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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

NEEDLESS ANNOYANCES IN FERRYBOAT TRAVEL.

Although the ferryboat system of New York city is probably the best in existence, it is marred by a few serious drawbacks which the companies could easily remove if they set about to do so. In each case the trouble, which amounts to a positive nuisance, results from the extensive use of the ferries which is made by horse-drawn vehicles. We refer, in the first place, to the preventable and extremely annoying delays which occur at periods of high tide, owing to the inability of overloaded teams to mount the hinged bridges connecting the shore with the ferryboats, and in the second place to the intolerable odor which, in hot weather, pervades the wagon drives which extend through the central gangway of the boats. Primarily the delay which occurs when stalled teams are being coaxed up the incline is due to the fact that they are grossly overloaded; but since overloading unfortunately seems to be an evil that is going to stay with us, it is the duty of the ferryboat companies to provide some means by which a stalled dray or wagon can be assisted onto the boat. This might be done either by providing an extra hand-winch on the ferry pier and a snatch block on the ferryboat, so that a rope could be run to the boat and back to the wagon, and the team assisted up the ferry slip by the operators who warp the boats to the slip; or, a small steam winch (of a few horse power) might be placed at the front end of each engine house of the ferryboats for use in emergencies of the kind.

The unsanitary condition of the carriage and wagon driveways is altogether inexcusable, since it is entirely owing to the fact that wooden floors are used where asphalt or some similar impervious material should be laid down. If an asphalt surface were provided and a length of hose connected up in each gangway, the surface could be kept perfectly sweet and clean, and a nuisance which at present calls loudly for the interference of the Board of Health would be at once abated.

NEW METHOD OF ARMOR PLATE MAKING.

A new process of super-carbonization, or "face-hardening" of armor plate has been developed by an officer in the American navy which promises to exert a greater influence upon the struggle for supremacy between guns and armor than was produced either by the American Harvey, or the German Krupp processes before it. The method of increasing the resistance of homogeneous armor plate by hardening its face may be said to have originated in this country when Harvey introduced his process of increasing the hardness by causing the surface of the plate to take up an excess of carbon during treatment in the furnace. Armor with a hard face upon a tough back had, it is true, been already produced abroad, the compound armor, which so many of the old English battleships carry, being of this character. But compound armor had the serious defect that the hard face consisted of a separate plate of steel welded upon a backing of softer and tougher metal. The hard face was secured at the expense of homogeneity, and the serious nature of this defect was realized at the proving grounds when the surface flaked and broke away from the softer back, leaving the plate open to penetration by shells of small caliber. The incontestable superiority of the Harvey armor led to its all but universal adoption throughout the world. Krupp eventually improved upon it, substituting gas treatment in place of the layer of carbonaceous material used in the Harvey method, and also improving the quality of the plate by very careful attention to the details of the furnace treatment. While the high quality of Krupp plate is unquestionable, its excellence is gained at enormous cost, as high as $550 per ton having been paid for this class of armor.

The invention of Lieut. Cleland Davis, of the navy, marks, both in effectiveness and in cost of manufacture, a great advance upon the Krupp system. His method includes the substitution of electrical currents for the heat of the gas-fired furnace, and the direction of these currents against the face of the armor plate while it is in a heated condition by means of massive carbon anodes, in form not unlike the carbons used in arc lights, but of vastly greater size. During his course of experiments, Lieut. Davis found that if a current of electricity were sent from a carbon into the surface of a plate, it carried with it a certain amount of the carbon and implanted it within the body of the metal. The depth of the hardening is determined by the period of time during which the current is applied, and it is claimed that not only is the surface thus treated harder than that treated by the Krupp process, but the depth to which the hardening is carried is increased. The economy of the process may be judged from the statement that while the Krupp plate is kept in the soaking pits at a red heat for from fifteen to twenty days, the same amount of impregnation with carbon is obtained with the Davis process in five hours.

The experimental plate was made at the works of the Bethlehem Steel Company. A moderate thickness, five inches, was chosen, and the only complaint made against the quality of plate was that the hardening of the face was not uniform, a fault which is attributed by the inventors and makers entirely to the experimental nature of the electrical appliances employed and not to any inherent defect in the process. In the next plate that is fabricated, carbon rollers are to be substituted for the present anodes, and with these it is expected that a uniform depth and hardness of carbonizing will be secured. It is estimated by Lieut. Davis that as compared with Krupp plate of equal resistance, the new system will produce plates from 20 to 30 per cent lighter in weight. Further developments of this process will be watched with the greatest interest, and should it prove possible to secure these remarkable results on a commercial scale, the effect upon warship construction will be more radical than anything that has happened in the naval and coast defence world for many years.

It is possible that in the new plate the navy has made answer to the new army high-explosive shell.

MID OCEAN WIRELESS TELEGRAPH STATION.

A scheme is on foot in Liverpool which, it is claimed by the English shipping journals, will soon be in commercial operation for utilizing wireless telegraphy in a mid-ocean post office and signal station. It is the intention to permanently moor at a point 110 miles west of the Lizard a ship which will be equipped with a search-light and a complete set of Marconi apparatus. As the water at the point selected will involve the use of a mooring chain 400 or 500 feet in length, the weight of which would prevent the bows from riding buoyantly over the heavy seas, the vessel will be provided with a horse-pipe placed in the keel of the foremast. The search-light is to have a vertical beam for the purpose of illuminating the clouds and enabling the floating post office to be picked up at night from a distance of 60 miles or more. As the vessel will be located in the fair way of the English Channel, it will be advantageously placed for the distribution of orders sent from shore by the owners to vessels which are passing in or out of the Channel. Thus a ship coming in from the west or from the south could be directed as soon as it picked up the station, to proceed either to Liverpool, Bristol, or an English Channel port. By this means pilotage and port dues would be reduced, and, of course, there would be a considerable saving of time. The vessel will serve as a floating station, which can be approached in any state of the weather, and picked up for wireless communication. The value of this form of post office is expected to be very great. Moreover, lying at the junction of the three great thoroughfares of British and continental marine traffic the station should prove particularly valuable in salvage work. The scheme on the face of it appears to be thoroughly practicable, and if carried out it should prove to be of considerable service in the maritime world.

SOME FURTHER GUNNERY EXPERIMENTS WITH THE "BELLEISLE."*

BY OUR ENGLISH CORRESPONDENT.

The Naval Department of the British government has carried out further elaborate gunnery experiments with the obsolete battleship "Belleisle," to ascertain the relative penetrating power of modern projectiles discharged from heavy guns, and the resisting power of modern armor. This is the third test of a similar character carried out by the British Admiralty during the past two years, and much valuable data, otherwise unobtainable, has been gathered. Naval experts and theorists have maintained that the armor generally employed for protecting battleships is proof against gun-fire as it will be delivered under battle conditions, but these practical tests have conclusively proved that the balance of power is yet distinctly in favor of the gun. That is to say, the progressive development of the weapon in respect to velocity, weight, and explosive potency of the shell is superior to the protective armor, and that the thickness of the latter, and its resisting qualities, have not developed commensurately with the improvement of the former. The effect has been of far-reaching importance to the British authorities, since owing to the results obtained with the two previous experiments with the "Belleisle," which were duly and fully related in the Scientific American at the time, several important alterations have been made in connection with the armor belts and deck defences of the latest English war vessels. For instance, the second experiment unexpectedly proved that the 4-inch armor was quite easily penetrated by 6-inch projectiles. This thickness of armor had been already fitted or ordered for several of the new cruisers. The authorities at once altered the protection for the new vessels to 6-inch armor.

For this latest experiment the "Belleisle" was once more patched up, and placed in a condition similar to that which would exist in an actual naval engagement. An ammunition hoist replete with electrical fittings and trucks was placed in precisely the position relative to the armor which it would occupy in action. The hoist was erected in a battery behind compound armor. The object of this particular arrangement was to enable the Admiralty to ascertain exactly what would ensue if a shell exploded in the vicinity of the ammunition hoist, and how far the machinery of the latter would be deranged by the force of the explosion.

The test was also undertaken to illustrate one or two other important points in connection with naval gunnery, upon which there is considerable divergence of opinion, and also to determine whether certain innovations in connection with projectiles and charges recently carried out in the navies of the various powers are advantageous. For example, England still adheres to cordite as a propelling charge, while other powers employ nitro-cellulose powder. Also, the Johnson cap is regarded dubiously by the British naval authorities. It has been contended that these two acquisitions have resulted in great efficiency and superiority in certain navies. The United States 100-pound projectile, discharged with nitro-cellulose powder, gives a muzzle velocity of 3,000 feet to the missile, as compared with 2,400 to 2,600 feet obtained with a cordite charge, and the former shell with a Johnson cap will penetrate over 10 inches of armor, while its penetration is several inches less without this cap.

Another important feature of the trial was to ascertain the efficiency of a new explosive, similar to maximite, which has been introduced into the British navy as a shell filler.

The "Belleisle" was towed from Portsmouth and anchored off Bembridge as before. Two gunboats, one carrying a 6-inch gun, and the other a 9.2-inch weapon, were selected for firing. The first gunboat stood off at 1,000 yards from the "Belleisle" and fired a shell from the 6-inch weapon, the precise point of attack on the target being the exposed starboard central battery. The shell crashed through the torpedo netting, and pierced the side of the "Belleisle" just above the water line. The armor belting at this spot was of compound type, in vogu twenty-five years ago. A moment after the shell disappeared through the side of the vessel there was a terrific explosion, and a huge column of black dust was hurled high into the air, proving that the shell had penetrated to the coal bunkers and had there exploded.

Another shell was then discharged from the 6-inch gun. The point of attack this time was the conning tower. The shell struck with precision, as the white paint indicating the mark was completely blotched out. The next 100-pound shell was fired at the central battery. A great column of dust was blown into the air, and fragments of steel and splinters of wood were thrown to a distance of 200 yards.

The fourth 100-pound shell was fired at the conning tower, but it did not cause any serious damage so far as could be ascertained from an external examination.

The 9.2-inch gun was then brought into action, and a 380-pound shell was fired at the hulk from the same range of 1,000 yards. The first shot was directed at the central battery. It tore a big hole in the compound armor, and exploded with such violence that the "Belleisle" listed heavily.

A second 380-pound shell was then fired at the conning tower, with the result that the deck was torn up for several yards, and the bridge, situated just above

* The following account of the "Belleisle" trials makes no pretensions to give any detailed account of the destruction in the interior of the vessel, but is merely a description of the purpose and scope of the trials, and the effect of the gun-fire as seen by our correspondent from the outside of the cordon of vessels which was established by the government around the "Belleisle. It is impossible to secure any detailed facts regarding the condition of the ship after the attack for the reason that the Navv Authorities have taken elaborate precautions to prevent such facts becoming public.

the tower, was completely torn from its position and twisted into a fantastic wreck.

Two other shells—a 380-pound and a 100-pound, respectively—were then fired at the central battery; but at this juncture the vessel was so battered that the damage caused by successive shells could not be ascertained, and the trial was brought to an end.

Upon the conclusion of the trials the "Belleisle" was inclosed in canvas to conceal the results achieved and towed into Portsmouth dockyard, where she was dry-docked and a thorough examination was made by the naval officials. The "Belleisle" is to be again patched up for further trials with torpedoes.

HOW OSTRICH FEATHERS ARE CULLED

News comes from California that ostrich farming is now a paying industry. About this season of the year many people from Los Angeles go out to the farms at South Pasadena to watch the plucking of the feathers. To many in the East the plucking of ostrich feathers is probably associated with a violent laying on of hands and a tying down of the bird. As a matter of fact, the gathering of the feathers is a very delicate task.

When the time comes a man carefully examines the flock, and picks out those birds whose feathers are ripening, groups them into dozens, and pens them in, so that they cannot run about and injure their beautiful plumage. When the plucking time comes, the bird is enticed into a narrow, dark passageway. The entrances are then closed and the bird thus imprisoned. A cloth bag is thrown over the creature's head. Then the plucking begins. Three men, perched upon platforms without the pen, reach over the board inclosure and with curious scissor-like appliances pluck off the feathers. Whatever wounds a bird may receive are immediately dressed. The tail feathers are pulled and not cut, simply because they reproduce better than other feathers of the ostrich. While the plucking is in progress the ostrich keeps up a dismal roaring. Were it not for the staunch construction of the pen the creature would kick the boards into splinters.

The first plucking is the most valuable. For that reason the older ostriches are kept simply as breeders.

How successful is the ostrich industry in Southern California may be gaged from the fact that about three-quarters of a million dollars are now invested in it, and the annual output of feathers is worth about $100,000.

MILITARY PHOTOGRAPHY.

Nearly all European nations have had a share in the development of photography in the last ten years, considering it as an important adjunct to the army in both peace and war. During the Spanish-American and South African wars photography was greatly in evidence, and correspondents fairly besieged every fighting force, carrying with them cameras to take pictures of everything of interest to their papers. So remarkable was this outbreak of war photography that the country was flooded with photographs of the war, some of considerable value and others of little use or interest to any. Nevertheless, the actual photographs of the different scenes of the war published in the illustrated papers furnish a fairly accurate history of the most dramatic events, and readers of the future can look back upon those stirring times and gain a far more correct idea of the conditions of the countries and armies than if no photographs had been taken.

But this sort of photography is very different from that undertaken by the war departments of the various nations for purely military purposes. An immense number of photographs of an official nature were taken and developed during both of these recent wars, and these form a part of the regular reports. The general public seldom see these pictures or their reproductions, and there would be little in them of actual interest to the average reader if published. The pictures consist not so much of dramatic events and battles as of dry details of military roads, bridges, breastworks, and photographs taken of the surrounding country from balloons. They are intended to show the nature of the country in which the battles were fought, and the character of the progress made by the army in its invasion. In other words, these official photographs are supposed to illuminate the reports of the officers, and to verify statements concerning the plans and developments of battles. They take to a certain extent the place of military diagrams, which formerly accompanied official reports.

Military photography thus becomes an important part of a campaign. The pictures show the condition of troops at certain critical moments, their arrangements, the condition of the country, and technical points that cannot be illustrated in any better way. During a campaign through an enemy's country the camera in a balloon helps to unfold matters of great importance to one commanding the invading army. During the South African campaign the British time and again obtained their most correct maps from the photographers who took bird's-eye pictures of the country from the cars of balloons. Telephotography became a science that yielded important results to the British commanders in invading a land so little known and so full of pitfalls.

While the South African and Spanish-American wars brought military photography peculiarly to the front, they were not by any means the first wars in which the camera was employed. Most of the European war departments had official photographers attached to the different armies ten and fifteen years ago. In the Abyssinian war England had a corps of official photographers, who provided the commander with pictures of the country around. These photographers accompanied and preceded the army to take photographs of the country for miles in advance, and the commander was thus enabled to study out his march with more accuracy. As early as 1886 there was a field photographic department attached to the English army which performed excellent work for the surveyors. At the Royal Naval College at Greenwich there was a photographic course which enabled officers to learn the mysteries of photography. Every war vessel carried a complete photographic outfit and a dark-room for developing. Since photography has taken rapid strides in improving the process, the English army and navy have broadened their work in this field, and to-day the corps of photographers connected with both navy and army number several hundred.

Russia did not organize a photographic department for army services until the military balloon came into practical use. Then realizing the importance of taking accurate pictures of the surrounding country from the balloon, a corps of expert photographers was organized in 1884 for co-operation with the balloon sections of the army. Since then the department has increased and broadened rapidly, and to-day photography is an important adjunct to the military educational system. There are some dozen or more officers in the army who are experts in this science, and they are masters of all the details of engineering and military science, so they know how best to photograph the country for technical purposes.

To France probably belongs the credit of using the camera for war purposes in a most satisfactory manner at a time when it was of the utmost importance. When Paris was besieged communication with the outside world was had only by means of balloons and carrier pigeons. The despatches sent by the carrier pigeons were photographed on small films, which could be attached to the feathers of the birds, and in this way a single bird could carry thousands of words. Likewise the aeronauts who hovered over Paris, and made the dangerous voyage through the air across the invading army's lines, used the camera for photographing the different positions of the Prussians. These photographs were the first ever taken of an invading army from a balloon. Profiting by this experience, the French army and navy have not only increased their carrier pigeon and balloon services, but they have made the most of photography. Several hundred officers in the French army are expert photographers, and every engineering corps carries with it complete photographic outfits.

Germany is also foremost in this field of military photography, and all the military schools teach the students how to avail themselves of this art. Every balloon corps carries with it photographers who are able to make perfect reproductions of the surrounding country. Italy organized a photographic corps in 1895. It has half a hundred men in the service, and pictures are constantly taken and exhibited for inspection by officers. The barracks, arms, fortifications, and topography of the country are photographed and sent to headquarters for examination. The Austro-Hungarian army and navy have likewise been provided with experts who understand the art of military photography, and all the naval and military schools emphasize the importance of this study.

Without exception all of the leading nations have adopted the camera as a part of every well-equipped army sent into the field, and to be ready for emergencies in times of war the experts are constantly laboring to make their department the most perfect. The engineering corps and the balloon sections in particular depend a good deal upon photography as an aid to their work. Scarcely a regiment of infantry or cavalry will in the next war go into the field without at least one officer or expert accompanying it to take photographs of important parts of the country.

The modern inventions in photography have naturally greatly facilitated military manipulation of the camera for technical work. The modern improved films are now used instead of plates, owing to their light weight and compactness of form. Magnesium lamps are provided for night photography, which sometimes proves the most important of any in reconnoitering. Special dark-room tents for developing the pictures are also provided, and neat, compact cases for carrying the different chemicals. The modern telephotographic attachments have naturally proved of almost indispensable value to the military photographers. By means of it pictures of the surrounding country can be taken at a balloon height of a thousand or two feet, and, so far as the details of the picture are concerned, they are almost as vivid and accurate as if taken fifty feet away.

The army bicycle corps is generally provided with photographic apparatus, and some of the European armies equip each company of bicyclists with cameras, and even send spices out mounted on wheels to snap pictures of the land. Small cameras are carried on the wheels, and they are intended for obtaining snapshots of the land over which the army is to travel. Incidentally, if any sharpshooter appears in the picture he is easily discovered when the picture is developed. For photographing rivers, mountain gorges, and dangerous trails through a new country by an advance corps of engineers or guides, the camera is decidedly important in its ultimate results, and its future usefulness in this direction will continue to increase. G. E. W.

THE AMOUNT OF WATER USED IN IRRIGATION.

The Office of Experiment Stations, United States Department of Agriculture, has just issued an interesting and valuable report of its irrigation investigations for 1901. It is handsomely illustrated by twenty-five plates and twenty-nine text figures. In it are given the results of the year's measurements and studies of a large number of leading irrigation experts of the arid region, acting under the direction of Elwood Mead, Chief of Irrigation Investigations, among whom are: A. F. Doremus, State Engineer of Utah; D. W. Ross, State Engineer of Idaho; Prof. O. V. P. Stout, of the University of Nebraska; Prof. J. M. Wilson, of the University of California; Prof. O. L. Waller, of Washington; Prof. Samuel Fortier, of Montana; Prof. J. C. Nagle, of College Station, Tex., and W. H. Code, of Arizona, recently appointed Inspector of Irrigation Surveys in the Interior Department, all of whom are resident agents of those investigations in their respective States.

Prof. Mead, in his introduction, speaks of the nature of the work being carried on and the importance of a general knowledge on this subject, for which purpose the bulletin has been written. He speaks of the growing demand for the construction of irrigation work by government aid, and that prior to such construction the government authorities should know how much land can be reclaimed by each proposed enterprise, and that precautions should be taken along this line to prevent mistakes which might seriously retard the development of the West for many years. This is followed by the discussion of the experts above mentioned.

All have made a careful and painstaking investigation and, although they deal with phases of irrigation typical of their own States, the conclusions of all are exceedingly interesting and will be carefully studied by Western farmers and all interested in the development to be inaugurated under national aid.

Mr. D. W. Ross, State Engineer of Idaho, calls attention to the increased duty of water, which is being brought about by a modification of water right contracts. Mr. Ross has given considerable attention to this reform and, owing to his efforts and others connected with this investigation, canal companies are substituting contracts in which the water is measured to the farmer and he pays only for what he uses, in place of the earlier contracts where he was charged for the acres irrigated. In this way the farmer is led to economize because he gets the benefit of his savings. Changes of this kind have increased the need for more accurate methods of measuring water, hence the designing of cheap, efficient water registers has been given much attention by this branch of the department, and a number of new patterns have been invented and are now being furnished to irrigators by some of the leading instrument makers of the country at very reasonable prices.

The duty of water is the leading subject dealt with in all the reports, although each paper discusses the local practice of the region where the measurements were made. These are reviewed in the discussion of the amount of water needed to irrigate an acre of land, by Clarence T. Johnston, Assistant Chief of the Investigations. It shows that the average depth of water being applied to irrigate fields is more than four feet, being 4.35 feet in 1899, 4.15 feet in 1900, and 4.60 feet in 1901. Measurements like these are necessary in order to determine how much land can be irrigated from the reservoirs which the government is to build, and also what will be the value of the water stored in them. Without this information serious errors might be made as they have been made in the past, either because of allowing more water than was needed or in attempting to irrigate too many acres.

The report is in four parts, any of which can be had by applying to the Director of the Office of Experiment Stations, United States Department of Agriculture.