GAUMONT-KALEE
PROJECTION LENSES
AND
ARC LAMP MIRRORS

A GAUMONT-KALEE PRODUCT

GB-KALEE

GB-KALEE LTD

MORTIMER HOUSE
37/41 MORTIMER ST
LONDON W1

Telephone: MUSEUM 5432
Telegrams: GEBEKAY LONDON

GAUMONT-KALEE

PROJECTION LENSES, SERIES "H" & "K"

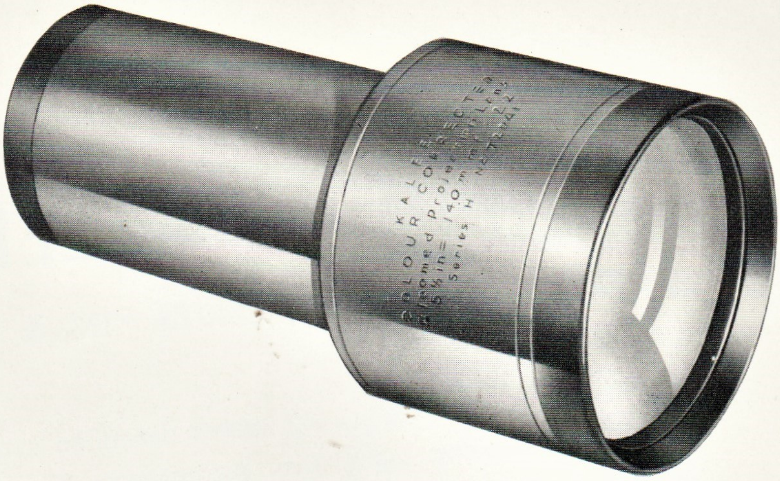
The "Series H" and "Series K" Lenses described in this book fulfil all requirements for 35 mm. projection in Cinemas, and between them will suit almost every type of equipment.

Many years of experience in the computation, design and manufacture of high-quality lenses are represented by the Series "H" and "K" lenses which are designed to collect and transmit the whole of the light available in the gate; as examples of the care and accuracy involved in manufacture and testing, grinding and polishing tolerances are maintained within a few millionths of an inch and focal length is kept within S.M.P.E. recommendations, i.e. within 1% of the specified figure, thus avoiding the necessity for special pairing, and facilitating interchange of lenses.

All air-to-glass surfaces of the Gaumont-Kalee Series "H" and "K" lenses are Hard-Coated, by a process sometimes called "Blooming," with an anti-reflective medium, to increase light-transmission and to improve image contrast. This process normally affects colour-rendering, but the exclusive, patented Gaumont-Kalee process gives colour-correction with consequently "whiter" light. The Hard-Coating of the Gaumont-Kalee process is as durable as the glass itself and will withstand repeated cleaning.

The High Definition and Light Transmission properties of all Gaumont-Kalee Lenses are the guarantee of perfect projection in the Theatre.

GB-KALEE



GAUMONT-KALEE PROJECTION LENSES
SERIES "H"

HARD-COATED AND COLOUR-CORRECTED

These lenses are designed to fit almost any projector; within the physical limitations imposed by this consideration, they are of the maximum possible aperture and efficiency.

The complete Series "H" ranges in focal lengths from 3″ to 7″; the shorter focal lengths, from $3\frac{3}{4}$″ down to 3″, are Anastigmats, in order to maintain good definition at the very wide angles corresponding to their short focal length.

The comparative light-loss often experienced with Anastigmats has been countered by colour-corrected hard-coating.

Series "H" lenses will be found most useful and versatile for service in existing equipments which cannot make efficient use of the more modern and powerful Series "K" lenses.

The Series "H" lenses are available in the following sizes and focal lengths :—

"H" ANASTIGMATS

Focal lengths: 3″, $3\frac{1}{4}$″, $3\frac{1}{2}$″, $3\frac{3}{4}$″. All f.2.

"H"

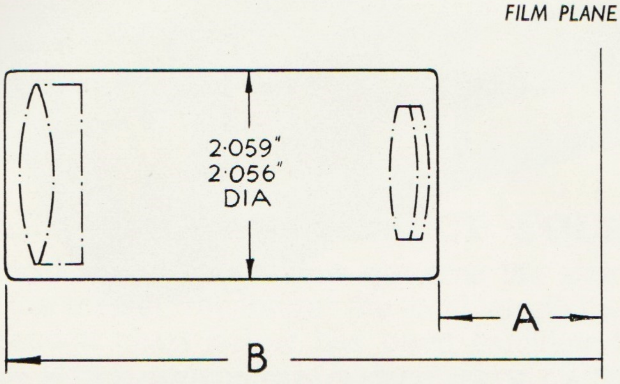
Focal lengths: 4″ to 7″ in steps of $\frac{1}{4}$″, as under :—

4″ to $5\frac{1}{4}$″ inclusive	f/2.2
$5\frac{1}{2}$″	f/2.3
$5\frac{3}{4}$″	f/2.4
6″	f/2.5
$6\frac{1}{4}$″	f/2.6
$6\frac{1}{2}$″	f/2.7
$6\frac{3}{4}$″	f/2.8
7″	f/2.9

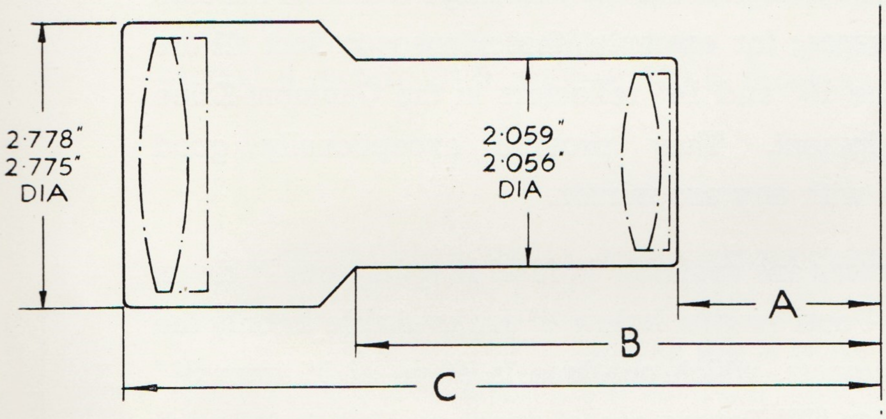
All of these lenses fit lens-holders of 2.06″ (52.4 mm.) diameter

PROJECTION LENSES SERIES "H"

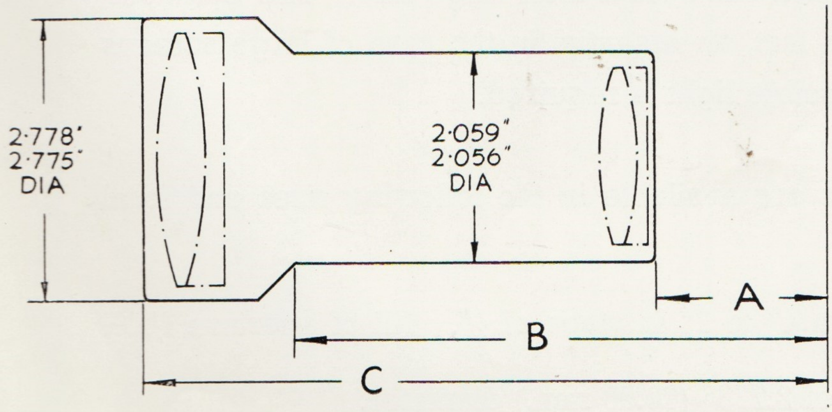
Table of Dimensions



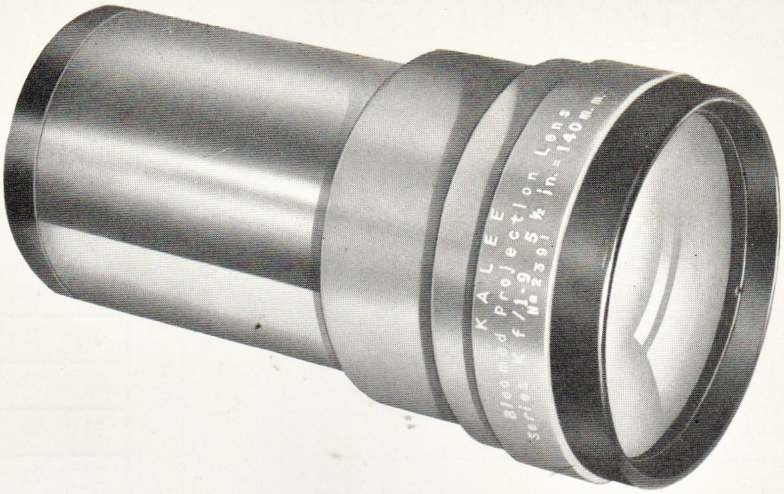
Equivalent Focus		A		B	
ins.	mm.	ins.	mm.	ins.	mm.
3	75	1.54	39	5.80	147
3¼	83	1.56	40	5.82	148
3½	89	1.72	44	5.98	152
3¾	95	1.62	41	6.30	160
4	102	1.48	38	6.42	163
4¼	108	1.60	41	6.72	171



Equivalent Focus		A		B		C	
ins.	mm.	ins.	mm.	ins.	mm.	ins.	mm.
4½	114	1.74	44	5.68	144	7.28	185
4¾	121	1.88	48	5.94	151	7.60	193
5	127	1.98	50	6.04	153	7.82	199
5¼	133	2.12	54	5.80	147	8.30	211
5½	140	2.22	56	5.90	150	8.50	216
5¾	146	2.38	60	6.06	154	9.04	230



Equivalent Focus		A		B		C	
ins.	mm.	ins.	mm.	ins.	mm.	ins.	mm.
6	152	2.52	64	6.20	157	9.36	238
6¼	159	2.62	67	6.32	160	9.84	250
6½	165	2.74	70	6.06	154	9.90	251
6¾	171	2.92	74	6.22	158	10.44	265
7	178	3.06	78	6.38	162	10.84	275



GAUMONT-KALEE PROJECTION LENSES
SERIES "K"

HARD-COATED AND COLOUR-CORRECTED

Series "K" Lenses are designed for use with large-diameter mirrors and modern light-sources; for example, these lenses collect all the effective light from the 16″ and 14″ reflectors in the Gaumont-Kalee "21" and "20" Equipment. They provide exceptionally good marginal illumination with any arc mirror.

The Series "K" Lenses are available in focal lengths from 7″ down to 4″, in steps of $\frac{1}{4}$″. Focal lengths below 4″ are available in only the Series "H", as Anastigmats, which continue in steps of $\frac{1}{4}$″ from $3\frac{3}{4}$″ down to 3″. All Series "K" Lenses are of aperture f/1.9, to take full advantage of the most powerful modern Arc Lamps.

We recommend the choice of "K" Lenses wherever possible; i.e. with all projectors which can accept their large size. The Gaumont-Kalee "K" Lens is, in fact, an essential in the case of large screens where the utmost possible light is required.

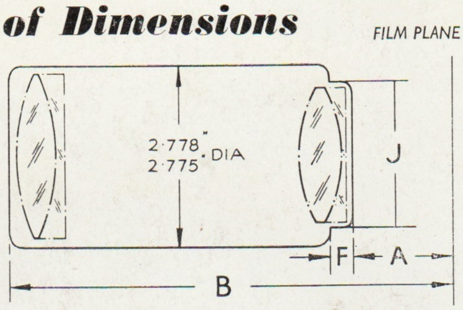
Series "K" Lenses are available in the following sizes and focal lengths :—

Focal lengths from 4″ to 7″ in steps of $\frac{1}{4}$″. All of aperture f/1.9.

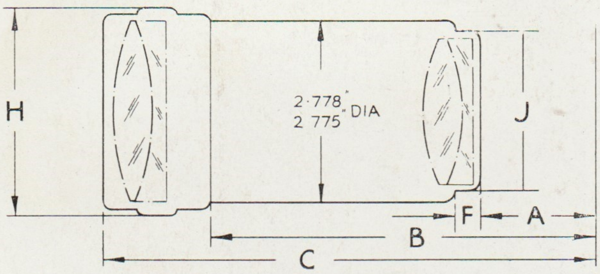
For lens holders of 2.778″ (70.56 mm.) diameter.

PROJECTION LENSES SERIES "K"

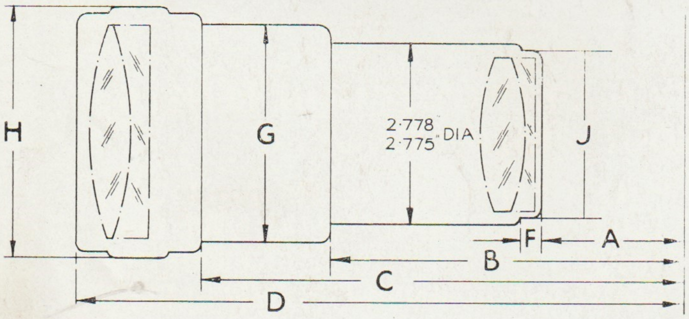
Table of Dimensions



Equivalent Focus		A		B		F		J	
ins.	mm.	ins.	mm.	ins.	mm.	ins.	mm.	ins.	mm.
4	102	1.44	36	6.56	167	.38	10	1.96	49
4¼	108	1.46	37	6.96	177	.38	10	2.07	52
4½	114	1.58	40	7.20	183	.38	10	2.21	56

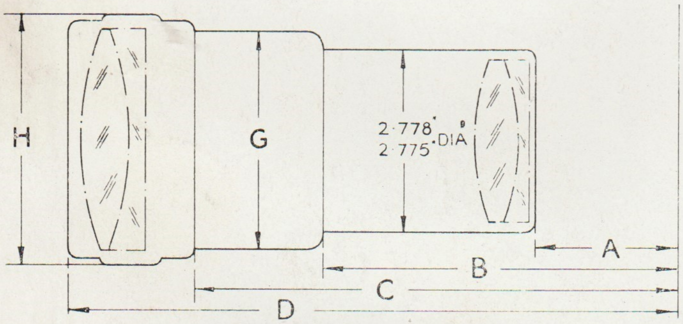


Equivalent Focus		A		B		C		F		H		J	
in.	mm.	ins.	mm.	ins.	mm.	ins.	mm.	ins.	mm.	ins.	mm.	ins.	mm.
4¾	121	1.70	43	6.00	152	7.62	194	.38	10	3.00	76	2.30	59
5	127	1.74	44	6.36	162	8.06	204	.38	10	3.16	81	2.40	61

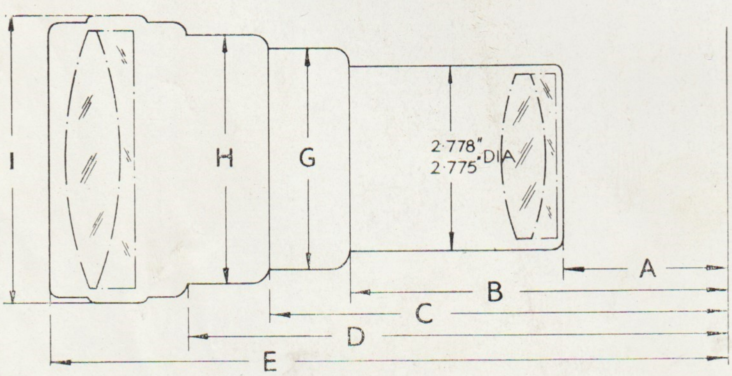


Equivalent Focus		A		B		D		F	
ins.	mm.	ins.	mm.	ins.	mm.	ins.	mm.	ins.	mm.
5¼	133	1.82	46	5.82	148	8.26	210	.38	10

Equivalent Focus		G		H		J	
ins.	mm.	ins.	mm.	ins.	mm.	ins.	mm.
5¼	133	3.00	76	3.30	84	2.50	64

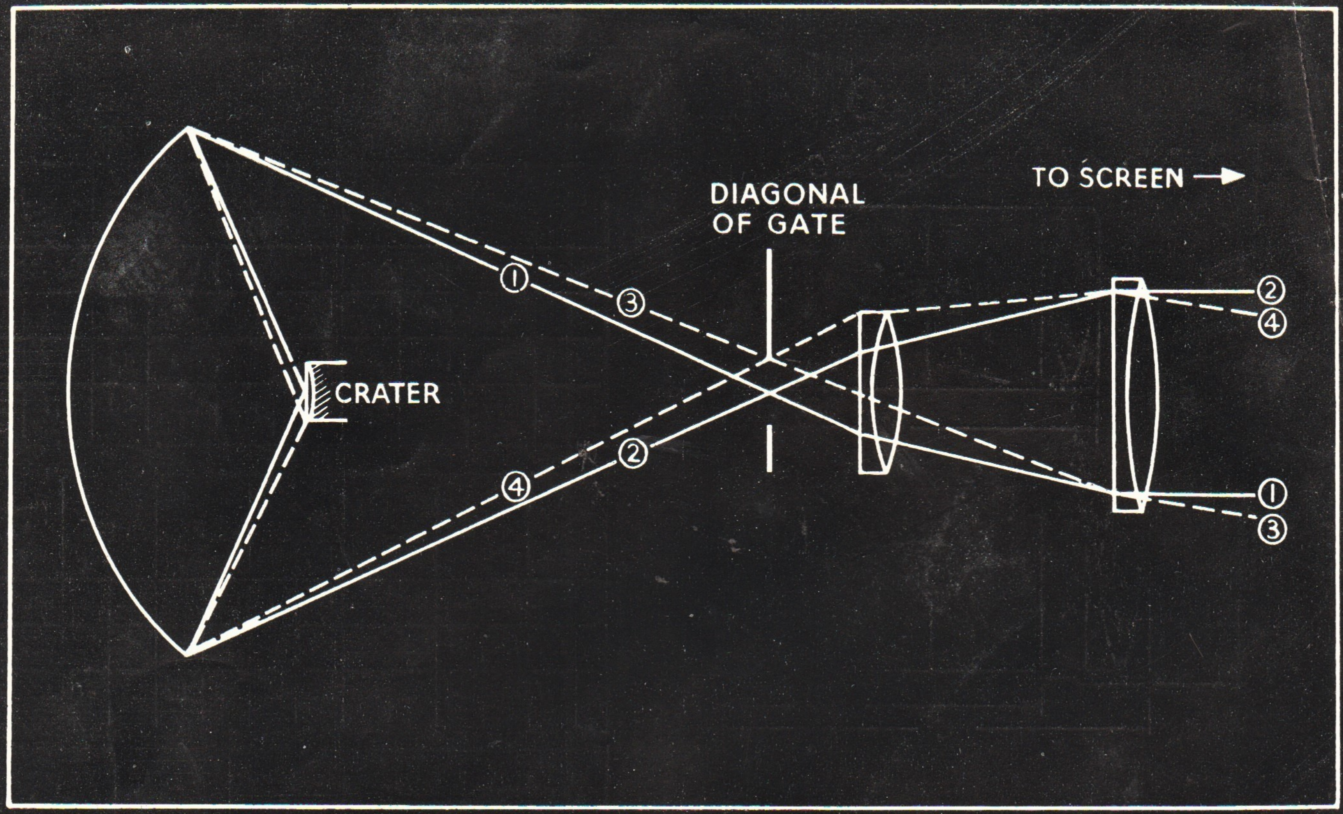


Equivalent Focus		A		B		C		D		G		H	
in.	mm.	ins.	mm.	ins.	mm.	ins.	mm.	ins.	mm.	ins.	mm.	ins.	mm.
5½	140	1.92	49	5.86	149	6.75	171	8.76	222	3.09	78	3.42	87
5¾	146	2.02	51	5.58	142	7.09	180	8.94	228	3.18	80	3.60	91
6	152	2.12	54	5.68	144	7.50	192	9.44	240	3.24	82	3.72	95
6¼	159	2.24	57	5.80	148	7.68	195	9.86	250	3.31	84	3.86	98



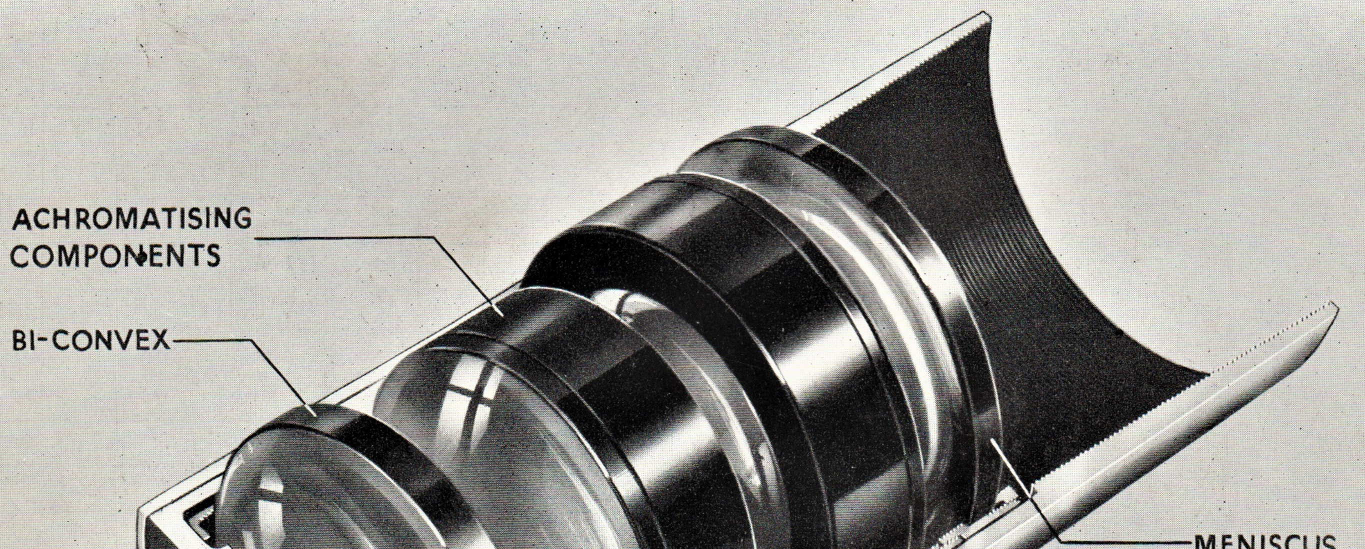
Equivalent Focus		A		B		C		D	
ins.	mm.	ins.	mm.	ins.	mm.	ins.	mm.	ins.	mm.
6½	165	2.34	59	5.90	150	6.81	173	8.00	203
6¾	171	2.50	64	6.06	154	7.28	184	8.28	210
7	178	2.64	67	6.20	157	7.31	185	8.62	218

Equivalent Focus		E		G		H		J	
ins.	mm.	ins.	mm.	ins.	mm.	ins.	mm.	ins.	mm.
6½	165	10.28	262	3.18	80	3.56	9.0	4.02	102
6¾	171	10.80	274	3.31	84	3.68	93	4.16	106
7	178	10.94	278	3.31	84	3.75	95	4.30	109

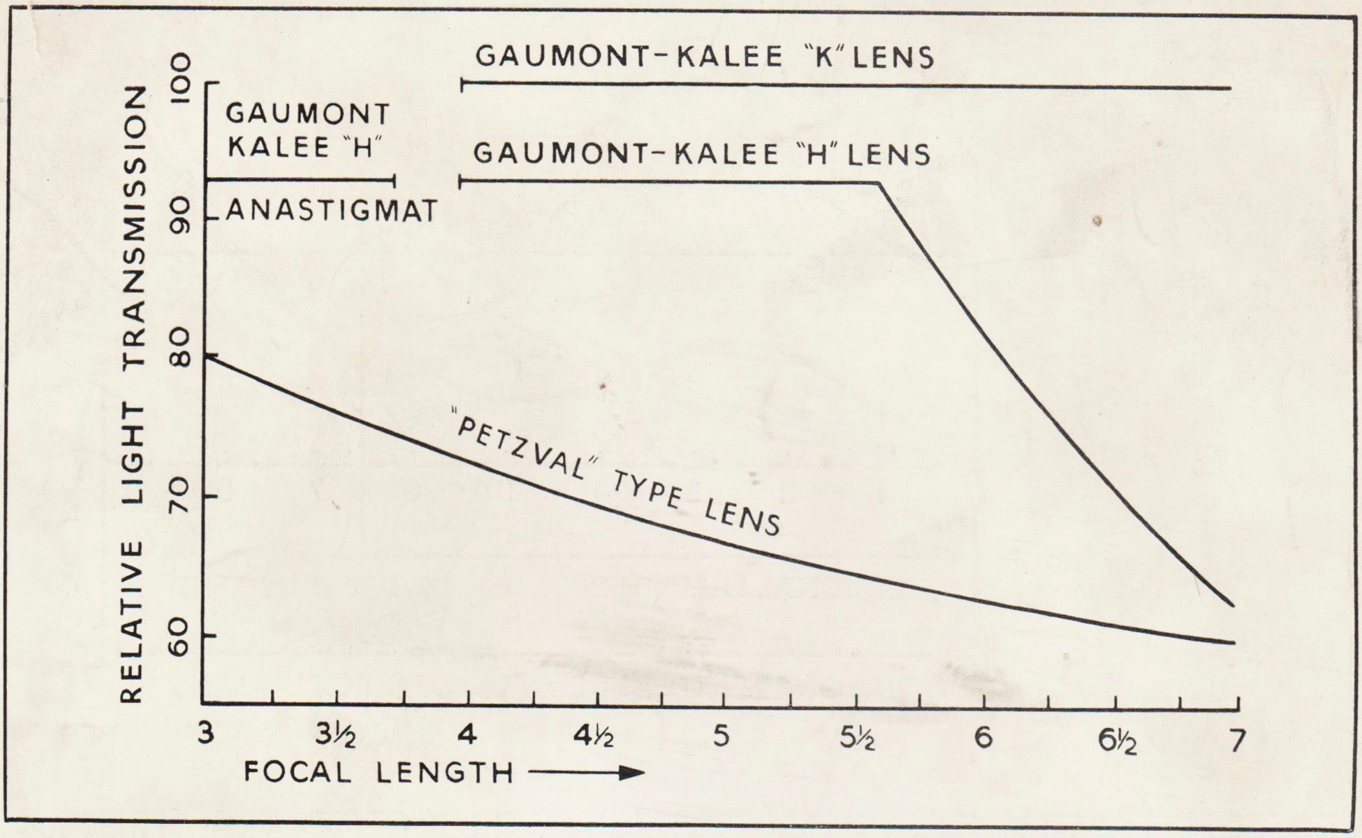


HOW THE GAUMONT-KALEE "H" & "K" PROJECTION LENSES FUNCTION WITHOUT VIGNETTING

**RAYS ① & ② BOUND THE CONE OF FULL CENTRAL ILLUMINATION.
RAYS ③ & ④ BOUND THE CONE OF FULL MARGINAL ILLUMINATION, i.e., FROM THE FULL MIRROR DIAMETER, THROUGH THE CORNER OF THE GATE, THROUGH THE PROJECTION LENS TO THE CORNER OF THE SCREEN**

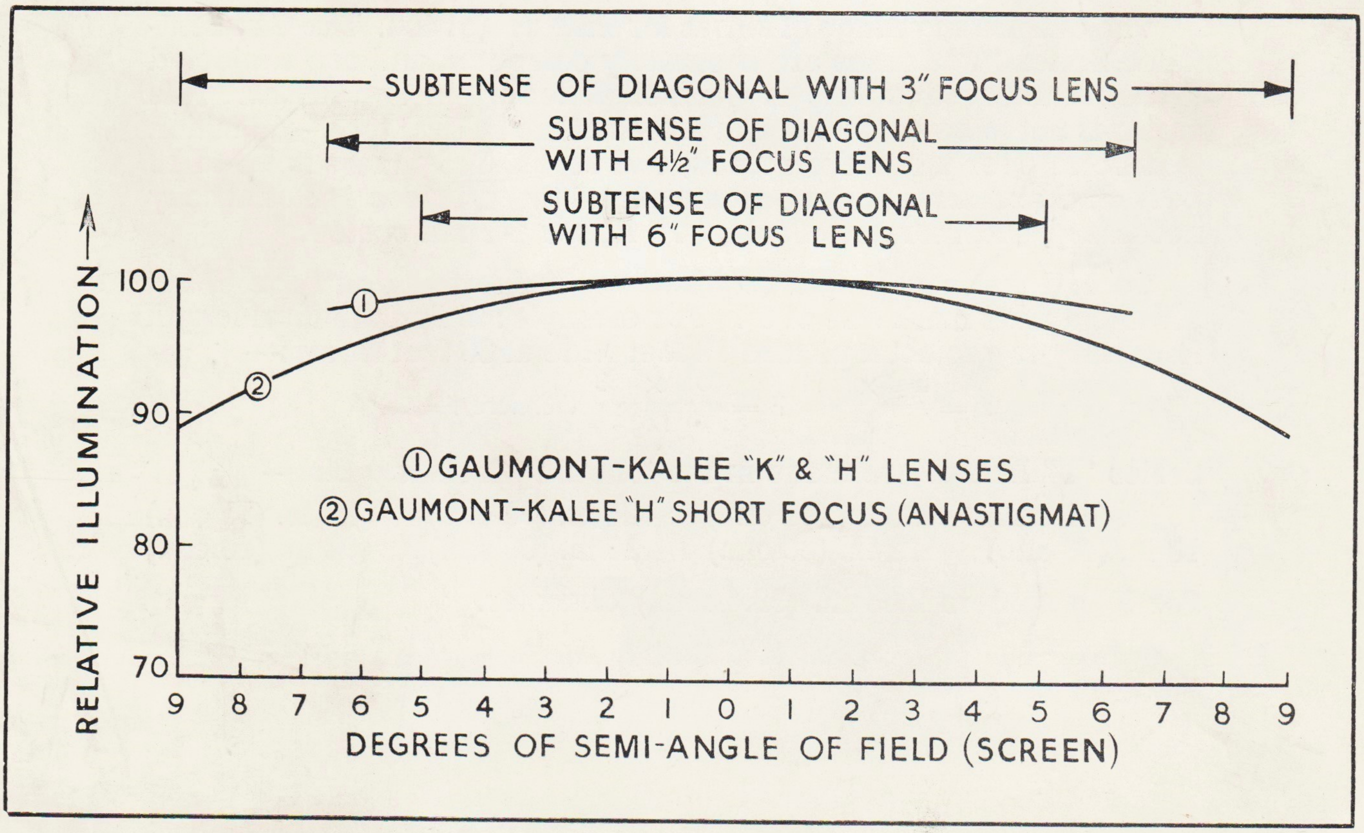


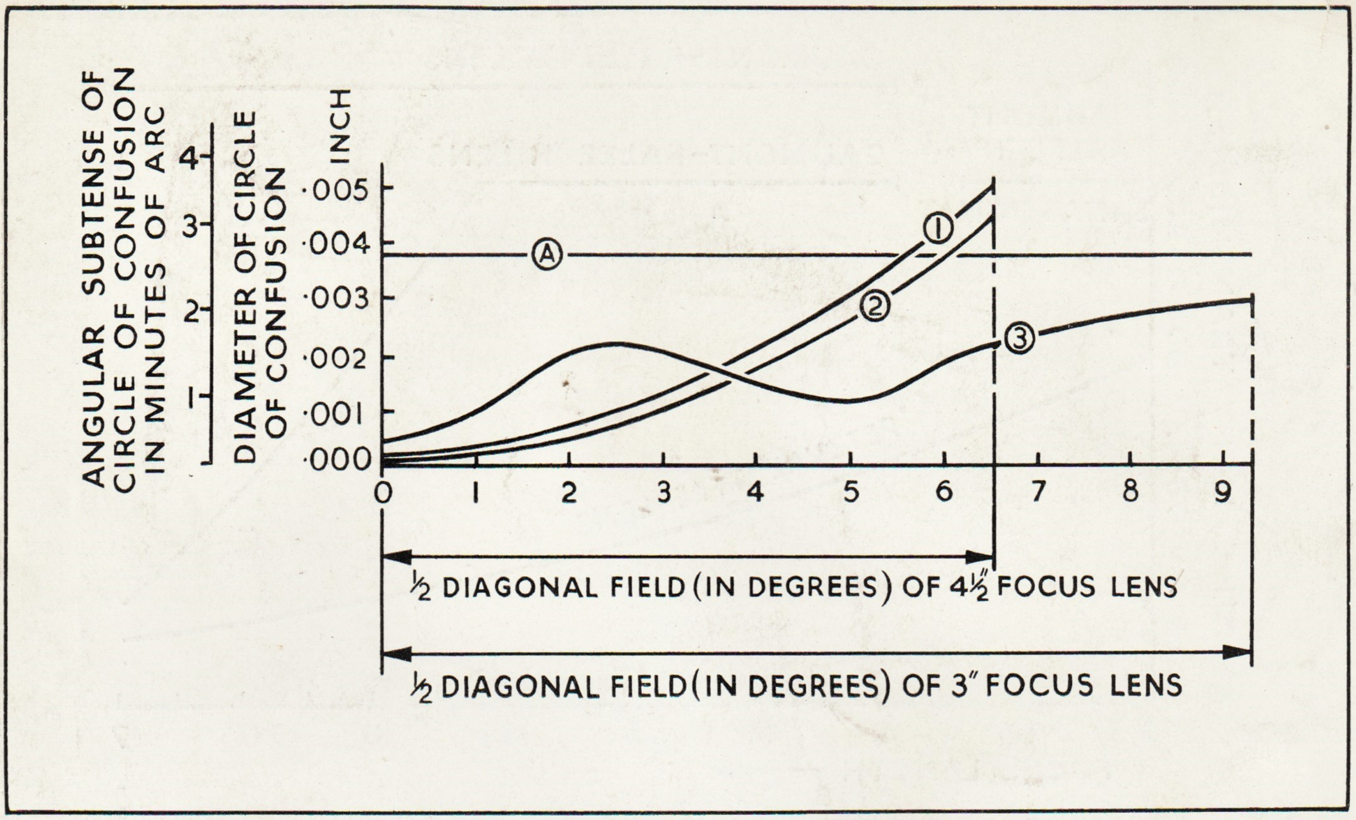
GAUMONT-KALEE **SERIES "H" LENS**, HARD-COATED & COLOUR-CORRECTED



Comparative Projection Lens efficiencies based on use with highest efficiency condensing systems.

Distribution of light across the screen as a property of the projection lens, i.e. independently of the condensing system.





Maximum permissible diameter of circle of confusion in projection for (A) critical definition.

Circle of confusion for:

1. Gaumont-Kalee "K" 4½" 2. Gaumont-Kalee "H" 4½" 3. Gaumont-Kalee "H" Anastigmat 3"

GAUMONT-KALEE "T" LANTERN LENS

The outstanding range of lenses for slide projection. The Gaumont-Kalee Series "T" Lenses are accurately computed and are subjected to the same exacting tests as Gaumont-Kalee projection lenses. This series is not to be confused with lenses of the Petzval type—definition is uniform over the entire screen, and screen brightness is up to 15 per cent. greater. Surface treatment of these lenses is not strictly necessary, and therefore *Series "T" lenses are not coated.*

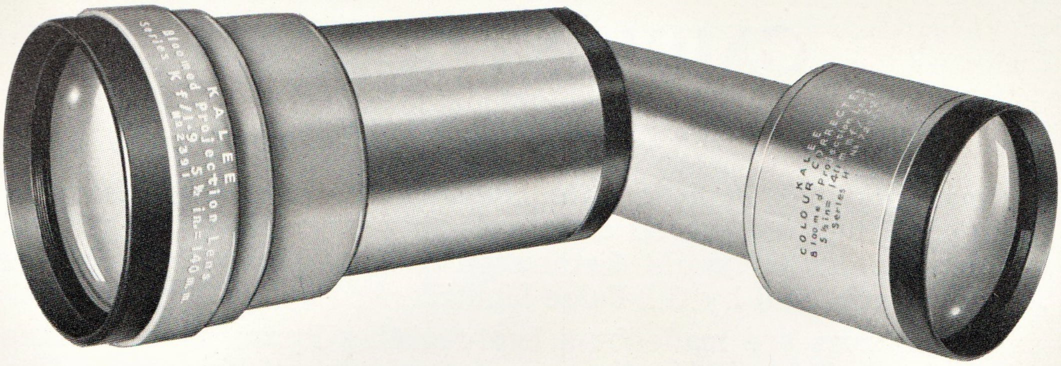
To find the focal length required use the formula on Page 9, but assume a slide mask size of 3". For example: to find the focal length necessary to project a picture 12 feet wide at 80 feet throw:—

$$F = \frac{D \times M}{P} \quad F = \frac{80 \times 3}{12} \quad \text{therefore } F = 20''$$

Series "T" Lenses are made in the following focal lengths:—

16 in. (41 cm.)	20 in. (51 cm.)	24 in. (61 cm.)	28 in. (71 cm.)
18 in. (46 cm.)	22 in. (56 cm.)	26 in. (66 cm.)	30 in. (76 cm.)

For lens holders 2.06 in. (52.4 mm.) diameter.



SELECTION OF CORRECT FOCAL LENGTH

The focal length of the lens governs the size of the picture projected to the screen; the longer the focal length the smaller the picture. The projection chart below has been calculated for cinematograph projection lenses assuming a gate mask of .825″ × .600″ commonly used with sound on film systems.

Accurate selection may be made by using the formula below:—

D = distance from lens to screen (in feet)
P = width of picture (in feet)
M = width of mask (in inches)
F = focal length of projection lens (in inches)

Example for use of the formula:

To find the focal length of the projection lens necessary to project a picture 23 ft. wide at 120 ft. throw:—

$$F = \frac{D \times M}{P} \qquad F = \frac{120 \times .825}{23}$$

therefore $F = 4\frac{1}{4}''$

PROJECTION TABLE FOR CINEMATOGRAPH LENSES

Showing width of Screen Picture at different distances with Lenses of different focal lengths.

Distance Lens to Screen. Feet.	FOCUS OF LENS IN INCHES																																	
	3 in.		$3\frac{1}{4}$ in.		$3\frac{1}{2}$ in.		$3\frac{3}{4}$ in.		4 in.		$4\frac{1}{4}$ in.		$4\frac{1}{2}$ in.		$4\frac{3}{4}$ in.		5 in.		$5\frac{1}{4}$ in.		$5\frac{1}{2}$ in.		$5\frac{3}{4}$ in.		6 in.		$6\frac{1}{4}$ in.		$6\frac{1}{2}$ in.		$6\frac{3}{4}$ in.		7 in.	
	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.
20	5	5	5	0	4	7	4	3	4	0	3	9	3	7	3	4	3	2	3	0	—		—		—		—		—		—		—	
25	6	9	6	3	5	9	5	5	5	1	4	9	4	6	4	3	4	0	3	10	3	8	3	6	3	4	3	2	3	1	—		—	
30	8	2	7	6	7	0	6	6	6	1	5	9	5	5	5	1	4	10	4	7	4	5	4	2	4	0	3	10	3	8	3	7	3	5
35	9	6	8	9	8	2	7	7	7	1	6	8	6	4	6	0	5	8	5	5	5	2	4	11	4	8	4	6	4	4	4	2	4	0
40	10	11	10	1	9	4	8	8	8	2	7	8	7	3	6	10	6	6	6	2	5	11	5	8	5	5	5	2	5	0	4	9	4	7
45	12	3	11	4	10	6	9	9	9	2	8	7	8	2	7	8	7	4	7	0	6	8	6	4	6	1	5	10	5	7	5	5	5	2
50	13	8	12	7	11	8	10	11	10	2	9	7	9	1	8	7	8	2	7	9	7	5	7	1	6	9	6	6	6	3	6	0	5	9
55	15	0	13	10	12	10	12	0	11	3	10	7	10	0	9	5	9	0	8	6	8	2	7	9	7	5	7	2	6	10	6	7	6	4
60	16	5	15	1	14	0	13	1	12	3	11	6	10	11	10	4	9	9	9	4	8	11	8	6	8	2	7	10	7	6	7	3	7	0
65	17	9	16	5	15	3	14	2	13	4	12	6	11	10	11	2	10	7	10	1	9	8	9	3	8	10	8	6	8	2	7	10	7	7
70	19	2	17	8	16	5	15	3	14	4	13	6	12	9	12	1	11	5	10	11	10	5	9	11	9	6	9	2	8	9	8	5	8	2
75	20	6	18	11	17	7	16	5	15	4	14	5	13	8	12	11	12	3	11	8	11	2	10	8	10	2	9	9	9	5	9	1	8	9
80	21	11	20	2	18	9	17	6	16	5	15	5	14	7	13	9	13	1	12	6	11	11	11	4	10	11	10	5	10	1	9	8	9	4
85	23	3	21	6	19	11	18	7	17	5	16	5	15	6	14	8	13	11	13	3	12	8	12	1	11	7	11	1	10	8	10	3	9	11
90	24	8	22	9	21	1	19	8	18	5	17	4	16	5	15	6	14	9	14	0	13	5	12	10	12	3	11	9	11	4	10	11	10	6
95	26	0	24	0	22	3	20	9	19	6	18	4	17	4	16	5	15	7	14	10	14	2	13	6	12	11	12	5	11	11	11	6	11	1
100	27	5	25	3	23	6	21	11	20	6	19	4	18	3	17	3	16	5	15	7	14	11	14	3	13	8	13	1	12	7	12	1	11	8
105	28	9	26	7	24	8	23	0	21	7	20	3	19	2	18	2	17	2	16	5	15	8	14	11	14	4	13	9	13	3	12	9	12	3
110	30	2	27	10	25	10	24	1	22	7	21	3	20	1	19	0	18	0	17	2	16	5	15	8	15	0	14	5	13	10	13	4	12	10
115	31	6	29	1	27	0	25	2	23	7	22	3	21	0	19	10	18	10	18	0	17	2	16	5	15	8	15	1	14	6	13	11	13	5
120	32	11	30	4	28	2	26	3	24	8	23	2	21	11	20	9	19	8	18	9	17	11	17	1	16	5	15	9	15	1	14	7	14	0
125	34	3	31	7	29	4	27	5	25	8	24	2	22	10	21	7	20	6	19	6	18	8	17	10	17	1	16	5	15	9	15	2	14	7
130	35	8	32	11	30	6	28	6	26	8	25	1	23	9	22	6	21	4	20	4	19	5	18	7	17	9	17	1	16	5	15	9	15	3
135	37	0	34	2	31	9	29	7	27	9	26	1	24	8	23	4	22	2	21	1	20	2	19	3	18	5	17	9	17	0	16	5	15	10
140	38	5	35	5	32	11	30	8	28	9	27	1	25	7	24	2	23	0	21	11	20	11	20	0	19	2	18	4	17	8	17	0	16	5
145	39	9	36	8	34	1	31	9	29	10	28	0	26	6	25	1	23	10	22	8	21	8	20	8	19	10	19	0	18	4	17	7	17	0
150	41	2	38	0	35	3	32	11	30	10	29	0	27	5	25	11	24	8	23	6	22	5	21	5	20	6	19	8	18	11	18	3	17	7

Width of Picture

The height of the picture is approximately $\frac{3}{4}$ the width.

GAUMONT-KALEE

Arc Lamp Mirrors

are made by C. A. Parsons & Co. Limited of Newcastle, specialists in the manufacture of silvered glass reflectors for over 50 years. The exclusive rights for world distribution of these mirrors for Cinema Arc-lamps are held by G.B-Kalee Limited.

The mirrors are made from heat-resisting Pyrex glass, in sizes ranging from $5\frac{1}{2}''$ to $16''$ in diameter, for any type of Arc Lamp. The low expansion co-efficient of Pyrex makes it the most useful glass in arc lamps where the reflector is subjected to high temperatures or intense local heating. The co-efficient of light absorption is also comparatively low, resulting in an absolute reflectivity, when silvered, of some 91.%

TYPES OF MIRRORS

The main types of mirrors in use are Ellipsoidal, Paraboloidal and Spherical, and of these the most convenient and efficient is the ellipsoidal. With this type of mirror, the optical system of the projector consists of the mirror and the objective lens; in projectors employing paraboloidal or spherical mirrors, a frontal condenser lens is required in addition to the objective. With Ellipsoidal mirrors, there is no condenser lens to absorb light, and thus more reflected light is utilised upon the screen; there is also no question of condenser breakage.

BENDING

In manufacture, the mirrors are bent accurately to the required shape in temperature-controlled ovens and then cooled in special annealing chambers; afterwards they are ground to remove any surface skin formed during bending, and to present a fresh surface for polishing.

POLISHING

Inside and outside surfaces are next polished with rouge and felt on high-speed machines, after which the mirrors are cut roughly to size, the outside edges are ground smooth to the correct dimensions, and the mirrors are then polished to the brilliant finish required for maximum reflection. The holes are trepanned, and the reflectors cleaned chemically and washed thoroughly in distilled water, ready for silvering.

BACKING

The reflecting surface is provided by a heavy coating of silver backed by a coat of electrically-deposited copper, followed by a final coat of anti-oxidising material; an outside covering serves the dual purpose of distributing heat uniformly over the back of the mirror, and of holding it together in case of breakage.

TESTING

At every stage of production, scientifically controlled tests and inspections are imposed, with automatic rejection of mirrors which fail to pass these exacting tests. Ellipsoidal mirrors are tested for limits of spot-size by placing a small light-source at the primary focus and projecting it on to a screen placed at the secondary focus; paraboloidals are tested for light concentration in a collimated beam and rigidly limited for the size and shape of the resultant spot.

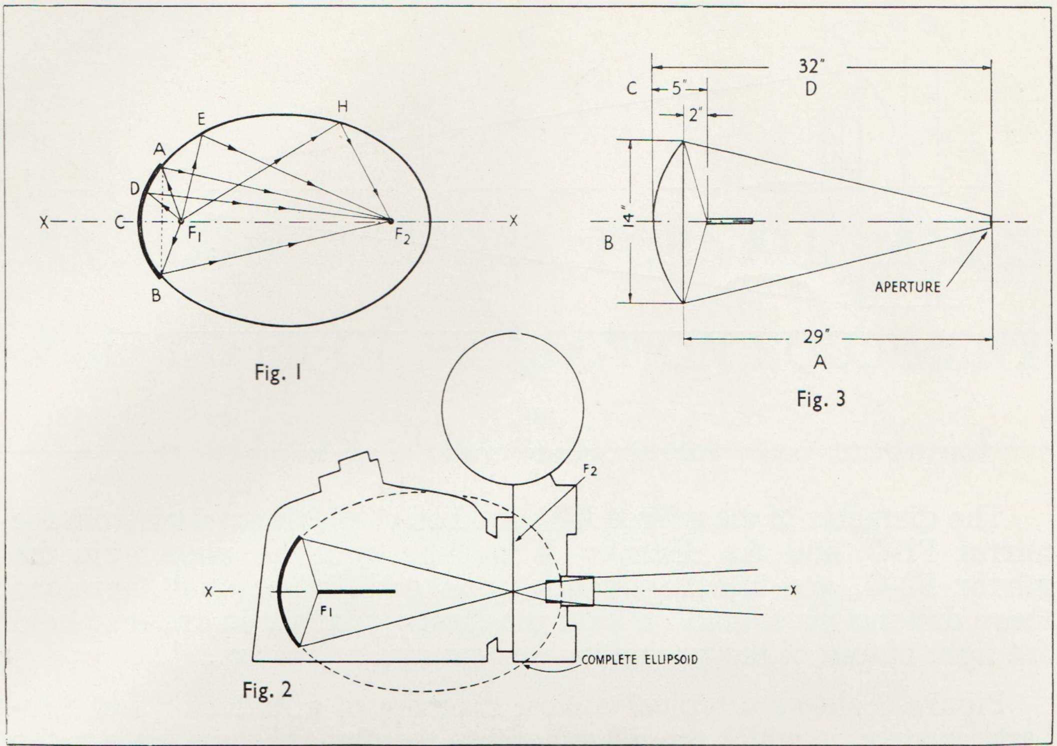


Fig. 1

Fig. 2

Fig. 3

Ellipsoidals

Most modern Arc-Lamps use Ellipsoidal Reflectors; all longitudinal sections of an ellipsoid are elliptical, and all right-angled sections are circular. As shewn in Figure 1, an ellipsoid has two focal points, F1 and F2, on its longitudinal axis X-X. If a reflector were made in the shape of an ellipsoid, any light coming from a light source placed at F1, would be reflected to the other focal point Fs as indicated by the rays F1 to D to F2, F1 to E to F2, etc.

Not all of the ellipsoid can be used as a reflector. Since the carbon crater projects light in one general direction, only the section of the ellipsoid facing the arc is used as a reflector (as indicated by the heavy arc A-C-B, Figure 1). The area, or size, of the reflector will determine the amount of light that will be collected from one focal point and reflected to the other focal point. Accordingly, in the lamphouse the carbon crater is placed at F1 facing the mirror, and the film aperture plate is placed at or near to F2. Figure 2, which is drawn to scale, shews the proper location of a lamphouse and a projector in the complete development of the ellipsoidal optical system.

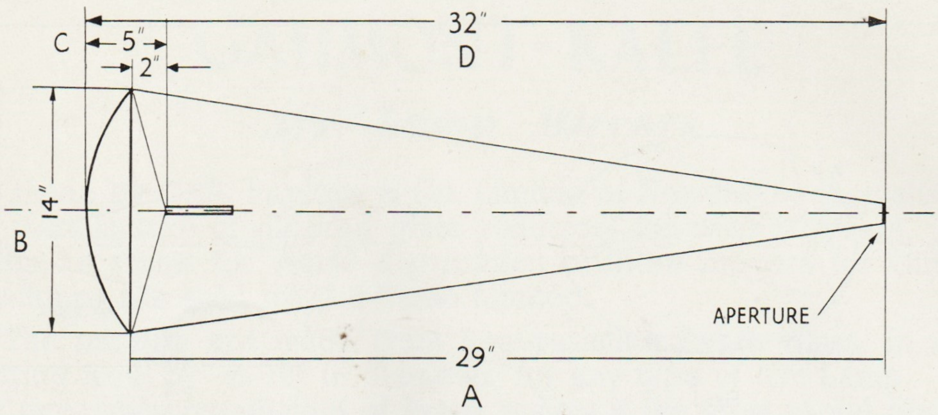


FIG. 3

The diameter of the mirror A-B, the distance of the carbon from the mirror F1-C, and the distance of the film aperture plate from the mirror F2-C, are interdependent upon each other, and therefore these dimensions should be kept practically constant in order to hold the light output of the projection system at a maximum.

Figure 3 shews a typical optical diagram of a Reflector and Arc-Lamp system, in which the distance from the film aperture plate to the rear of the reflector is 32 inches, and the distance from the carbon crater to the rear of the reflector is 5 inches. This indicates that the magnification factor for this system is 32 divided by 5, which equals 6.4. This means that the image of the carbon crater, in being reflected on the aperture plate, will be enlarged 6.4 times. The speed (f. number) of this reflector can be computed by dividing the distance A by the dimension B. In this case, 29 divided by 14 gives a speed of approximately 2.08 (f/2.08). Thus, although it is not current practice to mark the "f. number" upon an arc-lamp mirror, it can be estimated fairly easily.

The tables give the range of standard sizes which can be supplied at very short notice. Other sizes can be manufactured if the relevant data, i.e. diameter and foci are supplied or if a sample reflector is provided.

DIMENSIONS IN INCHES

B Dia.	C Prim. Focus	D Sec. Focus
16″	6″	36″
14″	5″	36″
13½″	5″	31″
13″	4½″	31½″
12″	5″	31″
12″	4¼″	29¼″
12″	4¼″	25″

B Dia.	C Prim. Focus	D Sec. Focus
11½″	5″	31″
10¼″	4¼″	25″
10″	4¼″	25″
10″	3¾″	25″
10″	3½″	25″
8⅛″	4¼″	25″
7⅞″	4¼″	25″

DIMENSIONS IN MM.

B Dia. in mm.	C Prim. Focus in mm.	D Sec. Focus in mm.
406	152	914
356	127	914
343	127	787
330	115	800
305	127	787
305	108	743
305	108	635

B Dia. in mm.	C Prim. Focus in mm.	D Sec. Focus in mm.
292	127	787
260	108	635
254	108	635
254	95	635
254	89	635
206	108	635
200	108	635

ARC-LAMP MIRRORS FOR ALL MAKES AND TYPES OF PROJECTION EQUIPMENT

When ordering, please state make and model of
Arc-Lamp, or dimensions **A,** B and C, Fig. 4
page 12, and also diameter of hole
required in mirror

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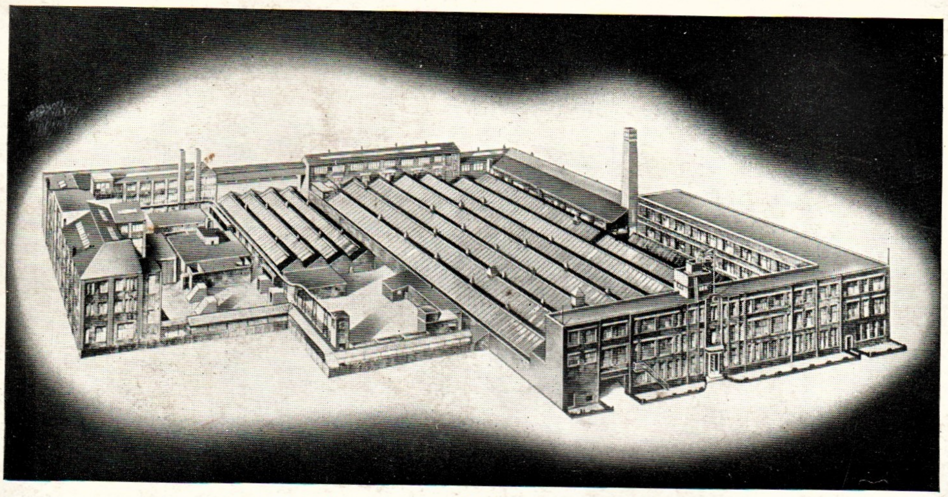

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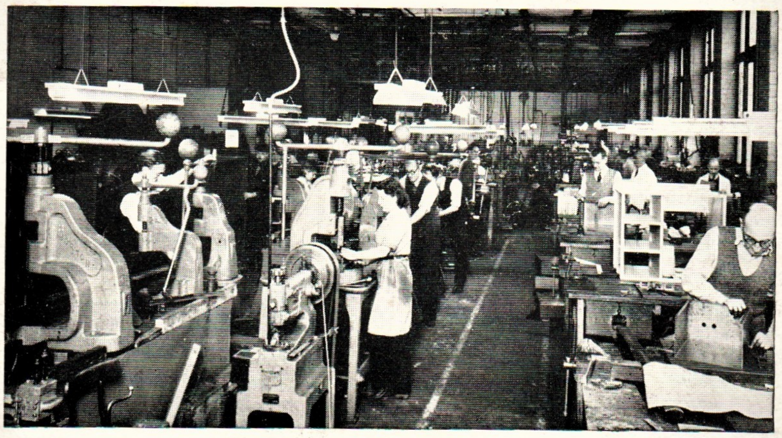

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