

compared with the great advantages which the provision of a thoroughly efficient smokeless powder may secure to the possessor of it, especially in naval warfare.

That the opinions respecting the importance of such advantages are founded upon a sound basis, one can hardly doubt, after the views expressed by several of the highest military and naval authorities, although opinions as to their extent may differ very considerably even among such authorities.

The accounts furnished from time to time from official and private sources of the effects observed, at some considerable distance, by witnesses of practice with the smokeless powders successively adopted in France, have doubtless been regarded by military authorities as warranting the belief that the employment of such powders must effect a great revolution in the conduct of campaigns. Not only have the absence of smoke and flame been dwelt upon as important factors in such a revolution, but the recorders of the achievements of smokeless powder—whose descriptions have doubtless been to some extent influenced by the vivid pictures already presented to them of what they *should* anticipate—have even been led to make such explicit assertions as to the *noiselessness* of these powders, that high military authorities have actually been thereby misled to portray, by vivid word-painting, the contrast between the battles of the future and the past;—to imagine the terrific din caused by the discharge of several hundred field-guns and the roar of musketry in the great battles of the past, giving place to noise so slight that distant troops will no longer receive indications where their comrades are engaged, while sentries and advanced posts will no longer be able to warn the main body of the approach of an enemy by the discharge of their rifles, and that battles might possibly be raging within a few miles of columns on the march without the fact becoming at once apparent to them.

It is somewhat difficult to conceive that, in these comparatively enlightened days—an acquaintance with the first principles of physical science having for many years past constituted a preliminary condition of admission to the training establishments of the future warrior—the physical impossibility of such fairy tales as appear to be considered necessary in France for the delusion of the ordinary public, would not at once have been obvious. Yet, even in professional publications in Germany, where we are led to expect that the judgment of experts would be comparatively unlikely to be led astray through lack of scientific knowledge, we have, during the earlier part of last year, read, in articles upon the influence of smokeless powder upon the art of war (based evidently upon the reports received from France), such passages as these:—"The art of war gains in no way as far as simplicity is concerned; on the contrary, it appears to us that the absence of so important a mechanical means of help as *noise* and smoke were to the commander, requires increased skill and circumspection in addition to the qualities demanded by a general. . . ." "The course of a fight will certainly be mysterious, on account of the *relative stillness* with which it will be carried on."

In an amusing article, in imitation of the account of the Battle of Dorking, which appeared in the *Deutsche Heeres Zeitung* of April last, the consternation is described with which a battalion receives the information from a wounded fugitive from the outposts that the enemy's bullets have been playing havoc among them, without any visible or audible indications as to the quarter of attack. Later in the year, and especially since the manœuvres before the German and Austrian Emperors, when the employment of the new smokeless powder was the event of the day, the absurdity of the assertions as to the noiselessness of the new powders became a theme for strong observations in the German service papers; the assumed existence of a noiseless powder was ridiculed as a thing equally impossible with a recoil-less powder; the violence of the report, or explosion, produced upon the discharge of a firearm being in direct relation to the volume and tension of the gaseous matter projected into the surrounding air.

The circumstance that blank ammunition was alone used in the smokeless powder exhibition at the German manœuvres, may have served to lend some support to the assertions as to comparatively little noise made by the powder—the report of blank cartridges being slight, on account of the small and lightly confined charges used. It is said that the sound of practice with blank ammunition at the German manœuvres, was scarcely recognized at a distance of 100 metres. In a recently published pamphlet on the results of employment of the latest German smokeless powder in the manœuvres, it is stated, on the other

hand, that the difference between the violence of the report of the new powder and of black powder is scarcely perceptible; that it is sharper and more ringing, but not of such long duration. This description accords exactly with our own experience of the reports produced by different varieties of smokeless powder, and of the lecturer's earlier experience with gun-cotton charges fired from rifles and field guns. The noise produced by the latter was decidedly more ringing and distressing to the ear in close proximity to the gun, but also of decidedly less volume than the report of a black-powder charge, when heard at a considerable distance from the gun.

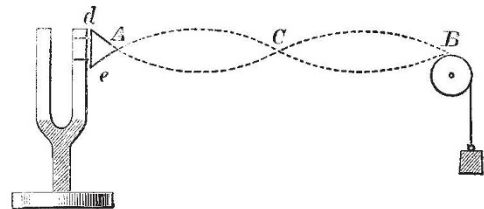
As regards smokelessness, the present German service powder is not actually smokeless, but produces a thin, almost transparent, bluish cloud, which is immediately dissipated. Independent rifle-firing was not rendered visible by the smoke produced at a distance of 300 metres, and at shorter ranges the smoke presented the appearance of a puff from a cigar. The most rapid salvo-firing during the operations near Spandau did not have the effect of obscuring those firing from distant observers.

That, in future warfare, if smokeless or nearly smokeless powders have maintained their position as safe and reliable propelling agents for small arms and field artillery, belligerents of both sides will be alike users of them, there can be no doubt. The consequent absence of the screening effect of smoke—which, on the one hand, removes an important protection and the means of making rapid advances or sudden changes of position in comparative safety, and, on the other hand, secures to both sides the power of ensuring to the fullest extent accuracy of shooting, and of making deadly attack by individual fire through the medium of cover, with comparative immunity from detection—can scarcely fail to change more or less radically many of the existing conditions under which engagements are fought.

As regards the naval service, it is especially and, at present at any rate, exclusively for the new machine and quick-firing guns that a smokeless powder is wanted; for such service the advantages which would be secured by the provision of a reliable powder of this kind can scarcely be over-estimated, and their realization within no distant period may, it is believed, be anticipated with confidence.

#### NOTE ON MR. MELDE'S VIBRATING STRINGS.

THE effect of Mr. Melde's pretty experiments with the vibrating stretched thread attached to one of the prongs of a tuning-fork is often spoiled to the spectators by the unfavourable plane of vibration assumed by the thread. A very simple device removes this inconvenience, and enables the operator to suit his own choice for the plane of vibration. The accompanying sketch sufficiently explains itself, and shows the arrangement for restricting the vibrations to the vertical plane.



Instead of attaching the end of the thread to the prong of the tuning-fork, it is tied to the middle of a short thread  $dAc$ , and the ends  $d$  and  $e$  of this are attached to the prong in a vertical line. It is clear that if the distance  $A$  from the line  $de$  is an appreciable part of the quarter wave-length of the vibration, and  $AB$  is an integral multiple of the half wave-length, vibration is possible only in the vertical plane. For in the horizontal plane this rate of vibration is impossible,  $A$  being not a fixed point of the thread for vibration in this plane, and the length from the prong to the pulley being not an integral multiple of the half wave-length of vibration. And in any other plane the vibration, if possible, would be compounded of two, viz. of the vertical which is possible and of the horizontal which is impossible.

The most convenient form of fixture for the short thread  $dAc$ , is a light steel wire with an eye at each end, lashed to the prong



with two turns of fine thread. The plane of vibration can then be easily adjusted to suit the spectators by sluing the wire in its lashing.

*Note.*—The triangular thread  $d\Delta e$  should be of the same quality as the vibrating length. If it is much heavier length for length the arms of the triangle may become half wave-lengths of the vibration for the tension employed, and then they lose their control over the plane of vibration.

The arrangement has its own worth, independently of the aid it lends to visible effect, as an illustration of the suppression of all half wave-lengths which are not true sub-multiples of the vibrating length of the cord. When the fork is moved from its position in the figure to bring up the line  $de$  to the position of  $A$ , the vertical vibrations are suppressed, and only the horizontal vibrations are possible.

W. SIDGREAVES.

### EIGHTH CONGRESS OF RUSSIAN NATURALISTS.

THE eighth Congress of Russian Naturalists and Physicians was opened on January 9 at St. Petersburg, and was a great success. It was attended by no fewer than 2000 members, half of whom came from the provinces, and at the three general public sittings (corresponding to the sittings of the British Association devoted to the delivery of the Presidential addresses), as well as the meetings of the Sections, the public were well represented. At the first general sitting, Prof. Mendeleeff delivered a most interesting address on the methods of natural science as applied to the study of prices. His parallels between the prices of goods and the specific weights and specific volumes of chemical bodies were very suggestive. The next address, by Prof. Sklifasovsky, was on the wants of Russian medical education. At the second general sitting, Prof. Stoletoff spoke of ether and electricity. Prof. Famintzyn's address on the psychical life of the simplest representatives of living beings, partly based upon his own recent researches into the intelligence of Infusoria, was full of facts as to the means used by various micro-organisms in attack and defence. Prof. Wagner dealt with the physiological and psychological views upon hypnotism, and Prof. Gustavson spoke of the micro-biological bases of agronomy.

The work of the Sections was very varied, and will be fully reported in the Diary of the Congress, the publication of which began during the sitting of the Congress, and will be continued till a full account has been produced.

The Sections of Geography and Anthropology, Hygiene, and partly of Agronomy, were most largely attended, and many interesting communications were made in them. At the combined sittings several important questions were raised as to the geography of Russia, its meteorology, and the bearings of a scientific study of climate and soil upon agriculture.

The following communications relative to geography and anthropology were especially worthy of note. Captain Makaroff reported the results of his careful measurements as to the differences of level of various seas of Europe. Taking the average level of the Atlantic Ocean opposite Lisbon for zero, he found that the level of the western parts of the Mediterranean is 434 millimetres below zero, its eastern part, - 507 millimetres; the Ægean Sea, - 563 millimetres; the Marmora Sea, from - 360 to - 291 millimetres; while the Black Sea is + 246 millimetres—that is, higher than the Lisbon zero; the western part of the Baltic, + 259 millimetres; its eastern part, + 254 millimetres; and the Gulf of Finland, + 415 millimetres. Dr. Blum's anthropological measurements amidst twelve different tribes of the Caucasus show that there are no pure races in Caucasia, all of them being mixtures between Semitic and Indo-European races. Like conclusions were arrived at by M. Kharuzin as regards the Bashkires, who proved to be a mixed race, presenting features both of the Mongolian and the Caucasian races.

Prof. Klossovsky's researches into the variations of level and temperature in the coast region of the Black Sea are most valuable, as they are based on accurate measurements made since 1879 at 16 different places. They fully disclose the importance of atmospheric pressure upon the level of the Black Sea, and it is worthy of note that the passage of a cyclone over Odessa resulted in a rise of the level of the sea by fully 5 feet over the average, followed by a sinking of the level by fully 7 feet, in accordance with the variations of atmospheric pressure.

Dr. Orzanski's extensive anthropological researches amidst

the population of Russian prisons, and his numerous measurements, show no difference between the supposed "criminal's skull" and the average Russian skull. Numerous photographs were exhibited to illustrate this conclusion, so different from those arrived at by Dr. Lombroso.

Two new periodicals—one of them devoted to Russian natural science, and the other to meteorology—were founded while the Congress was at work. The meeting came to an end on January 20.

The Congress hoped to obtain from the Government permission to appoint a permanent Board, and thus to lay the foundation of a Russian Association for the Advancement of Science.

### TECHNICAL EDUCATION IN ELEMENTARY SCHOOLS.

THE Committee of the National Association for the Promotion of Technical and Secondary Education have submitted to the Education Department the following suggestions for the modification of the Code as regards elementary technical education:—

#### A.—Drawing.

- (1) Drawing to be introduced in infant schools, at least for boys.
- (2) Drawing to be made compulsory in boys' schools.
- (3) The Minute requiring cookery to be taught in girls' schools as a condition of receiving grant for drawing, to be repealed.

#### B.—Object Lessons.

- (4) No school to be recognized as efficient which does not provide in the three lower standards a graduated scheme of object lessons in continuation of Kindergarten instruction in the infant school.

#### C.—Science.

- (5) In order to encourage science as a class subject, the clause requiring English as one of the class subjects to be cancelled, and the teaching of science as a class subject to be further encouraged in the upper standards by an additional grant.
- (6) Scholars of any public elementary school to be allowed to attend science classes held at any place approved by the inspector, and such attendance to count as school attendance.
- (7) Examinations in science to be conducted orally, and not on paper, especially in the first five standards. If the inspection is satisfactory, an attendance grant of 4s. to be made for scientific specific subjects.

(8) Managers to be encouraged to submit alternative courses of instruction in specific subjects under Art. 16 (Code 1888). Such subjects to receive a grant on the same principle as the subjects enumerated in Art. 15.

[Art. 16. "Any other subject *other than those mentioned in Art. 15*, may, if sanctioned by the Department, be taken as a specific subject, provided that a graduated scheme of teaching it be submitted to and approved by the inspector."

But Art. 109 (g) which lays down the condition for grants, says, "The specific subjects which may be taken *are those enumerated in Art. 15.*"

- (9) Grants to be made towards apparatus for science teaching and school museums.

#### D.—Manual Instruction.

- (10) Manual instruction to be introduced in boys' schools, corresponding to needlework for girls.
- (11) Instruction in the use of *simple tools* to be introduced in the higher standards as a specific subject, and grants to be paid thereon.

(12) Provision to be made for the introduction of *elementary modelling* in connection with the teaching of drawing, and a grant to be made in connection therewith.

(13) Instruction in *laundry work* to be encouraged in girls' schools, so far as practicable, as a part of domestic economy.

#### E.—Evening Schools.

- (14) The clause providing that "No scholar may be presented for examination in the additional subjects alone" to be cancelled, to enable scholars to earn grants though not receiving instruction in the standard subjects.