The Water Works of Philadelphia, Pa.

We are indebted to Frederic Graff, Esq., Chief Engineer of the Water Department of Philadelphia, for a copy of his annual report for 1871, which contains interesting information.

"The supply of water distributed during the past year has been much greater than any previous year. The average daily supply from all the works, for the whole year, has reached 37,149,385 gallons. The average supply for the month of July was 46,008,735 gallons per day—and the maximum supply of any one day was on July 20, 1870, when 54,655,509 gallons were delivered. This was equal to 81 gallons per day for each one of the population of the city per last census; but our citizens do not all get a supply from the works, many in the rural wards obtaining water from springs and wells. The water supplied on that day was equal to $92\frac{3}{10}$ gallons for each of the population who actually receive water from the works, and 540 gallons for each of the water tenants now upon our books; of course, no one can believe that each man, woman, and child of the population supplied, consumed for their actual wants $92\frac{3}{10}$ gallons a day; therefore, the immense amount wasted must be evident.

"The increase in the water supply is in much greater ratio than the increase of population. This occurs, probably, on account of the multiplication of modern conveniences for using water; such as water closets, wash basins, stationary wash tubs, wash pavements, and the increased number of each now considered necessary or desirable in our dwellings; besides the moer lavish discharge of waste water into drains and sewers than formerly—whereby it can be wasted without fear of detection.

"Whilst the supply of water delivered in our city is as copious as that of any other in the United States, the price charged for it is very much lower; a very trifling increase in some of our charges, for what may be considered as the "luxuries of water supply," and which would scarcely be felt as onerous, would enable us to make a marked increase in our revenue, and a corresponding decrease in direct taxation.

"Over 26 miles of distributing pipe have been laid, including mains of 30 and 36-inch diameter, making the aggregate amount of mains and pipes used in distributing the water 488½ miles, a greater amount, by nearly 150 miles, than any other city in the United States, and only exceeded in the world by the city of London.

"A LARGE SUBMERGED WATER MAIN.—It was decided to use the Belmont Reservoir for the supply of the high wards on the east side of the river, particularly the 20th and 28th Wards; to do this, it became necessary to cross the river Schuylkill with the main, and it was decided to use a sub merged pipe, designed and patented by John F. Ward, of Jersey City, N J.; a contract was accordingly made with that gentleman, and the main has been successfully laid.

"It is 36 inches in diameter, has a movable joint of simple and peculiar construction which admits its being sunk length after length, from scows, by suitable skids and derricks.

"The inside of the bell of the pipe is turned smooth to a spherical form, the small end of the pipe having grooves in it to retain the lead; when two pipes are put together, a lead joint is cast and caulked in the ordinary way. The smoothness and form of the inside of the bell permit the requisite motion, the lead joint slipping upon that, whilst it is retained firmly by the grooves in the small end of the pipe.

"The total length of the pipe is 963 feet, and the deepest water 25 feet; at each side of the river, at the shore ends, a suitable channel was dredged to receive it."

Progress of Ignorance.

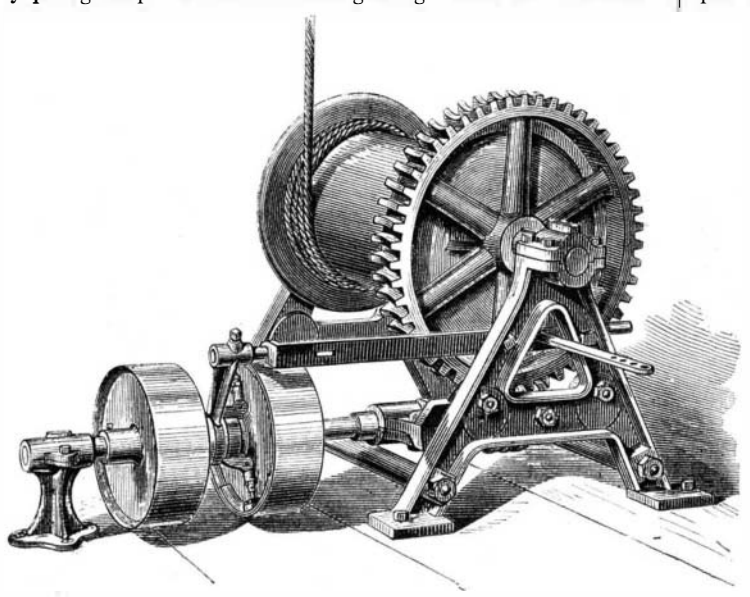
We read in the London *Builder* that a "civil engineer" recently wrote to an English government department, on the subject of the ill-fated ship *Captain*, and in his letter remarked "that a good deal had been said about the center of gravity of the vessel, but the fact was that no hollow bodies could have any center of gravity."

This will disturb the gravity of our readers, and afterwards, in their serious moments, they will agree with us that some examination ought to be made of persons intending to practise engineering, as it is of candidates for the admission to the ranks of medicine, law, and divinity. The term "civil engineer" would then present some definite idea to our minds; at present, it may mean anybody, from Robert Stephenson or I K. Brunel, down to the abovementioned theorist, who seems unconscious of the existence of a center of gravity in his own head.

AMERICAN INSTITUTE OF ARCHITECTS.—LECTURES.—An experimental course of lectures is in progress, before the New York Chapter of the American Institute of Architects, on Mondays and Wednesdays of each week, the course to end on May 31, 1871. The lectures are given by Mr. P. B. Wight and Mr. R. G. Hatfield alternately, the former discussing the History and Æsthetics of Architecture, and the latter, Architectural Construction. Tickets for the course are sold at $10. The lectures commence at 8 P.M., at 925 Broadway (near Twenty-first street).

IMPROVED POWER HOISTING MACHINE.

This machine is designed for elevators and other hoisting purposes, where it is desirable to hoist, and also lower, loads at a regular uniform speed. In the machine illustrated in the accompanying engraving, the desired result is accomplished by the worm and worm gear on the drum shaft. The worm is driven in opposite directions, by means of two friction couplings, with cross and open belts, which operate smoothly in connection with the worm and gear, and are almost entirely noiseless in working, raising or lowering loads with great steadiness. By means of the worm and gear, great power with minimum gearing is secured. The friction



couplings operate quickly, and save all shifting of belts, and also always have the full width and power of the belts on the pulleys. The two main bearings of the worm shaft, on each side of the worm, are made of extra length so as to be durable, and are also both connected or cast in one piece, so that they cannot get out of line. They are also bolted to the main frame, which keeps both shafts in the proper relative position, without danger or liability of loosening, as frequently occurs where the main bearings are separately bolted to the wood framework of elevators. The iron frame is compact and stiff in form and easily set up.

The friction clutch pulleys, as used in connection with the worm and gear, constituting the driving and reversing mechanism of the machine, were patented February 25, 1869. These machines are manufactured by Volney W. Mason & Co., Providence, R. I.

BORING FOR OIL.

The following description of tools and methods employed in boring for oil in Pennsylvania is extracted from Blake's "Notices of Mining Machinery":

The discovery of petroleum in quantities in Western Pennsylvania, West Virginia, Ohio, Canada, and other localities, has given a great development to the art of well boring in the United States. The cumbrous pole tools have been rejected, and the cable, upon the ancient Chinese system, substituted.

The great advance has been in the construction of the tools, and in the adoption of simple apparatus for giving motion to the drill by means of steam power. For prospecting and for sinking co moderate depths of 50 to 150 feet, the spring pole, worked by hand, is frequently employed. This was the apparatus chiefly used in California a few years since, when the oil regions were prospected.

The constructions in common use in Pennsylvania at the oil wells, and used for a time during the oil excitement in California, consist of a derrick, bull wheel, band wheel, sansom post, and walking beam, and a portable steam engine. The descriptions and dimensions given below represent the average as determined by experience.

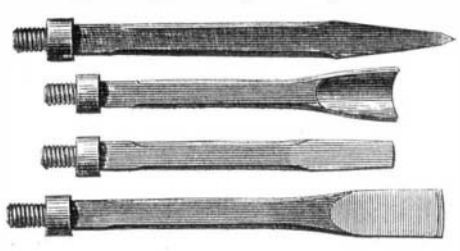
The derricks are usually constructed of plank and boards, when they can be obtained, or of unhewn poles. They rise to a hight of 50 or 60 feet, and taper upwards from a base about 15 feet square. The standards are of 2-inch plank, 8 inches wide, and the cross braces 8 inches wide and 1 inch thick. The tools are suspended by the cable, which, passing over the pulley at the top, descends at the side, and is wound upon the drum of the bull wheel, the shaft of which rests on bearings in the standards. The drum of the bull wheel is about 10 inches in diameter.

The walking beam, of wood, 26 feet long, is supported at the center, upon the top of the sansom post. One end is connected, by a pitman, with a crank of 22 inches radius upon the end of a shaft, receiving motion by a belt from the engine; the other end, projecting within the derrick, and directly over the well, carries suspended, the temper screw to which is attached a clamp for seizing upon the rope. The rotation of the crank shaft gives a reciprocating motion to the end of the beam, and this is imparted to the rope, carrying the tools at its lower end.

The form of the temper screw is shown by the gure. By this, the drill may be lowered or "fed out" to a certain extent during the progress of boring. The rope is seized and held fast by the clamp, and when the whole length of the screw is fed out, the position of the clamp is changed.

The drilling tools consist of center bits, reamers, an auger stem, sinker bar, and the "jar," besides a socket for attaching them to the lower end of the rope, and wrenches and other accessories to aid in attaching and unscrewing the bits. There are, besides, a variety of tools for recovering broken bits or other parts of the apparatus lost in the well, and sand pumps for removing the *débris*.

BITS AND REAMER FOR DRILLING



The bits are represented by the annexed cuts. They are 3½ inches broad on the face, and the reamers are 4½ inches. They are made, however, of various sizes, and all have strong, square shanks, so that they may be firmly screwed into the auger stem, made of 2¼ inch iron and 20 feet long.

The "jar" is a contrivance by which the auger stem and bit are, in a measure, detached from the rope. By it a blow or sudden jerk may be given upwards, so as to loosen the bit, in case it becomes wedged in the hole, while the same device serves to give a blow downwards upon the auger, after the bit strikes the bottom, thus doubling the efficiency of each stroke. It serves, also, to maintain the tension of the rope during the stroke. These jars are made of 1¼ inch iron on the sides, with 12 inch heads and 18 inch stroke.

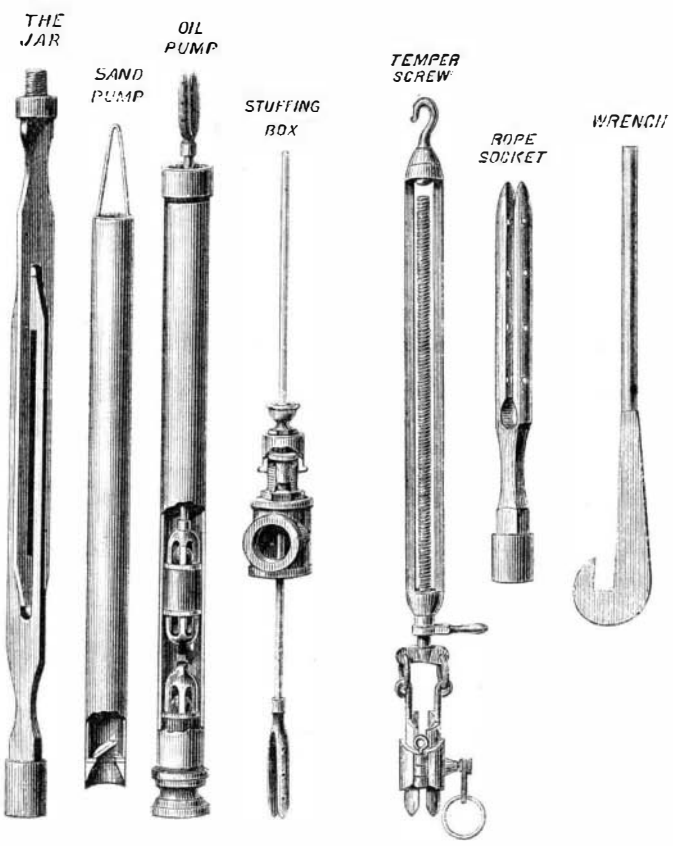
The sinker bar, 10 feet long, is attached by a screw to the upper end of the jar, and above this is the rope socket, securely united, by means of rivets, to the end of the rope.

The bits and other parts of the drilling tools are connected and disconnected by means of two large wrenches, 3 feet 9 inches long, with broad flat heads, shaped as shown in the figures.

The drilling ropes or cables vary from 1¼ inch to 1¾ inch diameter, and weigh from 48 pounds to 86 pounds per 100 feet.

The sand pumps, made of heavy sheet iron or galvanized iron, sometimes of copper, are about 5 feet long, and from 3 to 4 inches in diameter, and are fitted with leather valves resting upon iron seats, as indicated at the lower end of the figure.

These tools, and the iron fittings for the walking beam wheels, and other parts of the apparatus for well boring, are manufactured by Messrs. Hart, Ball & Hart, of Buffalo, N. Y. The steam engines in use are portable, and generally 8 or 10 horse power. A 900 feet well can be drilled with an 8 horse power engine. Rope for a well 900 feet deep, with the tools, will weigh about 800 pounds.



Before commencing to drill, it is usual to drive down a cast-iron pipe through the loose soil and alluvial deposits until the firm bed rock is reached. These pipes are made in lengths of 8 feet, and are from 5 to 6 inches in diameter. They are joined together, end to end, by means of wrought iron bands carefully welded, and sized to shrink on to a shoulder turned upon each end of the pipe in a lathe, so that a flush joint is formed by the band. The lower end is made sharp, and the band is edged with steel. This form of joint has been patented by Mr. Bolles, whose name it bears, and it gives great satisfaction. The 5 inch lengths weigh 55 pounds per foot, or 440 pounds in all; and the 6 inch, 69