

line. This is strongly curved and pointed, and the basilar tubercle forming a heel is greatly developed—characters that are found again in the didus, and indicate a poorer runner than the æpyornis and the dinornis.

If the phororhacos ceases a little, as to stature, to the æpyornis, the Brontornis Burmeisteri, of which it remains for us to speak, was certainly the most colossal of all the birds known. It was much more massive in build than the phororhacos. The bill, while possessing the same form, was shorter, wider and thicker vertically. The leg was really monstrous, as is shown by the following dimensions: femur, 16 inches; tibia, 30 inches; metatarsus, 17 inches; in all, 63 inches for the height of the haunch, say 9.5 inches more than the æpyornis ingens. This bird must have been more than 13 feet in height. The shaft of the femur was 3 inches in diameter and the head of this bone measured no less than 7 inches. The toes were shorter and more massive than those of the phororhacos and the ungual phalanges were much wider, flatter and less pointed, like those of running birds. The ungual phalanx of the median toe was 2.5 inches long and 2 inches wide at the base. These characters indicate habits somewhat different from those of the phororhacos. What were the habits of these large birds, so remarkable by reason of their strong hooked bill, so different from the short and conical bill that characterizes the æpyornis and dinornis? We know that the diet of the latter was almost exclusively vegetable, like that of the ostriches and cassowaries, but, when it concerns the phororhacos and the brontornises, it is difficult to admit that this powerful bill could have served only for pulling up roots and breaking branches of trees.

It is asserted that the didus fed upon plants solely, but the habits of this so quickly exterminated bird are scarcely known to us except from the stories of sailors, who are ignorant and but slightly observant of things relating to nature. It is more probable that this large bird was omnivorous and fed indifferently upon fruits, roots, mollusks and reptiles.

Such must also have been the diet of the wingless birds of Patagonia, several species of which do not exceed our swans or the marabouts of Calcutta in size. What confirms this hypothesis is that Mr. Ameghino has found upon the skull and bill of the phororhacos certain exostoses and distortions that can be nothing but the trace of deep wounds cicatrized by a deformed callosity. These birds, says Mr. Ameghino, were true ferocious beasts that engaged in frequent battles. It may be admitted, too, that these powerful bipeds did not fear to measure their strength with reptiles of large size.

The paleontological researches made by Messrs. Ameghino and Moreno teach us that, at the end of the cretaceous epoch, the reptiles, and especially the dinosaurs, were abundant and varied in the south of Patagonia. Mr. R. Lydekker has described their remains under the names of titanosaurus and argyrosaurus. It is even probable that this point of the globe is the last in which these gigantic reptiles, so flourishing in the jurassic epoch, had representatives before becoming extinct forever. Like the baloniceps of the present epoch, which destroys many young crocodiles upon the banks of the White Nile, and like the serpenty of southern Africa, which makes bloody war upon snakes, and which is the only running rapacious bird known, the phororhacos must have given chase to reptiles, which their long legs allowed them to pursue into the swamps. Seizing such reptiles with their strong claws, they must have killed them with strokes of their bills in order to devour them afterward at their leisure, when another bird of their own species did not come to dispute such prey with them. The brontornis must have preferred dry ground, as is shown by the conformation of its toes, the nails of which must have become worn by walking, as in the case of the ostrich.

If we suppose that these large birds already existed in the cretaceous epoch, as seems probable, it is not rash to believe that the phororhacos and the brontornises did not remain strangers to the extinction of the dinosaurs of Patagonia.

COMPARATIVE EXPOSURES FOR LANTERN SLIDES BY CONTACT AND REDUCTION.

By Rev. G. T. W. PURCHAS, B.A.

AMONG the numerous photographers who usually make their lantern slides by reduction from negatives of a larger size, there must, I believe, be many who like myself have often wished for information as to the exposure required as compared with the exposure in the case of a slide exposed in contact with the negative. Most makers of plates give the exposure required in the latter case, when artificial light is used, such as ordinary gas or lamplight, but I am not aware of any maker who gives the exposure required when reducing in the camera and using artificial light. One reason for this no doubt is the fact that when reducing by means of a lens many factors have to be taken into consideration, namely, the ratio of reduction, the stop used, the density of the negative, the rapidity of the plate, and the distance of the source of artificial light from the negative; whereas, in the case of a slide made by contact, only the three factors last named have to be considered.

But since enlargements are frequently made by artificial light as well as direct prints on bromide paper, it appears to me that an examination of the connection between the exposures in the two cases would probably be of interest to many amateur photographers besides myself. It is true that there is one great drawback to the use of artificial light for making lantern slides by reduction, namely, the length of exposure required, but, on account of the variation in the actinic power of daylight in this climate and the constancy of the actinic power of artificial light, there are very considerable compensating advantages, especially if one slide is developed while the next one is being exposed. Many, moreover, are more at liberty in the evenings, and would therefore be glad to be able to use artificial light for making slides.

I have therefore been at some pains to reason out the connection between the exposures in the two cases of a print by reduction and one by contact, and though mathematical terms are necessary, I have endeavored to make the results of the calculation intelligible even

to those who have no mathematical knowledge. With this introduction I will proceed to the calculation.

Let I denote the intrinsic brightness of a small part of the negative. Let a denote the area of this small part, and let b denote the area of the corresponding image formed by the lens on the plate. Let c be the distance of the negative from the optical center of the lens, and d the distance of the image on the plate from this point. Let e be the ratio of reduction in linear dimensions, so that

$$e = \frac{c}{d} \text{ and } \frac{a}{b} = \frac{c^2}{d^2} = e^2.$$

Let f be the equivalent focal length of lens, and $\frac{f}{g}$ the diameter of the stop used. Lastly, let E denote the exposure required for a slide by contact, the illumination of the negative being supposed the same as in the case of making the slide by reduction. Then, by well known laws of optics,

$$c = (e + 1)f, \text{ and } d = \frac{e + 1}{e}f.$$

Now the area of aperture of stop

$$= \left(\frac{f}{2g} \right)^2 \cdot \pi.$$

If we assume that the aperture of the diaphragm receives light directly from the negative, then the amount of light passing through the stop from the area a of the negative will be

$$I \cdot \left(\frac{f}{2g} \right)^2 \cdot \pi \cdot \frac{a}{c^2} = I \cdot \frac{a \cdot \pi}{(e + 1)^2 \cdot 4g^2}$$

But this light is distributed over the area b of the plate, and therefore the intrinsic brightness of the small area b will be

$$I \cdot \frac{\pi}{4(e + 1)^2 \cdot g^2} \cdot \frac{a}{b} = I \cdot \frac{\pi}{4(e + 1)^2 \cdot g^2} \cdot \frac{c^2}{d^2} = I \cdot \frac{\pi \cdot e^2}{4(e + 1)^2 \cdot g^2}$$

Now this expression will be true for all small areas of the negative and of the image, and it is clear that the exposure will be inversely proportional to the intrinsic brightness.

Therefore the exposure for the slide by reduction

$$= E \cdot \frac{4 \cdot g^2}{\pi} \left(\frac{e + 1}{e} \right)^2$$

Take the value of π as $\frac{22}{7}$, and we have exposure by reduction

$$= E \cdot \frac{14 \cdot g^2}{11} \left(\frac{e + 1}{e} \right)^2$$

Probably the most ordinary case is that in which a lantern slide is reduced from a half plate negative, so that the longer side of the picture is reduced to fall within the side of a lantern plate. In this case the picture will be reduced to half its linear dimensions, and therefore $e = 2$.

If we suppose the stop used to be $f/16$, then $g = 16$, and the exposure by reduction is found to be 733 times the exposure necessary for a slide by contact, or, to put the matter more simply still, for every second of exposure required for a slide made in contact with the negative, rather more than twelve minutes would be required when the slide was being made by reduction to half size in linear measurement, the stop used being $f/16$. The exposure required in the case of other stops may, of course, be readily calculated on the same principle as for ordinary photographic exposures.

The exposure required for an enlargement may be calculated from the same formula, only remembering that in this case e will be a fraction, since it is the ratio of the length of the side of the negative to the length of the corresponding side of the image. If, therefore, we know the exposure required for a print by contact on bromide paper, we can at once find the exposure for an enlargement on the same kind of paper, or since, as a rule, slow paper is used for contact prints and rapid paper for enlargements, we can find the exposure for an enlargement on rapid paper if we know the comparative rapidities of the two papers.

In the same way, working backward, we can, if we know the exposure for an enlargement, find also the exposure for a print by contact, and thus use up any small pieces of enlarging paper by making direct prints.

The only point in the above calculation which appears to me at all open to question is the assumption that I have made that we may neglect the effect of the front lens of a rapid rectilinear combination in calculating the amount of light which will pass through the aperture of the diaphragm, but a little consideration will, I think, show that this is a justifiable assumption, because a single landscape lens which has the stop in front of the lens is found to have the same rapidity as a rapid rectilinear with an aperture bearing the same relation to the focal length. In fact the slight loss of light in the second case through having more reflecting surfaces is counteracted by the slightly greater amount of light which passes through the diaphragm owing to the rays of light being refracted by the front lens.—The Amateur Photographer.

PURIFYING BLACK LEAD.—Following are four processes which have recently been patented for effecting the purification of black lead, with a view to removing iron and other impurities and obtaining the resulting product in a fine state of division: (a) Pulverized black lead is moistened with concentrated nitric or sulphuric acid, or both. It is next washed till the wash water is free from acid, and then calcined. (b) The black lead may be heated with a solution of bichromate or permanganate of potash and acid, and subsequently calcined. (c) Brodie's process may be employed by substituting nitric for sulphuric acid. (d) The black lead is heated with concentrated nitric or sulphuric acid, scooped out, washed and calcined. To obtain a finer product, the black lead obtained at the end of these processes can, if desired, be thrown into water, stirred, scooped off, and dried.

SELECTED FORMULÆ.

Disinfectant.—A good disinfectant, recommended by the Illinois Board of Health, is:

Iron sulphate.....	13 ounces.
Crude carbolic acid.....	12 "
Water.....	48 "

—Pharmaceutical Era.

Headache Tablets.

Powdered acetanilid.....	300 grains.
Caffeine.....	50 "
Sodium salicylate.....	400 "
Sugar.....	50 "
Powdered acacia.....	25 "

Mix intimately, then moisten, and pass through sieve and dry. Lubricate with vaselin, and, when dry, pass through sieve again. Finally, make into 100 compressed tablets.—Spatula.

Depilatory Collodion.

Iodine.....	75 centigrammes.
Oil of turpentine.....	20 drops.
Castor oil.....	2 grammes.
Alcohol.....	10 "
Collodion.....	30 "

To be applied once daily for three or four days. When the collodion is removed, the surface beneath is rendered free from hair.—Bull. de Pharm. de Lyons.

Acid Phosphate Solution.

Phosphoric acid.....	64 parts.
Precipitated chalk.....	12 "
Calcined magnesia.....	1 "
Potassium carbonate.....	1 "
Distilled water.....	178 "

Add the chalk to the acid gradually, and then add the magnesia and stir well. Dissolve the potassium in 9 fl. oz. of the water, add the solution gradually to the acid liquor, admix the remainder of the water, set aside for one or two hours, then filter.

Indelible Inks for Metal and Glass.—Schoebel, in the Fortschritte der Medicin, recommends the following inks for labeling glassware, metal, etc.:

BLACK.

Sodium silicate.....	1 to 2 parts.
Liquid India ink.....	1 part.

WHITE.

Sodium silicate.....	3 to 4 parts.
Chinese white (Winsor & Newton's).....	1 part.

Barium sulphate may be used instead of the Chinese white, in the same proportion.

The bottles containing these inks should be kept airtight, and, of course, should be thoroughly shaken before using. Steel pens may be used for writing with these preparations.—National Druggist.

Ammoniated Collodion.

For bites and stings of insects.

Ammonia water.....	5 drachms.
Collodion.....	6 "
Salicylic acid.....	3 grains.

Mix and apply.—Pacific Med. Jour.

Tolu Chewing Gum.—Take $3\frac{1}{2}$ pounds gum chicle, 1 pound paraffine, 2 ounces balsam tolu, 1 ounce balsam of Peru; dissolve the gum in as much water as it will take up; melt the paraffine and mix all together, then dissolve 10 pounds of granulated sugar and 4 pounds of glucose in 3 pints of water; boil to "crack" degree and pour the sirup on an oiled slab and work into it sufficient of the gum mixture to make it tough and plastic. It may be flavored with cinnamon, chocolate, myrrh, ginger, sandal wood, etc. When cool, roll into sticks.

To Take Oil Stains Out of Linen.—Immerse the goods in a soap bath, which should be kept at nearly a boiling temperature. If the stains are fresh, smear them with tallow or lard, and afterward rub the goods with soap in cold water. Benzine or turpentine is also sometimes successfully used in removing oil stains. How to remove stains caused by acids, vinegar, etc.—For white cottons and linens: Wash with pure warm water or warm chlorine water. Colored goods or silks: Ammonia diluted according to the fineness of the tissue and delicacy of the color. Coffee and milk stains may be removed from silk, woolen or other fabrics by painting over with glycerine and then washing with a linen rag dipped in lukewarm rain water. It is afterward pressed on the wrong side with a moderately warm iron as long as it seems damp. The most delicate colors are unaffected by this treatment. For removing grease spots from white linen or cotton goods, use soap or weak lyes; for colored calicoes, warm soapsuds; for woollens, soapsuds or ammonia; for silks, benzine, ether, magnesia, chalk, yolk of egg with water.—Pharmaceutical Era.

Listerine.—W. N. Sherman (Pac. Drug.) says the following makes a preparation not easily told from the original.

Acid benzoic.....	2 drachms.
Borax.....	2 "
Boric acid.....	4 "
Thymol.....	$\frac{3}{4}$ "
Eucalyptol.....	10 drops.
Oil wintergreen.....	10 "
Oil peppermint.....	6 "
Oil thyme.....	2 "
Rectified spirits.....	5 $\frac{3}{4}$ oz.
Water, enough to make.....	31 fl. oz.

This still lacks baptisia. It is claimed by the makers that this is one of the ingredients used.

Cement for Attaching Leather to Iron Pulleys.—Cut your leather roughly to shape, allowing about 1 inch per 12 inches in the width of the pulley. Then soak your leather in water until it is wet through. Now stretch it well in the direction of the circumference of the pulley, and cut it to exact shape and length. It should next be sewn up, butt to butt, with a shoemaker's awl and thread, and the leather, having been stretched in the direction of circumference only, will, as it gets dry, have a tendency to resume its former shape, thereby shortening in circumference and "clip" to the pulley. A shallow groove might be made for the stitches to sink down in.