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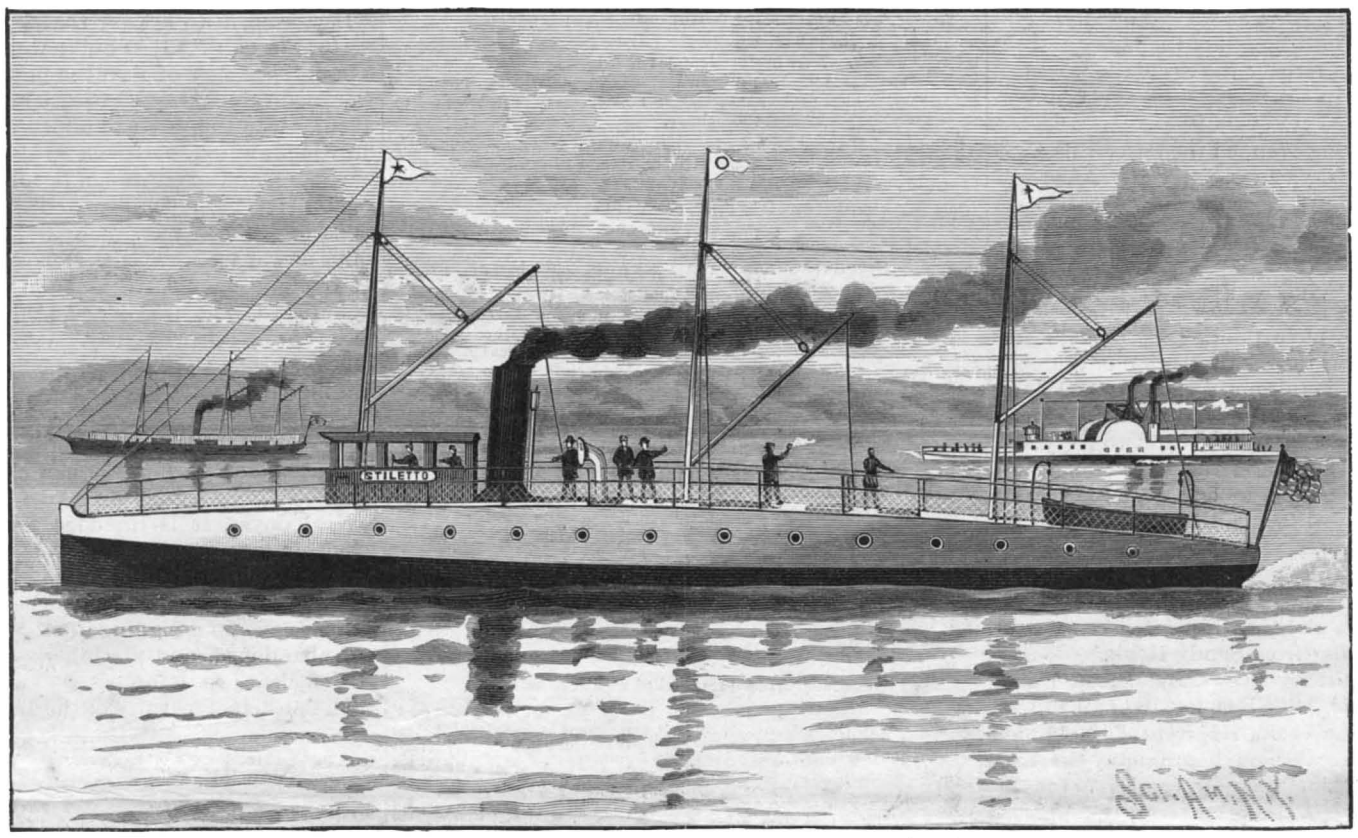
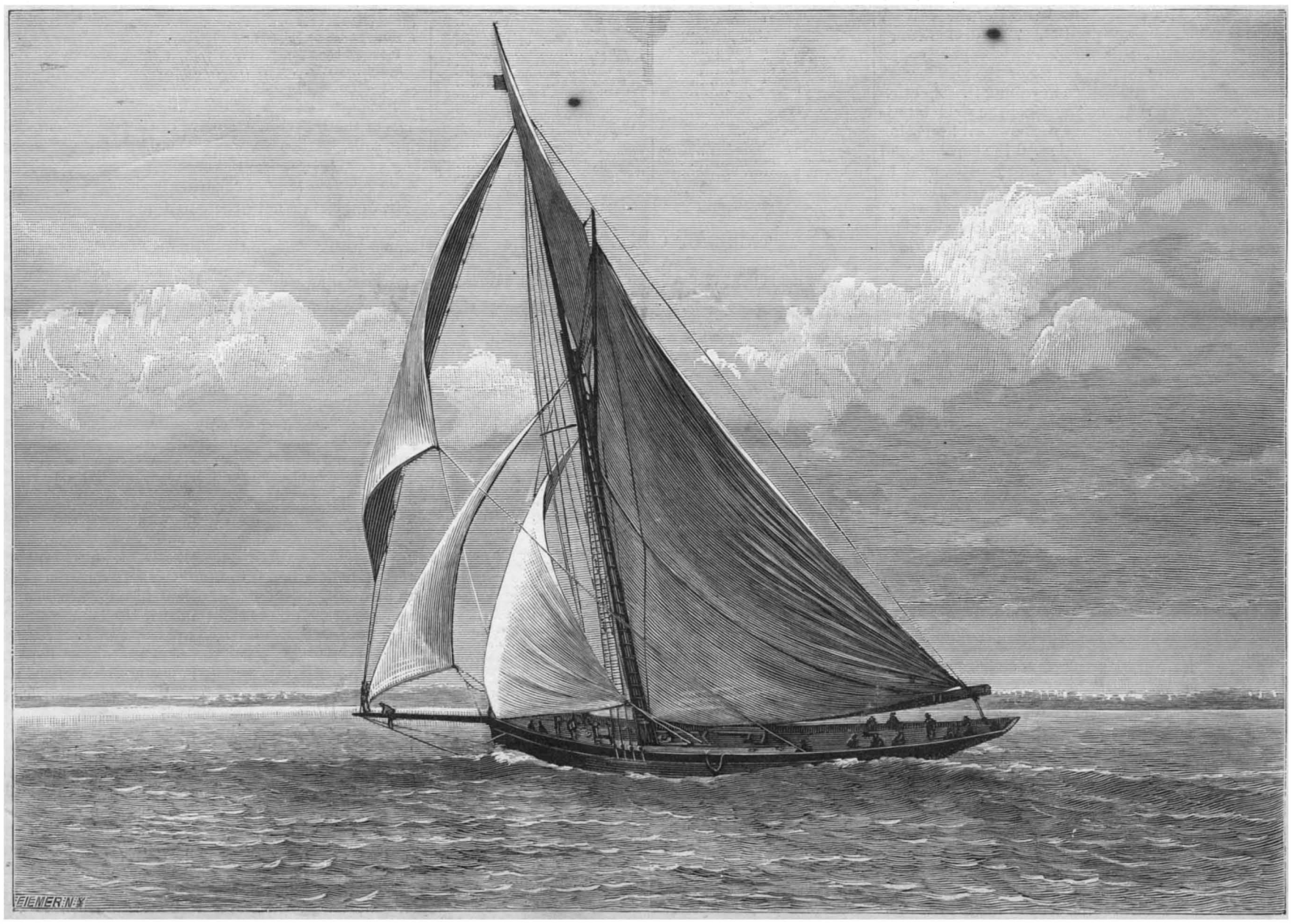
THE FASTEST RIVER STEAMER BEATEN BY A STEAM YACHT.

For more than twenty-two years the side wheel steamboat Mary Powell has been recognized as the fastest boat on the Hudson River; she makes an average of twenty miles an hour. and according to a pamphlet issued by the owners, "in the year 1882, she ran at the very fast rate of 26 miles an hour between Milton and Poughkeepsie, making the four miles in nine minutes." Boats of all sorts of shapes, big and little, side wheels and propellers, have unsuccessfully attempted to wrest from her the well earned title of Queen of the Hudson. But on the 10th inst. she was badly beaten in a long run by a small steam yacht of very insignificant appearance. The run was from this city to Sing Sing, a distance of thirty miles, and was made by the steam yacht Stiletto in one hour and fifteen minutes, the Mary Powell, on her regular trip to Rondout, being beaten about two miles.

The Stiletto was designed and built by the Herreshoff Manufacturing Co., of Bristol, R. I. She is 94 feet long over all, 90 feet on the water line, 11 feet beam, and weighs 28 tons. The hull is double planked, and sharp at both ends, the curves extending far toward the center. A slightly arched deck covers the whole boat. Forward is a pilot house sufficiently large to serve as a commodious cabin. Owing to the extremely small space taken up by the engine and boiler rooms, there is ample room for comfortable quarters for the crew and staterooms for the owner, guests, and officers. Power is furnished by a compound condensing engine of 12 inch stroke and cylinders 12 and 21 inches in diameter; the engine is supplied by a sectional water tube boiler in which steam can be got up quickly and which is calculated at 450 horse power. Although this boiler is similar in principle and operation to those of the regular Her-



THE STEAM YACHT STILETTO.



THE ENGLISH CUTTER GENESTA.—[See next page.]

reshoff type it varies greatly in construction, the tubes being arranged horizontally in sets immediately over the fire—each set being at right angles to those just above it. Exhaust steam is led to a surface condenser. An ordinary pump takes the water from the condenser, forces it into the upper set of boiler tubes, through the boiler to a separator located in front of the boiler, and to which the steam pipe is connected. The boiler will work safely with 160 pounds of steam, but in the race with the Mary Powell it was only found necessary to use from 120 to 125 pounds. The fire box is 6¼ feet square.

The screw is four-bladed, 4 feet in diameter, and 6½ feet pitch. At the stern the boat draws 4½ feet and at the bow 3 feet. We may notice that there are now building at the yards of Yarrow & Co., England, two torpedo boats which are expected to run, when light, at the rate of 24 knots an hour, or nearly 28 miles. The Stiletto must do better than 25 miles an hour before she can claim the broad title of the fastest boat in the world. In our issue of next week we will illustrate and describe in detail the construction of the boiler and engine and the method of forcing the circulation.

THE ENGLISH CUTTER GENESTA.

The greatest sporting event on the water this year will be the international yacht race for the America's cup, held under the auspices of the New York Yacht Club. Great interest is being manifested by the yachtsmen and others throughout the whole country in the coming contest, while the patriotic pride of many wealthy men in the race has been aroused to such a pitch that they have ordered several new and costly yachts to be built for the protection of the cup. Even General Butler has dropped politics (and law) long enough to say that he wants to enter the ancient America in the race. England will send two very fast yachts, with the hope that one of them will walk away with the prize. These are the cutters Genesta and Galatea. The former is the favorite, and seems to be most feared by the Yankee yachtsmen.

It is understood that the match is to be three races, best two to win—one a triangle 40 miles, one over the New York Club course, and the third, if necessary, 20 miles and return, starting from Sandy Hook.

The Genesta was built by Messrs. Henderson Bros., at Patrick-on-the-Clyde. She is 90 feet over all, 81 feet on the water line, 15 feet beam, 11¾ feet depth of hold, and 13½ feet draught. Although originally she had only 60 tons of lead outside, she now carries 70 tons of lead on her keel. She has also been recently coppered and fitted with new and heavier spars. Keelson stringers, frames, and strengthening plates are all of steel, while the planking is teak and elm.

With great accommodations beneath, the cutter's fittings are plain but substantial. The deck fittings present several novelties. The bowsprit comes over the steamhead in the center of the yacht, with more than the usual difficulties in reefing it. To obviate this difficulty, one of the checks of the steel bits is hinged. This device permits of the bowsprit heel being swung round clear of the scuttle and the capstan, and run aft alongside the mast. The fore scuttle, oval in form, is a steel tube, round which the wire-fall of the bobstay tackle is coiled in easier turns than it would be belayed in the ordinary way. Just before the mast is a second scuttle, which accommodates the steward, and also the crew, on racing days. Behind the mast is a third scuttle, down which canvas can be lowered into the sailroom under the cabin sole.

The Genesta will be without any provisions for screening the weather spray, besides a racing cabin. The Genesta has a fine saloon fitted up lightly and elegantly, a ladies' cabin aft, and spacious accommodations for the crew, steward, and captain. The whole length of the yacht has been utilized, and the space obtained is remarkable. The Genesta is to be in charge of C. Carter, who is well known on the Clyde as a clever yacht sailor. She is owned by Sir Richard Sutton. Our first page engraving is taken from an instantaneous photograph, representing the Genesta plowing through the water at full speed; it clearly shows the wave line, and indicates the ease with which she parts the water. All through the yachting season last year this boat met the best of the British fleets, and although not always a winner, she proved herself to be without doubt the best "all around" boat in the kingdom.

A New Military Shield.

Some interesting experiments have been carried out at Ryde, Eng., with a new arm of defense. The implement is simply a steel shield to be fixed on the muzzle of a rifle as a bayonet is fixed. It covers one superficial foot, weighs three pounds, can be easily slung under the arm, and does not appear to be unwieldy. On skirmishing duty the infantry soldier would take his "cover" with him, place the point in the earth, lie behind it, and pick off his men with ease, the shield forming a rest for the rifle. The shield, which is claimed to be bullet proof, has been submitted to the War Office, and the military authorities are said to view it with some favor.

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NEW YORK, SATURDAY, JUNE 20, 1885.

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THE NEW U. S. CRUISER DOLPHIN.

The fourth official trial of this new ship took place June 11, when by order of the Navy Department the vessel was sent out on the Jersey coast, near New York, for a six hours' continuous trial at sea. The requisition was that she should show herself capable of a speed of twelve knots an hour during the above period. The ship considerably exceeded this requirement, as she ran over fourteen knots per hour, and might have been driven to fifteen or sixteen knots.

On several of the preliminary trials of this vessel, when the machinery was new and stiff, the progress of the ship had to be stopped by reason of the heating of journals, a common occurrence with new steamers. These incidents were made the basis of certain letters and orders published over the name of the youthful Secretary of the Navy concerning the Dolphin; and some of the newspapers busied themselves by casting ridicule upon the ship and the contractor, Mr. John Roach, who executed the work.

It was made to appear that the Dolphin was little better than a worthless hulk; whereas in reality she is a noble specimen of naval architecture, fully equal in workmanship and speed to any boat of her class now afloat. The Dolphin was built in conformity with the drawings and specifications furnished by the Navy Department, and so far as can be ascertained, Mr. Roach, the builder, has faithfully carried out all the stipulations of his contract. The Dolphin is one of three ships of war for which the Department offered competitive plans for construction, and the bids of Mr. Roach were found to be nearly one million dollars less than those of any other builders. He has executed his work thus far in the most superior manner, and is entitled to the highest credit. We congratulate him upon the success of the Dolphin, and trust the other ships will show equally good work.

The governing condition in the design of the Dolphin has been high speed capable of being maintained for several days. It is intended for a dispatch boat for furnishing rapid communication from the seat of government to any point on the coast, or to act as fleet dispatch boat if a United States squadron should need its services. In designing it, all attempt at protection was abandoned, and machinery of the most durable and efficient type adopted.

The principal features of the Dolphin are:

Length between perpendiculars	240	feet.
Length, extreme	256·5	"
Breadth, moulded	31·85	"
Breadth, extreme	32	"
Depth from top of floors to top of main deck beams,	18·25	"
Depth from base line to top of main deck beams	20·07	"
Top of main deck at side above load water line	6·28	"
Mean draught	14·25	"
Displacement at mean draught	1,485	tons.
Complement of men	80	
Battery—one 6-inch pivot, four revolving cannon.		
Indicated horse power	2,300	
Speed	15	knots.
Capacity of coal bunkers	310	tons.

The contract price for the hull, machinery, and fittings of the Dolphin, exclusive of the masts, spars, rigging, sails, boats, etc., was $315,000.

New Mode of Hardening Plaster.

Mr. Julhe, in a note presented to the Academie des Sciences, describes some experiments that he has performed with a view to rendering the use of plaster still more general.

Of all materials used in building, plaster is the only one which increases in bulk after its application, while mortars and cements, and even wood, undergo shrinkage and cracking through drying. When applied in sufficiently thick coats to resist breakage, it offers, then, a surface that time and atmospheric variations will not change, provided it be protected against water. But it is necessary to give this material two properties that it lacks—hardness and resistance to crushing. This is what Mr. Julhe proposes to effect by his process.

Six parts of plaster are mixed with one of finely sifted unslaked lime. This mixture is used like ordinary plaster for moulding any object whatever, and, when once dry, the object is soaked in a solution of a sulphate having a base precipitable by lime, and the precipitate of which is insoluble. There form sulphate and oxide of lime, both of them insoluble, which fill the pores of the object and render it hard and tough.

Sulphates of zinc and iron are the salts that answer the purpose best. With the first the object remains white, and with the second it gradually assumes the tint of sesquioxide of iron.—*Chronique Industrielle.*

English Channel Tunnel.

The projected scheme for building a tunnel under the channel to connect France with England has met with so decided a defeat in the House of Commons, that the question will probably not be brought up again for some time to come. The majority which rejected the project recently is larger than on any previous occasion when the subject has been discussed. Not a hundred members were found willing to allow even the experimental works at Dover to be continued, and two hundred and eighty-one votes were registered in opposition to the proposal.

The Quaternary Fauna of Indiana.

BY H. C. HOVEY.

As every student of geology knows, the Quaternary period was characterized by great changes of climate, accompanied by remarkable sinking and rising of the earth's crust. Enormous quantities of clay, gravel, and bowlders were carried by glacial action from the higher latitudes as far south as the Ohio River, and even, at some points, a few miles into Kentucky. The area thus covered by drift extends from Cape Cod as far west as Dakota, and, farther north, to the Rocky Mountains and the Pacific coast. The limits of glacial action are marked by ridges known as moraines, in which have been found some interesting relics of ancient life. Following this glacial era came one of general depression, when the Atlantic Ocean extended inland so far that whales and seals played in the waters now known as Lake Champlain; while the chain of lakes along our northern border were connected with the Gulf of Mexico. A subsequent upward movement of the earth's crust restored this depressed region to its former level, when the continent took its present shape, and what is geologically known as the Recent period began, which is still in continuance.

The Quaternary period was remarkable for its gigantic mammalian fauna, and numerous animals then existed in North America that have now no living representatives. Years ago my attention was called to fossil bones and teeth found in the moraines and lacustral deposits of Indiana. There was a long moraine near New Albany, on the Ohio River, in which my friend, Dr. J. W. Sloane, imagined there must be inhumed the bones of animals caught between the foot of the glacier and the broad river formed by its melting torrents. Whether his theory were correct or not, his conjectures were amply verified. He bought the moraine and leveled it. One day he came riding at full speed on his black horse, crying, "Eureka! eureka!" The workmen had unearthed a mastodon. We examined the remains carefully. The white bones and long tusks lay perfect and entire in the mound of black loam that had once been the flesh of the monster. Efforts were made to preserve the skeleton, but the materials quickly crumbled to decay. The largest fossil elephant's tooth ever found anywhere was probably the one my father placed in the cabinet of Wabash College, in the year 1870. I do not know the precise locality whence it was exhumed. It weighs 21 pounds, is 15 inches long, and 13 inches in its vertical depth. The triturating surface of this huge molar measures 9 inches across. The teeth of the mammoth differ from those of the mastodon in the corrugations of their grinding surfaces. In the former these are crimped ridges of dentine; while in the latter there are knobby or mammillary protuberances, whence the name mastodon (nipple tooth). Both varieties have been repeatedly found in different portions of Indiana, and specimens, both of the tusks and the teeth, may be seen in various public and private collections.

A nearly entire skeleton of an adult megalonyx, or giant sloth, may be seen in the cabinet of the State University at Bloomington. It was obtained by Prof. D. D. Owen, on the banks of the Ohio River near Henderson, and was described by Prof. Leidy in 1853. It is conjectured that the living animal must have been as large as an ox. Its habits were arboreal, and its structure was such as to make it probable that the creature was accustomed to stand on its hind legs and pull the branches of trees down within reach for food.

Bones and teeth of an extinct species of beaver have been found in Carroll, Kosciusko, and Vanderburg counties, to which the name of *Casteroides ohioensis* has been given. Judging from the skull, which has a length of over 12 inches, this ancient representative of the beaver family must have been as large as a black bear, and larger than the modern capybara, said to be "the largest of existing rodents."

The remains of the *Bison latifrons*, an animal fully one-third larger than the common buffalo, have been found in Vanderburg County. The horn-cores being 21 inches in circumference, the horns themselves must have been more than 4 feet long. The musk ox is thought also to have been among the ancient fauna of Indiana, whence it ranged as far south as Texas. At Laketon fragments of an extinct quadruped allied to the living peccary have been found. The tapir, horse, and elk also had their ancient congeners. And while these peaceful creatures browsed amid the semi-tropical forests, or lazily wallowed in the marshes, or sunned themselves along the ancient river, compared with which the lordly Ohio is but a rivulet, there were gigantic lions and wolves lying in wait for their prey, amid the adjacent jungles. It does not appear, from any relics yet found, that man was a witness of this old-time scene of forage and strife.

Plates and descriptions of most of the above-named mammals may be found in Collett's Fourteenth Annual Report on Geology and Natural History (1884), prepared by Cope and Wortman, whose indefatigable labors in the department of comparative anatomy cannot be too highly praised. Prof. Cope remarks that the list of discoveries thus far made "displays but a small proportion of the species that inhabited Indiana during the Post-pliocene, or Quaternary, period, and it may be expected that the future will reveal many additions to the list." The places where such remains are most liable to be found are in the numerous caverns of southern Indiana, the wide marshes and swamps of the northern portion of the State, the moraines and other deposits left by the glacial action of the earlier part of the period, and the beaches and terraces characterizing the later portion. And it would greatly add to the interest taken in specimens displayed if, whenever possible, the exact nature of the locality should also be described, and even specimens be shown of the sand, clay, soil, or peat in which the bones, etc., lay inhumed.

Choosing a Pursuit Scientifically.

In the SCIENTIFIC AMERICAN for May 30, a short article was published under the caption of "Choice of Occupation," in which allusion was made to the resort made by some people to "professional head and face readers," to indicate the line to which the unformed mind should be directed. The general drift of the article seems to indicate that boys will naturally gravitate toward their proper line, and that, "circumstances not hindering," they will be likely to fall into their true pursuit.

I have no desire to inflict upon the editor or readers of the SCIENTIFIC AMERICAN a special plea in behalf of "character readers," or phrenologists, but merely to suggest what seems to me of great importance, giving young people some clear intimations of their mental peculiarities, so that they may be saved from making great mistakes. "Circumstances" appear to hinder or prevent the majority of young men from falling into the pursuit for which they are best adapted. A close observer writes:

"Thousands have spent the formatory period of their lives sweating over the classics or mathematics, or vainly endeavoring to become qualified for some profession or mechanical trade, and have failed to win respectability or secure their daily bread, and are thus made wretched for life."

Another observer, who won for himself special eminence in the field of education, Horace Mann, deemed it of the highest importance that every youth should, for his entrance upon life, be furnished with all the help at the command of science. He wrote: "By the temperament, which indicates the degree of activity; by the natural language, which is a hundredfold polygraph; and by the size of the organ, which is one of the measures of power, every man advertises what he is, and, unlike common advertisements, his are true, for the hand of Nature has written them."

There is so much of the artificial in our every-day life that "circumstances" are likely to become a stronger hinderance to the young man's finding his true sphere. This is particularly the case in the cities, which are crowded with the best of our young men and young women, for there they think that they shall soonest win reputation and fortune. They press into professional lines, because through them respectability seems most likely to be secured; but certainly very few of these in entering upon the practice of law or medicine or art adopt such a sphere because of a strong natural bent. We know an Ohio clergyman who for years before he ascended the pulpit was a cobbler in an obscure Western town, expecting to end his days in that capacity; but an almost accidental introduction to mental science, as it is presented in the treatises of phrenologists, led him to study and prepare for the ministerial calling. Again, an eminent inventor, Mr. Ray, was met by a well known practical phrenologist, while working as a common hand in a blacksmith shop; he was advised to try his hand at invention, and with but doubting confidence in the advice he *did* try, and several very valuable devices have made him rich and the world his debtor. The late Mr. Clark Mills, of Washington, had not thought of sculpture before he was encouraged by a "character reader" to study it.

Mr. Depew said, not long ago, to an audience composed chiefly of young men: "Failures are due to two causes: One, that you have mistaken your calling; the other, that you will not or cannot work; distinguished success is in nearly all cases the result of individual adaptation to the sphere selected, and patient industry." It is with this idea in mind that Carlyle says, "Happy is the man that hath found his work."

I know many persons of good standing in our community who think it is the duty of all to avail themselves of the advice of a scientific phrenologist with reference to the education of their children.

In one of his lectures, the Rev. James Freeman Clark says: "I recommend the phrenological arrangement of human powers simply as a convenient one in self-study; if a man wishes to know what he is fit for, and capable of, this gives him a useful method of investigation."

Intellectual and moral qualities are so important to balance of character and happy adaptation to circumstances, that I wonder our educators are not more urgent in advocating some well digested scheme for their development in the young. I believe that in the schools we have quite enough of intellectual training, and that the great need is for proper moral education, and in the application of any rules for this purpose there is need of a true system of mental organization.

Mr. Clark is but one of many sound thinkers who regard the phrenological arrangement of the human powers as excellent for the parent and teacher, and his judgment in this respect is also due, to a great extent, to the fact—that may be a surprise to most people who have not bestowed much, if any, attention upon the subject—that in the system advocated by George Combe and Horace Mann the only well systemized and practicable method for general mental training is to be found.

H. S. DRAYTON.

Mullein Leaves in Consumption.

Dr. Quinlan, of Dublin, read before the International Medical Congress at Copenhagen last year an interesting paper on the medicinal qualities of the mullein. It has attracted widespread attention, and among the more recent articles confirmatory of Dr. Quinlan's statements is one by Dr. Wilfert, of Cincinnati, which appears in the last number of the *Lancet and Clinic* of that city. From the results obtained in 127 cases of pulmonary consumption treated by Dr. Quinlan with mullein alone, he draws the following conclusions, which are condensed from his original article, viz.:

1. In the earlier and pretubercular stage of pulmonary consumption, mullein has a weight-increasing and curative power greater than that of cod liver oil, and equal to that of Russian koumiss.

2. In cases where tubercles are well established or cavities exist, the mullein has great power in relieving cough—a great boon to consumptives, whose weak stomachs too frequently cannot tolerate the usual cough remedies.

3. Phthisical diarrhœa is completely obviated by the mullein.

4. Mullein has no power or effect on the night sweats of consumption, which should be combated by atropia sulphate.

The method of using the mullein, which originated among the Irish peasantry, and was adopted by Dr. Quinlan just as he found it, is as follows: Three ounces of the fresh green leaves, or about ten times that much of the dried, are boiled in a pint of fresh cow's milk. After boiling a moment the infusion is allowed to stand and "sipe" for ten minutes, when it is strained, sweetened, and drunk while warm. This quantity is taken twice or three times a day. It is generally much relished by the patients, who regard it as a pleasant article of diet rather than as a medicine. The smoke of the mullein leaves inhaled into the respiratory passages relieves irritation and spasmodic cough.

Dr. Wilfert states that he has followed Dr. Quinlan's method in twenty cases of undoubted pulmonary phthisis, all of them more or less advanced, and all improved during the administration of mullein, no other drugs being used. These results are certainly very encouraging, and should be followed up.

Tricks of the Chewing Gum Trade.

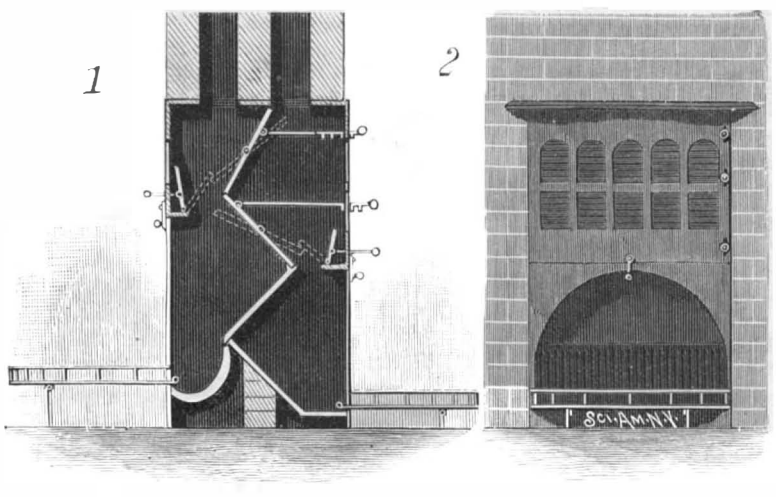
According to the Portland *Press*, this is a great gum year in Maine, especially on the Penobscot, and now that the sun is climbing up into the north and the lumbermen are coming out, the air is fairly redolent with the perfume of spruce. The logs, knees, and bark are not the only valuable parts of the great timber tree, for the gum is worth considerable even its rough state, just as it is hacked from the crotches of old trees. There are two or three firms in Maine which buy large quantities of it from lumbermen and gum hunters for the purpose of refining it, as they say. But as a general thing the refining consists in adulteration with resin. They throw it into a big kettle, bark and all, and boil it into about the consistency of thick molasses, skimming the impurities off as they rise to the surface. Then, if the purpose be to adulterate, some lard or grease and a lot of resin is added, and in some cases a little sugar. The mixture then becomes thicker, and, after more stirring, is poured out on a slab, where, while it is yet hot, it is rolled out in a sheet about a quarter of an inch thick, and then chopped with a steel die into pieces half an inch wide and three-quarters of an inch long. These pieces are wrapped in tissue paper and packed in wooden boxes. There are 200 pieces in a box. Some gum is treated in this way without adulteration. The best gum comes from no particular locality, but always from the biggest trees.

A Lime Light for Demonstration Purposes.

At a meeting of the Edinburgh Medico-Chirurgical Society, Dr. Foulis recently gave a demonstration of the circulation in the web of a frog's foot and of some botanical test objects by means of the oxyhydrogen light. The light, transmitted through a powerful condenser, passed through an ordinary microscope lens, and was thrown upon a large plate of ground glass at a distance of about 25 feet. The image of the object demonstrated could be focused on this plate with great exactitude, the definition even with high powers being excellent, and the general effect strikingly satisfactory.

IMPROVED DOUBLE FIREPLACE.

The invention herewith illustrated—patented by Mr. R. R. Jones, of Sprague, W. T.—provides a fireplace for heating two rooms; the fire place is so constructed that each room can be heated by one fire, or both rooms by one fire, or one room by two fires. Fig. 1 is a sectional elevation and Fig. 2 a face view. The chimney is arranged in the wall between two rooms, and is provided with two separate flues, below which is a fire box having two fireplaces. The back of one fire place is formed of an inclined cast iron plate, and the back of the other is formed of a plate, resting on a brick wall, and having its upper end resting under the lower end of the other plate; grates are formed in the lower portions of the fireplaces. The two faces of the fireplace box are furnished with openings which can be closed by hinged fenders; above the openings are registers. Within the fire box are damper valves having rods extending through the casing, which are formed with notches to hold the valves in any desired position; it will be readily understood that by properly arranging these valves the products of combustion may be made to take any desired route to the chimney. When the valves are adjusted as shown in the full lines in Fig. 1, the smoke, etc., from each fire box passes up its corresponding flue, and each fire box heats its room. The dotted and full lines show

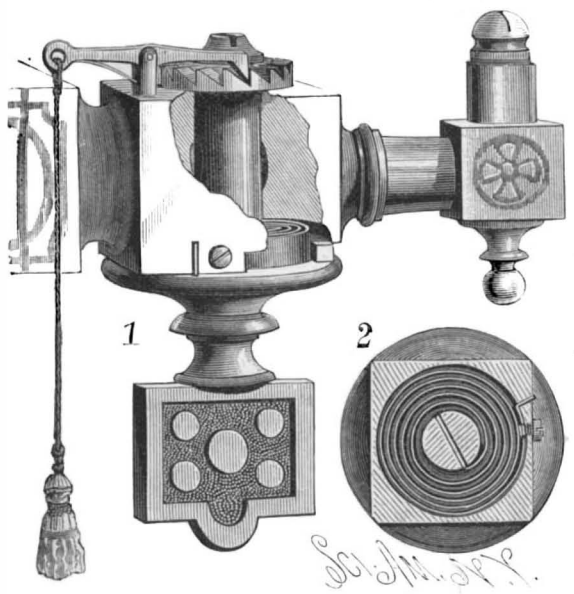


JONES' IMPROVED DOUBLE FIREPLACE.

the positions the dampers may be placed in, and it is evident that by properly arranging them, the heat from either or from both fires may be used to heat either or both rooms.

ATTACHMENT FOR GAS COCKS.

This attachment, invented by Mr. George Doutney, whose address is care of Messrs. Doutney Bros., 439 Broadway, New York city, closes the cock by means of a spring, and prevents it remaining partly open when the gas is turned off. It may be attached to any burner now in use. One end of a spiral spring, Fig. 2, is secured to the key and the other end to the casing surrounding the spring. The spring keeps the cock closed, and when the key is turned to open the cock the spring swings it back again, thus closing the cock automatically. On the upper end of the key is a disk formed with ratchet teeth engaged by a lever, Fig. 1, to one end of which a cord is secured. A spring keeps the lever engaged with the teeth. The key is locked in any posi-



DOUTNEY'S ATTACHMENT FOR GAS COCKS.

tion, whether the gas is to be turned on full or only partially, by the lever engaging with one of the teeth of the disk. To extinguish the gas it is only necessary to pull the cord, when the key is released and is turned by the spring, thereby closing the cock effectively and preventing any escape of gas. This attachment will prevent loss of life by careless or intoxicated persons leaving the gas key half way open, or by their turning off the gas and then turning the key partly open again. It will also prevent fires caused by the key being left open, and will prove to be of great interest to fire insurance companies and hotel keepers.

Bending Iron Cold.

Undoubtedly that iron which is so tenacious or coherent in its particles as to be bent forward and backward without showing visible disintegration is better (tougher) than that which cracks or "crinkles" under similar treatment. But no iron can sustain its integrity under this treatment. This statement does not refer to iron bent while plastic with heat, but means iron at the ordinary atmospheric temperature.

All manufactures and structures of wrought iron that assume such a quality in iron without permanent injury are faulty; iron cannot stand the strain of cold bending without injury, the injurious effect perhaps not being perceptible if the bending is slight and not often repeated, but nevertheless existing. The deduction from these premises is that wrought iron should be formed and fitted while plastically hot for the position it is to retain, just as cast iron is made to form. Still, wrought iron has a limit of safe elasticity—of resiliency—not allowable to even the best of cast iron; and in this quality of recouping, wrought iron is superior to cast iron. The idea sought to be conveyed is that wrought iron is not a mere metallic putty, that can be bent and rebent at will without losing its tensile character or impairing its tenacity.

Some recent experiments prove that wrought iron tends to disarrangement of particles, to change in structure, to weakening in mass, by being bent when cold, even though the bending is a gradual curve and not an angular change of direction. A bar of square section was cut off in the lathe perfectly square, and subjected to bending until it formed a segment of about one-third of a circle. It was noticed that the squared ends gradually changed from their perpendicularity to the length of the bar, the upper or rounding portion being shortened, so that measurements showed that the convex side of the curved bar had not so much elongated as the convex side had shortened. It was evident, therefore, that the bar had not moved in the bending as a whole, but rather as a series of superimposed plates might have been moved. Cutting the bent bar in two and examination under the microscope gave indications of a stretching, and in some cases of a rupture, of the fibers.

An attempt was made to verify this apparent demonstration, by the bending of a pile of thin strips of machine steel of a mass corresponding with the iron bar, but it was found that the "skin" of each strip had a tenacity or resistance greater than the body of the strip, owing to its being compacted in passing through the rolls in its manufacture. Still, enough was shown to indicate that wrought iron (and steel—mild steel) was liable to a dangerous displacement of fiber by being bent while cold.

Trunk Lines in the United States.

The tendency of the railways in the United States has been to combine into systems forming some of the longest lines of continuous railway administration in the world. The whole railway mileage in the United States and Canada is about 120,000 miles, and nearly half, or 57,954 miles, is in the hands of 15 companies, which in turn represent the amalgamation of a greater number of corporations. The magnificent distances traversed by these railroads are as follows:

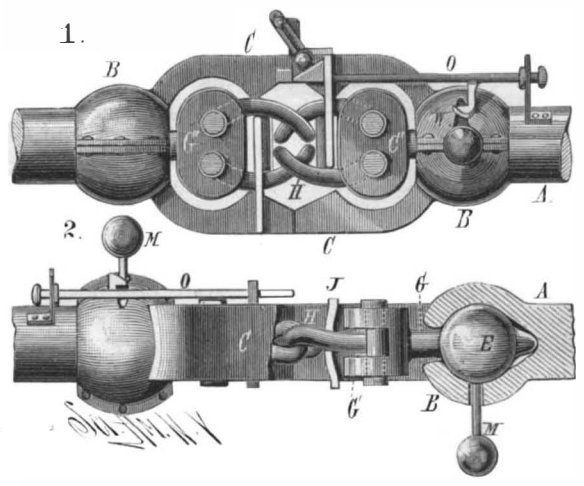
	Miles.
Missouri Pacific	6,045
Chicago, Milwaukee, and St. Paul	5,804
Chicago and Northwestern	5,645
Pennsylvania	4,807
Union Pacific	4,748
Central Pacific	4,194
Canadian Pacific	3,948
Wabash, St. Louis, and Pacific	3,507
"Vanderbilt" roads	3,066
Grand Trunk	2,950
Atchison, Topeka, and Santa Fe	2,799
Southern Pacific	2,789
Baltimore and Ohio	2,737
Northern Pacific	2,549
Louisville and Nashville	2,366
Total	57,954

The Binns Gold and Silver Fabrics.

The Binns Patent Band Co., manufacturers, Randolph Mills, Randolph St. and Columbia Ave., Phila., Pa., exhibitors at the New Orleans Exposition, have been awarded three gold medals of the first class, as the highest award in group 5, class 507: One gold medal for gold and silver trimmings, one gold medal for bullion cords, one gold medal for bullion yarns. The above firm have been running day and night for several months past. Leedham Binns, of the above firm, is the inventor and patentee of the machinery used by this firm.

CAR COUPLING.

The end of the draw bar is formed with a socket, B, from the open end of which the top and bottom buffer prongs, C, project. In the socket is a ball, E, having a stem on its rear end entering a recess to prevent the ball from swinging up or down or laterally. The free end of a stem projecting from the ball through the open end of the socket is formed with jaws, G, between which two S-shaped coupling hooks, H, are pivoted. Between the buffer prongs a plate, J, is held by diagonally opposite arms; the plate is between the hooks,



HAMPL & JACOBS' CAR COUPLING.

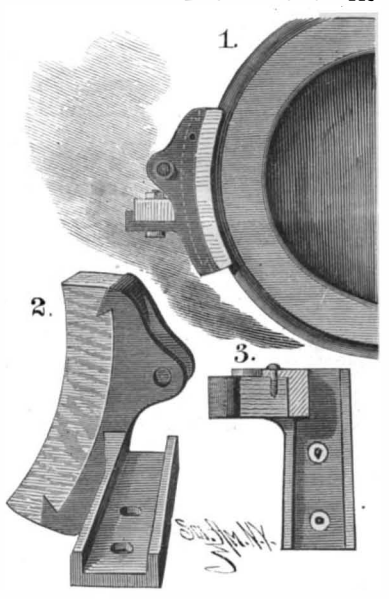
and separates them in the act of uncoupling. The stem, M, projecting from the ball, passes through a slot in the socket and carries a weight at its outer end. The rod, O, slides longitudinally, and has a stop button on its inner end and a beveled head on its front end. An angular arm projects upward from the top buffer prong, and a lug projects from the opposite side of the prong. Hung on the upper end of the arm is a slotted link having a ball on its lower end.

When a car is uncoupled, the jaws, G, are held diagonally in the draw head by the hook, W, on the bar, O, holding the weighted stem at an angle of about 45 degrees. The ball on the link rests against the front end of the beveled head. When the cars come together, the lug of one draw bar strikes the link ball of the other, and pushes the rod, O, back; this liberates the stem, M, which swings downward, thereby turning the ball, E, and the jaws, and interlocking the hooks of the two couplings. The link ball then slides upon the beveled top edge of the head. To uncouple, the stem, M, is raised, and the hooks are opened by the disk, J, while turning. The stem is then held by the hook, and the link ball slides down the bevel of the hook in front of the end.

This invention has been patented by Messrs. J. Hampl & D. Jacobs, of Fort Clark, Tex., and 74 Leonard Street, New York city.

IMPROVED BRAKE SHOE.

The engraving shows a new form of brake shoe designed particularly for street cars. The rubber or friction block has the usual concave rubbing surface, and is made of wood sawed out across the grain. This presents a better grip or hold on the wheel than a metal shoe, does not wear out the wheel so rapidly, and is cheap and durable. The metal backing, Fig. 2, is of arched form, and is provided with a single side flange and opposite hook shaped ends that enter similarly shaped recesses made in the ends of the block, which is thus held securely from splitting, and, only being bound on one of its sides by the metal head, may be easily removed on taking out a holding screw, Fig. 3, and be replaced by another without removing the whole shoe from the brake bar. The entire shoe may be carried in the usual manner.



This invention has been patented by Mr. J. H. Pitard; information can be obtained from Messrs. Goldsmith & Pitard, P. O. box 334, Mobile, Alabama.

Battery with Two Liquids.

The author succeeds in suppressing the nitrous vapors of the Bunsen battery by using a depolarizing liquid, consisting of nitric acid in which 75 grs. potassium dichromate have been dissolved per liter. In contact with the zinc he employs either acidulated water or potassium disulphate.—*A. Dupre.*

THE LAWS OF VISION AND THE HARMONY OF COLORS.

In ordinary language the word *color* is used in different senses. Sometimes it signifies coloring matter, and sometimes it designates the special sensation that we experience at the sight of the latter. The distinction between the two senses of this word should thus be clearly established, and it is in the last mentioned acceptation that it will be employed in this place. This distinction appears to be very simple, yet the different senses given to the word have caused much confusion, and eminent minds, such as Newton, Chevreul, and Helmholtz, have in turn confounded the mixture of coloring matters with the mixture of colored lights, and this latter with the mixture of colored sensations; that is to say, studying color, they have confounded what is external to us —the physical phenomenon—with what goes on within us—the physiological phenomenon. The masters of science whom we have just mentioned having especially viewed the physical side of the question, it is hardly astonishing that their rivals who have published treatises upon the science of color should have perpetuated the confusion. In all courses of physics there is still shown the Muschenbroeck disk for effecting a synthesis of white light, while in reality it is not colored lights, but colored sensations that are mixed in the eye. In what follows we present the question, then, from a physiological standpoint. Our object is to teach a means of juxtaposing colors that set one another off. In order to reach that result, it is evidently necessary to know the organization of our eye perfectly, not from an anatomical, but from the standpoint of the sensations that it experiences and of the judgment that we formulate.

The following is an experiment performed by Dr. Gillet de Grandmont before the French Society of Physics. The head of an observer is rendered immovable by means of a support, upon which rest the chin and forehead, and a screen is placed before one of the eyes. Then a brilliant metallic button is placed for a few seconds in front of the free eye, and a small bright green surface is made to appear alongside of it by means of a spring. In less than half a minute this green surface completely disappears from the sight of the observer, and he no longer sees anything. A wink of the eye suffices to make it reappear, but entirely gray. Then, by another motion of the spring, a white surface is substituted for the green; but the eye does not see it white, for it appears to be colored fuchsine-red—a color the complementary of green. At the first wink of the eye, however, the illusion disappears, and the surface seems to be simply what it is, that is to say, white.

Thus, then, when the eye is fixed for some time upon a color, it becomes blind to it, but such blindness lasts but an instant. Another conclusion that must be drawn from such experiments is this: when the eye has seen a color, it is disposed to see the complementary thereof, that is to say, it experiences in succession the sensations as a whole that constitute white. Thus the eye of itself reconstitutes the elements of the sensation of white, if one does not represent them to it. Hence, if we offer to this organ a collection of colors that go to make up white, we shall avoid this trouble; whence the conclusion that the principle of the harmony of colors in a shade made of two others resides in the use of complementaries. I have had many opportunities of establishing the truth of this fact. A simultaneous view of complementary colors is agreeable, the eye never tires of looking at them, and the more it sees them the better they please it. The following is a simple way of performing the experiment:

I have a collection of sheets of colored paper which together form 16 pairs of complementary colors. In order to simplify the judgment of the mind, I have taken care to select 32 colors as similar in intensity as possible, that is to say, all equally bright and deep. This collection is in the form of squares of the same dimensions. After mixing them up, I present them to some one, and ask him to group the papers in pairs, and put side by side such colors as appear to him to produce the most pleasing effect when juxtaposed. In selecting colored surfaces of an identical form, made of the same material, and differing only in quality and not intensity, the judgment is not influenced by accessory phenomena, and acts only upon the color. Under such circumstances, the colors are invariably classed by complementarics. I have remarked, moreover, that women take less time than men to make the classification, the female eye being very sensitive to contrasts.

How can we proceed in practice to determine complementary colors? Among the methods that are utilizable I have given preference to that of rotary disks, because it is as applicable to dilute as to pure colors. The colors are painted upon small disks of thick paper cut out by a special punch. These little disks are slit, partly according to a radius and partly according to the circumference, thus allowing two of them to be connected so as to cause the relative angle of the sectors to vary up to the moment when, through the rapid rotation of the disk, the surface appears of a uniform, perfectly colorless gray.

In order to judge whether the gray obtained really fulfills this condition, it is indispensable to have before the eyes a type of comparison that is of exactly the same *depth of tone* as the gray produced by the two complementaries. We obtain this as follows: In a wooden box, closed on every side, and lined internally with black velvet, a small aperture is made (Fig. 1). In front of this circular aperture, which is of as perfect a black as is possible to make it, I place a white sector of variable angle made of paper painted with pure sulphate of barytes. This sector may be rapidly revolved by means of an axle that traverses the box and terminates at the center of the aperture. There is thus produced a gray, of which I vary the tone at will by modifying the angle of the white sector. In the center of the circle I arrange, upon the same axis, the little slit disks painted with complementary colors. Through experiment we quickly succeed in obtaining two grays, which appear identical to the eye, although obtained in two so different ways.

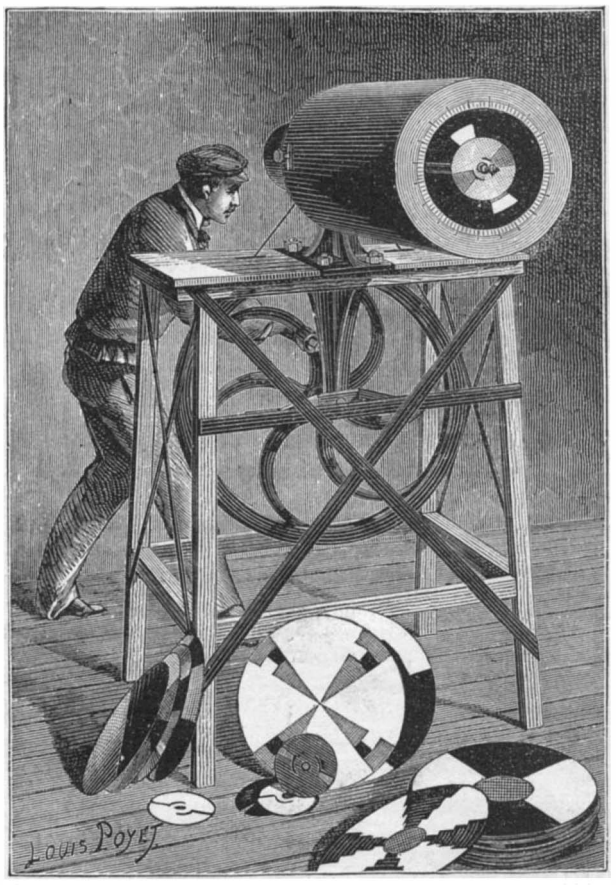


Fig. 1.—APPARATUS FOR STUDYING THE HARMONY OF COLORS.

By measuring the angle of the sectors we find (1) the proportion of two colors that reproduce the sensation of white, and (2) the quantity of white produced.

This revolving disk apparatus is especially one for study. The experiments can be seen by but a small number of spectators, for the disks must be viewed from the front, or at least at a very slight angle. This inconvenience has given Mr. De Luynes the ingenious idea of replacing the disks by revolving cylinders, in his lectures at the Conservatoire des Arts et Metiers. By painting stripes lengthwise upon a cylinder we can have at our disposal a certain number of colors upon one circumference, and, through rapid rotation, obtain mixed sensations (Fig. 2). The cylinder, according to its length, permits of juxtaposing a certain number of systems of bands of diverse composition, so that through rotation we see the result of several mixtures simultaneously.

The trouble with cylinders is that they do not show flat tints and do not permit of varying at will, and instantly, the proportion of the mixture, a thing very easily done with the slit disks.

Up to this point we have dealt merely with the use of complementary colors in order to avoid what M. Chevreul terms "contrast." But this is not the sole means. We shall evidently reach the same result by coloring with a monochrome of different degrees of intensity and luminosity. I am thus naturally led to present the results that experiment has taught me as to the *degradation of colors*. Here, again, the disks have been of the most advantageous use, since they have shown the grave error that is committed by degrading colors in the usual way. The hue of a coloring matter varies with the thickness of the coat in which it is seen, when it is mixed with colorless matters. In a thick coat it is redder than in a thin one. Moreover, the modification not only relates to the quality of the color, but also to its intensity. Coloring matters that possess of themselves a very intense hue, such as chrome yellow, give, through mixture with colorless matters, less and less intense colors, as might be expected; while with others, whose hue is of slight intensity (ultramarine, for example), the coloring power increases, on the contrary, under the same circumstances, up to a certain limit, beyond which the intensity decreases.

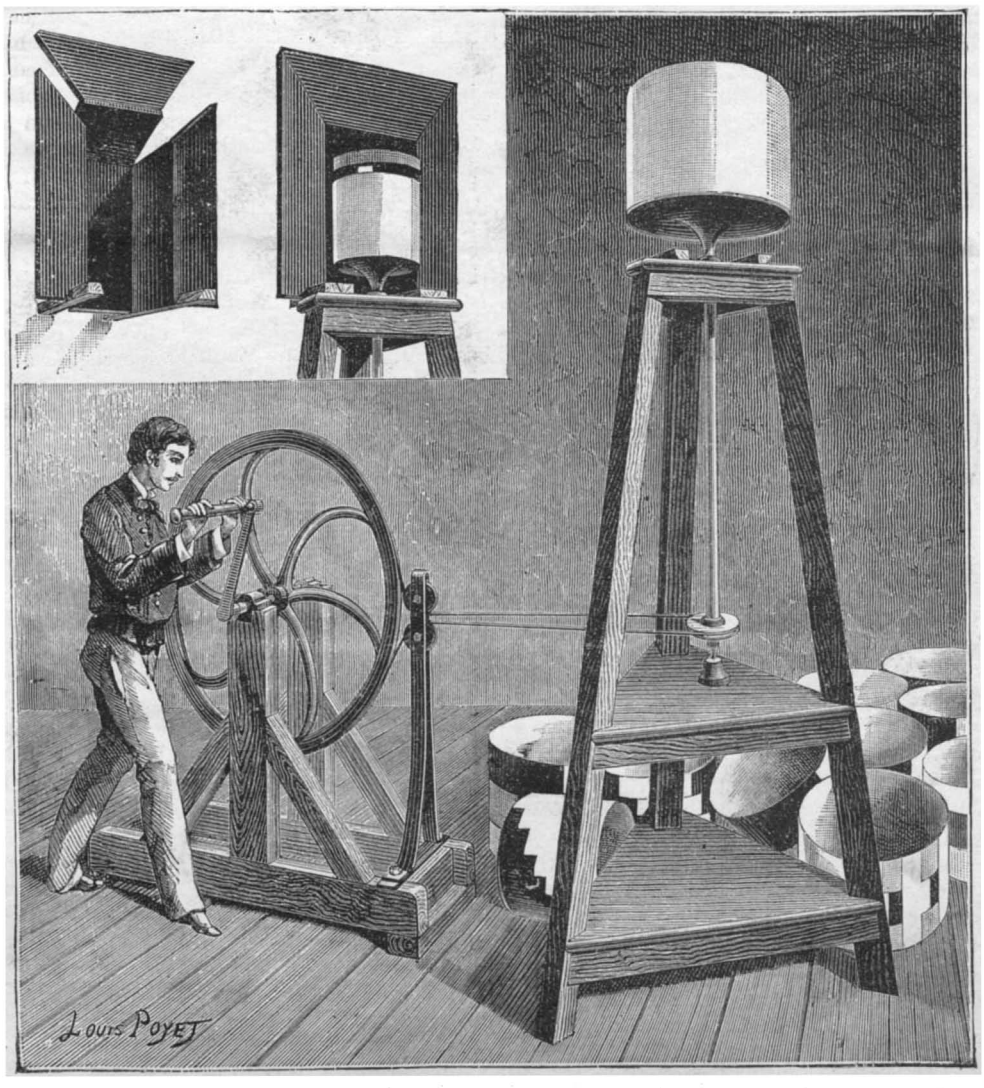


Fig. 2.—DE LUYNES' CYLINDER APPARATUS.

These facts explain why, if we seek the complementaries of tones of the same gamut of Chevreul's chromatic circle, we find that each tone has a different complementary, and that consequently all the tones of the gamut are derived in reality from one color. And it could not be otherwise, since Chevreul defines the "tones of one color" as "the different degrees of intensity that a color is capable of taking, according as the *substance* that represents it is purer, or simply mixed with white or black."

In order to obtain several tones of the same color that have definite relations to each other, it is necessary, in order to guard against such irregularities, to have a model in which we can follow a *true gamut*. Such a gamut, which I call an *esthetic* one, will be given by the result of a mixture of the sensations, such as we obtain, for example, by means of the disks. This instrument is an infallible guide that permits of ascertaining whether two tones of color are qualitatively identical, that is to say, whether they correspond to the same colored sensation, modified only as regards its intensity, or by the sensation of the white that is mixed with it.

Two colors are qualitatively identical when they are complementary; and two colors which, mixed, by means of revolving disks, with the common complementary,

produce a sensation of white with equal sectors are quantitatively identical. In short, we can now give the following conditions of the harmony of colors as certain:

(1.) *Hues derived from a pure color* (monochrome).—The degradations of one and the same color, according to the esthetic gamut, form with each other harmonious assortments.

(2.) *Hues derived from two pure colors.*—The most agreeable assortment is that of two complementary pure colors, and of their derivatives.

In the case of a tint composed of two colors it is necessary to add some advice relative to the selection of the shades, and this is, that the degree of intensity should be in ratio inverse the surfaces to be colored.

In applying the propositions that I have just formulated, it must not be forgotten that in order that a coloring shall be pleasing it is not enough that it shall flatter the eye by color, for there is a more important condition to fulfill—it is necessary to satisfy the mind, that is to say, it is necessary before all else to observe principles that are outside of the limits of the present paper, *i. e.*, those of distinct vision and concordance.—*A. Rosenstiehl, in La Nature.*

The Mind Cure.

Professor David Swing, in our excellent literary contemporary, *The Current*, published in Chicago, has an interesting article on the influence of the mind in the curing of diseases, from which the following is extracted:

On account of the dignity and wise look of large words, says the Professor, science never uses a simple term when a large one can be impressed into service. Thus the sleep produced by long gazing at a bright object or by the hands of a Mesmer is called *hypnotism*, while the sleep which comes from disease is called a *profound coma*. Following this tendency of science to use high sounding terms, those who discovered the value of the mind in overcoming disease saw fit to name the fact or theory *The Metaphysical Cure*. As those who are the parents of a child have the right to name it, so these discoverers of a new power in the mind had a perfect right to call it by the name that most pleased them.

It has always been known that the mind can exert a good or bad influence over the body. The old mental philosophies were full of stories which had a tendency to show how persons had taken to bed after having been told, by a succession of acquaintances, about the dreadful paleness of face or of a most unhealthy expression of the eyes. It was also affirmed, in the olden newspapers, that some mischievous wife made her husband believe that he was swelling up with dropsy, and should by all means hasten to the German Springs, and should take her along as nurse, his condition being so critical. The wife thus secured a trip to Europe—her art being that of taking pieces out of her husband's vests, so that it became almost impossible for him to make them reach around his abnormal body.

The Metaphysical Cure is, therefore, not a discovery, but the expansion into a medical practice of a power which had once been little else than a curiosity. A tendency of our age is to utilize forces. Nothing so pains the American mind as the thought of having anything go to waste. We are now in a worry lest there may be an electric potency that might turn all our wheels; we are attempting to run engines by sunbeams; the waste of water power at Niagara is the grief of many; while those who have escaped these forms of distress are made unhappy because the air is not as full of balloons as the streets are of cars and wagons.

In such a day it was very naturally concluded that if mind has a power over health and disease, let us utilize this power. Let us not permit the force to escape all duty, like the waters of Niagara. Let us not permit merely artful women to use it as a means of inducing dropsy and a foreign trip. Let us domesticate this mental influence, and extract from it valuable service.

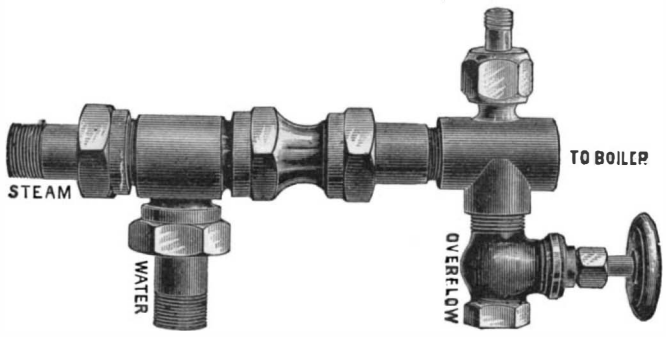
Thus came the "Metaphysical Cure" about eight or ten years ago. In the hands of extremists it is made partly one of the delusions of the world, but in the hands of the wise and moderate it is a tonic of great value, and will displace a large amount of quinine and wild cherry bitters. Its philosophy may all be summed up in the fact that the soul affects the body, and can rouse up its torpid blood, can make the liver, heart, lungs, and the brain—that nerve center—quicken their pace and use up or crowd out the diseased globules from the blood and fluids.

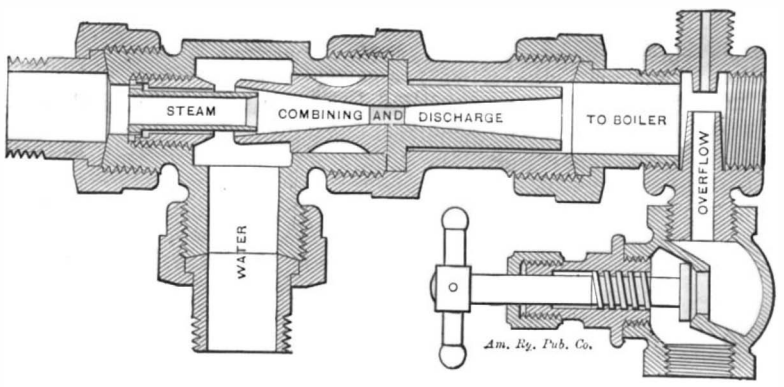
This is, then, the philosophy of the mind cure. It can do much for man, and is not to be reproached because it cannot do everything. If the influence of the mind may benefit one sick person in twenty-five, it will then surpass in value many popular medicines; and if it shall prevent many others from falling into any imaginary illness, it will confer a second benefit upon the community. Man is not in a condition to reject the help of any of nature's kind offers. By means of all these discovered helps the evils of ill health may be mitigated, if not banished from the world. Will, energy, medicine, fasting, good air, good food, good water, are all friends of health, but no one of these is master of the entire field of ailment. He will act most wisely who employs all these causes at different times of need.

With masses of evidence of the power of mind over matter, either to weaken it or to build it up, it is high time for us all to invoke the aid of this spiritual influence in not a few days of life; but to call it a general practice of medicine is to attempt to make a part equal the whole. This feat the new practitioners are attempting to perform. They are even attempting to cure disease when it is far away from the alleged doctor—the doctor throwing his mental force a thousand miles, and making it land like a bombshell amid the works of the enemy. This is that *reductio ad absurdum* which has been common in all times.

THE "UNIQUE" SINGLE TUBE INJECTOR.

The accompanying engravings show an injector possessing many admirable features, and, as will be seen, the aim of the manufacturers to make a perfect injector of the simplest construction, so as to be readily understood, has been most successful. This injector may be placed in any position, requires no change for varying pressures of steam, and the arrangement of its parts is such that the tubes can be conveniently taken out and cleaned when required. As it has no special valves to become defective by use, the necessity of often sending the injector to the maker for repair is avoided; all of the valves and fittings here required can be found where supplies for steam fitters are furnished. The overflow valve can be located at any point between the injector and check valve that may be most convenient. This style of injector is made either non-lifting or lifting, the latter form being shown in perspective and section in the cuts.





THE "UNIQUE" SINGLE TUBE INJECTOR.

The "Unique" injector is made by the Rue Manufacturing Company, of Filbert Street, Philadelphia, Pa., and although it has been on the market but about a year, its success has been most flattering. It is made of gun metal, neatly finished, and all the parts are fitted to standard gauges.

The Olive Oil Industry at Leghorn.

As soon as the oil is received at the warehouse, it is placed temporarily in tanks and large earthenware jars to settle. New oil from the country is always thick, and in winter time generally congealed; after having been allowed to remain undisturbed for six or eight days it is, if still congealed, slightly heated before being placed in the filters, in a large tin lined pan, with a double bottom or jacket, through which steam is made to circulate. Thus the oil does not come into contact with fire, but is gently warmed by steam until it is quite fluid. The oil filter is a rectangular wooden tank, lined inside with tin, and it is divided into two compartments, an upper and a lower one. The oil is pumped into the upper compartment, and is allowed to filter through perfectly clean carded cotton—brought here from Malta, and preferred to any other on account of its purity—into the second or lower compartment, when it has again to pass through another layer of cotton, and finally comes out into a tank placed beneath the filter, from which, if perfectly bright, it is pumped into large marble lined tanks, holding about 50 tons of oil each. If the oil is not perfectly bright it is passed through the filters again and again until it becomes so. As a rule, however, oil, particularly if of the finest quality, becomes perfectly bright after one filtering. In the large tanks the oil is allowed to remain undisturbed until required for exportation, whether for Great Britain or the United States of America.

Concentration.

Among the powers of the human mind that seem of themselves to make life worth living, that of concentration occupies a prominent place. To be able to fix the thoughts or the attention exclusively upon one subject, and to keep them there without wavering as long as is necessary, is a most important element of success in every occupation. It is a common mistake to think that although this ability is essential in professions, in literary pursuits, in the management of large enterprises, or in any position involving the laying of plans or the carrying out of systems, for the ordinary and commonplace worker, especially if his work be chiefly manual, it is of little consequence. This is one of those fallacies which lie at the root of much of the poor, inefficient, and inferior quality of work which is offered to the world in quantities far exceeding the demand. It is a well known fact that while hundreds of unserviceable men and women stand idle, waiting for employment which does not come, every one who is able and ready to do superior work in any department is eagerly caught up, and may almost command his own terms.

One of the most radical differences between these two classes of workers is this very power of concentrating the energy and strength of both body and mind upon the work immediately at hand. Two men, working side by side in the field or the factory, may be equally competent, as far as knowledge or physical strength or previous training go, to perform the labor before them. They begin with equal promise of good success, but in a short time, while one is persisting, the other is relaxing in effort. One pursues his work with unremitting zeal; the other spasmodically, with intervals of wandering thoughts and flagging attention. It is already an assured fact that the one who has acquired the habit of concentration will be the successful competitor. He will be anxiously sought for and re-engaged, while the other will soon go to swell the ranks of the unemployed. It matters not what is to be done; from the simplest mechanical work to the most abstruse and complex mental operation, the power of putting all the thought, energy, and attention on that and nothing else for the time being, will very largely determine the quality and amount of labor performed.

To some extent this is a natural gift. We see children at play who, without other motive than their instinctive tendencies, persist continuously in any effort they make, or purpose they form, with a perseverance and earnestness which may well shame many of their elders, while others will be distracted by every passing object, and forget their determinations as soon as they are formed. Yet here, perhaps more than in most tendencies, culture and practice come in to strengthen what is lacking. The discipline of the schools is most valuable in developing the concentrative power in the province of thought, and it would be a blessing to every child if, in some way, a like discipline helped him in the work of his hands. Like every other faculty, this, too, is strengthened by exercise. Each time we recall our scattering energies and wandering thoughts, and force them resolutely in one direction, we increase the power and develop the habit, and the exertion, at first painful and laborious, becomes in time easy and agreeable.

Mr. Thomas A. Edison attributes his success as an inventor largely to this faculty, which he gained by steadfast exertion, once being able only to think upon a given subject for ten minutes before something else would come into his mind, but gaining by long practice the power of continuous and uninterrupted thought for hours on a simple topic. At one time he worked with his assistants in trying to connect a piece of carbon to a wire. Each time it would break, and they would spend several hours in making another, until after working in this way one day and two nights they finally succeeded.

This habit does not necessarily make a person so absorbed in one thing as to become narrow and one-sided. He may become so by yielding wholly to a native impulse of dwelling on one thing; but the same self-control that concentrates his energies at will can also divert them at will into another channel when the proper time arrives. Many things rightly claim our attention, but none of them will receive it aright if our thoughts aimlessly wander from one to another, without compass or guide.—*Phila. Ledger.*

PROTECTIVE inoculation against yellow fever is being tried extensively in the Mexican army.

Correspondence.

Expected Advent of the Locust.

To the Editor of the Scientific American:

In your issue of 23d ult., under the heading of "Expected Advent of the Locust," you say that "the 17 year brood will appear at Fall River, in the southeastern portion of Massachusetts," and other States therein mentioned, but do not say when; but in the fifth paragraph you say that "the 17 year brood that is to occur this year has been well recorded for the years 1715, 1732, 1749, 1766, 1783, 1800, 1817, 1834, 1851, 1868." Now, I *know from personal observation* that the 17 year brood made their appearance in Freetown, an adjoining town of Fall River, in the southeastern portion of Massachusetts, in the years 1818, 1835, 1852, and 1869, one year later than your record. In 1818 they were very numerous; in 1835 they were less numerous; in 1852, still less; and in 1869 they were quite scattering, in comparison with 1818. * *

Fall River, May 25, 1885.

[Prof. C. V. Riley states that the facts above mentioned are in accord with what we know, and the insects which he thus noticed in 1835, '52, and '69 belong to Brood I., as classified by Prof. C.V. Riley, of the Department of Agriculture. This is a septemdecim brood, and has been recorded ever since 1767. It has no connection with the broods of the present year, and will, of course, appear again true to time in 1886. It will appear in the valley of the Connecticut River and in Franklin, Bristol, and Hampshire counties in Massachusetts.—ED.]

The Royal Society Soiree, 1885.

On Wednesday evening, May 6, Professor Huxley, the President of the Royal Society, entertained a large number of the Fellows of the Royal Society and a number of distinguished guests at the Society's rooms in Burlington House, and, as on previous similar occasions, there were exhibited throughout the different rooms objects of scientific interest. Upon the walls of the room in which the President received his guests was a series of studies in colored chalk, illustrative of the different phases of the eclipse of the moon of the 4th of October in last year, and another series of very interesting chalk studies recording the magnificent roseate effects of sunset and afterglow which during the winter of 1883–1884 attracted so much attention, and which gave rise to much speculation among meteorologists as to their cause and origin, and which by a remarkable consensus of opinion have been set down to the presence in the higher regions of the atmosphere of immense quantities of volcanic dust. Both these series of sketches were contributed by Mr. Ascroft.

In the reading room Mr. Frank Crisp exhibited, by means of an exceedingly prettily constructed little apparatus fitted on to the stage of a microscope, the combustion of different metals within the discharge spark of an induction coil; and by a supplementary spectroscope, also attached to the microscope, the spectra of the different metals so burnt could be studied and compared. In the same room Mr. Copprock exhibited a number of medical and other thermometers, in which the special feature of interest consisted in giving to the cross section of the stem of the thermometer a lenticular form, the two sides of the tube being portions of cylindrical lenses; by this means while there is no refractive displacement in a vertical plane so as to affect the reading of the instrument, the thickness of the mercurial column is magnified from eight to twelve times, and is therefore more easily read. Mr. Copprock also exhibited a combined sunshine recorder and sun dial for any latitude, and an anemometer for determining the velocity of currents of air in mines and other places. In the principal library, General Strachey, R.E., F.R.S., exhibited an interesting instrument, which would require the aid of drawings to describe, for tracing out sine curves, and by which the harmonic components of periodical phenomena can be represented by corresponding figures.

Mr. Andrews exhibited a series of photographs of fractures of railway axles, broken under breaking tests at the Wortley Iron Works, Sheffield; and Mr. T. G. Daw exhibited a specimen of his new type writer, by which, it is stated, a speech can be recorded and printed verbatim as rapidly as it is uttered by an ordinary speaker. This instrument exhibits great beauty of design and construction, and we intend to illustrate and describe it on an early occasion. Mr. G. Matthey, F.R.S., exhibited a number of beautiful specimens of objects of precision constructed of platinum and iridio-platinum. These consisted of (1) a series of iridio-platinum weights absolutely adjusted to a density of 21·566; (2) some unfinished weights for the *Comite Internationale du Metre*, also of the density of 21·566; (3) a coil of platinum wire of a diameter of 0·00075 inch prepared by simple drawing; and (4) a specimen of platinum wire produced by the Wollaston process, which consists of drawing a silver wire having a platinum core down to extreme fineness, and afterward dissolving away the silver in nitric acid, leaving the nearly invisible platinum core. Professor Hele Shaw exhibited some new applications of his very beautiful spherical integrator, which he recently brought before the Institution of Civil Engineers, one of these applications being a very simple and accurate instrument for computing the areas of inclosed figures.

Mr. J. J. Hicks exhibited one of Professor Herbert McLeod's sunshine recorders, which, by continuously photographing the luminous image of the sun as reflected by a spherical mirror or ball of silvered glass (the axis of the sphere and camera lying in the meridian), traces out on the sensitized surface a curve, the continuity of which is a measure of the prevalence of sunshine during the day, and the position of any break in that continuity is a record of the time at which the sun became overclouded. Mr. Hilger, who has now so high a reputation for high class accuracy and finish in physical apparatus, exhibited some exceptionally fine spectroscopes with diffraction gratings, and a very delicate star spectroscope fitted with prisms of Iceland spar and lenses of quartz, which he has lately constructed for the Observatory at Elphinstone College, Bombay. Mr. Hilger exhibited also a fine collection of large prisms and a very simple and accurate fan governor for controlling the speed of a telescope driving clock for the Observatory of Rio de Janeiro.

What were perhaps the most interesting contributions to the interest of the evening were those of Mr. Shelford Bidwell, whose name is well known to the readers of this journal for his very successful experiments in connection with both the phonograph and photophone. Mr. Bidwell exhibited a series of beautifully arranged experiments in illustration of the variations in the lengths of bars of iron, steel, and nickel produced by subjecting them to magnetization, and among others he showed the following most remarkable experiment. A vertical iron rod is placed in the axis of a magnetizing solenoid of insulated copper wire, its lower end is fixed to a rigid support, while its upper end is attached to the short arm of a long lever supported on knife edges, the longer arm of the lever actuating a small mirror by which the image of a luminous slit is caused to be projected on a vertical scale at the other end of the room, and by the displacement of which extremely minute variations in the length of the iron bar can be detected and measured. With this apparatus Mr. Bidwell showed that with a magnetizing current of electricity such as Dr. Joule called a saturating current—that is to say, a current of such a strength that the bar was magnetized to what was believed to be its maximum capacity, and beyond which it has hitherto been considered no increase of current could affect it—elongation is produced in a bar of iron or steel, a fact often demonstrated before; but by increasing the strength of the current to three times what was considered a current of "saturation," Mr. Bidwell has found and demonstrated, on the occasion to which we refer, that the length of the bar is unaffected on making or breaking the circuit, whereas on increasing the current to six times the "saturating" current, or twice that of the current last referred to, then the bar, instead of being lengthened, is considerably shortened.

Mr. Shelford Bidwell also exhibited an interesting experiment in physiological optics; he showed that if a vacuum tube, conveying an electrical discharge, is slowly rotated, it appears to be followed at an angular distance of about 30 degrees by a fainter spectral image of the tube, rotating at the same speed, and therefore always at the same angular distance behind it, and a still more remarkable phenomenon takes place if the rotation of the tube be suddenly arrested; for then, instead of the spectral image stopping at the same moment as the tube, and at the same angular distance from it as it remained during its rotation, or instead of disappearing at that moment, both of which effects might have been expected, it apparently goes on in its rotation, following up the tube itself and disappears at the point at which the tube appeared to stop. These experiments were very interesting, and attracted considerable attention at the soiree, which was very largely attended, and was in every way successful.—*Engineering.*

American Society of Civil Engineers.

The American Society of Civil Engineers will hold its annual convention at Deer Park, Md., from June 24 to the 27th inclusive. A special invitation has been extended to members and their families to arrive in Baltimore on Monday, the 22d, and take part in several excursions in and around the city. In the afternoon, two excursions are offered: one under the auspices of the Baltimore and Ohio Railroad, to visit, by steamer, the marine terminals of that road, and other points of interest in the harbor; and the other, under the escort of the Chief Engineer, to inspect the city waterworks. In the evening, invitations are extended for a concert at the Academy of Music.

On the 23d a special train will leave Baltimore in the morning, stopping *en route* to allow the tourists to inspect the Mt. Clare Shops, Harper's Ferry, and other interesting places, and will reach Deer Park in the early evening. Sessions will be held at the hotel during the continuance of the meeting, and visits will be made to the Cheat River Grade, Kingwood Tunnel, Tray Run Viaduct, and other points of engineering interest on the line of the Baltimore and Ohio road. President Graff will deliver the annual address at one of these sessions. Deer Park is beautifully located in the midst of the Alleghanies, 2,800 feet above tide water, and has a very attractive hotel, which will be the headquarters of the society. A better spot for a summer convention could scarcely have been selected. Already a large number have indicated their intention to be present, and the meeting promises to be one of particular interest.

The Ship Railway.

Recently, at the close of one of Mr. Corthell's lectures, in the large hall of the Massachusetts Institute of Technology, Boston, Captain Eads was introduced, and cordially greeted by the large audience present. We give a few extracts from his remarks:

"If we came before capitalists with a proposition to construct a canal across the Isthmus of Tehuantepec, possessing, as that location does, such great advantages over Panama and Nicaragua in healthfulness of climate and proximity to the United States, there would be no lack of money offered to build it; because everybody knows what a canal is. They are as old as the Pharaohs, and everybody knows that if one is wide enough and deep enough, a ship can be floated through it.

"We come before the world with a better and cheaper method of taking loaded ships across the Isthmus than any canal can posssibly be; but because of its novelty, we must overcome the same kind of unbelief which opposed the introduction of illuminating gas, the telegraph, the Atlantic cable, steam navigation, the power loom, the locomotive, and a score of other immense benefits which we now enjoy as commonplace things, but each one of which had to fight its way into popular favor against all manner of opposition, selfishness, prejudice, ridicule, and ignorance.

"It is but a few years since George Stephenson was pleading for the means with which to build the first few miles of that grand system of steel highways which now covers the civilized world with a network far more marvelous and beneficent than the wildest flight of a poet's fancy ever pictured, or the dream of an enraptured enthusiast ever compassed.

If Stephenson had devoted one tithe of the thought, energy, and talent to secure the capital for building fifty miles of a canal or a turnpike instead of that little piece of railway, he would have had an abundance of financial aid, because those means of conveyance are almost as old as Adam. But who now would invest a dollar in a stage coach if he knew that the locomotive would be its competitor? Who would take stock in an ordinary canal now, if he knew that a railway was to be built alongside of it?

"The ship railway is simply a proposition to carry larger burdens than have hitherto been carried on ordinary railways, and the same causes which tend to reduce the cost of transporting cargoes on the ocean in large ships instead of small ones must tend to lessen the cost of ship railway transportation below that of ordinary railways. For the same reason the ship railway must inevitably prove superior to the ship canal.

"When we proposed to deepen the mouth of the Mississippi with jetties, the people of New Orleans had so much more faith in the Fort Saint Philip Canal (a scheme to connect the deep water of the Gulf with the river, forty miles above its mouth) that their various commercial bodies were immediately called together, and forthwith sent two engineers of note to Washington to defeat our proposition, and the House, in response to the universal demand, actually voted eight million dollars with which to begin the construction of a canal which would have cost fifteen millions at least in money, and ten years in time, for its completion.

"Well, the controversy between that canal and the jetties is ended, and the country has been saved from a most expensive blunder. In four years afterward, and with one-third of the money, the old Father of Waters was made to open his mouth wide enough and deep enough to float the Great Eastern through it in safety to New Orleans.

"That channel has existed for the last five years, and it will continue, with a little care, to exist to the end of time. It has opened the immense agricultural products of a region one hundred and fifty times as large as the State of Massachusetts to all the people of the world who live to the east of our Isthmus. We now propose, through the grace of God and the simple means which this model illustrates, to open that mighty valley, with its illimitable stores of cereal wealth, its boundless treasury of food for man and beast, to all the rest of mankind who live to the west of that Isthmus.

"This work, when finished, will be the realization of the ardent wish of statesmen and philanthropists everywhere; the dream of kings and conquerors during the last three hundred and fifty years; and a fitting supplement to the grand achievements which have marked the progress of the nineteenth century."

An Ohio Gas Well.

At Shelby, Ohio, May 5, the largest vein of gas ever struck in Ohio was reached at a depth of 480 feet. The men were warned of its presence by a roaring sound, and fled for their lives, hardly escaping before the gas rushed from the orifice with a tremendous report, shattering the derrick and throwing the dirt and mud many feet into the air. A temporary pipe, seventy feet in length, has been laid, connecting with the well, and it furnishes a steady stream of fire twenty-five feet high. The discovery will supply the whole town with light and fuel for dwelling houses and manufactories.

Lumley Electric Light.

The Lumley system of lights and dynamo machines, which has been in use for two or three years in England, is now being introduced into this country; it comes to us with quite a favorable recommendation. The filaments in the incandescent lamps are arranged in the outline of a cross, and, according to the statements of the company, give more light to the horse power than can be obtained from any other system. They have not yet, however, been subjected, we believe, to any competitive tests. The filament is prepared from a fiber whose origin is kept a secret. The lamps range from 10 to 300 candle power, and are guaranteed for 1,000 hours, though there are lamps at the company's factory which are stated to have been burned over 4,000 hours without any apparent loss of power. The arc lamp is constructed to be run, when desired, in the same circuit as the incandescent. The dynamo is a modified Gramme machine, and has the merit of being quite cheap and very compact. Particular durability is also claimed for it, but as the life of any good dynamo is, with proper care, almost indefinite, the machine can do no better in this respect than to share the general merit of longevity. It is run at 1,600 revolutions, which may possibly account for the excellent results obtained.

IMPROVED TRACTION ENGINE.

The accompanying engraving represents a traction engine embodying new and valuable forms of construction, and which may be employed to plow, saw wood, gin cotton, thrash and grind grain, haul, or to do any of the work commonly performed by a steam engine. Heretofore in the operation of traction engines a serious difficulty has been caused by the slipping of the wheels in passing over sandy or soft soil. The engine here illustrated overcomes this to a great extent, as the surface of the wheel in contact with the ground is practically largely increased. This is accomplished by means of a V-shaped chain connecting each pair of wheels, thus forming a track on the pulling or tight side of the chain, that is laid on the ground for the drivers to roll on. Besides increasing the bearing surface this enables the engine to utilize more of its power than it would if rolling on the ground. The pilot wheels are of the same width as the drivers, and the weight is distributed on all four points; the guiding of these wheels is accomplished with a short axle pivoted at the center of the face of the wheels, so that the length of the chains is not altered when turning a corner. The engine rolls on its own rail, the pilot wheels laying it down; and being connected with the drivers they help forward the latter by taking their proportion of the weight of the engine.

In regard to the work which this engine will do, the inventor, Mr. Geo. F. Page, of No. 5 N. Schroeder St., Baltimore, Md., states that "with my twelve horse engine, I pulled through the red clay mud, up a grade of one in twelve, ten tons in two six horse wagons. The engine made better time, with less water and coal, than the old wheels on a dry road of the same grade."

Discovery of the Missing Link.

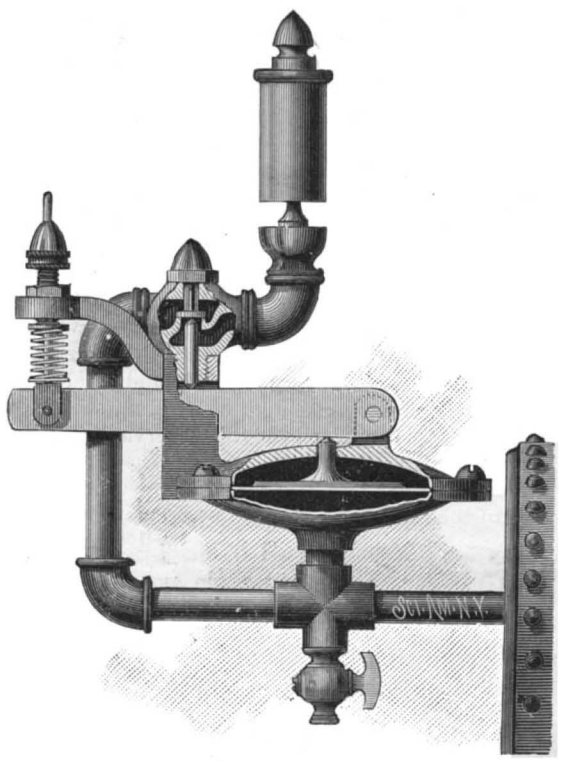
"They can talk all they please about their great scientists," said the brakeman to a Chicago *Herald* reporter, as he stepped between two freight cars and made his arms go up in the air, "but I did something the other day that Darwin, Haeckel, Huxley, and all them evolutionist fellers never could do, with all their larnin'. We were running along with about thirty cars, when our train broke in two sections. We stopped 'em, an' were goin' to couple up again, when we found we couldn't do it. Something was gone. 'Wait a minute,' says I to the conductor, and then I skipped out and run back along the track. It was then what I did what the crack scientists have never been able to do."

"What was that?"

"I found the missing link."

SAFETY VALVE AND ALARM FOR STEAM BOILERS.

The object of the device herewith shown is to cause an alarm, in case the safety valve fails to open, by the use of a pressure detecter in conjunction with an ordinary safety valve, so constructed as to insure the invariable opening of the valve when the pressure reaches a given point. Connected to the steam pipe attaching the device to the boiler is a steam chamber, across

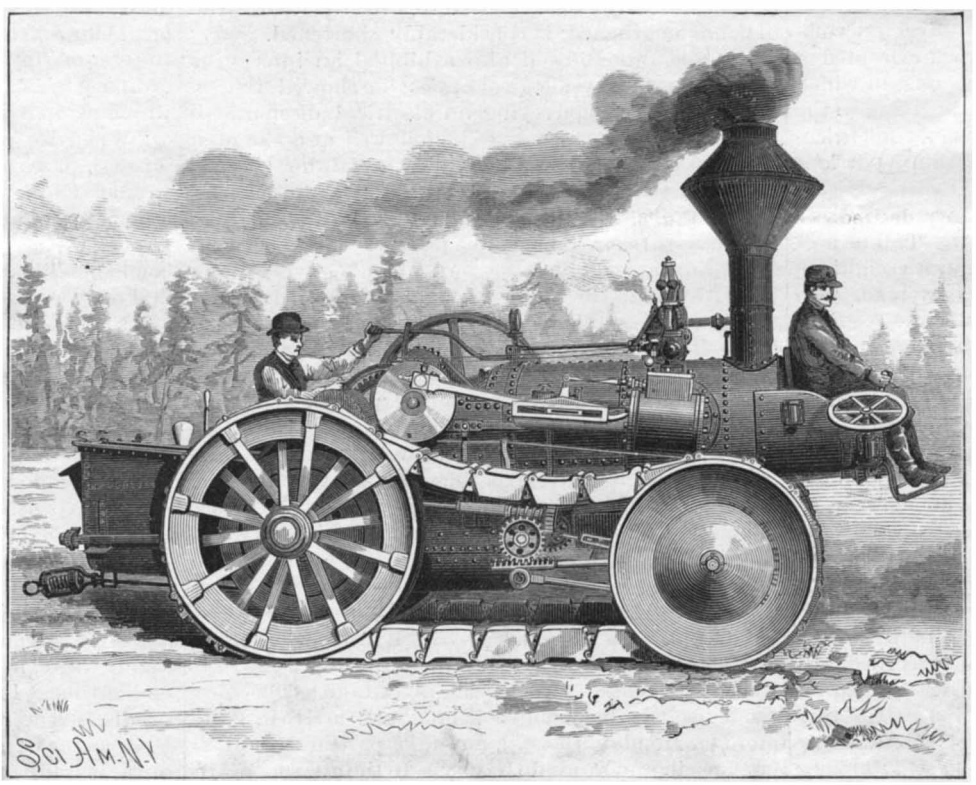


SAFETY VALVE AND ALARM FOR STEAM BOILERS.

which is secured a thin metallic diaphragm carrying a plunger extending through the upper side of the chamber into contact with a lever at a point near its fulcrum. The valve chamber is sustained by a slotted post through which the lever passes. To the outer end of the lever is pivoted a rod extending upward loosely through a sleeve nut screwed through the end of an arm projecting from the post; by turning the nut the tension of a spring surrounding the rod and the pressure on the lever can be regulated. Beneath the valve, the casing of which is broken away in the engraving to show the interior, is a slide pin extending through the lower part of the valve chamber to the lever. The valve stem extends upward into a guide mortise, and is fluted so to reduce the friction. A whistle is connected to the outer part of the valve chamber.

When used on a boiler provided with an ordinary safety valve, the lever is set by adjustment of the spring at the same pressure as the safety valve. In case the latter fails to open when the maximum pressure is reached, the steam, acting against the diaphragm, raises the lever, thereby pushing the pin and valve upward and admitting steam to the whistle. The form and arrangement of the valve are such that it is not liable to stick, and it opens easily and readily. When there is no pressure in the boiler, the lever rests on the bottom of the slot in the post, thus relieving the diaphragm of all weight.

This invention has been patented by Messrs. W. B. Railing and C. N. May, P.O. box 160, Mechanicsburg, Pa.



PAGE'S IMPROVED TRACTION ENGINE.

A Land Flowing with Wine, and the People all Drunkards.

Among the new missionary stations established by the American Board is that of Inhambane, on the east coast of Africa, situated in about latitude 24° and about 200 miles northeast of Delagoa Bay. The missionary at this station, the Rev. Dr. Richards, lately made an inland tour of 150 miles from the coast, to see what he could see, and in a recent number of the *Missionary Herald* is given a very interesting account of this journey, from which we abstract the following:

On the third day out the explorers came upon the Amakwakwa tribe, of whom Mr. Richards says: "They have no gardens at all. They are so frequently robbed by Umzila's *impis* (soldiers) that they have become quite discouraged. Another reason is that the native fruit is capable of sustaining life, and is abundant; and, again, the palm wine flows freely all over the country. This palm tree is usually four or five feet high, seldom ten feet. It manifests little life, save at the top, where a few leaves appear, looking like a flower pot on a stump. These leaves are all cut off, and from the cut each tree yields daily about a pint of delicious juice, but highly intoxicating when allowed to stand for a few hours. There seems to be no limit to these trees, and we were surrounded on every hand by drunken men and women. Even little children were staggering about as ingloriously as their parents. It was difficult to avoid trouble with these people, yet our guns were respected, and a ball fired carelessly at a near tree would produce quiet for half an hour. They were coarse, rough, drunken fellows, often plundering, often plundered, and accustomed to quarrels and fights not altogether bloodless. One could scarce expect to find pleasure in passing among them."

Nobert's Ruling Machine.

The world renowned ruling machine of the late M. Nobert was exhibited at the last meeting of the Royal Microscopical Society. It has been purchased by Mr. Frank Crisp, one of the secretaries. The foundation of the machine is the ordinary dividing engine used in the graduation of circles and sextants; this, by a vast amount of delicate superposed mechanism, is made to rule lines at a very minute but determinable distance; strange to say, the lines are not straight ones, but portions of a large arc; the lines, however, not exceeding one-fiftieth of an inch in length, the curvature is not perceptible. The diamonds used for ruling are worked to knife edges, in some instances ground, in others chipped, but made with such delicacy that microscopical examination fails to detect any serrations; in this and the glass employed would seem to lie the secret of the fine quality of line produced by M. Nobert. The note book of the inventor accompanies the machine, and in it the performance of each diamond has been recorded, and much useful information that will probably enable the machine to be used. Experts who have examined the machine since it has been in England do not consider the mechanical contrivances the best that could have been devised; but the fact nevertheless remains that Nobert contrived to execute rulings which have not been equaled. The resolution of the nineteenth band, in which the distance of the lines—according to the measurements of Dr. Pigott—is 112·595 to the inch, and formerly supposed to be impracticable, is now accomplished without much difficulty. There is also an adaptation for ruling the longer and comparatively coarser lines for diffraction plates for spectroscopes.

Effects of Heat and Cold on Steel Tools.

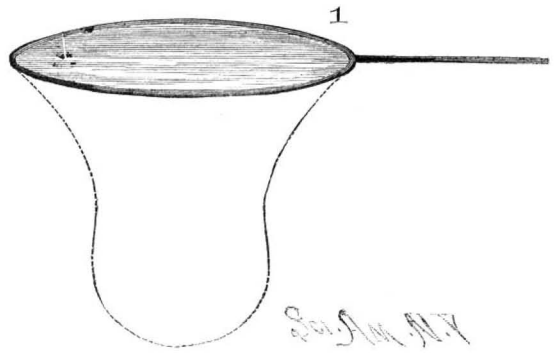
There are steels and steels. Some of them act queerly. A planer man was much annoyed at the breaking of his cutting chisels every morning in the cold weather. He had become infatuated with a "high" steel that was worked at a low red heat and was not hardened for tempering, but was left to cool under the hammer. But his planer was near a basement wall on which the frost has stood every cold morning during this "open" winter. Soon as he started a chip, away would go the point or edge of the tool. At last he put his thinking cap on, and procuring a small alcohol lamp from a glue pot, he swung it on the crosshead saddle so that the blaze came up by the side of the tool. This heated the tool so that it was almost painful to feel it. He had no more snap breakages. After the tool got heated by the friction of its work, the lamp was turned off. Another machinist, working on threading taps, heats up the threading tool in the morning by grinding it on an emery wheel.

EXPERIMENTS WITH SOAP BUBBLES AND FILMS.*

T. O'CONOR SLOANE, PH.D.

The true nature of a liquid film is comparable to that of a perfectly elastic and tightly stretched membrane. All liquids are bounded and inclosed by such a membrane, composed of the substance of the liquid

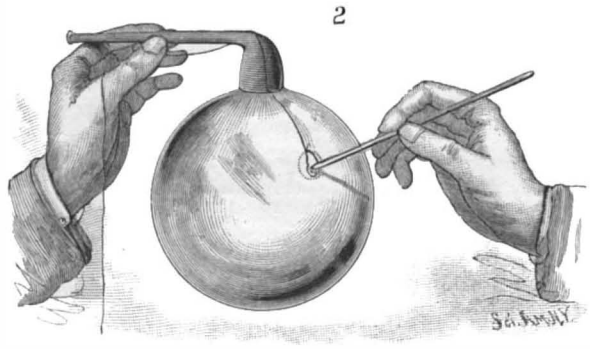
1



itself. The phenomena of films, under the form of soap bubbles, have been known for many generations. They were seriously studied by Sir Isaac Newton, and later by the scientist Dr. Plateau, of Belgium, a curious study for one, like the latter, afflicted with total blindness.

If a ring one or two inches in diameter, and provided with a handle, is dipped into a solution adapted for

2

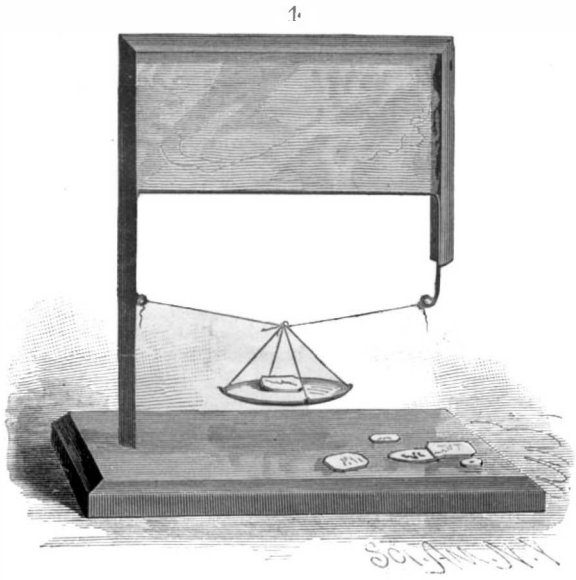


forming films, and is withdrawn, it will be found to be filled with a beautiful film, straight and firm, reminding us of the wing of a dragon fly, Fig. 1. If we blow against it, it will be driven out into a purse-like shape of very characteristic outline (see dotted line). If it be held between the mouth and a candle, it will screen the latter from strong blowing until it breaks, when the candle will be extinguished.

3

By particular management a hole of any desired size can be made in the side of a soap bubble. This is done by tying a small loop, less than the third of an inch, in the end of a silk thread, moistening it thoroughly with the solution, and hanging it over the bowl of a pipe just before blowing a bubble. As the bubble is blown, the end of the thread and the loop will adhere to it.

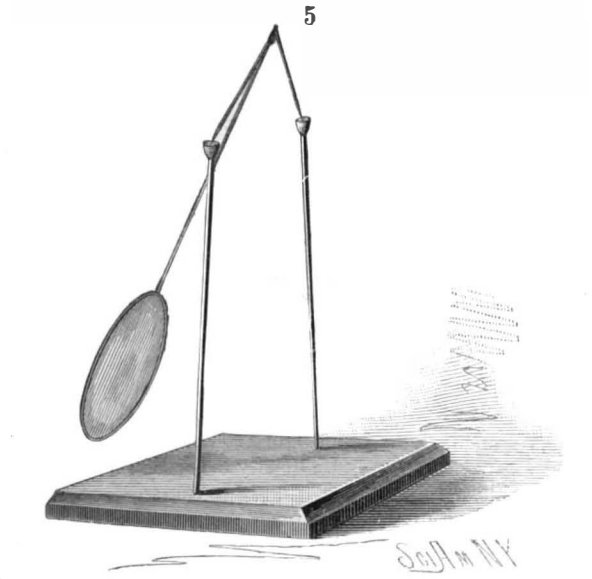
4



Then by touching the film within the loop, either with a hot wire or with a piece of blotting paper, the film will break inside of the loop, which will fly open to its widest extent, Fig. 2. The bubble will immediately collapse, or by vigorous blowing may just be kept inflated. The blast from the hole is sometimes enough to extinguish a candle.

This shows that the film is elastic. To measure di-

5



rectly the tension exerted by an inflated bubble, a glass tube bent at a right angle may be attached to the end of a pipe stem. After blowing a bubble, the end of the glass tube may be dipped into water, when the depression will show the pressure, Fig. 3. It will be but a small fraction of an inch.

To measure the tension of the film per unit of surface, a little frame with grooved sides is employed. In the grooves a wire carrying a little scale pan slides freely up and down, Fig. 4. The wire is pushed home to the top of the frame and some of the solution introduced, either by dipping the top or by painting it in with a brush. Then by adding weights the film can be pulled down like a delicate curtain until the limit is reached, and it breaks.

By mounting a ring as a pendulum and filling it with

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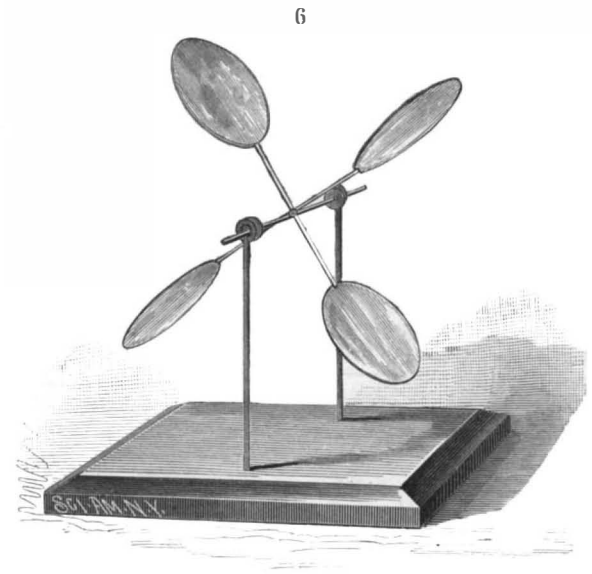

a film, Fig. 5, the retardation the latter exercises on its swing is quite striking.

Four of the rings may be mounted as a windmill, Fig. 6, and be made to turn several times by the breath until their perishable sails break one by one.

If a thread, well moistened with the solution, is laid across a ring containing a film, and the film is broken on one side of it, the thread will be suddenly snatched across the ring and be drawn up tightly against the opposite side. To facilitate manipulation, the ends of the thread may be fastened to the ends of a wire, or thin slip of wood. On drawing out the thread it will draw with it a curtain of film, and will assume the curve of the arc of a circle, Fig. 7. In this way the ring may be again filled with film and the thread be entirely removed.

A bubble may be blown, a moistened ring touched to

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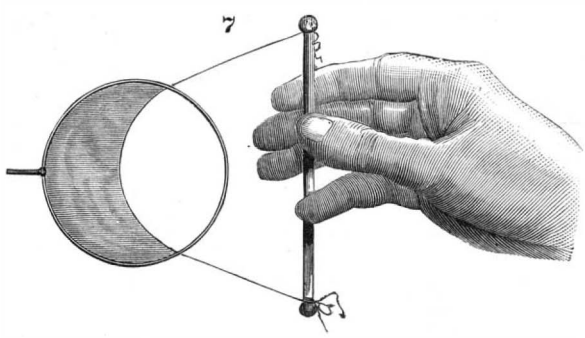

it, and the pipe pulled away, leaving the bubble adhering to the ring. The pipe may be again dipped, passed through the upper part of the bubble into its interior, and a second bubble may be blown thus in the interior of the first, Fig. 8.

By catching a bubble on a ring, as described above, and touching it with a second ring, previously moistened, it will adhere to both, so that it can be drawn out into the most elegant shapes, Fig. 9, reminding us of the iridescent glass vases so popular a few years ago.

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Again attaching a bubble to a ring, the air in it can be drawn out by inverting the mouth of the pipe until, on pulling away the pipe, a lenticular bubble will remain, Fig. 10.

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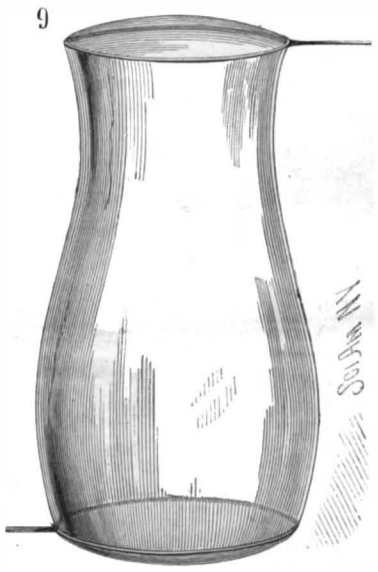

The well known diffusion experiment with a porous jar can be very nicely shown with a film. The mouth of the jar, a porous cup of a Bunsen or Daniell battery,

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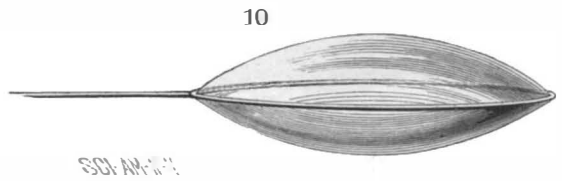

is dipped into the solution. A glass vessel full of hydrogen, or street gas, is inverted over it, Fig. 11. The lighter gas diffusing into the porous vessel blows a

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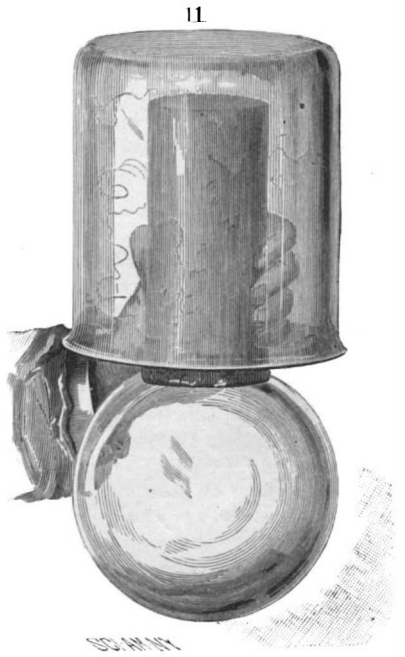

bubble from the film. On removing the outer jar the reverse action takes place, and the bubble collapses.

Very pretty effects can be produced by blowing bubbles full of tobacco smoke. By attaching the pipe stem by a rubber tube to the gas fixture, they may be in-

* From a lecture on "The Physics of Tenuity," to be given in full, with many additional illustrations, experiments, and formulas, in SUPPLEMENT, No. 495.

flated with gas, when they will rise like balloons. Many formulas have been published for making a good mixture. Plateau's mixture is thus prepared: 1 part of Marseilles soap is dissolved in 40 parts of water, at a moderate heat. It is filtered through very porous filter paper, after cooling, and 15 parts of the solution are mixed with 11 of Price's glycerine. The mixture is thoroughly shaken, and is allowed to stand for seven days in a room that is not too cold (over 67° Fah.). On the eighth day it is cooled for six hours to a temperature of 37° Fah., and filtered. A bottle of ice should be kept in the funnel. The first portions may need refiltering. Very porous paper must be used. Halbrook's brown oil silk soap or his Gallipoli soap, and Scheering & Glatz's glycerine work very well. The second filtration may be omitted—long standing and decantation from the sediment being used. After all the trouble the mixture may not give very good results.

To succeed in these experiments a little practice and niceness of manipulation is required, together with a good soap solution.

How Window Glass is Made.

The workmen were engaged in making window glass, and proceeded in a way that seemed very simple. A young man would take one of the long hollow iron pipes we saw the gaunt man juggling with, and approaching one of the mouths of the great furnace with the indifference of a salamander—first,however, protecting his face with a leather screen—would proceed by a series of wave-like movements of the pipe to gather at the end a ball of liquid glass, getting his supply from a fire clay pot. These pots contained a mixture of soda, lime, and sand, which had been reduced by firing for two days. After gathering a wad the size of a cocoanut, the young man would turn and cool it upon an iron plate, still keeping up the wave-like rotary motion. Then he would return to the pot and begin fishing again, then back to the iron plate for cooling, and then more angling. By this time he has gathered a ball of about sixteen pounds weight and of intense heat. Now cooling the pipe with water, he carries his burden over and deposits it on a larger iron plate—this one floating in a tub of water—gives the pipe to a glass blower, and seizing another iron, goes back to the furnace to perform his part once again.

The glass blower rolls the ball upon the plate until he has made the glass assume a pear shape, when he applies the pipe to his lips and blows till his cheeks stand out like red apples, blows till he is red behind the ears, blows until he becomes of a complexion as blooming as the glass. All this while he imparts a rotary motion to the pipe, and does not cease either the blowing or the rotating until the pear shaped glass has expanded into the rude semblance to a bottle with no neck and a very thick bottom. Now over he goes to one of the mouths of the side furnace, into which he thrusts the pipe to warm the mean looking bottle at the end. At his feet is the grave-like pit.

Now watch him. He takes the pipe from the furnace, blows in it, and lets it swing before in the pit. The glass begins to lengthen out, stove pipe fashion; into the furnace again; now out, and up over his head. Agitate the pipe. Blow. Now a big sweep from mid-air through the pit and up again. Blow. Now a pendulum-like movement—up—down—way cross—back! The glass is become a cylinder four feet long. Heat again and withdraw. Blow. Rotate. A little more jugglery —here—there—right side—left—a beautiful swing below! The cylinder is over five feet long now! The work is done!

These cylinders are placed still glowing on a stand. A tap with a piece of steel releases the blow pipe, the blower makes a measurement with a stick, wraps a string of hot glass about the cylinder, the superfluous part falls off as though cut with a diamond, and the completed cylinder—about five feet long and eighteen inches in diameter—is carried away to a place of safety. To-morrow a hot steel rod will cut each of the cylinders through one side, thus leaving it like a sheet of paper twisted until its upper and lower edges meet. This roll will be subjected to another gentle baking, when it will flatten out into a large sheet of glass. This will be cut into sheets of the proper size, and the work is done.—*M. Quad, in Detroit Free Press.*

The Medical Electric Lamp.

The electric lamp used for examining General Grant's throat is manufactured by agents of the Edison Light Company. It is mounted on a hard rubber holder, about seven inches long, having a reflector at the lamp end, by which the light can be thrown to any desired angle. The holder is connected by two silk-covered wires to a small storage battery carried in the pocket of the physician. The light is turned on by simply pressing a small button on the rubber holder, and the quantity is governed by another button convenient to the operator. The lamp is inserted in the mouth almost to the palate, with the reflector above the lamp, which throws the light down the throat. The lamp has no unpleasant heat, and gives a light equal to half a sperm candle. The extreme simplicity of the whole appliance makes it very valuable to the physician and dentist.

A New Japanese War Ship.

On the afternoon of March 17, a cruiser built by Sir William G. Armstong, Mitchell & Co., being one of two begun less than twelve months ago to the order of the Japanese Government, was successfully launched from the shipbuilding yard of the company at Walker, in the presence of a large concourse of spectators.

The Naniwa-Kan is the first of two powerfully protected cruisers which were begun at the Walker yard, about ten or eleven months ago. They were designed by Mr. W. H. White, intended for the swiftest and most heavily armed cruisers at present in existence. They are also the largest war vessels that have been hitherto built by the firm. During the last few years considerable activity has been displayed by the Japanese Government in connection with the development of their naval forces and the extension of their mercantile marine, a close connection existing between the two, and the merchantmen having been built so that some of the finest of them could be used as armed transports in case of war.

As regards the distribution of the armament and their external appearance, the two new cruisers will bear a considerable resemblance to the famous Esmeralda. In fact, they may be briefly described as enlarged Esmeraldas, with substantial improvements in defense, structural arrangements, protection armaments, and speed, these improvements having become possible in consequence of the increase in size. In dimensions the new cruisers are almost identical with the Iris and Mercury, dispatch vessels of the Royal Navy, and the Leander class of partially protected cruisers. They are 300 ft. in length, 46 ft. in breadth, draw 18½ ft. of water, and are of about 3,600 tons displacement. They have twin screw engines, which are to develop 7,500 H. P. at least, and their estimated speed is from 18 to 18½ knots. The armament includes two 28 ton 26 centimeter guns, mounted on center pivot automatic carriages as bow and stern chasers. These heavy guns are worked and loaded by means of hydraulic mechanism, which is an improvement on that fitted in the Esmeralda. On each broadside there are three 15 centimeter guns of five tons each, also on center pivot automatic carriages of Elswick design, and along the broadsides there are also placed no less than ten 1 in. machine guns and two rapid fire guns. There are two military masts, in the tops of which four of the improved Gatling guns made at Elswick will be mounted. All the guns, except those in the tops, are carried on the upper deck, and all of them have strong steel shields protecting the gun and crews from rifle and machine gun fire. Besides the gun armament, each vessel will have a complete armament of locomotive torpedoes, ejected from four stations, two on each broadside, situated at a small height above water.

Her powers of offense are further assisted by the presence of a most powerful ram bow, formed of an immensely strong steel casting, which projects forward under water, and would deliver a terrific blow upon the under water portion of any of the ships attacked. The powers of defense are also remarkably developed. Throughout the length, and covering the spaces occupied by machinery, boilers, magazines, and steering gear, there is a strong protective deck, the central portion of which rises a little above water, while the sides slope down to some depth under water. This deck is of steel, and has a thickness varying from two to three inches; the total weight of the material used in this protection amounting to something over 450 tons. The few openings in this deck are protected by strong armored covers, or armored gratings, and when the ship is ready for action, and these openings are closed, the chance of shell fire reaching the vitals of the ship is extremely small. In addition to the steel deck, the defense is assisted by means of minute cellular subdivisions of the space lying above the protective deck and below the main deck, which is about six feet above water. In these cellular subdivisions very large quantities of coal can be stowed, and when the coal is in the ship it will greatly add to the defense. Below the protective deck in the hold there are also very large coal bunkers, from which can be drawn the supply of coal necessary for working the ship for a considerable time when she is in action. Watertight subdivision is also carried out very minutely in the hold space proper below the protective deck. There are two separate engine rooms and two separate stokeholes. The magazines are all duplicated and formed into separate watertight compartments, and there is a cellular double bottom running through a very large part of the length of the ship.

This double bottom is fitted to be used for the stowage of water ballast, and in this manner the draught and trim of the ship can be controlled as she consumes her coals, or ammunition and stores, so that whenever she has to fight, her protective deck can be brought into proper relation to the water line. Moreover, the cellular bottom and the subdivision of the hold space will add greatly to the powers of the ship in resisting under water attacks by ram or torpedoes, or in preventing any serious consequences should the outer skin be damaged by grounding or other accidents. One very notable feature in the vessels is the extremely rapid rate at which they have been built and their advanced state of completion at the time of launching. The openings in the funnel, hatches, and engine hatches have been so arranged that the machinery and boilers can be passed on into the vessels without disturbing the decks in the least, and consequently it has been possible to push on with the internal fittings of cabins, mess rooms, store rooms, etc., previously to the launch. The magazines, shell rooms, gun supports, and armament fittings generally are also in an exceptionally forward state, and the interval between the launch and final completion of the ships will be proportionally shortened by the amount of work done while the vessel remains on the stocks. It may be questioned whether any war vessel of the size, and with the complicated fittings which are embodied in the design of the Naniwa-Kan, has been built in so short a time.

The accommodations and fittings of the interior of the vessel are of an exceptionally good and finished character, and, besides having four powerful electric search lights, carried in commanding positions at bow and stern, each of the cruisers will also have internal electric lighting of the more important hold spaces. In every particular these vessels will embody the latest improvements in armament and equipment, and although they have been so rapidly constructed, it is but right to state that, in quality of workmanship and material, they will bear comparison with any war ships built in the royal dockyards.

How to Make Cucumber Pickles.

In the SCIENTIFIC AMERICAN of March 28, 1885, Answers to Correspondents, No. 22, E. B. D. asks how cucumber pickles for the market are put up. Then follows a most extraordinary recipe, which, if followed would make each cucumber cost as much as Horace Greeley's turnips on his experimental farm—twenty-five cents apiece.

For those who care to know how to prepare pickles (cucumbers) for the market or for home use, I give a couple of as good recipes as ever were practiced, and better than most that have been published. I *know* about what I talk on this subject from eleven years of practice. No. 1. Cucumbers for immediate use may be pickled by making a brine—a saturated solution of salt, all the salt the water will take up; cover the cucumbers with it, adding water if necessary. The brine will act sufficiently in one night if poured on hot; if cold, give it twenty-four hours. Drain, and pack in a jar, and scald vinegar with cloves, cinnamon, and a lump of alum big as a marble for two gallons of cucumbers. Pour the spiced vinegar hot on the cucumbers and add a piece of horseradish root large as a human finger, and if desired two or three green peppers. These pickles are ready in three days, and with the horseradish will keep indefinitely. If the whole root of horse radish is not at hand, use some of the grated horseradish for the table.

No. 2. For family use or the market, as occasion requires; pack the cucumbers in salt, "the coarse fine salt," is best, covering them properly. When needed for pickling, freshen them in water three days, changing the water twice, or four days if they are desired fresh, and add cold vinegar, spice if wanted, and the piece of horseradish.

J. H. L.

The Cotton Industries.

The total number of spindles at the two different periods of 1870 and 1883 in operation in the great cotton manufacturing countries of the world is as follows:

	Great Britain. Spindles.	Continent. Spindles.	United States. Spindles.
1870	34,000.000	18,300,000	7,100,000
1883	42,000,000	21,215,000	12,660,000

The amount of cotton consumed by these countries from 1880 to 1883 is as follows:

	Great Britain Bales.	Continent Bales.	United States. Bales.
1880	3,018,000	2,618,000	1,774.000
1881	3,202,000	2,883,000	1,993,000
1882	3,439,000	2,910,000	1,989,000
1883	3,426,000	3,447,000	2,231,000
Total	13,085,000	11,858,000	7,987,000
Average per year	3,271,250	2,964,500	1,996,750

How Shall the Physician Cleanse His Hands?

Dr. Forster, of Amsterdam, contributes an article on this subject to the *Centralblatt fur Klinische Medicin.* He calls attention to the great importance of physicians thoroughly disinfecting their hands before leaving a case of infectious disease (especially any of the exanthemata), and at the same time he asserts that few of the disinfectants now in use really have the power of destroying those microspores which are recognized as so dangerous an element is modern medicine. After a series of careful experiments in the hygienic institute at Amsterdam, in which every precaution was taken to avoid error, the author decided that a solution of carbolic acid of the strength of two and a half per cent was not capable of "sterilizing" the finger, but that a solution of corrosive sublimate of the strength of one to two thousand formed a reliable antiseptic wash. He urges that the latter be adopted by all phvsicians as well as surgeons.—*N. Y. Med. Jour.*

ENGINEERING INVENTIONS.

A car axle has been patented by Mr. George W. Wilkinson, of West Rutland, Vt. The construction is such that the wheels are keyed upon the points of the axle and permitted to revolve independently of each other, the arrangement being calculated to avoid wear and tear upon the oilers and excessive friction in rounding curves.

A car coupling has been patented by Mr. George W. Hoover, of Keithsburg, Ill. Combined with a drawhead is a top plate having downwardly projecting bars, an angle piece with side lugs pivoted in the drawhead, and other novel features, the whole being an improvement on a car coupler formerly patented by the same inventor.

A switch stand has been patented by Mr. Charles W. Widney, of Wymore, Neb. There are vertical notches in the top of the head plate to receive a throw lever pivoted to the shaft which connects to the switch rails, with special details of locking mechanism for the throw lever tending to promote safety and security in the adjustment of railway switches.

An oscillating engine has been patented by Mr. Douia C. Putnam, of Wayne Center, N. Y. This invention consists in certain special features of construction of the valve motion, and in its connections to the valves and the starting, stopping, and reversing lever, providing for running the engine crank shaft in opposite directions, and for reversing the motion at will without the use of eccentrics.

A speed governor for steam engines has been patented by Mr. Ebenezer Hill, of South Norwalk, Conn. With the cylinder and its piston connected with the stem of a throttle valve is connected a second piston and a safety valve connected with the compression chamber of an air compressor, whereby an excess of pressure in said compression chamber will raise the pistons and close the throttle valve to check the speed of the engine.

A system of ventilating, cooling, heating, and lighting railway cars, and cooling their axle boxes, has been patented by Mr. George Van Duzer, of New York city. A separate car with independent boiler and motor operates an air purifying and cooling apparatus, from which flexible pipes carry the air to the cars of the train, and from which pipes also lead to the axle boxes for cooling hot journals; this independent car also provides steam for heating the train, and space for storage of illuminant, either gas or electricity, to be distributed by suitable arrangement of pipes or wires.

MECHANICAL INVENTIONS.

A method of making twisted boring tools has been patented by Mr. Charles Robin, of Chester, Conn. It consists in swaging a blank with a plane and a concave side and then twisting the same to form a bit, with a deep spiral groove on one side and a shallow spiral groove on the opposite side, making a bit which requires but little grinding.

AGRICULTURAL INVENTIONS.

A cutting apparatus for harvesters has been patented by Mr. Charles Galle, of Columbia, Mo. The sickle bar is made rectangular in cross section, the sickles sliding thereon, and consisting of blades with box ends adapted to fit the bar, and being held upon it by a nut screwed upon the end of the bar, thus making a durable and economical device.

A combined hay rake and loader has been patented by Messrs. Thomas Kirby and Robert Shea, of Emmetsburg, Iowa. This invention covers a specially devised mechanism, which may be connected with the rear axle of a wagon upon which the hay is to be loaded, or it may be drawn by a team at the side of the wagon, to facilitate the gathering and loading of hay.

A grain sacking and weighing attachment for thrashing machines has been patented by Mr. William H. Barber, of Ward, Ohio. With an elevator scale is a suspending crane, branched bag, filling spout, and automatic valve shifter and registering counter, to spout grain directly into bags, from the machine, and weigh and register the number of bags, simply and economically.

A corn harvesting machine has been patented by Mr. Elias M. Aikin, of Dawson, Dakota Ter. It is for harvesting the ears of corn from the stalks standing in the field, and is intended to be drawn along the rows, at the side of the wagon, so the stalks will be gathered by arms into a V-shaped guide, whence plates nip the ears off, and they are so delivered as to fall into a wagon box or other receptacle.

A harrow has been patented by Mr. William F. M. Ricketts, of Colton, Washington Ter. This invention covers novel features for giving increased flexibility to the harrow and varying the angular position of its teeth, with facility for removing and replacing the teeth as required, and for supporting the harrow frame in front, with or without sulky attachment in its rear.

MISCELLANEOUS INVENTIONS.

A truss has been patented by Mr. Pha Tefft, of Oriental, Col. Combined with a slotted belt and leg strap pivoted to it is a lever with buttons and carrying a pad, all contrived to furnish an easy wearing, self-adjusting, and reversible truss.

An earth scraper has been patented by Mr. William H. C. Goode, of Sidney, Ohio. This invention relates to a class known as wheel scrapers, and covers improvements to facilitate the scraping up of the desired amount of earth, transporting the same, and dumping the load, with the least expenditure of work.

A window screen has been patented by Mr. James W. Bachus, of New Windsor, Ill. This invention is more particularly for guiding and holding the window screen at any desired elevation, for which U-shaped strips are used with inwardly projecting tongues integral with the body of the guides.

A friction roller for wire cables has been patented by Mr. Thomas W. Flynn, of Pottsville, Pa. It is formed with a plain cylindrical surface to allow lateral play to the cable, with spring boxes for supporting the ends of the rollers, all so devised as to prevent rapid wear on either the cable or roller.

A sifter for flour, etc., has been patented by Mr. Abraham Wolf, of New York city. It is made with a scoop provided with a sieve, and has a stirrer which can be readily attached and detached, the whole constituting a sifter which is simple in construction, easy to be used, and effective in operation.

An apparatus for gathering cranberries has been patented by Mr. William C. Trahern, of Elm Lake, Wis. Combined with a float especially constructed to strip and gather the berries is an endless cable operated by power from a boat, so as to draw the picker back and forth over the marsh.

A pole and shaft coupling has been patented by Mr. George E. Thomas, of Abingdon, Va. This invention provides means for attaching a pole or thills of given width to a carriage having any length of axle, or for attaching the same to a sleigh, either to draw centrally or to one side of the center.

An umbrella has been patented by Mr. Giovanni Gilardini, of Turin, Italy. Combined with the stick and ribs is a sliding tube or rod, connected with the handle, or a ring near it, by a lever, in such way that an umbrella or parasol may be automatically opened or closed thereby as desired.

A churn has been patented by Mr. Finis M. Barney, of Kearney, Neb. It is made in the form of a cross, boxes diagonally joined being made to revolve with a crank, and when opened the two boxes in each half are fully exposed, so they may be readily washed after the contents have been poured out.

A sash holder has been patented by Mr. Cris Lee, of Paducah, Ky. Combined with the casing is a bolt and spindle in the same, and an eccentric plug on the spindle for operating the bolt, making an improved device for holding the sash at any desired elevation, or locking it to prevent its being raised.

A driving rein spur has been patented by Mr. Fielding B. Bever, of Ottawa, Kan. It is attached to the rein line, and so made that on slapping the horse with the rein the attached spur is projected into or against the flank or rear portion of the animal, obviating the necessity of using whip or other spur.

A fireplace heater has been patented by Mr. Thomas J. Bartlett, of Colorado, Texas. It is made with apertures in its back and side walls, with various special features, to adapt it to heating two or more rooms on the same floor of a building with a single fire, so as to economize fuel and labor of attendance.

An eye glass holder has been patented by Mr. Samuel F. Merritt, of Springfield, Mass. It is made from a single piece of wire, flattened and bent at one end to form a hook, and at the other end a pin, and so made as to prevent the holder from swinging against the garment and resting on its side as hooks usually do.

A kitchen cabinet has been patented by Mr. Thomas Nicholas, of Calumet, Mich. This invention covers a special construction and arrangement of such cabinets, especially adapting it for holding the implements and materials required for making bread, pie, cake, etc., one which is simple and compact, and will protect its contents from dust.

A cuff has been patented by Mr. William Frank, of New York city. The side edges are overlapped and sewed together, and a tab is attached to the underlapped end, thus making cuffs which can be readily put on and secured in place, are easily taken off, and require less labor and material to manufacture than the ordinary styles.

A street car heater has been patented by Mr. Freeman S. Hunter, of Fort Ritner, Ind. It is made with heating drums in a case held to the car floor below an opening, with a guard and grating, with draught openings at one end, and connections at the other end, with smoke flues passing through the floor and roof of the car.

A window frame and sash has been patented by Mr. John E. Jones, of New York city. The sashes are provided with packing strips at their vertical surfaces, combined with parting strips having ribs against which the packing presses, so the upper and lower sashes are packed at all sides, and the window made tight and prevented from rattling.

An apparatus for bleaching liquids has been patented by Messrs. Melancthon and Clarence C. Hanford, of Boston, Mass. By this invention the liquid to be bleached is forced through an atomizing nozzle, where it meets the acid bleaching fumes in the form of fine spray, so that each portion of the liquid is subjected to the action of the gas.

A curtain cord holder has been patented by Mr. Melville M. Moore, of Oxford, Miss. A rack with a pulley in its upper hooked end has also a lower hooked end, in combination with a plate having a pocket with a spring tongue and a clamping or wedging device, making a device especially adapted for drawing and holding taut curtain cords.

A machine for cross grooving axle trees has been patented by Mr. George Watson, of St. Charles, Minn. This invention covers a machine for simultaneously cutting the three cross grooves or gains in the axle trees and bolsters of wagons, giving to the side grooves either a straight transverse cut or an oblique cut, according to the lay of the hounds.

A foot boat has been patented by Mr. Sivert Hagen, of New Brighton, N. Y. Each foot boat consists of a water tight long box, which can be strapped on the foot in the same manner as a shoe, and can be used to travel on the water, while two of them can be united and provided with a paddle wheel to form a catamaran velocipede.

An artist's panel or plaque has been patented by Mr. Edward de Planque, of Hoboken, N. J. It is made of pasteboard covered on both sides with shellac, on which a layer of whiting is applied and then a layer of japan, the whiting preventing the japan from passing into the pores of the pasteboard, and the shellac preventing the peeling off of the whiting and japan.

A saw tooth swage has been patented by Mr. John M. Ryan, of Vicksburg, Miss. With a saw swage and set is combined a grooved bed plate, a swiveled base piece, so the latter can be turned axially and moved lengthwise of the slot, a die stock and saw arbor, with other novel features, for easily and efficiently swaging and setting saw teeth.

A gate has been patented by Mr. John W. Sims, of Jamestown, Ark. This invention covers a special construction of gate having for its object to stop the passage of hogs or other animals going one one way while permitting them to go the other way through, and may also be so arranged as to be operated by a cord by a person from a distance.

A machine for shaping chain hooks has been patented by Mr. Benjamin McKillen, of Verona, Mich. This invention consists in the combination, with a forked stock, of a lever pivoted in the same, and a die held on the forked end of the lever, constituting an improved device for making and shaping chain hooks of all sizes.

A lantern has been patented by Mr. Forrest Reichard, of Easton, Pa. It consists of a base with a candle holding device and flange to hold a lamp chimney, in which also are secured the ends of the bent wire handle, which extends up through the chimney, the device being very cheap and not liable to get out of order.

A gate has been patented by Pollie C. Cesna, of Macon City, Mo. The device consists in a combination of levers with a rock shaft provided with a slotted arm, to which the levers are connected by a slide piece, the levers extending from opposite sides of the gate so they may either be grasped from a carriage or have ropes suspended from their outer ends.

An evaporator for cane juices has been patented by Mr. William E. Butler, of Newbern, Tenn. The pan has grooves between its partitions below their bottom edges, with pipes in the grooves, skimming chains and water tank, to accomplish the whole work of reduction in one evaporating pan, so the juice can be run from the mill, passed through the evaporator, and then discharged direct to the striking pans.

A wick adjuster has been patented by Messrs. Charles A. Fletcher and William H. Wilder, of Gardner, Mass. Longitudinally grooved spindles operate in unison, so each rib on either spindle registers in the groove on the other spindle, instead of having opposite teeth which bite or hold on the wick, the new device giving a positive motion without obstructing the flow of oil through the wick.

A process of making cut nails has been patented by Mr. John Young, of Wheeling, W. Va. After the blanks are cut, the sides are clamped with dies short of the place where the head is to be formed, then swaging the end into a flat head, and swelling the neck by crowding a portion of the surplus metal longitudinally down toward the body of the nail.

An album has been patented by Mr. Lester Goodwin, of Newton, Mass. Combined with a cover having corrugated front and back edges, and a piece of sheet material secured thereto with slits to hold cards, a part of each of the slits is adapted to cross a portion of the card to be held, and another part to lie parallel to one edge, with other novel features, so that few or many cards can be held closely.

An earth auger has been patented by Mr. Thomas A. Porter, of Cameron, Tex. It is made funnel-shaped, with side cutting edges, and adapted to be inverted for emptying the auger, the arrangement of the cutting edges being such that the head of the auger fills as rapidly at the top as at the bottom, so that the cutting is not against a pressure of the dirt within the head.

A consecutive numbering machine has been patented by Messrs. James H. Reinhardt and Charles S. Ellis, of Memphis, Tenn. This invention covers improvements on the mechanism of numbering devices adapted to be set up in a printer's type form, where the action of the platen causes the numbers to change at each consecutive impression, and so number tickets, checks, etc., in serial order.

A syringe has been patented by Mr. William Molesworth, of Brooklyn, N. Y. Combined with a tube which has prongs at one end and a head at the other is a tapered tube adapted to be screwed into the pronged end, provided at one end with a head and a neck projecting therefrom, making a dilater which can be used as a drainer for washing wounds and as a syringe tube.

A top roller for drawing frames has been patented by Mr. John Brierley, of East Hampton, Mass. Combined with two or more series of bottom rollers are clothed top rollers coupled together in each series at their ends, and geared with the bottom rollers, over which they are arranged to operate in unison therewith, whereby the coupled rollers are positively driven by the bottom rollers.

A piano sounding board has been patented by Mr. John Brinsmead, of London, Eng. The sound board is fixed to the bracings or frame by a fulcrum between the sound board and bracings and distant from the edge of the former, and by screws bearing against the overhanging edge of the sound board, producing a leverage action intended to give increased purity of tone.

A harness has been patented by Mr. Charles F. Shedd, of Fairfield, Neb. The harness has side pieces or plates for conveniently attaching the horse, and the construction is such that the harness will keep its place, whether the horse kicks or plunges, being specially adapted for breaking vicious horses, and the invention being an improvement on a former patented invention of the same inventor.

A show case for cooling oysters, etc., has been patented by Mr. Alexius T. Lundqvist, of New York city. Within a wire case is a wire cage or basket, and within the inner apartment is a removable ice basket, making an improved case or box for showing oysters or other shell fish upon the counters of eating houses, etc., and at the same time keeping them fresh and cool.

A device for picking up and affixing stamps has been patented by Mr. Gerard W. Schimmel, of Amsterdam, Holland. It is a hand device with elastic rubber face, penetrated by sharp pins, for picking up and placing stamps, labels, etc., having adhesive backs, the pins holding the stamps sufficiently to enable them to be first dampened on a pad and then fixed where desired.

A loading winch has been patented by Mr. Favour Locke, of Bristol, N. H. The invention consists in a frame, with hooks for attaching it to a sleigh or wagon, a drum mounted on the frame, with a rope, ratchet lever and pawls for winding the rope around the drum, and a device for fastening a skid to the sleigh or wagon, to facilitate the loading of logs, stones, etc.

A lamp burner has been patented by Mr. Edwin Lawrence, of Brooklyn, N. Y. This invention provides an annular burner which will admit air to its interior from below without a tube through the lamp, or to adapt an annular burner to be screwed into the body of a lamp like a flat wick burner, and to control the size of the blaze without raising or lowering any part of the wick.

A device for lifting kettles has been patented by Mr. Lucius H. Goff, of Richford, Vt. A lever is provided with an elongated handle loop at one end, while the opposite end is bent at right angles and terminates in a head, another lever being pivoted to the first near the head in such way that the jaws or prongs may be pressed against the sides of the kettle to facilitate lifting, carrying, etc.

A fat cutter has been patented by Mr. Theodore Raeke, of Baltimore, Md. Combined with a slotted trough and a head carrying blades is a carriage fitted to slide in the trough, a shaft carrying a series of radial arms, and other special features of construction, making a machine particularly adapted for cutting up fat into pieces small enough to be easily reduced by heating.

A saw tooth swaging machine has been patented by Mr. Alexander Jacobs, of Cheboygan, Mich. The dies are contrived to shift forward on to the point of a saw tooth, pinch and swage it as required, then shift back for the saw to be moved along, while there are contrivances for gauging and holding the teeth sidewise as they are required to be presented to the swaging dies, the whole making a simple and cheap machine.

A tobacco drier has been patented by Messrs. James K. Hardwicke and Edward B. Welles, of Marshall, N. C. This invention provides for such arrangement of a structure that perforated cold air pipes will be made to pass in close proximity to the hot air heating pipes, thus securing such ventilation as will facilitate the quick curing of tobacco, while contributing to its uniform color, the prevention of sweating and spotting, etc.

Stringing pianos forms the subject of a patent issued to Mr. Thomas J. Brinsmead, of 18 Wigmore Street, Middlesex County, Eng. Combined with each string is a screw threaded wrest pin in line with the string, a nut on said pin and bearing against the frame, means for preventing the pin from turning, means for carrying the string through or by the side of the pin and readily attaching it, with other novel features.

The manufacture of starch, glucose, etc., forms the subject of a patent issued to Mr. Paul Radenhausen, of Altona, Schleswig-Holstein, Germany. The starch milk is precipitated after it comes from the separators with sulphuric acid, so ammoniacal putrefaction is immediately stopped, and the separation of solid matter rapidly accomplished, the residue being treated with dilute sulphuric acid and the liquor passed over the starch depositors.

A sash balance has been patented by Mr. George W. Arnold, of Knoxville, Ill. Cord spools or rollers and coiled springs are arranged in boxes preparatory to applying them to the window frame, and then applied by sliding the boxes into openings in the window frames, so the fitting and fastening of the spools and springs can be done more conveniently than they can be fitted directly to the frames, and they can be readily taken down.

An implement for moulding and packing bullets has been patented by Mr. Thomas Oldham, of Leipsic, Ind. The bullet mould is made of two levers, to one of which a jaw is pivoted, which, with the lever, forms the mould proper, a plate being secured to the top of one of the levers, and having an opening through which the lead is poured to form the bullet, the necks being cut off as the moulds are opened to eject the bullets.

A lantern has been patented by Mr. Charles W. Goodwin, of New York city. It is square sided, with a hinged or removable top or cover adapted to be locked, and with a flange to fit over the side frames, so that when the cover is locked it locks the door of the lantern, and the glass plates or panels in their frames, so that no person without a key can reach the light, making a lantern especially adapted for storage warehouses, etc.

NEW BOOKS AND PUBLICATIONS.

THE MODERN HOUSE CARPENTER'S COMPANION AND BUILDER'S GUIDE. By W. A. Sylvester. Boston: Cupples, Upham & Co., 1884.

This little manual on house carpentry is intended to supply in a convenient form the principal rules and information needed in everyday workmanship. It contains the simpler problems in constructive geometry, with such applications to building as will cover the ordinary methods of construction. Some details are given concerning Mansard roofs and the primary forms of truss. It also contains considerable information in regard to estimates, strength of materials, and the use of instruments of measurement. Expanded from the notes of a practical workman, the book is very good so far as it goes, but it is decidedly elementary, and will prove satisfying only to an artisan of rather limited experience. It is well illustrated with forty-five full page plates.

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

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Minerals sent for examination should be distinctly marked or labeled.

(1) G. E. S. asks (1) for information about hay caps. What size ought they to be, and what is the waterproof composition that they are covered with? A. Hay caps are from 4½ to 6 feet square. They are made of good muslin, and should be hemmed on the two torr. edges. It is best to have a cord hemmed in all around the cap provided with a loop at each corner, through which a wooden pin is stuck into the hay, thereby holding the cap on. It is not considered necessary to have them made waterproof, as they will sufficiently shed water if properly put on. The following preparation, however, will render them thoroughly mildew proof, and will enable the caps to shed water like a goose's back: Make a solution by soaking a bushel of wheat bran in 10 gallons of water for 48 hours; then boil for one hour, and strain. To this liquor add 2 pounds of alum. When completely dissolved, put in the caps, boil for 15 minutes, then wring out and dry. 2. I am thinking of putting in a hydraulic ram to force water up into my house and stock barns. The distance from brook to house and barns is about 350 yards, and the height from water to second story in house is between 50 and 60 feet. Can this be done, and with what fall? A. This you can readily accomplish. In order to elevate water to a height of 60 feet, we know theoretically that the quantity raised should be to the water supply as the fall in feet is to the height in feet, but practically we are compelled to allow for friction, etc., which varies widely. In actual practice only one half of one-sixth, or one-twelfth, could be delivered. Douglass makes an excellent ram, but many think that A. Gawthrop's Son, of Wilmington, Del., furnishes something better. It should be placed in a frost proof building, and the pipes must be laid in a trench below the reach of frost.

(2) J. R. asks: 1. Can mustard be easily raised on common soil? A. Yes. 2. Is rich or poor soil the best? A. Rich soil. 3. Can it be thrashed with the common thrashing machine? A. Yes. 4. How much does it produce per acre? A. From twenty to forty bushels. 5. How many acres will a bushel sow? A. Six. 6. How much is it worth per bushel? A. From 3½ to 4 cents per pound. 7. Where can I procure the seed? A. Any seedsman. 8. What is the proper season to sow it? A. As early in spring as it is possible to work the ground well. 9. Can it be harvested with the self-binder? A. Yes, if done as soon as ripe, and when damp with dew. 10. Can it be cleaned out of the ground by fall plowing, or what is the best way to prevent it from growing the next year? A. Thorough cultivation will clear it out. 11. Which is the most profitable millet to sow for seed? A. Genuine millet for feeding purposes. 12 What variety and what kind of land is the best adapted to its culture? A. Any good, rich land; a clay loam is excellent. 13. The proper season to sow it? A. Not till the weather is settled and warm. Say June 15, in central Illinois. 14. Can it be harvested with the self-binder? A. Yes. 15. How much is sown per acre? A. According to the richness of the land, from ½ to 1 bushel. 16. How much does it produce per acre? A. From 15 to 40 bushels. 17. Is there any machine that will thrash beans without splitting or damaging them? A. There is. 18. If you know of any, please give me the firm's address? A. A. J. Edicks, Wright's Corners, N. Y. 19. Also if you know of any way to plant beans so they will all ripen together? A. Plant clean seed that is all of one variety. 20. What is the best way to clean the grease off of gummed axles and old machinery? A. Caustic soda or potash will remove all grease from axles and machinery.

(3) A. S. writes: Can you tell me the secret of plastering a house so that the walls will not show cracks? I am just about to plaster my new residence, and upon inquiry I find some houses have been allowed to stand for months, and yet the cracks occur after plastering. Timbers guaranteed seasoned and no perceptible settling in walls, and the same thing occurs. So that I am inclined to believe that it is perhaps in the mixture and application of the mortar or plastering. A. Cracks sometimes occur in walls that have had the best of care. Apart from allowing time for the wood work to season, the best advice that we can give is to finish with 3 coats, as in our best work. First a scratch coat. When this is well dried, put on the brown coat. When this is well dried, finish with a white coat which has plaster of Paris in it. This is sometimes called a stucco coat. Sometimes a little hydraulic cement is mixed with the first coats to harden them. It makes them less liable to shrinkage.

(4) E. M. S. asks: 1. Give composition of a good cheap varnish to be rubbed on furniture with a rag, which will restore the original appearance where varnish has been scratched, etc.? A. See "Furniture Polish," in SCIENTIFIC AMERICAN for March 28, 1885. 2. A man is selling a liquid solder to the people about here to mend tinware, etc. Please tell what liquid solder is made of, and how? A. Dissolve as much zinc sulphate as possible in one pint of alcohol, and then add one ounce glycerine. 3. Please explain to us the astronomical terms, right ascension and declination. A. See Webster's dictionary under term of ascension. 4. What is the composition of window and tinware polish which looks like balls of chalk? A. It is difficult to say just what the article is unless we have a sample. A great many polishing powders are white. See the article on "Polishing Materials," in SCIENTIFIC AMERICAN of January 17, 1885.

(5) C. E. F. asks (1) the proper instrument to test lye to its degree of strength, and how much it costs. Do you refer to common caustic soda in your answer (17), March 28, 1885, or double refined greenbank 98 per cent? A. The instrument used is Baum's hydrometer for liquids heavier than water. Price is 75 cents. It will be best to use the greenbank alkali although any good caustic lye will answer. 2. Receipt for making compressed yeast? A. There is a "patent yeast" made as follows: Simmer 6 ounces hops in 3 gallons water for 3 hours; strain it, and in 10 minutes stir in ½ peck ground malt. Next reboil the hops in water, and add the liquor to the mash already made, which must be well stirred, covered up, and left for 4 hours; then drain off the wort, and when cooled down to 90° Fah., set it to work with one pint yeast (patent is best); after standing for 20 to 24 hours, take off the scum, strain it through a coarse hair sieve, and it is ready for use. One pint is said to be enough for 1 bushel of bread.

(6) T. D. B. asks: 1. How are the carbon filaments fastened to the platinum wires in the miniature electric lights? A. By electro soldering. 2. How are these very small lamps made? A. You will find information on this subject in the back numbers of the SCIENTIFIC AMERICAN and SUPPLEMENT. This subject is too extensive for treatment in these columns. 3. Would an exhausted incandescent electric light globe answer for a Geissler tube by using an induction current? A. No. 4. I have broken the platinum wires off short to the glass globe of a miniature incandescent globe; can you tell me how to repair it so it can be used for a stationary lamp? A. Fasten a wire to the glass with cement so that its ends will touch the platinum wire if possible. then complete the connection with a little amalgam scraped from a back of a mirror, and softened with a very small quantity of mercury.

(7) C. C. B. asks: 1. Is the process of burnishing electro silver plated goods a difficult one to learn? Does it require any particular knack or skill to accomplish? A. Burnishing silver plated ware is not difficult, provided the silver is deposited in a soft state and the burnishers are in good condition. Burnishers may be of hard steel or of bloodstone. They should be highly finished, and should be polished from time to time by rubbing them on a strip of sole leather charged with fine rouge. The burnishers should be wet while in use with a solution of white Castile soap with a little alkali added. 2. How is double or triple plating put on? A. By simply leaving the work in the battery for a longer time. 3. Is gilding burnished the same as silver plating? A. Yes. 4. How is the resistance coil or switch attached to or used with batteries? A. The resistance coil is connected with the battery, so that more or less of the length of wire of which it is composed may be introduced to the battery circuit at will.

(8) A. H. B. writes: Having constructed a Carre dielectric machine capable of a spark about an inch long, I am desirous of some experiments to perform with it, especially those which illustrate luminous effects. Would a glass tube with wires sealed in each end, and exhausted by boiling water in it and then sealing, transmit the electricity with that glow peculiar to the Geissler tube, or would the moisture in the tube carry away the charge invisibly? A. We do not think you could produce any visible effects in the vacuum tube prepared in this way. 2. Would boiling mercury in a tube produce the desired effect? A. You might, with sufficient care, be able to produce a vacuum that would answer the purpose. You should not inhale the vapors of the boiling mercury. 3. Are there any fluids or solids which become luminous when the current is passed through them? I don't mean the galvanic current, but the current produced by an electrical machine? A. The current from your machine would render fowls' eggs luminous. 4. I have one Geissler tube with vase of uranium glass, and want to know if there is any way I can produce the necessary vacuum without an expensive air pump? A. No. 5. I have heard that sulphate of quinine fluoresces on the passage of the current. Is this true, and on what conditions must the quinine be in? A. The solution of sulphate of quinine must surround the vacuum tube.

(9) E. N. L. asks: Has there ever been a telephone yet made, or device by which the voice of one talking in the transmitter at one end of a given line is reproduced or heard at the other end of the line, speaking the words out loud, so that it can be heard two or three feet from the receiver, and on how long lines? A. Edison loud speaking telephone does this. It works on lines of the usual length.

(10) P. P. B. writes: I have built a dynamo machine similar to that described in SUPPLEMENT, No. 161, only twice the size of one described. I wound the armature with 5 layers of No. 14 wire, the field magnets with 7 layers No. 12 wire. The machine weighs about 160 pounds. It will heat a 16 candle power incandescent lamp white hot, but will not heat it sufficient to make scarcely any light. Can I do anything to improve my machine? If so, what? Communicator springs are 2 inches wide; is that sufficient? How fast should it run to get best results? A. Try placing two lamps in multiple arc. We think you would succeed better by using more lamps of smaller candle power; say 8 candle power each. The speed of the armature should be from 1,500 to 2,000 revolutions per minute.

(11) M. V. C.—There is no danger attending the washing of the bedsteads with hot soap suds, provided, of course, that the mercury or quicksilver compound does not penetrate into the flesh through open cuts, etc., or in other words, it cannot be considered more dangerous than if cold water was used.

(12) J. G. D. asks: What will cement celluloid letters to the outside of show window? A. Try a thick solution of marine glue in wood naphtha, or else melt resin and stir in calcined plaster until reduced to a paste, to which add boiled oil, a sufficient quantity to bring it to the consistence of honey; apply warm.

(13) H. F. asks how to find the horse power of boilers. A. Divide all the surface that is exposed to the fire and heat, in square feet, by 14, which is the nominal horse power.

(14) W. R. J. asks the cause or causes of sound from stretched telegraph wires. A. The sounds are produced on the principle of the Æolian harp, the wires being set in vibration by the motion of the air.

(15) G. W. H. asks: What danger is to be apprehended from running electric wires underground, several united and insulated, in a cable, or in near proximity, as in usual street construction? This applies to electric light wires as well. A. No danger if the wires are properly laid and protected.

(16) C. J. G. asks how to soften a leather carriage top which has been varnished. A. You will find the removal of the varnish a somewhat difficult task. Benzine or turpentine will probably help some. Caustic soda will cut the varnish, but it will also ruin the cloth unless great care is taken. Turpentine and soap is used to remove varnish.

(17) R. L. H. writes: I make ink under a recipe taken from your SUPPLEMENT. The proportions and ingredients are: 168 grains extract of logwood, dissolved in one pint of either hot or cold water, and add 14 grains yellow chromate of potash. Sometimes add 20 grains common washing soda to prevent decomposition on exposure. This ink is somewhat objectionable because it is too pale, and eventually loses all its color. It however flows readily, and is the best noncorrosive ink I ever used. I can find nothing which will improve its quality; in fact, nearly all chemicals will destroy it. Can you suggest any additional chemical which will make it a good permanent black ink? A. It is very doubtful if the ink you describe can be improved. It is generally known as Runge's ink, and a great number of formulas exist, slightly differing from each other. The following is one of the many modifications:

Sodium carbonate	30 parts.
Warm water	1300 "
Extract of logwood	30 "

Dissolve, and add then a solution of 5 parts potassium bichromate in 100 parts of water. The addition of sulphate of indigo or of a small quantity of soluble aniline blue to the ordinary gall inks is recommended for the purpose of increasing their blackness. A superior quality of gall ink is composed of:

Galls	45 parts.
Ferrous sulphate	15 "
Gum	5 "
Water	200 "

(18) L. D. B.—There is considerable flax raised in this country. Its principal use until recently was for the production of the seed, but latterly it has been used for coarse carpet warp. The imported flax is of finer quality, and is used for the manufacture of thread.

(19) C. L. N. asks: 1. How is water power best used to compress air? A. By a water wheel working a pump. By a direct acting water and air pump. By an injector. By the falling of water down a long pipe. 2. How many pounds of dead weight will be lifted clear of the ground by 1,000 cubic feet of nominally pure hydrogen gas? A. 1,000 cubic feet hydrogen gas will lift 70 pounds. 3. Is there any process by which silk or other woven fabric can be made impervious to hydrogen gas? A. Varnish the silk with India rubber cement thinned with naphtha. Can be obtained at any rubber factory.

(20) F. H. B.—You cannot kill the life of steam until it is entirely condensed, and it might pass a thousand elbows, if they were near together, with a loss on a hundred pounds pressure of 25 per cent. The fact that the crosshead has an upward bearing while a locomotive is running forward should be apparent to any one. If the cylinders were placed behind the drivers, then the action would be the same as in the stationary engine. By studying the push and pull of the piston with the upper and lower position of the connecting rod, the philosophy becomes very plain to the most casual observer.

(21) W. B. B.—The best forms of wind mills develop from ¼ to ¾ horse power for a 12 foot mill. The tensile strength of Bessemer steel varies from 72,000 to 76,000 pounds per square inch, and occasionally will run up to 100,000. Hammered bar Bessemer has been tested to 150,000. The Siemens-Martin costs about 10 per cent less than for Bessemer. Bessemer for merchant bar, about $50 per net ton. Siemens-Martin, about $45. The prices vary very much according to sizes and shapes.

(22) W. K.—The only peculiarity in hardening mill picks is, to leave the edge thick, say one-sixteenth inch. Harden at the lowest heat that the particular kind of steel will take, in clean water at about 60°. Draw temper as little as possible, which may be ascertained by trial at a straw color to begin with. Do not draw temper with the same heat used for hardening. The pick after hardening should be tried with an old fine file, which by a little experience will tell you if the hardening is even. Then grind, and heat from the center for color drawing. If you use low grade steel of first rate quality, the color temper may be dispensed with. The greatest difficulty is caused by burning the corners in forging or in heating to harden. Therefore use a dull charcoal fire if possible with light blast. Blast often ruins the finest steel.

(23) G. C. K. writes: 1. A tank filled with water, 50 feet high and 10 feet in diameter, with a spigot at the bottom, 1 inch flow, what rate per cent will the first 25 feet of water run out faster, if any, than the last 25 feet? A. The average flow of the upper half of the tank will be equal to a pressure of 37½ feet, while the average flow of the lower half will be equal to 12½ feet pressure. The upper half will flow three times as fast as the lower half. 2. It is claimed that the standard of gas burning is a fifteen hole Argand lamp, interior diameter 0·44 inch, consuming 5 cubic feet per hour, evolving a light from common coal gas of from 10 to 12 sperm candles, 6 to the pound. How is this number of candle light power ascertained, when making a comparison with gas light to candle light? A. There

are many ways of making the photometric comparison between a standard candle and the standard Argand burner, but mostly by the unequal distance of the two lights when their shadow images are alike. For interesting illustrated descriptions of photometers and their use, see SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 283, 379, 284, and many others in our classified catalogue.

(24) J. M. W. writes: A says that a No. 10 shot gun, 32 inch barrel, will burn only 4½ drachms first quality powder when loaded in the ordinary way, 1¼ ounce shot. B says that same gun will burn any reasonable amount up to 8 drachms or more. Which is correct, if either? A. A is right. The larger amount is not all burned, but thrown out, as may be proved by firing through waxed paper at a few feet distance, when the unburned grains will be found sticking to the wax. You can find the exact amount that is effective by the penetration of the shot in a soft pine board or a ream of paper.

(25) C. W. H. asks: 1. Can you mention any compound or article that could be mixed with charcoal and niter that will on burning (smouldering) emit chlorine for disinfecting? A. Chloride of lime may be sprinkled on wet paper, which when dried may be burned. Carbolic acid may be used in the same way. These are both also volatile without heat. 2. Also, what is a good disinfectant for any room, that can be burned (smouldered)? A. Chromic acid and sulphur mixed in small quantities with sawdust or paper, and left just moist enough to smoulder, make most effective disinfectants. In disinfecting by burning, caution should be used regarding quantity used where persons are present. The vapor of the tincture of iodine is also a disinfectant: this has only to be evaporated from cloth or paper, and the cloth or paper burned after drying.

(26) G. E. K. asks (1) if there is any danger in drinking water filtered through common coke. A. No, provided the charcoal is renewed from time to time. 2. Do you know of any other substance better than charcoal, coke, or pumice stone for filtering water? A. We do not; metallic iron is sometimes used. 3. How can pumice stone be made into any desired shape? A. Pumice stone can be ground into powder or it can be cut into shape, but it is not moulded, as far as we know.

(27) H. F. R. writes: I made an electric machine as described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 161, and used 2 pounds of No. 18 cotton covered copper wire on magnets, and about 40 feet No. 16 on armature. I did not insulate the wire from the core on the armature; will it make any difference? Would like to make a motor out of it, but do not know how to proceed to do it. A. You should have used the No. 16 on your magnet and the No. 18 on your armature. It would have been safer if you had covered the armature with insulating material, but if you have no leakage from the wire to the iron, it will of course make no difference. The dynamo answers very well as a motor without any additions or alterations. You will not need a fly wheel.

(28) McN. desires a recipe for making a good tooth wash, to be made into cakes soft enough for the brush to take it and strong enough to clean on one application, and like it to be pink in color. A. Take 1 pound Paris white, ½ pound rose pink, 3 ounces orris root, alum ½ ounce, oil of cloves and nutmegs each 1 drachm. Use honey enough to form a paste. A finer article is made as follows: Take of prepared chalk 3 ounces, cuttle fish bone and white sugar (powdered) of each 2 ounces, orris root (powdered) 1 ounce, smalts 2 to 3 drachms. Mix with sufficient sirup of violets to make a paste. Use carmine for coloring.

(29) J. G. asks: 1. In constructing a wooden trough battery to be powerful enough to strongly magnetize steel bars of ½ pound weight, what number and size of cells will be necessary for using zinc and carbon plates 5x6 square? A. Six cells. They should be large enough to permit of readily plunging the elements, and should contain enough solution to enable the battery to run for two or three hours. Probably ¾ inch larger than the electrodes all around would answer. 2. If zinc and copper plates are used instead (5x6), what should be the number of cells? A. Same size and number. 3. If a different form and size of plates would answer better, please name them? A. If you use a bichromate solution, plate 3x6 inches would answer. 4. How thick should the carbon plates be to answer for a short time? A. ¼ inch. 5. Would the battery described in SCIENTIFIC AMERICAN of April 11 answer for operating microphones, bells, etc.? A. Yes, but we think a Leclanche would suit you better. 6. How far should naked wire be placed from a building heavily coated with lead paint, to not be influenced magnetically by it? A. The distance is immaterial. 7. Is galvanized steel wire suitable for magnetic line wire, and as good as iron wire? A. Yes. 8. How small wire will work a call bell ¼ to one mile? A. Use No. 12. 9. Should all wires for magnetic purposes, running through damp cellars, be insulated? A. It should be insulated.

(30) G. W. B. asks: 1. What kind of battery is used for telephones? A. Generally the Leclanche. 2. Are same sized cells used for long as for short lines? A. Yes. 3. About how many cells are used to a mile of line? A. One to two cells for any length of line. 4. Is the earth ever used to complete the circuit, as in telegraphy? A. Almost universally. 5. How many ohms resistance has an ordinary "bell" receiver? A. 25 to 75. 6. Size of wire? A. No. 36.

(31) W. G. G. asks: 1. If a party gives written guarantee in purchase of boiler that it shall be tested usual boiler test, and warrants it safe, and has not done so, is he liable? A. Party is liable under the common law for violation of contract. 2. When he cements up a crack and paints it over, with same representation, and you find on getting up steam that she is not fit at any pressure, is it not criminal? What is the remedy? A. The fact of imperfect work concealed does not constitute a crime, we believe, under the statutes. If you have paid for the boiler, you may sue in court for damages to the amount of the bill, using the guarantee as evidence of agreement, and prove by witness the worthlessness and dangerous condition of the boiler.

(32) F. T. writes: I have made dynamo full size as described in SUPPLEMENT, No. 161. Would it make machine of double its power, by placing another pair of field magnets at the other end, and using the same armature? A. It would increase the power somewhat but would not double it.

(33) O. F. McP. asks: 1. If the north and south poles of a permanent magnet be connected by a common copper wire, does the same effect take place as if they were joined by the regular iron armature? If so, why has it no effect on the ordinary coils of a telegraphic sounder? A. The copper wire being non-magnetic is not appreciably affected by the magnet. 2. Which is the simplest method of producing a spark from a permanent bar magnet, and, if impossible, how can it be done with a horseshoe magnet, giving a description of apparatus and parts used? A. With a small magnet this is impossible. With a large magnet you can produce a spark by applying the poles of the magnet to the poles of an electro magnet which is wound with very fine wire; on suddenly withdrawing the permanent magnet from the electro-magnet, the spark will be seen between the terminals of the electro-magnet if they are sufficiently near together. 3. Also describe a spark coil. A. See SUPPLEMENT, 160. 4. Also a formula of the best concrete which is used for the foundations of large buildings. A. See SUPPLEMENT, Nos. 183, 285, 418, 36, 338.

(34) H. R. S. asks: 1. Will the telephone employing U magnets, described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 142, work on telegraph wire the distance of six blocks, with ground connections and two Leclanche batteries at each end? A. One Leclanche cell will work a transmitter to that distance or farther, but a good magneto telephone ought to work that distance without a battery or transmitter. 2. If so, will I be infringing on any patent by using the same, using a strap key and common call bells, with a double pointed switch, by the use of which the bells can be rung and then switched so as to connect the telephone, then, when through talking, switched back, so the bells can always be rung by pressing the strap key. A. The Bell Telephone Company claim to control all speaking telephones. 3. Would magnets 3½ inches long be big enough? Also how long should the iron core be. Do the small binding screws on the back of the concave flange, E, touch the diaphragm or not? A. A magnet of that size would be large enough. The iron core should be long enough to reach through the bobbin and nearly touch the diaphragm. 4. Will you please tell me how to make an ordinary acoustic telephone (the diaphragm especially), and how far would it work? A. Two diaphragms of wood or metal supported at the edges and having their centers connected by string or wire, or still better a fine wire cable, form a good acoustic telephone, which will work under favorable circumstances for half a mile.

(35) J. E. J., Jr., writes: A man has been going through this city for some time past selling a silver plating preparation in small clear glass bottles. It has the appearance of pure spring water, and is as liquid as the same. He cleans off a bit of brass, copper, or silver, and starts to polish it with this stuff, and in a few minutes the article has the appearance of silver. A. It is probable that the solution to which you refer is simply a solution of nitrate of mercury and water. This solution can be readily made by dissolving a small quantity of mercury and nitric acid, and diluting the acid with water. But the mercurial coating applied in this way is not durable, and would prove injurious if applied to table ware. The following is recommended for applying a thin coating of pure silver: Nitrate of silver 80 parts, dissolved in 36 parts of pure water; add 40 parts of salammoniac and 160 parts of hyposulphite of soda and 160 parts of whiting. Apply with a chamois skin or piece of cloth.

(36) F. E. C. writes: I have a drive well; point down about 35 feet, and in sand. Water was at one time moderately hard, but has in the last two or three years become soft, and in the last few weeks tastes and smells bad. A vigorous pumping of several minutes does not improve it. Can you explain it? A. It is possible that the surface drainage has found access to your well. If so, it might possibly be stopped by puddling with clay, but it is best never to take any chances of using water contaminated from such cause.

(37) T. A. J.—To demagnetize a watch place it in a helix formed of about 100 convolutions of No. 16 insulated wire. Connect the helix with a current reversing key, and connect the key with a plunging bichromate battery of about 6 cells. Plunge the elements, and while slowly withdrawing them from the solution work the current, reversing key at the rate of about two movements per second. If the elements of the battery are large, it would be well to tip the battery, so that the zincs may leave the solution cornerwise. It would perhaps be well to experiment on some other magnetized object before trying the watch.

(38) W. V. L. asks for any cheap substance or material that can be applied to the wires of a fence between the posts to which they are attached, that would effectually prevent the lightning from passing over it, from post to post. There is general complaint in that vicinity (Iowa) on account of the accidents resulting from this source, and some are discarding the wire on that account. A. We would suggest that you provide your wire fence with efficient ground connections at intervals. Nothing can be applied to the wire which will prevent the lightning from passing over it.

(39) F. I. M. asks (1) why a smaller gravity battery cup is used on a main line circuit than is used on a local circuit. A. From motives of economy; the current required for the line is an intensity current capable of overcoming the resistance of the line. 2. The difference between a battery connected for quantity and one connected for intensity; how are they connected and why so? A. A battery is said to be connected, for quantity when all the zincs are connected together to one of the conductors, and all the copper plates are connected together with the other conductor. A battery connected in this way acts precisely like a single large cell. A battery is said to be connected for intensity when the zinc of one cell is connected with the copper of the next, and so on throughout the entire series. A battery so connected has a high resistance, and is capable of working over a circuit of high resistance when the battery connected for quantity would not. 3. How to maintain, and detect when a battery is getting weak? A. An acid hygrometer is generally used to determine the condition of the battery.

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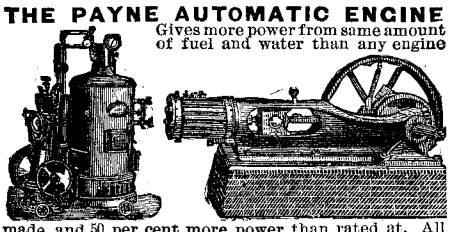

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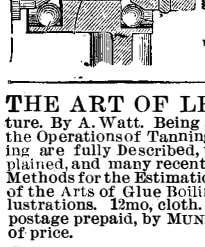

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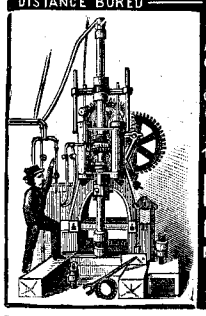

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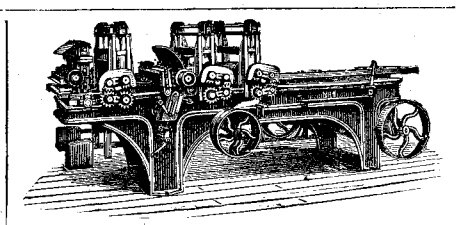

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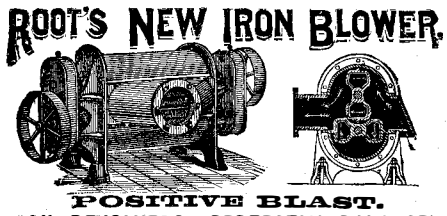

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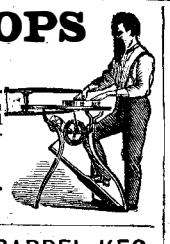

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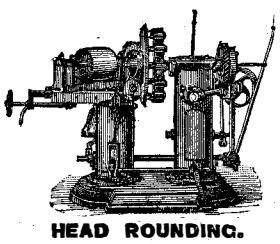

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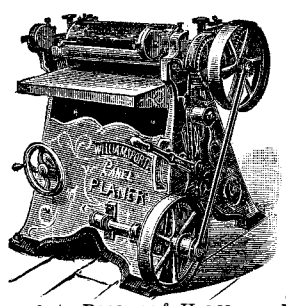

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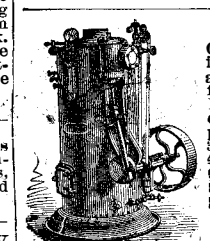

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