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G. D. MUNN, S. H. WALES, A. E. BEACH.

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To Advertisers.

The circulation of the SCIENTIFIC AMERICAN is from 25,000 to 30,000 copies per week larger than any other journal of the same class in the world. Indeed, there are but few papers whose weekly circulation equals that of the SCIENTIFIC AMERICAN, which establishes the fact now generally well known, that this journal is one of the very best advertising mediums in the country.

IMPROVED WEAPONS IN EUROPEAN WARFARE.

The busy, progressive, unresting brain of the nineteenth century is pressing into its service all the powers of nature for the purpose of ameliorating the condition of mankind. It has made the ocean its highway, electricity its messenger, and fire and water its willing slaves. Chemical and physical forces have been, so far, compelled to bear the burden of the primeval curse that, were it not for the ever-increasing desires and artificial wants of man, it could hardly be said that he is compelled to eat his bread in the sweat of his face. Aside from the pleasure that is experienced in triumphing over difficulties; the sense of power which is felt in subduing the forces of nature, which makes inventing, to a certain class of minds, the most fascinating of pursuits, the pecuniary results of any successful and useful invention, in days when all are making haste to be rich, are so tempting that inventive genius everywhere is called into untiring, ceaseless activity.

Well would it be for the human race, were our civilization sufficiently advanced, so that this inventive genius, almost omnipotent for good, should never be called into play for the purposes of evil. But a power for good is always a power for harm. The same class of brain, which, if benevolently directed, ameliorates, saves, and blesses, may curse, kill, and destroy. The same faculties that have given us the telegraph, the railroad, the steamship, the mower and reaper, the sowing machine, the printing press, the sun picture, in short, devices innumerable for our comfort and happiness, have also given us engines of destruction which more than rival the thunderbolts of heaven, and which are scarcely exceeded by the earthquake and the volcano.

Now, when the vast armies of two of the great European powers stand confronting each other, and the civilized world is awaiting with breathless anxiety the shock which will be felt throughout Christendom, one shudders to contemplate the terrible means of mutual destruction, almost mutual annihilation, in the possession of both parties. Our own recent terrific civil war called into play American inventive genius to an extent and with a success which astonished the world. Artillery of unprecedented range and power, projectiles of apparently irresistible force and unlimited destructiveness, were met by contrivances for defense almost impregnable. Strategy, traditional military method, personal courage, individual prowess, all that had, in former times most largely contributed to the success or defeat of armies, occupied but a secondary place when compared with mechanical ingenuity in constructing appliances of attack or defense.

The Merrimac, which, in her iron armor, could defy and destroy almost our whole wooden navy combined, was disabled by the little nondescript looking Monitor, and, from that moment, the existing navies of the world were obsolete. It was a struggle on the one hand to make irresistible ordnance and projectiles, and on the other to construct impenetrable armor for vessels on the water and impregnable fortifications on land. Shot that almost reminded one of the mountains hurled by the combatants in Milton's war of the celestial powers, glanced harmless from plates of steel, or imbedded themselves in yielding but still obstinate earth-works. And yet, the im-

provements in cannon and their projectiles are really not half so important as modern advances in small arms. The invention of the hollow-based conical bullet so fearfully effective in the Crimea, in the war between Russia and the allies, and which, fired from the Springfield rifled musket, was in most general use in our army, and above all, the introduction and perfection of the breech-loading carbine or rifle, have worked, or are working, as great changes in military operations on land as iron armor has wrought in naval warfare. Napoleon I. is said to have asserted that "Providence was on the side of the heaviest battalions," but in modern warfare, not to speak irreverently, Providence is likely to be, as it was at Sadowa, on the side of the best small arms. In that remarkable and decisive battle, it will be recollected that the Austrians, with their comparatively ineffective weapons, were completely at the mercy of the Prussians, with their fearful needle gun, and, although we have mysterious hints about certain terrible agencies which are to be brought into play in the coming struggle by the wily French Emperor, yet it is altogether probable that the relative efficiency of the small arms of the contending powers will be really the important and most decisive element in the contest.

It is the fearful Chassepot against the terrible Zundnadelgewehr. It is to be the first great contest in which both contending armies are provided with breech-loading weapons. At Sadowa the needle gun, and at Mentana the chassepot wrought unpreceded destruction, but these weapons were not opposed by those of a similar character. In our civil war, only a comparatively small portion of the troops were armed with breech-loaders, and, as we have said, the principal small arm was the Springfield rifled musket, which was confronted on the part of the Confederates by the Enfield rifle, or by a weapon of nearly the same make as ours. But now armies of immense numbers and perfect discipline, wielding the most destructive of all weapons, the breech-loading rifle are to confront and do battle with each other. What is to be the result? It is not possible to foretell. If the battle should be tried, as of old, "man to man and steel to steel," if there is to be anything like "square, stand-up fighting," the result must be speedy victory to one side, or annihilation to both.

On the side of the French, it is said the Mitrailleuses, or les files du commandant, as they have been sportively called, are to play an important part. It is stated, that recently three hundred horses, bought from a "knacker," for a few francs each, for the purpose of the experiment, were killed by two of these weapons in three minutes, and that, subsequently, five hundred horses were destroyed with still greater rapidity. It is quite possible that there may be something sensational about these reports, as with regard to other marvelously destructive devices, the possession of which is darkly shadowed forth by report and rumor as in possession of the French, and to be operated in the coming contest. But about the small arm there can be no doubt. Although, in the opinion of experts, neither the chassepot nor the needle gun is in any way superior, if equal to our best breech-loaders, yet both theory and experiment have demonstrated them to be so murderous in their effects, that protracted open-field fighting between armies provided with these weapons is impossible. It must, as we have said, either terminate speedily or annihilate both. Yet it is questionable whether this will really tend to shorten the war itself. One of the most striking practical results of the use of the breech-loader is the advantage thereby given to the defensive in military operations. The advantage of the initiative, the offensive, the sudden dash, the brilliant charge, is gone, and gone forever, between troops at all equally matched in numbers and morale. With breech-loaders, well-drilled soldiers can load and fire in any position—as well lying flat upon the ground as in any other. The soldier, in working his piece, is not compelled, as with the old muzzle loader, to elevate or expose his arms, and without in the least checking the rapidity or impairing the efficiency of his fire, he can place himself so as to be covered by any slight advantage which the ground may offer; or, if not covered at all, by lying flat upon the ground and only elevating his head sufficiently to sight his piece, he is very little exposed as compared with one who is delivering his fire from a standing position. These points are of immense advantage, not only in skirmishing, but in fighting on the defensive in line of battle. But suppose both parties to fight without cover, to stand up and give and take. The defensive, standing firm, has decidedly the best of it over the offensive, advancing to attack, in steadiness and accuracy, as well as rapidity of fire, and it may be laid down as impossible for any body of troops, no matter how courageous or well disciplined, to advance directly upon and under the fire of a line of battle, armed with breech-loaders, and delivering, at short range, steadily and accurately, ten, eight, or even six discharges per man per minute. But this is not all. A very slight intrenchment, a breastwork such as our troops in the Army of the Potomac used frequently to construct in an hour, suffices completely to cover a line of battle, and to render it, as far as any attack by the front is concerned, invincible. Even with the Springfield or Enfield muzzle-loading rifle and conical bullet, this was nearly the case with the armies of both sides, in our civil war. Two hours' time, with intrenching tools, rendered the defensive as good as an odds of three to two, or two to one. But with the breech-loader, discharged from a rest, under the cover of an intrenchment, and with the steadiness and confidence which troops feel under such circumstances, a very slight intrenchment is, as against troops advancing, and, of course, entirely exposed, absolutely impregnable. It was this, though to a less extent, with our muzzle-loading arms, which rendered many of our most sanguinary conflicts so indecisive. Unless the worsted party was completely routed, and at once, a skillful retreat of a few miles, a judiciously chosen position, and a very few hours' work, and the apparently defeated force

stood like a rock. From all this, it would seem by no means impossible that the destructiveness of modern arms, which would appear, at first, calculated to make the present war in Europe "short, sharp, and decisive," may really prolong the conflict. The saber, the bayonet, the solid assaulting column of infantry, the thundering charge of masses of cavalry can no more succeed against implements of modern warfare, than the spears, the shields, and the solid squares of the old Greek phalanx.

It may take the warring forces a few months to learn fully all the lessons taught by the breech loading rifle, but it seems not impossible that, unless the contest is decided by one or two murderous engagements, as at Sadowa—which is scarcely probable—the result may become more a question of resources and endurance than of brief campaigns and brilliant, decisive battles; that we may see magnificent armies confronting each other, in intrenchments, for weeks and months, neither daring to hazard the attack, and that maneuvering for position, cutting off communications, raids upon bases of supplies, etc., may become the order of the day to even a greater extent than with us during our recent war, and thus the conflict may become much more protracted and less sanguinary than has been anticipated.

THE LAW OF COMPENSATION.

All about us is silently working a law by which all life continues, from the tiniest plant to the loftiest forest tree; from the microscopic animalcule up to man himself. This law may be called the law of compensation.

Farmers in certain sections find their wheat destroyed by weevil, or the plum trees by the curculio. They cease to grow wheat and plums. Years pass, and finally some individual concludes to sow an acre or two of wheat, or plant a plum tree. He is surprised to find the weevil and the curculio gone. His neighbors follow his lead, and soon the wheat and plums are restored to their former favor among the crops profitable to the section. The food of the insects being removed, the insects die. By and by they will gradually creep in again from distant sources, and the same result will be experienced.

The husbandman kills off one scourge only to find that some other as bad as the first multiplies to ruin and desolate. The sparrows brought to New York and Brooklyn could not be kept in the parks until the squirrels were removed. The sparrows have done the service they were expected to perform, and have effectually destroyed the disgusting and destructive caterpillars which infested the trees previous to their importation. Now the number of these brisk little chattering has so increased that they are themselves becoming a nuisance. They roost in large flocks in trees before residences, and cover the walks and fences with filth. It would seem almost necessary to go back to squirrels again in order to diminish the numbers of the sparrows by the destruction of their eggs.

Death is necessary to life. Smellie, in his "Philosophy of Natural History," has attempted to show that the total destruction of any species must ultimately destroy all. The total destruction of life was recently prophesied by an able chemist from the ultimate conversion of all the carbon on earth into carbonate of lime, through natural processes now going on.

It is probable that neither of these authors has taken into account the possible compensations which might prevent the results named. If in the case of the destruction of a species the food of another species were destroyed, and if this latter species could, under impulse of keen hunger, feed upon no other species, and if this were the case with each successive species deprived of food by the destruction of a preceding species, the reasoning would hold good. But such a supposition does violence to our knowledge of the magnificent compensations of nature. The higher we ascend the scale of existence the less we shall find the sustenance of any one species limited to single sources, and the more difficult the conception of its possible extinction. So in the geological changes the earth is destined to undergo, it is quite possible to conceive compensating influences which shall avert the disasters some are fond of predicting. The cycles of nature are so vast, and man in his weakness can see only such a small portion of a cycle, that it seems the height of rashness to attempt the filling out of the portion we cannot see from the comparatively few cosmological data we have been able to grasp.

The law of compensation is, however, capable of being applied to the benefit of mankind. We have seen how the decrease of one species involves the increase as well as decrease of others. When a rival is destroyed, that which fed upon it loses a portion of food; that upon which it fed has one less destroyer.

We are at present in this country overrun with hosts of destructive insects. Not a flower grows, not a single fruit reaches maturity without attack from these voracious hordes. Horticulturists are sorely perplexed to relieve themselves of these ravages. Relief, if it ever comes, will come by a wise recognition of the law of compensation. Before resolving upon the destruction of any race of animals whose numbers have so increased as to become a nuisance, it should first be known what pest will unexpectedly rise in its place, and to what extent its numbers may be reduced without incurring greater damage than is at present sustained. In this way man, acting intelligently instead of blindly, as heretofore, may so reduce the numbers of such insects as dispute with him for food that they will cease to greatly annoy him. This cannot, however, be done without thorough knowledge of insect life, and it is thus that the science of entomology becomes one of paramount importance to the human race.

Few are prepared to believe that insects devour and destroy