

fourth prism with an angle of emergence equal to A , and be parallel with the axis of the telescope. This symmetrical passage implies minimum deviation through the train of prisms, and thus any ray which is brought into the center of the field of the telescope has undergone minimum deviation through the train of prisms, and possesses the clearness of definition which that fact always implies.

The accompanying illustration (Fig. 7), reproduced from a photograph of part of the solar spectrum, was made with a lens of $1\frac{3}{4}$ inches focal length applied to a telescope magnifying ten times. When an arc lamp in which sodium is present is used as a source of light, then the spectrum of the light from the arc shows the second of the two D lines (viz., D_2) to be itself double. This seems an accomplishment for a spectroscopy of only four prisms, especially with so small a magnifying power in the telescope.

The dispersion between the A and G lines is 18 deg. 20 min. During last year the instrument has been exhibited at Mercers' School, the Royal Institution, and before the Royal Society and the Physical Society of London. It is now provided with a telescope eyepiece which raises the magnifying power to 30. This step seemed warranted by the extreme brilliancy of the field with the lower powers at first provided. The line A and its region are admirably displayed, and the H lines are quite visible.—Technics.

THE SUCCESSION OF CHANGES IN RADIO-ACTIVE BODIES.*

It has been shown by Rutherford and Soddy that the radio-activity of the radio-elements is always accompanied by the production of a series of new substances possessing some distinctive physical and chemical properties. These new substances are not produced simultaneously, but arise in consequence of a succession of changes originating in the radio-elements. The radio-activity of these products is not permanent, but diminishes in most cases, according to an exponential law, with the time. Each product has a distinctive rate of decay of activity, which has not, so far, been altered by any physical or chemical agency. The law of decay has been explained on the supposition that the product undergoes change according to the same law as a monomolecular change in chemistry. The change occurs in consequence of the expulsion of an α or β particle, or both, and the activity of a product is thus a measure of its rate of change. While the products, like the emanations, and Ux , lose their activity according to an exponential law, the matter emanation X , which gives rise to the phenomena of excited activity, does not lose its activity according to a simple law. The experiments of Miss Brooks and the author, and of Curie and Danne, have shown that the decay of the excited activity of radium is very complicated, and depends upon the time of exposure to the exciting cause, viz., the emanation. The author has shown that the excited activity produced in a body by a short exposure in the presence of the thorium emanation increases at first for a few hours, passes through a maximum value, and then decays with the time according to an exponential law.

In the paper the curves of decay of excited activity of radium and thorium are given for both short and long exposures to the emanations, and it is shown that the law of change of activity with time can be completely explained on the theory that emanation X of thorium and radium is complex, and undergoes a series of successive changes.

The mathematical theory of successive changes is given in detail, and a comparison is made of the theoretical and experimental curves obtained for the variation with time of the excited activity. In the case of thorium, two changes are found to occur in emanation X . The first change is a "rayless" one, i. e., the transformation is not accompanied by the appearance of α , β , or γ rays. The second change gives rise to all three kinds of rays.

The decay of activity of emanation X of radium depends greatly on whether the α or β rays are used as a means of measurements. The curves obtained by the β rays are always identical with those obtained by the γ rays, showing that the γ and β rays always occur together and in the same proportion. The complicated decay curves obtained for the different types of rays, and for different times of exposure, can be completely explained on the supposition that there are three rapid successive changes in the matter deposited by the emanation, viz.:

(1) A rapid change, giving rise only to α rays, in which half the matter is transformed in about three minutes.

(2) A "rayless" change, in which half the matter is transformed in twenty-one minutes.

(3) A change giving rise to α , β , and γ rays together, in which half the matter is transformed in twenty-eight minutes.†

A similar rayless change is shown to occur in the "emanating substance" of Giesel.

The occurrence of a rayless change in the three radio-active bodies is of considerable interest. Since the change is not accompanied by rays, it can only be detected by its effect in the change or changes which

follow. The matter of the rayless change is transformed according to the same law as the other changes. The rayless change may be supposed to consist either of rearrangement of the components of the atom or a disintegration of the atom, in which the products of the disintegration are not set in sufficiently rapid motion to ionize the gas or to affect a photographic plate. The significance of the rayless changes is discussed, and the possibility is pointed out that similar rayless changes may occur in ordinary matter; for the changes taking place in the radio-active bodies would probably not have been detected if a part of the atom had not been expelled with great velocity.

The radiations from the different active products have been examined, and it is shown that the β and γ rays appear only in the last rapid change of each of the radio-elements. The other changes are accompanied by the emission of α particles alone.

Evidence is given that the last rapid change in uranium, radium, and thorium, which gives rise to β and γ rays, is far more violent and explosive in character than the preceding changes. There is some evidence for supposing that, in addition to the expelled α and β particles, more than one substance is produced as a result of the disintegration.

After the three rapid changes have taken place in emanation X of radium, there remains another product, which loses its activity extremely slowly. Madame Curie showed that a body which had been exposed for some time in the presence of the radium emanation always manifested a residual activity which did not appreciably diminish in the course of six months. A similar result has been obtained by Giesel. Some experiments are described, in which the matter of slow decay, deposited on the walls of a glass tube containing the emanation, was dissolved in acid. The active matter was found to emit both α and β rays, and the latter were present in unusually large proportion. The activity measured by the β rays diminished in the course of three months, while the activity measured by the α rays was unaltered. The active matter was complex, for a part which gave out only α rays was removed by placing a bismuth plate in the solution. The radio-active matter deposited on the bismuth is closely allied in chemical and radio-active properties to the active constituent contained in the radio-tellurium of Markwald. The evidence, as a whole, is strongly in support of the view that the active substance present in radio-tellurium is a disintegration product of the radium atom. Since the radium emanation is known to exist in the atmosphere, the active matter of slow dissipation produced from the emanation must be deposited on the surface of all bodies exposed to the open air. The radio-activity observed in ordinary materials is thus probably, in part, due to a thin surface film of radio-active matter deposited from the atmosphere.

A review is given of methods of calculation of the magnitude of the changes occurring in the radio-elements. It is shown that the amount of energy liberated in each radio-active change, which is accompanied by the emission of α particles, is about 100,000 times as great as the energy liberated by the union of hydrogen and oxygen to form an equal weight of water. This energy is, for the most part, carried off in the form of kinetic energy by the α particles.

A description is given of some experiments to see if the α rays carried a positive charge of electricity, with the view of determining experimentally the number of α particles projected from one gramme of radium per second. Not the slightest evidence was obtained that the α rays carried a charge at all, although it should readily have been detected. Since there is no doubt that the α rays are deflected in magnetic and electric fields as if they carried a positive charge, it seems probable that the particles must in some way gain a positive charge after their expulsion from the atom.

Since, on the disintegration theory, the average life of a given quantity of radium cannot be more than a few thousand years, it is necessary to suppose that radium is being continuously produced in the earth. The simplest hypothesis to make is that radium is a disintegration product of the slowly changing elements uranium, thorium, or actinium present in pitchblende. It was arranged that Mr. Soddy should examine whether radium is produced from uranium, but the results so far obtained have been negative.

I have taken solutions of thorium nitrate and the "emanating substance" of Giesel (probably identical with the actinium of Debierne) freed from radium by chemical treatment, and placed them in closed vessels. The amount of radium present is experimentally determined by drawing off the emanation at regular intervals into an electroscope. A sufficient interval of time has not yet elapsed to settle with certainty whether radium is being produced or not, but the indications so far obtained are of a promising character.—Nature.

BEAVER FURS.*

By CHARLES H. STEVENSON.

DURING the seventeenth and eighteenth centuries the beaver furnished the principal item in the fur trade of the world, but at present it is of somewhat minor commercial importance among the aquatic fur-bearing animals. The skins received by the wholesale dealers from various localities show different characteristics of pelage. In winter, the color on the back and sides is generally dark bay or brownish black, tipped with

chestnut or russet, and seal-brown on the under parts, legs, and feet. The prevailing color ranges toward the south to a yellowish tinge upon brown, and in the north approaching a glossy blackish brown. In general, the beavers obtained in cold latitudes are darker than those secured in warmer climates, but those from the northwestern part of the United States are very light in color. A few black beavers and still fewer spotted ones are obtained; also, at very rare intervals, a yellowish white or pure white one is taken. The Labrador beaver, now somewhat scarce, is superior to those caught farther west, while those of Canada in general, as well as of the northern parts of the United States, are superior to those taken in the Southern States.

The overhair of the beaver is from $1\frac{3}{4}$ to $2\frac{1}{2}$ inches in length, rather stiff, and of a dull color for two-thirds of its length from the base, and is terminated by shining points ranging in color from the most delicate brown to rich, glossy blackish-brown, giving the general color to the pelage. The underhair or fur is very thick, fine, and soft, from one-half to three-fourths of an inch long, and of a uniform bluish or brownish-gray color from the roots to the tips. It is denser and shorter on the underparts than on the back. The fur becomes prime in October in the latitude of the northern boundary of the United States, and continues in good condition until May, when it begins to deteriorate. The pelts are marketable, however, till about June 15, although they are somewhat thin, light in weight, and of less value.

THE MARKETS FOR BEAVER SKINS.

The economic use of beaver pelts antedates the discovery of America. As far back as the Middle Ages, at least, beaver skins were used as clothing by primitive people in Europe. Their principal use, however, was as furnishing material for fashionable hats for men. Beaver hats were worn as early as the twelfth century, but their popularity was not permanently established until the sixteenth century, and then for more than two hundred years the beaver supplied the fashionable world with hat material. As the business increased, it resulted in the slaughter of hundreds of thousands of the animals, the market consumption in certain years approximating 400,000 skins, practically all of which were obtained from Canada and the United States. So extensive and regular was the beaver trade that in the eighteenth and the early part of the nineteenth century the skins were accepted as currency throughout the western part of Canada and the United States, and were the standard for bartering with Indians.

It was not long before the market demands outran the resources of nature and the beaver was in danger of extermination. The price of the skins increased correspondingly, selling at times for \$8 or \$10 per pound, and the finished hat for \$20 or more. At length the supply of the fur became so inadequate that other materials were necessarily substituted, resulting about 1839 in the general adoption of the silk hat by the fashionable world.

The demand from manufacturers of hats diminishing, the price of beaver pelts fell so low that the hunt proved unprofitable. Later a demand developed for the skins in the dressed-fur trade, and the price became steady at about \$2 or \$3 each. This fur became fashionable about twenty years ago, and the indications are that it will be in favor for many years. Small quantities, partly damaged in the curing, are yet used by the hatters, but its employment is mainly as dressed fur for caps, mufflers, gloves, trimmings, etc. Sometimes entire garments are made of it, but its weight makes it objectionable for that purpose. The darker pelts are usually purchased for the European and Canadian markets, while the medium and paler shades are worked up for consumption in this country.

The greater portion of the beaver skins taken on the American continent during the last 200 years have been handled at the London auction sales. The first sale occurred on January 24, 1672, and was an event of much importance. From that time to the present the total number of skins handled in London approximates 30,000,000, with a total valuation of \$100,000,000. The average annual sales at present approximate 50,000 in number.

In addition to those handled in London, about 20,000 beaver skins are now marketed each year, being sold at Leipzig and at private sale in the United States and Canada. This makes a total of about 70,000 skins marketed annually in recent years, of which about 10,000 are obtained in the United States and 60,000 in the Dominion of Canada.

In the markets, beaver skins are classed not only according to the general localities whence they are obtained, but also according to their size and the quality of the fur. In assorting them four grades are recognized. Those of the first grade have a flesh-colored pelt, which appears fresh and sound, and with long heavy fur, which separates down to the membrane when blown into, and appears uniformly even, fine, and silky. The seconds are almost clear in the pelt, and the fur only slightly scant or poor. In the thirds the fur is thin, scant and poor, and the pelt dark. Fourths are of the poorest quality, with pelt almost black or bluish-green color, and the fur short and thin. Each of these grades is divided according to size, the large, medium, small, and kits. The prices range from \$1.25 for the poorest to \$10, \$12, and even \$16 for those of choicest grade, averaging somewhat less than \$6 per skin.

Fifteen years ago large quantities of beaver fur were used in this country, and as much as 65 per cent of

* Bakerian lecture delivered at the Royal Society on May 19 by Prof. E. Rutherford, F.R.S.

† A statement of the nature of the three changes occurring in emanation X of radium was first given in a paper by Rutherford and Barne (Phil. Mag., February). A brief account of the theory from which the results were deduced has been given in my book "Radio-activity" (Cambridge University Press). Later, Curie and Danne (Comptes Rendus, March 14) arrived, in a similar way, at the same conclusions.

* From U. S. Fish Commission Report for 1902.

that sold in London was purchased for the United States trade. At that time long garments were fashionable, and plucked and dyed beaver was much in demand for trimmings. During recent years, however, beaver fur has been largely out of fashion in the United States and Canada, and consequently the consumption in these countries has not been extensive.

DRESSING AND FINISHING BEAVER SKINS.

On arrival in the markets beaver skins are rough and greasy, with the fine rich fur almost concealed by the coarse brownish hair. In the process of dressing, the skins are first soaked in water over night. The following day each one is placed, flesh side up, on a flat hardwood beam, and with a breaking knife a workman breaks up the grain of the pelt, thus softening it. The pelts are washed with warm water and soap, and then prepared for plucking. The water is removed by passing them through either an ordinary roller wringer or a centrifugal wringer, or, in some houses, by pressing them with the breaking knife. The hair side is dried and warmed by artificial heat, care being taken to keep the pelt side damp; chalk is sprinkled over the surface, and the hair removed. A small percentage of beaver skins, probably not more than 1 per cent, are left "in the hair"—that is, the overhair is not removed. Only a small demand exists for natural beaver, however, owing to its rough and coarse appearance.

Formerly it was customary to shear beaver skins, instead of plucking them, and many are yet prepared in that manner on the continent of Europe. In this case it is necessary to moisten the pelt preparatory to plucking; but, placing the skin, flesh side down, on a beam and using a comb and shears, a workman clips off the greater part of the long hairs in much the same way as a barber operates. Beaver thus prepared bears some resemblance to sea-otter fur, especially when very dark pelts are used, and sheared beaver is often used in imitation of that costly fur. The imitation is greatly enhanced when the overhairs are whitened by means of an acid.

After plucking, the pelt is shaved for the purpose of reducing its bulk preparatory to leathering. The pelt side is then dampened with cold salt water and allowed to so remain over night. The following morning it is stretched lengthways and crossways and partly dried. Butter or other animal grease is rubbed on the pelt side, and a number of skins placed in a fulling or tramping machine in which two hammers push or beat and turn them for eight or ten hours. The skins are then placed with a quantity of hardwood veneer sawdust in a large drum, over either a gentle charcoal fire or steam heat, and revolved for three or four hours. Next they are placed with sawdust in tubs, where they are tramped by barefooted workmen for about three hours, each tub containing about twenty skins.

On removal from the tramping tubs the pelts are thoroughly stretched by hand, and the leather side dampened over night preparatory to shaving on the following day. Shaving is the most difficult feature, and is entrusted only to skilled workmen. Each skin is placed, fur down, on a perfectly smooth hardwood beam, similar to that used in skiving, and by means of a skiving knife the operator shaves off the membrane of the pelt until the roots of the fur are almost made visible.

The skins are again stretched lengthways and crossways by hand, dried, and for the second time placed in the tramping tubs with hardwood sawdust for further softening and leathering. After two or three hours' tramping they are removed, straightened or stretched out, and returned for two or three hours further tramping. They are next thoroughly beaten with bamboo sticks to remove the sawdust, and then combed with a fine steel comb to lighten up the fur. The skins are then placed on a beam and by means of a large flat-bladed knife, sharp as a razor, a workman shaves over the top surface of the fur, removing all scattering hairs and impurities, thus completing the dressing process.

While it is not customary to dye beaver fur, many light skins are blended to a darker shade, and a few are dyed in much the same manner as fur seal. Some few skins are bleached golden brown, and a smaller number to a creamy white. Some are silvered by passing lightly over them a solution of sulphuric acid, and some are made a golden yellow by means of peroxide of hydrogen.

About twenty years ago many beaver skins were "pointed," the plain solid color being ornamented by inserting white hairs at irregular intervals, in imitation of the pelage of the sea otter or the silver fox. The hairs were generally sewed in the pelt by wig makers, but in some cases they were firmly fastened with cement. Badger hairs were most frequently employed, but white hairs of the gray fox, cony, and skunk were also used. On account of its varied white tips, the hair of the Egyptian ichneumon was also in great demand, being superior to the hair of the fox, or even the badger. Some skins were likewise ornamented with the white tips of small feathers taken from the breast of the grebe and less frequently the peacock. This ornamentation was quite fashionable from 1881 to 1884.

Beaver fur is especially serviceable for making hats because of its remarkable felting characteristics and its durability and glossiness. So strong are its felting properties that coats made from cloth of this material, manufactured solely by the felting process, have been known to wear for years, and it is claimed that in former times beaver fur was sometimes felted for hosiery purposes. While it is the most desirable of all

furs for hat making, its high cost prevents its general use for that purpose. Practically the only beaver fur now received by the hatters is the blown fur obtained from the manufacturers' clippings and that cut from skins damaged in curing or otherwise. But even in using fur from these sources, a light hat made from beaver cannot be purchased for less than about \$10, and the price is likely to be \$15 or more.

TRADE NOTES AND RECIPES.

Note on Bronze Casting.—The composition of bronze must be effected immediately before the casting, for bronze cannot be kept in store ready prepared. In forming the alloy, the refractory compound, copper, is first melted separately, the other metals, tin, zinc, etc., previously heated, being then added; the whole is then stirred, and the casting carried out without loss of time. The process of forming the alloy must be effected quickly, so that there may be no loss of zinc, tin, or lead through oxidation, and also no interruption to the flow of metal, as metal added after an interval of time will not combine perfectly with the metal already poured in. It is important therefore to ascertain the specific weights of the metals, for the heavier metal will naturally tend to sink to the bottom, and the lighter to collect at the top. Only in this way, and by vigorous stirring, can the complete blending of the two metals be secured. In adding the zinc, great care must be taken that the latter sinks at once to the level of the copper, otherwise a considerable portion will be volatilized before reaching the copper. When the castings are made, they must be cooled as quickly as possible, for the components of bronze have a tendency to form separate alloys of various composition, thus producing the so-called tin spots. This is much more likely to occur with a slow than with a sudden cooling of the mass.—Metallarbeiter.

Manufacture of Hollow Silver Articles by Means of Galvanization.—Rauscher's process for making hollow figures consists in covering models of the figures, made of a base or easily soluble metal, with a thin and uniform coating of a nobler metal, by means of the electric current in such a way that this coating takes approximately the shape of the model, the latter being then removed by dissolving it with acid. The model is cast from zinc in one or more pieces, a well-chased brass mold being used for this purpose, and the separate parts are then soldered together with an easily fusible solder. The figure is then covered with a galvanized coating of silver, copper, or other metal. Before receiving the coating of silver, the figure is first covered with a thin deposit of copper, the silver being added afterward in the required thickness. But in order that the deposit of silver may be of the same thickness throughout (this is essential if the figure is to keep the right shape), silver anodes, so constructed and arranged as to correspond as closely as possible to the outlines of the figure, should be suspended in the solution of silver and cyanide of potassium on both sides of the figure and at equal distances from it. As soon as the deposit is sufficiently thick, the figure is removed from the bath, washed, and put into a bath of dilute sulphuric or hydrochloric acid, where it is allowed to remain till the zinc core is dissolved. The decomposition of the zinc can be accelerated by adding a pin of copper. The figure now only requires boiling in soda and potassic tartrate to acquire a white color. If the figure is to be made of copper, the zinc model must be covered first with a thin layer of silver, then with the copper coating, and then once more with a thin layer of silver, so that while the zinc is being dissolved, the copper may be protected on either side by the silver. Similar precautions must be taken with other metals, regard being paid to their peculiar properties. Another method is to cast the figures, entire or in separate parts, out of some easily fusible alloy in chased metal molds. The separate portions are soldered with the same solder, and the figure is then provided with a coating of copper, silver, etc., by means of the galvanic current. It is then placed in boiling water or steam, and the inner alloys melted by the introduction of the water or steam through holes bored for this purpose.—Technische Rundschau.

Tempering Copper or Copper Alloys.—The process of tempering copper or its alloys described in the *Zeitschrift für Werkzeugmaschinen und Werkzeuge* (Journal for Machine Tools and Tools) consists in heating the metals in question for a time at the requisite temperature, sprinkling them while in a heated condition with sulphur, and then plunging them hot into a bath of blue vitriol. It is advisable to reheat the metal before it has become quite cool. Numerous experiments have shown that the new tempering process is specially suitable for alloys of copper, and that remarkably good results can be obtained by treating an alloy of copper and tin by the process just described. Any of the various alloys of copper can, however, be used, the choice depending of course upon the nature of the article for which it is intended. The copper or alloy is usually put into the required shape (e. g., a wheel or tool) before tempering. The castings are then heated for a suitable time, say three minutes, over a fire, preferably a charcoal fire, at the proper temperature. The best results are obtained when the temperature is raised to the melting point of tin. The articles are placed on the fire and, together with the neighboring blocks of charcoal, sprinkled with powdered sulphur, till they are entirely covered by it, the sulphur-vapor thus being brought into contact with the castings. It is best to add the sulphur when the articles are thoroughly heated. After

being covered with the sulphur the castings remain in the fire for a time; they are then plunged hot into a solution of blue vitriol, and allowed to remain in it for a short period. When the castings are taken from the vitriol, it is well to reheat them, and allow them to cool without the intervention of a cooling mixture. The new method of treating copper and its various alloys produces a remarkable hardness without impairing the ductility of the metal, thus rendering it specially useful for purposes for which a high degree of hardness and, at the same time malleability, ductility, and toughness are required.

ENGINEERING NOTES.

The results of some trials made by the French Automobile Club to ascertain the distances at which motor cars can be stopped when running at various speeds are likely to upset the popular impressions formed by many motorists that a car can be brought to a standstill in its own length from a speed of 30 miles an hour. The trials in question were conducted in the Bois de Boulogne, and while they show that motor cars can stop quicker than horses, yet they required a distance of 10 feet in which to come to rest when traveling at a speed of $7\frac{1}{2}$ miles an hour. At a speed of 10 miles an hour they stopped in $13\frac{1}{2}$ feet, and at $12\frac{1}{2}$ miles, in $16\frac{1}{4}$ feet. At 16 miles an hour, 33 1-3 feet were required to stop in, and 60 feet at a speed of 25 miles an hour.

It is gratifying to learn that science has at length discovered the real cause of "caisson disease"—the terrible scourge which is the dread of engineers where submarine or tunneling operations have to be carried on under a pressure greatly exceeding that of the normal atmosphere. It has long been recognized that work done under such conditions is attended with much danger to those employed, and produced very distinct physiological effects, though these varied considerably with different individuals; while experience has taught that risk could be greatly mitigated by making the process of translation from one pressure to another—whether an increase or decrease—a gradual one combined with a free ventilation of the working chambers in which the men are engaged. Various hypothesis had been advanced by medical men to account for the different symptoms displayed by victims of the disease, and which in some cases would produce intense pains in the joints, in others some form of paralysis, and in others again, deafness, vertigo, loss of consciousness, etc.; but it has remained for Profs. Hill and Macleod to lay bare the whole pathology of the symptoms displayed, and by completely solving the problem of causation give engineers not only confidence in controlling and largely mitigating the evil results of working under pressure, but of extending the range of operations which have hitherto been regarded as possible for human endurance in diving and caisson work. The result of the careful and prolonged investigations which have been conducted by the two eminent scientists named were given in a recent communication to the Times, and though they do not in some ways teach anything new as regards the principle of the preventive measures needed to diminish the risks of injury, they demonstrate the scientific connection between cause and effect so clearly as to greatly accentuate the importance to be attached to them and thus to insure their more rigid observance. The investigations in question have shown that the various symptoms displayed by victims of caisson disease are produced by the effervescence of the blood in the small blood vessels consequent on the escape of the excess of air which exposure to pressure has forced into solution, and which subsequently effervesces like the gas in a freshly-opened bottle of sparkling wine. This escape of air from the blood vessels obstructs the circulation in the parts nearest them, and the nature of the bad symptoms displayed depends on the position of the blood vessels in which most air happens to be absorbed at the time, and in which effervescence is most readily effected. The gravity of the result depends on the intensity of the pressure, the length of exposure, and the rapidity with which the process of effervescence of the absorbed air is effected. A careful series of experiments on animals has shown that the occurrence of all these symptoms may be entirely prevented up to pressures of considerable amount, by the simple precaution of a very slow readjustment of pressure, under which the air in solution escapes from the blood gently and gradually, and no tendency to frothing occurs. The sole condition of safety appears to be the provision of a proper chamber in which this gradual escape of air from the blood may be carried out. This involves some degree of compulsion and curbing of the natural impatience which induces a workman, as soon as he has finished his shift, to escape as quickly as possible from his toil. Profs. Hill and Macleod are convinced as a result of their experiments that by the simple yet stringent insistence of the precautions suggested, caisson work may be carried on at pressures practically double those which are now considered the limit of human endurance, and which is roughly equivalent to about 70 feet or 100 feet head of water, or from 30 pounds to 45 pounds per square inch. Although divers do now occasionally descend as much as 120 feet beneath the surface, it is only exceptional constitutions that can stand such treatment, and even to such individuals the strain is severe. An extension of the practical range of pressure to a depth equal to 200 feet of water opens up possibilities in connection with pearl fishing, wreck salvage, and sinking operations as to make the discovery of the real nature of