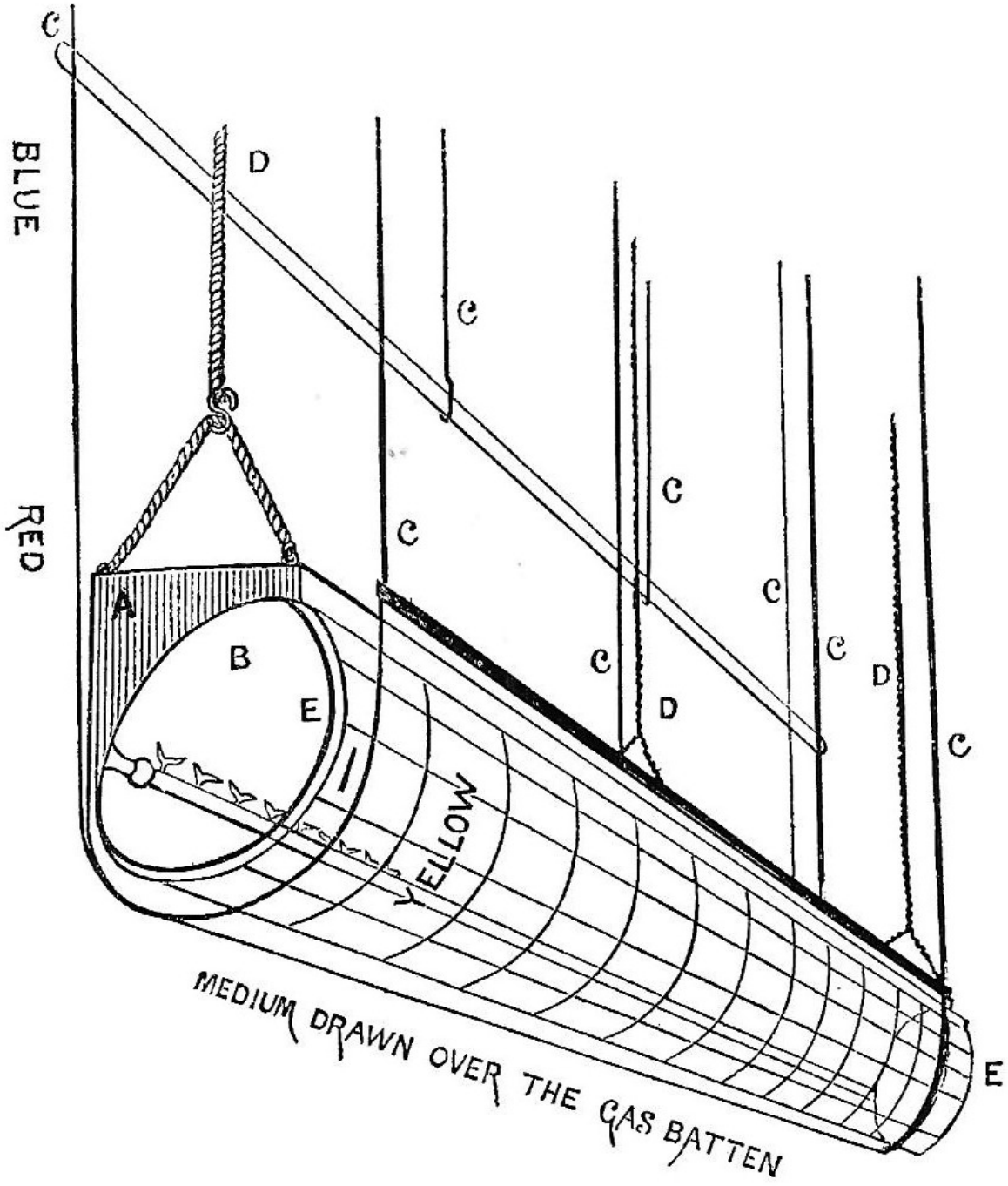
10. Patent gas float of Defries, *British Patent no. 2301* (1866).

VICTORIAN THEATRES & MUSIC HALLS

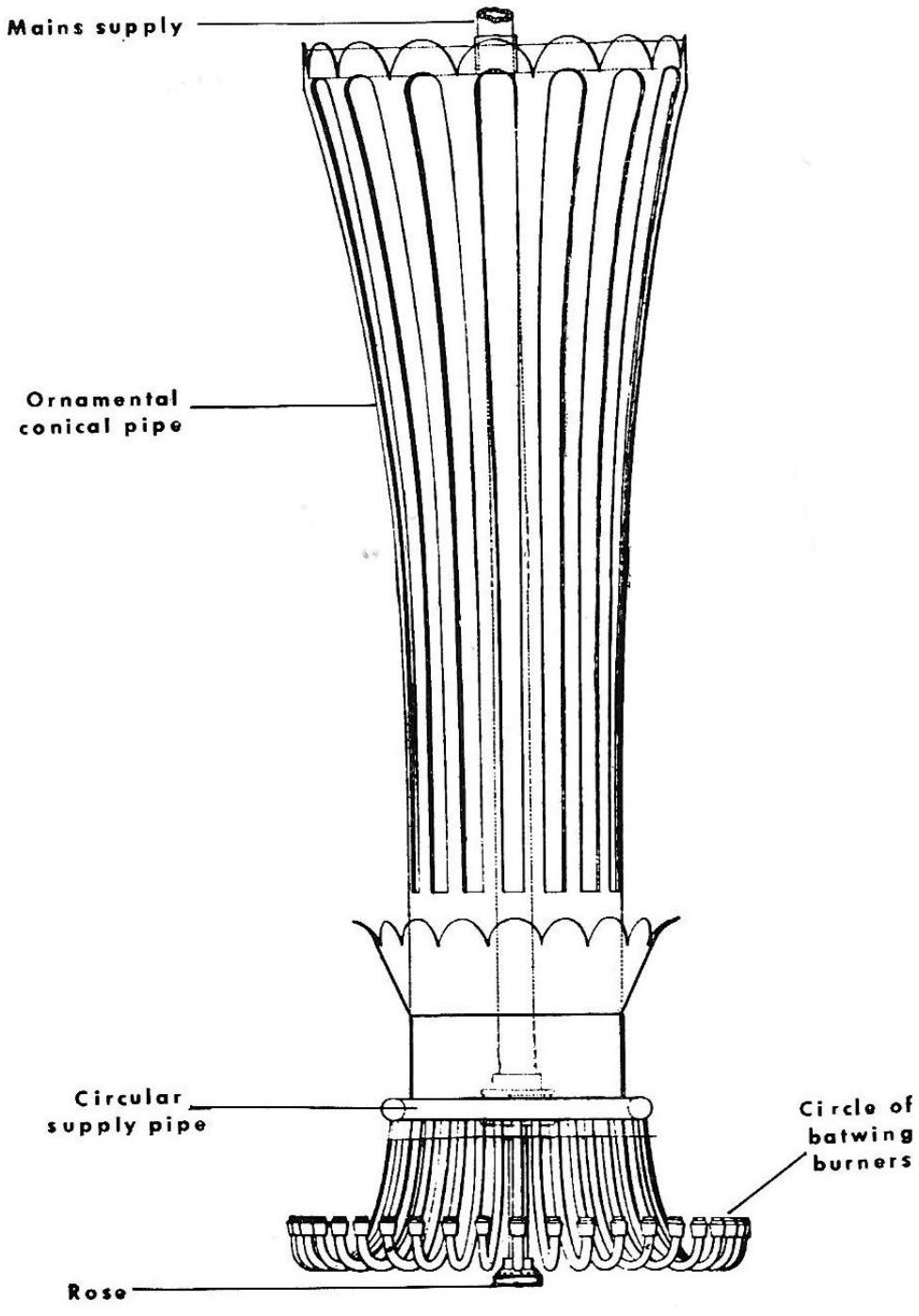




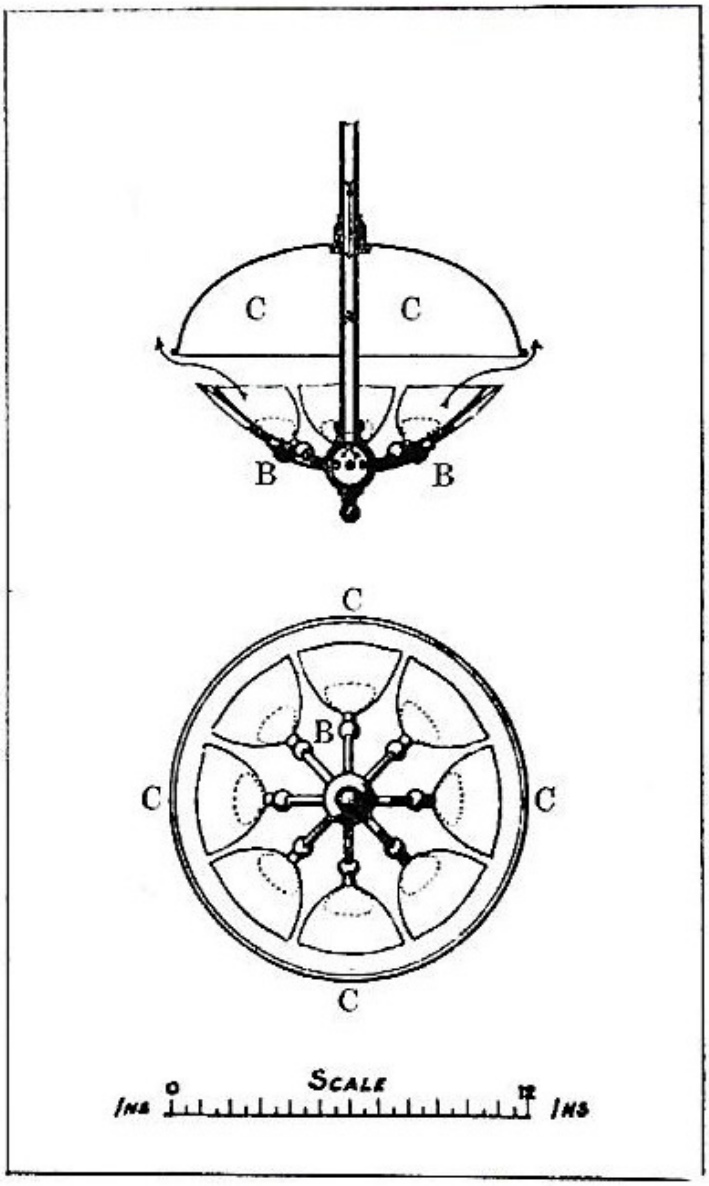
9. Patent gas float of Melon and Lecoq, *British Patent no. 1711* (1861).
11. Inverted gas float of 1875. *Nature*, 11 (1875) 351.



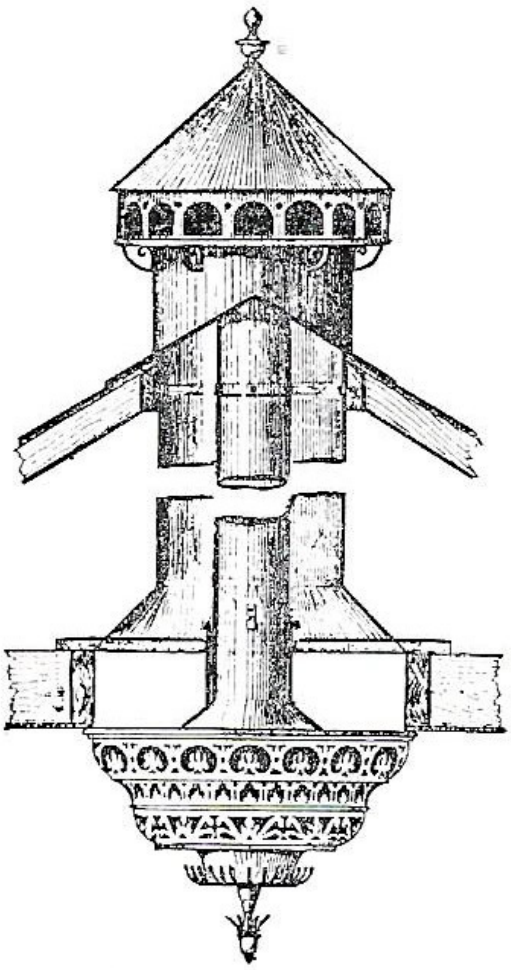
17. Gas batten fitted with cloth mediums. F. Lloyds, *Practical guide to scene painting* . . . (London: 1875).



60. Patent sunlight of W. Bradford. *British Patent no. 2354* (1856).

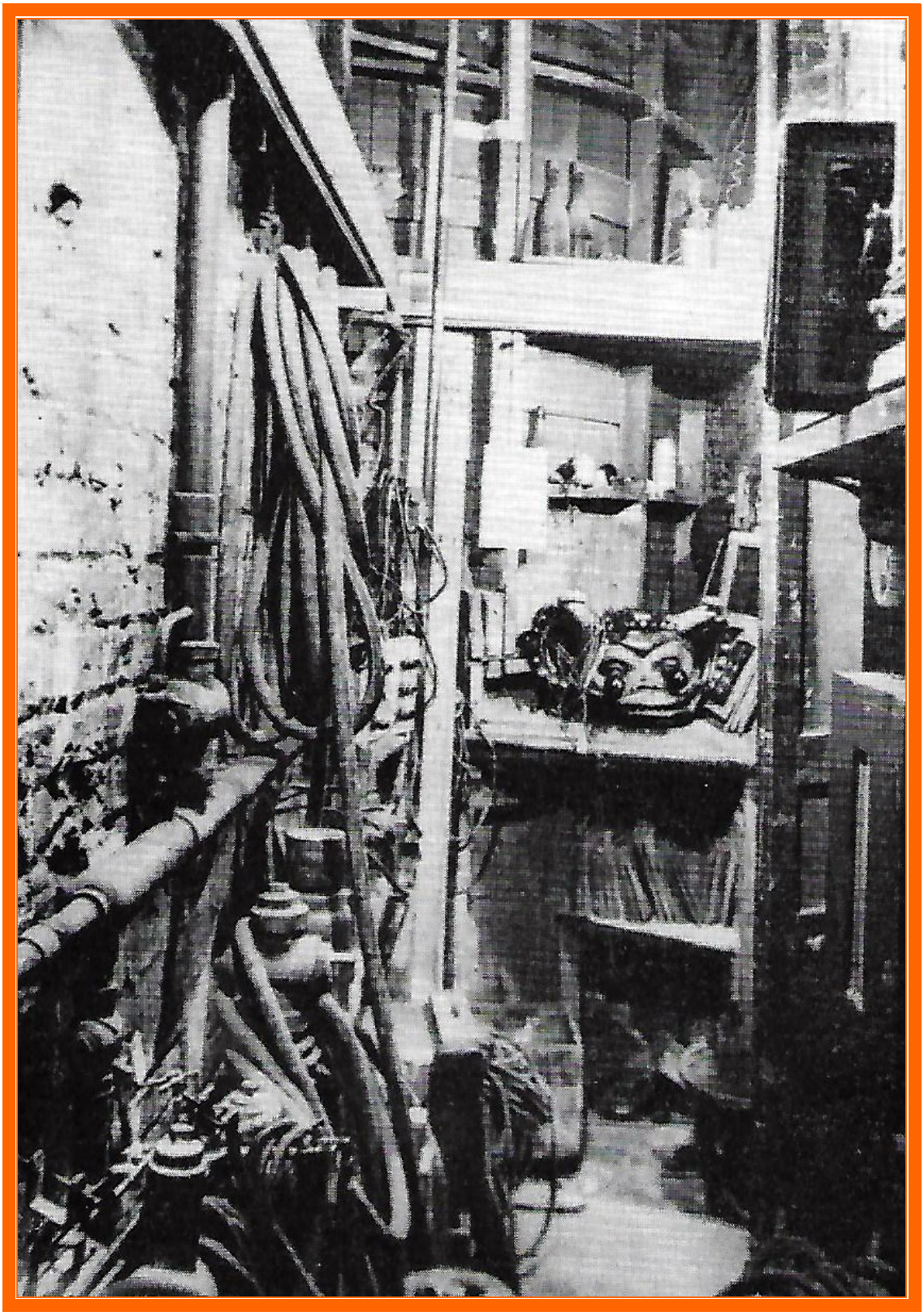


61. Patent sunlight of Thorp. *British Patent no. 10698* (1886).

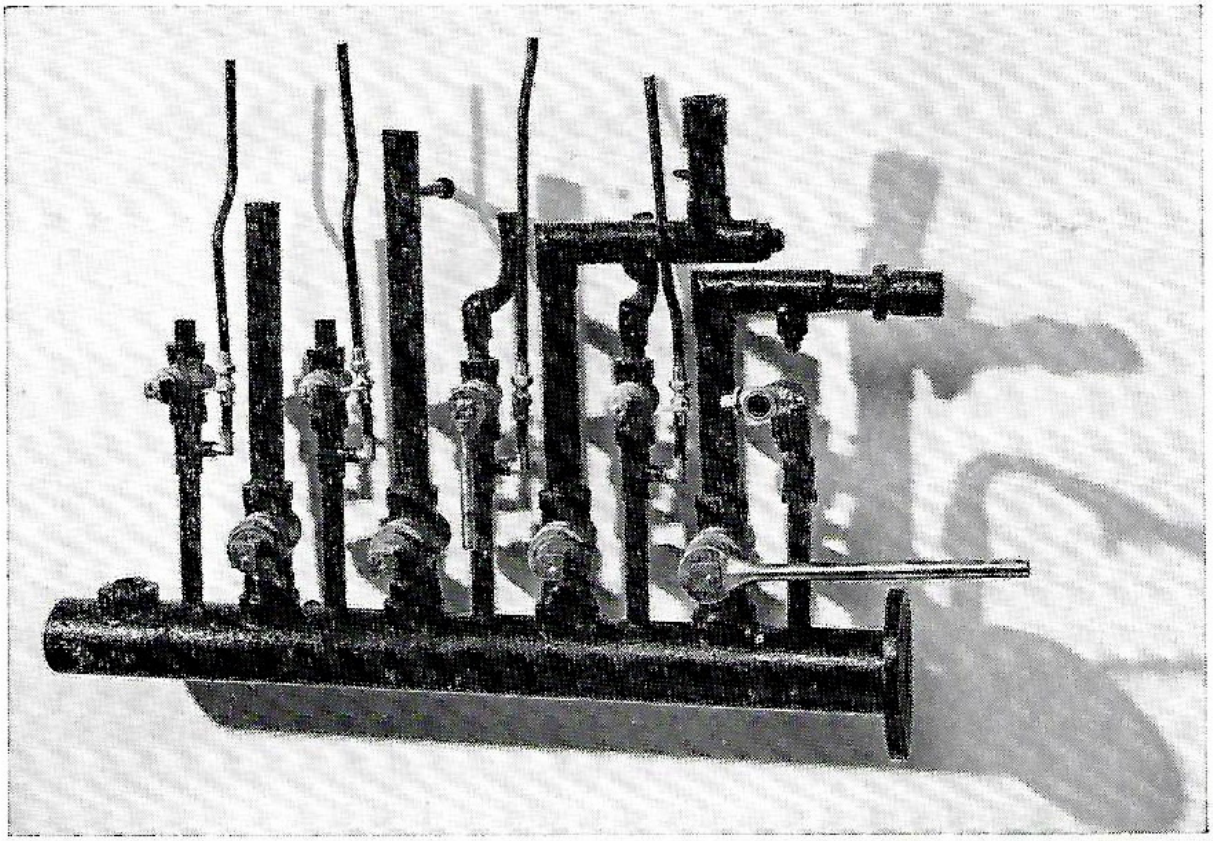


64. Sunlight or sunburner : elevation. P. N. Hasluck, *Practical gas fitting*, (London : 1900).

VICTORIAN THEATRES & MUSIC HALLS

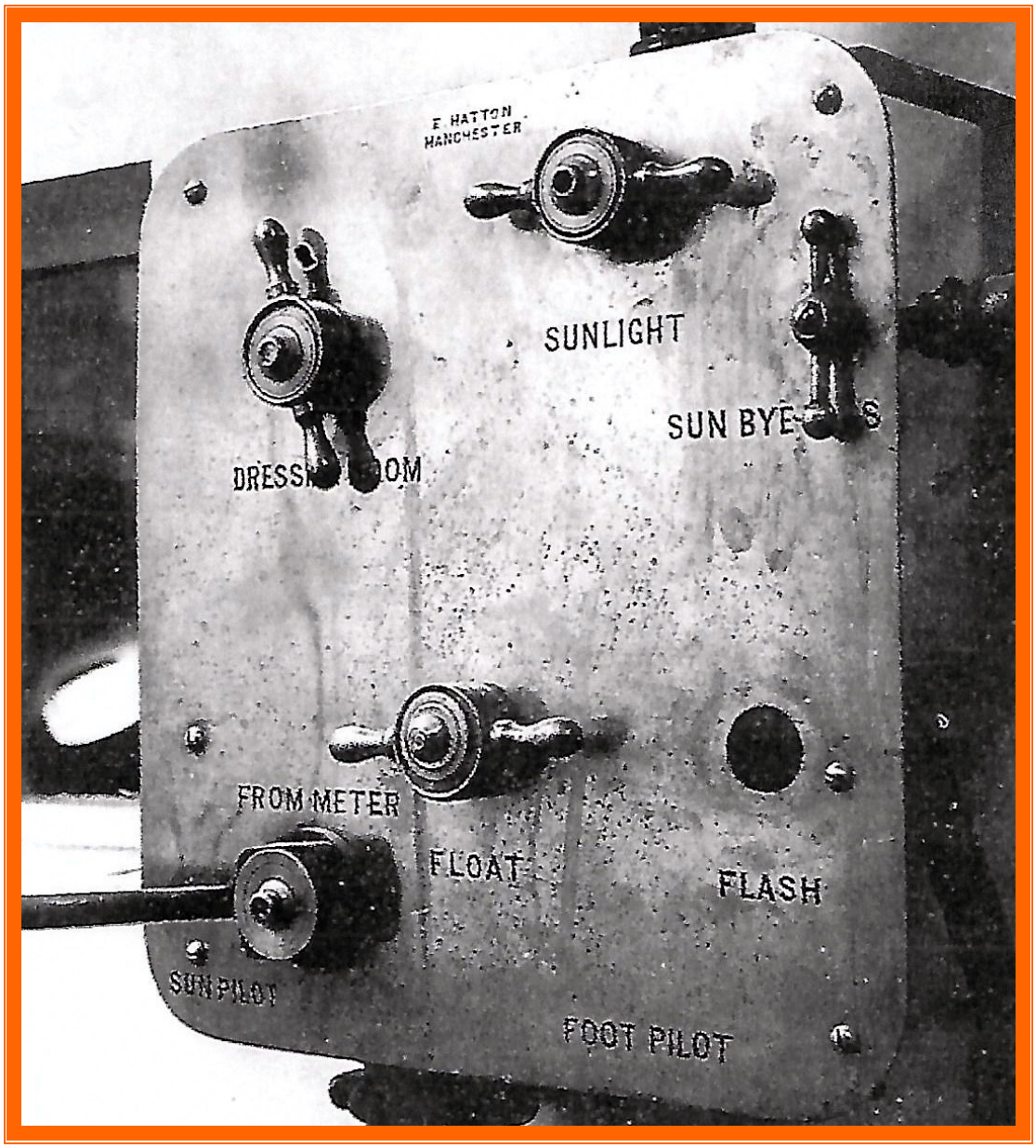


"The (theatre) department of the lighting expert-- the *gas-man* in the days before electricity and for some time after, while electricity was first being used in theatres, A complex of gas pipes and control valves is seen at the left...." place and date unknown (Southern)



67. Gas plate of the Star Music Hall, Bermondsey. Crown Copyright. Science Museum, London.

VICTORIAN THEATRES & MUSIC HALLS

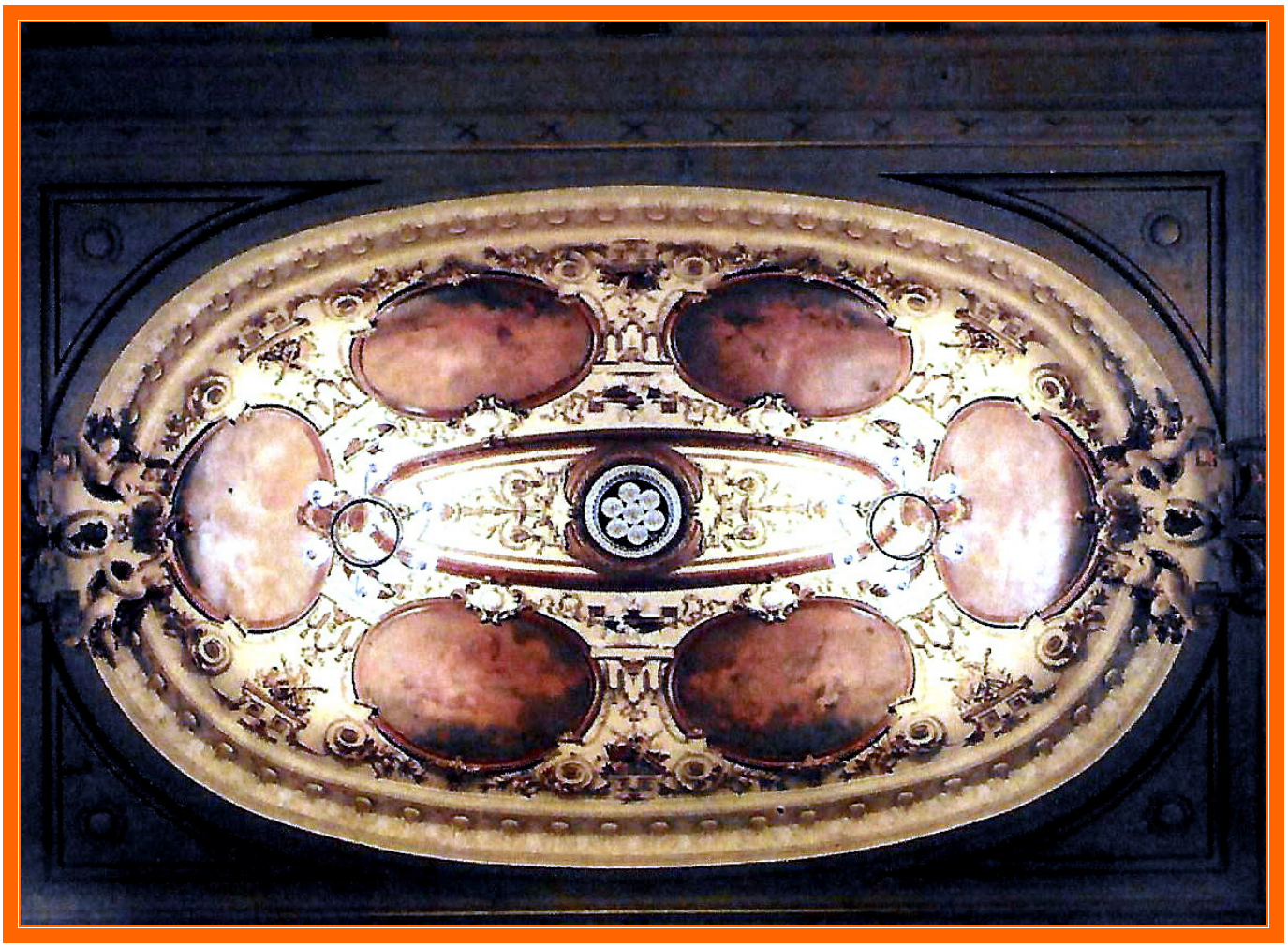


The gas distributor at Buxton Opera House, 1902 (High Peak Theatre Trust)
The theatre was also provided with a stage and auditorium electricity lighting system

The controls are labelled:
From Meter, Sun Pilot, Foot Pilot, Float (footlights)
Flash, Sunlight (sunburner), Sun Bye-Pass and Dressing Room
with Manufacturer's Mark: E Hatton Manchester

The Float was on the most sophisticated triple system: Pilot, Flash and main supply.
The Pilot lit the Flash, the Flash the whole of the footlights.....
This three-tier system provided safe and gentle ignition that was not possible with
the inevitably explosive leap from single Pilot to full length Footlights.

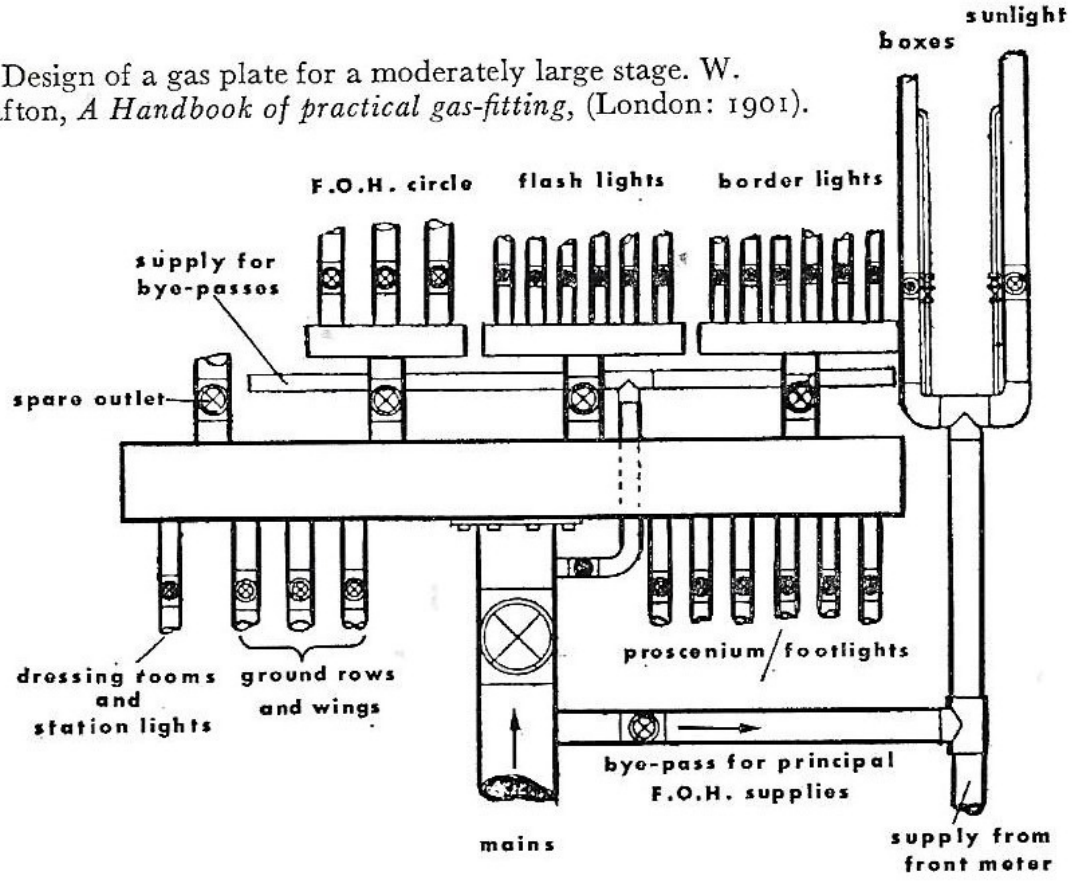
VICTORIAN THEATRES & MUSIC HALLS

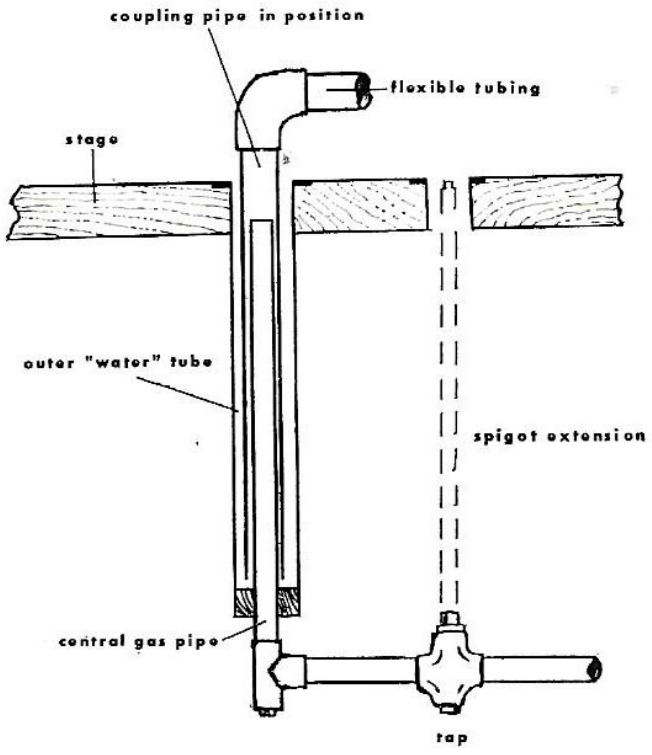


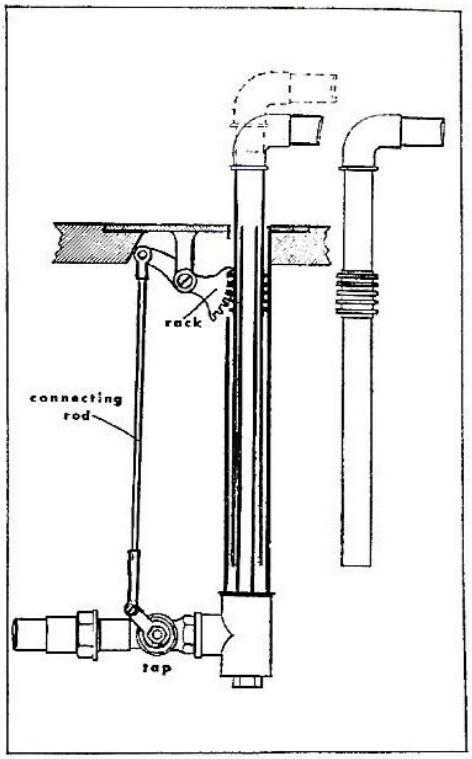
The ceiling at Buxton Opera House with central gas sunburner, 1902 (High Peak Theatre Trust)
The theatre was also provided with a stage and auditorium electricity lighting system

VICTORIAN THEATRES & MUSIC HALLS

68. Design of a gas plate for a moderately large stage. W. Grafton, *A Handbook of practical gas-fitting*, (London: 1901).







70. Plan of a simple water joint. (Grafton, 1901).

71. Patent water joint of Vaughan and Brown. *British Patent no. 8627* (1887).

NOTICE!

WHEREAS, ACCIDENTS BY FIRE, of an alarming nature, having lately occurred at several of the London Theatres, owing to the indiscretion and want of proper precaution on the part of its different Members, particularly as regards THE BALLET; Mr. CAVE begs to call the attention of the Members of his Company to the following Rules and Regulations, which he desires may be implicitly observed, as under no pretence whatever will they be deviated from.

1. Any Lady going beyond the proscenium wing in Dancing, &c.—First offence 1s. Second offence, Instant Dismissal.

2. Any Lady Crossing the Stage to get to her situation, after the Gas is Lighted—first offence. 1s. Second offence, Instant Dismissal.

3. Any Lady, after the Scene is over, attempting to make an exit at a Wing until the Men holding the Coloured Fires have entirely cleared away—Instant Dismissal.

4. Any Lady having Garlands or other Properties to carry on the Stage, catching them on Fire, (the Gas having been placed above their heads,)—Instant Dismissal.

5. No Fires allowed in the Dressing Rooms of the Ballet Ladies. Any Lady attempting to light one—Instant Dismissal.

6. Any Ballet Lady not obeying the Carpenters or any other person employed on the Stage, in reference as to danger by Fire—Instant Dismissal.

7. Any Lady or Gentleman seeing the above Rules infringed, will oblige Mr. CAVE, by giving immediate information to the Stage Manager or Prompter.

Printed by Nowell's (late Peel's) Steam Machine, 74, New Cut, Lambeth.

(1864)

REGULATIONS

FOR THE BETTER

Protection against Accidents by Fire at Theatres,

Licensed by the Lord Chamberlain.

I.

All fixed and ordinary GAS BURNERS to be furnished with efficient Guards. Moveable and occasional Lights to be, when possible, protected in the same manner, or put under charge of persons responsible for lighting, watching, and extinguishing them.

II.

The FLOATS to be protected by a Wire Guard. The first Ground-Line to be always without Gas, and unconnected with Gas, whether at the Wings or elsewhere. Sufficient space to be left between each Ground-Line, so as to lessen risk from accident to all persons standing or moving among such lines.

III.

The rows or lines of GAS BURNERS at Wings to commence Four Feet at least from the level of the Stage.

IV.

WET BLANKETS or RUGS, with BUCKETS or WATER-POTS to be always kept in the Wings; and attention to be directed to them by PLACARDS legibly printed or painted, and fixed immediately above them. As in Rule I., some person to be responsible for keeping the Blankets, Buckets, &c., ready for immediate use.

V.

These REGULATIONS to be always posted in some conspicuous place, so that all persons belonging to the Theatre may be acquainted with their contents; every Breach or Neglect of them, or any act of carelessness as regards Fire, to be punished by Fines or Dismissal by the Managers.

SYDNEY,
Lord Chamberlain.

Lord Chamberlain's Office,
St. James's Palace,
February 5, 1864.

Printed by Harrison and Sons, 54, Martin's Lane.

The "Stott-Thorp" Reflex Light.

PATENT THEATRE SUNBURNER.

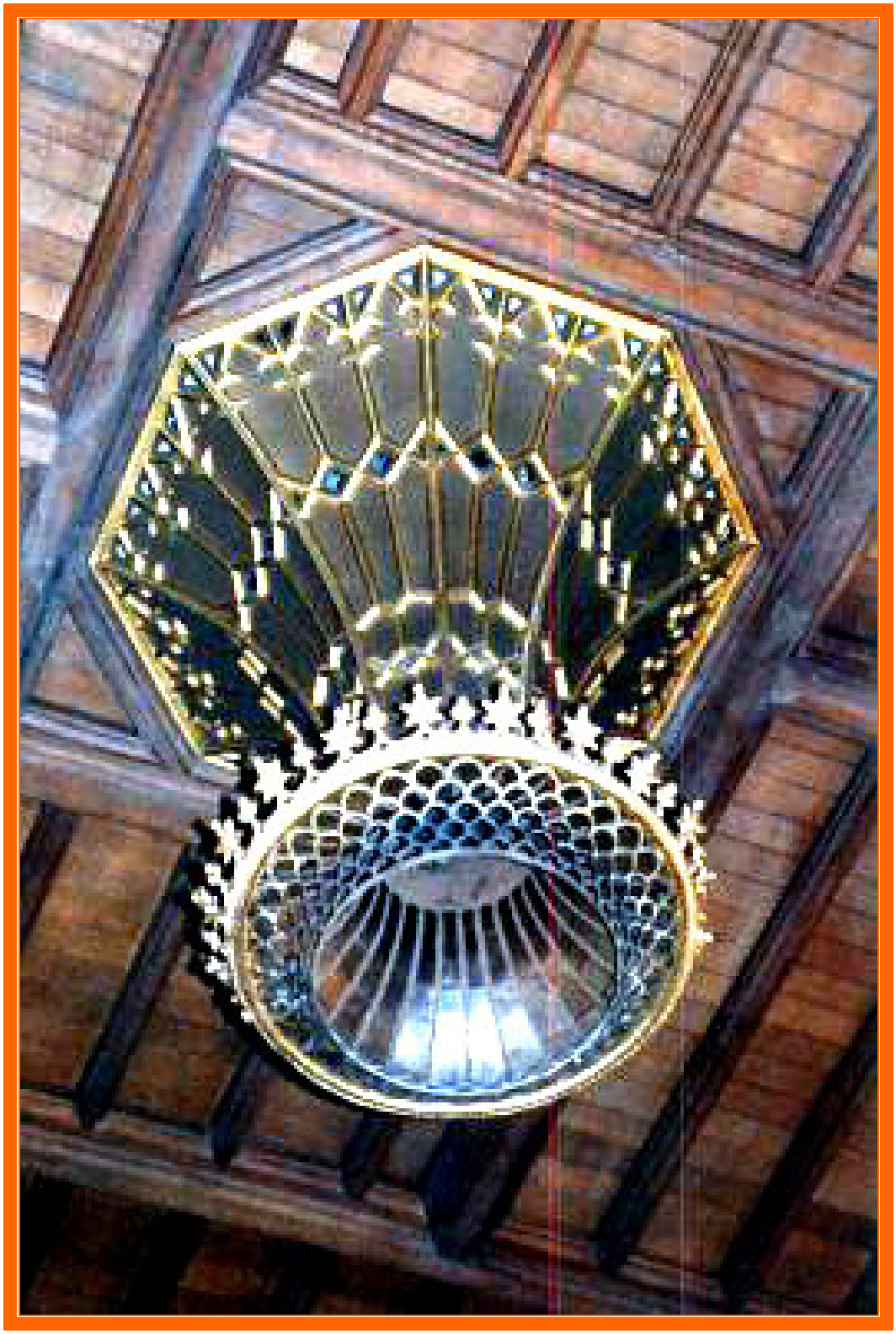
7. The Stott-Thorp Sunburner.

[From: J.Stott & Co. Trade Catalogue, 1907]

VICTORIAN THEATRES & MUSIC HALLS

Colour photographs from www.williamsugghistory.co.uk showing examples of gas sunburners although not in theatres.

By (Chris Sugg: CIBSE Heritage Group)



VICTORIAN THEATRES & MUSIC HALLS

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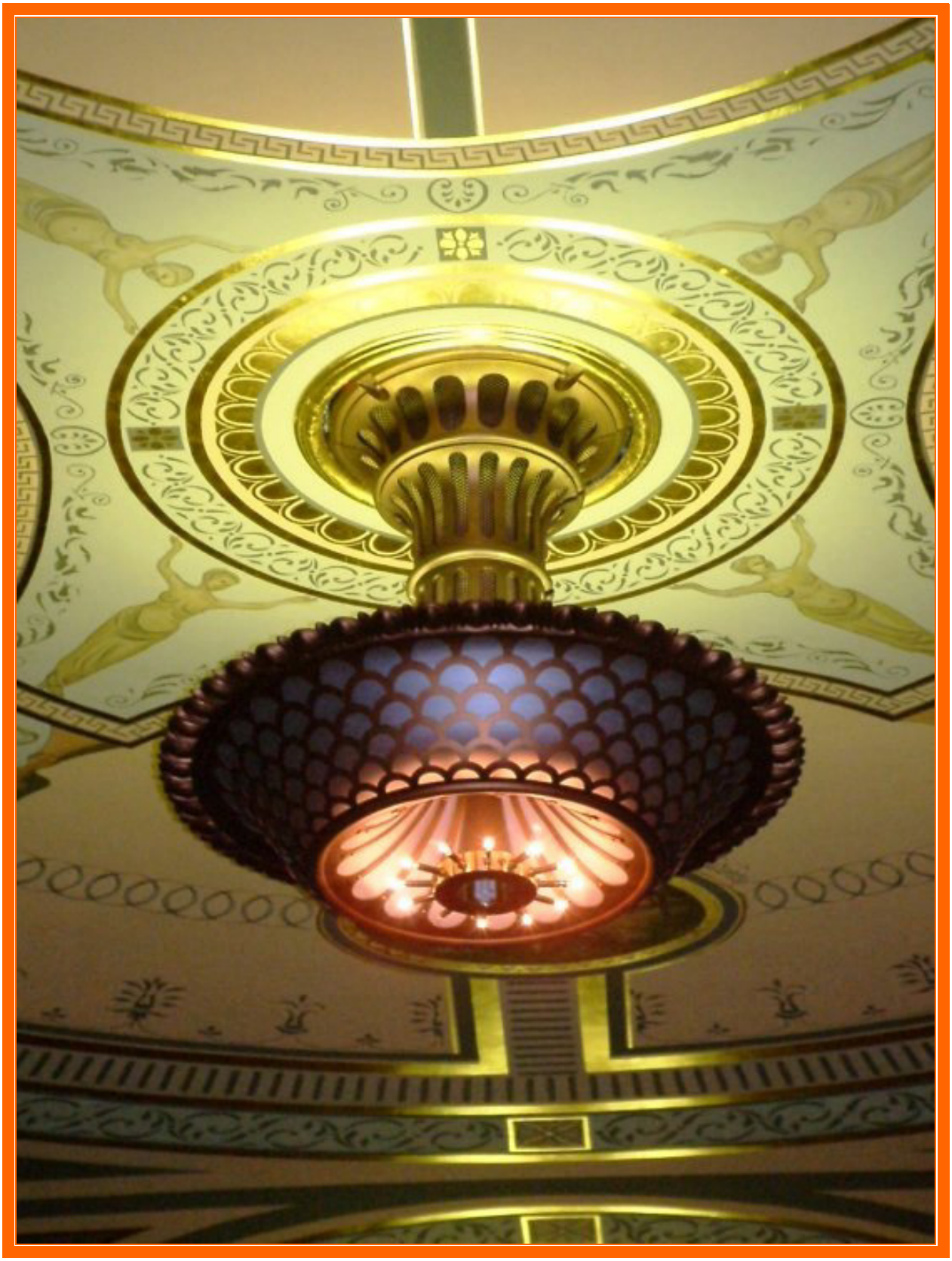
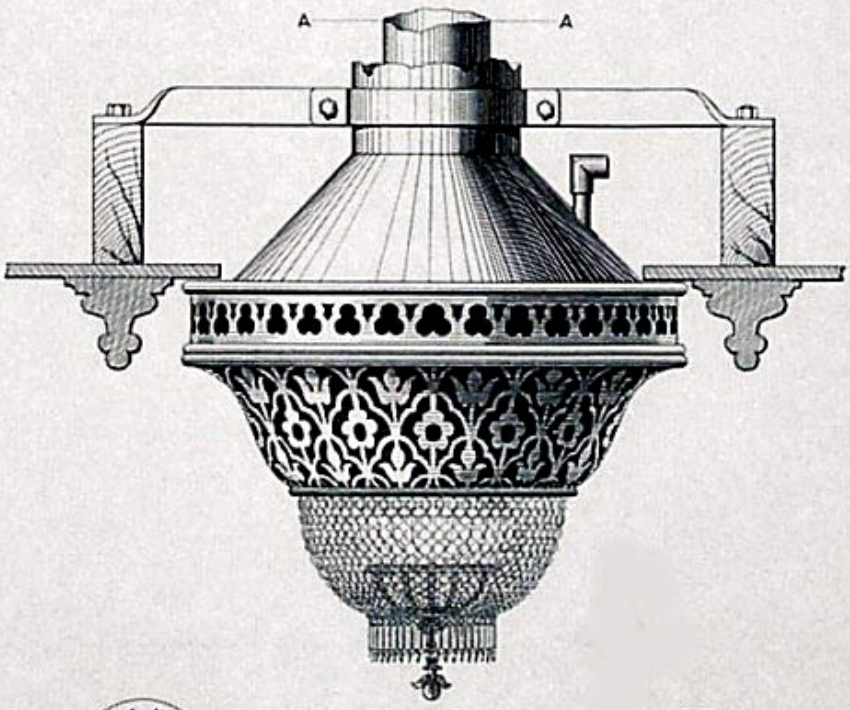


SUGG'S PATENT
VENTILATING SUNLIGHTS.
WITH VERTICAL FLAMES.

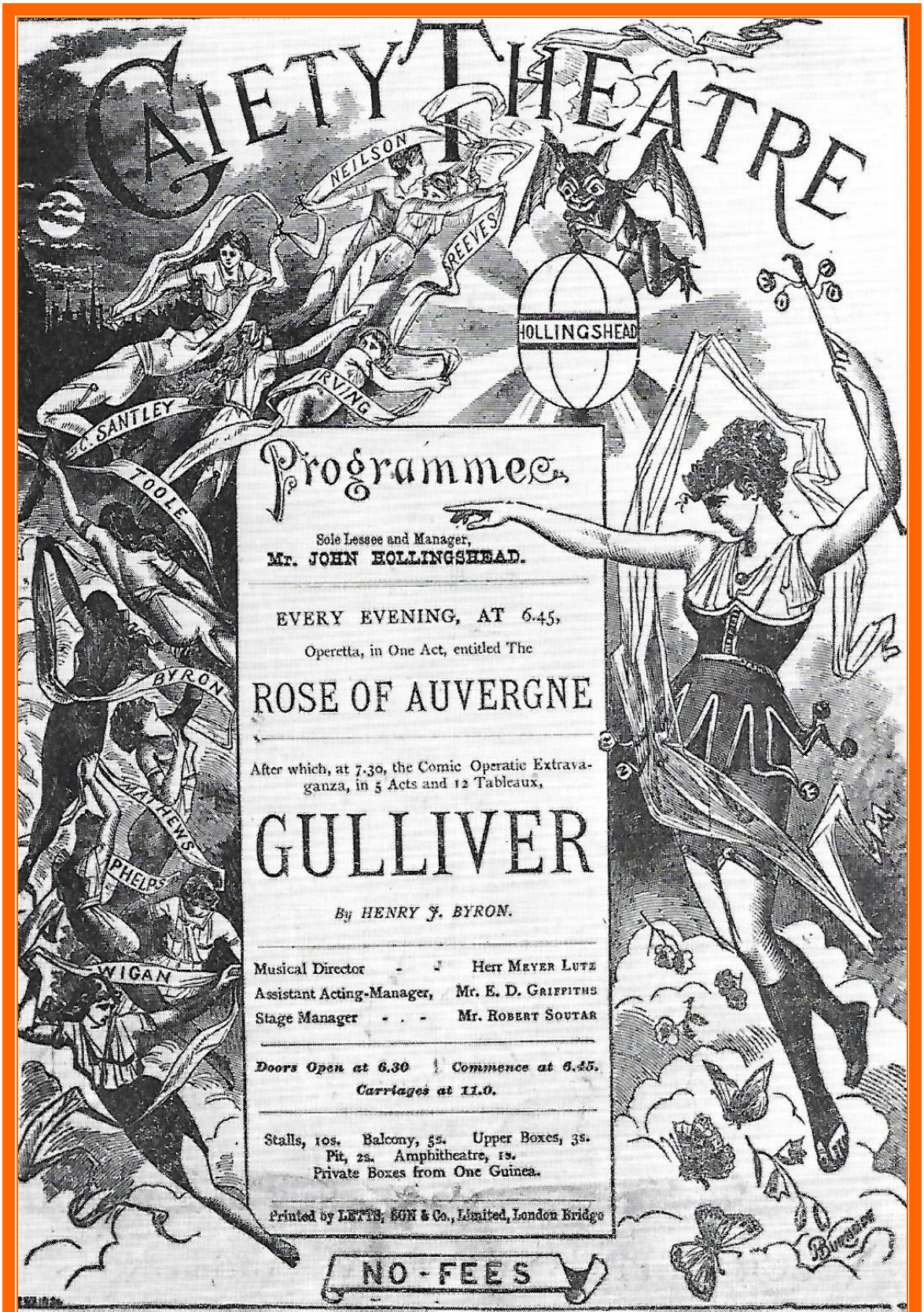
No. 1229.

THE "ST. STEPHEN'S."

As used in the GRAND COMMITTEE ROOMS of the HOUSE OF COMMONS.



SCALE, ... $\frac{1}{2}$ in = One Foot.



Programme.

Sole Lessee and Manager,
Mr. JOHN HOLLINGSHEAD.

EVERY EVENING, AT 6.45,

Operetta, in One Act, entitled The

ROSE OF AUVERGNE

After which, at 7.30, the Comic Operatic Extravaganza, in 5 Acts and 12 Tableaux,

GULLIVER

By HENRY J. BYRON.

Musical Director - - Herr Meyer Lutz
Assistant Acting-Manager, Mr. E. D. Griffiths
Stage Manager - - - Mr. Robert Soutar

Doors Open at 6.30 | Commence at 6.45.
Carriages at 11.0.

Stalls, 10s. Balcony, 5s. Upper Boxes, 3s.
Pit, 2s. Amphitheatre, 1s.
Private Boxes from One Guinea.

Printed by LETTS, SON & Co., Limited, London Bridge

NO-FEES

VICTORIAN THEATRES: APPENDICES
APPENDIX ONE

Extract from "Theatre in the Victorian Age," Michael R Booth, Cambridge University Press, 1991

The Gas Light and Coke Company was formed in London in 1812, and gas lamps, much admired by the public, were placed on streets, squares, bridges and the fronts of public buildings, including theatres. In 1817 Drury Lane and the Lyceum installed gas lighting for the stage as well as the auditorium; other theatres followed suit. Some withstood innovation: the Haymarket did not introduce gas until 1843 and Sadler's Wells until 1853. In the provinces the conversion process was leisurely, just as it was from gas to electricity many years later.

In the auditorium gas illumination at first took the form of elaborate and beautiful chandeliers, festooned with drops of crystal. They looked most attractive but dazzled the occupants of the upper seats and obstructed their view of the stage. Gradually these chandeliers evolved into the 'sunburner' or 'sunlight' of the mid and late Victorian theatre, the gasburners concentrated together, the chandelier hanging closer to the ceiling, and the whole apparatus venting through flues above it to the outside air – almost the only means of ventilating the auditorium. Auditorium lighting was still left on during performance, although it might be lowered for special effects such as a ghostly vision or a moonlit scene. If anything, however, the level of auditorium light was brighter than it had been with candles, even though this level could now be easily regulated. In 1876 the critic Dutton Cook objected to the new sunburners, which 'shoot down fierce concentrated rays upon the audience . . . Aching brows and distressed eyes, unavoidable under the existing system, are sufficient afflictions to warrant a demand for improvement.' Cook called for a compromise with managers: 'Let them make their stages as bright as they list if they will but leave the "auditorium" in twilight.'[15] Five years later Percy Fitzgerald qualified a similar argument: 'The body of the house should be kept dark while the

APPENDIX ONE

play is going on ... That almost Cimmerian gloom which certain theatres affect is an excess, as is also the bright gay glare which is found in French theatres. A theatre should be lit soberly enough to see faces and features and to read a play, but that utter darkness is unnatural, and in a measure destroys the illusion and intensifies the glare on stage.'[16] It is doubtful if the 'utter darkness' referred to meant that the house was completely blacked out during a performance, but certainly some theatres at least were headed in this direction. Irving made a practice of blacking out the Lyceum auditorium during scene changes, but there is no evidence that he did it during the stage action. Such a procedure was still socially unacceptable, and considered inappropriate for certain forms of drama. As late as the 1930s the actor-manager Seymour Hicks believed that for a comedy the house lights should be one-quarter up.

Stage gas lighting was arranged in several parts. At the front of the stage were the footlights. By the use of metal reflectors, the naked gas flame, which could be a foot high, was shielded from the audience, although the heat, glare and foulness of air caused by eighty or a hundred footlights were fearfully unpleasant for the actors. The shields themselves were a good eighteen inches high, and could obstruct the view of spectators in the front orchestra stalls. Many were the complaints about the height of the shields and the glare, and in the 1860s new systems were introduced whereby footlights could be partially sunk and the shields much lower. There were further complaints about the unnatural shadows cast upward upon the face of the actor, but nothing could really be done about this until it was eventually possible to do away with footlights and replace them by efficient lighting from the auditorium, a matter for the twentieth century.

APPENDIX ONE

The second main division of stage lighting, the wing lights, was a variation of the old ladder of oil lamps by the attachment of a vertical gas pipe to a wooden upright. The pipe was guarded, not very effectively, by a single wire cage, or the individual jets by wire globes. Because of a history of serious accidents when the dresses of dancers caught fire from contact with wing ladder jets extending almost to the floor, the Lord Chamberlain finally decreed in 1864 that such jets should be no less than four feet above the stage, that they had to be protected by a wire guard, and that wet blankets and buckets of water had to be kept in the wings at all times during a performance. The fire hazard from the footlights was even worse.

The Restoration and eighteenth-century theatre had used overhead chandeliers to light the area behind the proscenium. Garrick got rid of these and introduced wing lights. Early in the Victorian period overhead stage lighting was reintroduced in the form of gas battens, which were lengths of gaspipe fastened to a heavy wooden (later metal) frame; sheet iron protected the wood from the flame. The battens could be anywhere between 25′ and 70′ long (as long as the proscenium was wide) and each contained scores of jets. They were hung by ropes from the gridiron, parallel to the proscenium, protected by a hoop-like wire guard, and concealed from the audience by the borders. Their number depended on the depth of the stage; four or five were standard in medium-sized theatres. It was their light that made the flies and the gridiron so hot and caused most of the fire risk during performance. The battens immeasurably increased the brightness and glare of the Victorian stage, as well as fully illuminating the upper scenery and making it finally possible for the actor to stay behind the proscenium arch and still be seen clearly.

APPENDIX ONE

The last category of gas stage lighting was portable. Varying short lengths of pipe were set up behind furniture, ground rows or other bits of scenery, or hung behind doors and windows in flats. Gas jets were also clustered at the top of a standard or bunch light, a vertical pipe set in a heavy iron base, which could be placed anywhere on the stage. The lengths, standards, wing lights and battens all had to be attached to the source of supply, and the means of connection was flexible hosepipe made of oiled leather or india-rubber attached to gas taps in the side or back walls of the stage; Irving had them set in the floor beside the wings. Whichever way it was done, there was no escaping the hundreds of feet of piping lying about the stage (out of sight of the audience, of course) and posing a hazard to the unwary. The gas supply to the stage and auditorium – there were thousands of jets in a fair-sized theatre – was regulated during performance at the gas plate or gas table on the prompt side by a gasman at the prompter's or stage manager's instructions. A gas plate was fixed to the wall where the mains supply came in.

Before the pilot light was invented around the middle of the century, the lighting of all gas instruments had to be done by hand, an especially cumbersome procedure in the case of the central chandelier or sunburner; in this case a lamplighter poked a long bamboo rod with an ignited sponge soaked in spirits at the end of it at the burners, while leaning out from the ventilating flue above, or actually standing on the chandelier – a perilous operation. Even after pilot lights were used for stage instruments, this primitive method prevailed in the auditorium. The pilot lights themselves had to be lit by hand, since there was no electric ignition. Before a performance the lamplighter went about his duties, lighting up both stage and auditorium; all lights were then turned as low as possible until the audience was admitted and the performance began.

VICTORIAN THEATRES: APPENDICES
APPENDIX TWO

From "Theatre Lighting in the Age of Gas,"
Terence Rees, The Society for Theatre Research, London, 1978

The introduction of gas into the auditorium was at first managed by the use of fittings based on those originally designed to take candles, the candle being replaced by the gas burner, with or without a lamp glass.

The *gas bracket* was developed from the wall sconce, and was simply the extension of a gas supply pipe out of the wall, with a control tap at some point and carrying a flat-flame or Argand burner at the far end. (Fig. 1).

A *girandole* was an elaboration of this in which two or more brackets emerged at different angles from the same point in the wall. See Figure 59 where they are fitted around the circles of boxes. Like the single brackets, they were sometimes equipped with a deal of ornamental metal-work.

The *tee-piece* was a simple device for bringing light into the centre of a room but does not seem to have had an immediate precursor in the realm of candle fittings unless it is regarded as a rudimentary chandelier. The gas supply entered through the middle of the ceiling and passed down an inverted letter 'T' with a burner at each end of the cross-piece.

The main source of light in the auditorium was the central *gas chandelier,* initially traditional in shape with festoons of glass drops, admitting only those modifications which allowed the passage of gas pipes and the free burning of the gas jets. The first of its kind at Covent Garden was claimed to yield a light equal to three hundred Argand lamps[1] though the size of these lamps was not specified. The chandelier in use there at the time of the fire of 1856 was equipped with eight hundred burners, each of which was capable of producing a flame $2\frac{1}{2}$ in. high at maximum gas flow.[2] Because of the susceptibility of the Argand flame to draught and the impracticability of replacing glasses, gas chandeliers, or 'gasaliers' as they were sometimes called (the spelling was variable) were commonly fitted with one of the flat-flame burners.

The burning of substantial quantities of gas within the confined space of a theatre gave rise to unaccustomed high temperatures and a general 'stuffiness' of the atmosphere, both of which demanded an immediate re-appraisal of ventilation techniques. Since hot air rises, the simplest way of

APPENDIX TWO

keeping temperatures within reasonable bounds was to make suitable apertures in the roof of the auditorium, preferably above the chandelier where the rate of air flow would be accelerated by the many burners directly below. The technique was recognised and adopted from the beginning:

> The proprietors respectfully inform the publick that a New Method of LIGHTING; and likewise a New Principle of VENTILATING the Theatre has been adopted. The FIRST has been effected by a MAGNIFICENT CHANDELIER . . . and the Heat is directly carried off through a tube communicating with the open Air . . .[3]

This was the 1817 chandelier at Covent Garden; its successor (Fig. 59) in the redesigned interior of 1856 was supplied with ". . . a flue 20ft in height and 8ft in diameter . . . for the purpose of ventilating the house . . ."[4]

With the passage of time gas chandeliers became simpler in design. The burners drew closer together and the glass drops and ornamental metalwork atrophied until there emerged a new lighting device which, from the concentration of its burners within a comparatively small space, took the name of 'sunlight' or 'sun-burner'. While the term was much abused, two distinct stages can be seen in its evolution, both intimately associated with the problem of ventilation.

VICTORIAN THEATRES: APPENDICES
APPENDIX THREE

How to fit a theatre throughout with gas. A turn-of-the century guide for gas fitters.

Extract from "Theatre Lighting in the Age of Gas," Terence Rees, The Society for Theatre Research, London, 1978

Even after the turn of the century new theatres were often equipped with a complete system of gas lighting before and behind the curtain. The following (abbreviated) account of the installation of gas in theatres and music halls was written in 1901[1] and gives a good view of the practice of that time.

"In all places of entertainment the gas fitting is an extensive piece of work requiring some skill and care in order to get good lighting results. This is more particularly the case when the building is a theatre, subject as it will be to the adoption of different plays, each requiring some modifications of lighting. Music halls are somewhat similar, but requiring less elaborate and intricate arrangements, while other public places of amusement, as assembly rooms, concert rooms, and public halls, have still a different arrangement for the distribution of gas. But in all these cases the actual fitting together of the pipes is the same, and no faulty connections are allowable as every fixture must be of the strongest.

"The gas-fitting is usually done by contract and carried out according to a scheme of work. In London the nature of lighting and mode of supply is subjected to the London County Council for approval. The Council insist upon modern places of entertainment having at least two, and often three, distinct services from the gas company's main in the street. In the case of a theatre a service is required to supply the staircases and landings, and is connected with a separate 10 to 20-light meter, according to the size of the building; a second service to supply the front is connected with a 150 to 200-light meter, and a third to supply the stage and connected with a 400 to 500-light meter. It is, however, also found useful to supplement this last with a 300-light meter, which is often used on special occasions when additional gas is wanted, and for rehearsals.

"Meters must be fixed in properly constructed brick rooms provided with ventilation. These, with the above, are precautions found necessary in case of fire.

"Most of the lights in theatres are under control and worked from the prompt side of the stage (right-hand when viewed from the auditorium), where the outlet of the stage meter must be run. The service varies considerably in size, so also do other gas-fittings, being dependent upon the requirements of the theatre . . .

"In briefly describing the gas-fittings of a large theatre it is assumed that the requirements are known, and that the cast-iron service from the outlet of meter is a 6 in. one. Proceed to run it to the wall where the manipulating cocks are to be fixed . . .

"A main cock is fixed to the service above the stage line; then a short piece of pipe, provided with a flange, to which a chamber, 6 in. square and about 5 ft. long, is bolted. Well soak the millboard in water ere painting with lead mixture to ensure a good tight joint. Leakage must not be risked by any such neglect of paint, whether in making a flange or a screw-joint, as there is quite sufficient

APPENDIX THREE

gas escaping from the many cocks without adding thereto by faulty joints. The chambers are of different lengths, cast square or round in shape, and can be obtained having a varying number of outlets on the top and bottom. The supply from the meter is in the centre, and so they really form, when fitted up, a branching tee-piece, already described in a previous chapter. This chamber again supplies other distributing chambers usually with from three to six outlets. One of the chief chamber outlets is provided as an extra one against something special likely to crop up requiring gas at a future date; the supplies can be fitted when needed. By this means gas can be obtained without disturbing any other communications.

"Into the chamber screw short pieces of pipe, each provided with a main cock, then a further short piece, to which the distributing tee is connected. This is again fitted with short pieces and cocks of the size necessary for the supplies leading therefrom to the lights. In this way a great number of services can be supplied with gas from one meter.

"In theatres and many music halls this is essentially necessary for the requirements of the performance, which may need much, little, or no light at a moment's notice on the stage or in the auditorium. Many of the good effects would be lost or greatly marred if the gasman had to turn down every cock provided, as, for instance, on the services to the border or flash lights. But by having such and similar multiple lights fed from a chamber common to all, the inlet cock to any particular chamber is the principal regulator of the gas supplied therefrom; the cocks on the separate services being simply used to control, or stop, the supply on any one service when required, and should the gas be adjusted it remains in that position since the principal cock turns the gas on or off. Similarly the supplies to the flash-lights, pilot-lights and circles have to be under complete and rapid control . . .

"A smell of gas is always self-evidence of leakage, and the better the connections the less apparent will this drawback be . . . It is far better to use a branching-tee, or chamber, which is cast in one piece and thus gives much less work, not to speak of probable irritation avoided.

"To construct the border lights, procure a length of 1 in. pipe, the width of the stage, and drill and tap holes at intervals of 4 in. to suit 5 ft. per hour iron burners. Now, the flash-lights must be constructed out of $\frac{3}{4}$ in. barrel of equal length and fitted with special burners . . . Pilot lights are also required, and are formed out of a similar length of $\frac{1}{2}$ in. barrel. Three or four pilot-lights will be sufficient to light the flash-lights, which latter in turn ignite the border lights. These three pipes, or sets of burners, form one series of border-lights proper, and are fixed within an inch or so of each other (the first mentioned being at the top with the other pipes in the order treated below) to an angle-iron batten having sheet-iron fastened to the back of it, with provision to take wire gauze or wire netting to guard the lights from firing the sky borders, as illustrated in section, [Fig. 20]. The flat-flame burners must not be set as illustrated, but having the flat side of the flame in a line with the pipe. The gas is supplied by means of a leather hose having spiral wire inside, which is found to be much more satisfactory than india-rubber tubing.

"The sheet iron is sometimes whitened with a mixture of whiting and tallow, this being found to stand heat much better without scaling off, as is the case when ordinary whitewash is used.

"This done, the battens are suspended by means of pulleys for convenience, so that they may be easily raised and lowered as occasion demands.

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"The supplies to the border and flash-lights should be ¾ in., while the burner pipe is 1 in. barrel. The circles are usually of a horse-shoe shape, and are best lighted by three supplies from a chamber. To do this, run a ¾ in. service round each circle, from which the burners ... are directly taken. This ¾ in. pipe is supplied by running the 1¼ in. supply from chamber to the nearest end of the service and making connection by diminishing from 1¼ in. to ¾ in.

"But before this connection is made two 1¼ in. tee-pieces must be put on. One to supply the other end of the ¾ in. pipe on the 'O.P.' side by running an inch service under the stage, reducing to ¾ in. at the point of connection. The other supply, also 1 in., is run round inside the balustrade and at the foot of it, to about the middle of the circle, where connection is made by a diminishing T-piece. Syphons must be fixed at the lowest point wherever the supplies drop down from the lever board. Similarly deal with the other two circle supplies. Should the nature of the plays not permit of the services being run in any direction under the stage, as when the cellar is used for disappearing subjects, as in transformation scenes, or where a portion of the stage is made to drop and slide underneath, the pipes would be in the way, if care be not taken to see that they are kept together under the stage by running them close up to the proscenium line.

"Bye-passes are fitted to each supply and carried well above the taps.

"From the underside of the chamber take a 1 in. service to supply the dressing rooms, passages, property-room, under the stage, and such other places which require gas always burning, as will not interfere with the progress of the play. All such lights are summed up under one title, i.e., station lights. They must be guarded by using wire globes, as naked lights are not permissible in theatres where there are many articles moved about of an inflammable character. It is usual to have in the daytime, for rehearsals, &c., a form of standard representing a large tee 5ft. high with a 4 ft. top, made out of ½ in. or ¾ in. barrel. Near the foot of the stem insert a tee-piece fitted with a short piece of pipe to which is connected the flexible tube from the supply service. The best service to supply the standard from is the station-lights' supply, since the latter is on all day; and it is desirable to have an hydraulic joint [water joint] for this near the footlights. The standard can be fixed by employing a piece of cast iron with a hole in the centre, the stem of the former being leaded into this hole, thus making the standard portable. The burners are put into the head-piece at intervals of 5 in. This form of burner is used to enable the manager to see the general effect, and so judge of the proficiency of the performers.

"Next come the ground-rows and wing-lights, for which 1¼in. supplies will be required. Three at least are necessary, fitted with taps and bye-passes. From each of these mains there is an outlet taken to supply an hydraulic joint for each wing. There are usually six sets of wings, each provided with red, white and green lights. Proscenium lights are supplied, three 1 in. services also taken as before, direct from the chamber. The last three 1 in. supplies from chamber are for the footlights, and are generally placed on the wall in front of the stage, but in such a way that when the burners are fitted the flames are level with the stage. The pipes, therefore, are below the level of the stage and lying side by side. It is necessary to note that although there are three services there must only be one row of burners, fitted alternately with clear, red and green chimneys, the latter being supported preferably by a brass clamping gallery, and not a crutch as illustrated in [Fig 8]. The crutch allows the chimney to rattle against it. The object of this arrangement is to get a good effect, since if the burners were fitted directly over each service shadows would be produced when the front rows were

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lighted. The pipes must be placed close together so as to mark on each pipe the position of the burner in rotation, as front, centre, back, allowing 4 in. apart, which is equal to 12 in. on each pipe, then through these marks drill and tap $\frac{3}{8}$ in. holes. Now, as the pipes when fitted will be about 1 in. apart it will be necessary to fit on the front and back pipes short male and female elbows. Make up the distance with short pieces of brass tube fitted with another elbow so as to bring the centre of this up-turned elbow immediately over the central pipe. The elbow is now fitted with a tap and argand burner. The burner that is fixed directly over the centre pipe will require a short piece of tube screwed into the pipe to bring it to the level of the other burners. Argand burners are the best for footlights, and if they are not fitted with a lever tap, ordinary $\frac{3}{8}$ in. brass taps must be employed to regulate the flames to one height. As this kind of burner requires a chimney to ensure a good flame, it also affords an easy way of obtaining different coloured lights by using coloured chimneys. The pipes must be securely fixed on a firm base to prevent vibratory motions produced by dancing and other rapid movements on the stage.

"The footlights must be screened from the view of the audience by means of sheet iron of such width that no light can be seen from the auditorium. It is fixed on its edge and given a coat of the whitewash prescribed on a preceding page. A better and more artistic method is to have a wooden frame fitted with porcelain and mediaeval glass. The porcelain acts as a reflector, while the stained glass prevents the glare from dazzling the eyes, at the same time giving a pleasing effect. These lights must also be guarded by wire netting being fixed from the stage to the screen, but a more common way is to use brass uprights fixed at intervals along the front of the stage with brass tubing lacing them together. As a further precaution against setting fire to dresses, brass mesh-net should be fastened to the railing. The whole is represented by [Fig 8].

"Before leaving the stage the chief supplies for the boxes and sunlight have to be fixed alongside the distributor, as they are also controlled from the stage, although the meter is fixed in front of the building. Having run a 2 in. service from the meter to the stage, a T-piece must be put on at a convenient height, so as to carry therefrom a bye-pass connection to the 6 in. inlet to chamber a little distance below the cock ... The bye-pass must be fitted with a tap as shown in the illustration [Fig 68], which represents the arrangement of the pipes so as to distribute gas over a large building. Continue the 2 in. supply to the level of the 6 in. chamber, then branch off with a tee, on each of which screw diminishing elbows by means of nipples. For the boxes a 1 in. and for the sunlight a $1\frac{1}{4}$ in. service will be required, each fitted with cocks. Like all other services, except station lights, bye-passes must be fixed ... In the case of the bye-pass gas for border, circle and other lights it will be noticed, upon reference to the illustration, that the supply (usually 1 in. or $1\frac{1}{4}$ in.) comes from below the principal chamber, and is run up behind the latter and the other pipes from a horizontal feed-pipe. The desired number of bye-pass supplies are taken from this, similar to those represented for boxes and sunlight, and are constructed out of $\frac{3}{8}$ in. brass tube.

"The auditorium is sometimes lighted by a large gasalier, sun-burner, or star-lights. Whichever system of lighting is adopted, great care is necessary to see that the lights are strongly fixed to the ceiling, using extra strong bridge-wood. Ventilation in theatres is absolutely necessary in order to remove the vitiated air. This is much accelerated by fixing the flue or ventilator immediately above the sunlight or other burner, but it must not allow down-draughts or rain to

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enter. The electric sunlight does not aid ventilation, and in some theatres the auditorium is principally lighted by gas in order to take advantage of the heat generated, which causes a draught upwards, and so is of valuable assistance in bringing about thorough ventilation. In other parts of the building electric light has many advantages over gas in the way of decorative lighting. When the auditorium is lighted by electricity, ventilation is brought about by the system of forced air.

"A service must also be run to supply the pilot lights. In constructing the wing-lights see that the coloured lights are placed projecting outwards and at an angle to each other, but alternately over one another, since if they were not so, the heated air ascending would greatly interfere with the steady burning of the flames in the chimneys. For the white lights this is not so essential owing to the use of flat-flame instead of argand burners. These movable lights, like the rehearsal standard, are supplied from hydraulic joints by flexible tubing . . .

"The refreshment-bar is supplied with gas from a separate meter, as the catering is generally let out to a business firm. From the outlet of the front meter a service is connectted to what is technically called a 'pass-meter', which latter registers only the gas consumed in the bar department for heating and lighting . . .

"A jet or two should also be fixed on the counter or small tables for the convenience of smokers.

"Theatres of any pretensions at all should employ a good gas-fitter and not, as is often done, get a man to come in nightly to work the lever board. This latter plan is more costly, owing, no doubt, to the fact that the man has no interest in the quantity of gas consumed, and does not trouble about leakage or anything beyond manipulating the cocks. Whereas a man on the premises sees to all taps and syphons in the daytime and periodically tests for leakage. A gas-fitting firm cannot always send the same man, and there being so many services in a theatre, some of which require occasional attention, that ere a stranger can locate a defect a considerable amount of time has often slipped away, thus running up a bill for very little work done. While a gas-fitter on the premises soon knows where to look for the defects, and, besides, he can execute extensions or alterations as desired by the manager. Illness falls to the lot of all men at some time or other; and should the gas-fitter be away, a stranger would have a difficulty in knowing which part of the building was supplied by any particular service, and so on. To save inconvenience every service should be labelled with a brass ticket, bearing the name of the lights supplied by it. It is also desirable to have the whereabouts of syphons and stray taps stated on paper, and hung on the wall near the lever board.

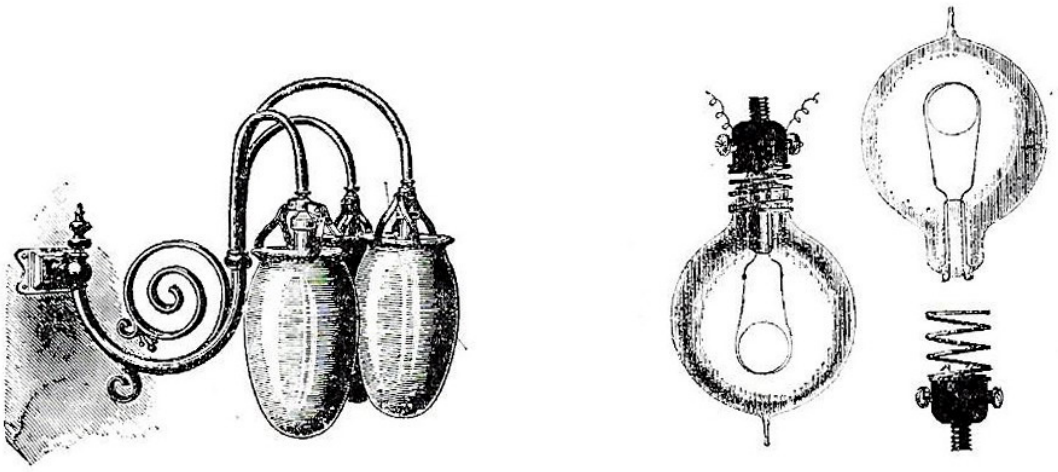
"Music Halls do not require such elaborate fitting up; three or four chief supplies from a chamber or distributing-tee will generally be found sufficient. One for the footlights; one for the sunlight and brackets of the auditorium; one for the station lights; and one for the front and the refreshment bars. Occasionally the hall is lighted by star-lights and the galleries by wall brackets or small star burners. The services are branched right and left and run under the galleries, tee-pieces being inserted at about every four or five yards, from which drop down a necessary length of $\frac{3}{8}$ in. iron piping provided with a reducing male or female elbow. The male end is screwed for $\frac{3}{8}$ in. brass, so that the back and bracket can be readily fixed. In fixing the sun or star burners, see that the bridge wood is securely fastened to the joists; in all other respects the work is similar to that already dealt with."

THEATRES: EARLY ELECTRIC LIGHTING

THE SAVOY THEATRE, LONDON

THE NEW SAVOY THEATRE, FRONT TOWARDS THE THAMES EMBANKMENT.

THE SAVOY THEATRE, LONDON

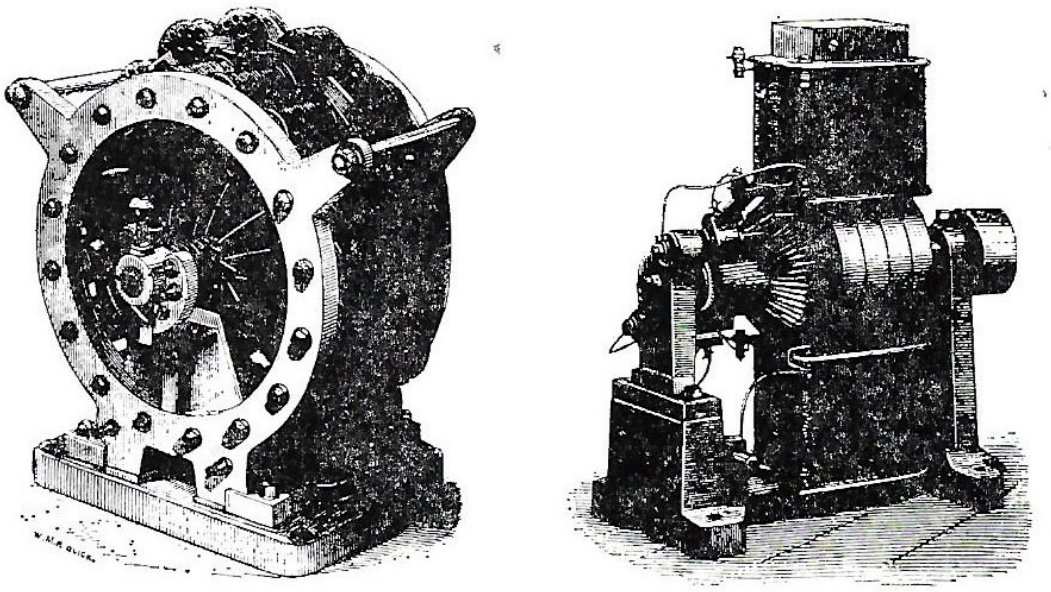


81. One of the thirty-four electric light brackets fitted in the auditorium of the Savoy Theatre, 1881. *Engineering*, 33 (182), 206.

82. The Swan incandescent filament electric lamp, as used at the Savoy Theatre. *Engineering*, 33 (1882), 206.

83. Siemen's "W1 alternate current machine". *Engineering*, 33 (1882), 206.

84. Siemen's "dynamo-electric machine". *Engineering*, 33 (1882), 206.



(Rees)

THE SAVOY THEATRE, LONDON

I think I may claim to have carried out some improvements deserving special notice. The most important of these are in the lighting and decoration. From the time, now some years since, that the first electric lights in lamps were exhibited outside the Paris Opera-house, I have been convinced that electric light in some form is the light of the future for use in theatres, not to go further. There are several extremely good incandescent lamps, but I finally decided to adopt that of Mr J. W. Swan, the well-known inventor of Newcastle-on-Tyne. The enterprise of Messrs Siemens Bros. Co. has enabled me to try the experiment of exhibiting this light in my theatre. About 1,200 lights are used, and the power to generate a sufficient current for these is obtained from large steam-engines, giving about 120 horse-power, placed on some open land near the theatre. The new light is not only used in the audience part of the theatre, but on the stage, for footlights, side and top lights, etc., and (not of the least importance for the comfort of the performers) in the dressing-rooms – in fact, in every part of the house. This is the first time that it has been attempted to light any public building entirely by electricity.

But the generation of power on such a scale was at that time so fraught with uncertainty that Carte felt obliged to equip his theatre throughout with gas by way of insurance. This was a wise move if only because the stage electrical installations were not completed until many weeks after the opening night. In his prospectus, Carte was careful to point out the disadvantage of gas:

The greatest drawbacks to the enjoyment of the theatrical performances are, undoubtedly, the foul air and heat which pervade all theatres. As everyone knows, each gas-burner consumes as much oxygen as many people, and causes great heat besides. The incandescent lamps consume *no* oxygen, and cause no perceptible heat.

"When building (of the Savoy Theatre) was nearing completion Richard D'Oyly Carte took the opportunity of issuing a prospectus in which he described exactly what he had in mind for the illumination of his new theatre" (Rees)

THE PALACE THEATRE, LONDON

New technology: the Palace (1889–91)

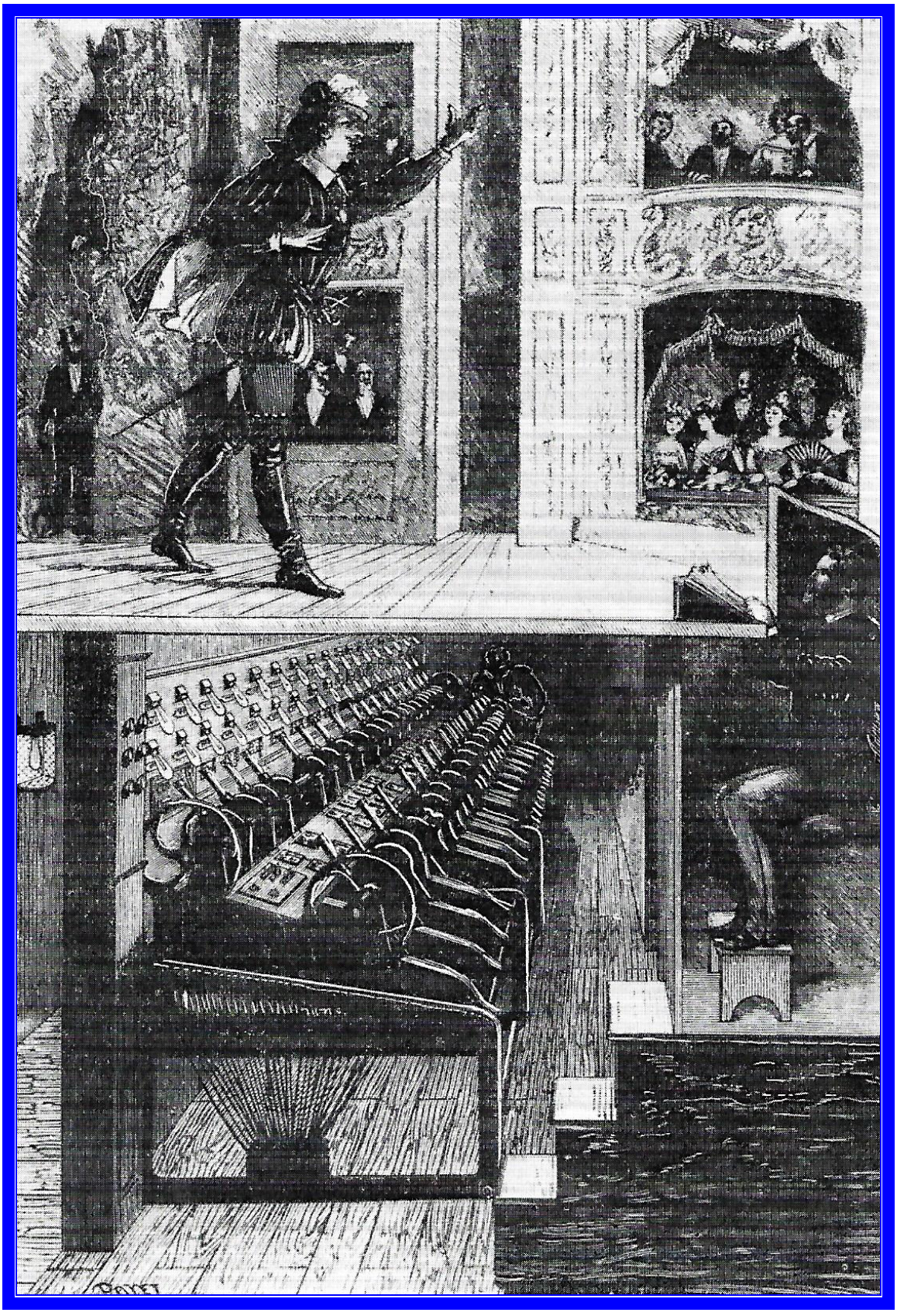
D'Oyly Carte was a brave man. Besides coping with Gilbert and Sullivan, he eagerly embraced every new technical development and, not content with the success of the Savoy, started building his new Royal English Opera House in 1889. He worked with the master builder G. H. Holloway, and T. E. Collcutt, the Gothicist, was only summoned at a later stage to undertake the architectural elaboration. The new theatre opened on 31 January 1891 with Sullivan's *Ivanhoe*, to great acclaim. It was thought to be the best new theatre in Britain. Cantilevers, in modified form, were used in the Alhambra when it was rebuilt in 1883, but D'Oyly Carte's were 'unparalleled in any other theatre in Europe' (*110*). Far below the stage its own current was manufactured; 'with its 2,000-odd lights it has the largest theatrical installation in the world'. The 'electro-motors' also supplied the house with 'fresh air, passed over ice in summer and hot-water pipes in winter. Stale air was electrically extracted', a very early use of full air-conditioning.

Collcutt had clothed the building in an intricate fenestrated screen of brick and terracotta tiles, 'the climax of the Reign of Terracotta', as Sir Albert Richardson called it (*109*). Their ornament is Plateresque, the style of the early Spanish Renaissance (*111*).

But D'Oyly Carte's dream was short-lived. By December 1892, the Opera House had been sold to Augustus Harris and it reopened as the Palace Theatre of Varieties (*112*).

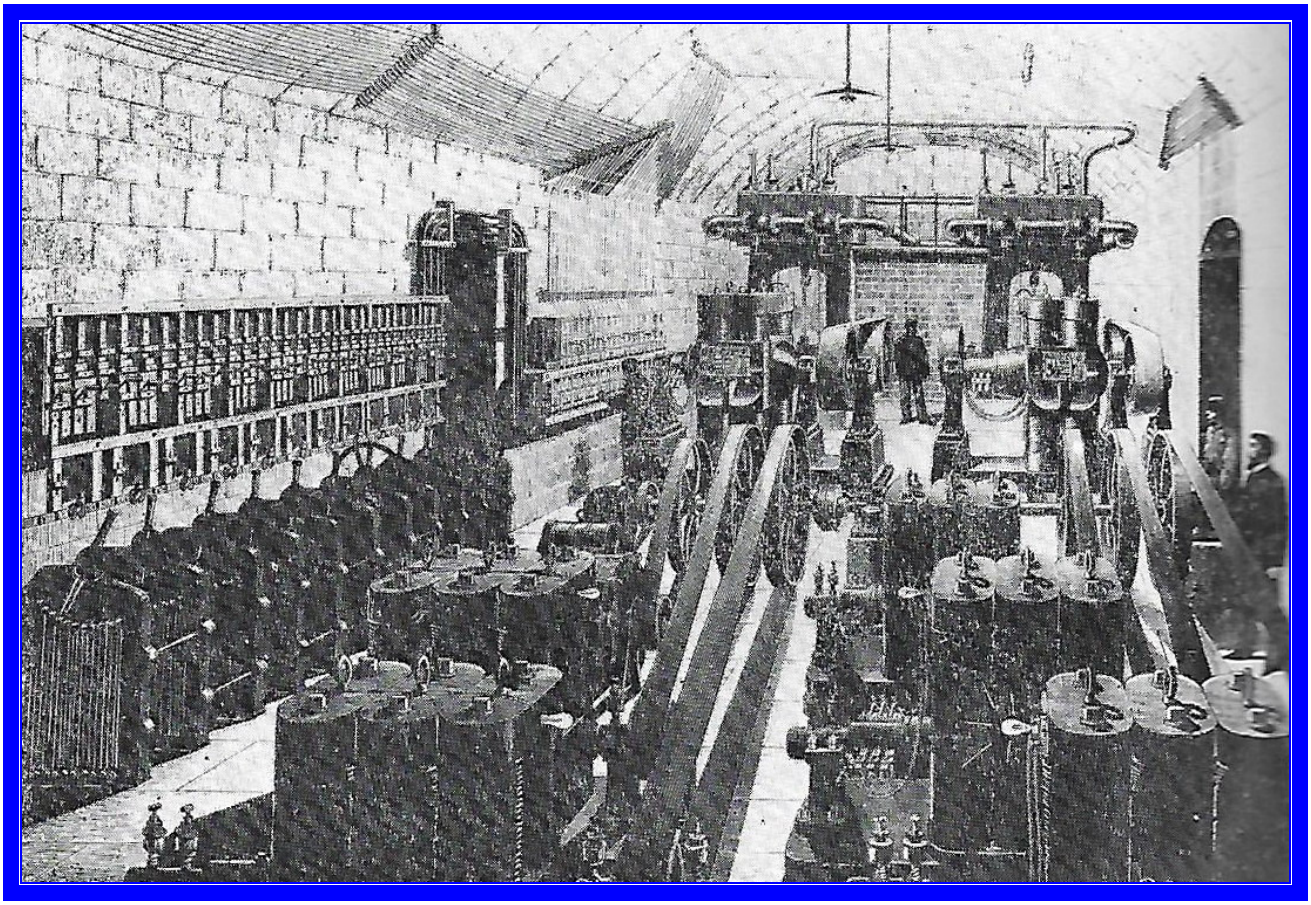
(Glasstone)

THE PARIS OPERA HOUSE



Electric switchboard below the stage at the Paris Opera, 1887 (Rees)

THE PARIS OPERA HOUSE



Power supply in the cellars of the Paris Opera, 1887 (Rees)

LONDON THEATRES AND MUSIC HALLS WITH EARLY ELECTRIC LIGHTING

The audience at the Britannia Theatre, 1901 (Trustees of the V&A Museum from Booth)

After the installation of electric lighting in the Savoy Theatre in 1881:
"The relatively cool electric light soon began to find its way into other theatres."

1883 The Criterion Theatre in Piccadilly Circus

1883 The Grand Theatre, Islington

1884 The Prince's Theatre in Coventry Street

1885 The New Pavilion Music Hall, Mile End

1887 Terry's Theatre in the Strand

1888 The new Court Theatre, Sloane Square

1888 The Lyric Theatre, Shaftesbury Avenue

1888 The Tivoli Theatre in the Strand

However, it is reported that all of these establishments incorporated an auxiliary system of gas lighting (just in case), except for the Lyric which was lit by electricity alone.

The West End at the turn of the century (Weightman)