"On the Effect of the Spectrum on the Haloid Salts of Silver." By Captain W. de W. Abney, C.B., R.E., D.C.L., F.R.S., and G. S. Edwards, C.E. Received November 26,—Read December 12, 1889.

In 1881 one of us gave, in the 'Proceedings of the Royal Society,' a paper with the same title as the above. Since then, however, he has been able to work out a more exact means of measuring the effect of the spectrum on these salts of silver, and it is our desire now to lay the improved results before the Society.

In January, 1887, one of us read a paper before the Photographic Society of Great Britain, "On the mode of measuring Densities of Photographic Deposits, with some remarks on Sensitometers," and in it alluded to the possibility of measuring the relative sensitiveness of a photographic plate to the different parts of the spectrum. The plan there indicated, with some instrumental improvements, has been employed in the present instance.

The method employed consists in throwing an image of the photographed spectrum on a white screen and measuring the density of the photograph at different points. As the spectrum of sun light abounds in dark Fraunhofer lines, it was evident that the sun would be a very inconvenient source of light by which to form the spectrum. It was also inconvenient on account of the variation in intensity at different times of the year and day in its different parts. After trials of various sources of light we came to the conclusion that the most practical source to employ was the light from gas, burnt in an Argand burner. A somewhat whiter light would have been better, perhaps, since the ultra-violet rays would have been stronger; but it appeared that, taking all things into consideration, the convenience of gas light more than counter-balanced its disadvantages. We may mention that the crater of the positive pole of the electric light was used in some instances; but, as certain minima of action on some of the salts of silver experimented with lay at parts of the spectrum where bright carbon bands were to be found, the main researches were carried out by the aid of gas light.

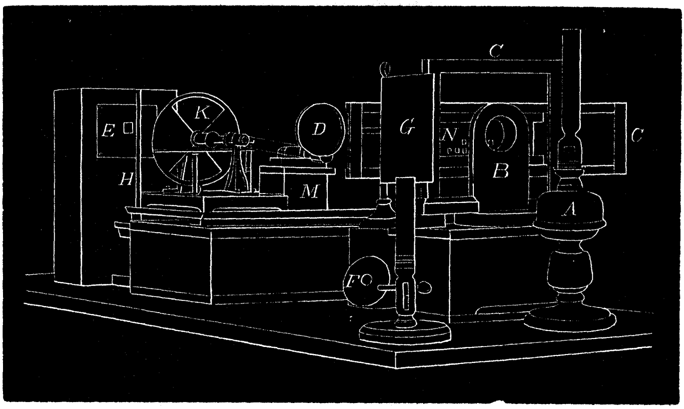
The apparatus employed for photographing the spectrum was that employed in the previous research already alluded to. The two prisms employed were of medium dense white flint, each having an angle of 62°. The collimating lens was of the same material, and the photographic lens was a rapid rectilinear doublet by Dalmeyer, of 16-inch focal length. In some cases one of the lenses of the doublet was dismounted, and the other used as a single lens, giving a focal length of about 30 inches. An image of the gas flame was thrown

on the slit of the collimator, producing a bright image when the slit had a width of $\frac{1}{200}$ of an inch. The bottom half of the slit was closed by a shutter when the gas spectrum was photographed. To know the locality of the part of the gas spectrum impressed, a second spectrum of the electric arc was photographed below the gas spectrum, lithium and sodium being volatilised, to give a sufficient number of fiducial lines. The plate was then withdrawn from the slide and placed in an apparatus by which a series of small square portions of the plate lying parallel and below the last-named spectrum could be exposed at will.

The exposures of this series of squares varied between $3\frac{1}{4}$ seconds and 5 minutes, generally being $3\frac{1}{4}$, $7\frac{1}{2}$, 15, 30, 60, 90, 120, 180, 240, and 300 seconds. The exposure was made to the light from an Argand paraffin lamp placed at 6 feet from the plate. When the height of the flame was kept constant, no practical difference in illumination was found, and no variation was found during a series of exposures if the lamp were allowed to attain a constant temperature by burning ten minutes. The plate thus impressed with the various images was developed in the ordinary manner with the proper developer.

If a gelatine plate were used, ferrous oxalate was usually employed; whilst acidified sulphate of iron was employed if a collodion wet plate were being experimented with. It has not been thought worth while to record all the measurements of the various plates, but a selection has been made of the most important results. It may be remarked that only 5 per cent. addition of bromo-iodide of silver to a bromide of silver emulsion sufficed to shift the place of maximum sensitiveness of the plate from the blue towards the green, as shown in the diagram. After development the plates were fixed as usual and dried, and were then ready for measuring. The following diagram shows the apparatus employed for the measurement, the description of which is taken from a previous paper by one of us.

A is the source of light—gas, paraffin, or other lamp; B is a lens of about 9 inches focus, used as a condenser; C is a double frame for carrying the negative, N, which has an upward and side motion, so that any part of the negative may be brought in front of the condenser; D is a lens on a stand, used to focus the negative on the screen E, which is black except one small square, as shown, where the image of the part to be measured is thrown; F is one of a series of diaphragms used with D for the purpose of sharpening the image and reducing its brightness when required; H is the rod used to cast the shadow on the white patch; G is a flat mirror reflecting a beam also on E; K is the rotating apparatus placed in the path of the light reflected from G, to diminish it at pleasure; M is the small electromotor which drives K. The rod H is so placed that the shadows



cast by the beam from G, and coming through the negative, just touch, and the two are equalised in brightness by means of opening more or less the rotating sectors K.

The negative to be measured was marked with a scale of $\frac{1}{24}$ inches, and, in cases of sudden change of density, to less. It was then placed in the measuring apparatus and measurements commenced. When the square patches were measured, a thickish rod was employed, but for the photographed spectrum a knitting needle, $\frac{1}{8}$ of an inch thick, was substituted. The opacities of the different parts of the film were calculated from where the negative showed "no deposit," and the opening of the sectors when the direct and reflected light balanced was taken as the standard. The required opening of the sectors showed but little variation for any of the photographs.

The scale of density corresponding to different times of exposure was plotted from the readings of squares, and the readings of the different parts of the photographed spectra were applied to the curve so derived, and the density corresponding to the times of exposure tabulated. From the photographed spectrum of the arc the positions of the different measured densities were known and the curve with the reference Fraunhofer lines plotted in the usual manner. From these curves the curves for the normal or wave-length spectrum were calculated, and it is these curves which are shown in the accompanying figures.

Reverting to the paper to which we have referred ('Roy. Soc. Proc.,' No. 217, 1881), it will be seen that the figures therein shown differ from those here given. This is caused by the fact that the former curves were only eye estimations of density, whilst the latter are the comparative sensitivenesses derived from measured densities.

That the former are not in great error will be seen by comparing the place of maximum density of the former with the place of maximum sensitiveness of the latter.

It may be well to remark here on one point to which objection might be taken in the results. It has been assumed in making the scale that length of exposure is equivalent to the intensity of the light. This is not a hasty assumption, but has been carefully tested. When the exposure is but the minute fraction of a second, then the substitution of length of exposure for intensity does not apparently hold good; but, when the exposures are such as are given to the scale, the substitution is perfectly legitimate.

In the following tables the curves of the simple haloid salts of silver are given, as well as mixtures of two or more, and also double salts. Where double salts of silver are shown they were prepared by mixing the alkaline salts in proper equivalent proportions, and then emulsifying in gelatine or collodion by adding the requisite amount of silver nitrate to them. Where simple mixtures are shown, emulsions containing the proper equivalent amount of the silver salts were prepared and subsequently mixed. It has been deemed desirable to give the values for the haloid salts when stained with certain dyes, such as are usually employed in rendering photographic plates what is termed isochromatic. Attention is called to the fact that a mixture of solutions of two dyes does not render the salts of the same sensitiveness to different parts of the spectrum as do the two dyes if applied separately, washing taking place between the application of each. For erythrosin Mallman's well known formula was used to obtain the coloured solution. The erythrosin was obtained from Germany, and showed only traces of fluorescence. The cyanin was obtained from Messrs. Hopkin and Williams, and appears to be made after Greville Williams' formula. When cyanin was employed, 5 grains was dissolved in 1 oz. of alcohol, and water added to make up to 2 ozs. This solution was poured over the plate, which was then allowed to dry. The plate was then washed with equal parts of spirit and water, and finally with water, and then exposed to the spectrum. Similar results were obtained whether the film was dry or moist.

[In all the tables except VII, VIII, IX, X, XV, and XVI, the following are the points on the scale numbers of the principal Fraunhofer lines: H, 13·8; G, 10·9; Li, 9; F, 7·6; E, 6·0; D, 4·3; Li, 2·8.

In Tables VIII and IX the following are to be substituted: H, 14·0; G, 11·0; Li, 9·0; F, 7·7; E, 6·2; D, 4·6; Li, 3·1.

In Tables VII, X, XV, and XVI the following are to be substituted: H, 6·7; G, 9; Li, 10·7; F, 12·1; E, 13; D, 14·3; Li, 15·7. —Feb. 10, 1890.]

Table I.

AgBr. (Collodion plate.) See Fig. 1 (p. 269).

Scale number.	Mean sector reading.	Opacity.	Relative sensitiveness.	Reduced to maximum of 100.	Ordinate of curve to wave-length scale.	Scale.		
						Exposure.		Sector reading.
						mins.	secs.	
Bare glass	79							
8	75	4	2	1	0¾	5	0	5
8½	56	23	16	8	..	4	0	5½
8¾	34½	44½	42	21	..	3	0	9
9	25	54	63	32	33	2	0	13
9¼	15	64	104	53	..	1	30	19
9½	12	67	140	71	..	1	0	26
10	8½	70½	188	96	92		30	43½
10½	8	71	197	100				
10¾	..	..	..	..	100		15	59½
11	8	71	197	100	99			
11½	8⅓	71	192	98	97		7	66½
12	10	69	165	85	87			
12½	11	68	150	76				
13	12½	66½	134	67	68			
13½	15	64	104	53				
13¾	..	..	..	..	43			
14	20	59	80	41				
14¼	24	55	73	37				
14½	28	51	55	28				
14¾	32½	46½	45	23				
15	37	42	39	20	20			
15¼	42	37	32	16				
15½	47	32	26	13				
15¾	51	28	21	11				
16	55	24	17	9	9			
16½	61	18	12	6				
17	65	14	8	4	4			
17½	70	9	4	2				
18	73	6	3	1½	1½			
18½	74½	4½	2	1				
19	76	3	1	0½	1			

H is 13·8 ; G is 10·9 ; Li is 9.

Table II.

AgCl. (Gelatine plate.) See Fig. 2.

Scale number.	Mean sector reading.	Opacity.	Relative sensitiveness.	Reduced to maximum of 100.	Ordinate of curve to wave-length scale.	Scale.		
						Exposure.		Sector reading.
						mins.	secs.	
Bare glass	73½							
10½	..	..	..	..	1		15	72¾
11	73½	..	..	..	6		30	66¼
11½	72	1½	17	20	19	1	0	43⅓
12	66	7½	30	35	34	1	30	23
12½	60½	13	37½	44	43	2	0	11
13	54½	19	45	53	52			
13¼	51	22½	50	59	58			
13½	44½	29	58½	69	69			
13¾	39	33½	66	78	78			
14	33	40½	75	88	88			
14¼	29	44½	81	95	95			
14½	28	44½	82½	97	97			
14¾	26	46½	85½	100	100			
15	29	43½	81	95	95			
15¼	33	39½	75	88	88			
15½	39	33½	66	78	79			
15¾	45½	28	57	67	67			
16¼	48	24½	54	64	65			
16	53	19½	47	55	57			
16½	56	16½	43	50	51			
17	59½	14	39	46	47			
17½	67	5½	28	33	34			
18	72	1½	17	20	20			
18½	73½	..	..	..	10			
19	..	..	..	..	5			

Table III.

Ag_2BrI. (Gelatine plate.) See Fig. 3.

Scale number.	Mean sector reading.	Opacity.	Relative sensitiveness.	Reduced to maximum of 100.	Ordinate of curve to wave-length scale.	Scale. Exposure.		Scale. Sector reading.
						mins.	secs.	
Bare glass	75					6	0	17
13	75	0	0	..	..	5	0	15
13½	69	6	3	3½	3½	4	0	16
14	58	17	7	8	8	3	0	18
14½	44	31	16	19	19	2	0	19
15	35½	39½	28	33	33	1½	0	21
15½	28	47	48	57	57	1	0	25
16	24	51	64	76	76		30	35
16½	23	52	71	84	84		15	46
17	22	55	77	91	91		10	51
18	21	54	85	100	100		5	64½
19	21	54	85	100	100			
20	22	53	77	91	91			
21	25	50	60	71	71			
22	28	47	48	57	57			
23	30½	44½	40	47	47			
24	34	41	31	37	37			
25	38	37	24	28	28			
26	42	33	18	21	21			
27	47	28	13	15	15			
28	52	23	10	12	12			
29	60	15	6	7	7			
29½	62	13	5½	6½	6½			
30	65½	9½	4	4¾	4¾			
30½	67	8	3½	4	4			
31	70	5	2	2½	2½			
31½	71	4	1½	1¾	1¾			
32	72½	2	1	1	1			

Table IV.

$Ag_2Br.Cl$. (Gelatine plate.) See Fig. 4.

Scale number.	Mean sector reading.	Opacity.	Relative sensitiveness.	Reduced to maximum of 100.	Ordinate of curve to wave-length scale.	Scale. Exposure.	Scale. Sector reading.
						mins.	
Bare glass	72						
9	71	1	28	23	23	5	17
10	63	9	49	41	41	4	25
10½	44	28	84	70	70	3	41
11	29	43	112	94	94	2	57
11½	25	47	120	100	100	1½	65
12	29	43	112	94	95	1	71
12½	30	42	110	91	91		
13	37	35	97	81	81		
13½	47	25	79	66	66		
14	58	14	58	48	48		
14½	68	4	38	32	32		
15	71	1	28	23	23		

Table V.

$\frac{3}{4}$ AgBr, $\frac{1}{4}$ AgI } Gelatine plate. See Fig. 5.

Scale number.	Mean sector reading.	Opacity.	Relative sensitiveness.	Reduced to maximum of 100.	Ordinate of curve to wave-length scale.	Scale. Exposure.		Sector reading.
						mins.	secs.	
Bare glass	75							
3	73	2	3	2	..	4	0	9
3½	66½	8½	6½	4	0·75	3	0	9
4	63	12	9½	6	5·5	2	0	12
5	55	20	15½	10	9	1	35	14½
6	52	23	17½	12	11	1	0	22
6½	46	29	22½	15	..		30	37½
7	44	31	24	16	15		15	56
7½	38	37	29½	17	16		7	66
7¾	35	40	33	..	..		3	73
8	29	45	42½	26½	27		1⅔	71½
8¼	22	53	60	42½				
8½	18	57	75	53½	54		0	75
9	13	62	108	77½				
9½	10½	64½	140	94				
10	10	65	150	100	100			
10½	11	63½	132	88	95			
10¾	13½	61½	104	70	71			
11	14½	60½	95	76	63			
11½	17	58	80	50	54			
12	18	57	75	50	51			
12½	18⅔	56⅓	67	46				
13	20½	54½	65	43	44			
13½	22½	52½	58	39	40			
14	28½	46½	43	29	31			
14½	34	41	34	22½				
15	43	32	25	16½	19			
15½	52	23	17½	12				
16	56½	18½	14	9	9			
17	69	6	5	3½	3			
18	70	5	4½	3	3			
19	74	1	1	⅔	1			

Table VI.

½ AgBr, ½ AgI } Gelatine plate. See Fig. 6.

Scale number.	Mean sector reading.	Opacity.	Relative sensitiveness.	Reduced to maximum of 100.	Ordinate of curve to wave-length scale.	Scale. Exposure.		Scale. Sector reading.
						mins.	secs.	
Bare glass	79							
2	78	1	½	¾	..	4	0	9½
3	73½	5½	1½	2	2	3	0	11
3½	67	12	4	5½	..	2	0	12
4	63	16	5	7	6	1	30	15
4½	60½	18½	6	8½	..	1	0	18½
5	56	23	7½	10½	9		30	29
5½	53½	25½	8	11	..		15	42
6	50	29	9½	13	12		7	59
6½	49½	29½	9½	13	..		5	63½
7	50	29	9½	13	13		3	70
7½	47½	31½	11	15	15		0	79
8	38	41	17½	24½	23			
8¼	29	50	30	41				
8½	25	54	37½	52	51			
9	18½	50½	62	87	86			
9½	17	62	72	100	100			
10	17½	61½	69	96	96			
10½	20½	58½	52	72	73			
11	23	56	37	51	56			
11½	26	53	36	50				
12	27	52	33½	46½	48			
12½	28	51	32	44½				
13	31	48	26	36	38			
13½	33	46	23	32				
14	39	40	16½	23	24			
14½	44	35	13	18				
15	52	27	8½	12	13½			
15½	59	20	6½	9				
16	64	15	5	7	7			
16½	68½	10½	3½	5				
17	70	9	3	4	4			
18	72½	6½	2	2¾	2½			
19	76	3	1	1½	1½			

Table VII.

¾ AgCl, ¼ AgI } Gelatine plate. See Fig. 7.

Scale number.	Mean sector reading.	Opacity.	Relative sensitiveness.	Reduced to maximum of 100.	Ordinate of curve to wave-length scale.	Scale.		
						Exposure.		Sector reading.
						mins.	secs.	
Bare glass	77½							
4	72½	5	25	10	..	4	0	18
4½	69	7½	38	15	..	3	0	26
5	68	9½	41	16	..	2½	0	35
6	59½	18	67	26	..	2	0	40
7	52	25½	88	34	..	1½	0	52
8	46	31½	104	40	..	1	0	66
9	43	34½	112	43	..		30	69
9½	38½	39½	127	49	..		15	76
10	34	43½	145	56	..		0	77½
10¼	32	45½	155	60				
10½	29	48½	170	65				
10¾	40½	37	118	70				
11	54	23½	83	32				
11½	62	15½	60	23				
12	60	17½	66	25				
12½	51½	26	90	35				
13	42	35½	115	44				
13½	33	44½	150	58				
14	23½	54	199	77				
14½	17	60½	248	95				
15	16	61½	260	100				
15½	19	58½	232	89				
16	22½	55½	212	82				
16½	24	53½	195	75				
17	28	49½	175	68				
17½	37	40½	133	52				
18	42	35½	116	45				
18½	56½	21	76	29				
19	65	12½	51	20				
20	74½	3	17	7				

Table VIII.

$\frac{3}{4}$AgCl, $\frac{1}{4}$AgBr } Gelatine plate. See Fig. 8.

Scale number.	Mean sector reading.	Opacity.	Relative sensitiveness.	Reduced to maximum of 100.	Ordinate of curve to wave-length scale.	Scale.	
						Exposure.	Sector reading.
Bare glass	75					sec.	
8	69½	5½	17	9	8	380	9
8½	47	28	45	23	22	300	10½
8¾	36	39	60	31	30	240	12
9	20	55	94	49	48	180	22
9½	12½	62½	118	61	61	120	36
10	9	66	190	99	99	90	46½
10¼	..	..	194	100	100	60	60
10	9	66	190	99	100	30	70
11	10	65	165	85	86	15	75½
12	11½	63½	126	65	69	0	76
13	12	63	120	62	64		
14	17	58	102	53	55		
14¼	19	56	97	50	52		
14½	24	51	85	44	46		
14¾	27	48	78	40	41		
15	35	40	·62	32	33		
15¼	39	36	55	29	30		
15½	47	28	45	23	24		
15¾	51	24	40	21	22		
16	57	18	33	17	18		
16½	64	11	25	13	14		
17	65½	9½	23	12	13		
17½	69	6	18	9	10		
18	71	4	15	8	9		

Table IX.

$\frac{3}{4}$ AgBr, $\frac{1}{4}$ AgCl } Gelatine plate. See Fig. 9.

Scale number.	Mean sector reading.	Opacity.	Relative sensitiveness.	Reduced to maximum of 100.	Ordinate of curve to wave-length scale.	Scale. Exposure. mins.	Scale. Exposure. secs.	Scale. Sector reading.
Bare glass	74							
8	73	1	7	6	6	6	0	5
8¼	72	2	8½	7	7	5	0	6
8½	56½	17½	18	14	14	4	0	7
8¾	43	31	23	19	19	3	0	8
9	18	56	43	35	34	2	0	11
9½	9	65	71	58	58	1½	0	17
10	7	67	120	99	99	1	0	30
10¼	..	..	122	100	100		30	64½
11	9	65	71	58	60		0	74
11½	8	66	90	74	75			
11¾	9	65	71	·58	59			
12	12	62	57	47	48			
12½	11	63	60	49	51			
13	16	58	47	39	40			
13½	20	54	40	33	34			
13¾	24	50	35	29	30			
14	31	43	29	24	25			
14¼	35	39	26	21	21			
14½	46	28	21	17	18			
14¾	51	23	20	16	17			
15	60	14	17	14	14			
15½	66	8	14	11	11			
15¼	69	5	12	10	10			
16	72	2	8	7	7			

Table X.

AgBr stained with Erythrosin. (Gelatine plate.) See Fig. 10.

Scale number.	Mean sector reading.	Opacity.	Relative sensitiveness.	Reduced to maximum of 100.	Ordinate of curve to wave-length scale.	Scale.	
						Exposure.	Sector reading.
						secs.	
Bare glass	110						
4	100	10	1	1	1	120	107·5
5	80	30	4	4·4	5	100	12
6	59	51	7·5	8·5	10	90	13
7	39	71	17	19	21	80	14·25
8	33	77	23	26	31	60	18
9	27	83	13	14·3	15·5	50	20·5
10	25·5	84·5	37	40·7	43·5	40	24
10½	35	75	30	33	35	30	28
11	53	57	21	23	24·5	20	35
11½	59	51	7·5	8·5	8·5	15	43
12	44	66	14	15·4	16	10	53
12½	25·5	84·5	37	40·7	42	5	69
13	15	95	74	82	83	0	110
13½	13	97	19	100	100		
14	35	75	21	23	23		
14½	86	24	6	6·6	6		
15	108	2	0·5	0·5	0·3		

Table XI.

$\left.\begin{array}{l}\frac{3}{4}\ AgBr \\ \frac{1}{4}\ AgI\end{array}\right\}$ Dyed with Erythrosin. See Fig. 5.

Scale number.	Mean sector reading.	Opacity.	Relative sensitiveness.	Reduced to maximum of 100.	Ordinate of curve to wave-length scale.	Scale.	
						Exposure.	Sector reading.
Bare glass	78					mins. secs.	
4¼	48	30	10	12½	12	2 0	17½
4½	32	46	26	32½	27	1 30	19½
4¾	23½	54½	57	71	..	1 0	24½
5	20	58	82	100	100	30	30
5¼	26	52	45	56	..	15	40½
5½	34½	43	22	27	28	10	48
5¾	47	31	10½	13	..	5	70½
6	55	23	7½	9½	9	0	78
6¼	61	17	6½	8			
6½	64	14	6	7½	7		
7	68	10	5½	7			
8	69½	8½	5	6¼	7		
8¼	64½	13½	6	7½			
8½	57	21	7	8¾			
9	45	33	11½	14¼	15		
9¼	40½	37½	15	18¾			
9½	37	41	19½	24	26		
10	36½	41½	19	23½	25		
10½	40	38	15	18¾			
10¾	44	34	12	15			
11	47½	30½	10	12½	14		
11½	52	26	8½	10½			
12	54½	23½	7½	9½	10½		
12½	57	21	7	8¾			
13	59	19	7	8¾	10		
13¼	63	15	6½	8			
13½	65	13	6	7½			
14	69	9	5½	7	8		
14½	73	5	4	5			
15	76	2	2	2½	3		
15½	76½	1½	1½	2			

Table XII.

$\left.\begin{array}{l}\frac{1}{2}AgBr\\ \frac{1}{2}AgI\end{array}\right\}$ Dyed with Erythrosin. See Fig. 6.

Scale number.	Mean sector reading.	Opacity.	Relative sensitiveness.	Reduced to maximum of 100.	Ordinate of curve to wave-length scale.	Scale.		
						Exposure.		Sector reading.
						mins.	secs.	
Bare glass	75							
4½	35½	39½	31	21½	18	4	0	25
4¾	29½	45½	77	53	..	3	0	27⅓
5	28	47	145	100	100	2	0	28¾
5¼	34	41	36	25	..	1	30	29
5½	43	32	20	14	14	1	0	30¾
5¾	53	22	12½	8½	..		30	36
6	56	19	11	7½	8		15	48¾
6¼	64	11	8	12	..		10	58½
6½	64	11	8	12	12		5	71
6¾	67	8	6½	4½			0	75
7	71	4	5	3½	3			
7½	71	4	5	3½	3			
8	69	6	6	4	4			
8½	63	12	8½	6				
9	57	18	10½	7	7			
9¼	55	20	11½	8				
9½	53	22½	12½	8½				
9¾	54½	20	11½	8				
10	52	23	13	9	10			
10¼	55	20	11½	8				
10½	58	17	10	7				
10¾	63	12	8½	6				
11	63	12	8½	6	6			
11¼	66	9	7	5				
11½	67	8	6½	4½				
12	68	7	6	4	4			
12½	69	6	6	4				
13	70	5	5	3½	3			
14	73	2	4	2¾	2½			
15	74½	½	1	¾	¾			

Table XIII.

AgCl dyed with Erythrosin. (Gelatine plate.) See Fig. 11.

Scale number.	Mean sector reading.	Opacity.	Relative sensitiveness.	Reduced to maximum of 100.	Ordinate of curve to wave-length scale.	Scale. Exposure.		Scale. Sector reading.
						mins.	secs.	
1	250	0·2	6	0·4	0·5			22
2	240	0·45	16	1	1	5	0	93
3	232	0·8	24	2	2	4	0	27½
4	208	1·4	48	3	3·5	3	0	57
5	192	2	64	4·3	4·5	1	0	83
6	176	3	80	6·4	7	½	0	108
7	220	1	36	2·2	2·4	¼	0	132
8	245	0·25	11	0·5	0·4	⅛	0	150
9	256	0	0	0	0		5	176
11	256	0	0	0	0		3	
11½	192	2	64	4·3	4·5			
12	160	4·5	96	10	10			
12½	128	8	28	27	17			
13	84	30	72	65·1	65			
13½	66	46	90	100	100			
14	99	20	157	43·4	43			
14¼	192	2	64	4·3	4			
14½	220	1	36	2·2	2			

Table XIV.

$\left.\begin{matrix}\frac{3}{4}AgBr \\ \frac{1}{4}AgI\end{matrix}\right\}$ Dyed with Erythrosin and Cyanin. See Fig. 12.

Scale number.	Mean sector reading.	Opacity.	Relative sensitiveness.	Reduced to maximum of 100.	Ordinate of curve to wave-length scale.	Scale.		
						Exposure.		Sector reading.
						mins.	secs.	
Bare glass	47							
2	43	4	2	9½	9	1	0	8
2½	40	7	3½	16	16	0	30	10⅔
2¾	34½	12½	7	32½	30½	0	15	23½
3	27	20	12½	58	61	0	10	30
3½	17	30	21½	100	100	0	5	37¼
4	23	24	15½	72	73	0	0	47
4¼	23	24	15½	72	74			
4½	23½	23½	15	70	65			
4¾	19	28	19	88	91			
5	20	27	18	84	88			
5¼	30	17	10	46	48			
5½	33	14	8	37	38			
5¾	35	12	6½	30	31			
6	37	10	5	23	25			
6½	36½	10½	5½	25	27			
7	38½	8½	4½	21	23			
7½	40	7	3½	16	18			
8	40	7	3½	16	18			
8½	36	11	6	28	30			
9	32½	14½	8½	39	42			
9½	28	19	11½	53	56			
10	28	19	11½	53	56			
10½	29½	17½	10	46	48			
11	32	15	8½	39	42			
11½	34	13	7	32	30			
12	34	13	7	32	30			
13	34	13	7	32	17			

Table XV.

Edwards' Isochromatic Plate. See Fig. 13.

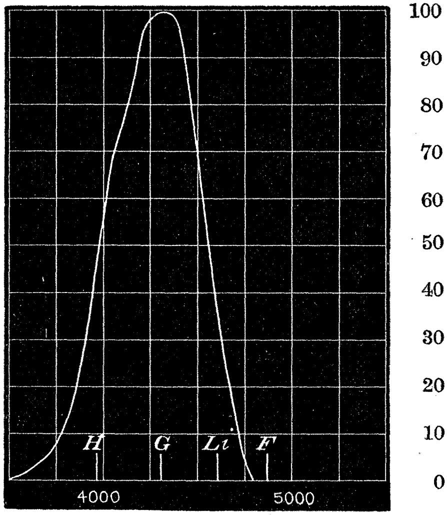
Scale number.	Mean sector reading.	Opacity.	Relative sensitiveness.	Reduced to maximum of 100.	Ordinate of curve to wave-length scale.	Scale.	
						Exposure.	Sector reading.
						secs.	
5	130	8	2	1·7	2	180	16
6	128	10	3	2·5	2·5	120	22
7	120	18	5	4·4	4·5	100	29
7½	112	26	7	6	6	80	42
8	106	32	9	7·8	8·5	60	16
8½	100	38	11	9·6	10	50	22
9	75	63	19	16·6	18	44	30
9½	63	75	22·5	19·8	21·5	30	44
10	50	88	27·5	24	25	25	56
10½	46	92	29	25·4	27	20	72
11	50	88	27·5	24	25	15	88
11¼	66	72	22	19·2	20	10	104
11½	78	60	18	15·8	16	5	120
12	90	48	14·5	12·6	12·5	0	138
12¼	74	64	19·5	17	17		
12½	53	85	26·5	23	23·5		
12¾	26½	111½	44	39·5	40		
13	17½	120½	57	50	50		
13¼	6	132	102	91	92		
13½	5¾	132¼	115	100	100		
13¾	6½	131½	106	92·5	93		
14	10	128	83	72·5	71		
14¼	63	71	22·5	19·6	19		
14½	120	18	5	4·7	4		
15	138						

Table XVI.

Edwards' Isochromatic Plate treated with Cyanin. See Fig. 14.

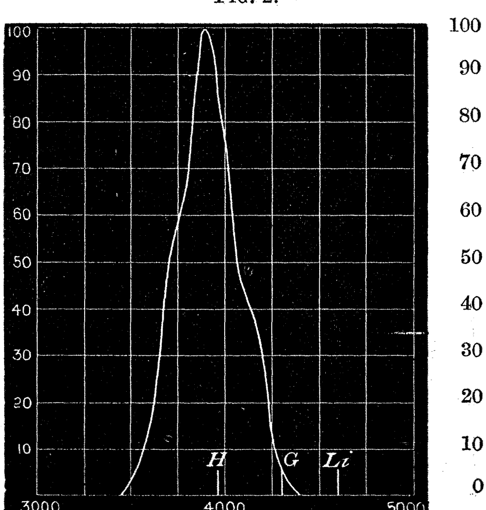
Scale number.	Mean sector reading.	Opacity.	Relative sensitiveness.	Reduced to maximum of 100.	Ordinate of curve to wave-length scale.	Scale.	
						Exposure.	Sector reading.
						secs.	
5	96	10	2	3·5	4	90	3
6	92	14	2·5	4	4·1	80	4
7	79	27	5	8	8·5	60	6
8	64	42	8·5	11	12	50	7·5
9	42	64	14	22	25	40	10
9½	32	74	18	29	17·5	30	16
10	23	83	23·5	37	41	20	28
11	19	87	26·5	42·5	47	15	40
11¼	23	83	23·5	37·5	41	10	57
11½	29	77	19·5	31	33	5	79
11¾	36·5	69·5	16	26	28	0	106
12	39	67	15·5	25	26·5		
12½	33·5	72·5	17	27·5	29		
12¾	26·5	79·5	21	33·5	36		
13	18	88	27·5	44·5	46		
13¼	11	95	38	61·5	64		
13½	6¾	99¼	55	88	92		
13¾	7	99	53	84·5	89		
14	9	97	44	69·5	72		
14¼	9	97	44	69·5	70·5		
14½	6¼	99¾	58	93	94·5		
14¾	5½	100½	63	100	100		
15	10	96	40	63	63		
15¼	24	82	23	37·5	37		
15½	41	65	14·5	22·5	22		
15¾	71	35	7	11·5	11		
16	86	20	3	5	4·5		

FIG. 1.



AgBr.

FIG. 2.

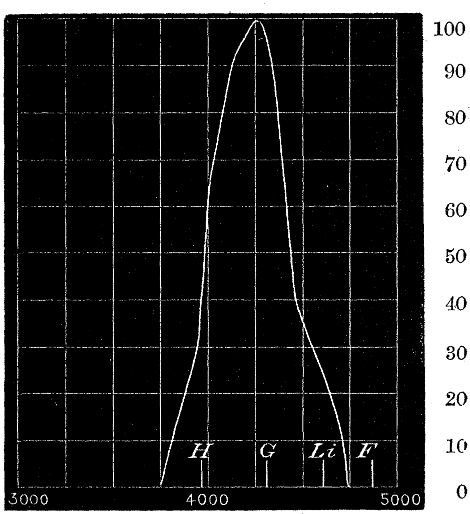


AgCl.

FIG. 3.

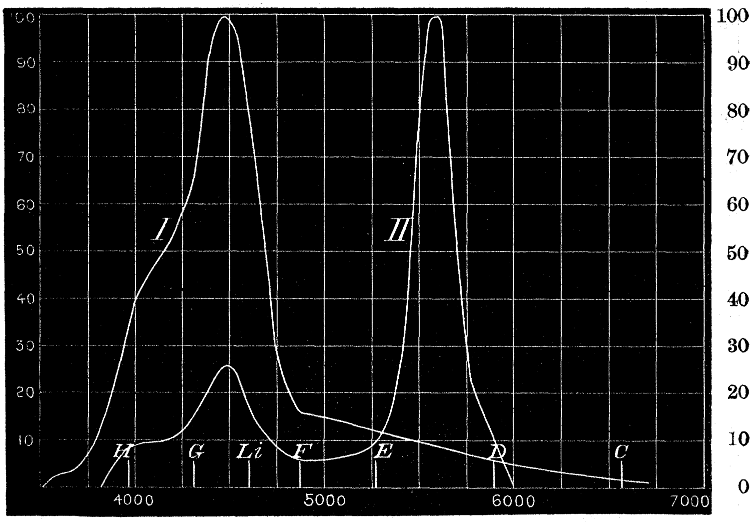
Ag_2BrI.

FIG. 4.



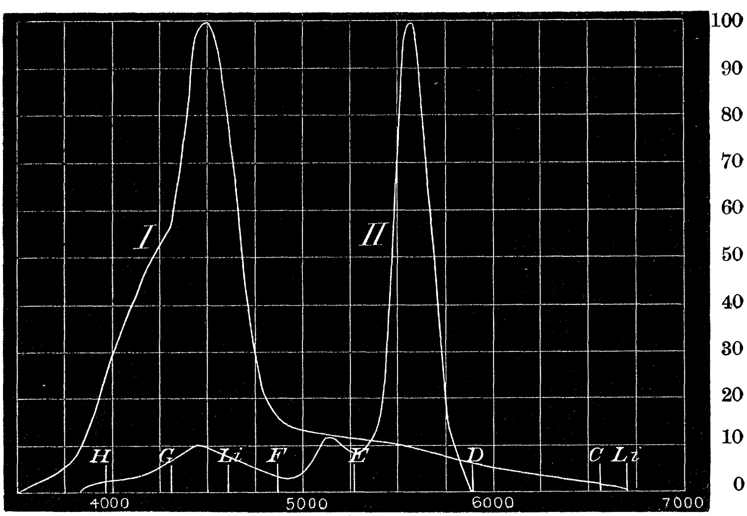
Chloro-bromide.

FIG. 5.



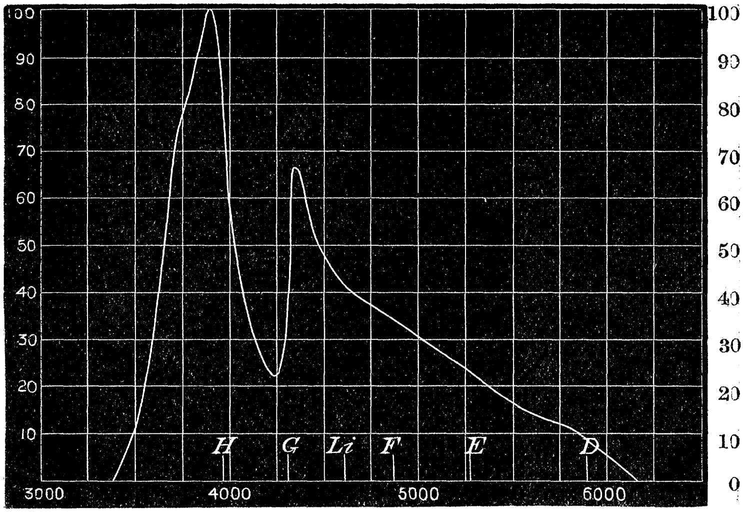
I is $\frac{3}{4}$AgBr, $\frac{1}{4}$AgI   II is $\frac{3}{4}$AgBr, $\frac{1}{4}$AgI } Dyed with erythrosin.

FIG. 6.



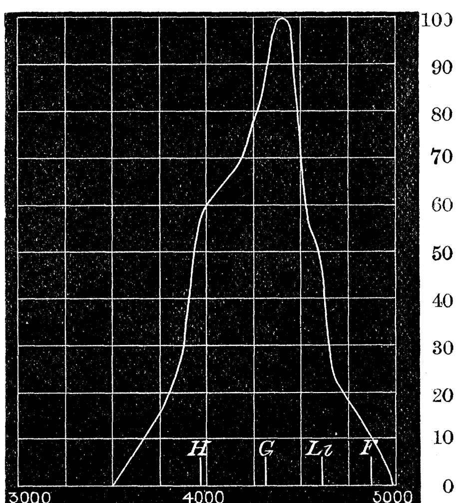
I is $\frac{1}{2}$AgBr, $\frac{1}{2}$AgI   II is $\frac{1}{2}$AgBr, $\frac{1}{2}$AgI } Stained with erythrosin.

Fig. 7.



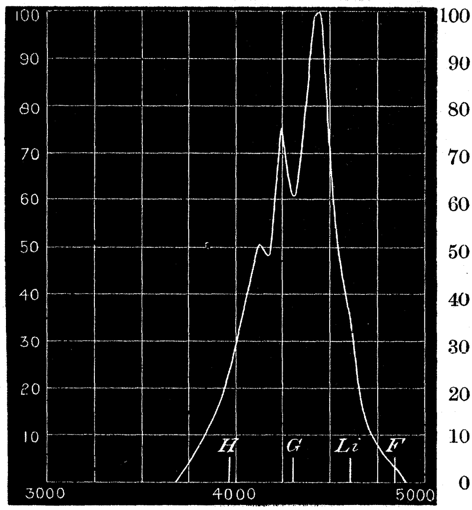
$\left.\begin{array}{l}\frac{3}{4}AgCl\\ \frac{1}{4}AgI\end{array}\right\}$

Fig. 8.



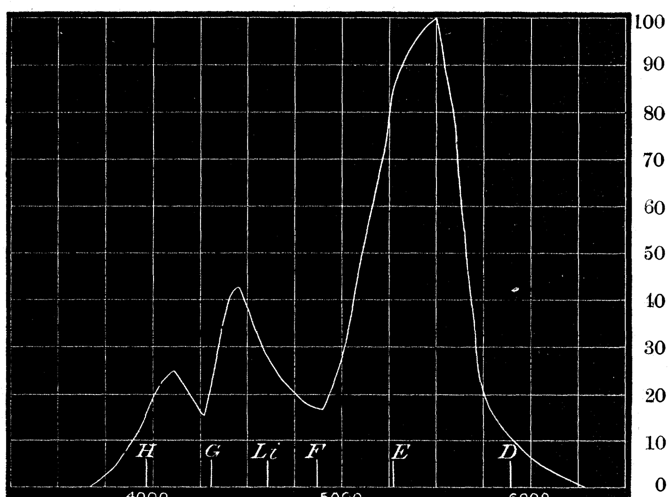
$\left.\begin{array}{l}\frac{3}{4}AgCl\\ \frac{1}{4}AgBr\end{array}\right\}$

FIG. 9.



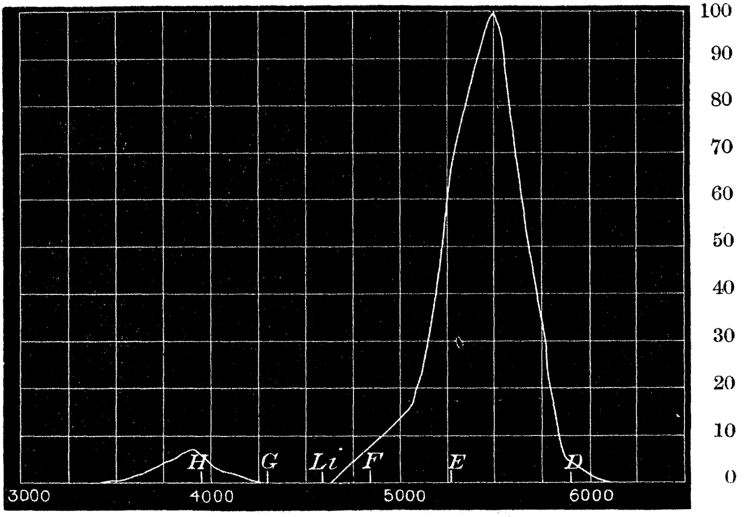
$\left.\begin{array}{l}\frac{3}{4}AgBr\\ \frac{1}{4}AgCl\end{array}\right\}$

FIG. 10.



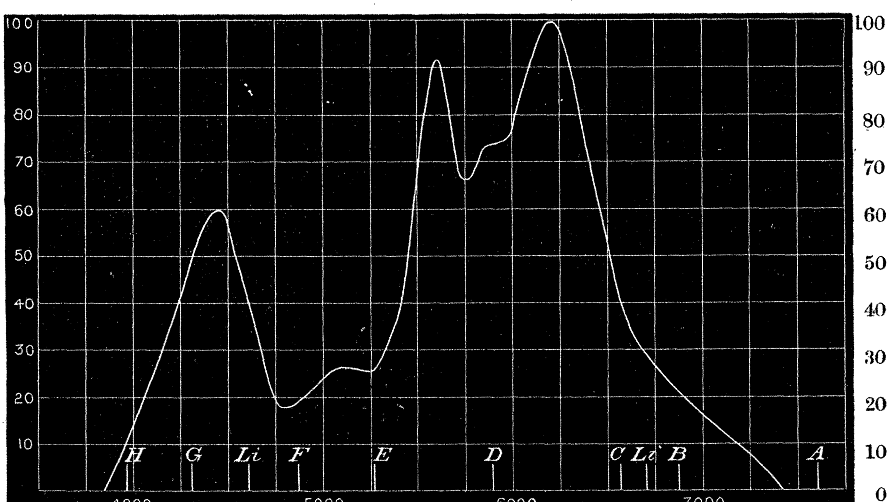
AgBr stained with erythrosin.

FIG. 11.



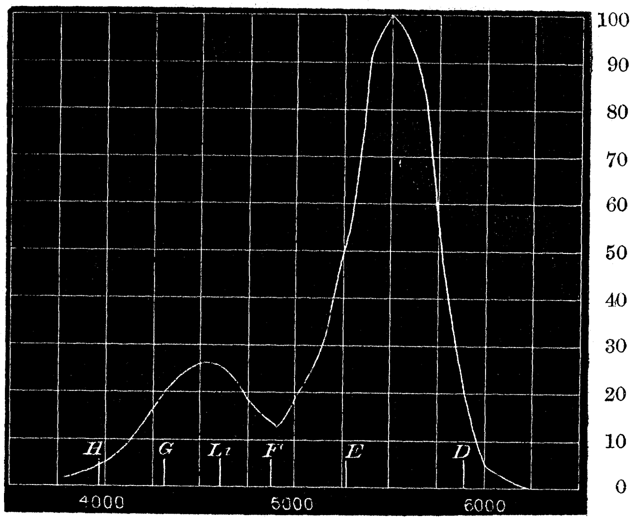
AgCl stained with erythrosin.

FIG. 12.



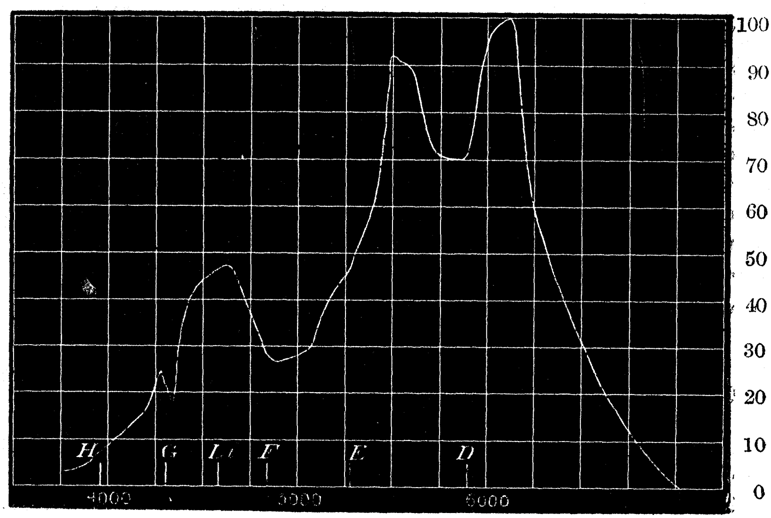
$\frac{3}{4}$AgBr, $\frac{1}{4}$AgI } Stained with erythrosin and cyanin.

FIG. 13.



Edwards' isochromatic.

FIG. 14.



Edwards' isochromatic treated with cyanin.

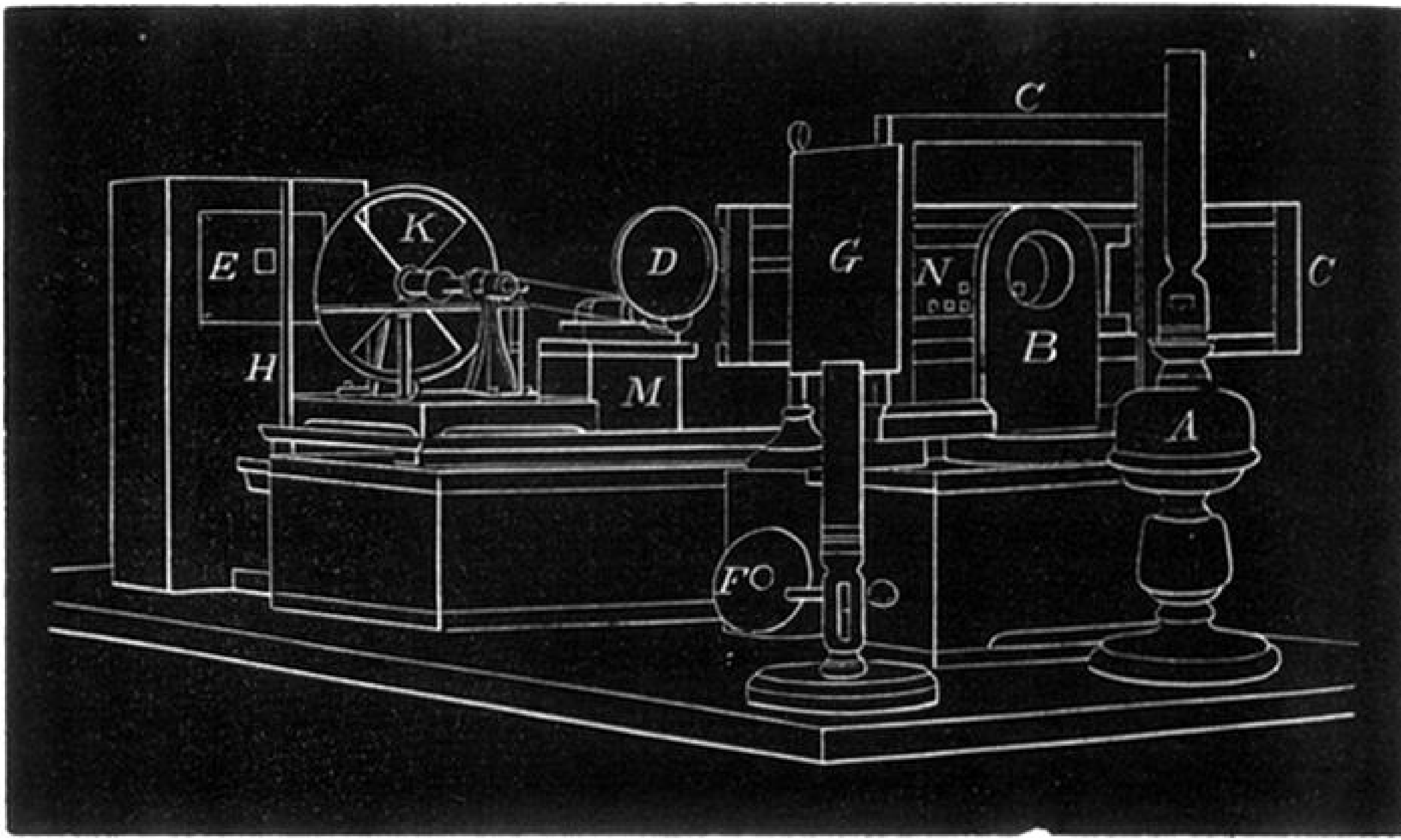
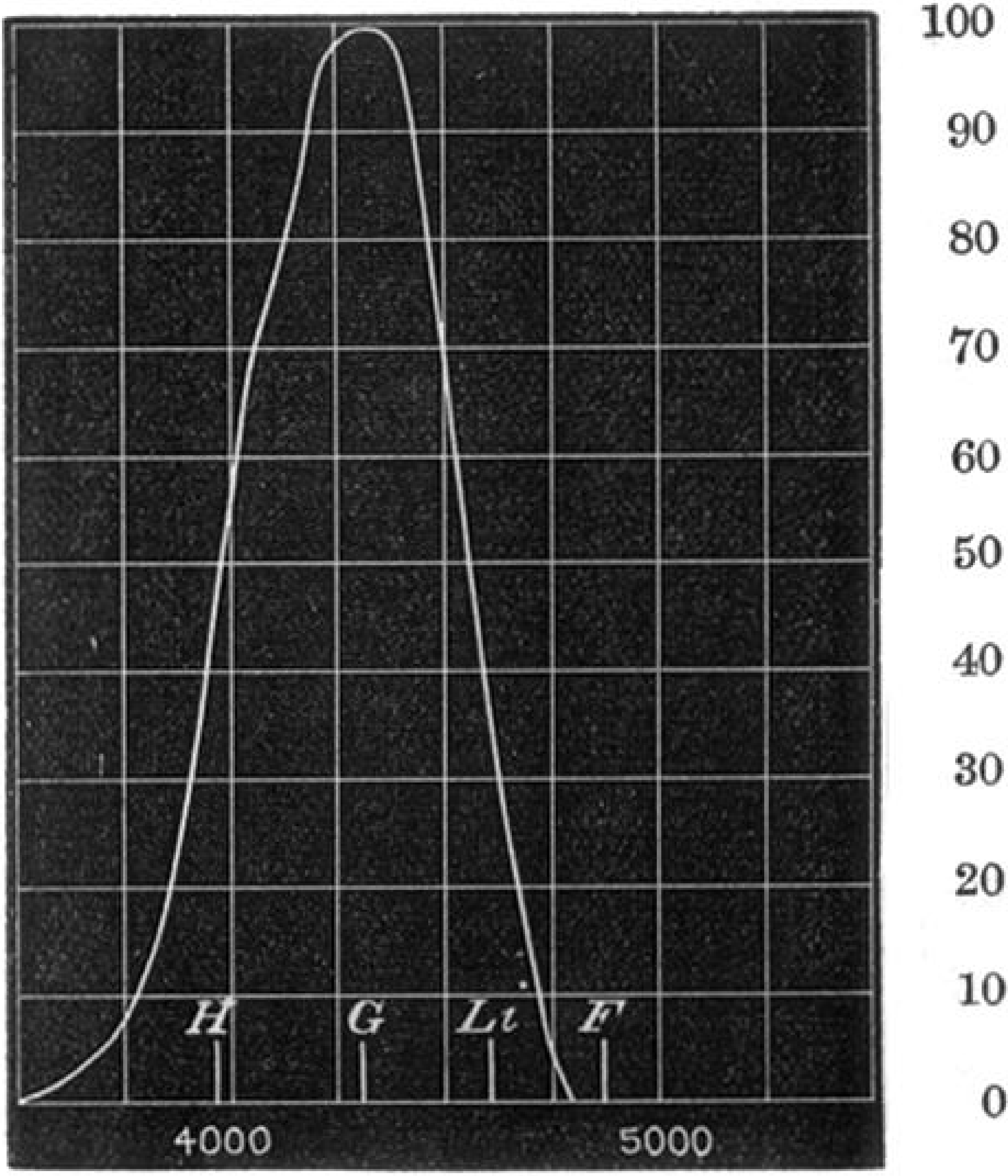
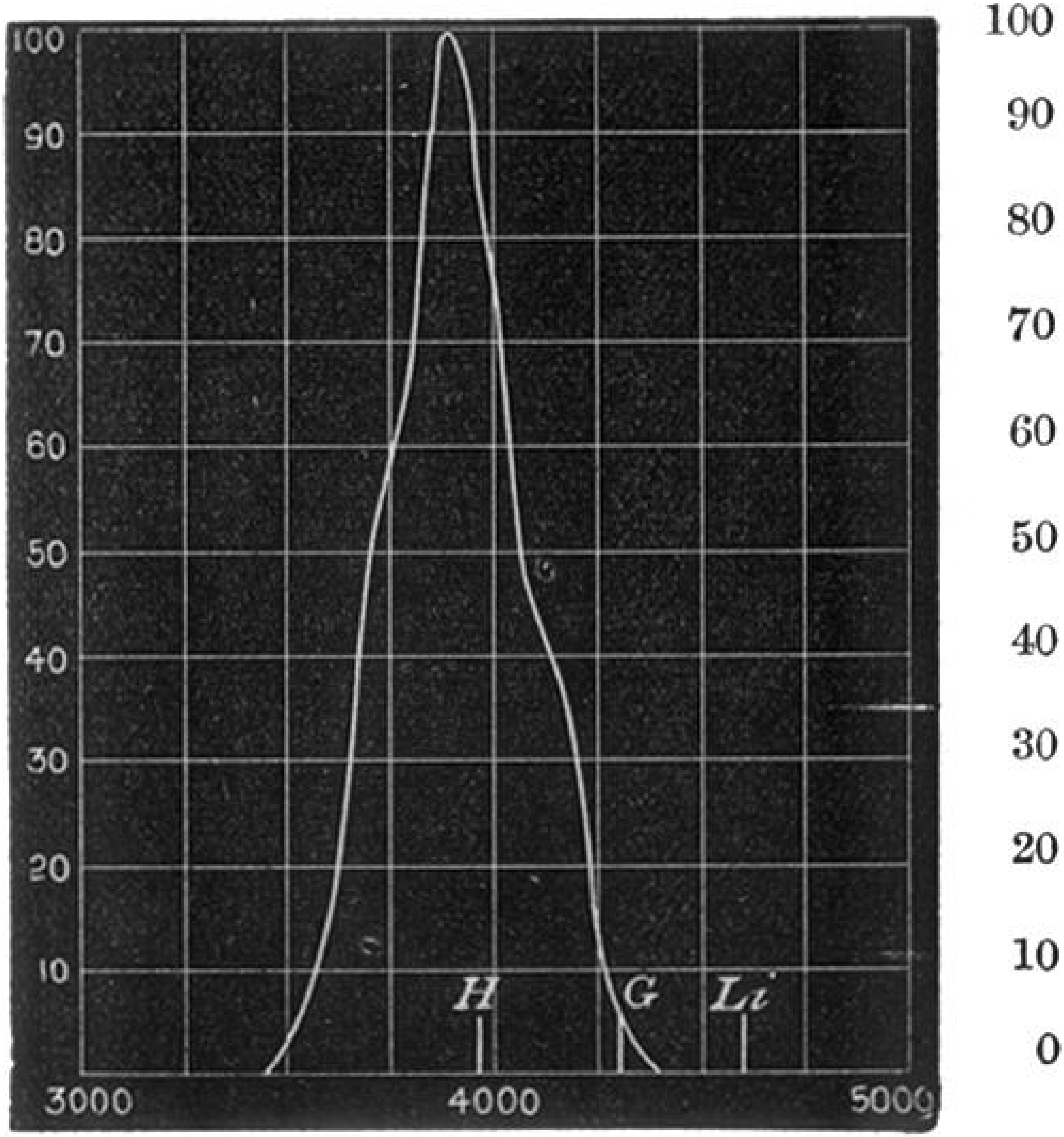

C
C
K
E
D
G
N
B
H
M
A
F

FIG. 1.



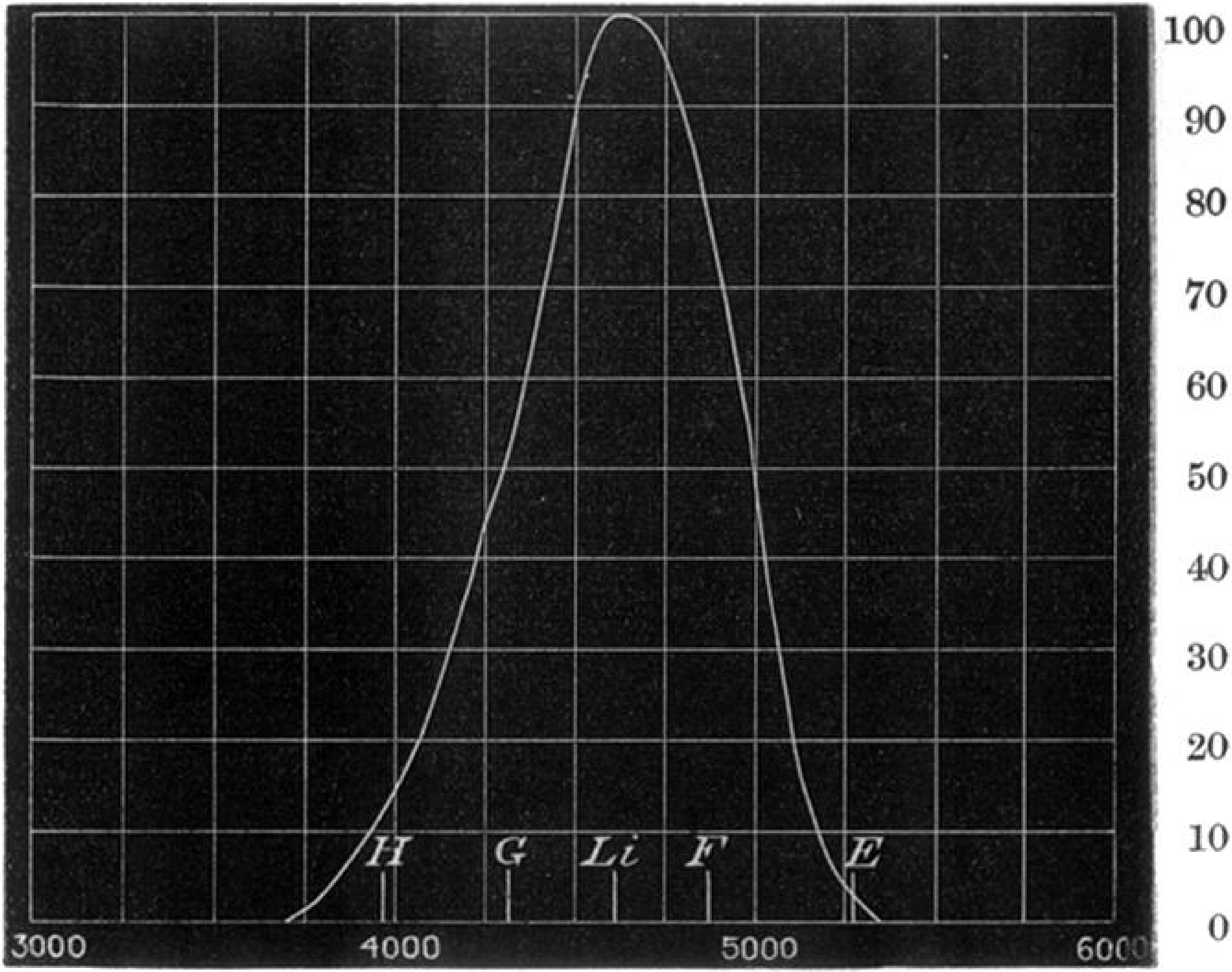
AgBr.

FIG. 2.


100
90
80
70
60
50
40
30
20
10
H
G
Li
3000
4000
5000
100
90
80
70
60
50
40
30
20
10
0

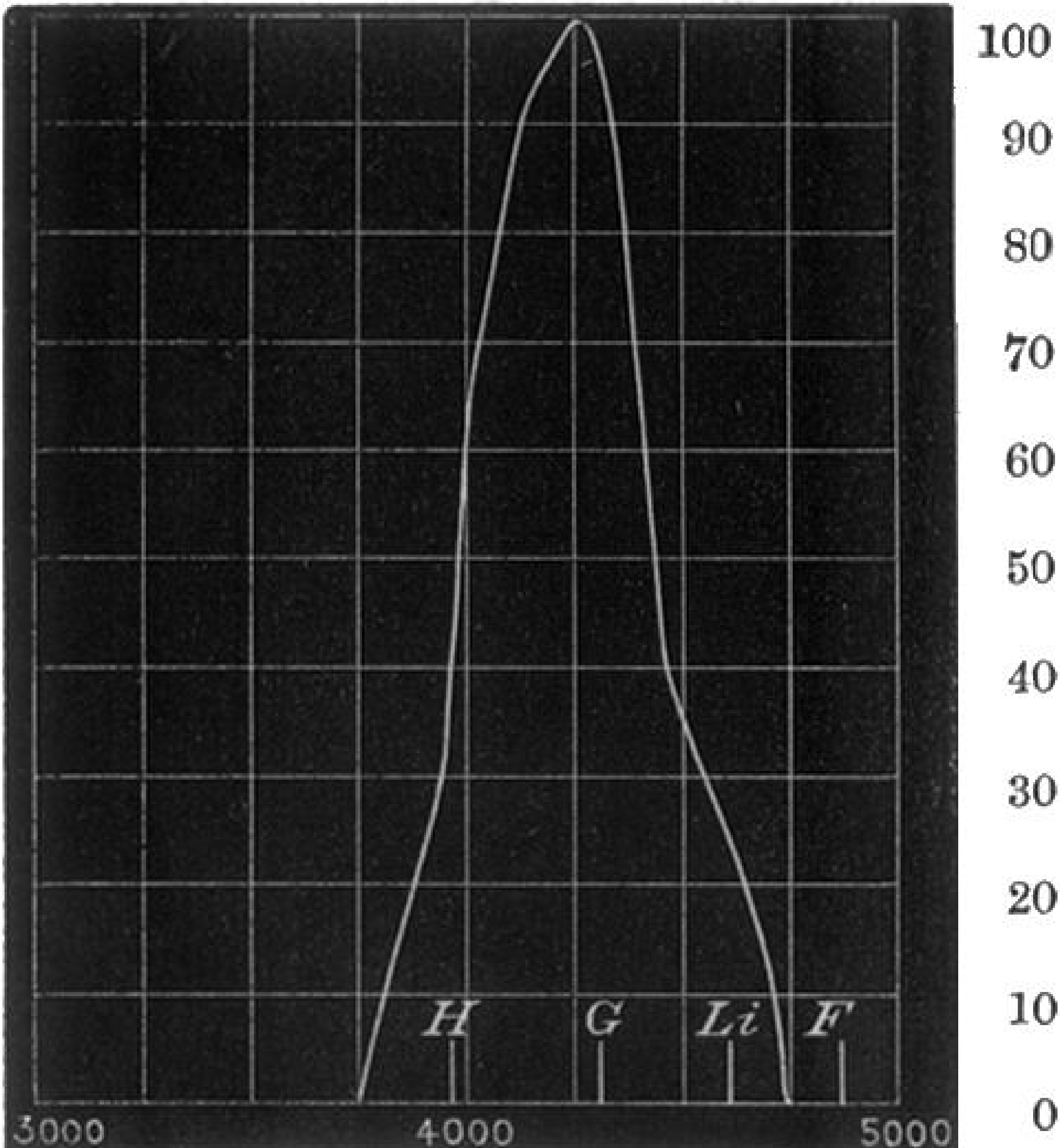
AgCl.

FIG. 3.



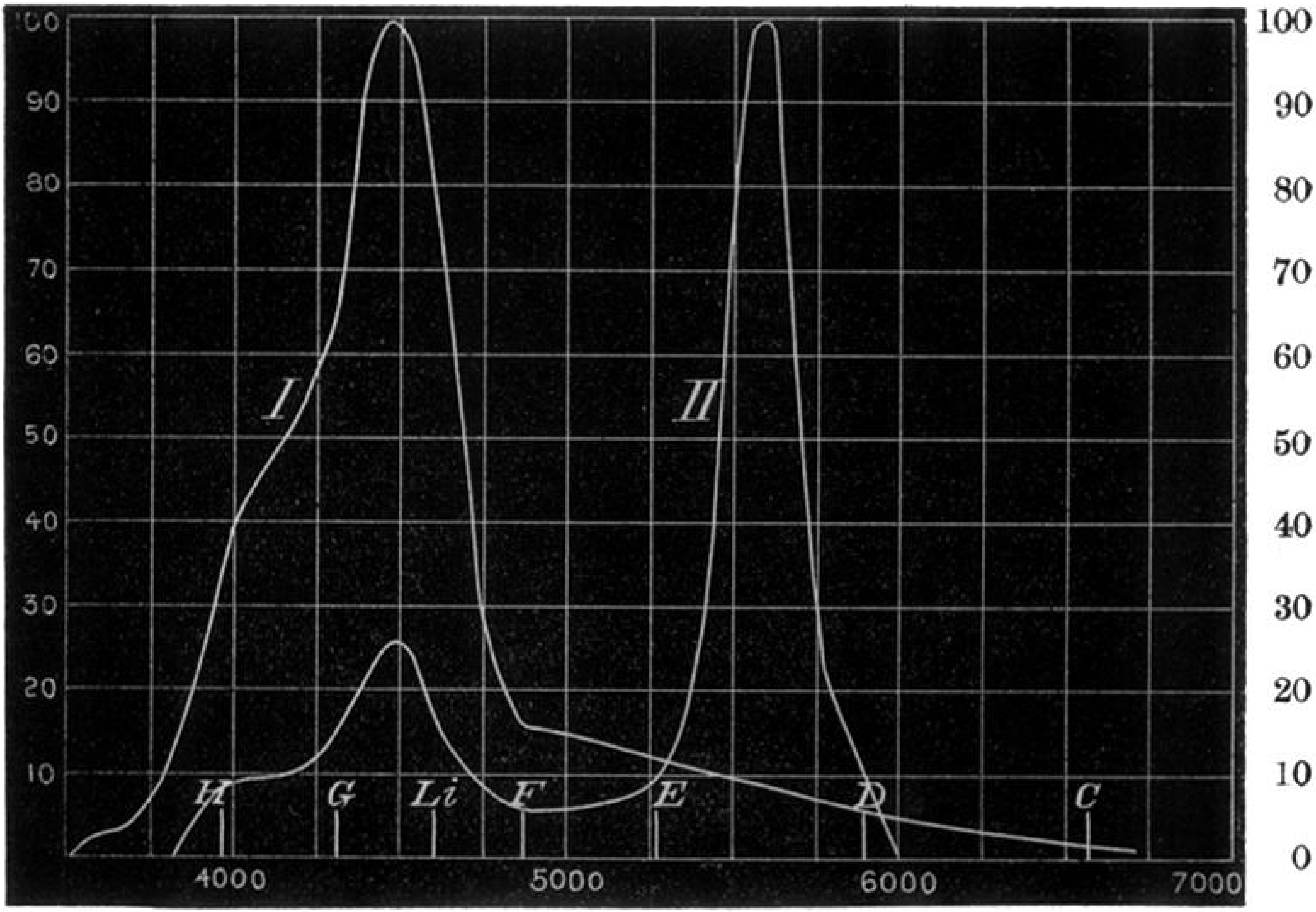
Ag_2BrI.

FIG. 4.



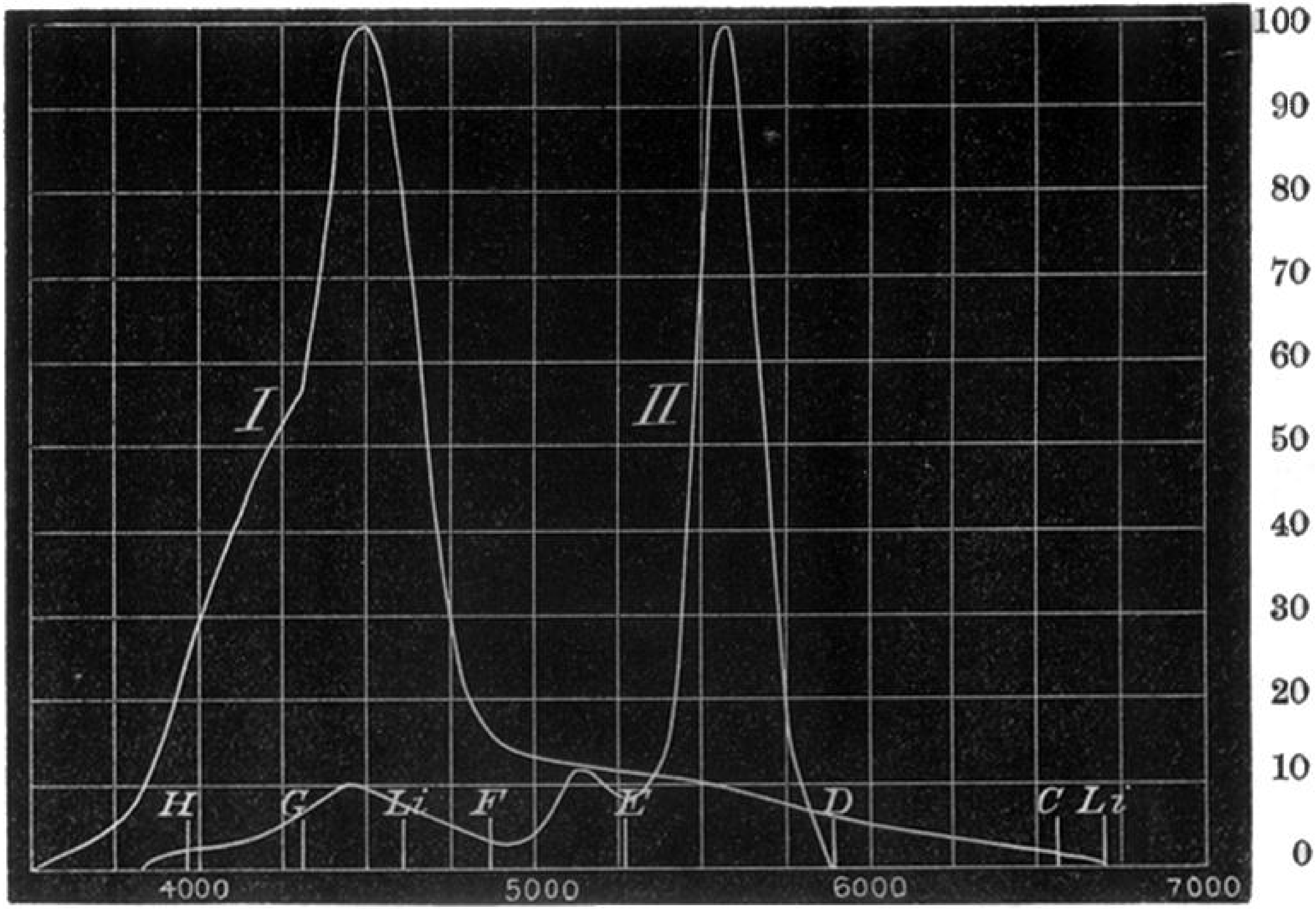
Chloro-bromide.

FIG. 5.



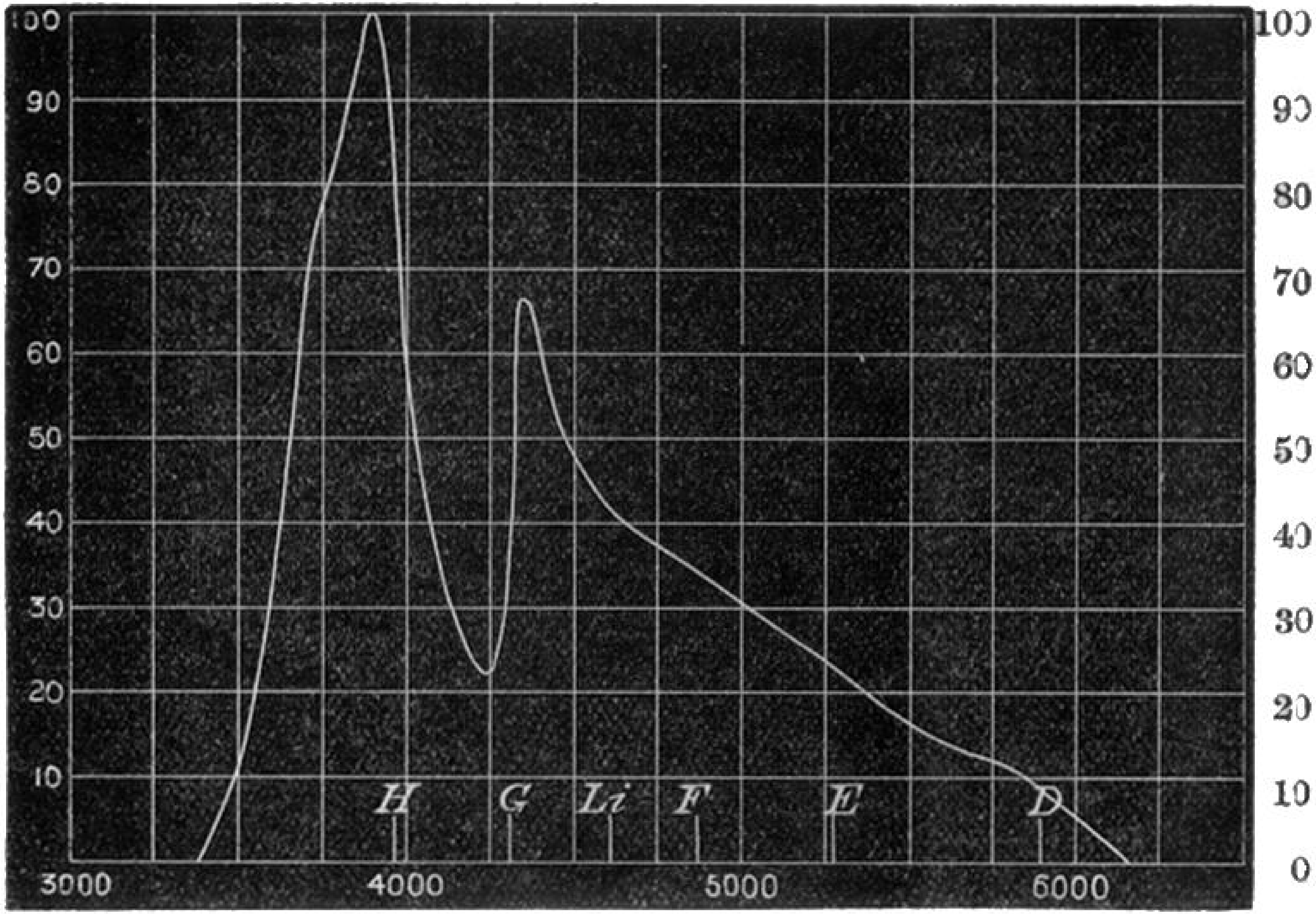
I is $\left.\begin{matrix}\frac{3}{4}AgBr\\ \frac{1}{4}AgI\end{matrix}\right\}$ II is $\left.\begin{matrix}\frac{3}{4}AgBr\\ \frac{1}{4}AgI\end{matrix}\right\}$ Dyed with erythrosin.

FIG. 6.



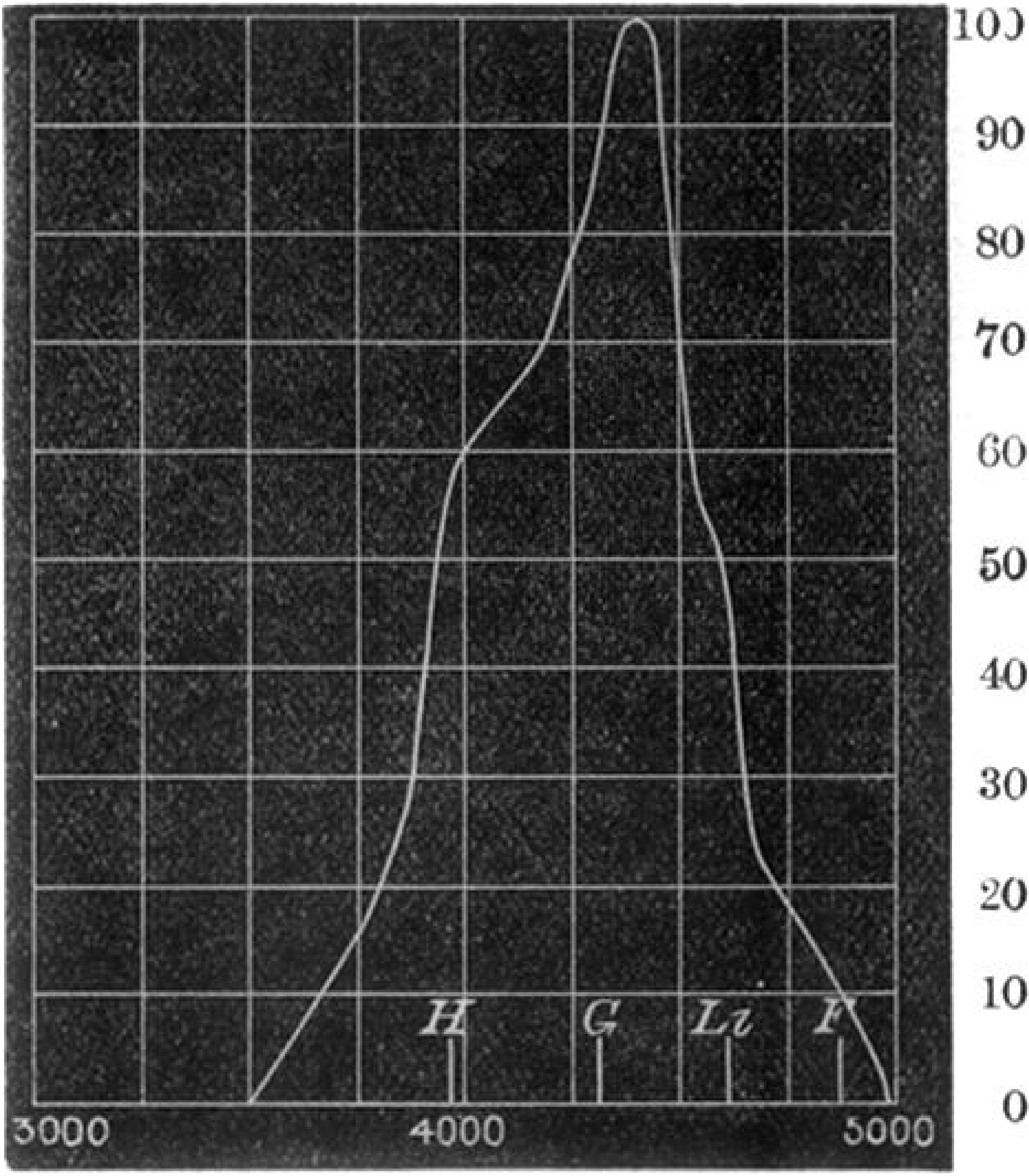
I is $\frac{1}{2}$AgBr / $\frac{1}{2}$AgI   II is $\frac{1}{2}$AgBr / $\frac{1}{2}$AgI } Stained with erythrosin.

FIG. 7.



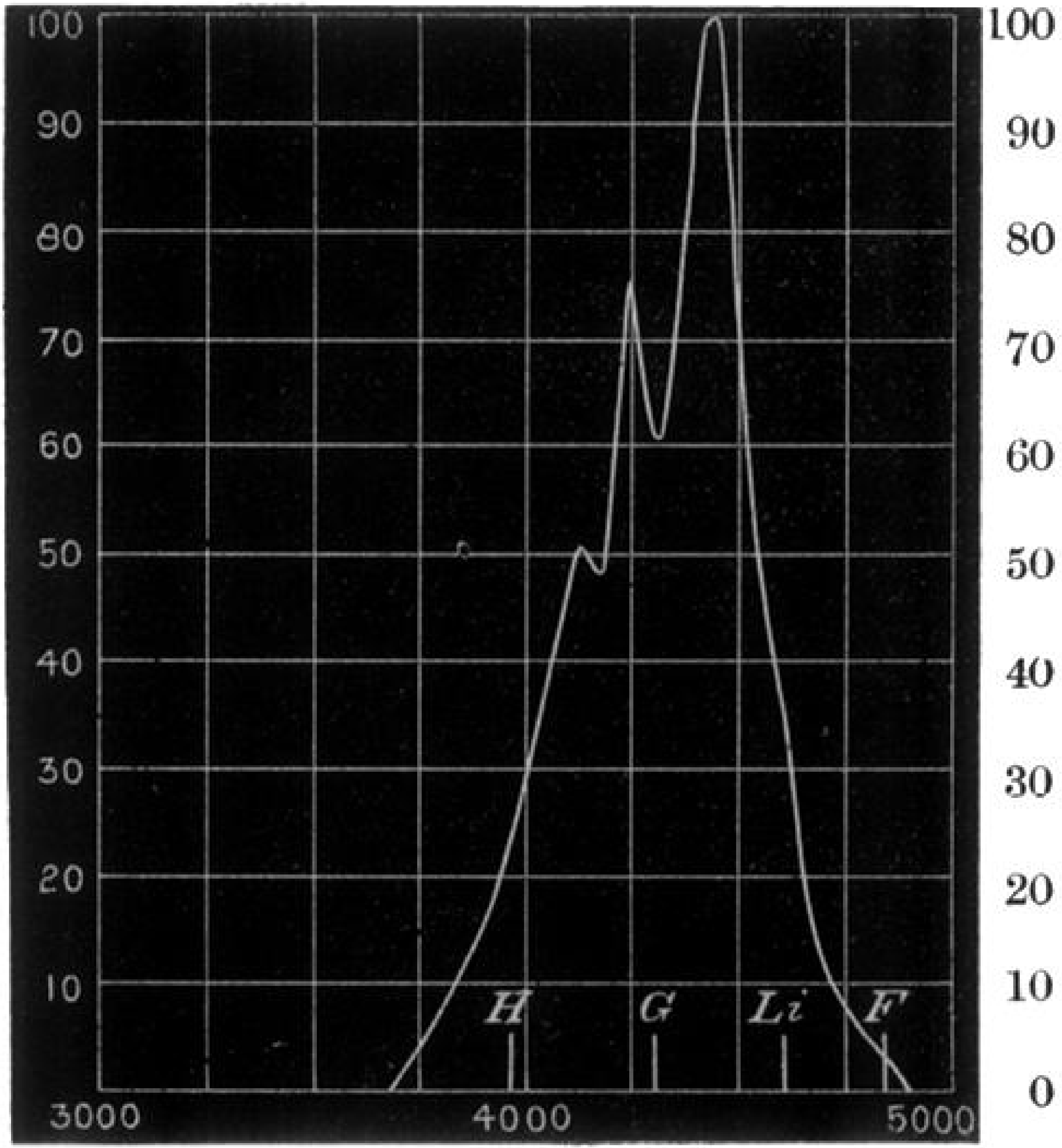
$\frac{3}{4}$ AgCl }
$\frac{1}{4}$ AgI }

FIG. 8.



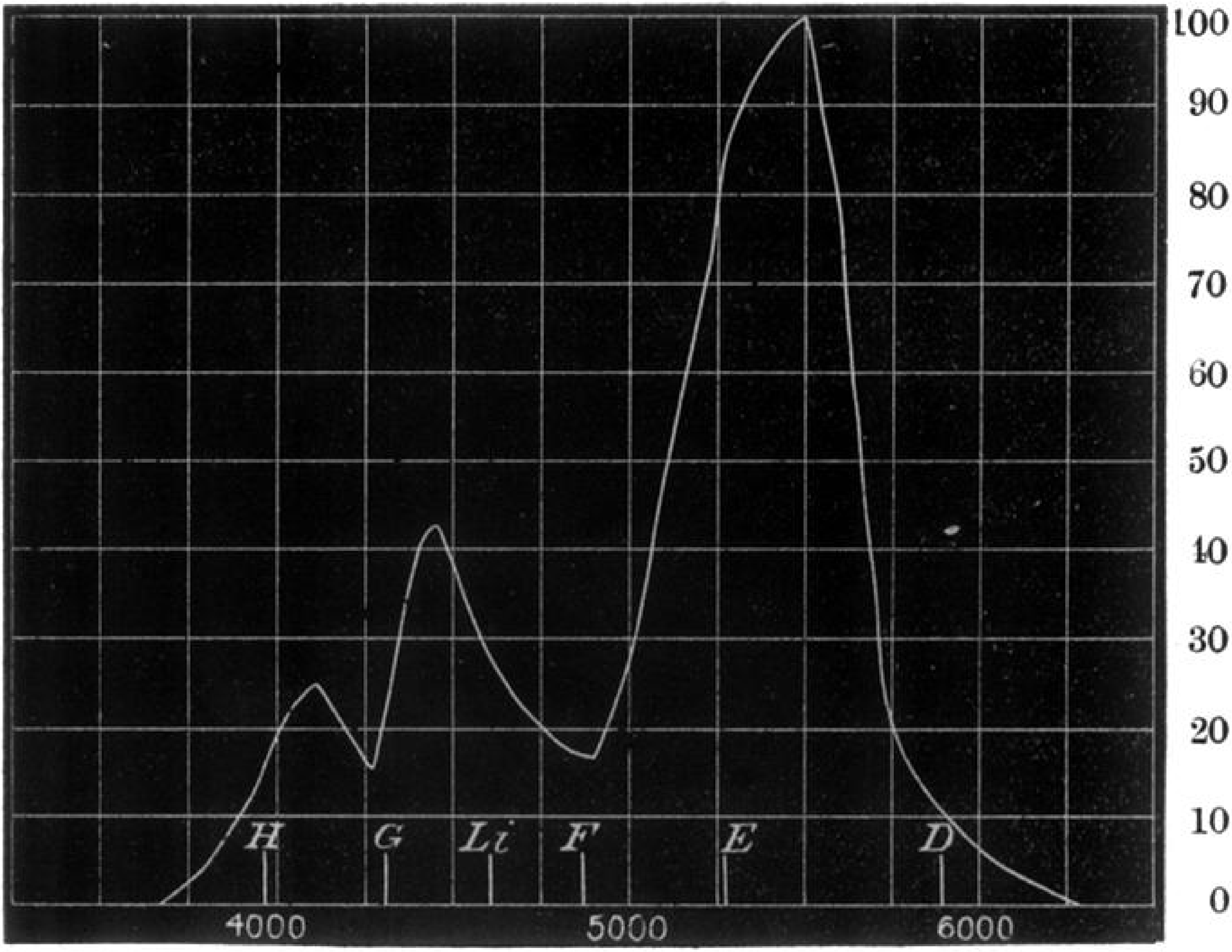
$\frac{3}{4}$ AgCl
$\frac{1}{4}$ AgBr

Fig. 9.



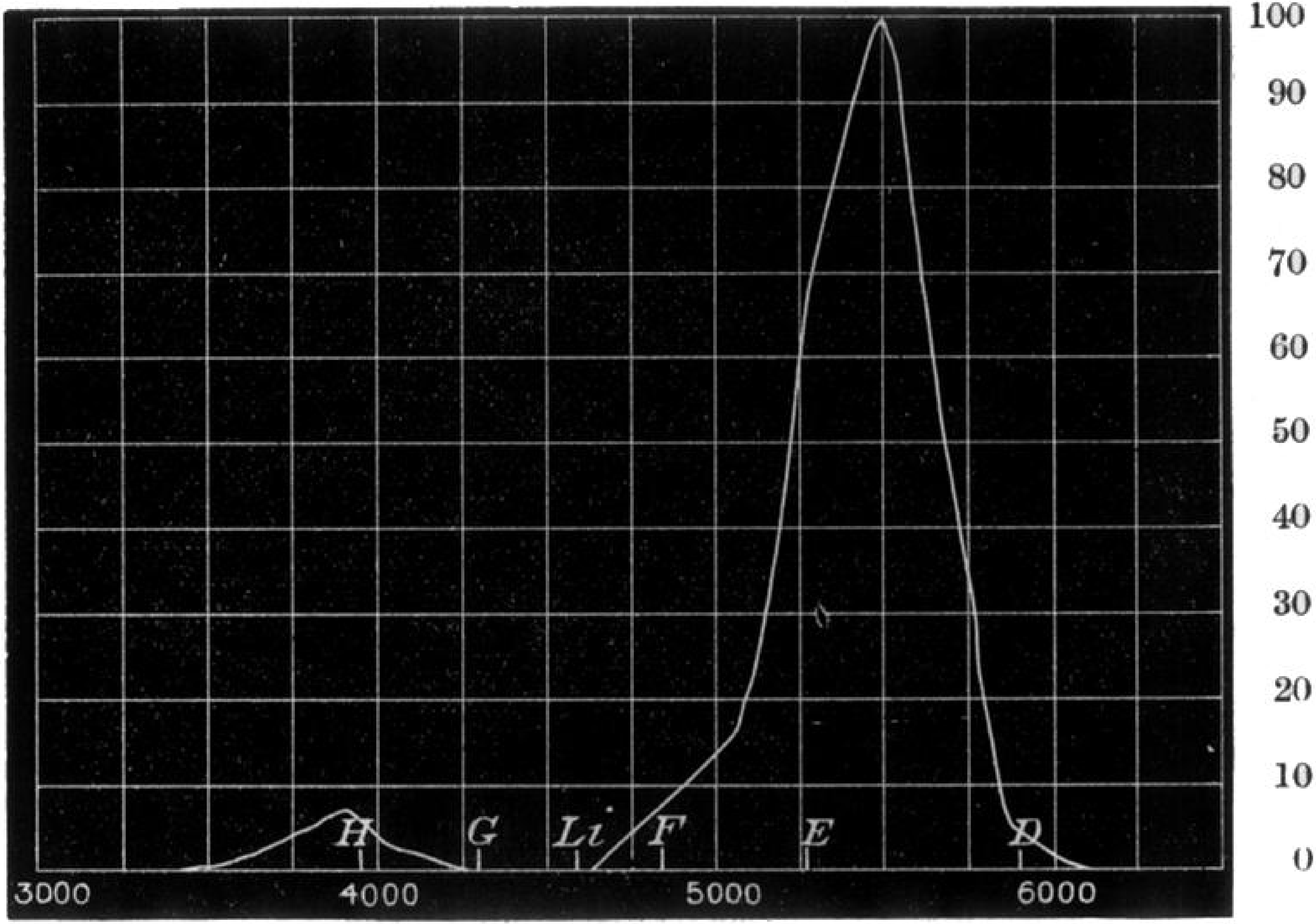
$\frac{3}{4}$ AgBr }
$\frac{1}{4}$ AgCl }

FIG. 10.



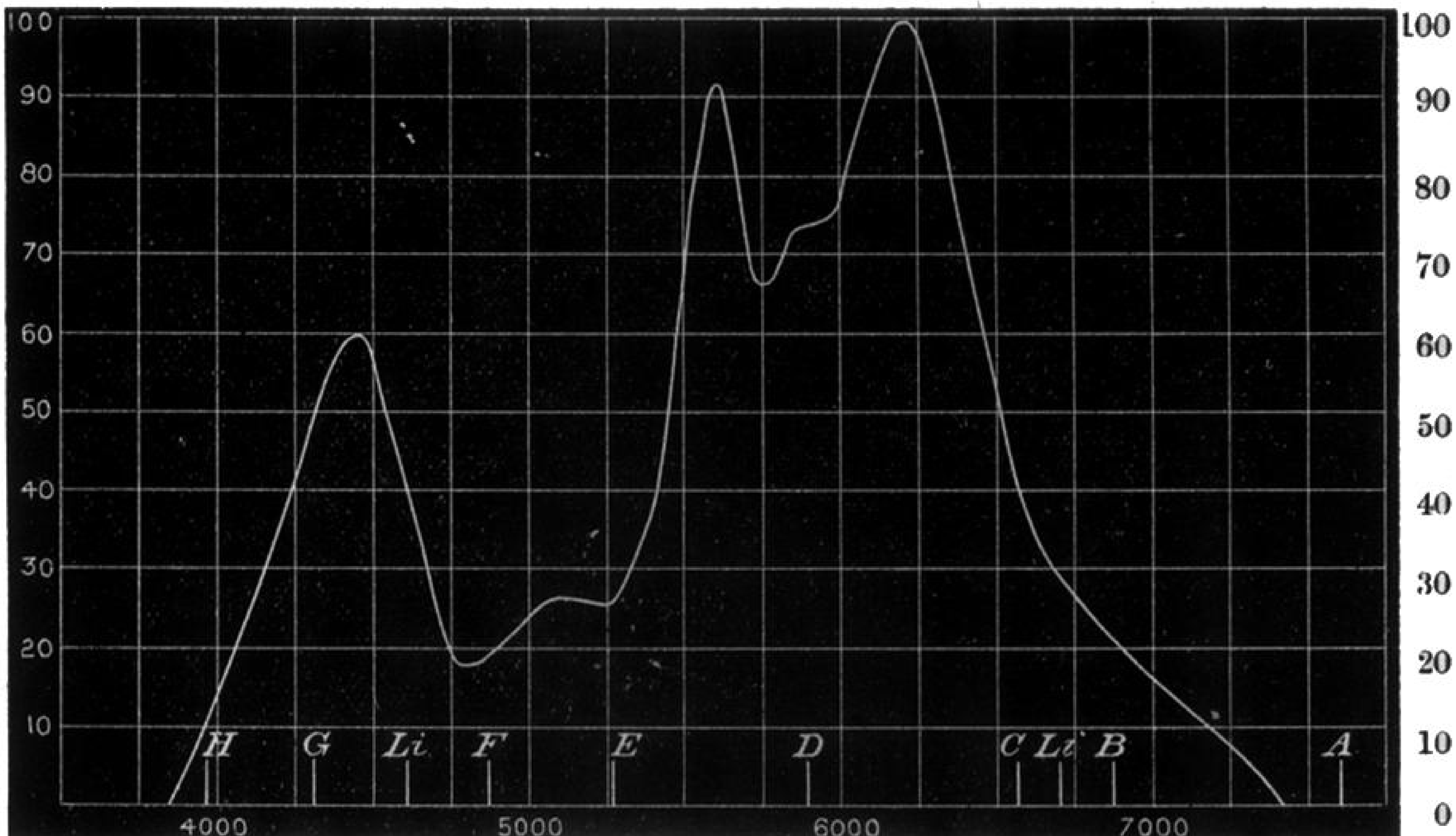
AgBr stained with erythrosin.

FIG. 11.



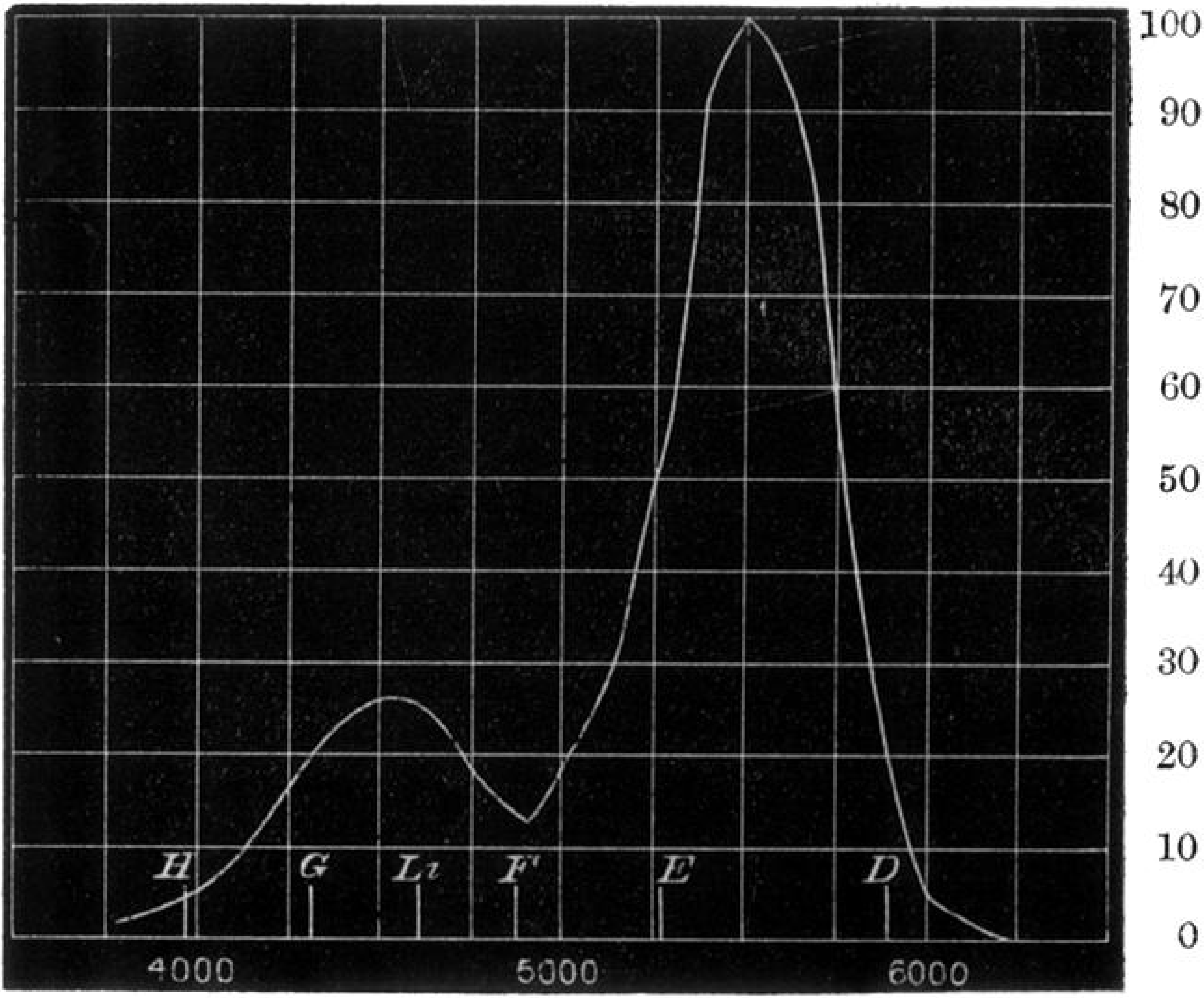
AgCl stained with erythrosin.

FIG. 12.



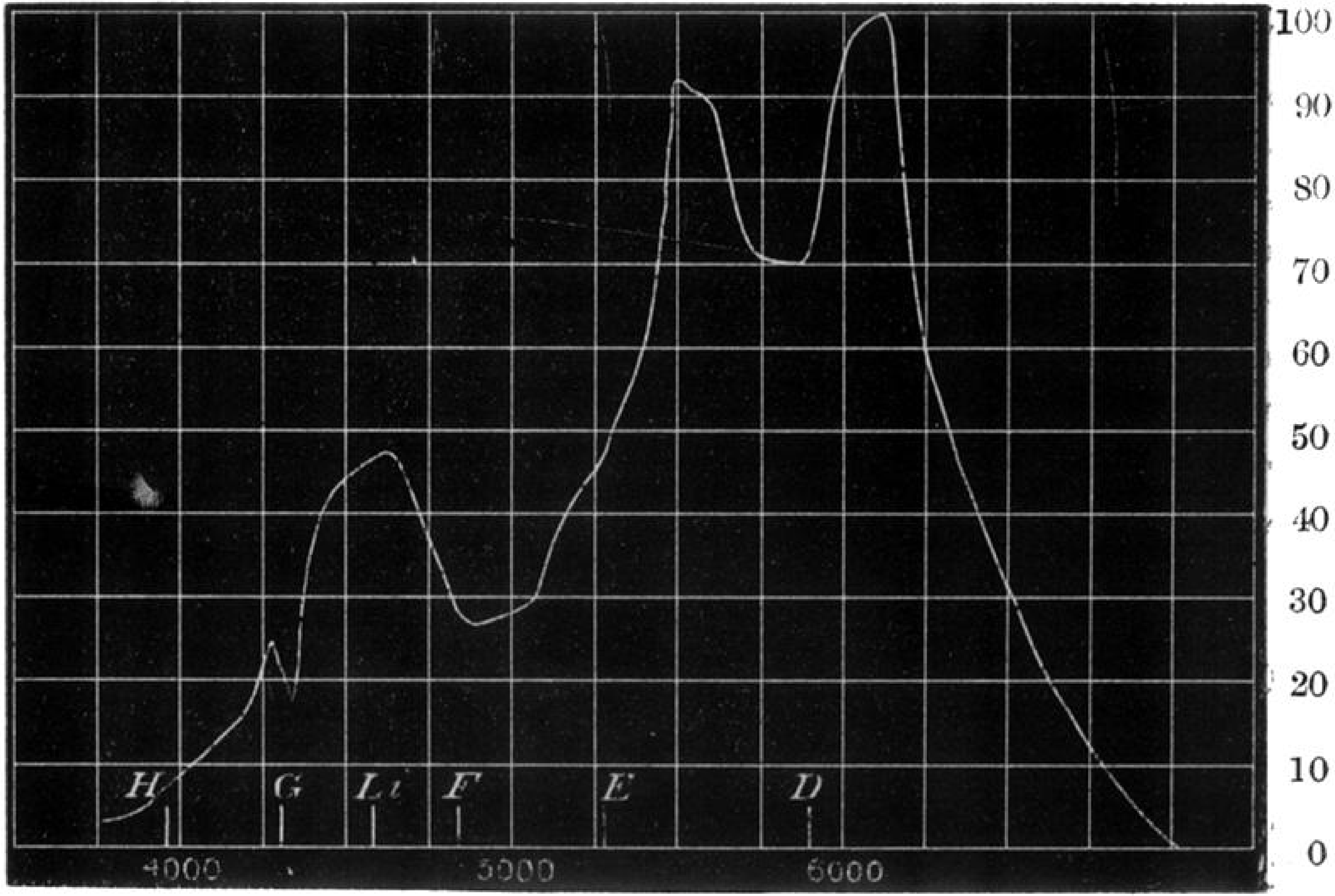
$\frac{3}{4}$AgBr } Stained with erythrosin and cyanin.
$\frac{1}{4}$AgI

FIG. 13.



Edwards' isochromatic.

FIG. 14.



Edwards' isochromatic treated with cyanin.