

Where Science Joins Hands with Art

The Modern Taxidermy as Revealed in San Francisco's Great New Museum

By Samuel Hubbard

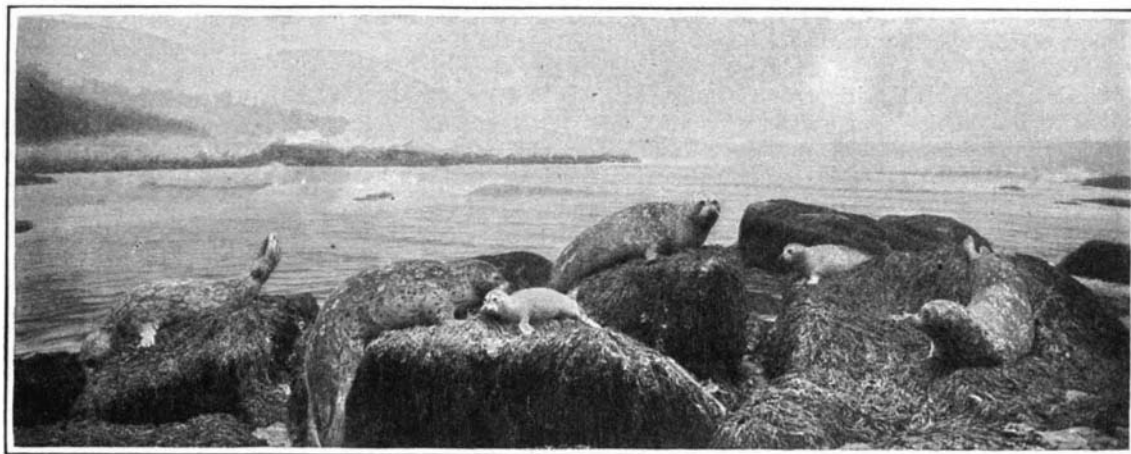
IT has remained for the Far West to speak the last word in museum construction and the installation of habitat groups. The California Academy of Sciences, whose new museum in Golden Gate Park, San Francisco, was opened to the public in September, 1916, has now the most up-to-date museum in the world and the most beautiful and artistic mammal groups ever created. This is the opinion not only of enthusiastic supporters of the institution, but of scientific museum men as well, men who are unprejudiced and who are entirely competent to judge of such matters.

Like every other art, science and craft, the art of taxidermy has been undergoing the usual process of evolution, and has been steadily seeking better and higher methods of expression. As in all other matters dealing with science and art our inspiration comes from Europe. There most of the first art galleries were discarded palaces and most of the museums were modeled after them. It has now come to pass that buildings which were designed originally for human habitation, with the customary side windows and cross lights, are not by any means ideal either for the exhibition of pictures or for museum purposes.

groups, such as the flamingo colony, the white pelican rookery, and many others. Their building was not adapted to groups of this character for the reason they could get no top light. They were therefore obliged to put the groups in a side gallery and light them artificially. Mammal groups were attempted; but usually, as in the Field Museum in Chicago, they were placed in the

lection and building, the disaster only brought about a resolve to build bigger and better than before. So quietly and unostentatiously was this work done that the public generally believed the Academy had gone out of existence. And even yet the people are not fully aware that the Academy's exhibit of habitat groups surpasses that of any other museum in the world.

The board secured the services of Mr. John Rowley, as curator of mammals. His 18 years' training in the Museum of Natural History in New York especially fitted him for the task. A site was then secured in Golden Gate Park where complete isolation from fire hazard was obtained, as well as ample room for future expansion. Plans were then drawn, by a well-known firm of architects, for a building without side windows and lighted only by top light. One wing of the building has now been completed, some fifteen habitat groups of mammals



At home with the California Leopard Seal

middle of the gallery without a painted background, hence the illusion was destroyed.

The California Academy of Sciences is managed by a board composed of the leading business men and scientists of San Francisco. When the great earthquake and fire of 1906 completely destroyed their col-

and birds have been installed, a notable collection of Indian ethnological material has been loaned and installed, and the building has been thrown open as a free museum.

Owing to the fact that the larger California mammals are fast approaching extinction, on account of the encroachments of civilization, it was determined to collect them first. In Mammal Hall there are spaces prepared for eleven large groups. The cases in which the groups are installed average twenty-five feet long by twelve feet deep and twenty feet high. They are a part of the building and are lighted only from the top. The background for the oil painting is curved and plastered. It is 20 feet high and is 40 feet long around the curve. The front of each case is protected by a large pane of plate glass 10 by 15 feet, which is dust tight.

The following large groups have already been installed:

California or dwarf elk	Kern County
Northern black-tailed deer (summer scene)	Mendocino County
Mule deer (winter scene)	Siskiyou County
Antelope (fall scene)	Modoc County
Big horn sheep (desert phase)	Riverside County
Steller's sea lion	Ano Nuevo Rookery
California sea lion	Santa Cruz Island
Harbor or leopard seal	Cypress Point
	Monterey County

Smaller groups:

Cougar's Den	Coyotes' Den
Black Bear's Den	Coons' and Skunks' Dens

The birds have not been overlooked, for in a wing called Bird Hall there are the following:

Farallon bird rookery	Donated by William H. Crocker
San Joaquin Valley summer bird group	Donated by Joseph D. Grant
Desert bird group	Donated by William B. Bourn

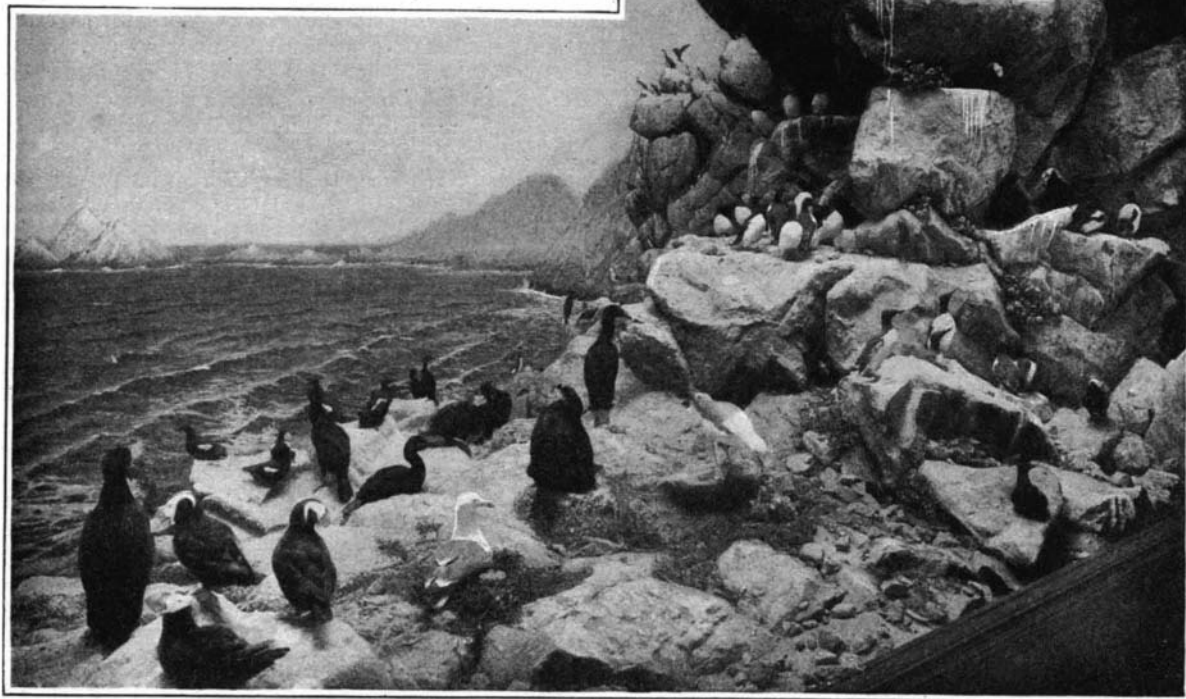


How the sea lion lives

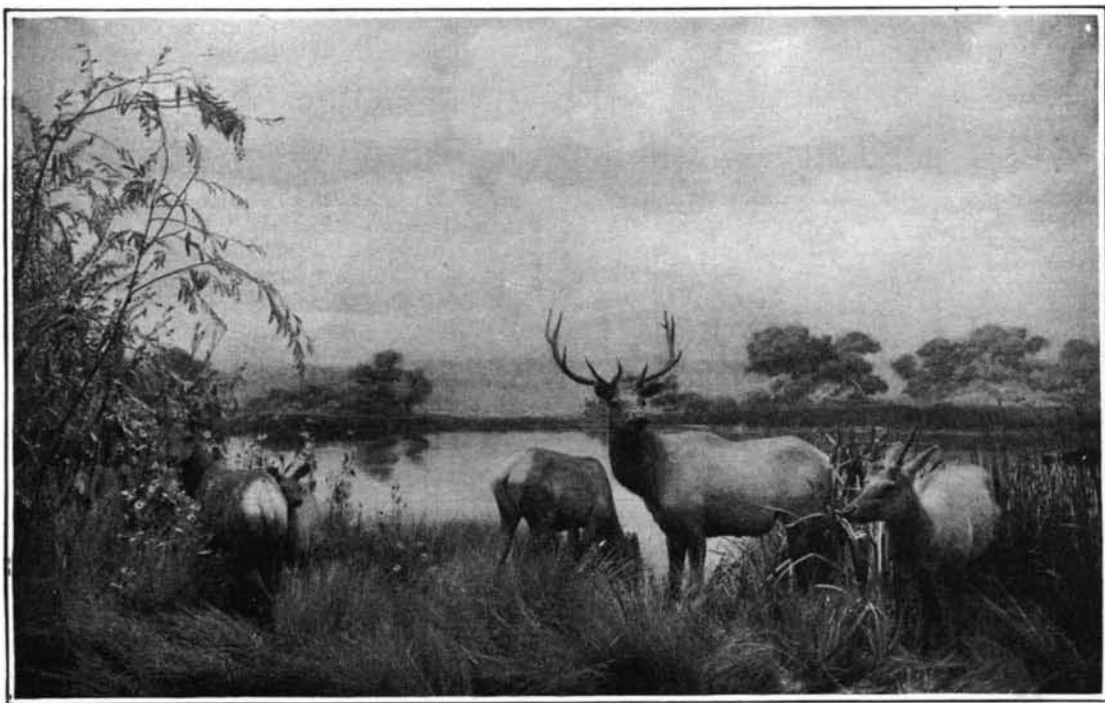
This change in ideals has come about very gradually for museums, especially in the older centers, are well established institutions and are managed by exceptionally conservative people. Again, when a museum has once been built, it is very expensive and often impossible to change, hence the management has perforce to continue in the old way.

Everything has a beginning, so it may be of interest to relate briefly the apparently trivial circumstance which has in effect relegated nearly all the museums of the world to the scrap heap. An English gentleman, walking in his park one spring morning, discovered a pheasant's nest. He was so struck with the beauty of the sight, the brown eggs snuggled in the green grass and surrounded by wild flowers, that the desire came to him to have others enjoy it as well. So he determined to reproduce the scene just as it was before his eyes. He went to London and found a woman who was skilled in making artificial flowers. He secured an artist to paint the background and a taxidermist to mount the birds. The scene was installed in a glass case and was then presented to the British Museum. It won such instant recognition and approval from the public that the museum staff began making similar bird groups in a small way.

Then the plan was taken up by the American Museum of Natural History in New York City. They improved and enlarged on the idea and began making larger



Farallon Islands bird group



California valley elk group



Birds from the San Joaquin Valley

The birds and animals were all collected and mounted by the museum staff. They also made all the accessories, such as rocks, snow, flowers, grass, moss, leaves, trees and shrubs. These minor details require an amount of study, labor and painstaking care that can scarcely be appreciated except by those familiar with the work. The groups cost on an average about three thousand dollars each. The work began under former Director Leverett M. Loomis, and is being completed by the present director, Dr. Barton Warren Evermann.

It has been evident for some time past that the old style of exhibiting animals and birds on wooden stands in glass show cases had become obsolete. The public gets a confused idea of a mass of material without carrying away any distinct impression. By the group method, however, a distinct picture is created which is so impressed on the mind that it is not easily forgotten. Hence the spectator is not only delighted by a scene of artistic beauty, but is also unconsciously instructed.

There is no limit to the field these groups may occupy. They may be used not alone for natural history, but for ethnology, for historical subjects, for agricultural scenes, and for illustrating mechanical processes. It is not venturesome to prophesy that the museum of the future will be planned almost exclusively for habitat groups, that it will have no side windows, and that exhibits of this character will put it on a higher plane, where it will increase in popular regard and become an essential factor in the community's educational system.

Increased Amount of Fog a Feature of Last Year

RESULTS obtained by the United States Bureau of Lighthouses by tabulating the figures from the various fog-signal stations throughout the service show

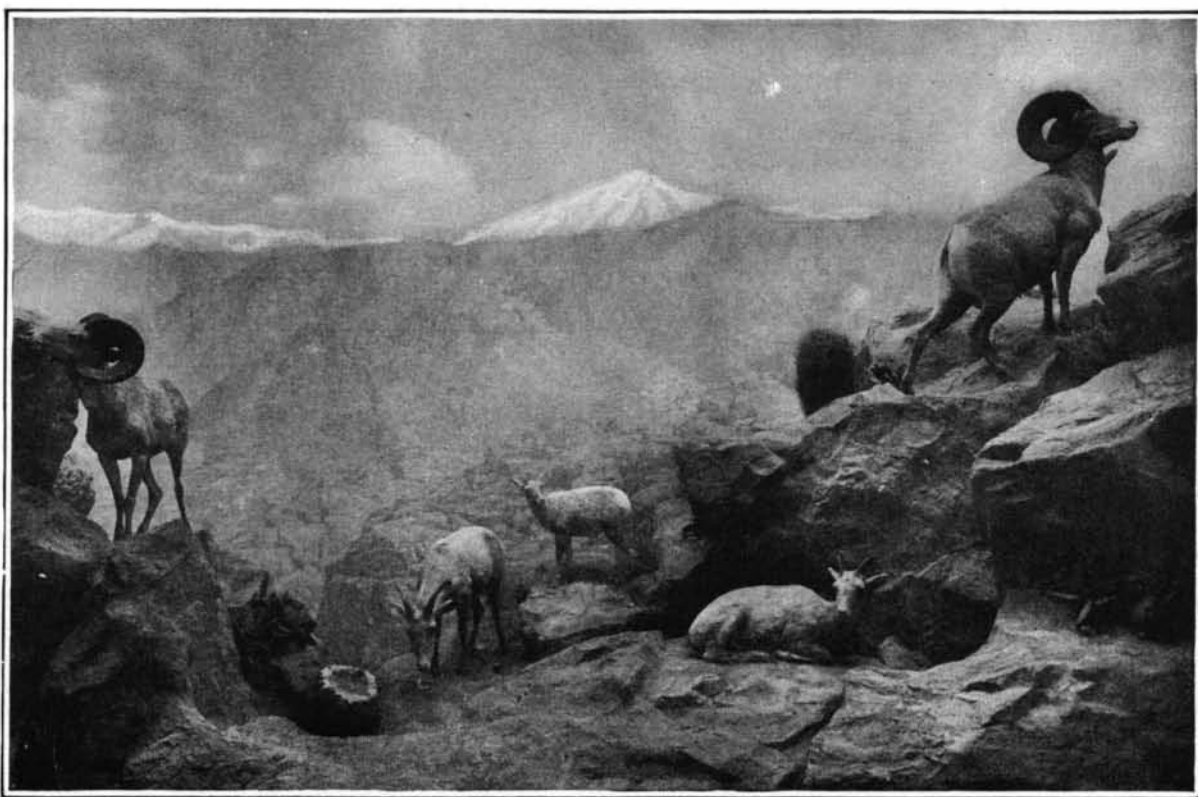
that the average amount of fog was greater during the fiscal year 1916 than during the preceding year, except in the lake districts where the amount varied very little from that recorded in the fiscal year 1915.

The greatest amount of fog was observed at San Francisco Light Vessel, Cal., in the eighteenth district, aggregating 2,221 hours for the year, or approximately 25 per cent of the time. The highest record on the Atlantic coast was that at Egg Rock, Me., in the first district, where 2,043 hours of fog occurred, equivalent to about 23 per cent of the year. The most dense fog in the dog days is found along the coast of Maine, New Brunswick and Nova Scotia. During this season

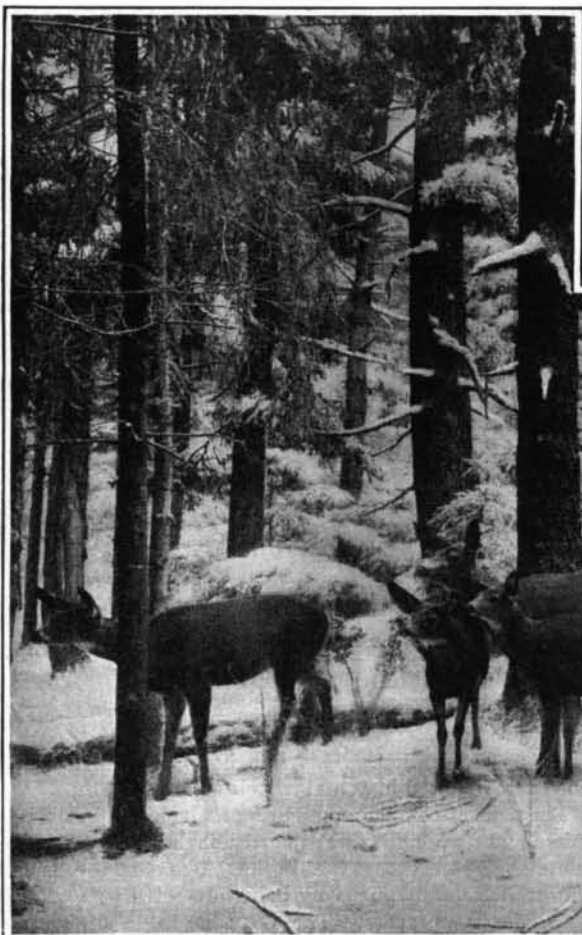
the fog is so heavy that it is sometimes impossible to distinguish persons or objects twenty-five feet away.

The Current Supplement

THE diversified character of the contents of the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT will be greatly appreciated by all who like to keep themselves informed on general scientific subjects, as it contains articles covering a wide range of subjects. *The Contributions of Geodesy to Geography* shows that the determination of the shape and size of the earth, and the location of places on its surface, referred to fundamental planes, are the geodesist's principal con-

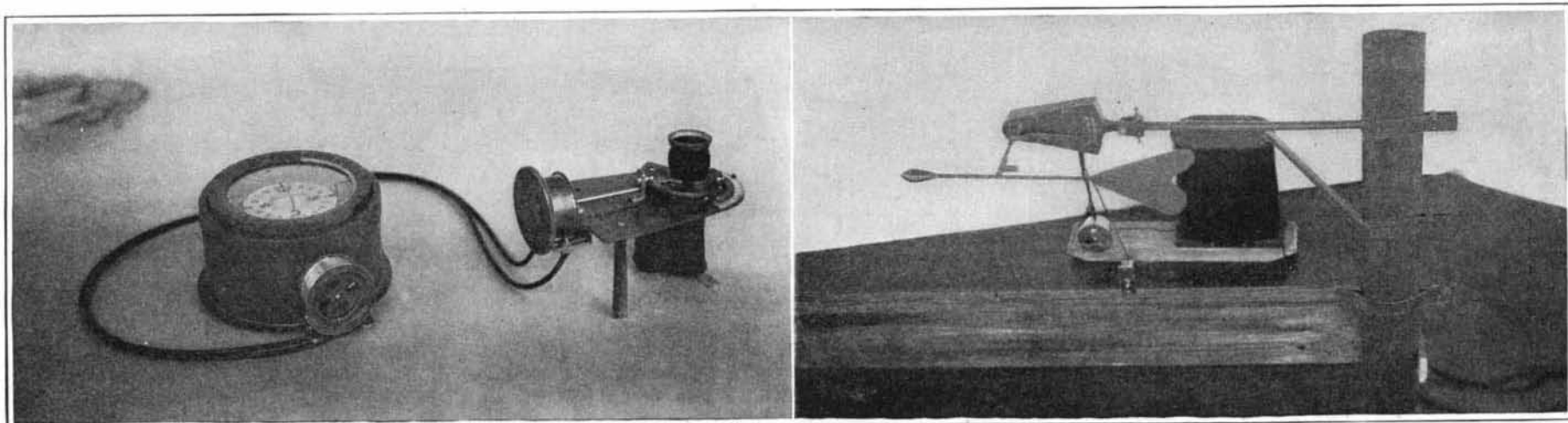


Desert mountain sheep group



Mule deer in a painted winter

tributions to geography. *Anomalies in the Animal World* is the first of several papers that will appear from time to time in the SUPPLEMENT, and the present article deals with flying mammals, flightless birds and other curious forms. These papers will be found of particular interest, discussing as they do biological questions that have heretofore been generally overlooked. The papers will be fully illustrated. *Promoting Our Supplies of Food Fishes* tells of a few things the government is doing for the benefit of both the producer and the consumer. It is accompanied by a number of excellent photographs. *Capillary and Electrocapillary Chemistry* is a valuable survey of the more important phenomena and their technical applications, and involves a subject of wide interest that is of particular value to many outside the ranks of the chemical profession. *A Study of Wave Motion* is directed to discovering means for counteracting the rolling of ships. It is accompanied by diagrams and illustrations. There is a short article giving important facts relating to *The Total Solar Eclipse of June 8, 1918*, and it is accompanied by a chart that shows the path of the moon's shadow across the United States, with the standard times of beginning of totality, the duration of totality and altitude of the sun. The intensely interesting series of lectures on *Vibrations, Waves and Resonance* is concluded in this issue.



Two aeronautical instruments that simplify the aviator's task: At left, a Sperry synchronized drift set; at right, an incidence indicator

Aeronautical Equipment Which Lightens the Work of the Aviator

SCIENTIFIC aviation accessories, showing the progress made in aerial navigation equipment from the days when an altimeter was the only instrument on a flying machine to the present-day equipment of automatic pilots, synchronized drift sets, azimuth stabilizers, incidence indicators and other apparatus found on many aeroplanes are to be seen at the Pan-American aeronautical exposition now being held at the Grand Central Palace, New York City.

The visitor to the exposition is immediately impressed with the fact that the aeronautical engineers have been hard at work in designing apparatus that assure every pilot the utmost safety under all conditions of aerial navigation. Since the equipment can be installed on any type of aeroplane or seaplane, flying may be made easier and more comfortable, as well as safer, for whoever sits in the cockpit with hands on the control levers.

The relief from physical and nervous strains guaranteed a pilot using up-to-date apparatus is as important as the selection of a modern machine in preference to an old-type aeroplane. Take the Sperry synchronized drift set for example: By using this instrument an aviator can fly directly to the point of destination regardless of whatever side winds are encountered. Moreover, the correction for velocity and direction of air currents is done without making mathematical calculations.

Some apparatus never before exhibited publicly are being shown at the exposition, among them an azimuth stabilizer, stallometer for warning against stalling, a chart holder and inclinometer, which is used for indicating the fore and aft positions of an aeroplane with reference to the horizontal.

An Aerial Torpedo That Makes Bombardments from the Air More Effective

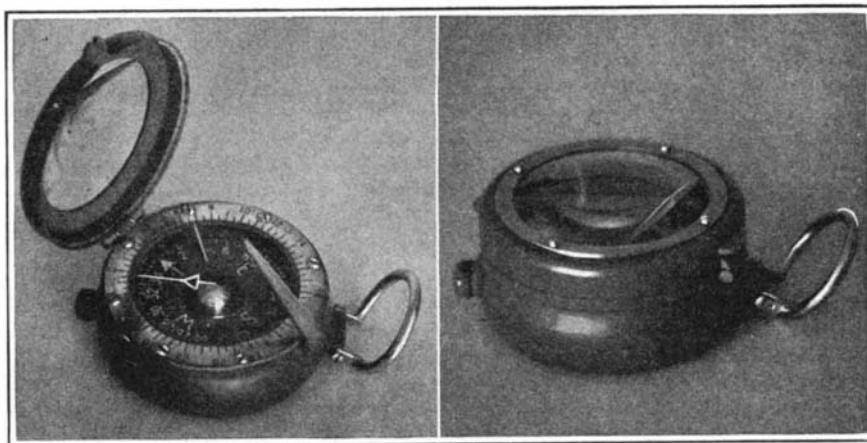
TESTS recently conducted at the Mineola flying grounds on Long Island with a new form of aerial torpedo have gone far to disprove that aerial bombardments are more or less a highly spectacular form of pyrotechnics. It is too often forgotten by military men and others who rush into harsh criticism of the effectiveness of aerial bombardments in the present war that the bombs employed by the airmen thus far have been either of an improvised type or at best of poor design.

Perhaps the main fault with present-day aerial bombs is that they explode on contact, so as often as not the bomb buries itself in the earth for a considerable distance before it explodes. Thus the explosion meets with the soft, yielding earth, and little of the intended destruction is accomplished. Most of the European belligerents are employing standard artillery high-explosive shells which are fitted with a special tailpiece. The latter causes the contact denoting device to become alive only after the bomb has been released, but bombs of this sort are capable of inflicting extensive damage only if they happen to strike a substance that offers considerable resistance.

In the United States of late a number of aerial torpedoes have made their appearance, and much interest is being displayed in some of these by our Army officials. One of these torpedoes is illustrated in cross-section in the accompanying drawing, and its operating features may be taken as more or less standard for others that are also time controlled. The main advantages of this form of aerial projectile are that it is safe to handle, that its destructive power extends over a considerable zone, and that it is time-controlled.

In many respects the present aerial torpedo can be compared to the standard field-gun shell. For instance, the aviator calculates the distance he is from his target

and sets the nose of the torpedo opposite the graduated ring *b*, which corresponds to this distance. The bomb is then released; and the momentum of the first 50 feet of descent fires the auxiliary primer *n*, this being accomplished by the rotary motion of the propeller *x*, mounted on the shaft *c*. The method by which this is brought



Two views of the compass that has been designed especially for the use of aviators

about is ingenious. The propeller shaft, by means of the thread *r*, frees the spherical end of the stirrup cup-spring *e*, the arms of which have until now been engaged in a recess in the cylinder wall. With nothing to hold

This in turn burns away, releasing the plunger stem *l* which is forced by the spring *p* into the chamber below. It is then and for the first time that the picric acid booster charge at *q* is incased around the denotator *n*, through the action of the spring *p*. Meanwhile the primer *o* has been brought in contact with the firing pin *j*, and the flame is carried to the denotator by means of the long or shortened time trains determined by the setting of the nose of the torpedo. The explosion of the main charge follows as soon as the flame reaches the denotator.

Now supposing the aviator misjudged the distance of the target, so that the setting of the time fuse would bring the explosion some time after the torpedo had reached its mark, which would probably mean that the torpedo would fail to accomplish its mission. It is to meet just such a condition that the present torpedo is also equipped with a contact denotator or impact denotator located in the rear of the stem. The firing pin is seen at *z*, the primer at *s*, the safety wire at *t*. The force of the denotator explosion is communicated to the main charge, and so at its worst the torpedo is as effective as the best contact exploding bomb. Lastly, *u* is a steering vane for guiding the torpedo toward its mark.

The torpedoes tested by the Army officials at Mineola are known as the Barlow torpedo, and are made at the Frankford Arsenal. Quite naturally the details of this torpedo are being carefully guarded, although in its main essentials it probably follows the design of the torpedo described in the foregoing.

Aviator's Compass Which is Visible at Night by Its Own Light

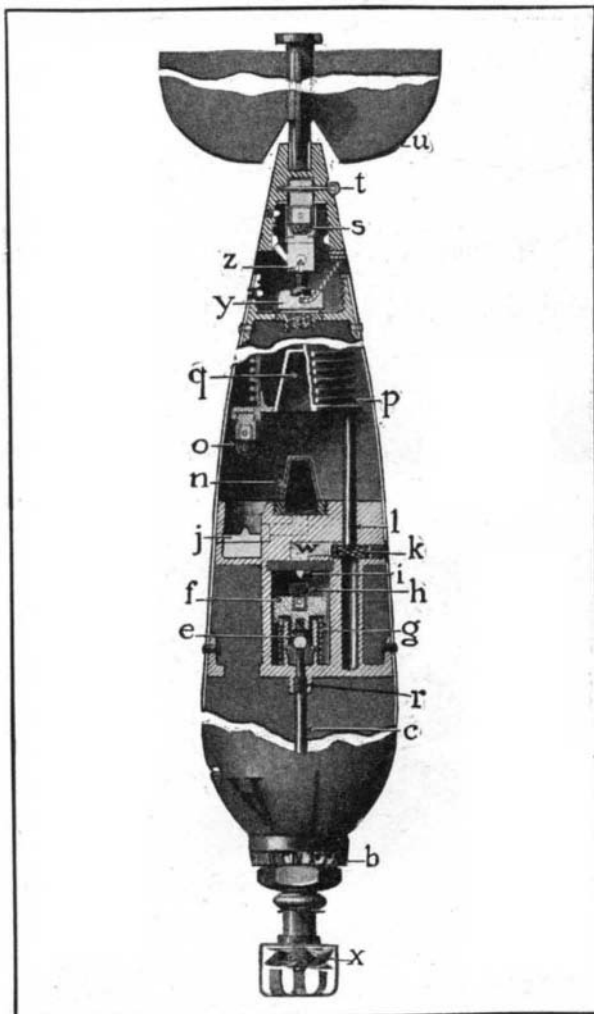
A POCKET compass which is unusually accurate because the magnetic dial is suspended in a liquid and which can be read at night by its own light, has been recently introduced for the use of aviators, sportsmen, military organizations, and everyone requiring a small compass that is dependable under all conditions.

A knowledge of navigation is not essential for laying a course with this compass. The first step is to set the instrument upon the chart at the spot indicating the user's location. The zero mounting of the outer ring, in line with the arrow point on the glass crystal, should point toward the north or top of the map. Any course desired (or the direction to be traveled in going from one location to another) may be found by elevating, to an angle of 45 degrees, the arm of metal attached to the outer ring and then sighting over its top and the niche in the magnifying glass bezel ring to a pin stuck in the chart at the point of destination. Such a process illustrates one important advantage of this compass over similar instruments, namely, that parallel rules for sighting are unnecessary and may be dispensed with.

In order to travel from any location to a particular destination it is essential to apply the magnetic variation. With other compasses it is necessary to add or subtract this magnetic difference, depending upon whether the variation is westerly or easterly. Doing so gives the magnetic head to be traveled, read on the center dial in the bowl. In using this compass, however, both adding and subtracting are done away with. It is merely necessary to move the lubber's line, indicated by a white line and arrow painted on the crystal, to the point of destination. This line becomes the lubber's line to be followed in actual travel.

The present compass, measuring an inch and a quarter thick and two and three-quarter inches in diameter, contains no steel except that in the magnet, so the needle cannot become deranged by being attracted by another part of the compass. The bowl is made of bronze and painted, while the fittings are of brass. A magnify-

(Concluded on page 161)



Sectional view of a typical aerial torpedo, showing the time-fuse and the contact detonator

it back the spring *g* forces the plunger *f* upward, bringing its primer *h* in contact with the firing pin *i*.

The flame that results is carried through the vent *w* to the cylinder of plaited rope powder composition *k*.



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Aviator's Compass That is Visible at Night by Its Own Light

(Concluded from page 156)

ing glass, mounted in the bezel ring and fitted over the dial, enlarges the figures on the latter so that they may be read more easily. A nickel ring attached to the outside of the bowl is for convenience in carrying the instrument with a strap, if desired.

To increase the accuracy of this compass, the card is mounted in a mixture of alcohol and distilled water, thus rendering the magnetic float more bouyant and sensitive. The markings on this compass are readable at night in the light from the radium dial, which is graduated every five degrees and numbered every 20 degrees. The east zero is omitted in all numbers to avoid crowding.

Segregation in Steel

(Concluded from page 157)

three and a half inside. This quarter-inch metallic ring showed up in the picture very brown near the inside surface and clear white on the outside, with a well defined dividing line about through the annular center.

In comparison with this, the picture of the end of one of our four-inch billets, from which such pipe was drawn, showed clear about the circumference, but spotted with brown through the central regions. In other words, segregation was very marked, and in a most unfortunate manner. For the piercing tool removes no metal, it merely forces all the center metal of the billet to the inner surface of the tube, pressing it into streaks circumferentially.

The results of this were disastrous. It is well known that sulfur melts at a much lower temperature than does steel. Consequently at rolling temperatures we have next the piercing tool a layer of plastic or even fluid material; and under severe twisting strains the steel cannot help but fail along these greased planes, as they may well be called.

It is quite astonishing how much harm a little sulfur can do, when misplaced in steel.

Facts About the Panama Canal

(Continued from page 147)

figure is less than the forty-eight ships per day expected of the Canal, but that figure could be attained by shutting down the hydroelectric station and using the auxiliary steam generating station. The year of minimum discharge of rivers into Gatun Lake of the twenty-five on record gave an average value of 4,435 sec. ft. If all this water was utilized by proper storage by the building of the Alhajuela and additional dams the average water capacity of the canal for the year would be about 2,600 sec. ft., sufficient for the passage of about forty-eight ships a day and for sixty ships a day with the hydro station shut down.

The maximum momentary discharge into Gatun Lake from its tributaries on record is 175,000 sec. ft. and on one occasion a flow of 137,500 sec. feet occurred for a period of thirty-three hours.

Gatun Spillway, built for disposing of the surplus inflow, has a discharge capacity of approximately 180,000 sec. ft. with the lake at elevation 87 ft. The maximum number of gates opened to date has been

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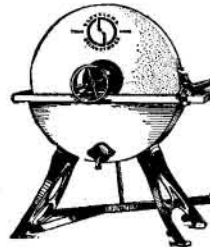
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Using Electric Lift Bridges to Reduce Trucking Distances on Freight Platforms

BY introducing electrically operated lift bridges which span a group of tracks at two points, the handling of freight at the local freight terminal of the Atchison, Topeka & Santa Fe railroad at Los Angeles has been simplified to a great extent. These bridges, which effect a saving in trucking distance of hundreds of feet per trip for the electric tractors and trailers, present an interesting departure in freight house operation.

The freight terminal in question consists of two buildings, one for outbound and one for inbound freight, each about 1,000 feet long. Between these parallel buildings are the seven house tracks, interspaced with two transfer platforms, thus dividing the tracks into three groups. The house tracks come to a stub end on a line with the inner end of the freight houses, and a cross platform connects the two longitudinal platforms and the two freight houses at this point. Now it is obvious that to transfer goods from a point on one transfer platform to a point on another transfer platform, or from one freight house to a platform or to the other freight house, the electric tractors and trailers employed in the work would have to make a round-about trip, going down the platform to the cross platform and then up the other platform or freight house to the desired point. Depending on how far up the platforms the points of departure and arrival happened to be, a trip of several hundred feet or even a thousand or more feet would be quite common.

It was to eliminate these long trips that the railway engineers introduced a system of lift bridges for spanning the intervening tracks so that goods might be transferred from one platform to another by a more direct route. At first the bridges were of an elementary design and had to be removed by hand each time a train of cars was moved. A string of cars standing alongside a platform was divided opposite each bridge to make room for it.

But the bridges, while most practical as a means of saving trucking expenses, proved rather expensive because of their manual operation, and a study of power-operated bridges disclosed the fact that these would effect a considerable saving over the existing ones. As a result, two bridges have been installed of the type shown in the accompanying illustration, providing movable spans over the three groups of tracks at two intermediate points in the length of the station; while in the throat of the yard a third bridge has been installed.

It will be noted that the bridges consist of platforms which, being hinged at their lower end, can be raised or lowered by means of cables winding up on drums driven by $7\frac{1}{2}$ horse-power alternating current motors. One motor operates the three-track bridge, while another motor operates the two smaller bridges simultaneously. Controllers are installed on the posts of the operating structure, and the motors are provided with automatic cut-offs which shut off the current supply when the bridges are fully opened. Since these bridges come up to a true vertical position when opened, the weight of the bridge is in no way effective to start it downward when the bridge is to be closed. It is particularly when a wind is blowing against the bridge in a direction opposite to that of the closing movement that this feature becomes quite an obstacle in the operation. Fortunately, however, pushers are provided which push the bridges out to a sufficient distance to make the weight of the bridge effective in carrying it downward, and which also serve as buffers when the bridges are opened. For the two smaller bridges the pushers are operated by counter-weights, while the larger bridge employs a motor operated pusher.

The operation of the bridge is simple. When the bridge is to be closed a drum in clutch with the motor operating the bridge through worm drive, winds up a cable and the pusher is forced outward. When the full reach of the pusher has been obtained a small lug on the end of the pusher rod comes in contact with the clutch lever and throws the drum out of clutch with the motor, so that the pusher remains stationary

during the remainder of the downward movement of the bridge. A reversal of this operation takes place in raising the bridge.

Segregation in Steel

By Duncan Taylor

MUCH is being said and written upon the subject of steel segregation. Briefly, this means a separation out of the sulfur content, present to a certain

sort of problem which the steel maker has to face.

Seamless tubing is made by forcing a steel billet over a piercing tool while at high temperature. It is then pressed over sizing mandrels and rolls, and otherwise treated like ordinary welded pipe. There is a strong twisting action on the billet while forcing it over the piercing tool, and many pieces have to be scrapped because of slippage of one layer of the metal on another under this strain. Once such slip occurs, it cannot be welded together by further rolling, and must go into the discard.

My company recently found itself in danger of losing a valued customer, because its steel was not up to the requirements of the seamless tubing made by the latter. A large percentage of the billets pierced had buckled, showing a partial slippage of the metal. A competing steel of the same analysis and under identical conditions gave very little trouble.

Exhaustive chemical and heat tests applied to stock steel and to pieces which had failed as described did not show any decisive difference between our steel and that of the competitor. As a final test we took sulfur prints of the ends of the pieces of defective pipe, though none of us had any idea that segregation really lay at the root of the matter. Without going into details, I may say that this process consists of photographing the end of the pipe on such a paper, and developing in such a solution, that in the finished print all the sulfur in the section of the steel exposed shows as dark brown spots.

In this test we obtained two very interesting prints which made it clear why our steel was not suitable to the conditions of this tubing. The piece of defective pipe exposed was four inches in outside diameter,

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Rocks and Minerals Made by Artificial Means

By L. William Thavis

THROUGH the steady progress of science, nature's secrets are being bared one by one, and not only is her most sacredly guarded secret—how earth was made, of what its rocks and minerals are composed—now being solved, but actual rocks and minerals are being reproduced by artificial means, reproduced in a much purer form than they were originally made by nature. The place at which these wonderful experiments are being conducted is the Carnegie Geophysical Laboratory, a part of the Carnegie Institute of Washington, D. C.

Nature has not given up her secrets willingly. They have been wrenched from her by hard work and the expenditure of large sums of money. The Geophysical Laboratory represents an outlay of half a million dollars, and what will be spent in the future for conducting these experiments is not known. While the brain of man of course is the dominating factor in this work that brain is helped out by intricate and costly machinery. There is a furnace where a heat of 3,000 degrees Fahrenheit may be obtained; there is a machine capable of exerting a pressure of 100,000 pounds to a square inch; there are measuring and recording devices of the most exquisite delicacy.

The Carnegie Geophysical Laboratory is a building within a building. Outside the exterior brick wall is an insulating layer composed of six inches of hollow terra cotta, with air spaces laid horizontally and closed at the ends. This insulation, which will keep the heat out in summer and in in winter, is almost as strong, structurally, as the brick wall underneath. The delicate measuring and observing instruments in the laboratories on the upper floors are protected by a novel arrangement from the jar of the heavy machinery below. Each basement room containing heavy equipment has for floor a thick slab of cement

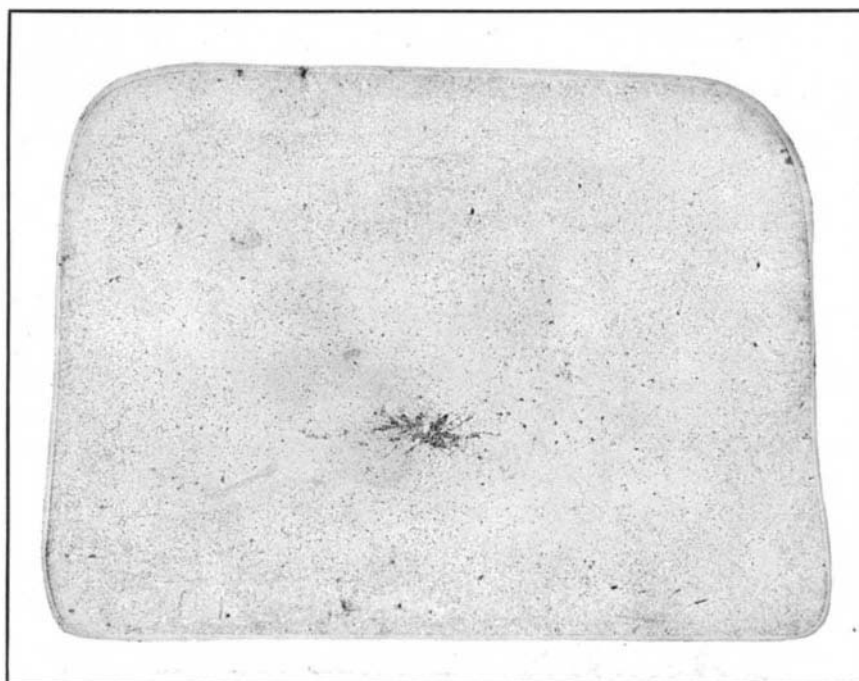
separated from the adjoining walls, bottom and sides, by a six-inch layer of dry sand. These same delicate instruments are protected from dust by filtered air.

"Rock formation, like other physical and chemical phenomena," says Dr. Arthur L. Day, director of the Geophysical Laboratory, "is the result of certain forces acting upon certain forms of matter. An exact knowl-

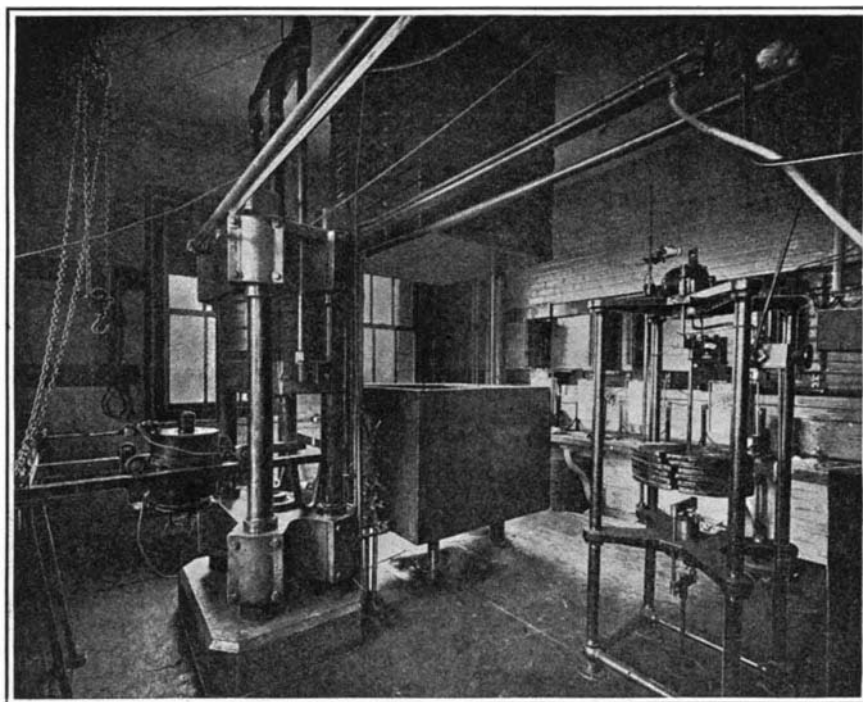
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These two electrically operated lift bridges reduce the trucking distance in transferring freight from platform to platform



The little patch of sulfur showing dark in the center makes this steel bar unfit for many purposes



The Geophysical Laboratory at Washington. Left—gage to measure high pressures. Right—press which develops pressure of 4000 atmospheres at 1000° Centigrade

percentage in all steel, so that instead of being mixed uniformly throughout the mass of the material, the sulfur is found more or less aggregated in one part only. The practical steel man is gradually becoming impressed with the importance of segregation; and a recent experience in the effects of this phenomenon upon seamless steel tubing will indicate the necessity of preventing it, and throw a little light upon the