THE SCHNEIDER TORPEDO-LAUNCHING STATION.

The Schneider Company is completing a structure of a novel and unique character for the launching and regulation of the automobile torpedoes which it constructs for the French navy. The mechanism of these torpedoes is very intricate and delicate, including a four-cylinder motor, an auxiliary motor for steering, many pipes, valves, and cranks, and a system of gearing by which power is transmitted from the motor to the twin screws.

In addition, there is the ingenious regulating mechanism, including a clock, a hydrostatic piston, and a gyroscope, by which the vessel is held rigidly to the prescribed course and depth of immersion.

All of this machinery is contained in a hull 23 feet long, a large part of which is occupied by the compartment containing the compressed air by which the motors are driven.

It is easy to understand that the assembling of all these delicate organs is a difficult task. It is necessary to co-ordinate the movements of the various parts and to regulate their action until the torpedo can be relied on to pursue a perfectly straight course.

The regulation is effected by making infinitesimal changes in the positions and motions of the rudders, the clock, and the hydrostatic piston, the adjustment being determined half by theory, a quarter by practical experience, and the remaining fourth by trial and error. The regulation involves a number of launchings and trial trips, which must take place under certain favorable conditions. It is necessary, above all, to select a sheltered spot, where still water can be found even when the sea is rough, and where the torpedo can accomplish its full range, about 2½ miles, without risk of encountering vessels or other obstacles or a depth of water less than 50 feet. The trial ground must also be situated near a seaport and a railway, and it must have attached to it structures suitable for the preparation, regulation, and launching of torpedoes.

A site offering the conditions requisite for an establishment of this sort is not easily found. The company thoroughly searched the Atlantic and Mediterranean coasts of France before it found a suitable location, in the fine roadstead that extends between the Hyères islands and the Mediterranean shore, near Toulon. Even this site has the defect that a depth of 50 feet is not found sufficiently near the shore to make it practicable to erect the required buildings on land. Torpedoes are usually adjusted to travel about 12 feet below the surface, but as they are launched from a considerable height they go much deeper at the first plunge and make several oscillations upward and downward before they become definitely established at their normal level. Hence it is necessary to have a considerable depth of water in order to avoid all danger of striking the bottom, and a depth of 50 feet is deemed requisite.

Under these conditions the company decided to construct, at the point where this depth is found, and whence the course extends seaward, nearly at right angles to the shore, an artificial island to support a building containing all the appliances required for regulating and launching torpedoes.

This ingenious project is now accomplished and the tourists and fishermen see a many-windowed building, resembling a commodious dwelling, rising 30 feet above the water and apparently resting on it, 800 feet from the shore. The building is made entirely of armored concrete. It was designed by the engineers of the Schneider and Hennebique firms, in collaboration, and constructed at the shipyard at La Seyne, 20 nautical miles distant from its present site. The lower part of the structure is a huge caisson with slightly inclined walls. This caisson, the construction of which was commenced in March, 1908, was launched in August like an ordinary vessel and remained afloat two months. After its completion it was towed to its destination by two tugs, very slowly and with many precautions, on a calm, still night, early in November. The emplacement had been prepared by divers, and a carefully leveled bed of stone, about 12 feet thick, had been laid on the sea bottom. The caisson was moored very exactly over this foundation and gradually sunk by admitting water into compartments designed for that purpose. These difficult and delicate operations were performed in exceptionally favorable weather and with perfect success. A few hours after the floating island had become a fixed one it was exposed to the fury of a violent tempest, which it sustained without injury, and thus gave a gratifying proof of its stability.

The structure will be completed, it is expected, during the present month.

The caisson, the greater part of which is submerged, terminates in a platform 11 feet above mean sea level. It is almost a solid mass of concrete, but contains a subaqueous water-tight chamber, in which are placed tubes for launching torpedoes under water. These tubes project through the wall of the chamber, and are fitted with water-tight joints. Their outer ends are surrounded by a lock, which, when closed and pumped dry, permits examination and repair of the tubes and their doors. At and above the water line, the caisson is protected by wooden fenders from injury by vessels, torpedoes, and other floating objects.

A two-story building is erected upon the platform. The lower story contains tubes for launching torpedoes above the water level and is connected with the chamber beneath by a large opening in the floor. After each torpedo has finished its course it will be picked up by a vessel, brought back to the station, hoisted to the platform by tackle running on a concrete beam and received in a large recess in the first story, whence it will go to the regulating and repair room for further adjustment. All the hoisting, conveying, and other machinery, including a series of railways, a pump for emptying the subaqueous chamber, and air compressors for charging the torpedoes, will be operated by electricity furnished by two generators, driven by petroleum motors.

The upper story of the building will contain offices, lodgings for caretakers, and an observation room placed directly over the launching tubes, and supported on cantilevers outside the wall of the building. This room will have a bay window with a glass floor, so that the moment at which the torpedo leaves the tube can be noted, for the purpose of determining the velocity. The observation room will be surmounted by a signal tower from which communication can be held with observers stationed on floats at various points of the course.

The Amateur Wireless Operator.

Some time ago, when the fleet was on its last lap of the famous around-the-world trip, trouble was experienced by the operators of several naval wireless shore stations scattered along the Atlantic coast. Complete messages could not be received by these stations, because amateur wireless operators would interfere. Their periodicity was nearly the same as that of the ships of the fleet, that is, 425 meters wave length, and many of them have as strong a sending apparatus as the ships.

Take Washington, D. C., for instance. There are at least fifty well-equipped stations. Their operators range from twelve to fifty years of age. They may not be able to send as far as the naval station, but when it comes to receiving, they get everything that is in the ether. Many of them at times hear distant stations calling the navy yard, and when no answer is heard, these young operators then call the naval station, and report that a distant station is calling them. It is claimed that the operators on watch never respond to these favors, and go on with their regular business. It certainly seems as though the naval operators were not appreciative.

Complaints are sent in every day at the Navy Department. If this continued interference keeps up, the wireless amateurs will get themselves into trouble. Two plans to regulate these youngsters are under consideration. One is to limit them to certain hours of the day, when they can do their talking. The hours most likely to be adopted will be from 3:30 to 7. Another plan is to license these stations, as they do over in England.

About a year or so ago, a high school student, who had a wireless station, thought he would have some fun by sending fake messages to the navy yard and sign the "Dolphin." The operator on watch later caught the guilty offender. A report of this occurrence was immediately made to the Navy Department, which referred the matter to the District Attorney. It was found that nothing could be done with the young man, who promised to "be good" when it was explained just what damage his mischievous pranks with wireless might do.

The Current Supplement.

A new method and a machine for degreasing wool continuously are described in the opening article of the current Supplement, No. 1733. Dr. Robert Grimshaw exposes some wire-nail fallacies. Prof. Reginald Fessenden's paper on Wireless Telephony is continued. John S. Fielding writes on "Safety Factors in Dams." San Francisco's new fire-protection system is exhaustively described. Brimming with many a quaint bit of historical information is Franz Feldhaus's "Submarine Experiments of the Past." A. E. H. Tutton contributes an excellent paper on the Crystallization of Water. In a paper entitled "The Untilled Field of Chemistry" Arthur D. Little dwells on the stupendous stores of potential energy bound up in matter. In 1885 the distinguished physicist Helmholtz wrote a paper entitled "Theoretical Speculations Concerning Dirigible Balloons." For the benefit of aeronautical inventors we publish in the Supplement a translation of this paper.

Magnesium is now being employed to some extent as a deoxidizer in brass manufacture, having the advantage over phosphorus that an excess may be used without harm, and, indeed, may improve the quality of the brass. Magnesium is a metal which belongs to the same family as zinc. Ordinarily the addition of 0.05 per cent of magnesium to the brass is sufficient for deoxidizing purposes.

Correspondence.

GENERAL FORMULA FOR COMBINATIONS OF NUMBERS.

To the Editor of the Scientific American:

I was much interested in Dr. J. G. Bland's letter in the issue of February 13th, as I had made some researches in a similar direction. I was seeking combinations of numbers that would bring any finite results in problems illustrating Euclid's proposition No. 47, Book I.

In the (Boston) Journal of Education of September 5th, 1907, and April 2nd, 1908, appeared communications from me bearing on this.

I would now submit an equation in harmony with which must be all problems, which secure finite results, illustrating this proposition:

$$(ln)^2 + \left[l \left(\frac{n^2}{2m} - \frac{m}{2} \right) \right]^2 = \left[l \left(\frac{n^2}{2m} + \frac{m}{2} \right) \right]^2$$

Frank Jerome, Sr.

Boston, Mass.

ACCURACY IN SCIENTIFIC DICTION.

To the Editor of the Scientific American:

Prof. S. A. Mitchell's article in the Scientific American of February 6th contains a number of inaccuracies that should not pass unnoticed.

First, the extremely loose way in which the terms "temperature" and "heat quantity" are used is to be deprecated. It should be remembered that the thermometer measures temperatures, and that such terms as "degrees of heat" have no meaning.

In explaining the action of the thermopile Prof. Mitchell says: "When heat strikes a thermopile it alters the resistance offered to an electrical current passing through it, and this change of resistance is measured by the galvanometer." The most elementary text-book shows that the action of the thermopile is nothing of the sort.

Further on we find: "Where the strength of the solar heat is the large number 10,000,000 that of the moon (i. e., reflected solar radiation) is only 12; or in other words the sun shines with an intensity 800,000 times that of the moon." It would be pleasing to learn what justification there may be for the term "strength" as applied to solar heat. This sentence, however, commits the graver fault of treating two distinct propositions as identical. It may be that the sun shines with an intensity 800,000 times that of the moon, the comparison being made with the photometer, but when the total radiations of the two bodies are compared the ratio is about 180,000 to 1, and the latter is the ratio here involved, as nearly as I can make out.

What is meant by the "intensity of the corona at 1.5 millimeters from the sun's limb," etc.? We may guess that Prof. Mitchell means the rate of radiation of the corona at the above-mentioned distance from the edge of the solar image (size not specified) given by his particular apparatus, but as the language stands it really means nothing at all. It is an extremely dangerous practice to use scientific terms in other than their exact and accepted signification.

C. C. Hutchins.

Bowdoin College, Brunswick, Me.

FROM THE TRACK-WALKER'S STANDPOINT.

To the Editor of the Scientific American:

The unveiling of disagreeable facts sometimes helps to needed reforms. In a late editorial you bore down heavily on the antiquated railroad spike as out of place in the modern American roadbed and track, and only fit for a museum of railroad antiquities; at the same time commending the general excellence of the best modern American roadbed and track.

I venture the assertion that there is as little of such bed and track in proportion to the whole as there is of the best American highway.

The locomotive is said to be the most perfect and useful or satisfactory machine that man has made, and the ordinary wheeled vehicle, to say nothing of the automobile, has also reached a high state of perfection. Yet they both run upon roads that in general are full of defects.

In all the controversy between the railroads and the railmakers over the weakness and imperfections of the rail, the railmen have always acted upon the defensive, whereas they might well, and with perfect safety, have carried the war into the camp of the enemy. Rails are sometimes defective, it is true, but the treatment they receive, and the abnormal strains to which they are subjected and in the main endure without injury, entitle them to be called one of the very best products of the American manufacturer.

The rail as delivered to the consumer is a straight piece of steel, and is intended to lie flat, with more or less rigid connections, upon a comparatively unyielding surface. It is actually placed upon a bed almost as yielding in proportion as the packed soil of the ordinary highway yields to the carriage wheel. In most cases it very soon assumes a bent condition, usually lowest at the joints, and in many cases very much depressed, so that in looking along the line from a little above its level, it seems to be made up of arcs of circles. These are short in perspective, and so they are in the rapid transit of heavy wheels over them, making the shock of impact very abrupt. Moreover, they do not lie still, but a wave of depression passes along them as the wheel advances. In a short time, as you say, the vertical motion has loosened the spikes, and the depression at the joints increases. How hard it is to make a level joint appears from the fact that on many bridges and trestles where the foundation is timber and not soil, this joint depression is plainly to be seen.

In the electric traction experiments at Berlin, it was found that high speed was so destructive to the track, that an entirely new system of road building had to be devised. It may come to this for the use of our fast and heavy locomotives before safety can be assured. The imperfections mentioned would seldom be noted by the unpractised eye from the level of the car, but from the level of the trucks they are only too apparent.

I have repeatedly watched the great depression at the rail joints from the passing of locomotives on good track and away from stations. In one instance, five heavy mountain engines coupled together passed me between stations on a road accounted one of the best. The rails not only bent deeply at the joints, but the ties away from the joints seemed to move freely up and down in the ballast. The ballasting, though apparently of the best, was too coarse, so that it did not hug the ties, and a large proportion of the spikes did not bind the rails to the ties. Though the curves were short here, and the grades heavy, there was no lateral bracing of the rails to insure their standing up, and I was told that accidents on this part of the line were of frequent occurrence. And here was in use a heavy, wide, tie plate, which practically covered the full width of the ties, whereas the ordinary tie plate, as I have seen it, is so narrow as to afford but little more bearing than the rail itself. Section men say that the short life of the tie is owing not so much to decay as to the cutting occasioned by the pounding of the wheels. How necessary, then, to employ a tie plate with a wide bearing on the tie.

On at least one great transcontinental line, the tie plate, so essential in preventing lateral movement also, is conspicuous by its absence; and this line boasts some of the heaviest locomotives in use. I noted also along this line piles of ties just removed and awaiting the torch, which seemed to be but masses of splinters and decay, so long had they been kept in the ground.

On another line I saw one place where the shattered ties, four or five together, afforded but little support for six or eight feet of rail. And no doubt it is in such places as this that the rails spread, as certainly there is little to hinder. One fast train which I failed to catch, I was later interested in learning, was ditched while running at good speed on straight track, by spreading rails.

No doubt individual pieces of track show care, or the want of it, on the part of the section boss, but the lack of tie plates, and of lateral bracing on curves, indicate a defective system.

I saw two rails, opposites, in which only two spikes at each end of the rail were driven home, the section men evidently having been called off to other work. All the rest were started only, and stood from one to three or four inches above the rail base. This condition lasted for forty-eight hours on a main line where there was an average of a train an hour, many of them fast and heavy express trains. It was invitation to disaster, and yet had a derailment and wreck occurred, who even of the officials would have suspected the cause?

On one electric line I watched for many miles a new curve. The usual joint depression was marked, but in addition the rails were spread at the joints, where they were highly polished by the pounding of the wheels, while on the apex of the curve the wear showed only on the inner half of the rail face. While high speed was made on this road, its roughness appeared from the fact that it was difficult to keep one's seat without bracing the feet. The rails were comparatively light, and more readily responsive to the inequalities of the roadbed.

I think these observations go to show not only the remarkable endurance of the American rail, but the need of a better bed for it to lie on, not only for its own life, but for that of the traveler.

Chicago, Ill. George S. Paine.

THE LOCUST TREE: AN IMPORTANT FIELD FOR INVESTIGATION.

To the Editor of the Scientific American:

The locust is one of the most valuable trees growing in the United States. In common speech we have the black, yellow, and honey locust. The botanists recognize the false acacia, or *Robina pseudacacia*, and the *R. Lispida*. The wood has a strength as great as or greater than any of our native woods. Its only rival in common use is the hickory. The latter, however, is not nearly as strong. Hickory has the one advantage of being much more elastic. The locust resists crushing in experiment to the extent of 9,800 pounds, and its tensile strength is put at 18,000 pounds per square inch. The wood is almost insensible to decay, and lasts under water like white pine, which is in that position indestructible. Its great tensile strength and durability caused its universal use for treenails in wooden ships. No other wood ever took its place for this purpose.

The insensibility of the wood to decay appears to be due to some form of pitch or waterproof varnish within the wood. It seems to the casual observer that there was some chemical combination with the cellulose itself, which rendered it immune from the action of water. Even a locust post seems perfectly indifferent to decay at the surface of the ground.

Since the cellulose of the locust seems not to be different from that of other trees, the importance of a chemical investigation, which shall discover the secret of its remarkable and valuable characteristics, can at once be seen. The discovery of some means of converting ordinary cellulose into a compound having the same properties as that of the locust would be simply invaluable in the arts. If merely a method of imparting its waterproof qualities to the cellulose of the spruce, for example, could be discovered, it would result in the creation of a new and gigantic industry, perhaps several.

An investigation of this subject opens a wide field to the young man. Its importance and value can hardly be overestimated.

It will be interesting to note the fact that the finest, strongest, and most desirable locust timber in the United States is said to be found on Long Island. It is also said that the tree grows more rapidly there than anywhere in the country. From the so-called annual rings, it appears to be one of our most rapidly-growing trees. Owing to the extreme hardness of the timber, it does not promise to be a favorite with lumbermen. It is somewhat surprising that the locust is not more frequently recommended for railroad plantations.

B.

WHAT IS THE SELDEN PATENT?

BY CHARLES B. HAYWOOD.

Although manufacturers' organizations, formed as the result of differences of opinion concerning its validity, have done a great deal to spread knowledge concerning it and have greatly emphasized its importance, much confusion exists in the public mind as to just what the so-called Selden patent is. Exactly what its claims cover is something of which even the majority of well-informed motorists have but the haziest conception. Probably the one thing that is generally known regarding what bids fair to make for itself a niche in American patent history, as lasting as that of the Bell telephone, or McCormick reaper litigation, is that there are a certain number of manufacturers who acknowledge the validity of the Selden patent and pay royalties under license; likewise that there are others who refuse to part with even the small percentage of their profits now demanded as tribute. Originally the royalty paid by the licensees to the owners of the patent was 1.25 per cent. A reduction to 1 per cent was afterward made by the owners of the patent, voluntarily, as the volume of business increased. Subsequently, owing to the refusal of several of the licensees to pay the royalties at the old rate to the receivers of the Electrical Vehicle Company, the owners of the patent, a petition, filed by the licensees, was granted by the Federal Court for a reduction in the amount of royalty from 1 per cent to 0.8 of 1 per cent.

It is also generally known that the two trade organizations in question have been formed for the mutual protection of the interests of their members; one to uphold the Selden patent, hold automobile shows, and generally advance the welfare of its supporters by various means, such as the maintenance of a laboratory, an engineers' department holding monthly meetings, and the like; the other to fight the patent, its objects otherwise being the same as the first, though it has not developed them to the same extent as yet. These are respectively the Association of Licensed Automobile Manufacturers and the American Motor Car Manufacturers' Association, generally known as the Licensed Association and the Independents. Each holds an automobile show in New York annually. In Chicago, they sink their differences for the time and exhibit together simultaneously. This serves to sum up the extent of general knowledge on the subject. It may be added here that there are other manufacturers, of no small importance, who acknowledge the standing of neither association by holding aloof from both. Needless to add, they pay no royalties.

The Selden patent was granted to George B. Selden, of Rochester, N. Y., November 5th, 1895, and is known in the United States Patent Office files as No. 549,160. The application for patent rights was filed sixteen years earlier, or on May 8th, 1879. The subject of the patent is set forth by the applicant as an "Improved Road Engine," while its chief advantages are stated as "the elimination of the great weight of the boiler, engine, water, water tanks, the complicated apparatus necessary to adapt the machine to the roughness of the roads which it must traverse, the necessity of a skilled engineer to prevent accidents, and the unsightly appearance of locomotives built on this plan."

Parts of the specifications upon which the inventor and the Licensed Association found their appeals to the courts to sustain the basic nature of the Selden patent, are as follows: "I have succeeded in overcoming these difficulties by the construction of a road locomotive propelled by a liquid hydrocarbon engine of the compression type, of a design which permits it to be operated in connection with the running gear . . . very largely reducing the weight of the machine in proportion to the power produced, and which enable me, while employing a most condensed form of fuel, to produce a power road wagon, which differs but little in appearance from, and is not materially heavier than the carriages in common use, is capable of being managed by persons of ordinary skill at a minimum of trouble and expense, and which possesses sufficient power to overcome any ordinary inclination. Any form of liquid hydrocarbon engine of the compression type may be employed in my improved road locomotive. As the general mode of construction and operation of liquid hydrocarbon engines of this class are now well known, it is considered unnecessary to further describe them here.

"The traction wheels are attached to the axle by clutches, splined on the driving shaft and held in mesh by springs in order to permit of the wheels rotating independently of each other to facilitate progress over rough roads and the turning of corners. These clutches may also be used for the purpose of disconnecting the engines from the traction wheels. Friction or ball clutches may be used for this purpose. Provision is made for backing my improved road engine by reversing the motion of the driving wheels by a set of reversing gears . . . a clutch is interposed between the engine and the driving wheels so as to admit of running the engine while the carriage is stationary."

Selden accordingly made the following claim:

"The combination with a road locomotive, provided with suitable running gear, including a propelling wheel and steering mechanism, of a liquid hydrocarbon gas engine of the compression type, comprising one or more cylinders, a suitable liquid fuel receptacle, a power shaft connected with and arranged to run faster than the propelling wheel, an intermediate clutch or disconnecting device, and a suitable carriage body adapted to the conveyance of persons or goods, substantially as described."

It will be apparent from this that the patent granted to Selden accordingly covers every one of the fundamental essentials of the gasoline automobile of the present day—the internal-combustion motor working on a compression cycle, a clutch or means of disconnecting the road wheels from the engine, the latter being designed to run much faster than the road wheels, and a means of reversing by a gear train. The differential principle of driving the wheels was also involved, but this has no bearing on the patent. Evidently, if Selden's claims can be substantiated, they are basic, and enormous royalties may be collected. It all hinges upon whether or not Selden was anticipated by other investigators in the same field, or as the legal phraseology of the Patent Office has it, whether there is anything in the "prior art," which would render his claims to originality entirely unfounded.

Apparently, this is rather a simple question and it has been settled times without number, both *pro* and *con*, by automobile enthusiasts, who are willing to pass unequivocal judgment in accordance with their own views without the slightest hesitation. Thus far, however, it has consumed nine years of litigation, almost half a million dollars, and 60,000 folios of testimony to provide the courts with something upon which to base a decision, and this has yet to be rendered. The life of the Selden patent comes to an end, November 5th, 1912, and there is at least a doubt as to whether the question of its validity will be finally settled before it legally expires. It has been considered in automobile circles that this is somewhat of an exceptionally long-drawn-out instance of patent litigation, but the telephone, reaper and binder, and the sewing machine furnish parallel cases that greatly exceed it, these landmarks in our patent history having been in the courts throughout practically the entire terms of their legal existence of seventeen years.

As early as 1899, George Day, then president of the Electric Vehicle Company, became convinced of the value of the Selden claims, and his company accordingly acquired a controlling interest in the patent. The company in question, which is now operating in the hands of a receiver, was then making gasoline as well as electric vehicles, and in 1900 it undertook the task of enforcing its right by bringing an action against the Buffalo Gasoline Motor Company, and the Automobile Fore Carriage Company (it was always Selden's idea to drive the forward wheels) as infringers. Half a year later, another action was instituted against the Winton Motor Carriage Company, which was one of the first concerns in this country to market gasoline-driven vehicles on any scale. About two and a half years then passed without any developments of note, and then George Day, having resigned as an official of the Electric Vehicle Company, undertook the organization of the Association of Licensed Automobile Manufacturers. It was on March 10th, 1903, that the association came into existence with ten American manufacturers of automobiles as charter members. The litigation against the Buffalo and Winton concerns was then amicably terminated by the defendants agreeing to become members of the association and to pay royalties. A number of minor actions in the shape of petitions to the federal courts to enjoin the use of imported vehicles were brought against individuals and importing companies about the same time, with varying results. One or two were allowed to go by default through the defendant's failure to appear and contest the case, and injunctions obtained under such circumstances were exploited as evidence of the validity of the patent, Judge Hough of the United States Circuit Court for the Southern District of New York, denying an application to punish for contempt of court the violation of one of the injunctions obtained by default, stating emphatically that the patent could not be established by injunction. As a whole, the result of these actions was not any great gain or loss to either side.

About six months after the actions against the first infringers to be proceeded against had been ended by their capitulation, the Ford Motor Company was organized in Detroit. One of the most important clauses in the articles of agreement of the Association of Licensed Automobile Manufacturers is to the effect that only firms which were actually engaged in the manufacture of automobiles on or before the date of its organization (it is not an incorporated body) were eligible to membership, and as the industry was hardly in its first swaddling clothes in the early part of 1903, it will be apparent that many important companies entering the field later were barred, willy-nilly. A notable instance of this was found in the organization of the Selden Motor Car Company in 1907, the inventor being com-