THURSDAY, MAY 17, 1877

SCIENCE AND WAR

RECENT wars have had particular interest for the man of science. If we go back some fifteen or twenty years and consider the different wars which have unfortunately occurred since that time, we shall find connected with each one of them certain features which undoubtedly mark progress in the art of killing and wounding. Some argue—and on very good grounds, no doubt—that the more sharp and terrible warfare is made the more speedily must it come to an end, and hence look with favour upon the means taken every day to render weapons more destructive and the soldier more cunning in his dangerous trade. We do not propose to discuss this argument, nor to enter at all into any comparison between the wars of our forefathers and those of to-day, but at a crisis like the present we need hardly apologise for bringing before our readers some points illustrating the marked influence of science upon modern warfare.

Starting from the close of the Crimean war, the first in which the electric telegraph was employed, we find ample examples of the assistance furnished to the soldier by scientific research. One instance taken from the war of 1858 is especially interesting. The Austrians held Venice at the time, it may be remembered, and to protect the harbour, torpedoes were laid down. The torpedoes were fired by electricity, and contained gun-cotton, this being the first instance on record of the employment of electric torpedoes and of the newly-invented nitro-compounds. Nor was this all. The torpedo-system devised at Venice by the Austrian engineers had yet another point of scientific interest. A camera obscura was built overlooking the harbour, and upon the white table of this instrument were reflected the waters of Venice. As the torpedoes were sunk one by one a sentinel in the camera noted the place of their disappearance with a pencil, giving each torpedo a consecutive number. A row-boat in the harbour described a circle around the sunken torpedo indicating the zone of its destructive power, and the sentinel again, with his pencil, made a corresponding ring upon the camera table. In the end, therefore, while the harbour itself was apparently free from all obstruction, a very effective means of torpedo defence was established, the key of which was only to be found in the camera obscura. The sentinel here had wires in connection with every torpedo, and was in a position to fire any one as soon as he observed—by means of the camera—the presence of a hostile vessel within the limits of any of the circles marked upon his white table.

In the American war of 1860, the electric torpedo, invented but two years before, played a most conspicuous *rôle*, and formed indeed with the use of big guns and monitor ironclads, one of the most important features of the struggle, at any rate from a scientific point of view. The war of 1866, when the Austrians suffered such a terrible defeat at the hands of the Prussians, will long be remembered as a combat between the old muzzle-loading rifle and the breech-loader, in which the latter was victorious. The Franco-German struggle of 1870 again, though marked by the employment of no special arm, if we except the mitrailleuse, was assisted by important applications of science; to wit, the reproduction, by means of photo-lithography of the French ordnance maps and plans, which were distributed in thousands throughout the German army, and the establishment in France of *la poste aérienne* to communicate with the besieged garrison of Paris. The regularity with which the mails left Paris *par ballon monté*, must still be fresh in the memories of our readers, the publication of correspondence from the French capital being maintained in our journals during the whole period of the investment. From September 23 to January 28, when Paris was practically cut off from the rest of the republic, no less than sixty-four balloons left the city with passengers, mails, and pigeons, and of these only three were lost, while five were captured. The return-post by "homing pigeons" was hardly so regular, but nevertheless half the number of despatches given in by correspondents at Tours and elsewhere, or in other words 100,000 messages, were by the unflagging energy of the postal authorities carried into the beleaguered capital. The despatches, most of them as brief as telegrams, were distinctly printed in broad sheets and photographed by the aid of a micro-camera; impressions upon thin transparent films were then taken and rolled in a quill attached to the tail of the winged messenger which was to bear them into Paris. Arrived at their destination, the tiny photographic films were enlarged again by the camera, and the despatches being once more legible, were distributed to the various addresses.

The present Russo-Turkish war cannot well be less interesting than those that have so recently preceded it, and we may especially point out two directions in which fresh examples of scientific warfare will probably manifest themselves—in connection, namely, with the cavalry pioneer and the Whitehead torpedo. Both of these will probably be seen in warfare for the first time, and before many days are past we may hear of their doings in action.

The cavalry pioneer must not be confounded with the Prussian Uhlan who played so conspicuous a part in the last war. The ubiquitous Uhlan, terrible as he was, did not work the injury which some of the Cossacks will have it in their power to inflict if accoutred as pioneers. These are selected from the smartest and most daring troopers, lightly armed and well mounted. In a belt round their waists they carry a few pounds of gun-cotton or dynamite, and with this highly destructive explosive they may work incalculable harm. A small charge of gun-cotton placed simply upon a rail and fired with a fuze suffices to blow several feet of the iron to a distance of many yards, thus rendering the railway unserviceable on the instant. A trooper may dismount, place a charge at the base of a telegraph pole, fire it, and be in his saddle again within sixty seconds. Wires may thus be cut and communication stopped in the heart of an enemy's country by fearless riders, who have but to draw rein for an instant to effect the mischief, while lines of railway in the neighbourhood are entirely at their mercy. Even light bridges and well-built stockades may be thrown down by the violent detonation of compressed gun-cotton, and forest roads considerably obstructed by trees thrown across, which are never so rapidly felled as when a small charge of this explosive is fired at their roots.

The influence of the Whitehead torpedo, of which we have heard so much of late, will likewise be felt for the first time during the present war. An implement so ingenious in its character that, as Lord Charles Beresford the other day happily remarked, it can do almost anything but talk, is in the possession of both belligerents, and will doubtless be heard of ere long on the Danube and in the Black Sea. These torpedoes are manufactured at Fiume on the Mediterranean, and, like Krupp guns, are to be purchased by any one who chooses to pay for them.

The British Government manufactures its own Whitehead torpedoes in this country, having paid several thousands of pounds for the privilege. The machinery inside this torpedo is still a secret, which is strictly maintained by our Government, but the principle of the invention is well known. It is a long cigar-shaped machine measuring a dozen feet and upwards. In the head is a charge of some violent explosive, such as gun-cotton, or dynamite, which explodes as soon as the torpedo strikes an obstacle. The motive power is compressed air, which is forced into the machine by powerful air-pumps, immediately before the torpedo is discharged into the sea, no less than 600 lbs. on the square inch being the pressure exerted. The Whitehead is shot from a tube, and moves through the water as straight as a dart, the compressed air working upon a screw in the tail of the machine. The delicate machinery permits the torpedo to swim at any depth below the surface that may be desirable, and it flies straight in the direction it is aimed, at a speed of something like twenty miles an hour. If it fails to strike the foe, then the intelligent apparatus at once rises to the surface, becoming innocuous as it does so, and may in this condition be captured without difficulty.

A torpedo of this sort striking the sides of an ironclad would almost infallibly send her to the bottom, and although it has been proved that a network or crinoline around the ship is capable of retarding the progress of a "fish" of this nature, and exploding the same harmlessly in its toils, it is obviously a very difficult matter thus to protect one's craft. Against heavy torpedoes, indeed, there seems no way of defence at all (the Whitehead generally carries a charge of 70 lb. or 80 lb., but moored torpedoes may contain a 500 lb. charge), and therefore Turkish vessels will have to give Russian ports a wide berth. All must remember how the magnificent fleet of the French was kept at bay by the torpedoes of the Germans in the North Sea in 1870, and the Black Sea ports are no doubt similarly protected. So demoralising is the dread of the torpedo with sailors apparently, that they will dare anything rather than venture into waters which conceal these cruel foes.

H. BADEN PRITCHARD

THE OWENS COLLEGE UNIVERSITY QUESTION

IN his address on Tuesday last week, at the London University, the Chancellor noticed in dignified and sensible words the proposed application of Owens College to the Government for a Charter of Incorporation as a university, either by itself, or as the centre of a family of northern colleges. Nothing could well have been more unfortunate or ill-judged than the furious onslaught of Mr. Lowe, the member for the University, in the *Fortnightly Review*. The complaint of the Manchester people is that the London system, however suitable in itself, hampers the educational activity and usefulness of institutions capable of an independent existence, and it was scarcely decent for the member for that university to step forward in her interests as a mere partisan of the *status quo*. In fact there is no antagonism. Manchester has never denied that it is a good thing that there should be a university in London to examine all comers. She has said that she thinks it a bad thing for institutions with a sufficient permanent teaching staff, a large enough number of students and a solid establishment in the district to which they belong, to have to shape their work according to the ideas of any central university that must suit all comers. Mr. Lowe is the one member of Parliament who should have held his tongue on the matter till he was forced to speak, because a hasty utterance on his part could not but seem to compromise his University. Lord Granville took pains to remove the injurious impression of an unworthy jealousy in London which Mr. Lowe's article could scarcely fail to create. He tells us that London feels "absolutely no objections of a merely jealous character," and that London would have a "very friendly feeling to any university which, after due deliberation and with a sound regard to the real advantages of education, may hereafter be established." In that wise and sensible attitude it is open to the University to consider either of the two schemes suggested for the northern university. The first of them, which is that favoured by the college authorities, is that Manchester should be created a university much as Glasgow is. According to the views of the supporters of that scheme we should be prepared to multiply our universities as the Scotch have done, by chartering one in any large town where its students and its endowments, its history and its reputation offer equally solid guarantees of permanence. The other is that Manchester should be the capital—*primus inter pares*—of a new northern university on the original affiliation basis from which London has departed. The weakness of the affiliation principle is that it is scarcely in nature that it should not gradually relax, so that colleges should be affiliated on easier and easier conditions till it becomes useless to keep up the farce. But both schemes, the latter of which, indeed, is Dr. Carpenter's, are practicable —both worthy of careful consideration and discussion— and it is pleasant to see that the University of London, through her Chancellor, disavows any settled policy of obstruction.

Lord Granville reminded his hearers of what most people have forgotten—the history of the incorporation of the University. It was a subject of excited debate in this country and in Parliament, for ten years from its first inception. The project was started in 1825. Funds were then raised by subscriptions in 100*l.* shares, and the institution was in activity in 1828. In 1830 an application was made to the Crown for a charter, and the charter as prayed for had gone through nearly all the necessary preliminary stages, when its progress was stayed by the opposition of Oxford and Cambridge. In 1833 the application was renewed, and it was supported by an address to the throne from the City of London. It was opposed