SCIENTIFIC AMERICAN

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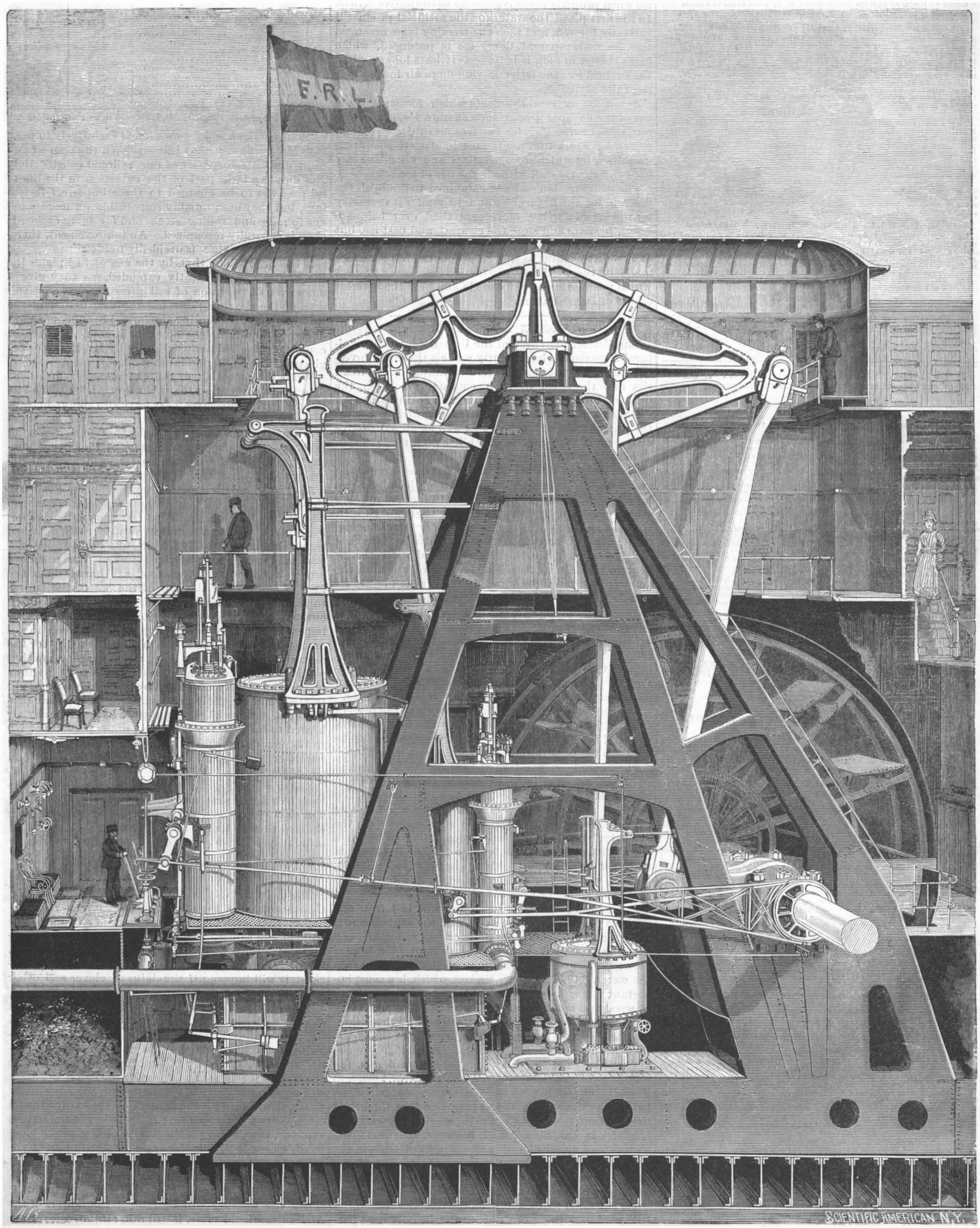

COMPOUND ENGINES OF THE FALL RIVER STEAMER PURITAN—7,500 HORSE POWER.—[See page 87.]

Scientific American.

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NEW YORK, SATURDAY, FEBRUARY 7, 1891.

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(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 788.

For the Week Ending February 7, 1891.

Price 10 cents. For sale by all newsdealers.

THE HUDSON RIVER ICE HARVEST.

So far as thickness of ice is concerned, the crop this year is satisfactory; but the heavy snows that have occurred, accompanied by rain, have formed a thick and tenacious crust upon the surface of the ice, which it is difficult to remove; and the labor involved in the removal forms a serious item in the expense of harvesting.

The entire failure last year of the Hudson ice crop, and the slim supply of the previous year, had the effect to develop and establish in this city quite a number of mechanical ice works. These were able to supply the finest grades of ice to customers at prices but little in excess of those charged for natural ice. The artificial ice when properly made is superior to the native article. In the first place, the water for the artificial product is carefully filtered, and then the freezing is so arranged that clear, transparent, dense ice is produced, which looks better, in fact, is better—as it lasts longer—than the natural ice, the latter having more air locked in it than the artificial.

Again, many establishments which formerly made use of the cheaper grades, such as snow ice, for cooling purposes, having been for two seasons subjected to high prices, have put into use the mechanical refrigerating machines, by which storage cellars and chambers are kept sufficiently cool without the use of ice.

These circumstances have combined to diminish the demand for the natural ice and to render it necessary for the ice men to use more care than ever before to select, prepare and store the clearest and best ice, but at increased expense, as above indicated. The progress of inventive genius is well illustrated in the advances made in the artificial production of ice—advances which promise soon to supersede and beat the severest efforts of Dame Nature.

WOODEN RAILWAY TIES.

The Forestry Division of the United States Agricultural Department has recently made a thorough investigation as to the consumption of timber for railroad ties and the effect of such consumption upon the forestry interests of the country. The investigation included a discussion of the various methods in use for the preservation of tie timber as well as an exhaustive statement of the progress which has been made in substituting metal for ties of wood.

The results of this investigation are most interesting and valuable, as every phase of the subject has been fully covered. The consumption of timber for railroad uses is placed at twenty per cent of the total supply, and B. E. Fernow, chief of the Forestry Division, who superintended the gathering of the statistics, says that the tie timber is now largely composed of the thrifty young growth, the promise of the future, and thus the amount of timber produced to the acre is greatly reduced. The most durable and valuable timbers only are desired, and by subjecting forests to the thinning out process necessary to find desirable tie timber, they deteriorate. Mr. Fernow instances the case of Kentucky forests, where oak represents forty per cent of the natural growth after it has been culled—mostly for railroad purposes—the new growth contains not more than five per cent of this most valuable timber.

The destructive effects upon the forests of the present demand for tie timber is shown by the fact that this material is now largely cut from trees that will make only one tie, or, at least, only one tie from a cut.

The annual consumption of railroad ties is placed at 73,000,000, which requires 365,000,000 cu. ft. of raw material. Mr. Fernow states that the opinion generally held by railway managers that young wood is more desirable because it is young is erroneous. "On the contrary," he says, "young wood, which contains a large amount of albuminates, the food of the fungi, is more apt to decay, other things being equal. Sound, mature, well grown trees yield more durable timber than very young or very old trees."

It has been found that hewn ties will last from one to three years longer than sawn, and the explanation is given that the sawn face is more or less rough and collects the water and thus gives opportunity for fungus growth, while the smoother face of the hewn tie sheds the water. The life of tie timber, which is a most important factor in considering the relative advantages of wood and metal, is affected by the breaking of the wood fiber by the flange of the rail and by the spikes.

Another cause of the shortening of the life of the tie is rot or decay, due to a fungus growth. These elements of destruction are accelerated or retarded by the condition of the road bed. When the New York and New Haven Railroad a few years ago adopted stone ballast for their track, it was supposed that the life of the chestnut ties, which are used, would be greatly extended. It has been found, however, that with the high rate of speed of trains and weight of engines the ties don't last more than five years, the cutting of the rail on the upper and the stone on the lower side wearing them out rapidly. Ties are less liable to rot on stone ballasted roads, but even the oak ties which the Erie road uses are worn out on the heavily used portions of the road before they rot.

The following table shows the age of ties of different kinds of wood, and was made up from reports received from 283 railroad companies:

Kind.	Range.	Average.
Conifers:		
Redwood	8-15	11-12
Bald cypress	4-12	8-10
Red cedar	....	10
Tamarack	4-12	7- 8
White cedar	4-10	7
Pine, long leaf	5-10	6- 7
Pine, red and white	4- 8	6
Pine, bull (California)	6- 9	6- 7
Pine, bull (Colorado)	3- 6	5
Hemlock	2- 8	4- 6
Spruce	3- 7	5
Broad-leaved trees:		
White oaks	3-12	7- 8
Chestnut	4-12	7- 8
Honey locust	....	10
Coffee tree	7-10	....
Cherry, black walnut, locust, sassafras	6-10	7
Mulberry	5- 6	6
*Mesquite	....	....
Elm	4- 9	6- 7
Black oaks	2- 7	4- 5
Ash, beech, maple	2- 7	4

* The life of mesquite, if sound, is claimed to be interminable.

"The common spike, now almost exclusively in use," says Mr. Fernow, "must be considered the poorest and most unsatisfactory part of our railroad construction. Not only is a large part of the reduction in the life of railroad ties to be charged to these imperfect fastenings, but they are probably responsible for more damage to rails and rolling stock and for more accidents than is generally recognized. An improvement, therefore, in rail fastenings is decidedly needed."

It has been found that by the use of bed plates the life of ties can be greatly extended, as they give a more even distribution of rail pressure over a greater area of the tie, thus retarding the destruction of the tie by cutting, preventing the lateral bending of spikes or screws, and thereby loosening the rail. Mr. Fernow commends the bed plate designed by Mr. Post, the engineer of the Netherlands railroad.

While the attention of railroad managers has been directed to preventing the rapid destruction of the tie by mechanical processes, they have also adopted means to preserve it against rot. In France not a tie is put down without its being first subjected to a preserving process. The same practice prevails in Europe generally, though little use has so far been made of the process in this country.

As the rapid destruction of our forests is clearly shown in this report, as it has been elsewhere, the adoption of the best method of treating railroad building material so that the utmost service can be obtained from it becomes a vitally important factor in the question of forest preservation. Most of the processes now in use for preserving wood are based upon the idea of eliminating the sap of the wood, and substituting in part, at least, an antiseptic which is to keep out moisture and to make the germination of fungi impossible. The vulcanizing process has been in use on the elevated railroad lines in New York City for the past six years, and Col. Hain, the manager, says that yellow pine timber thus treated after six years shows no rot and hardly any wear by cutting, whereas untreated timber rapidly decayed. The vulcanizing process consists in subjecting unseasoned wood to dry air heated to from 400 to 600 deg. F., under pressure of 100 to 175 pounds per square inch, heat and pressure being regulated according to the nature of the timber and the result to be obtained.

Heavy oil of tar, commonly called creosote, and also the chloride of zinc are used for preserving timber. The latter process is called burnettizing, and it is claimed that by its use the life of a hemlock tie, which ordinarily is three years, can be extended to sixteen years.

Barometric Plants.

The *Petit Traité de Meteorologie Agricole*, by Mr. Cana, contains a list of prognostics *apropos* of the aspect that certain plants present according to the state of the atmosphere. The following are a few examples: If the head of the gith (*Nigalla sativa*) droops, it will be warm; if the head of the same plant stands upright, it will be cool; if the stalks of clover and other leguminous plants stand upright, there will be rain; if the leaf of the wood sorrel turns up, it is a sign of a storm; if the leaf of the whitlow grass slowly bends up, there will be a storm; if the flower of the convolvulus closes, it will rain; if the flower of the pimpernel closes, it will rain; if the flower of the hibiscus closes, it will rain; if the flower of the sorrel opens, it will be fine weather; if the flower of the same plant closes, it will rain; if the flowers of the carline thistle close, there will be a storm; if the flower of the lettuce expands, it will rain; if the flower of the small bindweed closes, look out for rain; if the flower of the pitcher plant turns upside down, it will rain; but, if it stands erect, it will be fine weather; if the flower of the cinque foil expands, there will be rain; but, if it closes, the weather will be fair; if the flowers of the African marigold close, it will rain; if the scales of the teasel became close pressed against each other, it will rain.

A Great Engineering Work in India.

The southern extremity of the peninsula of India consists of a broad plain, flanked on the west by the narrow mountainous kingdom of Travancore. In this plain the district of Madura has one large stream, the Veigei, which rises on the precipitous eastern slopes of the Travancore mountains, and, tumbling down into the plain, flows slowly along its sandy bed until it empties into the sea on the east. It often does not reach the sea, for the rainfall is so slight and its waters are drawn off into so many channels and tanks that it has to be in flood to ever reach its mouth.

On the other hand, there are streams in those same mountains of Travancore that rise at a higher elevation than the Veigei, and not very far from it, being separated only by a mural precipice, and yet flow westward through the narrow Travancore country, and pour their volume of fresh water into the sea without doing much good to man. Besides this, the rainfall is very heavy in that region, and the land does not need the water thus carried into the sea.

The benefits that would accrue to Madura could one of those streams be turned eastward, without inflicting any injury to Travancore, were recognized more than two centuries ago by the Hindoo rulers of Madura. The stream nearest to the border, and at the same time the largest of the Travancore rivers, is the Periar.

In 1798 the prime minister of the kingdom of Ramnad, in the eastern part of Madura, is said to have sent some intelligent native officials to examine into the practicability of opening a channel for turning the Periar into the Veigei. They reported that the construction of a dam would secure an abundant supply of water to all the districts through which the Veigei flows.

In 1807 and 1808 two English officials explored the jungles of those regions and declared the scheme impracticable. So nothing was done until 1861, when Captain Ryves explored a portion of the course of the Periar and reported that that stream could be diverted at a reasonable cost. Other engineers seconded his proposals. So in 1867, the government passed an order directing a new survey of the course of the river within the region to be affected.

Two years ago Col. Pennycuick, now the chief engineer under the Madras government, took up the work with such zeal and enthusiasm as to set it in actual operation and make it a probable reality within the next decade.

He chose a site for the dam seven miles below the original site chosen. It is in a deep valley, narrowed by two knolls that push out from the mountain ridges of the sides. The river runs due west at this place, and the south knoll is 150 feet high, which is just the intended height of the dam, but its connection with the mountain beyond is by a saddle 40 feet lower than itself, so that the dam will have to be thrown across the depression. The north bank rises 250 feet from the stream, and its connection with the mountain on that side is also depressed, but not to the level of the dam. And right here the engineers are cutting down the ridge for an escape when the water rises abnormally high.

The dam itself is to be 150 feet high, 60 feet wide at the base, tapering to a width of 15 feet at the top, and as long as may be necessary to plant it firmly on the bed rock on either side. This rock is not found as near the surface of the hillsides as was expected, and the engineers are in a state of some anxiety as to how deep it will be necessary to excavate in order to find it. The construction of the dam will be thin walls of stone on the outer sides, filled in with a great mass of cement for the body of the dam.

By this dam the waters will be raised so as to flow back over the course of the river some ten miles. And at a point northward seven miles away they will fill the valley inclosed by the mural precipice overlooking the plains of Madura. This rocky wall will be pierced by a tunnel 5,700 feet in length and about 7 by 10 feet in diameter.

Already a perpendicular shaft has been sunk 100 feet at the upper end and the boring carried on for 200 feet, while at the lower end the tunnel is 800 feet in length. In order to check the force of the water at the perpendicular shaft a circular tunnel has been cut at the junction of the shaft and the tunnel.

At the dam 44 feet of the outer stone wall has been built up, extending across the stream and raising the water 12 feet. Below, the wall is progressing, and it will soon be ready for its filling of cement. At the same time hundreds of coolies are cutting down the banks. The stone is brought down from the cutting for the water escape above, where four stone crushers are at work. A gravity railway carries the loaded trucks down the long incline. On the banks of the stream a machine shop has been erected and a turbine wheel set in place, to be worked by the water, that will have an increasing fall as the dam rises.

Already the water has been set back two miles, and a beautiful narrow lake formed to that extent.

The force of Europeans in charge comprises a superintending engineer, an executive engineer, two subdivisional engineers, and a young man in charge of the plant.

One of the subdivisional engineers resides at the tunnel works, the others at the dam, having their residences on the knoll of the north bank that overlooks the dam.

Under them are 1,000 coolies at the tunnel and 1,700 at the dam. These comprise Eurasians, Portuguese, Mussulmans, Malayalees, Tamils, speaking many different languages.

Then there is a military squad of 200 pioneers of the Madras army, under the command of their affable commander, Major Fenwick, an Englishman. These men do the same work as others, and after a short period of service will be sent back to be replaced by others, that they may be accustomed to such work.

Cooly power, water power, ox power, elephant power, compressed air power, and steam power, are all in active operation.

Twenty lacs of rupees (Rs. 2,000,000) have already been spent, and the estimated cost is from 60 to 70 lacs, but it will undoubtedly foot up 100 lacs ($4,000, 000) before it is finished.

The coolies are congregated in two great settlements, which are lighted with street lamps. The Mussulmans have a square platform, with flags above, for their place of worship, the Hindoos a couple of rounded upright stones, and the Christians a thatch chapel.

It is a feverish region, and the services of the medical assistant are in constant requisition. And the malaria is so virulent from March to June as to stop all work in those months.

But when accomplished it will bring life and verdure to a land now smitten with drought and poverty.

In addition to work on the mountains, a long and broad channel is under construction to carry the surplus water a distance of 38 miles to the northern part of Madura District, where the supply of water is most deficient. In connection with this large channel are many smaller distributing channels to carry the water supply to as many fields as possible. The artificial reservoirs or tanks that lie in the way of the main channel will be utilized and will become unfailing ponds or lakes. At present they are dry all through the hot season, when their water would be most grateful. Of the 38 miles of channel, 22 are already dug.

There will be bridges to build over the stream that now is fordable, but will then be continually full.

Cyrus turned the waters of Babylon from the Euphrates channel to conquer human foes. The British government is turning this river to conquer famine and starvation and save humanity.

Madura, So. India. JOHN S. CHANDLER.

Completing the St. Clair Tunnel.

The *Railway Review* says: The stone work of the portal of the St. Clair tunnel at each end is now complete. The east portal face is a wall about forty feet high and nearly one hundred and fifty feet long, built of immense blocks of stone, some of which are over a yard square each. In the middle of the wall is the opening of the tunnel, twenty-two feet in diameter. The excavation on the Canadian side is down to the required depth of sixty feet for a small space just at the tunnel portal, and a large force of men is employed enlarging the excavation to the proper width, so that work may be begun at the proposed retaining walls, which will extend east from the portal one thousand and fifty feet. The retaining wall will be of the same ponderous masonry as the portal, and will be further strengthened by anchorage walls extending at right angles into the bank.

Inside the tunnel is just now a busy hive of industry. Tram cars are hurrying back and forth from the portal along the temporary tracks with loads of brick, cement, lumber, rails, and other materials, and the long line of twinkling electric lamps which stretches back from the entrance into the dim vista of the great bore reveals an army of workmen engaged in an apparent chaos of operations—calking, brick laying, excavating, grouting, track making, cementing, pipe fitting, rail laying all going on at once. The seeming confusion, however, explains itself when it is seen that the work of putting in the permanent track is going on from each end toward the middle and that the whole work is being carried on simultaneously, each working party keeping a little ahead of those engaged in the succeeding operation. The iron lining of the tunnel must be thoroughly calked at every point and seamed throughout, to prevent leakage, and this work is almost completed.

The brick bulkheads for the air locks had to be taken out, and this was no small undertaking, for the cement in which the bricks were laid had hardened like flint, and though a force of men has been drilling and sledging at it ever since the compressed air was taken off, much of the brick work of the wall at the Canadian end yet remains to be taken out. For the permanent way the whole tunnel is first lined with brick work laid in cement reaching half way up the sides. A floor of concrete made of Portland cement is next laid in the bottom to make a level bearing for the track. On this floor four lines of timber are laid, as stringers, a pair on each side, close under where are afterward to come the lines of rails. Across the stringers heavy beams are laid four inches or so apart, and screwed down to the stringers with screw bolts. Beams and stringers are of Georgian pine, soaked with creosote to prevent decay.

After the needlebeams are laid, a floor of cement is put in between the ends of the timbers and the wall of the tunnel on each side, to keep the track in place, and to make a foot walk for the employes. On top of the needlebeams are spiked the ponderous rails, one hundred pounds to the yard and thirty feet long, and the track is then complete. In the roof are placed suction pipes communicating with the pumping station, by which the air is pumped out and ventilation is secured, and at intervals along the walls safety ladders like small fire escapes are built into the sides of the tunnel, on which the track walker may take refuge when he chances to meet a train. This work is all well advanced, and when it is finished and the electric light wires put up and proper lamps attached, the tunnel itself will be complete and ready for business.

The St. Clair tunnel extends from the town of Port Huron, Mich., under the St. Clair River, to Sarnia, Canada.

Chiseling Gun Cotton.

Gun cotton, said Professor Munroe, in beginning his lecture on that explosive, at the Lowell Institute, recently, is pure cotton dipped in a mixture of pure nitric and sulphuric acids. In seeking a method by which these ingredients might be obtained absolutely pure and the cotton thoroughly treated with the acids, many years have been spent and serious accidents have occurred.

According to the Boston *Journal of Commerce*, the lecturer traced the experiments with the explosive from its discovery, in 1832, up to the present time, and spoke of several of the most fatal explosions which attended the experimental stage.

After experiments by Professor Hill, of the United States torpedo station, gun cotton was adopted as an explosive for use in the navy in 1884. In preparing it for this service the gun cotton is, by successive pressings in hydraulic presses, the last of which has a pressure of 6,800 pounds to the square inch, made into little blocks measuring 2½ inches each way. It now contains from 10 to 16 per cent of water, but when issued to the service contains 35 per cent. Before being made up into blocks it is carefully tested.

Professor Munroe declared that gun cotton, correctly prepared and handled according to directions, was the safest of the explosives to use. It was dangerous only when the materials had not been thoroughly purified, or the union of acid and cotton incomplete.

In proof of what could be done with it, a picture was thrown upon the screen showing the workman cutting it with chisel, jig saw, and lathe to fit it into a shell. Another illustration was the extinguishing of a block that was burning by pouring water upon it. Two thousand pounds of it had been burned in a bonfire without an explosion.

One volume of the explosive gives 829 of the gas, and the pressure developed by combustion is eighty-one tons to the square inch, and by detonation 157·5 tons, the latter being in contact, however. The effect of the explosion of one particle on another is so rapid that it would take only one second for it to pass through 19,000 feet of the explosive.

It was shown by the stereopticon that the letters U. S. N., with the date of manufacture, that are on the bottom of each block, are impressed upon an iron plate upon which the gun cotton may be exploded. It is a curious fact that, if the marks on the block are in relief, the reproduction on the iron will be raised, and, if cut in, there will be an indentation on the plate. Professor Munroe's theory is that when the letters are cut into the explosive, the gases generated in the indentations are hurled from them as a projectile from a gun. If a leaf or a delicate piece of lace be laid between the gun cotton and the iron, its impress will be left in all the perfection of outline of the original, though the article itself is absolutely annihilated.

WE have received from the United States Iron and Tin Plate Co., Limited, of Demmler, Pa., an ornamental paper weight of sheet tin, on which a poetical effusion is printed, the purport of which is to announce that the manufacture of tin plate has been commenced in this country, and has come to stay. We hope this expectation will be realized; but "one swallow does not make a summer." The consumption of tin in this country is enormous, and it will require many gigantic establishments to supply the demand. The world's product of tin plate is 562,000 tons per annum, of which the United States require 369,000 tons, nearly all of which at present comes from England.

THE harvester trust, whose formation was recently announced, failed to complete a working organization, and the several firms who were to be members will still continue their business as individual enterprises. The trust was to have had a capitalization of $35,000,000, and contemplated the control of the manufacture of all the agricultural machinery in the United States.

NEW GAS AND PETROLEUM MOTOR.

The problem of designing and perfecting a motor for small and medium powers, for universal use, is one that has received a great deal of attention from engineers and inventors; but many failures have been made in attempts to meet all the requirements of the case.

The principal difficulty has been, not so much in the production of a working machine, as in designing a motor which is at once efficient, economical, safe, and capable of being used anywhere and by any one, whether experienced in mechanics or not. A machine having these qualities is shown in the annexed engravings. It is a new gas and petroleum motor, the invention of Mr. Gottlieb Daimler, the eminent engineer, Cannstadt, near Stuttgart, Germany.

These motors are built in sizes varying from one to ten horse power, and in several modified forms to adapt them to various uses, the small industrial motors being designed for convenient connection with machines requiring only a small amount of power, say less than one horse power, such as cream separating machines, sewing machines, pumps, ventilating fans, watch maker's machinery, light wood-working machinery, and for the use of amateur mechanics.

The larger sizes of the industrial motor are suitable for driving dynamos, printing presses, elevators, grinding mills, etc.; while those adapted to boats and vehicles differ but little from those applied to other uses.

Although these motors are built with a view to durability, with all the parts proportioned to safely stand the working strain, they are by far the smallest and lightest motors of their class. They are designed to run at a high speed, and are arranged so that they can be started in less than a minute, and may be run independently of either gas or water mains. When operated by petroleum gas, they run with still greater economy than with ordinary illuminating gas.

These motors are preferably made vertical, to economize space and reduce friction. In our engravings, Fig. 1 is a vertical transverse section of a double cylinder engine; Fig. 2 is an exterior view of the same; Fig. 3 is a perspective view of a single cylinder engine; Fig. 4 is a similar view of a double cylinder engine; Fig. 5 is a vertical section taken on a plane at right angles to the plane of Fig. 1; Fig. 6 is a diagramatic view of the gas-producing apparatus; and Fig. 7 is a perspective view, showing the application of the motor to a boat.

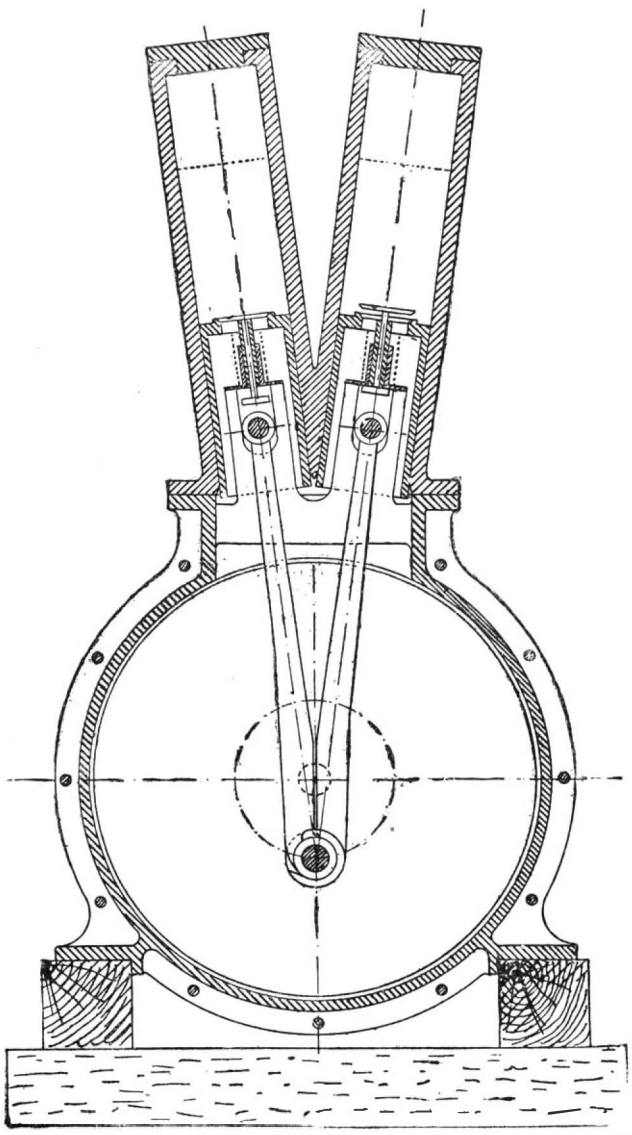


Fig. 1.—VERTICAL TRANSVERSE SECTION OF GAS AND PETROLEUM MOTOR.

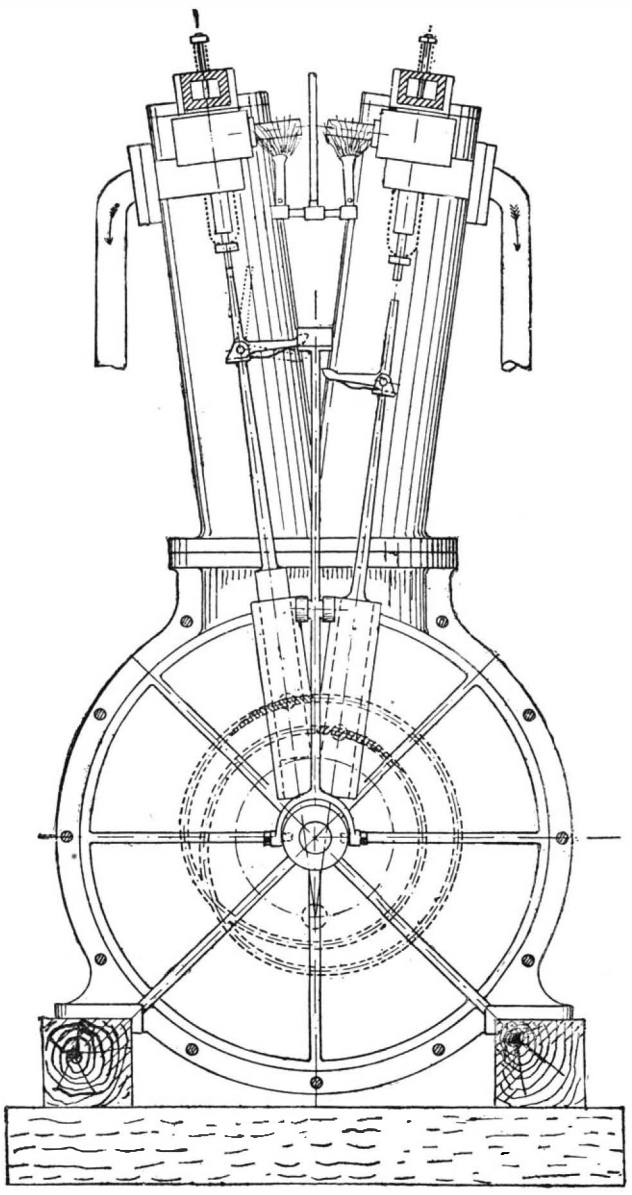


Fig. 2.—SIDE ELEVATION OF DOUBLE CYLINDER MOTOR.

The base of the motor consists of a cast iron gas-tight, circular chamber, with a valve inlet for combustible mixture or air. In the base are placed two disks, mounted upon the two sections of the main shaft and connected by a crank pin, the disks serving the double purpose of a crank and fly-wheels. In one of the disks is formed a double slip-cam groove, which passes twice around the crank shaft, and returns into itself. In this cam groove is placed a follower, which operates the valve gear so as to make every alternate stroke a working stroke.

Upon the base are mounted one or more working cylinders, according to the power required. When two cylinders are used, they are either arranged parallel with each other or joined at the base so as to spread out at the top, forming a slight angle, as shown in Figs. 1, 2, and 4. Each cylinder contains a piston furnished with a valve for the transfer of air or gaseous mixture from the base, the valve being provided with a fork by which it is operated. It will be observed by reference to Fig. 1 that both the connecting rods of both pistons in the double cylinder engine are received upon the same crank pin. The space in the upper end of the cylinder above the piston is the explosion chamber, with which are connected the inlet and exhaust valves. All the valves used in this engine are of the type known as poppet valves, these having been found in actual practice preferable to sliding or rotating valves. Every alternate stroke of the piston is a working stroke. During the upstroke of the piston, following the working stroke, a preliminary charge of air is drawn into the lower part of the working cylinder, from the crank chamber in the base, as the piston rises. At the same time, the upward movement of the piston forces the products of combustion from the explosion chamber through the exhaust valve, which is opened by the slip cam. During the following downstroke, the air in the cylinder below the piston is forced upwardly into the working part of the cylinder. At the same time a charge of combustible gas is admitted, and the following upstroke of the piston compresses the explosive mixture in the explosion chamber, forcing it out into the capsule, C, projecting from the inlet valve chest, and this capsule being heated by the burner, D, ignites the explosive mixture, the expansive power of which forces the piston downward. The ignition of the charge is retarded until the crank is on the dead center, by the introduction into the ignition tube of a charge of mixture weaker than that contained in the cylinder. The speed of the engine is controlled by a sensitive governor contained in the pulley, and arranged to intermit the admission of the combustible gas when the speed exceeds the normal. The movements of the piston, when no combustible mixture is introduced, resulting in simply compressing and recompressing the air contained by the cylinder.

By the order of operations adopted in this engine the power cylinder is emptied of most of the residual products of combustion and a purer charge of combustible mixture is used than possible with any other system. As a consequence the fuel, whether it be coal gas or petroleum vapor, is used to the best advantage and with the greatest economy.

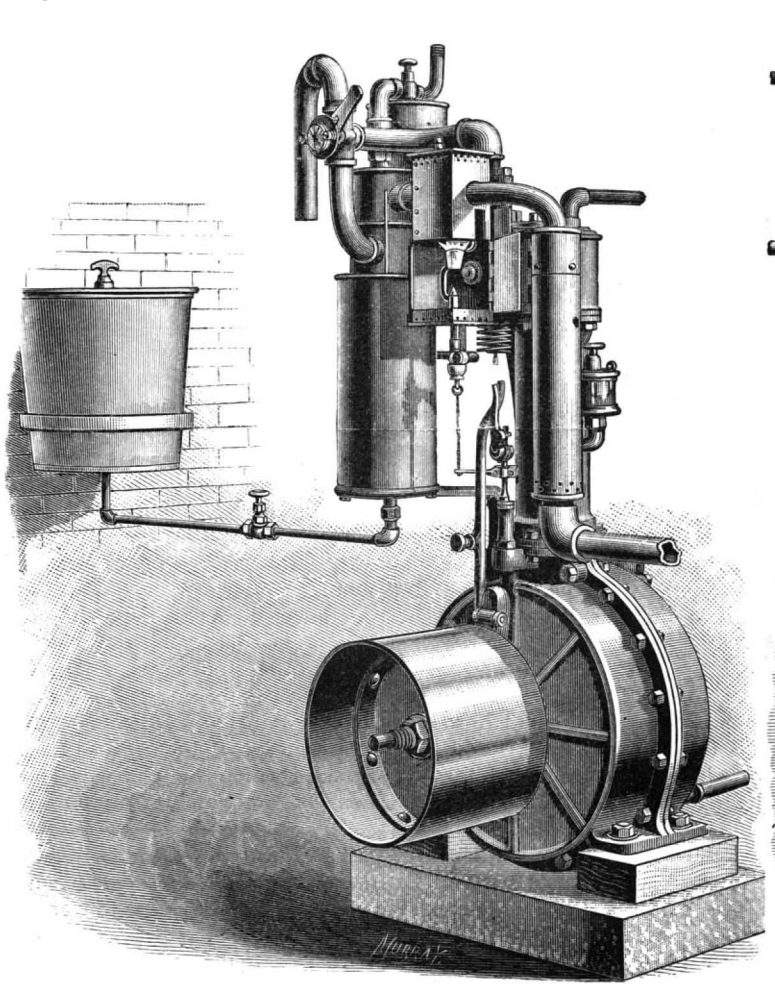


Fig. 3.—DAIMLER GAS AND PETROLEUM MOTOR.

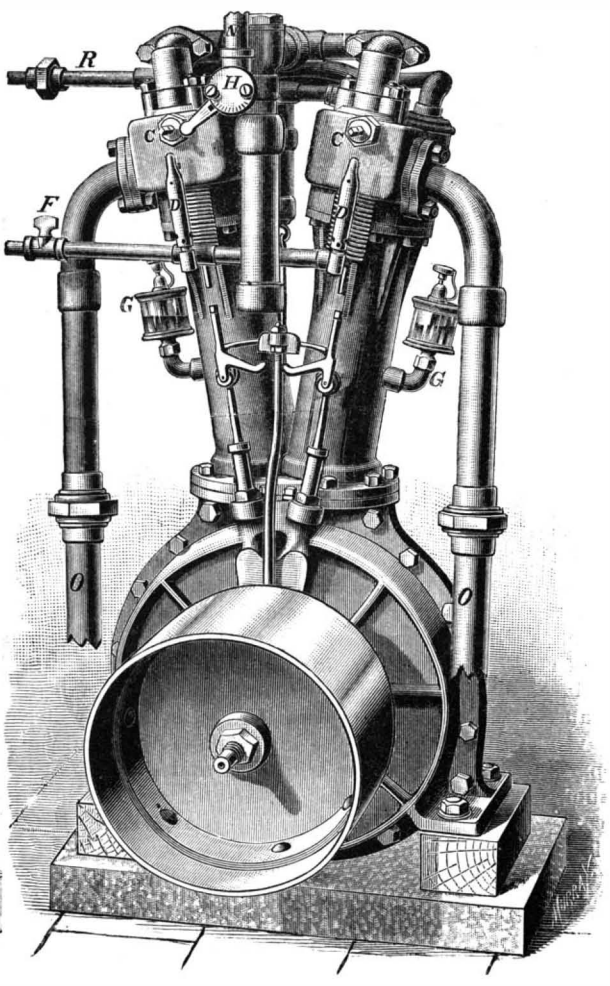


Fig. 4.—DOUBLE CYLINDER DAIMLER MOTOR.

The ingenious mechanism by which the necessary alternating motion of the valves is secured without the use of gearing is worthy of notice. In engines using gears for actuating the valves, the principal and most objectionable noise is the rumble and jarring of the gearing. In this engine there is no noticeable noise; in fact, it may safely be called a noiseless engine. The inclosure of the working parts in a casing contributes largely to this result. This construction also insures a rigid base, which is an important item in a gas engine when the power is developed in the cylinder almost instantaneously. Besides this advantage, the chambered base secures in a very simple way the perfect lubrication of all the working parts, at the same time confining the oil so that it is economized to the fullest extent without being scattered about where it is not wanted. The motor is lubricated by a single oil cup, G, connected with the lower part of the cylinder. The oil received in this manner falls toward the bottom of the casing, and is repeatedly thrown up by the revolving disks.

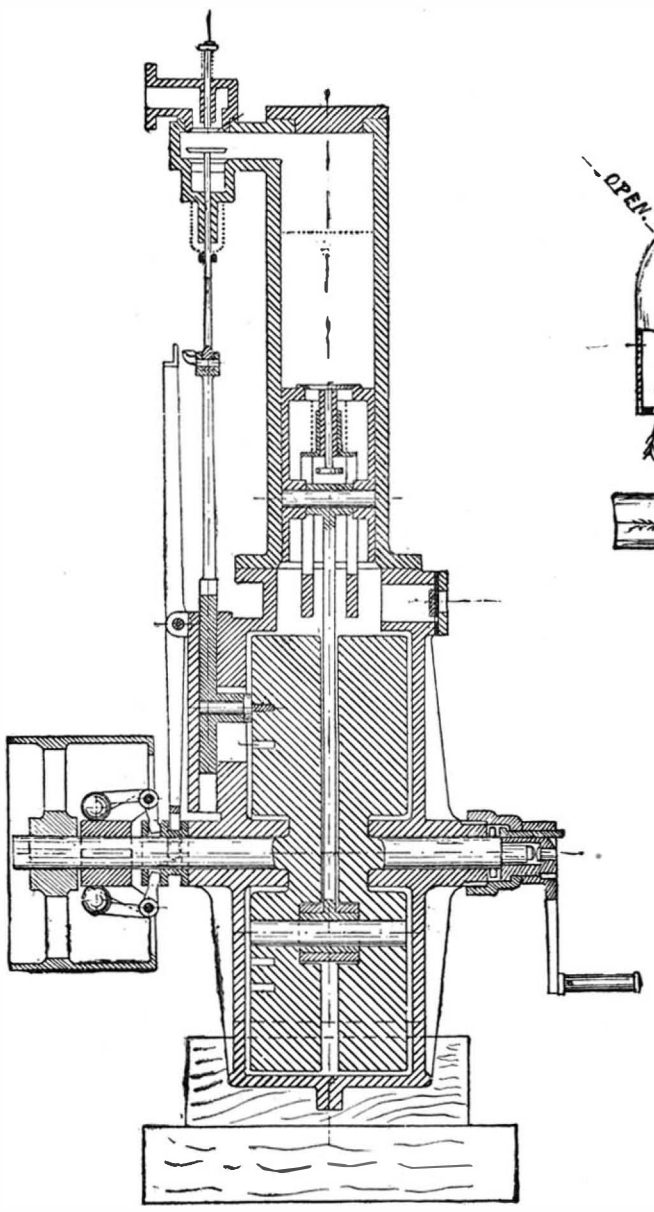


Fig. 5.—VERTICAL SECTION OF GAS MOTOR ON THE LINE OF THE SHAFT.

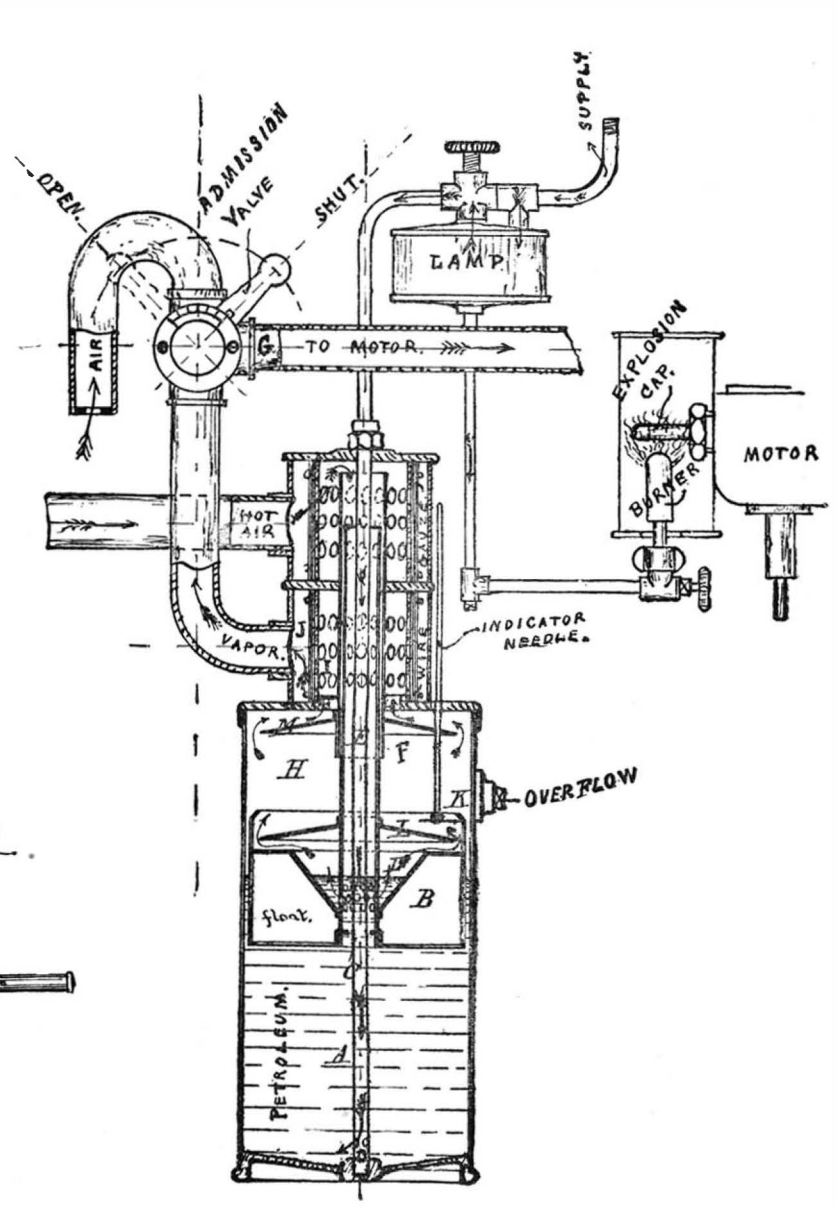


Fig. 6.—CARBURETING APPARATUS.

The explosion chamber is surrounded by a water jacket, and is kept at the proper temperature by a small quantity of water circulating through it, the water being taken from a tank and circulated by gravity in stationary engines, while in portable engines the circulation of the water is effected by means of a pulsometer worked by the exhaust.

By these simple means the necessary cooling of the cylinder is effected without any outlay for water in stationary engines, and without the consumption of any power in portable engines.

The motor is started by means of a crank handle on the main shaft, having a clutch which engages the shaft as the crank is turned in the act of starting the engine, and which automatically releases the handle as soon as the engine, after one or two turns, begins to run itself.

Where petroleum is used as fuel, the carbureter shown in Fig. 6 is employed. The lower part of the carbureting apparatus consists of a small petroleum tank, H, containing a float, B which rests upon the petroleum. The float is provided with a central funnel which communicates with the main body of the liquid in the tank through a small opening at the bottom, so that while the liquid is maintained at a constant level in the funnel, it is practically isolated from the main body of the petroleum. The float is provided with an air tube entering the funnel, and perforated below the surface of the petroleum. This air tube slides freely in a tube, F, attached to the cover of the apparatus and acting as a guide, allowing the float to rise and fall, according to the supply of petroleum. Hot air is admitted to the carbureter through the pipe attached to the upper part of the apparatus, the air being heated in its passage to the carbureter by the products of combustion, which pass through a jacket surrounding the air pipe, on their way to the open air. The carbureted air passes through the vapor pipe in the direction indicated by the arrow, and unites with a stream of air drawn into the motor cylinder through the admission valve, G. This valve is provided with a graduated scale, which facilitates the adjustment. It has also an automatically operating safety valve. The reservoir, H, is filled through a supply pipe extending down to the bottom through the air tubes and float. The supply pipe communicates with the lamp font, which furnishes the fuel to the burner which heats the ignition capsule.

The time required for heating the capsule and starting the motor is only a minute or so. The motor is stopped temporarily by shutting off the supply of combustible gas, allowing the ignition burner to continue burning, but for a complete stop the ignition burner is extinguished in addition to shutting off the gas.

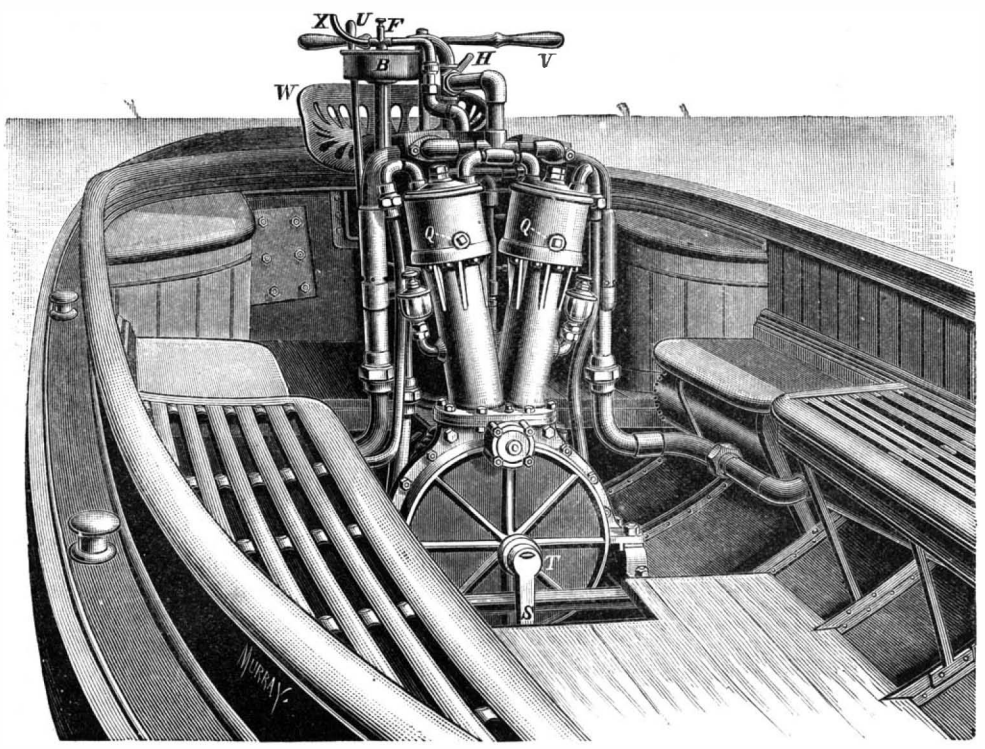


Fig. 7.—DAIMLER MOTOR APPLIED TO BOAT PROPULSION.

This motor is not only admirably adapted for all stationary purposes, but has been applied very successfully to the propulsion of small boats, to operating street cars and trolleys, and to road wagons and carriages. The smallest tramway in the world is operated in the streets of Cannstadt, Germany. The car is driven by a one horse power motor of this class. It will carry ten persons, and will run a mile in four minutes.

Boats driven by these motors are, during the season, in daily operation on Bowery Bay, north shore of Long Island City. Boats of the same class are running successfully on many of the lakes and rivers in Europe.

As this motor is readily supplied with fuel and is independent of water supply, it can be used in many places where a steam engine would be out of the question. It will undoubtedly be largely used for agricultural purposes, when it will find applications in thrashing, grain cleaning, wood sawing, feed cutting, churning, cider making, and in many other ways which will suggest themselves to our readers. It will also be welcomed by small manufacturers all over the country, who are in need of a motor of this kind. Many of these power users have been obliged to make use of animal, or even hand or foot power. Others have used small steam engines, which are proverbially troublesome. We imagine an engine of the class described will be gladly adopted by the small manufacturers who are remote from the great centers of business.

Another application of this motor will undoubtedly be to pumping water for irrigation, for filling house tanks, and for railroad water supply tanks.

It would be a difficult task to describe in detail the numerous uses to which an engine of this kind can be applied, but it is possible that for isolated electric lighting it may find greater use than in anything else to which power is applied.

This motor is manufactured by The Daimler Motor Company, Nos. 937 to 941 Steinway Ave., Steinway, Long Island City, N. Y., where motors from 1 to 10 horse power can be seen in actual operation. The New York office is at No. 111 East Fourteenth Street.

A MACHINE for making shoe strings out of paper is a recent Philadelphia invention.

Birds' Nests and Plants on Telegraph Lines.

It has frequently been found that birds, through their industrial instinct, are capable of offering impediments to telegraphic communications. The following are a few examples adduced by the *Revue des Sciences Naturelles Appliquées.* The American representative of our European woodpeckers, the green woodpecker of California (*Melanerpes formicivorus*) has now the habit of installing its dwelling and its innumerable storage places for food in the interior of the red cedar poles that support the wires of the lines of the western United States. A native of the mountains of Central America, this beautiful bird, of a dark green above and with a throat encircled with white, long ago spread throughout the western region of the United States without ever going beyond the territory of Arizona toward the east. Col. Clowry, an officer of the Western Union Telegraph Company, in a tour of inspection made by him in the far West, found that the summits of a large number of poles were deeply pierced by *Melanerpes* that had chosen a domicile therein. Performing its labor upon a height of about six feet, each couple of these birds forms two principal cavities, one above the other, with a space of about twenty-four inches between them, penetrating to the heart of the pole and communicating with the exterior by orifices of about three inches in diameter. The male, which occupies the upper cavity, keeps watch through small windows looking in different directions. The female and her brood occupy the lower story, which is of larger dimensions on account of the number of the inhabitants. Other holes of variable dimensions, widening toward the interior, are formed in vertical or oblique lines all around the top of the pole. These are the store houses in which the family of woodpeckers keeps various kinds of seed in reserve, the capacity of the cavity being proportioned to the bulk of the provisions that it is to contain. These holes, whose orifices measure about an inch or so in diameter, exist to the number of more than seven hundred upon each pole attacked, and it may be readily conceived to how great an extent they must reduce its duration, which usually reaches fifteen or eighteen years. The store houses are higher than wide, but their aperture, on the contrary, is wider than high, the object of this arrangement doubtless being to prevent the falling out of the seeds that they contain. This peculiarity of the *Melanerpes* (which are insectivorous birds) of accumulating seeds in the trunks of trees has long been known in America. So De Saussure, Sumichrast and several other authors had, by reason of this fact, considered them as granivorous. According to Clowry, the seeds are not eaten by the woodpeckers, but contain small larvæ upon which these birds feed.

A bird belonging to the family *Ploceineæ*, of the widow birds, forming large colonies in the south of Africa, at Natal, formerly saw its nests ravaged by snakes, which ate its eggs and young. The industrious bird had already displayed a certain architectural knowledge in the construction of its elegant nests, suspended from the branches of trees near dwellings. In making a new application against its dreaded enemy, it modified the plan of its aerial dwelling, the sole opening of which it formed in the bottom, directed toward the ground. The depredations of the snakes, which could no longer enter so easily, diminished without, however, ceasing. Seeing the number of tufted trees diminishing in the region, the birds began to suspend their nests from the telegraph poles; but, as the snakes found it difficult to ascend these perfectly smooth columns, the birds resumed their primitive plan and formed the opening at the side in order to have more easy access to it.

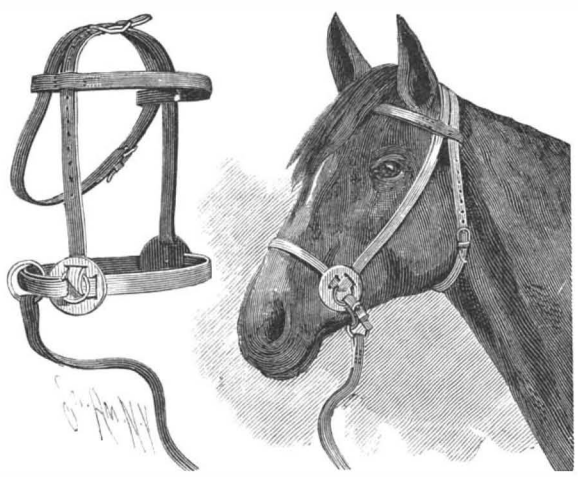
We now come to a new source of trouble in telegraphic communications, brought about this time by representatives of the vegetable kingdom. The telegraph wires radiating around Rio Janeiro are covered, it appears, with huge tufts of orchids hanging in festoons and garlands, and of a very pretty appearance without doubt, but which, by diverting the currents, cause frequent interruptions in the transmission of telegrams. The wind plays no part in this transplantation, which has birds alone for agents. These latter, being very fond of the capsules of the orchids, eat them in the forests, and the seeds, deposited upon the wires with their excrement, soon germinate and then vegetate in the most luxuriant manner.—*Revue Scientifique.*

The British Shipping Trade.

Many steamers have been laid up in northern ports. Other vessels are on their way home to lie idle, and it seems certain now that the winter will be a dull one in the shipping trade. All the reports from abroad speak of little demand and unpromising and unprofitable rates. The only vessels that seem to be doing any good at all are the newest and largest class of steamers supplied with the latest improvements of triple expansion engines. These are enabled to take large cargoes and make quick voyages as a rule, and as they are said to save about 15 per cent in the cost of fuel, there is no wonder that they can be kept working while others are altogether unemployed.

AN IMPROVED HALTER.

The illustration represents a strong, simple, and inexpensive halter, the size of which may be readily changed to fit it to the heads of different sized animals. It has been patented by Mr. L. E. Shippy, of Sandy Hill, N. Y. The check straps and nose strap of the halter are made of a single strip of leather, by means of a sliding engagement of such strip with two similar cheek guards, preferably made of stout leather, cut in disk form, and each having two slits, at nearly right angles to each other. The cheek strap passes down through one slit and out through the other slit to form the nose strap, a ring being placed on the strap at the fold thus made on the outer side of the cheek guard.

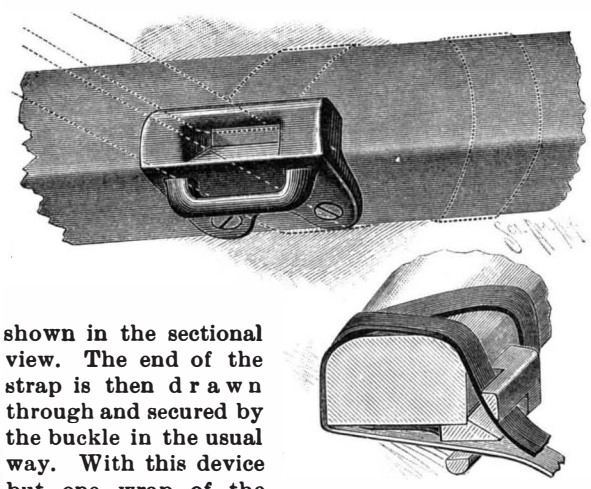


SHIPPY'S HALTER.

The nose strap passes in a similar manner through the cheek guard on the other side, and the two ends of the strap are united by a buckle at the top, whereby the two cheek straps and the nose strap may be lengthened or shortened as desired. Through the rings at the side of each cheek guard is inserted a curb strap, passing under the animal's mouth, and adjustable by means of a buckle, to draw the nose strap and cheek straps to proper position, the leading or hitching strap being attached to a ring placed on the curb strap. The end portions of the brow band of this halter loosely engage the cheek straps and the throat latch strap, such portions being folded and stitched to form elongated loops through which the straps slide.

A HOLDBACK DEVICE FOR VEHICLES.

The accompanying illustration represents a device whereby the holdback strap may be readily and firmly secured to the thill, and a "sulky hitch" accomplished with less length of strap than is usually required. It has been patented by Mr. Isaac H. J. Ellsworth, of Jackson, Mich. The device is preferably made of cast iron, and is secured to the under face of the thill by means of screws. The strap being secured to the breeching, its eyeleted end is passed through a slot in the bridge of the device, as shown in the perspective view, brought over and wound round the thill, and then passed downward through a slanting slot, the beveled face of which turns the end of the strap out, as



ELLSWORTH'S HOLDBACK.

shown in the sectional view. The end of the strap is then drawn through and secured by the buckle in the usual way. With this device but one wrap of the strap around the thill is required, and a neat, rapid, and substantial hitch is thus effected. For further information relative to this invention address the patentee, or Mr. L. C. Butler, West Bay City, Mich.

Growth of European Cities.

The census which has just been completed in Germany shows that the growth of cities is almost as rapid in Europe as in this country, and, in some respects, even more wonderful. Berlin has gone up past New York, with a population of 1,574,485. Hamburg, with its big suburb of Altona, has 715,170 inhabitants. Leipsic is credited with 353,272. Munich has a population of 344,899, and that of Breslau is 334,710. Cologne has 282,537 inhabitants; Dresden, 276,085; Magdeburg, 200,071; and Frankfort-on-the-Main, 179,850. In 1885, when the last previous census of Germany was taken, Berlin had 1,315,297 inhabitants; Hamburg and Altona, 410,404; Leipsic, 170,076; Munich, 261,981; Breslau, 299,405; Cologne, 161,266; Dresden, 245,515; Magdeburg, 114,298; and Frankfort-on-the-Main, 154,513. Such gains as are here shown can scarcely be matched by an equal number of American cities. The period between the two enumerations, it must be remembered, is only half as long as that from 1880 to 1890, which is used in all tables showing the growth of American cities, and yet while there are but four places in this country in which the increase in population has been as much as 120,000 in the last ten years, Germany has four cities which have increased from 121,000 to 259,000 each in five years. It is the same with some of the smaller cities. Magdeburg has gained about as much in five years as Detroit or Milwaukee in ten, and Munich is growing much faster than Cincinnati or San Francisco. The crowding into the towns which has caused so much comment in this country is found everywhere in the civilized world. Next year the census to be taken in Great Britain will show that not a few British cities have been gaining at an astonishing rate for old towns in a country where the population has long been dense. Even in ancient India the growth of the cities is out of all proportion to that of the country as a whole.—*Cleveland Leader.*

Phosphorescent Centipedes.

That there are luminous Myriopods has been known for many years, as also the fact that they occur only among the family *Geophilidæ* of the Chilopod Myriopoda. Both sexes are luminous, sometimes quite intensely so, and the luminosity spreads out over the whole ventral surface of the animal. If one of these Geophilids is taken up, the luminous matter communicates to the hand of the observer or to anything else with which the specimen comes into contact.

There is considerable dispute regarding the origin of this phosphorescent matter. According to Dr. R. Dubois, it is contained in the epithelial cell of the digestive tube, and the emission of the light depends on the moulting of the digestive tube. Mr. Macé, on the contrary, contends that the luminous matter is a glandular excretion, and that these glands (*glandes preanales*) are situated on the last two segments of the animal. Mr. J. Gazagnaire has satisfied himself that the luminous matter is secreted from glands situated on the sternal and episternal plates. Upon pressure these glands secrete a yellowish, viscous substance, having a peculiar odor and which is highly phosphorescent.

In a more recent article (*Mem. de la Soc. Zool. de France*, v. iii, 1890), Mr. Gazagnaire reviews all previous observations on luminous Geophilids, and finds that, so far as the European fauna is concerned, luminous specimens were found only between the end of September and beginning of November. The luminosity appears, therefore, only at a certain epoch in the life history of these Myriopods. Further, in all more carefully recorded cases, luminous specimens were never found singly, but always in pairs or in companies of three or more specimens. The few and fragmentary observations that have hitherto been made on the mode of reproduction in these animals seem to prove that the fecundation of the female takes place in autumn, or just at the time when the luminous specimens are found, and Mr. Gazagnaire is thus fully justified in connecting the appearance of luminosity with the excitement caused by sexual instinct.

In Algiers, Mr. Gazagnaire observed luminous specimens of *Orya barbarica* in the month of April, and he concludes that in other countries and in consequence of altered climatic conditions the period of luminosity probably differs from that observed in Europe.—*Insect Life.*

The Teredo.

The teredo is a nuisance and expense here, but the great Northwest coast, which tries in many ways to prove its superiority over California, in one respect at least carries off the palm, and that is in teredos. Captain Gibson, of the bark J. D. Peters, has presented this office with the section of a pile which was in a raft waiting to be used in the building of a wharf at Seattle. The pile had been in the water only thirty days, and when hauled out on the beach it was noticed the teredo had got in his deadly work, and the stick was, before it had ever been used, rendered worthless by this pest. The section referred to is about a foot in diameter, and contains by actual count 212 holes bored by this industrious wood worker. When the log was on the beach, it is said the little pests keep up boring, so that placing the ear near the pile, it sounded as if a sawmill was in active operation. With such an illustration of the futility of using wood for wharves, why is it that here and at the North some plan is not devised by city or State authorities to make permanent improvements on the water front of each city? Docks built of stone, though the first cost is greater, would in a very short time be cheaper than wooden wharves constantly needing renewal, and this section of a pile, which is on exhibition in this office, is an object lesson which merchants, tax payers, and particularly officials having charge of the wharves in this and other Pacific coast cities should study.—*Commercial News, Cal.*

PHOTOGRAPHIC NOTES.

A New Method of Mounting Prints.—The *British Journal of Photography* explains the following method of mounting prints on thick paper:

Part of the process consists in thoroughly damping the mount as well as the print, which in the case of a solid paper does not present the same difficulties as in the case of a built-up cardboard; while the mount is undergoing the damping process it is an easy matter to submit it to a little extra washing, or, if necessary, chemical treatment, in order to remove the impurities if such be suspected. Or the danger to the print may be at least lessened by applying a more or less impervious varnish to the mount, which, while not preventing the absorption of water, forms a protective coating when dry. Such a varnish is found in bleached lac dissolved in aqueous solution of borax. If this be applied to the paper mount before damping, it will dry without leaving any gloss, and when the mount is subsequently soaked any excess of borax will be removed, and when dry the impurities will be isolated from the print.

The method of mounting consists in immersing the mounting paper previously cut roughly to size in clean water, assuming that any necessary preparation has been already effected. When perfectly limp, the sheets are taken out of the water and, as required, blotted off between blotting paper. The wet prints are similarly treated, and then both print and mount—the latter over such part only as the print is to occupy—well impregnated with the mountant. If the print only be treated, it will in all probability peel off at the edges on drying. Nothing answers so well for mounting as arrowroot paste made pretty thick and allowed to cool, then squeezed through fine cambric to remove lumps. It should be used fresh, as it soon becomes watery, in which condition it loses its adhesive power.

A convenient plan for applying the mountant to the center of the mount consists in making a mask from stout, smooth paper, or perhaps, better still, from thin sheet zinc of the outside dimensions of the mount with a central aperture a little larger—say an eighth of an inch each way—than the print. If this be laid on the damp mount, the arrowroot is easily applied to the proper portions with a sponge, and the print can be laid down in its position before removing the mask. The narrow strip of arrowroot extending beyond the edges of the print may be removed by means of a damp sponge after the print is rubbed down, but this is scarcely needful, as it dries perfectly matt, and is only likely to show on a colored mount.

With regard to the rubbing down, this is not so simple a matter with gelatine-surfaced papers as with albumen or platinotype, but all difficulty is surmounted by interposing a sheet of the thin paraffine-wax-saturated tissue paper sold for wrapping or waterproof purposes. This, while it adheres closely to the gelatine surface during the rubbing, comes easily away from it when it has served its purpose.

We next come to the drying, which is the most important part of the process if perfection of result is desired. It will be noticed that in order to avoid "cockling" of the dried print the mount as well as the print has been moistened so that each may swell and shrink equally; but this is not alone effective. If left to dry alone, the edges of the mount will dry first, the extra thickness of the print-covered portion remaining damp for a considerably longer period, and taking a saucer shape from the contraction of the surrounding portions. To obviate this, the print as soon as mounted may be pinned to a flat board, or laid on a sheet of glass and the edges of the mount turned over and stuck at the back. But by far the better plan is to have a quantity of sheets of clean blotting paper slightly larger than the mounted prints. Let these be thoroughly dried by exposing them for some time in a hot oven, then packing in a mass, and wrapping in tinfoil until required.

The prints are allowed to become partially dry, but before they lose their limpness, or show any tendency to curl, they are taken singly and placed between the blotting pads, at least two sheets of drying paper intervening between each pair of prints. In the case of gelatine-surfaced prints a sheet of waxed tissue paper is also necessary. If the pile of interleaved prints be now placed under gentle pressure for a few hours, they will be found perfectly dry, and as flat as if they had been rolled. It only now remains to trim the mounts to size, and if desired, to apply a "plate mark" by giving the print a "squeeze" in a copying press between folds of paper or in the copying book, a plate of zinc of the proper size, and with its edges slightly beveled, being laid over the face of the print.

Such prints are equally suitable for framing, for binding, or for keeping loose in a portfolio. For the last two purposes, indeed, this method of mounting is more convenient than any others we have tried.

THE wire rope made by the Washburn Iron Manufacturing Company, Worcester, Mass., in 1890, for the Denver Tramway Company, Denver, Col., discounts the Glasgow cable. It is six miles long, and is made of crucible steel wire.

Correspondence.

"Was It a Telephone?"

To the Editor of the Scientific American:

I remember reading when a boy of the discovery of mining operations under the walls of a besieged town by the commander placing a cup of water on a drum head, and noticing the effect produced on the water by the vibrations of the earth beneath the drum and thus locating the exact position of the mine. May not this be the plan referred to in your article with the above caption in No. 4 of your paper?

T. J. W. R.

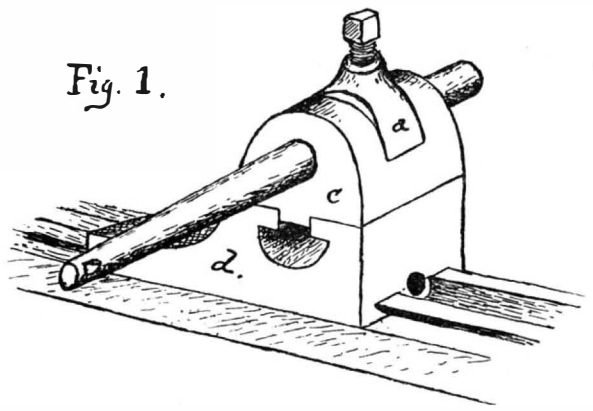
Washington, D. C., January 22, 1891.

A TOOL HOLDER THAT HOLDS.

To the Editor of the Scientific American:

Every lathe hand knows how exasperating it is to have a turning or boring tool slip while trying to fasten it, or, worse yet, after it has been set to work. It is a common thing to find a great many tool supports in the condition shown in sketch, Fig. 2. This is evidently one of the weak points of a lathe; no blame, however, should attach to the tool builders. The usual appliance is sufficiently strong for all ordinary purposes. It is when long tools are used, such as those for boring articles in a chuck, that difficulty arises in holding the tools securely. Not unfrequently ungainly braces or wedges are employed to prevent the tool from slipping. We remedied this defect on a lathe we were running a number of years ago. The sketch, Fig. 1,

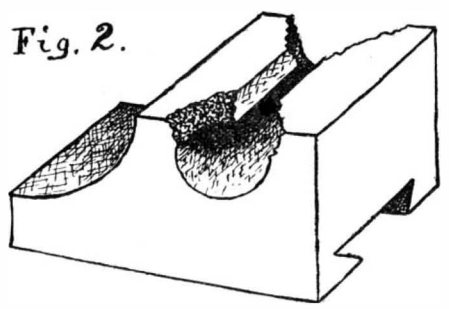
Fig. 1.



shows the contrivance employed. The block, *c*, was of cast iron, and the holder, *a*, of best refined iron, the lower end being gibbed into the rest, *d*, and a hole through the center sufficiently large to allow the boring bar to pass without touching, so that when the set screw was tightened, the whole was made fast to the lathe rest, *d*.

It was a source of satisfaction to know the boring bar could not swivel around and make a tapering hole.

Fig. 2.



The adoption of this device or something similar would save much trouble. It is difficult to duplicate a lathe rest, and almost impossible to repair one satisfactorily.

Chattanooga, Tenn., January 1, 1891. QUIRK.

An Ascent of Pike's Peak by Railway.

The autumn has been partially spent by your correspondent in the Rocky Mountains, crossing the "Great Divide," penetrating canons, climbing passes, prospecting gorges where walls soared thousands of feet above the beaten trail, traversing picturesque valleys, pausing at rich mining camps of gold and silver, visiting Indian reservations, in short, familiarizing myself with peaks, plains, lakes, rivers, canons, and mesas, the difficulty being, not where to go, but what to omit.

This mid-continent region, as is well known, possesses the finest scenery in the world.

But, after all, the most enjoyable experience was my ride to the top of Pike's Peak over the new so-called "cog wheel railroad," recently opened to tourists. It is the most novel railroad in existence. Compared with it, those of Mt. Washington, N. H., and of the Rhigi, Switzerland, are insignificant. The winding and curving necessary to attain three miles of altitude make the road ten miles in length. Its cost was a half million of dollars. The road bed is twenty feet wide, the culverts are of solid masonry, and the bridges and rails are of the heaviest steel, with a double cog rail in the center. The track is substantially anchored at short intervals into the solid rock.

The cars, without being tilted are hung within fifteen inches of the rails, and tire pinion brakes are so arranged that, when necessary, the train can be brought to a full stop in a space of ten inches, either ascending or descending. Each passenger seat is level.

The engine was coupled at the rear and pushed the train, a desirable innovation, relieving one's eyes from the constant annoyance of cinders. Stops were frequent at all sightly points. The round trip, costing five dollars, occupied three hours, and I considered it the best investment of time and money made during years of travel.

A brief chat with Sergeant O'Keeffe, in charge of the government signal station on the summit of Pike's Peak, elicited the following facts.

The gentleman having made the rude cabin on the peak his home for five years, and being the only person ever detailed twice to that station, his information may be considered reliable.

The lowest temperature he ever experienced was 57 below zero, the highest 62 above zero. The mean highest winter temperature was 14 below zero (all Fahrenheit).

The winter zephyrs were frequently of sufficient strength to cope with and blow through the whiskers of the most able-bodied man.

In one instance a speed of one hundred and thirty-five miles per hour was indicated, at which point the wind blew the balls out of the socket and the roof from the cabin, followed by a rapid increase in velocity, continuing several hours, during which he estimated that a speed of one hundred and fifty miles per hour was attained.

Bowlders weighing tons are not uncommon near the summit, and are frequently utilized for holding the cabin roof in position, for which purpose they are more effective than chains.

Sergeant O'Keeffe pronounces the thrilling narrative of the death of his associate while on duty at the station as pure fiction, no person of the name given having ever been employed there, and no death having ever occurred. He attributes the story to the effervescing but fertile brain of some Eastern scribbler, too far removed from the "seat of war" to invent a reasonable yarn.

W. Y. B.

The Anthracite Coal Fields of Pennsylvania.

BY JOHN H. JONES.

The anthracite coal fields of Pennsylvania are situated in the eastern part of the State, and extend about equal distances north and south of a line drawn through the middle of the State from east to west, in the counties of Carbon, Columbia, Dauphin, Lackawanna, Luzerne, Northumberland, Schuylkill, Sullivan, and Susquehanna, and known under three general divisions, viz., Wyoming, Lehigh, and Schuylkill regions. Geologically they are divided into five well defined fields or basins, which are again subdivided, for convenience of identification, into districts, as follows:

Geological Fields or Basins.	Local Districts.	Trade Regions.
Northern	Carbondale, Scranton, Pittston, Wilkesbarre, Plymouth, Kingston	Wyoming.
Western Northern	Bernice	
Eastern Middle	Green Mountain, Black Creek, Hazleton, Beaver Meadow, Panther Creek	Lehigh.
Southern	East Schuylkill, West Schuylkill, Lorberry, Lykens Valley	Schuylkill.
Western Middle	East Mahanoy, West Mahanoy, Shamokin	

The total production of anthracite coal in Pennsylvania during the calendar year 1889 was 40,665,152 tons of 2,240 pounds (equal to 45,544,970 tons of 2,000 pounds), valued at the mines at $65,718,165, or an average of 1.61\frac{6}{10}$ per long ton, including all sizes sent to market. In the above 35,816,876 tons is included unsalable sizes temporarily stocked at convenient points near the mines and tonnage loaded into cars but not passed over railroad scales, as well as waste in rehandling in the various processes of cleaning the smaller sizes. The quantity reported by the transportation companies as actually carried to market, which is the usual basis for statistics of shipments, was 35,407,710 tons during the year 1889; 1,329,580 tons were used by employes and sold to local trade in the vicinity of the mines, and 3,518,696 tons were reported as consumed for steam and heating purposes in and about the mines.

The number of persons employed during the year, including superintendents, engineers, and clerical force, was 125,229. The total amount paid in wages to all classes during the year was $39,152,124. The total number of regular establishments or breakers equipped for the preparation and shipment of coal was 342, 19 of which were idle during the year. Besides these, there were 49 small diggings and washeries, supplying local trade. There were also 18 new establishments in course of construction.—*Census Bulletin, No.* 20.

THE POPULATION OF JAPAN.—Official returns show that the population of Japan on December 31, 1889, was 40,072,020—20,246,336 males and 19,825,684 females—who occupied 7,840,872 houses.

DESTRUCTION OF ELECTRIC WIRES BY A SNOW STORM.

In the early morning of January 25, New York City and its immediate vicinity was visited by a snow storm which was very destructive of all kinds of suspended wires—electric light, telegraph, and telephone—the falling poles also doing considerable other damage, and temporarily interfering with travel to some extent, although no lives were lost. It had been raining the previous evening, but the rain changed to hail and then to snow shortly after midnight, with a high wind. The wind went down before daylight, but a heavy, wet snow continued to fall until about 9 o'clock in the morning, clinging to everything it touched, weighting down the branches of trees, and lodging on every abutment and in every crevice open to it, presenting everywhere spectacles of marvelous beauty. Such storms have always been especially dreaded by telegraph men, and in this case the wires soon began to feel the effects of the snow accumulating upon them. They constantly grew in size, until each wire became a great white cable, as large in many cases as a man's wrist. The tall poles from which the wires are suspended were not designed to support such weight. From the cross bars of some of them as many as two hundred wires are suspended, and, stout as they are, they soon began to lean over and break under their burden. The weakness or failure of one added to the load of its neighbors on either side, and there followed such a falling of poles, carrying electric light, telephone, and telegraph wires, as had never before been seen in New York City.

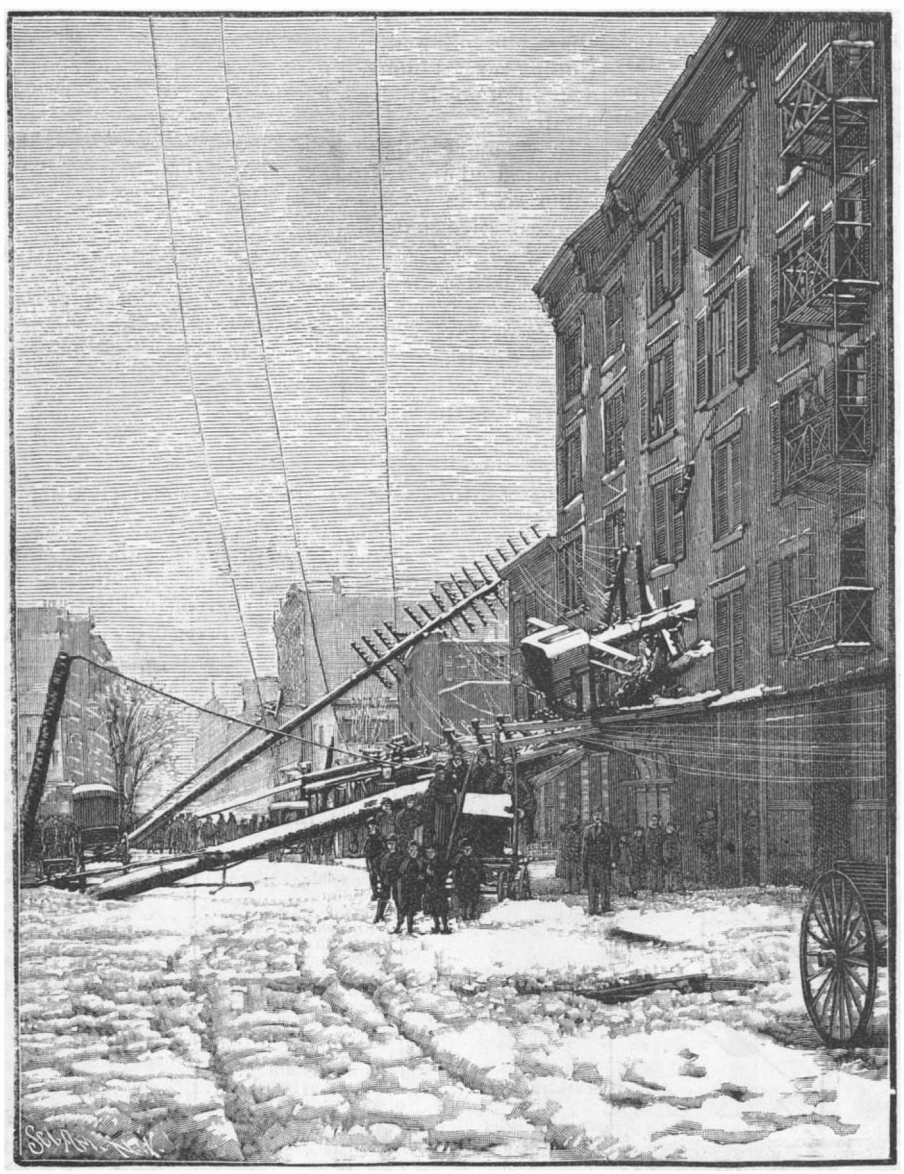
Our illustrations represent the scene presented by this breaking down of the poles, as seen from two different points on Thirty-ninth Street. The views are from photographs made just after the storm, by Mr. E. C. Slater, of the New York Society of Amateur Photographers. A branch telephone station and a telephone exchange being near by, many telephone wires ran through Thirty-ninth Street, and one of the views shows a telephone testing box on the upper broken-off end of a pole, the broken pole lying at an angle across the street against the side of a building, and thus supporting a mass of debris.

The falling poles in many cases broke off cornices, punched holes in the walls of budings, and smashed much glass, while it often happened that the apparent imminence of danger in a particular quarter drew groups of the curious, and seasonable warning was given to those who were threatened. The poles began to fall about 5 o'clock in the morning, when a large one snapped in two near its base and fell on the roof of the Fifty-ninth Street and Ninth Avenue Elevated railroad station. This pole pulled down others in succession, until not one pole was standing between Ninth and Eleventh Avenues, and the wires became tangled across the railway tracks, impeding travel until they could be cut away. From six o'clock until noon the poles fell in quick succession all over the city, and by Sunday night it was stated that not a single wire could be operated from the Western Union headquarters.

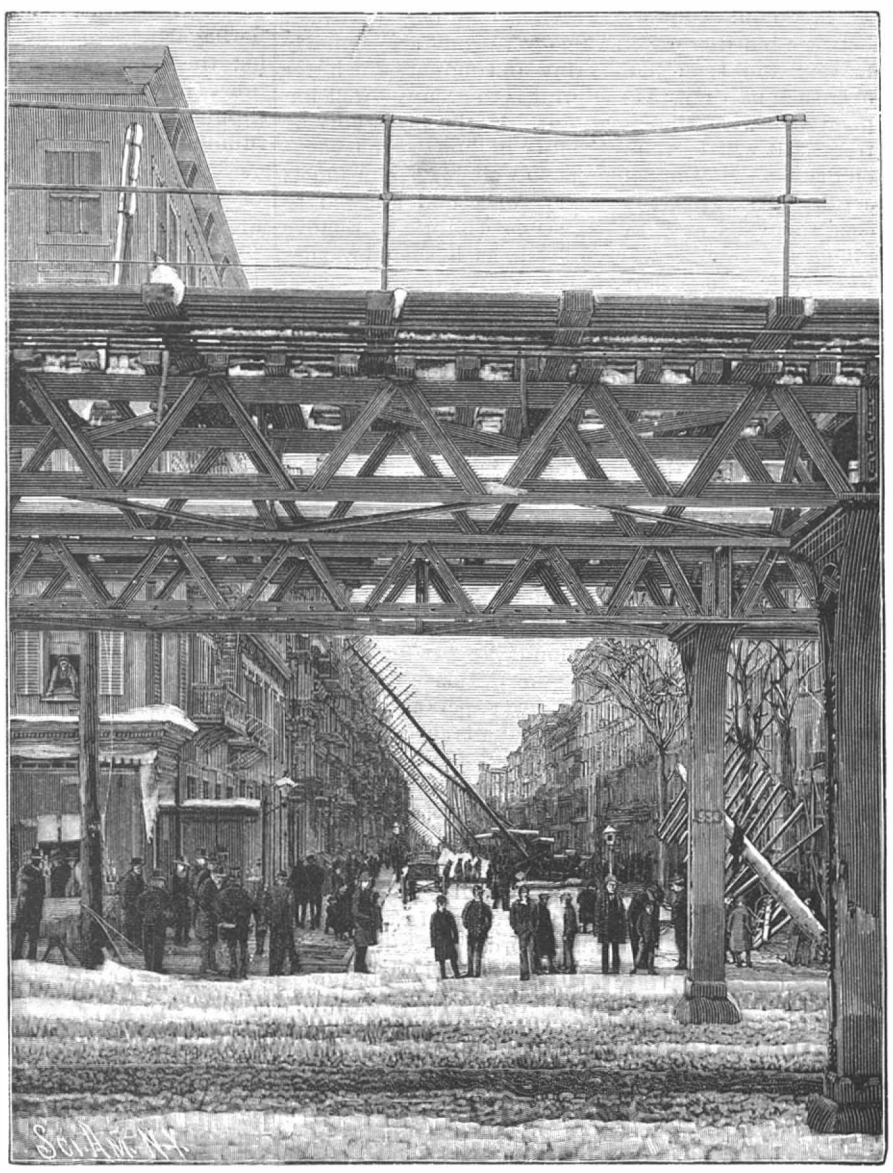
The electric light wires themselves, being mostly buried, escaped with comparatively little injury; but, from fear of accidents from crossed wires, orders were given early in the day, both in New York and Brooklyn, to shut off all current, and the greater portion of this service was thus disabled for two days. Had these wires, in themselves so heavy, been hung on poles, as was formerly the case, the destruction would have been much greater, and the companies, therefore, have to thank the city for compelling them to bury their wires, a work which was carried out only after the prolonged insistency of the authorities. The police and fire department wire service, by which every portion of the city has been thoroughly covered, was so completely paralyzed that patrols were organized to traverse the streets in many localities, and lookouts stationed on high buildings. In this respect, matters seemed as though we had gone back a quarter of a century, to the time when alarms of fire were rung out from a great bell in a tower just behind the City Hall, for among other temporary expedients, the fire department arranged to have fire alarms rung from the church bells in different parts of the city.

Actual figures as to the direct pecuniary loss thus caused are not obtainable. It has been estimated as high as $4,000,000. One company absolutely lost 3,200 wires, and partially lost 1,300 others; but all the sufferers are inclined to make their loss appear as small as possible, on account of the pressing demands made upon the companies so persistently of late years that all wires should be buried. It is extremely fortunate, if the term can be properly used in such connection, that this breakdown in all electrical service occurred on Sunday. Happening on a regular business day, and in some conjunctions of affairs, it may easily be seen how such a failure of the usual means of communication might have been the cause of great and widely extended disaster. This reason alone should operate to hasten the time when all trunk lines of communication between great cities will be placed beneath the surface.

THE underground system of telegraphs of the German empire has a total length of 3,600 miles, and has cost $10,219,000.



EIGHTH AVENUE AND THIRTY-NINTH STREET, LOOKING EAST.



NINTH AVENUE AND THIRTY-NINTH STREET, LOOKING WEST.

BREAKING DOWN OF ELECTRIC WIRE POLES BY SNOW.

Novel Scheme for Producing Rain.

Senator Farwell, of Illinois, proposes, after his term of office expires, which will be next March, to devote himself to the scientific work of trying to produce rain by the firing of cartridges of gunpowder or nitroglycerine high up in the air. During the last session, Congress appropriated two thousand dollars for carrying on experiments of the kind, but Senator Farwell does not intend to limit himself to this small sum, and will, if necessary, contribute from his own pocket such sum as may be necessary to complete the trial to his satisfaction. The main fact on which the theory of the experiments is based is the circumstance that heavy cannonading is often followed, after a day or two, by rain. Acting on this observation, attempts have been made at intervals, during the last hundred years, to produce rain by firing cannon, and producing concussions of the air in other ways, but without much success. Senator Farwell, however, says that, during the construction of the Central Pacific Railroad through the arid region east of the Rocky Mountains, where a great deal of blasting was necessary, it rained every day that there was blasting. For this reason he thinks that a sharp explosion of nitro-glycerine, produced high up in the air, would be more effective than cannon firing near the ground, and he proposes to send up balloons in the dry portions of Western Kansas and Colorado, furnished with torpedoes and slow matches, by which he hopes to obtain a concussion extending for fifty miles in every direction.

The *American Architect* thinks that while the scheme does not give a very great promise of success, it would be interesting to see the experiment tried and even partial success would be of great value. If the farmers of Colorado and western Kansas could get a shower once a week by sending up torpedoes every day, the result would be well worth the trouble, and there is plenty of reason to suppose that such artificial showers, by fostering the growth of vegetation, would in time produce the conditions which lead to regular natural showers, and the consequent permanent establishment of fertility throughout the region to which the process is to be applied.

THE commissioners appointed by the United States naval authorities to visit and report upon the nickel-bearing districts of Canada report that they are convinced, from the surface indications and the shafts already sunk, that the mineral cannot be exhausted by this generation. The deposits of nickel lie between walls of granite and diorite, and are easily to be distinguished.

THE FALL RIVER STEAMER PURITAN.

The Fall River line has no significance in its title relating to the city of Fall River, but takes the name simply for the reason that that port is the eastern terminus of the water route connected with the enterprise. The line itself is made up of 181 miles of water route—from New York to Fall River—and 49 miles of railroad, the Old Colony Railroad from Fall River to Boston, in all 230 miles of route, embracing in its direct ministrations the cities of New York, Newport, and Boston as terminal points.

The Puritan is the most successful achievement of the Fall River line and is the largest and finest vessel of the fleet.

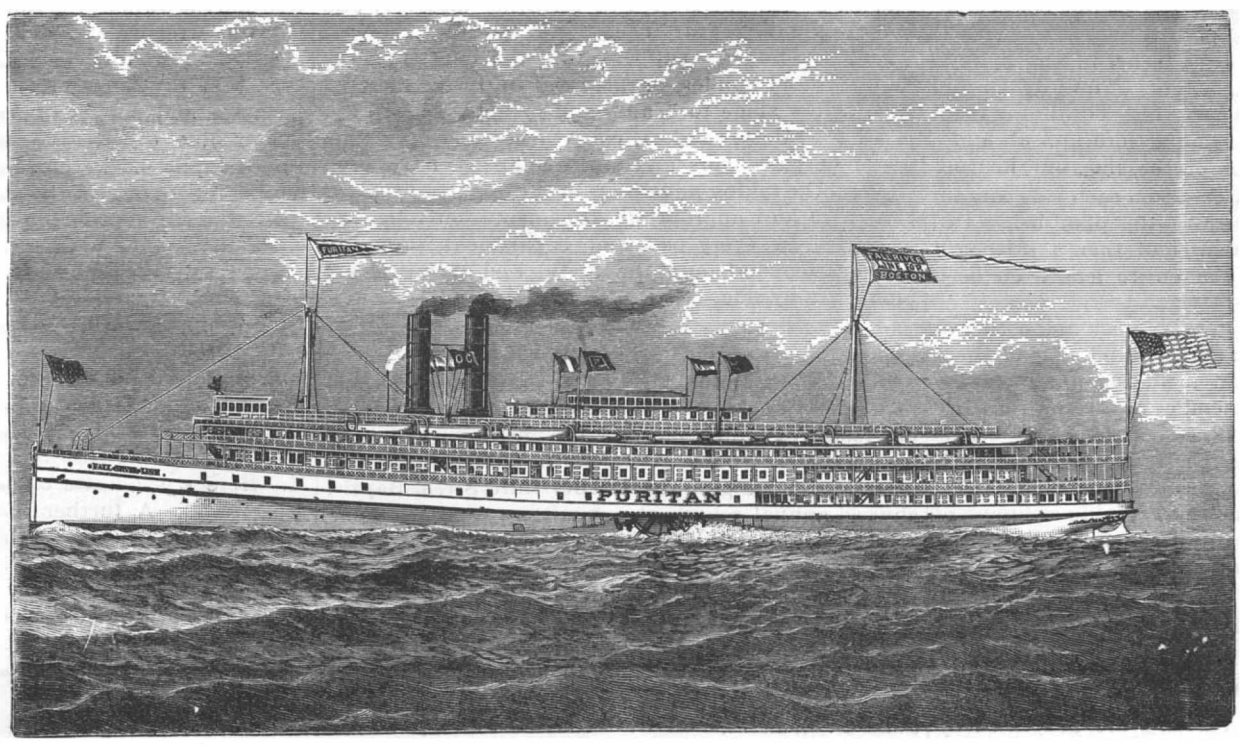
The model and general plans of the Puritan were designed by Mr. George Pierce, Supervisor of Steamers of the Old Colony Steamboat Company; the details of steel hull, etc., by Mr. Edward Faron, of the Delaware River Ship and Engine Building Company; and the hull was built at Chester, Pa.

Her principal dimensions are as follows: Length over all, 420 feet; length on the water line, 404 feet; width of hull, 52 feet; extreme breadth over guards, 91 feet; depth of hull amidships, 21 feet 4 inches; height of dome from base line, 63 feet; whole depth, from base line to top of house over the engine, 70 feet. Her total displacement, ready for a trip, is 4,150 tons, and her gross tonnage is 4,650 tons.

The Puritan is fireproof and unsinkable. She has a double hull, is divided into 59 water-tight compartments, 52 between the hulls and 7 athwartship bulkheads. In the fastenings of her steel hulls and compartments, there have been used 700,000 rivets, and she has upward of 30 miles of steel angle bar. Her decks are of steel, wood covered. Her masts are of steel, and hollow, to serve as ventilators, and are 22 inches in diameter. Her paddle wheels are incased in steel.

Steel, as a building material, has lately superseded iron in the naval world, and so it is that, in keeping with the progress of the age, the Puritan's hull is made of mild steel, which metal, weight for weight, is some 20 per cent stronger than iron, with 25 per cent reduction of weight, according to the best government tests.

Her wheels are of steel, and are 35 feet in diameter outside the buckets. The buckets are 14 feet long and 5 feet wide, each bucket of steel ⅞ inch thick, and weighing 2,800 pounds, without rocking arms and brackets attached. The total weight of each wheel is 100 tons. The two together are in the nature of enormous fly wheels for the machinery. The wheels are of the kind known as feathering, and the engine will drive them at the rate of 24 revolutions a minute. Her rudder is 14 feet 6 inches fore and aft, average height 13 feet, whole length of stock 18 feet. It is made of steel, filled with wood between the plates, and weighs nearly 30,000 pounds.



THE STEAMER PURITAN.

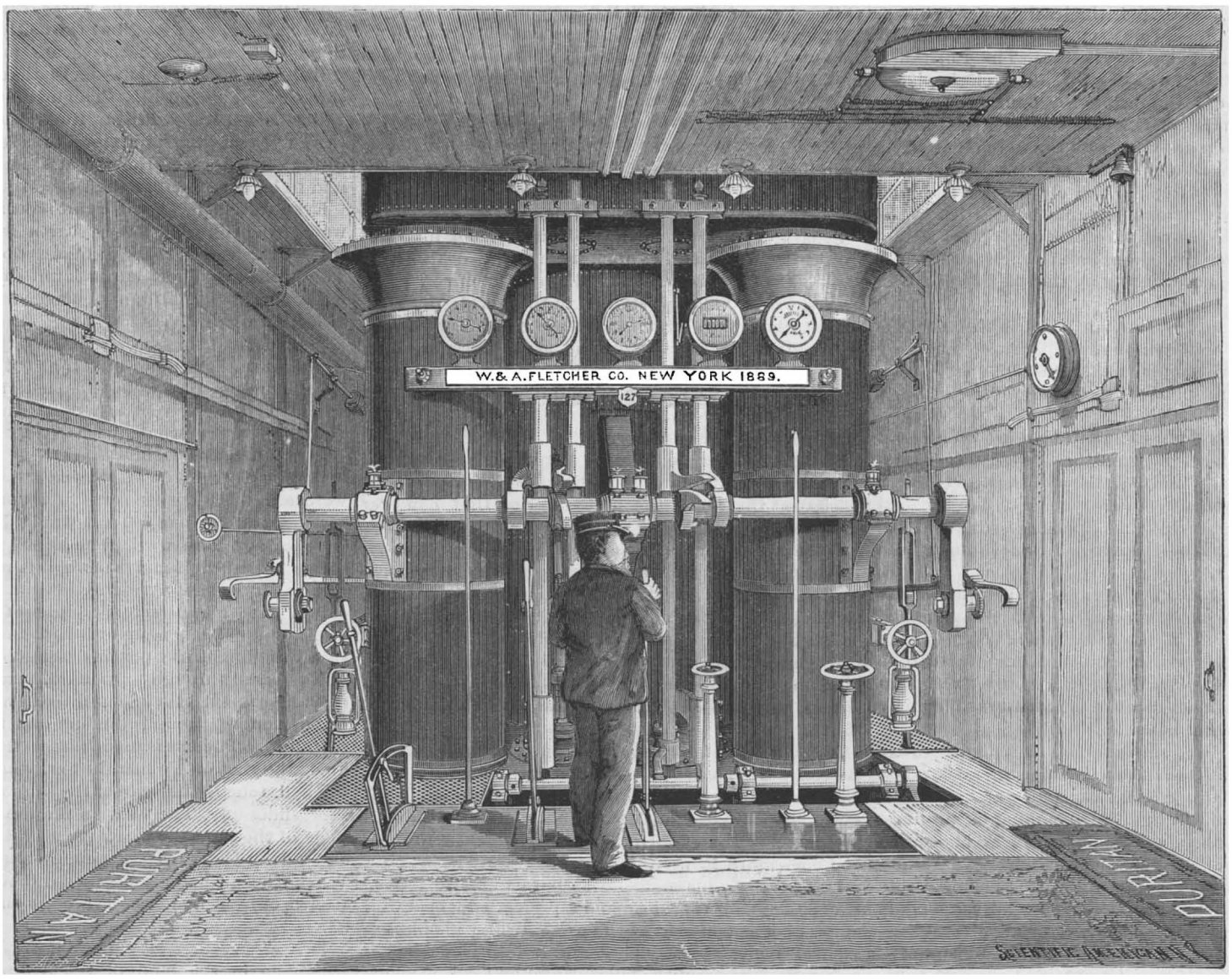
Of her machinery, boilers, etc., Messrs. W. & A. Fletcher & Co. (North River Iron Works) were the builders, and they were also the contractors for the building and completion of the ship in every part.

The Puritan has a compound, vertical beam, surface-condensing engine of 7,500 horse power. The high pressure cylinder is 75 inches in diameter and 9 feet stroke of piston. The low pressure cylinder is 110 inches in diameter and 14 feet stroke of piston. A horse and wagon could be driven through this cylinder, if laid on its side. The surface condenser has 15,000 square feet of cooling surface, and weighs 53 tons. Of condenser tubes of brass there are 14½ miles in the Puritan. Her working beam is the largest ever made, being 34 feet in length from center to center, 17 feet wide, and weighing 42 tons. When it is considered that the section of beam strap measures 9½ by 11¼ inches, one may get an idea of the enormous strain and the strength of resistance of this beam. The main center of the beam is 19 inches in diameter in main bearing. The shafts are 27 inches in diameter in main bearing, 30 inches in gunwale bearing, and are the largest ever made in this country. They weigh 40 tons each. The cranks weigh 9 tons each. The crank pin is enormous, the bearing being 19 inches in diameter and 22 inches long.

The gallows frame is of heavy steel plate, and by its angles easily supports the enormous working beam.

She has eight steel boilers of the Redfield return tubular type, and the maximum working pressure is 110 pounds to the square inch. Six of these boilers are 18 feet 1 inch in width and 15 feet 2 inches long; the other two are 10 feet wide and 14 feet long. Each of the wide boilers has two shells; the narrow boilers have one each, 7 feet 8 inches in diameter. The boilers contain 850 square feet of grate surface and 26,000 square feet of heating surface. The products of combustion pass through two superheaters, 8 feet 10 inches inside diameter and 12 feet 4 inches outside diameter, by 12 feet high; thence into two smokestacks, the top of each being 101 feet and 1 inch from the keel. The fire room is 78 by 12½ feet. There is a donkey boiler on the main deck for auxiliary purposes. Her steam steering apparatus has an engine of two cylinders, each 24 inches in diameter, 18 inch stroke. This engine alone is powerful enough for a big tug boat.

There are two centrifugal circulating pumps, each capable of throwing 10,000 gallons per minute. Besides these there are three other large pumps, with a combined capacity of 2,000 gallons per minute. Novel features are the three steam capstans, one forward and one on each quarter, used in docking the boat. Each capstan has a double cylinder engine, each cylinder 12 inches in diameter and 14 inch stroke. She has two Sturtevant blowers, furnishing fresh air for the fire room, each capable of 50,000 feet per minute. She burns about 120 tons of coal on the trip from New York to Fall River and back.



IN THE ENGINE ROOM OF THE PURITAN.

On the main deck the Puritan has an after cabin 82 by 53 feet, with floor space 72 by 24 feet. Still further aft is a ladies' private cabin, 42 by 27 feet. The dimensions of the social hall, or quarter deck, are 58 by 24 feet. The usual office rooms, barber shop and toilet, small baggage and coat rooms, etc., are arranged on this deck

in the most satisfactory manner. The freight deck contains about 80,000 cubic feet of space.

The forward cabin of the saloon deck is 76 by 22 feet, and the main saloon is 128 by 28 feet in measurement. The deck room forward, outside of the saloon, is 48 by 32 feet, and the deck room aft is 44 by 40 feet. The saloon or music room aft, on the gallery deck, is 64 by 24 feet, and the deck room outside is 48 by 36 feet. The continuous promenade outside the paddle boxes is afforded also on the gallery deck.

The dining saloon is 108 feet 4 inches in length, by 30 feet in width and 12 feet in heignt. The kitchen and pantry is 52 feet long by 20 feet wide. The dining room shows no racks or fixtures running fore and aft amidships, as in other steamers of the line, but, instead, arched spaces at regular intervals on each side contain elaborately finished sideboards, the plan being two sections of berths (concealed), and then a sideboard archway, alternating for the entire length on both sides of the saloon.

From stem to stern, and in every nook and corner of this ship, the electric wire is to be found. In all there are 12 miles of this wire, and including annunciators, fire alarms, etc., there are 20 miles of wire on the ship, and 12,000 feet of steam pipes. There are capacious gangways, grand and imposing staircases, heavy with brass and mahogany, lofty cornices and ceilings supported by tasteful pilasters, the tapering columns of which, in relief, flank exquisitely tinted paneling throughout the length of her grand and minor saloons. And over all this artistic work and exuberant coloring the incandescent electric light sheds its soft rays.

The electric light plant of the Puritan is very perfect. The system used is the Edison incandescent lighting, and it is furnished by the Edison United Manufacturing Company. The currents are generated by four dynamos of special type and construction, each having a capacity of 400 lights, or a total of 1,600 lights as a safety load, but capable of maintaining 1,850 lights if required. The dynamos are located in the forward part of the boat, under the officers' cabin. They are connected in pairs, the motor being supplied by two of Armington & Sims special double engines, of 50 horse power each, two of the dynamos being connected with each engine, and the two connected with each other by direct shafts, so that one or both dynamos can be used at will.

In connection with the electric apparatus is a most complete fire alarm system, with which, indeed, all the vessels of the Old Colony Steamboat Company are now equipped. The alarm relied upon is by thermostats. One of these thermostats is placed in every room, and at every point where there is the least danger to be apprehended from fire—an automatic fire watchman, at all times alert and ready for action. The Puritan is also fitted with watchmen's clocks. The clock placed in the captain's office indicates the hour and minute throughout each day of the year at which the 20 clock stations of the ship are visited by the watchmen. The connection between each station and the clock in the office is by electric wire, and the circuit is closed and registry made by the use of a simple key carried by the watchman. Thus any failure of duty by the watchman, through neglect, sleep, indifference, or for any reason, is revealed completely by the tell-tale clock in the office.

For fire fighting, the Puritan is equipped with the most thorough and complete apparatus, including steam and hand pumps, extinguishers, tools, etc. There are 50 connections to the steam pumps in different parts of the boat for fire purposes exclusively. She has three hand pumps, and these are of unusual size. She has eight Harkness fire extinguishers, and carries 175 fire pails and 36 axes, distributed through the ship at convenient points.

The life saving service and appliances of the Puritan are also of the best approved establishment and effectiveness.

As an adjunct of the life saving service, and for use in case the whole ship's company should be threatened, the Puritan carries a dozen 26 foot life boats, 12 life rafts and 1,400 life preservers. With all these provisions against disaster by fire or water, the claim that this ship affords the element of safety in traveling may fairly be made in her behalf.

The general style of the ornamental and decorative finish is that of the Italian Renaissance, the work raised and largely carved in wood, designs in white and gold, with liberal use of soft rich tints blending in the finest harmony, all ornaments pure and classic and no shams allowed. The raised work, consisting of garlands, friezes, scroll work, etc., is applied to ceiling, wall, door, or partition, to form the proper adjustments in relief.

Some idea of the immense amount of finish in the different departments may be obtained when it is understood that in the gilding alone, 185,000 gold leaves, each 3⅜ inches square, were used. In painting the ship, nearly 100,000 pounds of lead were expended.

The Puritan has in all 364 staterooms. These are in double tiers for the entire length of the main saloon and gallery decks, and upon the main deck there are 139 rooms. On the gallery deck there are 152 rooms, and for considerable area on this deck the staterooms are in treble tiers. This is made possible as the top of the wheels reaches only to the base of the gallery deck, thirty additional staterooms on either side being thus secured.

The sanitary arrangements of the Puritan are in accordance with the latest and most improved provision applied in the finest and most costly edifices on land, and are as near perfection as scientific discovery and invention have yet attained.

And let no one suppose that the efforts of the designers and builders of this great ship were directed with a view alone to beauty and magnificence. First of all the safety, comfort, convenience and accommodation of passengers and ship's company have been studied, the taking advantage of all opportunities for attractive and appropriate ornamentation following in order. In every part and department, provision matches demand, and the useful and beautiful are found side by side.

American Society of Civil Engineers.

The fortieth annual meeting of this society was held in this city on January 21 and 22. Some two hundred members, including most of the distinguished engineers of the vicinity, attended the sessions. At the first day's meeting, in the Twenty-third Street Baptist church, annual reports of committees were read, officers were elected, and general business was transacted during the first sitting. The treasurer's report showed receipts of $36,654.39, and disbursements of $34,089.03. The Norman gold medal was awarded to John R. Freeman, of Boston, Mass., for his paper on "Experiments relating to the Hydraulics of Fire Streams." The Rowland prize of $50 was awarded to O. Chanute, John F. Wallace, and W. H. Breithaupte, joint authors of a paper on "The Sibley Bridge."

"The following officers were elected: President, Octave Chanute; vice-presidents, Alphonse Fteley and Charles Hermany; secretary and librarian, Francis Collingwood; treasurer, John Bogart; directors, Chas. B. Brush, Rudolph Hering, Clemens Herschel, Edward P. North, S. Whitney.

"At the evening session the following committees gave their reports: On Compressing Cements and Settlement of Masonry, Uniform Methods of Testing Materials Used in Metallic Structures, Standard Rail Sections, Domestic Water Supply, Uniform Standard Time, Units of Measurement, International Engineering Congress, and Failure of South Fork Dam. A stereopticon description of the progress of the work of the Chignecto Ship Railway was given by John F. O'Rourke, of Amherst, N. S."

The next day, January 22, was devoted to the inspection of various places of interest in this city, Brooklyn and Jersey City. In the evening a reception was held in the rooms of the society, 127 East Twenty-third Street. The society has adopted the 24 hour notation of time. Its announcements of time include, therefore, such hours as 18 o'clock, 15 o'clock, and the like.

Horse Notes.

Senator Stanford received a dispatch from his California agent recently, announcing the death from rheumatism of his famous stallion Electioneer, probably the most valuable stallion in the world.

Just what his value was, says the *Amesbury Vehicle*, it would be hard to determine, as no price has been put on him for twelve years. He has earned as much as $40,000 in a year, though, and it would be safe to estimate his value at $200,000.

Electioneer was foaled in 1868, and was bred by Charles Backman, of Stony Ford, N. Y. Senator Stanford bought him of Backman twelve years ago for $25,000, at that time the highest price that had ever been paid for a stallion.

Since he came into Senator Stanford's possession, Electioneer's colts have sold at prices ranging from $3,500 to $18,000. Electric Bell sold at the latter figure before he was a year old.

Bell Boy had the most remarkable career of any of Electioneer's get. Senator Stockbridge took a fancy to him, and bought him from Senator Stanford for $5,000. He sold him for $35,000, and he was afterward sold for $51,000.

An extraordinary horse has recently been brought to Boston. He is a beautiful golden chestnut, with light mane and tail, white hind feet, and white face. He is seven years old, weighs 1,435 pounds, stands 16 hands high, and is three-fourths Clyde, one-eighth French, and one-eighth Printer.

Linus—that's his name—was born in Marion, Ore., May 20, 1883, and is considered a perfect and beautiful animal. The fact that at the present time his foretop is 8 feet, mane 8 feet 8 inches, and tail 12 feet 3 inches in length, is certainly wonderful, and makes him an extraordinary attraction.

No particular care or attention was given the horse until he was five years old, when his foretop, mane, and tail had increased so much in length that they reached the ground. At this time his owners commenced to put them in braids and bag them up. Some four months after it was braided the hair was loosened and found to have grown seven inches. On account of such rapid growth, the owners commenced to cultivate it, and it grew rapidly, and at the present time has reached the length mentioned above.

In the last twelve months the mane has grown 14 inches and the tail 16 inches, and both are still growing.

The horse commenced to attract considerable attention and the owners, the Rutherford Brothers, extensive Oregon cattle dealers, were induced to place him on exhibition in the town of Marion, Ore. Realizing, however, that the horse was peculiarly adapted for show purposes, and not having any knowledge of this particular line of business, they offered him for sale. Photographs of the horse were sent East, and a copy happening to attract the attention of C. H. Eaton, of the Eaton stock farm, of Lexington, that gentleman made up his mind to investigate.

The result was that Mr. H. W. Eaton made a journey to Marion. One sight of the wonderful equine convinced him of future possibilities, and in behalf of Eaton Brothers he made an immediate purchase of the longest haired (mane, tail, and foretop) horse in the known world. The price paid was $30,000 cash.

The horse was taken aboard the cars for Boston, and while in transit a stop was made at Albuquerque, N. M. Here a syndicate offered $50,000 for him, which was refused. A further inducement, in the shape of $1,000 for a three days' exhibition, was offered. This was also refused, and the trip to Boston was continued and finished after a journey of twenty-seven days.

The present owners of the wonder, the Eaton Brothers, are both horsemen, and are well known to all owners of thoroughbred stock throughout the United States. They have stock farms at Calais, Me., and Lexington, Mass.

At the Bottom of the Sea.

At the depth of about 3,500 feet waves are not felt. The temperature is the same, varying only a trifle from the ice of the north pole to the burning sun of the equator. A mile down the water has a pressure of over a ton to the square inch. If a box six feet wide were filled with sea water and allowed to evaporate under the sun, there would be two inches of salt left on the bottom. Taking the average depth of the ocean to be three miles, there would be a layer of pure salt 230 feet thick on the bed of the Atlantic. The water is colder at the bottom than at the surface. In many bays on the coast of Norway the water often freezes at the bottom before it does above.

Waves are very deceptive. To look at them in a storm one would think the water traveled. The water stays in the same place, but the motion goes on. Sometimes in storms these waves are forty feet high and travel fifty miles an hour—more than twice as fast as the swiftest steamship. The distance from valley to valley is generally fifteen times the height, hence a wave five feet high will extend over seventy-five feet of water. The force of the sea dashing on Bell Rock is said to be seventeen tons for each square rod.

Evaporation is a wonderful power in drawing the water from the sea. Every year a layer of the entire sea, fourteen feet thick, is taken up into the clouds. The winds bear their burdens into the land, and the water comes down in rain upon the fields, to flow back at last through rivers.

The depth of the sea presents an interesting problem. If the Atlantic were lowered for 6,564 feet, the distance from shore to shore would be half as great, or 1,500 miles. If lowered a little more than three miles, say 19,680 feet, there would be a road of dry land from Newfoundland to Ireland.

This is the plan on which the great Atlantic cables were laid. The Mediterranean is comparatively shallow. A drying up of 660 feet would leave three different seas, and Africa would be joined with Italy.

The British Channel is more like a pond, which accounts for its choppy waves. It has been found difficult to get the correct soundings of the Atlantic. A midshipman of the navy overcame the difficulty, and a shot weighing thirty pounds carried down the line. A hole is bored through the sinker, through which a rod of iron is passed, moving easily back and forth. In the end of the bar a cup is dug out and the inside coated with lard. The bar is made fast to the line and a sling holds the shot on. When the bar, which extends below the ball, touches the earth, the sling unhooks and the shot slides off. The lard in the end of the bar holds some of the sand, or whatever may be on the bottom, and a drop shuts over the cup to keep the sand in. When the ground is reached a shock is felt, as if an electric current had passed through the line.—*Ocean.*

THE *Electric Review* thinks it a poor place for the telephone in the land of the Arabs. They have no "hello" in their language. The nearest they can come to it is to throw a stone and hit a man in the back, and then ask him, as he turns around: "Does it please heaven to give you good health this morning?" There are some unscientific people who say they would prefer the stone in the back to a wrestle with the telephone on some exasperating occasions.

The American Slate Industry.

The superintendent of the census has lately published the report of William C. Day, prepared under direction of Dr. David T. Day, on the slate industry, from which it appears the total value of all slate produced in the United States in 1889 is $3,444,863. Of this amount, $2,775,271 is the value of 828,990 squares of roofing slate, and $669,592 is the value of slate for all other purposes besides roofing.

As compared with the census report of 1880, the slate product of 1889 is nearly twice as great in number of squares and in value.

Twelve States at present produce slate. A line drawn on the map from Piscataquis County, Maine, to Polk County, Georgia, and approximately following the coast outline, passes through all the important slate-producing localities. According to amount and value of product, the most important States are, in the order named, Pennsylvania, Vermont, Maine, New York, Maryland, and Virginia. In the remaining six States productive operations are of limited extent, and in the case of Arkansas, California, and Utah, of very recent date.

The twelve States referred to do not include all those in which merchantable slate is known to exist, since discoveries promising good results for the future have been made in a number of other States, among which may be specially mentioned Tennessee, where operations of production are beginning.

The Bangor region, which is entirely within Northampton County, Pennsylvania, is the most important. This region includes quarries at Bangor, East Bangor, and Mount Bethel, Pennsylvania.

The Northampton Hard Vein region is specially distinguished on account of the extreme hardness of the slate as compared with that produced in other regions of the State. This region includes the following localities: Chapman's Quarries, Belfast, Edelman, Seemsville, and Treichlers, all in Northampton County.

The Vermont and New York region includes an extensive slate formation occupying a part of the old Champlain Valley, lying between the western base of the Green Mountains of Vermont and the southern trend of the Adirondacks in New York. The area in which slate is actually produced at present is confined to a narrow strip in Washington County, New York, and a somewhat wider one lying next to it in Rutland County, Vermont. It extends from Castleton, Vermont, on the north, to Salem, New York, on the south, a distance of 35 or 40 miles, and has a maximum width of six miles, but the average is not more than a mile and a half. With the exception of red slate, the production of which is at present limited to Washington County, New York, the general character of the slate in Vermont and New York is the same.

The slate quarrymen of the country, and to a considerable extent the firms operating the quarries, are either Welsh or of Welsh descent, many of them having learned the methods of quarrying slate in the celebrated quarries of Wales.

The quarries are operated on an average of about 220 days in the year. The idle days are the result of rainy weather and holidays. The first day of every month is regarded as a holiday by the Welsh quarrymen, and no work is ever done by them on Saturday afternoons.

The average wages for the entire country paid to foremen or overseers is $2.48 per day; for quarrymen and millmen, $1.56; for mechanics, $1.64; for laborers, $1.27; and for boys, $0.76.

Sand on the Columbia River.

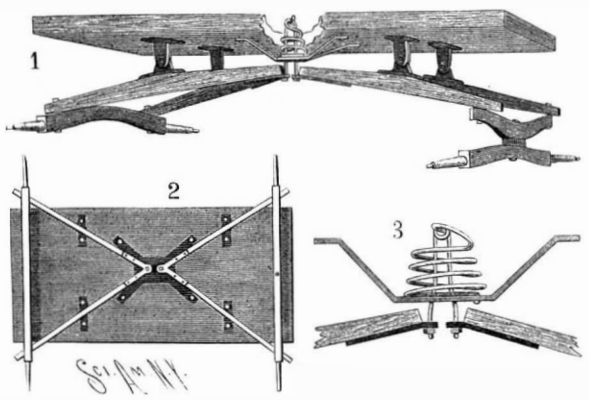
Sandstorms along the upper Columbia have long been a great source of annoyance and expense to the company operating the railroad through that section, trains frequently being delayed a day or more, at a time, from sand blown on the track. Heretofore no systematic effort has been made to get rid of the sand. A large gang of Chinese has been employed for years at an expense of about $18,000 a year, to simply shovel sand off the track, and pile it up on the other side in a most convenient place for being blown back again. In some places the sand was from eighteen to twenty feet high on each side of the track, the accumulation of years, and much of it has been shoveled over hundreds of times.

A scheme has been adopted for the removal of the sand by sluicing it into the river by means of water supplied by a force pump on the river, near which the road runs for a long distance. The scheme bids fair to prove a great success, as with a comparatively small pump the sand is washed into the river for four cents a cubic yard, and a larger pump is being sent to the front, by which it is expected that the sand can be moved for three cents a yard.—*Pacific Lumberman.*

ONE of the latest inventions in connection with the electric light is a silent cab call. Several clubs and hotels in London have already been supplied with this useful commodity. Two lamps are suspended outside the building, one red and the other green, and by pressing a knob in the entrance hall one or other of the lamps can be lit at will. The red light calls a four-wheeler, and the green a hansom.

AN IMPROVED CARRIAGE SPRING.

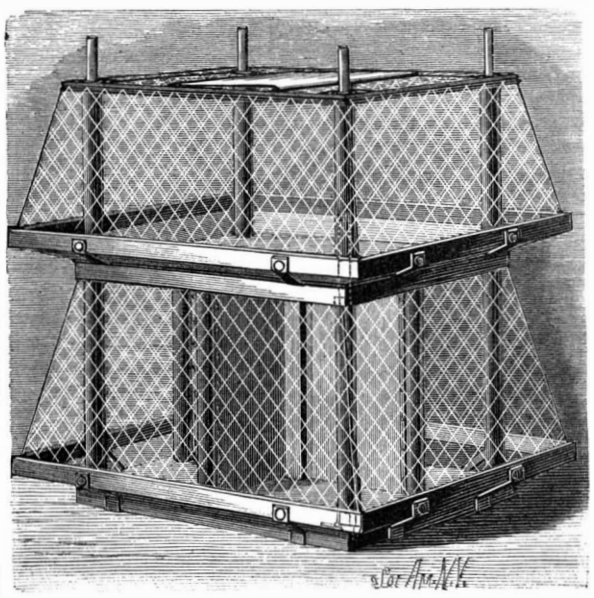
The construction shown in the illustration is very light, while with it the body settles evenly without regard to the placing of the load, does not tip when one gets in and out, and may be made of full width. It has been patented by Mr. Alfred Conner, of Exeter, N. H. Pivoted on the under side of the platform are four bearing arms or levers, whose outer ends are connected to the axles, and whose inner ends come together centrally under a spider-like supporting frame attached to the under side of the platform, as shown in Figs. 1 and 3, a conical spiral spring between the body and frame here connecting the inner ends of the bearing arms with the body. Any other suitable form of spring may be used instead of the one shown in the illustration. Fig. 2 is a bottom plan view showing the application of the invention. A vehicle in which this construction is followed is not liable to get out of order, and is designed to afford easy riding and obviate all rocking motion, while any tendency to upset in turning corners is materially lessened. With a heavy person on one end of the seat and a light one on the other, there will be no tipping of the seat to one side, the arrangement of the spring and bearing arms causing the body to settle evenly.



CONNER'S "CLIMAX" CARRIAGE SPRING AND HANGING APPARATUS.

A CRATE FOR SHIPPING AND EXHIBITING POULTRY, ETC.

A crate especially designed to safely carry and advantageously exhibit poultry, etc., and which may also be used for the conveyance of perishable articles generally, while, when not in use, it may be knocked down and packed in small compass, for storage and transportation, is shown in the accompanying illustration. It has been patented by Mr. Henry M. Bickel, of Larned, Kansas. The crate is made with opposite flat sides and beveled end sides, covered by wire netting, and has a detachable floor, on the outer edges of which are straps by which the floor may be connected with buttons on side strips. At the corners of the floor are beveled perforations, adjacent to which are hinged vertical posts, extending downward through the floor and upward through the ceiling of the crate, the upper ends of the posts being reduced in size, thus forming shoulders to support the ceiling, and means for connecting with supporting posts above, whereby any number of similar crates may be thus superimposed on each other, our illustration representing a double crate. The top of the lower crate has centrally sliding doors moving in slideways, and the top of the upper crate has a swinging door held closed by a suitable catch, whereby fowls, etc., may be conveniently placed and confined in the crate. Detachable posts are used in connection with the upper crates, and the floor of the bottom crate has a removable central post, which, with other posts near the edges of the floor, is adapted to support partitions of cloth or webbing, whereby the crate may be divided into such number of compartments as desired. The webs pass through slots in the center post, so that they may be easily regulated or moved. A detachable floor is also provided, of cloth or other flexible material, a strengthening rod or rib extending around its outer edge, adapted to fit within the side strips of the crates, this floor also having straps adapted to connect with buttons on the side strips. The crate shown, instead of being double, may be put together to afford one large interior compartment, with no dividing floor, the bevels from the top and bottom edges then giving a larger central horizontal portion. The network sides may also be made in globe form, the posts, supports, and side strips provided for in the construction admitting of application in the making of various shaped crates, as well as facilitating the nesting of them in such way as may be deemed desirable.



BICKEL'S KNOCKDOWN CRATE.

Stimulants for Pot Plants.

The successful florist has more faith in giving stimulants when the plants really need them than in keeping the roots buried in soil made rich and almost offensive by strong manure. When roots are few and the plants are almost at rest, the purer the soil and the less stimulant the plants receive, the better will they thrive when their roots come to draw up larger supplies of nourishment.

Moisture is needed to soften the soil and to allow the roots to extract nourishment from it, but when all the virtue is out of the earth and the plants begin to show signs of distress, all the watering in the world will not give vigor to the exhausted functions, but let a portion of guano or any well prepared manure be mixed with the water sufficient to color it, and let this be repeated at every watering instead of giving a much stronger dose at longer intervals, the result will be most satisfactory. The beneficial results obtained from manure water when judiciously applied to flowering and fruiting plants have long been recognized by cultivators, and its use is now becoming more general.

A valuable liquid is made by using ammonia, putting about one teaspoonful to two quarts water when watering the plants.

Plants require about the same treatment except in the matter of food. Ivies may be given plenty of warm water, but should not be stimulated with liquid manure.

Callas will bear stimulating to almost any degree. Give them an abundance of stable manure and warm water. Commercial fertilizers are of no value in creating blossom stocks.

Give your pinks a little lime water, but never stimulate them with guano or anything of the sort.

Give roses a little powdered charcoal or weak soot tea. If flowers do not mature well, they may be made to by placing a layer of powdered charcoal half an inch deep on the earth in the pot.

Commercial fertilizers or plant food should not be applied oftener than once in two weeks. Stir up the soil around the edge of the pot and sprinkle in a small tablespoonful of the fertilizer, watering the soil slightly immediately after.

All stimulants should be applied with care. Begonias are particularly sensitive to them, and they should be used but seldom on geraniums; but to roses, fuchsias, carnations, heliotropes, and others they may be given with more safety.—*American Rural Home.*

Telegraph Statistics.

The following comparative figures may be of interest:

Country.	Mlies of Telegraph Wire.	Messages per Annum.	Messages per Annum per Mile of Wire erected.
United States	776,500	56,000,000	72
France	220,890	30,050,000	136
England	180,000	50,000,000	277
Russia	170,500	10,280,780	60
Australia	105,300	12,000,000	114
Canada	58,500	4,027,581	69
Italy	19,500	7,000,000	360
Japan	16,500	5,000,000	303
New Zealand	11,375	1,835,394	161

Dentists' Moulding Wax.

Dr. P. David communicates to the *Journal de Pharmacie et de Chimie* an analysis of the composition known as "Godiva," or "Stent." Upon this he bases the following formula:

	Parts.
Stearin	25
Half-soft copal	25
Talc	50
Carmine	0·5
Oil of rose geranium	2 drops to the ounce

Melt the resin by the heat of a sand bath, and when slightly cooled add the stearin, stirring constantly. When this has melted add the other ingredients, previously intimately mixed, and stir so that a homogeneous product may be obtained.

The adhesiveness of the composition may be increased or diminished by modification of the amount of copal. A more thorough blending of the color may be insured by dissolving the carmine in a little potash solution before mixing with the chalk.

RECENTLY PATENTED INVENTIONS.

Engineering.

FURNACE AND PROCESS FOR TREATING ZINC ORES.—William West, Denver, Col. Two patents have been granted this inventor for means designed to facilitate the saving of all the metal in minerals composed of zinc and lead sulphides carrying gold and silver, for which purpose the roasting furnace is provided with a drying floor, in combination with leaching tanks and a blower, whereby the gases may be drawn from the drying floor and forced beneath a false bottom of the leaching tanks, and the zinc will be separated and recovered from the other metals as a sulphite, this being effected in a single economical operation, and the other metals left in good condition for further treatment.

STRENGTHENING DIKES. — Albert Q. Withers, Victoria, Miss. This invention covers an apparatus to facilitate forming a vertical channel in a levee or dike, filling the channel with a suitable grout, such as cement mortar, to form in the dike a vertical plate or wall of solid cement, the invention covering a novel combination of parts designed to afford a most efficient construction.

BOILER FURNACE. — Samuel Porter, Denver, Col. The grate of this furnace is mounted to turn, and the fire box and ashpit are transversely divided, while a water drum passes transversely through the fire box, with other novel features, designed to form a simple and durable construction, to insure complete combustion, and consume all smoke and gas.

Railway Appliances.

CAR BRAKE. — John Kinney, Philipsburg, Montana. By this invention a rod is mounted to slide on the end of the car and connected by a chain or rope with the brake mechanism, a lever or levers pivotally connected with the rod being fulcrumed on the car, to enable the operator to quickly set or throw off the brakes from either the side or the top of the car, the device being specially designed for box and flat cars.

FARE COLLECTOR. — Moses D. Greengard and Fradelshon Harris, St. Louis, Mo. This invention covers a casing with interior mechanism, to be carried by a conductor of a street car and presented to each passenger for the deposit of the fare, the construction being designed to prevent the extraction of money therefrom, or in any way tampering with it, without detection.

INTERLOCKING BOLT. — Thomas J. Bush, Lexington, Ky. The formation of this bolt is such that when its flattened surfaces come in contact with each other, all tendency of the bolts to turn is obviated, and adjustable sloping washers are provided for use therewith, to permit of a rail thus fastened to be adjusted to the proper gauge, while by slackening the nuts the rail may be removed and replaced.

BOLT MAKING DIE. — Thomas J. Bush, Lexington, Ky. This invention relates to a machine for making interlocking bolts patented by the same inventor, the bolt being faced off and recessed to form a locking shoulder, which is effected by compression without removing the metal, whereby its strength is not materially weakened.

Mechanical.

PIPE OR ROD CUTTER. — William Vanderman, Willimantic, Conn. This device has a body frame to which is attached a chain adapted to surround the article to be cut, rotary cutters being mounted in the links of the chain and an adjusting device connected with the frame, making a readily adjustable device adapted to cut pipes or rods of various sizes.

ARTESIAN WELL BORER.—Thomas H. Logan, U. S. Army (El Paso, Texas). Combined with a tube in which reciprocates a shank to operate an auger are dogs adapted to engage the well casing and hold the tube from rotary movement, with other novel features, forming a simple and durable auger, actuated by the weight of the connecting rods, to sink wells in rock, gravel, etc., without the use of water.

BRUSH TO CLEAN METAL CASTINGS.—Louis P. Mahler, New York City. This is a rotary brush with metal bristles arranged in bunches and having flexible connection with the brush core, whereby they will yield sufficiently to prevent their being easily broken, and will yet stand the strain of severe service.

PAPER MAKING MACHINE. — Heinrich Hoeborn, Hemer, Germany. In this machine the paper, in its passage from the couch rolls to the press rolls, is made to pass between two felts, and is guided in a broken line forming an obtuse angle to the press rolls, the same machine being designed to make paper of all kinds of materials, and of any desired thickness, from cardboard to tissue paper.

Agricultural.

CULTIVATOR. — Nathaniel F. Bloominger, Rochester, Ill. This cultivator is made with an improved shank, whereby, when the blade meets an obstruction, the blade will yield and be automatically carried rearward, being returned to its normal position when the obstruction is passed, thus guarding the share and the parts connected with it from liability to breakage.

POTATO DIGGER.—Augustus Leonard, Newell's Run, Ohio. This is an attachment designed to be quickly secured to the curved beams of an ordinary shovel plow, a digging shovel being bolted upon a short standard, the blade being of spade form and having its upper edge bifurcated, to disintegrate the soil and expose the potatoes, the device being very simple and inexpensive.

Miscellaneous.

CHAIR. — Henry U. Pohl, Saginaw, Mich. This invention covers an improvement in rocking chairs, providing means whereby the back may be readily set at different inclinations, and the chair so adjusted that the occupant can assume a comfortable reclining position.

HEAD REST FOR CHAIRS. — Isaiah D. Crispell, West Stockbridge, Mass. A block secured to the back of the chair has a rack on which is pivoted the head rest, while a handle lever is adapted to engage the rack and hold the head rest in adjusted position, the construction being specially adapted for use in connection with dentists' or barbers' chairs.

FIREPLACE HEATER. — Nathaniel A. Boynton, New York City. Combined with the body of the heater, its base and frame, is a novel arrangement of flues or passages for the escape of the products of combustion, including flues down either side of the body in front, whereby the heat is more thoroughly utilized within the apartment in which the heater is situated.

DENTAL MALLET AND RE-ENFORCING ATTACHMENT.—Dr. J. L. Mewborn, Memphis, Tenn.—Two patents have been issued to this inventor for a device he styles the "Mulley mallet," with which the old hand pluggers, burnishers, and chisels are used, no points or bits being required, but adapted to deliver 2,000 blows per minute on the hand plugger to condense the gold, or on the chisels, trimmers, and burnishers in the other work. The re-enforcing attachment takes the place of the bit in other mechanical pluggers, converting them into re-enforcing mallets, so that those who already have the electric or other pluggers may use this attachment with advantage, it being a cup-shaped tool to be inserted in the plugger to receive the end of an ordinary hand tool.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

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Notes & Queries

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Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in miud that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(2793) J. L. F. asks: 1. Would you kindly tell me how to make a gelatine pad, such as is used in offices for copying 100 or more letters from one original? A. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 438, and as below. 2. How to keep copying ink from running when used on wood, and exposed to the rain. A. It cannot be done while the ink retains its copying qualities. 3. The formula to make a transparent cement, used for pasting advertising labels on show windows. The cement is put on the engraved side, and water will not wash label from the glass. A. Attach with a solution of gum tragacanth and when dry varnish, or at tach directly with dammar varnish.

(2794) R. V. H. asks: 1. Is there any simpler form of hektograph than that described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 38? A. No; nothing could be much simpler. See also SCIENTIFIC AMERICAN, March 15, 1890, p. 166. 2. How is paste shoe blacking made? A. See answer to query No. 1704. 3. What is the composition of those so-called magical ink erasers? A. Possibly potassium binoxalate, or perhaps a mixture of tartaric and oxalic acids. 4. Is there any composition which if rubbed on softened stiff hats will restore the stiffness and brilliancy somewhat? A. Hats are stiffened by a solution of shellac in borax water. The solution can be made quite strong, but it never stiffens to the same extent that an alcoholic solution will.

(2795) E. E. asks: 1. Are sulphate of lime and oxide of iron harmless when taken internally, either separately or together, and what is the ordinary dose? A. They are harmless. Hydrated oxide of iron is administered as an antidote to arsenic poisoning. Sulphate of lime in large quanties might give rise to troublesome concretions. No dose can be prescribed. 2. Can you recommend a book upon the elements of chemistry, which can be had at a moderate price? A. We recommend Fownes' "Chemistry," $3.25, in cloth. We can supply others at lower prices.

(2796) How can the ravages of bookworms be stopped? A. It is said that the best method of putting a stop to the depredations of book worms is to take equal parts of powdered camphor and finely chopped tobacco, and then to sprinkle this mixture over the shelves. This operation should be repeated every six or eight months.

(2797) A. E. P. asks: What is the best thing to take out printer's ink from woolens and tweeds? A. It is almost impossible to effect. Benzine or chloroform may do it. Apply in a circle all around the spot, and gradually work in to the stain.

(2798) M. T. writes: I observed that gas would not burn on a cold day, in Omaha, Neb. Why was that, did the pipe freeze up, or was the pipe full of condensed moisture? A. The pipe was probably filled with ice condensed from the gas as water, and freezing in contact with the cold metal pipe.

(2799) G. M. P. says: Please inform me through the SCIENTIFIC AMERICAN whether or not you ever printed in the said paper any such notice as this: "That the government or any party offered twenty thousand dollars for a nut lock that would never become unscrewed," or words to that effect. A. We think no such statement was ever printed in SCIENTIFIC AMERICAN.

(2800) G. R. L. asks how to read an aneroid barometer. A. A very slight tap may be given before reading, to cause the index to reach its proper place. This is not always advocated, however. The figures may be for inches and decimals, or for millimeters.

(2801) F. J. G. asks: What chemical or compound is used by the so-called fire eaters to protect them from being burned? A. Dilute sulphuric acid, or a strong solution of alum.

(2802) J. E. F. asks what size wire the field magnet of Bishop's motor is wound with. A. No. 24.

(2803) A. A. H. asks how to amalgamate zincs. A. This is accomplished in several ways: 1. By dipping the zinc in dilute sulphuric acid and then dipping the end of it into a small quantity of mercury, afterward rubbing the surface with a brush. 2. Dissolve 1 pound of mercury in 5 pounds of nitro-muriatic acid (nitric acid 1 part, muriatic acid 3 parts), heat the solution gently to hasten the action. When a complete solution of the mercury is effected, add 5 pounds more of nitro-muriatic acid. The solution should be applied with a brush, as immersing the zinc in it is wasteful. 3. To the bichromate solution commonly used in batteries, add to every pint of solution 1 drachm of bisulphate of mercury or a similar amount of nitrate of mercury (mercury dissolved in nitric acid). By employing this method, the amalgamation of the zincs is maintained continuously after the first amalgamation, which must be accomplished by method 1 or 2. 4. In the Bunsen Grove, or Fuller battery the amalgamation may be accomplished by placing a small quantity of mercury in the cells containing the zincs. 5. Place a little mercury in a saucer with some dilute sulphuric acid. Dip the zincs into dilute acid. Then with a little strip of zinc or galvanized iron touch the mercury under the acid and rub it on the zinc. This will transfer a little to the surface, and a few minutes' rubbing will make the zincs as bright as silver. A very small globule of mercury is enough for a single plate.

(2804) J. F. B. asks: 1. Are the materials and processes in patent medicines patented, or only the name and trademark? A. The composition and the method of making may be patented. 2. How to find the safe working pressure of a boiler. A. Examine the boiler carefully for corroded places, go over it carefully with a hammer to ascertain if there are thin places, and finally subject the boiler to a test by hydrostatic pressure, which should be 50 per cent more than the working pressure. If no defects appear, the boiler may be safely worked to a pressure ⅔ that reached in the test. 3. Do the carbon plates for batteries need as much care in making and as long baking as the rods used in arc lights? A. The plates may be more porous than electric light carbon. They require the same baking. 4. Are the dynamos used for electric welding wound for high E. M. F., or heavy current strength? A. The dynamos for welding are generally made to deliver an alternating current of high E. M. F., which is reduced to a very low E. M. F. by the transformer. 5. What is the resistance of No. 26 copper wire? A. The resistance of 23·54 feet of No. 26 wire Am. W. G. is 1 ohm. One pound of the same wire has a resistance of 55·33 ohms.

(2805) A. L. asks what the ingredients are of stamping powder that is used by dressmakers in stamping embroidery designs on cloth. A. Powdered talc is good for marking cloth. For blue marks on white goods use ultramarine blue.

(2806) O. C. H. asks (1) how benzine or gasoline can be made so as not to have a disagreeable odor. A. Treat with cold solution of bichromate of potash and concentrated sulphuric acid, agitating thoroughly and allowing to settle. Decant, wash with weak alkali, followed by pure water, and if necessary distill, rejecting first and last portions of distillate. 2. Can it be colored red or blue? If so, what shall I use? A. For red, use extract of alkanet root. For other colors use oleates of the aniline bases. See SCIENTIFIC AMERICAN, vol. 63, No. 16, page 248.

(2807) S. E. H. asks how to prepare (1) a varnish, lacquer, or metallic compound with which I will be able to give a thin coat to a plaster Paris impression without heat and which will not peel off, but make a hard, smooth surface with no air bubbles, so that when a cast is moulded from it, the latter will come out very smooth. The article, if possible, should stand boiling water for an hour without change. A. Your requirements are too severe. Possibly by shellacking and subsequently japanning, you might effect your purpose, but we doubt it. We would suggest a trial of hydraulic cement for the moulds, made as smooth as possible, but unvarnished. 2. Please inform me if potash lye poured into clogged drain pipes will injure lead, iron, and glazed drain pipes by corroding the same, and to what extent? A. It will do no injury, unless on standing a long time.

(2808) E. S. F. asks: 1. Will you please tell me a good recipe for making a paste or gum that will make paper adhere to greasy cans? Something I suppose has to be added to the paste that will corrode the tin first. A. If the can is really greasy, remove grease by hot water. Use gum tragacanth in thick mixture with water for a paste. Also consult SCIENTIFIC AMERICAN, vol. 63, No. 15, page 227. 2. What essen-

tial oils can best be used to give an agreeable odor to flour paste? A. Oil of cloves. 3. Please give a recipe for a good mucilage, one that will keep? A. Gum arabic solution perfumed with oil of cloves. 4. When I make a gum out of dextrine, it is of a brown color. How can I make it white without disturbing its keeping qualities? A. Use pure dextrine. Filtering through bone black will tend to improve it.

(2809) M. M. asks: 1. What is the E. M. F. of a plunging bichromate battery with 2 carbon and 1 zinc plates 4×6 inches each? A. Very nearly 2 volts. 2. How many amperes of current will it give? A. On a short circuit of 0 resistance the battery would yield a current of from 4 to 8 amperes. 3. What is the voltage of the simple electric motor described in SUPPLEMENT, No. 641? A. It requires a current having from 8 to 12 volts E. M. F. 4. What is its current capacity and what part of a horse power will it develop with the battery mentioned? A. It requires a current of 6 to 8 amperes and will develop about ⅛ horse power under favorable conditions.

(2810) W. G. asks: Can you tell me 1. How I can clarify bleached shellac varnish, for use on drawings? A. Long settling might answer. 2. Also if there is anything better for the purpose than the above varnish? A. Try Canada balsam or dammar varnish thinned with turpentine, or if you wish an alcoholic solution, use gum sandarac varnish.

(2811) C. A. W. asks: 1. What would you dissolve phosphorus in, so you could apply it with a brush on a wall to have it illume up at night? A. Olive oil. Balmain's luminous paint is better. See SUPPLEMENT, Nos. 229, 249, 497. 2. What is the fastest printing press in the United States, and how many impressions will it take, and how many completed papers will it print a minute? A. The Hoe perfecting press; it will print and fold 500 eight page papers a minute, the size of the page being about 17 by 22 inches. 3. What pay does the average machinist get, and is that a good trade for a young man to learn? A. It would be hard to strike an average that would be worth anything; the wages vary from $2 to $5 a day. It is a good trade, but requires intelligence and hard work to get to the top. 4. How do you temper drills, so they will bore the hardest steel known? A. Heat to dull redness and plunge into a strong solution of zinc chloride. This hardening is only superficial and will have to be repeated after the drill is ground.

(2812) H. L. J. asks: Will you please inform me how to prepare canvas for oil painting? A. Nail the canvas on the stretcher, then give it a coat of thin glue size. Allow this to dry, then apply paint of the desired tint with a palette knife. The paint should have about the consistency of that sold in artist's tubes.

(2813) H. J. D. asks how to make white stain for the bottoms of shoes. A. Leather is bleached with a solution of oxalic acid. It is apt to injure the leather.

(2814) G. R. asks what the chemical ingredients are that are in the smoke emitted from soft coal. A. Principally carbon and vapor of water, with possibly minute quantities of hydrocarbons.

(2815) McF. & Co. ask: Why cannot water be made by gravity to run through a square coil of pipe, such as is sometimes used in the heaters when laid in a horizontal position? By pouring water in at the top it will not run out at the lower end. We think we know the air prevents it, but why does it? We certainly know the water is heavier than the air, and think that three inches or four inches of head should force both the air and water down and up through the returns of pipe and down out through bottom outlet, but it won't. We have tried it. A. A coil, either square or circular, with a number of turns, when laid on its side, forms a series of siphons, in which, if there is but one turn, water will flow through when the ends terminate on a level with the top and bottom of the coil. When there are two turns, the head where the water is poured in must be twice as high as the diameter of the coil, with three turns, three times the height and so on. The coil becomes a series of siphons, each siphon after the first, re-enforcing the preceding siphon by its own hydrostatic pressure. Thus the first coil or siphon overflows and the water drops to the bottom of the second, and seals the air in the down leg and forcing the water up the next leg, the air remaining in the down leg, and so on through a series, each upward leg of water adding its quota of hydrostatic pressure to be overcome by adding to the height of the water inlet.

(2816) T. P. A. writes: Suppose the + wire of an incandescent circuit is grounded, the — wire being perfectly insulated, does any current go to ground? If not, what is the object of ground detectors? A. If one wire is grounded and the other is perfectly insulated, there would be no circuit, and as a consequence the current would not flow. Perfect insulation, however, is impossible. With the best there will be a small leakage, but this is negligible. The object of a ground detector is to determine when both branches of the circuit are grounded to such an extent as to interfere with the working of the circuit. 2. I have been told I could get a shock by grounding, say + wire, the — being perfectly insulated. I say no. What do you say? A. Generally enough of the current will find its way to the ground by leakage to give a serious shock. In the case of some arc light circuits, a ground connection through the body has proved fatal.

(2817) G. R. asks: Between what ages can a boy serve as a "page" in the national House of Representatives? What is the salary paid, and do they get pay monthly, whether House is in session or not, and about how many pages are required in that House? A. The House of Representatives has thirty-two pages, who get $75 per month during the session, nothing when House is not session. A boy is eligible at 12 years of age and can remain as long as he has a good political backing up to 24 years of age.

(2818) F. F. V. asks: If 25 open gas jets are burning to the best advantage in a room 18 by 18 feet, and the same amount of gas is burnt in an improved gas stove, in a room the same size, will the temperature register the same in both rooms, and if so, why? And if not, why? A. There will be but little difference in the total amount of heat. The gas jets would overheat the top of the room, while the gas stove would equalize the heat by heating the air near the floor, and would also produce a general circulation and equalization of the heated air throughout the room. The thermometer, if hung high, would indicate in favor of the gas lights.

(2819) J. R. asks: How are plans for exterminating Australian rabbits entered for the prize with the New South Wales government? A. Address Hon. F. Abigail, Sec. for Mines, Sydney, New South Wales.

(2820) J. A. W. asks: 1. Can you furnish me with a book containing the recipes for making gold, silver and nickel solutions? A. We supply Watt's "Electro-Deposition of Metals," $3.50 by mail. Also see SUPPLEMENT, No. 310, for a very good article on the subject. 2. Can you furnish me with a recipe for coating brass that will wear well and withstand the action of hot potash and cyanide of potassium? A. This is almost an impossibility. You might cover with an India rubber tube, or even deposit India rubber on it by deposition. This would have then to be vulcanized, preferably by treatment with chloride of sulphur dissolved in naphtha, followed by heating toward the boiling point of water.

(2821) H. H. writes: Can you give me a receipt for an ink (waterproof) that will do just as well for drawings as the so-called India ink? A. We recommend you to rub up India ink in a solution of shellac in borax water. If it were not for its corroding qualities, an ammoniacal solution of shellac would give an absolutely waterproof vehicle for India ink.

(2822) C. L. H. asks: I am a stamp collector wishing to know how to make adhesive paper to hinge stamps in an album. A. Nothing is really better than solution of gum arabic just perfumed with oil of cloves. Postage stamp mucilage has often been published, as follows:

Dextrine	2 parts.
Acetic acid	1 "
Water	5 "
Alcohol	1 "

(2823) J. V. D. writes: I have a quantity of cider that has taken up a taste from a cistern coated with tar. Is there any way by which the taste can be removed or neutralized? A. Try placing a bag of bone black in a sample of the cider. Success is doubtful.

(2824) A. B. asks how to cement polished glass to cast iron (planed smooth). I have tried Major's cement; it sticks good, but in taking it off with hot water, small pieces of glass break off and spoil it. I wish to know if there are other cements that will hold as tight as Major's, but can be removed without injury to the glass, and how to do it. It must be a liquid cement. A. Soak fine white glue or gelatine in water over night. Pour off the surplus water and add molasses equal to about 25 per cent of the bulk of glue. Heat gently and stir until the mixture is formed. You can vary the proportion of molasses to suit. Glycerine may be used instead of molasses.

(2825) A. W. B. asks: 1. What causes the singing noise that is heard on telegraph poles? A. The noise is due to the vibration of the telegraph wires, produced by the movement of the air. 2. Has alcohol ever been frozen? If so, at what temperature? A. Alcohol has been rendered viscid by low temperature, but never solidified. 3. Can the simple electric motor be arranged to produce the electric light, and how? A. Yes. By using a cast iron field magnet and winding the magnet and armature with No. 20 wire. 4. What is the best work on physics? A. It would be difficult to say which is best. For the advanced scholar, Daniell, Ganot, or Deschanel can be recommended, while "Experimental Science" is suited to all interested in physics. 5. Are the paper conductors in the simple Holtz machine placed on the same side of the apertured disk, and next to the revolving disk, when they are in position? A. They are both on the side of the disk remote from the revolving plate.

(2826) M. A. H. writes: What number complies with the following proposition: That if 5-7 of its $^{2}\sqrt{}$ be multiplied by 9-12 of 5-10 of its $^{3}\sqrt{}$ and then add 4543542399999·5227344295 to the product, and then extract the $^{5}\sqrt{}$ of the result, then divide by 20 and add 13 to the quotient, the final result is equal to 30? A. The easiest way is to commence at the bottom and work upward as far as possible. Thus 30—13=17=the quotient last named. Multiply this by 20, giving 340, which by the statement is the 5th root of the sum of the long number given (4543542399999·5227344295) and of a certain other number. Then 340^{5}=4543542400000. From this the given number must be subtracted, giving 0·4772655705. By the conditions $5\text{-}7x^{\frac{1}{2}}\times 9\text{-}12\times 5\text{-}10\times x^{\frac{1}{3}}=0{\cdot}4772655705$. The first member of the equation reduces to $225\text{-}840x^{\frac{5}{6}}$ and the whole equation reduces to $x^{\frac{5}{6}}=1{\cdot}78177813$. Solving, preferably by logarithms, we find $x=2$.

NEW BOOKS AND PUBLICATIONS.

ELECTRICITY IN DAILY LIFE. Illustrated. New York: Charles Scribner's Sons. 1890. Pp. xv, 288. Price $3.

The articles on electricity which have appeared in Scribner's Monthly Magazine during the past year are here collected into book form, producing a volume similar in its way to American Railways, produced by the same firm in the same way. The reputation of the authors of this work and the choice of topics are the best guarantee of its excellence. The illustrations are of the quality familiar to the readers of the magazine, and are also very numerous and pertinent to the subjects treated. It forms about as good a popular presentation of the subject as has yet been put before the public.

The Illustrated American.—This beautiful weekly publication, which is now issued in an improved form, so as to bind into conveniently sized volumes for the library, continues to be of as fine quality as ever. The issue for the week ending January 31 has, as opening article, the Geo. I. Seney collection of paintings, with an excellent portait of Mr. Seney. Many of the pictures of the celebrated collection are reproduced, and marginal cuts give the portraits of the famous artists whose works are displayed. The reproductions are admirable, giving all the softness and general effect of the original works. The great collection of Mr. Seney, which has a wide reputation for its excellence, is soon to be disposed of at auction in this city, and the *Illustrated American* gives the record of its masterpieces. Another article in this number describes and illustrates "Sioux Women at Home" as seen at the Pine Ridge Agency. The everyday life of the agency Indian is well shown, with graphic pictures of the semi-civilized product reproduced from photos taken on the spot. Another article is devoted to the U. S. S. Philadelphia, and, with numerous illustrations, gives an excellent idea of the great flagship of the North Atlantic squadron. Music, literature, history, and last, not least, "Women," receive their meed of attention in this issue.

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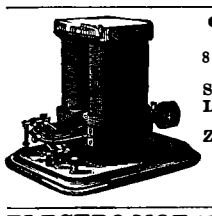

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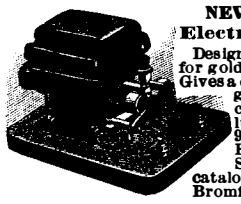

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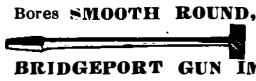
BIT  Bores **SMOOTH ROUND, OVAL,** and **SQUARE HOLES. Mortising Core Boxes, etc.** Invaluable to Carpenters, Cabinet and Pattern Makers. Highest Award. Send $8.00 for set (⅜ to 11-8), in neat case, or 50c. for sample Bit, mailed free with Illustrated List.
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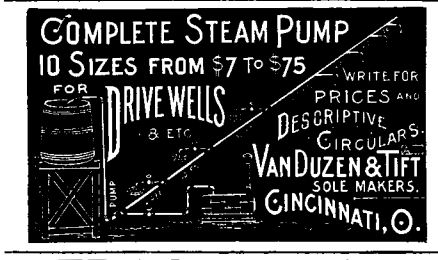

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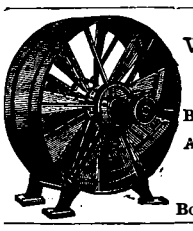

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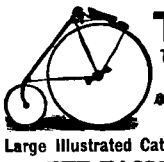

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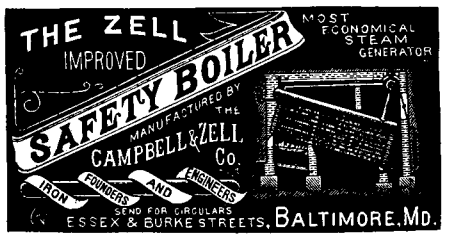

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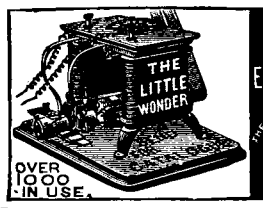

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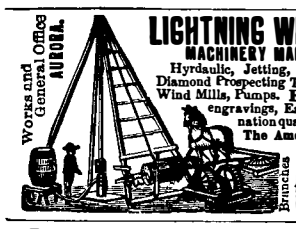

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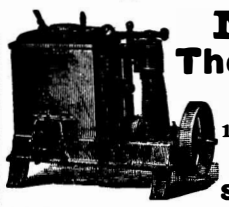

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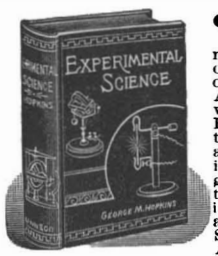

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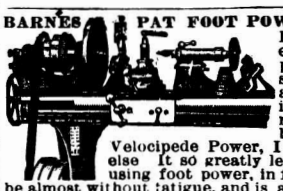

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