

CONTINENTAL CRITICISM OF ENGLISH RIFLE BULLETS.

THE CONVENTION OF 1868 (ST. PETERSBURG).

It appears likely that we in this country may shortly be called upon to come to a decision as to whether or not we are to be content to use in our wars only the same small-arm bullets that other great military Powers are employing.

The weapons with which the foot soldiers of all the civilised Powers are at present provided are a small calibre rifle, a mantled bullet to be fired from it by smokeless powder, and a sword bayonet. Some differences exist between the weapons of the different Powers, but they are so slight that they may be disregarded.

The question that presses on us to-day amounts to this—Shall a change that will render the soldier's rifle bullet more deadly and powerful be permitted or not; and, if so, under what circumstances? Hitherto, with one notable exception, no objection has been made to any Power increasing the deadly nature of its arms. The large weapons and projectiles of the artillery have been made more and more effective by modern inventors, not only without objection, but with general approval; explosive shells of greater size, longer range, and increased destroying power are fired from them; Maxim and Nordenfolt guns, mines, torpedoes, Lyddite shells of tremendous energy, etc., are sanctioned in modern warfare by the general voice of all the nations concerned; and electricity, aerial balloons, and submarine vessels have been talked of and examined into without any expression of remorse by the great military Powers of civilisation.

Even in the small arms for its infantry each State has been free to adopt, without cavil, variations in regard to its bayonet; its rifle may possess a greater range, and its bullet be propelled with increased velocity and energy, and by any explosive powder, smokeless or otherwise, as it sees fit. Those who devote themselves to sport, and have to face savage beasts, have expended their ingenuity freely in perfecting the most deadly projectiles to discharge from their hand-weapons so as to destroy more surely and easily the game which they may be hunting.

Humane individuals have written here and there in vain against the increasing deadliness of modern weapons, large and small, but their desire to arrest the increasing power of our means of offence and defence has only led to the one limitation referred to, namely, that since the St. Petersburg Conference of the Powers held in 1868, explosive bullets from small arms are not employed by civilised nations in their warfare. To many the restriction seemed to be a singular one—that while the most destructive instruments and explosives were to be sanctioned for the killing of mankind, from artillery or otherwise, save only from small arms, a missile that was permissible against a charging tiger, elephant, or buffalo, was to be forbidden against a charging human enemy, however fierce and tiger-like his onset might be. That, however, is the position in which the military Powers are placed at the present time.

THE EFFECT OF THE MANTLED PROJECTILE.

The efficiency of the modern rifle with its mantled projectile has never yet been extensively tested and decided in a great war between any two of the great civilised Powers. They have been used, however, in short wars in various parts of the world—in South America, Greece, the Indian North-West Frontiers, Cuba, Madagascar, Egypt, and elsewhere; but the reports received regarding their powers have not been all to one effect. In nearly all instances where competent persons have described them, as far as they can be ascertained in warfare, they have seemed deadly enough where vital or important parts have been struck, while in non-vital parts, particularly in mere flesh and muscle wounds, the small size of the bullet, the hardness and unyielding nature of its mantle, and the rapidity of its flight, have sometimes caused the wounds inflicted by it to resemble moderately severe punctured wounds that may not seriously disable their recipient, and occasionally, even when numerous, leave him, we may say, almost as efficient for carrying on warfare as he was before he received them.

SOFT-POINTED BULLETS.

England especially has been forced by circumstances to lay these lessons to heart. Her soldiers have found, in fighting with active and brave barbarian foes, that the mantled bullet was sometimes a missile of doubtful efficiency, and she has consequently been led to arm her soldiers, in barbarian contests, with a bullet capable, like the former leaden projectile, of expanding when it struck, and of rendering flesh wounds as disabling as they used to be when the older weapons were used.

For this end her troops have been armed with bullets whose mantle was partly removed at the apex, so that while they retained all or nearly all the power, long range, velocity, and even all or sufficient of the penetration of the fully-mantled bullets, they were more efficient in disabling the enemy when only flesh wounds were produced.

The gain thus obtained seemed, so far as can be judged, no slight one. As an instance of its importance to ourselves it is believed by many that in our recent advance into the Soudan, and at the battle at Omdurman, had our troops been armed only with such small arms as are used by the other European Powers the issue of that campaign might have been different and even adverse to our arms. At the very least it is held that the killed and wounded in our army would have been greatly more numerous.

Hence the use of bullets partly deprived of their mantle, so as to be more effective in flesh wounds, is, it will be apprehended, one of no little importance to ourselves, liable as we are at any time to be engaged in wars with semicivilised or barbarous races who practise no humanity in their warfare and would unhesitatingly employ against us any weapons they might obtain, even the expanding bullets introduced by ourselves, or any other destructive engine with which they might be furnished. If our foes were spared in such a case it would be at the expense of our own soldiers' lives.

So much may be said on behalf of these bullets. The other side of the question must next be shown.

THE DUM-DUM BULLET.

Continental authorities have been directing their attention to the bullets we have been using in our wars; and Professor von Bruns, of Tübingen, as was reported in this JOURNAL,¹ made experiments with bullets resembling the so-called Dum-dum bullet which was used in our Tirah campaign and wars on the north-west frontiers of our Indian Empire. His results were vitiated by the fact that he employed Mäuser big-game bullets, showing a long point of soft lead, while the Dum-dum bullet had its leaden core barely visible at its apex; nevertheless, such as they were, his results were accepted by the Society of German Surgeons, in a meeting at which a large number of their military surgeons were present, and they concurred in von Bruns's conclusion that the German military authorities should take steps to obtain by international agreement such a modification of the St. Petersburg Convention that only such small-bore leaden bullets be employed in war as are wholly steel-mantled, or at least mantled at their tip.

THE WOOLWICH BULLET.

Subsequently to this, in our Soudan campaign against the Khalif Abdullah and in the battle of Omdurman, a different form of bullet was served out to and employed by our troops. It possesses properties similar to the Dum-dum bullet, and is known as the "(Mark IV) C," or Woolwich bullet.

Of these projectiles, described and delineated in his pamphlet as containing an air chamber opening at their apex, and being therefore hollow-fronted or expanding bullets, von Bruns obtained a supply, through a London firm of manufacturers whose name he does not give, and instituted a series of experiments as to their effects. On these he has now reported in a pamphlet entitled *On the Effects of the Most Recent Bullets in Use in the English Army (Hollow-Fronted Bullets)*.²

Experiments on wood, clay, a living horse, and human cadavers, at distances of from 20 to 600 metres, are detailed in his report, and illustrated by photographs and skiagraphs. He

¹ BRITISH MEDICAL JOURNAL, September 17th, 1898, p. 813; Modern Small Bore Bullets.

² Ueber die Wirkung der neuesten englischen Armeegeschosse (Hohlspitzgeschosse). Von Prof Dr. v. Bruns, Tübingen 1899.

arrived at the conclusion that, in a ballistic point of view, these bullets are equal to the fully-mantled bullet, the hollow apex in no wise impeding their flight; indeed, it seems from his figures, which are, however—as he did not possess the fully-mantled English bullets—obtained not from trials but from calculations, that their velocity is even slightly greater than that of the fully-mantled bullet. He further concluded that they lose their shape more readily on striking an object than the fully-mantled, but less readily than bullets with an exposed leaden apex.

When striking at short distances they produce much more severe injuries than the fully-mantled bullet, and enormous destruction in cavities containing liquids, such as the heart and bladder, the bullet expanding and flying into pieces when it strikes such viscera. Compared with the leaden-pointed bullets they produce decidedly less severe injuries of the soft parts (flesh), but equal them in destructive power should they strike upon a bone. As compared with fully-mantled bullets their greater destroying power on soft parts exists up to 400 metres, and up to 600 metres on bone; but beyond these ranges these effects cease, and their wounds are similar to those inflicted by the fully-mantled bullet. In penetrating power they resemble the latter, save when striking any object which destroys their shape, but leaves the fully-mantled bullet unaltered, and then the greater their loss of form is, the less of course is their penetration.

PROFESSOR V. BRUNS'S EXPERIMENTS.

But it will, perhaps, be best to give the translation of von Bruns's own words, selecting the most important passages.

"Our experiments have shown that the hollow-pointed bullet is unusually easily altered in form when fired from short ranges.....In hard and dry substances struck in the usual way, the alteration of form occurs in a regular fashion. The apex is broadened out, its cavity widened, and the mantle tears open in front; the leaden core next emerges and spreads out in front into a mushroom shape, while the posterior part of the mantle is left empty. In the greater degrees of alteration the mantle is torn from point to base by several longitudinal rents, and is at the same time folded backwards to such a degree that it is turned inside out, this going sometimes so far that the front parts of the strips of mantle turn back behind the base for a distance equal to that of the whole length of the original bullet. The leaden core is partly squirted about, and partly kneaded firmly on to the strips of the mantle.

"But the greatest degree of loss of shape of the hollow-pointed bullet occurs when it is fired into moist or fluid materials, which do not alter in any way the shape of the fully-mantled bullet. In all our experiments with moist clay or water, both mantle and core were shattered into small or very minute fragments, even when—to lessen its velocity—the bullet had previously traversed two, three, or four bags of sawdust. This violent effect is to be explained by the fact that on striking the soft or liquid material the column of air enclosed in the cavity of the bullet and the water forced into it attained so high a degree of pressure that the projectile exploded.

"The missile was often found broken across near its anterior end at a point corresponding with the bottom of its air chamber. In such cases the chamber was, as a rule, enlarged conically towards its blind end, and to such an extent that its wall was thinned out to a sharp edge. And clearly the separation of the bullet into two parts was due to the wall of the air chamber being so blown out as to burst.....

"An English fully-mantled bullet, fired from 25 metres distance, will pierce thirty-nine or forty planks of deal each 1 inch thick; the hollow-fronted bullet thirty-seven or thirty-eight. But in beech wood, on the other hand, where the former bullet retains its shape and the latter bullet loses its shape, the fully-mantled bullet at the same range penetrates for 54, the hollow-fronted only for 14 centimetres. The penetration, therefore, where much loss of shape takes place, is lessened to about a third part..... The fully-mantled bullet pierces an evenly cylindrical canal scarcely as wide as the calibre of the missile. The hollow-fronted bullet makes a track, which regularly shows at first a cylindrical and then a conical form, the cylindrical part being on an average 6, the

conical 8 centimetres in length, broadening out as it goes from 8 to 36 millimetres in diameter.....

"The hollow-fronted bullet, when fired into solid substances, is less altered in shape, but if into fluids is much more altered in shape than is the leaden-fronted bullet..... In liquid and semi-liquid substances, such as water and moist clay, the hollow-fronted bullet is so completely broken up that both mantle and core are rent into fragments, some of which are of very small size; while the leaden-fronted projectile is very much broadened out, but retains its continuity, the core being shortened from 30 down to 6 millimetres in length, and the mantle torn into strips and bent backwards towards its base.

"The three forms of bullet, fully-mantled, leaden-pointed, and hollow-fronted, do not show such differences in their effects as the above when fired at short ranges against very resisting objects, such as steel plates. Here the penetration is pretty much alike in all; steel plates of 14 mm. thickness show an indentation 6 or 7 mm. deep, and on the other side a bulge, which may, if the plate be only 12 mm. thick, exhibit cracks and fissures. This result is due to the energy of the bullets, whose relative hardness is of little consequence in comparison with the iron or steel of the plate.....

"Taking up next wounds of the soft parts; they are at short ranges (25 to 50 metres) distinctly more severe if they affect the extremities than those from the fully-mantled bullet, though they do not produce the vast destruction of the leaden points. Exit and entrance wounds are always separate, the former a circular opening of 7 or 8 mm. diameter, the latter a gaping lacerated wound 30, 60, or 90 mm. long. Once or twice the skin had been rent into two to four parallel lacerations, and so was torn into several narrow strips, which were mostly divided across in addition, and so hung in shreds out of the wound. The track of the bullet is always funnel shaped, enlarging towards the exit, and admitting one or two fingers. These are much severer injuries than with fully-mantled bullets, which show, at distances under 100 metres, exit wounds of, on an average, 9, 5, or an extreme of 15 mm. diameter, and a cylindrical track in the muscles of rather more than the bullet's calibre, assuming the funnel shape only when it is very long, and then it is not wider than 25 mm. (v. Coler and Schjerning). The leaden-pointed bullet, on the other hand, often bursts open the track from entrance to exit, leaving a wound 100 to 150 mm. long.

"The bursting effect on the soft parts becomes less at 200 to 400 metres range. There the exit measured once 20 and once 50 mm., but was generally 10 to 15 mm., the track being cylindrical or faintly conical. Tangential shots produce smooth wounds with small entrance and exit apertures. At 600 metres the bursting action on the soft parts disappears, and the wounds are the same as those of the fully-mantled bullet.....

"We see, then, where the velocity is greatest, violent bursting action even in the muscles, but in viscera containing fluid the effect is one so enormous that hitherto it has hardly been paralleled..... The wall of the heart is completely torn throughout its length and breadth, the exit wound gaping for more than a handbreadth, and measuring 23 cm. by 19 cm., and its margins are much ragged and studded with small fragments of the bullet..... In the half-filled bladder of a cadaver also, a small entrance wound and lacerated exit wound 35 mm. long were produced by a shot fired 400 metres away..... This enormous action on the distended heart and the urinary bladder correspond with the results of our experiments on water and moist clay, in which the hollow-fronted bullet burst into fine fragments.

"Next, as to the wounds in bones. At short ranges—25 to 50 metres—the wounds made by hollow-fronted bullets in bones are incomparably more severe than those caused by fully-mantled bullets, and about as severe as those from leaden-pointed projectiles, and the missile is always broken up into small fragments. The extensive lacerations of the soft parts behind the bones are very prominent. While the aperture of entrance in the skin measures generally but 7 to 8 mm. the exit aperture is enormous, measuring 8 to 20 cm. in length and 6 to 15 cm. in breadth. The latter are therefore not mere exits or rents, but defects as large as the hand, with shattered and frayed margins, showing fragments of muscles and tendons hanging out of them. This destruction

of the skin is due to its being burst into two, three, four, or six longitudinal rents, with cross tears between them, so that they are partially projected outwards.....

"The injuries to the bones are not specially marked by an unusual degree of fissuring.....but the splinters are smaller and more numerous, and are hurled along the track of exit and out of its aperture.

"At 200 to 400 metres range hollow-fronted bullets likewise cause decidedly greater injuries of the bones than the fully-mantled, although the difference is somewhat less marked. But the extensive destruction of the soft parts beyond are still distinctive: the exit wounds where the shafts of the bones are struck show a length of 5 cm. to 16 cm., and a breadth of 3 cm. to 11 cm. The exit wounds are no mere burst wounds but broad defects.....The area of comminution behind the bone, of the size of a walnut, hen's egg, or a goose's egg, extends generally to the very aperture of exit.

"The splintering of the bones in shaft fractures is as extensive as at short ranges, though the fragments are less numerous, and remain in partial connection with their periosteum.....The missile is always broken up into fragments in the injuries of the shafts.....

"At a range of 600 metres hardly any of the special effects of the hollow-fronted bullets can be observed. Only where the shafts are struck and the projectile broken up, is the exit aperture in the skin sometimes found as long as 5 cm. The area of comminution may be as large as a hen's egg, but does not reach so far as the exit in the skin. We noted, however, a number of minor injuries of the bones, such as are regularly produced by the fully-mantled bullet at still longer ranges."

OBSERVATIONS ON PROFESSOR V. BRUNS'S EXPERIMENTS.

These quotations represent von Bruns's views. But we must again emphasise the fact that whenever he mentions Dum-dum or leaden-pointed bullets, or where we have done so in commenting on his paper, the words really refer only to the sporting Mauser lead-pointed bullet, a very different missile from the real Dum-dum. As was shown in this JOURNAL,³ he has never experimented with the leaden-pointed bullet used by the British troops.

One interesting point in his paper is his mention of the recent introduction of a new model of fully-mantled bullets capped with a thimble of lead upon the apex. He does not state, and the writer does not know, where or by whom these have been manufactured, but they are presumably of German or Continental origin.

In the concluding paragraph of his present pamphlet, von Bruns speaks of his writings as having aroused a feeling of animosity in the English newspapers. We believe we can assure him that no such feeling exists, or if it does, that it is limited to a very few. We in this country, even where we cannot entirely agree with him, are, on the contrary, indebted to him for the observations and evidence he has contributed to this most interesting subject. But many of our campaigns are necessarily conducted under conditions so different from those which Germany, for example, is called upon to face, or can understand, that we must be careful lest we be led, by a false philanthropy, in such a matter to adopt suggestions that may prove most unjust and even inhumane to our own troops in their wars against desperate enemies devoid of all humanity. But we ought to say that if von Bruns in his writings will avoid such phrases as the following:⁴ "It is principally the hard mantle which makes the injuries of the arms of small calibre less barbarous, actually indeed even too little barbarous for the English military authorities;" he will do something to avoid arousing the feeling of animosity on which he animadverts, and towards helping the medical profession and the public to discuss and settle the whole question in that spirit of humanity and justice which it conspicuously demands.

PROFESSOR ESMARCH'S APPEAL.

Von Bruns's observations have naturally excited much interest, and his earlier work on leaden-pointed projectiles has evoked from Professor Friedrich von Esmarch of Kiel—well known to the medical profession in our own country as one of the greatest and most magnanimous of the Continental surgeons, and one who is by no means to be suspected of un-

friendliness towards England—an appeal which we give in a somewhat abbreviated translation as follows. It is addressed to the Editor of the *German Review*,⁵ and dated Kiel, December 10th, 1898:

"An international Conference of Peace will shortly be summoned at the suggestion of His Majesty the Emperor of Russia. According to the concluding words of the Imperial memorial of August 24th, 1898, 'this Conference should by the blessing of God be a favourable omen for the coming century. It should unite in one powerful combination the efforts of all the States that are honestly concerned about it towards the triumph of the principle of universal peace over the elements of disturbance and disorder. It should stamp its assembling with a unanimous consecration of the principles of right and justice, on which rest the security of States and the well-being of peoples.'

"The future will show how far the noble intentions of the Russian Emperor, to which His Majesty our Most Gracious Kaiser has given his most hearty adherence, are capable of being realised. No one, of course, expects or hopes that there is any immediate prospect of wars being put an end to. The opposition of different nationalities to one another is still too great for this, as well as the supposed or actually conflicting interests of different peoples. Sooner or later we are likely to see war again, with the horrors, suffering, and misery that inevitably follow in its train.

"Meanwhile, the philanthropist must remain content to be for ever striving to diminish, as far as may be, at any rate, the barbarities of warfare..... It is our duty as medical men to take the lead of others in entering our protest in the name of humanity when arms or projectiles are introduced into use that go beyond their necessary object of disabling a foe, and mutilate him as well. There is considerable reason to fear that this last is what will take place owing to the introduction of the new military rifles. The small-bore weapons that have now been adopted by almost all European nations possess a very high initial velocity (640 metres). Their projectile is a leaden bullet covered with a mantle of hard metal. In employing such projectiles their power of penetration is found to be very considerable. At a range of 3,000 metres they are capable of traversing three or four human bodies one after the other. But it is otherwise if the metal mantle be removed from the point. In that case the very great energy (*vis viva*) co-operates with the loss of shape of the small-bore, leaden-pointed bullet, to produce a fearful explosive effect (*Sprengwirkung*) in the hard, and especially in the soft, tissues of the body. Bullets of this kind, the so-called Dum-dum bullets..... have been employed by the English troops in their Chitral campaign against the tribes on the Indian frontiers, and gave rise to 'truly barbarous wounds,' so that these missiles would, the English surgeon, Davis, thinks, 'most probably not be permitted in any European war.' Before they were made use of the English soldiers are believed to have found that many of their antagonists, after being pierced through by fully-mantled bullets, were still able to continue their onset. And, according to Hamilton, similar projectiles have been produced in Egypt.

"In consequence of these reports, Professor Bruns, in Tübingen, instituted a numerous series of experiments on dead bodies with the leaden-pointed bullet, and the injuries produced in this way exceeded the worst anticipations. Bruns found," and so on.

"It is perfectly evident that conservative surgery, which has in the last fifty years achieved such good results in gunshot wounds, must be quite powerless in the presence of such injuries. There would be no help for it but to amputate the limbs of such of the wounded as had not bled to death from the extensive wounds of the soft parts.

"Bruns draws attention to the fact that the energy of the leaden-pointed projectiles is all expended on the object struck, in consequence of the alteration of shape and breaking up of the bullet, that consequently their penetrating power is much inferior to that of the fully-mantled bullets," and so on.

"The employment of such missiles is, perhaps, excusable in a war with fanatical barbarians, who, ignorant of the rules of international law, give and take no quarter, and who, as lately happened in Egypt, though lying wounded and helpless

³ BRITISH MEDICAL JOURNAL, September 17th, 1898

⁴ Pamphlet, page 28.

⁵ Offenes Sendschreiben, *Deutsche Revue*, January, 1899. p. 103.

on the ground, yet assailed their enemies when their backs were turned; but it would be a matter for the deepest regret were barbarous engines of destruction ever to come into use in European wars.

"It may occasionally happen that a soldier struck by a mantled bullet may nevertheless rush onwards in his charge; while, if he had been hit by a leaden-pointed bullet he would have been sure to collapse. Such instances cannot justify the substitution for a bullet designed to disable a foe, and nearly always doing it, of another which, as a rule, mangles him. Such a procedure would be in no harmony with the traditions of this century, which has done so much more than all former centuries in the contest between humanitarian tendencies and the horrors of war.

"Once already in 1868 has an international conference meeting in St. Petersburg done honour to humanity by forbidding by international agreement the use of explosive missiles under 400 grams of weight; and this agreement has been kept inviolate by the nations concerned in it.

"Should the Peace Conference of 1899 decide by international agreement that only such small-bore leaden bullets shall be used as are provided everywhere, or at least on their points, with a mantle of hard metal, such a decision would be, we think, in entire harmony with the high motives of its august convener, and with the unanimous sympathy the Czar's ideas have met with in all the civilised world. And if the representatives of the Powers, great and small, in whose hands the matter lies, will use their influence, so that every wounded soldier shall at once have a protective dressing applied, if they will further use their influence in having the inviolability of the Red Cross deeply impressed on the heart and mind of every soldier, then the conference of 1899, though it may not result in entirely putting an end to war, will notwithstanding occupy an important place in the history of the humanitarian efforts that mankind is making."

We must all sympathise with the generous letter of Professor von Esmarch, and no one can do so more deeply and sincerely than the writer. Yet those who have to interest themselves in the evolution of this question and its true bearings must not conceal from themselves the fact that von Esmarch's appeal, so far as it refers to bullets, was evoked by von Bruns's first paper, which itself proceeded on the unproved assumption that big game Mauser bullets were the same thing as the English Dum-dum bullets, and had von Esmarch known that this was so, in all probability his appeal would not have been written, at least not yet.

Under present circumstances it will be no surprise to Englishmen that the French press should lay hold of von Bruns's publications; that *La Semaine Médicale*, for instance, should (January 18th, 1899) discuss the subject of the hollow-pointed bullet as it had previously done the Dum-dum, and draw attention to his results. Its article is a sharp criticism of the application of "two principles of philanthropy, two weights, and two measures, one applied to civilised peoples, the other to barbarian races and distant countries." The English, it says, have closed their ears to the protests raised against the Dum-dum bullet, and made use in the Soudan war of a projectile whose effects are often more murderous still, an explosive bullet called the hollow-pointed bullet, which bursts into a thousand fragments that pierce and destroy the tissues all around; and in the wars with the more or less barbarous hordes, where the combat takes place at short ranges, produces its maximum murderous effect, leaving the enemy so cut up that surgery is powerless to attenuate the gravity of its wounds. But as the criticism furnishes no new facts, or practical ideas we need not further advert to it.

THE CZAR'S MANIFESTO.

The proposals of the Emperor of Russia on the subject of the intended conference against armaments, which reached this country in January last, contain a paragraph that will not improbably be held to include the consideration of the bullets of newer type, its words being "to interdict the use of any kind of new weapon or explosive, or any new powder more powerful than that which is in use at present for rifles and cannon." The appeal of Professor von Esmarch, as well as the approval of the Congress of German Surgeons of the proposal of von Bruns, in his observations on leaden-pointed bullets, to the effect that the German military authorities

take steps to exclude from use in war all small-bore projectiles that are not entirely, or at least at their apex, covered with a mantle of hard metal, in April of last year, are almost certain to bring the subject under the consideration of the conference.

FURTHER EXPERIMENTS NECESSARY.

It is much to be wished that the fullest consideration of the question should be given to the matter in our own country before any final resolution on the subject be come to, and any surgical expression of opinion will have its weight. The researches of von Coler and Schjerning, which von Bruns considers conclusive as to the comparative effects of fully-mantled bullets, are not known in this country, at least the writer of this article does not know them. But he has experimented with all the bullets in question, and though he is not at present at liberty to publish his results, and some time must elapse ere they are so complete that he can do so, he may say that he is not disposed entirely to agree with von Bruns's statements; and the published experiments of the anonymous writer signing himself D***⁶ may be now adduced as tending to cast doubt on the great difference which von Bruns has noted between the fully-mantled bullets and its partly-mantled modifications.

FRENCH EXPERIENCE AND EXPERIMENTS.

"D***" commences by saying that the destructive power of the new small arms having been called in question, he found it desirable to ascertain whether the small-bore rifle is in reality a weapon that possesses the alleged defects. He cites the alleged failure of the fully-mantled projectiles to arrest the onset of the enemy in the French war in Dahomey, in the English Chitral campaign, and the Italian contest with King Menelik in Abyssinia, in all of which it had been stated to occur, and adds to these that many newspapers and pamphlets had maintained that the same thing had been observed in the conquest of Madagascar by the French, but that from the fighting going on in Tonkin no such adverse reports had been received. He quotes the testimony of officers as to the destructive effects of the small mantled bullet, and recalls instances where, with older forms of projectiles, soldiers have continued to fight even after the receipt of several wounds, and points out that a battle field is not the place where the real efficiency of the bullets can be best ascertained. Then follow his experiments. He found that mantled bullets, fired against moist clay, caused fusiform or spherical tracks, smaller—4 to 7 cm. broad—where the bullet does not break up, and larger—10 to 18, or even 22 or 30—where it does. He found the bullets remained unbroken at the short ranges, 140 and 189 metres, the velocity being 2,500 and 2,000 metres per second respectively; while they were broken up at 316, 404, 541, 578, 646, 678, and 768 metres range, the bullet's velocities being respectively 860, 400, 260, 200, 160, 80, and 25 metre seconds.

Experiments on horses showed that at 50 metres range the orifices of exit were at least three times the size of those of entrance; that in traversing a muscle or viscus great damage was done, the muscle being rent into small pieces, and the viscera into flaps; and that on striking bones the ball produced chiefly radiating fractures. A horse's heart, struck by a ball, showed an opening 4 cm. large; the lung was reduced to pulp along a track 8 cm. broad; a stomach wound was 10 c.m. by 12 c.m., and its contents had escaped into the abdomen. One bullet striking the horse's trochanter reduced it to a pulp; and another, which struck it in the face and passed below the brain, had rent the cranium so that brain substance was found in the pharynx. A ball fired against the cranium burst it open and pulverised the brain. A ball fired at 140 metres range, with 2,500 metre-seconds velocity, entering the shoulder above the olecranon made an aperture so small as to look like one made by the point of a cautery, and so small as not to allow the escape of any liquid, but led to a muscular track where the muscles were torn, broken up, and infiltrated with blood; it then passed through and tore the heart, and finally emerged behind the opposite shoulder by an exit larger than its entrance.

In fact the lesions detailed by "D***" read like those of von Bruns in his experiments on leaden-pointed and hollow-

⁶ *Les Armes de Petit Calibre et leur Puissance Meurtrière*. Par le Commandant D***. Paris: Baudoin. 1898.

pointed bullets, or even worse, as where both liver and stomach were extensively rent, and the latter opened, by the passage of the ball in their vicinity, without directly piercing either the one or the other; and they show the necessity of our obtaining fuller information from different quarters, and of weighing it well before coming to a final decision on this important question.

THE PURPOSE OF THE MANTLE.

It ought not to be kept out of sight that it was no humane intention or design of lessening the injuries from modern bullets that led to the mantle being used to cover them. This was added merely to prevent their stripping in the grooves of the barrel from the force and velocity with which they were propelled through it. And as the mantle and core do not form one solid piece, but are separate and possess different energies, so that on striking an object they strive to become dissociated, the effect is that in bullets whose mantle completely covers them in front the lead is forced towards the apex, and will burst if it be thin or break upon a hard body; while in a hollow-fronted bullet striking a liquid the front pressure often tends to force the lead in the opposite direction—namely, out at the rear of the mantle; and as, further, the mantle used in all bullets be incomplete at some part, before or behind, the disintegration of bullets must tend to occur in every such bullet with such initial velocity. An international agreement such as von Bruns suggests would not have the result of rendering the new bullets as humane as the older leaden ones whose velocity was comparatively low. It may be doubted indeed if it would settle the question in any way, for so long as the core and mantle are separate and the core is the heavier, a thinning of the mantle at the apex, while meeting the requirements von Bruns would impose, would yet, if carried sufficiently far, reduce the mantle's power of resisting internal pressure, and leave the bullets equivalent to those whose apex was not mantled at all. To render all European nations equal, an international agreement as to the thickness and tenacity of the mantle, especially at the apex, would have to be come to.

THE COMPLEXITY OF THE QUESTIONS TO BE SETTLED.

The questions concerning modern small-arm bullets are indeed of no simple nature, such as was that of explosive or non-explosive bullets in 1868. If we are to condemn the hollow-fronted and Dum-dum bullets in war, we ought logically to condemn all the modern mantled bullets of small calibre as well, and return to our former larger bores and black powder cartridges that gave a low initial velocity.

Owing to such considerations the subject is, in spite of von Bruns's researches, not yet, in the opinion of the writer, ripe for a decision, and further evidence must be awaited regarding it before it is so. And the demand that is made upon us must be made more precise. As it is at present formulated by von Bruns and homologated by the Society of German Surgeons, it stands that the bullets we use shall be declared inadmissible in any war. Does it follow that change of circumstances does not, in regard to bullets, alter the case? That what is unreasonable in contending with a civilised foe who gives quarter and cares for the lives of wounded, sick, and disabled men, is also unreasonable when dealing with those who, if successful, wage a war of annihilation, and despatch armed and unarmed, wounded, sick, men, women, and children alike, whether on the battle field or in cold blood, and whether they be overpowered in war or captured by stratagem or treachery?

These are some of the questions we ought to consider and be prepared to answer, since upon our reply to them may depend, for instance, whether it will be possible for our soldiers to avert an impending disaster that will entail their annihilation, or even, it may be, lead to English men and women falling human sacrifices to some African Ju-ju, in some African city of blood, by the use of small-arm projectiles more efficient than they would employ against a civilised nation, kindred, perhaps, to ourselves in blood.

THE UNITED STATES NAVY RIFLE, AND THE INJURIES IT PRODUCES.

An interesting paper on the navy rifle now in use in the United States appears in the January number of the Boston

Medical Society's journal,⁶ from the pen of Mr. Henry G. Beyer.

The navy of the United States has recently been furnished with a new small-bore rifle and projectile of special character, and Mr. Beyer's paper deals with the effects it is capable of producing. He says:

The United States navy rifle, M. 1895, is known as the Lee straight pull rifle, and is a rapid-fire and repeating arm rather than a magazine gun. It may be used as a single loader if the magazine be not charged, but in general it will be used as a repeater, five cartridges in a clip being entered in the magazine, and the gun not reloaded until this charge is exhausted. In case loose ammunition is furnished, the magazine may be charged with single cartridges, any number from one to five being entered. The original bullet was made of hardened lead (95 per cent. lead and 5 per cent. antimony), with a jacket of a material known as cupronickled steel. It was steel-plated, with an alloy of copper and nickel. The weight of the bullet was 135 grains. In March, 1897, a change was made in the bullet, bringing the weight down to 112 grains, substituting a copper jacket, tinned, in place of the steel jacket covered with an alloy of copper and nickel, thus raising the velocity from 2,460 to 2,560 feet per second, thereby, however, also increasing its liability to deformity.

The diameter of the rifle is 6 mm.

Mr. Beyer tested the effects of the rifle against plates of lead, india rubber, chrome steel, and glass; against tin cans filled with air, water, marbles, or dry plaster of paris; and against canvas bags filled with oakum tightly packed, or with oakum compressed very tightly by means of a screw jack. The range was 5 feet from the muzzle in every case save the chrome steel plate 7 mm. thick, where it was 50 yards, but he varied the muzzle velocity of the projectile by alterations of the charge of the explosive, and paper screens were hung up before and behind the objects fired at. With the full velocity the lead perforations showed exits larger than entrances, and the bullet and mantle were broken up. With 1,500 foot-seconds velocity the exit was smaller than the entrance, the mantle and bullet were broken up; with 750 foot-seconds velocity the bullet and mantle were still broken up, though the force had failed to produce perforation of the lead. In every case the lead was 3 cm. thick. The empty tins and those filled with water showed the usual well-known results, the former being merely perforated, the latter burst by hydraulic action.

The cans filled with marbles showed the marbles driven in all directions, some even perforating towards the shooter, and the tins rent from the centrifugal dispersal of the marbles like the rents of hydraulic force.

The plaster of paris arrested the flattened bullet after penetrating for 14 cm., and the top of the tin was blown off, though the tin vessel was not bulged out of shape.

Mr. Beyer speaks of the impact on the chrome steel having melted particles of the bullet, but his conclusions on this point may be perhaps doubted. At least in similar experiments of my own, where the heat generated on impact had been so great as to vastly augment the plasticity of the lead, high powers of the microscope always showed the lead particles irregular, but not fused, and Mr. Beyer had merely judged from their impressions on screens and targets. The screens in front and behind showed that particles flew off with force in both directions from the impact. The bullets were rent and altered in shape on striking the cans filled with water.

A second series of experiments by Mr. Beyer on flesh and bone yielded interesting results. A shot of full velocity at 10 feet range pulverised the brain of an ox, broke up the cranium, and rent the bullet and its mantle into pieces. But a similar wound of a young calf with 1,484 foot-seconds velocity, at 5 feet range, made a smooth track through the imperfectly ossified bones and the brain, the bullet seeming to have retained its shape.

Wounds of inflated lungs, livers, and kidneys of pigs, cows, and bullocks, caused extensive wounds of the last two with full velocity, and smaller wounds or mere tracks with 1,000 foot-seconds velocity.

A full-velocity shot at a bullock's heart, 5 feet range, tore an extensive wound of 3½ by 2 cm., and an exit which is described as an irregular large-sized hole, exposing freely the inner cavities, carrying away part of the septum, and tearing part of the heart into shreds. A 1,163 foot-seconds velocity on a contracted calf's heart made a clean perforation of the organ.

⁶ Observations on the Effects Produced by the 6-mm. Rifle and Projectile. An Experimental Study. By Henry G. Beyer. *Journal of the Boston Society of Medical Sciences.* Boston (Mass.), January, 1899, p. 117.

The inflated lungs showed clean perforations with both full and 1,000 foot-seconds velocity, only in the former the entrance track and exit were respectively 15, 15, and 20 mm., while in the latter they were smaller than the bullet. Mr. Beyer says of these experiments on crania and viscera:

The high degree of explosive effect produced by the highest-velocity bullets becomes less as the velocity decreases, and ceases altogether when the velocity has reached 1,000 feet per second. We may therefore conclude that the limit for the production of explosive effect on viscera by our bullet.....will probably be found to lie near a point corresponding to a distance of 1,000 yards from the muzzle of a gun fired with full charges of ammunition.

Mr. Beyer's further experiments on bones and joints gave similar results to the above. With full velocity and at near ranges the bullets produced injuries of much greater diameter than the bullet, the bones being broken into powder and small fragments, and the bullets disintegrated, even on passing through the thin plate of the ilium; and it was not till very low velocities—750 foot-seconds—were used that a clean perforation and undeformed bullet were obtained in wounds passing through this region, "even in flat bones in which clean perforative injuries with hard-jacketed bullets are the rule even with the highest velocities, with our bullet these are obtained only with the lowest velocities," are the words in which he sums up this section. And in concluding his paper, he says:

From the accounts of the injuries on bones, we find that the injuries produced by the highest velocities are simply terrible, and those produced by the lowest far from benign.....It may be assumed, with a fair show of reason, that such injuries as will probably be produced in the human subject by our projectile will influence the methods of treatment both in the rear of the fighting line and in the hospitals afterwards, in that they will require the treatment laid down for "near shots" (*Nahschüsse*)—that is to say, they must from the very beginning be treated as infected injuries. Owing to the further fact that the projectile often goes to pieces, portions of its copper jacket and of its lead lining the track, we may reasonably expect that amputations will have to be done more frequently, and that the percentage of mortality will be higher, no matter how well equipped the hospital nor how skilful and experienced the surgeon.

I have contended that the whole question of modern bullet wounds is far more complex and less perfectly known than the advocates of an international agreement excluding the bullets used by the English troops in India and the Sudan would have us believe. Mr. Beyer's paper strongly points in the same direction. He shows a fully-mantled bullet acting on soft parts and viscera containing liquid in the very way which these writers contend is almost peculiar to our "Dum-dum" and "(Mark 4) c" bullets. A reduction of the strength of the mantle, if pushed far enough, will render the projectile even more liable to disintegrate, or explode as it has been called, than an opening or hollow in its apex. The truth is that the tendency to breaking up of the bullet, or to its producing hydraulic destruction in liquid or semiliquid structures, is inseparable from high velocities, and all bullets so propelled will produce what are called "explosive effects," though some of them are more ready to do so than others.

ALEX. OGSTON.

INDIAN METROPOLITAN HOSPITALS.

THE medical institutions of the Presidency towns of Calcutta, Madras, and Bombay are larger, better officered and equipped, and more specialised than the urban and rural hospitals and dispensaries scattered throughout the provinces. The more important of them are affiliated with medical colleges and schools for purposes of clinical instruction. They possess the advantages of the ministry of professors, teachers, students, and nurses, and work to the highest attainable standard. The patients and diseases treated are much the same in class and kind as in provincial hospitals. The slums of great cities supply, however, less favourable material than is drawn from country towns and villages, and the reputation established by some metropolitan hospitals attracts a larger proportion of more serious cases from a wider area, especially on the surgical side. The returns of operations, therefore, present a greater number of the more rare and important procedures demanding special skill, experience, and appliances. These institutions are the subject of separate reports in the three Presidencies. The following brief notes refer to the transactions of the year 1897:

Calcutta.—The report, submitted by Surgeon-Colonel T. H. Hendley, C.I.E., embraces 15 institutions situated in Calcutta and its suburbs—8 general hospitals, 1 for eye diseases, 2 for females, 1 police hospital, and 3 dispensaries. The year was an unhealthy one, on account of the scarcity

and high price of food, and numbers of destitute sick and famished persons flocked into the city. The death-rate of Calcutta was 36.1 per 1,000, which is a very high figure and seldom equalled in the past. There was a decrease in deaths from cholera, and an increase in small-pox, fever, bowel complaints and "other causes." The number of indoor patients was 23,955, and of the outdoor 206,806, being an increase of 3,308 and 2,012 as compared with 1896. The death-rate among indoor patients was 16.4 per cent., the highest in eleven years. The proportion of men, women, and children treated were 64.28, 19.67, and 16.05. There was an increase in the number of cases of small-pox treated, and the death-rate was higher. Fewer cases of cholera were admitted, but the disease was more fatal. Both dysentery and diarrhoea gave larger admission figures and a higher case mortality, and though the number of cases of malarious fever treated were fewer, the proportion of deaths was greater. These facts disclose an insalubrious year and diminished vital resistance. Surgical operations were more numerous, and include 87 amputations with 13 deaths, 13 ovariectomies with 2 deaths, 60 laparotomies with 21 deaths, 79 operations for hernia with 17 deaths, 84 liver abscesses with 20 deaths, and a goodly array of other important cases. The cost of these institutions was Rs. 763,447, of which Government contributed Rs. 518,580. The invested capital amounts to Rs. 592,700.

Madras.—The report, which is clear and concise, and much shorter than its predecessor, is submitted by Surgeon-General C. Sibthorp, C.B., F.R.C.P.I. It includes 14 institutions—3 general hospitals, 3 for females only, 1 ophthalmic, 1 leper, 1 voluntary venereal, and 5 dispensaries. The year was a healthy one, the death-rate of the town being 35.5 per 1,000—under the average of previous years. There was a slight excess of cholera and small-pox deaths, but a decline in fever, bowel complaints, and "other causes." The number of patients treated indoor was 18,908, and outdoor 198,809—an increase of 1,303 and 12,566 respectively. The death-rate among indoor patients was 6.05 per cent. of treated, a high figure which is not satisfactorily explained. The percentages of men, women, and children treated were 48, 34, and 18. The chief diseases were malarial fevers, worms, rheumatism, bowel complaints, venereal diseases, and affections of the skin, chest, ear and eye. There was a fall in the number of female venereal cases both in the special and general hospitals, which Surgeon-General Sibthorp is unable to explain. There was an increase in the number of surgical operations, which include 50 amputations with 6 deaths, 8 hernia operations with 6 deaths, 17 ovariectomies with 2 deaths, 42 laparotomies with 14 deaths, and 21 openings of liver abscess with 11 deaths. The long list of operations done in the Government Maternity Hospital is specially noteworthy. The expenditure of all the hospitals amounted to Rs. 421,226, of which Government contributed Rs. 320,509; invested capital Rs. 119,510. A case of plague, imported in the person of a native groom who came from Bombay to attend the Guindy races, was treated in the General Hospital. The case died and was examined *post mortem*. The resident medical officer and a *toly* who assisted him contracted the disease. The latter died. Precautions were adopted, and no further cases occurred.

Bombay.—Surgeon-Major-General G. Bainbridge, M.D., who submits the report, did not take charge till towards the close of the year, and being subsequently occupied with plague duties was unable to obtain personal knowledge of the 11 hospitals included in it. The report is therefore mainly arithmetical, and the local government does not comment on it. Of the 11 institutions 3 are general, 2 for females, 1 ophthalmic, 1 leper, 1 police, 1 school, and 2 dispensaries. The number of patients treated indoor was 15,178, and outdoor 56,564, a decline of 1,055 and 28,584 in 1896. The death-rate among indoor patients was 13.7 per cent. against 10.6 in the previous year. No explanation is given of these unfavourable results. The proportion per cent. of men, women, and children were 57, 25, and 18. The cases of cholera and small-pox treated were few, and there was a marked reduction in the number of cases of venereal diseases treated. In other respects the returns of diseases present no peculiarity. There was a striking reduction in the number of surgical operations performed, but this is explained by the elimination of trivial cases. The list, however, includes a large amount of important and successful work, including 57 amputations with 12 deaths, 28 hernia operations with 10 deaths, 2 ovariectomies with 1 death, 20 laparotomies with 11 deaths, 74 liver abscesses with 41 deaths. The total expenditure of these hospitals amounted to Rs. 411,983, of which Government contributed Rs. 282,067; invested capital is represented by Rs. 21,500, held by the Jehangir Nasarvanji Wadia Dispensary.

VACCINATION CERTIFICATES IN SOUTH UIST.

At the Inverness Sheriff Court on March 15th Mr. John Lamont, Licentiate of the Royal Colleges of Physicians and Surgeons, Edinburgh, and the Faculty of Physicians and Surgeons, Glasgow, was charged before the Sheriff and a jury with having during 1897 and 1898, in the island of South Uist fabricated 16 vaccination certificates by setting forth that he had successfully vaccinated 16 children in the parish, while the fact was that he had not done so. At the end of a trial lasting eight hours the jury retired, and after the lapse of three minutes returned a verdict of "Not Guilty," which was received in court with loud and prolonged cheering. In this respect the decision must be thoroughly satisfactory to Mr. Lamont, but the proceedings themselves suggest comment in two directions.

In the first place, as regards vaccination certificates, it seems that in some sparsely populated Highland districts, what with long journeys and bad weather and insufficiency of medical men, some looseness of practice has developed. Instead of the vaccinator paying a second visit to his cases after the usual interval he may occasionally certify the