THE

BRITISH JOURNAL

Photographic Almanac,

AND

Photographer's Daily Companion,

FOR

1867.

A COMPLETE COMPENDIUM OF PHOTOGRAPHIC ART-SCIENCE.

EDITED BY J. T. TAYLOR.

PRICE SIXPENCE.

LONDON: H. GREENWOOD, 2, YORK ST., COVENT GARDEN, W.C.
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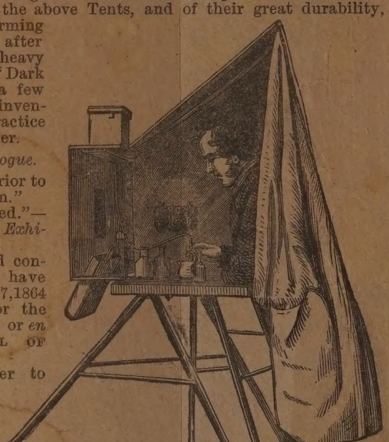
IMPROVED MODEL PHOTOGRAPHIC TENTS.

For working Wet Collodion Plates of all Sizes, Preparing Dry Plates, etc.

Acknowledged by all the most eminent Photographers, both Professional and Amateur, at home an abroad, to be the only really perfect substitute for a dark room.

Hundreds of letters and testimonials have been received by W. W. Rouch and Co., speaking in the highest terms of the great convenience and pleasure the writers have experienced in working with the above Tents, and of their great durability, lightness, and excellence, many affirming that they have made the selection after a trial of one or more of the many heavy and unwieldly "Dark Boxes" and "Dark Tents" in the market, and not a few declaring that but for this admirable invention they must have given up the practice of Landscape Photography altogether.



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"One of the most complete and conveniently arranged tents which we have yet seen."—*Photographic News,* Nov, 7, 1864

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This elegant contrivance is a modification of the above well-known TENT, and is recommended to Amateurs and Professional Photographers for working plates up to 7½ by 5, or 9 by 7 inches. Its principal feature is extreme portability, occupying when closed the small space of 14 inches in height, 6 inches in width, and 21 inches in length, and weighing only 12½ lbs.

Not an atom of room is lost; it is fitted with spaces for seven bottles of ample size to contain the whole of the chemicals, &c., required for a long day's work; dropping bottle, gutta-percha cap, two developing glasses (the whole packet *in situ* to avoid breakage), a novel and ingenious plate and drying box to hold 27 clean 7½ by 5-inch plates, a glass bath mounted in mahogany, a cistern for water fitted with a convenient clip and tube, and a new arrangement of sink and waste pipe, &c., &c. The ordinary tripod head is dispensed with, and the stand is wonderfully light and firm. Packed in a neat black leather cloth case, it presents the appearance of a small portmanteau, and may be placed under the seat of a railway carriage or other conveyance.

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CAUTION.—Messrs. Rouch & Co., beg to caution Photographers against INFERIOR and UNPRINCIPLED imitations of their Tents, every genuine instrument being stamped with their name and address.

For further Information, Dimensions, Prices, &c., see Catalogue; containing also ll Particulars of all PHOTOGRAPHIC LENSES, CAMERAS, CHEMICALS, and ARATUS.—*By post,* 6d. The whole of the above may be seen at

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With air-tight covers, mahogany bracket, ½ plate. 13*s*.; 1/1, 16*s*. 6*d*.; 10 × 8, 21*s*.; 12 × 10, 26*s*. 6*d*.

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	¼		⅓		Stereo.		½		1/1		7¼ × 4½		
	s.	*d*.	*s*.	*d*.	*s*.	*d*.	*s*.	*d*.	*s*.	*d*.	*s*.	*d*.	
	14	0	14	0	19	0	20	0	36	0	24	0	per doz.
	1	4	1	4	1	8	1	8	3	4	2	3	each.

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	1/9		⅙		¼		⅓		6½ × 4¼		7¼ × 4½		½	
	s.	*d*.	*s*.	*d*.	*s*.	*d*.	*s*.	*d*.	*s*.	*d*.	*s*.	*d*.	*s*.	*d*.
Common crown, per gross	0	10	1	9	2	8	...		...		...		...	
Best polished and flatted crown, per gross	1	6	3	0	4	9	7	0	...		...		12	0
Ditto, per dozen	0	2	0	4	0	5	0	8	...		...		1	2
Extra thick crown, polished and flatted, per gross	...		...		8	0	13	0	17	6	24	0	20	0
Chance's patent plate, per dozen	0	4	1	0	2	0	3	0	...		5	0	4	6
Opal glass, best flat patent plate, per dozen	...		...		5	0	7	0	...		...		10	6

Opal Sheet can be supplied, ¼ size, 3*s*.; ⅓, 4*s*. 6*d*.; ½, 7*s*.; but as perfect contact is necessary Patent Plate is recommended.

PLATE BOXES, best London make, dovetailed and varnished,—
50 grooves, ¼ size, 1*s*. 10*d*.; ⅓, 2*s*. 8*d*.; ½, 3*s*. 4*d*. 25 grooves, ¼, 1*s*. 6*d*.; ⅓, 2*s*.; ½, 2*s*. 6*d*.

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[*See next page.*

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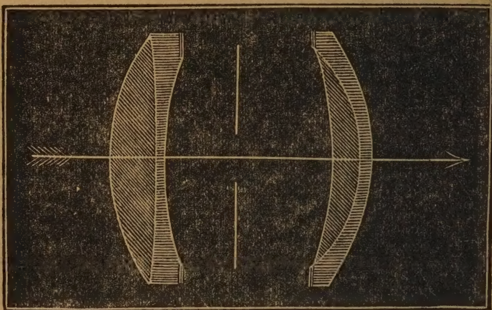
For Landscapes, Architectural Subjects, Enlarging and Copying.

TESTIMONIALS & SPECIMENS MAY BE SEEN AT



2 & 3, FEATHERSTONE BUILDINGS, HOLBORN, LONDON, W.C.

THESE Photographic Lenses are remarkable for the angle of view they embrace, the ordinary-angle Doublet giving about 74 degrees, and the large-angle Doublet about 95 degrees (if the smallest stop be used) of perfect definition, measured on the diagonal of the plate the Doublets are advertised to cover. The largest stop should be employed only when using plates two sizes smaller than those for which the Lenses are advertised.

The above observations are intended to be of general application for Landscape Subjects only, as the large-angle Doublet should be limited to 60 degrees of angle for Architectural Subjects. The large-angle Doublet, therefore, possesses two advantages over the other, viz.:—It takes in 20 degrees additional of angle for Landscapes, and the Photographer has the means of getting much nearer to his subject than he otherwise would: the latter advantage is very frequently of immense importance.

By the construction of these Lenses, which are remarkable for vigour and freedom from distortion, "flare" is most completely prevented.

All the ordinary-angle Doublets have an internal and an instantaneus shutter, the latter being intended to answer the purpose of a sky shade. The large-angle Doublets are also furnished with an internal shutter; if a sky shade be required with this lens, an extra charge is made.

Ordinary Doublets.

Angle subtended by Diagonal of Plate, about 74 degrees; ditto by Horizontal Base Line, about 60 degrees.

Size of Plate.	Diameter of Lenses.	Back Focus.	Equivalent Focus.	Price.
In. In.	In.	In.	In.	£ s. d.
5 by 4	1	4	4½	4 0 0
6 ,, 5 & 7¼ by 4½	1 4/10	6	6¾	4 10 0
8 ,, 4½	1½	6¼	7¼	4 15 0
8½ ,, 6½	1¾	6¾	7¾	5 10 0
10 ,, 8	2	8	9	7 15 0
12 ,, 10	2½	9¾	11¼	9 10 0
15 ,, 12	3	12	13¾	12 0 0
18 ,, 16	3¾	16½	18¼	17 0 0
*22 ,, 20	4½	19½	22	26 0 0
*25 ,, 21	5⅛	21¼	24	40 0 0
*30 ,, 24	6	25	28	60 0 0

* These sizes are made only to order.

[*See next page.*

Large-Angle Doublets.

Angle subtended by Diagonal of Plate, about 95 degrees; ditto by Horizontal Base Line, about 80 degrees.

Size of Plate.	Diameter of Lens.	Back Focus.	Equivalent Focus.	Price.	With Sky Shade.
7¼ by 4¼	1 3/10	3¾	4¼	£5 10 0	£5 18 6
8 ,, 4½	1 3/10	4¾	5¼	5 15 0	6 3 6
8½ ,, 6½	1 6/10	5¼	6	7 0 0	7 10 6
10 ,, 8	1¾	6	6¾	9 0 0	9 10 6
12 ,, 10	2⅛	7	7¾	11 10 0	12 0 6
15 ,, 12	2¾	9	10	14 0 0	14 12 6
18 ,, 16	3¼	11	12½	20 0 0	20 15 0

Large-Angle Stereographic Doublet.

Back Focus, 2½ inches; Equivalent Focus, 3 inches. PRICE £4.

This Lens is fitted with a revolving wheel of diaphragms which has five apertures, and is suitable for the following work:—

With No. 1 Stop, for Vignetted Heads *Carte-de-Visite* size;
,, 2, for Masked Heads and Groups *Carte-de-Visite* size;
,, 3 and 4, for Groups and Ordinary Stereoscopic Subjects;
,, 5, for Views to be cut from Plates 4 by 3.

If the back lens be removed, and the adapting tube placed between the front lens and the tube which carries the diaphragms, stops Nos. 3, 4, and 5 may be employed for Landscapes on Plates 7¼ by 4½ and under. The equivalent focus of the front lens is 5½ inches.

Stereo-Doublet Camera.

Expanding from 2½ to 8 inches,

Has a folding tailboard, and is exceedingly compact; it may also be used with any of the usual Stereo. Lenses, with the ordinary and the large-angle Doublets 8½ by 6½ and under, with No. 1 Triplet, and with Nos. 1, 2, and 3 *Carte-de-Visite* Lenses. A new arrangement has been added to the inner partition, which prevents the overlapping of the images at the middle of the plate when two large-angle Doublets are employed. The Camera front has a light brass sliding plate, with three circular apertures, the middle one being closed with a brass cap for binocular work when the Lenses are screwed into the side apertures; when the front combination of the Doublet is used as a single lens, the middle aperture receives the lens, and the side apertures are closed, the one by the cap, the other by the spare Doublet. Sizes and Prices:—

Camera for Plates....	8 by 5	Dimensions when closed	10 by 8¼ by 4½	.... £5 10 0
,,	7½ by 5	,, ,,	9½ by 8¼ by 4½	.... 5 5 0
,,	7¼ by 4½	,, ,,	9¼ by 7¾ by 4½	.... 5 0 0

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2,500 No. 2	**Do.**	**Do.**	**10/6 per 1,000**	**..5,000 at 9/0**	**..10,000 at 8/6.**
2,500 No. 3	**Do.**	**Do.**	**9/0 per 1,000**	**..5,000 at 8/0**	**..10,000 at 7/6.**

No charge for Plate, if 5,000 ordered; if Printed two sides, 2s. per 1,000 extra. Enamelled, Glazed, and Printed—One side, 12s. per 1,000; Ditto, and Printed two sides, 14s. per 1,000; in Colour, 6d. per 1,000 extra.

CABINET MOUNTS, Plain, at 4s. per Gross—not less than 3½ Gross. If Printed, 3s. per Gross extra.

Proof and Sample of Card before Going to Press.

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THE standard excellence of these LENSES is so generally appreciated that the Patentee has ceased for the past year to advertise them. He continues to receive from first-class Photographers (Amateur and Professional) their unqualified approval of them; and, notwithstanding the sundry Lenses latterly advertised as *new*, there is none which equals the "APLANATIC" for covering a large field *well*, or being so well adapted for both Views and Groups. The LENSES (generally) are fully equal to those of any other make, and considerably less in price than other first-class lenses. A NEW LENS for CABINET PORTRAITS has been lately added to former, viz.:—**B3—Aperture, 3¼ inches; Back Focus, 8 inches. Price, £13.**

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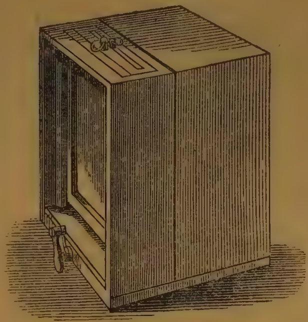
Of best English Optical Glass, *Tested and Warranted*, for *Carte de Visite*, Cabinet, and other Sizes. For 12 by 10 Portraits and Groups, **£15**; Ditto, for 15 by 12, **£25.** Cabinet Lenses, $2\frac{5}{8}$ inches diameter, **£5 5s.**; Ditto, $3\frac{1}{4}$ inches diameter, **£8 8s.**, fitted with Waterhouse Stops. Triplets, Doublets, Globe Lenses, and ordinary View Lenses. Prices on application, *or see List.*



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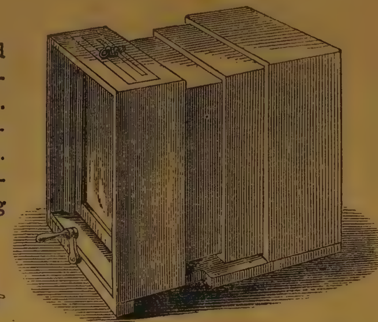
☞ Telescopic Camera ☜



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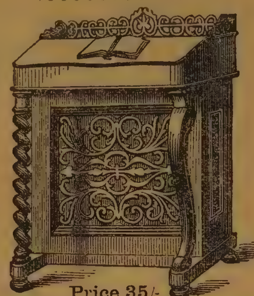

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Card Mounts, plain, from **6s.** to **10s.** per 1,000. 5,000 Ivory Mounts (Dauvois), named, for **50s.**

Baths (Glass, Porcelain, and Ebonite), plain and water-tight. Glass, all sizes, in Crown and Patent Plate.

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Is adapted for Single or Double *Cartes de Visite*, for Half and Whole-plate Pictures, for the **NEW CABINET PICTURES**, and can also be used for Copying. It possesses so many advantages that no other Camera is necessary for ordinary work in the Studio.
Price, for 8½ by 8½, **£6 15s.**; 6½ by 6½, **£5 10s.**

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SPECIALLY COMMENDED at the International Exhibition, 1862. See *Jurors' Report*, p. 346. Price with one Single Back two Inner Frames,

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10 by 8	6	0	0	15 by 12	9	10	0	10 by 10	7	0	0	15 by 15	10	15	0

Swing-back Action can be Fitted to these Cameras.

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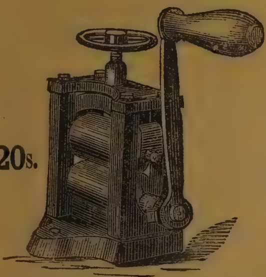

20s.

Teak Wood Pressure Frames, ¼-plate, 6s. per dozen.

Carte-de-Visite Mounts, 4s. 6d., 5s. 6d., 7s., and 9s. per 1,000.

Pyrogallic Acid, 3s. 3d. per oz.

Protosulphate of Iron, 4d. per lb.

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Methylated Alcohol, 65 O.P., 3s. 9d. per gallon.

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Blanchard and Huggon's Collodion, 6s. 6d. per lb.

Mawson's Collodion, 7s. per lb.

A variety of **Slips** and **Backgrounds,** on Brown Paper and Canvas, from 4s. and 6s. 6d. each.

Cameras, Lenses, Rolling Presses, and all articles used in Photography, Cheaper than any other House in the Trade.

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New Cabinet Lens, £5 10s.

2¾ inches diameter, 6 inches focal length. Complete with Waterhouse Diaphragms. Requires 14 feet between Sitter and Lens.

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THE BRITISH JOURNAL

PHOTOGRAPHIC ALMANAC,

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Photographer's Daily Companion

FOR

1867.

EDITED BY J. TRAILL TAYLOR.

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PREFACE.

THERE is about a new year's gift a kindliness and cheeriness which gives it an increased value in the estimation of the recipient. The present yearly "handy book" or Almanac for 1867 contains many valuable new year's gifts, promptly and cheerfully contributed by gentlemen who, having bestowed upon special branches of photography much of their attention, are eminently qualified to furnish from their own stores of knowledge valuable instruction and suggestion to those whose experience has been more limited.

The Editor highly appreciates and cordially thanks his numerous friends for their contributions to this annual volume, thus aiding, by articles, formulæ, and suggestions, in the production of a work which, he believes, will be found useful to all who read it—from the experienced professional to the amateur tyro in photography.

During the past year the desire for practical directions for copying and enlarging having been frequently expressed, the Editor has given more than usual prominence to this branch, with which, however, he has blended the production of opalotypes and transparencies, both of these being destined, in his opinion, to occupy a more important position than at present many would seem to be aware of.

The glossary of optical terms used in photography has this year been enlarged and otherwise rendered more complete; and many hints and suggestions concerning the nature and properties of the photographic lenses in everyday use will be found embodied in that chapter.

The various formulæ given are those most approved, and the recipes, hints, &c., are all reliable, and calculated to be very useful.

With these remarks is submitted to the public THE BRITISH JOURNAL PHOTOGRAPHIC ALMANAC AND PHOTOGRAPHER'S DAILY COMPANION for 1867.

J. TRAILL TAYLOR,
Editor.

2, *York Street, Covent Garden,*
January 1, 1867.

JANUARY.

New Moon	6th	0h. 30m. Morn.
First Quarter	13th	4h. 34m. Even.
Full Moon	20th	7h. 36m. Morn.
Last Quarter	27th	2h. 47m. Even.

D M	D W	Remarkable Days.	Sun Rises.	Sun Sets.
1	Tu	Circumcision	8 8	4 0
2	W	*North London Photo. Assoc., Edin. Photo. Soc.*	8 8	4 1
3	Th	*Sheffield Photo. Soc., Glasgow Photo. Assoc.*	8 8	4 2
4	Fr	R. Ascham died, 1568	8 8	4 3
5	Sa	Bank Dividends due	8 8	4 4
6	S	**Epiphany**	8 7	4 6
7	M	Plough Monday	8 7	4 7
8	Tu	*Photo. Soc. of London, Photo. Soc. of Scotland*	8 6	4 8
9	W	Fire Insurances due	8 6	4 9
10	Th	*S. Lon. Pho. Soc., Man. Pho. Soc., Pho. Sec.*	8 5	4 10
11	Fr	*[Lit. & Phil. Soc. Man., Liverpool Pho. Soc.*	8 5	4 12
12	Sa	Lavater died, 1801	8 4	4 14
13	S	**1 Sunday after Epiphany.** Hilary, Bp.	8 3	4 15
14	M	Oxford Term begins	8 2	4 17
15	Tu	Orsini attemp. to kill Napoleon III., 1851	8 1	4 19
16	W	*Edinburgh Photographic Society*	8 0	4 20
17	Th	Battle of Falkirk, 1756	7 59	4 21
18	F	Prisca, V. and M. Old Twelfth Day	7 58	4 23
19	Sa	Copernicus born, 1473	7 57	4 24
20	S	**2 Sunday after Epiphany.** Fabian, B. & M.	7 56	4 26
21	M	Agnes, V. and M.	7 55	4 28
22	Tu	Vincent, Martyr	7 54	4 30
23	W	William Pitt died, 1806	7 53	4 32
24	Th	R. Boyle died, 1627	7 52	4 33
25	Fr	Con. of St. Paul. Prin. Royal mar., 1858	7 51	4 34
26	Sa	Dr. Jenner died, 1823	7 50	4 36
27	S	**3 Sunday after Epiphany**	7 49	4 38
28	M	Orionis souths 9h. 17m. 21s.	7 48	4 40
29	Tu	*Liverpool Amateur Photo. Assoc. (Ann. Meet.)*	7 46	4 42
30	W	Martyrdom of King Charles I.	7 45	4 44
31	Th	Hilary Term ends	7 43	4 46

FEBRUARY.

New Moon .... 4th .... 6h. 17m. Even.
First Quarter ....12th .... 1h. 40m. Morn.
Full Moon ....18th .... 7h. 41m. Even.
Last Quarter ....26th ....11h. 32m. Morn.

D M	D W	REMARKABLE DAYS.	SUN Rises.	SUN Sets.
1	Fr	Pheasant shooting ends	7 41	4 48
2	Sa	Candlemas Day	7 40	4 49
3	S	4 **Sunday aft. Epiphany.** Blasius, B. & M.	7 38	4 50
4	M	Aldebaran souths, 7h. 30m. 20s. after.	7 36	4 52
5	Tu	Agatha, V. and M.	7 34	4 54
6	W	*North London Photo. Assoc., Edin. Photo. Soc.*	7 32	4 56
7	Th	*Sheffield Photo. Soc., Glasgow Photo. Assoc.*	7 30	4 57
8	Fr	Half Quarter Day. Mary Q. of Scots beh.	7 29	4 59
9	Sa	Dr. Maskelyne died, 1811	7 27	5 0
10	S	5 **Sun. aft. Epiphany.** Queen Vic. mar. 1840	7 25	5 2
11	M	Rigel souths, 7h. 42m. 34s. aft.	7 24	5 4
12	Tu	*Photo. Soc. Lon. (Ann. Meet.), Photo. Soc. Scot.*	7 22	5 6
13	W	Revolution, 1688. Sirius s., 9h. 5m. 37s. aft.	7 20	5 8
14	Th	*S. Lon. Pho. Soc., Man. Pho. Soc., Pho. Sec.*	7 18	5 10
15	Fr	[*Lit. & Ph. Soc. Man., Liverpool Pho. Soc.*	7 16	5 12
16	Sa	[Cardinal Wiseman died, 1865	7 14	5 14
17	S	**Septuagesima Sunday.**	7 12	5 16
18	M	Procyon souths, 9h. 38m. 51s. aft.	7 11	5 18
19	Tu	Galileo born, 1564	7 9	5 19
20	W	*Edinburgh Photographic Society*	7 7	5 21
21	Th	Trinidad taken, 1797	7 5	5 23
22	Fr	French Revolution, 1848	7 3	5 25
23	Sa	Handel b., 1684. Sir Jos. Reynolds d., 1792	7 1	5 27
24	S	**Sexagesima Sunday.** St. Matthias, Ap.	6 59	5 29
25	M	Hydræ souths, 10h. 18m. 33s. aft.	6 56	5 30
26	Tu	*Liverpool Amateur Photographic Association*	6 54	5 32
27	W	Treaty of Amiens, 1802	6 52	5 34
28	Th	Elliott's Engagement off Ramsey, 1760	6 50	5 36

MARCH.

New Moon	6th	9h. 38m.	Morn.
First Quarter	13th	8h. 47m.	Morn.
Full Moon	20th	8h. 55m.	Morn.
Last Quarter	28th	7h. 46m.	Morn.

D M	D W	REMARKABLE DAYS.	SUN Rises.	Sets.
1	Fr	St. David, Abp.	6 48	5 37
2	Sa	Chad, Archbishop. Bustard shooting ends	6 46	5 39
3	S	**Shrove Sunday**	6 44	5 41
4	M	Diameter of Saturn 15″·8	6 42	5 43
5	Tu	SHROVE TUESDAY	6 40	5 45
6	W	*N. Lon. Ph. Assoc. (Ann. Mg.), Edin. Ph. Soc.*	6 38	5 46
7	Th	*Sheffield Photo. Soc., Glasgow Photo. Assoc.*	6 36	5 48
8	Fr	Regulus souths, 8h. 22m.	6 34	5 50
9	Sa	Aldebaran souths, 5h. 20m. 36s. aft.	6 31	5 51
10	S	**1 Sunday in Lent.** Prince of Wales mar-	6 28	5 53
11	M	[ried, 1863	6 26	5 55
12	Tu	*Photo. Soc. of London, Photo. Soc. of Scotland*	6 23	5 57
13	W	Priestly born, 1733. Ember Week.	6 21	5 58
14	Th	*S. Lon. Pho. Soc., Man. Pho. Soc., Pho. Sec.*	6 18	6 0
15	Fr	*[Lit. & Ph. Soc. Man., Liverpool Pho. Soc.*	6 16	6 2
16	Sa	Prince Imperial born, 1856	6 13	6 4
17	S	**2 Sunday in Lent.** St. Patrick	6 11	6 6
18	M	Princess Louisa born, 1848	6 9	6 8
19	Tu	Rigel souths, 5h. 21m. 2s. aft.	6 7	6 10
20	W	*Edinburgh Photographic Society*	6 5	6 11
21	Th	Benedict, Abbot. B. of Alexandria, 1801	6 3	6 12
22	Fr	Goethe died, 1832	6 1	6 14
23	Sa	Procyon souths, 7h. 29m. 6s. aft.	5 59	6 15
24	S	**3 Sunday in Lent**	5 57	6 17
25	M	Annunciation. LADY DAY	5 54	6 18
26	Tu	*Liverpool Amateur Photographic Association*	5 52	6 20
27	W	Peace of Amiens, 1802	5 50	6 22
28	Th	Castor souths, 6h. 58m. aft.	5 48	6 24
29	Fr	Hydræ souths, 8h. 12m. 43s. aft.	5 45	6 26
30	Sa	Regulus souths, 9h. 30m. 8s. aft.	5 43	6 28
31	S	**4 Sunday in Lent**	5 41	6 30

APRIL.

New Moon .... 4th ....10h. 4m. Night.
First Quarter ....11th .... 3h. 9m. After.
Full Moon ....18th ....11h. 6m. Night.
Last Quarter ....27th .... 2h. 1m. Morn.

D M	D W	REMARKABLE DAYS.	SUN Rises.	SUN Sets.
1	M	Day increased, 5h. 45.	5 38	6 31
2	Tu	Bombardment of Copenhagen, 1801	5 36	6 33
3	W	*North London Photo. Assoc., Edin. Photo. Soc.*	5 34	6 35
4	Th	*Sheffield Photo. Soc., Glasgow Photo. Assoc.*	5 32	6 37
5	Fr	Regulus souths, 9h. 4m. aft.	5 29	6 38
6	Sa	OLD LADY DAY	5 27	6 40
7	S	5 **Sunday in Lent.** Prince Leopold b., 1853	5 24	6 41
8	M	Hydræ souths, 7h. 33m. 24s. aft.	5 22	6 43
9	Tu	*Photo. Soc. of London, Photo. Soc. of Scotland*	5 20	6 44
10	W	Hydræ souths, 8h. 6m. 45s. aft.	5 18	6 45
11	Th	*S. Lon. Pho. Soc., Man. Pho. Soc., Pho. Sec.*	5 15	6 46
12	Fr	[*Lit. & Ph. Soc. Man., Liverpool Pho. Soc.*	5 13	6 48
13	Sa	Oxford Term ends	5 11	6 50
14	S	**Palm Sunday.** Princess Beatrice b. 1857	5 9	6 52
15	M	Easter Law Term begins	5 7	6 53
16	Tu	Buffon died, 1788. Franklin died, 1790	5 5	6 55
17	W	*Edinburgh Photographic Society.* Nap. III.	5 2	6 57
18	Th	Maundy Thursday [vis. Eng., 1855	5 0	6 59
19	Fr	GOOD FRIDAY. Alphege, Archbishop	4 58	7 0
20	Sa	Emperor of France born, 1808	4 56	7 2
21	S	**Easter Sunday**	4 55	7 4
22	M	EASTER MONDAY	4 53	7 6
23	Tu	EASTER TUESDAY. St. George	4 51	7 8
24	W	Oxford Term begins	4 49	7 10
25	Th	St. Mark, Evangelist. Prin. Alice b., 1843	4 47	7 11
26	Fr	Cambridge Term begins	4 45	7 13
27	Sa	Sir W. Jones died, 1794	4 43	7 14
28	S	**Low Sunday**	4 41	7 16
29	M		4 39	7 17
30	Tu	*Liverpool Amateur Photographic Association*	4 37	7 19

MAY.

New Moon .... 4th .... 7h. 40m. Morn.
First Quarter ....10th ....10h. 4m. Even.
Full Moon ....18th .... 1h. 52m. After.
Last Quarter ....26th .... 5h. 22m. Even.

D M	D W	Remarkable Days.	Sun Rises.	Sun Sets.
1	W	*North London Photo. Assoc., Edin. Photo. Soc.*	4 35	7 21
2	Th	*Sheffield Photo. Soc., Glasgow Photo. Assoc.*	4 33	7 23
3	Fr	Invention of the Cross	4 31	7 24
4	Sa	Dr. Barrow died, 1677	4 29	7 26
5	S	**2 Sunday after Easter.** Nap. I. d., 1821	4 28	7 27
6	M	St. John Evangelist, ante Port. Lat.	4 26	7 29
7	Tu	Altair rises, 9h. 25m.	4 24	7 30
8	W	Ursæ Major norths, 7h. 50m. 50s.	4 22	7 32
9	Th	*S. Lon. Pho. Soc., Man. Pho. Soc., Pho. Sec.*	4 21	7 33
10	Fr	*[L. & Ph. S. Man. (An. Mg.), L'pool Ph. Soc.*	4 19	7 35
11	Sa	Percival shot in House of Commons, 1812	4 17	7 36
12	S	**3 Sunday after Easter**	4 15	7 38
13	M	Easter Law Term ends	4 14	7 39
14	Tu	*Photo. Soc. Lon., Photo. Soc. Scot. (Ann. Meet.)*	4 12	7 41
15	W	*Edinburgh Photographic Society*	4 11	7 42
16	Th	Daniel O'Connell died, 1847	4 10	7 44
17	Fr	Dr. Jenner born, 1794	4 8	7 45
18	Sa	Benjamin Franklin died, 1790	4 6	7 47
19	S	**4 Sunday after Easter**	4 5	7 48
20	M	Ursæ Major norths, 9h. 50m. 2s. aft.	4 4	7 49
21	Tu	Maria Edgeworth died, 1849	4 3	7 50
22	W	Mutiny at the Nore, 1797	4 2	7 52
23	Th	Linnæus born, 1707	4 0	7 53
24	Fr	Queen Vic. b., 1819. Cam. Term divides	3 59	7 55
25	Sa	Princess Helena born, 1846	3 58	7 56
26	S	**Rogation Sunday**	3 57	7 58
27	M	K. of Han. b., 1819. Trinity Term begins	3 56	7 59
28	Tu	*Liverpool Amateur Photographic Association*	3 55	8 0
29	W	Restoration of King Charles II., 1660	3 54	8 1
30	Th	Ascension Day. Holy Thursday.	3 53	8 2
31	Fr	Alexander Pope died, 1744	3 52	8 3

JUNE.

New Moon .... 2nd .... 3h. 12m. After.
First Quarter .... 9th .... 6h. 37m. Morn.
Full Moon .... 17th .... 4h. 54m. Morn.
Last Quarter .... 25th .... 5h. 28m. Morn.

D M	D W	Remarkable Days.	SUN Rises.	SUN Sets.
1	Sa	Nicomede, Martyr	3 51	8 4
2	S	**Sunday after Ascension Day**	3 51	8 5
3	M	Diameter of Saturn 16″·6	3 50	8 6
4	Tu	British Institution founded, 1805	3 50	8 7
5	W	*North London Photographic Association*	3 49	8 8
6	Th	*Sheffield Photographic Society*	3 48	8 9
7	Fr	Oxford Easter Term ends	3 47	8 10
8	Sa	Oxford Trinity Term begins	3 47	8 11
9	S	**Whit Sunday**	3 46	8 11
10	M	Whit Monday	3 46	8 12
11	Tu	*Photographic Society of London*	3 45	8 13
12	W	Ember Week. Stafford beheaded, 1641	3 45	8 14
13	Th	*S. Lon. Pho. Soc. (An. Mg.), L'pool Pho. Soc.*	3 45	8 15
14	Fr	Battle of Marengo, 1800	3 45	8 16
15	Sa	Magna Charta sig., 1215. Luther ex., 1520	3 44	8 16
16	S	**Trinity Sunday**	3 44	8 16
17	M	Alban, M. Trinity Law Term ends	3 44	8 16
18	Tu	Camb. commencement. B. of Waterloo, 1815	3 44	8 17
19	W	*Edinburgh Photographic Society*	3 44	8 17
20	Th	Accession of Queen Victoria, 1837	3 44	8 18
21	Fr	Proc. of Q. Vic. Cam. Easter Term ends	3 44	8 18
22	Sa	Machiavelli died, 1527	3 44	8 18
23	S	**1 Sunday after Trinity**	3 45	8 19
24	M	St. John Baptist. Midsummer Day	3 46	8 19
25	Tu	Scorpii souths, 9h. 43m. 32s.	3 46	8 19
26	W	George IV. died, 1830	3 46	8 18
27	Th	Dr. Dodd executed, 1774	3 46	8 18
28	Fr	Q. Vic. crowned, 1838. Ld. Raglan d., 1855	3 46	8 18
29	Sa	St. Peter, Apostle	3 47	8 18
30	S	**2 Sunday after Trinity**	3 47	8 18

JULY.

New Moon .... 1st .... 9h. 48m. Even.
First Quarter .... 8th .... 5h. 31m. Even.
Full Moon ....16th .... 7h. 56m. Even.
Last Quarter ....24th .... 2h. 32m. After.
New Moon ....31st .... 4h. 43m. Morn.

D M	D W	Remarkable Days.	Sun Rises.	Sun Sets.
1	M	Battle of the Boyne, 1690	3 48	8 18
2	Tu	Visitation of Virgin Mary	3 49	8 17
3	W	Dog Days begin. Oxford Act	3 50	8 17
4	Th	*Sheffield Photographic Society*	3 51	8 16
5	Fr	Chusan taken, 1840	3 52	8 16
6	Sa	Old Midsummer Day. Oxford Term ends	3 53	8 15
7	S	**3 Sunday after Trinity**	3 54	8 15
8	M	Invasion of Maryland by Confederates, 1864	3 56	8 14
9	Tu	Sheridan died, 1816	3 56	8 14
10	W	Columbus born, 1447	3 57	8 13
11	Th	*Liverpool Photographic Society*	3 58	8 13
12	Fr	Erasmus died, 1526	3 59	8 12
13	Sa	Bastile destroyed, 1789	4 0	8 11
14	S	**4 Sunday after Trinity**	4 1	8 10
15	M	Swithin, Bishop [in Burmah, 1846	4 2	8 9
16	Tu	Perpetual concession by K. of Ava for r'ways	4 3	8 8
17	W	*Edinburgh Photographic Society*	4 4	8 7
18	Th	Earl Grey died, 1845 [Hill, 1233	4 5	8 6
19	Fr	Prin. Augusta b., 1822. Battle of Hallidon	4 6	8 5
20	Sa	Margaret, Virgin and Martyr	4 7	8 4
21	S	**5 Sunday after Trinity**	4 9	8 3
22	M	Mary Magdalene	4 10	8 2
23	Tu	Robert Burns died, 1796	4 11	8 0
24	W	Gibraltar taken, 1804	4 12	7 58
25	Th	St. James, Apostle	4 14	7 56
26	Fr	St. Anne	4 15	7 54
27	Sa	French Revolution, 1830	4 17	7 53
28	S	**6 Sunday after Trinity**	4 19	7 51
29	M		4 21	7 50
30	Tu	Cook's first voyage, 1768	4 23	7 49
31	W	Gray died, 1771	4 24	7 47

AUGUST.

First Quarter .... 7th .... 7h. 9m. Morn.
Full Moon ....15th ....10h. 37m. Morn.
Last Quarter ....22nd............ 9h. 22m. Even.
New Moon ....29th .... 1h. 5m. After.

D M	D W	Remarkable Days.	Sun Rises.	Sun Sets.
1	Th	*Sheffield Photographic Society.* Lammas Day	4 25	7 46
2	Fr	Battle of Blenheim, 1704	4 26	7 44
3	Sa	Edward Baines died, 1848	4 28	7 42
4	**S**	**7 Sunday after Trinity.**	4 30	7 41
5	M	Lord Howe died, 1799	4 31	7 40
6	Tu	Prince Alfred born, 1844. Transfiguration	4 33	7 38
7	W	Name of Jesus	4 35	7 36
8	Th	*Liverpool Photographic Society*	4 36	7 34
9	Fr	J. Dryden born, 1631	4 38	7 32
10	Sa	St. Lawrence, Martyr	4 40	7 31
11	**S**	**8 Sunday after Trinity.** Dog Days end	4 41	7 29
12	M	Length of day, 14h. 45m.	4 42	7 27
13	Tu	Old Lammas Day	4 44	7 25
14	W	Lord Clyde d., 1863. Printing invented, 1437	4 45	7 23
15	Th	Sir W. Scott b., 1771. Napoleon I. b., 1769	4 46	7 21
16	Fr	Bomarsund taken, 1854	4 47	7 19
17	Sa	Neptune souths 3h. 17m.	4 49	7 17
18	**S**	**9 Sunday after Trinity**	4 51	7 15
19	M	Ursæ Minoris souths, 8h. 24m. 27s. aft.	4 52	7 13
20	Tu	Robert Bloomfield died, 1823	4 53	7 11
21	W	*Edinburgh Photographic Society*	4 55	7 9
22	Th	Battle of Bosworth, 1485	4 57	7 7
23	Fr	Cuvier died, 1838. Herschell died, 1822	4 59	7 5
24	Sa	Massacre of St. Bartholomew	5 1	7 3
25	**S**	**10 Sunday after Trinity**	5 2	7 1
26	M	In. of the P. Consort Statue at Coburg, 1865	5 3	6 59
27	Tu	*Liverpool Amateur Photographic Association*	5 5	6 57
28	W	St. Augustine, Bishop	5 7	6 55
29	Th	St. John Baptist beheaded	5 8	6 53
30	Fr	Paley born, 1743	5 10	6 51
31	Sa	John Bunyan died, 1688	5 12	6 49

SEPTEMBER.

First Quarter .... 5th ....11h. 31m. Night.
Full Moon ....14th .... 0h. 33m. Morn.
Last Quarter ....21st .... 3h. 9m. Morn.
New Moon ....27th ....11h. 42m. Night.

D M	D W	Remarkable Days.	Sun Rises.	Sun Sets.
1	S	11 Sunday after Trinity	5 13	6 46
2	M	London burnt, 1666	5 15	6 44
3	Tu	Oliver Cromwell died, 1659	5 16	6 42
4	W	John Home died, 1808	5 18	6 40
5	Th	*Sheffield Ph. Soc., Glasgow Ph. As. (An. Mg.)*	5 20	6 37
6	Fr	Hannah More died, 1823	5 21	6 35
7	Sa	Enurchus, Bishop	5 23	6 32
8	S	12 Sun. after Trinity. Nativ. of V. Mary	5 25	6 29
9	M	Lyræ souths, 7h. 19m. aft.	5 26	6 27
10	Tu	General Lamorciere died, 1865	5 27	6 25
11	W	Mahommed born, 569	5 29	6 22
12	Th	*Manchester Photo. Soc., Liverpool Photo. Soc.*	5 31	6 20
13	Fr	C. J. Fox d., 1806. Battle of Quebec, 1769	5 32	6 18
14	Sa	Holy Cross Day	5 33	6 16
15	S	13 Sun. after Trinity	5 35	6 14
16	M	Aquilæ souths, 7h. 18m. 16s.	5 36	6 12
17	Tu	Lambert, Bishop	5 38	6 10
18	W	*Edinburgh Photographic Society*	5 40	6 7
19	Th	Ember Week. Battle of Poictiers, 1356	5 42	6 5
20	Fr	Battle of the Alma, 1854	5 43	6 2
21	Sa	St. Matthew. Sir Walter Scott died, 1832	5 45	6 0
22	S	14 Sun. after Trinity	5 46	5 58
23	M	J. F. Herring died, 1765	5 48	5 56
24	Tu	*Liverpool Amateur Photographic Association*	5 49	5 54
25	W	Porson died, 1808	5 51	5 52
26	Th	Cyprian, Bishop. Old Holy Rood	5 53	5 50
27	Fr	Cephei norths, 9h. 2m. 18s. aft.	5 55	5 47
28	Sa	Aquarii souths, 9h. 30m. 17s. aft.	5 56	5 45
29	S	15 Sun. after Trinity. St. Michael	5 58	5 43
30	M	St. Jerome	5 59	5 41

OCTOBER.

First Quarter .... 5th .... 6h. 17m. Even.
Full Moon ....13th .... 1h. 24m. After.
Last Quarter ....20th .... 9h. 17m. Morn.
New Moon ....27th .... 1h. 3m. After.

D M	D W	Remarkable Days.	SUN Rises.	SUN Sets.
1	Tu	Cambridge Term begins. Pheas. sh. begins	6 1	5 40
2	W	*North London Photo. Assoc., Edin. Photo. Soc.*	6 3	5 38
3	Th	*Sheffield Photo. Soc., Glasgow Photo. Assoc.*	6 5	5 35
4	Fr	Neptune souths, midnight	6 7	5 32
5	Sa	Lyræ souths, 5h. 36m. 46s. aft.	6 9	5 30
6	S	**16 Sun. after Trinity**	6 10	5 27
7	M	Jamaica riots, 1865	6 12	5 25
8	Tu	Lyræ souths, 5h. 37m. 40s. aft.	6 14	5 22
9	W	St. Denys, Bishop	6 16	5 20
10	Th	*S. Lon. Photo. Soc., Man. Photo. Soc. (An. Mg.)*	6 17	5 18
11	Fr	*[Pho. Sec. Lit. & Ph. Soc. Man., Liverpool*	6 19	5 15
12	Sa	Wat Tyler d., 1381 *[Pho. Soc. (An. Mg.)*	6 20	5 13
13	S	**17 Sun. after Trinity**	6 22	5 11
14	M	Fire Insurance due	6 24	5 8
15	Tu	Aquilæ souths, 6h. 4m. 46s. aft.	6 25	5 6
16	W	*Edinburgh Photographic Society*	6 27	5 4
17	Th	Etheldreda, Virgin	6 28	5 2
18	Fr	St. Luke. Lord Palmerston died, 1865	6 30	5 0
19	Sa	Wreck of the Carioca, 1865	6 31	4 58
20	S	**18 Sun. after Trinity**	6 32	4 56
21	M	Death of Nelson, 1805	6 34	4 54
22	Tu	G. W. Gordon executed at Jamaica, 1865	6 36	4 52
23	W	Royal Exchange founded, 1667	6 38	4 50
24	Th	Chaucer died, 1400	6 40	4 47
25	Fr	Crispin, Martyr	6 42	4 45
26	Sa	Hogarth died, 1764	6 44	4 43
27	S	**19 Sun. after Trinity**	6 46	4 41
28	M	St. Simon and St. Jude	6 48	4 39
29	Tu	*Liverpool Amateur Photographic Association*	6 50	4 37
30	W	St. Marcellus	6 51	4 36
31	Th	All Hallow Eve	6 53	4 34

NOVEMBER.

First Quarter .... 4th .... 2h. 27m. After.
Full Moon ....12th .... 1h. 9m. Morn.
Last Quarter ....18th .... 5h. 6m. Even.
New Moon ....26th .... 5h. 11m. Morn.

D M	D W	Remarkable Days.	Sun Rises.	Sun Sets.
1	Fr	All Saints Day	6 56	4 32
2	Sa	Michaelmas Term begins	6 57	4 31
3	S	**20 Sun. aft. Trin.** King Wm. III. landed,	6 59	4 29
4	M	[1688	7 0	4 27
5	Tu	Gunpowder Plot, 1605	7 2	4 25
6	W	*North London Photo. Assoc., Edin. Photo. Soc.*	7 4	4 24
7	Th	*Sheffield Photo. Soc., Glasgow Photo. Assoc.*	7 5	4 23
8	Fr	Cambridge Michaelmas Term divides	7 7	4 22
9	Sa	Prince of Wales born, 1841	7 9	4 20
10	S	**21 Sun. after Trinity**	7 10	4 19
11	M	Diameter of Saturn 14″·0	7 12	4 17
12	Tu	*Photo. Soc. of London, Photo. Soc. of Scotland*	7 14	4 16
13	W	Britius, Bishop	7 16	4 14
14	Th	*S. Lon. Pho. Soc., Man. Pho. Soc., Pho. Soc.*	7 18	4 12
15	Fr	*[Lit. & Phil. Soc. Man., Liverpool. Pho. Soc.*	7 19	4 11
16	Sa	Pleiades souths 11h. 57m.	7 21	4 10
17	S	**22 Sun. after Trinity**	7 23	4 9
18	M		7 25	4 8
19	Tu	Neptune souths, 8h. 55m.	7 27	4 7
20	W	*Edinburgh Photographic Society*	7 28	4 6
21	Th	Princess Royal born, 1840	7 30	4 4
22	Fr	Cecilia, Virgin and Martyr	7 31	4 3
23	Sa	Old Martinmas Day. St. Clement	7 33	4 2
24	S	**23 Sun. after Trinity**	7 34	4 0
25	M	Michaelmas Law Term ends	7 36	3 58
26	Tu	*Liverpool Amateur Photographic Association*	7 37	3 57
27	W	Princess Mary Adelaide born, 1833	7 39	3 56
28	Th	Uranus souths 2h. 27m.	7 40	3 55
29	Fr	Pleiades souths, 11h. 6m.	7 42	3 55
30	Sa	St. Andrew, Apostle	7 44	3 54

DECEMBER.

First Quarter .... 4th ....10h. 21m. Morn.
Full Moon ....11th .... 0h. 10m. Noon.
Last Quarter ....18th .... 3h. 34m. Morn.
New Moon ....25th ....11h. 39m. Night.

D M	D W	Remarkable Days.	SUN Rises.	SUN Sets.
1	S	1 **Sunday in Advent.** Princess of Wales	7 46	3 53
2	M	[born, 1844	7 47	3 52
3	Tu	Uranus souths, 2h. 7m.	7 48	3 52
4	W	*N. Lon. Pho. Assoc., Edin. Pho. Soc. (An. Mg.)*	7 49	3 51
5	Th	*Sheffield Pho. Soc. (An. Mg.), Glasgow Pho. As.*	7 51	3 51
6	Fr	Nicholas, Bishop	7 52	3 51
7	Sa	Aquarii souths, 4h. 20m. 44s. aft.	7 53	3 50
8	S	2 **Sun. in Advent.** Conception of Virgin	7 54	3 50
9	M	[Mary	7 56	3 50
10	Tu	*Photo. Soc. of London, Photo. Soc. of Scotland*	7 57	3 49
11	W	Grouse shooting ends	7 58	3 49
12	Th	*S. Lon. Pho. Soc., Man. Pho. Soc., Pho. Sec.*	7 59	3 49
13	Fr	*[Lit. & Ph. Soc. Man., Liverpool Pho. Soc.*	8 0	3 49
14	Sa	Prince Consort died, 1861	8 1	3 49
15	S	3 **Sun. in Advent.**	8 2	3 49
16	M	Cambridge Michaelmas Term ends	8 3	3 49
17	Tu	Oxford Michaelmas Term ends	8 4	3 49
18	W	*Edinburgh Photographic Society.* Ember Wk.	8 5	3 50
19	Th	Nicholas Wood died, 1865	8 5	3 50
20	Fr	Wreck of the steamer Boristhenes, 1865	8 6	3 50
21	Sa	St. Thomas. Shortest day.	8 6	3 51
22	S	4 **Sun. in Advent**	8 6	3 51
23	M		8 7	3 51
24	Tu	Sir Charles Eastlake died, 1865	8 7	3 52
25	W	Christmas Day	8 8	3 53
26	Th	St. Stephen, Martyr	8 8	3 53
27	Fr	St. John	8 9	3 54
28	Sa	Innocents	8 9	3 55
29	S	1 **Sun. after Christmas**	8 9	3 56
30	M		8 9	3 57
31	Tu	Silvester, Bishop	8 9	3 58

PHOTOGRAPHIC SOCIETIES, &c.

Photographic Society of London.

FOUNDED 1853.

The Ordinary Meetings held at King's College, at Eight o'clock p.m., on the second Tuesday of each month, with the exception of July, August, September, and October. Annual General Meeting on the second Tuesday in February.

COUNCIL AND OFFICERS.

President—The Right Hon. Sir Frederick Pollock., Bart., F.R.S.

Vice-Presidents—Francis Bedford, James Glaisher, F.R.S., Dr. H. G. Wright.

Council—The Earl of Caithness, A. Claudet, F.R.S., J. J. Cole, F.R.A.S., T. Sebastian Davis, J. Durham, F.S.A., A.R.A., R. M. Gordon, A. R. Hamilton, Jabez Hughes, F. Joubert, W. W. King, J. E. Mayall, H. P. Robinson, J. Bell Sedgwick, M.R.I., J. Spode, C. Thurston Thompson, Elphinstone Underwood, T. R. Williams.

Treasurer—H. White.

Secretary—Hugh W. Diamond, M.D., F.S.A., Twickenham House, Twickenham, S.W.

North London Photographic Association.

ESTABLISHED 1857.

The Ordinary Meetings held at Myddelton Hall, Islington, at Eight o'clock, p.m., on the first Wednesday in each month, from October to June, inclusive. Annual Meeting on the first Wednesday in March. The year commences on the 1st of April.

President—Charles Woodward, F.R.S., J.P., &c.

Vice-Presidents—George Shadbolt, W. Hislop, F.R.A.S., W. W. King, J. J. Cole, F.R.A.S.

Committee—W. Ackland, J. Bockett, H. Cooper, Jun., E. W. Foxlee, A. Goslett, J. How, Thomas Ross, G. W. Simpson.

Treasurer—D. W. Hill.

Secretary—John Barnett, 12, Ockenden Road, Southgate Road, Islington, N.

Glasgow Photographic Association.

ESTABLISHED JUNE, 1862.

The Ordinary Meetings held at the Andersonian University, George Street, at Eight o'clock, p.m., on the first Thursday in every month, from September to May, inclusive. Annual Meeting on the first Thursday in September.

President—John Jex Long.

Vice-Presidents—Edmund Brace, Andrew Mactear.

Council—Peter Kennedy, Thomas Laing, J. C. Bourne, Robert Dodd, George Barlas, James Sheriff.

Treasurer—George Bell.

Secretary—Archibald Robertson, 37, Glassford Street.

South London Photographic Society.

ESTABLISHED MAY, 1859.

The Ordinary Meetings held at the City of London College, Leadenhall Street, City, at Eight o'clock, p.m., on the second Thursday in each month, from October to June, inclusive. Annual Meeting on the second Thursday in June.

During the months of July, August, and September meetings are held in the open air in some picturesque localities in the suburbs of London, from time to time as agreed upon.

President—Rev. F. F. Statham, M.A., F.G.S., &c.

Vice-Presidents—T. Sebastian Davis, G. W. Simpson, A. H. Wall.

Committee—Messrs. Blanchard, Cooper, Hart, How, Harman, Bockett, Foxlee, Cocking.

Treasurer—Noel E. Fitch.

Secretary—F. Howard, 10, Lansdowne Road North, South Lambeth, S.

Amateur Photographic Association.

12, YORK PLACE, PORTMAN SQUARE, W.

President—His Royal Highness the Prince of Wales.

Vice-Presidents—His Grace the Archbishop of York, the Most Noble the Marquis of Drogheda, the Rt. Hon. the Earl of Caithness, F.R.S., the Rt. Hon. the Earl of Uxbridge, the Rt. Hon. the Viscount Ranelagh, the Rt. Hon. the Earl of Rosse.

Council—Sir Thomas Maryon Wilson, Bart., Lieut.-Col. the Hon. Dudley F. de Ros, the Hon. L. Wingfield, Matthew Marshall, Jas. Glaisher, F.R.S., F.R.A.S., &c., John V. Gooch, M.I.C.E., J. D. Llewelyn, F.R.S., A. Farre, M.D., Geo. Shadbolt, W. Prideaux.

Referees—J. Glaisher, F.R.S., F.R.A.S., &c., George Shadbolt.

Honorary Secretary—Arthur J. Melhuish, F.R.A.S., 12, York Place, Portman Square, W.

Edinburgh Photographic Society.

ESTABLISHED 1861.

The Ordinary Meetings held at the Religious Institution Rooms, 5, St. Andrew Square, at a quarter-past Eight, p.m., on the first and third Wednesday of each month, except in June, July, August, and Sept., when meetings are held only on the third Wednesday of the month. Annual Meeting on the first Wednesday in December.

President—James D. Marwick, F.R.S.E.

Vice-Presidents—Edwin Musgrave, Norman Macbeth.

Council—John Nicol, Duncan Anderson, William Neilson, Wm. K. Wason, George Campbell, George Waterston, Jun., Andrew Neilson, James Richardson, Wm. Handyside, James Blackadder, W. D. Clark, W. H. Davies.

Treasurer—George Barrie.

Auditor—Alex. T. Niven.

Curator—John Peat.

Secretary—George H. Slight, 34, Leith Walk.

Photographic Society of Scotland.

ESTABLISHED 1856.

Patron—H.R.H. the Prince of Wales.
President—Sir David Brewster, K.H., F.R.S., &c.
Vice-Presidents—Rev. D. T. K. Drummond, George Moir.
Council—Horatio Ross, James G. Tunny, Wm. Scott Elliott, C. G. H. Kinnear, T. B. Johnston, Archibald Brown, A. Y. Herries.
Treasurer—H. G. Watson.
Secretary—W. D. Clark, Mayfield Loan.

Manchester Photographic Society.

ESTABLISHED 1855.

The Ordinary Meetings are held at the Memorial Hall, Albert Square, at Seven o'clock, p.m., on the second Thursday in each month, from September to May, inclusive. Annual Meeting on the second Thursday in October.
President—Rev. St. Vincent Beechy, M.A.
Vice-Presidents—W. T. Mabley, M. Noton, E. Offer, F. C. Töbler, G. T. Lund.
Council—C. Adin, R. Atherton, J. Eaton, Jun., C. Hebert, J. Kershaw, R. Knott, R. H. Percival, H. Petschler, W. Radcliffe, J. Wade.
Treasurer—J. H. Young.
Secretary—Arthur Coventry, 2, Gambia Terrace, Dickenson Road, Manchester.

Photographic Section of the Literary and Philosophical Society of Manchester.

The Ordinary Meetings are held at the Rooms of the Literary and Philosophical Society, 36, George Street, at half-past Six o'clock, on the second Thursday in each month, from October to April, inclusive. Annual Meeting on the second Thursday in May.
President—The Right Rev. the Lord Bishop of Manchester.
Vice-Presidents—J. P. Joule, L.L.D., F.R.S., &c., H. E. Roscoe B.A., Ph.D., F.R.S., F.C.S., Joseph Baxendell, F.R.A.S.
Council—John B. Dancer, F.R.A.S., E. C. Buxton, John Rogerson, Joseph Sidebotham, Samuel Cottam, Leslie J. Montefiore.
Treasurer—Thomas H. Nevill.
Secretary—A. Brothers, F.R.A.S., 14, St. Ann's Square.

Royal Archæological Institute of Great Britain and Ireland.

ESTABLISHED 1842.

The Ordinary Meetings held in the Rooms of the Arundel Society, 24, Old Bond Street, at Four, p.m., on the first Friday in the month.
President—The Lord Talbot de Malahide.
Hon. Secretaries—J. Burtt, Charles Tucker, Albert Way.

Liverpool Amateur Photographic Association.

ESTABLISHED 1863.

The Ordinary Meetings held at the Free Public Library and Museum, William Brown Street, at half-past Six o'clock, p.m. (the Council meet at Six), on the last Tuesday in each month, with the exception of June, July, and December. Annual Meeting on the last Tuesday in January.

Patron—The Earl of Caithness.

President—J. A. Forrest.

Vice-Presidents—C. Bell, W. H. Wilson.

Council—Rev. T. B. Banner, Rev. G. J. Banner, A. Cooke, R. Cooke, W. H. Golding, E. Phipps, J. N. Sleddon, W. W. Hayes, J. Henderson, P. Mawdsley, O. R. Green.

Treasurer—Richard H. Unsworth.

Secretary—George F. Williams, 58, Lime Street.

Liverpool Photographic Society.

ESTABLISHED 1865.

The Ordinary Meetings are held at Mr. Pixton's Rooms, 46, Church Street, at Seven o'clock, p.m., on the second Thursday in each month. Annual Meeting on the second Thursday in October.

President—William Keith. *Vice-President*—Harry J. Emmens.

Council—John J. Atkinson, R. B. Bradly, H. Burrows, Thos. Kay, Geo. Matheson, Joseph Wood, G. F. Wright, J. B. Pixton.

Treasurer—John Atkinson, Sen.

Secretary—Richard Brown, 42, Virgil Street.

Sheffield Photographic Society.

ESTABLISHED 1864.

The Ordinary Meetings held in the Council Hall, on the first Thursday in each month, at Eight o'clock. Annual Meeting on the first Thursday in December.

President—F. T. Griffiths, M.D.

Vice-Presidents—C. J. Fleming, H. Seebohm.

Council—J. Thomas, E. Atkinson, G. W. Kirby, W. Thompson.

Treasurer—Fredk. Barber.

Secretary—J. H. Rawson, 30, Sycamore Street.

British Archæological Association.

ESTABLISHED 1843.

Public Meetings are held at 32, Sackville Street, Piccadilly, at half-past Eight o'clock, p.m., on the second and fourth Wednesday in each month, from January to May inclusive, and on the second Wednesday in June.

President—Lord Boston. *Treasurer*—Gordon M. Hills.

Secretaries—Edward Levin, M.A., F.S.A., British Museum; Edward Roberts, F.S.A., 25, Parliament Street.

Introductory Remarks.

The year 1866 has been characterised rather by the steady and patient development of already existing features in photography than by the advent of anything specially new. Lenses have been modified and improved; chemicals have been, if possible, rendered purer; formulæ and manipulations have been revised; and the makers of our cameras still maintain their pre-eminence over those of other countries.

It would be out of place in a handy-book like the present little volume to review formally the progress of events of the past year, especially as all our spare space can be occupied by matter of more practical interest. Still, among the matters of importance that have transpired during the year, two may be specially alluded to—the attention that has been bestowed upon the removal of the last traces of hyposulphite of soda from paper photographs, thereby securing their greater permanency, and the impetus which is being given to supplementing the *carte* portrait by the introduction of a somewhat larger size. Half-plate portraits were at one time a favourite size, and in some localities were in great demand. The "cabinet" portrait differs from the standard half-plate only in a very slight degree. It is hoped that the public will not be slow in appreciating the advantages of the peculiar size now referred to.

Some names familiar to scientific and local photographic circles have lapsed from among us during the past year. Among these we may class Professor Brande, Mr. Parry, Mr. James Ewing, Mr. Alexander Bryson, Mr. Frank Howard, and others.

Photomicrography, in the hands of Drs. Maddox and Woodward, has arrived at a high state of perfection; and the subject of the latent image and the sensitiveness of iodide of silver has received a more than usual share of attention.

To those interested in the details of the year's progress we recommend a careful perusal of the pages of the thirteenth volume of The British Journal of Photography, which contains a faithful and minute record of the transactions of the year.

Manipulation and Processes.

INSTRUCTIONS FOR BEGINNERS IN PHOTOGRAPHY.

It is scarcely to be supposed that a course of lessons in practical photography can be rendered as complete in the pages of the Almanac which we can devote to it, as in the elaborate manuals and treatises which are now within the reach of every tyro. Still, by confining the subject strictly to its practical details, we hope that enough will be said to enable any intelligent person, who is willing and anxious to learn, to acquire sufficient knowledge to enable him to produce a successful photograph, together with the art of preparing those of his own solutions which it is necessary for him to manufacture or mix for himself—not omitting to indicate to him suitable remedies for the various evils and mishaps which sometimes beset a young photographer.

Let us presume, then, that with the view of acquiring a practical acquaintance with the fascinating art of photography, our intending *élève* has obtained a camera and lens mounted upon a suitable stand. These he must purchase from a respectable dealer, who will exchange them should they accidentally turn out to be unsuitable. To state here the properties of a good camera and lens, and how to make a suitable selection, would be foreign to the object of these lessons. Information on these points may be deduced as we proceed.

The first thing to be done is to learn to focus sharply. Let us suppose that the scene of operations is in a garden. Place the selected sitter in a firm chair facing the light, and a few yards distant from the camera. Having directed the instrument to him, uncap the lens and look upon the ground glass, on which will be discerned an inverted image of the sitter. In order that this may be the more distinctly seen, throw over the head a piece of dark cloth, which, by shutting out the light which would otherwise fall from behind upon the ground glass, will allow the image to be seen much better than it could be without the aid of this focussing cloth. Now move the lens in or out, or, if its range be not sufficient, slide in or out the back of the camera until the sharpest possible focus be obtained. When this has been accomplished in a satisfactory manner, then ascertain if the size of the image upon the focussing screen be such as is pleasing or desirable. Very possibly the face or figure may be too large. Nothing is more easy than to reduce its size; remove the camera a few feet or yards farther from the sitter, and it is accomplished. But this increasing the distance between camera and subject will have the effect of putting the image somewhat out of focus; hence it will be necessary to focus again in order to secure the former sharpness. In this case the lens must be turned in towards the focussing glass. Had the converse been the case, and a *larger* image been wanted, the camera would have had to be placed *nearer* to the sitter, and to secure the sharpest image the lens would have had to be turned out.

The size of the plate to be used should be drawn by means of a pencil upon the ground glass; and, when focussing the image of the sitter, care should be taken that it be kept in a suitable position within the limits of the allotted size. Do not place the head at the very top of the plate, nor yet exactly in the centre, as many beginners do, but be guided in this respect by a study of any good portraits—remembering that if you are called upon to photograph a tall man; his head should be somewhat higher up on the plate than when the person for whom you perform a similar office is of diminished longitudinal proportions.

Having acquired some facility in these preliminary features, it is now necessary that the chemical operations of taking the picture be set about.

It is requisite that the place in which the manipulations are performed be a room from which the sunlight is strictly excluded. No light should enter but what passes through deep yellow glass, or through one or two thicknesses of yellow paper, calico, or other material of a yellow colour. Yellow light has so little deleterious effect upon the chemicals which compose the sensitive surface of the plate that enough may be admitted into the "dark room" to allow of everything being distinctly seen. Use every precaution to exclude white light.

A glass plate which fits properly into the dark slide of the camera must be carefully cleaned. There are various detergents used for this purpose, and among the useful recipes in this book some will be found devoted to the subject of cleaning plates, from which one may be selected. Previous to cleaning the plates the edges should be roughened by means of a piece of sandstone, a file, or other appliance. Just before being used, a broad camel's-hair brush kept exclusively for this purpose, should be passed over both surfaces of the glass to remove particles of dust, the presence of which would mar the beauty of the finished picture.

From a bottle of bromo-iodised collodion must be poured over one surface of the plate sufficient collodion to coat it. This may be accomplished by taking hold of the plate at one corner by the forefinger and thumb of the left hand, and, holding it quite level, pouring slowly and carefully a small pool of collodion on to the middle of the plate. Tilt it gently so as to cause the collodion to flow, first to the corner by which it is held, and then to the others in succession, draining off the superflous collodion back into the bottle from the corner last covered. A little experience will soon enable the tyro to accomplish this in a satisfactory manner. He may at first err from pouring on the plate an insufficient supply, and in all probability he will incline the plate so violently as to cause it to spill over the corners or sides, but time and experience will soon aid him in overcoming these petty evils. While pouring back the excess of collodion oscillate the plate gently edgeways, to prevent the formation of streaky marks. In ten or fifteen seconds the film will have set sufficiently to warrant its being immersed in the bath of nitrate of silver.

The nitrate of silver bath, or exciting solution, is composed of crystals of nitrate of silver dissolved in water, in the proportion of about thirty grains of the former to an ounce of the latter. But as the exact condition of this bath exercises a most powerful influence upon the quality of the pictures which it is the desire of the operator to produce, we have preferred to devote a separate chapter (to be found in another part of the book) to its preparation, its management, and its renovation when deranged. By following the directions there given, a solution may be prepared which will yield pictures of the most perfect kind, so far as perfection is dependent upon this most important item among the solutions used by the photographer.

The kind of vessel or dish in which the nitrate of silver solution is held is a matter of some consequence. The material of which the vessel is made should be glass, in preference to either ebonite or gutta-percha. Its shape may either be that of a narrow, deep dipping trough, or a flat dish. For plates of large size only occasionally used the latter form may offer the advantage of requiring less solution to excite a plate, but the former is the kind found from everyday experience to be the most convenient. A dipper accompanies it, and when the collodionised plate is placed on the dipper, it may be immersed in the solution with great facility. After remaining undisturbed for a couple of minutes it is then raised out of the bath and examined. The plate when immersed was quite transparent; it is now found to be covered with a creamy-looking film. This is accounted for in the following way:—The collodion contains a haloid salt, such as iodide of potassium. The film containing this salt being brought into contact with the nitrate of silver solution, undergoes, in its contents, a change; the iodide of potassium which was dissolved in it having been acted upon by the nitrate of silver, a decomposition ensues, producing iodide of silver in the film instead of the iodide of potassium. Now, although both the nitrate of silver and the iodide of potassium are in solution quite transparent, the new substance (iodide of silver) formed by bringing them together is opaque and of a light yellow colour; hence the opacity or opalescence of the collodionised glass after removal from the silver bath. The fact in which the practical photographer feels interested is that, as soon as it is removed from the nitrate of silver bath, it is extremely sensitive to the action of light—so much so, that the feeble image of the camera obscura being allowed to fall upon it but for a second of time will induce a change in it which can subsequently be rendered visible. Sufficient time should be allowed for the plate to remain in the bath, both for the purpose of getting rid of certain oily-looking markings consequent upon the repellant action existing between the spirit in the collodion and the water in the bath solution, and also to complete the formation of the iodide of silver. Bromide of silver is more slowly formed in the film than iodide, and as all collodions now contain a bromide, the duration of the immersion in the exciting bath should be extended to ensure the formation of the bromide as well as the iodide of silver.

The back of the plate must now be wiped with a piece of blotting-paper, and, after draining for a short time, it is placed, face downwards, in the dark frame. The sitter should have been arranged and focussed previous to coating the plate, so as to occasion no delay after the dark frame containing the plate is ready for being placed in the camera. Previous, however, to doing this, take one glance more at the focussing glass to see that everything is right, after which cap the lens and remove the focussing frame, inserting the dark slide in its place. Draw up the shutter, and, everything being ready, remove the cap from the lens.

The duration of the exposure is dependent upon so many circumstances that no definite rule can be given. If the lens be a quarter-plate one, working without any diaphragm, and the day be bright, with clouds, an exposure of two or three seconds will probably be enough.

To develope the image—for up to this stage there is no picture visible on the plate—a quantity of developing solution sufficient to cover the surface of the plate is poured on along one edge. Were it poured on the centre a large transparent spot would most probably indicate the place where it had been applied.

The developer is composed of the following:—

Protosulphate of iron	$\frac{1}{4}$ ounce.
Glacial acetic acid	$\frac{1}{4}$,,
Alcohol	$\frac{1}{2}$,,
Water	8 ounces.

This solution should be poured carefully on the plate, over which it will flow like oil. The presence of the alcohol facilitates this ease in flowing. In a few seconds after its application the image will appear, at first faintly, but rapidly acquiring strength and vigour up to a certain stage, if the exposure has been properly timed.

If it be desired to retain the picture as a glass positive, the development should not be carried so far as in the case of a negative, but should be checked as soon as, by looking through the plate, the details of the shadows are faintly visible. The application of water suffices to stop the action of the developer by washing it off. Few photographers, however, now stop at that stage, but continue the development so as to obtain a negative. The difference between a collodion positive and a negative is merely one of degree. Both are negative when looked through, but in the negative-proper the development is carried so far as to present strongly marked contrasts between the lights and the shadows.

It may be that the first application of the developer fails to give such density as will be required to yield a vigorous print in a subsequent operation. Any degree of intensification may in this case be obtained by thoroughly washing off the first developer, and applying the following solution in the manner to be described:—

Pyrogallic acid	4 grains.
Citric acid	3 ,,
Distilled water	2 ounces.

First put into a suitable glass measure two or three drops of a solution of nitrate of silver about thirty grains to the ounce of water, and then add to it as much of the above solution as may be judged sufficient to cover the surface of the plate. When this is applied to the negative, it causes the image to become intensified, and its application may be repeated if necessary.

After washing *carefully*, to prevent the film from being loosened or carried away, the picture must then be fixed, by which term is meant the removal from the film of the iodide of silver, which still veils the details of the image when viewed by reflected light.

Two substances are in daily use as fixing agents—cyanide of potassium and hyposulphite of soda. Of these the former is the more energetic in its action; but, being of a much more poisonous nature than the other, some think that its advantages as a fixing agent are more than counterbalanced by the danger attending its use. The pupil may select from the following formulæ whichever of the two he may prefer:—

No. 1.

Cyanide of potassium ....40 grains.
Water .... 4 ounces.

No. 2.

Saturated solution of hyposulphite of soda.

The application of either of these solutions will remove the iodide of silver, the completion of which can be better observed by inspecting the back than the front of the plate. When fixed, the plate must be carefully and thoroughly washed, after which it is reared up on a piece of blotting-paper to dry, or, if preferred, it may be dried before a fire.

The negative thus obtained must be varnished before being printed from, otherwise the film will become injured. To accomplish this a bottle of the thin spirit varnish sold by all photographic dealers for the purpose must have been procured. The negative, having first been gently warmed, is held between finger and thumb, and the varnish is applied precisely in the same manner as the collodion was. The superabundant varnish having been returned to the bottle, the drying of the plate may be hastened and completed by holding it before a clear fire.

The negative is now finished.

In this description we have assumed that no hitch has occurred in the operation, and that the exposure has been correctly timed. Unfortunately the path of the young photographer is not quite devoid of thorns, which occasionally spring up and annoy him. We shall now proceed to indicate some of the troubles which may assail him, and the suitable remedies to be applied.

It is first of all necessary to point out the means by which he will be able to determine whether the exposure the plate has received in the camera has been correctly timed. If, on examination, the picture show violent contrasts between the lights and the shaded portions, the latter of which are too faintly, if at all, visible, then the exposure has been too short, and the remedy is obvious.

If, on the contrary, the image appear flat and quite wanting in contrast—the details all visible when looking through the plate, but presenting an uniform grey surface when looked upon, the exposure has been too long.

But, even with the most correct timing of the exposure, a grey fog sometimes spreads all over the plate. In this case a little diffused light may have fallen upon the plate, either through some screw-hole or chink in the camera, or from the admission of white light into the dark room. The judgment of the operator must be called into requisition to determine to which (if either) of these causes it is attributable. It, however, most frequently happens from a disordered state of the nitrate of silver solution; and should it prove to be so, appropriate remedies for almost every abnormal condition of this solution will be found on another page.

Before suspecting the silver bath, the state of the collodion should be seen to. If it be of a sherry colour, more or less deep, it is not so likely to produce fogging as when it is colourless. In the latter event a few drops of tincture of iodine should be added until it has acquired a yellow tint. If by this treatment the tendency to fogging be not prevented, the bath should then be examined and the suitable remedy applied. We have assumed that the lens and camera are correct, but it sometimes happens that there are reflections from the brass work of the lens which are prejudicial to brilliancy of effect in the picture. A piece of black velvet placed in the tube, or a little dead black varnish applied, by means of a brush, to any specially offending parts, will prove an effective remedy.

If opaque or transparent spots are present in the negative, search for the causes in dirt, dust, or fragments of collodion in the solutions, which must be filtered out. Should the fault prove to centre in the nitrate of silver bath, apply the remedy given in the article on that subject. If a line appear across the plate, it indicates that a stoppage has been made in the act of immersing the collodionised plate in the bath. If the film appear mottled, unequal, and thick, dilute the collodion with a little sulphuric ether. If dirty smears and stains occur, it raises the suspicion that the glass plates are either bad or imperfectly cleaned. On some coarse kinds of glass it is very difficult to obtain clean pictures.

Preserve order and care in using the various solutions, and see that each bottle is distinctly labelled. As almost all the solutions and chemicals used by photographers are poisonous in a greater or lesser degree, care must be taken to keep them out of the reach of children or inexperienced persons.

Printing.—The negative having thus been obtained, we now describe the means by which prints on paper may be made. The principle of printing is as follows:—A sheet of paper is so prepared that it shall become dark on being exposed to light. It is covered by the negative, and then submitted to the action of the sun. The dense parts of the negative prevent the light from acting on those parts of the paper shielded by them, while the transparent parts permit the light to stain the other parts black, the result being a positive picture, or one in which the lights and shadows are the reverse of those in the negative. The sensitive material being then removed from the surface the picture is finished.

There are several kinds of printing, but we shall confine ourselves to that most commonly employed, viz., printing upon albumenised paper. This paper is purchased in a prepared state ready for being excited. This operation should be effected on the morning of the day on which it is intended to accomplish the printing, because, after preparation, it will not keep for any length of time without deterioration.

Provide a flat dish, and pour into it some solution composed as follows:—

Nitrate of silver..........................	60 grains.
Distilled water	1 ounce.

This strength of solution has been given because it will suit most kinds of paper now sold. It may, however, prove to be too strong for some descriptions of paper, and too weak for others. If a special strength of silver be required for particular kinds of paper, it will be indicated on the wrapper of the paper or by the person selling it. We have seen prints of the most brilliant and beautiful quality produced by a silver bath half of the above strength; on the other hand, we have seen poor, tame-looking prints obtained from a bath very much stronger. It will thus be seen that in the strength of this exciting solution there is considerable latitude. One observation may here be made:—Do not use your negative nitrate of silver bath for sensitising your paper, else you will destroy it.

Having cut the paper into sheets of suitable size, lay one of them carefully down, albumenised side downwards, upon the silver solution in the dish, and take care that the solution does not run over the back of the paper. After floating for four or five minutes remove it by the aid of a pair of pincers made of horn, bone, ebonite, silver, or glass; and by means of one of the common American clothes pegs suspend it by one corner from a line in a darkened room until dry. Then place it in a portfolio or drawer until required for use.

To print, the sensitive paper must be pressed in close contact with the negative, both being face to face. This is effected by one of the ordinary printing-frames, procurable from every dealer at a mere fraction of the price for which any one could make it for himself. The exposure to the light must be regulated by the density of the negative, the sensitiveness of the paper, and the power of the light. The back of the printing-frame being hinged allows of the progress of the printing being occasionally inspected without disturbing the exact register required. Continue the printing until the picture is somewhat deeper than you would desire it to be when finished. The reason of this is that in the subsequent operations of toning and fixing the picture is somewhat reduced or dissolved away.

The print must now be toned. This should be proceeded with at the close of the day's printing operations, the prints meanwhile having been kept in a dark drawer. Immerse all the prints in a dish of distilled water, which answers better than plain water for the purpose, and agitate them until the nitrate of silver has been dissolved out. This and the other changes of water should be poured into an earthenware jar containing a small quantity of salt, by which all the silver is recovered in the form of chloride, which settles down at the bottom. Change the water in which the prints are being washed about three or four times, allowing them to be immersed in each change of water two or three minutes.

The prints must now be placed in a solution containing chloride of gold, several reliable formulæ for the preparation of which will be found among the recipes at the end of this volume. It is desirable at first to immerse only two or three at a time until experience has been acquired, after which a large number may be operated upon simultaneously. The effect of this toning bath is to cause the tone of the prints to pass through various hues from brown to deep violet-black; and, according to the tone desired, so must be the time the prints are allowed to remain. If a deep black tone be desirable, the printing should be deeper and the toning more prolonged than under other circumstances.

It is not necessary that the room where the toning is being effected should be as dark as when sensitising; care should, however, be taken to avoid much light.

From the toning bath the prints are transferred to the fixing solution, which consists of—

Hyposulphite of soda	1 ounce.
Water	½ pint.

In this solution the prints should remain from five to fifteen minutes, according to temperature, &c., its action when warm being much more energetic than when cold. The tone is somewhat lowered by this solution, but in most cases it is regained when the picture is finished.

When fixed the prints must be washed, and it is of the greatest consequence that this be thoroughly effected. Placing them in a running stream of water for a few hours warrants the expectation that no fading of the prints will at least ensue from insufficient washing. Improvements upon this method of fixing and washing will be found ably treated of in this volume. The method we have given above is that adopted by most professionals, and will on the whole be best for the inexperienced beginner, who, after acquiring facilities in operating, may then extend his means.

With respect to the mounting of the prints: after being dried and ironed, they must first be trimmed and cut to the shape required, after which the backs are sponged over with freshly-made starch or hot glue, and immediately laid down upon the mounting boards. When dry, they are finished by being passed through a rolling press, which communicates to them a finished appearance.

REPRODUCTION.

ON COPYING AND ENLARGING.

It may safely be assumed that, at no period during the yet brief career of photography have the several forms of reproduction—copying, reducing, and enlarging—been practised to the same extent as they are at the present time. This branch is, without doubt, the most comprehensive in the art, embracing as it does transparencies for the stereoscope, the magic lantern, and the window; opalotypes, in so far as they are produced by the camera and development, as we believe most of them now are; copying, ordinarily so called; enlarging, in its various phases, whether direct on to large sheets by development, by the solar camera, or by sun printing from an enlarged negative. These indicate the comprehensiveness of the subject now to be discussed, and the multiplicity of its ramifications. Of all these branches of reproductions, that which perhaps comes naturally first in order is—

Copying Paper Prints.

When a large paper print is copied on a very reduced scale no special preparation is necessary; but when the copy to be taken exceeds, or even equals, in size the original, the coarse granular texture of the paper is also shown, no matter how carefully the light may be directed upon the subject. This texture or granularity may be destroyed in two ways—first, by placing the surface of the paper in optical contact with a plate of polished glass; and, secondly, by glazing or enamelling the surface of the paper, so that its coarseness of texture shall not be apparent. The first of these has this advantage—that a print so treated is, when quite done with, restored to its original condition, so that, if it has been borrowed, it is restored to its owner in precisely the same condition as that in which it was received.

To put a print in optical contact with a plate of glass, it is only necessary to press the two in contact with a film of water interposed. The plate of glass must previously have been thoroughly cleaned, then made wet with water, in which condition the print, also wetted with water, is laid down upon the glass with such precautions as to prevent any air bubbles being formed. Should these appear they must be rubbed out by applying pressure behind the print, when they may be forced out to the edge.

When a print is thus placed in contact with a flat plate of glass, the texture of its surface, no matter how granular previously, will be found to be destroyed; and if copied by the camera in this condition, the resulting negative will be much finer than if it were obtained from a print not treated in this way. It is to the absence of such a precaution, or of that presently to be described, that the copies of *cartes* and similar pictures done by professional copyists are frequently so coarse in texture.

The other method of destroying the granularity of the surface of paper prints consists in enamelling them—that is, giving to them a surface so smooth and polished as to render them of a glassy appearance. The enamelling of paper prints is performed in the following manner:—A plate of glass, having been thoroughly cleaned, has a few drops of a solution of white wax in sulphuric ether rubbed over its surface, by means of a pad of cotton wool, the surface being afterwards cleaned by means of an ordinary cloth. It is now coated with a good, tough, uniodised collodion, of which there is plenty to be met with in the market under the name of "enamelling collodion." When the collodion has well set the surface is made to receive another coating—this time one of gelatine—which is prepared in the following manner:—

Steep half-an-ounce of gelatine in six ounces of water for two or three hours, or until it has become much swollen, after which place the vessel containing it in hot water, when it will soon become liquified. In this state it is not sufficiently pure for the delicate use to which it is about to be put, but it may be clarified in a very perfect manner by stirring up with it some white of egg, previously beaten up with a little water. Stir this well among the gelatine solution, and place over the fire in a suitable vessel to boil for a minute or two. After filtration through flannel or similar material, the gelatine will be found beautifully bright and clear. This solution is used for coating the collodionised glass, which, when dry, may be stored away in any clean place ready for use when required. When a print is about to be enamelled it must have its surface sponged all over, and in this state be pressed in intimate contact with the glass, avoiding air-bubbles. Instead of merely wetting the surface of the print with water, some prefer giving it a previous coating of the hot gelatine, and allowing it to set so as to become tacky before being laid down upon the collodionised plate. The presence of air-bubbles is fatal to the perfection of this operation, but by looking at the surface of the print through the glass the state of the adhesion will be readily ascertained, and any imperfection promptly remedied by pressure on the paper at the point requiring it. The glass, with the print adhering, is now laid aside to dry, the exact time required for which will vary with the heat of the room and other circumstances. Although we have seen pictures successfully enamelled after drying only thirty minutes, it will be a much safer and better plan to allow them to dry for eight or ten hours. Now pass the edge of a penknife round and under the surface of the print, when it will immediately become detached from the glass, and present a surface of exceeding brilliancy and beauty.

A print treated in this manner may be enlarged by the camera to more than its original size without showing the coarseness so peculiar to the copies seen every day. In this state they are under similar conditions of copying to Daguerreotypes and collodion positives on glass, and the same means of copying the latter apply equally to the former.

Copying Daguerreotypes and Glass Positives.

The angle of incidence is equal to the angle of reflection; when, therefore, a polished surface is placed in front of the camera, unless due care be taken in the position and lighting of that object it will merely act as a reflector, throwing into the camera the images which are reflected from its surface. The light falling from the Daguerreotype or other picture to be copied must, therefore, be radiated—not reflected. If the light fall upon the picture at an oblique angle, so that while the surface is strongly illuminated no light is reflected into the camera, then so far as the source of light is involved the subject will be properly illuminated for copying. It must not, however, be forgotten that a polished surface like that of a Daguerreotype plate will reflect into the camera all that is placed before it, including the instrument itself. For this reason it is advisable to have the camera draped with black velvet, so that the image reflected shall be so black as not to interfere with the image to be copied. Radiation must be at its maximum, reflection at its minimum intensity. We have seen Daguerreotypes copied with great success by having a piece of square velvet suspended in front of and immediately below the centre of the camera. The Daguerreotype was tilted forward very slightly, so that the reflection from the surface was that of an unlighted plane of black velvet. This, it is obvious, will secure the utmost intensity in the blacks that can be obtained.

The direction at which the light falls on a Daguerreotype is of some consequence; it should, as nearly as possible, be at right angles to the grain left on the plate by the polishing buff. By means of a mirror properly placed, there will be no difficulty in directing the light so as to secure the full advantage from a well-directed source of illumination; for in this branch of photography, as well as in producing negatives from life, very much depends upon judicious lighting.

The hints here given apply to a great extent to the copying of glass positives; but from the less perfect polish of the surface of this kind of picture fewer precautions are required, and still fewer when the picture to be copied is on paper. In proportion as the glossiness of the surface diminishes so are the facilities in copying increased. We have frequently seen negatives taken in the manner and with the precautions just described, which were so sharp and delicate as to convey no impression to even a skilled observer that they were copies.

Copying Engravings.

What we have indicated as the means to be employed in copying an ordinary photograph applies also, and in a special degree, to the copying of engravings. The utmost sharpness, together with accuracy in placing the picture quite parallel with the sensitive plate, are essential. It is also important that the contrasts between the lights and the shadows be violent, for without this feature the finished print will be flat and dull. In copying ordinary photographs any good collodion and chemicals will answer; but in making a copy of an engraving the *desideratum* is intense contrast between the blacks and whites—clean glass representing the former, and perfect opacity the latter. For securing this necessary contrast the collodion best suited is an old one, in which the iodides preponderate to a somewhat greater extent than in many of the bromo-iodised collodions of the day. The developer, too, must be such as to yield strong contrasts, for which purpose a small proportion of gelatine should be added to it. One of the most convenient methods of doing so is to have a solution in a separate bottle, so as to add as much or as little as, in the judgment of the operator, is really requisite. To equal parts of glacial acetic acid and water add gelatine in the proportion of twelve grains to each ounce of the mixture. Set in a warm place and the gelatine will soon dissolve. When this is added to the ordinary iron developer, it confers densifying properties to a much greater extent than the developer would yield without such addition. It is also better that the usual proportions of protosulphate of iron in the developer should be somewhat exceeded.

Prolonged development is usually unfavourable to that clearness of the lights in a negative which is so essential when it is requisite to have recourse to after processes of intensification. In the case of an engraving it is especially necessary that the blacks of the picture be represented by perfectly clean glass. When the first development is completed, and all the vigour and density obtained that can be had without any appreciable deposit on the shadows, the negative should then be fixed and examined. If it be perfectly clean and sharp it matters little how feeble it may be, seeing that density can be afterwards secured without much difficulty. Without, however, the most absolute clearness of the shadows in the negative, it will never be rendered a good one. It is therefore requisite that we describe

How to Clear the Shadows of a Negative.

This is accomplished by a double operation, although of a very simple nature. Make a solution of iodine in water, in the proportion of two grains to the ounce; and here we may observe that, although iodine is only partially soluble in water, the addition of a small quantity of iodide of potassium confers great solvent properties upon the water. While the negative is still wet some of this iodine solution is poured over it, when the active ingredient immediately enters into combination with the silver forming the image, iodide of silver being the result. The portion of silver which is thus converted is, however, very small, depending in this respect upon the strength of the solution of iodine. Hence, should subsequent experience dictate a weaker or stronger solution than that above given, as being better adapted for special circumstances, the proportions may be varied to any extent. The thin deposit of metallic silver on the shadows, by this treatment, becomes converted into the iodide, to remove which it is only necessary to pour over the surface of the negative some of the usual fixing solution—either hyposulphite of soda or cyanide of potassium. An examination of the negative after this treatment will disclose the fact that it is now quite freed from that deposit of silver upon the shadows usually known as fogging. Having been carefully and very completely washed, the negative is now ready for being intensified.

To Intensify Negatives After Fixing.

Although we have never failed in obtaining the requisite density by applying a solution of pyrogallic and citric acids (three grains of the former and two of the latter in two ounces of water) to which have been added a few drops of a solution of nitrate of silver, yet many, especially those who produce negatives for photolithographic and engraving purposes, find that intensification by means of bichloride of mercury answers better in some instances. Make a saturated solution of this salt (corrosive sublimate) in hydrochloric acid, and to each ounce of this solution add eight ounces of water and one ounce each of alcohol and nitric acid. Without allowing the negative to dry pour over it some of this solution, which will flow freely over the surface. In a few minutes the picture will appear of a beautiful white colour, so pearly and delicate that one almost feels a repugnance to proceeding further with the operation, and spoiling its beauty. It is, however, at this stage unsuited for its purpose as a negative. It must be carefully washed, so as to remove all traces of the mercurial salt; and, in washing it, attention must be paid to the fact that the film is not now so strongly adherent to the glass plate as before. It will, however, stand being thoroughly washed, this operation being necessarily conducted with due care. The pearly surface of the negative is now treated with a solution of sulphide of ammonium, the smell of which is exceedingly offensive, but which possesses the counterbalancing advantage of answering better than any other substance.

With respect to the strength of the solution, although we have seen some use it diluted with an equal volume of water, we believe this to be unnecessarily strong, one part of the sulphide to four or six of water giving quite sufficient strength. The negative, on this application, immediately assumes great opacity, the image being converted into a very deep brown colour. So dense may this deposit be made that we have seen a negative of a line engraving which, from its clearness, yielded a good print in a few minutes in bright sunshine, and yet had its whites so impenetrable to the rays of the sun as to show no discolouration on the whites of a print which, by design, had been left under it, exposed to strong light during a whole day. It is often difficult, and seldom necessary or expedient, to carry the densification to such a length; but in skilful hands it may be obtained.

Opalotypes and Transparencies.

These interesting branches of photography are conducted both by a copying camera and by superposition. Both branches are so nearly allied that our remarks on the one will apply equally to the other. The finest paper print which can be obtained from a negative is inferior in delicacy and beauty to a well-executed print upon polished opal glass; and when it is considered that photographers can execute them with a greater degree of rapidity than they can print upon paper, and in weather when, from the dullness, no other photographic operation could possibly be carried on, it is somewhat surprising to find this branch so much neglected.

The operator who wishes to attach to the other branches of his business that of the production of opalotypes should have a properly-constructed copying camera; for, although without any special apparatus the very highest class of pictures may be obtained, it is attended with much trouble and loss of time compared with operations conducted with a camera constructed for the purpose.

An ordinary copying camera fulfils every requirement in opal printing. It consists of a long box with an arrangement at one end for holding the negative to be copied, and at the other an appropriate groove in which to insert the focussing-glass or dark frame. Midway between these is placed the lens by which the reproduction is to be effected. The camera should be a double expanding one; that is, *both* ends should slide in or out of the central portion to which the lens is attached. The necessity for this will appear from a consideration of the fact that when the lens is situated midway between both ends, or is equi-distant from the two planes—the negative to be copied and the sensitive plate on which the picture is to be received—the picture will be of exactly the same size as the negative.

Many instances occur in which it is desirable to reduce or enlarge considerably the print from the original size; and to effect this reduction it is imperative that the negative be withdrawn to a greater distance from the lens, the focussing-frame suffering at the same time a diminution of its distance from the lens. By consulting a table of enlarging and reducing at the end of this work, the exact distance requisite to separate the lens from either end to secure any given degree of reduction or enlargement will be found tabulated.

With respect to the general dimensions of the copying camera it need only be said here that it must, for copying any object the size of the original, be four times longer than the focus of the lens employed. For example: if the solar focus of the lens be six inches, it is necessary that it be placed twelve inches from the negative, and an equal distance from the focussing-glass, thus making the length by the camera—for a lens of six inches focus—twenty-four inches.

The amateur who has no camera such as we have described may, notwithstanding, produce opalotypes of great beauty by the simple expedient of placing the negative up against a window and copying it with an ordinary camera, bearing in mind what has just been said relative to the focus of the lens and the relation existing between it and the other two planes.

The collodion and the other chemicals to be employed in printing opalotypes are of the usual kind; one thing, however, must be observed—the picture produced must be quite devoid of density. The collodion in ordinary everyday use, when diluted very much by a mixture of ether and alcohol, answers every purpose. Nothing but experience can indicate the length to which the development should be carried. In most instances, until this experience be attained, the pictures will be over-done, and in consequence will present a heavy and gloomy appearance. The progress of the development must be carefully watched, and as soon as the details are fully out the surface should be immediately washed, no over-doing, as in sun printing, being necessary. A very thin collodion, formed by diluting that ordinarily employed for negatives, appears to answer much better than a collodion having a full body. One advantage it possesses may be stated—it allows the exact stage of development to be more justly appreciated by the operator than when a dense and opaque film is operated upon.

When the picture is developed it must then be fixed. A weak solution of cyanide of potassium should be employed, and only in the event of the picture appearing too much overdone should recourse be had to a strong solution. By the use of a cyanide fixing bath of three or four times the usual strength, many pictures which would otherwise be too black have been restored to the right condition.

When fixed the tone of the picture is far from being desirable. It is neither vigorous nor well coloured, but both of these *desiderata* are supplied by one operation, viz., pouring over the surface a very weak solution of chloride of gold. Immediately the feeble print becomes invigorated and appears of a deep rich colour. The gold solution which is used for this purpose will serve the same purpose frequently; hence the expense is not an element to be taken into serious consideration. Many, however, prefer a warmer tone than that yielded by the gold; and this is easily obtained by first flooding the newly-fixed print with a solution of bichloride of mercury, similar to that recommended in a former part of this article for the intensification of negatives, only much weaker than the strength there given. Indeed a dilution to the extent of one-half will render the mercurial solution there given much more manageable and generally better in every respect for toning opalotypes. The solution of sulphide of ammonium should also be much more diluted than when used for the purpose of densifying negatives. It may be used alone for toning, and we have occasionally seen some good transparencies obtained by its aid, but it is inferior to the other methods just mentioned.

Although these remarks apply equally to opalotypes and transparencies, seeing that, in a certain sense, one is identical with the other, there are features peculiar to each which must be attended to. A transparency for the stereoscope must be more deeply printed and more fully developed than a similar picture intended for exhibition in a magic lantern; while, again, a lantern picture must in its turn be more deeply impressed than a picture upon opal glass, which is to be viewed by reflected light. These constitute the chief distinguishing features between these pictures—we mean as to their production. Popular taste seems to run in favour of a rich deep brown for stereoscopic transparencies for the stereoscope; a neutral or black tone is most effective for pictures intended for the lantern. We have placed at the disposal of the reader the means of securing any tone which the nature of the subject or his own taste may demand.

Opalotypes and Transparencies by Contact Printing.

For this purpose either artificial light or that of the sun may be employed, although we always prefer the former, on account of its stability and the consequent certainty which attends its employment. That kind of light which we use is obtained either from a paraffine lamp or the ordinary gas supplied from the main.

The plate used for receiving a print in this manner must be "dry." This remark, however, is subject to a disclaimer we shall by and by make. Many dry processes are already before photographers, and many more will, we hope, be submitted to their notice. The special process for the purpose before us, for which we shall become the advocate on this occasion, is unfortunately not one with which a man of science would quite relish having his name associated; for the preservative agent employed in it has neither the merit of being costly nor difficult to procure. No delicate conditions of bath nor exact constitution of collodion are requisite to develope its good properties; for, under circumstances in which more fashionable and more favourite contemporaries would at once " strike," the preservative agent employed in this process never fails to yield the most reliable and beautiful results. Admitted by the greatest chemists to be of the most complex nature, by physiologists to be of the most powerful nature, by English historians to be of a most poetical nature, by a worthy class of moral reformers to be of a most baneful nature, and by "jolly good fellows" to be of a nature highly conducive to the enjoyment of life, if not even necessary to existence, we scarcely know whether to confess to a feeling of pride and pleasure or of shame in confessing that we find no preservative agent for transparencies on dry plates to equal the ale of everyday use. Saccharine matter, gum, tannin, alcohol, and all the requirements of success may be found in this most unscientific liquid. When, from the condition of the collodion or the bath, tannin, gum, gelatine, or albumen, used as a preservative, might prevent success by fogging the picture, this simple agent most frequently proves itself to be in excellent working order.

There are, however, some conditions under which it yields more successful results than under others. First, however, a word or two as to the preservative agent itself. Strong old Burton or Scotch ale seem better adapted for this purpose than the thin and watery ales most in demand. "Bitter beer," although far from being objectionable for other purposes, does not seem to answer quite so well for transparency printing as the heavy samples just mentioned. The collodion should be of a rather deep tint from the presence of free bromine or iodine, and the bath should be somewhat acid. When a plate has been excited it should be removed to a dish of water and washed thoroughly. Having been drained, a small portion of the preservative solution should be poured on at one end and allowed to flow well over the surface, when it should be poured off at a corner. A second dose should now be applied, and when it has spread itself over the surface of the plate, the latter should be set aside to dry. Spontaneous drying will be found the most convenient when the operator wishes to prepare several dozens of plates at a time, and has convenient room for storing them away to dry; but an amateur who may be preparing only a few plates will find it better to dry the plates by the heat of a fire, or, still better, by a hot water bath, a notice of which will be found in another part of this book.

Plates so prepared will keep for several days ready for use. When about to expose them under a negative ascertain that they are quite dry, for the deliquescent nature of the preservative frequently causes them to be slightly tacky. This is easily remedied by holding them for a few seconds before a dull fire, or close to a hot iron.

The exposure with an average negative is about thirty seconds when held at a distance of six inches from the flame of fire. We may remark, *en passant*, that plates so prepared answer well for taking negatives in the camera; but when employed for this purpose it should be borne in mind that the sensitiveness is inferior to either a Fothergill, tannin, or collodio-albumen plate.

The development is effected with a solution of pyrogallic acid, two grains to the ounce of water, to which is added citric acid in the proportion of two-thirds of the pyrogallic acid. The only precaution to be enforced is to be very sparing in the quantity of nitrate of silver solution that is added to this developer, for a picture which has been developed with a minimum of silver is finer than one in the production of which this metal has been used more liberally. The remarks made concerning fixing and toning in a former part of this article apply also to dry plates.

Although a special preservative agent has been advocated, it must not be supposed that it alone has been found to yield good results; on the contrary, excellent pictures may be obtained from any of the dry processes now in use. Gum arabic, gelatine, tannin, unfermented malt infusion, raisin extract, albumen, and many other substances, may be made to yield pictures of the highest class. The tones given by tannin are warm and agreeable; and, although we have not seen any opal pictures prepared by it which we esteemed, yet when employed for transparencies the greatest amount of beauty is attainable. The strength of the tannin solution should be fifteen grains to the ounce, and a small quantity of raspberry syrup should be added, on account of the influence it has upon the tone of the finished picture. The tone is also much influenced—no matter what preservative be used—by the kind of restraining acid employed in the developer. When acetic acid is employed, the picture will be of a much warmer tint than when citric acid is used. Our readers must remember that the most delicate pictures are those which are obtained by slow developing; and to secure this end let no more silver be added to the developer than can be avoided.

Although the phrase "contact printing" implies close contact between the negative and the sensitive plate, we mean to violate the niceties of philology by describing under this heading a method of printing which, although effected by superposition, is certainly not entitled to be designated as *contact* printing, as although in close proximity, the two surfaces (*i.e.*, the negative and the sensitive plate) are studiously kept apart. When care is used, the method we are now about to describe will approve itself to many on account of its simplicity. An ordinary collodionised plate having been excited in the usual manner, it is placed at once under the negative, from which, however, it is kept separate by means of two strips of card placed at its margin, a small piece of blotting-paper serving to absorb the superfluous fluid. In this condition, and while held firmly in position by the fingers, it is exposed for a brief period to the flame of the gas. The duration of the exposure depends of course upon the distance at which the negative is held from the flame; and it is of some consequence that this distance be much greater than in the case of dry-plate printing to ensure sharpness; for it need scarcely be remarked that when a space intervenes between the negative and the sensitive surface sharpness can only be secured when the light is emitted from a point, as it were. For the same reason the plate must be held quite steady during the exposure, for the slightest movement of the plate entails loss of sharpness. With proper care the two surfaces may be separated to such a distance as even to allow a half-crown to drop between them, and yet no such falling off in sharpness ensue as can be detected with the unassisted eye; but in this case the light must be removed to a distance of several feet. The full advantages of this method of printing can only be appreciated by those who have given it a trial. The development is effected by the ordinary protosulphate of iron solution.

Instead of employing a development process in the production of opalotypes or transparencies, chloride of silver may be mixed either with gelatine or collodion and poured over the plate. When dry, it is at once ready for exposure under the negative. The printing, of course, is effected by solar light, in the same manner as when printing upon albumenised paper.

This process is better adapted for opal printing than for transparencies, as such; indeed, for the former class of picture, it is not inferior in the beauty of its results to any of the other methods of producing them which we have described. The print should be considerably over-done; and, when removed from the printing-frame, it should be washed slightly and then treated in the same manner as a silver print on albumenised paper.

Enlarging.

From what has been said on producing transparencies or opalotypes in the copying camera, it will readily be perceived that to enlarge a picture up to any size it is only necessary that the back portion of the copying camera be as large as is requisite, and the body of such a length as to permit the sensitive plate to be withdrawn to a sufficient distance. If an enlarged negative be wanted for printing by the sun in the usual manner, a transparency must be obtained and placed in the enlarging camera. This, when enlarged, yields a negative. If it be preferred to enlarge direct on to the paper, a small negative instead of a transparency should be employed. The paper must be prepared with iodide of potassium, sensitised in a bath of aceto-nitrate of silver, exposed in the camera while wet, developed with gallic acid, and fixed with hyposulphite of soda.

The following proportions have been used with effect, but each operator must vary them to suit his special requirements and the particular kind of paper he employs:—

Iodising Solution.

Iodide of potassium	4 grains.
Bromide of potassium	3 ,,
Chloride of ammonium	2 ,,
Gelatine	3 ,,
Water	1 ounce.

Exciting Solution.

Nitrate of silver	45 grains.
Glacial acetic acid	5 minims.
Distilled water	1 ounce.

Developing Solution.

Saturated solution of gallic acid.

Should the picture show any tendency to stains or fog, increase the proportion of acetic acid in the exciting solution. It is also found advisable, under some circumstances, to add a small quantity of the same acid to the developer.

When developing, it is best to lay down the sensitive paper, face upwards, upon a table upon which has been previously laid a large sheet of paper. Bend up the edges of the sensitive sheet like a tray, and clip them at the corners; pour into this tray a small quantity of the developing solution, and spread it over the surface by means of a bent rod of glass or a tuft of cotton.

The fixing is effected in a solution of hyposulphite of soda, three ounces to the pint of water.

When artificial light is used for enlarging, an apparatus similar to the ordinary magic lantern must be employed, the negative to be enlarged taking the place of the picture which is thrown upon the screen. The best light for the purpose is the oxyhydrogen or lime light, and the best burner is that in which the gases are mixed before they issue forth from the nozzle of the jet against the lime. It will be evident that this light is inferior to daylight in sensitiveness; hence the various solutions used should be as strong as convenient, and the quantity of restraining (acetic) acid reduced to a minimum. The developer, too, should be warmed before being applied.

As all the best lanterns now in use have achromatic lenses, we have not considered it necessary to call attention to the fact of this being absolutely requisite.

The exposure with the lime light varies from one to five minutes, according to the degree of enlargement, the sensitiveness, the strength of the chemicals, the density of the negative, and other similar circumstances.

It may be asked what method of enlargement do we specially recommend for an amateur who may desire to produce an enlargement, at occasional intervals only, with appliances most readily at command. We answer—make a transparency from the negative, place it in the copying camera, obtain from it a large negative, and from this negative produce a print by the ordinary process of sun printing.

The solar camera differs from the magic lantern only in the source of light, the sun supplying the place of the lime; but, from the distance of the sun, a different kind of condenser is necessary from that employed in the lantern. The relative positions of the achromatic object glass and the negative are unaltered; but the condenser must be of longer focus, larger size, and be placed at a greater distance from the negative. According to the size of the condenser so will be the intensity of the light which is sufficient to allow of a print being obtained direct upon albumenised paper instead of by development, as already described. The rays of the sun are to be directed upon the condenser by means of a mirror, and arrangements must be made by which the mirror may be moved to follow the direction of the sun. Without this the prints will prove deficient in sharpness.

TONING FORMULÆ.

To secure a pleasing tone in a photograph is the aim of every photographer. No matter how charming the subject may be, or the delicacy of the gradations in its pictorial representation, if the tone be inartistic and unsuitable the picture is lacking in one of its chief graces—waiving at present all consideration of the permanence given to a print by its being properly toned.

Various metallic salts have been more or less successfully utilised as toning agents, but gold is now exclusively used for this purpose. From the cost of this metal it would at first sight appear as if its employment would be attended with great expense; the expense, however, is much less than would be anticipated, for the quantity it takes to tone a print is indeed homœopathic.

Toning solutions may be made so as either to answer only for the day on which they are prepared or to retain their toning properties for many months. The following formulæ may be depended upon as yielding rich and very desirable tones. They are contributed as being used in the everyday working practice of photographers of the highest eminence. The Editor is indebted to Mr. Rouch, for many of the following formulæ:—

No. 1.

Lime Toning Solution.—Neutralise just as much of a solution of chloride of gold (one grain of gold to one drachm of water) as is required, by shaking it up with a little prepared chalk—the quantity does not matter; then allow it to settle, and filter off the clear liquid.

Take of the above solution .... 10 drachms.
Acetate of lime .... 20 grains.
Chloride of lime .... 1 grain.
Hot distilled or rain water............ 20 ounces.

This mixture improves by keeping, and retains its toning properties for several months. To use, add two ounces of it to eight ounces of tepid water, which will prove sufficient to tone a full-sized sheet of paper.

No. 2.

Chloride of gold .... 1 grain.
Acetate of soda.................. 30 grains.
Distilled water .... 8 fluid ounces.

This preparation should be mixed twenty-four hours before use. It may be used over and over again, and may be strengthened with fresh solution when it tones slowly. It gives warm, rich, sepia tones.

No. 3.

Chloride of gold .... 1 grain.
Phosphate of soda................ 20 grains.
Distilled water.................. 8 fluid ounces.

Dissolve the phosphate of soda in two ounces of the water, to which add the chloride of gold; after five minutes add the remainder of the water. No more should be mixed than is required for immediate use. The above quantity will tone a whole sheet or four 10 × 8 prints. This formula gives very rich, dark purple, brown, or black tones. It is somewhat more troublesome than No. 1, and is therefore not so well adapted for commercial purposes.

No. 4.

Chloride of gold .... 1 grain.
Bicarbonate of soda .... 4 grains.
Distilled water .... 8 fluid ounces.

This formula is very extensively adopted; used soon after mixing, it will be found to give excellent results.

No. 5.*

Solution of bicarbonate of soda......... 40 minims.
(Strength eight grains to one ounce of distilled water.)
Solution of chloride of gold............ 20 minims.
(Strength fifteen grains to five drachms of distilled water.)
Distilled water .... 4 ounces.

Mix an hour before being used.

The solutions both of gold and soda may be kept ready for use in separate bottles. The above quantity will tone half-a-dozen 10 × 8 pictures, if warm tones only are required. The time of immersion varies from thirty seconds to two minutes. Over-tone slightly to allow for subsequent reduction in the silver bath.

More formulæ might have been added, but everything that the professional or amateur photographer can possibly desire will be found embodied in the above.

* R. W. Thomas.

Dry Processes.

PRACTICAL HINTS ON THE COLLODIO-ALBUMEN PROCESS.

By John Homersham.

When invited to contribute to The British Journal Photographic Almanac an account of my method of working the collodio-albumen process, I at first felt some diffidence in doing so, my method of preparing the plates being so similar to those already published; but, on further consideration, I think that the making known my own difficulties at commencing, and the manner in which I overcame them, may assist those who are about to try the process in question.

I took as my guide the formula of Mr. Petschler, published in last year's Almanac, and which in the hands of himself and others has given such beautiful results.

Like most tyros I found, on commencing, difficulties I had not anticipated, one of the first and most serious being the blistering and loosening of the film during development, although I took the greatest care in cleaning the plates—first with tripoli and alcohol, and then finishing with a little old collodion thinned down with alcohol and ether. Another annoyance was inequality in the development, with insensitive spots on the plates. The former defect I corrected by coating them with a weak solution of albumen (about one ounce of albumen to six of distilled water), and since adopting this method I have had no further troubles from blisters. The unequal development and insensitive stains I found originated from the unequal temperature of the plates, caused by too much handling of them when coating with collodion. I found it, therefore, desirable to allow the plates to remain a short time after polishing them, to allow the temperature to again become uniform; and, instead of using a pneumatic plate-holder, which is liable—especially in warm weather—to change the temperature at the place where it comes in contact with the plates, I now prefer holding them, when coating them with the collodion, on a piece of wash-leather folded double. This, in the hottest weather, I have found to effectually prevent the warmth of the hand from affecting the plates.

I use a bromo-iodised collodion not very new, and, should the film not be perfectly smooth and even, I reduce the thickness of the collodion by adding about equal parts of ether and alcohol until it flows in a satisfactory manner. This mixture I always keep ready, as it is very convenient to have it at hand. I prefer the collodion to set well before placing in the nitrate bath, which is the same as I use for wet plates, and I allow them to remain nearly five minutes in summer and somewhat longer in cold weather. I then remove and wash them thoroughly under the tap, and place them in a dish containing water sufficient to well cover them, to which has been added a little common salt. For a plate

8 × 5 I use about eight ounces of water and as much salt as will lay on a shilling. After allowing the plates to remain in this dish from two to three minutes I then wash them again under the tap, and let them drain on a tumbler or preserve jar for a minute or two.

They are now ready for being coated with a solution of albumen, prepared as follows:—

Distilled water	2 ounces.
Iodide of potassium	27 grains.
Bromide of potassium	12 ,,

To this I add as much iodine as will give it a light sherry colour, together with one drachm of ammonia. I now take the whites of six eggs (the newer the better) and put into a pint bottle containing sundry pieces of broken glass; I add the above solution, and shake well up together until thoroughly frothed. It requires to stand for several hours before it is fit for use. The method of using it is this:—Put into a developing glass as much as is required to cover the plate; pour this on and off two or three times from different corners, allowing sufficient time for it to thoroughly permeate the collodion film, then throw it away, and use a fresh solution in the same manner. This second solution can be used to commence coating the next plate with. Let the plate rest in a glass tumbler or jar until throughly drained, and then warm it before a clear fire, or by using a hot water bath; when dry it becomes quite transparent.

Plates so prepared may be stored away in grooved boxes until required for use, and, so far as I am able to judge, in this state will keep for an indefinite period without deterioration.

The next and last sensitising I should recommend not to be done until the plate is required to be used. The aceto-nitrate bath I use is the usual nitrate of silver bath for wet plates, to each ounce of which I add about half-a-drachm of glacial acetic acid, using rather more of the latter in warm than in cold weather. I place in a dish sufficient to cover the plate, which should remain in it about three minutes. Before immersing the plate I take a piece of glass of suitable size and draw it across the surface of the solution in the dish. This, better than bibulous paper, and with less waste of the nitrate solution, removes any particles of matter floating on the surface, which, with all the care used, it is sometimes difficult to get rid of entirely.

A useful little article for removing the plates from the dish, both in this case and when developing them, is a strip of patent plate glass, having one end cut into a lozenge shape, the point being "knife-edged." By using this for lifting the plate it allows of its being drained before touching it, for the less the fingers come in contact with the plate or solution the better.

Having removed the plate from the dish, and before washing under the tap, I take a tuft of cotton wool, and carefully and lightly go over the surface of the plate to remove any insoluble particles or extraneous matter which might fail to be carried away by washing under the tap. This, I find, add to the perfection of the negative when finished.

After washing thoroughly under the tap, and finishing it with distilled water, the plate is placed in the dark closet to dry, after which it is ready for exposure. The sooner after preparation it is used the more successful will be the result.

A plate prepared by this process requires about four times the length of exposure as for wet plates. When developing, instead of pouring on the plate the pyrogallic acid solution, I prefer to place the negative in a dish with sufficient solution to cover it, having previously wet it under the tap. The bath for this purpose is composed of two grains of pyrogallic acid to an ounce of distilled water in warm weather, and three grains when the weather is cold. To each ounce of the solution is added about one drop of glacial acetic acid, which prevents any tendency to fog, especially when the negative has to remain in the bath any length of time from having been under-exposed. During this and the subsequent operation care should be taken to avoid touching the plate with the fingers, on account of the contamination which ensues. Let the negative remain in the pyro. solution until the details are fully visible by reflected light; for facilitating examination the negative should occasionally be lifted with the slip of glass already described. This will agitate the solution over the surface of the plate more effectually than any rocking motion given to the dish when the plate is left stationary in it.

When the details have become thoroughly (though faintly) visible, remove the negative from the bath and proceed to intensify it. The intensifying solution I use is prepared according to Mr. Petschler's formula, consisting of—

Nitrate of silver	10 grains.
Citric acid	20 ,,
Glacial acetic acid	1 drachm.
Distilled water	1 ounce.

I place the negative on a glass tumbler or preserve jar having a piece of damp bibulous paper, folded two or three times, laid on one part of the edge or rim. I prefer this to the pneumatic holder, as being cleaner and less liable to alter the temperature of the plate during development. The negative will adhere to the rim of the tumbler with sufficient tenacity for all practical purposes. I now take a sufficient quantity of a freshly-made three-grain pyro. solution, pour on and off two or three times, and then add to it a few drops of the above nitrate solution, using but very little at the commencement, and regulating the quantity by the state of the negative. One which has been fully exposed requires less of the nitrate of silver solution than one under-done. A well-exposed collodio-albumen negative will show a slight transparency in the sky, and give a tint to the prints taken from it. The negative, when developed, should again have a clean tuft of cotton wool lightly rubbed over the surface to remove any extraneous particles on it. It must then be thoroughly washed under a tap, and fixed with hyposulphite of soda. The plate, after being thoroughly washed, is then dried and varnished, a longer time being required to fix a collodio-albumen plate than one by the ordinary wet process.

THE TANNIN PROCESS.

By W. Warwick King.

Not considering that the tannin process is moribund, I most willingly accede to the request of my friend, the Editor, that I should give him a few notes on the subject.

I may here mention that every photographer practising a dry process will do well to notice *every* observation on the working of the different dry processes. By means of this he will often gain a most useful hint for some improvement in the manipulation of that one to which he devotes his attention.

First, as to the preparation of the plate. A good bromo-iodised collodion should be used (Rouch's answers admirably in my hands) with the ordinary thirty-grain nitrate of silver bath. The glass plate must be scrupulously clean, and when coated immersed for the usual time in the nitrate bath. When the silver solution flows off evenly place the plate in a dish of distilled water for about a minute, moving it up and down by means of a hook till all the greasy lines disappear; then put it under a tap, turning the water on freely and moving the plate about during that operation, which should last two minutes. I do not consider that a washing of one minute is sufficient. Then swill the plate with distilled water to remove any remaining trace of the common water. When this is done place the plate on a level stand, and pour on a solution of tannin fifteen grains, filtered through blotting-paper.

Every sample of tannin has answered well in my hands. It should be mixed, unless very pure, an hour before use, and stirred occasionally. Throw away the first solution, and then pour on a second quantity. Allow this to remain on the plate for two or three minutes, so that the tannin may thoroughly penetrate the collodion film. Then stand the plate in a box on one corner to drain on a piece of blotting-paper two or three thicknesses. When quite dry, which will be seen by the plate presenting a highly-polished surface, paint the back with a mixture of burnt sienna and gum water. This should be laid on rather thickly; thus one great fault of the tannin process (blurring) is entirely avoided. Lastly, varnish the edges with old spirit varnish, to prevent the film slipping. Exposure: on this subject I can give no definite rules.

To develope, cover the plate with a solution of spirits of wine and distilled water mixed in equal proportions. Pour this off (it may be used again), then pour off and on distilled water several times, till all the "oily" lines caused by the spirits of wine disappear. Make the following solutions:—

No. 1.

Pyrogallic acid	2 grains.
Distilled water	1 ounce.

No. 2.

Citric acid	10 grains.
Nitrate of silver	10 ,,
Distilled water	1 ounce.

No. 3.

Citric acid	40 grains.
Nitrate of silver.....................	10 ,,
Distilled water	1 ounce.

Solutions 2 and 3 will keep for some time, but all must be filtered before use. Take sufficient of No. 1 to cover the plate, add thereto one drop of No. 2 to each drachm of No. 1, then pour on the developer.

If the picture appear in all its details instantly, it has been over-exposed. Pour off the developer, and continue the development with plain distilled water, to which add a few drops of solution No. 3 till sufficient intensity be attained. Now wash, and fix with saturated solution of hypo. If the picture has been rightly exposed all the details will appear gradually, and when out the intensity can be gained by adding to the developer a few drops of the last-named silver solution.

It will be thus seen that the process has the merit of simplicity, and I think may compare with any of the other dry processes in keeping qualities after exposure, though I would adhere to the golden rule that it is best to develope all dry plates as soon as possible, and thus prevent any risks to which they might otherwise be liable.

THE GLYCERINE PROCESS.

By William H. Harrison.

The object of the recent researches into the photographic value of glycerine for outdoor work was to abolish dry plates, dark tents, dark boxes, washings of the film, and intensification after development; also to render the process available for instantaneous pictures.

For ordinary outdoor work, where a less exposure than five seconds is not desired, the following formulæ are recommended:—

A well-cleaned plate is coated with any good bromo-iodised collodion of commerce, and then immersed in the nitrate bath, composed of—

Pure recrystallised nitrate of silver	350 grains.
Distilled water	10 ounces.
Acetate of soda.........................	2 grains.
Glacial acetic acid	3 drops.

The trace of acetate of soda is added to secure freedom from free nitric acid, which would decompose the glycerine preservative. An iodised plate should be allowed to stand in the bath for a few hours when first made. The foregoing bath, like the collodion, will also do very well for the ordinary work of the glass house.

The preservative solution consists of—

Pure glycerine	2 ounces.
Pure honey	2 ,,
Distilled water	2 ,,
The foregoing bath solution	2 ,,
Pure kaolin	¼ ounce.

These should be well mixed and shaken together, and the sticky solution then allowed to stand in diffused daylight, not sunlight, for two or three days. It will first darken, then throw down a precipitate, leaving the upper part of the solution clear and bright. The upper part of the solution should then be filtered into a second and clean bottle. The invaluable preservative thus made with little trouble will last for years without at all deteriorating in photographic value. The glycerine must be quite pure, and as that of commerce is usually largely contaminated with lead, care on this point is necessary.

When the plate is taken from the bath, some of the preservative is at once poured upon its surface, made to cover the whole of it, and to drive the bath solution before it back into the measure from which the preservative was poured. A second time the same solution is run over the plate, and allowed to sink well into the film, after which it is again poured back, and the plate set on end upon clean blotting-paper in a dark box to drain for about a quarter of an hour or more. One ounce of the glycerine solution can be used with three or more plates in succession, after which it can be poured back into the dirty bottle in which it was first made, shaken up with the sediment therein, and filtered back into the clean bottle when it needs replenishing. Thus about six ounces of glycerine solution will last for years, the liquid from the bath preventing decrease in bulk.

The prepared plates when drained from excess of solution are placed in the dark slides. The time of exposure depends upon the lenses and the light, varying in stereoscopic work from five to thirty seconds. With brilliant short-focus lenses it will rarely exceed fifteen seconds.

The developer consists of—

Pyrogallic acid	2 or 3 grains.
Citric acid	1 grain.
Water	1 ounce.

With the above, which is recommended, or with any other pyrogallic developer, intensification is never needed, and the picture, when not under-exposed, has plenty of half-tone. An iron developer may be used, but demands shorter exposure, and sometimes after-intensification. In ordinary tourists' work it is a mistake to reduce the time of exposure much below ten seconds, because it is then easier to make a mistake as to the right time of exposure, and with sensitive chemicals the error may be an important one.

Wash; then fix with cyanide in the usual way; varnish, and the negative is finished.

Glycerine plates, it is believed, will not keep well more than twelve hours after preparation; but a dark room can always be extemporised at the temporary place of residence whilst travelling, and out of doors the photographer is burdened with nothing but his little box camera and portable stand. Every ray of white light must be rigidly excluded from the room, which may be illuminated with a candle.

For instantaneous pictures the collodion should contain ten grains of bromide of cadmium to the ounce. The bath:—

Pure nitrate of silver	600 grains.
Distilled water	10 ounces.
Acetate of soda..........................	2 grains.
Glacial acetic acid	3 drops.

Leave the plate in the bath for a quarter of an hour at least; then coat with the preservative, and drain as before. In bright weather the waves of the sea may be photographed on these plates with an exposure of one-tenth of a second. Any iron developer may be used, the strongest the manipulatory skill of the operator will allow him to employ being the best. The proportion of acetic acid should be reduced as low as possible, to secure all possible half-tone with the minimum of exposure. These pictures require after-intensification by any method the operator likes best. Where in bright light an exposure of one second or more can be allowed, an iron developer usually brings up the picture to full printing intensity at once, and a pyrogallic and formic acid developer always does so. When longer exposures are given, and the citric and the pyrogallic acid developer is applied, the film blackens intensely to the tone of the operator's boots, and would probably do well for transparencies, as by transmitted light the colour is deep and rich.

Some gentlemen who have made experiments with the glycerine process have recommended the omission of the honey. As they also state that the preservative so prepared requires "doctoring" after a few pictures have been taken, I do not recommend it. Six ounces of the solution should do for several hundred pictures of the stereoscopic size, and keep for two years at least, as mine has done.

Glass obstructs many of the actinic rays of light, so is a faulty substance to make into lenses for rapid work. Some kinds of glass are more opaque to photographic rays than others. To keep a check upon opticians, every photographer can easily tell the relative chemical transparency of his lenses, after unscrewing them from their tubes. Cut some small pieces of equally sensitised albumenised paper out of the middle of a sheet, and place them under the lenses in the dark room. Then expose them for a few seconds to the direct light from the sky, but not in the glass house, the roof of which would previously cut off most of the rays which glass can stop. When the papers are very faintly tinged take them back into the dark room, and see which of the lenses stops most light. The paper must not be allowed to take more than a faint shade of colour, as the deeper the tinge the more unreliable are the indications.

The box cameras at present in the market are usually beautifully made, but cause travellers much unnecessary trouble and loss of time. The tourist should refuse to purchase one which wil not allow the lenses to remain in position in the camera inside the box. Screwing them on and off for each picture, and carrying them at other times in the coat-tail pocket, causes loss of time and risk of breakage. A splendidly-made "gingerbread" camera, which weighs nothing, trembles in every passing breeze, and requires much screwing together for every picture, is an endless source of annoyance. Some practical information about a simple travelling camera, which can be placed in position in a minute, and taken to pieces as quickly, so as not to detain the photographer more than five minutes over each view, is described in THE BRITISH JOURNAL OF PHOTOGRAPHY of May 11, 1866, but cannot be reproduced here without the aid of diagrams.

THE FOTHERGILL PROCESS.

By FRANK HOWARD.

THE Fothergill process, which now includes those washed albumen modifications which have been suggested by various photographers, may be successfully practised in the following manner:—

The plate is coated with a collodion giving a rich creamy film, sensitised in a bath giving good negatives by the wet process; upon removal from which the plate is immersed in a dish of filtered rain or distilled water, and gently agitated till the water flows evenly over the plate, which is then removed and attached to a plate-holder, and covered with the albumen solution, viz.:—

Albumen	1 ounce.
Water	2 ounces.
Liquid ammonia	30 minims.

(This should be well shaken in a bottle, or beaten, and filtered through sponge.) After having been flowed over the plate three or four times, the plate is to be immersed in a dish of water and well agitated, the water poured off, and another quantity used in the same manner, and again a third time; the plate is then set up to dry spontaneously in a cupboard or box. These plates are very sensitive, but will not keep for a long period. For keeping qualities the plates must be washed in two or three changes of water after leaving the nitrate bath; and after the final washing (after albumenising) must have poured over them a five-grain solution of gallic acid, and be then set aside to dry. By this method great keeping qualities are obtained, but the plates require a very much longer exposure. The development should be very slowly accomplished, and by using care in the preparations excellent results can be obtained.

The following remarks may prove of service to photographers working the process:—It is found that the denser the albumen solution can be used the softer will be the detail in the negative. This arises from the development being more under control, the deposit is not so black, and the high lights do not intensify too rapidly.

Softness and detail are much promoted by separating the process of development from that of intensification. If the most artistic result be aimed at this should always be done.

The plates before development should be varnished round the edge; amber varnish is the best for this purpose, for by no possibility will the pyrogallic solution become injured, however soon after varnishing the plate be developed. The only defect in this process, which has never been satisfactorily explained or accounted for, is the marblings or grain-like streaks which will sometimes appear on a batch of plates as annoyingly and as unaccountably as the blisters on the collodio-albumen plates. On the one hand the greatest care will not prevent their appearance, and on the other the greatest carelessness will not lead to their production. I am inclined to attribute them to the albumen not absolutely and intimately mixing with the aqueous silver film after the first washing. The use of strong liquid ammonia and a dense albumen solution will materially assist in avoiding them.

BENNETT'S DRY PROCESS.

After coating the plate with collodion, and exciting in an acid silver bath, wash it in three or four changes of water. Now pour over the surface a saturated solution of gallic acid, and allow to drain for a few minutes.

A hot solution of gelatine, four grains to the ounce, is then poured over the surface, after which the plate is dried either spontaneously or by artificial heat. The development is effected with pyrogallic and citric acids, together with an admixture of nitrate of silver in the usual way. We have seen some very fine negatives taken in this manner.

THE HOT WATER PROCESS.

The plate having been collodionised and excited in the usual manner, is subjected to a thorough washing, after which must be poured over it a diluted solution of albumen, prepared by adding to the white of one egg from four to six ounces of water, together with ten drops of ammonia. These are well shaken up and allowed to stand until the froth has subsided, and the solution is filtered before being used.

After the excited surface of the plate has been coated with this solution, it is drained for a minute or two and then immersed in a dish containing boiling—or very hot—water. This coagulates the albumen and completes the preparation of the plate, which should, however, be rinsed in a little distilled water before being placed aside to dry. When thus prepared, the plates will keep for several weeks.

The developing is effected in the same manner as that recommended by Mr. Homersham in his description of the manipulations in the collodio-albumen process.

In this, as in all processes in which albumen plays a part, the fixing must be effected by means of hyposulphite of soda rather than by cyanide of potassium.

Plates prepared in this manner have, in the hands of the Editor, always proved of the most reliable nature ; and, while the sensitiveness is not inferior to that of dry plates generally, the delicacy and gradation of tone are excellent.

Optics of Photography.

A FEW OPTICAL TERMS POPULARLY EXPLAINED.

Achromatism *(Freedom from Colour)*.—When a ray of light is transmitted through a prism or single lens, it is decomposed into its primitive colours. In photography, as well as for many other purposes, it is necessary to employ lenses which refract the various colours of which a white pencil of light is composed to as nearly as possible one point. If a single or non-achromatic lens were held so as to throw an image of the sun on a sheet of paper or other medium, such image would be confused in consequence of its being in reality a compound image, that next the lens being blue, one a little further removed being yellow, and one still more distant being red. This confusion is removed by achromatising the lens, by which the variously-coloured images are brought to one point, practically speaking, thus producing a brilliant, sharp, and uncoloured image. An achromatic lens must consist of a concave lens of flint glass in contact with a convex lens of plate or crown glass.

Angular Aperture.—This quality in a lens is erroneously supposed by many to mean its power of reproducing a view comprising more or less subject. If there are two lenses of exactly the same focus, but of different diameters, that one having the largest diameter has the largest *angular aperture*. A lens only one inch in diameter may have a much larger angular aperture than one four times its size, provided its focus, relative to its diameter, be shorter than the other. The acting angular aperture of a lens varies with each different stop that is employed. The angular aperture of a portrait lens is, in practice, much greater when worked "open" than when a stop is used. The larger the angular aperture of a lens the quicker, *cæteris paribus*, will be its action. Lenses for instantaneous work should possess this requisite in a large degree.

Angle of View.—Landscape photographers are often annoyed because they cannot get in as much subject in their pictures as they would wish, in consequence of which many objects are excluded which would greatly add to the pictorial effect or to the interest of the subject. Some lenses will embrace a much wider range of subjects than others, or, in other words, they are capable of reproducing a wider *angle of view*. If a landscape lens—say of one inch diameter and ten inches focus—be compared with another lens of exactly the same focal length but of two inches diameter, the latter (provided the stop in both cases be similar in regard to aperture and is properly placed) will include much more subject than the former: the *angle of view* it will embrace is greater.

Aplanatism *(Freedom from Error)*.—This phrase was applied by Sir John Herschel to lenses in which the *spherical* aberration was destroyed, in contradistinction to *achromatism*, which served to signify the removal of the prismatic colours in certain lenses. An object glass for a telescope should possess both qualities. It should be aplanatic—that is, free from spherical aberration; and it should also be achromatic, or free from the power of rendering the image coloured. In photography, the term "aplanatic lens" has been applied by Mr. Grubb to a lens which he patented some years ago.

Astigmation.—A peculiar kind of imperfect definition whereby what should be a point is misrepresented by a short line, causing the whole image at the margin of the picture to appear as if drawn in ink and rubbed in one direction before the ink was perfectly dry. The defect arises from the great obliquity of the pencil of light incident upon the lens, whereby the angle formed by the margins of the lens with reference to the radiant point is smaller in one direction than in that at right angles to it.

Catoptrics.—That department of optical science which treats of light as influenced by the laws of reflection.

Chromatic Aberration.—White light when refracted by a lens of one kind of glass only becomes decomposed into the constituent coloured rays, having different refrangibility; consequently the blue rays converge to a focus nearer to the lens than is the case with the red rays, and the intermediate colours have intermediate foci. This of course produces a more or less confused image, which is due to the chromatic aberration.

Copying Lens.—When a portrait lens is employed for copying any object, care should be taken that the size of the original be not exceeded. If it be necessary to enlarge the object copied the lens should be reversed, so as to present the front lens to the ground glass. Portrait combinations are unfavourably constructed for copying exactly the size of any object. For this purpose a "doublet" or "triple achromatic lens" will answer better. A good copying lens may be extemporised by removing the back lens of the portrait combination and inserting in its place another *front* lens. A combination of this kind requires a small stop, but when the size of the copy approaches that of the original it yields a picture of great brilliancy.

Depth of Focus is a term frequently used by photographers. As the focus of a pencil of rays is strictly a point, it is obvious that the term is scientifically inaccurate. Depth of definition has been suggested as more correct. It is meant to convey that property possessed in a greater or less degree by lenses of representing objects situate at widely varying distances from the camera with equal distinctness; and, in accordance with the power possessed by a lens of doing this, so is said to be its depth of focus. This property is conferred on a landscape lens by reducing its stop. The shorter the focus of a lens, whether for portraits or for landscapes, the greater will be the depth of definition which it will give.

Diaphragm or Stop.—A piece of metal inserted in the mounting of a lens, having a hole in its centre. When judiciously placed it gives more flatness of field, general sharpness, depth of definition, and width of angle of view than could possibly be obtained without it.

Diffusion of Focus.—This phrase has recently been introduced to express the presence of so much spherical aberration in a lens as, by suppressing optical sharpness in any one plane, shall prevent that plane becoming obtrusive from its sharpness at the expense of other parts. Mr. Talbot was the first to suggest a means of lowering intense sharpness in such circumstances where it was deemed objectionable. This he accomplished by interposing one or more sheets of paper between the negative and the sensitive paper. The Editor of this Almanac exhibited to the Photographic Society of Scotland, in the beginning of 1864, a lens he had constructed, which, at the will of the operator, would either yield pictures intensely sharp or images delineated in what is termed a "diffused focus." There was a small slit in the lens mount from which a pin projected very slightly. When the pin was pushed up to one end of the slit, the lens gave exceedingly sharp definition by sliding it down to the other end; the image was *generally sharp* all over a large plate, but was *particularly sharp* nowhere. The effect was obtained by a certain amount of spherical aberration introduced by the moving of the index pin in the slit, which effected an alteration of the position of the lenses. M. Claudet has recently advocated screwing the lens in or out during the exposure, by which similar effects are obtained, his object being to have the various planes of the face represented with equal sharpness, even though that sharpness be of a lowered character.

Dioptrics.—That department of optics referring to the laws governing rays of light passing through transparent media.

Dispersion.—The property possessed by refracting media of decomposing white light.

Double and Triple Combinations.—Lenses formed of two or more *single combinations*, the components not usually in immediate contact with each other.

Doublet.—A combination composed of two lenses. The ordinary portrait lens is a doublet, although the term is now usually employed to designate a combination intended for landscapes or copying purposes. Its advantage over the single achromatic lens is that, within reasonable limits, it gives pictures quite free from distortion. The globe lens of Harrison, of New York, which was introduced a few years since, was felt to be a great improvement on the lenses previously in use, on account of the great width of angle it included, together with freedom from distortion. A fault possessed by it is a tendency to produce a bright flare spot on the centre of the plate when directed to a bright sky. Ross has since brought out a cemented doublet in which the flare spot does not exist, and in which the angle of view exceeds that of the American form. Darlot, of Paris, has also introduced some forms of doublet lenses. All these doublets referred to are composed of a more or less deep meniscus lens placed at each end of a short tube, with a stop between them. The peculiarity of each consists in the curvatures and methods of achromatising.

Field of View.—The space visible when looking through a lens.

Field of Delineation.—The surface upon which an image is distinctly defined in the focus of a lens.

Flare Spot.—Some double combinations of lenses, when used with a small stop and pointed so as to include a portion of sky on the ground glass, cause a small bright spot to appear on the centre of the picture. Various sources have been assigned for this; the true one will be found in certain rays being reflected from the back lens on to the front, which in turn reflects them back into the camera, the size of the flare spot on the ground glass being limited by that in the diaphragm, Waterhouse stops being supposed to be used. The ordinary portrait lens, from the construction of its back element, produces the flare spot in perfection; an alteration in the nature of the curvature of this portion of the lens effects a remedy more or less complete.

Focus.—A point towards which, or from which, rays passing through a lens converge or diverge.

Meniscus Lens.—This lens has one of its sides convex and the other concave, being thicker in the centre than at the margin. From the earliest times in photography this form of lens has been adopted for landscape purposes, on account of the flatness of field yielded by it, conjoined with good definition when a diaphragm is placed in front of it and next to the concave surface. The deeper the hollow of this lens the flatter, *cæteris paribus*, will be the field of definition. In the early days of the art the meniscus lenses were much deeper than those subsequently made by English opticians; indeed the landscape lenses of French opticians have always been deeper than those made in this country. Our opticians are now making their single achromatic combinations of a much more decided meniscus form than they have previously done, in consequence of which a wider angle of view is better included than when a plano-convex lens is employed.

Optics—That science which treats of the laws and properties of light generally.

Orthoscopic or Orthographic *(Correct Vision, Correct Delineation)* **Lens.**—A double combination lens chiefly intended for taking views, and possessing a more than usually flat field of delineation. The designation is certainly a misnomer, for the image produced is distorted in the opposite direction to that from an ordinary meniscus lens.

Over-Correction.—When a lens is achromatised by combining the yellow with the more active of the actinic group of rays, it is said to have its visual and chemical foci coincident. Many lenses, however, of great excellence are corrected by grouping together as many of the chemical or actinic rays as possible without reference to the yellow ray. These lenses are commonly stated to be over-corrected, because the relative position of the yellow and blue rays are reversed. It has been affirmed, with some show of reason, that a lens of this kind will work more rapidly and produce a more intense picture than when the chemical and visual foci coincide. A certain amount of trouble is sometimes experienced in focussing sharply with lenses of this description. Mr. R. H. Bow invented a most ingenious method of correcting this. A spectacle or other common lens, of such power as to cause the visual focus to equal in length the actinic focus, is temporarily fixed into the lens tube; the image is then focussed as sharp as possible on the ground glass, and when placing the cap on the combination the adjusting lens is removed, the picture resulting from this arrangement being intensely sharp. The introduction of a weak concave lens of the proper power lengthens out the focus, so that the luminous or yellow focal point is exactly situated upon the ground glass, fixed at that distance from the lens which previous trial had determined as its chemical focus. On withdrawing the concave lens the visual focus is displaced, and its place is occupied by the chemical focus. This arrangement seems to answer perfectly for all distances and under all circumstances.

Panoramic Lens.—A peculiar kind of lens was patented by Mr. Sutton some years ago under this name. It consists of a sphere of glass filled with water, with a small stop in the centre, something in the style of the Coddington lens. The thickness of the glass shell, which is flint, is such as to achromatise the water inside of it. An ingeniously-contrived stop serves to admit the oblique pencils in quantity equally with the central ones. A curved plate must be employed on which to take the picture. The angle of view embraced is very wide.

Radiation.—When light falls upon a surface that is not polished, it is thrown back from every point on that surface, but in a manner different from what follows when the surface is polished, each point becoming a radiant from which the rays are thrown off in every direction.

Reflection.—A property possessed by polished surfaces of "turning back" rays of light falling thereon without decomposing them—the "angle of incidence" and the "angle of reflection" always equalling one another.

Refraction.—If a ray of light passes vertically through a piece of glass having its two sides parallel—such as a piece of plate glass—the ray passes on without suffering deviation from its course; but if the sides are not parallel, as in the case of a prism or a lens, the ray is bent from its course, and is said to suffer *refraction*. Some substances possess the power of refracting light in a greater degree than others. The diamond, for example, has a more refractive power than glass; or, in optical language, its *index of refraction* is higher. Water in this respect is much inferior to many other liquids—bisulphide of carbon, for instance. Glass varies considerably in its index of refraction according to its composition, flint glass being more refractive than plate glass.

Single Combination.—A lens formed of two or more lenses *in immediate contact* with one another, and generally cemented together.

Spherical Aberration.—When rays of light pass through a lens with spherical surfaces—an ordinary double convex lens, for instance—those passing through near the centre of the lens are brought to a focus more remote from it than those which pass through it nearer to the edge. Hence, with a lens of a given focal length, the larger its diameter the more apparent would be the confusion arising from this spherical aberration.

Speculum.—A metallic reflector. The name is usually applied to the concave speculum of reflecting telescopes, although every polished surface of regular form, whether concave, convex, or plane, may be so designated.

Triple Lens.—This name has reference rather to the number of completed lenses in the mounting than to the number of pieces used in achromatising any one of the lenses. As usually understood, the central lens is a concave, introduced for the purpose of flattening the field and correcting some of the aberrations of the other lenses. Archer was the first to introduce a concave for the purpose, among others, of lengthening the focus of a portrait combination, thus enabling a much larger size of plate to be covered by it. Sutton subsequently advocated a triple lens as a means of getting rid of the distortion caused by ordinary landscape lenses. Goddard followed with one which embraced a very wide angle of view without distortion, and was followed in turn by Dallmeyer, whose triple lens, although including less angle of view than Goddard's, was superior to it in its freedom from flare. Other makers have since varied the construction of the triple lens, and elicited new features in its working.

WHAT A LENS SHOULD COVER.

By George Shadbolt.

From the earliest days, since photography on paper became an art, or at any rate a popular art, the desire to include a large angle of subject has been generally entertained by its votaries, whether of the professional or amateur class. Few cameras were constructed to include more than about 30° of subject at the time of the introduction of the collodion process, for the simple reason that the lenses then in existence were not adapted for a more extended field of delineation. The writer well remembers at one of the first season's meetings of the Photographic Society the enthusiastic admiration elicited by a calotype landscape subject which had been taken in two sections and neatly joined, the two pictures when united including an angle of about 54° or 55°. Since those days a wonderful change has come about amongst the producers of lenses; they not only strive to meet the wants of the times by constructing lenses to cover a reasonable amount of surface well, but in the opinion of some aim at the impossible, and by rival advertisements vaunting the extent of angle each one's lenses will include, foster an unhealthy demand for that which, besides being of but little use in fact, must, if attained, cause the sacrifice of some equally, if not more, useful quality.

It may not be amiss to enter once again into the question of "what a lens will cover" upon a plane surface, and by a few simple calculations endeavour to arrive at some rational conclusions on the subject; for it is a very noteworthy fact, that as the angle of picture is alleged to increase, the size of the aperture in the diaphragm decreases in more than an equal ratio; and it is more than probable we shall find on inquiry that this straining after a "few more degrees" costs a great deal more than they are worth. The inutility of discussing the question with reference to any other than a plane surface scarcely needs demonstration; for, irrespective of other considerations, the hideous distortion of horizontal lines produced by flattening out a picture taken upon a curved surface is alone sufficient to condemn it, while the impossibility of viewing such pictures when curved, and from the right point of view, by more than one eye at a time, renders them practically useless.

Though all photographs appear more truthful to nature when viewed from the position occupied by the lens in their delineation, those upon plane surfaces suffer less deterioration from a change in the point of view than any others. Horizontal lines still appear horizontal, and perpendicular ones appear perpendicular, whether the pictures are looked at directly or obliquely, from a nearer or more distant point of view, than the normal one; hence, for all general purposes, a plane surface of delineation may be regarded as a *sine quâ non*, and this without any reference to mere convenience of reproduction. A panoramic picture, taken upon a flat plate by means of a rotating lens, is practically exactly equivalent to one taken upon a curved surface and subsequently flattened out, so far as delineation is concerned.

The most perfect result, as regards correctness of perspective, can be secured by means of a mere dark box of a rectangular form, furnished with a minute circular hole in the centre of one of its sides—say with a hole about the size of an ordinary pin, made in a piece of thin blackened brass plate. If this be presented towards a well-illumined subject an image thereof in perfect drawing will be formed on the opposite side of the dark box, and this will be the case no matter what may be the distance between the pinhole and the plane of delineation; but the farther they are separated the larger will be the scale upon which the delineation is effected. Although this image be perfect in drawing it is unfortunately not practically available, in consequence of two defects inherent to its method of production—it lacks both intensity and definition, each defect being aggravated as the scale of delineation increases. But though we cannot use an impression of this kind for the production of a photograph, it is valuable as a means of comparison for a test of the amount of distortion to which a lens-formed picture may have suffered, and it serves to indicate what we require in a lens that is intended to cover a large angle of delineation.

If we regard the pinhole as the lens, we cannot fail to discover that the perfection of the picture produced by it is due in part to the absence of deviation of the rays forming the image, and in part to the absence of any particular focus, the last-named fact involving the advantage of *all parts* of the plane of delineation being in equally good (or bad) focus. But it is evident that the distances between the pinhole and a point on the plate to which it is vertical on the one hand, and another point near the margin of the plate on the other, must differ very considerably; consequently it follows that, in order to construct a lens which shall produce an image equally perfect, we must contrive it so that an oblique pencil of rays must have a much longer focus than a direct one through the same lens. Now hitherto this has been found impossible of attainment. By certain contrivances the oblique pencils have been somewhat elongated in focus (or it has been alleged that this is the case), but the extent of elongation has been trifling when compared with the requirements—in fact, infinitesimal in quantity. It must not be supposed that the extra length of focus required for the oblique pencil is but trifling; it is so when a small angle of picture is included, but the extra length needed progresses with a constantly-increasing ratio as the angle of picture increases. The difference between foci required for the axial and most oblique pencils of rays is mathematically expressed by that between the radius and the secant of half the angle of picture. As an example: if the focus of the axial pencil be ten inches, the extreme oblique pencil for a picture of 100° would require to be a trifle over fifteen and a-half inches; while for a picture subtending but 60° the focal length of the extreme oblique pencil need only be a little more than eleven and a-half inches.

The form of lens that most effectually lengthens out the oblique focus as compared with its axial one is perhaps that known as the *aplanatic lens*, a special form of the meniscus lens; but unfortunately, like all lenses with a diaphragm at a considerable distance from the refracting medium, it produces some distortion at the lateral parts of the picture, to say nothing of a disturbance of the correctness of perspective, owing to displacement of the direction of the incident pencil of rays. This lateral distortion increases to a highly offensive extent when the angle of picture is very large, so that we soon arrive at a moderate limit, beyond which we cannot proceed. If, therefore, we must have a lens to produce a picture of great angular extent, we must seek for it in some form of lens by which there is no deviation caused in the direction of the pencils of rays, or at any rate which allows them to emerge in a direction parallel to that in which they enter. This condition may be fulfilled by a triplet, doublet, or single combination; but in either case the oblique pencils will come to a focus at a distance from the lens but little, if any, further from it than the axial pencils. Here, then, we are confronted with another difficulty—our field of delineation becomes curved instead of flat, and a picture produced by such a lens on a plane surface must be frightfully "out of focus," either in the centre or at the margins. Nevertheless we are of necessity restricted to one of these forms of lenses, and it remains to be seen how we can best palliate the defect above alluded to, or rather how our best opticians have attempted to do so. The focus of a lens is that "circle of least confusion" where the rays of a pencil of light cross each other, and where a section thereof is smallest; in fact, we may term it the point of the pencil. Now, it is evident that the more acute we make the point the less inconvenience we shall be subjected to in drawing if we accidentally break off a small piece from the point; then our pencil will not be so blunt as if we had broken off a piece of equal length from a pencil having a more obtuse termination.

This is in effect the way the opticians have dealt with their lenses. They have rendered it difficult to define an exact focus by reducing the aperture to an enormous extent—in fact, they have returned as nearly as circumstances will allow to the condition of the pinhole; but with its advantages they have been obliged to submit to some of its evils also. The intensity of the image is lamentably reduced, the crispness of defini ion is impaired, and the time requisite for its impressing a sensitive surface materially increased.

The deteriorating effect of astigmation on definition by the oblique pencil has been purposely omitted from consideration, as this is materially lessened by the excessive diminution of the aperture adopted for lenses intended to cover wide angles of pictures; but when it is borne in mind that an angle of 60° will mostly include quite as much of a subject as can be observed in nature at once—that is, without changing the direction of view—and that lenses to include that extent can be constructed without the serious disadvantages adverted to, it may well be seriously considered whether it is worth while to give up so much in order to gain so little.

To Preserve Gelatine Solution.—Gelatine, after being dissolved, is liable to get rapidly mouldy. The addition of a minute quantity of carbolic acid is said to make it keep in good condition. The proportion recommended is three drops of medicinal carbolic acid to eight ounces of the gelatine solution.

The Best Days for Landscape Photography.—On this subject Mr. Rejlander remarks:—"I often hear amateurs say:—'I am waiting for a bright sunny day before I venture out with my camera;' but this is a great error. Direct sunlight is positive ruin to a fine picture. The best days for landscapes are those on which white clouds are floating about, with occasional bursts of sunshine. On such occasions the light is always diffused, and the operator has always time to get all the minutiæ and detail well defined. He may then close the lens and wait for a bright gleam of sunshine, when, by rapidly opening and closing the lens, a most beautiful effect can be produced."

Art.

ON COLOURING PHOTOGRAPHS.

By Una Howard.

There is no doubt that colouring exercises a great influence for good or for evil in the artistic finish and beauty of a photograph. What is necessary is for the artist to appreciate and "assist" the subject on which he is about to operate. The many different tones produced in photography require deep study either to neutralise the one or aid the other, as the case may be; and all these various shades must be as variously treated.

Some persons there are who never will appreciate colour, just as there are some who have no ear for music. Of the latter class our immortal poet has said:—

> "The man that hath no music in himself,
> Nor is not mov'd with concord of sweet sounds,
> Is fit for treasons, stratagems, and spoils;
> The motions of his spirit are dull as night,
> And his affections dark as Erebus:
> Let no such man be trusted."

Now, I should be sorry to go so far in condemning those who possess no affection for colour, although music and painting are sister arts. We all know that nature, which is perfect, loves colour: nothing is created without it. The blue sky—the green verdure—the rosy-tinted morn—that lovely child, with its sparkling eyes, ruddy cheeks, and glistening golden hair—produce an effect that must strike home to every eye in any way sensitive to the sublime works of the Great Creator.

Colour is essential to create a truthful representation of the "human face divine." I never yet saw a person devoid of it. If such a being really existed, he or she would be the wonder of the age. Hence we see the necessity of painters doing *their* work as well as photographers. But when the eye is offended by seeing the miserable misrepresentations of nature displayed in our shop windows as coloured photographs, we cannot feel surprised at the dissatisfaction so often expressed by those who send their portraits to be painted. In such productions coarseness and vulgarity are chief characteristics.

There are some who profess a royal road to colouring—a wash of their magic pigments is to produce a *finished* specimen. So it does in many instances; for people generally commit such *artistic* productions to the flames as soon as received.

To colour with refinement, delicacy, and finish requires long years of study, excellent taste, and an innate love of art. Keeping true to nature should always be our aim—*preserving implicitly the likeness*, "making the rough places smooth," aiding the good points, and finishing the whole with an execution at once soft and brilliant.

Some say the art is mechanical: I deny it. No doubt much is done for the colourist by the photographer, but much is required in return. We see that each must assist the other in producing results at once beautiful, truthful, and striking.

ON TINTING PHOTOGRAPHS IN WATER COLOURS.

By A. H. Wall.

A PHOTOGRAPH simply tinted with oil or water colours is superior to any other coloured photograph, excepting one really highly finished by a colourist who is, what few photographic colourists are, viz., really an artist. Some hold that a coloured photograph is simply a spoilt photograph. With these I am far from agreeing, although, remembering how commonly photographs are thus spoiled, I can easily understand how such a conclusion may have been very frequently arrived at. Very few artists will colour photographs, and those who do so find very little pleasure in the process unless they are happily associated with a photographer who is an artist also. It is but mill-horse work to be labouring, for instance, on a photograph in which the light and shade is so ineffective that unless you alter it your picture will be a poor, flat, feeble thing; and if you do alter it, the chances are a hundred to one against your preserving the likeness. This to the artist who loves and takes pride in all he does is a very melancholy state of things, seldom productive of anything pleasant or satisfactory beyond or above the pay he receives.

In *tinting* photographs, on the contrary, an eye for colour and some taste are the main requisites. Many of those who succeed best in so doing are those who are quite unable to draw and have never received any kind of artistic education. I have myself given tuition to scores of pupils who could neither draw nor paint, nearly all of whom had never before handled a brush, but who nevertheless afterward practised as photographic colourists, with various degrees of success it is true, but still professionally. For this reason I think a few brief hints on tinting photographs in water colours may not be unwelcome to many who purchase the Almanac.

The tone of the mounted photograph should be, as a rule, of a cool grey, and it may be prepared either with a little oxgall in water, or by simply passing the tongue over it, or by using a preparation sold for the purpose by Newman & Co., of Soho Square, London.

Commence by filling your brush with cobalt, "bodied" with the slightest possible quantity of Chinese white or Naples yellow, according to the complexion—using the former for a fair delicate white complexion, and the latter for one in which yellow plays the more prominent part. Wash this over the whole of the shadows and half-tints of the flesh. When dry, touch the darkest shadows carefully with Indian-red, mixed with a very little scarlet vermilion, and with the same mixture warm the nostrils, the darkest part of the upper lip, the dark line dividing them, and the lines of the eyelids. Now use a little rose madder for the carnations in the cheek, touch the upper lips with carmine and the lower with rose madder, delicately tinge the eyelids, nostrils, bridge of nose, chin, and parts more immediately above the brow with pink.

When all this is completely dry carry over the flesh a wash composed of extract of vermilion, rose madder, and raw sienna, by varying the proportions of which complexions of every kind may be very successfully imitated. Great care must be used in carrying this wash over the face so as not to disturb the tints already applied; and it is in doing this that the beginner will find his first great difficulty, but practice and thought will soon show him how to get over it. Take enough colour to cover the requisite space, if it be not too large, and, under any circumstances, never suffer the edge of the wash to cease moving until the whole of the space is covered. Use the brush with a light, feathery, sweeping touch, and do it as quickly as is consistent with a due degree of care and attention. If the wash should dry unevenly the remedy is in carefully stippling the lighter parts up to the darker, or in touching over the darker spots with a little Chinese white, skilfully applied, so as to harmonise with the general effect. Now strengthen the greys with cobalt, the deepest shadows with madder brown, the reflected lights with orange vermilion No. 2, the carnations with rose madder and vermilion, so as to obtain the natural strength of colour, and give a lifelike warmth and fleshiness to the face and hands. The eyes should be next coloured, putting the line round the iris if it be sufficiently defined, using indigo for grey eyes, and sepia for brown eyes. Touch the pupil with indigo or black, and the spark of light on it with Chinese white, tinted with a slight touch of cobalt. The eyelashes may be strengthened with sepia, and the same colour used for the hair if it be neither auburn, golden, nor dark; but if it be either of the latter use Roman ochre, brown ochre, burnt sienna, Indian red, neutral tint, or a black composed of sepia, crimson lake, and indigo, which will compose either a brownish, purplish, or bluish-black, as the occasion may demand. Keep the high lights cold and reflected lights warmest.

For draperies use first a general wash of the colour required, touch in the high lights with a little of the local colour mixed with white, and deepen the shadows, using a little more gum in your pigment.

COQUETRY.

From a conversation with O. G. Rejlander.

* * * Thus photographic coquetry smiles upon the followers of the "black-art" while all the world is looking on, but retires into secrecy when the painter, the sculptor, or the engraver seeks the sunshine of her favour.

Our lens-makers can tell stories of lenses supplied to many of the best artists of the day, our camera-makers have similar tales to tell, and all our artistic photographers could whisper secrets of moment concerning the production of pictures of world-wide repute, only in honour they are bound to secrecy. Yet it is said that photography is not a fine art! The artist-photographer produces a picture which the artist-painter copies—nothing more; yet this simple process of copying makes that a fine art production which before was but the offspring of a mechanical process! The tracing from a photograph, even if imperfectly executed, is a picture, the work of an artist; while the identical photograph from which he traced remains classified with manufactured goods, such as are sold by the gross and made in the workshops of mechanics.

But the artists do not ignore the value of photography—the fact of their using it proves this; nor have they any motive for secrecy more ignoble than this. The public do not believe in photography as a fine art! There's the mischief. If it were not for that there would be an end to this coquetry; artists and photographers would meet openly at the *séances* of our societies, to compare notes and give each other the benefit of their respective experience. Herbert publicly acknowledged the use he made of photography in his great fresco at Westminster; and see what critics who were prejudiced against photography said of his work in consequence of that admission.

It is the public we have got to convert to the belief in photography as a fine art, not the artists; they already fully appreciate it, and have themselves practically tested it. If any other more unquestionable proof of this were wanted, the change which has dawned on modern art-work since the advent of photography ought to suffice. The coquette favours one suitor openly because Papa Public smiles upon the courtship, but flirts behind the screen with the other, because Papa Public thinks Mr. Fine Art is so far above Miss Photography's station in life that his intentions cannot be honourable. Perhaps they judge from the facility with which anyone can learn to take a photograph, not knowing how immensely difficult it is to make a truly good art-looking one.

A WORD ABOUT PHOTOGRAPHIC ART FROM A COMMON SENSE POINT OF VIEW.

By Aliquis.

Whether it was from a fear that if he asked *much* he would get none at all, or from a suspicion of my tendency to fall a-prosing, when occasion offered, to all lengths, I cannot tell, but certain it is that the Editor of the Almanac, in proffering his request that I should write a line for his behoof, made it particularly emphatic that of all things he chiefly desired brevity. Brevity is a good thing to be sure; and it is easy for a man to be brief if he have got an idea in his head. He has only to fetch it out, and there's an end. But how if one's sole object be to *write*, no matter what or how, provided it be sentences and something! The possibility of being brief under such circumstances is very remote, seeing that the writer begins and ends, so far as subject is concerned, nowhere. Still it is necessary to obey the editorial behests; and so—the enunciation of ideas not being possible—we shall adopt the dogmatical tone, in order that, when his judgment deems the rhapsody long enough, he may effectually stop the torrent with his scissors! First, however, lest homileties be too dry at new year time, let us allure thee onward, Oh reader, with an appropriate tale.

Once upon a time, then, when the fair handmaiden of art, which men in their wisdom have named Photography, was yet but somewhere in her teens, and while as yet the world wondered, and all its John Willets wagged their heads solemnly at whatsoever pots, human or other, they had—for the child was wrapped in endless mystery—an event happened in our village. A young man (a grocer) at some evening ball or merry-making met with an accident which so injured his right leg that the surgeon, to save the lad's life, had to cut it off below the thigh. Weakened in health and unfit thenceforth to leap the counter, he revolved in his mind, as he slowly recovered his strength, the problem of his future life. Among other dreams that haunted him in the long sleepy summer days there was one that ever and again recurred with increasing witchery to his mind. "Could I not call to my aid this new marvel of the age? Could I not photograph? It is said to be easy." He resolved to try. When recovered he went to the nearest city, purchased a small apparatus, got *four* lessons from a primitive disciple of the recent "greatest birth of time," and came back to his village a full-fledged practitioner. Verily, the world moves fast, my friend!

I remember the day well when first I approached with anxious feelings the new magician. The parents of a school chum of mine were to be operated upon at their own dwelling, and I, a favoured individual, was admitted within the sacred circle. When there, what astonished me most was the furious rate at which the performer stumped backwards and forwards between a queer-looking box with an eye in it and a mysterious closet. The flutter, the flume, and *gaucherie* of the man was obvious even to me. He fought away the whole afternoon, but nothing could be got to do its duty—everything was wrong. Anathemas were invoked upon sprites of strange-sounding names, and baths and everything were awry. At last, giving over further attempts, he took to polishing off his plates—glass positives—and perfecting his work by touching in the italianed parts of the old lady's cap with the point of a pin, and such like highly artistic performances. Further attempts proved no more successful, and he concluded that his teacher had humbugged him, and went somewhere else to learn a new way of working.

Such is my tale. Is it not a brief one? And has it not an obvious moral? Let it suffice for a text; and now for the application. Is it not a thing which every photographer is very prone to do—that of trying another way, a new method, when the artistic effect of the old does not please him? "Oh no! say you; we stick to the old methods; only when any new formula comes out we like to try it." Just so, and rightly so; but is it not the case that most photographers are apt to lay the blame of their non-success upon their chemicals, and not on any want of taste on their part? The evil with us all is that we look always to our chemical combinations to produce certain effects by the mere law of their action, independent of any control whatever exercised over them on our part. Hence we too often go to work entirely ignorant both of the object of our work and the method of employing our agents so as to attain that object.

A certain formula or series of formulæ is prescribed for obtaining certain given effects. We try them, are disappointed, and try another and another—always as if the effect were bound to follow the cause infallibly as the conclusions in a proposition in Euclid. Acting thus, thousands of photographers welter hopelessly down, and ever further down from all semblance of beauty in their work, sighing perhaps the while—"If I but knew chemistry better!" If this, if that,—any "if" but the right one. I know a man who has dabbled in chemistry ever since he began, some fifteen odd years ago, to take photographs. He will discourse science to you by the ell and perform experiments without end; *but his pictures have grown worse and worse until, as art, no name could be too execrative for them.* Clearly, my friend, the remedy for bad pictures is not "to know chemistry better," but to get some idea of what is beautiful and lovely in art into your head, and, that done, to set to work and make the *modus operandi* you are acquainted with express that beauty to the utmost of its power. Do not long after every new formula published in the journals as if it were to be the potent antidote for all your woes. Remember that the man who has discovered it, or with whom it has become a pet, may have so grown to know its outs-and-ins and odd ways as to be able to coax it into expressing *his* purpose. And when a man comes to you, and with oily words and many pretty specimens offers to sell you the secret of some wonder-working concoctions—asking perhaps, to begin with, £5, coming down to £3 or £2, or £1 even, rather than be so uncharitable as not to allow you this chance of eclipsing all your brethren—do not make a fool of yourself by giving him heed. Granting it is all he says, it is wiser, cheaper, and better to hold to your own way. That, so long as photography is what it is, will always stand truest to you, and it will do all you could do with any other good formula once you get it in your power. Then, again, in the next place, remember that photography is a distinct art from all others, and that it cannot be wedded to, nor welded with, other kinds of art, so as that these last shall atone for the defects of the first. Our friend with his pin point did not improve the effect of the flat border of the lady's cap; neither will you by painting up the image in your negative—the dress, the legs, the hands or face of your figure—the sky or trees or water of your landscape—make your picture any better, but most surely worse. You can never hold yourself a photographer until you have made your pictures beautiful solely by means of the chemicals put into your hands by the man of science. This is no easy task, and perhaps the learning of it will be found harder than the gulping down of any number of formulæ. I know it will be so, but if photography is to live as an art it must be done.

Not to be going forward is actually to be retrograding, and this is what our art is fast doing as things now are. Until we cease to pore over measures, and filters, and modifications, and all mitigated and unmitigated humbugs of the quack *genus*, and honestly set to study art, it must do so. By studying art I do not mean learning to draw; that, though good, is not necessary. Study pictures rather, and, above all, watch nature. Study each human face that comes before you—not merely to ascertain the temper that dwells within, but to catch the hue of its flesh, the cast of its features, its lines and wrinkles, and determine how best you can make the means at your command express its fullest individuality.

How much is constantly needed in this way! Cannot your experience tell you better than I? To the landscape photographer the same advice is applicable. It is not a mere transcript of a scene that is wanted; it is something beautiful—something that will abduct, as it were, the loveliness that is in nature, and make it dwell in art for ever. The eye must be pleased with the harmony of the picture, or with its wildness and sublimity. The triumph of art is to make a picture the representation of more than it contains. Can hard, unyielding photography do this? Perhaps it can. I know not, nor can you till you try. And withal have somewhat of a soul in your work; be not a creature of rules and tethered limits. What Mr. Carlyle says about soulless science is equally applicable—even more conspicuously applicable—to art. Let me conclude with a quotation:—"What is that science which the scientific head alone, were it screwed off, and (like the doctor's in the Arabian tale) set in a brain to keep it alive, could prosecute without the shadow of a heart, but one of the mechanical and menial handicrafts, for which the scientific head (having a soul in it) is too *noble* an organ? I mean that thought without reverence"—aye, and work too—"is barren, perhaps poisonous; at best dies, like cookery, with the day that called it forth—does not live, like sowing, in successive births and wider-spreading harvests, bringing food and plenteous increase to all time."* Substitute art for science, and think the lesson over; it will do you good. And for those who crave ever for some new way, and chase novelties as children the butterflies of the meadow, suffer this one sentence—"Any road, this simple Eutempfuhl road, will lead you to the end of the world."† Now I have done. *Pax vobiscum et simul sapientia.*

* *Sartor Resartus*, page 40. † *Ibid.*

Miscellaneous Articles, Formulæ, &c.

SURFACE MARKINGS ON COLLODION NEGATIVES, AND THEIR REMEDY.

By John Anthony, M.D.

There are markings which must be familiar to most photographers as more or less resembling the marbling applied to the edges and covers of books, only that, instead of in colour, they show as formed of frosted silver. For years these patches were a great source of annoyance to me, and they made me consign to the refiner many a bath which I now know a very little trouble would have put into good working order. I discovered on a day when these spots were present in large numbers, and when developer after developer was used with like result, that there was present on the surface of the bath-fluid a slight iridescent film, some of which I found was attracted to the plate whenever it was put into or taken out of the bath, and which could be seen upon the sensitised coating of the plate as quite distinct from, though partially adherent to, it. This filmy matter I found was, by the action of the developer alone, and without the plate being exposed to light, made the nucleus of a patch of reduced silver, and, once on the track, careful experiment showed that most of the patches of similar appearance were due to this film on the surface of the bath; and that, although the eye could not always detect its presence, yet the same means were always efficacious in preventing these spots from forming upon the plate. These means consisted in simply drawing a slip of writing-paper once or twice along the surface of the bath-fluid before inserting the plate; it certainly put an end to the nuisance, and the white paper when withdrawn generally showed upon its surface a portion of this film far more delicate than a spider's web.

So much for the *cause*, now for the *remedy*:—Observing these films (which I venture to consider organic impurity in the bath favouring the reduction of silver to the metallic state) to be loosely attached to the collodion surface, though not removable by washing, I adopted the simple means of wetting a small tuft of cotton wool and brushing it lightly over the patch of reduced silver, which I found would adhere to the wool in preference to the collodion, and practically I found that this moderate amount of brushing in no way injured the image upon the plate.

I have said that organic impurity in the bath is the cause of these patches, but the fact is that organic matter from other sources will produce the same effect when in contact with the fluid which is applied to the sensitised plate as a developer. There is a source of impurity in the corners of all much-used plate-holders; and although the plate and its layer of silver fluid are generally protected by slips of blotting-paper, yet in cases of long exposure, and when the corners of the plate-holder are foul, the fluid silver on the plate and the matter from the corner of the holder manage to establish an alliance, and the result is manifest to a good eye, as streaks and patches of glistening silver floating upon the surface of the developer, and which are very apt, except care be used, to become attached to the film when the developer is poured off, thus necessitating the use of the tuft of cotton wool.

I may be asked why—if I find the bath to be in this condition, and so contaminated with organic matter—I do not turn it out, and make a fresh one? My answer is, that I may be in circumstances where it would not be easy to replace the bath, as on a tour, &c.; and that, moreover, a bath which has a tendency to throw up a scum and to form these spots, is in other respects calculated to give excellent pictures, and is perhaps far more certain in its working as regards "density" and "clearness" than a new bath might be. The remedy for the defect is, as I have pointed out, simple; but you may say—"Why not filter the bath?" This operation is not always convenient in a tent or on a journey; and I may say that I habitually filter my bath as little as possible, believing, as I do, that with each filtration at least as much extraneous matter gets into the bath as is got out of it, so I just point out the means I use to get rid of these plague spots without in the least asserting that other methods might not be equally useful.

As this paper is intended to be of a practical character, I will not speculate upon the sources of this organic matter in the bath; but I will conclude by calling attention to the distinction to be drawn between reduced silver patches *over* the collodion film, and those which occur *under* the film, or between it and the glass. The former I have described; the latter I believe to arise from imperfectly-cleaned or "smudged" glass, the markings being more zigzag than marbled in shape, and showing a yellowish tinge by transmitted light. The production of this last kind of marking is doubtless *assisted* by the bath being in a condition favourable to having its silver reduced to the metallic state, owing to the presence of organic matter. The accidental touch of a damp cloth on the surface of the plate prior to coating, or the omission of the use of the leather to polish off the markings left by the cloth which dried the moisture off the plate when it was cleaned, would entail a liability to have such stains as I have last described; and as they are quite unsusceptible of removal by any known means, they are, I believe, pretty generally taken to be the sign-manuals of clumsy or careless manipulators.

VEGETABLE PARCHMENT.—The fact that unsized paper could, by immersion in sulphuric acid, and afterwards in water, be converted into a species of parchment, is believed to have been discovered by Mr. Beasly; certainly it is published in his receipt book in 1852.

DEVELOPING.

ORGANICO-IRON DEVELOPER.

By Henry Cooper, Jun.

A twelvemonth's farther trial of the organico-iron developer in no way induces me to alter the opinions I expressed on the subject last Christmas; indeed, each month's work has steadily confirmed them. I am pleased to say that I have also received good accounts of the service it has rendered to many photographers who have been persuaded to give it a trial.

During the year I have been several times requested to give a short, concise, and practical description of my mode of working. This circumstance has led me to think that a *short* recapitulation of the formulæ given last year might be acceptable to the readers of the Almanac for 1867.

I make and keep in stock two solutions. No. 1 is made by dissolving sixty grains of gelatine in two fluid ounces of glacial acetic acid, and six fluid ounces of water. No. 2 is composed of gelatine which has been acted upon by sulphuric acid. Soak 150 grains of gelatine in water. When soft remove it, drain from the water, and, having placed it in an earthenware jar, pour upon it one fluid ounce of sulphuric acid (strong commercial). Stir, and allow to remain some time; then add four ounces of water, and render it slightly alkaline by means of liquor ammonia. When it has become cold add half a fluid ounce of acetic acid (glacial), and sufficient water to make the quantity sixteen ounces.

The strength of my developer I vary according to the circumstances, such as subject, temperature, kind of collodion, condition of bath, &c. The average is about twenty grains of sulphate of iron to an ounce of water. Fifteen minims of solution No. 1 added to this will usually make a very useful developer. If there be any tendency to fog use more of No. 1, and if a lack of intensity add a small quantity of No. 2. To intensify add a few drops of a solution containing twenty grains of nitrate of silver and thirty grains of citric acid to the developer. If from the state of the chemicals there be a want of softness and harmony in the negative, a few minims of formic acid in the developer will go far to remedy this.

I generally use a large proportion of bromide in my collodion—sometimes equal proportions of bromide and iodide. I have been very much pleased with the class of work obtained by using this large proportion of bromide in conjunction with the gelatino-iron developer.

It seems scarcely necessary to repeat the caution that too much must not be expected from mere formulæ, but still, perhaps, it is as well to keep this idea continually before the mind, as we are all too apt to blame the process and not ourselves when things go wrong, or when we cannot succeed with the formulæ greatly praised by some more fortunate worker. It is this feeling that has kept me from here putting down a mere set of formulæ; which are all very well in their way, but are something like a body without life, or a musical instrument without a performer.

I have given formulæ for the making of the gelatine solutions I use, because experience has taught me that the proportions given are most likely to give a satisfactory result. The mode of using them must, in a great measure, depend upon the discretion and ability of the operator, as quantity and relative proportions necessarily vary with every change in the conditions which govern the mode and manner of working.

As I have devoted a good deal of time to the consideration and working out of the subject of gelatine in the developer, I shall have pleasure in using the experience I have gained to help any who may not be so fortunate as myself in finding the benefit of the organic addition to their developers. I shall feel glad to answer any inquiries through the medium of the photographic journals.

FIXING.

CARBONATE OF AMMONIA IN THE BATH.

By Henry Cooper, Jun.

Since Mr. Spiller recommended the employment of carbonate of ammonia in the fixing bath I have constantly used it, and would recommend all photographers to do the same. Mr. Spiller's object in using it was to try and remove the silver that always remains in the whites of prints on albumenised paper. This he found it to effect to a considerable degree, so this alone would be a great recommendation for its use. But there are others. The bath containing it fixes the prints more perfectly and *rapidly* than when hypo. alone is used, the danger of sulphur toning is entirely obviated, and the colour and general character of the print is improved. The toning is more certain, as the colours given by the gold are very little affected by the fixing.

To every three ounces of hypo. I use half-an-ounce of carbonate of ammonia. I dissolve this quantity in about twenty-five ounces of water. From twenty to thirty ounces may be used according to circumstances, remembering that the thicker the paper or the weaker the bath the longer is the immersion required. I generally allow prints on thick paper to remain twenty, and if on thin fifteen, minutes, well turning them about whilst they are in the bath. When the prints are removed to the washing tank they appear very much reduced, owing to the greater transparency of the paper, than when the ordinary bath is used. When the print is dry, and the paper has regained its opacity, the image will appear in all its pristine vigour.

A method of fixing adopted by Mr. M. Whiting appears to me so scientific, so easy in practice, and so satisfactory in result, that, with his permission, I take this opportunity of describing it.

When the prints are rinsed after toning Mr. Whiting takes all that are of one size and rapidly immerses them, one by one, in a deep dish containing a sufficient quantity of fixing solution. When all are in they are pressed with a strong glass triangle from the centre to the edges, or from end to end, in order to expel the liquid lying between them, and also to a great extent that in the pores of the paper. They are now turned over *singly*, and when a fresh quantity of the solution has passed between each the pressing process is repeated. This is done three times, and the prints are then considered fixed.

It will at once be seen that this process is analagous to that of washing a sponge by alternately filling it with water and wringing it out. The water clinging to the prints is first squeezed out, then the pores are filled with the hypo. This in its turn is pressed out, and its place taken by a fresh supply. It appears to me that in this way the prints receive a more complete fixing than by any other with which I am acquainted. As the prints are immersed in large numbers great loss of time is obviated, and, moreover, the prints are all treated alike. Fixing by this method in a bath containing carbonate of ammonia, and then thoroughly washing, appears likely to render silver prints as permanent as it is possible for them to be. The increase in cost in using carbonate of ammonia is so *very* slight that it ought not to be taken into account where increased beauty and permanence in our prints are concerned.

Photographers have from time to time been indebted to Mr. Spiller for many valuable suggestions, and I am inclined to think that for no other that he has given us ought we to feel a greater amount of gratitude than for the one under present consideration. This, of course, remains to be proved by experience, and I only trust that photographers will give the process a fair trial, as I feel confident that they will not regret having done so.

The carbonate of ammonia should not be purchased in powder but in lumps, and should be kept out of contact with the air, in closely-stoppered or corked bottles. The cost per pound is about eightpence. In fixing paper prints care should always be taken that the hypo. be of good quality, as there are some samples in the market that are quite unfit for this purpose. Remember that, although carbonate of ammonia prevents the elimination of sulphur from the hypo. on account of its alkalinity, if sulphur be once eliminated no amount of carbonate will cause its recombination.

The good old rule—*always to use your hypo. fresh*—must not be lost sight of when using the new bath, as, although there is less danger of decomposition, it is not safe to keep for any length of time a solution in which prints have been fixed.

More dry plates are spoiled from improper development than from any other cause.

A FEW SUGGESTIONS FOR THE COMPARISON OR COLLATION OF THE RESULTS OF PHOTOGRAPHIC EXPERIMENTS.

By J. R. Johnson.

How vague and indefinite are all our notions of photographic processes, and of the reactions of the chemical substances employed therein. Yet what an immense number of published experiments upon these subjects! Much of vagueness arises from the want of system and habit of research of experimenters; much from their desire to rush into print and record every supposed new fact even before its verification; but much more from the want of a fixed standard of comparison or unit of measure for the work done, or of the intensity of the agent employed—that is, of *light* or of the *actinic force* associated with it.

It appears to me that the researches of Professor Roscoe and of his *collaborateurs* have furnished us with the desired standard. He has found that paper prepared with definite proportions of chloride of silver is definite in its character; that is to say, it blackens to a definite tint by the action of a definite amount of actinic force. It is greatly to be desired that our mathematical instrument makers should furnish us with this instrument together with its scale of tints and prepared paper duly verified, by collation, with a standard instrument.

In the absence of such a verified standard, every photographer about to experimentalise upon any branch of our art-science should provide himself with a substitute by preparing suitable paper himself, and taking some tint as a standard, obtained by mixing definite quantities of some pigments tolerably definite in character to produce that tint. Professor Roscoe has shown that the colour yielded by the paper need not be the same as that of the standard, if the results be compared with the latter illumined by a monochromatic light; but if the standard tint be nearly that of the compound to be experimented on, the gradual approach of the latter to the former may be observed in ordinary light, and the various observations be thereby greatly facilitated. If the experiments about to be made should refer to the action of different modes of sensitising albumenised paper, the standard tint might be of *purple brown* (oxide of iron), mixed with a definite quantity of *Chinese white* (oxide of zinc). These substances as found in commerce are very nearly chemically pure, and wherever purchased will vary but little in their character.

The unit of measure would be the production of the chosen tint upon the prepared paper. Such a measure will be independent of the intensity of the light, the variable nature of this being compensated by the time during which the paper is exposed. The tint produced records a definite amount of work done, and is the result of the actinic intensity multiplied by the time of exposure.

All experimental results on the sensitiveness of printing agents referred to this standard would thus have a numerical value, and could be compared with the results of other experimenters made under the same circumstances.

If the processes to be compared differ greatly in their relative sensitiveness, it would be necessary to have a scale of such tints of say twenty in number. These may be easily prepared if we bear in mind that they must bear a geometrical ratio to each other, so that there be the same distance between 9 and 10 as between 1 and 2. If we prepare this scale by printing the times of exposure (the intensity of the light being supposed to remain constant), it must be thus arranged:—For example,

Expose say—	1st tint.	2nd.	3rd.	4th.	5th.
	10″	20″	40″	80″	160″ &c., &c.

If the tints be prepared by pigments the proportion of the coloured pigment to the white must be in corresponding proportion, say ten per cent., twenty per cent, &c. Such a scale, whether prepared by pigment or printed paper, would be invaluable in all experiments in dry processes, for instance. How unscientific are all our labours on this much-discussed subject! Yet this would disappear at once by the use of Roscoe's actinometer. Let us suppose that we have found that, with a given lens, in order to obtain sufficient effect, it is necessary to expose a tannin plate until the standard paper blackened to tint No. 3. Having once ascertained this, we should for all future time avoid the necessity of any under-exposed plate. Whatever the nature of the light we have only to watch our actinometer, and whenever the paper arrives at No. 3, having of course been started simultaneously with our tannin plate, we know that that plate is sufficiently exposed.

If we now wish to ascertain the effect of different agents in modifying our process, or the effect of keeping them, &c., we have only again to watch the tint at which the paper arrives while giving due exposure to the modified plate, and the numerical value of the process is at once determined.

Of not less importance is a standard for the comparison of lenses. How absurdly inaccurate and indefinite is all our language as to the relative rapidity of different processes in the camera! Experiments are gravely recorded in which neither the equivalent focus of the lens nor the actual size of the aperture is stated!

Then, again, how vague is the term "focus!" If we make it more definite by the term "*equivalent* focus," how difficult is it to determine this by the methods usually given! The equivalent focus is the distance of the ground glass from the optical centre; but the optical centre in the meniscus lens—that usually employed as a single landscape lens, or in the formation of the new doublets—is a point without the lens, its position behind the back surface varying with the nature of the curves; with the thickness; and with the refractive index of the glass. In a doublet the optical centre lies between the two lenses, and its position is not constant, but varies for every pair of conjugate foci.

The whole of the indefinite language upon this subject would disappear, and we might at once compare our respective lenses, were we to agree to refer them, not to their foci, but to the size of the image which they give of any object of definite size placed at a definite distance—say of an object one hundred inches long placed one thousand inches from the lens.

To determine this place the camera opposite a wall, so that the ground surface of the focussing glass be exactly 1,000 inches from that of the wall. Place upon the wall, one hundred inches apart, two sheets of white paper with a black cross upon each, the distance being measured from the centre of each cross. Focus these by bringing out the lens so as not to disturb the glass, which should have the ground surface behind. Mark with the point of a pencil the centre of the image of each cross, and with a pair of dividers measure the distance of these on an ordinary scale which has the inclined lines to enable us to measure to $\frac{1}{100}$ of an inch.

The size of this object would be the most convenient standard of comparison, as no further calculation would be needed. But the focus is easily deduced from the data so obtained; thus, if we call the focus—that is the distance—from the ground glass to the optical centre (f'), and the size of the image (d), then

$$\text{As } 100 : d :: 1000 - f' : f'$$

from which we deduce the length of f' to be—

$$f' = \frac{1000\,d}{100 + d}$$

If the size of the image on the glass screen be found to be one inch, then the focus—

$$f' = \frac{1000 \times 1}{100 + 1} \text{ or about } 9{\cdot}9 \text{ inches.}$$

If the size of the image was 0·2 only, then the focus would be—

$$f' = \frac{1000 \times 0{\cdot}2}{100 + 0{\cdot}2} = \frac{200}{100{\cdot}2} \text{ or less than two inches.}$$

It must be borne in mind that this is the focus of the lens for nearly 1000 inches ($1000 - f'$), and not the focus (f) for solar rays. The difference is, however, extremely minute, and for all but lenses of very long focus may be considered identical for all practical purposes. The solar focus is easily deduced from this by the formula given in every work on optics.

If we consider that what we want usually to estimate in lenses is their relative rapidity, we shall see that this depends upon their condensing power, and this of course may be directly measured by the relative sizes of their respective images. To explain this let us place a board 100 inches square at the distance named, with the same lens as in the first experiment. The size of the image will be one inch square, and all the rays of light reflected towards the lens from the object will be condensed into that space. A lens of about one inch focus would give us an image 0·1 of an inch long—that is, of an area of 0·01 inch. We may conveniently take such a lens as our unit of measurement, and, calling its condensing power 1000, measure all other lenses by that standard. If we took a lens of about five inches equivalent focus and placed it before our test object at 1000, it would give us an image of about 0·5 long or 0·25 area, which is twenty-five times larger than the standard, consequently its condensing power would be—

$$\text{As } 25 : 1 : 1000 : x,$$

$$x = \frac{1000}{25} \text{ or } 40$$

A lens of about ten inches would have a condensing power of about 10.

If we adopt this standard of comparison, and agree also upon a fixed aperture for the diaphragm, say of 0·2 inch, all our future experiments on the relative rapidity of lenses, &c., will be definite and may be duly collated. The fixed aperture is not absolutely necessary if that used be carefully measured and duly stated, but the adoption of one area of aperture would greatly simplify the comparison, and render the results arrived at more evident. With the standard actinometers, and a careful observation of the condensing power of the lens employed, our experiments upon dry processes would become of an exceedingly interesting character, and we could readily tabulate the results, assigning to each process an actual numerical value.

ON THE PREPARATION AND MANAGEMENT OF THE NITRATE OF SILVER BATH FOR NEGATIVES.

This bath, which exercises such an important influence on the quality of photographs, is simply composed of nitrate of silver dissolved in water. When dissolved it should be nearly neutral, the deviation from neutrality being in favour of acidity.

In much of the nitrate of silver of commerce there is imprisoned a certain quantity of nitric acid, which, when the crystals are dissolved in distilled water, renders the solution acid in too great a degree. If the ordinary commercial crystals be employed, crush them into a coarse powder and apply heat, which drives off the excess of nitric acid. Then dissolve them in distilled water, in the proportion of thirty-five grains of the crystals to one ounce of water. Use only half of the water intended to be added, and then add (previously dissolved in a small quantity of water) about three grains of iodide of potassium. The iodide of silver formed by this addtion will be dissolved, after which add the remaining half of the water, and then filter.

With most of the samples of nitrate of silver no other preparation is required. If, however, the picture taken prove deficient in clearness, add one or two drops of a very diluted solution of nitric acid, composed of half-a-drachm of the acid in an ounce of distilled water. This for a bath of twelve or fourteen ounces will, in most instances, prove sufficient.

An efficient method of making a neutral bath is to dissolve one ounce and a-quarter of crystals of nitrate of silver in four ounces of distilled water, and, when dissolved, to add to it four grains of iodide of potassium dissolved in a drachm of water. Shake, and add sixteen ounces of distilled water. Now add to this a small quantity of oxide of silver (prepared by pouring a solution of caustic potash into a solution of nitrate of silver, and washing well the precipitated oxide) until the solution, already turbid from iodide of silver, is of a dirty brown colour. The quantity of oxide added is of no consequence.

When the solution is filtered it will be found very slightly alkaline, in which condition it would yield foggy pictures. Previous, however, to using it, five minims of the following diluted acid should be added :—

Nitric acid (1·50)	6 minims.
Distilled water	1 ounce.

The bath is now ready for use, and will prove to be in the most perfect condition.

When, from repeated use, a bath becomes disordered and produces foggy pictures, it should be tested for acidity by immersing in it a slip of litmus paper. If it do not turn red after being immersed for some time, add some of the dilute acid (given above) until it do so. Fogging in an old bath is easily cured by rendering it slightly alkaline (with diluted ammonia, for example), and exposing to sunlight for some time. By this means all organic matter is precipitated. After filtration one or more drops of the diluted nitric acid will be found necessary to restore the requisite acidity.

Some baths, which from use or abuse have failed to yield clean pictures, have had their working qualities restored by adding a few drops of a solution of cyanide of potassium, which in the precipitation of the cyanide of silver formed carries down the offending organic matter. Each photographer seems to have his own favourite method of restoring the bath when disorganised; but, as the restoration occasionally involves a loss of time, it is desirable that *two* baths be kept in stock, one relieving the other.

PHYSIOLOGY OF BINOCULAR VISION.

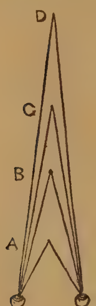
By A. Claudet, F.R.S.

The stereoscope invented by Wheatstone has been the means of illustrating the principle of binocular vision, and explaining the cause of the wonderful sensation it produces. It has proved that there is no exact appreciation of distances except by the combined perception of two eyes, and the constant play of the optic axes converging on the various points of vision.

From the name given by Wheatstone to his instrument, which means to "see a solid," the effect produced has been called "stereoscopic." But although there is a kind of relief which can be obtained by monocular vision when we look at the external world—and this relief is even stronger than when we look at a single picture with two eyes—this kind of relief is the result of the proportions given by perspective and by the distribution of lights and shades upon solids, or by artificial means imitating these natural effects.

It is now generally understood in scientific *parlance* that the particular and distinct effect produced by the comparison of two perspectives, either natural or artificial, united by binocular vision, is called stereoscopic, while the greatest illusion of solidity which can be obtained by monocular vision, or by binocular vision, upon a single perspective picture is simply called "relief."

These two effects are very different, and cannot be confounded or taken one for the other. Yet, from want of comparative experiments and sufficiently understanding the physiology of binocular vision, it happens too often that persons, even of general scientific abilities, imagine that they can obtain or produce the stereoscopic effect without the essential conditions which constitute it. They constantly mistake relief for stereoscopic illusion. It is, therefore, important that these conditions should be fully explained and well understood, in order to prevent henceforth any misconception or confusion, and to eradicate all erroneous notions.



When we look with both eyes at objects A B C D, situated in several planes in the space before us, we are obliged, to obtain a single vision of any of these points, to converge the optic axes precisely on each point; for all the points not coinciding at the meeting of the optic axes fall on dissimilar parts of the two retinæ, and there form double and distinct images. Therefore, the optic axes must be directed exactly upon every point we want to examine; consequently, it must be observed that the angle of convergence diminishes as the object is more and more distant, and increases as the object becomes less and less distant. From this constant and rapid play of convergence of the optic axes, we acquire the habit of judging of all the distances of objects by the angle of convergence required to have a single and perfect vision of them.

We will not here pretend, as mathematicians would do, that we actually compare the angles of convergence; not by any means, for their various changes take place unconsciously to us, as we do not know to what extent, when, how, and why, we exert the muscles by which we move our arms or legs. But the action of the muscles of the eyes, by which a certain degree of convergence is adapted to every distance, produces a physiological sensation which, being always the same for every particular distance, communicates to our mind the judgment of the distances for which each separately necessitates a certain angle of convergence. Therefore, the stereoscopic effect is only the sensation which is produced by the rapid and continual movement of the optic axes while they converge alternately and consecutively upon the various planes where natural objects are situate; or upon their representations by photography when two images of these objects have been taken respectively at the perspective natural to each eye, in which case, as for the natural perspective, the optic axes are in constant action to direct their convergence upon the similar points of every plane of the two pictures. Without alteration of the degree of convergence of the optic axes there cannot exist that real sensation of distances which is called stereoscopic effect, and which is only a physiological phenomenon belonging exclusively to binocular vision.

In looking at two pictures superposed, whether they are identical or taken at different angles, or looking at two identical pictures in the stereoscope, there is no illusion of stereoscopic effect, because the optic axes remain all the while fixed at the same angle of convergence, whatever part or plane of the flat picture we examine. The fact is that in such cases, by the unnatural fixity of the angle of convergence, which ought to change continually while we peruse the various imaginary planes of the image, the objects appear less in relief or less separated than when we look only with one eye; for, when we look with a single eye on a single perspective picture, we have precisely the same sensation that we have in looking at natural objects with a single eye, and our mind is satisfied; but if we look with both eyes we feel a deficiency in the sensation, and that deficiency destroys the idea of distances. While the both eyes convey their axes upon the surface of the picture there is an irresistible tendency in our mind to feel that all the various imaginary planes are exactly upon that surface, and therefore, in spite of ourselves, we discover (if I may be allowed to use such an unscientific expression) the trick of the painter for producing the illusion of relief.

We may compare the cause which makes us to judge of distances by the action of the optic axes to the cause which makes a blind man judge of distances by the feeling of his arm, in extending it more or less according to the distance of the object he touches. The effort and time required to reach an object are, in his mind, the exact measure of its distance. It is precisely the same thing with the visual rays on the optic axes, which, by the degree of convergence, are extended, like the arm of the blind, according to the distance of the object upon which we direct our attention. Therefore the length or extension of the visual rays, like the extension of the arm, brings to our mind the comparative measure of all the distances. The effort of the muscles of the arm, and the effort of the muscles of the eyes to reach and feel the object have both the same physiological effect on our senses. In both cases we really touch the objects; and in vision, when we touch the objects, they all take their respective places, like chessmen displayed on the board.

ACKLAND'S COLLODIO-ALBUMEN PROCESS.

By George Giberne.

As I have frequently derived much useful information from many of the correspondents in The British Journal of Photography, I consider it partly a duty, or it may be a pleasure, to contribute to the Almanac the results of my practice, which, if not conveying anything new, may still add to the evidence already given on certain points. I consider the collodio-albumen process, according to Mr. Ackland's excellent method of manipulating, the most convenient and satisfactory in every respect for an amateur, and this I have adopted.

After coating with collodion, and exciting, I wash the plates thoroughly—that is, in two dishes of distilled water—and then in a dish with a hole in the bottom and a tap above, the water thus running through in a stream. From this the plates are put in a tray of salt and water for five minutes, and afterwards in the dish under the tap for five minutes. They are then drained and placed on a levelling stand, and the albumen, prepared according to Mr. Ackland's formula, is poured over them three or four times, drained, and set up to dry, and if in the winter heated well before the fire and stowed away. In this state I believe they will keep any length of time.

When required they are sensitised in the aceto-nitrate bath, and washed as before in every respect, including the salt bath; and after the last washing they are flooded with a saturated solution of gallic acid. Some have said that the *salt bath* makes the plates keep well, and this is no doubt the case to a certain extent; but I have tried plates which have been salted—half washed with gallic acid and half left without—and, after keeping them many months, found the half washed with gallic acid gave a perfect picture and the unwashed half no picture at all, but turned red all over.

I believe the sensitised plates will keep good for years; I have kept them myself between three and four. I have also kept them upwards of a year after exposure, and on development have perceived no difference in the one or the other. I developed always, until the last season, in baths of gallic acid and pyrogallic acid, applying cups of hot water under the bath to any part of the picture which appeared slow in developing, and which rarely failed to bring out the part required.

I have been satisfied with the process in all but two things. The exposure required is very long. A well-lighted landscape with buildings and trees, in summer, taken with a triplet or a view lens for a picture 10 × 8 and stop half-inch diameter, would require from fifteen to twenty minutes. By this process I do not remember a case of over-exposure, but in many a want of it. The other imperfection I have continually met with arises from what are commonly called "pinholes" in the sky, to correct which I have long exhausted all the known methods of cure without success. These have to be painted out, and do not affect the picture, but are unsatisfactory.

During the last season, however, I have almost abandoned the mode of development above alluded to for the alkaline process, and have been most successful in its use. The pinholes have generally vanished, the negatives are particularly soft, and there is a very wide field for pressing forward a slow, or controlling a too rapid, development. I think also that the average time of exposure may be reduced.

I was doubtful until lately whether the alkaline process would answer for developing plates kept long after exposure. I therefore kept some for different periods; the last, a 10 × 8 plate, sensitised in May, 1865, was exposed July 14th, 1866, and developed with the alkaline process on the 5th December, 1866—that is, five months all but nine days after exposure. The weather was cold, and the development occupied thirty-one minutes; in hot weather it takes from five to twenty minutes. I have not tried the application of heat, but the negative, so far as the manipulation is concerned, is faultless; and so were several others I tried before, varying in the time of keeping.

After several experiments I find the following the most satisfactory for ordinary purposes:—First wash the exposed plate with alcohol and water half and half, then pour over it some rain water until it rests evenly on the plate; if this be omitted the film will either rise in blisters or split off the plate; drain and pour on a 10 × 8 plate nine drachms of a solution of carbonate ammonia two grains to the ounce of distilled water, in which add one drachm of a solution of pyrogallic acid three grains to the ounce of distilled water, and nine drops of a solution of bromide of potassium five grains to the ounce of distilled water; pour this off and on, and gradually the picture comes forward. When the details are fully out wash well and drain, and pour on the pyrogallic acid solution with fifteen or sixteen drops of a citric acid solution sixty grains to the ounce of distilled water to correct the alkaline, and afterwards add fifteen or sixteen drops of a nitrate solution sixty grains to the ounce of distilled water; when sufficiently intense, wash and fix as usual.

The quantities of the carbonate of ammonia, pyrogallic, and bromide potassium solutions may be varied according to circumstances. The first plate I tried I mixed half and half of the solutions of carbonate of ammonia and pyrogallic acid, and the picture started out instantaneously; this was in hot weather. The next plates all fogged instantly with the same proportions, so I reduced the pyrogallic acid and added a few drops of the solution of bromide of potassium, which restrained the development and checked the fog; with under-exposed pictures the bromide solution is not required. I have tried the solutions with five grains each, half and half, to an under-exposed plate, and this brought out a picture which the ordinary proportions would not. I have also tried ten-grain solutions, but I found them unsatisfactory.

The advantages of this alkaline development are —that you may change your proportions as you proceed. It is always safest to commence with a few drops of the bromide of potassium solution added, and if the picture do not soon appear wash off the solution and try without it, altering the proportions of carbonate of ammonia and pyrogallic acid according to the appearance of the picture. I found the strongest developer was half and half of solutions of carbonate of ammonia and pyrogallic acid, five grains to the ounce each; but for ordinary use I prefer the weaker solutions, according to the proportions shown above.

ON THE BASIC ACETATE OF LEAD AS A DEVELOPER.

By George Kemp, M.D., Cantab, F.C.P.S.

The object of this paper is to enter more into detail on this developing agent than was done in a recent number of The British Journal of Photography, to state the conditions under which it may be most favourably pressed into the service of photography, and, so far as the intricacy of the subject admits, to explain the *rationale* of its action.

It must at the onset be remembered that oxygen, in its statical or fixed condition, is found combined with metals in various proportions, and that the compound body thus formed is also capable of combining with acids in different proportions, thus producing, from the same elementary materials, a new class of compounds, differing in a very marked manner from the original substances of which they are formed as well as from each other. Thus, with reference to the acetates of lead, we have two compounds—the substance usually called sugar of lead consisting of equal equivalents of acetic acid and oxide of lead, and the fluid to which this paper specially refers, the *basic* acetate of lead, commonly known as "Goulard's extract," containing one equivalent of acetic acid and two of oxide of lead.

Now it must not be assumed that because these two bodies are compounded of the same elements their behaviour to other bodies is identical, even in a strictly chemical point of view; we know, in fact, that this is not the case. In certain animal fluids, the bile, for instance, a very copious precipitate is formed by the addition of the neutral acetate of lead; but when this is added to excess, and when, by its agency, no further precipitate is thrown down, on adding the acetate of lead with excess of oxide a large additional amount of organic matter is precipitated.

We must, however, bear in mind that in photographic phenomena minute physical changes take place which are entirely beyond the range of chemical observation or reasoning, and that on this account, however plausible, any deductions from the more palpable changes which become appreciable to the senses in chemical operations must be applied with extreme caution. We have an instance of this in the operation of toning prints by means of gold. To a neutral solution of the chloride of that metal we add a certain quantity of the acetate of soda; the characteristic yellow tint of the gold solution may continue in a low temperature for hours without sensible change, but if the temperature be raised, or the mixed solutions be exposed to sunshine, molecular disturbance is at once set up, the yellow tinge disappears, and consentaneously with this the toning property commences. Still more closely allied to our subject are the phenomena observed in what is known as alkaline development. Take, for instance, a plate prepared by the Fothergill process; here it is well known that every trace of free nitrate of silver has been most carefully washed away. If, after due exposure and washing to moisten the film, the plate be treated with a weak solution of carbonate of soda, or, better still, a solution of tribasic phosphate of soda, five grains to the ounce of water, in which have been dissolved a few grains of pyrogallic acid, molecular action is established, resulting in the appearance of the image; here again the molecular changes which occur are infinitely too delicate to be traced by physical means, and can only be appreciated by the result.

It has long been known that the salts of lead in conjunction with those of silver produce unique results in photography; and although at present our knowledge is confined to a few isolated cases, the whole subject opens out a wide and promising field of research, and has engaged much of the writer's attention. Amongst other points the basic acetate of lead commended itself as worthy of experiment in connection with alkaline development; but at the outset, it was apparent that it could not be used with either gallic or pyrogallic acid in the same manner as carbonate or phosphate of soda, as from both the former, in solution, it throws down a copious precipitate.

From an early period in the history of photography the gallate of lead was recognised as a very efficient aid to photography; and Mr. Carey Lea extended its use to printing by development, his plan being to add a solution of gallic acid to a solution of either the acetate or nitrate of lead, taking up the precipitate with acetic acid. It is not, however, with the precipitate from the solution of gallic acid by means of neutral acetate of lead that the writer has to do, but with that obtained by means of the *basic* acetate, which appears to present many advantages, the developer being prepared as follows:—

In a flask or large test-tube raise distilled water to the boiling point, and add crystallised gallic acid in the proportion of five or six grains to the ounce. It is not necessary to weigh the quantity, the only condition being to add the gallic acid in excess of its known solubility in cold water. This forms the gallic acid solution. At any country druggist's shop may be purchased an ounce of the solution of di-acetate of lead, or Goulard's extract, by which in such places it will be better known. This quantity will suffice for the primary development of some scores of negatives. Take now a plate prepared by any known dry process, expose it for the time adapted to it, place it on a levelled stand, and wash it with distilled water. When the film is equally permeated pour over it a mixture prepared thus:—

Into a perfectly clean developing glass drop two drops of Goulard's extract, add two fluid drachms of distilled water with the same quantity of the cold saturated solution of gallic acid, and redissolve the precipitate formed with glacial acetic acid, added by drops, avoiding excess. Agitation will help this step. When perfectly clear add two or three drops of a solution of nitrate of silver, twenty grains to the ounce. Stir with a glass rod, and pour over the negative. This quantity is sufficient for a stereoscopic or even half-plate. The image will shortly appear, very well balanced as to gradation of lights, but too weak to print from. When the details are fully out wash well and intensify with pyrogallic acid, citric acid, and silver, in preference using Mr. Carey Lea's organic developer.

We have yet, however, to trace the connection which this method holds in relation to the alkaline development, and the following explanation is the most satisfactory which the writer can suggest.

Notwithstanding the large addition of acetic acid, the *basic* lead salt seems to retain its peculiar catalytic functions, the acid for the limited time employed in the operation of development at least acting merely as a controlling power.

As to the dried plates prepared by different processes, the following remarks may be useful:—

1. Tannin plates, as originally proposed by Major Russell.

In consequence of the quantity of glacial acetic acid required for the solution of the precipitate, there is danger of losing the film during the repeated washing necessary in the processes of development and fixing.

2. Tannin plates, with glycerine, as proposed by the writer.

The above danger is considerably less, as an amount of elasticity is given to the film, and the exposure shorter, in comparative experiments, as 1 : 3. In both the above cases, however, the film, in pictures taken in a moderate light, or even in a dark glen, is much firmer than when taken in a blaze of sunshine. Indeed, the writer looks upon this as the special value of the tannin process and its modifications.

3. The malt process, which can only have failed to be popular from a supposed difficulty in preparing the solution. It is in fact very simple. Sufficient exposure should be given, and, with the *basic* acetate of lead developer, it is not necessary to re-dip the plate after exposure. The writer has not found the same tendency as in the former processes for the film to leave the glass, provided the collodion be in a proper condition.

4. The various albumen processes:—Collodio-albumen, Coagulated A., Fothergill, &c.

These are gems of processes, and in connection with the developer alluded to are as perfectly under the control of the operator as can be wished, the only precaution being not to carry the secondary development too far, and not to use a drop of the solution of nitrate of silver more than necessary. Of course in these cases cyanide of potassium must not be used for fixing.

In conclusion: the lead salt does something more than stated. Into a small quantity of uniodised collodion drop a diluted solution of basic acetate of lead: a dense opaque film will be formed, requiring a considerable quantity of acetic acid to dissolve it. Hence we find that in all cases, when finished, the film on the glass plate is remarkably firm.

Again: to diluted albumen add a drop of diluted solution of *basic* acetate of lead: a dense film will appear. Thus, not only have we the means of producing a favourable change in the structure of the collodion, but indeed in the albumen also. In the collodio-albumen process no varnish is required—a great desideratum for negatives submitted to the enlarging process by the magnesium or other artificial lights.

BURNT-IN PHOTOGRAPHS.

Take—

Saturated solution of bichromate of ammonia ..	5 parts,
Albumen	3 ,,
Honey	3 ,,

And dilute with twenty parts of water. Pour this over a glass or enamelled plate, and, after drying, expose for a few seconds under a glass transparency. Now remove to a damp room, and brush over the surface some enamel colour until the image appear. Fix with alcohol, to which a little acetic acid has been added, and, when dry, rinse in water, dry again, and place in a muffle to burn in.

PHOTOMETRY.

By Robert H. Bow, C.E.

Nearly all photometers are arranged to give the comparative values of any two lights, so that, when one of these is chosen of a standard power, the illuminative value of the other becomes known. The standard usually adopted is the light given by a spermaceti candle, consuming 120 grains of its substance per hour. If the consumption be really as usual more rapid than this, a corresponding allowance must be made in calculating the value of the light; thus, for example, if an Argand gas light be shown by the photometer to be equivalent to sixteen times the light given by the candle employed, and the rate of consumption of the candle be found (by weighing it before and after the experiment) to be equal to 135 grains per hour, then the above value, viz., sixteen, must be augmented in the proportion of 120 to 135, so that the real value of the gas light will be equal to eighteen standard candles.

In estimating the values of different gases, the consumption by an Argand burner must be reduced to the standard of five cubic feet per hour; so that, if it be found that in the above described experiment the rate of consumption has only been four and a-half cubic feet per hour, the result must be increased in the ratio of four and a-half to five, thus the value of the above gas would be rated as twenty-candle gas.

The photometer in most favour with the managers of gas works is that fitted with a piece of paper, part of which is saturated with spermaceti or grease, while the remaining part is kept quite clean. This piece of prepared paper is placed between the two lights to be compared, one face being illuminated by each light. In using the apparatus the paper is made to slide towards the one or other light, until the whole of either surface seen from a proper position appears equally bright. The distances of the paper from the lights are then noted, and the squares of these distances taken in reverse order express the relative illuminating powers. This photometer, when all in good order, appears to give very satisfactory results, but it requires much care and skill in its management.

For everyday use Professor Ritchie's photometer appears decidedly the best. In it a wedge, covered with white paper or other suitable material, takes the place of the partially-greased paper in the Bunsen photometer above described. The sharp edge of the wedge is turned towards the observer, and the lights are placed on either side, so that their rays will fall at equal angles upon the respective faces of the wedge. It is a convenient arrangement to make the standard candle or light slide towards or from its side of the wedge upon a graduated rod. In using the photometer the object is, of course, to find the positions of the two lights which cause the two faces of the wedge to appear equally illuminated.

In a paper read before the Royal Scottish Society of Arts I have described several improvements upon this photometer. One of these consists in making the angle of the wedge of such a value that errors arising from faulty construction or careless use will be reduced to a minimum. In my experiments I used a fine cardboard with very little gloss, and found that for that material the best angle of wedge, or inclination of the one illuminated plane to the other, was 68°. Another advantage that is secured by this considerable departure from the usual angle of 90° is, that we get rid of the effects of most of the direct reflection from the gloss that is always more or less present.

All ordinary photometers, however, fail to give satisfactory results when applied to the comparison of two lights which differ considerably in colour. Thus, if we compare the light of the standard candle with the light of the moon when at a great altitude, the one appears brown and the other blue; and different eyes, or the same eye in different states, will get very contradictory results from the photometer when estimating their illuminative powers. The consideration of this difficulty led me to a new branch of photometry, viz., "analytical photometry," which I treated of in the paper already mentioned.

The object of analytical photometry is to arrive at the relative values of the constituent colours of the lights; and the simplest mode of proceeding is to use one of the ordinary photometers in conjunction with a coloured transparent screen placed in front of the eye. Now if a list of coloured screens were fixed upon as standards, definite information could be recorded as to the real character and power of different lights. Certain thicknesses of properly-prepared coloured fluids held between plates of colourless glass would form the most accurate screens to work with, although for more ordinary use pieces of coloured glass might be more convenient.

When a yellowish-green glass screen is used (cutting off the extremes of the spectrum), the facility of comparing the values of differently-tinged lights for ordinary illumination will be increased. When a violet-blue screen of solution of ammoniuret of copper is used, the results will indicate in some degree the photographic values of the lights. Another but less perfect instrument for analytic photometry might be formed by substituting for the white wedge in the Ritchie photometer a series of coloured ones.

In conclusion: I may, as a sample, but a very imperfect one, of analytic photometry, give a table of the composition of daylight compared with that of the standard sperm candle when the quantities of light without a screen appeared equal:—

The red screen consisted of the British Phar. volumetric solution of iodine half-an-inch in thickness.

The green was a deeply-coloured glass.

The yellow was equivalent to a thickness = 0·22 of saturated solution of bichromate cf potash.

The blue was equal to 0·22 inch of solution of ammon.-sulph. of copper of the B. P., but with a slight excess of ammonia.

The first line of results in the table was with the light taken from a point 30° west of the sun at half-past twelve o'clock on the 9th of March, 1865, at Edinburgh—sky dull or grey white, sun sets at 6h. 1m.

The second and third lines of results were with light taken from near the setting sun on the same day—the second line at 5h. 20m., and the third at 5h. 35m.

The fourth line of results is that for light taken from the west, near the horizon, at between 5h. 45m. and 5h. 50m. on the 11th of March, the sunset being *dull*, and the sun quite obscured.

Table of Composition of Daylight Compared with that of a Sperm Candle:—

Red.	Yellow.	Green.	Blue.	Hour.	Date.
				P.M.	
0·38	0·72	1·40	6·1	12 30	9th March.
0·58	0·80	1·27	2·9	5 20	9th ,,
0·64	0·95	1 26	2·6	5 35	9th ,,
0·49	0·60	1·36	6·8	5 47	11th ,,

ON DEVELOPERS AND INTENSIFIERS.

By J. Stuart.

During the spring of last year I occupied a portion of my spare time in comparing the relative merits of various developers and intensifiers published in the journals for some years back, with the view of turning to account in the coming summer campaign any improvement that might suggest itself in my investigations.

First of all I naturally turned my attention to the "new organic developer," which had been so much lauded that I, in common with many others, believed it would supersede all previously-known developers, and would rank amongst other permanent improvements effected in photography of late years, such as alkaline toning, &c., and therefore, on comparing plates developed with it with others done by the ordinary developers exposed in the same camera and under the same conditions of light, I was scarcely prepared to find that the new organic developer was not only inferior to the ordinary protosulphate of iron developer in rendering detail and softness, but also that plates developed with it required a third longer exposure in the camera. At first I was inclined to attribute this shortcoming to my own supposed want of skill in preparing the organic solution, but on receiving a supply made by a photographic chemist of reputation the same results manifested themselves.

There are, however, one or two conditions in favour of the organic developer. It is much more manageable in using it than the ordinary sulphate developer, acting in this respect like pyrogallic acid, and it has also the merit of giving a more intense image on the first application than most other developers; but, with the serious drawbacks already mentioned, together with the fact that its preparation is both troublesome and uncertain, a much more powerful rival must, in my opinion, make its appearance ere I be induced to abandon in its favour the ordinary developers now in use.

Having satisfied myself that photosulphate of iron is the best developing agent yet known, I made several experiments and comparisons with the different acids usually employed in conjunction with it. There is no doubt (if the conditions of light, temperature, &c., permit) the less acid of any kind that is added to the developer the softer and more vigorous the negative will be, yet circumstances frequently arise under which it becomes absolutely necessary to add acid to it in large proportion; and it is, therefore, for the operator to judge which acid is most suitable for restraining the action of the developer, preserving the half-tones, and leaving the film in a suitable state for after intensification.

I have used one part of glacial acetic acid and two parts of formic acid for some years, and have not found any other formula so effectual for the purposes mentioned. Mr. Rodger, of St. Andrew's, advocated the use of formic acid many years ago, but I do not think it ever came into general use.

While I quite agree in the *theory* that one application of the developer should be sufficient to produce a negative capable of yielding brilliant prints, yet I have never in practice been able to obtain such desirable results, and have had occasion always to fall back on the old system of using a developer containing silver.

Intensifying.—Innumerable methods have from time to time been published with the view of remedying the necessity of dosing the plate with silver, yet none of those I have tried are in any respect equal to the use of persulphate of uranium in conjunction with ferrid-cyanide of potassium, as recommended by Professor Towler. The effect of this solution applied to the plate (an over-exposed positive developed with protosulphate of iron,) is almost magical, changing its colour from a weak grey to a brilliant chocolate-brown, very suitable for printing from, and leaving no deposit to destroy the half-tones of the negative.

I have used this intensifier during the last season with great success, and have adopted the following formula and method of using it:—

Dissolve one drachm of persulphate of uranium in ten ounces of water, to which add one drachm of ferrid-cyanide of potassium, also previously dissolved in ten ounces of water. The mixture immediately assumes the colour of dark sherry. Allow it to stand aside for twelve hours, and then filter out the deposit. I find it acts better after it has been a few days prepared.

I put this mixture into a vertical bath and immerse the plate, taking it out in a few seconds to examine its progress in daylight. The colour and vigour will be found to have changed, and, by prolonged immersion, almost any intensity can be obtained.

If the operator prefer it, the solution may be poured on and off the plate in the usual way in daylight, but I have found the bath suit best in my practice, rendering the action more uniform.

From the energetic nature of this mixture, sometimes the addition of a few drops of dilute chloride of gold helps to equalise its action, but if the plate be dried before being immersed it will be found unnecessaay to add the gold.

When the proper intensity is obtained, more than ordinary care must be taken in washing the negative under the tap. When dry the plate will appear to have gained much more intensity than is requisite, but on applying varnish this fault is completely rectified.

Having been induced by my friend the Editor of these pages to contribute the above short article on the "new intensifier," I have much pleasure in complying with his request, and am confident that if photographers will give this intensifier a fair trial it will amply reward them for their trouble.

The Buying of Silver.—Metallic silver is bought and sold by Troy weight, of which the ounce contains 480 grains. Nitrate of silver being sold by Avoirdupois weight, an ounce of that salt contains only 437·5 grains.

PHOTOMICROGRAPHY IN A FEW WORDS, WITHOUT MICROSCOPICAL OBJECTIVES.

By John Bockett.

The science of photography appears to attach itself with singular tenacity to those gentlemen who are fond of their microscope and its revealings. Bearing this in mind, and knowing how anxious many microscopists are of photographing some one or other of the slides which are continually coming into their possession, causes me to give a few simple and, I may add, inexpensive instructions whereby (unless very large amplification be required) good negatives of microscopic objects may be obtained without the use of expensive microscopical objectives. The usual method has hitherto been to make use of the microscope, extending its body by means of a lengthening tube, the end thereof carrying a focussing glass or dark slide; the object glasses of the instrument being brought into requisition, the difference between chemical and visual focus having been ascertained by experiment. This plan is still necessary where very minute objects are dealt with; but the present paper has reference only to those which are of medium size, and which require enlargement to say only five or six diameters. In the first place, a camera or box, at least three feet long, should be provided; if made in three or four pieces sliding into each other the better. The front, into which (by means of a flange) the lens is screwed, should be removable, in order that lenses of different capacity may be used. The back portion of the camera is, of course, fitted with a ground glass focussing screen, and also a back for exposing the sensitive plates. With regard to the focussing screen, the very finest, or smooth ground glass, should be employed. Claudet, Houghton, and Son, of High Holborn, supply an article of very superior description. A still further improvement consists in smearing a little sweet oil over the roughened surface, which considerably increases its transparency. By drawing with a black lead pencil lines from corner to corner diagonally, the exact position of the image upon the sensitive film can be ensured.

With regard to the lens, any stereoscopic single or double lens answers remarkably well; and here it is that this plan bears favourable comparison with microscopical objectives. These latter are all over-corrected, the violet rays being beyond the visual, so that the difference between chemical and visual focus has to be found by turning the lens a little back from the object, taking up some considerable time, and unless a very large number of negatives of the same subject is required few people would care to have to produce negatives of very many objects in one day; but in this case, using lenses specially constructed so that the two foci coincide—negatives of a varied character can be taken very rapidly. Whether the subject to be photographed is transparent or opaque makes very little difference; it is only necessary to support the slide or substance at such a height that it shall coincide with the centre of the lens; and in proportion as the lens is brought close to the object, so must the camera be elongated to obtain a distinct image on the screen. It is a very good plan to make a tray, similar to a sort of tramway, in which the long camera can glide, at one end of which, by means of hinges, a board about two feet square should be fitted; this must be covered with cardboard, over which should also be adapted a screen of black velvet. With one or other of these screens a light object can be suited with a dark background, or *vice versâ*, The objects best suited for the purpose will be found to be whole insects, ferns, flowers, wood sections, shells, &c. The usual wet collodion process is used, daylight always being the means of illumination. The exposure will in general be somewhat longer than might be expected from quick-acting short-focus lenses; but the closeness of the objective to the subject, as well as the colour of the object itself, often reconciles the apparent disparity.

The uses to which this apparatus can be put are various. Good enlargements of *cartes de visite*, medallions, fossils, &c., &c., have been made, and when it is considered that the whole can be made at a very small cost, the possession of such a piece of apparatus will be found to be a desideratum.

INSOLUBLE ALBUMENISED PAPER.

By W. H. Davies.

The probability of a much more extended use of comparatively weak baths for printing gives an interest to this subject which it could not otherwise claim, and a few words on some of the methods of rendering albumenised paper wholly or partially insoluble may not be out of place in a photographic year book.

Until our manufacturers adopt the principle, and supply us with this kind of paper ready for use, those who wish to use it must take the trouble to prepare it for themselves. Probably the easiest way for the makers to produce it would be to pass the sheets at once from the albumenising bath into a close chamber heated up to from 200° to 250° Fah. This amount of heat would probably coagulate the albumen before it became dried on the sheets, and would save all further trouble. Steaming is doubtless the easiest, cleanest, and best way of coagulating ordinary albumenised paper, and with very little apparatus any one may do it in the following manner:—

Provide a box of a size sufficient to hold a full sheet easily; let the front of it open like a door or be capable of removal, and let the upper part be hinged like a lid to open upwards, so that when open there may be free ingress and egress. The inside is covered with coarse flannel to allow the steam to enter without a rush, and the whole box is pierced with holes about an inch in diameter. Two sheets are now fastened back to back on a light lath with points; and the lath, which is slightly longer than the breadth of the sheet, is placed in the box, where it rests on a ledge, which keeps the sheets suspended without touching the sides or bottom.

As many more sheets as the box will hold are fastened in a similar manner, and placed in it; the front is then closed and the lid shut down. A larger and steam-tight box is now put over the first one like an extinguisher, or like a big hat on a little head, a pipe from a boiler attached, and the steam turned on for a few seconds only, until the paper is rendered slightly damp. When it is judged to be sufficiently limp the steam is turned full on. The time it takes to effect the desired end depends on the pressure of the steam; thus, a pressure of from twenty-five to thirty pounds will answer the purpose in from fifty to seventy seconds, while from three to four minutes will not be too much if the steam be obtained from an ordinary kitchen boiler.

In a sufficiently large steam chamber the inner box might be dispensed with, its purpose being merely to prevent the jet of steam from playing on the albumen before it is coagulated, and so injuring it. Care should be taken not to keep the paper longer under the influence of the steam than will be just sufficient to effect the purpose, otherwise there is a chance of disorganising the albumenous coating, and so producing an accession of minute rust-coloured spots. This, however, occurs only with some samples of paper, and is probably due to the specific chloride or quality of chloride used in the preparation of the paper, the defect alluded to being more likely to occur in that prepared with chloride of ammonium. This precaution effects another purpose—that of preventing the *complete* coagulation of the albumen; for if this, by accident, occur, the ordinary solution of silver seems to fail in penetrating the horny albumenous coating. Recourse must then be had to the ammonia-nitrate bath, which seems to be able to penetrate the most completely-coagulated film with great facility, while at the same time it does not remove the albumen from the imperfectly-coagulated samples recommended to be used.

Dry heat has been stated as a possible agent to coagulate dry albumen on paper. I have not, however, been able to effect it even with a temperature higher than that of boiling water; but if the paper be damp, and the heat applied by placing the paper between plates so that the steam cannot easily escape, then the albumen becomes coagulated, probably through the action of the hot steam generated by the heated plates. This method is not suggested as a practical one for the purpose desired.

Passing the albumenised sheet through a bath of absolute alcohol renders it insoluble, and floating or brushing with methylated spirit (sixty-four over proof) renders it sufficiently hard to prevent any action from aqueous solutions of nitrate of silver of thirty grains and under.

The principal advantages claimed for the coagulated paper are—the beautifully clean condition in which it keeps the silvering bath; the immunity from stains, streaks, lines, or bubble marks; and, lastly, the long time the paper keeps after being sensitised without turning yellow or its printing qualities becoming deteriorated.

ENLARGEMENTS BY ARTIFICIAL LIGHT.

By Alfred Harman.

Although I have nothing specially new to say upon the subject, still a few remarks of a practical nature by one who has bestowed much attention to it, and who has practised it daily, may not be uninteresting to the readers of the Almanac.

Now, *about the apparatus employed and the kind of light.*—I hear that some persons are employing magnesium for enlarging, but I find from numerous experiments and trials I have made that it is not well adapted for the purpose. The principal difficulty to contend with is the flickering of the flame, which, of course, proves fatal to the enlargement; for it is impossible to obtain a sharp picture unless the light be perfectly steady. Another drawback is the *size* of the flame, for no doubt the smaller the flame the sharper the picture will be. I have been enabled, to a certain extent, to overcome these defects by placing a diaphragm immediately in front of the flame, to cut off all the light except that from the centre of the burning magnesium. For this to answer perfectly it should be in *contact* with the flame; but then, unfortunately, the hole in the diaphragm gets stopped up entirely by the white deposit usually left after burning the metal.

I am of opinion that, on the whole, the oxyhydrogen light is best adapted for producing enlargements; for, being perfectly steady, there is no danger of the pictures suffering from want of sharpness—presuming, of course, that the optical arrangements are of the best description. The rays of light, likewise, emanating as they do from almost a point, overcome the defect above alluded to. Moreover, it is much cheaper than magnesium—a fact of no small importance.

Again: *respecting the apparatus usually employed for burning this light.*—And, first, the burner itself. I would recommend all persons, when purchasing them, to insist upon the nozzle being tipped with platinum; for, while it involves very little extra cost, it proves the means of its lasting three times *longer* than it would otherwise do. Of course it is very easy to adapt this to old burners at a trifling expense.

There is a fault in the construction of the burners I have seen that requires the consideration of manufacturers. Instead of the tubes being bored straight through, in most cases there are sharp angles, which effectually prevent their being cleaned out with ease. Every person who has used the lime light to any extent is aware that not only the metal tubes become in time partly clogged with oxide, but that there is a white deposit forming in the oxygen gas bag from the first day of its use, which, in process of time, becoming detached from the sides of the bag, is forced up the pipe and into the burner, effectually preventing the light burning as it should do. When this happens—as is not unfrequently the case—in the middle of an exposure, it is a great nuisance, and involves the unscrewing of the whole apparatus. Now, were the burners made with the bores quite straight, all we should have to do to dislodge the obstruction would be to push a wire, or anything more convenient, through it. This would save a great deal of valuable time, for it generally happens when every minute is of consequence.

My lantern is an upright box fixed on a table at the proper height, having a chimney at the top in the ordinary magic-lantern fashion, and a door at one side to get at the burner, if necessary. This door has a piece of yellow glass let into it, so that the light may be seen during an exposure without affecting the sensitive paper. The camera itself is made very much after the fashion of an ordinary solar camera—of course without the mirror, and having a short-focussed condenser substituted instead of that employed in the solar camera. The camera fits on to the front of the lantern, where there are fittings to receive it. The taps can be conveniently worked from under the table.

Some cameras I have seen for working with artificial light have a *fixed* groove for the negative, the distance between the negative and object glass being adjusted by the rack and pinion of the latter. This I consider a mistake, as a proper disc of light equal all over can only be obtained when the object glass is in the exact focus of the condenser, a very short distance either way being quite sufficient to cause the disc to be lighter in the centre, or *vice versâ*. I think, therefore, that the lens should be adjusted in the first place to give the best results, and not moved afterwards. The picture on the screen should be focussed by moving the negative, and this can readily be done with an endless screw working the carrier in which it is placed.

Lastly: *about gas bags.*—These I find very often a source of trouble. An oxygen bag will, in time—say in two years—become quite rotten, and any attempt to mend it is throwing money away, as I know from experience. It is better to lay it aside and procure a new one, without wasting time or money upon it. The white deposit before mentioned is a great annoyance, and I am not aware of any way of preventing it.

These remarks apply only to the bag containing the oxygen. The hydrogen bag will last much longer, and is at all times worth mending. A writer in THE BRITISH JOURNAL OF PHOTOGRAPHY a short time since suggested a method of cleansing the oxygen bag after use by filling it with air once or twice, of course pressing it all out between each filling. This is certainly very effective. I should suppose that small gasometers might be made at a cost not more than double the price of gas bags. The additional cost would certainly be saved in a year or two, and altogether I think they would be a great improvement over the India-rubber bags.

But that which deserves our most serious consideration is to perfect and have introduced a receiver to hold compressed oxygen, with a tap whereby the supply from it can be regulated at pleasure. That this in time will entirely supersede all other gas-holders for such purposes as photographic enlargements and exhibitions I have no doubt. It will enable us to dispense with gas bags, the concomitant annoyances of weights, and so forth. Its greater portability will not prove one of the least of its virtues.

THE CAMERA AND THE LANTERN.

By John Nicol.

The doctrine of "self help" is one of much value, and ought to be inculcated with all the zeal that such an excellent principle deserves by all who aspire to teach their fellow-men. But while due prominence is given to it, it should not be forgotten that there is a companion doctrine equally important, although apparently very opposite in its nature, which ought to receive equal attention, namely, that of "mutual dependence."

The advancement made in the various branches of scientific research during the past quarter of a century affords ample illustration of the value of this principle of mutual dependence, and its correlative, "mutual-aid giving," each discovery in any one department having been led up to by several or all of the other departments, and, in its turn, paying the debt thus incurred, by assisting discoverers in all, and, generally speaking, in more than the branches from which it had borrowed.

In like manner the magic lantern and the camera have played into each other's hands, to a certain extent, although not nearly so much as they are capable of doing; and my object in this paper is to urge all who have either one or other or both of those instruments to lend a helping hand in bringing about the greatest amount of good that can be got from their mutual aid.

Hitherto the lantern, as was perhaps fitting from its much greater age, has been the most benefited by the union of interests. Before the camera made its appearance the lantern was hardly better than a toy for the amusement of a leisure hour, and although some tolerably good pictures had been prepared for its use, their cost confined them to a very few hands, and lantern exhibitions were generally very poor affairs indeed. The camera, however, and collodion stepped in and soon transformed the lantern into an educational instrument of considerable value, furnishing pictures at the cost of a few pence of much greater value than could have been produced by any amount of labour that the hand of man could have put upon them.

The production of beautiful pictures can be of little value unless they can be seen after they are produced, and their value and effect as things of beauty are just in proportion to the numbers that can see them. In this way the lantern does good service to the camera, enabling thousands to see simultaneously and enjoy together what could only be seen, to much less advantage, by one or two at a time if the picture were passed from hand to hand. In this way the public have enjoyed some very fine exhibitions, and the public taste has been more or less improved; but much remains yet to be done in this direction before the capacities of the lantern and camera, as handmaidens to public exhibitions, are fully developed. As a rule, hitherto transparencies for the lantern have been prepared from negatives produced with a view to the production of prints on paper; and, although occasionally really fine results have been obtained, they are not always or even frequently so excellent, the great bulk of them being hard and chalky, too strong in contrast, and wanting in detail. This arises from the fact that the kind of negative best suited for printing on paper is least suited to print transparencies from. Lantern pictures of first-rate quality can only be printed from negatives that contain the largest possible amount of detail and half-tone, in combination with the smallest possible degree of density—such a negative as a printer would put up with if he had an order for a large number of copies in November, but that he would certainly not make, if he could help it, in July.

During the past half-dozen years I have had a good deal to do with lantern exhibitions in several of the principal towns in Scotland, and can confidently say that the taste for such exhibitions promises a rich reward to photographers who will turn their attention to the production of really good pictures for the purpose.

To this end I would suggest that landscape workers should, in all cases where it is practicable, take two negatives—one intensified in the ordinary way for paper printing, and the other, as already indicated, for transparency printing; and so, with little additional trouble or expense, be in a position to supply the best pictures for both purposes. While making this suggestion, however, to those who already do well as landscape photographers, and who would not of course like to give up a profitable certainty for what they may not be quite sure of turning out a paying speculation, it should be kept in mind, that he who will go in for lantern negatives alone may do so with more comfort and less cost, as his apparatus may be of the smallest size, sufficient only to work up to four inches square, and the whole *impedimenta* easily carried by himself.

Having thus indicated what I consider almost a new field for the profitable practice of photography, I may add a few words on the printing of transparencies from the negative so produced. To the amateur of limited resources, both as regards time and material, printing by superposition is perhaps the most convenient; and I think plates preserved with strong, sweet ale are best for this purpose. They are easily prepared, work clean, and give a finished picture of suitable colour, and the whole operation may be conducted without apparatus other than an ordinary printing-frame or dark slide, and a gas jet or paraffine lamp. One great objection to this method is that the size of transparency is fixed by that of the negative and *vice versâ*, thereby limiting very much the sources from which good things may be got.

The copying camera and wet collodion offer many advantages—so many, indeed, that there can be no question as to which should be adopted, where the best class of pictures are aimed at. As the copying camera is used only at home, the question of weight or portability need have no part in its construction. It should be made of sufficient strength to prevent vibration, and long enough to reduce or enlarge at least two diameters. Probably the cheapest and best would be a frame of cast iron, with two double-threaded screws running from end to end, both terminating in handles at the focussing-glass end. The centre frame for supporting the lens, which should be a triplet, also, of iron and a fixture, and the frames for negative and focussing glass should be iron too, and moving easily by the long screws. The distance between the negative and lens, and lens and ground glass respectively, may be conveniently filled up by a series of light wooden frames—three sides of a box, in fact, of various sizes—or with such frames sliding into each other *telescopically*. Such a camera need not cost much, and would, perhaps, be the most perfect instrument for the work required.

Any good bromo-iodised collodion and iron developer—both, if possible, pretty aged—would give good results; and if the camera be pointed to a northern sky, inclined at such an angle as will clear housetops or other obstructions, the exposure in copying the size of the negative will be only a matter of seconds; and, if daylight be not available, equally good results may be obtained with either gas or paraffine directed through the negative by suitable reflectors. Indeed, I rather think that experiment will prove that for this purpose artificial light, properly managed, will be better than daylight, as when once the operator has ascertained the required length of exposure, he can trust to its being pretty steady in its power, which he cannot do with the light from our capricious sky. At least I know this to have been the case with one of the largest producers of "microphotographs" in London, who did all his work, amounting at one time to several gross per day, with gas burned in an Argand burner.

The colour of the picture produced by the iron developer is not generally good, being too cold and grey to be pleasant; but it may be easily toned to any required tint. Two or three drops of a grain to the drachm solution of chloride of gold to an ounce of water will at once give the common blue black; or if the warm brown (which I think is much better) be wanted, a few drops of hydrosulphuret of ammonia in an ounce of water will give it.

In this way the production of transparencies for the lantern is a very simple operation; and, while I should like to see it practised much more largely by amateurs, I would strongly press it on the attention of professional photographers, as I am certain that good pictures would meet a ready sale, and do very much to educate the taste of the public, for whom lantern exhibitions are got up.

ON A METHOD OF OBTAINING IMPERISHABLE PHOTOGRAPHS.

By Walter B. Woodbury.

Had the process of photography as at present used by us been practised by the Egyptians, there is little doubt that but for, perhaps, some hieroglyphic representation of a camera or stand, or of some unfortunate Egyptian undergoing the operation—with what, from its peculiar form, we might imagine to have been some instrument of torture applied to the back of his head—we should now remain in entire ignorance of the fact, owing to our knowledge that even our most permanent processes would not have been able to stand the test of so many years. Silver prints (why name them?) and carbon prints would have been so much dust; even the enamels of Camarsac, which are, as far as we know, the most lasting of all, would most likely have lost all trace of what at one time might have been dearly prized by some Cleopatra of the age.

Knowing, as we do, that a photograph on paper will in the lapse of years succumb to the hand of Time, and even an enamel surface lose its brightness, it behoves us to go *deeper* into the matter, and produce our photographs not only on the surface, but deep down under it, and in materials that will defy, if such a thing were possible, "Time's destroying hand." The method that I am about to describe, which is similar in many respects to the photo-relievo process, will, I think, give us a result that will probably outlast any process that we have at present any knowledge of.

If we take a relief produced by the action of light on bichromate, and having taken a reverse from it in plaster, wax, or other white material, then pour a few drops of coloured water in the centre, and lay a piece of plate glass over it, we have at once a beautiful photograph posessing all delicacy of gradation and half-tone, which, however, disappears the moment we raise the glass, or which, if left, would soon be lost by evaporation of the water. But, by substituting for the wax a substance such as porcelain or white enamel, and for the coloured water coloured glass or enamel, our picture is at once a solidity—it is no longer a thing of the moment; and if substances even more lasting than those named may be procured, so much the better. Light-coloured metals may be substituted for the porcelain; in fact, by this method we can at once choose from the most lasting materials we are acquainted with to produce our pictures, and to leave a memento to future generations. The method of producing the relief, which forms the basis by which we can produce the results described, has already been given to the world, therefore it would be useless to give the details over again. I will merely take a passing glance at the general method to be adopted.

A relief is first obtained by exposing a film of bichromated gelatine under a negative, and washing away the insoluble portions. From this relief an intaglio may be produced by pressure, electrotyping, or by moulding in plaster, either of which may be used to mould or cast the basis of the picture from in porcelain or metal.

In the case of porcelain being used, the clay of which the mould is formed is then baked, and is ready for the process of filling in the hollows with the enamel colouring matter. A small quantity of this is placed in a state of fusion in the centre of the mould on porcelain, and forced by pressure into the hollows, thus forming a solid lump of matter, in which no picture is at this part of the process visible.

Now comes the most delicate part of the process—the searching for this picture, if such in its present state it may be called, which is hidden somewhere in the mass before us. This is done by grinding away on a flat surface the upper material, until the picture formed by the layer of transparent matter begins to show itself; then by watching carefully the result, as we go deeper and deeper, we arrive at that exact amount of grinding away which gives us the desired result.

We can, by attending closely to this curious method of development, obtain any class of picture we desire. Merely by taking away a little more or less of the surface, a picture possessing great softness or a hard chalky picture, and the large range between these, is entirely at our command.

By now again submitting our picture to the action of fire the two substances become as one. Surely those who cavil at the permanence of every process, and must submit it to the action of water, acids, and even fire, can have little fault to find with this one, which in my opinion gives us the very essence of permanence.

Of the commercial use of this process I will say nothing, as its various applications for jewellery and other ornamental purposes will be quite apparent.

ON THE PREVENTION OF MARKINGS IN THE DIRECTION OF THE DIP OF THE PLATE.

By T. Sebastian Davis.

There is scarcely any defect in practical photography that is more obtrusively objectionable than a series of lines or markings across the surface of a photographic picture, and occupying a particular direction. They are immediately associated in the mind of an art-critic with the notion of a chemical and manufacturing process, and are regarded as one of the many other defects necessarily connected with a mechanical production. Since the first intrusion of this objectionable feature in my own practice, I have noticed that the evil is far more general than I had previously imagined, and it was only recently that a series of pictures were exhibited by one of the most eminent of our professional photographers, in which the defect was most glaringly apparent. Under these circumstances I have been invited to draw special attention, in the present manual, to the prevalence of the evil, and to the means by which it may be entirely avoided.

In a paper upon the subject, read before the members of the South London Photographic Society in the year 1864, I proved that the defect primarily arose from some peculiar condition or conditions in the bath and collodion, which, under certain circumstances, interfere with the uniform reaction of the one upon the other. The free ether retards for an interval the action of the aqueous solution upon the prepared film, and the mechanical force by which the plate is introduced into the bath generates an unequal action in the direction of the dip. If a plate be lowered into the silver solution contained in a glass vessel, when the markings are particularly troublesome, and full daylight be allowed to fall on its surface at a convenient angle, the formation of the lines may be seen to take place from the moment of immersion, and to increase in intensity until the expiration of about a minute. No subsequent endeavour, by moving the plate in and out of the bath, will efface the inequalities already produced, and upon development every one of them will be especially apparent in the background or plain portions of the picture.

Before arriving at a satisfactory remedy, I carried out a series of experiments in connection with the constitution of the collodion, and the more or less concentration of the nitrate of silver solution; the results were, however, of a negative character. These investigations embraced an increase in the proportion of alcohol to the ether in the collodion, and an elimination of all free ether from the bath. Upon finding, however, that the formation of lines commences with the contact of the ethereal with the aqueous solution, and are primarily caused by the repellant action of the two liquids towards each other, I felt myself in a position to overcome the difficulty without having recourse to any alteration in the chemicals used.

This remedy consists in an adoption of the plan of raising and lowering the plate in and out of the bath *immediately* after its first immersion, and repeating this until the silver solution flows evenly over its surface, when it may be safely left until the operator can conveniently transfer it to the dark slide. This method of proceeding, instead of the orthodox plan of leaving the plate at rest for a short time after its first introduction into the bath, involves no extra trouble whatever, and may therefore be advantageously adopted under all circumstances. It is, moreover, particularly convenient in field and dry-plate photography, inasmuch as the plate may be safely left, after having been treated as recommended, in the bath until the artist is ready for the next operation, when it can at once be transferred to the dark slide.

THE PHOTOGRAPHER'S LENS CHEST.

By Jabez Hughes.

The more intelligence there is infused into photographic operations the greater is the desire to make improvements wherever there is a fault or a deficiency. Every agent and every process in its turn is submitted to a rigorous examination. The lenses employed are not excepted, and, to the credit and enterprise of English opticians be it said, they are willing to surrender many of their trade axioms to furnish photographers with tools to produce their pictures more perfectly. One by one the old faults disappear, each new lens supplying some new want or removing some admitted deficiency.

Every advantage that is gained in one direction has, however, to be paid for by some forfeit in another. Such a thing, therefore, as a perfect lens, according to a photographer's standard, cannot be made. If the greatest quickness be demanded, it must be at the expense of definition; if extreme sharpness, then exposure must be prolonged; if correctness of marginal lines, or great width of angle be insisted on, some new trouble is involved; and so on through the whole range of photographic optics. The fact then, must be admitted that absolute perfection cannot be obtained, but that each lens must be treated on its own merits and used for the special purpose for which it was constructed. If it succeeds in this it is a useful instrument.

This leads at once to my idea that, whatever work the photographer undertakes to do, he should use the lens invented to do it, and not expect it from another one made for a different purpose. A lens is a tool, an instrument to depict with; and as the artist has his various tools or brushes—the draughtsman his pens, pencils, and drawing instruments—the sculptor his various modelling tools—the engraver his cutters and gravers—even the handicraftsman, be his trade what it may, has all the tools to suit his varied wants, so should the photographer be expected to have his range of lenses—his tool-chest also.

Time was when there were only two lenses—the "portrait lens" and the "single lens." These two were supposed to be a sufficient equipment to enable a photographer to do every kind of work necessary. We have changed all that, and much credit is due to the opticians for their inventive ability in extending the photographer's power by the use of special tools for special uses. It is for the photographers to sufficiently appreciate this.

All knives are made for cutting, and all lenses for defining, but every different kind of cutting requires a special kind of knife to do that kind of cutting in the most perfect manner; so we are beginning to discover that all kinds of defining is best done by a lens made expressly for that kind of work. There is no such thing as an universal knife fitted to cut every kind of thing. There is no such lens—there never can be any one—that is equally fitted for all kinds of defining.

Although many kinds of lenses exist, yet all the photographer's wants are not yet supplied. There has long been a yearning for a kind of lens that could be used in taking large portraits that would equally define all the planes of the picture. In taking a portrait with the usual double combination lens, especially if the head be on a large scale, it is found that there is one plane where the definition is unexceptionally marked, while all in advance and behind that plane is offensively out of focus. This kind of picture is an opprobrium to scientific as well as to artistic photography. Science aims at absolute definition—art at pleasing expression; neither are obtained.

The want, then, is for a lens that shall work sufficiently quick for the studio, and that shall not have the optical planes so strongly marked; for, especially in large heads, while the absence of proper definition both before and behind the optical plane is so obnoxious, yet where the definition exists there is too much of it. Not only are the general features defined, but every wrinkle, freckle, wart, and other anatomical texture of the skin is painfully brought forth. Opticians have done great feats, and to their other laurels we wish them to add this one—to make lenses that shall take some of the sharpness away from this exact focal plane, and put it on the parts that are before and behind it.*

We want to define a large head so that all the broad and general features are unmistakably there, both in front and behind, as well as in the centre, without any unnecessary definition of the structure of the skin.

The usual photographic image of a large head reminds me of an ill-arranged banquet table, where all the good things are concentrated to a surfeiting degree in the middle, while top and bottom have scarcely common necessaries. I would like the good things to be more equally distributed, so that all should partake and enjoy.

But a lens with this distributed focus is only a special lens, and can only be used for the purpose for which it was intended. It would be quite unfit for the usual small pictures, and would only be another and a softer tool for the photographer to put in his chest.

For sharp work, let there be lenses giving as keen a focus as a razor; for quick work, let them be as rapid as glass and knowledge can make them; for wide angles, let them yield an extent of panorama to satisfy *both* eyes; and, for large portraiture, let them give a picture as soft and as pleasing as an artist's drawing.

In short, let it be recognised that a photographer should have his lens chest; let there be a lens for every use that each individual requires, in whatever variety of the art he practises, and then he will be ready for all emergencies, using *the right lens in the right place.*

A SUBSTITUTE FOR A DARK ROOM IN FIELD OPERATIONS.

By James Valentine.

During an experience of nearly fourteen years I have tried almost all the known methods of dry, moist, and wet collodion processes; but, in common with the majority of our leading professional photographers, I have given my preference to the latter, the wet process, and therefore I long ago turned my attention to securing the best substitute for a dark room, and have worked in several differently-constructed tents with more or less comfort and success. No one can doubt that in these modern times there are wondrous tents, cameras, and tripods which weigh next to nothing—the former so impervious to light as to defy the penetrability of the sun's rays, and the latter so rigid that scarcely could a tornado overturn them; but, notwithstanding the march of improvement in these pieces of apparatus, few who devote much attention to the production of large-sized negatives out in an open country will

* Since writing the above Mr. Dallmeyer has announced a new portrait lens, in which the desired quality of distribution of definition is contained.

doubt the necessity, or at least desirability, of a conveyance for the transporting of self and "traps" to the field of operations.

It occurred to me, some years ago, that instead of the carriage being useful only for *carrying* the tent, I might make a tent of it; and so, working out my idea, I procured an old barouche, removed the cushions, and in their place put a movable bag fitted up with compartments for the various bottles, a water-tight glass bath, and division with a glass slide on which to lean the sensitised plate, the bottom being covered with several piles of blotting-paper to absorb the superfluous silver solution. The lid of the box, when open, leans slantingly against the back of the carriage, and being several inches deep, holds the dark slide open ready to receive the plate after being allowed to drip. One of the carriage doors is permanently closed, and the glass portion covered with orange-coloured paper; against this door, and resting by its ends on the front and back seats, I place the sink, which is drained by a *bent* pipe passing through the bottom of the carriage. On an upright board fastened to the back of the sink is attached a stopcock. The water cistern—a square zinc box having a straight stopcock at one corner—I place, when in use, on the driver's seat, and connect its stopcock with that above the sink by a piece of India-rubber tube, which passes into the carriage through an aperture in the board which is fitted into the space at the back of the driver's seat, usually occupied as the front window. The cistern is made to fit, along with a box which holds my camera and lenses, under the driver's seat. Thus equipped, I start sometimes for a sixty miles' journey ere I reach the field of my operations, and have everything so arranged that only a few minutes' preparation is necessary before commencing my work.

I have now used this carriage, &c., for upwards of three years. I have found great comfort in my work, and seen no subject to which I could not get sufficiently near with my conveyance. In order to show what can be accomplished with its aid, I will relate a day's experience. At the end of September last, I started one day at nine o'clock in the morning to take some views, drove five miles, and took three 8×10 negatives. I went four miles further and took three more negatives of the same size. After refreshing man and beast, drove four miles further over rough farm roads, and took a 10×12 plate, finally reaching home before dark. I do not think that with the best constructed tent, owing to the necessary time required to pitch it and get the things put in working order, such a day's work could have been accomplished.

Heisch's Formula for Lime-Toning.—Dissolve one grain of chloride of gold in one drachm of water; to this add lime-water until the blue colour is just restored to reddened litmus paper. Now dissolve eight grains of dried, but not fused, chloride of calcium in five ounces of water; to this add the solution of gold, stirring all the time; and finally add about three ounces more of water. Very slight over-printing is required.

HINTS TO INTENDING VISITORS TO PARIS.

By R. J. Fowler.

There are five principal routes from London to Paris:—

Viâ 1. Dover and Calais.
2. Folkestone and Boulogne.
3. Newhaven and Dieppe.
4. London and Boulogne, by the Thames.
5. Southampton and Havre.

To those with whom time is an object the first and second routes are to be selected, the journey between London and Paris being performed in about ten hours, with only two hours' sea passage. The time of the journey is uncertain by the other routes, and no one wishing to travel third-class should go by Newhaven and Dieppe, as he may have to make stoppages on the road which will cost him as much in time and money as if he had taken another ticket. The route by the Thames is the most agreeable, if a long sea voyage be not objected to. The traveller obtains a sight of the noble river from London Bridge to the Nore, and the only change necessary is at Boulogne. The journeys between Dieppe and Paris, and Havre and Paris are through far more beautiful country than from Calais or Boulogne.

The route being selected, I would advise the passenger to bring only as much luggage as can be carried by himself. This will save considerable delay at the end of the journies, when all the packages which have been registered are subjected to an examination at the Paris and London termini. The traveller with his bag in his hand can leave the station at once and proceed to his hotel. Be civil to all the custom-house officials, and ready to show them anything required; they rarely take advantage of their powers when they meet with courtesy.

Fix upon the hotel you intend to stay at before you leave for Paris, and if you cannot pronounce French well, have the address written upon a card very legibly and show it to your cabman first thing, and remember he is not entitled to more than two francs—not including twenty centimes for *pourboire*, which is always expected—for the journey, of *whatever length it may be*, inside the barriers of Paris,* provided your luggage be small enough to be taken inside the cab with you. Four persons can ride in the cab for the same fare.

It is best for the visitor to provide himself with a *little* French money on board the steamer, or on landing, at the stations; but he should reserve the bulk of his cash to be exchanged *as required* in Paris at some respectable money changer's. In this way he runs less risk of receiving too little for his English money, for the exchange is generally a little over twenty-five francs to the sovereign, and by not exchanging more than is necessary he is not obliged to lose much upon returning to England; besides, small change in

* If between 12 p.m. and 6 a.m. the fare is three francs.

French money is useful *en route*, and to pay porters (who expect a fee), cabmen, &c., and last, though not least, the useful though not elegant conveniences which are found at the chief stations, and for entering the best of which fifteen centimes, or 1½d., is charged. I may here mention that these places or "cabinets" are found in the principal streets of Paris, generally in the "passages" or covered ways; they are clean, well kept, are marked generally in French and English, and are thoroughly respectable.

With respect to money—English gold and Bank of England notes are the best to bring. The prices of goods, &c., are expressed in francs and centimes when ticketed in the windows, or quoted in lists, &c. The value of an article is often given *verbally* in sous, and to enable the visitors to form a quick estimate of the corresponding value in English currency, I have drawn up the following table:—

£ s. d.	Francs.	Centimes.	Sous.
4 0 0	*100	—	—
1 0 0	25	—	—
0 16 0	*20	—	—
0 12 0	15	—	—
0 10 0	12·50cs.	—	—
0 8 0	*10·00 ,,	—	—
0 5 0	6·25 ,,	—	—
0 4 0	*5·00 ,,	—	100
0 2 0	2·50 ,,	—	50
0 1 0	1·25 ,,	—	25
0 0 7½	—	75	15
0 0 5	—	*50	10
0 0 2½	—	25	5
0 0 1	—	*10	2

The first column contains amounts in English money, which are converted into francs and centimes in the next, except the copper English coins, the equivalents of which are shown in the third column expressed in centimes, and in the fourth in sous. Those sums marked with an asterisk form actual coins of those values, the 4 in the second column being of gold, the half-franc piece or fifty centimes in silver, and the ten centimes or two-sous piece is bronze. An easy way to obtain the approximate value of an article in English money when expressed in centimes is to consider the first figure as so many pennies, and the last tenths of pennies; thus, 75 centimes $7\frac{5}{10}$d., or 7d. and a-half. Amounts above a franc are expressed by francs and centimes, and sometimes by sous, which term is also used for smaller amounts. Considering a sous equal to a halfpenny it is only requisite to halve the number of sous to obtain the amount in pence.

The coins in general use in France are *bronze pieces* of 5 centimes (1 sous or 1 halfpenny), 10 centimes (2 sous or 1 penny); *silver pieces* of 20 centimes (4 sous or 2 pence), 50 centimes (10 sous or half-a-franc, or 5 pence), 1 franc (20 sous), 2 francs, and 5 francs; *gold pieces* of 5 francs, 10 francs, 20 francs, and 50 and 100 franc pieces are sometimes met with—notes of 20, 50, 100, 200, 500, 1000 francs. There are 100 centimes in a franc, and all amounts, however large, are expressed in francs and centimes. The gold 20-franc piece is sometimes called a Napoleon, in the same way that our sovereign may be called a Victoria; but this is only in speaking, never in accounts, &c.

It may be useful to know, also, that Italian gold and silver coins are in circulation, and pass as easily as French money, being of the same appearance and value. A monetary treaty has been concluded between France, Italy, Belgium and Switzerland, by which the money *unit* has been made the same in all the countries, and consequently the money of either will pass in all. At present the Belgian and Swiss money is not so much seen here as the Italian.

The ordinary weights of articles are expressed in livres (pounds) and fractions of livres, and in grammes and kilogrammes. The livre is equal to about one pound one ounce English. The kilogramme consists of two livres, thirty grammes are about equal to one ounce English, and 1000 are contained in a kilogramme. The measures of length are centimetres and metres; five centimetres equal two inches, and a metre is about one yard and one-tenth.

I have been thus explicit about money, because if the information I have given be well "got up" before coming here, visitors will have a much clearer idea of how much they are spending, and thus in many cases add much to their comfort.

A few words upon hotels. *Always* ascertain *before* taking your room what you are going to be charged, and let a clear understanding on this point be established before you commence your residence at the hotel, or you may find you have been charged much too high when you come to settle your bill upon leaving. The prices of rooms vary according to the floor upon which they are situated, the higher stories being the cheaper. It is a mistake to look for private lodgings, even if you intend to stay for a month; for, if you wish to have a meal in the house, there is generally a difficulty in obtaining it, and when served is both worse and dearer than at a hotel. You are by no means required to take your meals at the hotel, and it is not considered strange if you do not take any there. I do not advise persons, either, to pay a fixed sum per day for board and lodging at their hotel. It ties them very much as to time, and they are not so independent in many ways as if they simply engage a room, and take their meals in whatever quarter of the city they may happen to be at meal times, or in the hotel, as inclination may prompt. Of course, those who "cannot speak a word of French" must patronise those hotels, shops, &c., &c., where English is spoken, and where that accomplishment is more or less charged for. If visitors, too, are determined to live as in England, they will find they will have nothing really good unless they go to genuine English establishments—English cookery not being generally understood here, and the mixture of *cuisines* is not to be recommended.

The hours and meals are—in the morning, coffee and bread and butter, and eggs if required. Between eleven and two, *dejeuner*, consisting of meats, vegetables, wine and dessert, and sometimes soup or *bouillon*. The dining hours are from five to seven. It is very undesirable to try to obtain meals between these periods, as it is a chance if there be anything good ready, and the waiters, &c., are preparing for their next meal, or clearing up after the last.

There are various ways of obtaining a dinner in Paris, and amongst them I may mention :—

1. At the tables d'hotes, which are found at most of the hotels, where visitors have no trouble in selection of dishes, taking what is offered. A good English dinner may be obtained in this way at Austin's Hotel, Rue d'Amsterdam.

2. At the restaurants, at fixed prices, generally two francs and upwards. At Richard's, in the Palais Royal, you obtain as much as you can desire, well cooked and well served, for two francs.

3. At Duval's establishments, where each dish is charged separately, and you may dine from 2d. and upwards. The service is good and well-conducted here.

4. At restaurants, where you order what you wish, and where you pay accordingly.

A few words on the cabs and omnibuses. Cabs are of two kinds—those with brass figures on the lamps, and those with red; the former are the cheaper. A list of the fares is given by the driver whenever he is asked for it. The omnibus system is very complete. Inside passengers pay thirty centimes, outside fifteen centimes, for the journey. If you want to go to any place in Paris, and you are at an omnibus office (*bureau d'omnibus*), ask what omnibus will take you. If there be not one going direct they will tell you to take one going so far, and then to take a *correspondence ticket* and proceed by another. This is considered and paid for as *one* journey. If you are not near an office, hail the first omnibus going in the direction required, and, getting in, ask the conductor for a "correspondence" for the place you wish to go to, and he will tell you where to get out. When at an office, always ask for a "*numero*" for the place you desire to go to; this number secures your turn in the omnibus, and gives you the preference over all *without* numbers. Always give up your correspondence tickets upon entering the omnibus, or you are liable to pay again. Outside passengers, or those *a l'Imperial*, are entitled to correspondence on payment of inside fare. A correspondence ticket can only be used *from* an office, *i.e.*, you cannot get into an omnibus which is half-way, say, between two offices, and tender your ticket as payment. The omnibuses run from eight to twelve. To reach the Exhibition there will doubtless be several extra services of omnibuses, &c.; but, as far as is known at present, the following will be the most direct ways of going to the building:—

1. By rail from the St. Lazare station. This will occupy some time, but lands the passengers in the building. Passengers will also pass over one of the finest railway viaducts in existence. The cost of the journey will be about seventy centimes.

2. The American omnibuses running on rails, and starting from the Place de la Concord, near the river. The passengers are left at the Pont de Jena, which must be crossed on foot before the Palais is reached. The fare is thirty centimes.

3. Omnibuses from the Place du Palais Royal to Passy and Anteuil, go by the same route, at the same price.

4. Omnibuses from the Porte St. Martin to Grenelle, and from the Bastille to Grenelle, will take passengers, but leave them at the opposite side of the Exhibition to the main entrance. Fare thirty centimes. Then all the other omnibuses of Paris *correspond* with the lines just named, so that, as a general rule, any omnibus will take you to the Exhibition by means of a correspondence—the route in some cases very long, and the delay will probably be great.

5. A line of steamers will be commenced on the Seine, landing passengers close to the ground of the Exhibition, and the fares will not exceed those by railway. There will also be a service of boats propelled by rowers, and these will land passengers in the park surrounding the Palais.

6. The cabs; and for a party these will be the cheapest and quickest mode of conveyance, a party of four being able to go from any part of Paris to the doors of the Exhibition for two shillings, including a substantial *pourboire*.

The principal entrance to the Palais is opposite the Pont de Jena, but as numerous guide-books to the Exhibition will be published, it is not my intention to encroach on their province. I may just state that the building is made up of seven circular zones or galleries, numbering from the centre to the circumference. Photographic apparatus will be found in gallery No. 2—*i.e.*, the second from the centre of the building, which is formed into a garden. In the same gallery will be found all kinds of photographs, but photographic apparatus for travellers will be found in gallery 4, with other *articles de voyage*. Chemicals will be found in gallery 5, and the picture gallery will be No. 1. The Exhibition will be opened at ten and close at six. Refreshments may be had on the spot.

I may add that if persons are desirous of securing apartments, rooms, &c., before coming here, and will write to me saying what class and price of accommodation they require, and will enclose four English stamps for return postage, I shall be glad to secure lodgings, and give any information that is in my power. If, too, upon arrival here, I can be of any service to visitors, it will afford me pleasure to give it.

11, *Rue d'Enghien, Paris.*

Useful Recipes, &c.

RICE GLUE.

This elegant cement is in various ways calculated to be of much use to the photographer. It is thus prepared:—Mix rice flour intimately with cold water, and then gently bring the mixture to boiling point. It is very white, semi-transparent, durable, and susceptible of a high polish.

TO PHOTOGRAPH IN A GALE OF WIND.

Attach to the screw in the head of the camera-stand a piece of string terminating in a loop. Let the length be sufficient to reach the ground, and place the foot in this loop, pressing it firmly to the ground, and thus keeping the string quite tight. This will prevent the camera from shaking when photographing during a gale.

TO PHOTOGRAPH ON SILK.

Immerse the silk in—

Water	1 ounce.
Gelatine	5 grains.
Chloride of sodium	5 grains.

Hang it up to dry; then float for half-a-minute on a fifty-grain solution of nitrate of silver; dry, print, tone, and fix as usual.

TO REMOVE WRITING-INK STAINS FROM PHOTOGRAPHS.

Dissolve one drachm of oxalic acid in an ounce of warm water. Now, by means of a camel's-hair pencil, wet the surface of the print with warm water, and then apply a small quantity of the acid solution, also previously made warm, and rub it gently over the spot, which will soon begin to disappear. The operation may be repeated until the picture is made thoroughly clean, after which it must be very carefully and thoroughly washed, to prevent the after formation of stains.

TO PREPARE ALBUMEN PRINTS FOR RECEIVING THE COLOUR.

The difficulty of getting water colours to "take" to albumenised prints has been experienced by all. There is a want of attraction between the colour and the film. The simplest, most effective, and most economical means of overcoming the difficulty is the following:—Previous to applying any colour, proceed over the picture with the moist tongue, and the colours will flow with facility. By the same means the difficulty often experienced of writing on parchment is entirely overcome.

TO DRY COLLODION PLATES.

It is often necessary, especially in the preparation of dry plates, to have some means by which they can be dried speedily without having recourse to a fire for the purpose.

The simplest and best way to do this is to have a tin bath with flat sides and a ledge at the foot on which to rest the plate. When this is filled with hot water it dries the plate in a very admirable and rapid manner.

PREPARATION OF OX-GALL.

Procure from a butcher half-a-pint of ox-gall. Place this in a clean saucepan and add an ounce of powdered alum and an ounce of common salt. Place over the fire, and when it boils remove for half-an-hour to cool; then boil again, and repeat this boiling and cooling for three or four times. After this, allow it to settle for four hours, and decant off into a bottle, in which put two or three drops of essence of lemon. Cork and preserve for use.

TO REMOVE STAINS FROM THE HANDS, LINEN, &c.

Mix together:—

Common alcohol	20 parts.
Iodine....................................	1 part.
Nitric acid..............................	1 ,,
Hydrochloric acid	1 ,,

When this is applied to the stain it renders it easy of removal by subsequent application of hyposulphite of soda or cyanide of potassium. After the stain has disappeared, wash well.

ON THE RESTORATION OF DISCOLOURED NEGATIVES.

After a negative has been in use for some time it gets discoloured, in consequence of the nitrate of silver acting on the varnish which protects the film. It may not be generally known that such discoloured negatives may be restored, without much trouble or expense, to all their original brilliancy and freshness.

The method of effecting this restoration is as follows:—Place the negative, face upwards, in a flat porcelain or glass dish, and pour over the surface of it sufficient methylated alcohol to cover it. After a minute or two, wave the alcohol over the negative by gently tilting the dish. In about three minutes the whole of the discoloured varnish will have been removed from the negative. It is necessary that all violence in the tilting should be avoided, so as not to endanger the film, which might otherwise be apt to get raised up or torn. When the old varnish has been totally removed, rinse the surface with some fresh alcohol, and set up to dry. The restored negative must now be varnished anew, when it will be found to produce prints equal to those originally obtained from it. An analysis of the discoloured varnish shows the presence of silver in considerable quantity.

TO ELIMINATE HYPOSULPHITE OF SODA FROM SILVER PRINTS.

This discovery is one of the most important of the past year, and consists in placing the prints after being fixed and partially washed in a vessel of water, to which has been added a small quantity of peroxide of hydrogen. After remaining in this bath for a short time, the hyposulphite of soda remaining in the paper is converted into the sulphate, which is innocuous even if left in the picture, but which should be washed out after removing the prints from the bath of peroxide of hydrogen. To Dr. Angus Smith is due the merit of this discovery.

TO PREPARE PAPER FOR RECEIVING COLOURED IMPRESSIONS.

Paper properly prepared with subchloride of silver is capable of receiving coloured impressions. To M. Poitevin the public is mainly indebted for researches in this direction, and on the paper prepared by him the colours of nature may be impressed.

It is prepared by floating plain salted paper over a forty-grain solution of nitrate of silver, and, when dry, placing it in a saturated solution of bichromate of potash containing a small quantity of sulphate of copper. Now place it in water acidulated with hydrochloric acid, and afterwards in a solution of protochloride of tin, twenty-five grains to the ounce; and in this condition (while in the solution) expose to the sun until the chloride be changed into the *violet* subchloride, taking care that it do not pass into the black chloride.

TO CLEAN GLASS PLATES.

A mixture of nitric acid and water applied to the surface of a glass plate will prove a highly efficient means of rendering it clean. It must, of course, be followed by a complete rinsing in water, and subsequent polishing with a piece of dry wash-leather.

Old collodion is another efficient substance for cleaning plates. See that it be carefully wiped off.

The following solution, for which we are indebted to Mr. M. Carey Lea, is highly recommended:—

Sulphuric acid	1 ounce.
Bichromate of potash	1 ,,
Water	1 pint.

The plates should be allowed to remain in this for a short time and then be removed and polished.

A speedy way of removing old varnished films from glass plates is to pour some hot water into a suitable dish, add some common "washing powder," washing soda, or pearl-ash to it, and then immerse the old plates. In one or two minutes the films will have been quite removed from the surface of the glass.

TO REMOVE COLLODION NEGATIVES FROM GLASS PLATES.

The power of effecting the removal of the collodion film from the glass plate in an unbroken condition is one which it is well for the photographer to have at command, seeing that occasions frequently may, and do, arise which render it valuable. In the very earliest days of collodion, Mr. Archer removed many of his negative films from the glass and retained them in a portfolio. He found that in this way they were much less bulky, and equally effective for printing from. The method originally employed by him was inferior to that which he afterwards adopted; which was to pour over the unvarnished negative a solution of gutta-percha in benzol, and, after drying it before the fire, to run a knife round the margin and immerse the plate in a vessel of hot water. In a few minutes the film was found to have separated from the glass.

This method is undoubtedly very simple, but it is not so good in some respects as that more recently adopted by Mr. Wenderoth, which is as follows:—

Make a solution of gelatine, to which add glycerine in the proportion of ten drops to the ounce. Then coat a sheet of plate glass (previously rubbed over with an ethereal solution of wax) with plain collodion, and allow it to become hard. Then pour over it a quantity of the gelatine, and set aside in a level position until it has become dry. In about twelve hours or a little better a knife may be run round the edge, and the sheet of gelatine removed and placed carefully away until it is required. The glass plate on which the negative is taken must also have the solution of wax applied previous to its being collodionised. When the negative is finished and washed, and while still wet, the gelatine sheet, previously immersed in one part of water and three parts of alcohol for about a minute, is laid down, collodion side uppermost, and pressed gently in contact. After about an hour it will be sufficiently dry to permit its removal being effected.

DIVINE'S METHOD FOR THE RECOVERY OF GOLD AND SILVER FROM RESIDUES.

Not more than five per cent. of the silver used in photography is utilised, or actually consumed in forming the image of the negative or print; the rest becomes distributed through the washings and solutions, and is wasted unless means are taken to collect and save it. With a little care and attention, three-fourths of the whole amount of silver used can be recovered. We shall give the most practicable methods of precipitating and saving silver from the various solutions which contain it, and also the manner of recovering gold from toning baths.

No. 1. *The Wash from Negatives.*—The iron of the developer suffices to precipitate the silver that is washed from the plate, and it may be saved by having the sink properly constructed. It may also be saved by developing over a barrel, and running off the water, when it is settled clear, by a faucet placed a little distance above the bottom. Care should be taken not to introduce hypo., cyanide, or ammonia into the barrel, as they prevent precipitation. The barrel may be used to collect the free nitrate of prints, the first and second washings being thrown in and precipitated with common salt. The water in the barrel should never be drawn off until it is settled perfectly clear.

A great excess of salt must not be added to throw down the silver, for fear of producing a double chloride of sodium and silver, which is soluble. It is unnecessary to add salt so long as a drop of nitrate of silver solution produces a milkiness.

No. 2. *Cyanide Solution.*—The cyanide for fixing should be kept in a tray, and, when it becomes so saturated as to clear a negative too slowly, it should be poured off in a jar, and the silver thrown down with a piece of sheet zinc. The silver is thus reduced to the metallic state, and attaches itself to the zinc in the form of a grey powder.

No. 3. *Hyposulphite Solution.*—The silver in this solution may be thrown down as black sulphuret with sulphuret of potassium; but it is better to precipitate with zinc the same as No. 2.

No. 4. *Free Nitrate Solutions and Washings.*—May be thrown in No. 1, and precipitated with common salt.

No. 5. *Ammonia Silver Solutions.*—These can be precipitated with zinc. Mix with No. 2 or 3.

No. 6. *Acid for Cleaning Plates.*—This, alter long use, acquires considerable silver. Throw the acid in the barrel with No. 1.

No. 7. *Silvered Paper and Filters.*—May be burned in an open iron vessel, or a stove with a very light draft, and the ashes preserved.

Toned paper is not worth saving for either silver or gold. As we have recommended, prints should be trimmed before toning, in order to save silver and gold.

All the residues obtained by the above methods may be mixed and dried in an evaporating dish, or other suitable vessel placed over the stove, or in the sun. They may then be converted into metallic silver by mixing them with twice their weight of anhydrous carbonate of soda in a crucible, and heating to whiteness in a furnace. The silver melts down to the bottom, and may be obtained as a button on breaking the crucible. The silver is very impure, however, and requires to be refined before it is fit for converting into nitrate.

No. 8. *Method of Saving Gold from the Toning Bath.*—As soon as the prints are toned, pour the solution in a glass or stone jar, and let it stand in a warm place for not less than twenty-four hours. The gold will fall down as a dark purple powder, and the clear water can be decanted, or run off with a syphon whenever the jar becomes full. The gold powder is very fine and light, and is easily lost. A little protosulphate of iron will cause it to precipitate sooner. When there is a sufficient accumulation of gold in the jar, it may be sent to the refiner, or it can be again converted into chloride suitable for toning by digesting in dilute sulphuric acid to remove impurities, washing, and dissolving in aqua regia.

PATENTS CONNECTED WITH PHOTOGRAPHY APPLIED FOR DURING THE YEAR 1866.

Isham Baggs: Construction of stereoscopes and stereoscopic apparatus.—W. B. Woodbury: An improved method of, and apparatus for, finishing impressions (in coloured gelatine or other soluble material) obtained from metallic or other plates produced by the aid of photography.—J. W. Swan: Mode of, and apparatus for, printing from intaglio plates.—D. Winstanley, Jun.: Producing printing surfaces by the aid of photography.—J. H. Dallmeyer: An improved photographic lens.—H. T. Avet: Improvements in photography, and in the process of producing surfaces and other like surfaces by the aid of photographic agency.—R. A. Brooman: An improved method of producing oxygen.—A. Stoddart: Apparatus to be employed in illusory exhibitions.—H. T. Humphreys: Reflecting optical instruments.—W. S. Laroche: Improved means and apparatus for producing new effects in photographic portraiture.—E. Cox: Portable dark chambers or tents for the purposes of photographic manipulation in the field, and of containing and transferring the necessary apparatus.—W. Grune: A new magic photography.—P. W. Gengembre: Improvements in stereoscopes, which improvements are also applicable to instruments for exhibiting single views.—W. Wray: Achromatic object-glasses.—W. Woodbury: Producing designs on wood and other materials by the aid of photography.—Southwell Brothers: Production of photographic prints.—C. M'Farland: An improved album for exhibiting photographs and other pictures.—J. H. Dallmeyer: Compound lenses suitable for photographic uses.—J. A. Salmon: Photographic printing frames.—W. Gould: Reflecting various-coloured lights and shades upon stereoscopic and other subjects for producing different effects upon them; also, to use a rack movement instead of the ordinary set screw to adjust the instrument.—J. H. Dallmeyer: Compound lenses for photographic uses.—J. H. Wrench: Apparatus adjusted to the representation of opaque objects on an enlarged scale.—H. Medd: Mount for *cartes de visite*.—Malbec de Briges: Obtaining photographic pictures.—T. Skaife: Improvements in a vibrating lightning lamp for the obtaining of photograms.—Luigi Bernieri: Photography.—R. H. Courtenay: Preparation of printing surfaces by aid of photography.—A. Fournet and Octave Nadaud: A magic camera.—David Winstanley: Improvements in obtaining basso-relievo or other such designs in relief or depression by means of photography.—Farndon Lane: Photographic pressure frame.

TABLE OF THE SOLUBILITIES OF A FEW IODIDES AND BROMIDES.

From the Dictionary of F. H. Storer.

IODIDES OF

Aluminum.—Known only in solution.

Ammonium.—Extremely deliquescent. Very soluble in water and alcohol.

Arsenic.—Soluble in a large quantity of water. Soluble in boiling alcohol.

Barium.—Very soluble in water. Easily soluble in alcohol.

Cadmium.—Permanent. Readily soluble in water and alcohol.

Calcium.—Deliquescent. Very soluble in water and absolute alcohol.

Cobalt.—Deliquescent. Soluble in water and in alcohol.

Lithium.—Very deliquescent. Soluble in water.

Magnesium.—Deliquescent. Very soluble in water.

Potassium.—Deliquescent in moist air. Very soluble in water. Soluble in 5½ parts of alcohol, 0.85, and in 39 to 40 of absolute alcohol.

Sodium.—Deliquescent in moderately moist air. Soluble in 0.39 parts of water at 60°. Very sparingly soluble in alcohol.

Zinc.—Very deliquescent. Soluble in water and alcohol.

BROMIDES OF

Aluminum.—Deliquescent. Very soluble in water and in alcohol.

Ammonium.—Readily soluble in water. Sparingly soluble in alcohol.

Arsenic.—Decomposed by water, &c.

Barium.—Very easily soluble in water. Easily soluble in absolute alcohol.

Cadmium.—Deliquescent. Readily soluble in water, alcohol, and ether.

Calcium.—Very deliquescent. Soluble in water. Very soluble in alcohol.

Cobalt.—Deliquescent. Easily soluble in water. Soluble in alcohol and in ether.

Lithium.—Very deliquescent. Soluble in water.

Magnesium.—Deliquescent. Soluble in water and in alcohol.

Potassium.—Permanent. Soluble in 1·18 parts of water at 60°, and in 200 parts of cold alcohol.

Sodium.—Readily soluble in water. Very sparingly soluble in alcohol.

Zinc.—Deliquescent. Soluble in water, in alcohol, and in ether.

Bromide of Cadmium.—This salt is stated to be a powerful emetic, being as three to one when compared with tartar emetic, and as twelve to one compared with sulphate of zinc. Half-a-grain dissolved in water would produce beneficial effects in such cases of poisoning as require an immediate emetic.

TABLE FOR ENLARGEMENTS.

Focus of Lens, inches.	Times of Enlargement and Reduction.							
	1 inches.	2 inches.	3 inches.	4 inches.	5 inches.	6 inches.	7 inches.	8 inches.
2	4 4	6 3	8 $2\frac{3}{4}$	10 $2\frac{1}{2}$	12 $2\frac{2}{5}$	14 $2\frac{1}{3}$	16 $2\frac{2}{7}$	18 $2\frac{1}{4}$
$2\frac{1}{2}$	5 5	$7\frac{1}{2}$ $3\frac{3}{4}$	10 $3\frac{1}{3}$	$12\frac{1}{2}$ $3\frac{1}{8}$	15 3	$17\frac{1}{2}$ $2\frac{11}{12}$	20 $2\frac{6}{7}$	$22\frac{1}{2}$ $2\frac{13}{16}$
3	6 6	9 $4\frac{1}{2}$	12 4	15 $3\frac{3}{4}$	18 $3\frac{3}{5}$	21 $3\frac{1}{2}$	24 $3\frac{3}{7}$	27 $3\frac{3}{8}$
$3\frac{1}{2}$	7 7	$10\frac{1}{2}$ $5\frac{1}{4}$	14 $4\frac{2}{3}$	$17\frac{1}{2}$ $4\frac{3}{4}$	21 $4\frac{1}{5}$	$24\frac{1}{2}$ $4\frac{1}{12}$	28 4	$31\frac{1}{2}$ $3\frac{15}{16}$
4	8 8	12 6	16 $5\frac{1}{4}$	20 5	24 $4\frac{4}{5}$	28 $4\frac{2}{3}$	32 $4\frac{4}{7}$	36 $4\frac{1}{2}$
$4\frac{1}{2}$	9 9	$13\frac{1}{2}$ $6\frac{3}{4}$	18 6	$22\frac{1}{2}$ $5\frac{5}{8}$	27 $5\frac{2}{5}$	$31\frac{1}{2}$ $5\frac{1}{4}$	36 $5\frac{1}{7}$	$40\frac{1}{2}$ $5\frac{1}{16}$
5	10 10	15 $7\frac{1}{2}$	20 $6\frac{2}{3}$	25 $6\frac{1}{4}$	30 6	35 $5\frac{5}{6}$	40 $5\frac{5}{7}$	45 $5\frac{5}{8}$
$5\frac{1}{2}$	11 11	$16\frac{1}{2}$ $8\frac{1}{4}$	22 $7\frac{1}{8}$	$27\frac{1}{2}$ $6\frac{7}{8}$	33 $6\frac{1}{2}$	$38\frac{1}{2}$ $6\frac{5}{12}$	44 $6\frac{2}{7}$	$49\frac{1}{2}$ $6\frac{3}{16}$
6	12 12	18 9	24 8	30 $7\frac{1}{2}$	36 $7\frac{1}{6}$	42 7	48 $6\frac{6}{7}$	54 $6\frac{3}{4}$
7	14 14	21 $10\frac{1}{2}$	28 $9\frac{1}{3}$	35 $8\frac{3}{4}$	42 $8\frac{2}{5}$	49 $8\frac{1}{6}$	56 8	63 $7\frac{7}{8}$
8	16 16	24 12	32 $10\frac{2}{3}$	40 10	48 $9\frac{3}{5}$	56 $9\frac{1}{3}$	64 $9\frac{1}{7}$	72 9
9	18 18	27 $13\frac{1}{2}$	36 12	45 $11\frac{1}{4}$	54 $10\frac{4}{5}$	63 $10\frac{1}{2}$	72 $10\frac{2}{7}$	81 $10\frac{1}{8}$

THE object of this table is to enable any manipulator who is about to enlarge (or reduce) a copy any given number of times, to do so without troublesome calculation. It is assumed that the photographer knows exactly what the focus of his lens is, and that he is able to measure accurately from its optical centre. The use of the table will be seen from the following illustration:—A photographer has a *carte* to enlarge to four times its size, and the lens he intends employing is one of six inches equivalent focus. He must, therefore, look for 4 on the upper horizontal line, and for 6 in the first vertical column, and carry his eye to where these two join, which will be at 30—$7\frac{1}{2}$. The greater of these is the distance the sensitive plate must be from the centre of the lens; and the lesser, the distance of the picture to be copied. To *reduce* a picture any given number of times, the same method must be followed, but in this case the greater number will represent the distance between the lens and the picture to be copied; the latter, that between the lens and the sensitive plate. This explanation will be sufficient for every case of enlargement or reduction.

If the focus of the lens be twelve inches, as this number is not in our column of focal lengths, look out for 6 in this column and multiply by 2; and so on with any other numbers.

TABLE, SHOWING THE POINTS OF THE COMPASS AT WHICH THE SUN RISES FOR LONDON, EDINBURGH, AND DUBLIN.

The object of this table is to enable any one, with the assistance of a map, to decide upon the hour of the day at which any particular view will be illuminated in the most effective manner, so that the intending photographer need not necessarily arrive at the spot until the conditions of light are favourable. Mr. Johnson's table, which is annexed, is reckoned in degrees of a circle north and south of *east*. This, of course, is for the sun's rising; for his setting it is only requisite to substitute the word *west* for *east*. It is evident that the sun must set just as many degrees above or below west as it rises above or below east.

	London.	Edinbro'.	Dublin.
Jan. 1	E 40° S	E 46° S	E 43° S
" 7	— 38°	— 44°	— 41°
" 14	— 36°	— 42°	— 39°
" 21	— 34°	— 39°	— 37°
Feb. 1	E 29° S	E 36° S	E 38° S
" 7	— 26°	— 29°	— 28°
" 14	— 22°	— 25°	— 24°
" 21	— 18°	— 20°	— 19°
Mar. 1	E 13° S	E 15° S	E 14° S
" 7	— 9°	— 10°	— 10°
" 14	— 5°	— 5°	— 5°
" 21	E	E	E
Apr. 1	E 6° N	E 6° N	E 6° N
" 7	— 10°	— 10°	— 10°
" 14	— 15°	— 15°	— 15°
" 21	— 19°	— 20°	— 19°
May 1	E 23° N	E 25° N	E 24° N
" 7	— 27°	— 29°	— 28°
" 14	— 30°	— 36°	— 33°
" 21	— 33°	— 39°	— 36°
June 1	E 36° N	E 42° N	E 39° N
" 7	— 38°	— 44°	— 41°
" 14	— 39°	— 45°	— 42°
" 21	— 40°	— 46°	— 43°
July 1	E 38° N	E 45° N	E 41° N
" 7	— 37°	— 44°	— 40°
" 14	— 35°	— 42°	— 38°
" 21	— 33°	— 39°	— 36°
Aug. 1	E 29° N	E 36° N	E 32° N
" 7	— 26°	— 29°	— 28°
" 14	— 22°	— 25°	— 24°
" 21	— 18°	— 20°	— 19°
Sept. 1	E 13° N	E 15° N	E 14° N
" 7	— 9°	— 10°	— 10°
" 14	— 5°	— 6°	— 5°
" 21	E	E	E
Oct. 1	E 6° S	E 6° S	E 6° S
" 7	— 10°	— 10°	— 10°
" 14	— 15°	— 15°	— 15°
" 21	— 19°	— 20°	— 20°
Nov. 1	E 24° N	E 25° S	E 25° S
" 7	— 27°	— 29°	— 28°
" 14	— 30°	— 36°	— 33°
" 21	— 33°	— 39°	— 36°
Dec. 1	E 37° S	E 42° S	E 40° S
" 7	— 38°	— 44°	— 41°
" 14	— 39°	— 45°	— 42°
" 21	— 39°	— 46°	— 43°

TABLE OF SYMBOLS AND EQUIVALENTS OF THE MORE IMPORTANT COMPOUNDS USED IN PHOTOGRAPHY.

Name.	Symbol.	Atomic Weight.
Acid, Acetic	$C_4 H_3 O_3 + HO$	60·00
„ Citric	$3 HO, C_{12} H_5 O_{11} + 2 Aq$	210·00
„ Formic	$C_2 HO_3$	37·00
„ Gallic	$C_7 HO_3, 2 HO + Aq$	94·00
„ Hydriodic	HI	128·00
„ Hydrobromic	H Br	81·00
„ Hydrochloric	H Cl	36·50
„ Hydrocyanic	$H C_2 N = H Cy$	27·00
„ Hydrosulphuric (Sulph. Hydro.)	HS	17·00
„ Nitric	HO, NO_5	63·00
„ Pyrogallic	$C_6 H_3 O_3$	63·00
„ Sulphuric	$HO SO_3$	49 00
„ Tannic	$C_{54} H_{19} O_{31} + 3 HO$	618 00
Alcohol	$C_4 H_6 O_2$	46 00
Ammoniacal Gas	NH_3	17·00
Ammonium, Bromide	$NH_4 Br$	98 00
Ammonium, Chloride	$NH_4 Cl$	53·50
Ammonium, Iodide	$NH_4 I$	145 00
Ammonium, Nitrate of Oxide of	$NH_4 O, NO_5$	80·00
Ammonium, Hydrosulphate of Sulphide of	$NH_4 S, HS$	51·00
Ammonium, Sulphocyanide of	$NH_4, C_2 NS_2$	76·00
Barium, Chloride	$Ba Cl + 2 Aq$	122·10
Baryta, Nitrate of	$Ba O, NO_5$	130·60
Benzole	$C_{12} H_6$	78·00
Chloroform	$C_2 H Cl_3$	119·50
Cadmium, Iodide	Cd I	183·00
Calcium, Chloride	Ca Cl	55·50
Ether	$C_4 H_5 O$	37·00
Gold, Terchloride	$Au Cl_3$	302·50
Iron, Perchloride	$Fe_2 Cl_3$	162·50
„ Iodide	Fe I	155·00
„ Nitrate	$Fe O, NO_5 + 7 HO$	153·00
„ Sulphate	$Fe O, SO_3, HO + 6 Aq$	139·00
„ Double Sulphate of Ammonia and	$Fe O, SO_3 + NH_4 O, SO_3$ .. 6 HO	156 00
Lead, Acetate	$Pb O, C_4 H_3 O_3 + 3 HO$	189 60
„ Nitrate	$Pb O, NO_5$	165·60
Mercury, Chloride (Corrosive Sublimate)	Hg Cl	135·50

TABLE OF SYMBOLS, &c.—Continued.

Name.	Symbol.	Atomic Weight.
Mercury, Subchloride (Calomel)	Hg_2 Cl	235·50
Potash, Bichromate	KO, 2 Cr O_3	147·60
" Carbonate	KO, CO_2	69·20
" Hydrate	KO, HO	56·20
" Nitrate	KO, NO_5	101·20
Potassium, Bromide	K Br	119·20
" Chloride	K Cl	67·70
" Cyanide	K Cy	65·20
" Iodide	KI	166·20
Sel d'Or	Au O, S_2 O_2 + 3 (Na O, S_2 O_2) + 4 Aq	501·00
Silver, Acetate	Ag O, C_4 H_3 O_3	167·00
" Bromide	Ag Br	188·00
" Carbonate	Ag O, CO_2	138·00
" Chloride	Ag Cl	143·50
" Hyposulphite	Ag O, S_2 O_2	164·00
" Iodide	Ag I	235·00
" Nitrate	Ag O, NO_5	170·00
" Oxide	Ag O	116·00
" Sulphide	Ag S	124·00
Soda, Acetate	Na O, C_4 H_3 O_3 + 6 HO	136·00
" Carbonate	Na O, CO_2 + 10 Aq	143·00
" Hyposulphite	Na O, S_2 O_2 + 5 Aq	124·00
Sodium, Bromide	Na Br	103·00
" Chloride	Na Cl	58·50
" Iodide	Na I	150·00
Uranium, Nitrate	U_2 O_3, NO_5 + 6 Aq	256·00
Zinc, Chloride	Zn Cl	68·00

THERMOMETER SCALES,

The zero of the Centigrade and of Reaumur's thermometer each corresponds to 32° Fahrenheit.

To convert degrees of Reaumur into equivalent degrees of Fahrenheit, multiply the degrees of Reaumur by 9, divide the product by 4, and add 32; the result will be the degrees of Fahrenheit. 9 Fahrenheit, 5 Centigrade, and 4 Reaumur are equivalents. In Wedgwood's Pyrometer the zero commences at 1·077° Fahrenheit; and each degree, instead of being equal to 130° of Fahrenheit, as was supposed by its maker, is only equal to about 20°.

Easy Rules for the Reduction of Scales.

To convert Reaumur into Fahrenheit, multiply by 2·25 and add 32°.
To convert Centigrade into Fahrenheit, multiply by 1·8 and add 32°.

TABLE OF THE SYMBOLS AND ATOMIC WEIGHTS OF THE ELEMENTS.

The equivalent or combining proportion of each element as given in the annexed table is that deduced from the most recent and trustworthy experiments. The following is a complete list of the elementary bodies at present known:—

Name.	Symbol.	Atomic Weight.	Name.	Symbol.	Atomic Weight.
Aluminum	Al	13·75	Molybdenum	Mo.	48·00
Antimony (Stibium)	Sb.	120·30	Nickel	Ni.	29·50
Arsenic	As.	75·00	Nitrogen	N.	14·00
Barium	Ba.	68·60	Osmium	Os.	100·00
Bismuth	Bi.	210·00	Oxygen	O.	8·00
Boron	B.	11·00	Palladium	Pd.	53·00
Bromine	Br.	80 00	Phosphorus	P.	31·00
Cadmium	Cd.	56·00	Platinum	Pt.	99·00
Cæsuim	Cs.	133·00	Potassium (Kalium)	K.	39·20
Calcium	Ca.	20·00			
Carbon	C.	6·00	Rhodium	Rh.	52·00
Cerium	Ce.	46·00	Ruthenium	Ru.	52·00
Chlorine	Cl.	35·50	Rubidium	Rb.	
Chromium	Cr.	26·20	Selenium	Se.	39·50
Cobalt	Co.	29·50	Silicium	Si.	14·00
Columbium (or Niobium)	Cb.	48·80	Silver (Argentum)	Ag.	108·00
			Sodium	Na.	23·00
Copper	Cu.	31·70	Strontium	Sr.	43·80
Didymium	Di.	48·00	Sulphur	S.	16·00
Erbium	E.	?	Tantalium	Ta.	37·60
Fluorine	Fl.	19·00	Tellurium	Te.	64·50
Glucinum	Gl.	4·7	Terbium	Tr.	?
Gold (Aurum)	Au.	196·00	Thallium	Tl.	
Hydrogen	H.	1·00	Thorium	Th.	59·50
Iodine	I.	127·00	Tin (Stanuum)	Sn.	59·00
Iridium	Ir.	98·60	Titanium	Ti.	25·00
Iron (Ferrum)	Fe.	28·00	Tungsten (Wolfram)	W.	92·00
Lanthanum	La.	46·00			
Lead (Plumbum)	Pb.	103·60	Uranium	Ur.	60·00
Lithium	Li.	6·50	Vanadium	V.	68·50
Magnesium	Mg.	12·00	Yttrium	Y.	?
Manganese	Mn.	27·60	Zinc	Zn.	32·50
Mercury (Hydrargyrum)	Hg.	100·00	Zirconium	Zr.	33·50

The word *actinism* was proposed for the chemical property of light by Mr. Robert Hunt, April, 1853.

TABLES OF SPECIFIC GRAVITIES.

Baume's Hydrometer for Liquids Lighter than Water.
Temperature $12\frac{1}{2}°$ C. or $54\frac{1}{2}°$ F.

Degree.	Specific Gravity.	Degree.	Specific Gravity.
10	1·000	42	·820
11	·993	43	·816
12	·986	44	·811
13	·980	45	·807
14	·973	46	·802
15	·967	47	·798
16	·961	48	·794
17	·954	49	·789
18	·948	50	·785
19	·942	51	·781
20	·936	52	·777
21	·930	53	·773
22	·924	54	·768
23	·918	55	·764
24	·913	56	·760
25	·907	57	·757
26	·901	58	·753
27	·896	59	·749
28	·890	60	·745
29	·885	61	·741
30	·880	62	·737
31	·874	63	·734
32	·869	64	·730
33	·864	65	·726
34	·859	66	·723
35	·854	67	·719
36	·849	68	·716
37	·844	69	·712
38	·839	70	·709
39	·834	71	·705
40	·830	72	·702
41	·825		

Cartier's Hydrometer.
Temperature $12\frac{1}{2}°$ C. or $54\frac{1}{2}°$ F.

Degree.	Specific Gravity.	Degree.	Specific Gravity.
10	1.000	42	·811
11	·993	43	·806
12	·986	44	·801
13	·979	45	·796
14	·972	46	·792
15	·965	47	·787
16	·958	48	·783
17	·951	49	·778
18	·945	50	·774
19	·938	51	·770
20	·932	52	·765
21	·926	53	·761
22	·919	54	·757
23	·913	55	·753
24	·907	56	·749
25	·901	57	·744
26	·895	58	·740
27	·890	59	·736
28	·884	60	·733
29	·878	61	·729
30	·873	62	·725
31	·867	63	·721
32	·862	64	·717
33	·856	65	·713
34	·851	66	·710
35	·846	67	·706
36	·840	68	·702
37	·835		
38	·830		
39	·825		
40	·820		
41	·815		

The collodion process was first practised by Archer, in 1850.

The term *fluorescence* was introduced by Professor Stokes to denote the remarkable property possessed by many solids and liquids of changing invisible actinic rays of high refrangibility into visible rays of low refrangibility.

DAWSON'S TABLE FOR ASCERTAINING FROM THE SPECIFIC GRAVITY THE AMOUNT OF NITRATE OF SILVER CONTAINED IN ONE FLUID OUNCE OF ANY PURE SOLUTION, AT 60° FAHRENHEIT.

Grs. per fl. oz.	Sp. Gr.	Grs. per fl. oz.	Sp. Gr.	Grs. per fl. oz.	Sp. Gr.	Grs. per fl. oz.	Sp. Gr.	Grs. per fl. oz.	Sp. Gr.	Grs. per fl. oz.	Sp. Gr.
10	1,021	32	1,063	54	1,105	76	1,146	98	1,187	120	1,227
11	1,023	33	1,065	55	1,106	77	1,148	99	1,189	121	1,229
12	1,025	34	1,067	56	1,108	78	1,150	100	1,191	122	1,231
13	1,027	35	1,069	57	1,110	79	1,152	101	1,193	123	1,233
14	1,029	36	1,070	58	1,112	80	1,153	102	1,194	124	1,235
15	1,031	37	1,072	59	1,114	81	1,155	103	1,196	125	1,236
16	1,032	38	1,074	60	1,116	82	1,157	104	1,198	126	1,238
17	1,034	39	1,076	61	1,118	83	1,159	105	1,200	127	1,240
18	1,036	40	1,078	62	1,120	84	1,161	106	1,202	128	1,242
19	1,038	41	1,080	63	1,122	85	1,163	107	1,204	129	1,244
20	1,040	42	1,082	64	1,123	86	1,165	108	1,205	130	1,245
21	1,042	43	1,084	65	1,125	87	1,167	109	1,207	131	1,247
22	1,044	44	1,086	66	1,127	88	1,168	110	1,209	132	1,249
23	1,046	45	1,088	67	1,129	89	1,170	111	1,211	133	1,251
24	1,048	46	1,089	68	1,131	90	1,172	112	1,213	134	1,252
25	1,050	47	1,091	69	1,133	91	1,174	113	1,215	135	1,254
26	1,051	48	1,093	70	1,135	92	1,176	114	1,216	136	1,256
27	1,053	49	1,095	71	1,137	93	1,178	115	1,218	137	1,258
28	1,055	50	1,097	72	1,138	94	1,180	116	1,220	138	1,259
29	1,057	51	1,099	73	1,140	95	1,181	117	1,222	139	1,261
30	1,059	52	1,101	74	1,142	96	1,183	118	1,224	140	1,263
31	1,061	53	1,103	75	1,144	97	1,185	119	1,226		

CORRECTION FOR TEMPERATURE.—For every 10° below 60° *deduct* one grain from the number quoted in the Table, and for every 10° above 60° *add* one grain to the number tabulated.

BILLS AND RECEIPT STAMPS.

INLAND BILLS AND PROMISSORY NOTES.

INLAND BILL DRAFT, or ORDER FOR PAYMENT to BEARER, or Order at any time otherwise than on demand:—

Not exceeding	£5	£0	0	1	Above £400	£0	5	0
Above	5	0	0	2	,, 500	0	7	6
,,	10	0	0	3	,, 750	0	10	0
,,	25	0	0	6	,, 1000	0	15	0
,,	50	0	0	9	,, 1500	1	0	0
,,	75	0	1	0	,, 2000	1	10	0
,,	100	0	2	0	,, 3000	2	0	0
,,	200	0	3	0	,, 4000 & upwards	0	10	0
,,	300	0	4	0	for every additional 1000.			

The Table of Duties for Promissory Notes is the same; but the Duty up to 1s. is on Notes for Payment in any other manner than to Bearer on Demand, and over that Duty, to Notes for Payment *either* to Bearer on Demand or in any other manner.

FOREIGN BILLS, drawn in, but payable out of the United Kingdom. —If drawn singly, or otherwise than in a set of three or more, same as on an Inland Bill of equal amount. If drawn in sets of three or more, for every Bill of each set:—

Not exceeding	£25	0s. 1d.	Above £500	2s. 6d.
Above	25	0s. 2d.	,, 750	3s. 4d.
,,	50	0s. 3d.	,, 1000	5s. 0d.
,,	75	0s. 4d.	,, 1500	6s. 8d.
,,	100	0s. 8d.	,, 2000	10s. 0d.
,,	200	1s. 0d.	,, 3000	13s. 4d.
,,	300	1s. 4d.	,, 4000	15s. 0d.
,,	400	1s. 8d.		

Foreign Bills, drawn out of, but payable within the United Kingdom, same duty as an Inland Bill of similar amount. When drawn out of and payable out of the United Kingdom, but endorsed and negotiated within, same duty as on Foreign Bills drawn within the United Kingdom, and payable out of same.

DRAFT or ORDER for payment of any sum to the Bearer or Order on Demand .... 1d.

RECEIPT or DISCHARGE for payment of £2 or upwards .... 1d.

Post Letters acknowledging the receipt of any Bills of Exchange, Promissory Notes, or other securities for money, are no longer exempt from Stamp Duty.

The Adhesive Stamp for Drafts and Receipts may be used for either indiscriminately. No vendor of Stamps shall charge for the paper on the sale of Bill or Note Stamps *not exceeding one shilling*, under a penalty of £10.

PROTESTS—BILL OR NOTE.

Less than £20	2s.	£500 or upwards	10s.
£20 and under 100	3s.	Or any other kind, per sheet	5s.
£100 & under 500	5s.		

Weights and Measures.

APOTHECARIES' WEIGHT.

SOLID MEASURE.

20 Grains	= 1 Scruple	=	20 Grains.
3 Scruples	= 1 Drachm	=	60	,,
8 Drachms	= 1 Ounce	=	480	,,
12 Ounces	= 1 Pound	=	5760	,,

FLUID.		Symbol.
60 Minims	= 1 Fluid Drachm	f. ʒ
8 Drachms	= 1 Ounce	f.
20 Ounces	= 1 Pint	O ℥
8 Pints	= 1 Gallon	gall.

The above weights are those usually adopted in formulæ.

All Chemicals are sold by

AVOIRDUPOIS WEIGHT.

$27\frac{11}{32}$ Grains	= 1 Drachm	=	$27\frac{11}{32}$ Grains,
16 Drachms	= 1 Ounce	=	$407\frac{1}{2}$,,
16 Ounces	= 1 Pound	=	7000 ,,

Precious Metals are usually sold by

TROY WEIGHT.

24 Grains	= 1 Pennyweight	= 24 Grains.
20 Pennyweights	= 1 Ounce	= 480 ,,
12 Ounces	= 1 Pound	= 5760 ,,

NOTE.—An ounce of *metallic* silver contains 480 grains, but an ounce of *nitrate* of silver contains only $437\frac{1}{2}$ grains.

FRENCH WEIGHTS AND MEASURES,

AND THEIR EQUIVALENTS IN ENGLISH.

1 Cubic Centimetre	= 17 minims nearly.
$3\frac{1}{2}$,, ,,	= 1 drachm.
28·4 ,, ,,	= 1 ounce.
50 ,, ,,	= 1 ounce 6 drachms 5 minims.
100 ,, ,,	= 3 ounces 4 drachms 9 minims.
1000 ,, ,, or 1 litre, = to 61 cubic inches	= 35 ounces 1 drachm 36 minims.

The unit of French liquid measures is a cubic *centimètre*.

A cubic *centimètre* of water measures nearly 17 minims (16·896); it weighs 15·4 grains, or 1 *gramme*. A cubic *inch* of water weighs 252·5 grains.

The unit of French weights is the gramme = to 15·4 grains; thus a drachm (60 grains) is nearly 4 grammes (3·88). An easy way to convert grammes into English weight is to divide the sum by 4, which gives the equivalent in drachms very nearly thus:—

Grammes.				Drachms.		Oz.		Drchm.		Grains.
100	÷	4	=	25	=	3	.	1	+	43

TABLE TO CONVERT GRAMMES INTO GRAINS.

Grammes.	Grains.	Deci-grammes.	Grains.	Centi-grammes.	Grains.	Milli-grammes.	Grains.
1	15·4346	1	1·5434	1	·1543	1	·0154
2	30·8692	2	3·0809	2	·3086	2	·0308
3	46·3038	3	4·6304	3	·4630	3	·0463
4	61·7384	4	6·1738	4	·6173	4	·0617
5	77·1730	5	7·7173	5	·7717	5	·0771
6	92·6076	6	9·2607	6	·9260	6	·0926
7	108·0422	7	10·8042	7	1·0804	7	·1080
8	123·4768	8	12·3476	8	1·2347	8	·1234
9	138·9114	9	13·8911	9	1·3891	9	·1389

The unit of French measures of length is the *millimètre.*
The millimètre measures 00·0393 inches.

The centimètre	,,	00·3937	,,	
The décimètre	,,	3·9370	,,	
The mètre	,,	39·3707	,,	= 3·28 feet.
One yard	=	1·0936 metre.		
One foot	=	30·4794 centimètre.		
One inch	=	2·5399	,,	
One square inch	=	6·4513 square centimètres.		

SIZES OF CAMERA PLATES.

	Stereoscopic	5½ by 3¼ inches,	6¾ by 3¼ inches.		
1/9	9th Plate		2½	,, 2	,,
1/6	6th Plate		3¼	,, 2¾	,,
1/4	Quarter-Plate		4¼	,, 3¼	,,
1/3	One-third Plate		5	,, 4	,,
1/2	Half-Plate		6½	,, 4¾	,,
1/1	Whole Plate		8½	,, 6½	,,
	Extra Sizes	10 by 8 inches,	12	,, 10	,,
		14 ,, 12 ,,	18	,, 15	,,
		24 ,, 18 ,,	30	,, 26	,,

A ready antidote to cyanide of potassium, when accidentally swallowed, is a solution of protosulphate of iron, followed by a sufficient dose of tincture of lobelia or other active emetic to cause vomiting.

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