bitter experience that a summer temperature which is comfortable when the percentage of humidity is low, becomes insufferable when that percentage is high. This is explained by the fact that when the air is dry, evaporation from the body is rapid, and the latent heat of evaporation, being drawn from the body, cools it off proportionately. When the atmospheric humidity is high, the air is less able to receive fresh moisture, evaporation from the body is slow, and its temperature is correspondingly high. Applying this to the low temperature of the winter season, we find that the very dry air of many houses conduces to a rapid evaporation from the human body, and a corresponding lowering of its temperature. Hence the interior of a house in which the air is abnormally dry must be at a higher temperature to be comfortable than an interior in which the percentage of humidity is high.

Speaking upon this question, Dr. W. M. Wilson, of the United States Weather Bureau, who has given the subject careful study, says: "It is safe to assume that during the winter months the normal relative humidity in lake cities is 72 per cent. From observations with respect to moisture in business offices and living rooms heated by steam, hot water and hot air, it is safe to assume that the average relative humidity in artificially heated dwellings and offices in the winter months is about 30 per cent, or about 42 per cent less than the average outside humidity, and drier than the driest climate known."

As the evaporative power of the air at a relative humidity of 30 deg. is very great, the tissues and delicate membranes of the respiratory tract are subjected to a drying process and a great increase of work is placed upon the mucous glands in the effort to compensate for the lack of moisture in the air. This increase of activity, and the frequent unnatural stimulation induced by the changing conditions of humidity from the moisture-laden air outside to the dry temperature inside of our dwellings, result in an enlargement of the gland tissues and a thickening of the membrane itself. It is only a question of time when the surface is prepared for the reception of germs of disease which tend to develop under exposure to the constantly changing conditions referred to. It has been stated by engineers who have given careful study to the subject that by holding the temperature of our school rooms, living rooms and offices at 60 deg. and raising the humidity to 70 per cent, about 25 per cent of the cost of heating might be saved. It is suggested by Dr. Wilson that to avoid the possibility of unpleasant results from condensation, our dwellings could be heated to 65 deg. with a relative humidity of 50 per cent and a saving of from 12½ to 15 per cent secured over the present cost of heating.

This interesting paper naturally raises the question as to whether humidity can be brought under proper mechanical control. That is to say, can atmospheric moisture be supplied artificially and accurately to the extent that may be desired? This is a field of research and experimentation in which some good results have been achieved, but which is yet open for considerable improvement. If the public could be brought to understand how intimately the question of humidity is associated with that of temperature in the matter of heating, there would be a demand for artificial control of humidity, which would react with a beneficial effect on the whole of the steam-heating industry.

THE PROPOSED HISTORY OF THE PATENT OFFICE.

The Patent Office of the United States has now been in existence one hundred and eleven years. During that time it has ever been one of the most efficiently conducted branches of the governmental service. Perhaps because it has so admirably met the requirements of the public, and perhaps because it has been protected as far as possible from baneful political influence, the Patent Office is rarely mentioned in the daily press and is, consequently, the one department of our government about which least is known. For the purpose of enlightening the general public on the work which the office has conscientiously performed during its existence, and of placing in the hands of inventors a book which will explain the method of procedure in obtaining patents and which will give such general information as may be valuable, the Commissioner of Patents has authorized the publication of "a complete history of the Patent Office, with useful miscellany." In the Official Gazette a letter has been published inviting all persons to furnish the chief clerk of the office with rare documents, printed articles, or material not readily obtainable that may prove of value in compiling the work.

The literary labor of preparing this history for publication has been entrusted by the Commissioner to five principal examiners, the chief of the Issue and Gazette division, and the chief clerk. This publication commission has already outlined the general plan of the history. From information which we have received the work will be a reference book of vast scope.

The historical chapters will begin with a discussion of mediæval royal monopolies and will show how they differ from the present patents. Besides narrating the history of patents in the United States, the work will describe the organization and administration of the Office, discuss the aims and advantages of the present system, compare that system with the methods followed in foreign countries, and briefly analyze our present laws. The commercial benefits to be derived from a well-conducted patent system will likewise form the subject of a chapter which should prove of unusual interest. One of the most important parts of the history will comprise a careful financial study of the value of patented inventions to the country at large. Statistics will be given to show how enormously the national wealth has been increased by the invention of such devices as the trolley, the telephone, the telegraph, the bicycle, Bessemer steel, the cotton gin, the steam engine, fireproof buildings, and labor-saving machinery. Abstracts from the reports of the Bureau of Labor will demonstrate what the patent system has done to cheapen the price of commodities by fostering inventions. Among the miscellaneous matter which will be included may be mentioned the articles on negro, Indian and women inventors; on the inventive genius of various races; and on the relation of environment to invention, as well as studies of certain prolific inventors, and a brief history of some principal arts.

That so ambitious a work, if successfully completed, will prove of inestimable value cannot be doubted. The office has received innumerable calls from legislators for specific reports on various topics, communications from all parts of the world requesting information not readily obtainable, and, indeed, has itself felt the need of a text-book which could be used by the examiners and their assistants. Hitherto it has been almost impossible to obtain accurate information upon certain subjects pertaining to the work of the Patent Office. Official reports, most meager in their details; the "fire issue" of the Official Gazette which bears the date of October 9, 1877; a handful of congressional documents bearing only upon certain points; Campbell's "The Patent System of the United States;" various periodicals, containing scattered articles comprise the entire information on the patent system at present readily available to the public. To issue a work which would exhaustively treat of the origin, development, and present condition of our Patent Office would be a task which no single person could successfully hope to perform. Only by setting all the machinery of the government in motion and by gathering from official as well as private sources the facts which have accumulated in a hundred years is it possible to bring forth a work in which the United States Patent Office of the past and of the present will be adequately described. From the present indications it seems reasonably certain that the history will be ready for distribution at the opening of the St. Louis Exposition of 1903.

WATER-TUBE VS. FIRE-TUBE BOILERS FOR NAVAL USE.

As our engineering readers are aware, recent experiments were instituted by the English government to determine the relative advantages of two types of boilers, fire-tube and water-tube, the test being made with two naval ships of nearly equal powers and displacements in a race of 1,000 miles, more or less, the vessel arriving first being considered the victor. It seems scarcely possible that such a trial as this has the countenance and support of English engineers generally, for it is in no sense conclusive or satisfactory as to the relative values of either type for naval work, being a sort of go-as-you-please contest, depending largely upon extraneous conditions as to the result, wholly unconnected with the boilers or their management. In this particular "race," as it was called, the fire-tube boiler arrived first, but the weather was so bad, by reason of fog, that the vessel it was in might just as easily have been the last.

Speed in a war vessel is, of course, of the first importance to catch enemies who are trying to escape, but there are other qualities equally necessary, and one of these is that the boilers of such vessels shall be able to keep the sea for a long time without needing repairs that cannot be made on board, also that the boilers shall be capable of being brought into full power quickly, and be easily managed during action. No one type combines all these qualifications, and it is not surprising that naval boards are puzzled as to a choice; there is much to be said for both fire-tube and water-tube boilers, but one of the greatest objections to the fire-tube type, as exemplified in the Scotch boiler, so called, is its extreme weight. The shell-plates of these boilers are from one inch and one-quarter to nearly one and one-half inches thick, or about 56 pounds per square foot; as the boilers are about fifteen feet long by the same diameter, it is easy to see that the shells alone are exceedingly heavy. In addition to this the tubes, furnaces and fixtures generally add a great deal more weight. The Scotch boiler is objectionable from the great difference of temperature between the top and bottom of the shell, and is subjected to enormous strains from this cause alone, aside from that of the steam pressure. The combustion chamber at the end, and the circular furnaces as well, give a great deal of trouble, and the fire-tube boiler requires a lot of watching—with modern steam pressures—to keep it up to its work. But the water-tube has troubles of its own also. Although it is lighter for a given power, and a quick steamer and 200 pounds per square inch can be generated from cold water in thirty minutes without injury, while it takes less space than a fire-tube boiler of the same evaporative power, the tubes, both small and large types, are a constant source of anxiety. With anything like fair treatment, however, the water-tube marine boiler does good work, and is capable of long-continued action.

The United States gunboat "Marietta," having water-tube boilers, went around the world, made quick time, and needed no repairs except renewal of a few tubes in her boilers, but naval officers are by no means a unit for their adoption, each type having its partisans. In our own navy we have vessels fitted with both kinds, fire-tube and water-tube boilers, in one ship, for the purpose of instituting comparison side by side, but neither type has been declared wholly unobjectionable, and the probabilities are that the battle of the boilers will be something like that between guns and armor—as much may be said upon one side as the other.

SCIENCE NOTES.

In 1900 in the Punjab, a section of India, where about one-half a million persons die annually, only 893 were killed by snake bites. Their bite is more often inflicted in houses than either in the fields or in the jungle. During the year in question 1,374 wild animals were slaughtered, including 11 tigers, 186 bears, 184 leopards and 99 wolves; 13,272 snakes were killed.

An expedition to Kolynsk, Russia, is being made by Russian scientists in order to bring to St. Petersburg the mammoth which has recently been discovered. It is unique of its kind, its hair, skin and flesh being entirely preserved, and there are remains of undigested food in its stomach.

The Small Art Palace, one of the permanent buildings of the Paris Exposition of 1900, will be used as an Art Museum for the city, and will receive the collections of works of art which are at present scattered in various places, says The Builder. A special architectural gallery will be provided in which drawings and models can be preserved.

An effort is to be made to remove a large red oak tree from the wildest section of Arkansas to Forest Park, St. Louis, for the Louisiana Purchase Exposition. The tree is 160 feet high and 12 feet in diameter at the base. A double tramway will be built from the tree to the river, where it will be floated and towed to St. Louis. It is estimated that this will occupy six months. The tree will be dug up by the roots instead of being cut, and none of its branches will be trimmed, so that it will appear on exhibition just as it now stands in the woods.

Consul-General Hughes writes from Coburg that, according to the German press, fibroleum, a new artificial leather, has just been invented by a Frenchman. It consists of pieces of refuse skins and hides, cut exceedingly small, which are put into a vat filled with an intensely alkaline solution. After the mass has become pulpy, it is taken out of the vat, placed in a specially constructed machine, and after undergoing treatment therein, is again taken out and put through a paper-making machine. The resulting paper-like substance is cut into large sheets, which are laid one upon another, in piles of from 100 to 1,000, and put into a hydraulic press to remove all moisture. The article is strong and pliable, and can be pressed or molded into all kinds of shapes and patterns. It is said to make the best kind of wall paper. Decorators who have used this article speak of it in the highest terms.

Dr. Alvah H. Doty, Health Officer of the Port of New York, has tried some experiments on the extermination of mosquitoes. His operations were confined to the basin in which is the malaria-infected village of Concord, S. I. Four ponds and a marsh were treated with crude oil donated by an oil company. A 100-barrel tank was run on a railroad siding and the oil was allowed to flow into a portable tank of 10 barrels' capacity. The tank was then taken to the scene of operations. Attached to the small tank was a compressed-air cylinder, and a pressure of 20 pounds to the square inch was used. From the valve of the tank ran a 200-foot hose which connected with a float which carried perforated gas pipes, so that the oil could be forced below the surface of the pond. When the pressure was applied the oil and water were thoroughly mixed. The float was drawn back and forth, so that every foot of the water was covered. The oil as it rose to the surface collected at the edges of the pond, thus destroying any matured larvæ. The experiment is watched with the greatest interest.

Electrical Effects—Luminous and Vibratory.

M. D. Negreans, of Paris, has made an interesting series of experiments relating to the vibrations and luminous effects produced in metallic wires by a Wimshurst machine. If one pole of the machine is connected to a wire stretched, insulated and contained in a tube, the other pole of the machine being connected to earth, the wire is seen to make transverse vibrations. If the vibrating wire is observed in the dark, alternately luminous and obscure portions are seen. When the wire is attached to the positive pole of the machine the phenomenon takes the form of brilliant and equidistant lines, which are wider at the middle of the wire and thinner at the ends. In the case of the negative pole, a series of equidistant luminous points is seen all along the wire. The experiment was made with a glass tube 8 feet long and 2.4 inches diameter, and a wire gaging 0.1 inch. If two wires of the same length are stretched parallel and connected with the two poles of the machine (the outer ends being electrically free), the wires enter into vibration. In the dark, a series of equidistant luminous points are seen on the negative wire, while on the positive is a series of luminous lines whose centers correspond to the luminous points of the first wire. The experiment is very brilliant if the two wires are fused in the ends of a glass tube, and the luminous lines and points appear very regular. If the wires are close enough together, only one of them need be attached to the machine, the second being connected to earth, thus giving a condenser effect.

IN THE TERMINAL STATION AT BUFFALO.

BY ARTHUR B. WEEKS.

As has been heretofore stated in a recent article in these columns, a third transmission line, of aluminium, has been finished and is now in operation between the cities of Niagara Falls and Buffalo, carrying electric current from the Niagara Falls Power Company's plant to the Pan-American Exposition. In the terminal station, just within the city limits of Buffalo, is found a fine example of modern insulating construction and protective devices, the experiences of years having brought to bear in producing marked changes and wonderful developments in the handling of high voltages.

The cables, on entering the terminal station, are connected to the time limit relay circuit-breakers and switches shown in one of the accompanying illustrations. At the rear of these specially built panels are the lightning arresters, consisting of spark gaps and choke coils. From these panels the cables are continued to six Westinghouse static interrupters, 100 amperes at 22,000 volts, one on each pole, a common ground wire being used for the interrupters, between each of which and the ground an inclosed fuse is in circuit.

From these interrupters, located in the rear of the transformers shown in our second engraving, the two three-phase circuits are continued and next connected to the six 2,250-kilowatt Westinghouse transformers, which, like others of that make, are oil-insulated and water-cooled.

The pressure is here reduced to 11,000 volts, and the three-phase cables continued to the distributing board, as will be seen in our third engraving. Here they are connected to two sets of bus-bars run through vitrified tiles, to prevent short circuits. From the bus-bars a number of circuits run.

The cables coming from the transformers extend upward through the floor, through porcelain insulators, at the rear of the distributing board. The circuits have single element switches which may be connected to either set of bus-bars. Each circuit on the distributing board has its circuit-breaker and switch. Some lesser parts of the wiring are as yet incomplete, as well as a railing which will take the place of ropes now stretched before the open, unprotected switches. In our illustration is shown a platform where circuit-breakers are opened or closed by means of a hand lever.

RELATIVE SPEED INDICATOR.

Kilroy's relative speed indicator, which is manufactured by Messrs. Evershed & Vignoles, Limited, Woodfield Works, Harrow Road, London, has been devised in order that those in charge of the engines

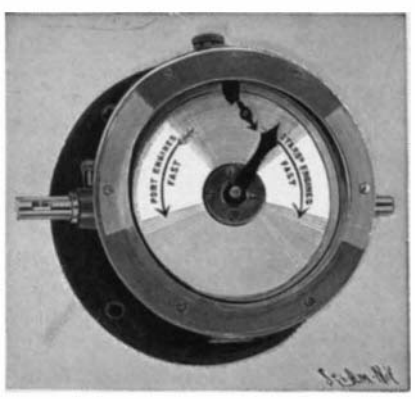


Fig. 1.

in twin-screw ships may be able to know at a glance whether the port and starboard engines are running at equal speeds, and, if not, which is going the faster. The indications given by this indicator are such as to enable the engineers quickly and easily to bring the engines to equal speeds, and maintain them so. The advantages gained in the engine-room by the use of this indicator are self-evident to those used to the management of marine engines. Deck officers will appreciate the benefits derived, as the equal running of the two engines, besides insuring a slightly better

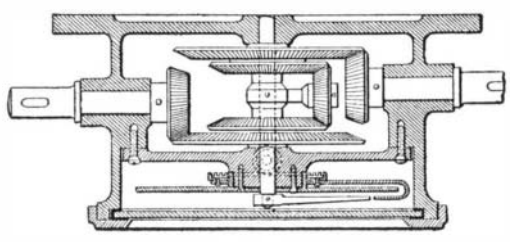


Fig. 2.

efficiency of propulsion, facilitates the steering of a ship under all steaming conditions.

The engraving shows an indicator. One of these would be fitted in each engine-room, suitably near the starting platforms.

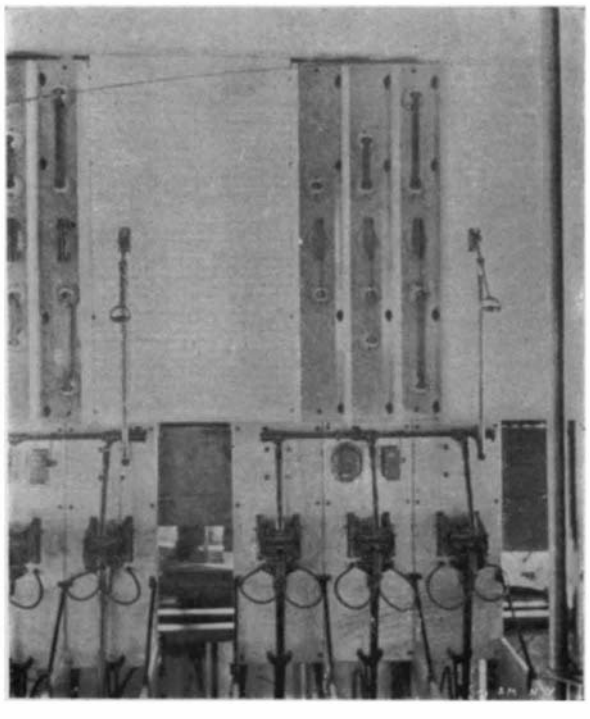
When the two engine-rooms are separated by a water-tight bulkhead, the two indicators could conveniently be coupled together, one on either side of the bulkhead; as, in this case, connection by shafting to the port and starboard engines need only be made to one of the two indicators. The direction of rotation of the pointer indicates the faster engine. The right-hand shaft is joined by shafting to the starboard engines; the left-hand shaft is joined by shafting to the port engines. When both engines are running at equal speeds, the pointer will remain stationary opposite the indicator mark. If the starboard engines are running faster, the pointer will move round in the direction indicated on the dial shown in the photograph. If the port engines are running faster, the pointer will move round in the opposite direction, as indicated on the dial. The small arrow pivoted under the indicating mark is always pointing in the direction in which the pointer has moved away from the indicating mark. Lubrication is provided for all the moving parts, an oil syphon being fitted in the usual way.

It will be seen from Fig. 2 that the shafts to be connected respectively to the port and starboard engines each engage, by means of bevel gearing, with a differential bevel gear, whose bevel pinion is mounted on an arm which is pinned to a spindle, to the end of which is fixed the pointer. An auxiliary pointer acts as the "indicating mark," and is fixed, behind the dial, to a crown wheel gearing with a pinion on a spindle, which is actuated by a knob on the outside of the instrument. This arrangement enables the "indicating mark" to be moved round the dial opposite to the pointer when necessary. The small auxiliary arrow pointer, which can be seen in Fig. 1, but which is not shown in Fig. 2, is pivoted under the "indicating mark," and has a cam attached to it behind the dial worked by a spring lever. At the back of the pointer is a spring pin or tooth, which engages in a hollow in the back of the arrow pointer in such a way as to leave it pointing in the direction in which the pointer has moved away from the "indicating mark." —We are indebted to London Engineering for the above description.

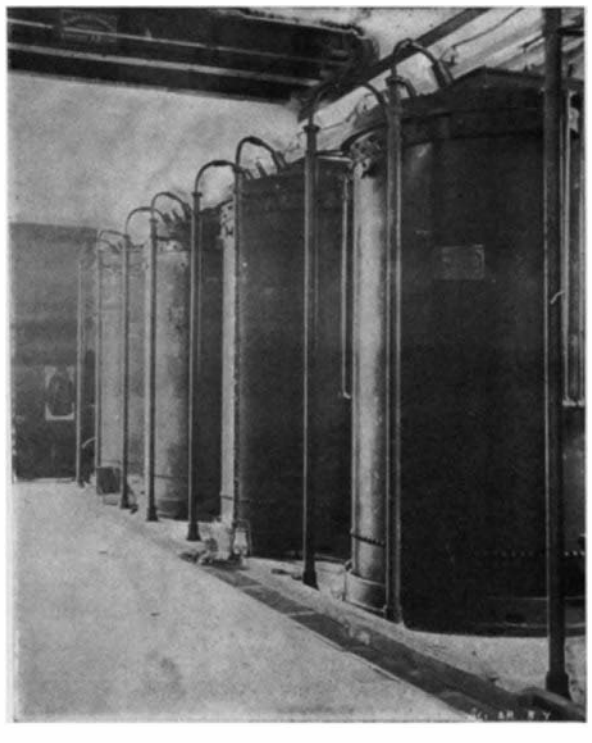
Restriction of Penny-Ice Trade.

The London Lancet sounds a note of warning concerning penny-ices, the number of peddlers of this delicacy being about as numerous in the British metropolis as in this country. The penny-ice man is usually an Italian who is anxious to return to his own country after ten or twenty years' hard work, and become a land owner. In order to do this he is compelled to live in unsanitary surroundings where there is every risk of contamination. The Public Health Committee of the London County Council recently brought out a report, which was adopted by the Council, recommending legislation forbidding the manufacture, sale or storage of ices in any cellar or room in which there was an inlet or opening to a drain, or in any other place where there is any risk of contamination or infection. A failure to notify in case of infectious or contagious disease occurring among persons employed in this place would lead to summary conviction and the infliction of a fine. Finally, every vendor must exhibit on his barrow a notice giving the name and address of the persons from whom the ices have been obtained. Many ices are made in small backyards of overcrowded tenement houses, and the conditions are as unsanitary as when the ices are made in an unhygienic room. From the public health point of view, it would be a great advantage if the ices were made in large and properly arranged establishments. Aniline colors are freely used in tinting the ices.

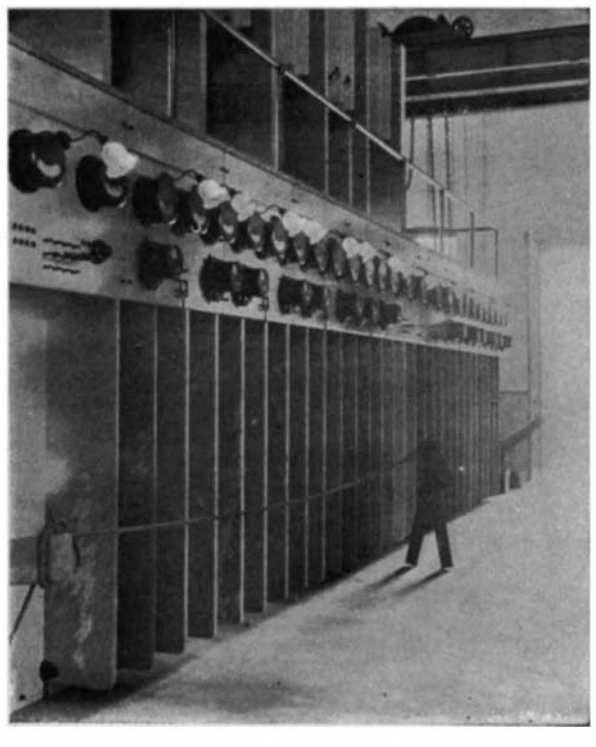
The chimney of the Oxford copper works at New Brighton, Staten Island, is 365 feet above the ground.



Time Limit Relay, Circuit-Breakers and Switches.



Transformers.



Distributing Board.

TERMINAL STATION AT BUFFALO.