reality their bad shooting was due to *pulling* the trigger instead of *pressing* it. It is clear that more rapid progress can be made if the learner can discover the particular defect to which his failures are due. Various devices have been used for this purpose.

In the sub-target the rifle is mounted on a universal joint, and on pressing the trigger a hole is punched in a card, thus indicating the direction in which the rifle is pointed at the instant. This appliance is expensive, and since the rifle is not free, defects due to trigger-pulling are not made evident.

The aim-corrector is a piece of plain smoked glass mounted behind the rear-sight so that its surface is inclined at 45° to the sighting line. The learner takes his sight through this glass in the usual way; the instructor watches the sights from the side, as they are seen reflected in the glass. Obviously, the instructor must possess considerable skill in order to use this appliance with advantage.

The aiming disc is a perforated metal disc which is placed in the observer's eye like a monocle. The learner aims at the perforation, and any *considerable* motion of the rifle during trigger-pressing can be seen by the observer. This appliance can only be used with advantage at short distances from the learner, and anyone accustomed to the use of fire-arms can scarcely avoid an uncomfortable feeling on watching a gun that is pointed at his eye.

I have devised a simple appliance by means of which most (if not all) of the benefits usually derived

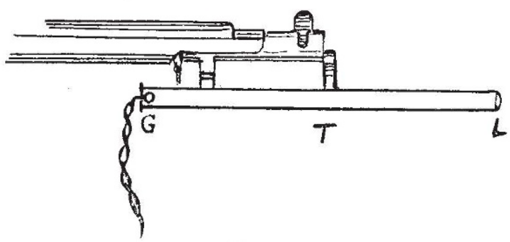

FIG. 5.

from a miniature range can be obtained without the use of ammunition. This appliance is represented diagrammatically in Fig. 5. A metal tube T, which can be fitted to the bayonet standards of a rifle, is provided with a lens L at the front end, and a small electric glow-lamp G at the rear end. The lens L can slide in or out, so that the image of the glowing filament of the lamp can be focussed on a white screen placed near the target. The current for the lamp can be supplied by three or four Leclanché cells; or a battery of dry cells, similar to that used for an electric torch, can be fixed to the tube T, thus obviating the inconvenience of the leads from the lamp to the cells. It is best to aim at a target about 10 yards away; an observer, who need possess no qualifications other than general intelligence and quickness of perception, stands or sits by the target and watches the image of the filament formed on the screen. I have obtained small electric glow-lamps which produce an image approximating in shape to a V. The position of the point of the V, at the instant when the trigger is pressed, can be marked on the screen; and if the rifle is moved during the act of trigger-pressing, the direction of motion, and its extent, can be marked by an arrow. If the position of the point of the V has previously been marked when the rifle was aimed by an expert, the correctness or otherwise of the learner's sighting is seen at a glance. I have found that most learners aim better than they shoot; that is, they sight the rifle on the bull's-eye with some approach to correctness, and then pull it away while they are actuating the trigger. If the learner is particularly bad at sighting, the rifle may be supported on a sand-bag or tripod stand, and sighting can be practised until a satisfactory "triangle of error" is obtained.

I have found, by the aid of the appliance just described, that different people can aim a rifle with perfect consistency according to the rules given earlier in this article.

EDWIN EDSER.

THE SOUTH-EASTERN UNION OF SCIENTIFIC SOCIETIES.

THE twentieth annual congress of the South-Eastern Union of Scientific Societies was held at Brighton on June 2–5, under the presidency of Dr. J. S. Haldane, F.R.S. The presidential address was entitled "The Place of Biology in Human Knowledge and Endeavour." Dr. Haldane gave to his hearers a deeper insight into the inexhaustible fulness of reality which science only partly explores, and puts us on our guard against the error of mistaking partial and abstract results for complete knowledge. He explained the marvellous nicety of the natural regulation of the act of breathing, and of the means by which constancy in the composition of the blood was maintained, and used these instances to prove the unwisdom of declaring ourselves to belong to either of the opposing schools of "mechanists" or "vitalists." In face of the evidences of "organic determination" which these instances gave, neither of these hypotheses could satisfy. In like manner, the partial character of even the highest conception of biology and of all science must be recognised, and recognising this, we should not be ready, merely because they are not susceptible of scientific treatment, to undervalue or ignore those higher elements of human experience which we designated moral and spiritual.

Incidentally, in noble and moving language, Dr. Haldane referred to the great struggle which is occupying all minds. "The flashes of war have lit up for us this spiritual world. The sense that it is our plighted duty to deal with an infamous disregard of elementary right has sent hundreds of thousands of our best and truest into the fighting line, and is marshalling the whole activities of our nation and its Allies in a manner in which they never were marshalled before. . . . Yet we are waging this war in the absolute determination to conquer, cost what it may. For we are fighting, not merely for our own advantage or safety, but for a higher duty; and the faith that this higher duty is a real one, and that in following it we are at one with that spiritual reality which is the only reality, gives us a resolution, a courage, and a confidence, which could come from no other source."

In a paper on the problem of terrestrial and fluviatile shellfish, Mr. Hugh Findon dealt with the genealogical history of genera of molluscs, tracing their ancestry by the aid of the geological record, and finding the ancestral habit at one time marine, and at another a fresh-water one. "As I read the geological evidence the history of the river mussels is exceedingly interesting. A line of marine mussels persisting from earliest ages until the present time gave off a branch which in Carboniferous times took to a fresh-water life, Anthracosa, and again in the Miocene period repeated the phenomenon in Dreissensia. The first branch, with the exception of Anthracosa, returned to the sea and gave rise to another persistent family, that of Trigonia. About half-way along this second line a branch was given off which also entered a fresh-water existence during the age of the Purbeck, and this time successfully, for the present age witnesses Unios flourishing as they never did before in the world's history. I have been unable to find any tendency to return a second time to a marine life in our living river mussels."

In speaking of the changes taking place in the Baltic Sea, Mr. Findon remarked that the sea was "becoming more shallow, and consequently the communication with the North Sea between the Danish Islands is less free than formerly. On the other hand, the drainage of the marshes of Petrograd has allowed more fresh-water to flow into it; thus there is less influx of salt-water at high tides, and the Baltic is becoming brackish. Indeed, the northern portion is almost fresh, and fluviatile shellfish have invaded the open water. Many well-known species of the sea-shore, on the other hand, have held their ground, and we have the phenomenon of salt-water species, such as mussels, cockles, and tellens with a periwinkle, *Littorina rudis*, the estuarine *Mya arenaria*, or gaper, and a small univalve, *Hydrobia balthica*, living in fellowship with the river mussel Unio, two pond snails, Limnæa and Bythinia, the fresh-water Neritina, and a small bivalve, Sphærium. The assemblage is a remarkable one, considering the normal habitat of each of these species, and thus in the Baltic to-day the Lamarckian theory of modification to, but not by, environment, is well illustrated by these marine species, which are gradually changing their salt-water habitat for a fresh-water one."

A paper was read by Mr. Edward A. Martin on Brighton's lost river, in which the gradual disappearance of this river, which at one time flowed out at the Steine Gap, was traced. The river must have been of some importance in prehistoric times, although in historical times its whole history is one of decadence and almost complete disappearance. From a consideration of other rivers on the south coast Mr. Martin endeavoured to build up a former condition of things, which enabled the old town of Brighthelmstone to be built on alluvial flats beneath the cliffs.

"When the Brighton river was in its prime, there is every reason to think that its action was the same as that which now characterises other rivers on the south coast. The flow of the water would bring down with it large quantities of sediment, and bars would be produced at its entrance into the sea. As these increased, alluvial flats would be formed. This, of course, was in pre-history. There were no harbour commissioners to remove the bar. Man had no interest in it. It may have been before his time in these parts. A delta was in process of formation, and would no doubt have been perfected, had not a rival power interfered. The formation of the Brighton delta was influenced at all times by the tidal rise, and this would have been increased on the forcing of the strait of Dover. The river acting in a north to south direction, and the tides acting in a west to east direction, brought about a combination of forces which caused the alluvial drift to move in a more or less easterly direction. There is every reason to believe that somewhere, a mile or more out at sea, the river was turned to the east by the tides, and that the river was bounded by an alluvial bank formed by the sediment brought down by the river, reinforced by the supply of gravel brought from the west, as it is now, by the tides. What has taken place at Shoreham, Newhaven, and Seaford, took place at Brighton, and I imagine that the Brighton river passed away towards the east below the cliffs for some distance, dropping its sediment on the way, before it was able to force and keep open its outlet into the sea. Lyell mentioned that in the reign of Elizabeth 'the town was situated on that tract where the Chain Pier now extends into the sea.'

"In the course of centuries the river became deprived of its excavating power, and many of its feeders were captured, so that the body of water flowing down became seriously lessened. The process was a slow one, but sooner or later the struggle with the tides proved an unequal one. Hitherto, all that the tides could do was to turn the river eastward and enclose it within a long, low-lying bank of shingle, and the denuding power of the wind and storm waves, raised on the shoulders of the tidal rise, was at a minimum. When the entrance of the considerable body of opposing water from the valley was modified, and the influence it possessed practically ceased, alluvium ceased to be deposited, and the denudation of the alluvial ground-covered flat and its destruction by the sea commenced. This went on unceasingly, until the whole of the land beneath the cliffs was washed away. Mantell remarks that 'the whole of the ancient town was situated on a spot now covered by the sands,' whilst Lyell mentions that 'the sea has merely resumed its position at the base of the cliffs, the site of the old town having been a beach which had for ages been abandoned by the ocean.' The old town had, as a matter of fact, been built on the alluvial flats which had been laid down by Brighton's lost river."

Discussion on the origin of the Brighton Rubble-Drift Formation in the Kemp Town cliffs elicited the fact that in addition to the palæolith from the raised beach (now at the British Museum), another implement of Chellean form has been obtained from the raised beach at Slindon, near Arundel, West Sussex.

Other papers read were by Prof. G. S. Boulger, on Kew: some notes on its connection with the history of botany; by Mr. A. Bonner, on the study of place-names; by Mr. A. W. Oke, on three Sussex worthies: Mantell, Robertson, and Jefferies; and by Mr. C. C Fagg, on regional surveys and local natural history societies. Excursions to points of interest in the district were made during the congress, which, in spite of many difficulties, was carried through in a very successful manner.

OSMOTIC PRESSURE AND THE PROPERTIES OF SOLUTIONS.

TWO monographs dealing with the properties of solutions have recently been issued by the Carnegie Institution of Washington. The first, entitled "Osmotic Pressure of Aqueous Solutions," is a report by H. N. Morse, on the investigations made in the chemical laboratory of the Johns Hopkins University during the years 1899–1913. This masterly investigation, extended already over a period of fifteen years, has been recognised at once, and universally, as one of the classics of scientific literature. As the substance of the investigation was originally issued in more than a score of papers, it is a great advantage to have the whole work summarised, corrected, and brought up to date by the author himself. The whole technique is now set out in a series of chapters dealing with the cells and manometer attachments; the manometers; the regulation of temperature; and the membranes. The fifth chapter contains a strong defence of the weight-normal system for solutions against criticisms and attacks that have been made upon it, arising mainly from the mistaken assumption that this method of working was the expression of some theoretical view of the nature of solutions or the mechanism of osmotic pressure.

The opinion is emphatically put forward that a comprehensive equation for the osmotic pressures of solutions can only be reached by means of experiments, and that so many phenomena are involved that it will be impossible to predict the osmotic pressure of a solution unless the magnitude of some of