CORNELL'S MAN-OF-WAR TANK

Interesting Scientific Experiments with Propellers on Cayuga Lake.

MAKING AND TESTING SHIP'S MODELS

Ingenious Devices for Determining the Resistance of Vessels and Their Propellers—Basis of Marine Engineering.

Civil engineers all over the world have been expectantly watching the completion of the new marine testing tank in the hydraulic laboratory in Cornell university, because through it they expect to find out some of the engineering secrets which the United States and other governments have been hoarding up for several years past.

CARVING A MODEL WAR VESSEL OUT OF A BLOCK OF PARAFFIN.

The various governments have been carrying on a series of experiments on war vessels in their model testing tanks, and, it is said, much invaluable data has been secured. But the information so obtained has been zealously guarded. If a new fact is discovered it is put under the seal of the strong box, and is not to be used except in urgent need, as, for instance, in case of war; each government thus expecting to be just so far ahead of its neighbors at the critical moment. This is one reason why a war between the United States and Spain is of such interest to the naval engineers of neutral nations. But this new tank at Cornell will change the condition of affairs somewhat, inasmuch as every fact ascertained will be given at once to the world at large to be used for what it is worth.

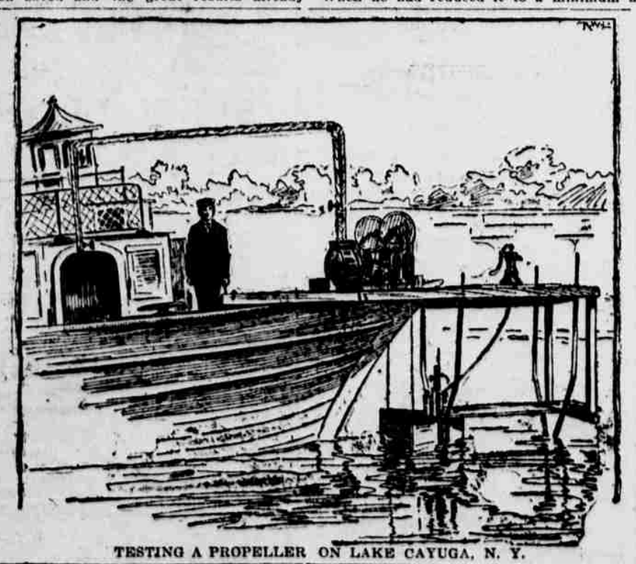
GOVERNMENT TESTING TANKS.

In these government testing tanks models of war vessels are operated with intricate machinery and experiments are made to determine means for increasing the speed; to discover ways of reducing water resistance; determine power using capacity; to find out how to increase coaling capacity and other things of a like nature, which, in case of war, might have great importance. The United States tank is about completed; it will be the largest in the world. There are two in great Britain; one belonging to the British government in Portsmouth, and one belonging to a shipbuilding firm in Balbarton, Scotland. Italy owns a tank and so does Russia. The French and Germans, however, have carried on their operations in flooded "dry docks," though the findings therein have been kept secret just the same. Generally speaking, these tanks are all alike in construction, and the same kind of apparatus is employed on all of them. They range in size from 350 to 500 feet long, by twenty to fifty feet in width, and ten to fourteen feet in depth. The United States tank is 500 feet long by fifty feet wide. It is fourteen feet deep. The Cornell tank is 350 feet long, sixteen feet wide and ten feet deep. Water of various depths may be had in these tanks, and it can be calm or made to run rapidly through them at the will of the operator.

ECONOMICAL VALUE.

The value of the tanks is almost incalculable. Had the United States government possessed one years ago it might have saved thousands of dollars in the construction of its crack cruisers and battleships. Probably $3,000,000 was spent in premiums by the government during the early days of the present navy. As Prof. Durand of Cornell points out, the commercial value of the expenditure as an incentive to builders is not to be denied, but much money might have been saved and the great results already achieved might have been much improved if a tank had been operated in those days. After the Italian war vessels Duilio and Dandolo were built and placed in commission, it was found that very slight changes of model would have allowed the battleships to have attained the same speed with an expenditure of very much less power, the difference costing more Italian money than would have equipped an entire experimental station. The head of a leading shipbuilding firm says that he was able to guarantee a speed of 20.5 knots (one knot in excess of that already attained) simply because of some model tank experiments. The vessels ran between Dover and Ostend, and went ahead of the expectations of their builder by making twenty-one knots an hour. He stated that he could have allowed the boats to maintain the old speed of 19.5 knots by saving nearly 1,000 horse-power. It is information of this nature that has been ascertained in the various tanks, and that is expected to be learned from the Cornell tank by civil engineers.

TESTING A MODEL WAR VESSEL IN THE CORNELL TANK.



TESTING A PROPELLER ON LAKE CAYUGA, N. Y.

equipment, so that a description of its apparatus will cover that of all. The tank in Ithaca has a trolley car structure extending across it, which is capable of being electrically propelled from one end of the tank to the other at any speed. This is for the purpose of testing the speed, thrust and area of propellers. It is used also in connection with the determination of the shape of vessels' hulls. This structure is the most interesting part of the tank equipment. It is supplied with delicate testing instruments and is in its way a moving laboratory. The operator rides upon it as it moves along the tank, dragging after it the model of a man-of-war in the water, or a special apparatus carrying various small propellers. The operator can work the structure by means of switches in circuit with the electric motors. If the model of a boat is being tested it is placed in the water under the trolley structure and drawn forward by a vertical metal rod, which extends up through the structure and is attached by a pivot. The upper end of the rod impinges upon a recording mechanism. When the water in resisting the forward motion of the boat causes the latter to sag backward, the upper or free end of the rod leans forward and records the resistance down below.

The general slope of the hulls of vessels is due to the theories of shipbuilders, who have been heretofore compelled to prove the truth of their assumptions by building large ships and giving the matter commercial tests. One builder tried to equip himself beforehand by arranging a small tank through which the water was caused to run very rapidly. In the tank he placed the model of a vessel which was secured to the upstream end of the tank by a small spring dynamometer. The rushing water caused the small boat to pull hard on the recording instrument. The builder chipped away on the hull of that model boat until he had reduced the strain in every possible way. When he had reduced it to a minimum he proceeded to build a full-sized craft on the same lines which the model had finally assumed, and the result really justified his trouble, for the new vessel was very fast.

MAKING A MAN-OF-WAR MODEL.

The Cornell method of shaping and testing models is a great improvement on the above. The newly drawn "lines" of the proposed boat are laid down on paper, which is secured in an especially constructed apparatus made somewhat like an elaborate pantograph. A huge block of paraffine is prepared, as near the shape of the proposed model as it is possible to get it. This block is placed on the bed of the model-forming machine. The block moves forward and backward under rapidly revolving cutters. The cutters are connected with a pointer. The designer moves the pointer along the lines he has laid down on his plan, and the cutters below cut a corresponding swath out of the block of wax below. In this manner the various water lines are accurately made on the block, and after the block has been polished it is ready to be tested.

which runs along the tank. If it is found that the newly planned boat offers too much resistance to the water in any of its parts the offending part is reshaped until the resistance is reduced. This can be very easily done by means of cutting tools. Thus it will be seen that an almost infinite number of experiments can be made at a very slight cost, and in a very short time, whereas if the model were made of wood much time would be lost and much expense would be incurred in reshaping them. It is probable that this method of constructing models and determining their various characteristics will result in the building of some very fast pleasure yachts and other vessels of a more commercial nature.

EXPERIMENTS ON PROPELLERS.

The trolley structure to be used on this tank will enable its operators to make some very valuable experiments upon the shape and the action of screw propellers. There seems to be a dearth of information in the line of propeller performance. Several private firms have made experiments concerning the shape and size of propellers, but the data obtained has not been sufficiently specialized to result in any radical improvement over heretofore existing styles. Prof. Durand and his assistants in Cornell college have been carrying on a series of experiments with propellers on Cayuga lake. They rigged up a steam launch with a false bow which was designed to carry a small propeller down in the water ahead of the boat. As the boat steamed forward the little propeller ahead of it was forced to revolve. As it was connected with delicate measuring instruments the character of its performance could be determined accurately by those on board the boat. Attached to this small propeller was a belt-rope which connected with an instrument known as a tachometer which measured its revolutions. A clock with a second's break indicated the speed of the apparatus forward through the water. The apparatus was tried over a course 1,000 feet long. The course was divided into ten parts of 100 feet each. Various kinds of propellers were tried, some having long and narrow blades, some having short and thick blades, some with four blades, and others with three. These experiments are still being carried on and the general results when plotted will be very valuable to marine engineers.

WORKING THE TROLLEY TRUCK.

But after all, these efforts are in a measure crude, because the medium which carried the propellers through the water was itself somewhat influenced by the resistance of the water and also by the resistance of the propeller in front. But the trolley truck, proceeding along the newly-made tank, will not be influenced in the least by the performance of the apparatus beneath it. Furthermore, some experiments will now be possible which were not possible with the boat. For instance, there is always a certain amount of interaction between a ship and her propeller, and the resistance of this combination is quite different from the simple resistance that is generated by the forward motion of the boat through the water. This interaction will be studied by means of propellers inserted in the water just behind the model, but unconnected directly therewith. For determining the resistance of a model boat and her propeller there will be a special trolley truck capable of carrying forward the model and provided with means for running the propeller steadily at any speed. This truck will also be provided with means for measuring the thrust developed by the propeller as well as the power required to run it. These facts will be recorded on a drum, so that a record may be made of the performance of the propeller as well as the resistance of the ship. The models are usually tried at various speeds and at various depths of immersion which is varied by adding or subtracting ballast. They are also tried at two or more sets of trims, or sidewise inclinations, such as would naturally be assumed by a vessel when pitching and rolling through heavy waves.

It is the desire of the Cornell professors to make experiments which will be more in the line of pure science than in the line of commercial science. The idea is to establish a set of general rules or laws which can be used by constructors whose efforts are entirely commercial. Their idea is to point out exactly what every kind of propeller will do, what every shape of boat will do under varying conditions, how much power would be needed to propel certain boats at certain speeds and the limitations which would govern these performances. These facts are to be ascertained merely for the benefit of science; then if the various governments or shipbuilders desire to take advantage of them and so construct very fast vessels or vessels using minimum amounts of power with maximum freighting capacity, they may do so. The remarks of Prof. Durand on this subject explain the condition of marine engineering problems. He says:

ENGINEERING PROBLEMS.

"Our idea is that marine engineering, like all other branches of engineering, must have a scientific basis. There has been in this country very little work in this line of a scientific character; that is, disassociated with the solution of a commercial problem. For instance, in the design of a proposed ship, there is, underlying it all, a fundamental field of problems in which the conditions relate not to one problem but to the whole field. My work has not been devoted to the design of any one propeller or to any commercial problem, but to ascertain certain facts and then furnish them to the profession at large, and leave it to the practicing engineer to exercise his own judgment from experience in the use of such data as to putting it into application. He is the one who must judge how far this matter is applicable to his particular use. But in order to treat any of these problems intelligently, he must have a certain number of facts. We have supplied in a small way some facts in propeller designs, to which I have been devoting the last year. The propeller of the present time is designed in very large measure upon mathematical and accidental methods, and the result is in large measure that it is not as it ought to be. But we don't know how to be sure to obtain the highest efficiency. This whole line of work is for the purpose of cutting down the margin of uncertainty. There are also large numbers of other problems which are rising regarding the conditions in the phenomena of engineering parts—in torpedo boats, fast yachts, etc. New conditions were found to exist when the screw propeller was coupled up with the turbine in England. Other problems are to be taken up of which we have very little scientific data.

WORK FOR SCIENTIFIC ENGINEERS.

"In order to receive just treatment at the hands of the engineer, they must first receive considerable amount of study at the hands of the scientific engineer, whose business it is to make a particular study of the

will enable the practicing engineer to know what will be the result of any use he may make of the facts deduced from them. It is not so much to design a propeller, for instance, but to furnish the data which will enable the engineer to see with some degree of assurance that, if he adapts certain proportions, the result will be so and so. It is left to his judgment. The government tanks and nearly all private tanks are for the most part occupied with commercial problems. They study problems having something to do with certain immediate solutions for a particular ship, a particular propeller, etc. The information gained at all these tanks is locked up, and the public never sees it. It is for the benefit of government design, and not for the advancement of general engineering science. It costs large amounts of money for the solutions of these problems, and even the private institutions could not afford to immediately give forth the data for the benefit of their rivals. Therefore, the private engineer is often at a loss when confronted with any great problem, and heretofore he has had no one to turn to for assistance out of his difficulty. It is this assistance denied to him by governments that we hope to supply."

Doubtless many of the problems alluded to by Prof. Durand have been solved by the several governments possessing experimental tanks. This is quite within the limit of possibility; but whatever facts have been obtained, probably will not be exploited until the looked-for critical moment is at hand. In fact, if all these secrets are really as important as they are reported to be, we may expect to see some wonderful accomplishments alike by the war ships and the merchant vessels of the near future.

THEODORE WATERS.

BEAR ON A COWCATCHER.

Held His Place for a Ten-Mile Run and Then Scooted for Timber.

Not long ago as a railroad train was passing through Wilder's Cut, near Olcut Run, Pa., the engineer was astonished to see a black bear coming around a sharp curve. The cut is so narrow that there is hardly room for a man to stand aside and allow an engine to pass without striking him. Bruin was more amazed than the engineer. Instead of stepping aside, he reared on his haunches and awaited events. The locomotive was running less than twenty miles an hour, for the place is a dangerous one. Upon seeing the bear the engineer shut off steam and applied the brakes, but the distance was too short to escape an accident. The cowcatcher slid under the hind legs of the brute and lifted him off the ground.

Thinking all trouble was over, the engineer put on steam once more, while the firemen climbed out of the cab window and stole along the guard rail to find out what had become of the bear. He was there, clasping the cowcatcher, the lower part of his body just grazing the ground and his head almost reaching the bottom of the headlight. He seemed to understand that the only thing he could do was to hold fast, and he did so during the run to the next station, ten miles distant. The station agent was standing at the depot door as the train approached. The sight of a full-grown bear on the cowcatcher fairly took away his breath.

As soon as the engine came to a standstill bruin slipped from his perch and made a break for freedom. This took him straight toward the agent, who dashed through the door, slammed it shut, leaped through the rear door and went up the street at a furious rate, calling out: "Bear! Bear! Somebody get a gun!"

Soon the town was in a turmoil, a yelling crowd following in hot pursuit of the bear, some of the boys pelting him with stones. Suddenly a big shepherd dog bounced out of a yard and dashed after the bear. Bruin paused but a minute or two, but when he passed on the rash dog had no future interest in the proceedings.

At the street corner a lawyer carrying a double-barrelled gun came face to face with the bear, but the latter turned down the nearest alley. The crowd increased and encircled the frightened animal, making escape impossible. Finding himself at bay, bruin backed up against a barn, rearing on his haunches. The lawyer sent two bullets into the bear, whereupon the wounded animal charged the crowd. One urchin fell, was trampled upon and had a leg broken. The lawyer slipped another bullet into his gun and sent the shot through bruin's head and finished him. By this time the engineer and fireman recalled the fact that a trainload of passengers were waiting at the station, and hurried back and resumed their official duties after a bear hunt of about twenty minutes.

STATURE OF AMERICANS.

Surgeon in the United States Army Says the Average is 67 Inches.

In a paper read by Major Henry S. Kilbourne, surgeon of the United States army, before the Association of Military Surgeons of the United States, says the Boston Transcript, he advocated the theory that the physical power of a race of people, and consequently their capacity for work, is measured by their average stature. For every inch of height between five and six feet the extreme breathing capacity is increased eight cubic inches; the vital capacity being at its maximum at 35 years. A table of measurements of 196,621 native white Americans, accepted for the military service of the United States, shows that the number of men below sixty-three inches in height is but little greater than that of the class above seventy-three inches. The most numerous class is included between sixty-seven and sixty-nine inches, and this standard class would have a greater chest girth than the average.

The mean height of 125 United States naval cadets above the age of 23 years was 67.80 inches. As these men are drawn from all parts and classes of the United States they represent very nearly the typical physical development of the American people of 25 years of age.

Major Kilbourne concludes that the commingling strains of Celtic, Danish, Norwegian and German blood among our people have thus far worked no deterioration of physical quality. "Not so the swarthy, low-browed and stunted people now swarming to our shores. Absorbed into the body of the people, these multitudes must inevitably evolve an inferiority of type. To realize the result of such a contingency, let it be considered that the loss of an inch in stature might bring in its train the loss of national ascendency. Let us take care then that the state shall suffer no injury."

HARD CIDER EGGNOG.

A Vermont Decoction that Caused Death and a Lawsuit.

The jury in the Windham county (Vermont) court returned a verdict recently in the most interesting case that has thus far come to trial at the present term of court, relates the Springfield Republican. The jury found that Mrs. Grace L. Dix of Whitingham was entitled to recover $5,000 from Albert Potter and Frank N. Mason for the death of her husband, Clarence Dix. The unusual interest in the case is occasioned by the peculiar circumstances and by the fact that it is the first case in the state to come up under the civil damages statute, which makes the owner of a building in which intoxicating liquor is sold liable with the seller for damages resulting from such sale. The case, briefly, is as follows: Clarence Dix, Clarence Plumb and Edgar Busby, July 26, 1897, rowed in a boat from the north end of Sadawga pond in Whitingham to the Mason farm on the south end, which, it is claimed, was then held by lease by the defendant, Potter. While there Dix and his companions became intoxicated by drinking eggnogg and about 8 o'clock at night they started to row home. Plumb, being dissatisfied with the manner in which the boat was managed, jumped into the water and swam ashore. The boat was overturned soon after and Dix was drowned. The evidence on the part of the plaintiff tended to show that Potter, at the request of the three men, procured two gallons of hard cider, some eggs and sugar, and mixed up about six quarts of eggnogg; that they all drank freely of the mixture, first out of doors and afterward in the part of the house occupied by Potter under his lease. It also tended to show that this was not the first time Potter had sold liquor on the premises, and that Mason had knowledge that Potter was using the house for that purpose. The evidence on the part of Mason tended to show that he was aware that Potter, on one occasion, had procured hard cider, which Potter and his hired man drank in the field, but that he had no knowledge that Potter ever sold liquor in the house; that before July 26, 1897, Potter had surrendered all rights under the lease and that on July 26, 1897, Mason was in Massachusetts. Busby, one of the men who accompanied Dix to [illegible] in the Mason house. He said that the boat was overturned while he and Dix were in the act of changing seats. He testified that they were all intoxicated, Dix being more so than the others. Counsel for the defense entered an appeal to the supreme court upon receiving the verdict.

FANTASTIC TIMEPIECES.

Old-Fashioned Watches Were Made in Many Curious Shapes.

Since timepieces have come within the reach of everybody and watches are made large enough for bicycle bars and small enough for the lady's ring, it is curiously interesting to recall some of the old-fashioned ones that served our ancestors so well generations ago. Even today some of us have caught a glimpse of the portly old gentleman whom Dickins loved to picture, with his ornate seals, wide guard nad enormous watch that filled to bursting the capacious fob that was its resting place, but like many other cumbersome fashions these respectable timepieces are interesting now only as curios.

Long before our time or that of our grandfathers watches were made in such fantastic fashion that it is a marvel that their owners managed to carry them about.

No one seems to know the exact date of the first timepiece, but the middle of the fifteenth century seems to have been the period when "portable clocks" began to appear. In the different collections of antiquaries there are a few specimens of the "Nuremburg Eggs," or watches made in oval shapes and coming from the town after which they were named.

In the possession of Lady Fitzgerald of England there was one watch which was shaped like an eagle, which had a small boy on its back. This odd ornament was made to hint at the story of Jupiter and Ganymede. The breast of the bird opened to show the dial beneath it, and the works were most elaborately ornamented. When the fair owner of this treasure did not wish to wear it on her girdle she could stand it on her table.

Gold and silversmiths seem to have let their fancies run free during the sixteenth [illegible] of ducks, acorns, of cockleshells and of all possible things made their appearance. Most of them struck the hour, and one notable invention fired a diminutive pistol at certain intervals.

When Henry II. of France fell in love with Diana of Poitiers (about 1547) she was a widow and wore mourning. Of course that offered an opportunity to the extravagant courtiers of the day, and the result was that all the ornaments at court were fashioned after such gruesome ideas that the ridiculous was close upon the sublime, to say the least. Rings were formed like skeletons, tiny coffins of gold were worn as ornaments and they contained enameled figures of death, but the most striking products of the hour were the watches, which dangled from fair ladies' belts and which represented grinning skulls, the tops of which lifted to disclose the dial plate. Of course the eyes were brilliant jewels and small fortunes were spent in the elaborate ornamentation of these funeral trinkets. But the watches, the trinkets and the people who wore them have all passed away, and since 1620, or thereabuts, the flat oval or round timepiece has been the general favorite.

Time does not go so fantastically with us as it did with those untutored geniuses of earlier times, and perhaps our plain, substantial watches tell as much of our character as did those bizarre inventions of earlier days about the men and women who wore them.

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BURIAL PLACE OF PATRICK HENRY.

Not in Richmond, but in Charlotte, Where He Lived.

Every now and then, relates the Philadelphia Press, we see in some newspaper the query, "Where is Patrick Henry buried?" and tourists in Richmond constantly ask to be shown his grave, with the mistaken idea that it is in that city. Much of his [illegible] paratively, know that the man who acquired the title of "The Tongue of the Revolution" lies in a quiet grave on the estate in Charlotte county where he formerly lived. Over him is a marble slab inscribed with the one line: "His Fame His Best Epitaph."

The estate lies on the Staunton river, thirty-eight miles from the town of Lynchburg, near the border line which separates Charlotte and Campbell counties. It derived its name of Red Hill from the peculiar color of the soil in that vicinity. When Patrick Henry bought the place it comprised about 3,500 acres. The land is rich—there was a saying in the neighborhood that poor land and Henry could never be mentioned together—corn grows there as high as a man on horseback; there is a general air of smiling fields and abundant prosperity. Its situation in early times was very remote. Neighbors were few, one of the nearest being the celebrated John Randolph of Roanoke, who lived in his chosen solitude fifteen miles away.

Red Hill is now owned by Henry's grandson, William Wirt Henry, a clever, cultivated gentleman of the "old school." He has in his possession some most interesting relics of his celebrated grandfather, including the desk he always used, which still contains his letters from Lafayette, Washington, Madison and other great men of early days; the large, roundbacked chair in which Patrick Henry died, and a portrait of him by the elder Sully, under which hangs a yellowed slip of paper signed by Chief Justice John Marshall and several others of his friends, testifying to the faithfulness of the likeness.

Gold Engaged for Import.

NEW YORK, March 29.—The Produce Exchange bank has taken $200,000 in gold for import. Additional gold engagements have been announced by L. von Hoffman & Co. of $250,000, by the Bank of British North America, $500,000; by Kuhn, Loeb & Co., $500,000; L. Freres, $1,125,000, and by Heidelbach, Ickelheimer & Co., $500,000.

Thirty-five years make a generation. That is how long Adolph Fisher of Zanesville, Ohio, suffered from piles. He has cured himself with [illegible]

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