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Contents:

(Illustrated articles are marked with an asterisk.)

CAN WE STAY?

It is time some one stood up for his country: some American, we mean. Not for its present prosperity and immediate prospects, there are plenty to do that: but for its distant past and distant future. We are tired of hearing the Continent called a graveyard of nations, the tomb of antecedent races, the one spot on earth which man cannot permanently inhabit!

It is bad enough to be told, by would-be wise ethnologists, that our climate is hostile to the Aryan type, that an irresistible Indianizing influence pervades the air and is rapidly converting us all into lean, high-cheeked, bilious-looking copies of Mr. Lo; and that our great grandchildren will be no better than so many Sioux. But that is not half so bad as to be told that it is a question whether their descendants will be able to stay here at all, except underground. Any existence is better than extinction: and it is possible to hope good things of our race even if it should assume the physical characteristics of the so-called American type.

The latest advocate of the extinction hypothesis is the somewhat prominent author of "Sex in Education." His essay, read before the National Teachers' Association the other day, set out with the discouraging announcement that no race of human kind has yet obtained a permanent foothold on this continent; and the lesson he sought to enforce was that, unless something extraordinary is done, we are doomed as a race to untimely extermination. The Asiatics, he said, trace their life to beginnings immensely remote. The descendents of the Ptolemys still linger in the valley of the Nile. The race which peopled Northern Europe, when Greece and Rome were young, more than maintains its ancient place and power. But the ancient races of America—where are they? "We only know that they are gone."

When Dr. Clarke talks of "Brain Building" and the "Education of the Sexes," he says much that is sensible and true: but when he infers our early destruction by climatic influences from the fact that other American races have vanished, our confidence in his judgment is seriously shaken. Grant that vestiges of two or more departed races are to be found within our borders, and that when the Mayflower discharged her marvelous cargo of cottage furniture to furnish heirlooms for all New England, the native race were hastening to the happy hunting grounds at a rate which whisky and gunpowder have but slightly accelerated: does that prove American races to be short lived? Rather let us call it evidence of exceedinglong life. Where else on earth will you find so few races bridging over so vast an interval of time?

When the pioneers of Italy and Greece, wild as Mohawks, fought their way into Europe, a peaceful and populous nation—whose unhappy remnant has lately given a President to Mexico—was cultivating maize in the valley of the Mississippi, mining copper at Lake Superior, and building temples in the South. The man of the Florida corals antedates not merely the Ptolemys—men of yesterday—but the Pharoahs, the shepherd kings, it may be the very land they owned and ruled. What wonder that his lineage is lost? We know from recent exploration that the desert regions of North Africa were under water in later tertiary times. Since then the sea has dried away, and across its sandy bottom the Nile has laid its annual layers of mud for the creation of the ancient granary of the world. There is geological evidence that, when the first mud layer was put down, a broad fresh water sea covered the now barren Bad Lands of our great West. There is similar evidence that men dwelt on its shores and fished from its headlands.

Since the pioneers of Western Europe sought shelter in the caves of France and Belgium, the Somme has sunk its bed through a hundred feet of gravel. Since a settled population flourished on the then fertile, now arid, plains of the Colorado, that stream has cut its mighty cañons deep in earth through two, four, perhaps six, thousand feet of solid rock! When the upper strata of the Himalayas were in process of deposition, and before our Aryan fatherland began its upward course in civilization and altitude, human beings were fishing among the islands of our Pacific coast, since lifted up to form the Coast Range. Ages afterward, when the Golden Gate had been opened and California drained of the sea which had filled the valleys of the Sacramento and San Joaquin, but before the gold gravels were ground into existence or buried beneath lava floods, other men came in and occupied the land, leaving their remains, with those of animals long extinct.

Yet because we cannot trace these nations historically through intervening ages, because they seem to represent a number of distinct successive races, shall we blame the climate and call the land inimical to humanity?

PREPARE FOR THE CENTENNIAL.

The short time intervening between the present date and the opening of the Centennial Exhibition renders it imperative that intending exhibitors should begin their preparations at once. We need not urge the fact that, owing to the magnitude of the affair and the large interests involved, the delays, so common in our yearly fairs, caused by not transmitting objects for exhibition until the last moment, will not here be possible. The Centennial commission has announced its readiness to receive applications for space, so that this important matter can now be definitely settled, leaving nothing to be done but to get the articles ready in conformity with the area of surface secured. Applications should be made immediately, in order that the commission may be allowed time to decide on the amount of room to be assigned to foreign nations. Lack of promptitude, therefore, on the part of intending exhibitors will probably result in their finding the space desired already occupied by less tardy applicants or set apart for foreign contributors.

Those most directly interested at the present moment are manufacturers who propose making large entries which will take time to construct or arrange, and the people who contemplate collective exhibitions of the natural resources or raw materials of different sections of the country, which cannot well be made by individual exhibitors.

It is especially desirable that provision for these aggregate contributions should be speedily made. The importance of the plan, as an incentive to immigration and to the investment of foreign capital, is very great: and liberal arrangements for the prompt and thorough performance of the work will amply repay those States or communities which undertake it.

The advertisement of the Director General of the Centennial will be found in another column, and from it may be learned how applications should be made. It is high time that the public should realize the fact that, leaving out all debatable questions as to its expediency as a national enterprize, our Exposition of 1876 is not an abstraction, as seems to be the prevalent idea, but something upon which work, now commenced, is briskly progressing. Ground has been broken, and the foundations of the great buildings are beginning to appear. Foreign commissioners have already established offices among us, and foreign governments have set apart liberal sums of money to ensure the representation of their industries. If we propose to make the fair a fit celebration for the anniversary which it commemorates and worthy of the high industrial and intellectual standard of our people, we must begin work for it at once—not at some vague, future period in next week, next month, or next year, but, earnestly and emphatically, *now*.

PENHOLDERS.

Goosequills are round: consequently penholders are round. Professor Syllogism might dispute the logic of this observation; it is correct, nevertheless. Evolution—the clearest expression of the Great Artificer's will in Nature—is the one unbreakable law which determines the products of human invention. Solomon's assertion that there is no new thing under the sun was therefore true in a wider sense than the kingly preacher imagined. In Nature and in Art alike, everything is the offspring of something gone before; and however unique it may seem at first sight, it will prove on examination to be only a more or less modified copy of something else.

Downward from the first metal worker, whose weapons and implements of bronze were exact copies of those his neighbors were toilsomely chipping from stone—thus allowing the necessities of one substance to determine the fashion of objects made of another, of entirely different character, by entirely different processes—one may trace the tendency of men to perpetuate form, even at the cost of sacrificing substance and usefulness. The material may change, and the mode of working, to correspond; but the figure remains, as though to justify Goethe's assertion that form alone is real.

The original maker of metallic pens could do no other than imitate the time-honored goosequill, thrusting a round stick into the end of the barrel for a holder. Subsequently the barrel was taken from the pen and made a part of the holder, which has since been modified in numberless ways, without departing essentially, however, from the cylindrical form. Accustomed to this shape, we can with difficulty think of any other. Indeed, so strong is the natural feeling that whatever is is right, it is more than likely that, if our readers were individually asked why a penholder is round, the majority would reply: "Because that is the proper shape."

But the argument from universal assent, so convincing to the theologian, is practically as little worth in matter of fact as in matters of faith. At best it only proves the matter not intolerable. Penholders are round because no one has ever made them otherwise. It by no means follows that a change would not be beneficial.

Place your thumb and forefinger against the second finger as in the act of grasping a pen, and notice the shape of the space between them. It is triangular. It is easy to put a round stick into a three cornered hole; but it needs no mechanical genius to see that it will not make the closest possible fit.

To write steadily and with a uniform slope, the pen needs to be firmly held in a fixed position. To write easily the pen must lie in the hand naturally, so as to maintain its position with the least effort. With a rolling penholder, these conditions are but poorly met. The contrary obtains with a three-sided holder, which presents a broad surface to each side of the finger's triangular grip, and gives a steady hold, without apparent pressure and without appreciably separating the fingers. The advantage of a triangular holder over a round one in the last particular is very great; and we are confident that holders so made would rapidly supersede the present style if once placed in market.

There is reason to make the change, and pen stick makers will do well to consider it. Should it be made, would the logic of our first observation be impaired? Would the new form have any other reason for being than the fact that it is the best form? No, and yes. It is the best form unquestionably; yet it owes its existence not to that, but to the apparently irrelevant fact that horsefoot crabs have three-cornered tails!

Visiting the seashore, we chanced to find the empty shell of one of these singular creatures. While holding it up by its spiky tail, a friend, of the sex that is said to have no inventive genius, remarked that the tail would make an odd penholder. The suggestion was carried out, and the product was odd enough. But it was something more. It was a revelation of a needed reform in penholders. We have used it for weeks, with a daily increasing conviction that the goosequill was an unfortunate model. The perfect penholder is three-sided.

THE MICROSCOPE AS A CRIMINAL DETECTIVE.

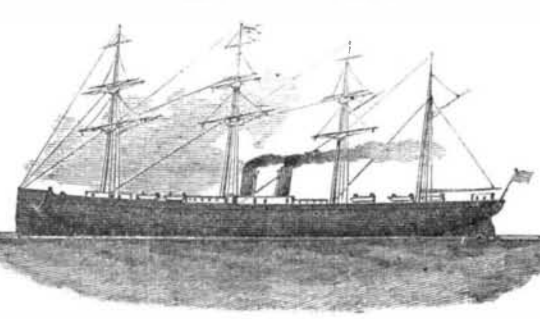
The annals of criminal jurisprudence furnish an abundance of cases in which the microscope, in the hands of an expert has been the means of eliciting missing links in the circumstantial evidence pointing to the guilt of the accused. Instances are cited where the instrument has shown hairs, clinging to the edge of an ax, to be those of a human being, in direct contradiction of the statement of the prisoner, ascribing them to some animal; and similar scrutiny of fresh blood upon clothing has proved the origin of the stain beyond a reasonable doubt.

When blood, however, has once become dry, several authorities assert that it is impossible to distinguish it from that of the ox, pig, sheep, horse, or goat. It is urged that the differences between the average sizes of their corpuscles are too irregular to measure accurately, and that a man's life should not be put in question on the uncertain calculation of a blood corpuscle's ratio of contraction in drying. In opposition to these views are some recent experiments, made by Dr. Joseph G. Richardson, of Philadelphia. This investigation disposes of the first objection above mentioned by pointing out that, while it may be valid as regards feebly magnified blood disks, it becomes void when these bodies are amplified 3,700 times. Regarding the second, he stamps it as incorrect, and cites a case in which seven human blood disks, whose mean diameter had been accurately determined at $\frac{1}{3236}$ of an inch, were subsequently computed to average $\frac{1}{3266}$, or only $\frac{1}{352292}$ of an inch less than their actual magnitude. Dr. Richardson also points out, with reference to the last objection, that, all the blood disks likely to be mistaken for those of man being normally smaller, instead of contracting they would have to expand to become conformed to those of human blood. This expansion does not occur, so that the only possible mistake in diagnosis would be to suppose that ox blood were present when man's blood had actually been shed; so that at the worst we might contribute to a criminal's escape, but never to the punishment of an innocent person.

In order to afford a positive demonstration of the facts, Dr. Richardson obtained, from each of two friends, three specimens of blood clots, from the veins of a man, an ox, and a sheep respectively, selected without his knowledge. By microscopical examination alone, he was able to determine, with perfect accuracy, the origin of each sample. The corpuscles of human blood averaged $\frac{1}{3430}$, with a maximum of $\frac{1}{3174}$ and a minimum of $\frac{1}{3636}$ of an inch; those of the ox blood gave a mean measurement of $\frac{1}{4662}$, with a maximum of $\frac{1}{4347}$ and a minimum of $\frac{1}{4674}$; while those of the sheep's blood afforded a mean of $\frac{1}{5952}$, with a maximum of $\frac{1}{5405}$ and a minimum of $\frac{1}{6461}$ of an inch.

From these and other experiments, Dr. Richardson concludes that, since the red blood globules of the pig, ox, red deer, cat, horse, sheep and goat "are all so much smaller than even the ordinary minimum size of the human red disk, as computed in my investigations, we are now able, by the aid of high powers of the microscope and under favorable circumstances, positively to distinguish stains produced by human blood from those caused by the blood of any one of the animals just enumerated; and this even after a lapse of five years (at least) from the date of their primary production."

THE ENGINEER'S TRIAL TRIP OF THE PACIFIC MAIL STEAMER CITY OF PEKING.



About fifteen hundred guests assembled, in response to invitations issued by the Pacific Mail Steamship Company, on July 22, to witness the trial of the company's new steamer City of Peking. This vessel is one of a pair, built by Messrs. John Roach & Son, in their yard at Chester, Pa., during the last year. The mate, City of Tokio, has been launched and is now receiving her machinery and equipment at the Morgan Iron Works, foot of East 9th street. New York city. These vessels were designed to meet the requirements of a law passed in 1872, granting the company a subsidy for carrying the United States mails between the United States and China, but stipulating that they should be carried in American built iron vessels of more than five thousand tuns burden. The following are the principal dimensions of the ship:

Length over all, 423 feet; length on water line, 407 feet; beam, 48 feet 9 inches; depth of hold, 38 feet 6 inches; tunnage (registered), 5,080 tuns; draft of water when loaded, forward 22 feet, aft 24 feet; displacement when loaded deep, 7,600 tuns; midship section, 930 square feet; total weight of iron used in construction of ship 2,400 tuns; thickness of iron in skin of ship, $\frac{11}{16}$ to 1 inch; tuns of space occupied by machinery, 1,120.

There are six watertight compartments. Three of the four masts are of iron, and the after or jigger mast is of wood. The total area of canvas that can be spread is 2400 yards.

5 in the one cylinder, and from 15 to 5 in the other, as is now the case.

The steam to work these engines is furnished by 10 cylindrical boilers, having each 3 internal cylindrical furnaces. The products of combustion return through tubes above the furnace, each furnace having its own nest of tubes, separated from the others by water legs. The steam passes through two superheaters on its way to the engine, where it is freed from the water held in mechanical suspension, and slightly superheated. The boilers are arranged in two sets, each set having its own superheater and smoke stack, coal bunker, feed pipes, and all fittings complete, as if placed in separate ships. The following are the principal dimensions of the boilers: Diameter, 13 feet; length, 10 feet 6 inches; diameter of furnaces, 3 feet 2 inches; length of grate bar, 5 feet 6 inches; diameter of tubes, 3 to $3\frac{1}{4}$ inches; length of tubes, 7 feet 6 inches; thickness of shell, $\frac{1}{1}\frac{3}{6}$ inch; thickness of furnace, $\frac{1}{2}$ inch; diameter of smoke stack, 8 feet 6 inches; hight of smoke stack, 70 feet; total grate surface, 520 square feet; total heating surface, 16,500 square feet; total superheating surface, 1,600 square feet.

It will be seen from the foregoing that, with the exceptions of the late Ville du Havre and the Great Eastern, the City of Peking is the largest trading ship yet built. The Great Eastern, on account of the tremendous space occupied by her machinery, did not prove a commercial success until she was employed in laying telegraph cables. The Ville du Havre was wrecked too early in her career as a screw vessel to determine her economy; but she was increased in size, after having been run a number of years, with the expectation of an improvement. The following comparison of the two ships shows that the City of Peking is not an experiment in marine engineering, as the managers of the French line gave their ship the same proportions after years of trial, although both vessels were being constructed independently at the same time

	City of Peking	Ville Du Havre
Length	423 feet	423 feet
Beam	48 feet 9 inches	49 feet
Tunnage	5,080 tuns	5,086 tuns
Draft	22 to 24 feet	22 to 24 feet
Diameter of screw	20 feet 3 inches	19 feet 6 inches
Pitch of screw (mean)	30 feet	29 feet 6 inches
Grate surface	520 square feet	532 square feet
Total length of ship occupied by machinery	92 feet	90 feet

The results of experiment may be more plainly seen by reasoning from the following facts: 1. The cost of a ship depends upon her tunnage or displacement. 2. The cost of fuel to propel her at a given speed is proportional to the square of the cube root of the displacement.

Take then the cases of two ships, to make a voyage of 5,000 miles at a speed of 15 knots per hour; and we have the following.

Tunnage	5080 tuns	2600 tuns
Displacement	7200 tuns	3600 tuns
Power required	5270 horse	3400 horse
Space occupied by machinery and coal	2130 tuns	1380 tuns
Available space for cargo and crew	2950 tuns	1220 tuns
Ratio of paying load	100	41
Ratio of cost to run	100	64
Ratio of first cost	100	52

Thus, it appears that, as the size of a ship increases, the economy increases, from the less cost of fuel to propel her in proportion to the paying load that she can carry, without considering the less proportionate cost of officers and crew for a larger ship. The size of ocean steamers has been continually increasing since their introduction, wherever they are able to run full and can be rapidly discharged and loaded. In addition to their economy, the large ships are much more comfortable for passengers on account of their less motion in rough weather.

The City of Peking will take the place, on the China and Japan route, of a vessel of 3,500 tuns burden. She is fitted for 150 cabin and 1,800 steerage passengers. The saloon and state room accommodations are as luxurious as in any ship entering the harbor of New York, while the comforts of the steerage are probably in excess, as will be appreciated by any one noticing the hight between decks, 8 feet, and the numerous air ports, whose hight above the water line at deep draft will allow of their being kept open in smooth weather. There is a Root's rotary exhauster, worked by a separate engine placed in the engine room, from which pipes are led into the most inaccessible portions of the hold and through the steerage, to withdraw the foul air and gas which would otherwise accumulate, its place being supplied by fresh air from the deck. The application of this exhauster is an experiment on merchant vessels, but it is believed that it will mitigate the poor ventilation incident to all ships, and the tendency of the inside of the skin of the ship to sweat, sometimes a serious objection to iron ships in warm climates.

The diagram shows the arrangement of the boilers and machinery in the City of Peking. The shaded portion shows the coal bunkers. There are eight doors to the coal bunkers for getting the coal into the fire room, four being forward and aft.

The starting engines and working handles are on the platform above the floor of the ship, allowing room for the oilers to walk beneath while watching the bearings, without interfering with the men working the engines, on the platform. The two independent centrifugal circulating pumps—one for each engine—are on the starboard side, on the floor of the ship. All other pumps, as also the donkey boilers, are on the deck, in order to be accessible if the lower hold of the ship be filled with water.

On the trial made on August 22, it was not attempted to run the engines at full speed, but only slowly, in order to wear the journals smooth, preliminary to the more extended trial which has since taken place, and to test the working of all parts of the machinery at sea. Such a trial was the more necessary, as the ship has, in addition to the propelling machinery, steam engines to move the rudder and to hoist the anchor. The ship left the North river, abreast of pier 42, at ten minutes past eleven, steamed around the lightship off Sandy Hook and returned, arriving abreast of the Battery at five minutes past four, having been under way five hours and fifty-four minutes. Only eight of the ten boilers were in use, and the pressure of steam carried was 50 lbs. The tide was running in during the whole trip, and there was a fresh east wind.

During the first part of the trip, the engines were run slowly, but were allowed to increase in speed; and during the last hour, they averaged the following:

Revolutions per minute, 46; horse power, 2,250; vacuum, 26 inches; temperature of feed water, 85°; temperature of discharge water, 87°; temperature of injection water, 70°: steam pressure 40 lbs.; speed, $12\frac{1}{4}$ knots; draft of water forward, 18 feet; draft of water aft, 19 feet.

The draft to the furnaces was very strong, and they will probably be able to burn 15 lbs. of coal per square foot. Therefore the following is an estimate of the probable performance of the ship at maximum power: Consumption of coal per hour $=520\times15=7,800$ lbs.; horse power $=\frac{7800}{2}=3900$; speed of ship $=\sqrt[3]{\frac{3900}{2250}}\times12\frac{1}{4}=14\frac{3}{4}$ knots. This speed can probably be maintained in smooth water without the assistance of the wind.

In a series of voyages, the winds blow as long in favor of as against any ship. When the wind is against her, she furls her sails; but when it is in her favor, she spreads them and takes all the advantage. Thus, on a long voyage or series of voyages, the wind helps more than it hinders. It appears from an average of a number of voyages that the wind increases the available power of a ship about one third, and therefore the available power of the City of Peking will be equivalent to 5,200 horse power, and the average speed, if worked at full power, at a draft of water of 18 feet 6 inches, will be: $\sqrt[3]{\frac{5200}{2250}}\times12\frac{1}{4}=15{\cdot}9$ knots. This speed would carry the vessel from San Francisco to China in 13 days on 85 tuns of coal per day. The amount of coal carried would have to be 1,500 tons, leaving 4,000 tuns of space for crew and paying load.

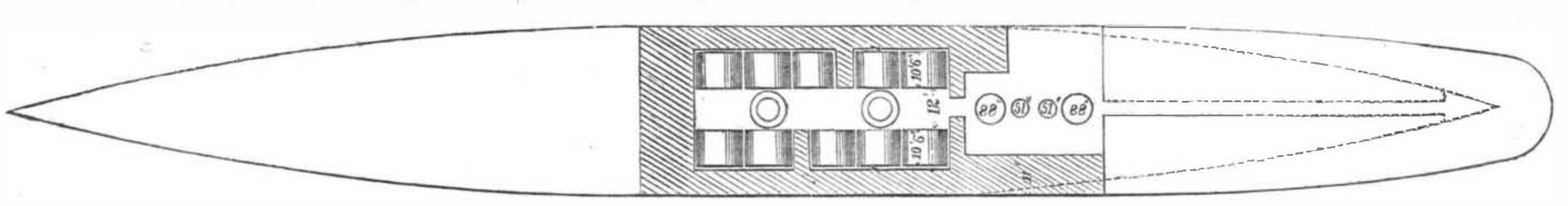


DIAGRAM SHOWING THE GENERAL ARRANGEMENT OF THE MACHINERY AND COAL BUNKERS OF THE CITY OF PEKING.

The ship is propelled by two pairs of compound engines, each pair having two cylinders: Diameter of high pressure cylinders, 51 inches; diameter of low pressure cylinders, 88 inches; stroke of pistons, 4 feet 6 inches. The object of using two pairs of engines is to guard against having the ship disabled if one engine should break down. As the ship has to make a trip of more than five thousand miles, through an ocean which is almost always in a perpetual calm, the breakage of one pair of engines might necessitate her to make her way, under sail alone, twenty-five hundred miles to the nearest port. But now, it any accident (with the single exception of breaking the crank shaft of the after engine or the line shaft or screw) happens, the remaining engine will suffice to bring the ship into port at a very slightly reduced speed. In order to avoid as far as possible the liability of breaking the crank shaft, it has been made in excess of strength, the diameter being 18 inches (in place of $17\frac{1}{2}$ inches as it would usually have been made), giving an excess of strength of 8 per cent over the usual practice.

The object in using a pair of cylinders in place of a single one was to divide the maximum strain upon the machinery into two portions, which are successively applied as each engine passes the center, thus allowing the machine to be built lighter, and still to retain the advantage of a high boiler pressure and great expansion, and to obtain as good or better economy than can be had in a single cylinder.

The general style of the engines is of the type developed by the late John Elder, of Glasgow, Scotland, having two cylinders connected to cranks at right angles, and an intermediate reservoir called a receiver. The steam enters the high pressure cylinders and follows the piston through about $\frac{1}{2}$ of the stroke, at a pressure of about 50 lbs., the difference between this and the boiler pressure of 60 lbs. having been lost in the friction of the steam pipe and the intricate passages in the valves. The steam is expanded in the high pressure down to 8 lbs. above the atmosphere, and is exhausted into the receiver at a pressure of 5 lbs. above the atmosphere. From the receiver it is admitted into the low pressure cylinder during nearly $\frac{1}{2}$ of the stroke, and is still further expanded to 7 lbs. below the atmosphere or an absolute pressure of nearly $7\frac{1}{2}$ lbs., where it is exhausted into the condenser, giving a total measure of expansion of nearly 9 times. In order to obtain this in a single cylinder, the steam would have to be cut off at less than $\frac{1}{18}$ of the stroke, and the variation of pressure would be from 68 lbs. to $6\frac{1}{2}$ lbs. per square inch, in place of from 50 to

The Royal Yacht.

The new royal yacht Osborne was launched in 1870, but, proving weak, has been strengthened, replanked, and finally finished. She recently made a trial trip of six hours, and attained a speed of 14·85 knots per hour. The following are some of her particulars: Extreme length, 278 feet; extreme breadth, 35 feet 1 inch; oscillating engines, cylinders, 6 feet $8\frac{1}{2}$ inches; feathering paddle wheels, floats 11 feet 6 inches; 2 funnels, twenty furnaces; mean steam pressure, 23·3 lbs.; mean revolutions, 24·98; mean speed, 14·85; mean indicated power, 3,374; mean consumption of coal, per indicated horse power per hour, 3·95 lbs.; capacity for fuel, two days' steaming.

The Liverpool Landing Stage.

This structure, probably the most magnificent floating platform in the world, was recently totally destroyed by fire. It consisted of a large number of pontoons, having iron frames and wooden fittings, which in all aggregated a length of 700 yards, and a width of 80 feet. The structure was used as a place of debarkation and embarkation for the many steamships in the harbor. The timbers were creosoted or tarred, and it is believed that the gas arising therefrom became ignited, communicating the flames to the newly caulked deck.

John E. Gavit.

We regret to learn of the death of Mr. John E. Gavit which took place on August 25, at Stockbridge, Mass. Mr. Gavit was President of the American Bank Note Company, Secretary of the American Institute, and an earnest student and promoter of microscopical science, in which branch of knowledge he was recognized as an authority. He was also identified with the art of steel engraving.

AMERICAN shad have been lately shipped in cans to Persia