THE BRITISH FIREMAN'S MASK AND SMOKE JACKET.

BY W. G. FITZGERALD.

The Metropolitan Fire Brigade of London now have among their outfit, not only at the Southwark headquarters on the south side of the Thames, but also at all the leading sub-stations, a number of ingeniously contrived apparatus which are something more than mere masks enabling the firemen to enter smoky buildings, being regular jackets and masks combined, and the wearer being supplied with fresh air by means of pumps, precisely as though he were a diver entering the depths of the sea.

The utility of this apparatus was very fully demonstrated a few weeks back, when a great and destructive fire broke out at a large chemical works on the eastern outskirts of London, the smoke from the burning material being dense, deadly, and poisonous in the extreme.

These apparatus, or at any rate, the more elaborate of them, are made by regular diving engineers.

Foremost among these apparatus comes the Fleuss dress, which is more especially designed to enable miners and mine officials to enter pits and shafts after a disastrous explosion of coal dust or fire damp, when it would mean certain death for any one to attempt to respire the poisoned air. It is not too much to say that hundreds of lives have been saved by means of the Fleuss apparatus.

A FIREMAN CLAD IN A PROTECTIVE SUIT, TO WHICH AIR IS SUPPLIED.

Then, too, in most of the big refrigerating works in England, these jackets and masks are kept handy, much as fire-extinguishing apparatus are kept, so that in the event of any accident happening in the ammonia chambers, the rescuers may venture in with perfect safety to themselves, and effect the work of rescue.

The London firemen are thoroughly well versed in the use of these jackets and masks, and in considerable fires where their use is necessary, they are taken on the engine in sets of two or four together with the necessary air pumps, which supply pure air to the communicating pipes.

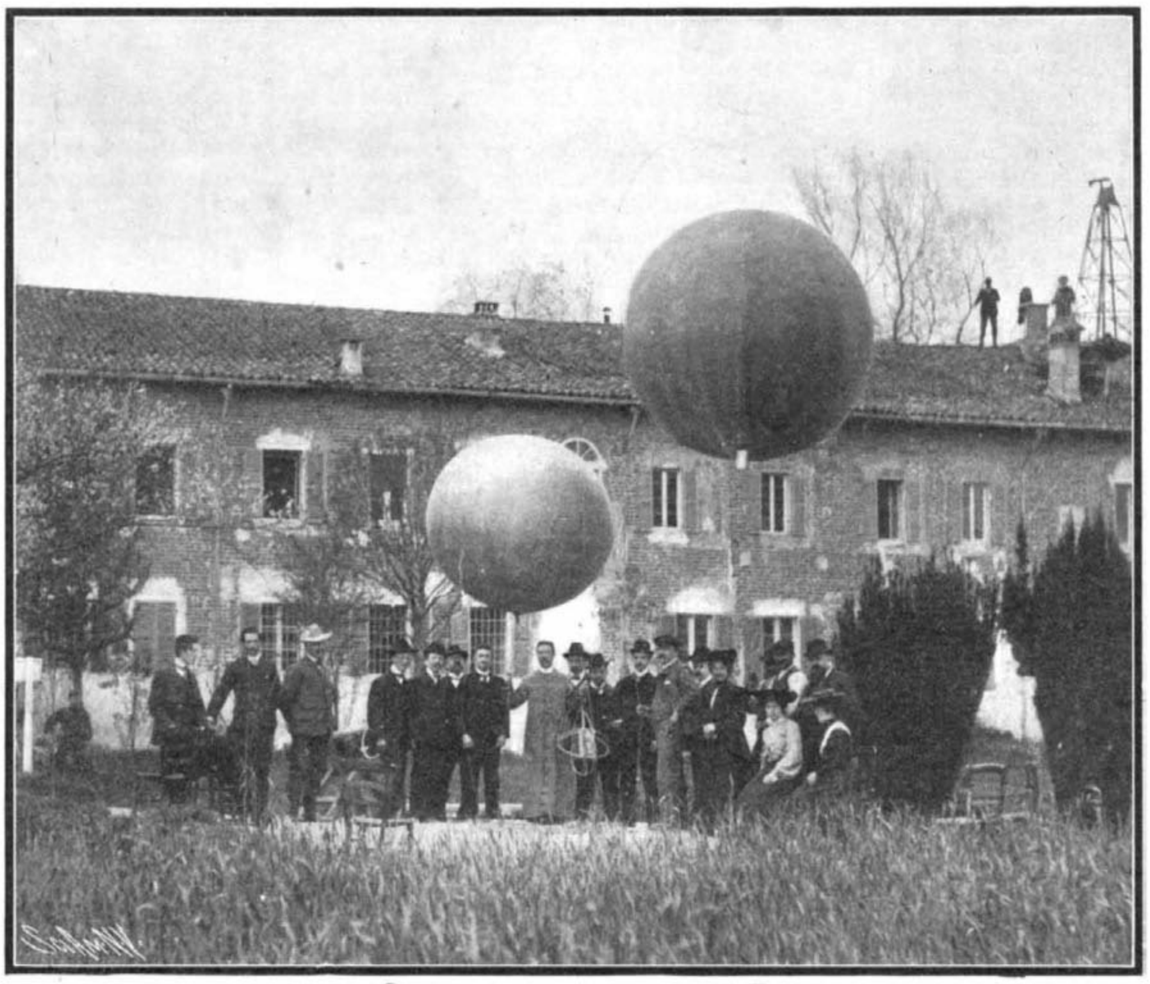
Of course the fireman so accoutered has to be very careful in making his way not to get his air pipes entangled. There are other apparatus of somewhat similar kind, however, which do not need to be supplied by outside air pumps, but have a system whereby the respired air is purified and the necessary elements added to it, so that it can be breathed over again.

Another class of London public servants who understand the use of this invaluable apparatus are the men who work in the great sewers of London. It happens by no means infrequently that a party of three or four men taking their way through the main sewers, jack-booted and up past their knees in water, suddenly encounter an accumulation of mephitic gas.

Probably one or two of them may contrive to escape, leaving their companion or companions unconscious in the water or in the flat-bottomed boat which is sometimes used in the great sewers of London. Forthwith a rescue party is organized, and the Fleuss apparatus or another of the same kind is brought into requisition, with the result that the men overcome are without difficulty brought safely to the bottom of the manhole, and then raised without difficulty to the street surface.

These curious "diving dresses," as they may be called, since they enable the wearer to breathe in an otherwise impossible element, are often carried on board British warships, so that in the event of explosion, or similar accident, rescues can be effected before men unconscious or wounded can be wholly suffocated by smoke or gas.

The masks and jackets may also be found in such establishments as the great government powder mills at Waltham Abbey, particularly in the department where the secret explosive cordite is manufactured out of gun-cotton. Many a rescue has been effected by the aid of this apparatus after a serious explosion in the incorporating mills, or the semi-subterranean cavernous structures in which the various nitro-compounds are handled.

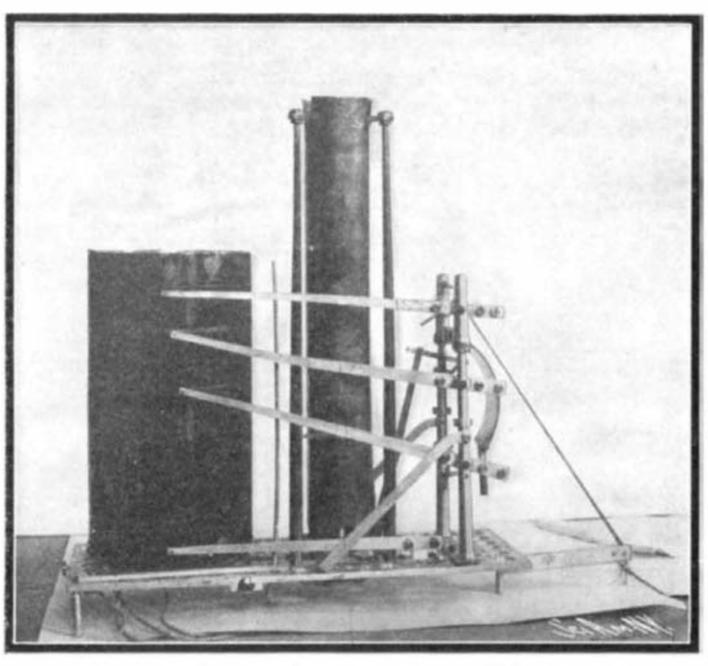


The Balloons Before the Ascension.

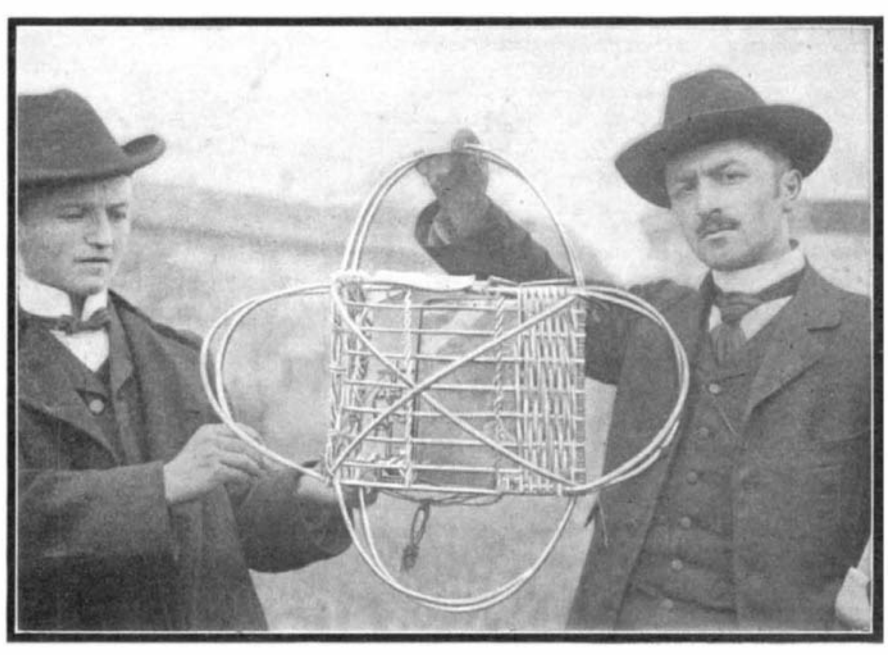
REGISTRATION BALLOONS IN ITALY.

Europe has recently taken the initiative in the use of balloons for fathoming the mystery of certain phenomena of the physics of the globe. An international commission with headquarters at Strasburg has been formed under the presidency of Prof. H. Hergasell.

It is proposed to send up registration balloons to different altitudes during each month with a view to establishing the laws relative to the variation, with the height of the pressure, humidity, and temperature. The idea is, generally speaking, to collect once a month data that shall permit of constructing, so to speak, a map with horizontal curves of the thermic, barometric, and hygrometric states of the atmospheric ocean on a given day by figuring alongside of the isobars at the sea (isotherms, etc.), the isobars at 5,000 meters (16,405 feet), and, if possible, at 1,000 meters (3,281 feet), etc., by making use of the data afforded by the balloons and of those furnished by mountain observatories.



Psychrometric, Thermometric, and Barometric Apparatus



Registering Apparatus.

REGISTRATION BALLOONS IN ITALY.

The *modus operandi* is as follows: The observatory directors have to study the registering apparatus before and after the ascension, and see that the ascension is properly made. As soon as a telegram is received announcing the place where the balloon has fallen, the director proceeds thither, takes notes as to the descent, and removes the balloon and apparatus. Upon returning to the observatory, he fixes the diagram with gum-lac dissolved in alcohol, makes a detailed report upon the meteorological conditions previous to and during the ascent, and sends the whole to Prof. Hergasell, superintendent of the Meteorological Institute of Strasburg. At Strasburg the various diagrams obtained at the different aeronautic stations are studied and the results thereof coordinated. The material is afterward published in a special organ entitled "Veröffentlichungen der internationalen Kommission für wissenschaftliche Luftschiffahrt."

The balloons employed are double, i. e., they consist of an upper bag 6½ feet in diameter, inflated with hydrogen to a tension so calculated as to cause it to burst when it reaches an altitude of 12 or 18 miles. The lower bag, on the contrary, is much less inflated, and is simply designed to act as a parachute when the other bursts. It carries the car and the exploring instruments, viz.: a thermometer, a barometer, and a hydrometer. These apparatus, through a clockwork movement, register different lines upon a revolving drum coated with lampblack.

In Italy, the first experiments were made on March 3 and April 14, 1904, and were directed by Prof. Camillo Alessandri, superintendent of the Meteorological and Geodynamical Observatory of Paris. This place was selected as the Italian station for sending up registration balloons because it is situated in the immense plain of the Po, far from mountains and the sea.

On the 3d of March the weather was so bad that it was impossible to take any other photograph than the one representing the members of the commission. On the contrary, we are indebted to the courtesy of Prof. Alessandri for a series of views of the ascension of April 14, two of which represent different phases thereof. Another represents the car with the registering apparatus, and another still the psychrometer, the thermometer, and the barometer tracing curves upon a cylinder coated with lampblack, along with the diagram of April 14.

The ascension of the 14th gave a very good diagram of the pressure. The minimum ordinate corresponds to a pressure of 82 millimeters (3.228 inches) of mercury in ordinary weather. The curve of the humidity (the highest of the three) is also very characteristic. The pen of the thermograph unfortunately ceased to operate at about two-thirds of the altitude. It takes the cylinder one hour to make an entire revolution. It is therefore impossible to introduce into the barometric indications the desired correction of temperature, and, consequently, to say what was the maximum altitude reached by the balloon, and what was the lowest temperature. This, however, is of but relative importance.

The experiment of March 3, on the contrary, reveals a new fact, and that is that, contrary to what has hitherto been thought, the temperature above 12 miles altitude appears to remain constant. This first result, should it be confirmed, will well inaugurate the series of experiments directed by Prof. Alessandri, from whom there is much to be expected in this matter, since it is under his direction, also, that is being built, at 14,092 feet above sea level, the observatory of Monte Rosa, which will be the highest one in Europe, and perhaps in the world.

SIR WILLIAM RAMSAY.

BY THE ENGLISH CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

The eminent English scientist, Sir William Ramsay, whose name is so intimately associated with the new element radium, is a born chemist. He has always lived and moved in a scientific atmosphere. His grandfather was a large manufacturing chemist; his father was also intimately connected with the science, though he practised as a civil engineer, while his mother's father and brothers were all physicians and chemists.

Sir William Ramsay is one of the world's youngest scientists, being only fifty-two years of age. He is a Scotsman by descent and was born in Glasgow in 1852. His uncle, who was a sugar planter, when he died left his library to young Ramsay's father. This library contained a selection of books on chemistry, one of which exercised a peculiar fascination for the youth. This was "Graham's Chemistry," which Sir William says he "read with great eagerness while he was a youngster," and which he describes as "clear and interesting as a novel." Curiously enough, some years later this scientist stepped into the shoes, as it were, of the master who had been his inspiration—professor of chemistry at London University College, an appointment formerly filled by Prof. Graham.

Sir William Ramsay received his primary education at the Glasgow Academy. From this he passed to the Glasgow University. When the time arrived for him to select his profession he decided to adopt medicine, and entered the laboratory of an analyst to gain his elementary knowledge. His spare time he devoted to attending lectures on chemistry at the University, and particularly patronized the lectures of Lord Kelvin, in whose class he secured the third prize.

At nineteen years of age he left Glasgow and went to Tübingen University, where he remained two and a half years and eventually secured his degree. He was twenty-one years old when he returned to England and became assistant to the technical chair of chemistry at the Andersonian University, which post he occupied for two years.

In 1874 he was appointed tutorial assistant in chemistry at the Glasgow University. This office he filled for six years, vacating it only to succeed to the professorship of University College at Bristol. At the time of his appointment Prof. Marshall, the eminent political economist, was principal of the college, but Sir William Ramsay had only been with him a year when he resigned, and the professor of chemistry became the principal of the college in his place.

This period was one of the most arduous in the life of Sir William Ramsay. He not only filled the principal's chair and carried out those official duties, but he continued his chemistry lectures as well, and filled the dual office for some six years. In 1887 the chair of chemistry at the University College, London, fell vacant, and Sir William Ramsay was appointed to the office, a position which he accepted, and forthwith resigned his Bristol appointments.

Sir William Ramsay may be said to have first brought himself to the public notice by his brilliant discoveries of unknown and unsuspected constituents of the atmosphere—discoveries made partly with the collaboration of Lord Rayleigh. As a reward for their labors these two scientists were awarded the Hodgkins prize of the Smithsonian Institution of $10,000.

Valuable though these discoveries were, they had merely brought Sir William Ramsay to the threshold of still greater possibilities. In the spring of 1895 his attention was drawn to the experiments of Dr. Hillebrand, an American chemist who had succeeded in deriving a new gas from certain minerals. The features of this gas caused the discoverer to advance the theory that the minerals from which he had prepared this gas were the constituents of argon.

Sir William Ramsay followed up Dr. Hillebrand's investigations and procured a quantity of these minerals. He heated them, and eclipsed his previous effort by obtaining helium. The characteristic line of this gas had been found in the solar spectrum by the French astronomer Janssen as far back as 1868, and had been designated helium by Profs. Frankland and Lockyer. Sir William Ramsay, however, was the first scientist to obtain it.

In 1897 in the course of an address before the chemical section of the British Association for the Advancement of Science at Toronto, Sir William Ramsay further stated that there were three other gases which had so far resisted discovery. Furthermore, he was so bold as to describe some of their most salient characteristics. This was a bold assertion to make, even for an expert chemist, and Sir William Ramsay must have been exceptionally confident of deriving them. Such a feat of prophesy has only once before been equaled. This was by Prof. Mendeljeff of St. Petersburg, the enunciator of the law of periodicity. The three gases which Sir William Ramsay so described before their actual discovery, were neon, krypton, and xenon.

In five years Sir William Ramsay had discovered no less than five new elements in the air—a remarkable achievement, the value of which may be more comprehensively gaged from the fact that from 1863 to 1875, a period of twelve years, only two elements had been discovered—indium in the former year and gallium in the latter.

At the present moment the scientific world is still busily occupied studying the results of Prof. Ramsay's experiments with radium, and the transmutation of metals. Prof. Rutherford and Mr. Soddy, of Montreal, suggested that it was not improbable that one of the products of decomposition of the emanation from radium salts would prove to be helium. Sir William Ramsay, in concert with these scientists, set to work to substantiate the theory, and undoubted spectroscopic evidence was obtained that helium is a product of the disintegration of the emanation.

This discovery was obtained in a peculiar manner. Mr. Soddy observed that the gas emanating from a compound of radium was not affected in any way by any chemical reagent, and that it is self-luminous. Prof. Rutherford and Mr. Soddy concluded from this fact that it was perpetually transforming, and that the luminosity was due to the parting of electrons in changing its condition. From this it was surmised that it changed into something, but the question was, What? Sir William Ramsay came to the rescue. He collected the gas of radium and subjected it to spectroscopic inspection. It was found to be peculiar. Two days later it was again examined and the spectrum of helium was observed, growing brighter and brighter as the spectrum of the gas decreased in distinctness. Ten days afterward the evolution was so far advanced that the material into which the luminous gas had changed was found. This discovery is momentous in its value; for does it not mark a new turning point in applied chemistry? At any rate, it must have been a source of peculiar satisfaction to Sir William Ramsay to discover that radium was emitting his own discovery, helium.

Sir William Ramsay is a most skillful mechanician. As he invariably works with such infinitesimal quantities, the experiments necessitate the employment of delicate and special apparatus. All this Sir William makes himself, as it would take too long to inculcate another workman as to his requisitions. He has even devised a new method of glass blowing in order to obtain the special minute vessels he requires for his researches. Some idea of the small quantities of material with which this distinguished scientist works may be gleaned from the fact that in some of his recent radium investigations, Sir William was using less than a cubic millimeter of gas, a quantity which could be placed in less space than a pin's head. This accumulation was the result of two months' work, from which one can estimate the rarity of radium.

Few men have received more decorations than Sir William Ramsay in recognition of their scientific achievements. That rare award, the Hoffman foundation gold medal, which is bestowed only once in five years upon a foreigner, was presented to him for "distinguished work in the field of general chemistry, particularly for the discovery of new ingredients in the air." This medal was instituted in 1888 and is called after the celebrated German chemist of whom, curiously enough, Sir William Ramsay was formerly a pupil. The English scientist was the first man to whom the medal was presented.

He is also an officer of the Legion of Honor, and a corresponding member of the Institute of France. He is furthermore an honorary member of all the leading scientific associations both in Europe and this country.

He has contributed numerous scientific papers dealing with his discoveries and their influence upon present scientific knowledge. The most important of these publications are those dealing with "The Molecular Surface-Energy of Liquids"; "Argon, a New Constituent of the Atmosphere," written in conjunction with his collaborator in this discovery, Lord Rayleigh; "Helium a Constituent of Certain Minerals"; "Neon, Krypton, and Xenon, Three New Atmospheric Gases"; and more recently several papers concerning the phenomena of radium. He is also the author of two text books on chemistry, as well as "The Discovery of the Constituents of the Air."

Although he is a busy worker, Sir William Ramsay yet finds time to indulge in his recreations, which comprise cycling, the study of languages, and mountaineering. He is also a great lover of music, and is an accomplished player upon the violin.

A New Satellite of Saturn.

In 1899 Prof. William H. Pickering, from an examination of photographs taken for the purpose with the 24-inch Bruce telescope, discovered a new and faint satellite of Saturn, having a period of about a year and a half. (See H. C. O. Circular No. 43.) A further discussion of a large number of photographs has served to determine the elements of its orbit. Eleven photographs taken by Mr. Frost at the Arequipa station, under the direction of Prof. Bailey, enable us to follow the satellite from April 16 to June 9, 1904, and to correct its ephemeris. A full discussion by Prof. Pickering will appear in a few weeks in a forthcoming volume of the Annals. Meanwhile, to enable astronomers elsewhere to observe it at once, its position, angle, and distance from Saturn may be stated to be on July 14, 77.4 deg. and 17.8 min.; on July 24, 79.8 deg. and 14.3 min.; and on August 3, 1904, 84.0 deg. and 10.5 min., respectively. Edward C. Pickering.

The Current Supplement.

"Steel Making at Ensley, Alabama," is the title of the article which opens the current Supplement, No. 1490. Excellent illustrations accompany the text. An article on the origin of radium explains in a popular way the elementary philosophy of radio-activity. Some interesting experiments in forcing plants by ether are described by the Belgian correspondent of the Scientific American. Messrs. C. E. Stromeyer and W. B. Baron conclude their discussion of water-softening apparatus. "Fertilizer from Fish Waste or Refuse" is the title of a most instructive article by C. H. Stevenson. Of archeological interest is an essay by Harlan I. Smith on a costumed human figure from Tampico, Washington. Many illustrations accompany this article. Emile Guarini, who has made a special study of the use of electricity in agriculture, was commissioned to deliver a course of lectures on electroculture by the Minister of Agriculture of Belgium. An abstract of