THE IVORY PLANT.

So different are the products of the animal from those of the vegetable kingdom, that even the most careless observer may be expected at once to distinguish them. Yet multitudes are in the daily use of ivory buttons, boxes, and small ornaments, who never doubt that they are made from the tusks of the elephant, while they are really the product of a plant.

The ivory plant is a native of the northern regions of South America, extending northwards just across the Isthmus of Panama, large groves of it having been recently discovered in the province of that name. It is found in extensive groves—in which it banishes all other vegetation from the soil it has taken possession of—or scattered among the large trees of the virgin forests.

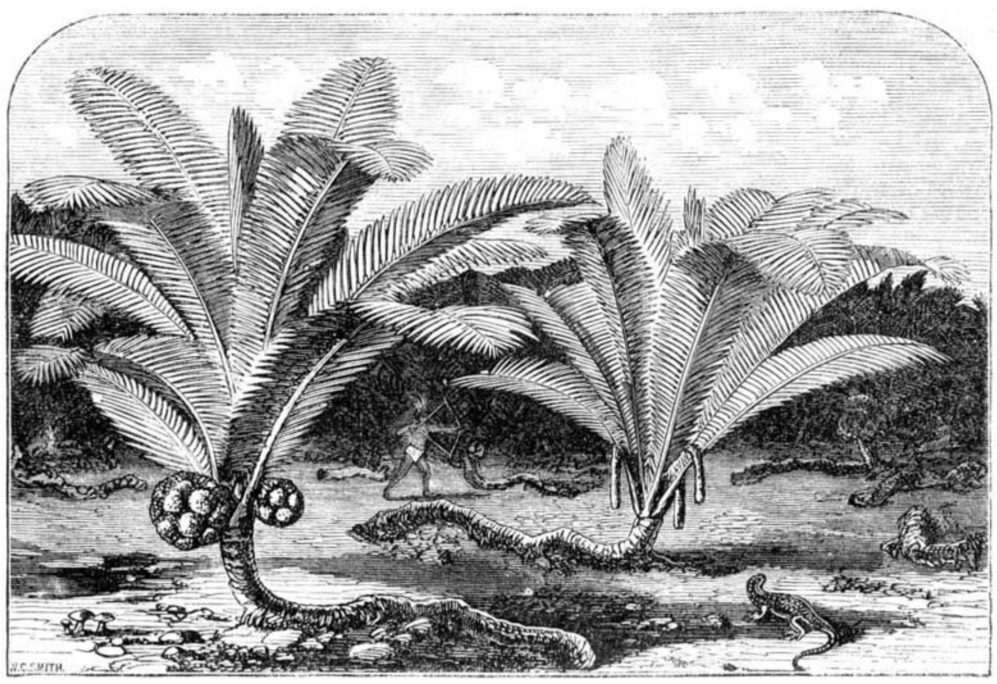
It has the appearance of a stemless palm, and consists of a graceful crown of leaves twenty feet long of a delicate pale green color, and divided like the plume of a feather into from thirty to fifty pairs of long narrow leaflets. It is not, however, really stemless, but the weight of the foliage and the fruit is too much for the comparatively slender trunk, and consequently pulls it down to the ground, where it is seen like a large exposed root, stretching for a length of nearly twenty feet in old plants. The long leaves are employed by the Indians to cover the roofs of their cottages.

Each flower of the ivory plant does not contain stamens and pistils, as in most of the British plants, but, like our willows, one tree produces only staminal flowers, while another has only pistillate ones. Such plants are said by botanists to be diœcious. Both kinds of the plants of the vegetable ivory have the same general appearance, and differ only in the form and arrangement of the flowers. In the one kind an innumerable quantity of staminal flowers is borne on a cylindrical fleshy axis, four feet long, while in the other a few pistillate flowers spring from the end of the flower-stalk. Each plant bears several heads of flowers. Purdie, who visited the plants in their native locality in 1846, says: "the fragrance of the flowers is most powerful, and delicious beyond that of any other plant; and so diffuse, that the air for many yards around was alive with myriads of annoying insects, which first attracted my notice. I had afterwards to carry the flowers in my hands for twelve miles, and though I killed a number of insects that followed me, the next day a great many still hovered about them, which had come along with us from the wood where the plants grew."

The group of pistillate flowers produces a large roundish fruit, from eight to twelve inches in diameter, and weighing when ripe about twenty-five pounds. It is covered by a hard woody coat, everywhere embossed with conical angular tubercles, and is composed of six or seven portions, each containing from six to nine seeds. These seeds, when ripe, are pure white, free from veins, dots, or vessels of any kind, presenting a perfect uniformity of texture surpassing the finest animal ivory; and its substance is throughout so hard, that the slightest streaks from the turning-lathe are observable. Indeed, it looks much more like an animal than a vegetable product; but a close comparison will enable one to distinguish it from the ivory of the elephant, by its brightness and its fatty appearance, but chiefly by its minute cellular structure.

This curious hard material is the store of food laid up by the plant for the nourishment of the embryo, or young plant contained in the seed. It corresponds to the white in the egg of the hen, and has been consequently called the albumen of the seed. In its early condition this ivory exists as a clear insipid fluid, with which travellers allay their thirst; afterwards the liquor becomes sweet and milky, and in this state it is greedily devoured by bears, hogs, and turkeys; it then gradually becomes hard. It is very curious that this hard mass again returns to its former soft state in the process of germination. The young plant for some time is dependent upon it for its food, and if the seed be taken out of the ground after the plant has appeared, it will be found to be filled with a substance half pulp and half milk, on which the plant lives until it is old enough to obtain its food on its own account.

From the small size of the seed, the largest not being more than two inches across its greatest diameter, the vegetable ivory can be employed in the manufacture of only small articles, such as beads, buttons, toys, etc. What is wanting in size is, however, often made up by the skill and ingenuity of the workman, who joins together several pieces so as to make a long object (especially when such articles are made by the turning-lathe, when it is easy to hide the joints from view), or makes a lid from one seed, and the box from another. In some years as many as 150 tuns of seeds have been imported into England, and they have been sold in the market at the rate of a thousand nuts for seven shillings and six pence.



THE IVORY PLANT.

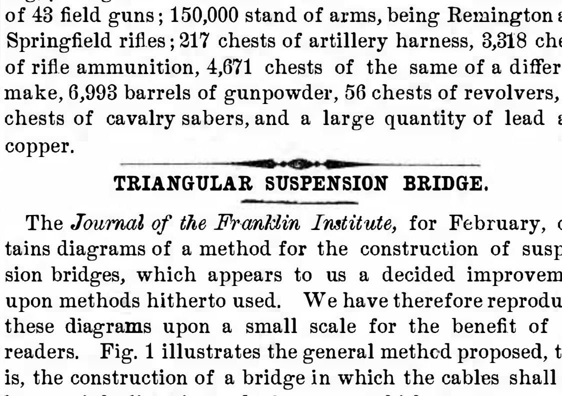
American Supply of Arms to France.

Since the commencement of the Franco-German war, France has been the principal purchaser of arms in the markets of the United States. Since the capitulation of Marshal MacMahon, at Sedan on September 3, and the proclamation of the French Republic on September 5, 1870, the shipments of small arms have been very large, amounting in value, between September 3, 1870, and January 4, 1871, to $9,717,606. The *Pereire*, in three trips to Havre, tooks guns worth $1,432,904; the *Lafayette*, in three trips, took guns worth $2,171,395; and the *Ville de Paris*, in two trips, took guns worth $1,927,263. The steamers *Erie*, *Ontario*, and *Avon*, sailing to Cowes for orders, each carried a cargo of arms valued in the aggregate at $4,216,008. A manufacturing firm in New York, it is stated, has been turning out daily 1,000 muskets of an improved pattern for the French Government. Of the guns shipped, 75,000 were Enfield rifles, originally imported from England, and disposed of last autumn by the United States Government at the public sales by proposals. A large surplus of arms sold on that occasion are not yet delivered, the purchasers being agents of the German Government, and having forfeited the deposit of $10,000 for non-compliance with the conditions of sale.

The shipments of artillery to France were small, the value amounting in the aggregate to $150,000. Harness in considerable quantities appears on the manifests of vessels sailing for Havre, and over 50,000 knapsacks have also been shipped to that port. In September, the *Lafayette* took out a shipment of arms. Early in the second week of January, a cargo reached Bordeaux in the *Lafayette*, from New York, consisting, among other warlike items for the French Government, of 43 field guns; 150,000 stand of arms, being Remington and Springfield rifles; 217 chests of artillery harness, 3,318 chests of rifle ammunition, 4,671 chests of the same of a different make, 6,993 barrels of gunpowder, 56 chests of revolvers, 76 chests of cavalry sabers, and a large quantity of lead and copper.

TRIANGULAR SUSPENSION BRIDGE.

The *Journal of the Franklin Institute*, for February, contains diagrams of a method for the construction of suspension bridges, which appears to us a decided improvement upon methods hitherto used. We have therefore reproduced these diagrams upon a small scale for the benefit of our readers. Fig. 1 illustrates the general method proposed, that is, the construction of a bridge in which the cables shall follow straight lines instead of curves, as hitherto.



Figs. 2 and 3 will illustrate the principle more fully. In Fig. 2, P *o o* P' represents the cable of the usual suspension bridge, and B B' the roadway. When any extra weight is brought upon the bridge at any point, as *n*, the roadway at that point is depressed, say to *n'*, the point *p* descending to *p'*; from the points *c* and *d* to each end, the roadway is elevated; between the points it is depressed. The cables tend to the lines P *p'* and P' *p'*, while the roadway tends to assume the form B *e d n' c* B'. This variation, in the forms of the cable and roadway lines, moves from point to point along with the extra weight. To obviate this, a heavy truss is generally used. Now, in Fig. 3, if the weight be transmitted in a vertical line to *p*, thence in straight lines to P and P', there can be no depression. The roadway will remain firm. This principle, of transmitting the weight directly, and in straight lines to the points of support, is the main feature of the bridge.

It will be seen on examination of Fig. 1, that the weight at any point of the bridge will be transmitted by the vertical cables or rods directly to their points of junction with the obliquely descending rectilinear cables or rods, and from the points of junction in right lines to the towers. Whatever deflection occurs, must therefore arise only from the stretching the cables, all the undulatory effect of heavy strains being entirely eliminated.

Railroading in the Olden Times.

William Hambright, an old conductor on the Pennsylvania Central road, who, we are told, is familiarly known throughout the State as "Cap," "Cappie," "Pap," or "Conductor Hambright," has given to the Columbia (Pa.) *Courant* some account of his experience.

Mr. Hambright commenced his career as conductor by taking the first train (horse cars) out of Lancaster, in 1833, after which time he ran regularly, and has been employed nearly all the time since as passenger conductor on the Pennsylvania Central Railroad. He then acted as conductor, brakeman, and greaser; his compensation was eighteen dollars per month —which was considered good wages at that time. His train of horse cars would leave Lancaster at five o'clock, P. M., and arrive at Philadelphia at five o'clock the next morning, making twelve hours for the journey; and the fare charged was $3·50. Stoppages were frequent, fresh horses being employed every fifteen or twenty miles. At times they would be greatly detained by the severity of the weather, the winters in those times being much colder than at the present day.

There was no fire in the cars, and when a stop was made to change horses, the conductor would make for the nearest haystack or barn for the purpose of procuring straw or hay to strew upon the floors of the cars in order to make his passengers more comfortable; he riding outside, the cars generally being packed so full that he could scarcely gain admission. Down grade the horses were always kept at a full run. Horseflesh was very cheap then—sometimes five good animals could be purchased for $100. In the year 1835 a locomotive, built by Norris, was brought from Philadelphia to Lancaster, in wagons (why it was not brought by rail we did not learn); however, the wonderful machine was put upon the track and fired up in presence of an immense assemblage of spectators. It appears the enterprise was not very successful, as it would run a short distance and then halt; then a number of muscular men would lend their assistance by pushing. Every device was resorted to, to make the "critter" go, but to no purpose. Some time after this, three small engines were purchased in England and sent over, which answered all the purposes for which they were intended, one of which is in use at the present time in York, Pa., sawing wood.

The Harrisburg and Portsmouth Railroad, as it was then called, being laid upon strong pieces of wood, using flat bar iron fastened down with spikes—it was necessary to carry hammer and spikes on the engine. Very often spikes would come out from the end of the bar, causing the end of the same to stick up, which were termed "snake heads," and the engineer would be obliged to stop and spike down before attempting to pass over. Information had to be given the engineer, before starting, where stops were to be made.

Here we may state that to Mr. Hambright belongs the credit of inventing the bell and rope system for signalling engineers. He got permission from his "boss" to put his idea of the thing into practicable shape. Procuring a rope and common door bell, he attached the latter near the engineer—no house being over the locomotive at that time—and then stretched the rope over the top of the cars. Ever after that, and up to the present time, bell ropes have been in vogue, though in a more approved style than the one just described.

Conductors were not required to make reports at the end of each trip, as is now practiced; they would hand over the gold and silver—perhaps two or three hundred dollars or more—to the clerk, who would enter it in a book provided for the purpose, somewhat in this wise: "Conductor Hambright, so many dollars," and that was all the formality about it. Checks for the baggage were not used, but when the cars arrived in Columbia or Philadelphia, the conductor would open the car door for the delivery of baggage, etc., to the passengers, who crowded around and secured their parcels by answering, "mine," to the conductor's interrogatory, "whose trunk is this?" which was kept up until all disappeared. If a trunk was marked "B" it was to go by boat; if "S," it was to go by stage line. Strange to say, there was not as much baggage lost then as now.

Very often the conductors would help the proprietors of the lines during harvest, and assist at other labor when off duty.

SHILLINGS were first coined, in England, in the year 1507

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.

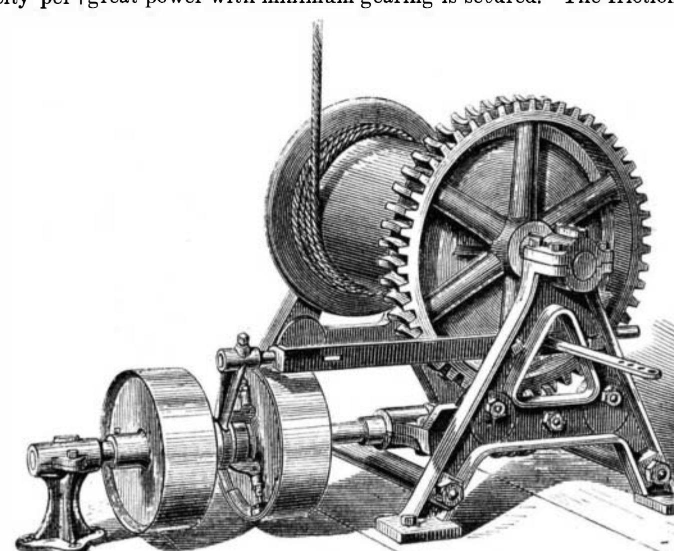
We read in the London *Builder* that a "civil engineer" recently wrote to an English government department, on the subject of the ill-fated ship *Captain*, and in his letter remarked "that a good deal had been said about the center of gravity of the vessel, but the fact was that no hollow bodies could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

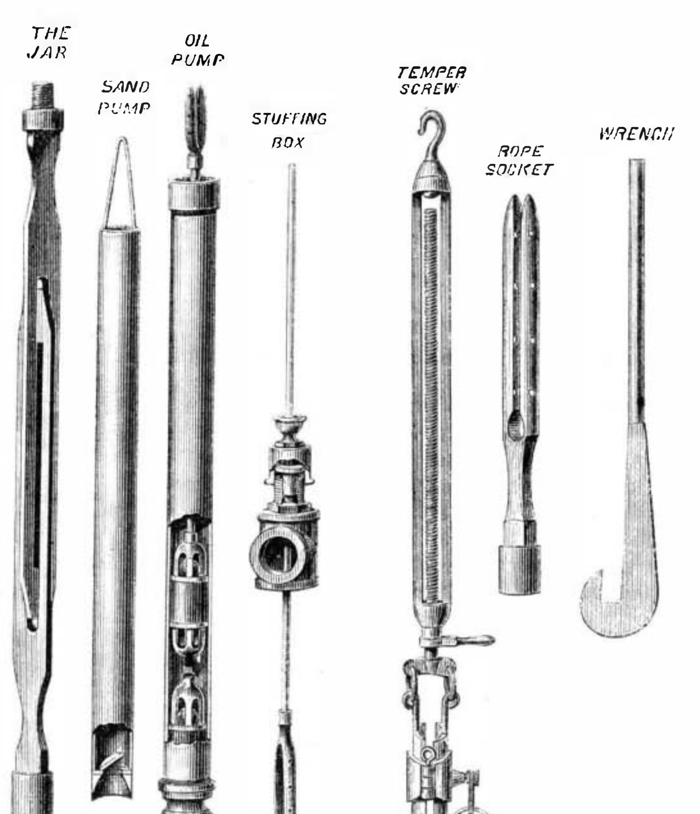


couplings operate quickly, and save all shifting of belts, and also always have the full width and power of the belts on the pulleys. The two main bearings of the worm shaft, on each side of the worm, are made of extra length so as to be durable, and are also both connected or cast in one piece, so that 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 to ls 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.

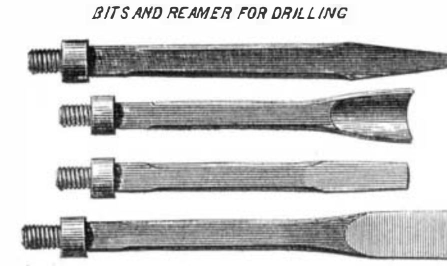
The derricks are usually constructed of plank and boards, when they can be obtained, or of unhewn poles. They rise to a hight of 50 or 60 feet, and taper upwards from a base about 15 feet square. The standards are of 2-inch plank, 8 inches wide, and the cross braces 8 inches wide and 1 inch thick. The 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 di- rectly 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, aud this is imparted to the rope, carry- ing 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 remov ing 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