REGISTERING THERMOMETERS AND PRESSURE GAUGES.

We illustrate herewith two apparatus which have the one feature in common of inscribing their indications in ink and in a continuous manner upon a sheet of paper which is carried along by a clockwork movement.

These apparatus are very portable, and can be applied everywhere without the necessity of having recourse to special employes to attend to them. They are constructed after the same pattern, and consist of a glass case which contains the mechanism and permits the tracing pen, as well as the paper band, to be seen from the exterior. The system of registering is identical in the two apparatus, and this accounts for the moderate price of them. The registering apparatus consists of a movable, vertical drum containing wheel work. The top of this contains two apertures for the insertion of the keys for winding, and which are closed by slides, and the bottom is traversed by an axle which carries externally a toothed pinion that gears with a fixed wheel. This latter is keyed to a rod mounted on the base of the apparatus and serving as a rotary axis for the drum. The toothed pinion performs the role of a planet wheel for bringing about a general rotation of the drum. This registering mechanism, as a whole, is capable of being easily separated from the rest of the system, it being only necessary to unscrew a button in order to disengage the drum without touching the other parts. By merely varying the proportions of the radii of the two planet wheels which regulate the final motion, the constructor can readily modify the velocity and consequently the duration of the revolution.

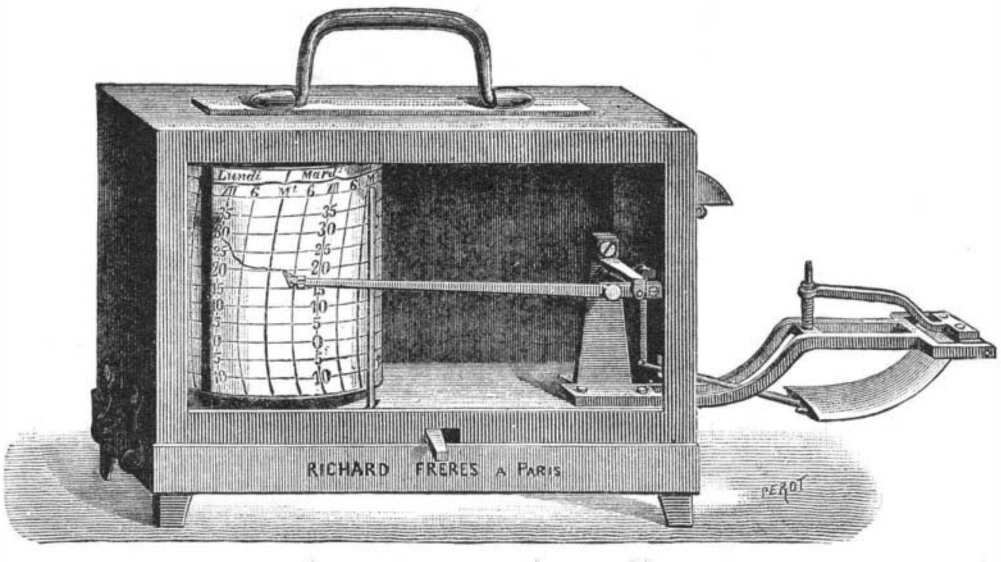

Fig. 1.—RICHARD'S REGISTERING THERMOMETER.

The bands of ruled paper that cover the drum are pointed beforehand, and the spacing of their horizontal lines, which are formed by circumferences parallel with the base of the drum, is regulated according to the nature of the instrument. The vertical lines measure the time, and their spacing is regulated according to the velocity at which the clockwork runs.

In the majority of cases, the duration of one revolution of the cylinder is one week and a few hours, so as to permit the bands to be changed every eight days at a given hour. The generatrices traced upon the ruled paper are spaced two hours apart, and are distributed in groups that represent an entire day. The names of the days of the week and the numbers of the hours are inscribed at the upper part. An interval of two hours is represented by a spacing of 0·12 of an inch. One can easily see by the eye half the distance between two lines that corresponds to the odd hours, and even a quarter of such interval.

Apparatus are likewise made in which the ban must be renewed every day.

Were the lines exactly rectilinear, it would be necessary to give the pen a very accurate vertical motion, which would involve the necessity of making the mechanism complicated, and, by creating passive resistances, destroy the sensitiveness. This is one of the principal difficulties in the construction of registering apparatus. The Messrs. Richard, who are the manufacturers of the instruments under consideration, suppress this inconvenience very happily. They so arrange the apparatus whose indications are to be registered that the vertical plane described by the long movable style shall be tangential to the cylinder, and they mount the pen of the style in such a way that it shall come exactly against the generatrix of contact of the cylinder and plane when the style is in its mean position of oscillation. Owing to this arrangement, and to the transverse flexibility of the style, the pen, in its vertical motion, does not leave the surface of the cylinder upon which it is tracing a slightly inflexed line. The error which might result from this inflexion is corrected by arranging the ruled lines according to the curve thus described upon the cylinder.

In practice these lines are confounded on the paper with successive portions of circumferences that have a constant radius equal to the length of the style. In fact, this arrangement, which is so simple, renders the transverse motion of the style possible, and permits of receiving directly upon a rectangular tablet the tracings of all those registering apparatus whose indications are furnished by the motion of a needle over a dial.

Each sheet of ruled paper is fixed to the cylinder in the simplest manner, the overlapping edges being merely held by the pressure of a flat spring, and the lower edge resting upon a flange at the base of the cylinder, so as to secure a parallelism of the horizontal lines with the base of the drum. When the drum is thus covered, it may be turned by hand in any direction whatever, because the clockwork movement is connected with the cylinder by a socket with friction mounting, as in the wheelwork of clocks. This permits of bringing the point of the needle exactly opposite that division of the paper which corresponds to the hour at which one is operating. It suffices afterward to leave the apparatus to itself in order to have it begin the revolution, during which the divisions of the cylinder pass successively before the pen.

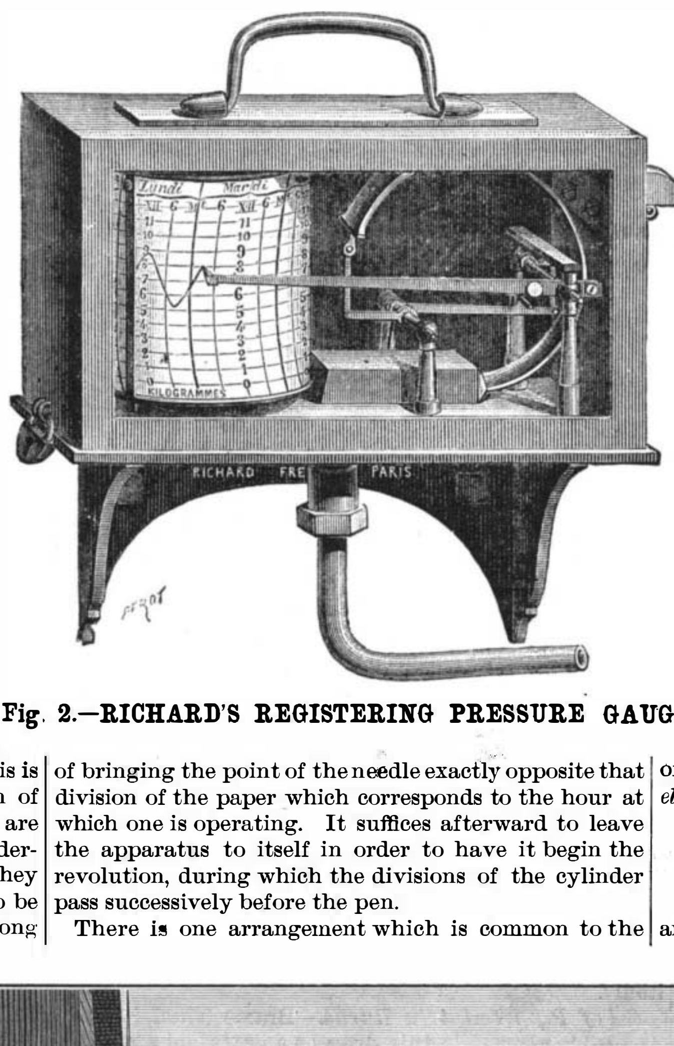

Fig. 2.—RICHARD'S REGISTERING PRESSURE GAUGE.

There is one arrangement which is common to the different types of these registering apparatus, and that is the arrangement of the pen. This latter is simply a small receptacle in the form of a triangular pyramid made of thin sheet metal. One of the faces of this is applied to the style, and fixed by a small socket. The opposite end grazes the paper, and the corresponding edge is split like the point of a pen, so as to bring about through capillarity a flow of ink. The ink used is made of aniline mixed with glycerine. A drop of this is placed in the reservoir of the pen. It is well to employ gelatinized paper in order to obtain sharp and fine lines, notwithstanding the prolonged contact of the pen upon the same points of the paper. The ink must be renewed every eight days, at the moment the paper is changed, and the clockwork wound up.

Fig. 1 represents a metallic thermometer whose operation is based upon the use of a bent Bourdon tube of copper having a flat section. This tube is filled with alcohol. It measures three-fourths of an inch in width and four inches in length. At first, it was, like the rest of the apparatus, covered with a metallic box.

An equilibrium of temperature between the interior of the latter and the atmosphere was established through two windows provided with wire gauze, and rapidly enough moreover to obtain diagrams representing exact thermometric means; but the curves produced by sudden variations in temperature were not rendered with all their instantaneousness. In order to obtain greater accuracy in the indications, the thermometer tube has been placed externally to the metallic box, so that it shall be in immediate contact with the atmosphere. This arrangement gives very satisfactory results as regards sharpness of the diagrams.

The dimensions of the levers are made such that a variation of one degree in the temperature shall be represented by a three-fifths inch displacement of the pen, this corresponding to the spacing of the divisions of the ruled paper.

These thermometers are very sensitive. The motive tube, by reason of its material, is an excellent conductor of heat. It has a large surface in contact with the air, and has but a slight capacity, thus permitting the alcohol to put itself quickly in equilibrium with the surrounding temperature.

Fig. 2 represents a registering pressure gauge, which is likewise formed of a Bourdon tube connected with a vessel containing steam. The motion of dilatation that results therefrom is transmitted directly to the needle that carries the pen charged with ink. There is constructed after the same type a gauge for measuring infinitesimal depressions, and in which the motor of the style consists of an extremely sensitive diaphragm. This instrument renders great services in the controlling of the pressure of gas or the draught of chimneys, through diagrams.—*Revue Industrielle.*

HYDRAULIC ACCUMULATORS FOR LOADING AND UNLOADING CARS.

There are at present few persons who have not had an opportunity of seeing what a series of maneuvers the loading and unloading of freight cars give rise to at the stations of large railways. The making up and breaking up of trains, and the loading and unloading of them, are so many operations that necessitate the shunting of cars from one track to another by means of switches and turntables. For all such maneuvers horses are employed. In ordinary weather a single animal will suffice to haul a car, but when the ground is slippery through rain or snow, it becomes necessary to employ two, three, and sometimes more. At large stations, where it becomes a question of shifting from 1,000 to 1,200 cars per day, it proves difficult, as may seem, to maneuver the number of men and horses necessitated by such work, without accident and loss of time, within a relatively contracted space. For this reason the

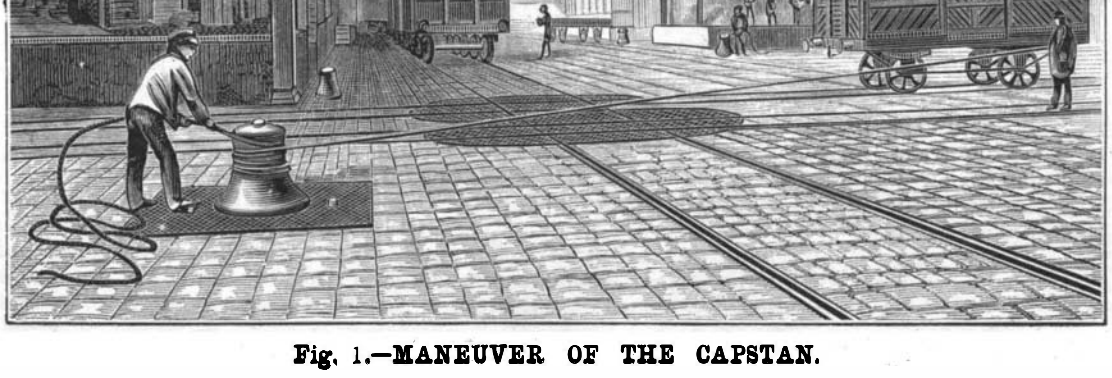

Fig. 1.—MANEUVER OF THE CAPSTAN.

Company of the North (France), abandoned the use of this primitive system a few years ago at its La Chapelle station, and, for horses, substituted machines analogous to those that have for a long time been employed in England. These apparatus, which are giving very satisfactory results, will themselves be replaced before long by more improved ones in which the transmission of power to a distance through electricity will perform the greatest role. The matter is now under study, and it is here again that the Railway Company of the North is at the head of such progress.

Our readers will be informed in due time as to the results of the experiments, and, in the mean time, we shall merely endeavor to describe and make understood the system at present in use.

Since the number of cars to be shifted varies at every instant, it requires considerable power at some moments, and not much at others. Under such circumstances, if, for example, a powerful steam engine were located at some central point, a portion of the power that it developed would not be utilized most of the time. If, on another hand, smaller engines were placed at different points around the station, the result would be the same—not economical—since it would often happen that one or several of the engines would not be employed. This, in addition, would be attended with the grave drawback that the number of enginemen and stokers would be multiplied.

The problem has been solved in another way, and that is by the use of an accumulator. This word is not used here in the sense of *reservoir of electricity*, that we have become accustomed to attribute to it since Gaston Planté's admirable discovery, for the apparatus under consideration are in no wise electrical.

Everybody knows, moreover, that "accumulator" is a general name for apparatus that are designed for the storage of any force whatever that cannot be utilized directly, and for restoring it at the moment desired, either all at once, if we need a powerful and momentary stress, or slowly and continuously (as in clockwork movements), or, finally, by fractions as small as may be desired, and at any intervals of time whatever. This sort of apparatus was therefore fully indicated for the particular case that occupies us.

Our engraving (Fig. 3) represents the central works in which force is accumulated. The accumulator consists of a series of cast iron disks of large dimensions, placed one upon another and resting upon the head of a plunger, as may be seen in the engraving. A 15 H.P. steam engine continuously actuates a pump whose gearings are seen to the right, and which, sucking water from the reservoir above, forces it under the plunger. In this way, the relatively low power that the engine develops is constantly employed in lifting the accumulator, and the latter is always ready to descend again, either wholly or partially, according as the water imprisoned under the plunger that supports it is allowed to escape for a greater or less length of time. When we state that its weight is 88,000 pounds, it will be understood that the force that we have at our disposal is considerable. In order to transmit this to the different points where it is to be utilized, and which are now twelve in number throughout the station, the hydraulic method was adopted, since this adapts itself to every circumvolution possible. At each of the twelve points selected there was accordingly arranged a capstan actuated by a hydraulic motor of the Brotherhood system; and there was laid a line of cast iron piping for connecting the pump chambers with each of the motors, to which latter the pressure exerted by the accumulator is thus directly transmitted. In these motors, the cock that admits water into the distributing slide valve is actuated by a pedal placed alongside of the capstan, thus permitting of setting them in motion and stopping them at the moment desired, without the aid of the hands. Both the piping and the motors are 30 inches beneath the surface, so as to place them out of the reach of frost. There is a special conduit provided for leading the water back to the reservoir after it has been utilized in the motors. The water used is therefore always the same—an economical provision that in certain cases is not to be despised.

The pressure conduit is circular; that is to say, starting from the accumulator and running to the right, for example, it returns to the left after passing in proximity to the motors, with which it is connected by branch pipes. This arrangement permits of isolating any point whatever for repairs without interrupting the service. With this same object, and to avoid a standstill, the machinery is double. In Fig. 3, the second accumulator may be seen at rest behind its mate.

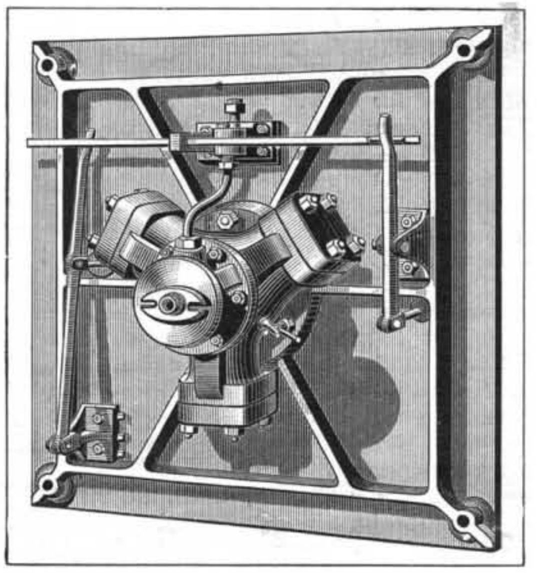

Fig. 2.—ARRANGEMENT OF THE BROTHERHOOD HYDRAULIC MOTOR.

Fig. 1 shows the arrangement of two maneuvers effected simultaneously on tracks at right angles with each other. In one of them, shown in the foreground, we see a man who has just wound a rope around the capstan, and is putting his foot upon the pedal. This rope may simply make two revolutions, and the adherence be sufficient to move the car attached to its other extremity as soon as the capstan is set in motion. The latter is stopped by ceasing to press upon the pedal as soon as the impulsion given the car is sufficient to make it continue its course by virtue of the velocity acquired. As soon as it reaches its destination, it is stopped by a man who has followed it for that purpose.

Each capstan is capable of doing duty for four or five turntables and all the tracks within a radius of 325 feet around it, either directly or by means of guide pulleys. Fig. 2 shows the arrangement of the Brotherhood motor that actuates the capstans.

It will be seen that with such arrangements it is possible to shift a car quickly from one extremity of the station to the other, and in any direction whatever.

One is struck with astonishment upon seeing the ease, rapidity, and safety with which these maneuvers are performed by a number of men which is relatively small in comparison with the large number of cars handled. The estimates made by the Company of the North establish the fact that loading and unloading effected in this way is three and a half times quicker than when horses are used.—*La Nature.*

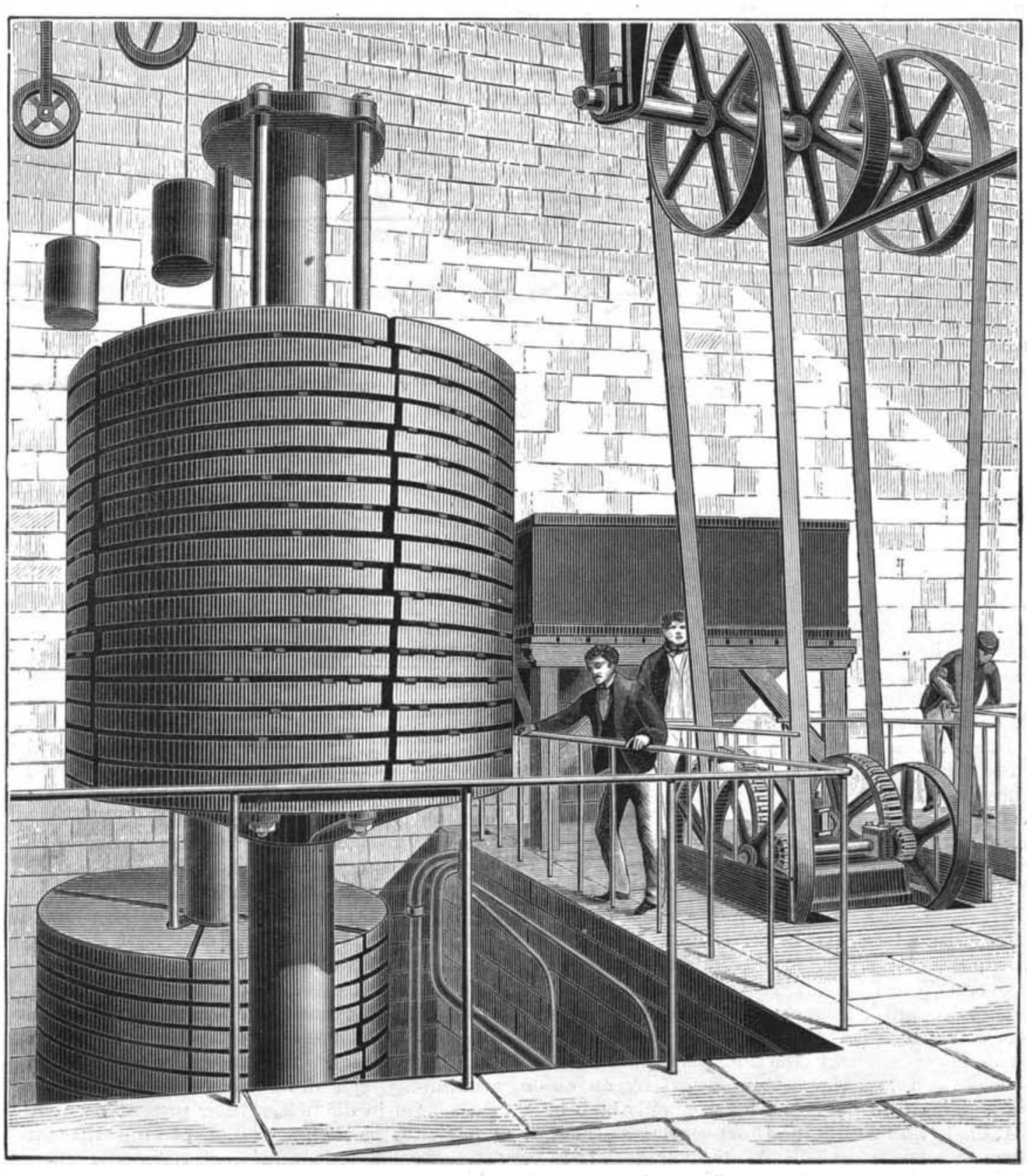

Fig. 3.—HYDRAULIC ACCUMULATORS OF THE LA CHAPELLE STATION, RAILWAY OF THE NORTH.

Bleaching with Gaseous Chlorine.

M. Albert Scheurer, at a recent meeting of the Societe Industrielle du Mulhouse, presented a note on the employment of gaseous chlorine as a discharge on indigo.

Chlorine, even when moist, destroys indigo but slowly. But if we print a thickened caustic alkali on an indigo ground, the discharge by means of gaseous chlorine is immediate. The same is true of Turkey-red. By this process colored discharges on blue and on red grounds may be produced. If we print a mixture of oxide of lead and oxide of chromium dissolved in soda, we produce by synthesis the chromate of lead; the blue is destroyed, and we obtain a yellow discharge.

To produce red discharges on indigo, we print with very alkaline aluminate of soda and expose to chlorine, then dissolve out the gum or thickening, and dye with alizarine.

The Allen Ice Machine on Shipboard.

In the SCIENTIFIC AMERICAN of June 14, 1884, we illustrated and described the Allen Dense Air Ice Machine. One of these machines, having a capacity of about 1,000 pounds of ice per day, has been placed upon Mr. James Gordon Bennett's yacht Namouna. One peculiarity of the invention is the small space occupied by the machine, which in this example is only 7 feet long, 4 feet wide, and 4 feet high. The residual cold air over and above what is needed for freezing the required ice is employed for cooling two refrigerating rooms, the larger of which is placed in the hold of the vessel, and is designed to be used as a store room; the other is located on the lower deck, and is intended to receive temporary supplies. The machine is worked with steam from the main boilers.

These machines are particularly applicable to service on board ship, since they are compact, they require but little attention, and all the working parts can be easily reached. They are manufactured by the Allen Dense Air Ice Machine Company, Delamater Iron Works, foot of West 13th Street, New York city.

Building a Bridge Over the Jordan, in Palestine.

U. S. Consul Merrill, at Jerusalem, reports that, during the past summer, an attempt has been made to build a bridge over the Jordan at Jericho. It has progressed slowly, however, as the lumber furnished had to be brought from Europe, and carried on the backs of camels from the port of Jaffa to the river. The Consul suggests that there might be some market in Palestine for American lumber, as the Austrian and Turkish lumnow used there is of poor quality and high priced, but the country is probably too poor to make much of a market for anything at present; the whole yearly imports at Jaffa, which is the Mediterranean seaport for Jerusalem, amount to only about $600,000.

The Pileated Woodpecker.

(*Hylotomus pileatus.*)

To those of the readers of the SCIENTIFIC AMERICAN who have never been in Florida, before describing the habits of the pileated woodpecker, let me first attempt to describe as near as possible a genuine Florida swamp. Imagine, if you can, a vast wilderness extending for miles in every direction, made up of tall cypress trees and water oaks, draped with a profusion of Spanish moss, which lends a gray aspect to the whole scenery, interspersed here and there with a maple, and the cabbage palmetto in profusion, and the whole interwoven with a strong network of creeping vines, thorn bushes, roots, and fallen trees, with anywhere from six inches to two feet of water covering the whole, and broken here and there by some deep creek or inlet, then you have before you some faint idea of a tropical swamp.

It is in such a place as this that the pileated woodpecker may be found most abundant, and where I have been for the past week closely studying him. To one who has spent an hour in trying to obtain a shot at a golden winged woodpecker, and at length given it up with the opinion that that Colaptes was "something more than mortal," let me say that he cannot be compared with my pileated woodpecker; for *he* is the very essence of cunning and craft in his maneuvers. I have sometimes spent an entire afternoon in trying to get near enough to one to observe his habits, and at dusk found myself as far away from the object of my pursuit as when I started. But rather than weary you with a detailed description of my long crawls on hands and knees through mud and water, with repeated failures, let me put before you the bird himself, clinging to the side of the decayed trunk of a tree a few yards in advance, and entirely unconscious that my untiring efforts to reach this coveted spot have at last been crowned with success.

There he is, hammering away as though his life depended on his getting that one grub. Suddenly he stops, turns his ear to the tree, and listens attentively for the sound of his prey crawling through the wood; soon he hears him, and uttering a low, guttural cluck of satisfaction, he proceeds with his work of excavation. All at once he stops, throws his head back from the tree, and gives utterance to a long, loud, piercing call, similar to that of Colaptes auratas, but in a much stronger and louder tone, best represented by the syllables "Wa-wa-wa-wa-wa-wa-wa-wa-wa," very rapidly and loudly repeated, and then pursues his work again. I have heard his call answered by a distant one, sometimes continuing it for two or three minutes, it evidently being a source of communication between the two, for several times on this occasion I have seen one that was near me suddenly leave his position and fly away in the direction of the call. Their hammering is unlike that of the smaller species of woodpeckers, for instead of the rattle of P. pubescens, for instance, it is a steady thump, thump, thump, and may be heard a long distance. When pecking on a decayed trunk, it is hollow and muffled; but when on the live tree, it is more sharp and loud. Strange as it may appear to some, I was misled several times on my trip into believing that a woodsman was near by chopping, when in reality it was only one of these forest birds at work on some hard stump or limb.

But to return to the one in front of me: He has tired of his present location, so off he flies to another. How heavily he flies, and with what a rushing noise! Another quarter hour's careful crawl, and I am near enough to watch him again. At first he does not find a place suitable for his work, but runs up the tree, then drops down, swings himself around, first to one side, then to another, when all at once he commences work, and I know that he has found the spot where he will make a meal. How the chips fly! big ones, too, and the ground is soon covered with evidences of prowess. The slight noise I make startles him, and in an instant he is off for safer quarters. Notice when alarmed how swiftly he flies, and after the usual woodpecker fashion. Soon I hear him at work where he has alighted, and after careful maneuvering, again obtain a position near enough to observe him. This time he is on a log, and, from his manner, evidently has found a rich harvest there. How hard he hammers away! One would think that he would knock himself to pieces instead of the log; but should you dissect his head, you would find it supplied with muscles that are very strong and hard, and admirably adapted to just such work. He pauses occasionally in his work to give utterance to his call, and how it does ring through the silent woods, silent save what bird life there is in it!

At my right stands an old dead tree, with a large excavation in it that some brother woodpecker has made. Examining it, I find it measures over two feet long, about eight inches wide, and six inches deep, in a tree scarcely one foot in diameter. On another near by is more of the same work—a ring extending half way around it, two inches wide and three deep, and the ground under it covered with chips. This bird does not depend entirely upon what he is able to find within the tree he pecks at; but I find him on a small knoll covered with decaying leaves, where he is alternately pecking and scratching for the grub or worm he first listened for, and then commences his work to get him. Occasionally he pauses to listen as he turns his ear to the ground, the same as when on the tree, only to renew his pecking and scratching; but I judge his success in finding food rather poor, for he soon flies to a tree, and is hard at work again there.

Moving on cautiously, I come upon a company of six of these birds all hard at work, but from their maneuvering conclude that the mating season is at hand; for suddenly one leaves his perch and darts at another, and away the pair go through the woods, with loud screams, rapid flight, sharp turns, and loud whirring noise, but are back again soon, and renew their work as hard as ever for insects, only to repeat the same maneuver again and again, until the pair goes chirping away together, leading me to believe that each has found a mate, and the selection of some hollow tree for its nest will soon follow. This "hollow" is usually at a great height in some almost inaccessible tree, standing in the loneliest and thickest part of the swamp. I am told that the breeding season commences before long, in which case I hope to be successful in finding the much coveted nest and eggs. On dissecting the stomachs of a number of these birds, I find the food to consist of grubs, insects, larvæ, small beetles, etc., and in one case I found *two immense* caterpillars in the stomach of one bird, besides thousands and thousands of the above mentioned lepidoptera.

Description.—Male: 18 inches in length, 28½ inches in extent. Iris yellow. Upper mandible plumbeous blue; lower mandible the same, but lighter at base. Tarsus black. Toes and claws black. Top of head, including the whole crest, scarlet; a long cheek patch of scarlet. General color dull black; a large space at the base of wing quills white, more or less tinged with sulphur yellow; the feathers of the sides and belly often edged with dull white, and sometimes some of the primaries and tail feathers are tipped with the same; a long white stripe from nostrils extending along sides of the head and neck, spreading on sides of breast; also tinged more or less with sulphur yellow, ending in a large patch of white under the wings, decidedly tinged with the same color. Nasal feathers white. Female differing from the male in having the forehead for about an inch a yellowish brown color instead of scarlet, but the whole crest extending from between and back of the eyes is bright scarlet, and in my specimens the crest is handsomer than that of the males. It also lacks the red cheek patch; in other respects she is similar to the male. E. M. H.

Palatka, Fla., Jan., 1885.

THE HYPNOSCOPE.

Sir William Thomson, in a lecture to the Midland Institute delivered some months ago, on the Six Gateways of Knowledge, pointed to the possibility of a

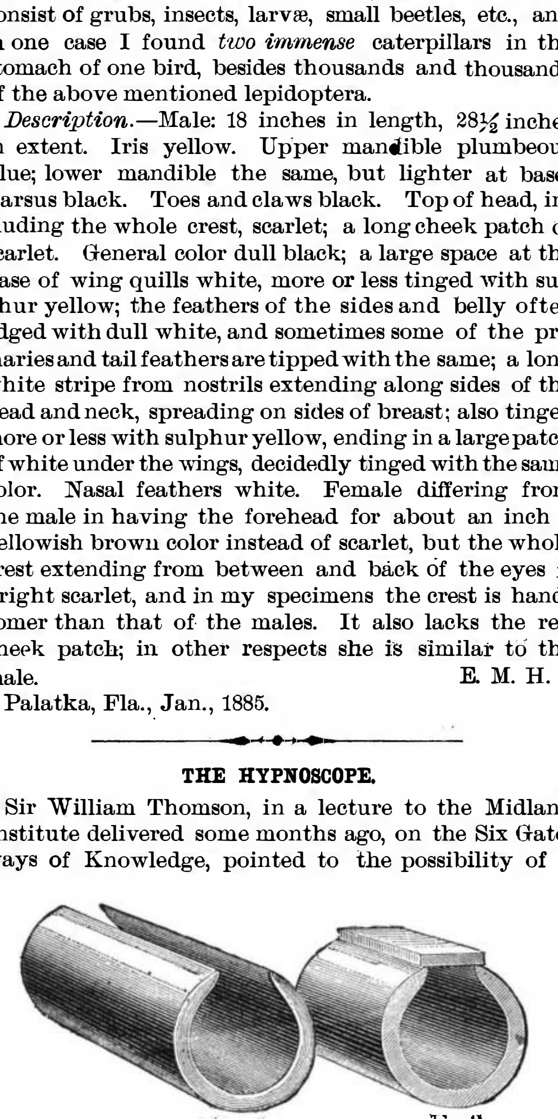

Fig. 1 Fig. 2

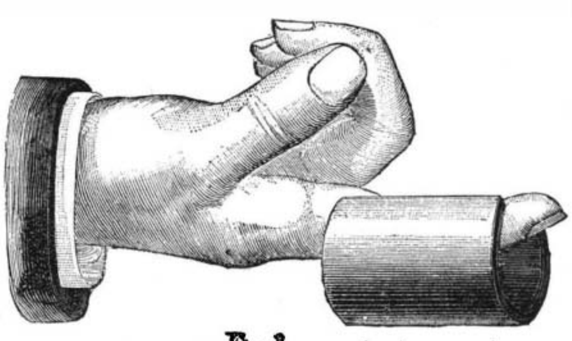

Fig. 3

THE HYPNOSCOPE.

magnetic sense, which might give a sensation of magnetism quite different from the sensations of heat, force, and so on. Soon afterward Professor W. F. Barrett recounted some experiments which came under his notice, and which tended to prove that certain persons were capable of feeling the presence of magnetism as developed by the core of a powerful electro-magnet. Dr. J. Ochorowicz has investigated the subject still further, and observed that all persons sensitive to the magnet are hypnotizable in a corresponding degree. In studying the matter he uses an instrument termed a hypnoscope, which is simply a tubular magnet slit up the side, the edges of the slit forming the poles, which are preserved by an oblong armature. Such an apparatus need only be 3 or 4 centimeters in diameter, and 5 or 6 centimeters long; weighing 150 to 200 grammes. Made of Alvar steel, it is very strongly magnetic, and will sustain twenty-five times its own weight. Figs. 1 and 2 show the magnet without and with its armature, and Fig. 3 illustrates the way in which it is used. After the armature is drawn off, the index finger of the person to be tested is thrust into the tube of the hypnoscope in such a way that the latter hangs from the finger by its poles, which are connected through the finger. After two minutes the magnet is drawn off, and the finger examined. Dr. Ochorowicz states, of a hundred persons chosen at hazard, and examined in this way, seventy will observe no change, but thirty will experience changes of two sorts, subjective and objective. For example, 20 per cent. declare they feel a pricking sensation as of needles entering the skin; 17 per cent., a cold air or a sensation of heat and dryness. These two sensations may coexist, one being felt in the right arm, and the other in the left. The cold air resembles that felt in front of an electrostatic machine. Some 8 per cent. of the total will probably feel disagreeable sensations, and a smaller number of sensations of swelling, heaviness of the hand, and irresistible attraction. The objective changes are either involuntary, insensibility (anæsthesia), paralysis, contraction of the muscles. These changes disappear after a few minutes by light friction, but without that will last several minutes, or even hours. Subjects of this class can be hypnotized in a single séance. Whether these effects are really magnetic, Dr. Ochorowicz considers doubtful. Magnetism, he thinks, does not explain all. It is only the substratum of another action so feeble from a physical point of view that it is not discoverable by our instruments of research. What this other action is, whether a new force or a new manifestation of force, he does not in the present state of our knowledge venture to say.

Gaseous Fuel and Smoke Prevention.

Under the title of "The Smoke Nuisance in Towns, and its Prevention," Herr R. Weinlig read a paper, at Magdeburg, last September, of which an interesting summary lately appeared in *Engineering*.

The whole question, says our contemporary, is treated in detail. Some statistics are given to show the enormous increase in the quantity of coal produced during late years; England being stated to have doubled and Germany to have quadrupled their output in the last 24 years. In dealing with the subject of smoke prevention, the author stated his opinion that very decided legislative interference is necessary; but he does not consider that this can be extended to domestic fires, though their importance as large contributors to the evils upon which he dwells cannot be denied or underrated. He considers that the one great cure for smoke from this source will be found in the introduction of gas firing, gas being supplied cheaply from central stations. This will certainly come to pass in due time, as it is well known that a suitable gas can be produced at a price of 3 to 5 pfennige per cubic meter (about 20 to 35 cents a thousand feet); and at such a price, firing with gas is fully as cheap as firing with coal.

Tests made by Dr. Fischer, of Hanover, show that in the ordinary domestic stoves in use not more than 20 per cent of the fuel consumed is really utilized for warming the rooms; whereas, with stoves burning gas, 80 per cent and more of the possible effect is obtained. In a certain sugar manufactory at Elsdorf, no steam engines have been used for several years. Gas is made at a cost of about 20 cents per thousand feet, and is used for lighting and for driving gas engines. At the iron works of Herren Schultz, Knaudt & Co., in Essen, water gas is made at a cost of about 8 to 16 cents a thousand feet, and serves both for fires and for lighting. For the latter purpose a ring is fixed over the burners, having rods or pencils of magnesia attached. These are made glowing hot by the non-luminous gas flame, and emit an excellent light.

These and other examples prove that cheap gas production is not any longer a mere experiment, and that we may reasonably hope to see its universal introduction. But we shall never be free from the smoke nuisance till we have no more burning of coal direct in grates. The use of gas, which has already done so much in some directions, will probably gradually do the rest. Large works of all kinds will more and more take to producing gas and using it for all purposes. Smaller works and private houses will, in due course, have gas supplied to them at such a price as shall render it cheaper than solid fuel under any conditions. Domestic heating and cooking appliances for use with gas have made enormous advances of late, chiefly by the untiring ingenuity and invention of Mr. T. Fletcher, of Warrington. It remains only to "educate" the public and the gas companies a little further, and some day we shall have cheap gas laid on everywhere, and our descendants will hardly realize that we once had loads of dirty coal shot into our houses, endured no end of dust and dirt inside, and poisoned the air outside. If ever the difficulties are practically solved which at present prevent the introduction of electric lighting into our houses, then, when the gas companies find their present occupation gone, they will turn all the sooner to the other great field that awaits them; and so all the sooner will our smoke nuisance disappear by a much more satisfactory method than government interference and compulsion.