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- Combs, Gills, and Hackles, 1 figure.
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- American Engineering—II. Foundations. Towers of the suspension bridge between New York and Brooklyn. Piers of the St. Louis bridge. The St. Charles bridge over the Missouri river. The Poughkeepsie bridge.
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- II. TECHNOLOGY AND CHEMISTRY.—Self Regulating Filter, 1 figure.
- Drying Box for Photo-Gelatin plates.
- Manganese Bronze.
- The History of Alizarin and Allied Coloring Matters and Their Production from Coal Tar. By W. H. PERKIN, F.R.S. Second lecture. Fig. 1, apparatus for the manufacture of Anthracene. Fig. 2, anthracene retorts. Fig. 3, chlorine apparatus. Fig. 4, chlorine ovens. Fig. 5, the converting apparatus. Fig. 6, the vacuum filters. Fig. 7, the soda salt converter.
- Alizarine Blue.
- To Test the Dye of Colored Fabrics. Blue.—Yellow.—Red.—Green.—Violet.
- Notes on Uranine.
- Ready Method for Preparing Diphenyl. By WATSON SMITH, F.C.S., F.I.C. 2 figures.
- On the Softening of Magnesia Hard Water. B. J. GROSSMANN, Ph.D.
- III. BIOLOGY.—A Speculation on Protoplasm. By PERSIFOR FRAZER, JR.
- Intravenous Injection of Ammonia. By GASPAR GRISWOLD, M.D., Bellevue Hospital, N. Y. Ammonia as a safe and powerful means of stimulation.
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- V. OBITUARY.—Karl Koch. The life and works of German botanist Karl Koch.
- VI. GEOGRAPHY.—Recent Explorations in Africa. Major Pinto's account of his journey across Africa.
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- VIII. MISCELLANY.—American Resources and Progress.

SHALL WE HAVE A CANAL OR SHIP RAILWAY?

In a recent speech at Rouen, M. de Lesseps expressed the belief that the Darien Canal would be completed in five or six years. A few days earlier, at Amiens, he said the first sod would be turned next New Year's day, and that the work would be completed in seven or eight years. Evidently these utterances are mere talk to hurry up subscriptions. Evidently, also, M. de Lesseps is not in position to form any definite idea of the time which the proposed "heroic" treatment of the Isthmus will require, even in the absence of climatic, political, and financial hinderances. The "official" utterances with regard to the probable cost of the proposed work are doubtless equally wild. The original estimates for the route selected were considerably more than double the sum now pronounced sufficient, and there has been no change of plan nor any cheapening of processes to account for the difference.

At Rouen M. de Lesseps declared that the friendship between France and the United States would greatly facilitate the work. Undoubtedly friendship is better than enmity, but it is not so clear that American good will toward France will go so far as to overcome the decided objection of our people to the establishment and control of such a commercial route across the Isthmus by European powers. The Monroe doctrine still has force among us, as Senator Burnside's resolution in Congress shows; and there is a further difficulty likely to arise, should the canal be built as proposed, from the circumstance that the greater part of its trade would be with American shipping, and American shipmasters might prefer to have the profit of the enterprise kept at home, and might prefer a route more convenient for them. That this is no shadowy difficulty is evident from the position of M. Paul Leroy Beaulieu, who points out in the *Economiste* that the advantages of the Nicaragua route may lead to the creation of a second canal, which would deprive M. de Lesseps' enterprise of the trade of the two coasts of the United States, on which it relies for its chief profits.

On the other hand, America is not at all sure that a ship canal is what is wanted at the Isthmus. As long ago as 1845 the SCIENTIFIC AMERICAN illustrated and described a plan of railway transportation for ships, with especial reference to the Isthmus of Panama. In 1867 the late Horace Day made an elaborate plan for a ship railway across the Isthmus, and took out patents for some important devices connected with the scheme. Since then the hauling of coal laden vessels overland from one water level to another has become a matter of daily occurrence in this country, and the feasibility of moving in this way, economically and expeditiously, the heaviest shipping from the Atlantic to the Pacific, is asserted by Captain Eads, whose ability to estimate the practicability of great engineering enterprises no one will question. In a recent letter Captain Eads asserts that for less than one-third the estimated cost of the Darien Canal, a ship railway can be constructed capable of transferring the largest ships, when fully loaded, in absolute safety across the Isthmus within twenty-four hours from the moment they are taken in charge in one sea until they are delivered into the other, ready to depart on their voyage. The details of the plan will be found on another page.

That such a road is practicable as a work of engineering no one can dispute. That it would be much less costly than the proposed canal, in spite of the necessity of its being made without curves, will scarcely be questioned by any one who takes account of the enormous tunnel involved in the plan of the canal. The only doubt will arise in connection with the cost of operating such a road. The opinion widely prevails that water carriage is—leaving out the time element—much more economical than land carriage. The experience of recent years, however, has tended to prove the superior cheapness of railway carriage, and in more than one instance canal beds have been converted into railways, owing to the marked advantages of the latter method of transport. When the interest on the heavier investment required for the canal is taken into account, the greater time required for the construction of the canal, the greater liability of the latter to injury by storm and earthquakes, to say nothing of the slower movement of shipping in water, the argument in favor of a railway becomes very strong.

THE CINCINNATI INDUSTRIAL EXHIBITION.

The seventh Industrial Exhibition in Cincinnati will open September 10 and continue one month. The last was held in 1875. The next year was skipped owing to the Centennial Exhibition at Philadelphia, and the two following years for lack of suitable buildings. This year the Exhibition will be housed in the splendid edifice built for the purpose by public subscription—the most spacious, costly, and suitable exhibition buildings in the country. The aim is to surpass in variety and magnitude everything in the way of industrial fairs that the country has seen, except the great International Fair of 1876.

The Cincinnati Exhibition is managed by a board of fifteen commissioners, appointed by the City Chamber of Commerce, the Board of Trade, and the Ohio Mechanics' Institute; and the commissioners especially announce that the Exhibition is in no sense a private enterprise or speculation. The management is gratuitous, and there are no charges for space.

The machinery and agricultural departments have over 60,000 feet of exhibiting space, 600 feet of line shafting, engines and boilers of over 200 horse power, steam, water, and drain pipes convenient for exhibitors. The horticultural de-

partment will be in a large conservatory constructed for the purpose, well lighted from the roof, heated with steam, and affording over 20,000 square feet of exhibition space. The fine arts and natural history departments have been generously provided for, and there is a promise of an exceptionally fine display. Great efforts are making to have the display of minerals, metals, iron and steel and their products adequately represented; and a special department has been provided for the representation of Mexican products.

Applications for space should be made early. With certain exceptions all articles for competition must be of American production. Gold, silver, and bronze medals and cash premiums are offered in the different departments.

THE OPENING OF THE MISSISSIPPI.

It is, relatively speaking, so long since the American people became convinced of the ultimate success of the splendid engineering enterprise just brought to successful conclusion at the mouth of the Mississippi, that there is danger that the immediate credit due to Captain Eads may be popularly underestimated. Men are too apt to forget that when he began the work he did so at his own risk, and in the face of strong and persistent opposition from engineers in high authority. They forget that all along he has had to conquer not only the commercial barriers at the mouth of our great river, but to do it hampered by severe restrictions, even the payments for work done being contingent on the approval of engineers whose greatest joy would be in his entire discomfiture.

There is danger, too, of forgetting the magnitude of the work, and the enormous commercial possibilities the scheme involves, as well as the great power of the opposing local interests whose prosperity was endangered by every stroke done toward opening the mouth of the Mississippi to the free and easy passage of commerce. The moral and financial victory won by Captain Eads is accordingly greater even than his victory over material obstacles; and the latter were great enough to justify our classing the work among the most difficult, costly, and courageous achievements of hydraulic engineering. In commenting on the work the *Tribune* reminds us that when the jetty company began its operations at South Pass, the commercial entrance to the Mississippi was at Southwest Pass, but only light draught vessels were sure of getting in. A ship drawing over sixteen feet was liable to get fast on the bar and remain there until she unloaded her cargo upon lighters. The cost of unloading and reloading and of the long delay more than absorbed the profits of the voyage. Besides the obstruction of the bar, which constant work by Government steam dredges for more than twenty years had failed to remove, there were the curious mud-lumps which, heaving up from the bottom outside the river's mouth, often caught ships in their sticky embrace. Southwest Pass was, however, the main channel, and the only practical entrance for craft larger than fishing smacks. South Pass had only six feet of water on its bar, and Pass à l'Outre and the old Belize had long been closed. The Government would not allow Captain Eads to work upon Southwest Pass, which, having by far the greatest volume of water, was most easily improvable. It was feared he would ruin the poor channel existing there, and so choke up the river completely. He had to take South Pass, and was compelled in order to get enough water in it, to throw sunken mattresses across the heads of the other passes. Then he had to conquer a shoal at the head of South Pass, and stop up an outlet through which a portion of the current escaped into the Gulf. All this was preliminary and additional to the real jetty work, which consisted in building two walls from the river's mouth straight out into the Gulf for a distance of nearly three miles, to the outer verge of the bar—a wall that would resist the force of the current and the buffeting of the sea.

Our readers have followed in the pages of the SCIENTIFIC AMERICAN the progress of this most useful work, from its inception to the successful conclusion recently announced. The river is now permanently open, and its currents are so controlled that the mighty stream will henceforth be the chief factor in keeping its channel clear of the barriers it naturally tended to build up against the commerce of the world. When the Mississippi valley harbors, as it soon will, a more numerous population than the whole country can boast of now; when its farms and factories are doing, as they soon will, half the productive work of the world—then it will be possible to form some adequate idea of the industrial and commercial benefit to flow from the unbarring of the outlet of what cannot fail to be the great artery of our national and international trade. It is a grand victory, and Captain Eads may be sure that popular appreciation of its grandeur will grow with the growth of the commerce it makes possible.

THE REFLECTING MAGIC LANTERN IN COURT.

During the recent trial of the Whittaker will case in Philadelphia, it became necessary to show the differences between a genuine signature and an imitation or forgery of the same. For this purpose Dr. Charles M. Cresson brought into court a powerful reflecting magic lantern. The room was darkened, and images of the two signatures, enormously magnified, were thrown side by side upon a screen before the judge and jury. The false signature was at once revealed. In the ordinary magic lantern, the object to be shown on the screen is photographed or painted on a slide of glass, and the light passes through the slide to the screen; in the reflecting lantern the light is thrown against the face of the