

Correspondence.

The Mississippi Jetties.—Letter from Captain Eads.
To the Editor of the Scientific American:

The following extract is from a private letter just received from Colonel W. Milnor Roberts. Believing it to be a well merited compliment, I cannot resist the desire to ask you make it public. As Mr. Corthell lately contributed to your valuable journal one of the most complete and intelligible descriptions of the construction of the jetties, and the principles upon which their application to the South Pass bar is based, that has yet been written*, I am sure you will cheerfully publish this handsome recognition of his ability, coming, as it does, spontaneously from one of the oldest and most eminent civil engineers in America, in praise of one who, though still young in the profession, has by his industry and talents largely aided in achieving the success thus far secured by the jetties.

MR. JAMES B. EADS, C. E.—Dear Sir: I have just returned from Philadelphia, from the annual convention of our society; and although pressed with an accumulation of various matters here, I must take time to congratulate you upon the grand success which your assistant, Mr. Corthell, achieved before the convention in his presentation of the operations and present status of the South Pass. It was clear, succinct, easily intelligible to those not familiar with the place, and delivered in a manner to impress every man with its truthfulness. It had, I think, a better and more potent influence, in clearing away doubts which existed in the minds of many who were present, than anything ever before presented.

Facts are stubborn things. I had prepared some remarks, chiefly based on the information I had received, some of which I gladly waived in the presence of the thing itself, so to speak, as shown to the convention by Mr. Corthell. If I say you could not have done it better yourself, I only say what I believe is true, and I know that you will understand my meaning. Yours, as ever, W. MILNOR ROBERTS.

I was unable to be present at the convention, but have heard from many others who were there that Mr. Corthell's presentation of the subject was most admirable.

JAMES B. EADS.

The Long Gas Pipe in Pennsylvania.

To the Editor of the Scientific American:

In your issue of June 24, we notice an article, taken from the *American Manufacturer*, which, if left unexplained, would do us both injustice; and as neither of us wishes to be an iconoclast of "tables and books on pneumatics and hydraulics," we will endeavor to give a correct statement of the experiment of passing gas through a three inch pipe, 32 miles long, from Millerstown, Butler county, to Harmer-ville, Allegheny county, Pa. The time was computed by watches adjusted before the experiment and compared after it. The pressure at the well before the cock was opened stood at 55 lbs.; after opening the cock, it stood at 50 lbs. throughout the day. At 32 minutes after the cock at the well was opened, we could smell the gas plainly at Harmer-ville, but it would not ignite for some time after. We had fixed at the discharge end of the pipe a 300 light meter; and by reducing the size of the opening so as to deliver 50,000 cubic feet in 24 hours, as registered by the meter, the pressure in the pipe increased to 34 lbs., and stood at that, being a loss of 16 lbs., delivering 50,000 cubic feet through 32 miles of three inch pipe; and by extending the same sized pipe to Pittsburgh (8 miles) the loss in pressure would equal 20 lbs.; and by increasing the opening so as to reduce the pressure to equal a column of water three inches high (the pressure required to lift the gas holders in our works), the delivery would equal 161,000 cubic feet in 24 hours.

This you will (we think) find is "in conformity with the theories and demonstrations of scientists," and it does not "look as though some facts would have to be changed or tables and books on pneumatics and hydraulics revised."

ROBERT YOUNG, JOHN MCELROY.

Engineers of Allegheny and Pittsburgh Gas Companies.

The Voracity of Fishes.

To the Editor of the Scientific American:

In your issue of June 24, you give us an engraving of fish hooks, etc., found in the stomach of a cod, by Mr. Frank Buckland. Some of our southern streams contain voracious fish. An acquaintance of mine caught a catfish in a lake on the Arkansas River, near Little Rock, some few years since, from the stomach of which was taken the larger part of an ox liver, twenty-three hen's eggs, three puppies, and a child's shoe. Whether the fish had swallowed the child whole, and it had been digested by the juices of the catfish's stomach, and the shoe alone remained to tell the child's sad fate, or whether the child escaped the jaws of the voracious fish, losing only its shoe in the *rencontre*, the evidence was not sufficiently clear to determine. But that the above enumerated articles were found in its stomach is undeniable; and I think this is enough to establish the fact that the catfish is also a voracious fish.

ROBERT L. STEEL.

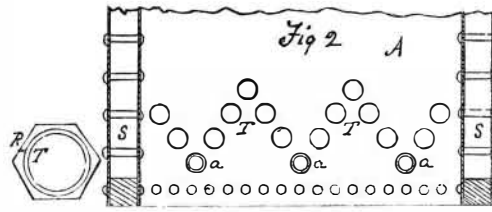
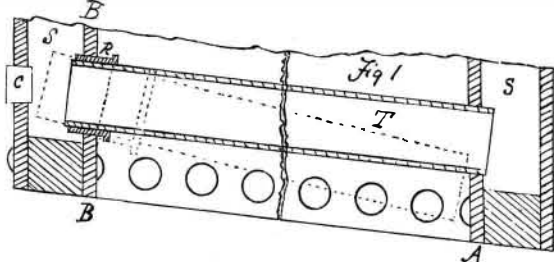
Rockingham, N. C.

The Water Grate.

To the Editor of the Scientific American:

It would seem that a series of wrought iron tubes, placed side by side, three fourths of an inch apart, would form a most appropriate and economical grate for every kind of steam generator, and especially for the furnaces of coal-burning locomotives, wherein the solid bars are so quickly destroyed. The few roads which have used the tubular or water grate have proved it to be highly economical and satisfactory in every way, as far as I can learn: and there seems to be no

reason why it shall not eventually supersede the solid grate everywhere and for every kind of fuel. The only care necessary in its use is to keep the tubes free from sediment.



If the tubes, 'T', in the engraving, are sufficiently inclined, say from one to two inches to a foot, they will not clog, if they are of proper size, unless the water spaces around the furnace with which they communicate first become clogged. If the tubes are more than three feet long, they should not have less than two inches external and one and a half internal diameter. If more than six feet long, I would recommend not less than two and a half inches external and two inches internal diameter; and if more than four feet long, they should have a central support. An inch and a quarter screw plug, 'C', should be placed exactly opposite one end of each tube, for the purpose of cleaning the tubes in case they get foul. These plugs, in connection with the four two inch ones placed at the corners of the fire box, will afford ample opening for removing all filth which collects around the fire box and in the tubes.

There are several methods of fixing the tubes into the fire box; the best plan, all things considered, is to screw them into the front sheet, 'A', of the fire box and secure the other end in a copper or composition ring, 'B', screwed in the rear sheet, 'B', Fig. 1, about three inches of the rear end of the tube having been previously turned to a nice straight fit to the inside of the ring, so that the ring may be slipped on to the tube a little further than the position it is to occupy finally, in order to facilitate the entering of the screw end of the tube, as indicated by the dotted lines. After the tube and ring have been firmly screwed into the fire box, the corner of the ring may be set up to the tube with a steel set punch and a light hammer, to insure a steamtight junction between tube and ring. The holes for the reception of the tubes may be cut in the sheets before the fire box is riveted together; but the threading of the holes should be done afterward, and then it should be done with a tap having a stem long enough to extend across the fire box and rest in the hole opposite the one being tapped, in order to insure perfect parallelism of the tubes and rings while being screwed in, without any side strain.

The holes for the reception of the tubes are sometimes arranged zigzag across the sheets, as shown in Fig. 2, instead of in a straight line: the tubes, 'a', at the lower angle being movable, and not water tubes, to facilitate the cleaning out of the fire box. The Philadelphia and Reading Railroad, I think, first adopted this arrangement; some of their water grates are nine feet long. When the tubes are set in a straight line, a single movable tube will suffice for cleaning the fire box; this may be either the center one or one of the side tubes. It is desirable that these grates should be easily accessible from beneath, so that the fireman can see the state of the fire from below and carry the poker along between the bars and dislodge the ash and cinder without disturbing the fire above. To this end, there must of course be a door at the rear end of the ash pan.

Worcester Mass.

F. G. WOODWARD.

[For the Scientific American.]

TECHNICAL EDUCATION IN THE UNITED STATES AS ILLUSTRATED AT THE CENTENNIAL.

The visitor who is interested in the methods of instruction adopted in this country can profitably spend a day at least in the examination of the educational exhibit at the Exposition. The writer, indeed, after a much longer study of these exhibits, finds his examination but partially completed. The chief point of interest to him, however, in this class, was the display made by several well known technical schools. The question as to the proper method of training engineers has excited great interest in professional circles of late, and numerous letters from your correspondents prove that information of these schools is desired by many of your readers. It is probable, therefore, that a few notes regarding the technical schools that are represented at the Exposition may not be unacceptable.

THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY.

Taken as a whole, the Massachusetts educational exhibit may fairly challenge comparison with the display of any other State, and the completeness of the exhibit is nowhere better illustrated than in the technical department. Many exhibitors seem to think that they have accomplished their duty by making an interesting display, apparently forgetting that, if they cannot furnish printed descriptions or attendants to give explanations, the true merits of their exhibits will rarely be appreciated by the visitor. The Massachu-

setts Institute of Technology, however, provides complete catalogues of all articles exhibited, with documents explaining the organization of the school and various other details of interest. The general plan of the institution is quite extended, embracing ten courses, each occupying four years, as follows: Civil and topographical engineering, mechanical engineering, geology and mining engineering, building and architecture, chemistry, metallurgy, natural history, physics, science and literature, philosophy.

How these subjects are taught is illustrated by the work of the students, consisting of theses, examination papers, drawings, models constructed by students, accounts of experiments made by them, results of operations in the laboratories, plans and descriptions of buildings, and a good collection of the apparatus employed in making investigations. It is worthy of observation that this exhibit is not made up of the work of the best students only, but is designed to be a fair representation of that done by the whole school. The visitor who makes a careful examination of this display will see that the students are encouraged to make experiments and original investigations, and that a prominent place is given in most courses to the subject of drawing. It is pleasing to notice, too, that the majority of the drawings are such as are required in actual practice, less attention being given to ornamental borders and titles than to the drawings themselves. Enough specimens of elaborate drawing are exhibited to show that the student can do this work if required. A fine illustration of this kind is a chart of the metric system, in which, however, it is to be regretted that the statement is made that all measures of the system, of length, surface, solidity, and capacity, are directly derived from the meter; for although this statement can be supported on the authority of United States law, it is none the less untrue as a scientific fact.

A hasty review of several of the theses shows exceptionally careful and thorough work on the part of the students. As is natural, in discussing doubtful questions, they are usually decided by reference to investigations at the Institute, which may not be generally regarded as possessing the authority of experiments made by other physicists; but taken as a whole, these theses contain much that can be read with profit by professional men and manufacturers. Occasionally, in glancing over the pages, some may regret that orthography was not embraced in the scientific course.

This institution opens its doors to members of the gentler sex, and it is pleasing to find an account of some thorough analytical work by one of the female graduates.

The school year is about 36 weeks, and the necessary expenses, including board and tuition, vary from \$500 to \$600 per school year, according to statements in the catalogues, the tuition fee being \$200 per year. There are, however, several free courses of instruction. Much of the apparatus at the Massachusetts Institute of Technology is unusually interesting; and although some of the more novel features are not exhibited at the Exposition, they are fully described, and may be mentioned in a future letter.

WORCESTER COUNTY FREE INSTITUTE OF INDUSTRIAL SCIENCE.

The exhibit of this school is partly in the room adjoining that of the Massachusetts Institute of Technology, in the east gallery of the Main Building, and partly in Machinery Hall. The mechanical engineer will find much to interest him in this collection, which illustrates the results of a course of instruction, combining practical exercise in a well equipped machine shop with the technical training required by the thorough mechanic. A catalogue of the exhibits, drawings of the school, illustrative charts, and a compilation of various details are of great assistance to the visitor who wishes to make a thorough examination. The Worcester Institute has an annual income of \$25,000. It was founded by John Boynton, and the machine shop was established by the late Hon. Ichabod Washburn. It has also received endowments from Hon. Stephen Salisbury and the State of Massachusetts. Tuition is free to all students from the county of Worcester, and also to 23 students from the State of Massachusetts, while to students from other localities the tuition fee is \$100 per annum. The annual expenses, other than for tuition, need not exceed \$300. The courses given embrace mechanical engineering, civil engineering, chemistry, physics, modern languages, and drawing. In professions where practical proficiency is required, it is imparted by practice. Mechanical students work for 5 months in the machine shop before entering the class rooms, and the subsequent course extends over a period of three years, in which 10 hours a week are devoted to practice in the machine shop for 10 months in the year, and 8 hours a day in the month of July. For other students, the course is 3 years. The work done in the machine shop consists of machine tools, models, and the drawing tables which are so well known. The manufactured articles are regularly sold in competition with those made in other establishments, and are readily disposed of. So far, the shop has not been established on a paying basis, the average annual excess of expenditures over profits being about \$3,000. It is, of course, doubtful whether a shop conducted on this system can ever be made to pay expenses, if due regard is given to the other instruction required by the students, but this is a matter of minor importance. Numerous examples of the work of the students are displayed, including all their specialties; and having disregarded the request about touching the exhibits, the writer has become very favorably impressed with the general accuracy and the thoroughness of the execution. In Machinery Hall, which contains lathes, grinding machines, drawing tables, and models, manufactured at this school, one of the machine lathes is driven by a belt of

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