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NEW YORK, SATURDAY, AUGUST 22, 1891.

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(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 816.

For the Week Ending August 22, 1891.

Price 10 cents. For sale by all newsdealers.

STRAINS ON RAILROAD BRIDGES.

The Board of Railroad Commissioners of the State of New York was established in February, 1883, and within a year from that date a thorough investigation was commenced, for the purpose of obtaining exact knowledge of the strains brought to bear upon the members of all the railroad bridges and trusses in the State. The report of this investigation has just been published and makes a volume of nearly two thousand pages.

The commissioners were moved to take this action by the occurrence of several accidents from defective bridges. On February 17, 1883, a temporary bridge or trestle over Allen's Creek, on the Genesee Valley Railroad, between Rochester and Hinsdale, gave way while a freight train was crossing which resulted in the death of the fireman and the severe bruising of the engineer. The master carpenter of the road admitted that he had recently made repairs to the bridge, but that he did not understand calculating the resistance of beams or trusses to strains. On October 22, 1883, an accident occurred on the Glens Falls branch of the Rensselaer and Saratoga Railroad, when three persons were killed and twenty-two wounded. The person in charge of the division of this road upon which the accident occurred declared that he was unable to calculate bridge strains, being merely a bridge carpenter by trade. He judged by experience as to what the different members ought to be, and the strains on the bridge had never been calculated by anybody.

At Weedsport, on the Southern Central Railroad, February 14, 1884, a train had reached the bridge over the Seneca River, when the north span gave way, and the engine, tender, and two box cars were precipitated into the river where the water was twenty-two feet deep. The engineer, fireman, and a brakeman were drowned, and the cause of the disaster was a defective truss.

An analysis of the strains upon the members of the bridges where the accidents above cited occurred disclosed the fact that in one case more than the breaking load was brought upon beams, and that in other cases strains were habitually brought upon web members, which made it a matter of astonishment that the bridges did not give way sooner than they did.

The railroad commissioners found at the very inception of their investigation that on many of the railroads of the State of New York there had been no competent calculation of the strains on the bridges for many years, if at all, the work requiring technical education, familiarity with the theory of mechanics, and a considerable knowledge of mathematics.

The commissioners, therefore, requested drawings or tracings of all the truss bridges, on all the lines, stating the location of each, and the time when built, and full descriptions. Some companies objected to this at first, but all finally complied, and the result has been that railroad managers found defects in many of their bridges of which they had no previous knowledge, and which might never have become known until revealed by some terrible accident. In a number of cases bridges were strengthened before the strain sheets were forwarded to the commissioners. After the sheets were received, they were carefully gone over and recalculated.

The number of railroad truss bridges in the State is about two thousand five hundred, not including the New York elevated roads, the strains upon which have also been calculated. Six hundred and sixty-nine truss bridges have been criticised by the board, of which five hundred and thirty-five have been repaired by the various companies, and one hundred and thirty-four entirely rebuilt. Cases have occurred, particularly in old bridges, where the iron in the suspension rods was strained at twenty thousand pounds to the square inch and more, and where three or more rods constituted the member, there being no certainty that the adjustment was such that each rod was doing its share of the work.

The commissioners accept the weight of the maximum rolling load, as furnished by each company, unless it is obvious that it is too light, in which case they assume a weight of locomotive, tender and train load likely to arise from the traffic of the road. The rules adopted by the commissioners require that iron should not be strained per square inch to a greater extent than ten thousand pounds, and wood than eight hundred pounds, in tension; nor more than ten thousand pounds or eight hundred pounds in compression, diminishing, however, as the length of the member increases in proportion to its diameter, in accordance with well regulated formulas.

There has been of late years a great increase in the weight of rolling stock. There were many bridges still standing which were built when the maximum weight of locomotives and tenders was fifty-five tons, and the maximum weight of a freight car and its load was nineteen tons. Now locomotive and tender weigh one hundred tons, and freight cars with their loads forty tons.

In regard to improvements in modern engineering, the commissioners say that in the early days of bridge building, particularly of iron bridges, it was the custom to construct trusses of complicated forms, the accurate calculation of the strains on which it is very difficult, in some cases impossible, to compute. An approximation close enough for practical purposes is always reached, however, but a better practice now prevails, and trusses of simple form, admitting of no ambiguity, are alone accepted by the best engineers. In exceptional cases complex trusses have to be resorted to, but they are avoided as much as possible.

The report gives an accurate record of the dimensions of every member of every truss railroad bridge in New York State, and of the strains thereon, as shown by the plans and strain sheets filed in the office of the commissioners.

If the same carefulinvestigation and correction could be made of the bridges of all railroads in the country, the dangers from accidents would be very much reduced.

GEORGE JONES OF THE NEW YORK "TIMES."

We record with much regret the decease of Mr. George Jones, of the New York *Times* newspaper, which took place at Poland Springs, Me., on the 12th inst. Mr. Jones, although for many years an invalid, reached the good old age of 80, his mind and faculties clear and active to the very last. He was in all respects an admirable man. His aspirations were plain, simple, and practical. As a manager he was unequaled. He aimed to produce a substantial, reliable newspaper. From this objective nothing diverted his attention, and a splendid success crowned his efforts. Under his direction the New York *Times* reached and maintained the highest position in the esteem and confidence of the public. No paper enjoys a better reputation for excellence in all its departments; while from a pecuniary point of view it is one of the most valuable newspaper properties in the world. George Jones was born in 1811, at Poultney, Vt. His father was a Welshman and worked at slate mining in Poultney. The father and mother both died when George was 13 years old, and from that time on he had to shift for himself. He and Horace Greeley were boys together, and great cronies. Greeley came to New York in 1831 as a printer, and Jones followed him soon after, and became a dry goods clerk. In 1841, when the New York *Tribune* was started by Greeley, young Jones joined him as manager of the publishing department; but Greeley was too wild in his business notions to suit the staid and steady mind of Mr. Jones, who soon left Greeley and set up a newspaper stand at Albany, N. Y. The new business from a very humble beginning soon increased, and in a few years, by dint of hard work and perseverance, Mr. Jones was the possessor of a few thousand dollars in ready money. In 1851, in conjunction with the late Henry J. Raymond, he began the publication of the New York *Times*, Mr. Raymond as editor, Mr. Jones publisher and business manager. The enterprise proved successful. In 1869 Mr. Raymond died, and the entire responsibility of the establishment from that time onward fell upon Mr. Jones.

His successor in the direction of the paper is his son Mr. Gilbert E. Jones, a young man of high character and superior abilities. Added to great wealth he inherits from his distinguished father many sterling qualities of mind, such as strong common sense, steadiness of purpose, habits of industry, and the desire to do in the best manner whatever he undertakes. Under his guidance the New York *Times* will lose none of its brilliant prestige.

DR. C. V. RILEY.

Dr. C. V. Riley, entomologist of the Department of Agriculture, was lately made the subject of a most unjust personal attack by the New York *Sun*, on the alleged ground that the doctor was engaged in using the publications of the department as vehicles for advertising and selling his patented devices for destroying insects; the implication being that the doctor had a pecuniary interest in the devices from which he derived profit, while at the same time he was receiving a regular salary from the government as entomologist.

The facts are that Dr. Riley, in the course of his many efforts to save the country from the immense losses annually occasioned by destructive insects, designed a peculiar form of nozzle by which the poisonous liquids used are sprayed to the best advantage upon trees and plants. This device is now everywhere known as the Riley nozzle; and when directions are given as to the best means of applying the protecting solutions to plants, it is common and natural for the most intelligent writers, Dr. Riley among them, to name the Riley nozzle as the distinctive thing that will give the best results. Now, there is no patent upon the device, it was given to the public freely by its author long ago, he derives not one penny of profit from it, and there was no occasion for the *Sun's* personal assault. This the *Sun* tacitly admitted in a subsequent number, in connection with a protesting letter from Dr. Riley, in which he explains his position as follows:

"I have been officially engaged for over twenty-three years, whether as a State or government officer, in original work having for its main object the control of

the numberless insects which injuriously affect our agriculture. During that period I have, either personally or with the assistance of others, made many discoveries of value, some of them of world-wide application and importance, and, from a business standpoint, of great money value.

"With pride, but without vanity, let me add that during all this time, where many have benefited largely, and some have made fortunes out of these discoveries, I have not received one cent therefrom beyond my legitimate salary. I have never taken a fee for information given (though often pressed to do so by honest and grateful beneficiaries, who saw nothing wrong in the proffer); have never attempted to control any of these discoveries for my own benefit; have never applied for a patent on any of them; and have strenuously opposed all attempts to do so that have come to my knowledge, whether by those employed under me, or by those not so employed. A few examples will, perhaps, give force to these statements:

"In 1868, for the Colorado potato beetle, and again, in 1873, for the cotton worm, the value of the arsenites was made known chiefly by my labors. Vast sums were made in the sale of various preparations of these insecticides for those purposes, and I was vainly urged to lend my influence and join in the resulting business.

"In 1871 my discoveries in connection with the grape phylloxera were the basis of a vast industry which has not yet ceased, and which has greatly enriched some of our vineyardists. The first applications from France for cuttings of such resistant stocks came to me, and a prominent Missouri grape grower vainly urged me to join him in a business capacity in connection therewith.

"So with the cyclone nozzle and the kerosene emulsion (one of the most effective and universally used insecticides). In each case large profits have been and are being made by those who offer them in various modifications, and under various names, and in each case I have been urged in vain to lend my name to share the proceeds of some business enterprise in connection with them.

"My work as a public officer has been for the public good. The inducement to it has been neither the pitiful salary of United States Entomologist, nor any other mercenary end. It has been rather the love of investigation and the consciousness of doing good."

International Congress of Electricians in Frankfort on the Main, Germany.

In connection with the electrical exhibition now open in Frankfort on the Main, an international congress of electricians will be held on the exhibition grounds from September 7 to September 12, 1891.

The call for the congress is signed by the most prominent electricians throughout the world, notable among them being the Americans, Profs. Dolbear and Carhart and Messrs. Edison and Brush.

A large number of papers will be read on various subjects relating to electricity. Discussions of proposed questions will also be had.

Of the American electricians, Prof. Dolbear, of College Hill, Mass., will speak on Electrical Terminology, and Prof. Carhart, of Ann Arbor, Mich., on (1) Substitution of Dynamos for Galvanic Batteries in telegraphy and (2) Regulators for Dynamo Machines. Papers will also be read by the following gentlemen:

Baumgardt, Dresden—Relations between Compressed Air and Electricity.

Von Dolivo-Dobrowolsky, Berlin—Electrical Transmission by Alternating Current.

Epstein, Frankfort on the Main—Use of Electromagnetic Measuring Instruments for Alternating Current.

Feussner, Charlottenburg—Material for and Construction of Measuring Instruments.

Frolich, Berlin—1. Projection of Vibrating Curves and Electric Acoustic Experiments. 2. Production and Use of Ozone.

Heim, Hanover—Accumulators.

Hoeffner, Giessen — Electro-chemistry and Metallurgy.

Holborn, Charlottenburg—Magnetic Conditions of Several Iron Alloys.

Hummel, Nuremberg—Magnetic Work and Currents.

Kahle, Charlottenburg—Accuracy of Measuring Instruments under Varying Conditions.

Kohlrausch, Hanover—The Best Method of Teaching for Electricians.

Lahmeyer, Frankfort on the Main—Improvements Relative to Currents.

Lindeck, Charlottenburg—Normal Elements.

Lowenherz, Charlottenburg—Normal Screw Threads.

May, Frankfort on the Main—Rules for Electric Transmissions according to Insurance Companies.

Meissner, Gottingen—Use of Lippman's Capillar Electrometer for Cable Telegraphy.

Muller, Hagen—Accumulator Switches.

Weber, Zurich—Theory of Incandescent Lighting.

Among the subjects proposed for discussion are:

Kareis, Vienna—1. To Prevent Others from Listening on the same Telephone Wire. 2. To Prevent Disturbances in Telephone Lines through Strong Currents. 3. To Improve Electrical Transmission in Telegraphy.

Penkert, Brunswick—About Electric Counters.

Rothen, Bern—Should a City System be Single or Double?

New Trials of the Sims-Edison Torpedo.

An interesting trial of this torpedo, in which some improvements have been effected, was made at Willets Point, near New York City, on August 12, in the presence of many engineers and officers of the navy. The construction of the torpedo is substantially the same as the one tried last year, which was illustrated and described in the SCIENTIFIC AMERICAN of July 26, 1890; but on the present occasion a longer cable was used, so that the torpedo was adapted to a range of over two miles. It will be remembered that the torpedo is a cigar-shaped copper cylinder about thirty feet long, adapted to carry four or five hundred pounds of a high explosive in its forward end, while about amidships it contains an electric motor and steering device, with a coil of cable to be paid out as the torpedo moves, and keeping it in constant connection with the shore. The torpedo is propelled by a thirty inch two-bladed propeller, and is suspended about six feet below a yawl-like float, the deck of the latter being only about six inches out of water.

In the recent trial the compartment for the explosive was filled with gravel, and the whole outfit weighed about three thousand pounds. The machine was lowered into the water and towed to the end of a pier, when it was started toward a yawl a mile off, by the turn of a crank on a switchboard, Mr. W. Scott Sims directing its course, and making it turn to either side at will. The torpedo was sent around the yawl, and close to poles set up near it, being evidently under perfect control, and came back at high speed to the starting point, the cable being laid in a loop on the bottom. Mr. Sims stated that she had developed 32 horse power, instead of 52, for which she was designed, and that her propeller had made 700 revolutions per minute instead of 850. Her speed was given as at the rate of twenty miles per hour, though it is thought she can readily run at a twenty-two mile rate, this being only the second trial of this boat. The amount of wire cable carried by this torpedo was 13,000 feet, the cable carrying two insulated conductors, one affording the power and the other connected with the tiller by which the device is steered.

When the torpedo was started by the turning on of the current, there was at first a slight strain on the cable and her nose plunged under the water several inches, while the froth came tumbling over the stern in a torrent. Then the slack ran out more easily, the bow came up and the stern dropped as does the stern of such a fast boat as the Cushing, while the water was thrown up in shining sheets more than two feet on each side of the knife-edged bow. On her return, after rounding the boat a mile off, full power was turned on, and the sight of the shining sheet of water and spray as she came driving in was thrilling. Arrived near the wharf, the bow was seen to be about a foot out of water, while about three-fourths of the hull was submerged in the foam of the wake.

It is evident from trials like this that the Sims-Edison torpedo is a highly valuable adjunct for harbor defense and also for naval operations in general.

A Home Contract for Big Guns.

Gen. Grant, Acting Secretary of War, in behalf of the government, entered into a contract on August 9 with the Bethlehem Iron Company, of Pennsylvania, for one hundred new high-power guns, in accordance with a recommendation made some time since by the Board of Ordnance and Fortification. Of these twenty-five will be 8-inch breech-loading, single charge, built-up, forged steel rifle guns, $17,246.55 each; fifty 10-inch guns, same pattern, $35.747.58 each; twenty-five 12-inch guns, same pattern, $54,473.22 each.

Under the contract the first of the 8-inch guns is to be delivered in 730 days, and the remaining twenty-four at such regular intervals that the last one will be delivered in 2,433 days "after notification of the acceptance of the type gun." This means nine years for the delivery of the twenty-five guns. The first, or type gun, of the 10-inch class is to be delivered in 822 days, or in two years and three months. Within 8,407 days after acceptance of the type gun the remaining forty-nine are to be delivered at regular intervals. This means nearly twelve years for delivery of the 10-inch guns. The first of the 12 inch guns is to be delivered in 1,095 days, and the remaining twenty-four at such regular periods that the last one shall be delivered in 3,194 days after the acceptance of the type gun. This means twelve years, or a little more, for delivery of these guns. It does not follow, however, but that the guns may be completed in far less time than the contract provides, and this is the more probable as the next Congress is likely to be called on to make further appropriations for large guns, the one hundred now contracted for being but a small proportion of the number actually needed.

The fact that this contract was made with an American firm, and that there were three American manufacturers ready to undertake the work, cannot fail to give general satisfaction. Four or five years ago it would not have been possible to place such a contract in this country, and efforts to secure favorable bids for these guns failed last year because the appropriation therefor was not large enough. At the last session of Congress, however, it was increased to $4,225,000, with the special provision that the prices paid should be such as would be "deemed fair to the manufacturer." The total of the bid of the Bethlehem Company for the one hundred guns was $3,785,850; that of the two other competitors for the work was, the Midvale Steel Company, $5,359,500, and the South Boston Iron Works (now established in Kentucky), $5,174,312. Should the next Congress call for more big guns, these firms, perhaps re-enforced by the firm of Carnegie, Phipps & Co., of Pittsburg, and may be others, might be counted upon as among the possible bidders, thus demonstrating that in this specialty our manufacturers are enlarging their facilities to the standard of the foremost establishments of England, Germany, and France.

Some comment has been made upon the high cost of these guns, coupled with the statement that they could be built for much less money and in half the time at the government arsenal at West Troy. It seems to be generally conceded that the government could do the work cheaper and quicker than called for by the contract, but it was manifestly the plain intention of Congress, and in accordance with a strong public sentiment, that private enterprise should be encouraged in the establishment of gun plants, in order that the available facilities of the country in time of need should not be limited to one or two government gun-making shops. It will do no harm, however, if the attention of Congress is now so directly turned to the subject that the Watervliet arsenal will receive an adequate appropriation for the much needed enlargement of its plant. It will be some years before our sea coast defenses and our new ships can be fully supplied with the heavy guns needed for their proper equipment by the combined work of a first-class government gun factory and a very liberal number of contracts with private gunmakers besides.

James Russell Lowell.

At his Elmwood home, Cambridge, Mass., on August 12, died James Russell Lowell, in the 73d year of his age, his birthday having been February 22, 1819. He was of a family which has made a name in Massachusetts history and in connection with Harvard College, the Lowell Institute, of Boston, having been founded and endowed with $250,000 by one member, and a leading city in the State perpetuating in its name the memory of another member. Mr. Lowell was graduated from Harvard College in 1838, when he studied law two years, and was admitted to the bar, but did not practice. Inheriting a competence, he was at liberty to follow the literary pursuits for which he was inclined, and in 1841 published his first volume of poems. He thereafter became a regular contributor to several periodicals, and frequently published poems whose wit and pathos, united with a singularly engaging style, attracted a constantly widening circle of readers, but it was not until 1846–48 that he began to attain a national reputation.

During these years was published the first series of the "Biglow Papers," a collection of political satires in Yankee dialect, directed mainly against slavery and the Mexican war. A second series appeared at the time of our civil war, and their effect in arousing and sustaining public sentiment in opposition to the cause of the South was very great. Although put in homely phrase, and giving expression in rugged earnestness to emotions and experiences ostensibly of the most simple-minded of people, it was at once felt that they were the work of a scholar and poet of a high order, and the "Biglow Papers" immediately attained a reputation in England almost as great as they achieved here. Of the other literary work of Mr. Lowell, dear as many of his poems are to scores of thousands wherever the English language is spoken, these columns are hardly the place for even a brief mention, although the sweetness and beauty of his verse, with the lofty ideals of pure character and high endeavor, and the hatred of selfishness and all forms of deceit, by which it is preeminently distinguished, have earned for his productions a high place in the classics of the language.

Of his diplomatic career of three years as minister to Spain and eight years as minister to England, it is only necessary to add that he filled both offices with entire credit to the country, and greatly advanced the reputation of America and American scholarship among foreign people.

THREE and two-tenths grains make one carat; 150 carats in one ounce of Troy weight; 1,800 carats in one Troy pound of 5,760 grains.

How to Pack Drugs and Chemicals for Export.

The following suggestions will be found of practical value:

1. Salts should be put in stoppered glass bottles or packed in casks, if sent in large quantities. Casks used for hygroscopic salts should be lined with oil cloth or parchment paper. Salts should never be packed in tin boxes or in paper only.

2. The glass stoppers of all bottles containing either liquids or dry substances should be greased with a little vaseline in order to avoid any difficulty in removing them.

3. Parts of plants, such as leaves, roots, etc., should be packed in sacks, and these again in cases; very delicate drugs in tin boxes. Vegetable powders should be packed in hermetically closed glass bottles or tin boxes. Drugs which occupy much space should be pressed as much as possible before being packed, especially if the shipping freight is calculated according to the bulk of the goods.

4. Boxes and cases should be lined with zinc, or where this is too expensive a strong and good oil cloth will usually be sufficient.

5. Although the utmost care is necessary in packing, yet packing materials such as hay, straw, etc., should be used as sparingly as possible, as duty has usually to be paid for the weight of these as well as for the goods themselves.

6. Cases should be secured by iron bands, and it is always desirable that the weight and volume of cases should be as small as possible.

7. Acids, caustic or inflammable substances must be packed according to the regulations of the different railways by which they are transmitted prior to shipment. As a rule stone bottles are best for acids and ammonia, and glass or tin vessels for volatile substances. All these should be closed by corks saturated with paraffine, and then wrapped in sail cloth, which, with the string securing it, should also be soaked in paraffine.

8. Acetic acid may be safely conveyed from place to place in carboys of 5 to 10 gallons capacity.

9. Liquor ammonia should never be put into iron vessels.

10. Vessels containing volatile substances should never be quite filled.

11. As acids and caustic and inflammable substances are conveyed on the decks of sailing vessels only, the cases containing them should be well closed, and the address, mark, number, etc., be such as will resist sea water.

12. Liquids should not be packed in the same case with dry substances.

13. Valuable or expensive chemicals, such as ethereal oils and essences, should be packed in strong tin vessels and closed with corks saturated with paraffine as before described.

14. The weights and measures of the country to which the goods are sent should always be used, to avoid loss and inconvenience.

15. Besides observing these rules for packing, consigners of goods should be thoroughly acquainted with the customs tariffs and regulations of the countries to which they are sending, as pecuniary loss and inconvenience may occur from ignorance of them. For instance, if a case contains various substances, the duties on which are different, it is usual in some tariffs to calculate the duty of the whole of the contents of the case or at least of the packing materials at the highest rate. The importance of packing together goods upon which the customs tariffs are similar is self-evident from this.

16. In cases of urgency small quantities of any substance suitable for such transmission, *e. g.*, quinine, antipyrine, salicylic acid, etc., may be sent as patterns without value, and thus avoid the delay caused by the customs office.—*C. Monheim, Chem. Zeit.*

Redevelopment of Thin Negatives.

Mr. C. F. Cooke, of Wilkesbarre, Pa., in an article received too late for insertion in the "International Annual," gives a formula for redevelopment of thin negatives, which he has used with great success, as follows:

STOCK SOLUTION NO. 1.

Mercury bichloride	80 grains.
Water	10 ounces.

NO. 2.

Iodide potass	50 grains.
Water	6 ounces.

NO. 3.

Bromide ammonium	50 grains.
Water	6 ounces.

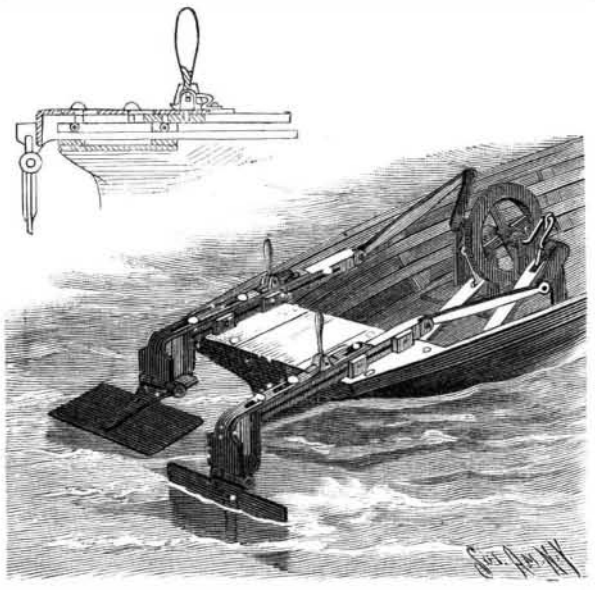
NO. 4.

Hyposulphite of soda, saturated solution, a few drops at a time, till red precipitate is just redissolved.

First dissolve the mercury, and then add Nos. 2, 3 and 4 in order. For redevelopment take of stock solution one ounce, and of water one ounce, and after thorough washing, proceed as in ordinary developing.—*Bulletin.*

A BOAT PROPELLING AND STEERING DEVICE.

By means of the attachments shown in the illustration a boat may be driven forward or backward, and readily steered, by foot power, or by the operating of a crank by hand. Affixed to each side of the stern, near the rear seat, is a keeper plate in which slides a longitudinally and horizontally slotted bar, extending out beyond the stern, each slide bar having a depending end, in which is pivoted a paddle. The paddles are secured to the slide bars by straps, which project above the pivotal point, and are adapted, as shown in the small sectional view, to engage the depending end



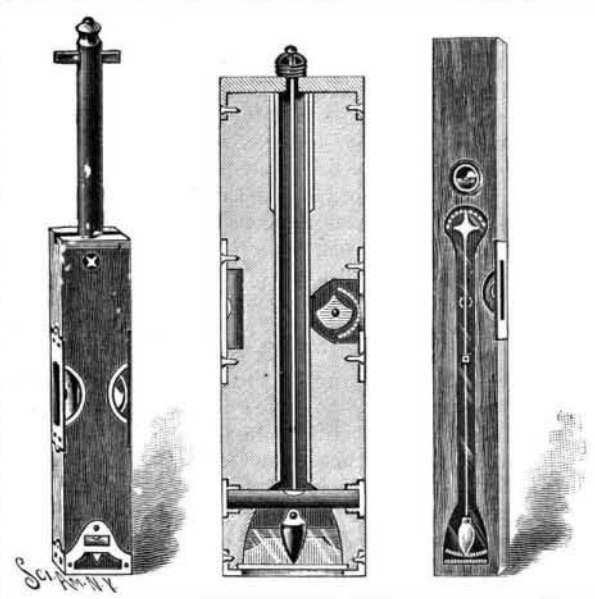
REHM & MARX'S PADDLE DEVICE FOR BOATS.

of a plate held to slide on the slide bar, by which the paddles are adjusted to move the boat forward or backward. When the plates are adjusted as shown in the large view, their depending ends are in the rear of the stops of the paddles, which will thus be held in a vertical position to push the boat ahead as they are moved backward, the paddles turning up edgewise as they are drawn forward, but when the depending ends of the plates are in front of the paddle stops, as shown in the sectional view, the paddle will operate to force the boat backward. Each adjusting plate has, near its forward end, lugs, in which a lever is pivoted within convenient reach, and by means of which the plate may be readily moved forward or backward upon the slide bar, and secured in place to hold the paddles in proper position for the forward or backward movement of the boat, or to prevent one of them from being operated at all, the latter feature affording great facility in steering the boat. The front ends of the slide bars are pivotally connected by pitmen with the cranks of shafts on opposite sides of the boat, the shafts being turned by pedals, which also turn a central shaft carrying a balance wheel, or the cranks may be arranged for operation by hand. To insure the easy working of the slide bars, rollers are arranged in the slots of the bars, by which the friction is reduced to a minimum.

Further information relative to this invention may be obtained of the patentees, Messrs. John Rehm and Ferdinand A. C. Marx, Westchester Avenue and Bronx River, New York City.

A COMBINED PLUMB AND LEVEL.

In this improved device, as shown in the illustration, the left hand figure represents a face view, with a



GARNER & CONNAUGHTON'S PLUMB AND LEVEL.

raised extension, the middle figure being a central sectional view, while at the right is shown a modified construction. The sides of the stock form straight edges, and at its lower end is a mortise in which plays an inclosed plumb bob over a glass plate provided with graduations, visible through an opening. The bob is also visible through side glasses, through which likewise may be seen a removably secured spirit level set transversely in the stock, the cord by which the bob is suspended being seen across the level. A short steadying rod projects into an opening in the upper part of the bob, to prevent its rotation and permit a limited swinging motion, and the bob cord extends up through a central recess or channel in the stock, a tubular extension being also supported to slide in the stock, through which the cord may be passed, to be secured to its cap, around which the cord may be wound when the tube is lowered into the stock. There are guide lines on the stock and on the extension, whereby the latter may be set accurately, and the extension has an arm or cross bar whose ends are in line with the straight edges of the stock, adapting the device for use on a longer surface than when the extension tube is down in the stock. At one edge of the stock is a spirit level, and in its opposite edge is a swinging gravity level, the weighted pointer of which is seated in a mortise having glass top and side plates, the latter marked with graduations. In the modified construction shown in the figure at the right, the recess for the bob cord is mortised in the face of the stock and covered by a glass plate, the suspension device being a pivoted bar having at its upper end a pointer registering along a graduated scale.

For further information relative to this invention, address the patentees, William J. Garner and Thomas Connaughton, Latourell Falls, Oregon.

Production of Copper in the United States.

Census Bulletin, No. 96, relating to copper production in the United States, has been prepared by Mr. Charles Kirchhoff, special agent, under the supervision of Dr. David T. Day, special agent in charge of the Division of Mines and Mining, of the Census Office. The report shows the United States to be the largest producer of copper in the world, its product for the year 1889 being 226,055,962 pounds, or 113,028 short tons. The total expenditures involved in this production were $12,062,180, of which there was paid in wages, $6,096,025; in salaries, $120,896; to contractors, $334,443; for materials and supplies, $4,067,970; and for taxes, rent, etc., $1,442,846, the total capital invested being $62,623,228, and the total employes, exclusive of office force, 8,721.

The copper product of the United States was as follows, in pounds, in the calendar year 1889:

	Pounds.
Arizona	31,586,185
Michigan	87,455,675
Montana	98,222,444
New Mexico	3,686,137
Colorado	1,170,053
Idaho	156,490
Nevada	26,420
Utah	65,467
California	151,505
Wyoming	100,000
Vermont	72,000
Southern States	18,144
Lead smelters and refiners	3,345,442
Total	226,055,962

During the last ten years, Arizona and Montana have made wonderful progress in the mining and production of copper, and to-day Montana, as will be seen from the above statement, leads all other States in this production, its product exceeding that of Michigan (which has heretofore been the leading producer) by 10,766,769 pounds.

American Screws in England.

Another industry, of an important character, is about to be introduced into Leeds. For some time past, says *Iron*, the American Screw Company, of Providence, R. I., has had in contemplation the establishment of a screw factory in this country, and circumstances being now favorable for the enterprise, Leeds has been selected as the industrial center offering the most advantageous conditions. An eligible site has been obtained in Leeds, viz., that of the Old Perseverance Iron Works, in Kirkstall Road. It is proposed to cover the frontage to Kirkstall Road to the extent of 100 feet, and to carry the building back for 344 feet, with a width (over the greater part of the latter) of 80 feet. When the time for extension arrives a duplicate of this building will be erected; and when this has been done, the two buildings running backward from the road will be separated by a yard 40 feet in width. The screws manufactured will be exclusively of the kind used by joiners and carpenters, and they will be of the English pattern. The machinery for the factory will come from America, and be adapted to the requirements of the trade in this country. The screws are packed in paper boxes, and these, together with the necessary labels and trade marks, will at the outset be procured from English firms; but the company intend eventually to make the boxes on their own premises, and will, in all probability, print the labels and trade marks there likewise. The finished wire used in the manufacture of the screws will also at the start be obtained elsewhere; but the scheme of the company includes the construction of wire mills and annealing furnaces alongside the screw factory.