SCIENTIFIC AMERICAN

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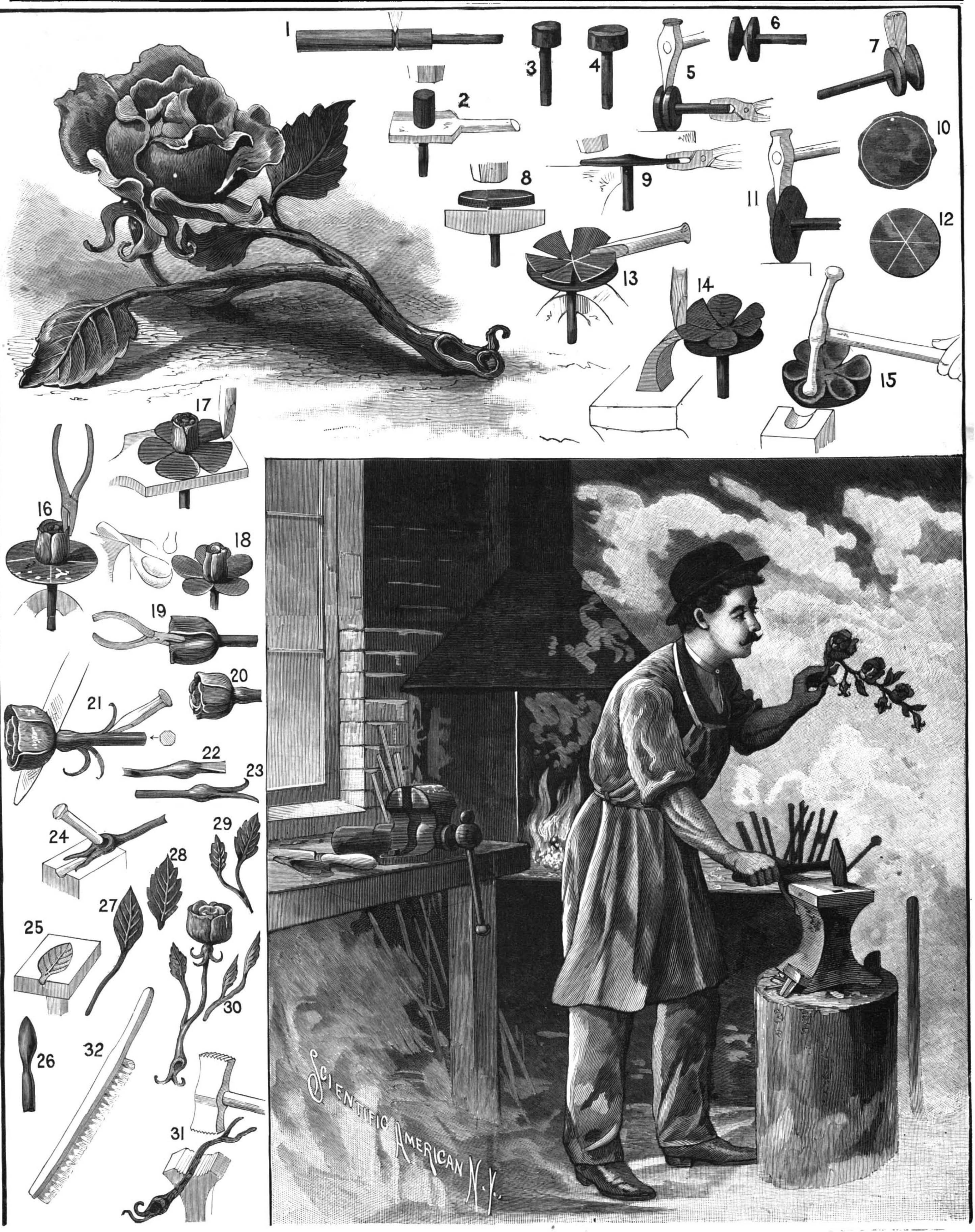

FINE HAMMERED IRON WORK—HOW TO FORGE A ROSE.—[See page 183.]

Scientific American.

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Contents.

(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 1029.

For the Week Ending September 21, 1895.

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THE AMERICA CUP RACES OF 1895.

With the withdrawal of Valkyrie III from the contest of September 12, the third race of the series was placed to the credit of the American cutter, and the safe keeping of the cup was intrusted for another indefinite period to its guardians, the New York Yacht Club.

Never in the history of these contests for the blue ribbon of the seas has the racing flag been hoisted under more auspicious and promising circumstances; and never has a contest realized a more unsatisfactory and altogether disappointing close.

The terms of agreement called for five races; three of them to be dead to windward and leeward and two on a triangular course.

The first race was sailed on September 7. The course was laid 15 miles out to sea, against the wind, and return. The wind was light and shifting. There was an enormous fleet of yachts and excursion steamers in attendance, and the maneuvering for the start, and the start itself, were made amid a confused crowd of attendant sightseers; the spectators vaguely speculating as to whether the starting boats were anchored, and the yachts themselves having difficulty in finding the same. In the first 11 miles of windward work, the performance of the two yachts was very even. Four miles from the mark the breeze hauled to the southward and freshened considerably; and, when the yachts laid for the mark, Defender was seen to be over three minutes in the lead. What was intended to be a run home before the wind, with spinnakers, was changed by the shift of wind into a reach, and Defender gained rapidly, coming home in handsome style, a winner by eight minutes and forty-nine seconds.

The second race was sailed on Tuesday, September 10, over a triangular course of 10 miles to the leg, of which the first leg was laid to windward. In the maneuvering for the start, and just as Valkyrie, who was half a length ahead of Defender and to windward, was straightening for the line, her main boom fouled the Defender, carrying away the latter's starboard spreader. The Defender put about, so as to relieve the strain on the topmast, speedily repaired the damage, and then set off on a stern chase for the English boat. Valkyrie gained in the windward work, but her lead was cut down on the two remaining legs of the course, so that she eventually came in a winner by the small margin of 47s. That Defender should have done so well in her disabled condition makes this second race a moral victory for the home boat. The protest by Defender was taken under advisement by the Cup Committee, and after hearing all the evidence, they gave judgment against the visitor.

The third race was sailed on Thursday, September 12. Both boats were at the starting point and crossed the line with the wind dead aft. Immediately after the start Valkyrie drew out of the race, alleging, as excuse for her withdrawal, that the Cup Committee would not guarantee a free course, clear of obstruction from excursion steamers.

The Defender stuck to her contract and sailed the course in gallant style.

The two marine pictures herewith given present a timely and interesting comparison. The historical schooner yacht America is shown on page 185 as she appeared at the time she was winning the cup in a race round the Isle of Wight in August of 1851. It was an easy victory for the schooner, and the many novel features embodied in her design and construction were quickly recognized and favorably commented on by the English yachting world.

The Defender of forty-four years later—page 187—shows the enormous increase in power that has taken place in the interval. Of much the same displacement, she carries nigh upon double the amount of canvas that was spread by her predecessor.

HIGH SPEED RAILWAY RECORDS.

During the closing days of last month the two great competing railways that run from London to the north of Scotland, known respectively as the East Coast and West Coast routes, commenced an acceleration of service on their through trains. In the active competition that followed, the West Coast companies covered the total distance of 540 miles in the unprecedented time of 512 minutes, or at the rate of 63·25 miles per hour.

The sustained speed was remarkable in any case, and especially so when it is considered that it was made by a regular daily train starting on schedule time, and that the latter half of the journey was made through a mountainous country, in which, for a distance of 60 miles, the grades are very severe, varying from 1 per cent to 1·33 per cent. The engines, moreover, that hauled the train were not the largest on the road, but in some cases were of a type known as the President class, that is now some 25 years old, but which, on account of its excellent performance, is still in active service.

On Thursday, September 12, the New York Central Railroad made up a special train that was a counterpart of the Empire State Express, drawn by their latest and most powerful engines, and set out with the express purpose of "breaking the record" of their transatlantic breathren. Over a course that is 100 miles shorter and over a line that is remarkably level and free from gradients, this special train, which was considerably heavier than the English train, made an average speed that was one mile per hour faster than that of the West Coast train, being 64·348 miles per hour, as against 63·25 miles per hour for the English train. These are both very remarkable performances. For purposes of comparison, however, they are useless, until we are in possession of all the conditions that prevailed. The bare question of speed is in itself no test of locomotive performance. This is a fact little understood by the public at large; but well understood by engineers themselves. To judge of two performances it is necessary to know:

1. The ratio of the weight of engine to the weight of the train hauled.

2. The ratio of the amount of coal burned, water evaporated, and oil used per mile to the weight of train hauled.

3. The state of the weather, whether wet or dry, and the force and direction of the wind.

4. Most important of all, the amount and extent of the grades and curvature on the two roads on which the record is made.

With all these data to hand a very close estimate could be made in each case of the actual units of work performed in a given unit of time. Only after such a comparison, based on accurate data, as above, could it be even approximately stated which performance was the most satisfactory.

FIRING OF BOILERS WITH MIXED COAL.

A very interesting experiment, and one that ought to revolutionize the firing of steam boilers, has been in progress at the flour mill of Urban & Company in this city for several months and has now proceeded so far that positive advantages can be claimed with confidence.

The mill has made 1,200 barrels of flour in 24 hours, though the ordinary output is much less. The engine is a Corliss pattern of about 400 horse power, driven by steam generated in two upright tubular boilers with twin furnaces and covered with a composition to retain the heat.

The fuel formerly used was run-of-mine soft coal, but last March Mr. Urban, having long been dissatisfied with the fuel, began to use in connection with it various proportions of screenings of hard coal. The improvement was marked from the first. The amount used was much less, the cost was reduced, and the smoke and soot practically disappeared.

When the experiment began, the furnaces required fully 1,200 pounds of soft coal per hour to develop on the average 380 horse power. The amount now required for the same service is 890 pounds on the average. The coal used is one part soft coal culm, or any of the cheapest product of the mines, and four parts hard coal screenings, such as is not considered valuable in the general trade and is sold to whoever will buy it at a mere nominal price.

All possible proportions were tried and hard coal was used entire, but the present proportion of four to one is found to be the best. This affords soft coal enough to cement the fuel into small masses, but is not enough to harden it into large masses, as was the case if a greater proportion of soft coal was used. As the soft coal ignites first, it in a measure cokes the whole, and the slow-burning anthracite assists in producing a very lasting fire, not needing replenishing for a much longer time than is the case with clear soft coal. Anthracite used alone fills the grates with ashes, but the accepted mixture burns very free.

The cost of hard coal screenings is $1.45 per ton and of soft coal slack $1.50. The difference is so small that either price may be taken, and reckoning the consumption at 900 pounds an hour, which is slightly more than the reported amount, a 24 hour run would consume 21,360 pounds at a cost of $16.02, reckoning $1.50 to the ton. The cost of run-of-mine soft coal is $2.20 per ton. At an expenditure of 1,200 pounds an hour, which is considered below the average requirement, a 24 hour run on soft coal would cost $31.68.

The saving appears to be largely in the entire combustion of the coal. If the test has proved anything, it is that a much greater amount of carbon is blown out of the chimney than any one has supposed. With soft coal there was not only a constant waste in the dense smoke that ruined so many things about the city, but a blower was needed to keep up the draught, and that carried the particles of carbon up the flue in a constant stream.

With soft coal the chimney had to be blown out every twelve hours, but with the present mixture no blower is used. The flue is scraped once a week, just as it was with soft coal. It is not difficult to see by this that the forcing of draught costs money.

The mixed coal is kept very wet; in fact, fairly saturated. In this condition it does not escape from the chimney at all, either in smoke or in fine particles independent of the smoke. For the most part there is no perceptible smoke and it is never more than a thin jet that does not become darker than a light gray. One requirement is that the boiler capacity shall be ample. It is from having to crowd the boilers quite as much as anything else that so much coal is thrown out of the tops of chimneys unburned. The above results cannot be obtained if the steam-generating apparatus is scant.

A further result is the small cost of repairs, which is due both to the style of fuel and the generous boiler capacity. Last year, with insufficient boiler capacity, the repairs to the boilers cost over $2,200. So far this year, with sufficient capacity, the repairs have cost next to nothing.

With the fuel in the above proportion it is found that the expenditure of 2·6 pounds of coal an hour is, under the most favorable conditions, sufficient for developing one horse power at the Urban mill.

It is believed that the advantages in cost of money and labor and in the ridding of manufacturing centers of smoke and carbon deposits independent of smoke, which are shown by this experiment, ought to lead to the development of a new system of firing steam boilers. With such a system in general use coal now considered practically worthless could be made of prime value and a nuisance would be abated.

JOHN CHAMBERLIN.

90 Johnson Park, Buffalo, August 17.

Gold in Photography.

It is not our purpose to write a treatise on bimetallism, though the erratic changes in the price of silver of late years have added to the difficulties of the plate maker; gold being the standard metal in this country, the pound's worth of gold which a sovereign originally contained is still the measure of its value. It is the physical qualities of gold and its salts that we now discuss. It is not a little remarkable that in the present day we never hear of this metal as a light-sensitive agent. Yet, in the early days of the science, there was considerable promise in the experiments made in this direction. So long ago as 1840, Sir John Herschel investigated its properties at length, and these were still further examined by Hunt. Washing the surface of paper lightly with chloride of barium followed by a wash of chloride of gold, then exposing a few minutes to the sun's rays the portions of the paper acted on by light—first whitened by the light—became a full purple brown when held in the vapor of boiling water or even dipped in cold water. If for the barium salt oxalate of ammonia be substituted, the paper passes rapidly to violet purple; but as the same effect is produced, though more slowly, in the dark, it would be difficult to utilize this property. Again, using acetate of lead instead of barium, we get a paper sensitive to light, the faint image so produced being capable of "development" by steam or cold water. Bichromate of potassium and gold chloride solution give a light-sensitive paper. When the print is placed in cold water, the yellow tint disappears entirely in the whites, while the image, which has passed in printing through deep brown to bluish black, becomes, according to the extent of the solar action, crimson, blue, brown, or deep black. It is evident that here we have a fertile mine of experiment if any one care to work it; but, in modern photography, the chief interest of gold lies in the toning powers of its salts—mainly its chlorides.

It might be thought that little remained to be said upon this well-thrashed-out subject; but so far is this from being the case, that we may draw attention to two very interesting papers on the qualities of this salt which have recently been read before the Chemical Society, a brief reference to one of them having already been given. When treating of "chloride of gold," most writers have in view the acid chloride. Very few people have ever seen the pure gold trichloride, free from acid. Indeed, Watts says, "the only method of procuring auric chloride perfectly free from acid salt is to decompose aurous chloride with water." This aurous salt is made by evaporating a solution of the acid chloride to dryness, heating the residue to about the melting point of tin, and constantly stirring it as long as chlorine is evolved. An almost neutral solution of chloride of gold is obtained by evaporating a solution of the acid chloride till the liquid is dark ruby in color and begins to emit chlorine. When cool, the result is a dark red crystalline mass, very different from the usual yellow crystals. We may say that we have often pointed out, in instructions upon making toning baths, this fact. Ordinary solution of commercial crystals of gold chloride, or the double salt, is a pale yellow color, but the neutral salt solution is entirely different, it is a rich brown. If a useful toning solution, uniform in character, is to be made, it is this brown, not the yellow, solution that should be employed.

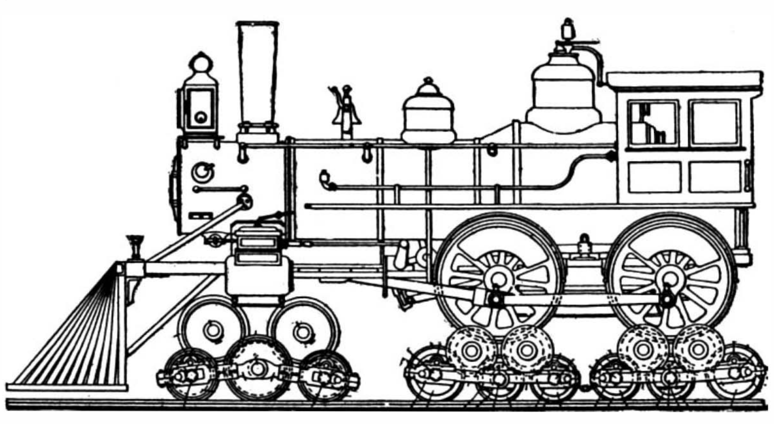
The question of the volatility of gold chloride or chlorine has often been before chemists, and most varied have been the opinions they have given. While one says it is entirely unvolatilizable, another says it can be driven off by heat at comparatively low temperature. A word of explanation of a table recently quoted by us may be given: The volatility referred to an atmosphere of chlorine, the words of Mr. T. K. Rose, whose paper was quoted from, being "it is certain that, when gold is heated in chlorine at atmospheric pressure, trichloride of gold is formed and volatilized at all temperatures above 180° C., up to and probably far beyond 1,100°."

Lest some of our readers who manufacture, and wisely, their own chloride of gold may be under the impression that, during the heating of the capsule in which it is prepared, some of the gold may be lost by volatilization, we will again quote from Mr. Rose: "It may be added that, when gold is heated in atmospheric air or coal gas, no gold is volatilized below 1,050°, and only about two per cent in thirty minutes at 1,100°. There need, therefore, be no trouble anticipated in heating the gold chloride to expel free acid in the usual manner."

Similarly free from danger of decomposition will the heating, if moderate, prove to be, for, again quoting Mr. Rose, we have: "The decomposition of gold trichloride in air might be expected to become perceptible at 70°, requiring, however, about twenty-five years for its complete conversion into monochloride, AuCl, at this temperature. The observed rate of decomposition at 100° shows that a similar change would require about 1,000 days at this temperature, while it results from calculation . . . that at 200°, thirty-six hours, and at the melting point, viz., 288°, less than one minute suffices for the complete decomposition of $AuCl_3$ in air." These interesting investigations, which have a practical value of their own, besides leading up to other practical aspects of our subject, do not leave us enough space to continue our survey at the present time, and we will therefore resume it at an early date.—Br. Jour.

SPEEDING TRUCK FOR LOCOMOTIVES.

Our engraving shows a device by William J. Holman, of Minneapolis, termed a speeding truck, which



A LOCOMOTIVE SPEEDING TRUCK.

consists of reversely flanged wheels having inwardly extended hubs running in contact with the treads of the locomotive drivers, and flanged traction wheels having outwardly extended hubs supporting the treads of said reversely flanged wheels, and with the axles of said traction wheels coupled by independent side rods adapted to oscillate about the central axles, whereby the speed of the locomotive may be increased without altering its running gear or increasing the speed of the moving parts and the requisite flexibility secured.

This machine might almost be termed the locomotive cycle. It appears to be intended to do for a locomotive what the bicycle does for a man—increase the velocity of travel over the surface of the ground without augmentation of exertion. By means of the bicycle a man can travel a given distance far more rapidly and with less expenditure of power than if he were to walk. It remains to be seen whether mounting a locomotive as here proposed will accomplish any such improved result. We understand an experimental truck is now in process of construction. The result of the trial will be duly noted.

Wood Pulp Pinions.

The great development of electrical mechanism during the past few years has caused engineers and mechanics to give special attention to anything connected therewith. It has been found that an objection to nearly all electrical power apparatus is the extensive vibration of the gear wheels, which in almost every instance revolve at a higher rate of speed than in ordinary machinery. The effect of this vibration is detrimental in several ways. The jar tends to loosen bolts and nuts. Besides, the noise created is not pleasant. A number of methods for overcoming the trouble have been adopted, among which has been the use of gears constructed on the combination plan, the spokes and rims being iron and the cogs wood. But the temperature affects wood, causing it to contract and expand, resulting in needed repairs and alterations in order to keep the mechanism going.

Compressed rawhide pinions and cogs made from same material have been adopted with some success. Even this material, however, has its drawbacks, all of which are claimed to be done away with by combining wood pulp with the same. Compressed rawhide and wood pulp form the foundation of the new pinions and adjustable cogs.

The Emancipation of Labor by Machinery.

One of the interesting proofs of the lightening of toil by the aid of machinery is found in the constantly enlarging sphere of labor being opened to self-supporting women, and the prediction is here made that within the next quarter of a century the ranks of the mechanic will be largely augmented by women.

Statistics show that the number of women to whom the sewing machine gives occupation to-day is vastly greater than the number who formerly gained a precarious livelihood with the needle, or who could obtain similar work under old conditions.

Contrast the "work-a-day" clothes and simply made "Sunday-go-to-meetin'" garments of the people of a century ago with the wonderful variety and complexity of finery comprising the holiday attire, and, indeed, the everyday wearing apparel, of those of a similar class to-day. If it is true, as stated, that one sewing machine operated by one woman will do the work of ten hand sewers, it is no less true that the modern woman possesses ten times as many garments as her sister of a former age, and each garment displays ten times as much machine-sewed work upon it.

But the sewing machine is a mere suggestion. The mind is fairly staggered in contemplation of the wealth of opportunity for wage earners that has been created by the steam engine—especially in the form of the steamship and locomotive, which have literally opened new worlds to the old world's poor. And what is true of the steam engine is true only in lesser degree of the telegraph, the telephone, the electric motor, the turbine and the whole range of modern agricultural machinery.

The modern bicycle—a theoretically perfect invention, and in some respects an almost perfect mechanism—has already produced beneficial effects upon the physical development of the wage-earning class sufficiently marked to attract general notice, and its future influence is incalculable. It is destined, in my judgment, to emancipate woman from many of the conventional shackles which have bound her for ages, and from some physical disabilities which have hitherto limited her sphere of occupation. This is only one of the many striking instances in which invention is helping to benefit the masses.

I am convinced that modern mechanical inventions have in all cases proved to be distinctively beneficial to the wage earner. He is through their aid better housed, better fed, better clothed, better educated, has more numerous and better amusements, and is thus approaching more nearly the condition of life of the employer; indeed, the wage earner to-day enjoys many advantages of civilization which were unknown to the employer of a generation gone by.

The majority of employers in this country are men who have risen from the ranks, and many of our most important inventions have been made by wage earners, who have the best opportunity, through experience in their daily work, to learn the necessities of the age.—A. E. Outerbridge, Jr., Engineering Magazine.

Queer Crankism of Electricity.

The Boston Journal of Commerce says that North Adams continues to be puzzled over a queer crankism of electricity in its vicinity. Although when the great 4½ mile Hoosac Tunnel was built no ores, magnetic or otherwise, were encountered, there was general expectation that rich ore pockets would be found; yet, for an unexplained reason, not an electrician has been discovered who can send a telegraphic message on a wire running from portal to portal of that tunnel, be such wire run inside of an ocean cable through the huge cavern or out of it. Therefore such messages have to be sent on wires strung on poles over the top of the mountain, fully nine miles, and that is the way in-going and outgoing passenger and freight trains are heralded to the keepers of the two tunnel approaches.

Phosphorescence.

M. Raoul Pictet, the French chemist, who has long been experimenting with intense cold, finds that phosphorescence ceases at very low temperatures. Glass tubes filled with sulphides of calcium, strontium, and barium were exposed to the sun and then taken into a dark room where the intensity and duration of the phosphorescence was noted. After being again exposed to the sun the tubes were put into a mixture where by rapidly lowering the pressure their temperature was reduced to —140°; they then showed no sign of phosphorescence, but after a time the upper parts of the tubes which had been least cooled began to glow, and as the temperature rose the light extended, becoming at last as bright as in the first experiment.

THE MANUFACTURE OF HORN COMBS.

A large portion of the combs used for the hair are manufactured from cattle horns, which are bought by the manufacturer at from three to twenty cents each, according to size; they range from one to three feet in length. The horns are first sawed up into what are called rings, from six to eight inch lengths, each ring being from two to four inches in diameter. From two to three cuts are made from each horn. The rings are then sawed through lengthwise and passed through a tumbling process which takes off the dirt and grit. The rings of horn, to the number of 300, are put into a barrel or cask, which is perforated with about 100 one inch holes and made to revolve in a tank of water for about two hours. After the tumbling process is completed, they are taken out and boiled in hot water for from one to one and a half hours to make them pliable. From the hot water they are then placed in formed by means of a draw-knife, which is passed across the surface of the plate, taking off the roughness and evening them up, the plates running in thickness from about one-eighth to one-half an inch. A good hand can scrape about 400 plates daily. After shaving they are again boiled for five hours to bring them to the right working point. They are then cut into the proper size and the edges trimmed. Scolloped edges are cut by means of dies. The next operation is the cutting of the teeth. This is performed by means of two steel cutters placed closely against each other, back to back, which, when the machine is in motion, move up and down one after the other, passing through the material, cutting the teeth of the comb. The cutting edges of the knives are shaped similar to an elongated S, the curved edges of one end turning in and the other out. The strip of horn is held down firmly in place by a binder, which moves forward with them against the wheel, which smooths them and rubs off the grit from the grindstone. This wheel is about eighteen inches in diameter and about eight inches in thickness and travels at the rate of about 2,800 revolutions per minute. About twenty gross of double combs are buffed daily. The ashes are washed off thoroughly and then they are prepared for staining. This is performed by dipping the combs in a heated solution composed of one-fourth nitric acid to three-fourths water, which gives them an amber color and makes them take the stain. They are left about five minutes and then taken out and washed in clear water, after which they are stained to imitate tortoise shell with a mixture composed of potash, lime and red lead. The color is put on thickly in stripes and the combs left to stand for from five to eight minutes. The combs are then washed, leaving a stain on them similar to tortoise shell. The combs are then dried and polished on a

THE MANUFACTURE OF HORN COMBS.

a kettle of hot whale oil for about half an hour, and then put through a pressing machine, which straightens and takes out the curl. The rings are placed separately between a number of heated iron plates, which are pressed tightly together by means of a gearing wheel, the threaded shaft of which connects with the center of one of the end plates. The wheel is turned by means of an iron bar or lever, the end of which passes between the cogs; the operator, by drawing down the bar, forces the wheel and shaft around, which in turn presses the plates together.

Four pieces of horn are pressed out at a time, the operation taking about five minutes. About 500 horn plates are pressed out daily. In the center of each iron pressing plate are two fire boxes about one and a half inches in width and about four and a half inches in length, running through from top to bottom, in which a charcoal fire is made for heating the plates. After pressing, the horn plates are reboiled for five hours in hot water and then shaved. The operation is performed every stroke of the knives until the whole comb strip has been cut through, each knife making a stroke of about half an inch. When one knife makes a cut the other takes it up, making one continuous cut through the entire strip. The guard teeth at each end are made by turning the knives slightly with a lever. The parts are then separated from each other, the cutting of which having formed two combs. About twelve gross of double combs can be cut daily. If the combs are to be curved, they are circled off by means of a circular steel cutter.

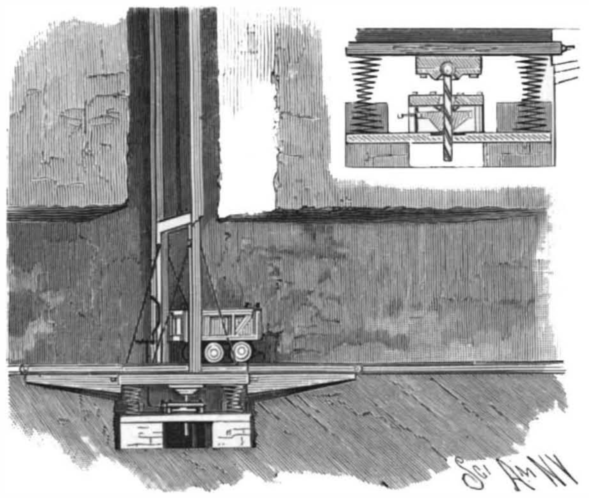
The next operation is drying, which is performed by placing a number of the combs on a drying or heating box for from five to eight minutes. After drying they are dressed up and have their teeth sharpened. This is performed on a grindstone traveling at the rate of about 3,000 revolutions per minute, after which they are put together again tooth to tooth and then buffed on a corn husk wheel. A mixture of fine coal ashes and water is put on the combs, the operator holding buffer sixteen inches in diameter composed of about 200 circular sheets of cotton flannel. This buffer travels at the rate of about 3,000 revolutions per minute, rotten stone and oil being used for polishing. The ends of the combs are then softened in warm sand and the guard teeth are drawn in, a piece of an old comb being used to keep them in place until they become cold. Bent or curved combs are made by tying a number of them down tightly to a circular wooden roller for five or six hours.

Combs are colored black by dipping them for half an hour in a hot solution composed of one-half pint of sugar of lead to four gallons of water. By dipping combs for half a minute in a solution composed of two tablespoons of muriatic acid to one pint of water it will produce a very good imitation of mother-of-pearl. The sketches were taken from the plant of James Wilkinson, New York City.

THE word Eskimo means "raw fish eaters."

A STOP FOR ELEVATORS AND MINING SHAFTS.

The illustration represents a device adapted to stop the cages in elevator wells, mining shafts, etc., serving as a cushion to receive the descending cage, thus allowing the engineer to run it with greater speed and

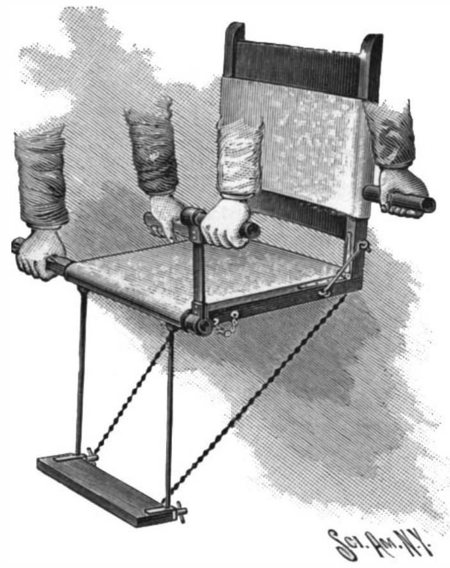


BELL & WILLIAMS' STOP FOR ELEVATORS AND MINING SHAFTS.

preventing damage to the cage from coming suddenly to the bottom. The improvement has been patented by Thomas Bell and John S. Williams, of Krebs, Indian Territory. The top striking platform is supported on springs resting on a suitably supported base plate, the downward movement of the striking plate being also limited by blocks on the base plate. Depending from the under side of the striking plate, and connected therewith by a ball joint, as shown in the sectional view, is a screw which extends through a support and through a ratchet wheel, a key in which engages the thread of the screw, so that the vertical movement of the screw turns the wheel, the screw also extending downward through a base plate and wear plate. The ratchet wheel is tapered on its under side to turn with but little friction when the plate and screw are depressed, but it turns with considerable friction when the plate is being lifted. The wheel is prevented from turning by a pawl fulcrumed on its under side, and the outer end of the pawl is pivoted to a connecting rod extending to the lower end of a lever, a spring-pressed extension of which extends into the path of the cage, whereby, as the cage ascends, the pawl will be automatically released, allowing the ratchet wheel to turn and the striking plate to rise. The locking of the stop device in its depressed condition holds the cage or car stationary while it is being unloaded or loaded.

A FOLDING INVALID CHAIR.

This very simple form of chair, to facilitate carrying invalids in upright position from one place to another, has been patented by Bernard E. Jamme (address in care of John Woolley, No. 111 Fifth Avenue, New York City). The invention consists principally of the handles at different heights on opposite sides of the chair, rendering it easier for two persons to carry up and down stairs and elsewhere an invalid seated in the chair. The chair may be placed upon the edge of a bed and the patient moved upon it or from it with the greatest ease, and when not in use it can be readily folded into a small, compact bundle.

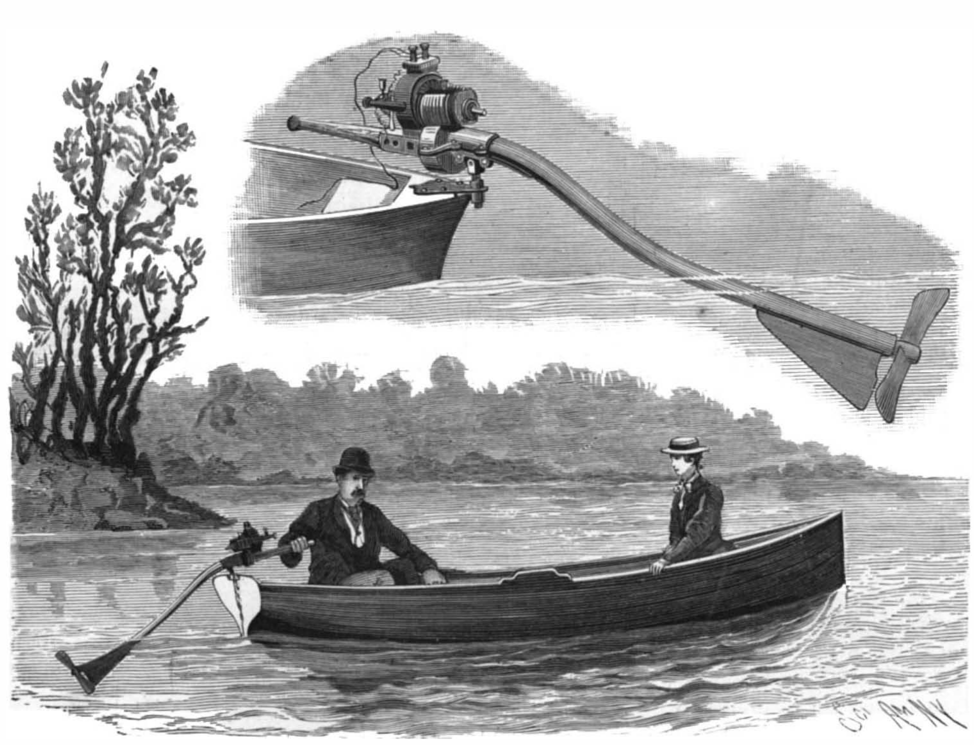


JAMME'S FOLDING INVALID CHAIR.

A PORTABLE ELECTRIC PROPELLER FOR BOATS.

Among the multitude of inventions that are offered to the public day by day there are some that commend themselves to the judgment at first sight, and fill offhand a long-felt want. The electric boat propeller, as shown in the accompanying views, is surely one such invention as mentioned above. It has the accumulated advantages of being cheap, portable, compact, and thoroughly safe to the user. Briefly described, it consists of a movable tube which is hinged at the stern of the boat, much as an oar is used in sculling. The tube contains a flexible shaft formed of three coils of phosphor bronze. This tube extends down and out into the water, where it carries a propeller, and at the inboard end an electric motor is attached, which is itself driven by batteries. The rudder and the propeller are thus in one, and the steering properties of a boat so fitted would be very swift and powerful. The tube, with its inclosed flexible shaft, is partly filled with oil; and these parts are thus automatically and constantly lubricated. The rate of speed is from three to five miles per hour. The combined propeller, motor, and rudder weigh only 35 pounds for a 10 foot to 18 foot boat. The batteries weigh from 100 pounds to 275 pounds, but being in four parts are easily handled.

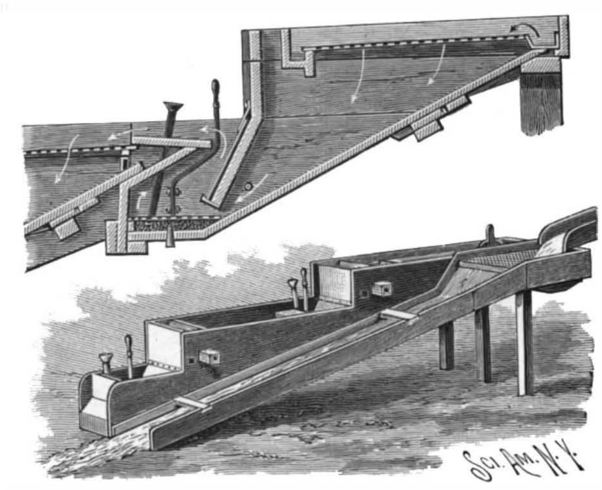
This very ingenious and effective invention will be gladly welcomed by the sea and river sportsman. Its handiness and noiselessness make it admirably adapted to duck shooting; and it will commend itself at once to the special needs of the fisherman. All sportsmen, at one time or another, when they have been following the windings of some narrow stream, or threading their way through the mazes of a rush-grown marsh, have wished for a means of propulsion of smaller compass than a pair of sculls, or even a canoe paddle. The electric propeller, working snugly in the wake of the boat, is admirably adapted for such work, or for any circumstances where a boat has to be handled in a crowded wakeway. This handy device is manufactured by the Electric Boat Company, of 136 Liberty Street, New York City. The motor, propeller, and batteries can be purchased for $150, and the running expenses amount to only 5 cents per hour.



A PORTABLE ELECTRIC PROPELLER FOR BOATS.

A GOLD SAVING APPARATUS.

The illustration represents, in sectional side elevation and in perspective, a gold saving apparatus designed to save nuggets, coarse gold, and flour gold, with but a small expenditure of water and labor. A patent has been granted for the improvement to Dennis G. Frisbie, Dayton, Wyoming. The hopper into which discharges the sluice box carrying water and gold-bearing sand from the placer mine or the quartz mill has a false bottom over which large rocks and other coarse tailings pass into a tailing chute, the gold, sand and water passing through the coarse perforations in the false bottom into a transverse channel leading into a nugget box in the upper end of a hopper, as shown in the sectional view. This hopper has a perforated bottom through which the gold-bearing sand and water pass to a settling tank with inclined bottom, there being a transverse passage at one end of the hopper into the tailing chute. At the lower end of the settling tank is a gold-retaining chamber, with a perforated false bottom under which is mercury, the bottom being preferably hung on an upwardly extending lever, which the operator shakes several times a day. The dividing partition between the chamber and the settling tank is inclined, and carries a removable copper plate adapted to take up any gold in the flow of the gold-bearing sand, as it passes over to a second hopper with perforated bottom and settling tank, with gold-retaining chamber at its lower end, the perforations or meshes of the second hopper being finer than those of the first. A pipe leading to the bottom of each gold-retaining chamber facilitates the introduction of a new supply of mercury when necessary. Any mercury



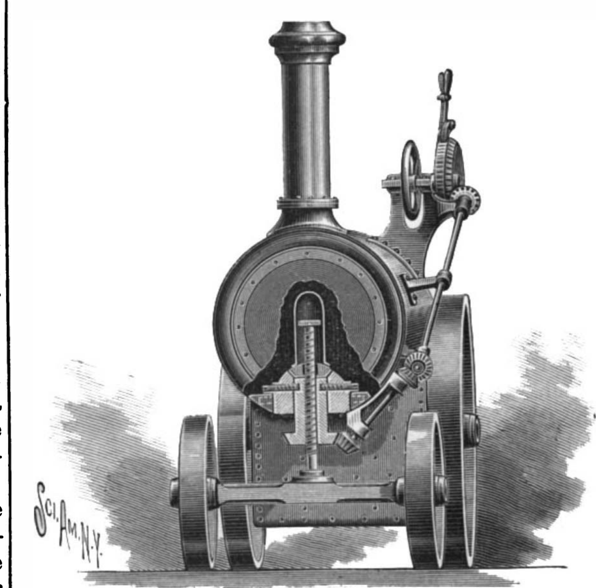
FRISBIE'S GOLD SAVING APPARATUS.

escaping from the quartz mill is readily caught and retained in this machine.

IN a series of interesting experiments made to ascertain why trees are so frequently struck by lightning, it was demonstrated that the green wood is in all cases a bad conductor of electricity, and so much the worse in proportion as the tree is richer in oil. On the contrary, the green wood of such trees as are poor in oil conducts electricity relatively well. Living wood is a much better conductor than dead. The existence of dead branches in trees of both categories, therefore, increases the danger.

A BOILER LEVELING DEVICE.

An improvement by means of which portable boilers, traction engines, and similar machines may be conveniently brought to a horizontal position when standing on uneven ground, or traveling up or down a hill, is represented in the accompanying illustration, and has been patented by Willie C. Hancock, of Albany, Ky. An upwardly extending screw rod is fastened to the front axle, and on the rod is a revoluble nut in the under side of a block, the nut being held in place by set screws engaging an annular recess in the upper part of the nut. The block has on its sides trunnions journaled in the smoke box of the boiler, shown in the broken away portion of the engraving. The screw rod extends through the top of the block into a tubular extension or casing, to protect it from soot, etc. On the lower end of the revoluble nut is a beveled gear in mesh with a pinion on a short shaft whose other end has a bevel gear connection with a shaft extending up and back at one side of the boiler, the latter shaft having a bevel gear connection with a larger gear wheel with ratchet teeth engaged by a pawl on a lever fulcrumed on the shaft of the large gear wheel. By operating this lever, motion is communicated through the gear wheels and shafts to the revoluble nut, to raise the front end of the boiler, and to lower it the pawl is disengaged and the large gear wheel is oppositely turned by means of a handle, the weight of the boiler then assisting in rotating the nut.



HANCOCK'S BOILER LEVELING DEVICE.

The Earliest Transatlantic Steamships.

Samuel Ward Stanton contributes an interesting paper to Engineering Magazine for September, from which we take the following:

On May 29, 1819, while the little schooner Contract, Captain Livingstone, was sailing quietly along on the Atlantic, in latitude 27° 30', longitude 70°, the lookout discovered what he supposed to be a vessel on fire, far off on the horizon. The Contract was headed toward the new comer, but, to the surprise of those on board, she passed along quickly and was soon lost to sight, notwithstanding all sail on the Contract was spread. The conclusion was then reached that the strange vessel was nothing more or less than a "steam packet," bound across the ocean.

The vessel in question was the Savannah, a ship of some 380 odd tons, and was bound to Liverpool from Savannah, having left the latter place on May 26. The Savannah was the first transatlantic steamship. She was built at Corlaer's Hook, on the East River, now part of New York City, by Messrs. Crocker & Fickett, and was at first intended for a sailing packet, but before she was finished was purchased by William Scarborough and others of Savannah, Ga., and machinery was placed in her. The engine—inclined direct-acting—was built by James P. Allaire, and the boilers by Daniel Dodge. The paddle wheels were so constructed that they could be taken apart with little trouble and placed on deck should occasion arise, the shaft having joints for that purpose. Skeleton frames of iron designed to surround the wheels, and covered with canvas, served for wheel houses. The Savannah's arrival at Liverpool created a small sensation; steaming up the harbor, with sails furled, a full head of steam on, and the American flag floating proudly over her, she no doubt presented an inspiring sight. The trip had occupied 22 days, on 14 of which steam was used. Leaving Liverpool, the Savannah sailed to St. Petersburg, stopping once or twice on the way, and finally returned to Savannah. The machinery was afterward taken out, and she plied as a sailing packet between New York and Savannah. She was finally wrecked on the Long Island coast.

Soon after the Savannah made her successful ocean trip, a fine large steamer, named Robert Fulton, of 750 tons, was constructed in New York by Henry Eckford, for the route from New York to Cuba and New Orleans. She was a stanch vessel, constructed "entirely of oak, locust, and cedar, and Georgia pine, copper fastened." She had a square, or crosshead, engine, of the type then in use on inland steamers; there were two boilers and two funnels. She left New York for New Orleans on her first trip April 25, 1820, stopping en route at Charleston and Havana. She was an entire success, and covered the 2,225 miles between New York and New Orleans in an average of 10 days. The New York Evening Post of June 15, 1820, contained the following notice of her arrival:

"The beautiful steamship Robert Fulton, Captain John Mott, arrived last evening, 17 days from New Orleans, via Havana and Charleston. At Havana she stopped 2 and at Charleston 4 days. She has aboard between sixty and seventy passengers, and has been at sea only 10 days."

In another notice, on the return of this boat in January, 1821, the Post said:

"Steamship Robert Fulton, Captain Mott, arrived in New York in 8 days from Charleston, having been to New Orleans, . . . 54 days' round trip to New Orleans, averaging 14½ either way. . . . The boisterous season, the rough and heavy weather which she has experienced this trip, must convince even the most incredulous of the perfect practicability of navigating the ocean by steam. Captain Mott gives her a decided preference over every vessel he ever commanded, both for safety and pleasantness during a gale of wind."

The Robert Fulton ran for three years very successfully; she was then sold to the Brazilian government, to be used as a cruiser, her machinery being removed.

Various small coastwise lines were in operation both in the United States and Great Britain between 1825 and 1835. In 1825 the steamship Enterprise made the trip from England to Calcutta, and it is said that her commander, Captain Johnson, received $50,000 for taking her out. She was of 470 tons burden—smaller than the Robert Fulton, but larger than the Savannah—and sailed from Falmouth August 16, 1825. Like the Savannah, her engine was only worked when the weather was fine, it being used 64 out of the 103 days required to perform the passage.

A steamer of 350 tons, called the Curacoa, built in England for a company of merchants of Amsterdam and Rotterdam, ran between Amsterdam and the Dutch West Indies for some time in the later twenties. The Meteor, a British steamship, ran between England and the Mediterranean in 1830; she carried the mails.

Following the Savannah, the next steamer to cross the Atlantic was the Royal William, a 363 ton ship, constructed in Quebec. She made the run from Quebec to London in something over 40 days, leaving August 5, 1833, and reaching Gravesend September 16.

One of the most famous of the early steamships was the Sirius, a small, but stanch, vessel that was sent from Queenstown to New York by the British and North American Steam Navigation Company on a regular line that had just been established. She left on her voyage to New York on April 5, 1838, with forty-six passengers, and reached her destination April 23. Later in the same day the steamship Great Western arrived from England, and the appearance of these vessels in the harbor caused great excitement in New York. The Great Western has left Bristol on April 7, thus making the passage in 15½ days as against the 17 of the Sirius. The Sirius had originally been built for coastwise service in England, but had been chartered in order to anticipate the Great Western, which was about ready to sail on her first trip. The Sirius made two round trips in the line, and was then placed on the route between Dublin and Cork, where she continued plying until January 16, 1847, when she was wrecked. The British Queen, newly built, took the place of the Sirius when she left the transatlantic route.

AN EXPERIMENT WITH HYDROGEN SULPHIDE.

BY GUSTAVE MICHAUD, D.S.

Here is a curious experiment, which can be performed with hydrogen sulphide.

If any colored flower is passed quickly through the flame of that gas, it becomes instantly as white as snow in all the parts that were in contact with the flame. The flower is not carbonized and does not fade. The cause of this phenomenon is, of course, that sulphur dioxide is evolved during the combustion of the hydrogen sulphide, but while it takes several minutes to bleach flowers in the ready made gas, its action is absolutely instantaneous when applied as stated above. Moreover, the flame acts merely on the part of the flower which is in immediate contact with it, so that odd figures can be drawn on the petals, as if with a brush and white paint.

Made in the flame of sulphur in combustion this experiment gives a negative result. The flowers are carbonized before being bleached. With carbon bisulphide the result is better, but not so good as with hydrogen sulphide. This difference of action may be explained by the fact that the gas evolved during the combustion of hydrogen sulphide is probably, for a moment, sulphurous acid SO_2H_2, and not sulphur dioxide SO_2.

Young readers, willing to repeat this experiment, will find in text books of chemistry how to prepare hydrogen sulphide and how to avert the two dangers of this preparation, viz., the explosion of the flask by premature lighting and the inhalation of the gas while it is not burning.

Women Jewelers.

Whatever may be woman's future in the arts, there is no doubt that the wife or daughter of the jeweler, country jeweler especially, may become, and ought to be, an invaluable assistant to him, not alone in his capacity as storekeeper, but as mechanic as well. So far, saleswoman duties have satisfied unaroused female ambition, only because it has been unaroused. There is no reason why the jeweler with a family should not educate one of his daughters as a jeweler proper, nor is there any reason why, when taught, she should not prove an adept at the art and an acquisition to the store. He could teach her, for instance, the art of engraving, for which her feminine instincts, fineness of fancy, and copiousness of patience peculiarly suit her. He could teach her, in a word, how to perform the numerous tedious tasks in a jeweler's and watchmaker's work in the performance of which application or delicacy of touch, both feminine characteristics, may be either a need or an advantage. Did she develop unusual talent, the transition would be easy to the more remunerative branch of setting precious stones and designing patterns. Curiously enough, women have so far cast no envious eye on this well-paid, steady, most interesting, and dignified calling. At a glance one can appreciate that its requirements are many and severe. A careful course of apprenticeship in order to gain the mechanical skill, an artistic sense to guide, a firm and delicate hand to execute, are some of the elements necessary to success as a worker in precious stones and metals. Yet many jewelers' daughters endowed with just such qualities throw away their cleverness on fancy work, and exhaust their eyesight over a needle, when, as designers of jewel patterns, or as lapidaries, a good fixed salary might be secured.—Keystone.

THE mayor of St. Petersburg has ordered the name of every individual who is found drunk to be posted in specific public places and printed in the Official Gazette. A good idea.

Correspondence.

The Proposed Cape Cod Canal.

To the Editor of the SCIENTIFIC AMERICAN:

I am glad to see that the SCIENTIFIC AMERICAN is awake to the importance of ship canals, supplementing the generous provision that nature has made for sheltered coastwise navigation almost from Maine to Florida. Thoughtful persons have often execrated the policy that has led our legislators to vote millions of the people's money for the improvement of unheard-of creeks (see river and harbor bills) when such a peninsula as Cap Cod lay awaiting for a short straight ditch to be digged, separating it from the mainland and cutting off something like 60 miles of dangerous, intricate navigation through Vineyard Sound and around Nantucket Shoals. In point of fact, Charles the Second was King and William of Orange was fighting the French in Flanders when the Cape Cod Canal began to be talked about in Eastern New England, and from that day to this the subject has been periodically agitated only to fall into the hands of speculators and die a succession of natural deaths.

Your paper of August 31, so far as it refers to the Cape Cod section of the canal project, favors what is known as the Bass River route. The earlier surveys, including one made in 1776, by an engineer named Machin, under authority of George Washington, contemplated the shorter and more direct line via Buzzard's Bay and the Sandwich Isthmus, and one has only to consult the United States Coast Survey charts, or indeed any map of New England, to perceive at a glance how unanswerable are the arguments in favor of that route. A government survey was made in 1860 and a special chart (No. 3042) was issued by the Coast Survey showing the proposed canal in detail. There are some reasons why the Bass River route is preferable for sailing vessels, but this is the age of steam, and whether for commerce or war, steam is the agent that must be considered. Personally I have little doubt that both canals will eventually be built, but if the decision is left to a competent board of engineers, as no doubt it will be, should the government take the matter up, there is small room for question as to which route will be chosen first.

CHARLES LEDYARD NORTON.

Sandwich, Mass.

The Seattle and Lake Washington Canal.

The citizens of Seattle, Wash., are jubilant over the beginning of work on a canal which is to connect the Puget Sound with the fresh water lake, Lake Washington. The Gas Light Journal says: "The work, which has been undertaken by the Seattle and Lake Washington Waterway Company, includes the excavation of two waterways, each about 1 mile long and 1,000 feet wide, from deep water through the tide flats of Elliott Bay; two Duwamish waterways connecting the east and west waterways with the mouth of the west channel of the Duwamish River; a canal waterway about 1 mile long and 218 feet wide at low water from the head of the east waterway through the flats eastward to the shore line; a canal through the upland 80 feet wide at the bottom, in a direct line nearly 2 miles to Lake Washington, into which it will open in Wetmore Slough; and the filling to a level of 2 feet above high tide of 1,525 acres of tide land with the excavated material. The two main waterways and the canal waterway are to be excavated to a depth of 26 feet at low tide, the canal itself to a depth of 30 feet at dead low water in the lake, and the Duwamish waterways to a depth of 12 feet at low tide. The amount of material to be excavated is 36,000,000 cubic yards, just about enough to do the filling required.

"While the east and west waterways will be 1,000 feet wide, according to the official map of the State Land Commissioners, the space clear for traffic will be only 552 feet between the pier head lines, the remaining 448 feet being allowed for the extension of wharves and slips to such lengths as to accommodate the largest ocean steamers. The construction of waterways on this plan, which would open wharves and slips instead of docks and tidal basins, is in accordance with the most modern ideas of harbor improvements, the revolution in ocean traffic wrought by the use of steamers instead of sailing vessels, the carrying on of land transportation by railroad and the use of machinery for loading and unloading ships having combined to make dispatch in handling cargoes at the same time necessary and possible. Thus the old system of floating a ship into a dock through tidal gates and unloading its cargo on trucks has almost been done away with. Trains are now run right alongside a ship at the wharf and the cargo is transferred from one to the other almost without the touch of a man's hand. With the provision made in the tide land plat for railroad tracks on every wharf and for steamers to run into the slips alongside the tracks, Seattle will have facilities on her waterways for carrying on ocean commerce with speed and economy equal to those of the greatest and most modern ports of America and Europe."

FINE HAMMERED IRON WORK.

The ability to wield a hammer well, whether it be only to shape a horseshoe or effect a difficult forging, comes only by long practice. That a full blown rose, perfect in its form and detail, may be forged with an ordinary blacksmith's outfit, seems impossible. Yet the engraving on our first page represents a rose forged from a round piece of iron, without rivets or screws, and we will try and make it clear to the skilled workman how he may do similar work.

A piece of iron, 1¼ inches in diameter, of the toughest class of Swedish iron, is first drawn down on one end to form a spindle about 6 inches long and ½ inch in diameter. This is cut off from the bar, leaving a head about 3 inches long (Fig. 1). After heating the head to a low cherry red, "work" the metal by upsetting (Figs. 2 and 3), hammering out, and repeating, thus working the metal, by much kneading, into a thoroughly tough, homogeneous mass—that it will at a later period of the work endure bending and rebending when needed—finishing finally into the shape shown in Fig. 4, the head being left ½ inch thick. The next step is shown in Fig. 5, starting the dividing of the head into two layers, the metal being hot, and continuing the cut as true as possible until the two layers are held together by a thickness of metal corresponding to the diameter of the shank, ½ inch, as shown in Fig. 6. Reheat and rub a piece of lead in the cut (Fig. 7), touching every part of the cut; of course the lead will melt and run off, but its application will have the effect of keeping the two layers separable when hammered together (Figs. 8 and 9). Carefully heat and flatten these two layers with a heading tool upon the anvil until brought to about 3 16 of an inch thick, and finish by thinning the edges to about 1-16 inch thick. When cool mark with compasses a circle that will trim off the irregular edges to about ⅛ inch less than the material will cut (Fig. 10).

The first layer is trimmed to a smaller diameter than the second layer. In separating the two layers with a sharp chisel (Fig. 11) it will be found that, owing to the use of the lead, they will readily come apart. Now trim the outer layer round with a cold chisel, and mark into six equal divisions with a slate pencil (Fig. 12), cutting accordingly in a vise to the separating hub, making six leaves (Fig. 13). Trim the edges of these leaves, the metal being cold, rounding with a cold chisel (Fig. 14), and hammer the edges out quite thin to an irregular round, avoiding any formal curve in the edge of the leaves. With a round-headed hammer and a swage block, the metal still being cold, round out the leaves, and dish them (Fig. 15), and then, with a pair of pincers, bend them up out of the way of the second layer (Fig. 16). The second layer is divided into five leaves (Fig. 17). With the metal cold, the edges are rounded and made thin, and then dished with the round-headed hammer shown in Fig. 18, being bent up with pliers (Fig. 19). After heating, the shank is drawn down in irregular diameter for the stem of the rose, leaving sufficient metal at the outer end for break, and, near the rose (Fig. 20), for cutting the bud burrs with a chisel (Fig. 21) from the stock, holding the piece in a vise to do this work. Then with a half round file finish the bottom of the rose and round both it and the bud burrs as shown in Fig. 21.

The other end of the stem should now be forged with a bulb ending in a flattened wedge piece (Fig. 22). With a cold chisel divide the wedge piece into two parts (Fig. 23), which are to represent the wood as torn from the stem, and with a round-ended punch indent the bulb as shown in Fig. 24, forming the natural cavity that occurs in pulling a rose from the stem.

The leaves may be forged and cut into shape with cold chisel and marked with the same, but it is better to make a die in approximate leaf form and impress into a steel swage block, giving the further character of the leaf by indenting the leaf ribs, as shown in Fig. 25. Having such a swage block, it will be necessary only to forge a bulb on the end of a half inch iron, and flatten it out or drop forge it in the swage and forge down for the stem (Fig. 27), serrating the edges with a file (Fig. 28), giving them a dishing, twisted, natural contour. Weld two of them together (Fig. 29), and weld the end to the stem (Fig. 30). As many leaves may be welded (using only a small fire to accomplish this delicate operation) to the stem as will appear natural and graceful. In Fig. 31 are shown the rough bark producing tool, a serrated-headed hammer and block. By placing the stems in the block and striking with the hammer, turning the work in all directions, a good imitation of bark is the result. An iron scratch brush (Fig. 32) removes scale and gives a softening effect. Now that the rose is all together in one piece, with pliers bend the rose leaves out, making the six inner leaves to conform to the headed loop of a rose and surround with the outer layer of five leaves, bending the stem into natural curvatures, and twisting the bud burrs into a natural downward curve, and with the torn ends twisted.

The rose from which our engraving was made is the handwork of Henry Sticht, a pupil of Armbrusters Brothers, Frankfort-on-the-Main, now in the employ of Winslow Brothers Company, art metal workers, Chicago, Ill. It was by this firm that the large hammered iron gateway was constructed that formed so striking an American exhibit at the Chicago World's Fair, and which has found so fitting a home at the entrance to the grounds of General Jos. T. Torrence, on the Lake Shore drive, in Chicago. The illustration which we present of this gateway will convey but partial idea of its beauty and richness of detail, as a good example of fine hammered iron work. For protection from exposure to the elements, all such work should be subjected to the Bower-Barff process after completion, this giving a good protective and lasting enamel to the surface.

A HAMMERED IRON GATEWAY ON THE LAKE SHORE DRIVE, CHICAGO.

The Horseless Vehicle Contest.

Electricians are studying with a good deal of interest and doubt their chances in the horseless vehicle contest that the Chicago Times-Herald has organized, to take place next November between Chicago and Milwaukee, a distance of about eighty-five miles, with two relay stations, one at Kenosha, Wis., and one at Waukegan, Ill., where renewal of power is permitted. Already, says the Evening Post, over seventy-five entries have been made for this race, but it is said that the electrical competitors are comparatively few. The main reason for the lack of prominence of electricity is that the batteries hitherto in use and on the market have been altogether too heavy and have had too limited a storage capacity. Hence, with the increase in strength of the frame to bear the burden has come a further drain on the insufficient power, and nobody seems able to reconcile these qualities. Yet another reason for the absence of electrical carriages is the rareness of charging stations, although the condition in this respect is steadily improving all the time. It is believed by electricians that not many years will pass before trolley systems penetrating into rural districts will allow their circuits to be tapped for lines to run over roads in such a way that any cart can hitch on by its trolley pole and get all the current it needs.

Our Insect Friends and Foes.

According to Professor Panton, of the Ontario Agricultural College, there are nearly 100 species of insects that prey on grain and forage crops; upward of 40 attack vegetables; no less than 50 menace the grape; and 5 threaten the apple. The pine has 125 species as enemies; the oak, 300; the elm, 80; the hickory, 170; the maple, 75; the beech, 150; while the unfortunate willow battles against some 400 species of insect foes. Some idea of the immense loss that is sustained by the human race from insect pests may be imagined from the fact that in 1884, in the United States alone, the amount is estimated to have been $400,000,000, but in 1891 it was $300,000,000, and, thanks to the investigations of German scientists, it is believed to be annually decreasing. It is not to be supposed, however, that the fullest knowledge available to man will suffice absolutely to prevent these losses; but these figures are so enormous that the reduction of them within smaller dimensions becomes a matter of very great importance. All insects are not our foes; and just what birds are most fond of beneficial insects it would be interesting to be informed. But we are somewhat in the dark about this even yet. Professor Panton gives a list of a few insects which are our friends:

Syrphus fly, trachina fly, tiger beetles, ground beetles, ladybirds, reduvius, soldier bugs, lace-winged flies, wasps, cuckoo flies, and ichneumons.

These insects are said to be of great importance in keeping the mischievous species under, the ichneumons being especially good at this business. They prey on certain grubs by depositing eggs on their living bodies. When these eggs hatch, the young worms feed upon their host till the latter can stand the strain no longer and forthwith dies. About this time the ichneumons are ready to fly as perfect insects. It is no uncommon thing to find upon a tomato or tobacco plant one of the large green worms which infest these plants, with a dozen or so small whitish thorns sticking into its hide. These are the ichneumon eggs which eventually kill the worm. Ladybirds feed upon plant lice; ground beetles are said to prey upon the potato beetle and various kinds of caterpillars; while the tiger beetle will eat almost anything in the insect line.—Public Opinion.

Cycle Notes.

At the shops of the Pittsburg, Cincinnati, Chicago and St. Louis, in Columbus, O., there are about 150 employes who come to their work on bicycles, and of course this number of machines standing around in the way all day became quite a nuisance. The master mechanic has therefore built two "stables," one to hold 25 machines and the other to hold 60. These stables consist simply of light posts, with rafters along and against a tight board fence or building, and covered with some cheap form of roof. There is a tie from each post to the fence which forms the partition between the stalls and also serves as a support for the wheels. The stalls are about 2 feet wide and 6 feet deep. Each stable is in charge of some office boy or other employe, who gives out checks to the owners of the machines, each stall being numbered.

A STATUE of Siemens and his friend Helmholtz, after the model of that of the brothers Humboldt in front of the Berlin University, is to be set up in Charlottenburg before the Technical High School.

THE EVOLUTION OF THE INTERNATIONAL RACING YACHT.—II.

On February 26, 1885, a challenge for the America cup was received by the New York Yacht Club from the Royal Yacht Squadron, on behalf of the cutter Genesta.

In looking over the list of boats available for the defense of the cup it was at once decided that there was no sloop afloat that could hope successfully to meet the crack English cutter. Accordingly two sloops were built, the Priscilla and the Puritan; of which the Puritan was selected to meet the challenger.

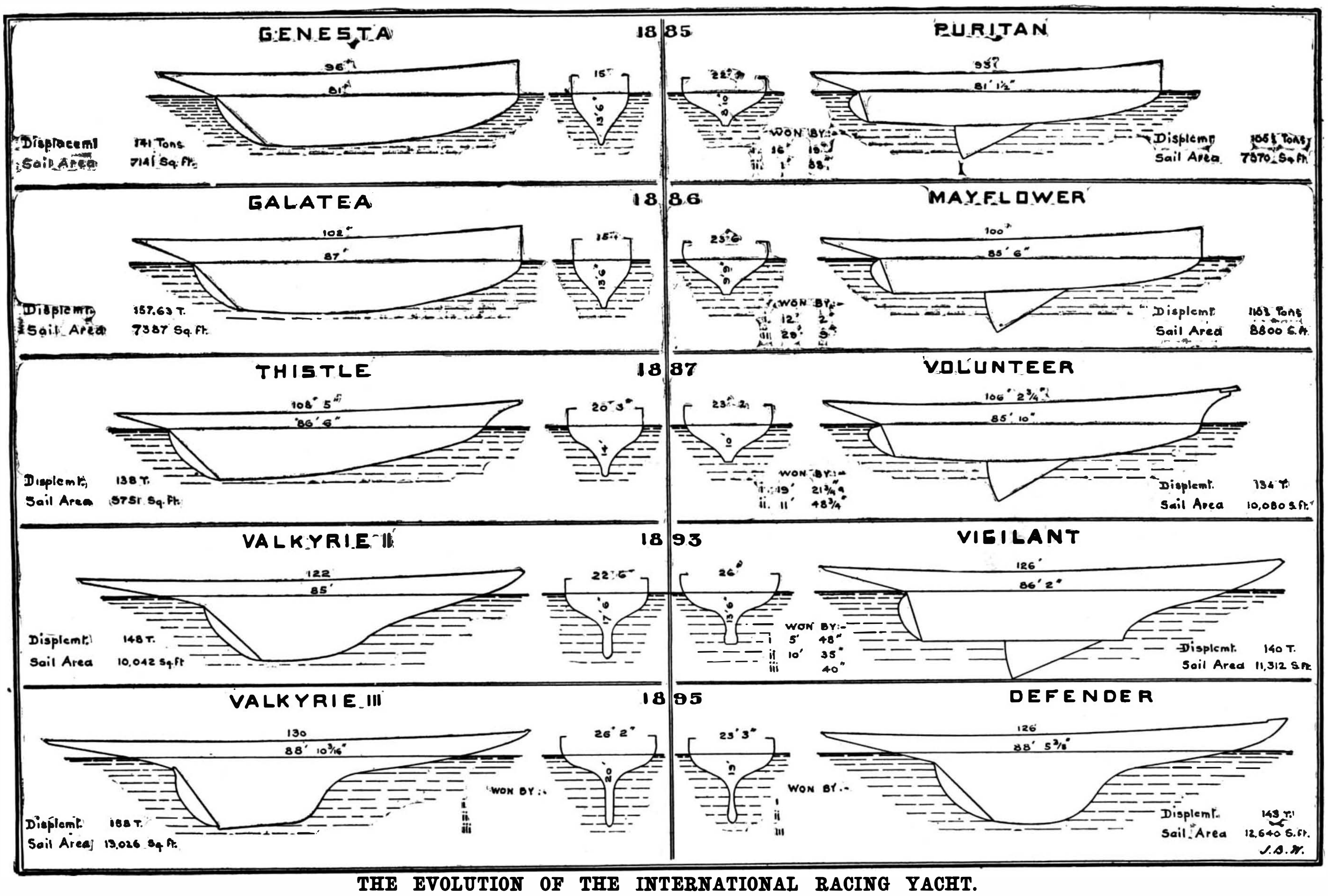
Strictly speaking, Puritan should be called a cutter sloop. She retained two good features of the national type (see preceding paper), namely, the broad and shallow hull and the centerboard; but she carried the cutter rig in its entirety, and also the cutter outside lead, having some thirty-two tons of this bolted to the bottom of her keel. She had a smaller displacement than the Genesta and showed a larger sail spread.

On the day of the first race Puritan fouled Genesta, carrying away her bowsprit. The cup committee on the Luckenbach there and then ruled Puritan out and told Sir Richard Sutton to sail over the course. Sir Richard's reply from the deck of his yacht was winner of a magnificent race by the narrow margin of 1m. 38s. To her credit be it said that before sailing for home Genesta contested and won three races, in the two last capturing the Brenton's Reef and Cape May cups.

The next competitors, Galatea and Mayflower, were similar to their predecessors, though larger. The Mayflower carried 42 tons in her keel, or 10 tons more than the Puritan. She had an easy victory over the Galatea, beating her in light winds by 12m. 2s. and again by 29m. 9s.

The measurement rule of the British Yacht Racing Association, which put a heavy penalty on beam, but none on draught, was responsible for the absurdly narrow type of English cutter. The hopelessness of winning the America cup under this rule of measurement was largely responsible for the adoption of a new rating rule, based on load water length and sail area. This left the English designer free to use all the beam he wished. The effect of this rule was seen in the next challenger, the Thistle. With 5 feet more beam than Galatea, and a much smaller displacement, she carried 2,400 square feet more sail. She had beaten all the English cutters with ease, and her owners came across the pond with the firm conviction that Thistle would carry back the America cup in her locker. But the her forefoot; but a glance at the two Valkyries, in the accompanying drawings, shows that their forefoot is cut away far more than Thistle's, and yet they are exceptionally fine boats in windward work.

The next challenger, Valkyrie II, designed by Mr. G. L. Watson, the designer of Thistle, was a further development toward the greater beam and shallower body of the American type. She showed in her profile or sheer plan the growing tendency among English designers to cut away all useless "deadwood" fore and aft. This was done to reduce the wetted surface of the boat. The researches of Mr. Froude, the English naval expert, had emphasized the fact that the larger part of the resistance of a ship is due to the friction of the water against her hull, or what is technically known as "skin friction." In the effort to reduce this area of wetted surface, the helm was tucked well in under the boat, and the keel forward was cut away until nothing was left but the body, or hull proper. This reduction of the "lateral plane" also produced an underwater form that would offer the minimum of resistance to turning when the boat was coming about. This latter result was very marked in Valkyrie II, and stood her in good stead when she was maneuvering for the start, or when she had Vigilant placed under her lee. The Vigilant introduced Mr. Herreshoff as a builder of cup



THE EVOLUTION OF THE INTERNATIONAL RACING YACHT.

prompt and characteristic: "We are very much obliged to you, but we don't want it in that way." He set a precedent in such contingencies, which, no doubt, all true-blooded sportsmen of each nationality will be quick to follow. The New York Herald of the following day voiced the public sentiment when it said, "The magnanimous decision of the owner of the Genesta is only what might be expected of Sir Richard Sutton and the club which he so admirably represents." The race finally came off on September 14. The wind was very light and "fluky." It suited the shallow, broad hulled boat and she won easily by 16m. 19s. The next race was sailed twenty miles to leeward and return. This, with one exception, was the most exciting race in the annals of the cup. There was a good breeze down to the mark, which the Genesta rounded one-eighth of a mile ahead. Then as they lay for the home mark, close hauled, the wind freshened and afforded a splendid opportunity for judging of the behavior of the two types in that grandest of all tests, a thrash to windward in a strong breeze and rough sea. The cutter kept up her topsail, and heeling until her seventy tons of lead in the keel could get in its steadying effect, she carried this great topsail home through half a gale of wind. The Puritan took in her topsail, housed her topmast, and under snug canvas began steadily to overhaul her rival. Her centerboard brought her closer to the wind, and she crept up well into the weather berth, coming home genius of the late Mr. Burgess, designer of Puritan and Mayflower, was equal to the occasion. He turned out a remarkably powerful boat, the Volunteer, showing in her a further development along the lines of compromise that he had followed in the two former boats. Compared with them, she had about the same beam, more draught and more outside lead, having 50 tons in her keel, besides a large amount of inside ballast in addition. Her sail plan was the largest ever seen on a "single sticker," and her career in the trial races was marked by easy victories over her predecessors, Puritan and Mayflower.

No cup race has aroused greater interest than the Thistle-Volunteer contest. The reputed prowess of the challenger, her wider beam and larger sail spread, had excited grave fears for the safety of the cup. The event, however, proved these fears to be groundless. In the first race, sailed in the usual light breeze, the Volunteer won by 19m. 21¾s. The Thistle people then offered copious libations to God Neptune and besought his deity to grant them a strong wind from heaven. He granted the request; and, behold, it availed nothing! for the centerboard cutter lay up so much closer to the wind than her keel opponent that she reached the weather mark 14m. ahead. The Thistle pulled up somewhat on the run home, reducing the Volunteer's lead to 11m. 48¾s. It was claimed that the Thistle's sagging away to leeward, when on a wind or close hauled, was due to the cutting away of defenders. She was a further development along the sloop cutter lines. She had the unprecedented beam of 26 feet, the great draught for a sloop of 13 feet 6 inches (as great as that of any previous challenger), and the large sail spread of 11,312 square feet or 1,300 feet more than the Valkyrie. She had 55 tons in her keel, besides 29 tons of inside ballest. She carried the characteristic centerboard of the sloop.

The first race was started to windward. The wind, light and fluky, veered around so that the race was a reach both ways. Mr. Watson's later boats have all shown a weakness in reaching, but excellent windward qualities. Mr. Herreshoff's boats are all excellent on a reach; and this change of wind meant sure defeat for Valkyrie. She came in 5m. 48s. astern. The second race, over a thirty-mile triangular course, was sailed in a strong whole-sail breeze. It consisted chiefly of reaching, and the Vigilant scored a brilliant victory, winning by 10m. 35s.

The third race, 15 miles to windward and return, was sailed in a strong reefing wind and a lumpy sea. It was Valkyrie's weather, and the comparatively narrow, fine lined cutter liked it better than the broad hulled centerboard, for Valkyrie turned the weather mark 1m. 55s. ahead of Vigilant. She pointed higher into the wind, and made better weather. It was a truly sensational scene, for here was the traditional centerboard, for the first time in the history of international cup racing, being fairly beaten by its time honored opponent, the keel boat. In the words of that most charming of all nautical writers, Mr. A. J. Kenealey, "Now came the surprise of the yachting season. The English keel boat seemed to eat her way out to windward in a manner almost magical, while the centerboard craft slowly sagged off to leeward. Conditions were reversed for the nonce, and the experts of the New York Yacht Club could scarcely believe their eyes." On the run home the 1,300 square feet excess of sail on the Vigilant stood her in good stead. She gained rapidly, but not rapidly enough barring accident to save her time allowance of 1m. 33s. It looked as though the English cutter were about to place at least one well earned victory to her credit. But here Dame Fortune, that fickle goddess, stepped in and said it should not be. Valkyrie's spinnaker was slightly torn in setting. A gust of wind tore it from top to bottom. Another was set, and that too was split to shreds. Meanwhile Vigilant swept by and landed across the line, a winner by the close margin of 40s.

While Mr. Herreshoff and Mr. Watson were fighting it out off Sandy Hook, there was a battle royal going on in the English Channel between two other creations of these two designers, namely, the Navahoe and the Britannia. They were practically sister boats to the Vigilant and the Valkyrie. The outcome was strongly in favor of the cutter. When it came to reaching, the Navahoe could hold her own; but in windward work she was completely outclassed. The next season the American champion crossed the ocean to avenge her twin sister, and met with a crushing defeat at the hands of the Britannia, a boat that stands to-day with a record of victories that has never been approached. It is true that, when there was any reaching to be done, and particularly when the wind was fresh, Vigilant scored some splendid victories; but the balance of the wins was vastly in favor of the keel boat. It was the same quickness in stays, consequent on her reduced lateral plane, and the same fine windward qualities which her twin sister Valkyrie showed in America, that won for Britannia so many victories over Vigilant. Mr. Herreshoff was aboard Vigilant during the third race of 1893; he was aboard her again in 1894 when Britannia so frequently tucked her snugly under her lee; and the lesson of this experience was not lost upon him. Lord Dunraven is quoted as saying on leaving for England at the close of the 1893 contests: "If I come again, I shall find a keel boat built to meet me."

The influence of the racing of 1893-4 on Mr. Herreshoff is seen in a comparison of the midship section and sheer plan of Defender with that of Vigilant and Valkyrie. As compared with Vigilant, he has thrown over the great beam, the moderate draught, the long straight keel, the almost plumb stern post and rudder; and, as compared with Valkyrie II, he has adopted the moderate beam, the deep draught (in Defender's case 5½ feet more than Vigilant), the cut away and rounded keel, the raking stern post placed well in under the boat; and finally, and most startling of all, he has thrown out the national and time honored centerboard! The midship section of Valkyrie III shows the influence of Vigilant on Mr. Watson. Following along the lines on which he worked in Thistle and Valkyrie II, he has greatly increased her beam, and consequently her sail spread; he cut further into the lateral plane both fore and aft, and he increased the draught.

In their performances the two boats show the same strong and weak points of sailing that have ever characterized the work of their designers; though it is scarcely just to speak of weak points in the work of Defender, for she is a most consistent performer all round. Her weakest point is running with spinnaker set and the wind dead aft; and her strongest point is reaching. Strange to say, the conditions are exactly reversed in Valkyrie. She is superb in windward and leeward work and a miserable failure on a reach, the three year old Britannia easily holding her on this point of sailing.

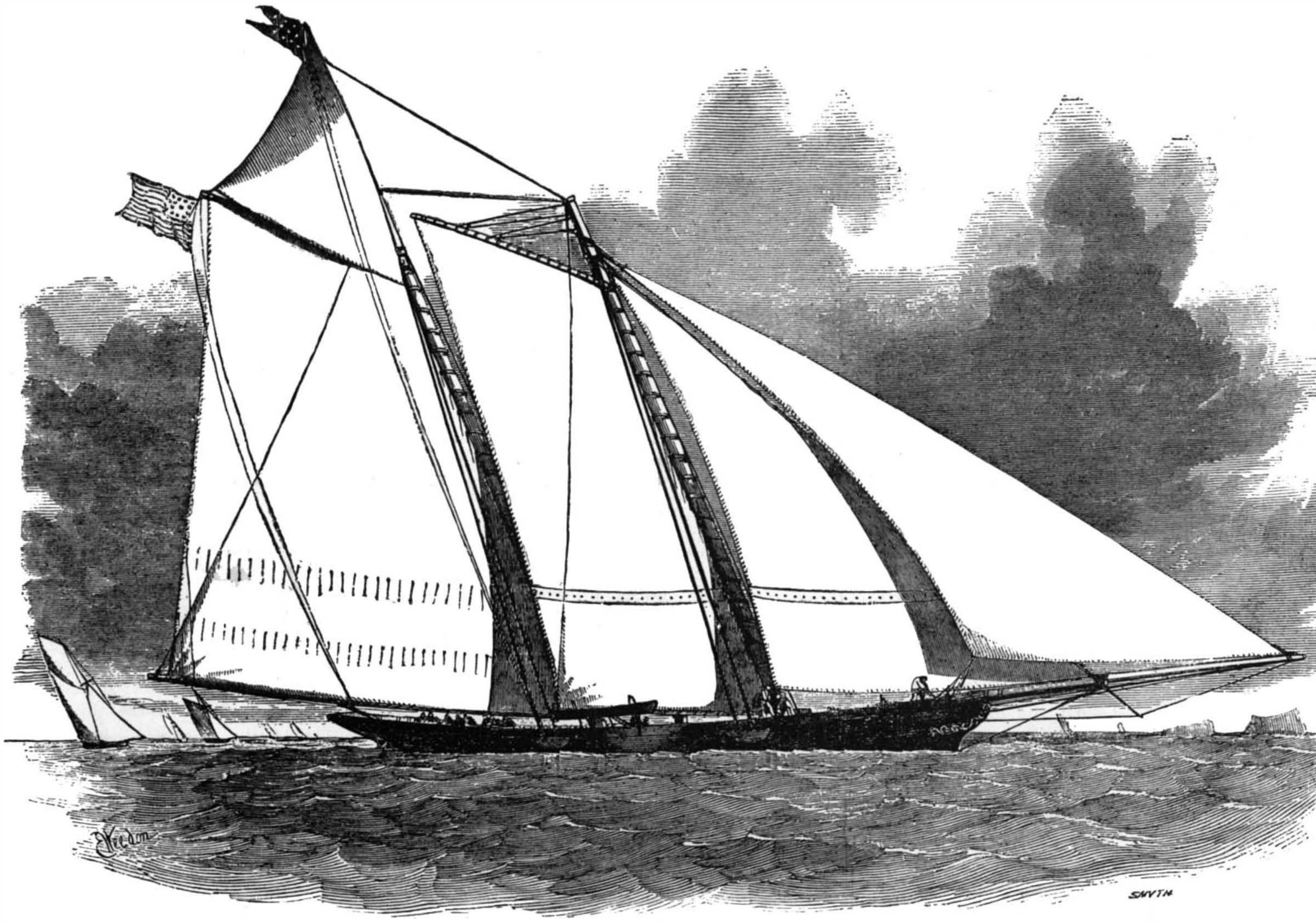
Judged by their previous performances, Valkyrie's best chance of winning would be on a windward and leeward course, and Defender should always win on a triangular course.

By a strange fatality the same shift of wind occurred in the first of the 1895 races to windward as did in the first windward race of 1893. When both boats were on the starboard tack and Defender to starboard of Valkyrie, the wind shifted several points to the south, bringing it further round on the starboard bow and placing Defender well to windward. This also changed the home course from a dead run with spinnakers, Valkyrie's best point of sailing, to a reach, Defender's best point of sailing; and the home boat literally ran away from Valkyrie, and won a splendid victory by between 8 and 9m.

The next race, over a thirty mile triangular course, was marred by a foul between the two boats, which the committee subsequently decided against the visitor. Defender, though crippled with a sprung topmast, sailed over the course under reduced sail, and actually gained ¼m. on one leg and 1m. 17s. on the last leg of the triangle, losing the race by only 48s. This was a moral victory for Defender, and seems conclusively to establish her superiority over such a course. Before the final race, Lord Dunraven, the principal owner of the Valkyrie, wrote the America Cup Committee, stating that unless they could guarantee a course free from obstruction by excursion boats, he would decline to sail his yacht. The Valkyrie was at the starting point under reduced canvas, and crossed the line in order to make the race count. Then she wheeled around and started for New York, leaving Defender to sail alone and secure the third and decisive race of the series.

Thus ended the most disappointing and unsatisfactory contest in the history of the cup races.

That the Defender is a better boat on the average than the Valkyrie, would seem to be proved; but that these two magnificent yachts should never once have spread their spinnakers, and never once have found a wind that lay their lee rails awash, is a source of genuine disappointment to all close students of yacht design and performance. J. B. W.



THE YACHT AMERICA, 1851.

The Trip Valve Gear on Marine Engines.

It is odd that a form of rapid cut-off valve gear has not been successfully applied to marine engines, as in the case of engines for stationary duty. It is well known that steam machinery has received the greatest amount of attention by engineers with the object of economical fuel consumption, and every source of waste of heat and steam has been most carefully studied. Especially have the efforts been marked for economical operation in the marine plant, where saving in coal is of vital importance. The marine triple and quadruple expansion engines, which are furnished with steam at a tremendous boiler pressure, are far ahead, in point of economy, of the stationary engines, which have very often better methods of "cut-off." The writer sees no reason why stationary engines should monopolize the best steam valves. It is clear that a valve of this kind would not be satisfactory on very small high speed screw engines, because of the inertia of the tripping parts, or perhaps on the engines of large ocean steamers, where the gear would have to be very massive, but there seems to be room on engines of medium speed and size for profitable experiments. The compounding of locomotives is comparatively a recent thing, and the improvement was brought about in the face of much opposition.

N. MONROE HOPKINS.

[There are some difficulties met in adapting the Corliss movement to large marine compound engines that more than compensate for any possible gain; as, beyond the operation of the high pressure piston, there is no gain in power.

The complication of parts in a valve movement of the Corliss type is not desirable, as it increases the liability to derangement or breakage on shipboard. Simplicity in construction is the first principle in marine machinery.—EDITOR.]

New British Torpedo Boat Destroyer.

The trial trip of the torpedo boat destroyer Salmon was lately run. This vessel has been built and engined by Earle's Shipbuilding and Engineering Company, of Hull, and is one of the larger class of the destroyers, her displacement being 280 tons. Her draught, on trial, was 5 ft. forward and 7 ft. 3 in. aft. The mean speed on the six runs on the mile was 27·88 knots, and for the whole three hours 27·608 knots, or at the rate of 31¾ miles per hour. The Snapper is a sister vessel, built by the Earle Shipbuilding Company for the Admiralty. The contract price for each vessel is $176,960, exclusive of armament.

El Capitan Meteorite.

BY E. E. HOWELL.

This handsome meteorite was found by a Mexican sheep herder, Julian Jesu, in July, 1893, on the northern slope of El Capitan range of mountains in New Mexico. Three small pieces were broken from the thin edge, which show beautifully the octahedral structure of the iron. The smallest of these, weighing a few ounces, was sent to the National Museum, and the two larger, weighing respectively 1 pound 12½ ounces and 3 pounds 14 ounces, together with the main mass, 55 pounds, came into my possession at different dates in 1894.

The weight of the iron when whole was about 61 pounds. It measured 10 × 9 × 5 inches, thinning at one edge, and had the usual irregular pitted surface.

My information in regard to the history of the meteorite, as well as the meteorite itself, was obtained from Mr. C. R. Biederman, of Bonito, N. M. Mr. Biederman says that he, in company with many miners, was standing in front of a store in Bonito some time in July, 1882, when "they saw a meteorite which looked like a fiery ball moving rapidly toward the north at an angle of 45° and vanish behind the Capitan range." Mr. Biederman thinks the meteorite found by the Mexican is the one they saw fall, and there is nothing in its appearance to disprove his claim. It is entirely free from oxidation and evidently fell at a comparatively recent date.

The Widmanstatten figures are developed very easily and clearly, as is usual with irons containing the percentage of nickel which this has, showing it to belong to the usual type of octahedral irons, with rather broad bands of kamacite somewhat like those in the Cooperstown meteorite.

I am indebted also to the courtesy of Professor Clarke for the following analysis of this iron by Mr. H. N. Stokes, of the United States Geological Survey:

Fe	90·51
Ni	8·40
Co	0·60
Cu	0·05
Si	tr.
P	0·24
S	tr.
	99·80

—Amer. Jour. Science.

Argon and Helium in Meteoric Iron.

Professor W. Ramsay, extending his researches upon the new element argon, has proved that it exists with helium in meteoric iron. The meteorite investigated was that of Augusta County, Virginia, two ounces of which, heated to redness in a hard glass tube, yielded 45 cc. of gas. This appeared to consist chiefly of hydrogen, but after it had been exploded with oxygen, and the carbon dioxide and excess of oxygen absorbed, a residue of half a cubic centimeter was obtained. Several vacuum tubes having been filled with this after being dried, spectroscopic examination proved it to be for the most part argon, the trace of nitrogen which first appeared rapidly disappearing. All the argon lines were observed and also, faintly, the yellow D_3 of helium. A comparison of the spectrum with that of the helium from cleveite showed the presence of the red, blue green, blue and violet lines characteristic of it. From quantitative observations with a mixture of argon and helium it is concluded that the latter element makes up less than 10 per cent of the gases obtained from the meteoric iron.—Nature.

The Story of the Paris-Bordeaux Race.

One of those who rode in the winning carriage has written for Figaro a spirited account of how the race was run and won. The contestants in the coming race will not be compelled to press on in the night, but there will doubtless be incidents fully as exciting as those described by Edouard de Perrodil, who writes as follows:

I took part in the race of the automobiles from Paris to Bordeaux and back in carriage No. 16, the winner of the first prize. The story is worth telling under the circumstances.

Nothing noteworthy occurred on the way to Bordeaux. The pace was 25, 30, 40, and even 50 kilometers [a kilometer is equal to about 0·62 of a mile] an hour on the down grades. After passing Blois night fell, dark as ink. The whole population was on the lookout, and from time to time one passed groups of people waiting along our route. The cyclists were legion. They, too, were massed along the road, and with their bobbing lamps they resembled a gathering of shadows, about which flickered here and there the will-o'-the-wisp. How cold it was! A wind which blew steadily full in our faces turned us to ice.

As day broke one had plenty of time to catch the efforts which the sun made to break through great banks of gray clouds. Toward 10 o'clock the weather again became superb. After leaving Couhe-Verac the automobiles simply flew. In this way were passed without a stop Ruffec, Angouleme, and Libourne, and we entered Bordeaux in triumph.

I only joined it again at Blois, to which place I traveled by rail. While I waited at Blois a telegram from Tours brought us the news that the struggle for the first prize had narrowed down to two carriages—No. 8, which had passed at noon, and mine, No. 16, which had passed at 12:30 P. M.

At Blois No. 8 arrived at 2:45. She took in petroleum and started once more at 3:05. Everyone was anxiously looking out for No. 16. "Has she gained ground?" Yes; she has gained five minutes. I have resumed my place beside the engineer, with a keen sense of satisfaction, mingled with excitement, for the fight is going to be a hot one. We are twenty-five minutes behind No. 8.

Our carriage travels splendidly. The road, too, is magnificent. I hold in my hand the ordnance map and I point out to the engineer the various places. We pass rapidly by Mer, Beaugency, Meung-sur-Loire, La Chapelle. Every other minute the engineer, Mr. Koechlin, or the other traveler, inquires: "Are they far ahead?" "Hurry up; they are half an hour ahead of you!"

At the umpire's station at Orleans an immense crowd. A halt of two seconds. One of the committee tells us: "You are twenty-five minutes behind No. 8." Why, we are still as far behind as ever.

We bound forward on the Paris road. We pass Saint Lye, Autruy. It is already late, and the day is visibly drawing to a close. "Sapristi! What is going to happen," I say to myself, "at such a pace at night, when we descend the hills of Saint-Remy and Buc?"

All at once an emergency arises. One of those that I had most dreaded. The drivers we met always kept a bright lookout, generally on foot at their horses' heads. But this time a dray horse at the sight of our automobile backs so violently that the driver cannot hold him. Our engineer does not stop. He describes an enormous elbow on the grassy slope, upon which the automobile leaps and doubles round the back of the dray. We have passed by safely!

Every minute now one inquires: "Where are they?" Every time the same answer: "Go on! Go on! Make haste! A quarter of an hour ahead!"

Mr. Koechlin, the engineer, loses his nerve badly. He is rattled. He no longer stops at anything. Night has now fallen, densely dark, as before. "Where are they?" yells the engineer to each passer-by. "Quarter of an hour ahead; push on!" "Thunder!" says the engineer; "shall we never overtake them?"

At the steep hills we get down to lighten the carriage and we run breathlessly behind. Here we are at Etampes. At the entrance of the town some one who was on the lookout for us throws us a bag of ice to cool the cylinders.

Suddenly, in the middle of Etampes, a young fellow calls to us: "They stopped here to take in water. Go ahead; they have three minutes' start!"

The engineer is quite beside himself. We dash forward into the night, and suddenly, on a hill which is before us, we make out a red fire and we recognize the sound of a motor—tuff, tuff, tuff! It is No. 8.

We attack the hill in turn. We leap from the automobile and courage! We are within 200 yards of No. 8. Hurrah! But our competitor has reached the top of the hill and is leaving us at full speed. We shall have to make two deep descents in zigzags—here comes the first. No hesitation. We attack it at 25 miles an hour. It is alarming.

Suddenly we come to a fork in the road. "Which way?" cries the engineer. It is terrible. I do not know.

"Left!" I cry. "No, right!"

The pace is such that the engineer's hesitation comes very near causing a catastrophe. For he has no time to make the sharp turn from left to right, and we shoot on toward a wall which stands at the angle of the roads. Our automobile was supplied with two air brakes. One can be worked by the feet, while still steering; the other, and much the more powerful brake, must be worked by hand. To apply the latter one has to release the guiding bar.

In our critical position the engineer showed great presence of mind. He dropped the guiding bar completely and applied both brakes at once. This saved us. The front wheels nearly ran up against the slope which was at the foot of the wall. All this took but a second. Here we are rolling along at a mad pace once more.

We pass through Versailles. A halt of two seconds at the umpire's station. No. 8 is still three minutes ahead.

This time the engineer no longer knows the road at all, but, on the other hand, I know it thoroughly, having traveled it an incalculable number of times on a bicycle.

Then, standing beside Mr. Koechlin, I find myself in the same position as the young son of King John the Good when, at the battle of Poitiers, standing beside his gigantic father, who was holding at bay the entire English army, he kept calling out: "Father, strike to the right! Father, strike to the left." I call out to the engineer: "Steady; turn to the right! Steady; turn to the left!"

And so, rolling and bounding along, we pass the Suresnes bridge, the riverside drive, Avenue de Madrid, Boulevard Maillot, and we reach our goal at two minutes and thirty seconds past midnight—two minutes later than No. 8, but we were winners! For No. 8 had left Paris fifteen minutes ahead of us. It was, therefore, thirteen minutes late.—Chicago Times-Herald.

A New Theory of Sleep.

Since the discoveries made by Golgi, Cajal, Retzius, and others of the peculiar anatomical characteristics of the nerve cells, a number of new theories regarding brain function and brain action have been in the field. The nerve cell, as it is now understood, consists of a very large number of long branched processes, which are called the protoplasmic processes, and a single axis cylinder which extends out, becoming eventually the nerve fiber and giving off fine lateral branches. It has also been shown that each nerve cell in the brain is in contiguity with some other nerve cell, or rather with the terminals of the axis cylinder process of that cell, but that no actual union takes place between the processes from the one cell and fiber process of the other. When one set of nerve cells, for example, are thrown into activity, impulses are sent out along the axis cylinders and their terminal end brushes and these affect by contact the protoplasmic processes of other cells.

Cajal and others look upon the axis cylinder and nerve fiber as conveying impulses out from the nerve cell or body, while the protoplasmic processes receive impulses brought to them and carry them to the cell body. These latter, therefore, are sometimes called cellulipetal, while the axis cylinder process is called cellulifugal. We are speaking, of course, now of the relations of the different groups of cells in different parts of the brain, rather than of the relations of these cells to the spinal cord and parts below. Some time ago Professor Duval proposed the theory of sleep based upon the peculiar relations of the brain cells and fibers. According to this theory, the nerve cells in repose retracted their processes,[which, as he thought, were really pseudopods. The cell processes being thus retracted, the contiguity of the cell with other cells was less perfect; hence their functions became lowered, consciousness was lost, and sleep ensued.

Kolliker objected to this view, on the ground that amœboid movements are never observed in nerve cells at least of the higher animals; Duval having contended that he had seen such movements in the lower orders of animals. Cajal, siding with Kolliker, states that no matter what way you kill an animal—by shock, strangulation, or anæsthesia—the nerve cells never differ in aspect, and one never can discover any amœboid movements among them, even when they are placed freshly in the field of the microscope. Cajal has, however, suggested another theory of sleep which he believes more rational and more in accordance with facts. While nerve cells do not have amœboid movements, there are, scattered richly throughout the brain tissues, other cells known as neuroglia cells. These are cells with very numerous fine processes, and they form in a large measure the supporting framework of the brain tissue, sending their fine processes in among the nerve cells and blood vessels.

Now Cajal's theory is that these neuroglia cells during repose extend or relax their fine hair-like processes. As the result of this the perfect contact between the processes of the nerve cells and the end brushes from the axis cylinders that surround them is interfered with, hence the brain function is slowed up and sleep ensues. During activity these neuroglia cells retract their numberless fine processes, the contact between the nerve cells becomes perfect again, and mental functions are resumed. The practical facts upon which Cajal bases this ingenious theory are that the neuroglia cells are found to be in different states. In some their processes are retracted and shriveled and in others they are extended. There is unquestionably an amœboid movement, therefore, in this class of cells.

Furthermore, it is in accordance, he says, with physiological facts that a cell would retract its processes during activity and relax them during repose. The physical basis of sleep, therefore, according to this view, would be the bristling up of the hair-like processes of the neuroglia cells, a squeezing of them in between the machinery by which the nerve impulses pass, and a sort of a clogging of the psychical mechanism. Such theories are of course as yet only theories, and may be regarded by practical minds with great contempt. Still, there is sometimes an advantage in scientific hypotheses, even if they furnish only an intellectual exercise to the student.—Medical Record.

Aluminum Boats.

A practical test was made of aluminum in the construction of small boats by Mr. Walter Wellman, who had three constructed to carry his polar expedition last year. These boats, it was said at the Navy Department, had been brought back to Washington, and an examination some time ago showed that the material had so deteriorated that it could be easily crumbled in one's hand.

Science Notes.

Pictet's Gas.—Mr. Pictet, having observed that an addition of carbonic acid to sulphurous acid seemed to materially increase its powers of disinfection, requested Professor D'Arsonval to investigate the value of this admixture and report thereon. Mr. D'Arsonval has communicated the results of his experiments to the Société de Biologie. He finds that carbonic acid and sulphurous acid, in the proportion of four of the former to six of the latter, combine chemically to form a gas (which he calls "Pictet's gas") possessing marked antiseptic properties and extraordinary powers of diffusion. Thus, cultures of typhoid and cholera were placed on rags between the leaves of a book which was enveloped in cloth and exposed to the influence of the gas. In the space of an hour the germs were found to be entirely destroyed. Pictet's gas has also proved fatal to microbes that were still living after treatment with sulphurous acid.

Direct Spectrum Analysis of Minerals.—Among the theses recently presented to the Faculty of Sciences of Paris, may be mentioned an important one by Mr. Arnaude de Gramont upon spectrum analysis. The process employed differs from those used up to the present time. A spark from a condenser is made to pass between two fragments of the mineral to be examined, and the methodical spectrum analysis of the rays that are produced furnishes accurate and quickly obtained data as to the chemical composition of the mineral. By this method Mr. De Gramont has also been able to find in fused salts the rays of the metalloids contained therein. He has given the rays of sulphur and silenium with a closer approximation than has ever before been obtained.

Formation of Drops.—In a paper presented to the Royal Society of Edinburgh, Mr. Hannay gives the following interesting data in regard to the formation of drops.

The drops were studied by allowing water to drop through oils of different density and viscosity and causing drops of oil to ascend through water. The volume of a normal drop of distilled water in olive oil was found to be equal to 0·4096 cubic centimeter. When the drops succeed one another at intervals of ten seconds, the volume is increased to 0·5611 cubic centimeter, while the drops formed from a cylinder of water so arranged as to eliminate the effects of gravity have a volume of but 0·5470 cubic centimeter, which shows that the determining factor in the formation of drops is contractibility. Gravity has a tendency to make the drop lose its spherical form, but the contractile force of the liquid prevents such distortion, and the result of those two contrary forces is the constriction of the drop and its separation.

Mr. Hannay confirms the observation made by Tate as long ago as 1864: "The weight of a drop is sensibly proportional to the diameter of the tube from which it falls. The force that retains the drop is wholly superficial. It is an extremely thin envelope that determines the size and form of drops."

This fact was proved by causing water at 20° C. to drop in the vapor of benzine at 37°, so that the latter was suddenly condensed and formed a thin stratum around the drops of water. The volume of the drop of 0·1081 cubic centimeter in the normal state was found under such circumstances to be reduced to 0·0449 cubic centimeter.

Properties of Carbonic Snow.—At a recent session of the Société d'Encouragement, Mr. P. Villard made known the results of some experiments made by him in conjunction with Mr. R. Jarry upon solid carbonic acid. Crystallized carbonic acid melts at —57° under a pressure of 5·1 atmospheres. This melting point was determined by means of a toluene thermometer plunged in the melting carbonic acid, which was contained in a glass tube protected against radiation by a metallic jacket. The crystals of carbonic acid have no action upon polarized light. The point of ebullition of carbonic snow at the ordinary pressure, that is to say, the temperature that it takes of itself when it is exposed in an open vessel, was likewise determined with a toluene thermometer carefully protected against radiation. Such point of ebullition is situated at —79°, and at this temperature the vapor emitted possesses an elastic force precisely equal to the pressure of the atmosphere, conformably to the laws of ebullition. It is, therefore, impossible to admit the temperature of —60° hitherto proposed, to which corresponds an elastic force of about four atmospheres.

Contrary to the opinion that has been held, ether added to carbonic snow does not lower the temperature of it. In whatever way the mixture is made, the minimum temperature is —79°, and this is not attained unless there is an excess of snow; and the feeble thermic effect due to the dissolving of the snow cannot manifest itself under ordinary conditions.

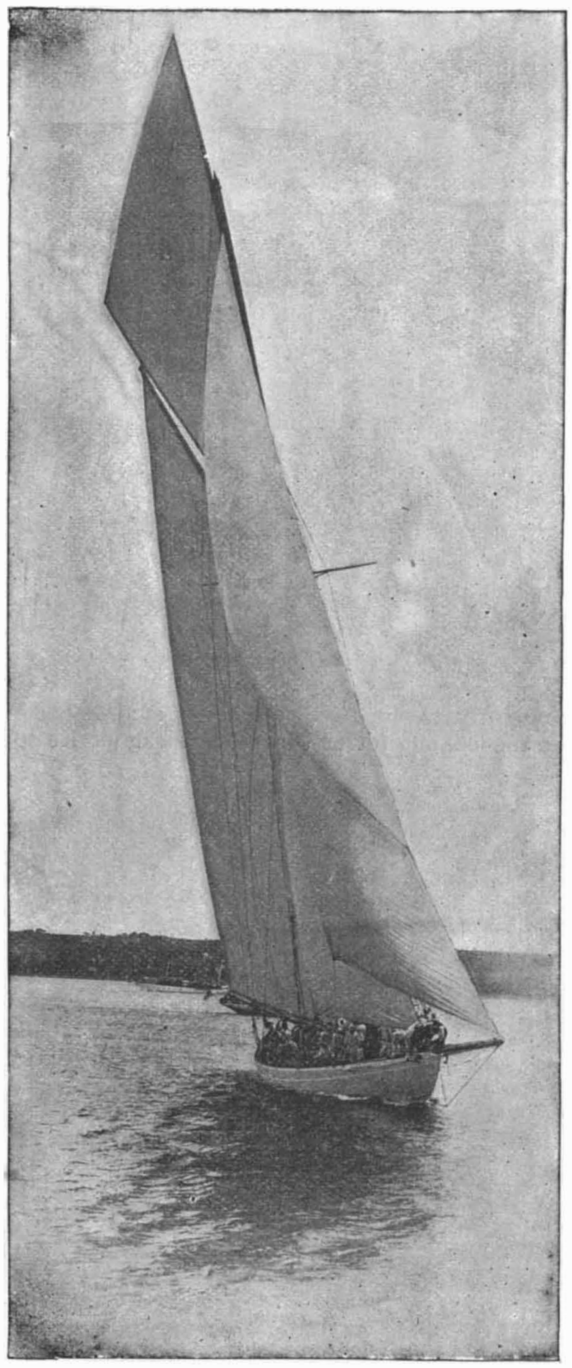
The cold obtained is due to the fact that the snow is cold and tends to maintain itself at its point of ebullition. Consequently, it brings to this point the liquid that surrounds it.

Chloride of methyl acts quite differently. The snow dissolves in this without any gaseous disengagement, starting from —65°, and, at the moment of saturation, the thermometer marks —85°, a temperature lower than that of the coldest of the bodies employed. We have thus a true freezing mixture comparable to a mixture of nitrate of ammonia and water.

Liquid protoxide of nitrogen was tried without success as a solvent of carbonic snow.

In a vacuum, the temperature of carbonic snow readily falls to —125°, and this degree of cold can be maintained for a very long time with little material. The author concludes from this that it is easy to succeed in liquefying oxygen without any other refrigerant than carbonic snow and with the ordinary resources of a laboratory.

Arsenic in Steel.—Mr. J. E. Stead has recently published a paper upon a subject to which metallurgists have hitherto paid but little attention—the presence of arsenic in steel. Mr. Stead finds that a proportion of from 0·1 to 0·15 per cent of arsenic can exert no influence upon the resistant properties of the metal employed in constructions. The resistance to breakage is slightly increased by the presence of a feeble proportion of arsenic. The elongation is in nowise



THE AMERICAN YACHT DEFENDER.

affected, and the contraction of the section of the broken trial bars is practically the same as that of steel that contains no arsenic. But with a proportion of 0·2 per cent of arsenic, the difference becomes marked in the steel obtained in the open hearth furnace. But even then the resistance to flexion alone is a little reduced. With one per cent of arsenic the resistance to breakage increases, the elongation diminishes a little, and the contraction is reduced. When steel contains four per cent of arsenic, the resistance to breakage ever increasing, the elongation and contraction disappear.

Electrification by Rain Drops.—In a paper recently presented to the Philosophical Society of Glasgow, Lord Kelvin showed, by the aid of special apparatus, that the passage of a drop of water through the air has the effect of slightly electrifying the latter. The electric action is much more intense if the drop of water meets with a solid body or a liquid surface. He has also found that if a drop of fresh water strikes a surface of salt water or a solid body, the air is negatively electrified, while if salt water is used, the air is positively electrified.

The clash of waves against each other likewise gives rise to a positive electrification of the air, and in a much larger measure than the negative electrification due to the fall of rain.

Theory of the Sensation of Colors.—Mr. George Arzens, struck by the insufficiency of the theory of vision from the view point of the perception of colors, has conceived the idea of applying the theory of stationary waves to the explanation of this phenomenon. He remarks, in the first place, that the nerve fibers, after traversing the retina, are so inflected as to present a direction inverse to that of the luminous rays, and that some of them are terminated by cylindrical rods and others by small cones. These nerve fibers receive an excitation from half-wave to half-wave. Mr. Arzens believes that they are differently impressed, according as it is a question of rods or cones. The first gave the sensation of light and the second that of colors. In the case of the conical fibers, there intervene phenomena of interferences that unequally displace the planes of the stationary waves. The planes that correspond to red light are thrust forward with respect to those of the red rays, so that the cone is impressed at different points by the rays of the various colors. In support of this theory, he makes the following remarks: (1) Nocturnal animals have no cones; (2) in the alterations of the retinal pigmentation due to senility or disease (achromatopsy), there is a suppression of the perception of colors; (3) when we consider points of retina remote from the central part, the notion of color diminishes in the same ratio as that of the number of cones to the number of rods.

Non-Shrinkable Fabrics. — Messrs. Mathelin, Floquet and Bonnet have just devised a process which they claim has the property of rendering thread and fabrics absolutely non shrinkable. They combine the old alumina or sulphate of alumina process with a treatment with a solution of carbonate of soda and the use of steam. The latter, in addition to its fixing property, permits of sensibly increasing the degree of solution of the alumina salts, while removing the unctuous, gelatinous or glutinous feeling resulting from the treatment.

Artificial Indigo.—What is known as "indigo salt" is now being introduced as the latest substitute for the genuine article. It is said to possess the property of being converted into indigo by means of caustic soda, and, in dyeing, all that is necessary is to treat the cotton in a bath of the salt and then pass the treated cotton into a solution of the soda. The value of this method may be estimated from the statement made that, in printing, it suffices to thicken a solution of the salt with dextrine, print this on, and pass the printed fabric through caustic soda.

Paper Pulp for Leaks.

Paper pulp is one of the most useful articles in the reach of mankind.

Mixed with glue and plaster of Paris or Portland cement, it is the best thing to stop cracks and breaks in wood.

Pulp paper and plaster alone should be kept within the reach of every housekeeper.

The pulp must be kept in a close-stoppered bottle, in order that the moisture may not evaporate.

When required for use, make it of the consistency of thin gruel with hot water, add plaster of Paris to make it slightly pasty, and use it at once.

For leakage around pipes, to stop the overflow of water in stationary washstands, where the bowl and the upper slab join, it is invaluable.

Used with care, it will stop leaks in iron pipes, provided the water can be shut off long enough to allow it to set. Around the empty pipe wrap a single thickness or two of cheese cloth just wide enough to cover the break, then apply the compound, pressing it in place and making an oval of it somewhat after the fashion of lead pipe joining, only larger.

The strength of this paste, when once it is thoroughly hardened, is almost beyond belief. The bit of cheese cloth prevents any clogging of the pipe by the paste working through the cracks.

An iron pipe that supplies the household with water had a piece broken out by freezing. The piece was put in place, bound by a strap of muslin, then thoroughly packed with paper pulp and Portland cement, and was to all appearances as good as new.

Paper pulp and fine sawdust boiled together for hours, and mixed with glue dissolved in linseed oil, makes a perfect filling for cracks in floors. It may be put on and left until partly dry, then covered with paraffine and smoothed with a hot iron.—Rural Mechanic.

An Earthquake on the Atlantic Coast.

A shock of earthquake was felt a few minutes after 6 o'clock on the morning of Sunday, September 1, along the Atlantic coast from Delaware to Long Island. The shock in New York City was very slight, but was sharp in New Jersey and to the east of New York. The vibration was attended by a slight rumbling noise. This makes the fourth shock which has been felt in New York City in the last eleven years. On August 10, 1884, at 2:14 P. M., there were three distinct vibrations, the second being the severest ever recorded in this vicinity. Other slight shocks were felt on August 31, 1886, and on March 8, 1893.

A Test of a War Vessel Frame and Armor.

The Naval Ordnance Board conducted an important test at the Indian Head Proving Ground, near Washington, September 4. Though primarily it was a test of a steel armor plate, it was in reality a trial of the strength of the frame of a modern warship. It has been claimed that the frames of modern warships would not withstand the shock caused by heavy projectiles striking against the armor which covers them.

It has even been asserted by some authorities that the armor, if not penetrated or shattered by the shock, would be driven through the vessel by the crushing of the frame. Some time ago the English government fired at an old armored vessel for the purpose of observing the effects of the shock, but this test at Indian Head is the first frame test ever made of a distinctly modern warship's frame with armor attached.

The plate tested represented twenty-four others weighing 620 tons. It was made by the Carnegie Company and was what is known as double-forged, being forged both before and after Harveyizing.

The plate was 14 inches in thickness and formed the outer surface of a target which was a representation of a side section of the battleship Iowa. It was 18 feet long by 7½ feet high, and represented that portion covering the vitals, and extending 5 feet below and 2½ feet above the water line. Behind the armor was a backing of 5 inches of oak, and then came the "skin" of the vessel—the inner and outer bottoms, each five-eighths of an inch of steel plate.

Some four feet further back was a ⅝ inch steel plate, representing the inner shell of the vessel. Between this plate and the "skin" were the frames or braces, also of ⅝ inch plate, alternately two and four feet apart. The whole structure was covered by a 2½ inch steel plate, representing a protective deck. Against the inner plate were heavy timbers resting on the side of a hill.

The conditions were not exactly the same as on board a ship in the water, because the water would yield, while the solid earth would not, but the difference would be very slight, as the vessel in the water could not yield quickly enough to be of any real benefit. The first shot fired was a 10 inch Carpenter projectile, weighing 500 pounds, which was propelled by 140 pounds of prismatic powder. The velocity was 1,472 feet per second. The shell was completely shattered by the impact, part being lodged in the plate. The backing and frames were found intact. The charge of powder was increased to 216 pounds. The projectile then had a velocity of 1,862 feet per second. Again the shell was shattered, a larger portion being embedded in the plate, which still remained without a crack or bulge. The frame was uninjured, except that one of the armor bolts was driven out. This completed the acceptance test for the lot of twenty-four plates. Then a shot was fired from a 12 inch gun, using a Wheeler-Sterling projectile weighing 850 pounds, which was propelled by 400 pounds of powder at a velocity of 1,800 feet per second. This test was one which was ordinarily used for the 17 inch armor plate. It was, therefore, thought that the projectile would pass entirely through the plate, but it did not. The plate was penetrated almost its entire depth and cracked from top to bottom, but the oak backing was scarcely disturbed and the frame was uninjured. A further test with a 13 inch gun will be made as soon as the gun can be set up.

The test of the new armor bolt designed by the Ordnance Board to replace the bolt now used in fastening armor to the ships was also entirely successful. The bolt is less than half the length of the bolt now in use, and the saving of weight in each ship will be considerable.

The test demonstrates the fact that the frames of our warships are able to meet ordinary demands and that the 14 inch armor for the new battleships will, under ordinary conditions, receive the fire of any vessel without serious damage.

Why the Bicycle is so Popular.

The evolution of the bicycle from the original idea of manumotion down to the present diamond-framed rear driver has been by certain positive steps, each step marking a distinct advance in the grand march of improvement.

In schools are taught something of the revolutions wrought by the steam engine, the telegraph and the loom, but the schools of the future will surely take notice of the wonders wrought by the bicycle, and will teach something about the Draisine or "go-devil," the velocipede, the bicycle and all such inventions of whatever name, by which man is enabled to travel quickly, merely through the application of his own muscular powers.

What makes the bicycle so popular with all classes of people? Cheapness? No; the trolley or cable is cheaper. Speed? No. If one merely wants to travel fast there is the railroad. Luxury? No. The brougham is far ahead of the bicycle on that score. And yet people with all these things at their command have taken to bicycling with great fervor. It must be because of the outdoor exercise, you say. No, again. The term outdoor comprehends infinite space, and as for forms of exercise—well, they are without limit. There never was a complaint of the lack of either outdoors or methods of exercise in it.

The secret seems to lie in the fact the wheel has revealed to us that our natural powers of locomotion have been multiplied. "Two blades have been made to grow where but one grew before."

The draught upon our strength necessary to walk a mile is sufficient to enable us on wheel to travel five miles or more. Astride of it "magnificent distances" become insignificant.

What a glorious feeling of freedom comes over us when the countryside, smiling and gay, brings to the rider a sort of contagious happiness! What independence! We have not had to be carried there by the horse or the railroad and we are proud to say, "I did it!"

Inventors of auxiliary power appliances for bicycles should take notice of the fact that the secret to-day of the bicycle's popularity is not merely because a person is enabled to ride fast or far, but because the riding was without foreign assistance. Vanity and egotism cut a considerable figure in the wheel's popularity. To say "I rode on an electric motor bicycle to Albany to-day," would mean the same as to say, "I rode on a railroad train to Albany to-day." But to say, "I rode my wheel to Albany to-day," means something entirely different. The rider who did this in fast time would be hailed with great applause, and the telegraph would announce the fact to the world.

In improving the bicycle the main idea is to get the most results out of the least power applied by man to the pedals. Auxiliary power has nothing to do with bicycle improvement. It belongs to a class of inventions designed to carry or convey, not to those by which man carries himself.—The Wheel.

The Philosophy of Pumping.

The limit of atmospheric pressure being 33 feet, water will rise from that depth if the air is wholly removed from its surface. This is simply the law of gravitation. The ordinary device for removing the air is the pump. As the air to be removed is in weight as the height of the column, it is plain that the same amount of work is required to displace it as to lift or force a column of water an equal height theoretically. Practically the water can be lifted with less labor because of its density and lubricating qualities. This is too often forgotten and leads to a common error in placing pumps in wells.

It is thought that if we exhaust a cylinder, the air will rush upward to fill the space thus exhausted. It will, but the air leaves a space, too, that the law of gravitation causes to press downward and produces a load or weight which is increased at every stroke of the piston in the cylinder, and which, when the pressure above and the draught below are more than equal, will cause the elastic air above to rush through any existing imperfections of the piston or cylinder to effect an equilibrium below. When this occurs, it is plain to be seen no water will rise.

A writer on the subject puts it this way: "To see why a pump will not draw water more than 33 feet vertically, suppose the pump cylinder to be 40 feet above the water, commence the process of pumping, the air will be pumped out of the pipe, the pressure of the atmosphere will force the water up the pipe until the pressure inside and outside is equal. It becomes equal when the water has reached the height at which the column of water weighs the same per square inch as the pressure of the atmosphere. When this point is reached the water will be lifted no higher by atmospheric pressure, even though a perfect vacuum be maintained above it. Therefore, if it is desired to lift water further than this distance, it becomes necessary to place the cylinder or working parts of the pump within the limits of atmospheric pressure."

A perfect pump does not long remain so, whether it be used or unused. So as to avoid trouble and annoyance, when making calculations for placing a pump, trust nothing to suction, but rather place the cylinder far enough above the bottom to insure a prompt action of the valves, and near enough to the water to avoid the necessity of an absolutely perfect airtight piston, except as the water shall make it so.

A practical rule that experience has taught is for wells of all depths greater than 15 feet to place the cylinder within 12 feet of the bottom and let the pipe extend, with a foot valve on end, to within 6 to 8 inches of the bottom.

This is as near a perfect pumping outfit for wells as can be made. The plunger is made to fit close at all times by water surrounding it, and the valves act promptly, insuring against loss by water running past them. Such a pump is always ready for use. If there is any water in the well, no priming is necessary. Care should be taken to not commit the common error of using pipe that is too small. Too large pipe cannot be used, that is the work is not increased by the use of large pipes; on the contrary, it is much diminished, because the particles of water being globular in form roll over each other with less friction than when in contact with a foreign substance, and the size of the valves being the limit of the moving column the height to which it is raised, plus the quantity, being the only measure of weight, it will be seen the larger the pipes the less labor will be required to raise a given quantity a stated height. This is combined in the old rule of half the diameter of the cylinder for the whole diameter of the pipe.

The friction in pipes is as the square of velocity; velocity increases as the squares of the diameters. The deduction from these rules is that the velocity of a given volume of water flowing through a two inch pipe would be increased four times if made to flow through a one inch pipe; the friction by the same law would be increased sixteen times; hence the advantage of using large pipes. Whatever kind of pump is used, place it as near the source of water supply as possible. If this cannot be done, then use as large pipes as possible. It is poor economy to try to make a small pump do the work of a large one by crowding it. It shortens the life and efficiency of the pump without corresponding benefit.—Rural Mechanic.

DECISIONS RELATING TO PATENTS.

United States Circuit Court—Western District of Michigan, Southern Division.

UNITED STATES PRINTING COMPANY VS. AMERICAN PLAYING CARD COMPANY.

Sage, J.:

Letters patent No. 381,716, granted April 24, 1888, to Samuel J. Murray for an improvement in a machine for printing cards, considered and Held valid and infringed.

Where it appears that all the elements of the combination claimed in the patent are old, but a new and valuable result has been obtained, the safety and efficiency of the machine greatly enhanced, and the profits resulting from its operation greatly increased, Held that the combination itself displays invention.

Damages can be collected from the manufacturer of a machine, and further damages from a subsequent purchaser and user of the same machine. The payment of damages for making an infringing machine does not give any right to the future use of the machine; but this may be restrained by injunction, and when the whole machine is an infringement, it may be ordered to be delivered up and destroyed. (Birdsell vs. Shaliol, 39 O. G., 261; 112 U. S., 485.)

Where a patentee takes a decree for profits against a manufacturing infringer, he sets the manufactured machine free. The profits of the infringer are full compensation to the complainant for the wrong done him; but a judgment for damages covers only damages in the past and has no relation to the future.

Where it was objected that defendant was not liable because the patented machine was not marked with notice of the patent, Held that such defense to be available must be set up in the answer and established by proof. (Rob. on Pat., sec. 1046; Goodyear vs. Allyn, 6 Blatchf., 38.)

The Stopping of Steamers.

Mr. William Dixon Weaver, late Assistant Engineer United States Navy, gives, in the London Engineer, some interesting calculations as to the length of time and distance required to stop a steam vessel going full speed ahead when the propelling machinery is reversed. Omitting the mathematical formulas, we come to Mr. Weaver's conclusions, which are given in the following table for the Cunarder Etruria, the Italian ironclad Lepanto, the United States naval vessels Columbia, Yorktown, Bancroft and Cushing, and the Russian torpedo boat Wiborg:

	Displacement.	Horse Power.	Speed.	Distance, Feet.	Time, Seconds.
Etruria........	9,680	14,321	20·18	2,464	167
Lepanto........	14,680	15,040	18	2,522	192
Columbia........	7,350	17,991	22·8	2,147	135
Yorktown........	1,700	3,205	16·14	989	83·9
Bancroft........	832	1,170	14·52	965	91
Cushing.........	105	1,754	22·48	301	18·4
Wiborg.........	138	1,303	19·96	373	25·6

Twenty-seven Whales Ashore.

A lucky discovery was made on the morning of July 4 by two Maoris outside the north head of the Kaipara Harbor, New Zealand, when no fewer than twenty-seven sperm whales were found on the shore, all within a few miles radius. It being the breeding season for sperm whales, they usually leave the cold latitudes of the Antarctic until the calves are strong enough to return, and it is assumed that in one of these voyages, being confronted by fierce gales, they endeavored to take shelter, but suddenly found themselves in shallow water, where the receding tide soon left them an easy prey for the hands of man. An enterprising firm, Messrs. Allison Brothers, of Auckland, have commenced the boiling down process, though their plant is somewhat inadequate for such a gigantic undertaking. A horseman who was riding along the beach soon after the discovery was lucky enough to find a large quantity of ambergris, valued at about £3,000. Many seekers are now on the ground expecting each tide to bring them a fortune.

RECENTLY PATENTED INVENTIONS.

Engineering.

EQUALIZING LOCOMOTIVES.—John E. Hughes, Pine Bluff, Ark. To keep the engine from causing the wheel flanges to be cut by the shifting weight, a longitudinal bar is pivoted about the center of its length to the engine saddle, with its front end secured to the truck cradle, and a transverse bar has apertures in its ends and a projection on its lower surface to which the rear end of the longitudinal bar is pivoted, while threaded hangers secured to the springs pass down through the apertures of the transverse bar. The equalizing devices are readily adjusted to cause the truck to guide the engine from one side to the other as necessary.

SUSPENSION BRIDGE.—Arthur Sherry, Fayette, Miss. This invention provides for such construction that the body or floor of the bridge will be self-adjusting, acccommodating itself to expansion and contraction, and a self-adjusting anchorage is likewise provided. The cables have a spring-controlled end movement, and a truss support connected with the pins has spring cushions, the entire construction being designed to be of a simple, strong, inexpensive character.

Railway Appliances.

CAR COUPLING.—John F. Tiner, Sutherland Springs, Texas. This is a device of the link and pin type, but with novel features to facilitate automatic coupling and safe uncoupling from the side of the car. In a vertical slot of the drawhead is pivoted a gravity block on which is loosely secured a lifting plate having a curved pin on its front, there being simple means to lift the pin and plate, while an elongated link is insertable in a horizontal slot intersecting the vertical slot.

CAR SIGNALING APPARATUS. — Charles Harold, New York City. This device comprises an alarm at the rear of a street car, to warn persons stepping from the car from attempting to cross other tracks. It is sounded by the driver or motorman at the forward end of the car, on the approach of a car from the opposite direction to pass the car on which the alarm is rung, so that persons crossing the street back of a stationary or moving car will be warned not to proceed until the second car has passed.

END SUPPORT FOR CARS.— Seth A. Crone, New York City. This is an adjustable support to raise the ends of cars in case of their sagging down, and comprises a double truss for each end of the sill, the truss including a sectional bottom knee brace, and a bracket extending from the sill forming an abutment for the lower ends of the knee brace sections. A socket engaging the forward end of the knee brace is attached to the end sill, and a truss rod engaging the socket extends upwardly over a post in the car, to then extend downward and form at its rear end a socket engaged by the rear end of the knee brace.

CAR FENDER.—William H. H. Diffenbauch, New York City. In this fender a vertical gate having bars of spring steel whose lower ends come close to the track is pivoted to the front end of an extension frame forming part of the truck frame of the car, and when the gate is struck by a person or obstruction it swings so as to move down upon the track a fender platform, beneath the car platform, in a position to pick up anything in the path of the car. The device readily passes over switches and other track fixtures.

CAR BRAKE.—James H. Core, Etna, Pa. This is a safety or emergency brake for electric or street cars. Each brake consists of a shoe whose lower portion is adapted to engage the track rails while its opposite face is concaved to fit the periphery of the car wheel, and each shoe has a link shaft connected with lifting chains and levers. The brakes are held raised slightly from the track when in inoperative position, but on releasing a lever they fall to the track and the wheels run upon them.

Electrical.

ANNUNCIATING TARGET.—Otto Kauffmann, Sacramento, Cal. According to this improvement the target is made with independent movable rings, which, as well as the bull's eye, are each adapted to make independent electric contact to actuate an annunciator located close to the marksman, whereby the value of each shot fired will be immediately and automatically indicated, and no scorer is required. The annunciator also indicates when the target is struck on the upper or lower or right or left hand sections, to aid the marks man in taking aim for the next shot.

Mechanical.

PORTABLE HYDRAULIC PUNCH.—Elijah B. Cornell, Philadelphia, Pa. This punch is especially adapted for making apertures in the webs of railway rails, or in metal beams or plates for architectural, bridge and other iron work, and the punch is hydraulically withdrawn as well as hydraulically forced through the metal, both operations being quickly and readily accomplished. All the valve chambers are accessible for making repairs without taking the punch or pump apart.

WATER WHEEL GOVERNOR. — Winfield S. Libbey, Lewiston, Me. According to this improvement provision is made to control the gate-operating shaft by a mechanism which includes a battery and electro-magnet, the governor being connected with a centrally pivoted lever under the ends of which are spring contacts, there being a fixed contact beneath one of the spring contacts. The governor may also be connected with a tilting bar to accomplish similar results mechanically, without the intervention of a magnet, the mechanism operating positively in either case to govern the motion of the wheel with a minimum of variation.

NUT LOCK.—Jefferson D. Tynes, Fort Smith, Ark. This is of that class of nut locks made as spring washers, and consists of a single metal bar bent in a peculiar shape. The bar has its ends curved around to form a bolt hole, one of the ends being bent back outside the body portion with a reversed curve of uniform radius and sprung outwardly and terminating in a beveled end, while the other end forms a flat bearing.

NUT LOCK. — Francis W. Coleman, Rodney, Miss. This device comprises a U-shaped plate of spring metal, one limb of which is seated in a recess on the end of a nut and the other limb polygonally apertured to fit on a polygonal shaped end of the screw bolt. The improvement is very simple and cheap, and is designed to hold a nut of any size from reverse movement on a screw bolt.

PLANTER.— Cyrus N. Baker, Crawfordsville, Ind. This planter is adapted for potato planting, although it may be used to plant any kind of seed. It is very light and inexpensive, and will plant in single or double rows. A seed wheel rotates partially in the hopper and partially in a chute connected therewith, a spring-controlled shaft being operatively connected with the wheel, while a drive shaft with mutilated gear has intermittent driving connection with the spring-controlled shaft.

Miscellaneous.

TELESCOPE, MICROSCOPE AND CAMERA.—Robert L. Stevens, Vineland, N. J. This is a combination instrument with an extensible body portion having an object glass at one end, a telescope connection having an eye or microscope end piece, while an intermediate section has a fixed focal point and its body portion is provided with a plate-receiving pocket or slit in line with the fixed focal point. In adjustment for use as a camera the sensitized plates or films can be connected without necessitating the use of a dark room or a ground or focusing glass.

GAS PRESSURE REGULATOR.—Thomas C. McGrath, Bolivar, N. Y. This is an automatic device in which the flow of gas is controlled by a slidable spring-pressed hollow valve or cylinder having one or more lateral openings that serve as gas passages, the changing position of the sliding valve, according to the gas pressure, governing the pressure automatically.

GAS BURNER.— Charles E. Dressler, New York City. This is an improvement upon a formerly patented invention for a burner for heating purposes, permitting the user to turn the burner into any desired position to allow of using the burner in connection with a blowpipe and for other purposes.

PRINTING PRESS PERFORATOR. — Horace G. Miller, Punxatawney, Pa. This perforator is adapted for attachment to the gripper bar, to be operated simultaneously therewith, a perforating knife being arranged to move upon a slideway, an end portion being held away from the slideway, while a side arm carrying perforating knives has a portion fitting into the space between the supporting bar and the end of the knife. The device is of simple and inexpensive construction, not interfering with the clearness of the impression, and readily adjustable to perforate the paper at the exact place desired.

AUTOMATIC LIQUID MEASURE.—James Cowan, Honolulu, Hawaii. This improvement comprises a tank centrally divided to form two compartments in which are rectangular tank floats, there being in each of the compartments an inlet valve at the top and valved outlets at the bottom, the floats being connected with lever devices by which the valves are alternately opened and closed. The apparatus is designed to automatically measure heavy or light liquid flowing through it, and is easily set for an operative condition in which the friction is reduced to a minimum.

SKIFF OR CANOE PADDLE.—Peder K. Mannes, St. Paul, Minn. This paddle has a bent shank portion from which projects a hand grasp, a ring or loop being pivotally mounted at the bend in the shank. It is especially adapted for use by hunters in boats, each arm being provided with a paddle which it will be unnecessary to lay down in firing the gun, and enabling quick rowing afterward toward the game.

OIL CAKE TRIMMER.—John S. Ovens, Buffalo Center, Iowa. To evenly trim the edges of oil cake and save the trimmings, this inventor has devised a machine in which are three revoluble cutters and a carrier adapted to be moved between them, the cake being pushed sidewise on the carrier to trim its ends, and endwise to trim its sides.

STORM CURTAIN FOR BUGGIES. — Bernard Martin, McPherson, Kansas. This curtain is made in two sections, each shaped to cover one-half of the vehicle front from the top of hood to bottom of body, and also a side portion of the body, each section also having sight openings and one of them a driving flap, and each section having a cord to connect with a support in the vehicle body. The entire front and sides of the buggy may be quickly closed by the curtain when desired, and readily opened for exit or entrance, and it may be used as an ordinary apron in pleasant weather.

CIGARETTE BOX.—Andrew L. Ellett, Jr., Richmond, Va. This box has a sliding holder, with a flexible strip or pull piece attachment, by which one or more cigarettes may be drawn part way out of the holder for convenient removal. The strip or pull piece is attached at its inner end to the body of the holder and its free end projects beyond the outer end of the cigarettes.

BOTTLE CUTTING APPARATUS.—August Benson, Streator, Ill. This inventor has provided a simple and inexpensive apparatus whereby, with bottles blown in turn moulds, the bottle neck may be easily cut off by mechanism controlled by the foot of the blower, thus leaving his hands free to do other work, the neck being smoothly cut, leaving the bottle in good condition for finishing in the "glory hole." The cutter is movable in and out at the neck of the mould, a water supply delivering into the mould near the cutter, there being a mechanism for moving the cutter and a valve controlled by the movement of the cutter to regulate the water supply.

ADVERTISING DEVICE.—George M. Underwood, Orange, Mass. This device comprises a card holder to which are attached supporting arms, terminal rigidly attached clamps being formed of opposing jaws which are adapted to clasp harness saddle terrets, adjusting bolts working in the jaws. It may be conveniently attached to any ordinary harness for the advantageous display of an advertising card at any point above a horse.

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.

NEW BOOKS AND PUBLICATIONS.

THE HUNT AIR BRAKE COMPANY INSTRUCTION BOOK. Pittsburg, Pa.: The Hunt Air Brake Company. 16mo. Pp. 56. Illustrated. Plates.

This instruction book is intended to teach how to handle the Hunt air brake system. It contains many excellent diagrams and in a pocket some loose folding plates, one of which is provided with a movable celluloid diagram illustrating the use of the Hunt air brake.

HOW TO MAKE RUBBER STAMPS FOR PROFIT. By J. Clark Barton. New York. 1891. 32 pp. Price $1.

This book is written by a practical manufacturer of stamps and stamp outfits. Full instructions are given for the various methods of stamp making, from the original plaster of Paris method down to the latest and best press mould process. Illustrations are given of an excellent vulcanizer.

AERIAL NAVIGATION. By Daniel Hawkins, M.D. Toledo, Ohio. 1895. 8vo. Pp. 90. Plates.

Outlines the author's views on aerial navigation and describes his air ship.

CURRENT HISTORY. Second quarter, 1895. Buffalo: Garretson, Cox & Company. 1895. $1.50 per annum; single copies, 40 cents.

This cyclopedic view of current history contains articles on "Argon and its Discovery;" "The Income Tax Decision;" "The Silver Question;" "The Yellow War;" "The Cuban Revolt," etc. This publication affords reliable information in condensed form on the events of the day.

ELASTICITY A MODE OF MOTION. Being a popular description of a new and important discovery in science. By Robert Stevenson, C.E., M.E. San Francisco: Industrial Publishing Company. 1895. 8vo, 61 pp. Diagrams. Price 50 cents.

An essay on the elasticity of motion, with true and approximate cause of universal gravitation.

☞Any of the above books may be purchased through this office. Send for new book catalogue just published. MUNN & CO., 361 Broadway, New York.

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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 mind 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.
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Books referred to promptly supplied on receipt of price.
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(6617) J. P. writes: 1. I am making a gas engine on the four cycle plan. Size of bore of cylinder is 3¼ inches. Please answer me the following questions through SCIENTIFIC AMERICAN. 1. How much should I compress the gas in the cylinder? A. The mixed gas and air should be compressed from ⅓ to ½ its volume. 2. How much space should there be between piston head and cylinder head at end of inner stroke? A. The cylinder chamber should be ⅓ to ½ the stroke. 3. What proportion of gasoline vapor and air make the best explosive? A. One part gasoline vapor to 10 parts air is the best proportion. 4. About what will be the pressure per square inch in cylinder after explosion? A. About 100 pounds per square inch. 5. My cylinder is ⅝ inch thick, will it be strong enough to stand the pressure? A. Cylinder thickness is correct. 6. About how much power will this give? I recently took apart a medical battery and found the galvanic cell to consist of a round (metal tube I think) tube filled with a substance like paste, with resin poured in the end of tube to seal it. Can you tell me what this paste-like substance is and how to make this form of battery cell? A. About ¾ horse power. It will pay you well to consult the latest work on gas engines by Donkin, fully illustrated, $6.50 by mail. There are many forms of dry batteries, contents known only to the makers. The following are from "Scientific American Cyclopedia of Receipts, Notes and Queries," $5 by mail. Dry.—A good effect can be obtained from a paste of plaster of Paris, 1 pound; oxide of zinc, ¼ pound; saturated solution of chloride of zinc, enough to make a thick paste. They are very good for medical coils. Filling for Dry Batteries.—Charcoal, 3 parts; mineral carbon or graphite, 1 part; peroxide of manganese, 3 parts; lime hydrate, 1 part; white arsenic (oxide), 1 part; and a mixture of glucose and dextrine or starch, 1 part; all by weight. These are intimately mixed dry and then worked into a paste of proper consistency with a fluid solution composed of equal parts of a saturated solution of chloride of ammonium and chloride of sodium in water, to which is added 1-10 volume of a solution of bichloride mercury and an equal volume of hydrochloric acid. The fluid is added gradually and the mass well worked up.

(6618) C. G. D. asks: 1. Is it possible to superheat water? A. Water cannot be superheated. Superheating means a greater heat than is due to the pressure of evaporation, and is not applied to liquids. Vapors or steam may be superheated or given a higher temperature than is due to their evaporative pressure. A full boiler may be heated to any reasonable degree of temperature above 212°, but is subject to the steam pressure due to the temperature, as well also the enormous pressure of the expansion of the water, which no boiler can resist. 2. If a boiler is filled absolutely full and heated, will the water be raised to a higher degree than 212°? A. In all boilers making steam under pressure the water is at or very near the temperature of the steam; at 100 pounds pressure the temperature is about 338° F. Hot water circulating pipes have been in use with a water temperature from 500° to 600° F., but the pressure was in proportion to the temperature.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

September 10, 1895,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

DESIGNS.

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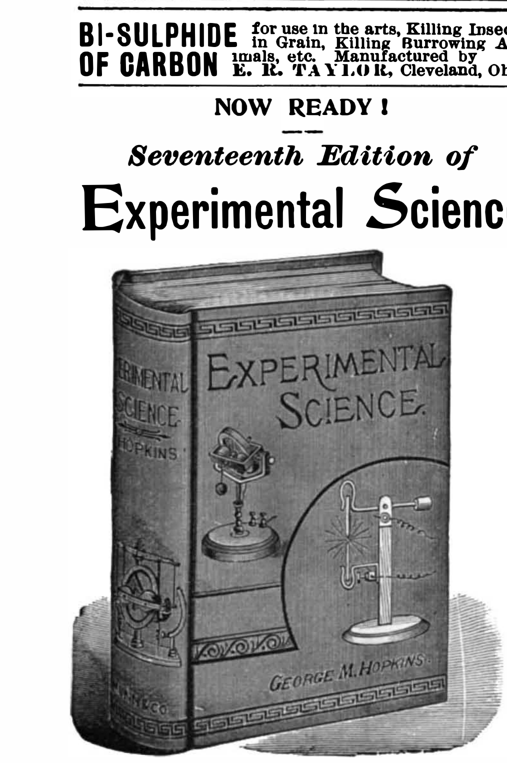

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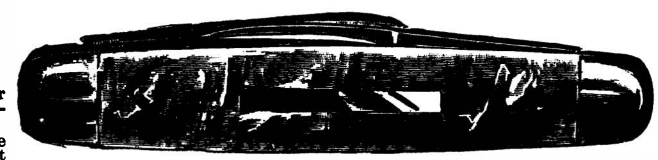

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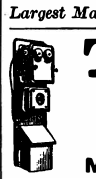

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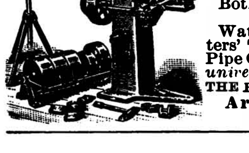

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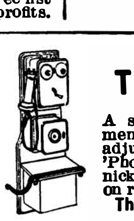

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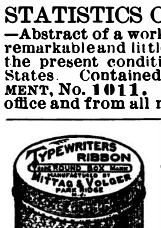

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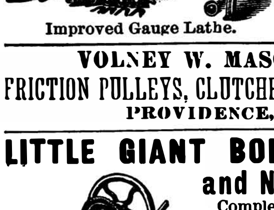

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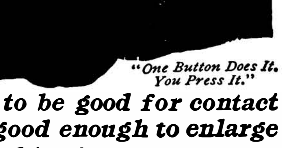

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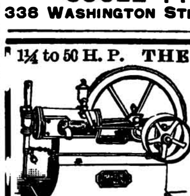

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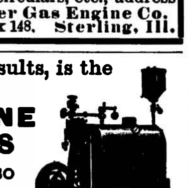

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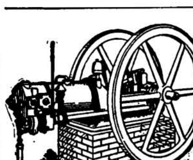

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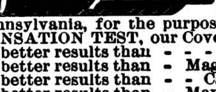

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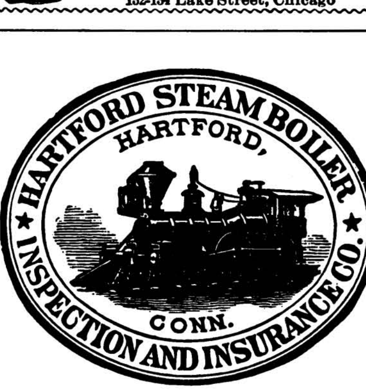

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