GOERZ CATALOG

C. P. Goerz American Optical Company

OFFICE AND FACTORY

317 EAST 34TH STREET, NEW YORK, N. Y.

Sole Representatives for the
United States of America

of the

Optische Anstalt C. P. Goerz, A. G.

BERLIN—FRIEDENAU

BRANCH OFFICES

London Paris Vienna St. Petersburg

BRANCH FACTORIES

Riga Pressburg Winterstein

A STUDY BY NICOLA PERSCHEID, OF BERLIN, TAKEN WITH

THE GOERZ PORTRAIT HYPAR

To Our Friends

RECENT years have witnessed a steady increase in the popularity of Goerz Lenses and Cameras. The vast numbers of anastigmat lenses, amounting to nearly 350,000, sent out from the C. P. Goerz factories during the last twenty-six years, have gone into all parts of the world, giving splendid service under every condition of temperature and weather. Many of the lenses manufactured in our earlier years are still in use—a fact which speaks volumes for the careful selection of optical glass, which is such an important factor in maintaining the reputation of our goods.

Goerz Lenses are in no sense in the experimental stage. On the contrary, they embody the vast knowledge acquired through years of study and experiment by a large staff of mathematicians, scientists and technical engineers; and they are manufactured in factories fully equipped with all the necessary scientific instruments and the best of modern machinery. The cameras and photographic accessories made by us also embody the most advanced ideas in their construction. Our aim has been to avoid all unnecessary and complicated parts, without in any way encroaching on the utility of the apparatus; and as they are furnished only with Goerz Lenses, they are constructed with a view of utilizing to the utmost the remarkable efficiency of our anastigmats.

In the twenty-six years since the founding of the C. P. Goerz Optical Works, the researches of our scientific staff have embraced many fields besides photography, and as a result we now manufacture a large number of scientific instruments.

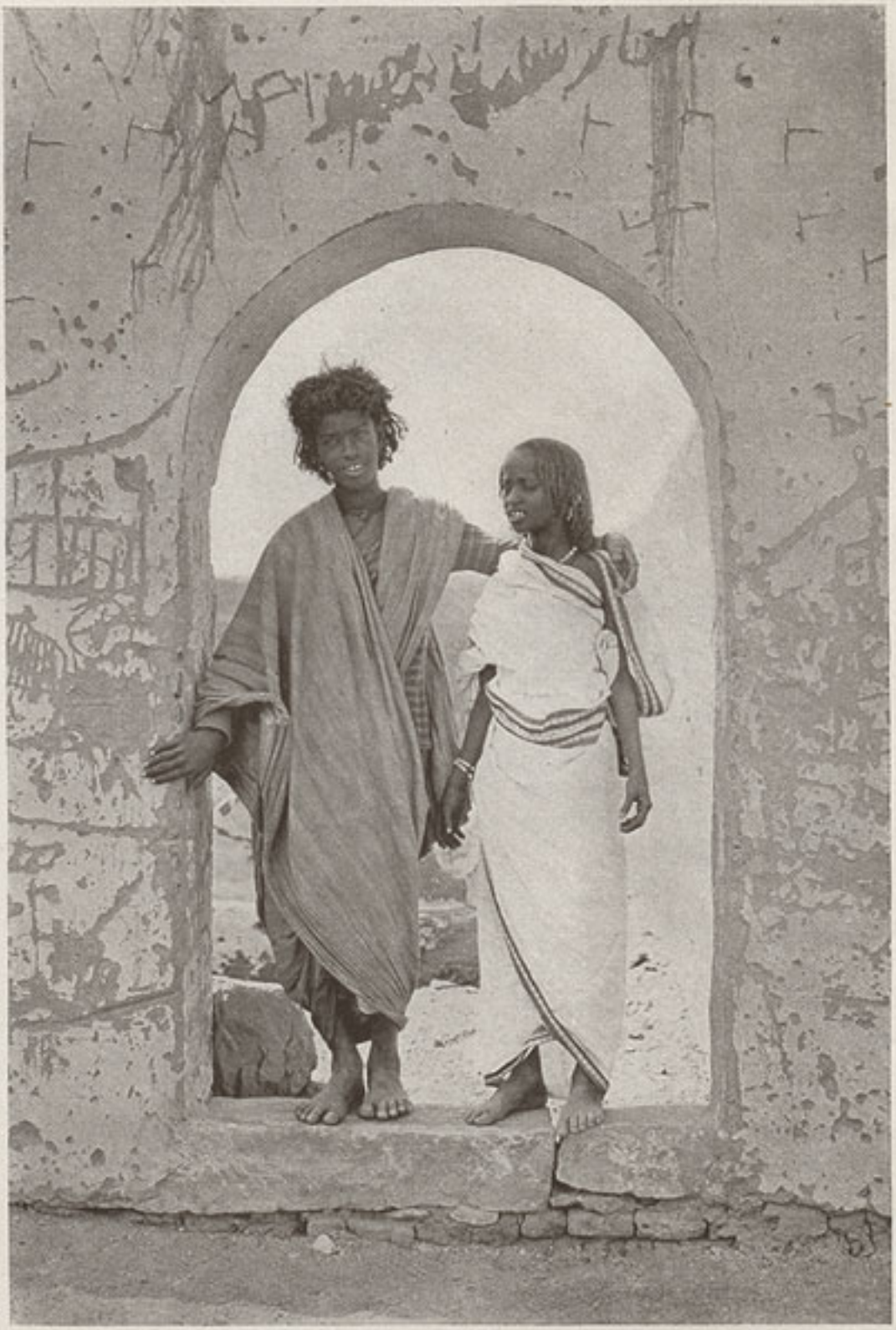
In addition to photographic goods we list in this catalog our well-known prism binoculars. These are of interest to many enthusiasts in the photographic art; with their aid the amateur photographer can discover many picturesque bits of landscape which would otherwise escape observation, and he can enjoy to the utmost the pictorial possibilities of any point of view, whether or not he is able to inscribe all of his impressions on the photographic plate.

We would also mention here the important departments in the C. P. Goerz factories for the manufacture of military and scientific instruments; not that they are of any special interest to the photographer, but because it is a proof of the high quality of our goods that in almost every army and navy, including those of the United States of America, there is in use a large and increasing number of instruments for the most precise observations and measurements, bearing the name "Goerz."

Prize Flashlight taken with Goerz Dagor No. 6
By WHITE STUDIO

GERALDINE FARRAR IN "KÖNIGSKINDER"

Table of Contents



Taken with Goerz Dagor No. 3
By A. W. CUTLER

BISHAREEN CHILDREN OF NUBIA

The Optics of Lenses

IN THIS book we discuss the subject of optics pertaining to the modern photographic lens, as thoroughly as space will permit. For additional information we would recommend some of the numerous photographic publications that treat the matter more elaborately. The knowledge gained in this way will be of great assistance in the proper selection of a lens.

For the modern requirements in the photographic field the old-time rectilinear and portrait lenses have been largely supplanted by the highly corrected anastigmat-type of lens. This is on account of certain defects in all the older types of lenses which render them not only unfit for solving any photographic problem calling for a combination of speed and covering power, but also incapable of giving critically sharp definition over an extended area.

The Aberrations most prevalent in the old-style lenses are spherical and chromatic aberration, astigmatism, curvature of field and distortion.

Spherical Aberration is the deviation in focus of the rays of light passing through the outer zones of the lens from that of the rays passing through the lens near its center, or axis, the various rays being focused in different planes. It results in general loss of definition and a fogged appearance in the negative.

Chromatic Aberration is of very similar character, and is explained by the fact that the violet and blue rays, which are most active on the sensitive emulsion of the plate or film, are focused by the lens in a different plane from the red and yellow rays, to which the eye is most sensitive. If a lens suffers from chromatic aberration, the image recorded on the plate will be blurred, notwithstanding that the eye may have observed a sharply defined image on the ground glass.

Astigmatism is the most serious defect in the old-style lenses. It shows itself in uncorrected lenses in such a manner that the horizontal and vertical lines of the object, although lying in the same plane in front of the lens, cannot be focused with equal sharpness at the same time on the ground glass. When the horizontal lines are sharply focused, it is necessary to move the ground glass forward or backward, in order to get the vertical lines sharp. This defect is principally visible along the margins of the plate, and results in a serious falling off of definition. Not until glass manufacturers had found a way of producing the so-called Jena glass—a material of entirely different properties from any glass previously known—were the opticians able to produce lens systems free from astigmatism. These lenses are known under the general name of anastigmats.

Curvature of Field is another common defect and it is found even in some modern anastigmat lenses. Theoretically, no lens has an absolutely flat field of sharp definition, but in Goerz Lenses the unevenness has been reduced to a negligible minimum. The remarkable flatness of field of Goerz Lenses is one of the principal reasons for their popularity, and in fact, has placed our lenses in a class by themselves.

Distortion is inaccuracy in recording the lines of the object, straight lines, for instance, being shown as slightly curved in the image, especially if they lie near the margins of the negative. This aberration is present in all single meniscus lenses, and in many of the higher-priced lenses as well, *including some anastigmats of unsymmetrical construction*. The Goerz DAGOR, CELOR, SYNTOR and HYPERGON *are symmetrical anastigmats; i.e.*, they consist of two similar combinations. *This construction insures complete freedom from distortion—a point of the greatest importance in selecting a lens for architectural and engineering photography, copying and legal photography of every description.*

In our Double Anastigmat Lenses these various aberrations have been corrected to such a degree that Goerz Lenses are recognized as a standard for excellence among the finest photographic lenses of today. The possessor of a Goerz Lens is assured that his work will not suffer through any of the above-mentioned optical deficiencies. There are, however, other considerations to be taken into account in selecting a lens for any particular kind of photography. These considerations are discussed below.

Focal length of a Lens—The equivalent focal length is the distance between a point in the lens system, called the second node, and the ground glass, when an object at infinity is in sharp focus. In symmetrical lenses this nodal point can be said to lie in the plane of the diaphragm between the two lens components. The focal length is then, for all practical purposes, the distance between the diaphragm in the lens and the ground glass, when a distant object is sharply focused. The choice of a lens of suitable focal length is important because:

First, the focal length determines the scale or the image size of the object photographed.

Second, the focal length of the lens used in relation to the size of the plate determines the angle of view—that is, the amount of subject included in the picture. With the same size plate the angle decreases as the focal length increases. (See table of angles, page 15.)

Third, the focal length determines the *perspective* at which objects appear in the picture, and the selection of the proper focal length is, therefore, of prime importance in architectural, interior and portrait photography.

As mentioned above, the equivalent focus of a lens is obtained when focusing objects at infinity. When focusing objects at nearer distances the focal length of the same lens increases in a definite proportion, expressed by the formula:

$$\frac{a \times f}{a - f} = b$$

where "a" is the distance of the object, "f" the equivalent focus, and "b" the resulting or effective focal length. It will be seen that if we focus at an object which is only twice the equivalent focal length away from the center of the lens, then the effective focus "b" of the lens has also increased to twice that of the equivalent focus, in which case the size of the image will be exactly the same as that of the object. Two other formulas are given here which express the inter-relation of object and image distance and focal length:

$$\text{Distance of object to center of lens} = (n + 1)\, f$$

$$\text{Resulting focus} = \frac{(n + 1)\, f}{n}$$

where "n" designates the scale which the size of the object bears to that of the image, and "f" is again equivalent focal length.

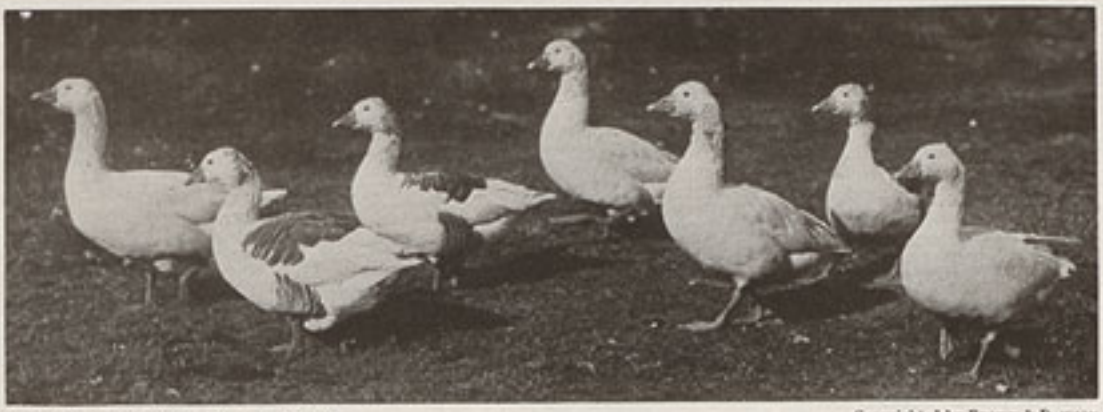
These formulas will be found useful whenever the photographer is called upon to select the proper size of lens or plate to meet certain conditions, and we give here a few examples of their application.

1. An object is to be photographed 1–10th natural size, at an available distance between object and lens of 25 feet. What must be the focal length of the lens? *Answer*—Focal length must be 27.2 inches.

$$25 \text{ ft.} = 25 \times 12 \text{ in.} = (10 + 1)\, f$$
$$300 \text{ in.} = 11 \times f$$
$$300 \div 11 = 27.2 \text{ in.} = \text{focus of lens}$$

2. What will be the size of the head in a portrait if we photograph the sitter with a lens of 14 inches focus at a distance of 120 inches between camera and sitter?

Answer—Size of head will be 1.32 inches.



Taken with Goerz Dagor No. 2

$$120 \text{ in.} = (n + 1)\ 14$$

$$n + 1 = \frac{120}{14} = 8.6$$

$$n = 7.6$$

Taking the average size of a head as 10 inches, a reduction of 7.6 times would give an image 1.32 inches in height.

3. What distance is required to take a standing figure (six feet tall) with a 14-inch lens on a 5 × 7 inch plate? *Answer*—Distance between sitter and lens, 182 inches.

Possible height of image on 5 × 7 plate = 6 in.

$72 \div 6 = 12$ = reduction number n

$(12 + 1)\ f = 13 \times 14 = 182$ in.

Selection of Focal Length—For general purposes—and among these we would class amateur photography—the lens should have a focal length not shorter than the long side of the plate. Different requirements of photographic workers along special lines make necessary other focal lengths, and the most suitable one should be selected for each case.

For architectural photography, especially interiors, it is frequently necessary to use a wide angle lens: *i.e.*, a lens of shorter focal length than the long side of the plate for which it is listed.

The fact should here be noted that in photographs taken with short-focus lenses, the perspective is apparently exaggerated: *i.e.*, objects in the background appear disproportionately small in comparison with those in the foreground. This is in the nature of an illusion; the perspective in a picture, like that in looking at the objects themselves, depends on the point of view. If a photograph taken with a three-inch lens could be viewed at a distance of three inches from the eyes, the exaggeration of perspective would disappear. But the eye is not able to see clearly at such short distance, and it is therefore advisable to use for landscape and record photography a lens having a focal length equal, at least, to the normal distance at which we can see the picture distinctly, which is about ten inches. Many objects—for example, all kinds of furniture—appear in pleasing perspective only when they subtend a narrow angle in the field of vision or on the photographic plate. For such objects, a lens of relatively long focus should be selected—*e.g.*, a 19 or 24 inch lens for an 8 × 10 plate.

The Speed of a Lens depends on the amount of light it transmits, and is measured by the ratio of its effective aperture to its focal length; for instance, a lens with a speed of F:6 has an effective aperture equal to one-sixth of its equivalent focus. The diameter of the free glass surface of the front of the lens must be equal, at least, to the effective aperture; but there are some lenses in which the glasses are larger than the effective aperture, and the diameter of a lens is in itself no criterion of its speed.

Neither is the opening of the iris diaphragm, with which all modern lenses are

Goerz Dagor Lens
By W. HELWIG

CONFIDING

supplied, equivalent to the effective aperture. In anastigmats the opening may be either smaller or larger than the effective aperture, depending on the construction of the front lens system. In our DAGOR, CELOR and SYNTOR, each combination is a positive or converging element, and the diameter of the diaphragm is less than the effective apertures, being one-twelfth smaller in the CELOR and SYNTOR and one-eighth in the DAGOR.

It is a general rule (subject to the above-mentioned qualification) that the opening of the diaphragm controls the speed of the lens. The engraved scale, which shows the relative diaphragm apertures serves, therefore, as a guide to exposures under any given conditions, and the numbers on this scale are often referred to as "speed numbers." There are different systems of designating diaphragm apertures. The best known are the "F" System and the Uniform System (U. S.), one or the other of which is used by all American lens manufacturers, and the Stolze System, adopted in Europe.

In the F system each figure shows the ratio between the lens aperture and the equivalent focus. For instance, if we stop down the lens to F:11, it will work at an effective aperture equal to 1-11th of its focal length. The necessary exposures, however, do not vary in the same ratio as the F numbers, but in proportion to the squares of these numbers. In the Uniform System, the diaphragm figures increase in the same ratio as the required exposures. Although, in deference to custom, we designate the maximum speed of our lenses in the F values, our diaphragms are marked in the U. S. system, unless otherwise specified, in order to facilitate the calculation of exposures. If you know that 1-100th of a second gives you a satisfactory negative at U. S. 4 under certain conditions of light, you should give twice as long, or 1-50th of a second at U. S. 8, four times as long, or 1-25th at U. S. 16, eight times as long at U. S. 32, and so on. The same principle is observed in marking diaphragm apertures according to the Stolze System, which is used on German-made Goerz lenses. The table below shows a comparison of these three systems.

Uniform System U. S.	1	1.2	1.4	1.6	1.9	2.5	2.9	4	8	16	32	64	128	256
Corresponding F values	4	4.5	4.8	5	5.5	6.3	6.8	8	11.3	16	22.6	32	45	64
Stolze System as used on German-made Goerz Lenses	1.5	2	2.3	2.5	3	4	4.6	6	12	24	48	96	192	384

Inasmuch as the focus of a lens increases when focusing nearby objects, whereas the diameter of the effective opening of the lens remains the same, it follows that at short distances lenses work at less speed than that which they are listed for. This should receive due consideration by giving prolonged exposures when photographing nearby objects. For instance, when copying in natural size, a lens listed at a speed of, say, F:8, operates only at a speed of about F:16, thereby requiring four times the exposure necessary for a lens of an effective opening of F:8.

Anastigmats of extreme speed are necessarily more bulky than those of moderate speed, and they cannot be fitted to some of the smaller hand cameras. Extreme speed also involves a sacrifice in covering power, and in depth of focus when the lens is used wide open. The latter implies the necessity of greater care in focusing with the CELOR than with the DAGOR and SYNTOR, when the lenses are used at their full

aperture. For most amateur work a speed of F:6.8 is sufficient, and as lenses for general photography we especially recommend our DAGOR and SYNTOR to the amateur. The CELOR is, however, admirably adapted to portraiture in the home or studio, to news photography with focal plane shutter cameras, and to many kinds of outdoor photography under unfavorable conditions of light.

Covering Power is the ability of a lens to evenly illuminate and define an image over its entire circle of illumination. The field of a lens being circular in form, the largest plate which may be used is such as can be set in this field without cutting off the corners. Goerz DAGOR Lenses are celebrated for their most remarkable covering power; they will embrace an angle of view to 90°, making them most satisfactory for wide angle work. A DAGOR No. 1, for instance, listed for the 4 x 5 inch plate, will almost cover an 8 x 10 plate when smaller diaphragm stops are used.

For photographing "skyscrapers" and large manufacturing plants, and for interior views in cramped situations, it is necessary to employ a special lens intended exclusively for wide angle work. Among special wide-angle lenses, the Goerz HYPERGON stands supreme. The HYPERGON with the star diaphragm cuts an angle of 135° and the form without the star, 110°.

The Depth of Field, also termed depth of focus, expresses the range within which a lens will reproduce near and distant objects sufficiently sharp on the negative plate. Theoretically a lens can only image sharply on the ground glass or negative plate objects lying in one plane in front of the lens. We find, nevertheless, that objects at different distances appear equally sharp in the picture; and the reason for this is that our eyes are unable to discover the very slight unsharpness with which these objects have been imaged by the lens. It is approximately correct, therefore, to speak of the depth of field of a lens.

This is a fixed quality in all lenses, and depends simply on the relation between the focal length and the aperture of the lens. In general it decreases as the focal length and size of aperture increases. Of two lenses with the same speed but of unequal focal length the one of shorter focal length will have the greater depth. Of two lenses of the same focal length but of unequal speed, the slower one will have the greater depth, *but if both are stopped down to the same aperture the depth will then be equal.* Depth of focus can always be obtained by stopping down the diaphragm, but this, of course, means loss of speed and proportional increase of exposure. It will thus be noted that when using fast lenses of rather long focus, at their full opening, it is impossible to obtain both far and near objects equally sharp on a plate. The question of depth of field is of great importance when photographing, for instance, street scenes with objects at various distances from the camera. For such subjects, pocket cameras with short-focus lenses possess a great advantage over bulkier outfits. In photographing street scenes and crowds, successful results can be obtained with the Vest Pocket Tenax and Coat Pocket Tenax, under conditions that could not possibly be met with larger cameras, owing to the necessity of stopping down longer-focus lenses to secure depth of field, thereby necessitating too long exposure to stop motion in the negative.

We append below a table giving the distances between which objects will appear perfectly sharp in the negative when using lenses of various focal lengths, if the index on the camera is set for a certain distance on the focusing scale, as provided with almost every hand camera. If the table is compared with those in some of our previous catalogs, it will be noticed that the depth of field appears, according to this new table, to be much reduced. This is explained by the fact that we have based our calculations this time on an allowable unsharpness, or so-called circle of diffusion, of 1-250th of an inch, instead of 1-100th, as in the old tables. That is to say, a point situated anywhere between the maximum and minimum distances from the lens, as given in the table, will be recorded in the negative as a point or as a circle not over 1-250th of an inch in diameter. We make this change in estimating depth of focus on account of the increasing popularity of pocket cameras, the negatives from which are generally used for making enlarged photographs. In such negatives a greater degree of sharpness of definition is desirable than is necessary in negatives for contact print-

ing. In contact prints the depth of field will be found considerably greater than indicated by the table.

The maximum depth of field is obtained if the index is set at the so-called *hyperfocal distance*, given in the table for the various diaphragm openings, when it will extend from one-half the hyperfocal distance to infinity. The formula for the hyperfocal distance is

$$\frac{F \times F \times 250}{\text{F-value}}$$

in which F is the focus of the lens in inches and F-value the size of the diaphragm stop in the F system. The multiplier 250 indicates the allowable circle of diffusion, 1–250th of an inch. It can be decreased to 200 or 100 if the negatives are to be used only for contact prints.

Depth of Field

Index on Focusing Scale			9 Ft. = 108 In.		12 Ft. = 144 In.		15 Ft. = 180 In.		25 Ft. = 300 In.		Hyperfocal Distance Inches		
Equivalent Focus	Diaphragm		The Depth of Field Extends										
	F:	U. S.	From	To	From	To	From	To	From	To	Index	Range From	To
3 Inches	4.8	1.4	88	140	116	208	130	292	181	830	**470**	235	Infinity
	5.5	1.9	86	147	107	222	125	322	173	1118	**410**	205	
	6.8	2.9	81	161	100	242	117	396	157	3300	**330**	165	
	8.	4.	78	176	95	299	110	504	.....		**280**	140	
3½ Inches	4.8	1.4	92	130	118	186	140	251	204	567	**637**	318	Infinity
	5.5	1.9	90	134	114	194	136	256	195	705	**557**	278	
	6.8	2.9	87	142	109	212	129	300	180	900	**450**	225	
	8.	4.	84	151	105	231	122	340	168	1398	**382**	191	
	11.	8.	78	178	95	302	109	521	.....		**275**	137	
4¾ Inches	4.8	1.4	99	119	128	164	156	213	239	403	**1175**	587	Infinity
	5.5	1.9	98	121	126	168	153	218	232	424	**1025**	512	
	6.8	2.9	96	124	123	174	148	230	220	470	**830**	415	
	8.	4.	94	128	120	181	143	242	210	522	**705**	352	
	11.	8.	89	137	112	200	133	278	189	725	**512**	256	
	16.	16.	83	156	102	244	119	368	162	2031	**352**	176	
	22.	32.	76	187	92	331	106	612	.....		**255**	127	
6 Inches	4.8	1.4	102	115	134	156	165	199	259	357	**1875**	937	Infinity
	5.5	1.9	101	116	132	158	162	202	254	367	**1637**	818	
	6.8	2.9	100	118	130	163	158	210	242	394	**1262**	631	
	8.	4.	98	120	128	165	155	214	237	409	**1125**	562	
	11.	8.	95	124	122	175	148	231	219	474	**817**	408	
	16.	16.	91	134	112	194	136	265	196	644	**562**	281	
	22.	32.	85	147	106	223	125	323	173	1141	**407**	203	
	32.	64.	78	176	95	296	110	504	.....		**280**	140	
7 Inches	4.8	1.4	104	113	136	153	168	194	268	340	**2550**	1275	Infinity
	5.5	1.9	103	114	135	154	167	196	264	347	**2227**	1113	
	6.8	2.9	102	115	134	156	164	200	257	359	**1800**	900	
	8.	4.	101	116	132	159	161	204	251	373	**1530**	765	
	11.	8.	98	120	128	165	155	215	236	411	**1112**	556	
	16.	16.	95	126	121	177	146	235	216	494	**765**	382	
	22.	32.	90	134	114	195	136	266	195	653	**555**	277	
	32.	64.	84	151	105	231	122	340	168	1398	**382**	191	

The Angle of View—For those desiring to find the angle of view included by lenses of various focal lengths on the standard size plates, we append a chart of angles.

Example No. 1—Find the angle included over the diagonal of an 8 x 10 plate, when using a lens of 12-inch focus.

1. Take length of diagonal for 8 x 10 plate from table to be 12.9 inches.

2. Take on horizontal base line focal length of 12 inches and on vertical line diagonal of 12.9, or practically 13, and find where the fine vertical and horizontal lines running from these points intersect.

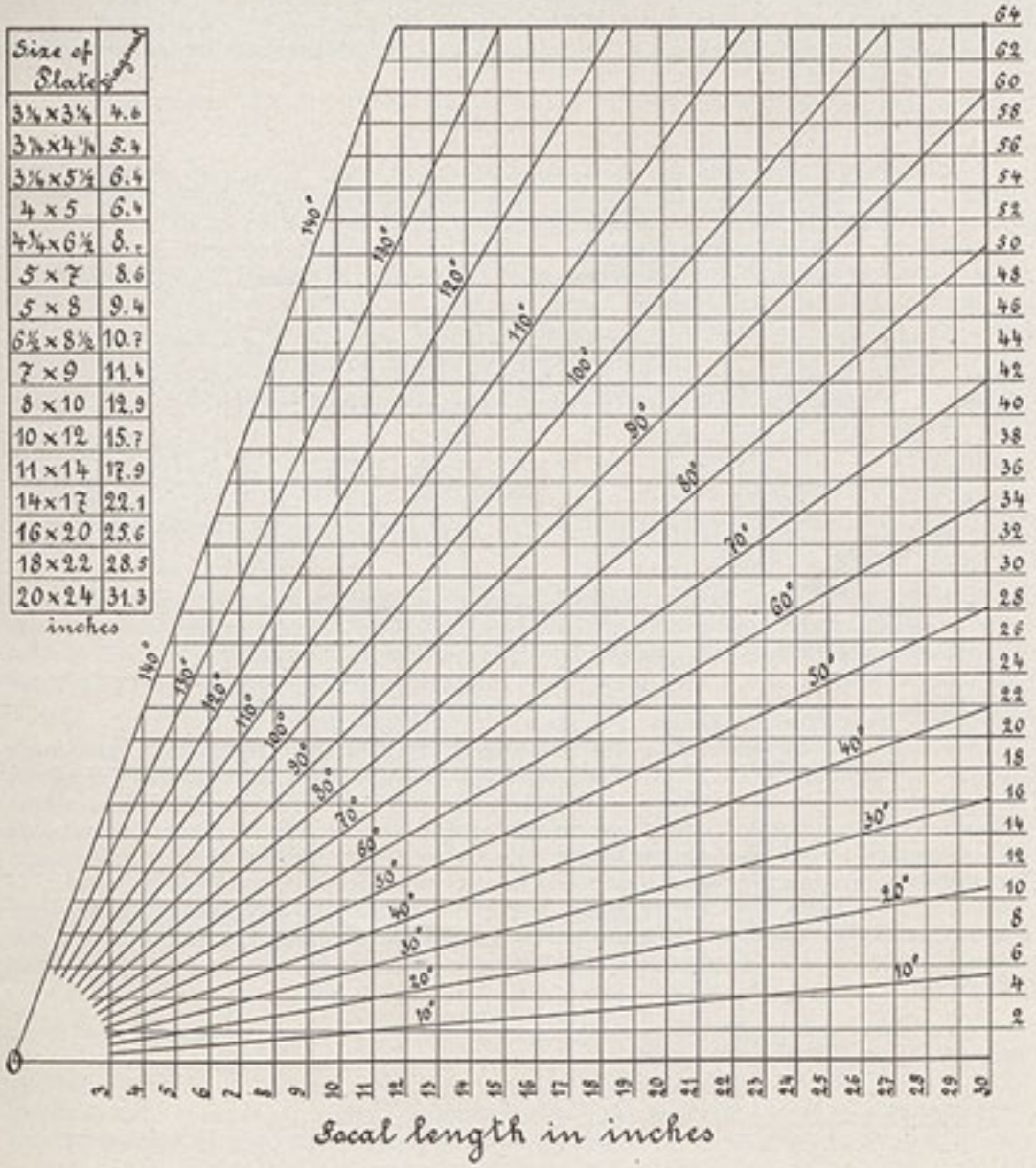
It will be found that the intersecting point lies just about half between the 50° and 60° line, so that the angle of view is 55°.

Example No. 2—What focal length must be used to include an angle of 90° over the diagonal of 11 x 14 plate?

Diagonal of 11 x 14 plate is 17.9 inches, or practically 18 inches, so follow fine line from 18 inches point on vertical until it intersects with the 90° line and follow down to horizontal line, which gives 9 inches as the required focal length.

Size of Plate	Diagonal
3¼×3¼	4.6
3⅝×4⅛	5.4
3¼×5½	6.4
4 × 5	6.4
4¼×6½	8.–
5 × 7	8.6
5 × 8	9.4
6½×8½	10.7
7 × 9	11.4
8 × 10	12.9
10 × 12	15.7
11 × 14	17.9
14×17	22.1
16×20	25.6
18×22	28.5
20×24	31.3

inches



Taken with Goerz Celor
By GEORGE ADAMS

YACHT RACE

For landscape work and portrait photography an angle of view of about 40° will usually be sufficient. For street scenes and genre photography, an angle of view of 40° to 60° should be selected. For interiors any angle of view up to 90° may be used to advantage. Wider angles, from 90° to 135°, should be included in a photograph only in case of necessity, as the exaggerated perspective explained before is annoying to the eyes in extreme wide-angle views.

Use of Lenses for Enlargements—When using lenses for enlarging it is well to use them in reverse position, with the front lens towards the enlarged picture, except in the case of strictly symmetrical lenses, which may be used in either position with equally good results.

If artificial light is used for enlarging, care must be taken to prevent the lens from becoming unduly heated. The leaves of the iris diaphragm are of rubber or fiberoid, which is easily affected by heat, and in the case of cemented lenses, the cement may also suffer from excessive heat. Screen the lens from the light except during the time necessary for the exposure.

Cemented Versus Uncemented Lenses—Some time ago the leading lens manufacturers of Europe appointed a committee to investigate carefully the relative merits of cemented and uncemented lenses. From their report it appears that each system has its advantages, and it was found to be impossible to give one type the preference over the other.

Air Bubbles or Bells in Lenses—Almost every modern anastigmat lens shows in some of its component parts minute air bells or bubbles. The exacting purchaser is often inclined to refuse acceptance of such lenses, believing the presence of these bubbles to be a defect. It is, however, impossible to obtain from the manufacturers of the so-called Jena glass this material entirely free from bubbles; and, furthermore, the presence of a few air bubbles does not in any way affect the work of the lens. We would be pleased to send on request a communication from the glass manufacturers on this subject. Until the manufacturers succeed in avoiding the bubbles in these special grades of optical glass, their presence is rather a guarantee of quality than otherwise.

The Care of Lenses—All lenses should be cleaned from time to time, but with proper care, as the adjustment of an anastigmat is easily disturbed by careless handling. Dust the surfaces first with a perfectly clean camel's-hair brush, which every photographer ought to have especially for that purpose. Then wipe them with a piece of old, soft linen or silk (an old cambric handkerchief that has been laundered several

times will answer admirably). Never use any acid or other strong fluid on the glass surface of your lens or it will be ruined. We have had to repolish many anastigmats which had been thus damaged.

In all our cemented lenses, such as the DAGOR and PANTAR, the clampring which holds the glasses in their cells *must not be removed*, or the centering will be disturbed. In the CELOR, SYNTOR and HYPAR the cellring, which holds the inner or negative lens, serves at the same time as clampring for the front or positive lens element. It may be unscrewed in order to get at the inside surfaces, if necessary, and the positive lens may then be taken out for cleaning. Great care, however, must be taken to have its seat free from dust and to replace the lens *with its stronger curved surface toward the outside.*

The surfaces of all lenses may become oxidized in the course of years, through exposure to the air. This condition is indicated by an iridescent reflection from the glass surface. To prevent oxidation, keep the lens capped when not in use and remove at once any moisture which condenses on it. Surface oxidation can be removed by repolishing the lens. All repairs to anastigmat lenses should be entrusted to the manufacturers of the lens, as they only are equipped with the necessary test glasses and tools for this delicate work. Any attempt at repairs by others may result in the complete loss of the lens. Our New York factory is fully equipped for repolishing and repairing Goerz Lenses, but we do not repair lenses of other makes.

Choosing a Goerz Lens

For Amateur Photography—This includes a wide variety of work, comprising most of the recognized branches of photographic activity. For landscape and architectural photography it is an advantage to possess a lens which can be used as a wide angle lens on a considerably larger size of plate than that for which it is listed, and which has a front or back combination efficient enough for instantaneous exposures, whenever larger images of distant objects are desired. No lens which works much faster than F:7 can meet these requirements. We therefore recommend the DAGOR with its maximum speed of F:6.8 as a universal lens for outdoor and indoor amateur photography. The extra speed of the CELOR, F:4.5–5.5 can be used to advantage in amateur portraiture and for instantaneous photography in dull weather; but whenever the CELOR is used wide open and focused by scale, especial care must be taken to estimate the distance of the object correctly. The SYNTOR, F:6.8 is a lens not to be despised, being a true anastigmat of "Goerz Quality," giving very sharp definition to the corners of the plate or film for which it is listed. For wide angle work it is not so efficient as the DAGOR. *but as a lens intended for use exclusively with a small hand camera, it can hardly be excelled.*

For Commercial Photography—The photographing of machinery, furniture, glassware and merchandise in general, and the recording of progress in building and construction work are the principal tasks of the commercial photographer. A fine perspective effect and perfect rendering of details are the necessary results to be obtained in this class of work. To obtain the proper perspective is merely a matter of selecting the proper viewpoint and using a long-focus lens, so that the camera can be set up at a suitable distance from the object; but to get the proper details and correct drawing of the object a lens that is corrected for distortion, spherical and chromatic aberration and astigmatism is of paramount importance. The DAGOR lens is the most suitable for this class of work. The wide-angle efficiency of the DAGOR, especially, is of prime importance to the commercial photographer.

News Photography, though a branch of commercial photography, has its specia requirements, and these are perhaps better met with the CELOR. Professional and amateur specialists in high-speed photography, who use cameras with focal plane shutters, like the ANGO, or reflecting cameras, frequently obtain good pictures with the CELOR, under conditions which would mean failure if a slower lens were used.

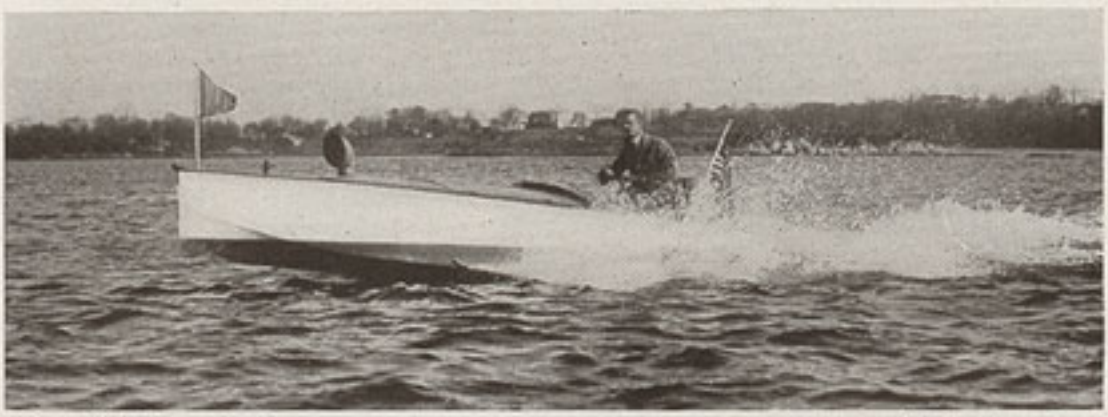
In Landscape and Architectural Photography it is frequently an advantage to have at hand lenses of different focal lengths, in order to secure just the right size of image and angle of view for each case. This end can be accomplished at a minimum expense by purchasing one of the CONVERTIBLE PANTAR SETS.

Photo Engraving—To meet the requirements of the *photo-engraver*, we now offer two special anastigmats—the PROCESS DAGOR, widely and favorably known to the craft on account of its speed and critical definition, and the ARTAR, a new lens of the uncemented type, especially corrected for color work.

For Portrait Photography—Home portraits by window light can be successfully taken with the DAGOR, and it is also an ideal lens for all kinds of flashlight photography. To those who specialize in home photography we would, however, recommend the CELOR. This lens has sufficient covering power for taking home groups, children at play, etc., and its speed reduces the necessary exposures from seconds to fractions of a second, thereby saving many negatives which would otherwise be hopelessly blurred by motion of the subjects.

For professional portraiture we offer two anastigmats—the CELOR, which in its longer focal lengths is in use in a large proportion of the best American studios, and the new PORTRAIT HYPAR. To the photographer who must rely chiefly on one lens for bust portraits, three-quarter and full-length figures and small groups, and who must be able to secure critically sharp definition on demand, we recommend the CELOR. The DAGOR is the best lens for large groups. As a portrait lens of extreme rapidity for busts and single figures, the HYPAR is the latest and most remarkable production of the optician's art. At its sharpest focus it gives beautifully soft but not "fuzzy" definition. Any degree of diffusion desired can be obtained either with the CELOR or HYPAR, by focusing for a soft effect. The exaggeration of perspective, inevitable with short-focus lenses, is especially annoying in portraiture. We therefore recommend that a lens of from 14 to 24 inches equivalent focus be selected for the studio, if space permits. It is a good rule to use a lens of a focal length at least twice as long as the largest bust to be made with it: *e.g.*, a lens of at least 14 inches focus for a seven-inch bust on an 8 x 10 plate. But in home portraiture and work in short studios, it is frequently necessary to disregard this rule. In all such cases special care must be taken in posing the sitter; if this is done, good portraits can be obtained with a lens of any focal length. We give below the distances between lens center and sitter when using the various numbers of our lenses for different sizes of portraits.

Lens Number	5	6	7	7a	8	9	10
Focal Length, inches	10¾	12	14	16½	19	24	30
	Distance in feet between sitter and lens center						
Cabinet standing figure, 4½ inches high	14	15¾	19	22	25	31½	39
Paris full-length figure, 6 inches high	10¾	12	14	16½	19	24	30
Cabinet bust, 3¼ inches in size	5¼	6	7	8¼	9½	11¾	14¾



Taken with Dagor No. 2

By George Adams

Double Print from Two Negatives made with Goerz Lenses

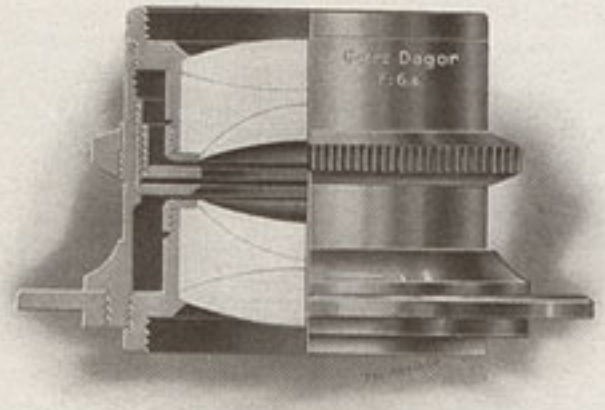
Home
Portraits
made by the
Light of
an
Ordinary
Window

Taken with

GOERZ
DAGOR
No. 4

by A. D. Allen

GOERZ LENSES



Goerz Dagor Anastigmat F:6.8

THERE is no lens which will do everything equally well, but there is one lens which will do the greatest number of things best, and that lens is the DAGOR. The superiority of the DAGOR as a general purpose lens is conceded by prominent amateur and professional photographers the world over. It has been imitated but never equaled.

The DAGOR consists of two symmetrical combinations, each combination made up of three elements which are cemented together.

DAGOR Lenses can be fitted to almost all makes and sizes of cameras. The smaller sizes, on account of their light weight and compact construction, are especially suitable for small hand cameras, kodaks, etc., as they insure a wealth and sharpness of detail which makes it possible to secure perfect enlargements from the smallest negatives.

The DAGOR is an all-around lens for landscapes, architecture, portraits, groups, interiors, nature photography, scientific work and commercial photography. Its speed of F:6.8 has been found by experience to be fast enough for focal plane photography of races, athletic events, etc., giving satisfactory negatives under good conditions of light, with the shortest exposures yet attained in shutter construction.

Each Goerz Dagor Double Anastigmat Supplies:

1. *A rapid lens*, for general purposes—landscapes, portraiture, commercial photography, architectural subjects, flashlights, copying and enlarging, etc., working at full aperture with extreme sharpness to the edges of the plate for which it is constructed.

2. *A wide angle lens*, when small apertures are employed for buildings, interiors, large groups, etc., sharply covering a much larger plate than the size for which it is listed.

3. *A long-focus lens*, for securing larger images of distant objects, when the front or back combination is used alone. The single combinations have nearly double the focal length of the complete lens. They require but little stopping down, and can be used for "snap-shots" in sunlight; the exposure should be about four times as long as when using the whole lens.

Astigmatism is completely corrected in the DAGOR, with the result that, even at full aperture, the image is as sharp at the edges as at the center. The curvature of field is practically eliminated within an angle of 72°; that is, in wide angle work, that

part of the image comprised within an angle of 72° is perfectly flat, affording minutely sharp definition. The co-existence of these two essential qualities, perfect anastigmatism and flatness of field, gives these lenses supremacy over all other types.

The DAGOR is free from internal reflections, and the image produced is accordingly brilliant and free from flare. On this account we especially recommend this lens for flashlight work, and also for landscape photography, in which the general rule that the source of light should be back of the camera must frequently be disregarded.

The two combinations of the lens are placed in close proximity, so that there is no falling off in illumination towards the edges of the plate or film. Each combination is spherically and chromatically corrected for the axial and oblique rays, even at a large stop.

By reason of the symmetrical construction of the DAGOR, which consists of two identical combinations, the image is perfectly orthoscopic under all conditions: That is, straight lines in the object are rendered as straight lines in the image, not as curves. This quality recommends the DAGOR as the best possible lens for copying maps, charts, mechanical drawings, etc., and for legal photography of every description. It is also invaluable in architectural photography and for many branches of commercial work.

The Dagor as a Wide-Angle Lens—The exceptionally fine correction of the Goerz DAGOR Lenses over their entire light circle, and the wonderful covering power obtained as a result, make possible the use of the DAGOR as a wide-angle lens, on a larger plate, up to an angle of 90°. They will give perfect definition over the whole image subtended by this angle when the smaller stops are used. Their brilliant illumination at the wider apertures is of great assistance in composing the view on the ground glass and in focusing; in which respect the DAGOR is greatly preferable to the ordinary wide-angle lenses, which allow only a maximum aperture of about F:16.

In short, the DAGOR, taking into account its maximum speed of F:6.8, its remarkable covering power, its freedom from distortion and the efficiency of its single combinations, is the nearest approach to a universal lens that has yet been produced.

Prices of Dagor Lenses

	No.	Equivalent Focus Inches	Barrel Iris Diaphragm	Fitted with Sector Shutter	Fitted with Compound Shutter	No.	Size of Plate Sharply Covered at F:6.8 U.S.:2.9 Inches	Size of Plate Sharply Covered at F:32 U.S.:64 Inches
F.6.8	0000	1½	$34.00	$49.00	$46.00	0000	1½ x 1½	2 x 2¼
	000	2⅜	34.00	49.00	46.00	000	2¼ x 2¾	2¾ x 3½
	000a	3	35.00	50.00	47.00	000a	2¾ x 2¾	3½ x 4¼
	00	3½	35.50	50.50	47.50	00	3 x 3	4 x 5
	*0	4⅝	37.50	52.50	49.50	0	3¼ x 4¼	5 x 7
	*1	6	45.00	60.00	59.50	1	4 x 5	6½ x 8½
	2	7	51.50	66.50	66.00	2	5 x 7	8 x 10
	3	8½	62.50	77.50	78.75	3	5 x 8	10 x 12
	4	9⅝	75.50	93.50	91.75	4	6½ x 8½	11 x 14
	5	10¾	91.00	109.00	111.00	5	7 x 9	12 x 16
	6	12	107.00	125.00	127.00	6	8 x 10	16 x 18
F.7.7	7	14	140.00		162.00	7	10 x 12	18 x 22
	7a	16½	182.00			7a	11 x 14	20 x 24
	8	19	219.00			8	12 x 15	22 x 25
	9	24	325.00			9	16 x 18	24 x 30
	10	30	539.00			10	18 x 22	30 x 36
	11	35	1,070.00			11	22 x 25	34 x 44

*For Kodaks and other small hand cameras we supply No. 0a and No. 1a of 5 inches and 6½ inches focus at the same prices as the No. 0 and No. 1 DAGOR respectively.

For stereoptic views, the lenses are "paired" at an extra charge of $2.50.

When lenses are used with between-lens shutters, the regular barrel with Iris diaphragm is not needed, and we do not furnish it, except on special order, when an extra charge will be made. Each lens, either with barrel or shutter, is supplied with a lens cap for protection and is furnished without extra charge. in an elegant plush-lined case. Focusing scales are supplied with all lenses up to No. 6.

Taken with Goerz Dagor No. 3, Wide Open, 1/1200 Sec.
Copyrighted by P. M. RICHARDSON

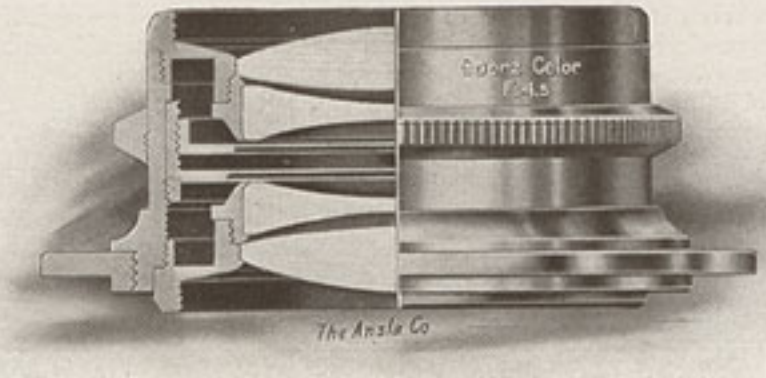
"CAUGHT OFF THIRD"

Taken with Goerz Dagor No. 5
By F. H. NOWELL

POLE VAULT

MADE WITH GOERZ CELOR LENS, F:5.5

By E. GOLDENSKY, PHILADELPHIA



Goerz Celor Anastigmat
F:4.5—F:5.5

THE CELOR is a double anastigmatic lens of symmetrical construction. Each combination is made up of two thin glasses separated by an air space. The loss of light through absorption is, therefore, very small.

The CELOR is an ideal lens for portraits in room or studio, for the highest speed work, copying and enlarging; natural color photography; telephotography; also for landscapes and views. Every CELOR Lens will cut sharply the size of plate for which it is listed.

There are in the market several anastigmat lenses working at a great relative aperture. Theoretically, their speed leaves nothing to be desired, but when they are used at their full aperture the extent of the field sharply covered is very limited.

A fast lens, to be really serviceable for general photographic work, should not only possess speed, but should at the same time cut sharply at full aperture an image contained within an angle of 60°, or, in other words, a plate the longer side of which is about equal to the focal length of the lens.

Our CELOR Lens combines these properties. It not only meets the requirements of the up-to-date studio as a lens for portraits and small groups, but it is also an ideal lens for high-speed photography with focal plane cameras and small pocket cameras in all kinds of weather.

We claim that CELOR Lenses are superior to all other anastigmats of equal aperture because of their larger field of sharp definition at full aperture. This is sometimes of advantage to the portraitist, because it enables him to select a lens of shorter focal length, where the length of the studio is limited. It means a gain in depth of focus and in actual working speed.

For Natural Color Photography on the new Autochrome plates the CELOR Lenses are particularly adapted. Not only does their great speed recommend them for this work, but also their very perfect chromatic correction, which insures equal sharpness for all colors composing the image.

Their chromatic correction makes them also suitable for reproduction work by the three-color process.

The CELOR makes high-speed photography possible under conditions which were formerly prohibitive. We especially recommend it to newspaper photographers and others who have to secure printable negatives regardless of weather and time of day

It is also an excellent lens for home portraits, having much greater covering power in comparison with its bulk and weight than the older types of portrait lenses. The reputation of the CELOR as an all-around studio lens is thoroughly established, and it is used by a large proportion of the professional portrait photographers of Europe

and America. While it is not so fast as the HYPAR, it has speed enough for portraits under the average skylight, and it is preferable to the HYPAR for all work calling for critical definition over a comparatively wide angle of view.

The depth of focus of the CELOR at full aperture is naturally limited; but if stopped down, it will have the same depth at the same aperture as will a DAGOR of equal focal length. The covering power of the CELOR includes an angle of 64° to 70°, as compared with 72° to 90° in the DAGOR. The single combinations of the CELOR, having nearly twice the focal length of the complete lens, can be used for long-distance photography, but require more stopping down than in the case of the DAGOR.

Prices of Celor Lenses

No.	Equivalent Focus Inches	Relative Opening	Barrel Iris Diaphragm	Fitted with		Size of Plate	
				XL Sector Shutter	Compound Shutter	Full Opening Inches	F:16 U.S.:16 Inches
000	2¾	F 4.5	$34.50	$49.50	$46.50	1¼ x 2¼	2 x 2½
000a	3	F 4.5	36.00	51.00	48.00	2 x 3	2½ x 3½
00	3½	F 4.8	38.00	53.00	50.00	2½ x 3½	3 x 4
*0	4¼	F 4.8	40.00	55.00	54.50	3¼ x 4¼	4 x 5
1	6	F 4.8	47.00	62.00	63.25	4 x 5	5 x 7
2	7	F 4.8	54.50	72.50	70.75	5 x 7	6 x 8
3	8½	F 5.	67.00	85.00	87.00	5 x 8	6½ x 8½
4	9½	F 5.	90.50	.....	112.50	6½ x 8½	7 x 9
5	10¾	F 5.	108.50	.....	130.50	7 x 9	8 x 10
6	12	F 5.5	126.50	.....	148.50	8 x 10	10 x 12
7	14	F 5.5	163.00	.....	.....	10 x 12	12 x 15
7a	16½	F 5.5	208.50	.....	.....	11 x 14	13 x 17
8	19	F 5.5	245.00	.....	.....	12 x 15	16 x 18

*For Kodaks and other small hand cameras we supply No. 0a of 5 inches focus at the same price as the No. 0 CELOR.

When lenses are used with between-lens shutters, the regular barrel with Iris diaphragm is not needed, and we do not furnish it, except on special order, when an extra charge will be made. Each lens, either with barrel or shutter, is supplied with a lens cap for protection and is furnished without extra charge in an elegant plush-lined case. Focusing scales are supplied with all lenses up to No. 6.

Taken with Goerz Ango Camera
Celor Lens

FOOTBALL SCRAMBLE

MOUNTED POLICE PRACTICE

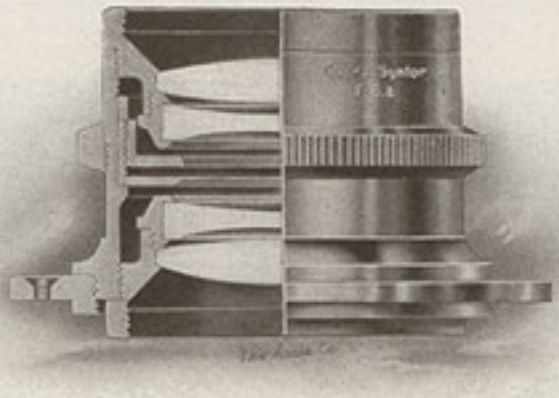
Goerz Celor Work
By GEORGE ADAMS

"HULLO GIRLS"

OLD MILL

Goerz Syntor Work
By E. F. Patch

STAGE COACH



Goerz Syntor Anastigmat F:6.8

THE Goerz SYNTOR double anastigmats are particularly intended for use on hand cameras. They meet the demand for an inexpensive but thoroughly efficient anastigmat. They are only made up to the No. 6 size (12 inches focal length).

The SYNTOR Lenses are perfectly corrected for spherical, chromatic and astigmatic aberrations; and the single combinations are brought very close together, insuring thereby a most even light distribution over the whole plate. Even at full aperture the SYNTOR is entirely free from coma and central spherical aberration.

The angle of sharp definition with the largest stop is 64°, increasing to 70° with smaller apertures.

The SYNTOR consists of two symmetrical uncemented combinations, and each combination can be used singly with a medium or small stop as a valuable landscape lens of approximately double the focal length of the complete objective.

The amateur photographer who wishes an anastigmat lens for his hand camera, but does not care to invest heavily, will find the Syntor a very satisfactory lens. It will cover sharply the size plate for which it is listed.

Although the Goerz SYNTOR is offered at a comparatively low price, it must not be classed or confused with other cheap lenses, as it represents the same high-grade workmanship necessary to produce our DAGOR and CELOR Lenses. Its simplified construction is the principal reason that permits its moderate price.

Prices of Syntor Lenses

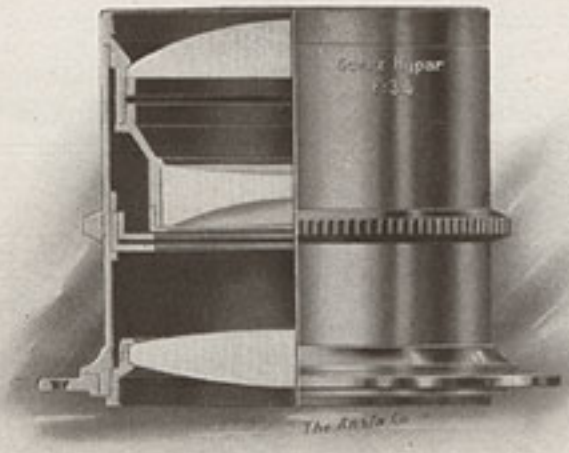
No.	Focus Inches	Barrel Iris Diaphragm	Fitted with		Size of Plate at F:6.8
			XL Sector Shutter	Compound Shutter	
000a	3	$22.00	$37.00	$34.00	2¼ x 2¼
00	3½	23.00	38.00	35.00	2½ x 3½
*0	4½	23.50	38.50	35.50	3¼ x 4¼
*1	6	27.00	42.00	41.50	4 x 5
2	7	32.50	47.50	47.00	5 x 7
3	8½	45.50	60.50	61.75	5 x 8
4	9½	54.50	72.50	70.75	6½ x 8½
6	12	72.50	90.50	92.50	8 x 10

*For Kodaks and other small hand cameras we supply No. 0a and No. 1a of 5 inches and 6½ inches focus at the same prices as the No. 0 and No. 1 SYNTOR.

When lenses are used with between-lens shutters, the regular barrel with Iris diaphragm is not needed and we do not furnish it, except on special order, when an extra charge will be made. Each lens, either with barrel or shutter, is supplied with a lens cap for protection and is furnished without extra charge in an elegant plush-lined case. Focusing scales are supplied with all lenses up to No. 6.

MADE WITH GOERZ HYPAR LENS, F:4.5

By GARO, BOSTON



Goerz Portrait Hypar F:3.5 and F:4.5

THE introduction of a new Goerz Portrait Lens is an event of more than passing interest to the photographic fraternity. It is, therefore, with special pleasure that we include in our catalog this year, for the first time, the Goerz PORTRAIT HYPAR. This new lens is our answer to a definite demand from the profession for a Goerz Anastigmat intended exclusively for portraiture and working at the widest possible aperture.

The HYPAR is an unsymmetrical anastigmat consisting of three single elements—one negative and two positive—and loss of light through absorption is reduced by this type of construction to an extreme minimum. The utmost care is taken in selecting glass for the lens, not only as to its composition and refractive index, but as to clearness, freedom from striæ and durability.

The HYPAR is free from internal reflections, permitting portraits to be taken against the light, if desired.

The PORTRAIT HYPAR works at a speed of F:4.5—fast enough for instantaneous exposures in the studio—in all sizes, from fourteen to twenty-four inches focal length. *Twelve and fourteen inch sizes working at the extreme speed of F:3.5 can also be supplied.* These are especially suitable for home portraiture.

The PORTRAIT HYPAR meets the requirements of photographers who wish a lens equally efficient for standard commercial portraiture and for the impressionistic rendering of character which distinguishes the work of the greatest photographic portrait artists of today.

It is not a special lens for producing a "fuzzy" lack of definition; but it blends the outlines and tone gradations of the masses of light and shade so as to produce exquisite modeling, together with just that degree of softness of definition which distinguishes an artistic from a mechanical reproduction. Experience has proved that such a medium softness of definition appeals to the most intelligent and prosperous patrons of the modern studio.

Although the Goerz HYPAR is an ideal lens for portraiture, in the strict sense of the term, it is not intended to supersede the CELOR as a studio lens.

The extra speed of the HYPAR is an advantage, especially in child photography, and to all portraitists who perfer to photograph their sitters unawares. The attainment of this speed, however, involves some reduction of covering power. The HYPAR F:3.5 cuts an angle of about 35° and the HYPAR F:4.5, 45°. Either of these angles of view is sufficient for portraits and single figures; but the CELOR, with its effective angle of

64°–70°—greater than that of any other high-speed anastigmat—is recommended to the photographer who is obliged to use the same lens for portraits, groups and occasional commercial work.

Prices of Portrait Hypar Lenses

Number	Equivalent Focus Inches	Speed	Barrel Iris Diaphragm	Size of Plates
6	12	F:3.5	$199.00	5 x 7 (C.D.V. and Cabinet)
7	14	F:3.5	272.00	5 x 7 (Cabinet)
7	14	F:4.5	174.00	6 x 8 (Cabinet and Boudoir)
7a	16½	F:4.5	218.00	6½ x 8½ (Boudoir)
8	19	F:4.5	290.00	7 x 9½ (Imperial)
9	24	F:4.5	544.00	10 x 12

Goerz Kino Hypar F:3.5

BELIEVING that we have in the new Goerz HYPAR Lens an instrument for motion picture work superior to anything of its kind hitherto placed on the market, we have modified its optical system in certain small sizes to meet the special requirements of this branch of photography. We can now supply it in three sizes, to fit all standard makes of motion picture cameras.

The KINO HYPAR is the ideal motion picture lens. Its extreme speed has been attained without sacrificing its simple and compact design, and its optical construction has been recalculated to afford the most microscopically sharp definition over the standard size of motion picture film. Its images are brilliant, crisp and free from flare. Since its recent introduction, the KINO HYPAR has met the approval of some of the leading motion picture men of America.

Prices of Kino Hypar Lenses

	In Barrel Iris Diaphragm	With Ango Focusing Mount
Kino Hypar F:3.5, Focus 2 inches	$30.00	$34.00
Kino Hypar F:3.5, Focus 2¾ inches	32.00	36.00
Kino Hypar F:3.5, Focus 3 inches	36.00	42.00

The Ango Focusing Mount is an improved focusing device working on the worm screw principle instead of the rack and pinion, affording perfect control on the part of the operator. (See page 48).

Special Focusing Mount—We have designed a special focusing mount for motion picture cameras, which is of similar construction to the Ango Focusing Mount, but still more exact. This mount has a micrometer adjustment which permits focusing with the most extreme precision. Price $15.00.

Taken with Dagor N. R. GRAVES

Goerz Pantar Sets

THE continued demand for a convertible Goerz Anastigmat has led us to place on the market the Goerz PANTAR. We supply the PANTAR only in special sets as listed below, each set consisting of one lens barrel and three single combinations, which may be used separately or any two together.

By providing himself with a PANTAR set, the photographer secures six different anastigmats at a price no greater than that frequently charged for one. Amateurs and view photographers who have two or more cameras of different sizes and desire an interchangeable lens equipment can use the PANTAR to advantage. The range of usefulness of any hand or view camera of long bellows extension can also be increased to a maximum by securing a PANTAR set. It is especially useful for landscape and architectural photography.

Most of the standard shutters can be fitted to the PANTAR and full particulars as to shutter equipment will be given upon request. The prices given below include three PANTAR combinations and one lens barrel, in a neat leather case.

Prices and Specifications of Pantar Sets

4 x 5 Set.....Price, **$85.00**		
Focus of Single Lenses	Speed	Angle of View
12	F:12.5	24°
9½	F:12.5	29°
7	F:12.5	38°

Combination	Focus	Speed	Angle
12 + 9½	6	F:7.2	44°
12 + 7	5¼	F:9	50°
9½ + 7	4⅜	F:7.2	56°

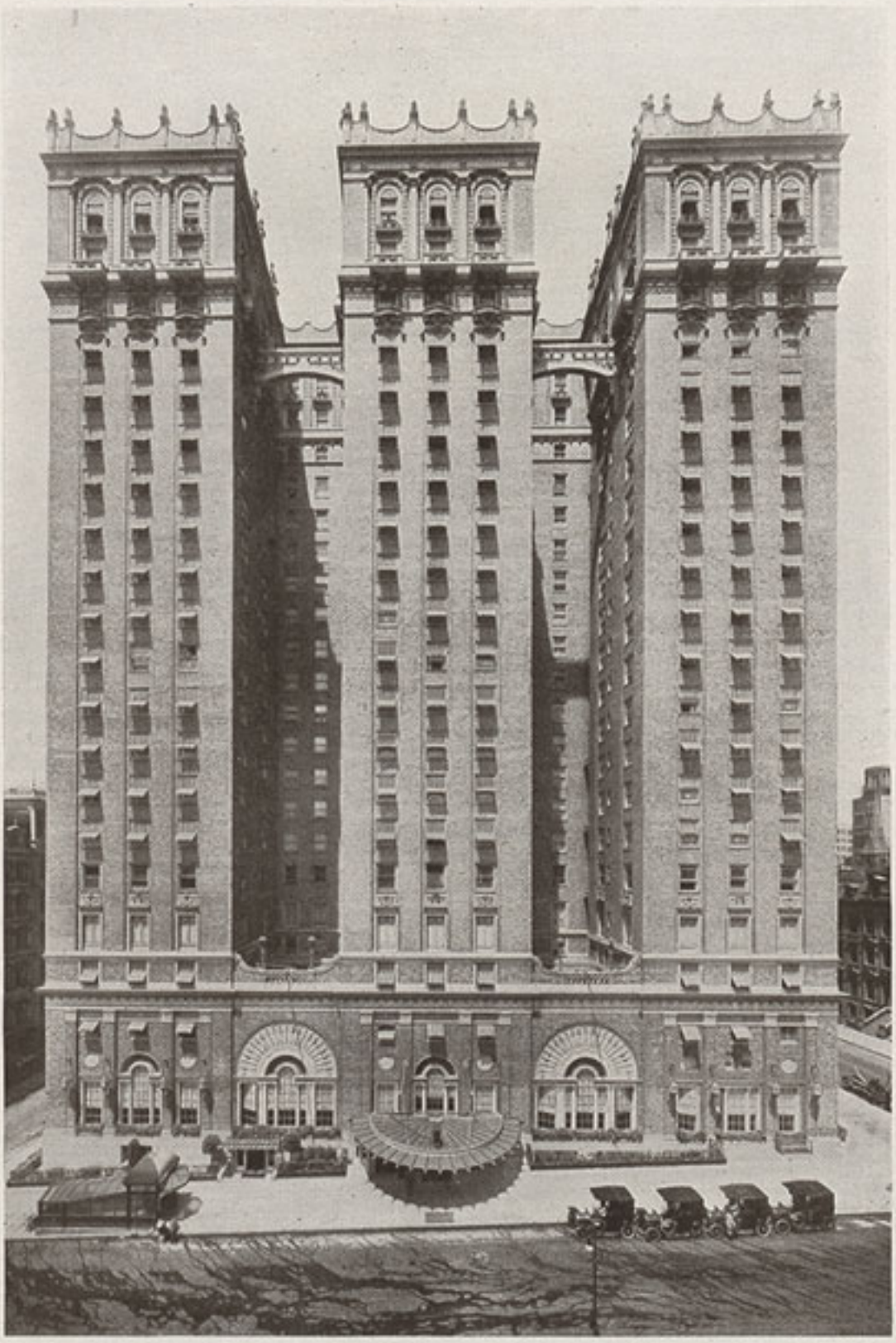
5 x 7 Set.....Price, **$98.00**		
Focus of Single Lenses	Speed	Angle of View
14	F:12.5	28°
12	F:12.5	33°
9½	F:12.5	41°

Combination	Focus	Speed	Angle
14 +12	7½	F:6.8	51°
14 + 9½	6½	F:7.7	57°
12 + 9½	6	F:7.2	61°

7 x 9 Set.....Price, **$150.00**		
Focus of Single Lenses	Speed	Angle of View
19	F:12.5	28°
16½	F:12.5	32°
14	F:12.5	37°

Combination	Focus	Speed	Angle
19 + 16½	10	F:6.8	50°
19 + 14	9¼	F:7.2	54°
16½ + 14	8¾	F:6.8	57°

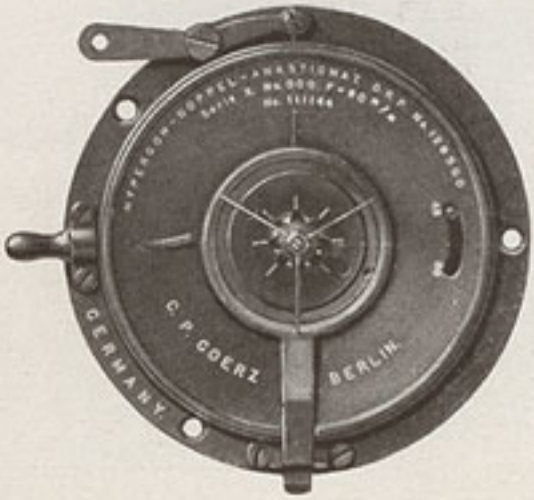
By combining two PANTAR combinations of the same focal length, a symmetrical anastigmat working at a speed of F:6.3 is obtained. The combination of two 12-inch lenses has a focal length of 6¾ inches; that of two 14-inch lenses a focus of 8¼ inches, and that of two 19-inch lenses a focus of 11 inches. Price of extra 12-inch lens, $18.00. Extra 14-inch lens, $23.00. Extra 19-inch lens, $43.00.



TAKEN WITH GOERZ HYPERGON 135° No. 000a

Focus 3 inches

From 8 x 10 Negative



Goerz Hypergon F:22—F:31

THE HYPERGON has for several years held a unique place among wide-angle lenses on account of its incomparable covering power. It is a symmetrical double anastigmat, consisting of two very thin hemispherical single glasses. Astigmatism, spherical aberration and curvature of field are completely corrected, and the definition is sharp to the very edges of the plate. The chromatic aberration is not corrected, but is eliminated after focusing by the use of the smaller diaphragm stop, F:31. The symmetrical design of the HYPERGON insures complete freedom from distortion of straight lines. The diminution of light toward the margin of the image, unavoidable in a lens cutting such an extraordinary angle, is corrected by an ingenious device in the form of a star diaphragm, which is rotated in front of the lens, by means of a bulb and tube attachment, during a part of the exposure.

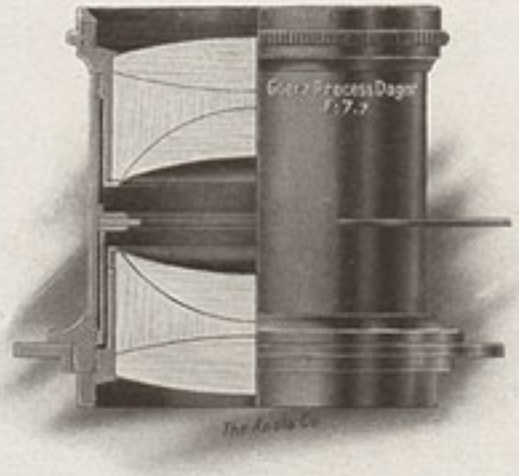
The HYPERGON is a special lens for wide-angle interiors, landscapes, architectural and panoramic pictures, and it should not be purchased with the idea that it can be used as a lens for general photography. It cannot be fitted to between-the-lens shutters.*

Hypergon Without Star Diaphragm—We have recently introduced a new form of HYPERGON without the star diaphragm. This cuts a maximum angle of 110° and requires no special adjustment to equalize the illumination. This lens can be attached to most view cameras without special fitting. It can be used for instantaneous cap exposures and flashlights, as well as time exposures.

Prices of Hypergon Lenses

No.	Equivalent Focus, Inches	In Barrel	Plate Covered Sharp at F:31	Hole in Lens Board	Diameter of Flange
000 with Star, 135°	2⅛	**$43.50**	5 x 7	2 7/16	3
000a " " "	3	**49.00**	18 x 10	2 7/16	3
00 " " "	3½	**52.50**	0 x 12	3 7/16	4¼
0 " " "	4¼	**62.00**	12 x 16	3 9/16	4¼
1 " " "	6	**72.50**	16 x 20	4 7/16	5
2a " " "	7⅛	**91.00**	24 x 28	7	7¼
000a without Star, 110°	3	**44.00**	5 x 7	1¼	2
00 " " "	3½	**47.50**	6½ x 8½	1½	2¼
0 " " "	4¼	**54.50**	8 x 10	2	2¼

* A special circular on the HYPERGON will be sent on request.



Goerz Process Dagor F:7.7

THE use of Goerz Lenses among photo-engravers is almost universal. Everywhere in the trade they are known for their remarkable perfection—their speed, unequaled covering power, even illumination, critical definition and accuracy of mechanical adjustments.

Improved methods in half-tone work have more and more established the want of a highly corrected process anastigmat of large relative opening, and this requirement is perfectly met in the PROCESS DAGOR F:7.7.

This lens has more than double the speed of our former Series IV anastigmat, which was so popular with engravers. It is completely free from coma, axial and marginal spherical aberration, and astigmatism. Its field is flat over an angle of 60° at full opening, and extends considerably farther with the use of smaller stops.

The entire absence of flare and secondary images, combined with the qualities enumerated above, recommends the PROCESS DAGOR as the best possible lens for half-tone and all black-and-white work. It is also much used for color work, having excellent chromatic correction, though it is not a special apochromatic lens, like the Goerz ARTAR, in the strict sense of the term.

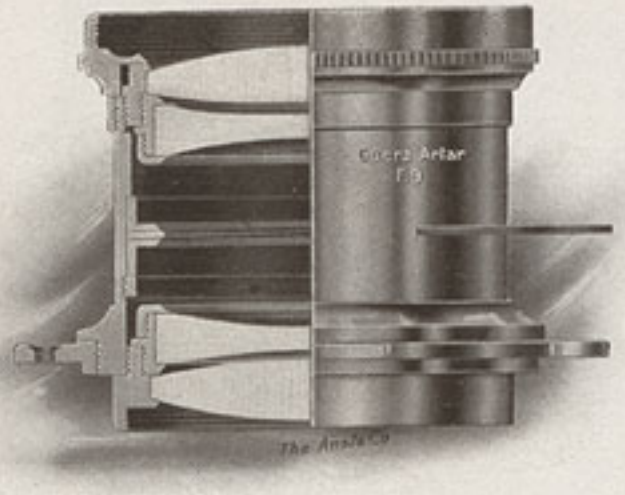
The half-tone cuts used in this catalog were made with a PROCESS DAGOR.

The PROCESS DAGOR lenses are regularly supplied in barrels with Waterhouse stops, a set of six different round openings being provided. Special shaped stops can be furnished to order.

The front cell of all our PROCESS LENSES has an externally threaded flange for attaching the Goerz PRISMS. When the prism is not in use, this threaded flange may be protected by a metal cap ring, over which the leather lens cap is fitted.

Prices of Process Dagor Lenses

No.	Equivalent Focus Inches	With Waterhouse Stops	Normal Size of Plate for Copying		Size of Plate Covered at F:7.7 for Reduction Inches
			Full Size F:15 Inches	Reduced F:15 Inches	
6	12	**$110.00**	16 x 20	10 x 12	8 x 10
7	14	**141.50**	20 x 24	12 x 16	10 x 12
7a	16½	**192.00**	24 x 28	14 x 18	11 x 14
8	19	**230.00**	28 x 32	16 x 20	12 x 16
9	24	**345.00**	36 x 40	20 x 24	16 x 18
10	30	**565.00**	40 x 48	24 x 28	18 x 22



Goerz Process Artar F:9-F:11

THE new GOERZ PROCESS ARTAR has been introduced to meet the ordinary requirements of half-tone and line work, and also the special requirements of the various color processes which have lately assumed such vast importance in the printing arts.

While much color work is undertaken with ordinary process lenses, the ideal lens for color processes must be not simply achromatic, but *apochromatic—i.e.*, corrected with equal precision for all the primary colors of the spectrum.

In three-color work, for instance, it is only by using an apochromatic lens that red, yellow and blue negatives exactly identical in size and degree of sharpness can be obtained. With all other lenses the various colors in the object are brought to a focus in slightly different planes, thus yielding negatives differing in size by a minute fraction of an inch, or sufficiently to prevent perfect register in printing.

The ARTAR is an apochromatic lens of perfect color correction. It is a double anastigmat and each combination consists of two uncemented single elements. It is perfectly corrected for spherical aberration, coma and astigmatism, free from zonal aberration and flare; and its symmetrical construction, as in the case of the DAGOR, insures complete freedom from distortion of lines in the image.

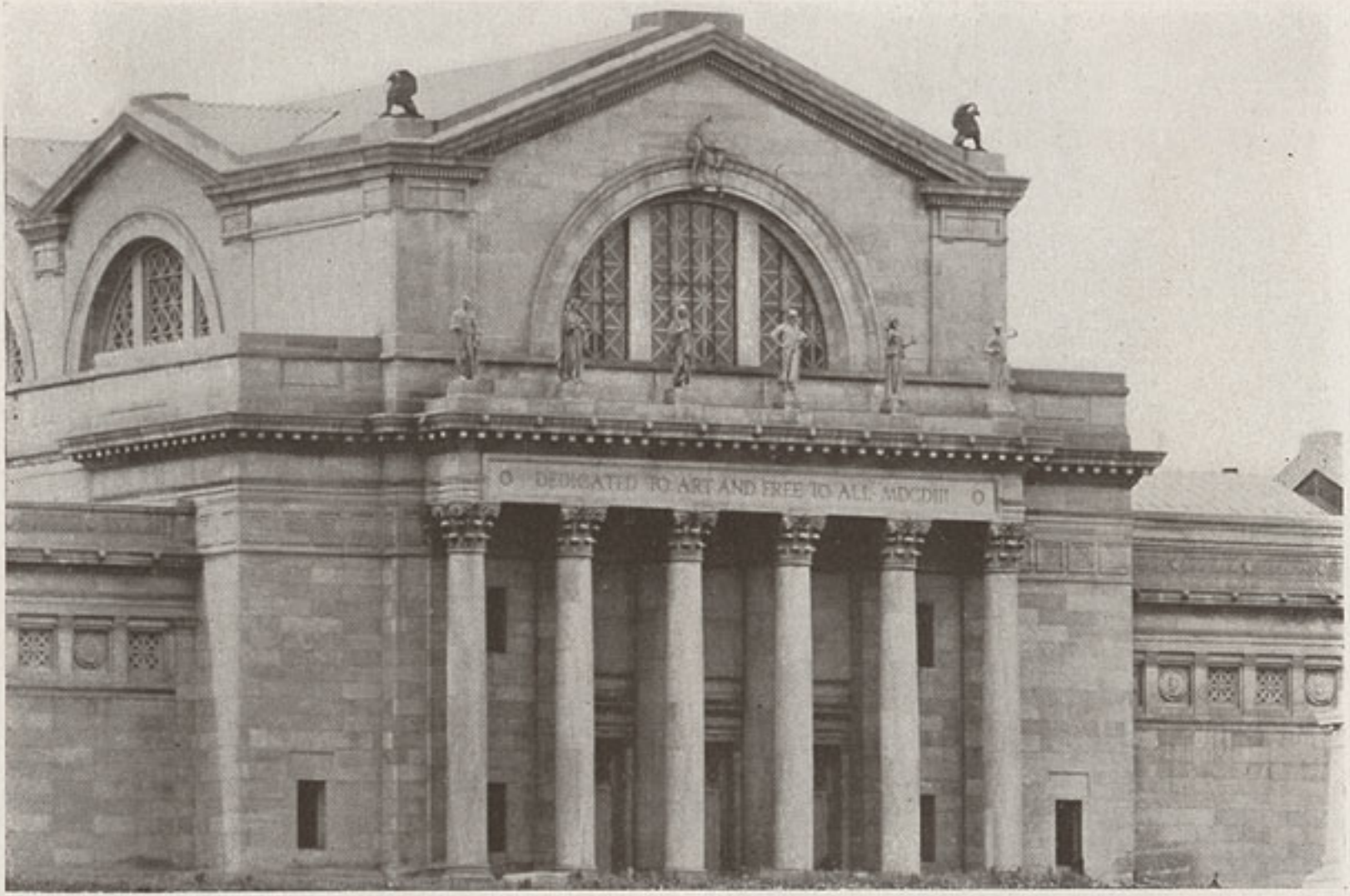
We take special satisfaction in the fact that, since our recent introduction of this lens, it has won out several times in the most severe comparative tests with other well-known apochromatic anastigmats; and we feel confident that the ARTAR is the best lens for three-color work on the market today.

The ARTAR is supplied in a barrel with Waterhouse stops, a set of six different round openings being provided. Special shaped stops can be furnished to order.

Prices of Process Artar Lenses

No.	Equivalent Focus Inches	Relative Opening	With Waterhouse Stops	Normal Size of Plate for Copying	
				Full Size	Reduced One-half Size
6	12	F:9	**$113.00**	12 x 14	8 x 10
7	14	F:9	**138.00**	14 x 17	10 x 12
7a	16½	F:9.5	**164.00**	16 x 20	12 x 14
8	19	F:11	**189.00**	18 x 24	14 x 17
9	24	F:11	**265.00**	24 x 28	18 x 20
10	30	F:11	**400.00**	30 x 36	20 x 26

Process ARTAR Lenses of 36 and 48 inches focus can be furnished on special order; prices on application.



Taken with Dagor No. 2 and Goerz Telephoto Lens, 9 X Magnification
(From same point of view as pictures on Page 39)

Negatives by F. L. Douglas

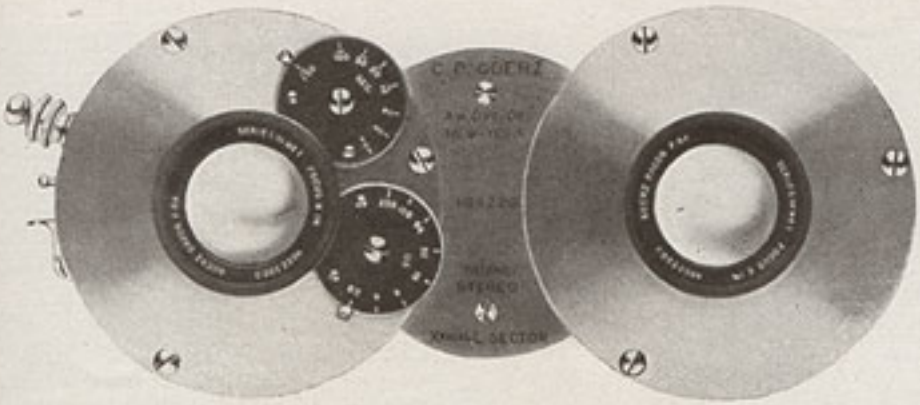
Goerz Telephoto Lenses

A TELEPHOTO lens is a photographic telescope. It consists of a negative lens and an adjustable tube and is used in connection with the regular photographic lens. The Telephoto lens and tube is screwed into the lens board and the regular lens is then attached to the front of the Telephoto tube. Through a rack and pinion the separation between the two lenses may be varied, and an optical system of variable focal length—from three to eight times that of the regular lens—is thereby obtained.

The Telephoto lens has, besides the wide range of focal lengths, the further advantage that the required bellows extensions are in all cases considerably shorter than the resulting focal lengths of the optical system would indicate. Objects at great distances—as, for instance, inaccessible mountain peaks—and also architectural details, birds and other animals, can be photographed with a short-bellows camera on a comparatively large scale. The necessary exposure increases with the square of the magnification; *e.g.*, if the tele-system is adjusted for an increase in the focal length of three times, an increase in exposure of nine times over that necessary for the regular lens alone would be required. When using our Telephoto lenses in connection with our high-grade CELOR anastigmat, instantaneous exposures at moderate magnifications are possible.

Some Selected Telephoto Combinations for Hand and View Cameras with Extending Bellows

Price of Telephoto Lens and Tube to Fit				Focus of		Magnification		Approx. Bellows Extension		Size of Plate Covered with	
Dagor No.		Celor No.		Positive Lens Inches	Negative Lens Inches	From	To	For Lowest Power Inches	For Highest Power Inches	Lowest Magnification Inches	Highest Magnification Inches
00	$29.00	00	$29.00	3½	1⅝	3x	8x	3¼	11¾	2¾ x 3¼	6½ x 8½
0	33.50	0	33.50	4¼	2⅛	3x	8x	5	16¼	3½ x 4¼	10 x 12
1	34.50	1	36.50	6	2⅞	3x	8x	5	16¼	3½ x 4¼	10 x 12
1	40.00	1	42.00	6	3	3x	8x	6½	21½	4 x 5	12 x 16
2	36.50	2	38.50	7	2¾	3x	8x	5	16¼	3¼ x 4¼	10 x 12
2	43.50	2	44.00	7	3	3x	8x	6½	21½	4 x 5	12 x 16
3	45.50	3	45.50	8½	3	3x	9x	6½	24½	4 x 5	12 x 16
3	52.50	3	52.50	8½	3½	3x	8x	8	25½	5 x 7	12 x 16
4	52.50	4	52.50	9½	3½	3x	9x	8	29	4½ x 6½	16 x 20
5	56.50	5	58.00	10¼	3½	3x	9x	8	29	4¼ x 6½	16 x 20
5	71.00	5	71.00	10¼	4¼	3x	7x	11	30	7 x 9	20 x 24
6	72.50	6	72.50	12	4¼	3x	8x	11	34¾	7 x 9	20 x 24
7	94.00	7	94.00	14	6	3x	7x	14	38	9 x 12	24 x 28

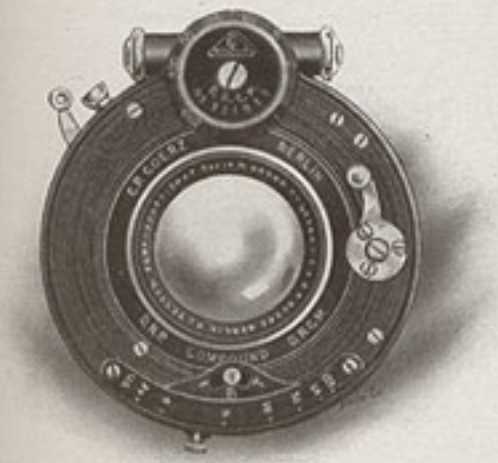


Goerz XEXCELL Stereo Shutter

THIS is the only high-grade stereo shutter giving a maximum speed of 1-150 of a second. As all adjustments are set and controlled in one of the cases only, perfect uniformity of exposure in both shutters is assured. It is made with a lens distance of 3½ inches; on special order we can furnish any desired lens distance from 2⅞ inches upward. Quotation on request. Nos. 1 and 2 Stereo XL have a diaphragm opening of 1⅛ inches.

Size of Shutter	Price	For Dagor	For Celor	For Syntor
1	**$27.00**	0–1–1a	0	0–1–1a
2	**30.00**	2–3	1	2–3

No. 2 shutter made to order only



Compound Shutter

THIS high-grade shutter is imported by us from Germany and we can highly recommend it in connection with our lenses.

The smallest shutters give variable speeds from 1 second to 1-250 of a second, decreasing to 1-75 in the large shutter. Time and bulb exposures are also obtainable.

The smaller sizes are furnished with wire release only, the larger ones with bulb and tube. The price of the shutter includes the proper release.

Prices of Compound Shutters

No. of Shutter	Price of Shutter	Suitable for		
		Dagor	Celor	Syntor
*0	**$12.00**	00–0	00	0
1	**14.50**	1–1a	0	1–1a
1a	**14.50**	2	.....	2
2	**16.25**	3	1	3
2a	**16.25**	4	2	4
3	**20.00**	5–6	3	6
4	**22.00**	6–7–7a	3–4–5–6	6
5	**28.00**	8	7	..

* A special 00 size for very small cameras can be supplied to order.