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THE NEW ELEMENTS IN THE AIR.

We are not at all surprised nowadays at scientific discoveries, even when they are of prime importance. We are apt to receive news of them as a matter of course. Within a week we have had the synthetic production of albumen demonstrated before a learned body, and within a month "coronium," which has been supposed to exist only in the sun, has been detected in solfatara gases, and the Italian scientists gravely observe that "there are probably other new elements in these gases." In June last, Prof. Ramsay announced the discovery of "krypton," a new gaseous element existing in the air, and close on its heels come two other elements, also obtained from the atmosphere, which have been named "neon" and "metargon." Krypton was named from the Greek word "krypto," meaning "to hide," and it was well named, for it eluded the vigilance of even the great chemists who have for a long time paid strict attention to the study of gases and the atmosphere, so that Prof. Ramsay scores one more brilliant victory over the unknown, which adds to his triumphs of the discovery of "helium," and jointly with Lord Rayleigh of "argon." For nearly two years, Prof. Ramsay and his assistant Maurice Travers have been searching for gases allied to them. In a brilliant paper read before the Chemical Section of the British Association, he gave his reasons for believing in the existence of an undiscovered gas. This is only another proof of our wonderful advance in science, when the discovery of an element can be predicted with reasonable certainty.

The search for the suspected gas was a long one. It was begun by examining the gases from various minerals and mineral springs and by fractioning helium through porous plates. It was not considered probable that another element would be discovered in the atmosphere, which had so recently furnished argon and helium, but finally mineral gases were discarded and atmospheric air was examined, with the result that "krypton" was discovered in liquid air, which is now fortunately available for physical and chemical purposes. About 750 cubic centimeters of liquid air were reduced by careful evaporation to 10 cubic centimeters, and the residue, if it may be so called, collected. The oxygen was extracted by means of red hot metallic copper, the nitrogen with the electric spark. Finally a mixture of magnesium and pure lime was used to deprive the gas of the oxygen which was left. There then remained a small quantity of gas, which was sealed up for the purpose of experiment in the Pflücker tube. The poles of the tube were now connected with an induction coil, a current was passed through, and the now isolated gas was examined with the spectroscope. It presented a weakly defined spectrum of argon and two strikingly brilliant lines not previously recognized, one corresponding to the yellow of helium and the other to the green line of helium. It has been suggested with some show of reason that the previously accepted lines of helium may have been partly influenced by the slight admixture of this then undiscovered element which we now call "krypton." Prof. Ramsay states that both he and Sir William Huggins are of the opinion that the green line of "krypton" is identical with the green line of the aurora, so that we again have an interesting fact when taken in connection with the finding of terrestrial coronium. The density of the new gas is approximately 22·5. It is an element and is monatomic. It is placed in the periodical table by Sir William Crookes between bromine and rubidium, and has an atomic weight of about 80.

The discovery of "neon" and "metargon" is also very interesting. The experiments were also carried on by Prof. Ramsay and Mr. Travers. A quantity of argon was liquefied, forming a colorless liquid, but a considerable quantity of solid substance was observed to separate and form around the sides of the tube and below the surface of the liquid. A gas also remained, which was at once removed for further examination. The frozen material was also separated for investigation. The gas was found to be the new element "neon" and the frozen substance was the element "metargon," so that in a remarkably short space of time these scientists have succeeded in adding three more to the rapidly lengthening list of elements.

The gas obtained was examined with the spectrum, and it was found to be characterized by a number of bright red lines. The atomic weight was found to be about 22, which would bring it into the neutral position between fluorine and sodium. The spectrum of the frozen substance proved to be very complex. It was totally different from that of argon. It was proved to consist of a single element, and this substance which was separated by freezing out of argon is a distinctly elementary body, though in some cases in close relationship with it, so that its discoverers promptly named it "metargon." In fact, as the investigators observed, "it occupies the same position in regard to argon that nickel does to cobalt, having the same atomic weight, yet different properties;" and Sir William Crookes classes it in an interesting table which he has just prepared, so that it shares the third neutral position with argon, and the atomic weight is about 40.

In the fall of last year Prof. Ramsay read a paper at Toronto on "An Undiscovered Gas," which is published in the SCIENTIFIC AMERICAN SUPPLEMENT, No. 1137, in which he said:

"The subject of my remarks to-day is a new gas. I shall describe to you later its curious properties; but it would be unfair not to put you at once in possession of the knowledge of its most remarkable property—it has not yet been discovered. As it is still unborn, it has not yet been named. The naming of a new element is no easy matter. For there are only twenty-six letters in our alphabet, and there are already over seventy elements. To select a name expressible by a symbol which has not already been claimed for one of the known elements is difficult, and the difficulty is enhanced when it is at the same time required to select a name which shall be descriptive of the properties (or want of properties) of the element. It is now my task to bring before you the evidence for the existence of this undiscovered element." After a lapse of several months Prof. Ramsay seems at last to have discovered the missing link and it is highly probable that "neon" will ultimately prove to be the gas which managed to elude them on the first search. It was a delicate attention when the eminent English chemist closed his now historic address at Toronto, when he said: "The history belongs to the old world. I have endeavored to share passing events with the new."

THE PERCENTAGE OF HITS IN WARFARE.

Foreign military critics at the seat of war have all spoken in high terms of the marksmanship of American gunners, and, in view of the special training which they received in the months preceding the outbreak of hostilities and their subsequent practice in the frequent bombardments of Spanish forts, it may safely be said that the work of our gunners in the naval battle of Santiago represented the best results that can be obtained with modern high-powered rifles.

With this fact in view, it is startling, and, to the enthusiastic admirer of the modern weapon, somewhat discouraging, to observe what a very small percentage of the shots that were fired, even on our side, hit the mark—not more, in fact, than about three per cent. This, apparently, is the best result that can be expected in the heat, smoke and confusion of an artillery duel at sea.

Until a more thorough examination of the Spanish ships has been made, and the full returns of ammunition expended have been published, it will be impossible to determine the exact proportion of hits to misses; but sufficient has been made known by official reports and the observation of trustworthy observers on the spot to show that the figure we have quoted is not very far from the mark.

The number of shot holes counted on the four cruisers as they lay upon the beach immediately after the fight was one hundred and thirty-one, distributed as follows: The "Oquendo," sixty-six; the "Teresa," thirty-three; the "Vizcaya," twenty-four; and the "Christobal Colon," eight. As the vessels were submerged somewhat below their normal draught, it is possible that some hits in the neighborhood of the waterline could not be counted. Waterline hits, however, are not likely to be numerous, and if we suppose that about a score of hits were made that could not be counted, we get a total of say one hundred and fifty for all four vessels. The very low freeboard and shorter length of the destroyers would render them difficult to hit, and they were so speedily sunk as to be only a comparatively short time under fire. We will assume, however, that sixty hits were made upon the two boats. This would bring the total number made on one side up to one hundred and eighty.

As regards the number of shells fired, we are informed by an officer who took part in the fight that the total of all shells, big and little, was six thousand. This agrees very well with the statement in the official report of Captain Evans, of the "Iowa," which credits this ship with having fired 1,473 rounds. Accepting the estimates of 180 hits and 6,000 rounds as correct, we find that the proportion of hits was only three per cent.

The disparity is largely explained by the fact that the dense volumes of smoke, both from our own and the Spanish guns, prevented accurate shooting by obscuring the mark during the greater part of the action.

There is an important lesson to be learned, however, from these figures; for if only three per cent of the shots reach the mark, the heavy 12 and 13-inch guns, which fire only once in three or four minutes, are at a great disadvantage as compared with the smaller quick-firing weapons. On the basis of three successful shots in a hundred, these big weapons are likely to be the better part of an hour at work before they land a successful shell on the enemy. This is actually proved by the fact that apparently only two or three of the biggest shells struck the Spanish ships, although the "Iowa" alone fired thirty-one 12-inch shells with full charges, and the "Oregon," "Indiana," and "Texas" were using their 12 and 13-inch guns throughout the fight.

Furthermore, it is noticed that the number of hits for each type of gun is in proportion to its caliber, the 8-inch doing good execution, the 4 and 5-inch rapid-fire guns even better, and by far the largest number of hits being due to the 6-pounders, of which a very powerful battery was carried by the several ships. The results are a strong indorsement of the rapid-fire gun, and they emphasize the necessity of increasing, by all possible means, the rapidity of fire of the larger guns on our battleships.

It is questionable if the 12-inch gun can be handled much more rapidly than it is in some of the navies of the world, and if we wish to secure greatly increased rapidity of fire, it can only be done by reducing the weight of the larger guns. Germany has apparently already grasped this truth, for her new battleships will carry no guns of a caliber greater than 9·45 inches. The small bore is compensated by the high velocity and energy of the projectile, the penetration of the weapon being nearly 26 inches of steel, or about the same as our 12-inch gun. Yet the German gun weighs only about 22 tons, against 45 tons for the 12-inch rifle, and it is a rapid-fire weapon in addition.

The 10-inch, 30-ton wire gun now being tested by the United States government is a more powerful weapon than the 13-inch, 60-ton gun of the navy, and if it is fitted with the most recent rapid-fire devices both in mounting and breech mechanism, it will be a vastly more efficient weapon and would form an ideal gun for our new 18-knot battleships. There are 8-inch rapid-fire guns afloat that fire four shots a minute to the one shot a minute rate of the 8-inch slow-firers of the "Brooklyn" or "Indiana." We should retain the 8-inch gun, but the 3 per cent results at Santiago teach us that we should make it a rapid-firer. Two such guns on each broadside would deliver twice the number of shells that can be thrown from the eight 8-inch guns on the "Indiana."

With four 10-inch, wire, semi-rapid-firers, four 8-inch rapid-firers, and six 6-inch rapid-firers, our new 18-knot battleships would be the most powerfully armed vessels of their day. But whatever may be the armament, Santiago teaches us that rapidity of fire should be made the supreme consideration.

DISCIPLINE AND DISASTERS AT SEA.

When all the phases of the navigation of the deep are studied, the wonder is not that accidents are so many, but that they are so few. Special and general navigation laws obtain in all countries having any pretense to civilization; but owing to the willfulness of owners, the carelessness of shipmasters or the lack of proper understanding, they are often rendered practically null and void. Man is naturally optimistic, sailors are unusually so, and freedom from accident in the past is too often assumed to insure immunity for the future.

Strenuous efforts have everywhere been made to educate the seafaring classes along higher and continually advancing planes; but, for some unknown reason, these efforts have failed to reach the man in the forecastle of the merchant marine. Notoriously, the forecastle is in many instances the final refuge of the illiterate and broken down. In spite of the earnest attempts which have been made to enforce that discipline and obedience that constitute the superiority of the crews of men-of-war over those of merchant vessels, something appears, continually, to be lacking. Perhaps what is needed is the physical and moral qualification which is demanded in the navies of the world. Discipline is recognized in the navy as not only essential, but imperative; but in the merchant marine it is too often enforced only in a half-measured and slipshod way.

The supreme value of naval discipline in emergency has been proved in cases innumerable. When a British troop ship foundered in the Bay of Biscay, a few years since, the soldiers stood in ranks at "attention," and went down to their death as if on parade, realizing that the boats were only sufficient to save the helpless women and children. Again, on board the battleship "Victoria," after she had been rammed by the "Camper-