A Test of a War Vessel Frame and Armor.

The Naval Ordnance Board conducted an important test at the Indian Head Proving Ground, near Washington, September 4. Though primarily it was a test of a steel armor plate, it was in reality a trial of the strength of the frame of a modern warship. It has been claimed that the frames of modern warships would not withstand the shock caused by heavy projectiles striking against the armor which covers them.

It has even been asserted by some authorities that the armor, if not penetrated or shattered by the shock, would be driven through the vessel by the crushing of the frame. Some time ago the English government fired at an old armored vessel for the purpose of observing the effects of the shock, but this test at Indian Head is the first frame test ever made of a distinctly modern warship's frame with armor attached.

The plate tested represented twenty-four others weighing 620 tons. It was made by the Carnegie Company and was what is known as double-forged, being forged both before and after Harveyizing.

The plate was 14 inches in thickness and formed the outer surface of a target which was a representation of a side section of the battleship Iowa. It was 18 feet long by 7½ feet high, and represented that portion covering the vitals, and extending 5 feet below and 2½ feet above the water line. Behind the armor was a backing of 5 inches of oak, and then came the "skin" of the vessel—the inner and outer bottoms, each five-eighths of an inch of steel plate.

Some four feet further back was a ⅝ inch steel plate, representing the inner shell of the vessel. Between this plate and the "skin" were the frames or braces, also of ⅝ inch plate, alternately two and four feet apart. The whole structure was covered by a 2½ inch steel plate, representing a protective deck. Against the inner plate were heavy timbers resting on the side of a hill.

The conditions were not exactly the same as on board a ship in the water, because the water would yield, while the solid earth would not, but the difference would be very slight, as the vessel in the water could not yield quickly enough to be of any real benefit. The first shot fired was a 10 inch Carpenter projectile, weighing 500 pounds, which was propelled by 140 pounds of prismatic powder. The velocity was 1,472 feet per second. The shell was completely shattered by the impact, part being lodged in the plate. The backing and frames were found intact. The charge of powder was increased to 216 pounds. The projectile then had a velocity of 1,862 feet per second. Again the shell was shattered, a larger portion being embedded in the plate, which still remained without a crack or bulge. The frame was uninjured, except that one of the armor bolts was driven out. This completed the acceptance test for the lot of twenty-four plates. Then a shot was fired from a 12 inch gun, using a Wheeler-Sterling projectile weighing 850 pounds, which was propelled by 400 pounds of powder at a velocity of 1,800 feet per second. This test was one which was ordinarily used for the 17 inch armor plate. It was, therefore, thought that the projectile would pass entirely through the plate, but it did not. The plate was penetrated almost its entire depth and cracked from top to bottom, but the oak backing was scarcely disturbed and the frame was uninjured. A further test with a 13 inch gun will be made as soon as the gun can be set up.

The test of the new armor bolt designed by the Ordnance Board to replace the bolt now used in fastening armor to the ships was also entirely successful. The bolt is less than half the length of the bolt now in use, and the saving of weight in each ship will be considerable.

The test demonstrates the fact that the frames of our warships are able to meet ordinary demands and that the 14 inch armor for the new battleships will, under ordinary conditions, receive the fire of any vessel without serious damage.

Why the Bicycle is so Popular.

The evolution of the bicycle from the original idea of manumotion down to the present diamond-framed rear driver has been by certain positive steps, each step marking a distinct advance in the grand march of improvement.

In schools are taught something of the revolutions wrought by the steam engine, the telegraph and the loom, but the schools of the future will surely take notice of the wonders wrought by the bicycle, and will teach something about the Draisine or "go-devil," the velocipede, the bicycle and all such inventions of whatever name, by which man is enabled to travel quickly, merely through the application of his own muscular powers.

What makes the bicycle so popular with all classes of people? Cheapness? No; the trolley or cable is cheaper. Speed? No. If one merely wants to travel fast there is the railroad. Luxury? No. The brougham is far ahead of the bicycle on that score. And yet people with all these things at their command have taken to bicycling with great fervor. It must be because of the outdoor exercise, you say. No, again. The term outdoor comprehends infinite space, and as for forms of exercise—well, they are without limit. There never was a complaint of the lack of either outdoors or methods of exercise in it.

The secret seems to lie in the fact the wheel has revealed to us that our natural powers of locomotion have been multiplied. "Two blades have been made to grow where but one grew before."

The draught upon our strength necessary to walk a mile is sufficient to enable us on wheel to travel five miles or more. Astride of it "magnificent distances" become insignificant.

What a glorious feeling of freedom comes over us when the countryside, smiling and gay, brings to the rider a sort of contagious happiness! What independence! We have not had to be carried there by the horse or the railroad and we are proud to say, "I did it!"

Inventors of auxiliary power appliances for bicycles should take notice of the fact that the secret to-day of the bicycle's popularity is not merely because a person is enabled to ride fast or far, but because the riding was without foreign assistance. Vanity and egotism cut a considerable figure in the wheel's popularity. To say "I rode on an electric motor bicycle to Albany to-day," would mean the same as to say, "I rode on a railroad train to Albany to-day." But to say, "I rode my wheel to Albany to-day," means something entirely different. The rider who did this in fast time would be hailed with great applause, and the telegraph would announce the fact to the world.

In improving the bicycle the main idea is to get the most results out of the least power applied by man to the pedals. Auxiliary power has nothing to do with bicycle improvement. It belongs to a class of inventions designed to carry or convey, not to those by which man carries himself.—The Wheel.

The Philosophy of Pumping.

The limit of atmospheric pressure being 33 feet, water will rise from that depth if the air is wholly removed from its surface. This is simply the law of gravitation. The ordinary device for removing the air is the pump. As the air to be removed is in weight as the height of the column, it is plain that the same amount of work is required to displace it as to lift or force a column of water an equal height theoretically. Practically the water can be lifted with less labor because of its density and lubricating qualities. This is too often forgotten and leads to a common error in placing pumps in wells.

It is thought that if we exhaust a cylinder, the air will rush upward to fill the space thus exhausted. It will, but the air leaves a space, too, that the law of gravitation causes to press downward and produces a load or weight which is increased at every stroke of the piston in the cylinder, and which, when the pressure above and the draught below are more than equal, will cause the elastic air above to rush through any existing imperfections of the piston or cylinder to effect an equilibrium below. When this occurs, it is plain to be seen no water will rise.

A writer on the subject puts it this way: "To see why a pump will not draw water more than 33 feet vertically, suppose the pump cylinder to be 40 feet above the water, commence the process of pumping, the air will be pumped out of the pipe, the pressure of the atmosphere will force the water up the pipe until the pressure inside and outside is equal. It becomes equal when the water has reached the height at which the column of water weighs the same per square inch as the pressure of the atmosphere. When this point is reached the water will be lifted no higher by atmospheric pressure, even though a perfect vacuum be maintained above it. Therefore, if it is desired to lift water further than this distance, it becomes necessary to place the cylinder or working parts of the pump within the limits of atmospheric pressure."

A perfect pump does not long remain so, whether it be used or unused. So as to avoid trouble and annoyance, when making calculations for placing a pump, trust nothing to suction, but rather place the cylinder far enough above the bottom to insure a prompt action of the valves, and near enough to the water to avoid the necessity of an absolutely perfect airtight piston, except as the water shall make it so.

A practical rule that experience has taught is for wells of all depths greater than 15 feet to place the cylinder within 12 feet of the bottom and let the pipe extend, with a foot valve on end, to within 6 to 8 inches of the bottom.

This is as near a perfect pumping outfit for wells as can be made. The plunger is made to fit close at all times by water surrounding it, and the valves act promptly, insuring against loss by water running past them. Such a pump is always ready for use. If there is any water in the well, no priming is necessary. Care should be taken to not commit the common error of using pipe that is too small. Too large pipe cannot be used, that is the work is not increased by the use of large pipes; on the contrary, it is much diminished, because the particles of water being globular in form roll over each other with less friction than when in contact with a foreign substance, and the size of the valves being the limit of the moving column the height to which it is raised, plus the quantity, being the only measure of weight, it will be seen the larger the pipes the less labor will be required to raise a given quantity a stated height. This is combined in the old rule of half the diameter of the cylinder for the whole diameter of the pipe.

The friction in pipes is as the square of velocity; velocity increases as the squares of the diameters. The deduction from these rules is that the velocity of a given volume of water flowing through a two inch pipe would be increased four times if made to flow through a one inch pipe; the friction by the same law would be increased sixteen times; hence the advantage of using large pipes. Whatever kind of pump is used, place it as near the source of water supply as possible. If this cannot be done, then use as large pipes as possible. It is poor economy to try to make a small pump do the work of a large one by crowding it. It shortens the life and efficiency of the pump without corresponding benefit.—Rural Mechanic.

DECISIONS RELATING TO PATENTS.

United States Circuit Court—Western District of Michigan, Southern Division.

UNITED STATES PRINTING COMPANY VS. AMERICAN PLAYING CARD COMPANY.

Sage, J.:

Letters patent No. 381,716, granted April 24, 1888, to Samuel J. Murray for an improvement in a machine for printing cards, considered and Held valid and infringed.

Where it appears that all the elements of the combination claimed in the patent are old, but a new and valuable result has been obtained, the safety and efficiency of the machine greatly enhanced, and the profits resulting from its operation greatly increased, Held that the combination itself displays invention.

Damages can be collected from the manufacturer of a machine, and further damages from a subsequent purchaser and user of the same machine. The payment of damages for making an infringing machine does not give any right to the future use of the machine; but this may be restrained by injunction, and when the whole machine is an infringement, it may be ordered to be delivered up and destroyed. (Birdsell vs. Shaliol, 39 O. G., 261; 112 U. S., 485.)

Where a patentee takes a decree for profits against a manufacturing infringer, he sets the manufactured machine free. The profits of the infringer are full compensation to the complainant for the wrong done him; but a judgment for damages covers only damages in the past and has no relation to the future.

Where it was objected that defendant was not liable because the patented machine was not marked with notice of the patent, Held that such defense to be available must be set up in the answer and established by proof. (Rob. on Pat., sec. 1046; Goodyear vs. Allyn, 6 Blatchf., 38.)

The Stopping of Steamers.

Mr. William Dixon Weaver, late Assistant Engineer United States Navy, gives, in the London Engineer, some interesting calculations as to the length of time and distance required to stop a steam vessel going full speed ahead when the propelling machinery is reversed. Omitting the mathematical formulas, we come to Mr. Weaver's conclusions, which are given in the following table for the Cunarder Etruria, the Italian ironclad Lepanto, the United States naval vessels Columbia, Yorktown, Bancroft and Cushing, and the Russian torpedo boat Wiborg:

	Displacement.	Horse Power.	Speed.	Distance, Feet.	Time, Seconds.
Etruria........	9,680	14,321	20·18	2,464	167
Lepanto........	14,680	15,040	18	2,522	192
Columbia........	7,350	17,991	22·8	2,147	135
Yorktown.......	1,700	3,205	16·14	989	83·9
Bancroft	832	1,170	14·52	965	91
Cushing.........	105	1,754	22·48	301	18·4
Wiborg.....	138	1,303	19·96	373	25·6

Twenty-seven Whales Ashore.

A lucky discovery was made on the morning of July 4 by two Maoris outside the north head of the Kaipara Harbor, New Zealand, when no fewer than twenty-seven sperm whales were found on the shore, all within a few miles radius. It being the breeding season for sperm whales, they usually leave the cold latitudes of the Antarctic until the calves are strong enough to return, and it is assumed that in one of these voyages, being confronted by fierce gales, they endeavored to take shelter, but suddenly found themselves in shallow water, where the receding tide soon left them an easy prey for the hands of man. An enterprising firm, Messrs. Allison Brothers, of Auckland, have commenced the boiling down process, though their plant is somewhat inadequate for such a gigantic undertaking. A horseman who was riding along the beach soon after the discovery was lucky enough to find a large quantity of ambergris, valued at about £3,000. Many seekers are now on the ground expecting each tide to bring them a fortune.