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.