Dr. Edward B. Rosa, of the U.S. Bureau of Standards, lays stress on the departure from established custom which is entailed by the fourth recommendation. He considers that such a system will make the State Service the refuge of the mediocrity, since there is no incentive to the individual worker. He would wish to see initial salaries determined by the promise of the candidate for a class.

The most serious objection which can be raised to the report is the almost complete failure of the Joint Commission to suggest a remedy for a disease which is only too prevalent in the United States Service: the lack of co-ordination and co-operation in research. Before the war each Department was watertight, the idea being to prevent the overlapping of research—which many consider vital to its prosecution—and consequent waste. It is not clear that any particular attention has been paid to this aspect of departmental practice. Above all, it is not evident that the Commission has fully appreciated the possibilities of the co-ordination of research and other scientific Departments of the State.

Efficiency in Industry.

WE referred last week to the comprehensive exhibition at Olympia organised under the auspices of the *Daily Mail* with the object of encouraging modern methods of increasing efficiency by the application of scientific principles. The range covered is large, dealing as it does with education, commercial organisation, factory equipment, and general industrial matters, but the keynote of applying scientific rather than haphazard methods to obtain the improved results now so badly needed runs through it all.

Scientific education is represented on the stand of the University of London, where, among other things, is to be found an interesting display exemplifying the development of the thermionic valve, which is the basis of most modern wireless telegraph work. This goes back to lamps fitted with internal plates by Prof. J. A. Fleming in 1887–89 for the study of the unidirectional conductivity effect discovered by Edison in 1883. Some of the original oscillation valves made as a result of these researches in 1904, and practically used in wireless telegraphy, are also shown. The later developments of the three-electrode valve are exemplified by a large number of valves of different design, including the form to which de Forest gave the name of the "audion." A recent four-electrode valve of Prof. Fleming's own design is to be seen, and the very latest development in wireless telegraphy is exemplified by a large transmitting valve made by the Marconi-Osram Valve Co. Some historic apparatus used by Sir William Ramsay in his researches upon the rare gases is also shown, and a collection of historic electrical apparatus from the laboratories of King's College includes some used by Clerk Maxwell.

Sheffield University shows exhibits relating to the production of cupro-nickel and some special apparatus developed by the department of glass technology. Armstrong College, Newcastle, shows Dr. Bedson's apparatus for the investigation of coal-dust explosions and the inhibitory power of inert dusts. A small amount of the dust mixture to be tested is blown by a puff of air on to a heated platinum wire in a glass bulb, and the sudden rise of pressure due to the little explosion is noted. Another educational exhibit is that of Loughborough College, Leicestershire, which is largely devoted to the work of students of the college. The technical training of partly disabled men occupies a deservedly large section of the exhibition, where the men are seen working at their various trades. An interesting exhibit relating to industrial efficiency is that of Major F. B. Gilbreth, consisting of a working laboratory for the recording of the actual movements of operatives in performing any given operation with the view of determining the most economical and least fatiguing way in which it can be carried out.

Among exhibits in the general engineering section it is interesting to see the Constantinesco wave system of power transmission working rock drills and other appliances on the stand of Messrs. W. H. Dorman and Co., Ltd. Attention should also be directed to an instrument for the regulation of temperature shown by British Oil and Fuel Conservation, Ltd. This is known as the Freeman precision control, and depends on the change of volume of the air in a bulb placed within the furnace or other chamber being heated. The expansion and contraction of the air drive a little column of mercury up and down an inclined tube, causing it to open or close a contact which, by means of a relay arrangement, controls the valve or other device regulating the supply of the heating medium.

Various branches of electrical engineering are represented in the comprehensive exhibit of the British Thomson-Houston Co., Ltd., including an electric welding plant in operation. Particular attention may be directed to a portable Röntgen-ray outfit employing the Coolidge tube with heated cathode. This is arranged to make up into four easily carried packages, and can be erected at the bedside of a patient. It is worked by means of a small transformer, with or without a rotary converter, from any ordinary direct- or alternating-current supply circuit. The power required is about 600 watts. Another remarkable piece of portable apparatus is a wireless receiving set, weighing no more than 20 lb. and needing no external connections, which will pick up messages from the chief Continental stations. A rectifier for charging small batteries from alternating-current circuits, acting on the same principle as the thermionic valve, is also shown.

A representative display of wireless telegraph apparatus is made by the Marconi Wireless Telegraph Co. A complete 3-kw. valve transmitting station for land use is shown, as well as several smaller sizes of valve receiving and transmitting equipments down to a 20-watt portable apparatus, Demonstrations are given by means of the "radio-megaphone," which is a combination of a wireless telephone receiving apparatus and a Creed "stentorphone." This latter in its ordinary form is a loud-speaking gramophone in which the record actuates a valve controlling a flow of compressed air, and gives purer and more powerful sounds than the ordinary gramophone. A large example used in this way is placed in the gallery, where it discourses music, etc., which can be heard all over the building. In the "radio-megaphone," however, the gramophone needle is replaced by a piece of specially designed apparatus which enables the wireless telephone receiver to actuate the control valve. One of these combination instruments on the Marconi stand is used to make audible the time-signals received from the Eiffel Tower and from Nauen, and to reproduce music and speech from a small wireless station at Surbiton. These are picked up on an aerial just outside Olympia.

Messages are also sent periodically from Surbiton in the Morse code at a high speed and are printed in

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ordinary type automatically on the neighbouring stand of Messrs. Creed and Co., Ltd. The Creed type of printer was recently described in NATURE (December 9, 1920, p. 472). The apparatus here exhibited is of the improved form, in which the use of compressed air is entirely done away with and a revolving type-wheel takes the place of the lever typewriter mechanism of the older apparatus. The main principles of the selecting arrangement whereby the Morse message is translated into type are the same. The new instrument has a working speed of 175 words per minute.

The most complete line telegraph exhibit is that of the Eastern and Associated Telegraph Companies, which includes a complete set of apparatus as used on a long cable circuit. This works with a Creed printer of the older pattern used with the Muirhead type of receiving perforator. Among objects of historical interest is an example of the original form of the Kelvin siphon recorder. Attention may also be directed to examples of different forms of relays used in cable work and an example of an "electrolytic magnifier," which is somewhat similar to a relay except that instead of containing actual contacts that are opened and closed by the galvanometer portion of the apparatus, the moving pointer alters the relative position of wires dipping into an electrolyte, and makes an alteration of resistance which affects the balance of the duplex circuits and actuates the receiving apparatus accordingly.

Recent advances in optical science are exemplified by the exhibits of Messrs. Chance Brothers, Ltd. A special feature is the demonstration of the properties of "Crookes" glass for ophthalmic purposes, which relieves the eyes from strain by absorbing the ultra-violet rays while allowing the whole of the visible spectrum to pass. The company also exhibits for the first time a new "daylight" glass, by the aid of which colours may be matched by artificial light exactly as in daylight. This is a glass of a bluish tint which is accurately balanced in colour against the source of light to be used so as to absorb a selection of the rays and to allow a mixture to pass through which approximates very nearly to daylight. The problem is attacked in a different manner by the Sheringham Daylight, Ltd., who show specially constructed reflecting shades which achieve a similar result by reflection instead of by transmission. In both cases the source of light employed is the half-watt lamp. Another optical instrument which should not be missed is the Optophone, which enables the blind to read from ordinary type. This has already been fully described in NATURE (May 6, 1920, p. 295, and August 5, 1920, p. 722), and is exhibited by Messrs. Barr and Stroud, Ltd.

A very comprehensive example of the methods of modern medical research is presented by the display arranged by the Middlesex Hospital, which includes a large number of prepared sections relating to parasites and bacteria mounted in microscopes. Apparatus is also shown typifying the methods used both for routine and research in photomicrography, Röntgen-ray work, and various branches of biochemical and physiological investigation. St. Mary's Hospital Medical School has also an exhibit relating to the part played by medical research in the promotion of industrial efficiency. Among the subjects illustrated are breathing apparatus for diving, mining rescue work, and gas protection. Apparatus for the recording of muscular effort is also shown.

Human Tails.

AT a meeting of the Royal Anthropological Institute held on February 8, Dr. W. H. R. Rivers, president, in the chair, Prof. Arthur Keith, in making a report on a specimen of a human tail which had been bequeathed to the institute by the late Dr. J. C. McLachan, of Halifax, Yorks, took occasion to review the present state of our knowledge regarding the occurrence of true tails in human beings. The specimen submitted was a true human tail exactly similar to one very completely examined by Prof. Ross Harrison and described by him in the Johns Hopkins Hospital Bulletin of 1901. Prof. Harrison's specimen, which was removed from a boy aged six months, was 40 mm. long at birth, 70 mm. long when excised, contained striped muscle, and moved under various emotional states. Dr. McLachan's specimen was removed from a girl aged three months, measuring 105 mm. long in its preserved state, 11 mm. in diameter at the base, and tapering to a conical point. It also contained strands of striped muscle, and must have had the power of movement. As is the case in all such specimens, with three recorded exceptions, no vertebræ were present, nor could any segmental arrangement be observed in the central core. The skin covering the tail was studded with hair-roots and sebaceous and sweat glands.

Thanks to the labours of Keibel and Elze, and of Prof. Streeter, of the Carnegie Institution, and of his pupils, our knowledge of the development of a true tail in the human embryo may now be regarded as complete. At the end of the fifth week of development, when the human embryo is approaching 5 mm. in length, caudal (post-sacral) segments begin to be differentiated from the tail-bud represented by the growing tip of the tail. By the beginning of the seventh week, when the embryo is about 12 mm. long, the human tail reaches its maximum growth and differentiation, there being then eight to ten caudal segments within the projecting conical tail. In the seventh week retrogression of the terminal and free segments takes place, and towards the end of the eighth week, when the fœtus measures about 25 mm. (1 in.) in length, the surviving four or five basal or coccygeal segments become submerged, drawing with them the terminal atropic segments, the point of disappearance of the terminal atropic part being marked by a dimple. The caudal appendage which occasionally occurs in children represents a persistence of the terminal segmented part of the tail which normally atrophies by the end of the eighth week.

The disappearance of the tail from the body of man is not a human, but a pre-human problem. It is part and parcel of the wider problem of how and when the upright, or, as Prof. Keith would prefer to call it, the orthograde, posture was evolved. The orthograde group of Primates is represented to-day by the gibbon, orang, chimpanzee, gorilla, and man; in all of them the muscles of the spine, and of the thorax and abdomen, and all the spinal and other nerve reflexes which regulate the action of muscles, have been transformed to suit the orthograde posture; in all of them the external tail has disappeared and the basal or pelvic vertebræ of the tail have been reduced to a coccygeal form. The tail is more vestigial in the primitive small-brained gibbon than in man; it is the discovery of a pre-gibbon stock which should give us the history of the disappearance of the human tail, and from the scant data at present available we may infer that such a discovery is likely to be found in strata lying well towards the base of Tertiary deposits.

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