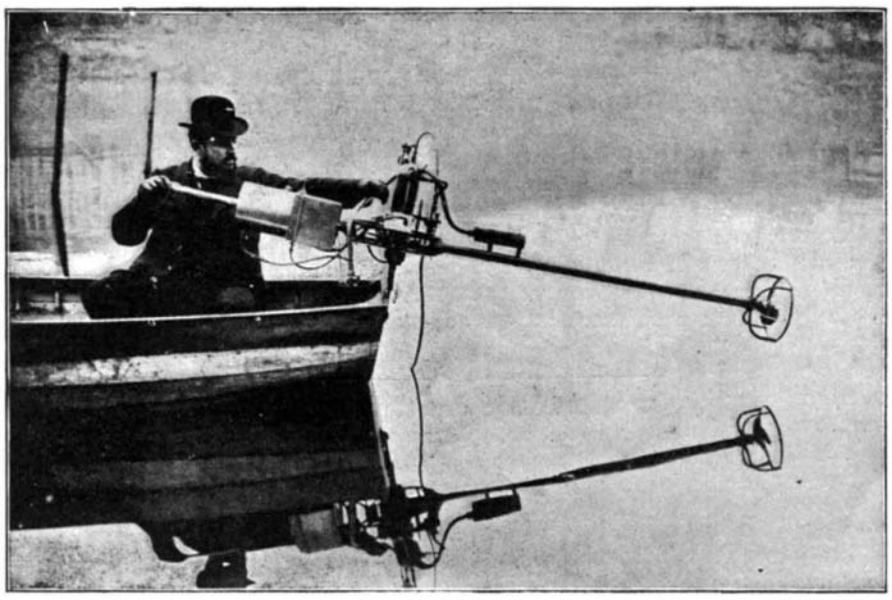
by the regulating plates, *C C'*. It will be understood that in this construction no attempt is made to adjust the plates in width as speed increases; but the advantage of the application of this principle is secured by designing the plates for each particular boat for one speed only (which is its maximum speed), and the lifting force required at other speeds (between starting and maximum) is obtained by the automatic regulating device which gives the plates at all times such an angle as is necessary.

Strange as it may seem, the chief obstacle encountered in early experiments was not to make the hydroplanes rise, but to prevent them from rising too far, and it was as a means to this end that the surface follower, as a regulating device, was adopted. By its use the boat becomes practically a soaring machine and bears the same relation to an ordinary boat, in the water, as does a soaring bird to a balloon, in the air; and this relation holds, also, in respect to their skin friction areas. It also possesses the following advantages over a soaring machine in the air, i. e., it soars in, and its propelling force is exerted upon water, which is seven hundred times as dense as air, while the displacement of the hull, with its necessarily large frictional surface, is all carried in the rarer medium, air, and above the water, the surface of which can be used to effect the regulation of the inclination of the supporting hydroplanes.

Another special advantage of a submerged hydroplane construction is that it will operate without hindrance in water sufficiently rough to totally unfit a gliding boat.

The strength of development and success will depend, not upon disproving or defying any established law, but upon strict application of rational laws and careful attention to details.



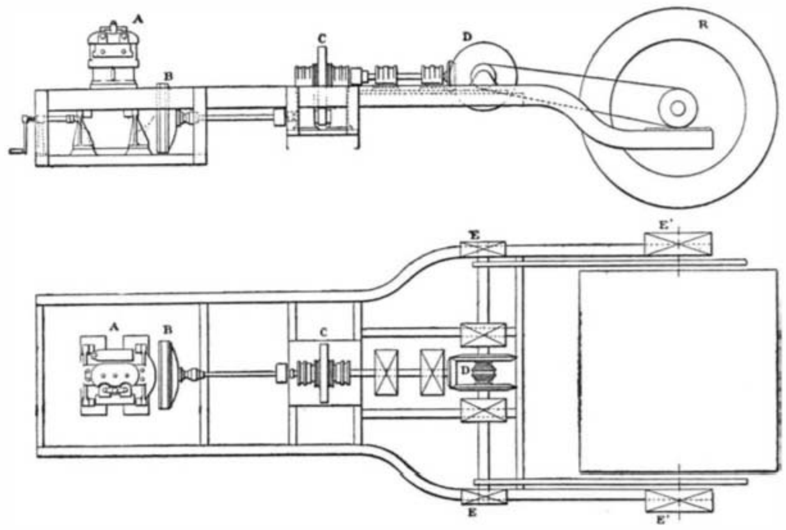
THE MOTOGODILLE, OR MOTOR SCULL, APPLIED TO A SMALL BOAT.

A MOTOR PADDLE WHEEL FOR SMALL BOATS.

In the accompanying engravings we give a side elevation and plan view of a detachable stern paddle wheel designed for the propulsion of small boats, and perspective views of the apparatus mounted upon a boat.

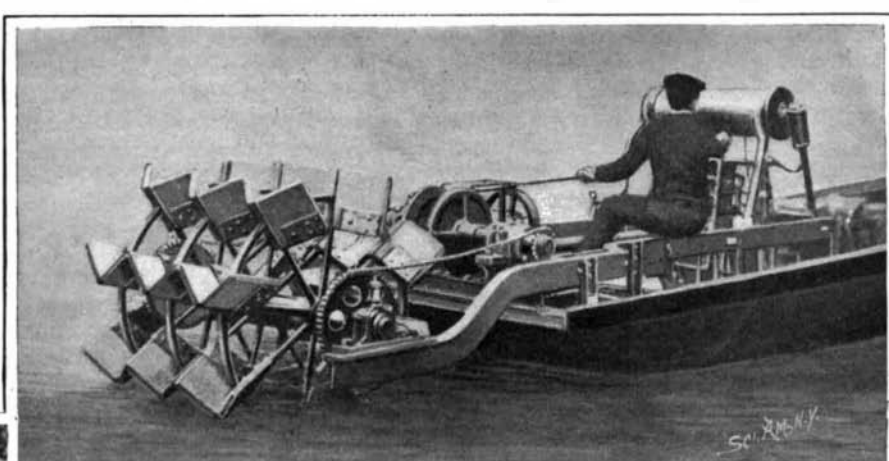
On examining the diagrams from left to right, we observe, at *A*, a two-cylinder de Dion-Bouton motor of 16 effective horse-power; at *B*, a clutch; at *C*, a speed reducer; at *D*, a reversing gear; and at *E* and *E'* sprocket chains connected with the paddle wheel *R*. This wheel consists of paddles inclined at an angle of 50 deg., small spaces being left, so that the stress is exerted upon a wider surface than if the paddle consisted of a single bow, as is usually the case. As the water is easily discharged, it creates no passive resistance, and thus a high efficiency is obtained. As this propeller is designed for Oceanica and has to be actuated by kerosene, the only fuel practical in that country, a special carbureter has been applied.

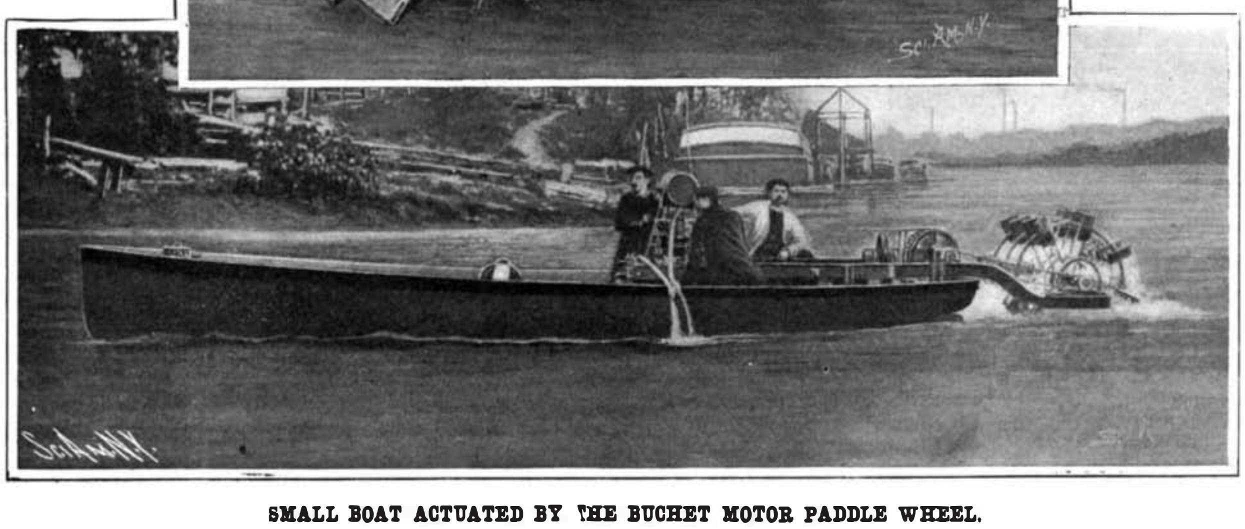
With this paddle wheel it is possible to carry from 18 to 20 tons of merchandise at a commercial speed of from 5 to 6 miles an hour with an output of fuel not exceeding 40 ounces per horse hour.—Translated from L'Automobile for Scientific American.



ELEVATION AND PLAN OF THE BUCHET MOTOR PADDLE WHEEL.

THE BUCHET MOTOR PADDLE WHEEL SEEN FROM THE REAR.





SMALL BOAT ACTUATED BY THE BUCHET MOTOR PADDLE WHEEL.

THE "MOTOGODILLE," A MOTOR DEVICE FOR PROPELLING SMALL BOATS.

BY THE PARIS CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

An interesting device in the way of applying a motor to small craft has been brought out in France. The apparatus has been designed to afford a very simple as well as inexpensive method of applying a small gasoline motor to boats. It is nothing more or less than a power oar and consists of a motor-driven propeller which is adapted to be placed on the boat; but contrary to other apparatus and motors which require to be specially built and installed in the boat so as to form part of the latter, it forms an entirely separate mechanism which is fitted to the stern of the craft in a few minutes, and which permits the immediate conversion of any ordinary boat into a motor-driven craft without any change whatever in the boat itself. By applying a simple socket-piece to the stern with four screws or bolts, the propelling apparatus, which fits in the socket by means of a pin in about the same way as a steering oar, can be immediately installed. The new propeller device, which is known as the "Motogodille," is of extra light, simple, and strong construction, and forms a single rigid piece having but a single contact with the boat. It serves to propel and steer the craft at the same time and also to change the speed. The socket and the support of the apparatus form a kind of universal joint which allows the pilot to raise the propeller or to plunge it to the required depth so as to vary the speed of the boat, or else to displace it to the right or left for steering. These movements are all carried out with one hand and without any more fatigue than is felt when using a rudder. As the propeller is mounted on a long shaft and works at a distance of 4 feet 6 inches from the stern, it runs in comparatively still water and gives a much better propelling effect than usual. The variable immersion of the propeller shows it to work with a flat-bottomed boat in very shallow water. A speed varying from 5 to 10 miles an hour is obtained (according to the size of motor which is used) with an ordinary boat containing 5 or 6 persons, with a consumption of 0.3 gallon per hour of gasoline. Two sizes are made, one of 1¼ horse-power weighing 35 pounds, and a second giving 2½ horse-power and weighing 90 pounds. A very practical application of the device is upon sailboats, as it will bring the boat into port in case of a calm, and it can easily be stowed in the hold. As will be noticed the motor is mounted upright just over the main pivot which works in the boat. Back of the motor and fixed on the steering bar is a box with sliding cover for the battery and spark coil. Above it is a cylindrical gasoline tank.

The Destruction of Flies.

The fly is doomed; the fiat has gone forth, and its days are numbered. Doctors have recognized the fact that the house fly is not only a nuisance, but also a real danger, because it is the bearer of microbes and nastiness of all kinds. Fired with the spirit of enterprise, and wishing to do good to humanity at large, the Matin, of Paris, recently offered a prize to the discoverer of the most practical and efficacious means of destroying these insect pests, and thus eliminating one great source of the spread of epidemics.

A pamphlet entitled "Delenda Musca" has carried off the prize.

According to the writer of this essay, very few people are aware that the domestic fly lays its eggs in cesspools, drains, liquid manure, and dung heaps of all kinds. In these delectable media the *Musca domestica* deposits its oblong eggs, which are opened by the detachment of a narrow longitudinal band or strip—much in the same way as the blade of a knife is opened. The larvæ grow with surprising rapidity, attaining their full size, in summer, in eight days' time. One fly may give birth to millions of others, as it breeds continuously for several consecutive months (usually from May to October). Assuming that one specimen lays 200 eggs (containing an equal number of males and females) then, as will be seen from an easy calculation, in six months' time one hundred thousand million flies will be brought into the world to tease bald-headed men and the helpless in general. After showing that it is useless to attack the full-grown insect, the author seeks some means of destroying it while it is in the period covered by the laying of the egg to the formation of the pupa—just when the insect is most vulnerable, and is found collected together in more or less considerable quantities. The greatest points of attention to this end are cesspools, muck heaps, drains, manure heaps, and the like. Arsenic and arsenical compounds should not be used for the destruction of flies' eggs and larvæ in open cesspools in country districts, where—too often, unfortunately—they are in underground or other communication with wells, watercourses, and springs, which might thus get poisoned. Recourse should be taken to some substance which not only dissolves in the liquid contained in the drain, but which will penetrate right into the heart of solid matter. This substance must be of a nature to withstand fermentations and all transformations experienced by the solids contained in the cesspool, as they are always, in such media, of ammoniacal and reductive nature. These reactions show that it is useless to employ sulphate of iron, sulphate of copper, etc., for although in the beginning these metallic salts might have some effect, they would subsequently become changed by fermentative influences and lose their efficacy. The first trials made showed that ordinary soda, mixed with ordinary chloride of zinc (in the proportion of 5 kilogrammes of each to every cubic meter of matter), was quite sufficient to kill the larvæ and prevent the hatching of further eggs laid in the same place during the season. This process could, if necessary, be used for stationary, hermetically closed cesspools, but it would not do for movable closets, sewage tanks, or open drains. Petroleum was then tried by the author of the pamphlet in question, in the proportion of one liter to every superficial meter; but in a short space of time—due probably to the slight rise in temperature caused by fermentative processes—the petroleum disappeared. This was verified by putting a stick into the cesspool; if petroleum had still been present, it would have left traces thereon. Coal tar was then tried with much better results, although they were still not all that could be desired. The most satisfactory results were secured with raw petroleum or raw schist oil (residue of distillation). Two liters per superficial meter were mixed with water, the whole being well stirred up with a piece of wood. This, on being poured into a drain or closet, will form a stratum of oil which will destroy all the larvæ, while, even should flies not be prevented from entering the drain, at least all the eggs they may deposit will be prevented from hatching. This oil is sufficiently consistent and tenacious to adhere to the walls of drains, to form a coating over solids, and remain attached thereto for a long time. This protective layer of oil also facilitates the development of anærobic bacteria which cause the rapid liquefaction of solids, thus rendering them quite unsuitable as a breeding ground for Diptera. In the case of manure heaps this oil may be mixed with earth, lime, and fossil phosphates, in which state it is sprinkled (preferably in the spring) over all sources likely to tempt young couples of the Diptera family to start housekeeping and the rearing of a family.

Electric Trains for the Simplon.

It was at first proposed to use steam trains in the Simplon tunnel, but afterward the electric system was decided upon on account of the high heat of the tunnel coming from the hot springs and again because it was difficult to ventilate the tunnel and carry off the smoke. The administration of the Swiss railroads has lately accepted the project of the Brown-Boveri electric firm for installing the system of dynamos and rolling stock. The traction will be carried out according to the system which is now in use on the Valtelline road in Italy. The hydraulic power of the Videria and the Rhone which already served for putting through the tunnel, will operate a turbine station and the latter will supply current to a number of sub-stations situated some 30 miles off. In these the high-tension alternating current will be converted to 2,300-volt current for the different circuits. A dam is now building which will be nearly 500 feet long. The head of water is some 30 feet. The main station contains two halls for the turbines, 120 feet long, and the dynamo hall lies between the two. Each of the turbine halls contains four pairs of horizontal turbines. Each unit is laid out for 3,000 horse-power at a speed of 200 revolutions per minute. The turbine shafts pass through the wall and in the dynamo room they have the alternators mounted on them. These dynamos have a capacity of 1,500 kilowatts and generate three-phase current at 25 cycles. Lombard governors keep the speed constant. The three-phase current passes to the transformer hall, where a bank of oil transformers raise the tension to 33,000 volts. For the traffic in the Simplon tunnel it is intended to use five electric locomotives at first, and the electric system is to be extended to all the sections of the Simplon road which are operated by the Swiss railroads, or a total length of 25 miles. The total cost of the electric equipment of the tunnel is estimated at $200,000. It is expected to open the new line about the 1st of May.

The Current Supplement.

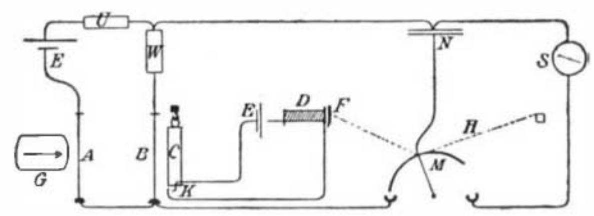
The current SUPPLEMENT, No. 1574, opens with a summary of the granite industry of New England. Of interest to mining engineers are Dr. Kunz's statistics on the precious stone industry in 1904, and some data on the coal mines of Japan. G. T. Beilby contributes a very interesting paper on gold molecules in the solid state, giving valuable results of most interesting experiments. Some analogies are drawn between light and electric waves, in an article by Prof. B. Dessau. The American Society of Heating and Ventilating Engineers by a strange coincidence happened to hold its annual meeting on January 17, 1906. Two hundred years ago on this very date Benjamin Franklin was born. For that reason the interesting paper which was read before the Society on "Benjamin Franklin, the First American Heating and Ventilating Engineer," should prove valuable. The paper is published in full. At the opening meeting of the Society of Mechanical Engineers, President J. R. Freeman read a paper on the safeguarding of life in theaters. The paper, which is abstracted, is the result of painstaking investigations on the author's part. A simple photographic and photo-micrographic apparatus is so clearly described and illustrated that any one can construct it. Dr. Alfred Gradenwitz writes on a modern testing plant for gasoline automobile motors. Some specifications of material used in high-speed automobile and motor-boat engines are published. A. L. Johnson contributes an excellent paper on steel for reinforced concrete.

SPEED AND ENERGY LOSS OF PROJECTILES IN WATER.

The singular explosive phenomena that are observed whenever rapidly-moving projectiles strike liquid masses have been investigated of late years by many experimenters, and it has been shown that neither the revolution of the projectile nor the heating it undergoes plays an important part. It has likewise been demonstrated that the phenomena are not due to the effect of hydraulic pressure, as the vessel does not explode until after the bullet has left it. In order further to study these interesting phenomena, Martin Gildemeister and Hans Strehl (see Annalen der Physik, Vol. 18) recently undertook tests to ascertain the magnitude of the forces concerned.

The kinetic energy imparted to the liquid is a maximum equivalent to that lost by the projectile as it passes through the liquid bulk, the amount immediately converted into heat being in all probability very small.

The arrangement used by the authors is represented in the accompanying illustration. After first breaking the wire *A*, the projectile causes the condenser *N* to be discharged through the resistance *W*, which is free from self-induction, the discharge ceasing as the second wire *B* is broken. The time elapsing between the two occurrences is calculated from the residual charge of the condenser, its capacity and initial charge



SPEED AND ENERGY LOSS OF PROJECTILES IN WATER.

being known. The following law is derived from the authors' experiments:

The loss in velocity of a projectile in water is proportional to the first power, and the loss in energy to the second power of the velocity of the projectile on entering the liquid.

A New British Range Finder.

The British Naval Department has adopted a new type of range finder, which is stated to be of great value. It is the invention of Lieut. Arthur Vyvyan, the details of the mechanism having been carried out by Mr. Newitt, R.N., an electrical engineer. The utility of this instrument is for automatically transmitting the range observations from the fighting control top to all the various gun positions on board the vessel simultaneously and automatically. There are a series of electric motors, one stationed in the fighting control top, and one at each gun position. These motors all run at a uniform speed, and when there is any movement in the one at the fighting top, the others are similarly affected automatically. For instance, when the officer in the fighting top descries a vessel or object to be brought under fire, he estimates the range, and instructs the officer in charge of the motor appliance. A trial shot is then fired some distance short of the estimated distance, say 400 yards. The instrument is set running for this distance, and by means of an indicator and pointer the range is transmitted immediately to the various gun positions, the instruments at which record simultaneously upon their indicators. Should the range prove too short, another shot is fired, the distance being increased by say one-half the underestimate, viz., 200 yards. The result of this second shot will bring the instrument's pointer to about the correct range. If not, then another shot is fired, the range being again proportionately increased. These trial shots only occupy a few minutes, and directly the correct range has been obtained by the recording officer in the fighting top, all the various gun positions have it as well, and firing can be continued without any delays. The instrument provides automatically for the deflection of the range and the speed of the ship. The transmitter has proved completely satisfactory under test, the correct range being invariably obtained by the second trial shot. It has been perfected during the past year, and is now in operation at the gunnery school at Whale Island and on board a war vessel, and its utilization is to be extended throughout the service.

A TRIPLE-SCREW MOTOR TORPEDO BOAT.

The torpedo boat shown under way in our illustrations is one of the latest productions of the English firm of Yarrow & Co. It is an exceedingly speedy craft, having excellent sea-going qualities and being intended to take the place of the usual steam-propelled second-class torpedo boat. The boat is 60 feet in length by 9 feet beam, and is fitted with triple screws and three four-cylinder Napier gasoline engines—two of 120 horse-power for the outer propellers and a 60-horse-power engine for the center propeller. The last-named propeller is reversible, and it is thought that a single reversing propeller is all that is necessary for this type of craft.

In a series of speed trials made recently this boat developed a speed of 25½ knots when running light. This is an advance of 5½ knots over what could be obtained under the same conditions with a boat having a steam power plant. The reasons for this increased speed are the much lighter weight of the machinery (there is probably a saving of some 50 per cent), and the form of hull, which, at these high speeds, for the displacement of a boat of this type, seems to enable it to skim or glide over the surface of the water—a fact made evident by the small surface disturbance. The power which is usually absorbed in making waves is therefore utilized for propulsion.

A motor boat of this type, if fitted with a revolving torpedo tube, could be readily used as a second-class torpedo boat, or as a gunboat for coast-guard service. On account of its light weight, which does not exceed 8 tons, it is quite easy to transport such a boat on a larger vessel to any part of the world. Regarding the cost of such a boat the statement is made that fifteen of them could be built at the cost of a modern destroyer. For the purpose of defending a port from an attacking or blockading fleet, there is scarcely any doubt that fifteen small, high-speed motor boats of this type would offer a considerably greater means of defense than one destroyer of large size upon which the fire of a number of guns could be concentrated.

In line with the construction of this first motor torpedo boat for the British navy mention should be made of the fact that Mr. Lewis Nixon, who built the motor boat "Gregory," that crossed the Atlantic a year ago and was subsequently sold to Russia, has designed and built for the Russian navy no less than ten of these small, high-speed craft. These are said to have a length of 90¼ feet and a displacement of 35 tons. They are driven by twin screws, each of which is driven directly by a reversible marine gasoline engine of 300 horse-power. A speed of 20 knots is obtained at 400 R. P. M. of the engines.

This is a second example which has occurred within the last five years of how backward our government is in seizing new and worthy inventions as soon as they are brought out. The other case in point is the Lake submarine torpedo boat, which, although tested and found far superior to any other boat of the kind either here or abroad, was abandoned and its inventor allowed to sell it to foreign powers, one of the largest purchasers among these being Russia.

The Color of Water.

L'Illustration (Paris) gives the following results of recent experiments on this subject:

"After long hesitation, scientific men agree to-day in admitting that water *physically* pure, seen in mass, is sky blue. This color is that taken by the white light of the sun when absorbed by the water, in consequence of a phenomenon the explanation of which would be a little long. It is not due to the *chemical* purity of the water, since the sea (which is the bluest water) is also that which contains the most salt. Nevertheless, according to Forel's experiments, the matter in solution should be the predominant cause of the modification of color; upon which act besides the matter in suspension, the color of the bottom, and the reflection of the sky and of the banks. Consequently blue water is pretty rare in nature; a good many seas and lakes that give us the impression of this tint are green. The water at present acknowledged to be the bluest is that of the Sargasso Sea, between the Cape Verde islands and the Antilles. The water of the Mediterranean off the French coast and around Capri is bluer than that of Lake Leman, much less blue itself than that of the lakes of Kandersteg and Arolla, in Switzerland.

"Hitherto they have not exactly determined the relation between the color of water and its degree of purity. The Belgian, Prof. Spring, who has been a long time studying this delicate question, has just communicated to the Academy of Sciences at Brussels some interesting figures. Pure water containing a millionth of ferric hydrate appears brown under a thickness of 6 meters; a ten-millionth is sufficient for it to be green; and, in order that it may remain blue, is needed less than a twenty-millionth. As to humic matter, it causes the blue coloring to disappear in a quantity less than a forty-millionth. The calcic compounds should have a great influence upon clarification, as they eliminate, up to a certain state of equilibrium, the ferric and humic compounds."