contemplating the hauling of great ships over land from one sea to another.

A ship, they say, is a structure made to float in the water, buoyed up by a mobile substance, the nature of which not only prevents unequal strains upon the ship from her general weight, but also helps her to resist the internal or bursting strain of her own cargo. Out of her proper element, they argue, all these conditions are reversed. The uniform support of the water is replaced by detached supports, subjecting the vessel to unequal and unpremeditated strains which she cannot safely endure. Accordingly, even if it were feasible to build a carriage strong enough to sustain a ship's huge bulk, or a roadbed firm enough to bear the weight of both ship and carriage, the proposed system of Isthmus transit must be a failure through the lack of adaptability of ships for that sort of handling.

In answer to these apprehensions it is enough to say that they are founded in a view of the case which every ship builder knows to be altogether inconsistent with fact. A ship afloat is not uniformly buoyed up by the water. On the contrary, especially where there are waves of any magnitude, a ship's support is not only unequal, but incessantly variable as to position. This fact is so well recognized by shipbuilders that every sea-going vessel is so built as to be able to bear her entire weight when supported only at the ends, or to withstand the strain of being held up wholly at the middle, with both ends unsupported in the air. If a ship is unable to endure these severe tests she is unfit to battle with the waves. As for the bursting strain of a cargo, with or without a counter pressure of water outside, every ship at sea has to withstand it, more or less completely, with the passage of every large wave; while at the same time she is buffeted with heavy seas, which strike with blows like those of a battering ram. Indeed it would hardly be possible to devise an apparatus capable of subjecting a ship to so frequent and severe horizontal, lateral, and tortional strains as a ship endures in every gale. In comparison with them the strains that would be put upon a ship in transit over a properly constructed railway would be as nothing. On the railway carriage the ship would rest on an even keel, uniformly supported from stem to stern, and as secure from lateral and twisting strains as when cradled in a dry dock; while the forward motion of transit over easy grades would be less trying even than that which ships are constantly subjected to in well-known marine railways connected with ship-yards.

In fact the ship railway proposed by Mr. Eads consists of nothing more novel than two marine railways of superior construction joined by a few miles of many-railed roadbed of easy grades. Every element of the system, as well as the ability of ships to endure out-of-water handling safely, has been practically familiar to engineers for half a century. The grades of the proposed railway, it will be remembered, need nowhere be steep, and the change at the summit is made by a tipping table, which prevents any lengthwise strain upon the vessel. At no other point of the road can such a strain occur except by the yielding of the road bed; a contingency which practical engineering is easily able to avoid.

If further assurance of the ability of ships to safely endure out-of-water handling were required, it might readily be found in the every-day handling of loaded canal boats at portages. In staunchness a sea-going vessel compares with a canal boat about as a well-made beef barrel does with a cracker box; and the capacity of canal boats to endure railway carriage was amply demonstrated forty years ago on the Portage Railroad of the Allegheny Mountains. To connect the canal systems of Eastern and Western Pennsylvania, a system of gravity railways with ten inclined planes was constructed between Hollidaysburg and Johnstown, thirty miles or more apart "as a bird flies"; and up and down these steep inclines the large boats of the "Pioneer Packet Line" made regular trips until the Pennsylvania Railroad was built.

In length of route and severity of grades, the Isthmus routes certainly offer nothing worse than was overcome on that Portage road; and it is absurd to say that modern engineering cannot do for ships what was then done for canal boats. Besides we have the direct evidence of some of the most experienced ship builders—among them the Hon. E. J. Reed, formerly Chief Constructor of the British Navy—to the effect that the transport of ships by rail is not only feasible, but that the plan is highly economical in comparison with a ship canal.

The essential features of his projected railway for transporting ships across the Isthmus were described and discussed by Mr. Eads before the Canal Committee of the House of Representatives last March. So many of the illustrative plans and drawings used by Mr. Eads on that occasion as are necessary for a clear understanding of his plan are reproduced in the engravings herewith. The large illustration on our front page gives a general view of one of the shore ends of the proposed road, with a large man-of-war just entering upon the transisthmian journey.

Fig. 1, at the bottom of the front page, shows a section of the basin, which constitutes the real terminus of the railway. To avoid extending the track out into the harbor, this narrow basin, 3,000 feet long, is excavated inland at right angles to the shore line of the harbor. At the harbor end the basin is deep enough to place the railway thirty feet below the surface level of the water. From that point the track rises one foot in the hundred, so as to reach the surface level at the shore end of the basin. This basin, and the corresponding one at the other end of the railway, will be lined with substantial masonry. The outer end will be provided with a caisson gate, or lock gates, so that the basin can be pumped dry for repairing the track under water. At all other times the gates will be open.

Fig. 2 shows the basin railway with a ship on the cradle. In transferring a ship from the harbor to the upland track the cradle or ship-car will have to be backed down to the harbor end of the basin, under water, by means of a stationary engine. The ship will then be floated in from the harbor, so that her keel will rest over the cradle. Then the various supports on which the keel and bilges will rest will be moved into place.

Fig. 3 shows, in cross section, a ship resting on the cradle in deep water, and illustrates the manner of supporting her, substantially as is done in every dry-dock. Her weight rests mainly on the keel, a portion being sustained by the opposing bilge blocks, which also serve to keep her from toppling over. A similar cross section near the shore end of the basin is shown in Fig. 4. In the latter cut the vessel has been drawn nearly out of water. When entirely out the stationary engine will be detached and two powerful locomotives will be hitched on to haul the massive load to the opposite sea. It is expected that the transit will be made at the rate of ten or twelve miles an hour, and an additional hour will be consumed in placing the ship in cradle and in discharging her at the overland journey's end.

As will be seen in the engravings, the railway will be composed of twelve rails, spaced four or five feet apart. The locomotives will be five times as large and powerful as ordinary freight engines, and the whole twelve rails will be used by the two locomotives and their tenders. The ship cradles are intended to be of suitable lengths to receive all classes of vessels, and will have wheels about three feet apart on each rail, making a total for large steamers of from ten to twelve hundred wheels.

The maximum pressure allowed to a wheel capable of sustaining twenty tons will be five tons, or considerably less than the ordinary pressure upon the driving wheels of a large locomotive, which is usually six and a half tons. The weight of the largest merchant ships fully laden is about 6,000 tons. This weight distributed over 1,200 wheels—one hundred on each rail—will make the pressure on the rails and road-bed quite moderate: The proportion of the strength of one wheel to the strength of the whole number of wheels is so insignificant that the failure of any wheel could have no serious effect on the rest. Each wheel will be independent of the rest and readily removable. The possibility of derailment, as well as the pressure upon the tracks, is obviously diminished by the number of rails. Indeed, any six rails could carry the whole weight, so that any probable breakage or displacement of rails would not endanger the stability of the load upon the cradle.

As will be seen in the detail drawings, 5, 6, and 7, two strong steel springs surmount each wheel, so that the ship will in reality rest upon an elastic cushion, which still further lessens the liability to strain. Each spring is so fixed that it can be removed by unfastening two bolts, and the wheel under it can then be taken off with ease. Another advantage of the multiplicity of rails and wheels is the great reduction of the liability to jolting or oscillation. When a speed of twelve miles an hour is maintained on a railway so constructed the ship's motion would scarcely betray itself. To derail a car carrying a ship in this way would be an utter impossibility. To provide for the passage of ships going in opposite directions on the single line of track, there would have to be stationed at different points transfer or turn tables for moving cars sideways. By such means it is now common to shift trains of cars from one track to another.

The easiest grades for a ship railway across the Isthmus are found at Panama, Nicaragua, and Tehuantepec, and a mean grade, not exceeding thirty or forty feet to the mile, can probably be found at each place. The cheapest line could be built at Panama, where the distance as well as the grade is least. The harbor improvements there, however, would involve a great deal of cost. These would be less at Tehuantepec, and much less in the Chiriqui route, which presents steeper grades, but offers superb natural harbors. The maximum cost of a road at Panama, including harbors, is estimated by Capt. Eads at $50,000,000.

Touching the relative economy of a ship railway compared with a ship canal, Mr. Eads is confident :

"That upon any route where it is possible to build a canal, it is equally possible to build and equip a substantial and durable ship railway for one-half the cost of a canal, if it be built with locks; and for one-quarter of its cost, if it be at tide level.

"That such a ship railway can be built in one-third or in one-quarter of the time needed for the construction of the canal.

"That when built, ships of maximum tonnage can be moved with safety at four or five times greater speed on the railway than in the canal.

"That a greater number of vessels per day can be transported on the railway than would be possible through the canal.

"That the capacity of the ship railway can be easily increased to meet the demands of commerce, without interruption to its business, whether it be to meet an increase in the size of the ships or in the number of them.

"That the cost of maintenance of the roadway and rolling stock will be much less than that of the maintenance of the canal.

"That the cost of maintaining and operating the railway, taken together, will be less than that of operating and maintaining the canal.

"That the railway can be located and successfully operated at localities where it is not practicable to construct a canal.

"That it is possible to estimate, with great accuracy, the cost of a ship railway, and the time needed to build it, because the work would be almost wholly upon the surface of the ground, whereas the canal is strictly a hydraulic construction, involving control of water and the execution of works under water, or liable to be submerged or interrupted by water, thus rendering anything like an accurate estimate of the time and cost of its construction an impossibility. Hence capitalists cannot know, with certainty, the amount of money and time required, or what the canal will probably pay when finally finished."

These are bold and significant assertions truly; the nonprofessional reader may pronounce them startling and extravagant. Coming from a speculative adventurer they would be; but Mr. Eads is no adventurer. He is an engineer who has shown his practical skill as a builder of ships of heavy tonnage, railway bridges of the boldest construction, waterways of the most extensive scope, and in every great undertaking he has demonstrated a financial ability not less remarkable than his engineering capacity. Not a few of the ablest and most experienced engineers and shipbuilders of the world have pronounced this plan of a ship-railway entirely practicable, and far more economical than a canal for the same work. Indeed, the cost of one canal such as Mons. De Lesseps proposes at Panama, would build a ship railway at four or five places along the Isthmus equal in capacity to the canal and several times more speedy in its operation. Again, the interest on the excess of capital required for the construction of a ship-canal for a given traffic, over the cost of a ship-railway of equal capacity, would duplicate the road every ten years. With capital supplied as fast as needed, the railway could be put in operation without difficulty in four years from the time of beginning its construction. The working expenses of the road need not exceed 40 per cent. of its revenue, against 50 or 60 per cent. on ordinary railways.

This superior economy would be due to the fact that the work would be more compact; there would be but one roadway to keep up, everything would be built in the most substantial manner, and all the freight would be handled in mass by steam-power. The liability to accident to shipping in transit would be less than on a canal. With the estimated traffic of 5,000,000 tons a year, a charge of two dollars a ton would yield a revenue of $10,000,000. Allowing 50 per cent. for operating expenses, the net revenue would give 10 per cent. on the capital invested. A tariff of eight or ten dollars a ton would have to be charged to make a canal at water level pay as well, and such a tariff would be practically prohibitory.

MISCELLANEOUS INVENTIONS.

An improvement in the class of targets which are constructed of movable parts and connected in an electrical circuit with an instrument which is located at or near the place where the shots are fired, and is adapted to indicate the portions of the target struck by balls or bullets, has been patented by Mr. Morris Ullman, of Alexandria, Va.

A machine for bending shafts or thills for buggies and other vehicles, has been patented by Mr. John H. Smith, of Bluffton, Ind. The invention consists in a novel construction and arrangement of straps and formers, a screw, a cam lever, and a frame or table, whereby provision is made for simultaneously bending the heel and the point of both of the shafts of a pair.

An improved window and door screen has been patented by Mr. Albert F. Demorest, of Muscatine, Iowa. The object of this invention is to furnish window or door screens so constructed that they can be readily adjusted into and secured in place.

Mr. Henry Schlimme, of Wiconisco, Pa., has patented a simple and durable tuyere for blacksmith's forges and the like. It consists in a bored cylinder provided with water chambers, longitudinal blast opening, a blast pipe and sliding valve, and water feeding pipes.

An improvement in fences has been patented by Mr. Joel D. Olinger, of Water Valley, Miss. The object of this invention is to construct fences so that they can be readily moved from place to place, and to make them strong, durable and less expensive in construction than fences made in the ordinary manner.

An improved thill coupling has been patented by Mr. James S. Welch, of Dodge City, Kansas. In this invention the conical bolt which holds the thill iron is considerably longer than the width of the thill iron, and the latter is constantly pushed toward the larger end of the bolt by a U-shaped spring.

Mr. Isaiah A. Clippinger, of Plainfield, Ill., has patented an improved spring for bed bottoms, which will facilitate and cheapen their attachment to the supporting slats of the bed bottom and the attachment of the springs to each other, and effect continuity of the bearing surface.

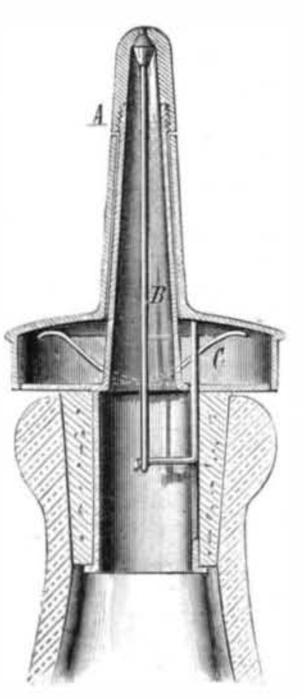
An improvement in dynamo-electric machines, which Mr. Charles J. Van Depoele, of Detroit, Mich., has patented, consists in the peculiar construction of the revolving armature, and in the arrangement of the same in the magnetic field and the bearings carried by projections from the sides of the case.

Serviette Magique.

In France, a species of cloth for polishing metal ware is manufactured under the name of serviette magique. It consists of small pieces of woolen cloth which are saturated with soap and tripoli and colored with fuchsine. It is manufactured by dissolving 60 grains of Marseilles soap in 300 grains of water and adding 30 grains of tripoli. The mixture is colored red by means of fuchsine, and the pieces of cloth are saturated in it and afterwards dried.

IMPROVED BOTTLE STOPPER.

The bottle stopper represented in the engraving consists of a flanged tube provided with a perforated screw cap, A, and a larger spring-actuated flanged tube set over the inner tube and connected with the rod, B, of the valve which closes the opening in the cap of the inner tube. It will be seen that whenever the flange, C, of the outer tube is pressed down the valve will be drawn from its seat, when the contents of the bottle may be discharged through the perforated cap.



HOUTS' BOTTLE STOPPER.

This novel bottle stopper was recently patented by Mr. John Q. Houts, of Sioux Falls, Dakota Territory.

Guatemala's Exhibition.

The largest and most enterprising of the Central American States, Guatemala, has entered the list of exhibitors, and announces the intention of holding an industrial exhibition in 1882. This is likely to furnish American manufacturers of articles suitable for the markets of that region a convenient opportunity for placing their products in a favorable way before the Guatemalan dealers and consumers.

IMPROVED BOLT FOR DOUBLE DOORS.

The engraving represents a novel bolt for double doors recently patented by Mr. William P. Brachmann, of 147 Walnut street, Philadelphia, Pa. This bolt is in the form of a right-angled lever pivoted at its angle, and provided with a spiral spring acting on its pivot, and having screws or spring pins for locking it in different positions. The bolts fit in appropriate sockets in the sill or jamb.

Fig. 1 shows the bolt applied to double doors with both doors fastened. Fig. 2 shows one door bolted and the other unfastened. Fig. 3 is an enlarged perspective view of the bolt, and Fig. 4 is a vertical section of the door and the bolts.

The bolt, A, is in the form of a right-angled lever, pivoted at its angle in a casing, B, attached to the door. Each arm of the bolt is provided with a recess for receiving the end of the spring pin, D, which serves to hold the bolt in either of its positions by engaging one or the other of the recesses. The pivot of the upper bolt is provided with a short arm to which is attached a chain for operating the bolt, and the pivot is provided with a spiral spring which tends to throw it into the position shown in Fig. 1, with one of its arms in the socket on the jamb and the other one in the socket on the other door. The chain is drawn down to throw the bolt into the position shown in Fig. 2, and to retain it in this position the ring at the end of the chain is placed on the pin projecting from the door.

BRACHMANN'S BOLT FOR DOUBLE DOORS.

The lower bolt, A', has no spring, and is kept in place by the spring pin, D'. One arm of the bolt enters the socket attached to the door, and the other enters a slotted socket in the door sill, as in Fig. 1, when both doors are bolted. When only one door is bolted, the lower bolt is in the position shown in Fig. 2.

This bolt fastens both doors with a single operation, and to securely bolt the top and bottom of both doors requires only two bolts instead of four as in the ordinary method, and the shrinking or swelling of the doors makes no difference in the operation of the bolt, as it engages a simple, open-hooked socket which admits of the lateral movement of the bolt without interfering with its working.

The bolt is made in very handsome shape, and is an ornament to the doors rather than otherwise.

The New Steamship City of Augusta.

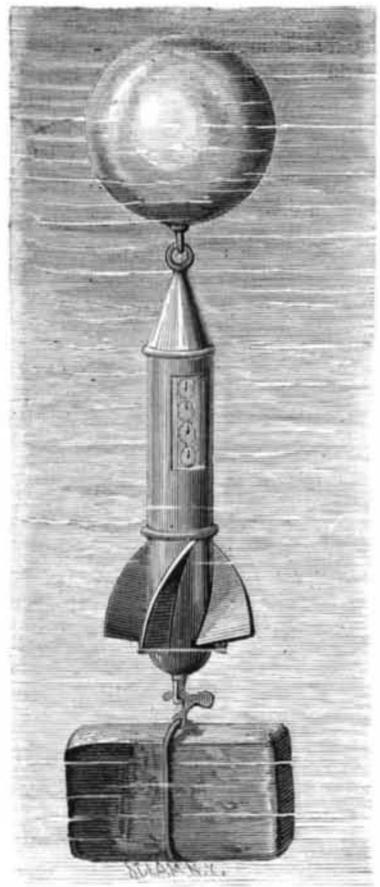
The new iron steamship City of Augusta, of the Ocean Steamship Company, is described as the largest ship engaged in the coast wise trade. Her capacity is 6,000 bales of cotton, or 3,000 tons. She is 310 feet long at the water line, 323 feet over all, and is of 40 feet beam. Her cabin accommodations are for 100 first class passengers. She is equipped with a compound engine, with two inverted cylinders, 42½ and 82 inches respectively in diameter, and each of them with 54 inches length of stroke. These engines are capable of a speed of sixty revolutions per minute. The screw is 16 feet in diameter, with 26 feet pitch. The working pressure is 100 pounds of steam. In addition to this there is an auxiliary or independent engine, with force pumps attached and an air circulating pump. Steam is furnished by six tubular steel boilers, 12½ feet in diameter and 11 feet 5 inches long, with one superheater 12½ feet in diameter and 13 feet high. These boilers are ample to furnish all the steam required for a speed of sixteen knots. There are steam steering gear, steam capstans and windlass forward and steam capstan aft, with donkey engines for freight hoists at all the holds.

The City of Augusta was built by John Roach, of Chester, under the supervision of Captain Lefevre, marine superintendent of the Ocean Steamship Company.

THE new dump car of the New England Car Company, which was illustrated in the SCIENTIFIC AMERICAN some time since, was recently tried at Brookline, Mass. The stockholders of the company and several railway men were present. The car, which was built by the Watson Manufacturing Company, is probably the longest and largest dump car in practical use in the country, and its size made the test of its workings all the stronger. It is thirty-two feet long, weighs 19,860 pounds, and contained 36,590 pounds, or over eighteen tons, of coal. All things being in readiness, a medium-sized man turned the crank, the machinery responded, the car tipped, the coal was emptied out where desired, and the car body went back into place, the whole time consumed from "the start to the finish," as one might say, being less than two minutes. The car has been tested, with like results, with loads of gravel, both damp and dry. The gentlemen present at the trial expressed themselves well pleased with the workings of the car, as well as its simplicity, strength, and durability.

DEEP SEA-SOUNDING APPARATUS.

The engraving shows an improved sounding apparatus recently patented by Paul C. Rousset, of St. Petersburg, Russia. The invention consists of a novel device for connecting the sinker with an ordinary registering log, and in the arrangement of a buoy of sufficient capacity to raise the log to the surface after the sinker has been detached.


ROUSSET'S DEEP SEA-SOUNDING APPARATUS.

The registering mechanism of the log is provided with a ratchet and pawl that prevents it from operating as the log descends, but allows the register to operate when the log ascends. A sinker is suspended from an eye on the lower end of the log by means of a hook which is weighted so that as soon as the sinker touches bottom the hook drops out of the eye, and the log being released is carried to the surface by the buoy, the screw meanwhile actuating the mechanism of the log, which records the distance through which the log passes.

This device renders a sounding wire or line unnecessary, and insures more accurate soundings than can be obtained in the ordinary way.

RECENT INVENTIONS.

A ball and instep stretcher for boots and shoes, so constructed that it can be readily inserted into and removed from the boots and shoes, has been patented by Mr. Francis A. Fay, of Brooklyn, E. D., N. Y.

An improved milliner's steamer and presser has been patented by Mr. Thomas Hicks, Jr., of Gravesend, N. Y. This invention relates to that class of devices designed for milliners' use for the purpose of raising the pile on velvets, etc.

An improved mechanism for changing and adjusting the height of revolving seats of stools and chairs has been patented by Mr. John M. J. Wernert, of Paw Paw, Mich. The invention consists of a spring-actuated rod inclosed in a slotted cylinder that projects downward from the under side of a chair or stool seat into a grooved socket which is fixed vertically in the central standard of the stool or chair, said rod being provided on its lower end with a laterally projecting lug, which is made to engage in the grooves of the socket and thereby hold the stool or chair seat at any desired elevation.

Mr. John R. Hastings, of Lampasas, Texas, has patented a military saddle so constructed that the valises and other equipments may be connected with the saddle in such a way as to distribute and balance their weight, and at the same time make the saddle comfortable for the rider.

Mr. John S. Worth, of Coatesville, Pa., has patented an improvement in gearing for rolling mill rolls and other machinery. The invention consists in gear wheels, each of which is provided with several longitudinal rows of epicycloidal