

TEACHING BRITANNIA HER JOB

THE British Admiralty have chosen for concealing their warships colors exactly opposite to their purpose. These navy men have undertaken a job absolutely in the painter's field—to-day, when everything else is in the hands of specialists.

At the beginning of the war Professor J. Graham Kerr, of the University of Glasgow, proposed to the government to give up his professorship and undertake the conduct of the bureau for the application of my discoveries to war needs. Professor Poulton, of Oxford, wrote to General Ian Hamilton urging that the government take counsel of me, and Professor Herdman, of the Liverpool University, proposed that the English naturalists sign a paper to this effect, saying to me "Your book has convinced us all." But neither the Navy nor the War Department could be made to understand that successfully to color ships or men years of special study of the science involved in concealing coloration are necessary.

Here is a perfectly absurd (however disastrous) case. In British waters nine months in the year they have twenty cloudy hours to one sunny hour (the estimate I got from one officer; fifty to one, as I got from another), and not much better the rest of the time—"filthy nine months in the year, and dirty the rest."

Obviously, then, the British navy want a color that conceals their ships mostly in cloudy weather. There is one color, and only one that even tends to conceal a ship in such weather, and that color they avoid with a superstitious awe, and choose among the rest, where one of them, or any combination of them, is as bad as another, achieving at best some difficulty in identification, making their ships, though always rankly visible, look perhaps like some group of scows.

All this will be plain to our thousands of seaside visitors this very summer after they have read this article and studied an hour or two the shipping out on the rim of the ocean on a cloudy day.

Here is a means to turn these thousands into a vast force to aid the Allies by helping break down this fatal error.

On a cloudy day place a stick horizontally upon two supports in a situation where it will be seen against the low horizon sky. (Figure 1.) Upon this stick fix firmly flat cards of any color you please, not omitting pure white cards, and also cards of the gray, and gray-patterned-with-black, that the navy use. So affix them that their surfaces come all in one vertical plane, and note which of the cards come nearest to matching the sky. You will find that on cloudy days the white ones will come far the nearest to doing so and that all the others will always look much too dark against it. Also, while the slightest modification of these cards' verticality, slightest revolving of the stick (or the slight shifting of the atmospheric illumination), may complete the effacement of the white card at a hundred yards or less, no such change of angle that leaves any of the other cards anywhere near vertical or any change in the illumination, will in the least degree diminish the rank conspicuousness of all the others. On the other hand, the white cards can become both whiter than the sky on your facing them more and more upward and dark brown on facing them more and more downward.

Ninety-nine hundredths of all of a ship that you see at a distance is essentially vertical, and at the fighting distance of seven or more miles ships seen even from each other's lookout, 150 feet above the sea, have the sky for a background even down the main part of their hulls.

Cut out of the blank margin of this newspaper the form of a cruiser, and pin it flat over A. (Figure 2.) Look at it in a diminishing light; you will find that this white ship will fade from your sight, while the gray and black ones remain visible.

This illustration shows you what you

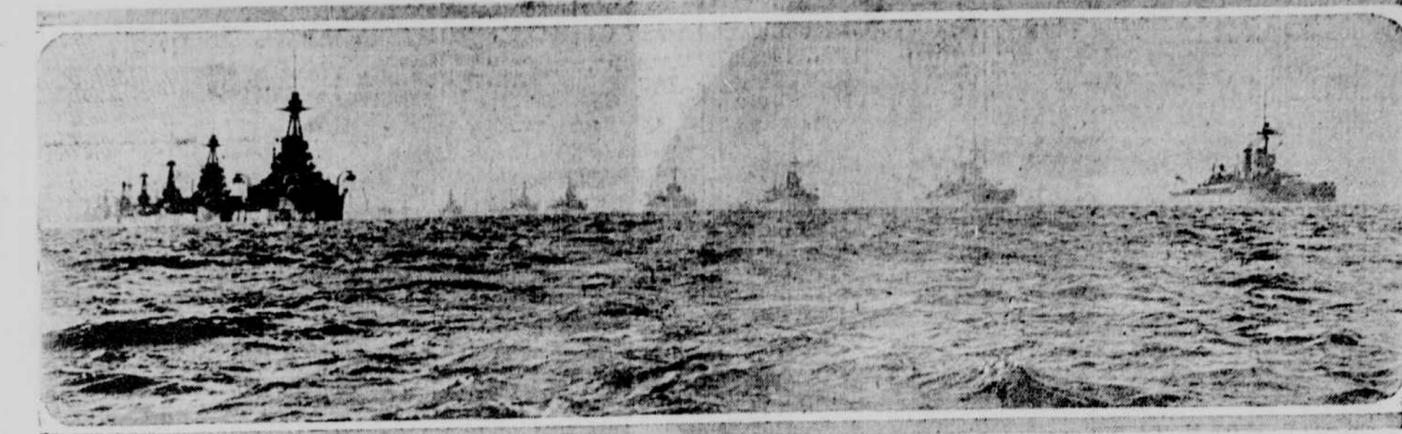


Photo by Underwood & Underwood.

The British Navy's Mistake in Attempting to Color Ships Without the Aid of a Specialist. Did Germany Avoid This Error? How People Now at the Seashore May Help the Allies by Their Testimony

Written and Illustrated by ABBOTT THAYER

can also see when you watch, on a cloudy day, any white vessel, or the white superstructure of any dark steamers, off on the sea line; namely, that white, instead of having the supposed mysterious luminosity, is simply a (pulverized) mirror of the whole sky that lights it, and fades or waxes with the increase or decrease of daylight. In cloudy weather (which secures uniform illumination) vertical pure white so counterfeits the sky against which you see it that only in the brightest moments is there any hope of your distinguishing it from the sky. All the rest of the time, as this watching the ships toward nightfall, or in thickening weather, or watching this illustration in a darkening room, proves all vertical white is utterly indistinguishable, while all darker forms stand out starkly visible. Yet every navy man would have to confess to-day that he would expect a white ship, or the white superstructure of a dark one, to show more as the day darkened.

For England to see these facts would treble her power before the end of a week; that is all the time it would take to paint every vertical inch of the whole navy, spars, cables and all, pure white.

With a view to the aviators, ships' horizontal surfaces must wear the gray of gulls' backs. Plainly a snow-white sided pearl-backed tern has the costume that has concealed billions of his ancestors in the greatest number of moments and situations. Yet even in a cloudy day, out of the hundred that at any moment match their background and es-

Abbott Thayer, the author of this remarkable article, which shows how warships may be protected against the attacks of the enemy by the application of a simple coat of paint, is one of the foremost of American artists, a member of that famous group which includes Saint-Gaudens, Whistler, Winslow Homer, George Inness and John Sargent. His paintings, usually of winged female figures, like the celebrated "Caritas," are among the most treasured canvases in the private and public collections of the United States. Some years ago Mr. Thayer's studies of natural life, begun at Monadnock, N. H., where he has his home and studio, brought him to the discovery of an extraordinary principle, which he demonstrated to the scientific world in a volume elaborately illustrated by his son and himself, "Concealing Coloration in the Animal Kingdom." In this book he showed how the coats of birds and beasts were so devised by nature as in many cases to aid the wearers in their defence against their enemies in field and forest. Mr. Thayer's ideas have excited warm discussion and some opposition—Colonel Roosevelt being among his critics—but they have also won cordial approval. Extending the scope of his researches, he has given particular attention to the question of supplying ships with a protective resource, and in the accompanying article he discusses it with relation to one of the leading subjects of the hour—the bearing of sea power upon the Great War. The reader is especially commended to that portion of the article which explains how the man on his vacation at the seashore may find entertainment in proving the argument for himself.

The seashore observer will also discover that in sunny weather, too, white, in a hundred situations, is beautifully ghostly.

Now, to cure white's one defect as a ship concealer (its occasional blazing brightness on its sunny side) it is only necessary for ships to have dark gray awnings ready to draw over the sunlit parts.

Must we actually abandon a matter that involves the very existence of

know that their mathematics, gunnery, navigation, etc., have put them beyond the competition of outsiders in their field can't take in that the like is also true of the specialists in all adjacent fields?

The moment I got ready to show all this about the powers of white to Professor Grey (professor of physics at Glasgow University) he said: "You don't need to show it; I know just what I shall see." And he proved to do so,

for any white pasteboard box that you set anywhere out under a cloudy sky. When you, and all the world except painters and physicists studying visibility, look at such cases as these cubes you show no signs whatsoever of realizing that only their tops are white in this position, and that each other plane has some other different and darker color, born of its momentary situation. This failure to understand visibility makes you utterly helpless, and—must I say?—makes your cocksurenness a dreadful obstacle to your country's safety at this particular moment.

I tried for several years, both in Europe and here, to reveal to naturalists the law of counter-shading, which I discovered about 1892, twenty-four years ago. Ultimately, piqued by lack of receptivity and even contempt, I alighted on the thought of the application of my law to artificial models. These I showed at South Kensington Museum, Oxford and Cambridge universities, at Bergen and Florence, and personally set up in each of these places (and in Japan and elsewhere by directing other men who wrote for instructions) permanent apparatus demonstrating the invisibility of a counter-shaded object. The thing became famous at once and went all over the world, and has ever since been called "Thayer's law."

Goaded in the same way again, I have devised these ship models to show the very same great fact in another application, and they will similarly go round the world.

The previously overlooked fact, which



FIGURE TWO.

"Cut Out of the Blank Margin of This Page the Form of a Cruiser and Pin It Flat Over A. Look at It in a Diminishing Light; You Will Find That This White Ship Will Fade from Your Sight, While the Gray and Black Ones Remain Visible."

scape your eye, the gyrations of many others keep scores of them in sight, by making them relieve, for the moment, either a little too light or too dark. It follows that the average man goes on accumulating an image of these sea birds conspicuously light or dark as the case may be (in general only an artist notices which way an object relieves) because the hordes of concealed ones build in his brain no image at all.

scores of warships and thousands of lives to the bungling of men who share this inconceivable, though universal, lack of sight-sense, and who are as ignorant of these principles as fifty years ago were medical men about malaria or tubercle?

The accompanying extract from a letter that went to a British naval expert is appended for the additional explanations it contains:

It would be amusing, were it not now, for the above reasons, an agony, to hear your navy talk of having the "best minds on this job" and of having tested colors "on the spot."

What you have all done is just this: Being all in the (inexplicable) trammels of a notion that white is intrinsically the one conspicuous color, you pass it by as out of the question, and call it testing colors to go out to sea and compare various combinations of the other colors, all practically always equally and ludicrously conspicuous out on the sea, for reasons unknown to you of the navy, but as plain as A B C to the physicist and the painter.

How does it happen that men who

and we had a laugh at the marine and lighthouse administration. "Why," said Grey, "do they paint lighthouses white? It was by its chancing to show dark against light of sunset that I detected the Scilly Light the other day."

You are all in a frightful hole, that cost the world the Titanic (because her officers supposed, like all the world, that a white berg shows, and especially at night); and the same ignorance cost, formerly, the Arizona; and it now offers to cost England half her navy, if Germany learns from our book, or otherwise, what that little white boat that Mr. Bayard left you can force upon you, if you test it as I provide.

It must be spotlessly white; and this fact alone entirely proves my case; because, at the very moment when you learn that all other colors show too dark against the sky, at all hours, you will find that it is purest white that alone can stand the verticality and still match the sky. An object of any other, even only slightly darker, color is a hopelessly dark figure out on the open sea practically all the time.

These cubes (Figure 3) may stand

both apparatus demonstrate, is that the particular color you paint on any surface is only one factor in its appearance, and actually a minor factor, the far greater one being the momentary position of this painted surface.

Naturalists, hunters, war departments and most other people display absolute unconsciousness of the existence of this great fact, and the navy's painting their ships gray, or, still worse, gray made a still darker ensemble (against the light of the sky) by patches of black, is a dis-

mal token of this blindness. Through this fatuous blindness the Titanic struck the berg, and your ships go about making the best thing they can out of the use of pattern (learned from our book, but here most erroneously applied) through avoiding the only concealing color, white. The case is perfectly comic. On land many different combinations of landscape colors, if only in contrasted patches, would serve to conceal, but out on the open sea there is just one color, and you fear to try it! The whole scene is always, in cloudy weather, just one series of whites in their normal light-and-shade relations, and a vertical white plane out there shares and imitates all the light-and-shade changes of the clouds. You make a well-wisher weep. Half of the ships that have been torpedoed would still be afloat had the naval experts perceived that there is a science of appearances, and that science does not form a part of a naval expert's training. One would think that some naval expert could be found with genius enough to perceive this, and get for his country the help of a scientific man whose specialty is concealing coloration.

It is as comical as if people couldn't count or calculate. Even after seeing their white ship invisible (most of the time) through the thirty to one cloudy hours round Britain, the moment they see the sun make one side of her too bright for one hour they go back at once to the gray that keeps the ship a black, conspicuous figure practically all the time in all weathers.

This moment of sun seems to put to rout the naval powers of thought! Let us accept this one hour of bright shine on one side, and let any one tell why not to pay this price for having the ship practically invisible (most of the time) through all the cloudy weather round Britain.

The only question which is here within the field of naval experts is whether they prefer mere disguise of a ship to having her invisible nine hours out of twelve in cloudy weather. (Cloudy weather being, at least, as any one will admit, vastly predominant through the greater part of the year around Great Britain.) The question of what color can vanish and what one can't belong to that science of appearances which is the painter's specialty.

Your gray-and-black patterned craft (except in the rare moments of being seen by a spectator at the precise angle, during sunshine, where the shine of the sun on her paint strikes his eye) is always a dark figure against the background. The only advantage you get by this patterning is to make the vessel ambiguous in appearance. Now, whether the navy prefer this ambiguity to nine hours a day of invisibility, with a still better and very simple device for ambiguity (which I could describe to you) the other three hours, is their affair, but there is only one color that when set up vertical is light enough not to be a dark figure against the sky beyond, and that color is white. Here I am the authority, but if you study those models, set up absolutely with vertical median planes, in CLOUDY WEATHER, on some unshadowed house-top high enough among its neighbors to escape neighboring shadows, and to enable you to see them against the bottom of the distant sky itself, and not against some terrestrial object, you cannot fail to discover the principle in question. So greatly does it darken any color to set it up edgewise (I speak, of course, of out-of-doors) that white itself, so placed, becomes the very gray you are trying to get, and all other colors thus set up become hopelessly too dark.

Proud of their navies, people frequently point to some inky dark cruiser, gray-painted, with her latest fashioned black disguise-patterns, and say, "That's for invisibility, you know." This has happened to me many times, at sea, and the vessel was always, as you will see must always be the case, a dark silhouette whose black forms merely ex-

Continued on Page Eight.

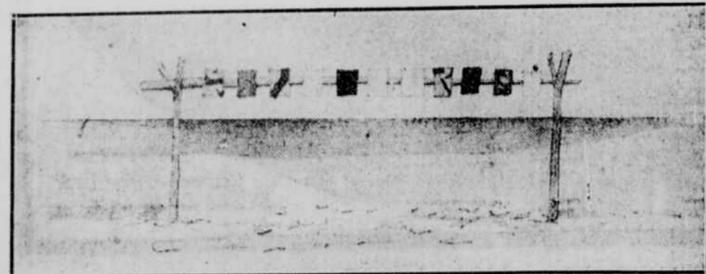


FIGURE ONE.

"You Will Find That on Cloudy Days the White Cards Will Come Nearest to Matching the Sky."

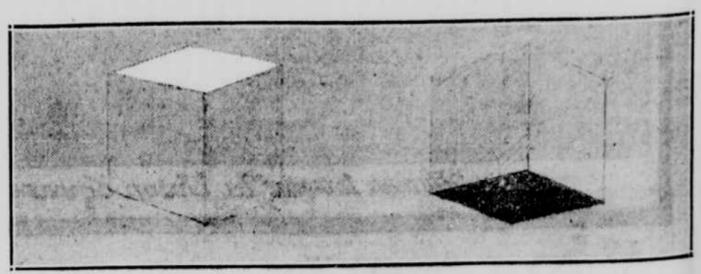


FIGURE THREE.

"These Cubes May Stand for Any White Pasteboard Box That You Set Out Under a Cloudy Sky."