The Colors of Birds.

A remarkable law of nature has only recently been discovered and formulated by the artist, Mr. Abbott H. Thayer, says the Home Journal. For more than a generation of men, naturalists have been studying the part which color plays in protecting animals from their enemies. Protective coloration is the technical name which is given to such cases of protection, and much keenness of observation and of reasoning has been shown by students of the great problems of evolution. Yet no naturalist has ever perceived the secret of protective coloration, which, as the name suggests, lies in the painter's province, and might never have been discovered by naturalists.

"The law of gradation in the coloring of animals," says Mr. Thayer, "is responsible for most of the phenomena of protective coloration except those properly called 'mimicry.' Mimicry makes an animal appear to be some other thing, whereas this newly discovered law makes him cease to appear to exist at all. For example, the screech owl, when startled, makes himself tall and slim, and, with eyes shut to a narrow line, simulates a dead stub of the tree on which he sits. Certain herons stretch their necks straight upward, and, with head and green beak pointed at the zenith, pass themselves off for blades of sedge grass. Many butterflies have stone or bark colored under sides to their wings, which make them look like a bit of bark or lichen when they sit still on a stone or tree trunk, with wings shut over their backs. The newly discovered law may be stated thus: Animals are painted by nature darkest on those parts which tend to be most lighted by the sky's light, and vice versa."

The ruffed grouse is a bird which shows the gradation in its simplest form, the color making a complete gradation from brown above to silvery white beneath. The top light makes him so like his surroundings that he is nearly, if not quite, obliterated. The cause of this obliteration has been assigned to the fact that his color is like that of the surroundings. Mr. Thayer ingeniously proves not only that, were he colored like his surroundings, he would be completely visible, but proves at the same time what the true cause of his concealment is. He carefully and accurately painted a dead grouse on the lower part of the body with brown to match his back, and painted the sides in gradation till the bird was uniformly colored all over, except that the upper surfaces were left as nature painted them. He then set the bird up in a lifelike position on the ground. The effect was magical. What was before almost invisible at a short distance became clearly visible, proving that it is only this gradation of color which deserves the name of protective coloration, and that it is the compound gradation made by the daylight's co-operation which conceals the animal.

Mr. Thayer made some wooden eggs of about the size of a woodcock's body, and mounted them on wire legs about six inches above the ground. Most of them were colored in imitation of the color gradation of a grouse or a hare, being earth color above to pure white beneath. To two of the wooden eggs he gave a coat of earth color all over, and then set the whole, like a flock of shore birds, on the bare ground in a city lot. He then invited a naturalist to look for them, beginning at a distance of forty or fifty yards. The naturalist saw immediately the two monochrome ones; but, although he was told exactly where to look, he failed to find any of the others till he was within six or seven yards of them, and even then he saw them only by knowing exactly where to look.

The reader can easily get an illustration of this law with no more trouble than merely using his eyes. Look at a horizontal branch or a twig of a tree in the woods, which is either on the level of the eye or below it. You will see that, although it has exactly the color of its surroundings, it is not at all concealed. This is because it is of uniform color above and below, and wears that uniform attitude of a solid—a gradation of shade from its light side above to its dark side beneath. This is the case of the painted grouse—mentioned above—right over again.

On November 9, 1896, Mr. Thayer gave an open-air talk, demonstrating his theory of protective color, to naturalists gathered from all over the country. He placed three objects, of about the size and shape of sweet potatoes, horizontally on wires a few inches above the ground. They were covered with a sticky material, and then dry earth from the road where they stood was sprinkled over them to give them the same color as their background. The two end ones were then painted white on the under sides, and the white color was shaded up and gradually mixed with the brown of the sides. When viewed from a little distance, these two end ones, which were white below, disappeared from sight, while the middle one stood out in strong relief, and appeared much darker than it really was. Mr. Thayer explained that terrestrial birds and mammals, which are protectively colored, have the under parts white, or very light in color, and that the color of the under parts usually shades gradually into that of the upper parts. This is essential in order to counteract the effect of the shadow side, which otherwise, as shown by the middle potato, makes the object abnormally conspicuous, and causes it to appear much darker than it really is. In the case of Mr. Thayer's experiment some of the witnesses could hardly believe that the striking difference in the visibility of the three potatoes was entirely due to the coloring of the under sides, and Mr. Thayer was asked to color the middle one like the two others, in order that the effect might be observed. Mr. Thayer complied with the request, painting the under side of the middle potato white, shading the white up into the sides, as in the case of the others. The effect was almost magical. The middle potato at once disappeared from view. A similar experiment was tried on the lawn. Two potatoes were painted green, to resemble the green of the grass above which they were suspended. One was painted white on the under side, and at once became invisible when viewed from a little distance, while the other showed plainly and seemed very dark, the shadow, superadded to the green of the under side, making it remarkably conspicuous. The experiments were an overwhelming success.

This device of nature is operative throughout the animal kingdom, the marine world offering scarcely any exceptions from its universality. When we realize that to this color gradation the animal kingdom, with few exceptions, owes its present status—that it everywhere finds this fact a balance wheel to check the rate of destruction of one species by another—the universality of the principle makes its discovery a great one.

RECENTLY PATENTED INVENTIONS.

Mechanical.

CUTTER HEAD AND KNIFE.—James B. Vuncanon, Asbeborough, N. C. To improve the efficiency and durability of rotary cutter heads for surface planing and moulding machines, and for the improved adjustment of the knives, the cutter head stock is four-sided, according to this invention, the knives having transverse slots, and the clamping plates having rabbets of the same depth as the thickness of the knives, there being two transverse rows of aligned screw-threaded holes in the under side of the rabbeted portions. Screws passing through and countersunk in the slots of the knives are adapted to enter any of the holes, the knives being thus adapted for individual adjustment and also for adjustment together with the screws. Fitting strips extend between the backs of the knives and the shoulders of the rabbets, and have lateral bends that fit together, preventing longitudinal displacement.

VALVE REGISTERING DEVICE.—Charles L. Quimby, Philadelphia, Pa. For registering and indicating the opening as well as closure of gate or other valves, this invention provides a simple and practical device adapted to be connected with the movable gate or equivalent part of a valve, to indicate the position and register on dials the movements of the valve, so that any change may be seen at a glance by an inspector. Gearing within the valve casing and actuated by the valve stem is supported upon spindles on which are also graduated dials, an apertured face plate above the dials exposing but one graduation on each dial, while an index finger, by its movement toward either of the words "open" or "shut," indicates the position of the valve.

PAPER MAKING MACHINE.—George L. Bidwell, Warren Paper Mills, N. J., and Samuel C. Reynolds, Comstock's Bridge, Conn. For cylinder machines this invention provides improvements whereby the pulp is perfectly couched and waste and loss of pulp are entirely prevented, the deckles also being adjustable for any desired width of paper while the machine is in motion. The cylinder mould shaft is journaled in the vat in bearings which form outlets for water from the cylinder, and the mould is engaged on part of its periphery by two deckles made as endless rubber bands, the face next the cylinder being of soft or spongy rubber and its reverse of harder and smoother rubber, the deckles not passing between the cylinder mould and the couch roll, so that the latter is free to perfectly couch the pulp on the cylinder mould.

Railway Appliances.

CAR AND BRAKE PIPE COUPLING.—John W. Bryan, Quincy, N. C. A car coupling which is designed also to establish communication between the brake pipes of the adjoining cars when they are coupled is afforded by this invention, the drawheads having mortises into each end of which a tube extends and there being connections betwen the tubes and the fluid pipes. The drawbar fits into the mortises of the drawheads and is formed of a block tapering from the middle toward each end, with a longitudinal channel joining at its ends the tube ends of the drawheads, there being also notches along its upper side, and pin bars arranged to be held in the thickened portions of the drawheads and engaged by the notches.

Electrical.

TROLLEY HANGER.—Theodore Fletcher, St. Louis, Mo. According to this improvement the hanger is made of two ears secured to the trolley wire a short distance from each other, the ears being connected by a short section of wire which passes over a pulley whose shank is embedded in an insulated block to which the suspension wires are attached. The construction permits a slight longitudinal movement of the trolley wire, and the support is somewhat flexible, doing away with any tendency of the wire to bend or buckle.

Bicycles, Etc.

BICYCLE HOLDER.—John F. Bengert, Brooklyn, N. Y. To support bicycles in an erect position when not in use, according to this improvement, a clamp having a tubular transverse bearing is secured to the frame, sleeves having lugs turning in the bearing and the lugs being connected and arranged to turn together, there being rods slidable in the sleeves, and means for securing the rods adjustably in the sleeves, whereby the rods may be made to fold along the frame of the bicycle or swung out to engage the ground and afford fixed supports for it. The device is adapted to be conveniently attached to and detached from bicycles of all kinds, and when in place does not interfere in any way with the operation of the machine.

Miscellaneous.

RANGE FINDER.—George M. Searle and George N. Saegmuller, Washington, D. C. Two patents have been granted these inventors for a range finder for determining the distance of remote objects, such as an enemy's vessel at sea, one which will, by a simple adjustment, indicate at once, without calculation, the distance of a remote object on the scale of the instrument. It comprises a graduated base line bar having a fixed right angular reflecting surface and also a movable one with a pointer traveling on the graduated scale of the base line, the two reflecting surfaces being in different planes to throw their images on different portions of the object glass of a telescope constructed to bring the two images into coincidence. The readings on the scale are marked, according to one of the patents, by the adjustment of one of the prisms, the position and form of the refracting plate remaining constant, while, according to the other patent, the two prisms are fixed and the readings are taken by the radial adjustment of the refracting or coincidence plate by means of a pointer on a cotangent scale.

KINETOGRAPHIC CAMERA.—Leo Grubman, New York City. A photographic apparatus has been devised by this inventor to take in succession upon a ribbon film a series of pictures of a scene or moving object, each picture being separated from the next by a very short period of time, and the apparatus being also adapted for use as a lantern to project the pictures on a screen. The apparatus is inclosed in a lightproof box, and the mechanism is so proportioned that the ribbon is advanced by steps for spaces exactly equal to those occupied by each picture, the feed device preventing any possibility of scratching or injuring the surface of the film.

HAND-PROPELLED VEHICLE.—Ferdinand Damour, Bolckow, Mo. This invention is for a vehicle to be propelled by hand and guided by the feet, the car moved by the operator being also designed to draw after it another car of novel construction. The propelling car has front steering wheels journaled in brackets in which are also journaled vertical shafts carrying gear wheels, both of which mesh with a gear on a shaft carrying a pinion which meshes in rack bars on opposite sides of the car and adapted to be moved by the feet for steering the car, while crank handles, to be operated by hand, are connected by sprocket wheel and chain to rotate the short axles on which the drive wheels are mounted.

HORSE DETACHER.—Joute L. Bouma, Wanari, South Dakota. For detaching runaway horses from their vehicles and steering the vehicles while they move on from the momentum previously gathered, a shaft carrying a drum is, according to this improvement, journaled just behind the dashboard, and a cord passed around the drum is connected with spring-pressed pins which hold the whiffletrees, the pins being withdrawn by rotating the shaft by turning a hand wheel and the team thus released. A sprocket and chain gearing connection is also made with the front axle, whereby, on turning a handle bar, the vehicle may be steered.

BAG HOLDER.—John Littlejohn, Aurora, Ill. A combined bag and pail holder is provided by this invention for retaining in convenient readiness for use what are styled "oyster pails," and the paper bags commonly used for wrapping purposes. It comprises a frame, preferably of wire, having side sections to which the pail receivers are secured, while a bag clamp is held to and adjustable along one of the side sections or upon the front, as many of these clamps as desired being employed for holding different sizes of bags.

SINK DRAINING BOARD, ETC.—John Foran, Flemington, N. J. This is a device adapted to be readily and conveniently applied to any form of sink. A combined adjusting and supporting rod or arm is used in connection with a novel form of bracket, whereby the draining board may be dropped to a vertical position below the top of the sink or carried to and supported in a horizontal or inclined position, with any desired inclination in the direction of the sink.

DESIGN FOR A SINK.—Robert M. Johnson, Hainesport, N. J. This sink has in one of its bottom corners a corner pocket, with semicircular or segmental front, the bottom of the pocket, on the inside, being a little distance above the sink bottom.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co. for 10 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS, ETC.

THE MAMMOTH CAVE OF KENTUCKY. By H. C. Hovey and Richard E. Call. Louisville, Ky.: John P. Morton & Company. Pp. 108. Price, paper, 50 c.; cloth, $1.

This is an attractively got up illustrated manual, with maps and many fine half tones, designed to afford the reader as complete an idea as possible, through words and pictures, of the beauty, grandeur, and sublimity of this most wonderful of caves. Readers of the SCIENTIFIC AMERICAN will doubtless remember some of the highly interesting and delightful descriptions of the Mammoth Cave which Mr. Hovey has heretofore written for our columns, and will therefore be prepared to welcome in this manual a complete and exhaustive treatment of the subject. Those who visit the cave can but poorly afford to do without having the book as their guide, and for those who cannot make the visit the manual affords much the best account yet published.

BLOCK SIGNAL OPERATION. A practical manual. By William L. Derr. New York: D. Van Nostrand Company. 1897. Pp. 270. Price $1.50.

This is a practical work by the superintendent of the Delaware division of the Erie Railroad. Its aim is to present the latest practice in block signal operation that obtains in this country and in Europe. It appears to be a thoroughly practical work and cannot but prove of interest and value to all those who are interested in the safe running of railway trains. The complicated system of interlocking at junctions is illustrated in very clear diagrams.

SIXTH ANNUAL REPORT OF THE BUREAU OF LABOR, STATISTICS AND MINES. To the Governor and Fiftieth General Assembly of the State of Tennessee. 1896. A. H. Wood, Commissioner and Labor Inspector of Mines. Nashville: Franc. M. Paul, Printer to the State. 1897. Pp. 310.

BULLETIN OF THE GEOLOGICAL INSTITUTION OF THE UNIVERSITY OF UPSALA. Edited by Hj. Sjogren. Vol. II. (1894–1895.) Upsala. 1896. Pp. 372.

A. D. LECTRA'S SHORT CUT CALCULATOR. Containing the most practical methods of business calculation. Pp. 108. Price $1.

The author is a professional accountant and calculator, and is therefore in a position to give practical advice regarding the relation of mathematics to business transactions. A large number of excellent short cuts are given, with illustrative examples. The author claims nothing new in the principles involved, only in the method of presentation.

CANOE CRUISING AND CAMPING. By Perry D. Frazer. Illustrated. New York: Forest and Stream Publishing Company. Pp vii, 87. Price $1.

This is a handsome little book, beautifully illustrated with well taken and well printed half tones. The author is evidently well versed in the subject, and all those who are in any way interested in the delightful sport of canoeing will find many kinks which will tend to secure their comfort.

THE DRAMATIC MAGAZINE. Chicago: Dramatic Magazine Press. Price $2.50 a year.

This is a new monthly publication devoted to theatrical and operatic subjects, copiously illustrated with half tone engravings of the most celebrated actors and actresses of the present day, and many full page scenes from plays which are being acted in this country and in Europe.

ELEMENTS OF ELECTRO-CHEMISTRY TREATED EXPERIMENTALLY. By Dr. Robert Lüpke. With 54 figures in text. London: H. Grevel & Company. Philadelphia: J. B. Lippincott Company. 1897. Pp. xv, 223. Price $2.50.

The present time is most opportune for bringing together the recent results of electro-chemistry in condensed form. The present work gives an excellent short survey to those who are not in a position to make an exhaustive study of the voluminous literature of the sub-

ject for themselves. The experiments which form the central part of the book are carried out with the simplest possible apparatus. Although the main purpose of the book is to set forth the purely scientific aspects of electro-chemistry, the practical side of the subject has not been left altogether unknown. Technical electro-chemical processes, especially the processes of electro-metallurgy, which is so important at present, are referred to in their proper places. It is a work of great value to all professors and students of chemistry.

Woodworkers' Tools (400 pages, price $1), by Charles A. Strelinger & Company, of Detroit, Mich., is a good deal more than an ordinary catalogue; for, in addition to its numerous illustrations of tools and machinery, it gives a great deal and a wide variety of practical information relative to their employment, well calculated to assist the workman or apprentice. It includes tools used by carpenters, builders, cabinet makers, pattern makers, millwrights, carvers, and ship carpenters, as well as implements for draughtsmen, etc. A supplementary chapter is designed to place before the practical mechanic simple illustrations of the first principles of geometry.

Business and Personal.

The charge for insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in the following week's issue.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(7189) E. G. A. asks: Please say in what number of your paper I can find instructions for making a kite without a tail. A. Valuable illustrated articles on the construction and flying of tailless kites will be found in SCIENTIFIC AMERICAN, Nos. 20, vol. 55; 12, vol. 58; 10, vol. 70; 11, vol. 71; 11, vol. 74; 4, vol. 76; also SUPPLEMENT, Nos. 583, 1013, 1016, 1070. Price 10 cents each prepaid by mail.

(7190) W. H. asks: 1. In making the eight light dynamo described in SUPPLEMENT, No. 600, could not the armature core be built of thin disks of iron, extending to the shaft, or could the wooden sleeve be replaced by one of brass? A. The armature core may be built of disks of the softest sheet iron about one-twentieth inch in thickness. These are sometimes perforated for ventilation. The disks are to be separated from each other by similar disks of thin paper or they may be oxidized. This prevents eddy currents through core. They may be keyed to the shaft or fastened together by bolts. No metal other than iron should be used in core, since iron alone has magnetic value. 2. Has an alternating current P. and N. poles? It seems to me, if the current were rapidly reversed, there would be no poles. A. The poles reverse two or more times with every revolution of the alternating dynamo, and no effort is made to name them. 3. What is meant by consequent and salient poles? A. Consequent poles are poles formed in the length of a magnet, and alternating in sign. In field magnets, salient poles are those projecting from the main body of the field magnet.

(7191) D. K. writes: I wish to light a 6 candle power 9 to 12 volt lamp for about 4 hours per night. I have 6 storage cells of 5 plates each, plates 6×8 inches. 1. How many Grove, Bunsen or Daniell batteries would it take to charge the above? A. Use 15 Daniell or gravity cells, or 10 Grove or Bunsen. 2. Which of the above batteries is the most suitable? A. Daniell or gravity. The others both give off corrosive vapors and must be kept out of doors or in a box outside of a window. 3. Would smaller plates in the storage battery be better? A. If the cells are of any of the standard makes, they could be cut down to about half the original size. To determine this, remove one pair of plates from each cell and find the amperes the battery will give as compared with full size. Then cut down the plates proportionally.

(7192) J. J. R. asks: 1. What does a dry battery consist of? How is it made up? Give me all the facts and what powders to use to bring out the electric spark. This must be a dry battery and a small one. Give me the cost of its make up. A. There are no dry cells, that is, cells containing only dry powders. The so-called dry cells are usually Leclanche cells in type. They are made with a rod or strip of zinc and a plate or cylinder of carbon. These are immersed in a paste composed of a saturated solution of sal ammoniac in water, into which plaster of Paris, gelatine, or some other substance is stirred till the liquid is held so that it will not run out if the cell is upset. In a sense it is dry. The cost depends on size, materials and make-up. It is not possible to give figures. See a valuable paper on dry cells in SCIENTIFIC AMERICAN SUPPLEMENT, No. 1001, 10 cents. 2. Also give me a few principles of how to deal with pyro-electricity of certain minerals possessed with the electric heat and form a brush glow spark. A. There are no minerals which give out electric heat and a glow spark with pyro-electricity. Tourmaline, boracite, and other minerals may be electrified by heating so as to attract light bodies to their ends, in a manner similar to rubbed sealing wax. Mica will glow in the dark on being suddenly split, and a lump of sugar will do the same on being crushed or cracked. A piece of card will give out sparks on being torn asunder in the dark. See S. P. Thompson's "Lessons in Electricity," Pp. 77–80. 3. Also if magnesium wire can be used possessed of heat, and can be controlled. A. Magnesium ribbon is burned in a lamp invented for that purpose, with full control. Apply to some dealer in physical apparatus.

(7193) A. J. C. asks for a recipe for making white metal. A. White metal is made by a number of formulas. It depends upon the use to which it is to be put. Try the following: Tin, 9 ounces; lead, 2 ounces; antimony, 1 ounce; bismuth, 2 ounces.

(7194) R. H. D. asks: How can I fasten cloth to brass or zinc? A. Use equal parts of pitch and gutta percha melted together and used hot. The following formula has also been recommended for the purpose: Gutta percha, 16 parts; pure, unvulcanized rubber, 4 parts; pitch, 2 parts; shellac, 1 part; linseed oil, 2 parts. Digest the rubber in the linseed oil; melt the gutta percha, pitch and shellac and add the digested rubber.

(7195) E. A. B. says: Please answer the following in your query column: In using a Baume hydrometer for acids at 60° F. in a diluted solution of 2 or 3 per cent acid, what is the variation of the hydrometer reading when the thermometer reading in the solution is over 60° up to 80° or 90°, for instance? A. The small amount of acid in solution 2 or 3 per cent will change the density of the water very little. The density of a 5 per cent solution in pure water is 1·033. Hence the change of hydrometer reading is practically that which is produced by change of temperature, and this is very little for a change from 60° to 80°. Not as much as 1 on Baume's scale. The temperature was not considered in making the Baume scale. You can easily determine the matter experimentally. Bring your liquid below 60° and heat it very slowly, stirring to keep it uniform in temperature throughout. Observe both thermometer and hydrometer and record the readings of hydrometer for temperatures from 60° to 80°, or, in fact, as high as you need in your work. You will then have a table of corrections for your hydrometer.

(7196) N. E. S. asks: Will you please publish, in "Answers to Queries" in SCIENTIFIC AMERICAN, the formula for making the hectograph? I have been a reader of this valuable publication for over three years past. I have noticed this formula in one of my papers, I think, but, as some of my papers were accidentally destroyed, I lost the formula. A. Formulas for hectograph compositions are given in our SUPPLEMENT numbers 438, 1092 and 1110, which we can supply at 10 cents each.

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AUGUST 17, 1897,

AND EACH BEARING THAT DATE.

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