SCIENTIFIC AMERICAN

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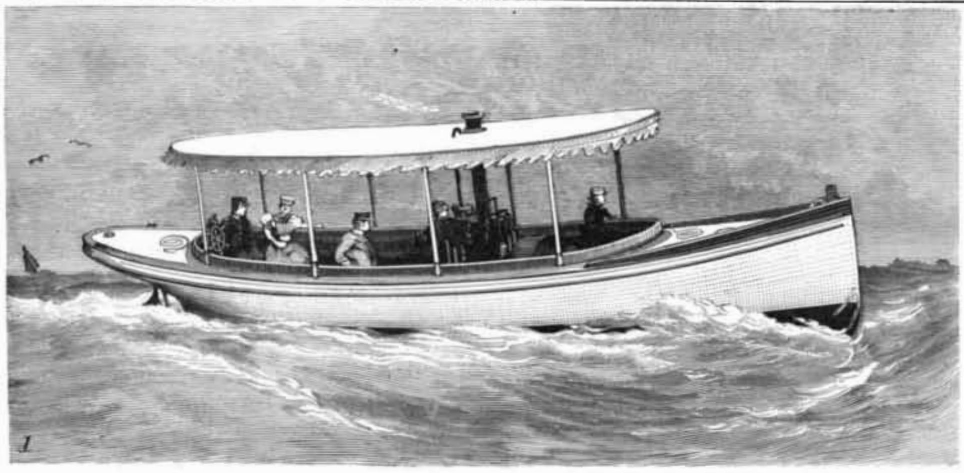
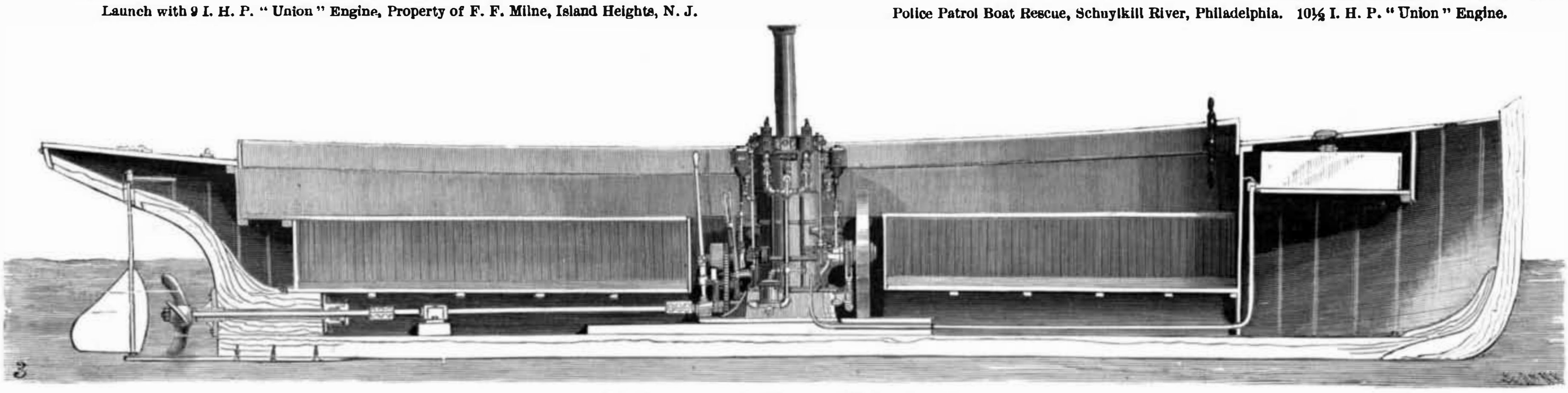
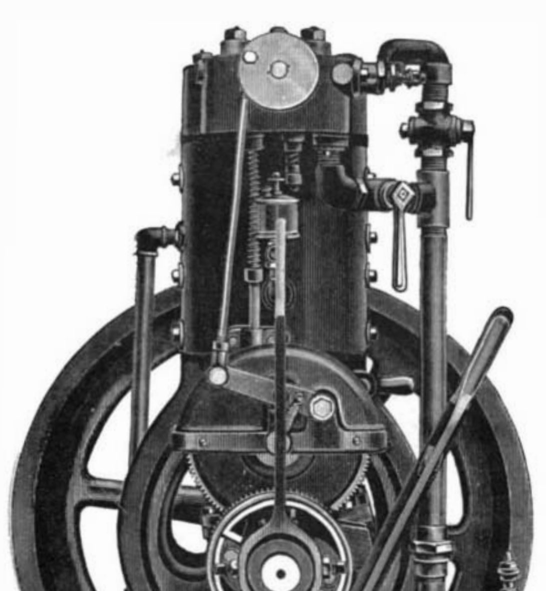


Launch with 9 I. H. P. "Union" Engine, Property of F. F. Milne, Island Heights, N. J.

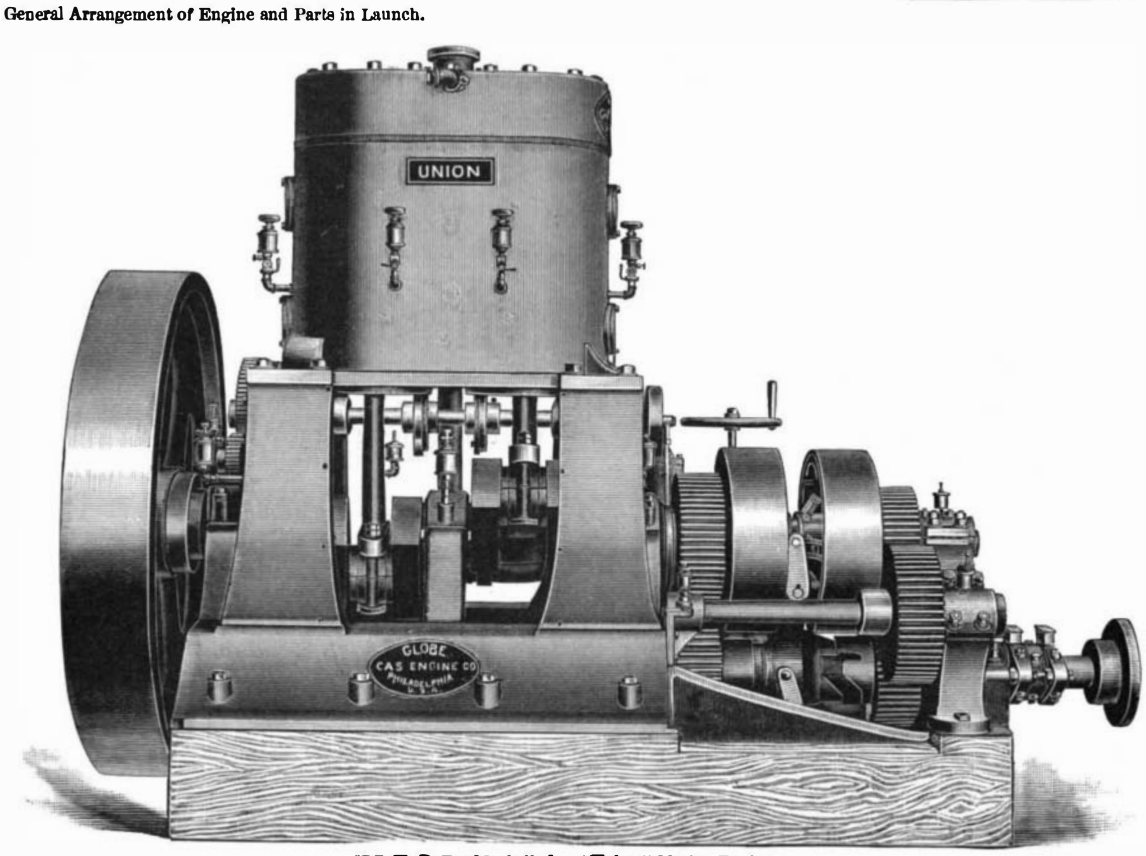
Police Patrol Boat Rescue, Schuylkill River, Philadelphia. 10½ I. H. P. "Union" Engine.



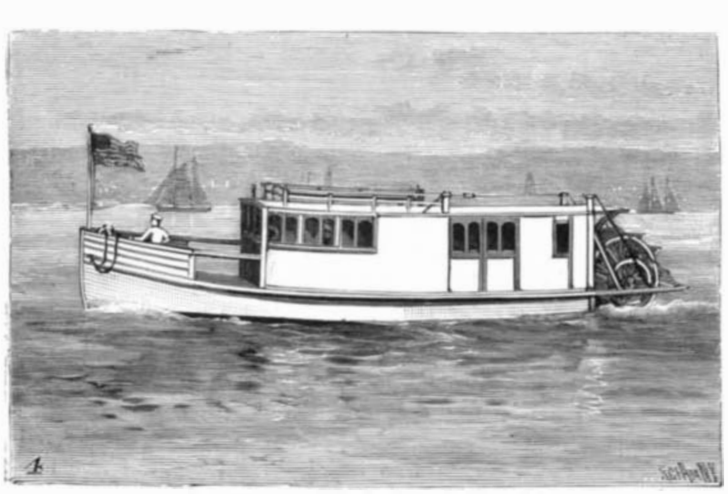
General Arrangement of Engine and Parts in Launch.



6 I. H. P. Single Cylinder "Union" Marine Engine.



75 I. H. P. Double Cylinder "Union" Marine Engine.



Stern Wheeler. 25 I. H. P. "Union" Engine.

Launch 42×9 ft., with 25 I. H. P. "Union" Engine, Property of A. N. Stanton, Bridgeport, Conn.

THE MARINE GASOLINE ENGINE AND GAS ENGINE BOAT.—[See page 311.]

Scientific American.

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NEW YORK, SATURDAY, MAY 18, 1895.

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(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 1011.

For the Week Ending May 18, 1895.

Price 10 cents. For sale by all newsdealers.

A GREAT INVENTION IN WEAVING.

James H. Northrop, of Hopedale, Mass., is the author of a large number of new inventions relating to weaving machinery, for which patents have been granted within the past three or four years or more. Some of these improvements have been put into practical shape by Messrs. Draper, the assignees of Northrop, and the results are such as to justify the prediction of an impending revolution in the economics of the art of weaving.

One branch of the Northrop inventions consists in devices for the automatic filling of shuttles in single shuttle looms, whereby the frequent stopping of the machine for refilling, or in consequence of breakage, is avoided. The practical result is that one first class weaver, who is now capable of attending six looms, is enabled, by means of the Northrop improvements, to attend sixteen looms, all of them running at the usual speed, so that the quantity of cloth produced is more than doubled without any increase in the cost. The Industrial Record says: "The invention is in practice in a mill where 400 of these looms are in operation, running at the rate of 190 picks per minute, the usual speed of a print loom. It is said that more looms can be run by one operative, but we will be satisfied with sixteen. This is enough for the incredulous, and doubles the number of looms that a first class weaver is now capable of handling on print cloths. One-half the labor cost is saved in this particular alone. But in actual experience it has been found that more than this is saved on account of the greater production per loom due to non-stoppages for supplying fresh filling.

"The labor cost in one yard of print cloth is about one cent, and four-tenths of this is represented in the cost of weaving. In Fall River, weavers receive 18 cents a cut of 45 yards. The labor cost in two Lowell print cloth mills is 5·90 to 6·01 cents per pound, and that of weaving alone is 3·46 to 3·54 cents per pound. It is safe to say that about half the cost of manufacturing is in the weaving, hence any saving here is a matter of some moment, especially when it attains the proportion of fully one-half. Calling the annual production of print cloths by Fall River mills at 10,000,000 pieces and we have a saving in the cost of weaving of $900,000, or nearly one-half the total dividends paid by all the mills of that city in the prosperous year of 1892, or nearly equal to all the dividends paid in 1891. In the manufacture of print cloths alone in this country a saving in the cost of labor can be made of $2,500,000 by this new loom. This saving in the cost of manufacturing is not necessarily a loss to labor, for the latter can be but temporarily idle, as it will be wanted in some remunerative form in factory employment due to the increased demands on manufacturing that lower cost to the consumer always brings about.

"There are in the United States, as near as we can estimate, about 360,000 cotton looms, 75 per cent of which are on plain cloth, and running single filling boxes. At least one-half of this full number of looms (180,000) are under 36 inches wide; most of them under 32 inches wide. These 180,000 looms and those operating them come directly within the influence of this Northrop invention as it is to-day. Allowing six looms to a weaver, and we have 30,000 weavers directly affected and likely to be reduced one-half in number, at a very conservative estimate, should this loom come into general favor. One female in four over 16 years of age, employed in our cotton mills, assuming that cotton mill weavers are females over this age, is sure to feel the potency of this invention.

"It is not for us or any one else to say how far the ideas or principles of this invention can be carried. At present it seems to be limited to the use of one shuttle, and though in its present form it may not be able to get beyond this, it is not easy to say how suggestive it may be of devices that will adapt it to a number of shuttles. If it can be made applicable to drop box looms, then it will affect the manufacture of ginghams, upholstery goods, etc., where different kinds or colors of weft are required. As it is, it is confined to the cotton manufacturing industry, but it requires no great amount of credulity to apply its usefulness to the needs of the woolen industry. This is one of the curiosities of textile inventions, their first development and application in the manufacture of cotton fabrics. This was so during that great era of inventions in the latter half of the eighteenth century, notwithstanding the insignificance of the cotton industry and the relatively great importance of the woolen industry, and it has been so ever since.

"The woolen mule was a thing that was thought to be impossible for fully thirty years after the self-acting cotton mule came into being. The worsted spinning frame was a creation after the spinning frame for cotton had long been in common use. The woolen loom can lay some claims to being in advance of the cotton loom, where complication in design of the woven fabric is desired, but there is here a suggestion that may be found as applicable to the woolen as to the cotton loom, and give the latter the lead."

MANY acres of land in Gloucestershire are devoted to the raising of wood for walking sticks.

THE DESERTED VILLAGE.

The village life of old times has been the basis of many an idyl in prose or verse. A village represents the center of the isolated community, made isolated by difficulties of transportation both of freight and person. Before the days of MacAdam every mile of bowlder-infested, sandy and muddy roads exhausted man and beast alike who were concerned in the transfer of wagons over it. In England where, owing to the very large proportional population, traveling was extensively indulged in, the matter had become very serious in the last century. The great lumbering stage coaches would be dragged over roads which in the contemporary literature are described as absolutely inspiring terror. But London was not then the absolute metropolis of the country. All through the land there were prosperous villages, whose inhabitants led cultured lives and very rarely journeyed to the large cities.

Then MacAdam evolved his plan of making roads with broken stone, formulating the curious precept that no stone must be used which was too large to go into the mouth. He would take a piece of road filled with bowlders, and breaking them to fragments, would make the road supply all or a great part of the material required for its own construction. William Cobbett, at the beginning of this century, representing the agriculturist, inveighs against the use of broad tires imposed by the authorities upon those who traveled upon the new roads which then began to traverse England in all directions. These roads enabled stage coaches to make ten miles an hour, and the population began at once to centralize more than before, and we find Cobbett again lamenting the growth of the "Wenn," as he termed London.

When the railroad replaced the stage coach, the growth of London and of the other great cities began in earnest. Meanwhile, in this country, the New England States had become filled with villages. The white-painted gable houses with green blinds, the village green, with town hall, public school and church facing it, had become characteristic features of these settlements.

For the better intellectual development of the natives or inhabitants of the villages, lyceums were founded, which arranged for courses of lectures to be given on various subjects. The life seemed, to a certain extent, ideal. There is in humanity a theoretical desire for repose and absence of strife, a desire which in many cases is purely theoretical, and whose exponent was found in the New England villages and communities of the same type in other States. The intellectual element of these places was responsive to the life of the day, and it is surprising how many of our greatest men have come from villages.

To-day the change is complete. The villages are being rapidly deserted. When factories began to be built of the large scale, they were placed in villages, but centralization has affected them also. They have left the villages, and Lynn, Fall River and similar cities have become great manufacturing centers, each representing enough industry to maintain all the villages in a State.

Some years ago the deserted farms of New England were made the subject of investigation by the government. Farms, which long ago were the objects of careful cultivation, and which seemed to the owners to represent the acme of progress, have been thrown upon the market at ruinous prices. They are gradually being taken up in part by French Canadians, who seem to bring with them some of the frugal and industrious traits of the old country French farmer. Now the deserted village takes the place of the deserted farm as an object of interest and of solicitude. The young people used to want to leave the farm, and did it. Now they want to leave the village, and are doing it. Steam railroads, supplemented by the electric road, cause that which is really an immense area to be subsidiary to each large city.

Mechanical progress affects all classes, and the inventor touches the life of every class. The farmer and villager at first sight would seem relatively little affected by modern machinery. But improved tools made farming more effective; steam was applied to its processes, cheapening them greatly; the railroads took the crude or raw products to steam mills, ending the work of the country grist mills. And now the railroad and trolley have taken the personnel of the farm and village in hand and have transported them to the city, and village life, such as it was even thirty years ago, is ended by the progress of mechanical art. The story of Concord, in Massachusetts, with its authors, Hawthorne, Emerson, Thoreau and the Alcotts, will hardly ever be told of any future village. The mechanic and the inventor have settled the question forever.

It would be hard to find a better instance of the effect of mechanical progress upon the home life of a nation. It may even have an effect upon its literature, for the quality of books is certainly affected by environment, and the inventor, scientist and mechanic have determined a new environment for the active portion of humanity.

Prof. Karl Ludwig.

A cablegram of April 27 announces the death of the eminent physiologist, Prof. Karl Ludwig, at Leipsic, Germany. He was born in 1816, at Witzenhausen. He studied medicine in Marburg and Erlangen. In 1841 he was made demonstrator, and in 1846 professor of anatomy at Marburg. In 1849 he was called to the chair of anatomy and physiology at Zurich. In 1855 he became professor of physiology in Vienna. In 1865 he took the chair of physiology at Leipsic, which he held at his death. Prof. Ludwig was one of the greatest physiologists of the world, ranking with Claude Bernard. He discovered the kynographic method for the study of blood pressure. Among the best known of his writings are, "The Gas of the Blood," "The Structural Conditions of the Heart, Liver, Kidneys, and Other Internal Organs," and "The Secretion of the Kidneys."

General John Newton.

General John Newton, one of the best known engineers in the country, died at his New York home on May 1. He was born at Norfolk, Va., August 24, 1823, and he showed from an early age a remarkable predilection for mathematical studies. He secured an appointment to the Military Academy at West Point, from which he graduated in 1842. He occupied the position of assistant professor of engineering while only a second lieutenant; he was later assigned to important engineering works along the Atlantic and Gulf coasts. He distinguished himself in the civil war by gallantry in the field and by able engineering work. On March 13, 1865, he was rewarded with the brevet of major-general of volunteers, and of brigadier-general and major-general of the regular army. In 1866, General Newton, as lieutenant-colonel of engineers, was ordered to New York to begin improvements, the greatest of which was the removal of the rock at Hell Gate. He resided in New York from this time until his death.

General Newton's wonderful engineering skill in removing these rocks, which had proved so dangerous to navigation, excited the admiration of engineers all over the world, and he received many honors. Hallett's reef was destroyed on September 24, 1876, and Flood Rock some years later, on Oct. 10, 1885. He also superintended the defenses on the Long Island side of the entrance to New York Harbor, the improvements of the Hudson River, the fortifications of Sandy Hook, the channel between New Jersey and Staten Island and various harbors on Lake Champlain.

On March 6, 1884, he was made chief of engineers in the regular army with the rank of brigadier-general, and at his own request he was retired on August 27, 1886. The next day he was made commissioner of public works of New York City, and for more than two years a wholesome example was given of the administration of a great city department from which politics were absolutely divorced. General Newton declined a second term and retired to private life. He became president of the Panama Railroad Company, which office he held at the time of his death.

Charles H. Cramp.

Charles H. Cramp, the Philadelphia shipbuilder, is an interesting man. In almost every way he differs from the common order of man. Mr. Cramp's fame as a shipbuilder will soon be added to, when the American liners, the St. Louis and St. Paul, are added to the fleet of the American Line. The St. Louis will start upon her first trip in about three weeks and the St. Paul not long afterward. England is watching for this event with great interest. There is probably not a person directly interested in the great shipyards of England that is not already wondering how these two ships which have about been finished in the Cramp yards will turn out.

Just now, at the beginning of a new epoch in our history of shipbuilding, Mr. Cramp becomes unusually interesting to the public. He is frequently in New York, and I saw him at the Waldorf the other day, the center of a group of friends. Mr. Cramp is known to laboring men all over the world as a model employer. He has never had any trouble with his workmen, and most of the six thousand odd men employed in his yards to-day were preceded by their fathers and grandfathers, and in many cases by their great-grandfathers. This great firm was founded by William Cramp, the father of Charles, and the present head of the firm learned the trade in his father's yards just as any other apprentice would. Mr. Cramp grew up among these men, and has always felt as if he were one of them. He has frequently said that his success was largely due to the loyalty and friendship of his employes. Every man employed in the yard feels a much greater interest than if he was a mere wage earner only interested in what he made. If he were a stockholder in the company, he could not feel more loyal than he does. He knows that if he gets sick his family will be provided for. If he wishes to attempt to improve his financial condition by going into business, the Cramps will help him. There are hundreds of shopkeepers in the vicinity of the great shipyards who were helped to get their start by Mr. Cramp, and many of these have grown to be well-to-do. A number of those who have held high positions in the municipality of Philadelphia were workmen in the Cramp yards. If one of his men runs for an office, the Cramps will help him in his canvass, and it makes no difference as to what party he belongs. Mr. Cramp is nearly seventy years of age, but he does not look to be much over fifty, and he certainly has more vitality than the ordinary man of that age. He always seems to be on the go, but never complains of being tired, and I have often wondered if he were born to never know fatigue. With all the great responsibility and worry of detail that he is called upon to look after, Mr. Cramp's amiable disposition never changes; he is always cheerful and agreeable.—Commercial Advertiser.

Character and Physical Conditions.

Perhaps, after all, in our pursuit of harmony in our lives, we are not paying enough attention to physical conditions. Science pretends to have made great progress in interpreting the relations of body and mind. We have, on the one hand, the advocates of physical culture as the reconciliation of our disordered faculties, and on the other the zealots who have a mind cure for every physical ill and disturbance. Training and diet for a specific and temporary purpose, like football contests or the ordeal of oratorical competition, we are familiar with. But anything like a broad, scientific study of the results of specific diet has hardly been attempted. There are certain popular notions afloat on the subject, as that fish and celery are good for the brain. The moral reformers have forced us to consider the properties of tea, coffee, and alcohol, and the physicians unite in condemning or commending at different times the same article of diet in relation to the health of patients. But the effect of different kinds of food upon people in a normal condition, upon the power or quality of their brain work, upon their dispositions, upon husbands' treatment of their wives, is hardly considered. We blunder along till we reach middle life, experimenting without any scientific programme, and at last, when the game is almost over, begin to learn what to avoid, and so mitigate the failures of our remaining years. We do not treat horses this way, or cows, or dogs from whom we expect any intelligent service in hunting.

We know that some plants are stimulants and some are narcotics; there is a belief even among savages that certain articles of food give courage and others make the eaters chicken-hearted. There is good reason to suppose that every sort of food, vegetable or animal, has an action as specific as what we call drugs have, and a specific relation to human quality and capacity. We calculate roughly that such a thing is indigestible, or that another article of diet increases nervousness—the special disease of this period of time. But we do not study what diet will make a man kind, or truthful, or a lyric poet, or an honest historian, or a disinterested politician. We have got so far as to see that we must discriminate about medicines, but it would be as reasonable to expect a dozen persons with as many maladies to go to the drug shop and swallow the same kind of doses as is the spectacle of a dozen people at a dinner table, all unequal in mental gifts and habits and in physical status, helplessly eating the same things.

This demoralization of the taste is probably a sign of a deeper insensibility. We may not be able now to prove that a bad egg will produce a bad man; it may be that only a bad man will eat a bad egg; but as we know that a man's disposition is affected by what he eats, and that much of the evil in life comes from bad digestion, it is a fair inference that moral and intellectual qualities are transmitted in food. It is the business of science to make better men and women. It gives itself great airs about heredity, but hitherto has done little in the investigation of the subtile causes of the so-called hereditary qualities in our consuming relations to the animal and vegetable world.—Harper's Magazine.

A Valuable Hint.

"My husband," said a physician's wife not long ago, "chanced to see one day, standing on a shelf outside our kitchen window, some moulds of jelly cooling for the night's dinner. They were uncovered, as they were out of reach of cats, and in full view of cook's watchful eye; but he questioned me about them, and asked if it was our usual custom to leave jelly thus unprotected. I was obliged to reply that, so far as I knew, it was. 'Then,' he said, 'don't you know that when we medical men want to secure minute organisms for investigation, we expose gelatine to the air or in places where we have confined malignant germs? The gelatine speedily attracts and holds them. I'm afraid your flavored gelatine does the same. Cool the jelly if you must, but cover it with a piece of close muslin.' And we have always done that since then."

It is to be feared that kitchen processes are sources of illness more often than is imagined. In many city houses the little kitchen annex were stands the refrigerator, and where various eatables are kept, is directly against a drain. Yet here stand daily uncovered milk, butter, often custards and puddings, and various other absorbents. The average cook is absolutely ignorant of sanitary cause and effect, and the eternal vigilance of the house mother is the family's chief safeguard.—Boston Journal of Commerce.

The Monkey and the Sugar.

A tame monkey in India recently was given a lump of sugar inside a corked bottle. The monkey was of an inquiring mind and it nearly killed him. Sometimes, in an impulse of disgust, he would throw the bottle away out of his own reach and then be distracted until it was given back to him. At other times he would sit with a countenance of the most intense dejection, contemplating the bottled sugar, and then, as if pulling himself together for another effort at solution, would sternly take up the problem afresh and gaze into the bottle. He would tilt it up one way, and try to drink the sugar out of the neck, and then, suddenly reversing it, try to catch the sugar as it fell out at the bottom. Under the impression that he could capture the sugar by surprise, he kept rasping his teeth against the glass in futile bites, and, warming to the pursuit of the revolving lump, used to tie himself into regular knots round the bottle. Fits of the most ludicrous melancholy would alternate with spasms of delight as a new idea seemed to suggest itself, followed by a fresh series of experiments. Nothing availed, however, until one day a light was shed upon the problem by a jar containing bananas falling from the table with a crash, and the fruit rolling about in all directions. His monkeyship contemplated the catastrophe, and reasoned upon it with the intelligence of a Humboldt. Lifting the bottle high in his claws, he brought it down upon the floor with a tremendous noise, smashing the glass into fragments, after which he calmly transferred the sugar to his mouth and munched it with much satisfaction.—Christian Advocate.

The Use of Compressed Air for Raising Water.

By means of compressed air, says the Sanitary Plumber, water can be lifted from a well of any reasonable depth without working parts of any kind being placed in the well. The air may be compressed in suitable reservoirs by any convenient mechanical means—steam, wind power or air expansion. Air can be made to deliver water at a steady and continuous pressure from underground reservoirs placed at any depth desired, and can be made a much more important factor in the work of domestic water service than it has been hitherto. In fact, air pressure is the ideal means of moving water in some instances, and when its capabilities are better understood by the many its superior service will be made available to an extent not even anticipated now. A reservoir placed underground takes up no room in the house, requires no unusual framing in the house to support it, offers no chance of flooding the house and its furnishings, it will not freeze in winter, and it keeps the water cool in the hot months of summer. In warm climates, reservoirs with large surfaces advantageously exposed to the rays of the sun will heat water sufficiently for all domestic purposes and in any required quantities without the aid of a fire. Now, with all these methods to select from, together with the data for erection and operation which manufacturers are always glad to furnish to any one who applies, the veriest novice ought not to fail of obtaining satisfactory results under conditions which would once have been looked upon as extremely difficult, even to an experienced engineer.

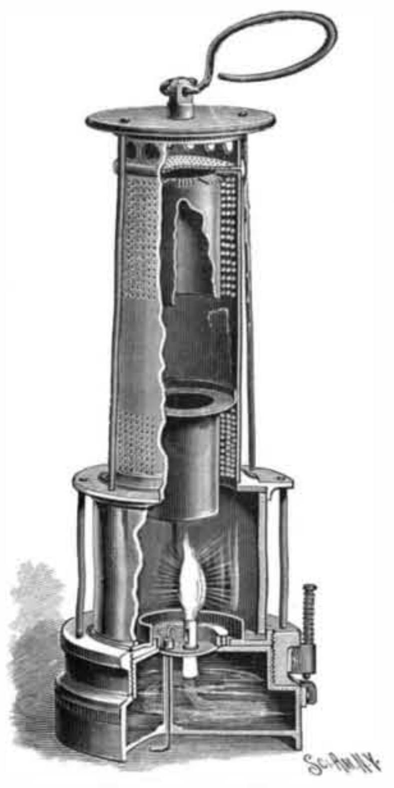
Maximum Air Pressures in which Men Can Work.

According to a writer in Cassier's Magazine, the highest working pressures recorded have been close to 50 pounds per square inch; but with extreme care in the selection of men and corresponding care on the part of the men, it is very probable that this limit may be considerably exceeded.

For the average pressure man, under average conditions, the top limit may be placed at about 45 pounds, the time of working varying from 4 to 6 hours per shift, according to conditions. In the cases where higher pressures might be used, the shifts for the men should be restricted to two of 2 hours each separated by a considerable interval. As an example of heavy pressure work under favorable conditions as to ventilation, without very bad effects on the men, Messrs. Sooysmith & Company had an experience with a work on which men were engaged in 6 hour shifts, separated into two parts by half hour intervals for lunch. This work was excavation in open, seamy rock, carried on for several weeks under about 45 pounds pressure. The character of the material through which the caisson is being sunk, or upon which it may be resting at any time, bears quite largely upon the ability of the men to stand the pressure necessary to hold back the water at that point. If the material be so porous as to permit a considerable leakage of air through it, there will naturally result a continuous change of air in the working chamber, and a corresponding relief of the men from the deleterious effects which are produced nearly always by over-used air.

AN IMPROVED MINER'S LAMP.

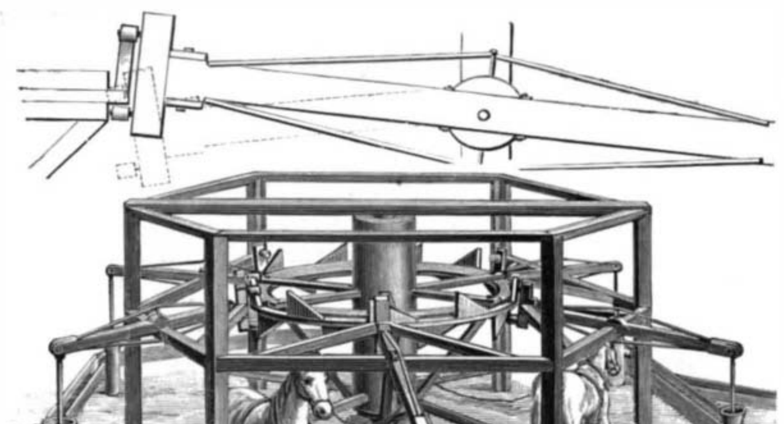
A lamp strong enough to resist the action of burning gas within it, which is perfectly ventilated, and which gives a steady light in a current of air, is shown in the accompanying illustration, in which portions are broken away to show the interior. It has been patented by Mr. William J. Callaghan, of Connellsville, Pa. The lamp proper, or oil-holding reservoir at the base, screws into the upper portion, to which it is secured by a safe and strong lock, in the form of a spring bolt with a catch on its outer end, which enters a socket in the lamp body. In the outer tube, above the glass portion, are top and bottom perforated sections, opposite which are internal shields, the lower one being adjustable up and down, as desired, these shields preventing any rapid propulsion of gas through the lamp. The upper shield is closed at the top by a perforated plate, above which are side apertures. Extending from the bottom up through the oil reservoir is a tubular way in which is loosely fitted a piece of wire, sharpened at one end, and bent to form a pick, by which the wick may be conveniently raised or lowered, or freed from incrustations. The construction is such that the flame cannot be projected outward from the lamp, and all parts are easily examined at any time.



CALLAGHAN'S SAFETY LAMP.

AN IMPROVED HORSE POWER.

The accompanying illustration represents, in perspective and sectional views, an improvement in horse powers designed more especially for pumping purposes. It has been patented by Mr. E. J. Wood, of Beckwith, Cal. It consists of a revolvable cam wheel held in position by a suitable framework, and having around its outer rim a series of inclines, as shown. A vertical cross piece upon the inner end of each lever carries two engaging pulleys of a proper distance apart to allow the alternating cams to pass between as the wheel is revolved, thus imparting a smoothly acting and powerful reciprocating movement to the levers. The framework is preferably of an octagonal shape, thus giving a combination of strength with an artistic effect, and also the capacity for operating a lever at each of its sides. The power is especially adapted for raising the underflow of surface water for irrigation and other purposes, as it will pump simultaneously from a group of pumps fifty feet apart if desired.



WOOD'S "ARID BELT PUMPING POWER."

Chime Whistles on Passenger Engines.

It is being announced by some of the technical papers that the Pennsylvania Railroad has adopted chime whistles as standard for its passenger engines. The fact is that this road has been equipping its passenger engines with chime whistles for the past two years, and is now pushing such equipment as rapidly as possible. This is not only complimentary to the good sense of the Pennsylvania's management, but it is also a healthy sign of the increased attention that is being given by railroad managers to what we have frequently spoken of as the refinements of railroad management.

The most successful managers of large retail establishments vie with each other in adopting refinements of their service that eliminate every possible phase of trade that is disagreeable to their patrons. The same policy should prevail in railroad operating. Railroads have transportation to sell, and much of it is retailed to individual passengers who are apt to bestow their future patronage where the results promise to be most pleasant; or, at least, where there is a minimum of disagreeable features. The squalling, bellowing, screeching whistles used on many passenger engines are properly classed among the latter. Their rasping tones are annoying in the daytime and exasperating at night, when they frequently startle sleeping passengers, or entirely chase away the gentle god vainly being wooed.

The action of such roads as the Pennsylvania and Michigan Central in recognizing these facts, and adopting whistles with soft, pleasant tones for their passenger engines, will surely have the effect of prompting other roads to do likewise or of drawing a larger proportion of patronage to themselves.—National Car Builder.

The Meerschaum Industry.

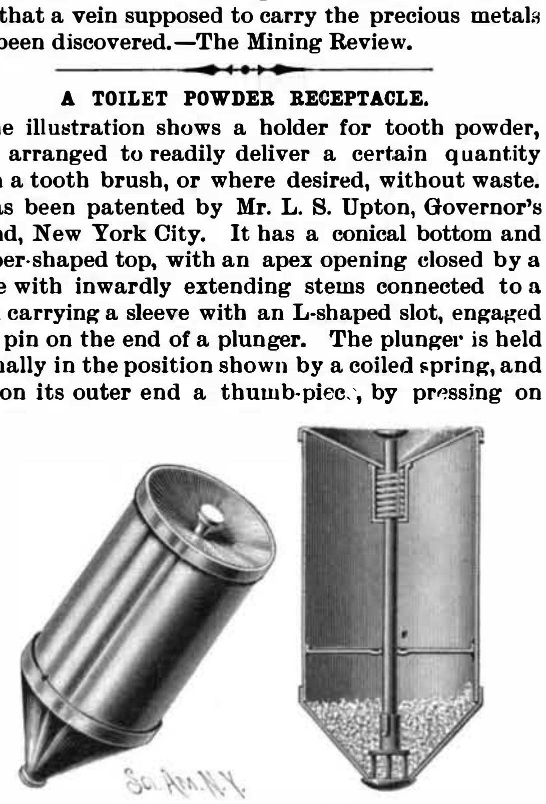
Mr. Cumberbatch, British consul at Angora, in his latest report, says that rich deposits of meerschaum are found 20 miles to the southeast of Eski Shehir, an important station of the Anatolian Railway. The Belgian consul in Constantinople, who recently visited the place, states that it would be difficult to determine the exact area in which the meerschaum is to be found. Judging from the number of pits at considerable distances from each other, it must be extensive. The localities where most work is carried on are Sepetdji-Odjaghi and Kemikdji-Odjaghi. The meerschaum is extracted in the same way as coal. Pits from 25 feet to 120 feet deep are dug, and as soon as the vein is struck horizontal galleries, sometimes of considerable length, are made, but more than two galleries are seldom to be found in one pit. The stone as extracted is called "ham tash," or rough block, and is soft enough to be easily cut with a knife. It is white with a yellowish tint, and is covered with a red clayey soil of about one inch thick. In this state the blocks are purchased by dealers on the spot, not by weight or by measurement, but according to approximate quantity, either per load of three sacks or per cartload, the price varying from £5 to £30 per load, according to quality. These blocks are dried and subjected to certain preparations before being conveyed to Eski Shehir. Some of them are as small as a walnut, while others attain the size of a cubic foot. Those which combine regularity of surface and size are the best. The manipulation required before they are ready for exportation is long and costly. The clayey soil is removed and the meerschaum dried. In summer exposure for five or six days to the sun's rays suffices, but in winter a room heated to the required temperature is necessary, and the drying process takes eight to ten days. When dried the blocks are well cleaned and polished, then they are sorted into about 12 classes, each class being packed with great care in separate cases, and each block being wrapped in cotton wool. The bulk of the meerschaum is sent to Vienna, where it is worked, and dispersed all over the world. Most of the finest specimens are sent direct to Paris. Certain American dealers have visited Eski Shehir with the object of obtaining the raw article direct instead of through Vienna, thereby saving the higher custom house duty payable on the worked meerschaum. The quantity annually exported is put down at 8,000 to 10,000 cases. The various taxes levied by the Turkish government amount to about 37 per cent ad valorem.

How to Locate a Claim.

To make a quartz location after July 1, the prospector must sink a hole at least ten feet deep to solid formation, must have at least one well defined wall, and must stake his ground so that the stakes can be found. The notice of location must be placed in a conspicuous place at the discovery shaft, where it can be seen—not on some stump or tree in the neighborhood. He is allowed ninety days to do this work. If he relocates an old prospect hole, he is required to sink it at least ten feet deeper than when he first found it, and stake and record his location the same as though it was an original discovery. If he runs a tunnel it must be at least ten feet long, so as to determine the fact that a vein supposed to carry the precious metals has been discovered.—The Mining Review.

A TOILET POWDER RECEPTACLE.

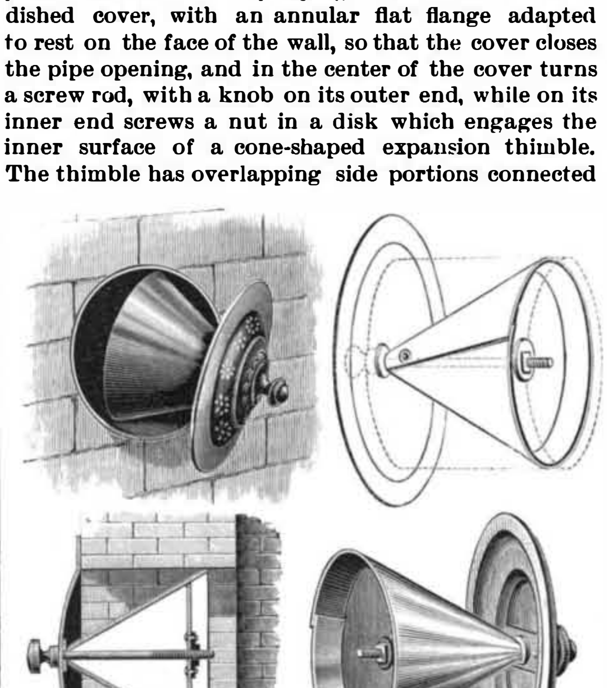
The illustration shows a holder for tooth powder, etc., arranged to readily deliver a certain quantity upon a tooth brush, or where desired, without waste. It has been patented by Mr. L. S. Upton, Governor's Island, New York City. It has a conical bottom and hopper-shaped top, with an apex opening closed by a valve with inwardly extending stems connected to a head carrying a sleeve with an L-shaped slot, engaged by a pin on the end of a plunger. The plunger is held normally in the position shown by a coiled spring, and has on its outer end a thumb-piece, by pressing on which the valve is opened to pass the powder out of the receptacle, the plunger returning to normal position on the removal of the pressure, and at the same time seating the valve. The valve is removably connected with the plunger to permit of conveniently placing the powder in the receptacle.



UPTON'S POWDER HOLDER.

A CHIMNEY FLUE PIPE OPENING COVER.

To prevent gases, smoke, soot or fire from passing into a room of the house from a pipe opening of the chimney flue, Mr. Axel A. Gustafson, of Axtell, Neb., has patented the device of which several views are presented in the accompanying illustration. It has a dished cover, with an annular flat flange adapted to rest on the face of the wall, so that the cover closes the pipe opening, and in the center of the cover turns a screw rod, with a knob on its outer end, while on its inner end screws a nut in a disk which engages the inner surface of a cone-shaped expansion thimble. The thimble has overlapping side portions connected with each other near the apex of the cone by a rivet which forms a pivot, permitting the base end of the thimble to readily expand or contract on moving the disk inward or outward by turning the screw rod. The device may thus be readily fixed in position in the pipe opening, and is removed without trouble when a pipe is to be placed in the opening.



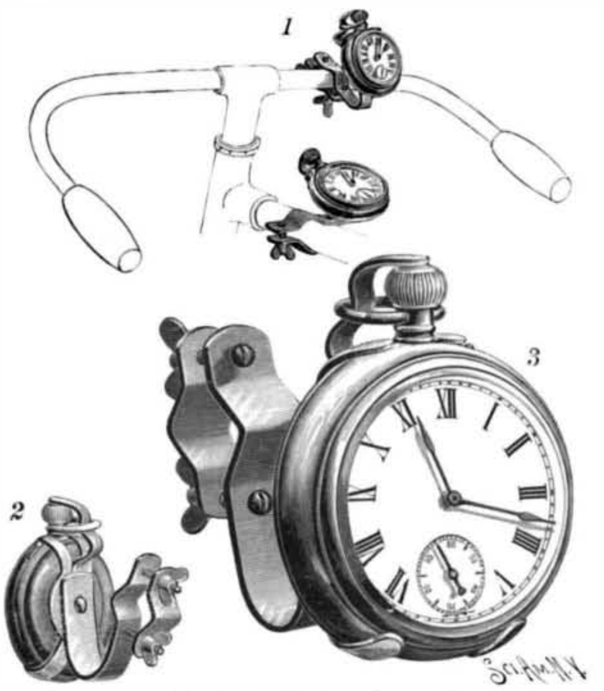
GUSTAFSON'S SAFETY FLUE THIMBLE COVER.

Ravages of Snakes and Wild Animals in India.

The number of deaths in India caused by bites of wild animals and reptiles is on the increase. The deaths from snake bites last year were 21,000, and in the same period nearly 120,000 deadly snakes were killed. Wild animals caused the death of 2,800 persons in the same year. The tigers killed nearly a thousand; leopards, 291; wolves, 175; bears, 121; and elephants, 68. On the other hand, nearly 15,000 wild beasts were killed, including nearly 1,300 tigers and more than 4,000 leopards. In addition to the loss of human life, nearly ninety thousand head of cattle were destroyed. The bounties offered by the government seem ineffectual to decrease the number of wild animals.

THE "CLIMAX" BICYCLE WATCH AND HOLDER.

Whether one is "making time" on a wheel or leisurely following where fancy may lead over new paths, the convenience of having the correct time always at hand, to be noted without the trouble of taking a watch out of the pocket, or taking the hands from the handle bars, cannot but be appreciated by all bicyclists. The improvements which have made this possible have, therefore, at once sprung into great popularity. The illustration represents a time-telling



THE "CLIMAX" BICYCLE WATCH AND HOLDER.

outfit of this kind manufactured by Messrs. Robt. H. Ingersoll & Brother, of No. 65 Cortlandt Street, New York, and which consists of an excellent low-priced watch and a simple, light and easily applied holder. The watch is without fine adjustments, heavy wheels and fine pivots, being designed to stand any amount of banging and shaking without losing or gaining a minute a day. By means of the holder it may be attached in a moment to either the frame or the handle bar, as shown in Fig. 1, Fig. 2 representing a back view and Fig. 3 a face view of the watch clamped in the holder. As will be seen, the watch is held by spring fingers, an upper finger engaged by the watch ring straddling the stem and holding the watch firmly in the clutch of the lower fingers. By releasing the ring the watch is readily removed. With a pair of pliers this holder may be fitted to any case.

AN ARTIFICIAL SPECTRUM.

That the different colors of the spectrum may be reunited so as to produce white light has been known for a long time, but the method of obtaining all the colors of the spectrum without the use of any other optical apparatus than the eye itself and its faculty of accommodation is recent and not so well known, and is worthy of notice.

According to Engineering, it was Mr. Charles E. Benham, of Colchester, England, who was the first to obtain the artificial spectrum of which physicists have, for the last five months, sought with more or less success a satisfactory explanation. Such explanation seems to have been quite recently furnished by Mr. Macfarlane Gray.

The artificial spectrum is obtained by means of a very simple device, a teetotum, a top, or any arrangement capable of communicating a rotary motion, around an axis at right angles with its plane, to a disk of white cardboard one or two inches in diameter upon which fractions of concentric circumferences have been drawn in black, one of the halves of the disk being completely black, as shown in Fig. 1. As we show in Fig. 2, this disk may also be mounted upon Newton's classical apparatus and the experiment be performed in a continuous manner. Upon giving the disk a rotary motion whose angular velocity depends upon the age, visual acuteness, and especially the faculty of accommodation of the observer, it will appear to be covered with circumferences or fractions of concentric circumferences assuming all the colors of the rainbow, very faint, but sometimes appearing with a richness of tone that depends both upon the illumination of the disk and the spectral richness of the light that it receives.

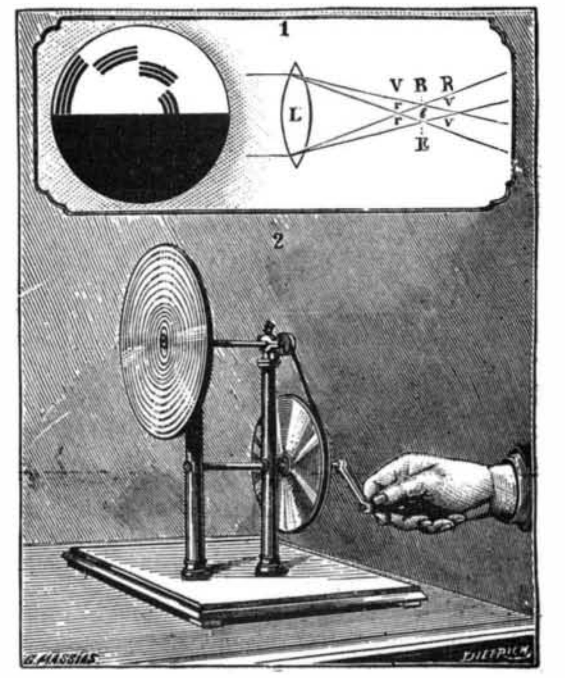
Mr. Macfarlane Gray explains the phenomenon as follows: Let L (Fig. 1) be the lens formed by the eye, the straight lines representing to an exaggerated degree (in order to facilitate the explanation) rays of different refrangibility. Let us suppose that the violet rays have their focus at V, and the red ones at R, and let us place the screen, E, at a constant distance from the lens. In order to obtain a sharp image of a violet colored object upon a black ground, it is necessary to diminish the convexity of the lens, to flatten it, so to speak, in order to bring to E the intersection of the violet rays occurring at V. Conversely, for the red rays the convexity of the lens must be increased in order to bring to E the red rays that cross each other at R.

White light may be divided into two groups of rays occupying the extremities of the visible spectrum, the red and the violet, and, supposing their refrangibility to be uniform, they will intersect each other respectively at the foci, R and V. The red and violet alone do not give white, but a combination of their respective groups does, and this suffices for the validity of the subsequent reasoning.

If the reader will please imagine that these rays are red and violet transparent screens producing white by their superposition, he will see that the screen will appear white at B, in the center of the lozenge formed by the rays. He will thus see that white light has not a definite focus like red and violet. The image of a white object upon a black ground will always extend beyond its real geometrical image to a degree equal to half the height of the lozenge at B. A white point upon a black ground will therefore occupy a wider surface upon the screen than a black point would occupy upon a white ground. This is the well known phenomenon of irradiation. When the violet is focused upon the screen, the violet objects are sharply defined without any marginal extension, but if at this instant a white point be substituted therefor, it will appear violet at the center and as if surrounded by a red aureola. In Fig. 1 the surfaces marked r are the red marginal rays and those marked v are the violet ones. The central lozenge intersected by the two groups is marked b. Here the light is white, and pure white at the center of the section. The network of lines may be assimilated to the well known toy soldiers mounted upon jointed strips of wood, but here the maneuvering is effected by a peculiar physiological action that the English call the "eye demon," but which we designate in France as the faculty of accommodation. It is this faculty that alters the convexity of the lens for producing upon the screen an image as perfect as the imperfect lens at its disposal permits.

This set forth, let us return to our top and call the two halves of the disk respectively the black half and the light half.

When the top spins, the accommodation is effected



ARTIFICIAL SPECTRUM.

FIG. 1.—Disk for obtaining the artificial spectrum, with explanatory diagram. FIG. 2.—Method of performing the experiment.

successively for the light and the black. After the black has been before the eye for a time, and this time is about a tenth of a second, seeing the rapidity of action of the accommodation, the joint of the network will be at E, the focus of the black. As the disk revolves in a direction contrary to that of the hands of a watch, the most peripheric white circular arcs will form their image with red margins resting upon the black lines and making them appear red. The accommodation acts, but with so much rapidity and energy that it exceeds the mark. After a rotation of 45 degrees, new white lines appear with yellow margins covering the black lines and making them appear yellow. After a new rotation of 45 degrees, the margins are greenish and the black lines appear green. After a rotation of 45 degrees, the margins are blue or violet and the black lines blue. The various colorations appearing upon the disk are due, as a last analysis, to the slowness or the haste of the accommodation in its endeavor to put the eye in focus at every instant. It is a semi-objective phenomenon. When the velocity of rotation of the disk is adapted to a given eye and synchronous with the speed of accommodation, the colors are well defined, but they become confused if the top spins too swiftly, the focusing not being effected quickly enough. The colors which disappear for a fatigued eye are still brilliant for a younger eye of which the accommodation is better. The apparatus, then, might, in a certain measure, let us remark by the way, play the role of an "accommodometer"

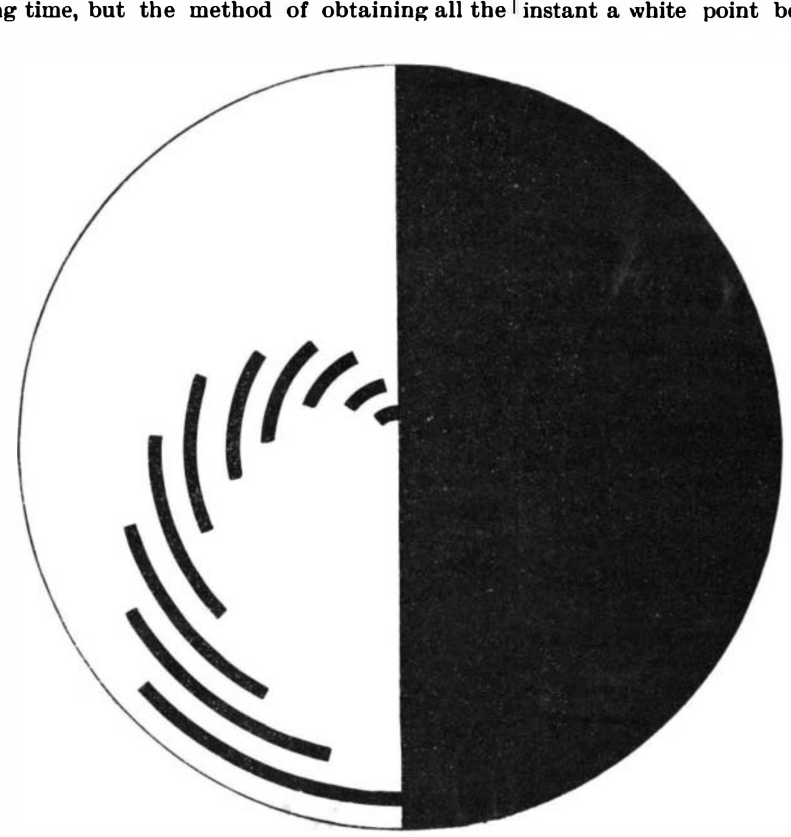


Fig. 3.

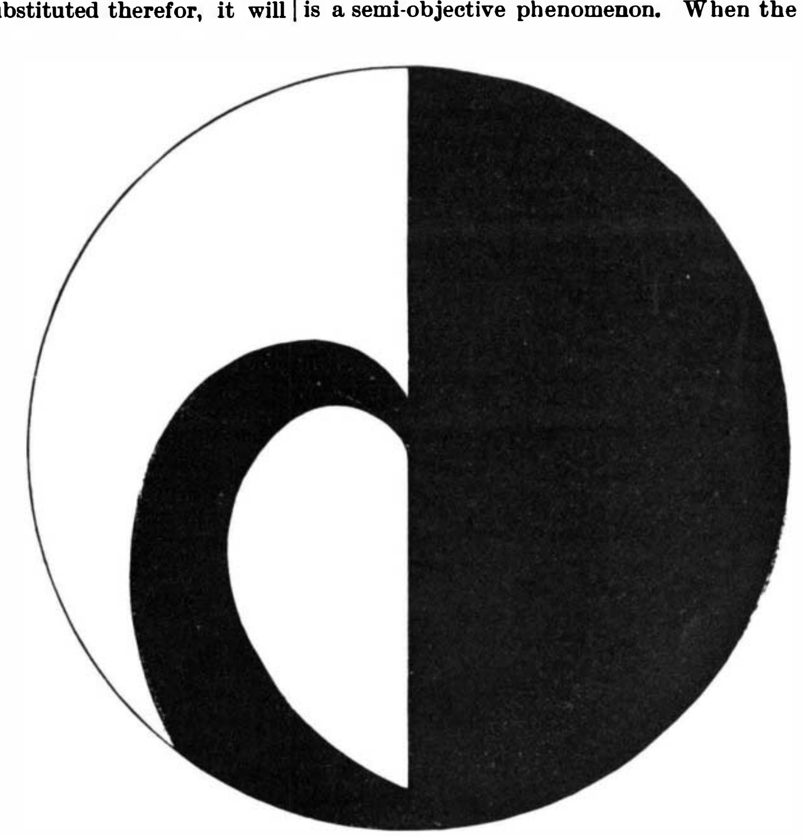


Fig. 4.

by mounting the disk upon a proper sort of tachometer, the faculty of accommodation being connected with the appearance of the colors, and, consequently, with the angular velocity of the disk.

It is for simplifying the reasoning that the diagram is drawn for two series of rays solely. The intermediate colors in the same manner produce margins of intermediate colors that give yellow and green upon the intermediate bands.

The distribution of the colors evidently changes with the direction of rotation of the disk, and the exterior edges of the lines are fringed as were the interior edges in the opposite direction of rotation. Between the black masses and the white lines the margins of the white lines are red. Between the white masses and the white lines the margins of the latter are violet.

Such is the theory of the phenomenon as given by Mr. Gray. It does not, perhaps, present that degree of clearness and precision to which we are accustomed in the study of optics. The field remains open to investigators for varying the experiments and completing this first exposé.

We take the foregoing from La Nature, and subjoin two modified forms for the surface of the top, given by Mr. Charles E. Wolff, a correspondent of Engineering, who says, in a recent number of that publication:

When the top first appeared, I made an obvious modification (shown in Fig. 3) to try and obtain a more continuous spectrum. This was quite successful, as might be expected. The next step was to fill up the white lines, producing a continuous spiral band of black, as shown in Fig. 4, which gives a continuous spectrum.

Now, if we suppose the colors to be produced by a sort of chromatic irradiation of the white lines over the black, this latter form should have been a failure, which is not the case.

Instead of a top, any one may try this experiment by making diagrams like the above on cardboard and using a central pin to spin the same like a top.

Writing to Nature on the curious phenomena exhibited by the spectrum top, in which black and white markings give, when revolved, an impression of colors, Mr. Dawson Turner describes an arrangement constructed by Mr. T. J. Walls, of Edinburgh, by means of which the effects in question may be shown upon a screen to a large audience. The markings are painted on a disk of glass, placed in a projecting lantern, and revolved by a multiplying wheel. A great variety of effects are producible in this way by interposing colored glasses in the path of the beam of light. Thus, with a green glass, and in diffused gaslight, the dark marks appear mauve colored when suddenly stopped after rapid rotation, or when very slowly rotated, but become of a dark blue when the gas is turned off. On rotating the disk in the usual way, the lines upon it appear to be blue, green, and violet. With a blue glass in gaslight, the markings on the disk appear to be yellow when suddenly stopped, but a fine purple without diffused light. The colors given by the lines at a moderate rate of speed are red, gray, green, and blue. With a monochromatic red glass, the lines appear to be blue, gray, red, and dark red. The appearance of blue by red light is remarkable. Mr. Benham, the inventor of the top, thinks that the phenomena of color presented by it have nothing to do with the wave theory of light, but are purely subjective. It has been suggested that they are due to visual fatigue on the part of the observer.

The Treatment of Colds.

Now that the time of year has arrived in which extra precautions must be taken against contracting acute catarrhal inflammations of the respiratory tract, it may be well to inquire into some of the causes which lead to the production of these diseases, and the most efficient methods of treatment.

As the warm days approach, alternating as they frequently do with a brief cold spell, the habit of laying off winter clothing becomes seemingly imperative. The dust and germinating animalcules which float about in the air are active local irritants to the mucous membranes of the respiratory tract, and the two agents go hand in hand for the production of colds.

The relationship between a cold and influenza is not marked. We have been so accustomed to call every little cold "an attack of the grip" that we run great danger, therapeutically, of hitting wide of the mark. Grip is a distinct, emphatic disease, which, when one has it, he is not very apt to mistake for an ordinary cold; while if one thinks he has the grip, but is not quite certain of it, the malady is pretty sure to be the ordinary cold.

In the treatment of colds the danger lies not so much with the inflammatory condition itself as in the liability which arises from continued irritation or direct extension of the inflammatory conditions to lung structures. Many an incipient phthisis arises from a simple cold.

Once thoroughly inaugurated, these spring colds usually occupy about a week of time, with the aid of the various remedies employed. The dangers are that we overcrowd remedies without regard to the pathological conditions presented. We must bear in mind that the system must become accustomed to a new condition of affairs, and that great prudence is necessary in exposing one's self to outdoor temperature without sufficient protection.

It is possible in the early stage of a cold, especially when such is of the nasal variety, by thoroughly irrigating the nose twice a day with warm water in which a little borax has been placed, to abort an attack. No syringe is necessary; but by simply immersing the nose in a basin of water, and making forcible inspiratory and expiratory movements, holding the breath at the epiglottis, the nasal passages may be thoroughly irrigated. Of course there are advantages in the syringe, which may be preferable from the standpoint of neatness.

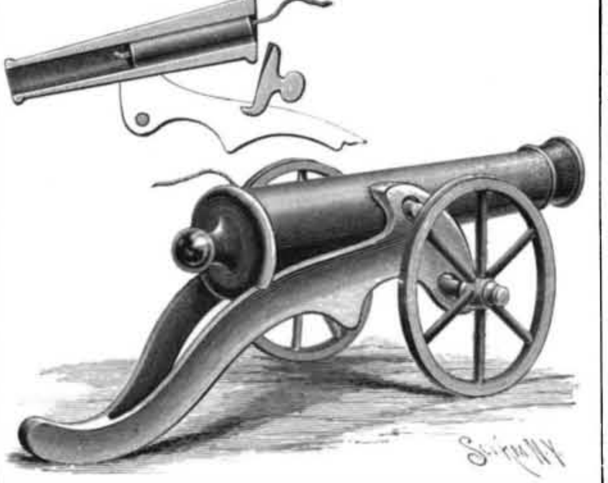
Aconite holds an excellent place in aborting colds, but care must be taken in its employment that fresh colds are not contracted. The dose usually employed should be a drop an hour, or half hour, as the severity of the case requires, which should be maintained until free perspiration results.

Quinine may also be employed, as well as the coal tar derivatives, but these are not as efficient as a well directed course of treatment by aconite.—Times and Register.

A CANNON TO BE LOADED WITH FIRE CRACKERS.

The illustration represents a breech-loading toy cannon in which a fire cracker is used for the load, the fuse or stem of the cracker being carried upward in a channel of the breech block for lighting, to explode the charge. The improvement has been patented by Mr. Milton J. Shimer, of Freemansburg, Pa. The cheeks of the carriage stock are curved inwardly, and have slots which receive the trunnions of the cannon.

At the rear of the cheek extensions a breech block is formed which may be integral with the carriage or at-



SHIMER'S TOY CANNON.

tached to it in any suitable manner. The cannon may be inclined to carry its breech upward to facilitate loading, as shown in the small view, but without being disconnected from the carriage, as the muzzle cannot be carried sufficiently downward and rearward to admit of the trunnions being displaced from their bearings.

An Inconsistent Policy.

The short-sighted and inconsistent policy which seeks to close to young men all entrance to the trades, and at the same time allows, without protest, the great influx of foreign workmen, needs little comment. It is intrinsically selfish and unnatural, and being such cannot long continue. The trade school has come to stay. It has come in answer to a great need, and must develop in answer to that need. The right of American youths to enter the trades, and to equip themselves in the most economical manner for a livelihood, cannot much longer be gainsaid or set aside. What might, under other conditions, become the tyranny of a class cannot long exist beside the free institutions of our country. On the contrary, the true interests of organized labor are to be found, not in futile opposition, but in active participation. The opportunity is at hand for the labor organizations of the country to actively influence and, to a certain extent, direct the trade school movement. By co-operation with the schools they can do much to realize the highest opportunity for usefulness that is open to them. By selfish and bigoted opposition they will do much to cripple and narrow their own power. A comprehensive system of trade training suited to the times would involve the recognition of the trade school graduate by the trade organizations of the journeymen, as well as of the masters, and his establishment with a definite place and a definite economic value in the industrial world. Such a system, while effectively preventing the admission of imperfectly trained workmen, would afford ample opportunity to every naturally qualified candidate. An arrangement of this kind would open the doors of the trades to American youth, without requiring the sacrifice of all opportunity for culture that is now demanded. Such an arrangement would mean to a large extent the Americanizing of the trades—it would mean the addition to our industrial army of young men who have had the opportunity of a good public school education, and who are fitted to assume the duties of citizenship with intelligence and patriotism, as well as to attain to the highest efficiency in the operation of labor.—Sanitary Plumber.

How to Fight Microbes.

A writer in the Evening Telegram very truthfully says that water, air, and sunshine are the best sanitary agents.

Within a few days the warm rays of the sun will begin their work of penetrating into the secret corners of the back yards and alleys where the snow and ice have kept in check for four or five months the disease-breeding bacilli, and the work of freeing the millions of disease microbes which have lain dormant for so long will have been fairly launched.

Water and air are the greatest sanitary agents. The germs of many of the worst diseases are conveyed in drinking water, and it, therefore, becomes a duty to use pure water only. Fresh air is something we all may obtain without money and without price. Sunshine is easy to obtain under most circumstances. There is nothing which will kill disease germs so quickly as the application of fresh air and the rays of the sun. Although the germs of most diseases may be frozen solid during the winter, without resulting in their destruction, hot water will kill them under ordinary circumstances.

Water can be rendered perfectly pure and safe by boiling and filtering. It is dangerous to drink water which has stood overnight in a closed room, especially in a room which has been occupied by persons or other living animals. Not only should the body be bathed systematically, but every nook and corner of the house, of the cellar, and the door yard should be closely scrutinized at this time of the year, and every particle of dirt of whatever character removed. It is impossible to tell how many microbes of disease may be lurking in a handful of dirt found in the corner of the woodshed or in the cellar or under the disappearing ice and snow in the yard.

Disinfectants should be used freely in all suspicious places, but even the best disinfectants will not purify the air without the aid of the sunshine, wherever it is possible to give the latter access. Copperas is a good and cheap disinfectant for many purposes. It is easy to obtain, and readily dissolves in warm or cold water. It should be used in the proportion of two pounds to the pailful of water.

Chloride of zinc is superior to copperas as a disinfectant, but is more expensive, and therefore not so available when large quantities are required. The proportion is half a pound to the gallon. This is a very effective solution to use in kitchen sinks, house drains, etc.; also in vessels used about the sick room. Corrosive sublimate in a solution consisting of one part of the salt to a thousand parts of water is one of the most effective disinfectants known. It is a poison and should be handled with great care. Quicklime and chloride of lime are valuable to scatter around wet places, under buildings, in stables, etc. A solution of sulphate of zinc, one pound; carbolic acid, two ounces; and water, four gallons, answers every purpose for washing soiled clothing taken from a sick room. After washing the bed linen and other clothing in this a thorough boiling will destroy all disease germs.

Fumigation will reach every corner where germs of disease are apt to lurk. The best thing to burn for this purpose, as well as the cheapest, is sulphur. But fumigation is not worth much unless all the windows, fireplaces, flues, keyholes, doors, and other openings are securely closed by having strips of paper pasted over them.

How to Find the Horse Power Expended in Climbing a Hill With a Bicycle.

An experiment which may be performed by any one riding a bicycle is the determination of the horse power of the rider, by a simple calculation after the ascent of a hill. The mechanical equivalent of a horse power, being 33,000 pounds raised through a distance of one foot in one minute, may be directly applied to a machine and its rider. The only requirements besides a man and wheel are a stop watch and a steep, smooth hill of known altitude. The hill should be steep enough to prevent one from ascending with any great velocity, and thus have the wind resistance vitiate the result. The weight in pounds of machine and rider being almost always known and the time readily taken, the altitude of the hill can be found by a level and staff. It will be seen that the length of the hill does not matter, so long as the incline is steep enough to prevent fast riding when the whole energy of the man is expended in propelling him up the grade. The figures found, when compared with the ones above, give the horse power in a pretty accurate way.

N. Monroe Hopkins.

THE MARINE GASOLINE ENGINE AND GAS ENGINE BOAT.

The gasoline gas engine, both from a theoretical and practical standpoint, is the most efficient of prime motors. This is particularly true of the "Union" and "Pacific" engines, built by the Globe Gas Engine Company, for the reason that in their engines the hot gases of the exhaust, usually wasted, are used to heat the air drawn through the vaporizer and into the cylinder. As heat is the essence of the power, the smaller the amount that is wasted, the greater the economy.

In the operation of the gas engine, as compared with the steam engine, there is an additional economy involved in the fact that no fuel is used except when running, and, while running, the expense for fuel is in proportion to the work the engine is doing.

We have already had occasion to describe and illustrate gas and gasoline engines of the Globe Gas Engine Company, of Philadelphia. Our present article is devoted to a special department of their business, a department which is of growing importance—gas engine boats—of which this company and its Western connection, the Union Gas Engine Company, of San Francisco, have constructed a great many, which are operated with perfect satisfaction to their owners on the waters of the two American seaboards. Our illustrations show different types of these boats, and also give views of two sizes of the engines. The latter are gasoline engines of the compression type, but which possess several very distinctive features, some of which we can only allude to. Thus, much of their success is due to the atomizer, by which the gasoline is finely divided and mixed with the air previous to ignition.

Another important feature is the igniting device. For this purpose an electric spark is used, produced by breaking an electric circuit containing a spark coil. The current is supplied by a few salammoniac cells. The spark is produced in the interior of the engine, so that no external flame or spark appears.

The usual mode of producing the ignition in a gas engine has been to employ either an open flame which, at the proper time, was drawn into the engine cylinder, or a tube heated by an external flame or blow pipe has been employed for the purpose. Both of these methods involved the employment of a constantly exposed flame. For marine purposes, the absence of any flame whatever is certainly an important feature. The external heat of the combustion tube is also a perpetual annoyance, as the tube burns out after a comparatively short period of running.

For marine purposes, the engines supplied may be of the single cylinder or double cylinder type. They are usually placed in the center of the boat, resting on a solid bed, and from them the propeller shaft runs aft. Forward, in the bow, is a gasoline tank. Immediately aft of the engine is a lever, by means of which the motion of the propeller can be reversed, the engine, like all gas engines, rotating always in the same direction. The reversing gear operates without shock. For the marine engines a twofold governing device is applied. This cuts off or readmits the gasoline as required by the circumstances, so as to regulate the motive power, while it also, by opening or closing the exhaust valve, operates to prevent wasteful cushioning. The air applied to the combustion is automatically heated by the exhaust. This heating effects considerable economy and comes into operation after the engine has made a few revolutions.

Returning now to the complete boat with its engine, it will be seen that we have illustrated different examples. Fig. 1 shows a small type of vessel without any cabin, in which can be clearly seen the general disposition of the interior. Fig. 2 is an interesting example, being the police patrol boat used on the Schuylkill River, Philadelphia, as it flows by Fairmount Park. The boat is thirty and a half feet long, six and a half feet wide and is driven by a Union gas engine of ten and a half indicated horse power. This little vessel can develop a speed of ten miles an hour, and ran 10,000 miles in one season without any repairs. One and a quarter gallons of gasoline per hour are sufficient to drive it.

Fig. 4 is a Western boat built for use on the Pacific coast. It is a flat bottom stern wheeler, 40 feet long, 10 feet wide and has a Union engine. The boat attains a speed of very nearly ten miles an hour. No belts are used in transmitting the power to the wheel.

Fig. 5 shows the launch Canvas Back, the property of Mr. A. N. Stanton, of Bridgeport, Conn., which has been used among the Norwalk Islands on Long Island Sound. Originally it was a steam launch. The owner then put in another form of engine, but not being satisfied, changed to the Globe Company's Union engine, and since then has had perfect satisfaction. The boat is 42 feet long, 9 feet beam and with an engine of 25 indicated horse power can make nine and a half to ten miles per hour.

Our illustration of the engines represents views of the double and single cylinder "Union" engines, which show the train of reversing gears and the general disposition of parts. Below nine horse power the marine engines are single cylinder, while the double cylinders range from nine to seventy-five horse power. The larger engine shown is 75 indicated horse power, built for the Kimball Lumber Company, and is in a lumber vessel 105 feet long, 22 feet beam, and is the largest gasoline marine engine in America.

One very valuable feature in connection with their use on board of boats is their governor. This operates to prevent racing, should the screw by any motion of the boat be thrown out of water. It is believed that in the production of an absolutely fireless power-propelled boat an important advance has been made, the "Union" gas engine being absolutely non-explosive, and in its operation having no possibility of setting a boat on fire.

Irrigation by Wind.

It is interesting to observe the progressive development of an original crude invention, and to study the added improvements which have led to its increased usefulness.

The bicycle is a convenient instance of the development of a crude idea, because its origin and its improvement are modern, and also because improvements in its construction are yet being made so rapidly that the bicycle of two years ago, or even of one year ago, seems antiquated compared with the bicycle of to-day, and it seems yet capable of improvements which may lead to startling results.

In 1816, in France, the bicycle may be said to have been born. It consisted of two wheels of equal size, one before the other, connected by a bar on which was a seat. The rider propelled himself by pushing on the ground with his toes. Apparently this was an unpromising invention, but it contained the germ of the idea which has made possible a bicycle on which 413 miles have been traversed within twenty-four hours, and on which messages have been carried from Chicago to New York, over 1,000 miles, in one hundred and eight hours.

In 1862, forty-six years after the first crude invention, the pedal, or the wrench axle, or the crank applied to a bicycle, was patented in this country, and not until then did the bicycle appear to have a promising future. Expert artisans experimented with it in all possible ways. Many improvements were made; only the fittest survived. The hand propeller, the foot propeller, the unicycle, the bicycle, the tricycle, the ice cycle, the celeripede, the velocipede, and all possible forms were tested and were accepted or were rejected, and the first crude construction has been so much improved that the original inventor, if he were now living, would be amazed to see the possibilities which were latent in his crude invention. Such rapid and effective improvement in construction would not have been possible in any other age. It was made possible by the improvements which have also been made in other arts, and the facilities which now exist for the rapid development of other crude inventions are much greater now than ever before. Given a clearly defined need for a new implement, and a crude invention of the implement, there are now ready to rapidly perfect the invention expert artisans, with expensive appliances and with resources brought out by the wonderful development in other arts, such as the world never knew before.

And this brings us to our subject, "Irrigation by Wind Power in the West." There is there a vast, nearly level, plain, with not a wind break from the North Pole to the Gulf, with but little wood or coal, with considerable but not sufficient rainfall, with fertile soil and a necessity for elevating water for irrigation. Clearly, there is need there for a cheap, simple, effective invention for elevating water.

The State of Kansas has appropriated $30,000 for experiments in irrigation. Everywhere in Western Kansas may be seen windmills of primitive form, horizontal, vertical, or vertical geared. Holland has 12,000 windmills, which average eight horse power, used to drain the polders. The States of the plains will soon apparently have more than that number used to irrigate the prairies. Steam pumps, gas engines, hydraulic rams, and pumps driven by animal power, and all of the known devices for elevating water are now finding experimental tests in Kansas. It is probable that valuable data in regard to comparative cost and efficiency of these different motors will be obtained from these experimental tests.

The work of elevating water for irrigation is very old. Singularly, arid countries in ancient and in modern times have sustained dense populations. It might naturally be supposed that methods for elevating water having been used so long would now be little susceptible of improvement. It is, however, quite possible that an improvement is possible in this age which would not have been possible in other ages, or likely in other countries than the States of the plains.

A crude invention, which is called the "Jumbo" wind engine, appeared in Western Kansas about ten years ago, and is now coming into extensive use; its ease of construction, economy in cost, capacity, in power and simplicity, seem to recommend it to those who observe its work. It resembles the paddlewheel of a stern-wheel boat, with a shaft 12 or 14 feet long, with a diameter of 12 or 16 feet, with six or eight radial arms. The lower half of this horizontal wheel is shielded from the wind, so that the air acts only upon the upper vanes. A crank upon one end of the shaft connects with a pump. Its power can be indefinitely increased at any time by increasing its length, which can be done by any one who is handy with tools. It is said that a "Jumbo" giving 100 horse power in a 15 mile wind can be put up at cost of $500. The wind acts upon this sort of paddlewheel from all points of the compass except two. It seems to require no "governor," but simply pumps more during a storm. No tower is required, and it is placed so that the radial arms will be clear of the ground. In fact, in Kansas, where there are few trees and no hills, it is claimed that the wind currents have greater force at the surface than high in air.

Perhaps in this crude device for raising water for irrigation in a wind-swept country there is the germ of an idea which, when fully developed and perfected, may become widely useful. If so, it will be quickly improved, for it is watched by many eager and anxious eyes, and now the development of an implement requires days where formerly centuries were needed. The crude "Jumbo" of to-day may become the perfected irrigating machine of to-morrow in level and treeless sections of country.

One of these wind wheels, now running in Kansas, is 21 feet in diameter, 27 feet long, with eight fans. The largest water wheel in the world is an overshot wheel in the Isle of Man, and is 72 feet 6 inches in diameter, 6 feet in breadth, with a crank stroke of 10 feet. It gives 200 horse power. There may be many wind power Ferris wheels in the States of the plains, bringing fertility where is aridity.

Even in Louisiana, where there is a semi-tropical rainfall, the average exceeding 60 inches, it is found that the crops frequently suffer from drought, notwithstanding the heavy occasional rains and the proximity of all the lands to an unlimited supply of water. Irrigation will remedy all this, and with falling prices and greater necessity, irrigation will come to be adopted in those States where, while not as essential as in the States of the plains, it will be wondrously beneficial in maintaining the necessary supply of moisture for the growing plants, which under the semi-tropical skies now so frequently suffer.

The capacity of Western Louisiana and Eastern Texas for rice production is practically unlimited, provided the water supply there constantly present, but some 20 or 25 feet below the level of the prairies, be economically raised to the surface. Perhaps irrigation by wind may solve the problem in the South as well as in the West.—La. Planter.

The Perception of Colors in Colored Light.

Experimenting on the perception of colors by light of various tints, Herr H. W. Vogel has found some very interesting results, which have been communicated to the Berlin Physical Society. Using oil lamps provided with pure red, green and blue shutters, Herr Vogel observed that, when white light was rigorously excluded, all sense of the color of objects disappeared from the perception of the observers, who could distinguish nothing but shades of black and white upon the illuminated objects. It was further noted that a scale of colors illuminated by red light showed the red pigments as white or gray, which abruptly changed into yellow —not red—upon adding blue light. Hence a color appeared which was not contained in either of the sources of illumination. Red and yellow patches appeared to be of the same color, so that they could hardly be distinguished from one another; but the difference at once appeared upon the addition of green instead of blue light. The kind of sensation experienced also depends very much upon the intensity of the illumination, as is easily seen in and about the region of the spectrum near the G line of Fraunhofer. This region appears violet when of low luminosity; blue when it is stronger; and may even appear of a bluish-white with strong sunlight. So that the often-made assertion that with normal eyes a definite color sensation corresponds with a definite wave length is not tenable. Herr Vogel arrives at the conclusion that our judgment of the color of a pigment is guided by our perception of the absence of certain constituents. Thus a red tint is only recognized as such when light of other colors is used, and we perceive its inability to reflect these. The observations bear directly upon some phenomena of photography and photometry.

New Process of Extracting Gold.

A new process of extracting gold from auriferous ores has been devised by Mr. C. Lorsen, and is described in the Technical World. He electrolyzes a solution of bromide of potassium, and thereby obtains an alkaline solution which contains hypobromide and bromate, which is capable of dissolving gold. The ore is treated with an excess of this solution by rotating cylinders. The solution is then filtered, the gold precipitated by passage over a mixture of iron and coal, and the solution, which now contains bromide of potassium mainly, is once more electrolyzed, and again used for extraction.

A POWER PUMP WITH VARIABLE CAPACITY.

More than one objection can be urged against the usual way of regulating the capacity of a power pump by starting and stopping. There is always a certain amount of wear and tear in starting machinery of any kind, and in a pump the action of air and water are both to be considered, in addition to the purely mechanical features. A pump in good working order, doing its work properly, is apt to continue to work well; whereas if it had to be often started and stopped, the case might be different.

A power pump, the capacity of which can be regulated with the greatest nicety, has been patented by Mr. F. L. Stone, of Brockton, Mass. In this pump, front and rear views of which are shown in the illustrations, the crank disk is provided with a radially slotted wing to which the base of the crank pin is fitted. A screw supported in bearings in the slideway fits a threaded opening in the crank pin block. One end of the screw is provided with a spur wheel, which is engaged by a spur wheel on a shaft journaled in the crank disk parallel with the screw. The inner end of the shaft is provided with a bevel wheel, which is engaged on diametrically opposite sides by bevel wheels placed respectively on a central spindle and a sleeve passing through the tubular crank shaft of the pump. The outer end of the sleeve is furnished with a hand wheel, and the outer end of the spindle which projects beyond the sleeve is also furnished with a hand wheel. By means of these hand wheels either of the central bevel wheels may be turned.

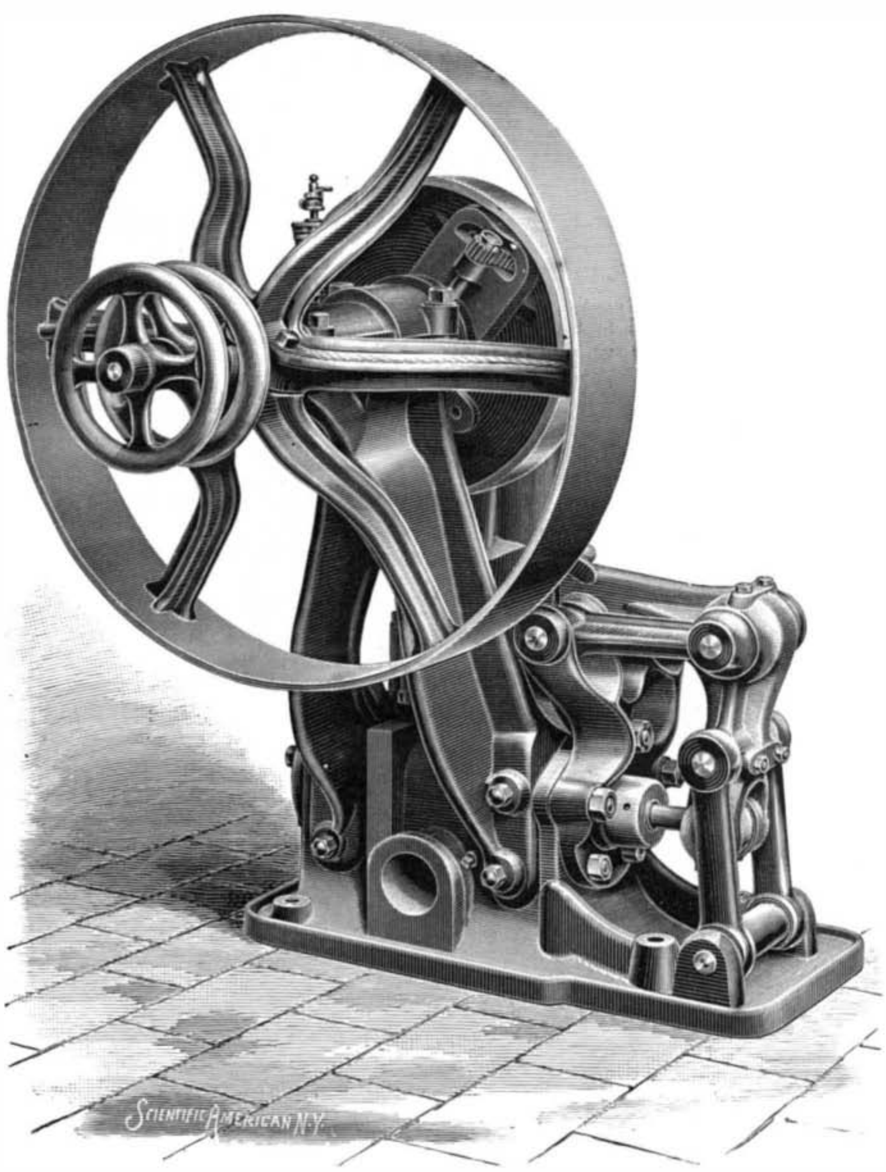
When it is desired to change the stroke of the pump, the screw in the slideway is made to turn in one direction by revolving the inner hand wheel, thus moving the crank pin in one direction, lengthening the stroke; by turning the outer wheel the crank pin is moved in the opposite direction, shortening the stroke of the pump. By increasing or decreasing the stroke of the pump its capacity may be regulated, and this may be easily accomplished while the pump is in operation.

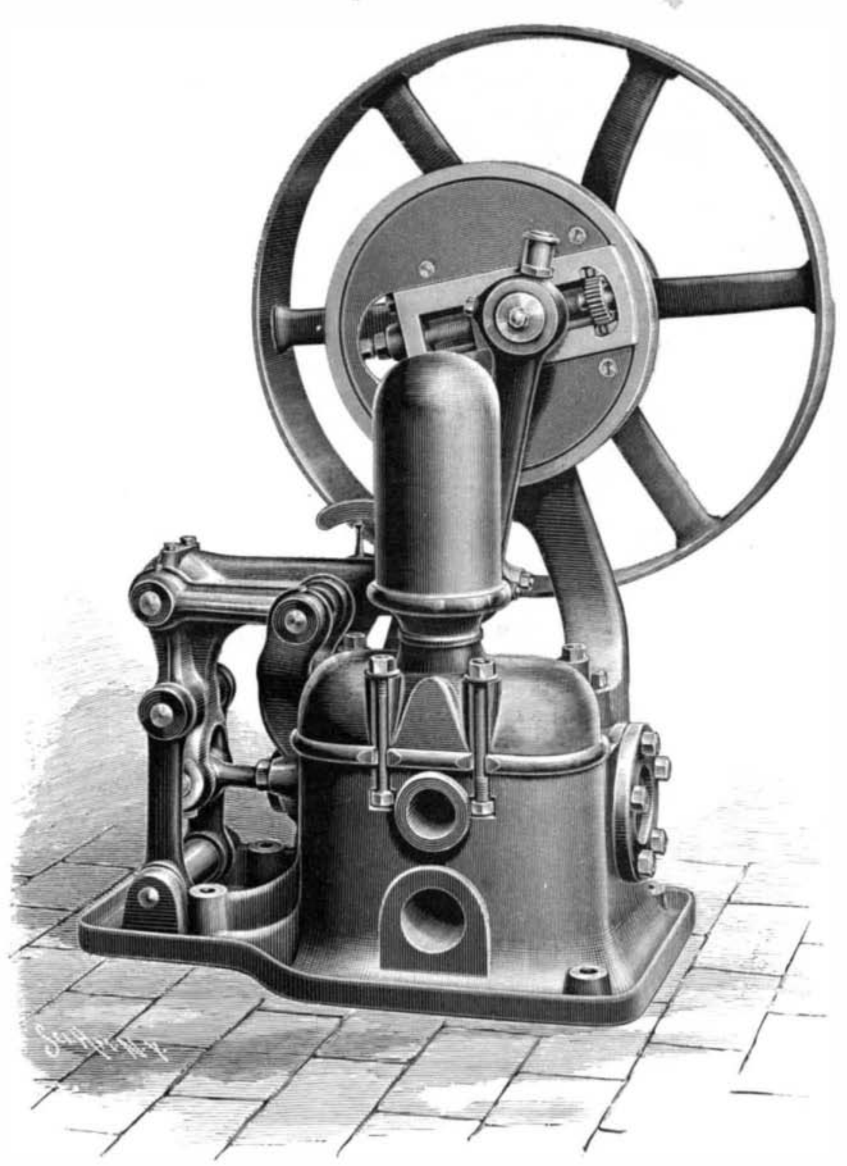
By means of this construction the pump is made to throw much or little water, according to the requirements. When the adjustment is effected while the machine is in motion, it is only necessary to hold one or the other of the hand wheels, allowing the adjustment to be accomplished by the rotation of the crank disk.

In addition to the stroke-adjusting mechanism of the pump, a new parallel motion is provided, which obviates the necessity of ways and long connecting rods, and insures a direct pull on the piston rod of the pump. The parallel motion consists of a right-angled lever mounted on links pivoted to an arm projecting upwardly from the pump cylinder. The shorter arm of the right-angled lever is pivoted to links swinging in bearings attached to the base. This arrangement for communicating motion from the crank pin to the piston rod renders the pump very compact, and, at the same time, avoids friction, thus saving power.

This pump is being introduced by Mr. Frank F. Phinney, Box 1181, Boston, Mass.

A series of tests with this pump have been conducted at the Worcester Polytechnic Institute, the results of which are said to have been very satisfactory.





STONE'S POWER PUMP, WITH VARIABLE CAPACITY.

Tools on Locomotives.

Mr. H. D. Lynch, storekeeper, Providence division N. Y., N. H. and Hartford Railroad, writes as follows to the Railroad Gazette:

The recent topical discussion at the New York Railroad Club on the question of locomotive tools developed nothing precisely in a line with what we are doing here. As I have had considerable experience on a locomotive, I have had pretty good opportunities to judge of the condition of locomotive equipment when left wholly in the care of the engineman, and think our practice may be of interest.

The efficiency of a locomotive, upon the road, is greatly enhanced by having a complete set of the requisite tools, in good condition. To attain this end, with the least possible expense, our people at this point have deemed it necessary that the engineman of every locomotive, immediately upon arrival at the engine house, must deliver the following articles, in good condition and carefully wiped, at the storeroom:

One red signal lantern, six fusees and eight torpedoes attached, one red lantern, one white lantern, one engine oil (stock) can, one valve oil can, one screw wrench, eighteen inches, one screw wrench, twelve inches, one box train numbers, one hand hammer, one hand chisel, one set screw wrench, one pail (tools and box of numbers in pail).

Engineman of departing locomotive, thirty minutes previous to departure, will upon presentation of check, showing amount of oil required, be furnished with a set of equipment, in good condition; he being held personally responsible for the safe return of the same. Any oil returned in the cans is credited to the locomotive from which it came.

Locomotives in service the entire twenty-four hours must exchange equipment when they draw oil.

At outside engine houses, where two or more locomotives are housed overnight, sets are left in a secure place under the watchman's care.

We find it the only method that insures a set of equipment, in serviceable condition, on every locomotive that leaves the house; and it is an efficient check on the issues, as we are enabled to locate the losses and breakages to a man, and with a saving of forty per cent in signal oil.

Constant exchanging of equipment insures each lantern being lighted two or three times each week. One day each month the contents of all red lanterns are emptied into the tank. The lanterns are then filled with fresh oil.

We have not had occasion to issue a new lantern, hammer, chisel, engine or valve oil can for the past four months, as daily inspection throws defective articles out for repairs.

Train numbers for headlights were a constant source of annoyance and expense—whenever a locomotive was placed on a strange train, the numbers of that train could not be found. The men had been in the habit of keeping them in divers places, from the headlight to the back end of the tank. We now have a complete set, well painted, in a box, on each locomotive.

Our issues of new coal scoops are confined to heavy, fast passenger and freight locomotives. After a scoop has had three inches worn from the blade we trim it up and issue to surburban and switching locomotives.

When a locomotive comes into the shop for general repairs, everything in the shape of tools is taken off, sharpened and repaired at the expense of the locomotive from which it came and delivered to the storekeeper to be put into stock. When a locomotive leaves the shop she is furnished with a set of tools, in good condition, with movable parts well greased, in which condition they remain for a longer time than one would expect. Any request for an article must be accompanied with the old article or such information as will enable the storekeeper to recover the same.

Paramount in the care of a locomotive should come that of her danger signals. Who among your readers that has served on the "foot-board" but can recall instances, when running light, when the only protection for the rear was that of the light from the open firebox door. Six and eight times we have had to trim lights in going fifty miles. One night in particular that comes to my mind we had been detailed to bring a disabled locomotive to the shop and she broke down on the way. Our third man, a wiper, went back with the red light, the only signal we had excepting the torch. He had been out about ten minutes when we, under the locomotive, heard him up in the cab. He had come in to fix the light, it having gone out.

MRS. MARY BROWN, one of the last remaining pensioners of the war of independence, died near Knoxville, Tenn., April 15, at the age of 91. In 1824 she married Joe Brown, a soldier of the revolutionary war, he being then 65 years old and she but 20. She was in Knoxville, March 12, to draw her pension of $12 a month, and though feeble seemed able to last many years.

THE LAYMAN PNEUMATIC SPORTING AND OUTING BOAT.

The old time Celtic coracle, with wicker framework and covering of hide, has its modern successor in the Layman pneumatic boat, a wonderfully ingenious and successful craft which is acquiring wide popularity among sportsmen and those fond of aquatic sports, as well as with ladies and children for use on the seashore. The sportsman who desires to kill can find no better ally than this noiselessly propelled craft, while those who spend the summer on the seashore or by lake and river side can have endless pleasure in floating bubble-like on the breakers or in exploring the inmost recesses of lake and "unknown river."

THE LAYMAN BOAT USED IN DUCK SHOOTING.

The Layman boat resembles in contour a horse collar. It is made of India rubber cloth. The irregular ellipse determined by the sides has as bottom a strong sheet of the same cloth, from whose forward portion two boots or leg cases depend. The bottom of the boots are provided with collapsing paddles, which open on the back stroke and close on the forward stroke, as does a duck's foot. The small end of the oval is the bow. A stiff rudder strapped in one position is attached to the stern. The office of this is to keep the bow in front—it is not used for steering.

For its shape the boat depends upon inflation with air. The oval sides represent two tubes, the lower one of large cross section, the upper one of smaller. The lower one is divided by cross partitions into three compartments; the entire upper tube forms a fourth compartment. To prepare the boat for use, the sides are inflated with air. This is best forced in with a blower, five minutes sufficing to inflate it. It can be inflated in three minutes by the lungs alone. When inflated, it at once stiffens up, as the sides take their characteristic oval shape, forming virtually a frame. As they distend, they bring the floor to a level, and the boat is ready for use.

Putting the feet into the cases and holding the boat up by hand loops, the boatman walks down the shore, and as the body of the boat takes the water the launch is made. By sitting comfortably on the bottom of the boat and paddling with the feet, a progress of two or three miles an hour can be made in any direction. Several people can crowd into the same boat, 400 pounds being the capacity of the large sized one. Loops are provided for awning stanchions, to give the last requirement for comfort. It will be seen that for the duck hunter it presents several advantages. It admits of a most effectual blind being used, one of which is shown in one of the cuts. The propulsion is done entirely with the feet, so that both hands are free for the gun. Its noiseless working gives every chance of approaching closely to the ducks. Places hitherto inaccessible can be reached by its means, and game can be secured which otherwise would escape.

One of the cuts illustrates a passage through Hell Gate, East River, New York, which was made without difficulty by a party including a lady. The experience is described as delightful, the waves of the steamers adding to the excitement. No water was shipped, the boats proving perfectly dry and seaworthy. An interesting modification is shown in one of the cuts in the wading pants, made on the general lines of the boat. These are heavy Mackintosh pants, attached to whose waist portion is the pneumatic boat. When deflated the wearer is prepared to wade about or walk on land. If deep water is to be entered, a few minutes of preparation inflates his boat and he is ready for work afloat. A strap which is secured beneath the knees gives the proper position for boat work.

FAMILY PARTY IN LAYMAN BOATS IN NARRAGANSETT BAY.

PASSAGE OF HELL GATE, EAST RIVER, N. Y., IN THE LAYMAN BOAT.

The fishing scene on Narragansett Bay is reproduced from a photograph from life, showing the inventor and family enjoying themselves à la Isaac Walton, near Bristol, R. I.

The cuts show the capabilities of the novel craft. It makes the user thoroughly amphibious. When afloat, a considerable load can be transported, as many as three children with an adult finding room in it. In the cut showing the use of the blind by duck shooters is also clearly shown the standing and sitting positions of the occupants. The boat, when deflated, is stowed away in a small valise, as shown in the same illustration. As regards weight, the boats vary from fifteen to twenty pounds. Owing to their compactness when deflated, they form an admirable tender for small yachts, and afford an effectual life preserver for use in cases of accident. Experiments have shown its absolute safety. Three of the compartments may be punctured and the fourth one will keep it afloat. A complete repairing outfit accompanies it in case any accident should happen. Owing to the strength of the fabric it is rarely torn.

We are indebted to Mr. H. D. Layman, of the International Pneumatic Boat Company, 851 Broadway, New York, for courtesies extended to our editor and artist in the preparation of the article and engravings.

How to Copy Engravings.

Many workers find a great difficulty in successfully copying engravings, so as to reduce the prominence of the lines and cross hatchings. These, when magnified by the lantern, spoil the picture. But it is possible to tone them down in such a way that they will not be objectionable. There are several methods of doing this. The best one is very easy to manage, so as to effectually break up those lines which appear so prominent in skies and foreground. Cover the engraving which is to be copied with a thin and finely ground piece of glass, the polished side downward. This glass must be exceptionally clean, and to insure this it should be brushed over with ammonia or nitric acid, afterward well water-washed. When the glass is in position it will be seen that the engraving, viewed through the glass, has the appearance of a pencil drawing. No lines are visible, but a general softness has taken their place. Of course it would be perfectly useless to photograph the print in this condition. To restore vigor to the important parts of the picture, go over the ground glass surface with a brush dipped in oil, painting, as it were, every portion except the sky and the immediate foreground, where the objectionable lines usually are to be seen. This operation will give the desired blackness, thus rendering the print capable of producing a first-class negative. If this method be adopted, the result will prove most satisfactory, for it will be impossible to distinguish the obnoxious lines.—Photography.

For Transparencies.

For lantern slides or transparencies, which yields tones of a peculiarly pretty warm black, varying with the particular plate used, but always of an agreeable kind:

Pyro	3 grains
Sodium sulphite	12 "
Bromide of ammonium	3 "
Carbonate "	6 "
Caustic potash	5 "
Water	1 ounce.

Electric Cars as Life Savers.

Strange as it may seem, a Brooklyn newspaper has printed a communication which proves that more lives have been saved by electric cars in that city than have been destroyed, and in comparison with the former the proportion of the latter is so small that it is insignificant. D. J. Lapley, a citizen of Brooklyn, says:

"For some reason the newspapers have had a good deal to say in condemnation of the trolley car and its record of 'one hundred fatal accidents' in Brooklyn. It seems to me that the case is not sized up judicially, and that most of the blame is misplaced. Nearly every fatality of this class has resulted from contributory negligence or gross carelessness, or even from suicidal purpose. The trolley has no monopoly as a source of danger. Children who are allowed to run the streets without being properly cautioned, and grown people who, from intoxication or any other cause, tempt fate recklessly, are always liable to disaster, fatal or otherwise. A larger number of people have been drowned by falling into the water from the piers, since the advent of the electric motor, than the trolley has to its credit, yet the papers have failed to harp on the deadly dock.

"The trolley, by lessening the defilement of the streets, has so ameliorated the sanitary condition of the city atmosphere that it has saved many times the number of lives it has destroyed. It has furnished a quick and comfortable transit to the outlying wards, which has reduced the prevalence of grip and pneumonia among the suburban passengers more than one-half. Many can recall the winter cars, with their slush-soaked straw and foul odors, and the tiresome and dangerous delays in the snow, when the passengers were forced to walk in the storm, or even to assist the wretched horses by pushing. Many a man has gone down to his grave from a cold contracted on such a trip. The trolley has saved thousands of lives by enabling the mechanic and clerk to move their little ones from the unwholesome tenements of the city to the pure air and sunshine of the country. It has added, in dozens of ways, to the sum of human welfare. Why, then, does the press persistently attack a system which accomplishes so much good that it has become a great public necessity?"

Coal Consumption on Torpedo Boats.

For the following interesting particulars respecting the coal consumption of the 27 knot torpedo boat destroyers, we are indebted to a correspondent of the Glasgow Herald. He states that the cruiser built by Messrs. Thornycroft, on a three hours' run just made, maintained a speed of 27·97 knots, practically 28 knots, or for the whole time 84 nautical miles; and while running this distance burned in her three water tube boilers 17¼ tons of coal. The rate of combustion is 68 pounds of coal per square foot of grate area per hour, although in some trials it has reached 79 pounds; but then the power per square foot of grate area is very high, 24 indicated horse power. The boats of this class carry 60 tons of fuel at a pinch, and this would enable them to go at full speed for a period of over nine hours, during which they would travel fully 250 nautical miles. The coal consumption is equal to 4 hundredweight per sea mile; that is to say, during the 2 minutes 9 seconds taken to a sea mile 4 hundredweight of coal are burned. A ton of coal, therefore, takes the boat five sea miles. But it would only be on a rush that such speed would be maintained. Now, other tests have been made at about half the speed—13 knots—and here, instead of five miles, the ton of coal carried the destroyer for a distance of about 38 nautical miles, so that the total distance at 13 knots with the 60 tons of coal would be nearly 2,000 miles. This shows the great cost of doubling the speed. The coal per horse power at 13 knots was 1·61 pounds.

The Invention of the Telephone.

In a recent address Prof. Hughes says it is 30 years since his first experiments with a working telephone. In 1865 while at St. Petersburg fulfilling a contract with the Russian government for the establishment of his printing telegraph instrument upon all their important lines, he was invited by Emperor Alexander II to give a lecture before the royal family, which he did. As he wished, however, to present not only his own telegraph instrument, but all the latest novelties, Prof. Philip Reis, of Friedericksdorf, Frankfort-on-Main, sent to Russia his new telephone, with which Prof. Hughes was enabled to transmit and receive perfectly all musical sounds, and also a few spoken words, though these latter were rather uncertain; at moments a word could be clearly heard, and then from some unexplained cause no words were possible. This instrument was based, Prof. Hughes states, upon the true theory of telephony, and contained all the necessary organs to make it a practical success. Its unfortunate inventor died in 1874, almost unknown, poor and neglected, but the German government has since tried to make reparation by acknowledging his claims as the first inventor, and erecting a monument to his memory in the cemetery at Friedericksdorf.

Bessemer, the Inventor, and his Treatment by the Britishers.

The Commercial Bulletin (Boston) gives the following interesting incidents in the life of Henry Bessemer, the distinguished inventor. His treatment by Great Britain, where he was born, conducted his experiments, and finally produced one of the greatest inventions of the age, is not creditable to the country of his nativity.

The inventor of the celebrated "Bessemer process" is the most modest of men, shunning rather than courting observation. A few years since he was sometimes to be seen taking a "constitutional" in the neighborhood of his unpretentious abode at Denmark Hill, in England, but the venerable gentleman with the benevolent face, in the old-fashioned frock coat and voluminous, many-folded choker neck cloth, is now rarely seen even by his immediate neighbors.

The British public, the British government, and British manufacturers did their very best at one time to crush one of the most useful men ever born in Britain, and failed ignominiously. Sheffield laughed at him, and Woolwich gave him the official cold shoulder; but Sheffield and Woolwich would be crippled indeed at the present time were it not for "Bessemer steel." Yet, even now, although foreign potentates have showered crosses and stars upon him, the English government has not conferred upon him any honor more important than an ordinary knighthood, and this in spite of the fact that he has created one of the largest and most important industries in the world.

Some fascinating calculations, made by Sir Henry himself, prove that one year's production of Bessemer steel might be represented by a solid column sixteen and a half times the height of St. Paul's Cathedral and as thick through as an ordinary gasometer—about 100 feet.

Henry Bessemer, son of the late Mr. Anthony Bessemer, was born in Hertfordshire in the year 1813. His earlier years were devoted to art, and we find that he was an exhibitor at the Royal Academy at the age of 20. At this early age he had discovered a means by which impressions of the designs on coins, medals, and other reliefs could be reproduced in any numbers on cardboard. Some of his work in this line is still extant, and when specimens come into the market they bring high prices.

This led him indirectly to a more important invention. He discovered that the government of the time was robbed to the tune of £100,000 per annum by unscrupulous persons, who were in the habit of removing the embossed duty stamps on legal and other documents and using the same again. Young Bessemer invented the useful little contrivance by which the stamp is embossed on the paper or parchment of the document itself, and submitted it to the then chief of the stamp department at Somerset House.

The potentate in question saw the advantage of this system at a glance, and soon afterward the authorities expressed their willingness to make use of it. A pretty little story is connected with this invention. When his model was completed, Bessemer showed it to the young lady to whom he was then engaged. Her first comment upon it showed that she was well fitted to become the wife of an inventor. She said:

"Yes, I understand this; but surely, if all stamps had a date put upon them, they could not at a future time be used again without detection."

This proved a very valuable suggestion, for Bessemer soon hit upon the idea of a steel die, with a space for a movable date, and in that form his invention was adopted by the authorities. Will it be credited that he never received a solitary farthing from the government for his services or the use of his invention?

Such is, nevertheless, the fact, and when he hinted mildly at legal remedies he was told by the Solicitor to the Stamp Department that he was entitled to no compensation, inasmuch as he had presented his invention to the government gratis! This was at a time, too, when he was by no means well off, when, indeed, he lacked the necessary money to set up housekeeping with the clever young lady whose brilliant suggestion had resulted in a perfect stamping machine! He received many generous promises from various ministers, of course; but one government went out of power after another, and to this day he has never been compensated in any shape or form.

A man of vast wealth now, Sir Henry Bessemer can afford to regard the troubles of that period of his life with comparative indifference—though he has since had more ample reason to cherish a dislike for all British governments and politicians. But his disappointment in this instance taught him a very salutary lesson. When he made the great discovery of his life—that by which it is possible to convert pig iron into steel by a simple and inexpensive process—he kept his discovery a secret. To some extent it is a secret to this day. The importance of the discovery can hardly be overestimated.

Before the Bessemer process came into use steel could not be bought under £50 a ton, and its price prohibited its use in numberless departments of industry where it is now considered essential. At that time, too, only 51,000 tons of cast steel were produced in Sheffield in a year. In 1892, 33,546 tons of steel were manufactured in the world every day according to the Bessemer process, the selling price per ton averaging £8 perhaps.

Everybody knows that steel is superseding iron in all departments where toughness and durability are considerations. In the building of ships and bridges and in the making of girders for buildings, of locomotives, rails, steam boilers of all kinds, steel is now universally used. It is chiefly due to Sir Henry Bessemer that one is almost as safe on a modern ocean steamship as on land, and that the modern structure of steel is nearly as imperishable as the ancient Pyramids.

Such a discovery, it might be supposed, would be hailed with enthusiasm by those interested in the iron trade of Great Britain. Not a bit of it. Bessemer met with every possible discouragement. The steel manufacturers of Sheffield were dead against him from the first, and the government ignored him. One does not expect to find unusual enterprise in a governmental department, so it is not surprising to learn that the British Admiralty could only be induced to adopt the Bessemer steel in the building of war ships when it had been in use in building merchant ships many years. Even the engineer of the London and Northwestern Railway declined to have anything to do with Bessemer steel. Encouragement, valuable encouragment, Bessemer did receive, however, from the late Mr. Platt, M.P., head of the famous Oldham firm, who gave him £50,000 for a fifth share in his patents.

On the Continent, too, his merits were immediately recognized. Krupp, the great gun manufacturer, was one of the first to pay him royalty on his patents. The Emperor Napoleon evinced the keenest interest in his invention, and would have decorated Bessemer with the Grand Cross of the Legion of Honor if it had not been explained to him that British subjects were not allowed to receive decorations from foreign governments except by special permission. The Emperor of Austria conferred upon him a knighthood of one of the most distinguished Austrian orders, and the King of the Belgians, when he was in London, drove out to Denmark Hill to call upon him.

The British government had to follow suit in some fashion, and a knighthood was conferred upon him in 1879. In 1880 he was presented with that highly prized distinction, the freedom of the City of London, "in recognition of his valuable discoveries, which have so largely benefited the iron industries of this country, and his scientific attainments, which are so well known throughout the world."

Americans have done their best to show their respect for this great man. In Indiana there is a flourishing young town called after him.

When the gold Albert medal of the Society of Arts was presented to him at Marlborough House by the Prince of Wales himself, Bessemer humorously confessed that, though he prized such distinctions, he was no less pleased with the £1,057,748 which he made by his patents.

Bessemer recently recovered from a severe illness, and is at present, in his 83d year, busily engaged in answering the great mass of correspondence which accumulated during his illness. Doubtless a large proportion of this correspondence consists of begging letters. He is one of the most charitable men of the day, though he does not like it to be known, and many a large benefaction from him finds its way anonymously into the coffers of the hospitals and orphanages of London.

It is a characteristic of the man that he should take a particular pleasure in his invention of a machine for the manufacture of nails, for the simple reason that this invention relieves hundreds of young girls in what is known in England as the "Black Country" and Wolverhampton of the degrading toil of forging nails by hand. In filthy, reeking dens these poor young things passed their lives in "unwomanly rags," engaged in unwomanly toil. But Bessemer has altered all that.

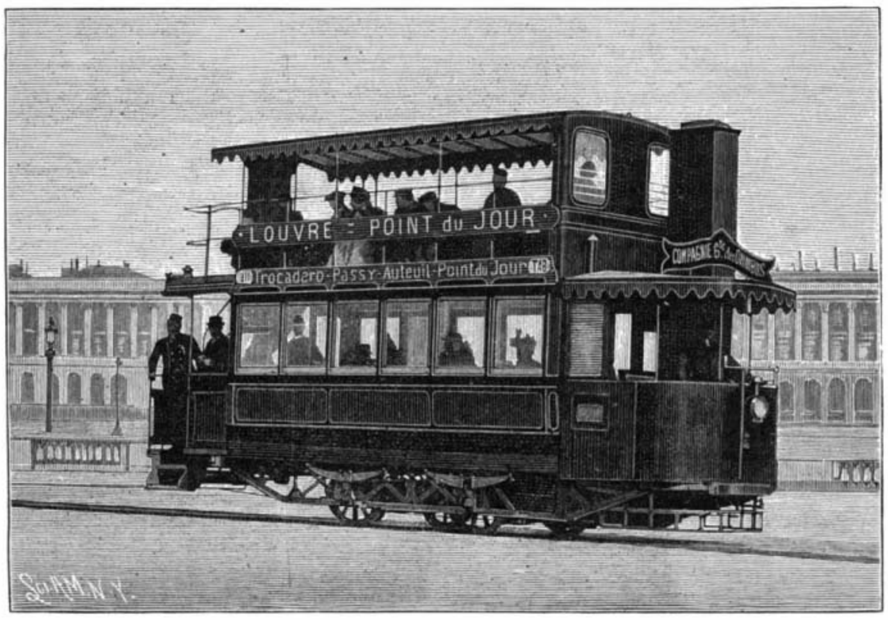
A Russian Student's Hair.

An Odessa correspondent of the London Times says: "An event has happened which has caused quite a consternation among the students attached to the university here. Prince Toumanoff, a member of an old and historical family in this country, has just received an order expelling him from the university here and directing him to leave the town within forty-eight hours. The extraordinary reason for this Draconian decree is that he declined to wear his hair short. He has been refused permission to go to St. Petersburg to present a petition, and now by his expulsion from this university he is not permitted to enter another in Russia; therefore his bright hopes and his aspirations to employ his talents for his country's benefit are wrecked and his career in Russia is ruined. The severity with which the university students in South Russia have lately been treated is viewed with dismay. Their grievances are left unredressed and petitions are useless. In these circumstances fresh disorders may be expected to break out at any time."

THE SERPOLLET AUTOMOBILE TRAMWAY IN PARIS.

In Paris, as in most large cities, it is very difficult for any corporation to get permission to build tramway lines where the motive power is other than that furnished by horses. The Serpollet system, however, is not open to the usual disadvantages of ordinary steam and cable tramways, so that the Compagnie Generale des Ommibus was allowed to equip its Madeleine-Asnieres line and its Porte Clignancourt-Bastille line with cars propelled by motors of this system. The fuel used may be coal briquettes, anthracite coal or coke. In cities coke is usually preferred. The boiler is of rather curious construction and is placed on the front platform, the long vertical tubes admitting of the heat being utilized to its full extent. The boiler really consists of two parts, the lower part composed of horizontal tubes heated directly by the fire and the upper part made of vertical tubes which are heated by the burning gases. The motive power is derived from a two-cylinder engine which is located between the two axles. Motion is transmitted to the axles by means of chains and gears, one turn of the axles being equivalent to three turns of the engine. The machinery is arranged to permit of its being run in both directions. The lubrication is automatic, so that the engine driver is not troubled with oiling during the trip. A pump is provided to automatically supply the boiler with water.

All the machinery is carefully protected from dust and mud by sheet iron cases, which are also arranged to suppress the odor of the hot grease. In winter the tramway car is heated by the exhaust steam. The car is provided with two brake systems, which are entirely independent of each other and which can be applied from either platform. Both of the cars which we illustrate are the well-known double-deck pattern and accommodate about fifty persons. The travelers do not experience any inconvenience from the heat, and the disagreeable odor of the gas is reduced to the minimum by the long chimney, which produces a powerful draught. The gases are so diluted, before they pass from the chimney, by a large body of ascending air that nearly all the odor is lost. The motion of this tramway is very easy and curves are passed with ease. The reduction of dead weight in this motor is very great, and on slopes it is possible to carry the steam pressure to 225 or 300 pounds to the square inch, so that the speed may not be diminished. We illustrate a car of the Serpollet automobile system crossing the Place de la Concorde in Paris and a car on the Porte Clignancourt-Bastille line which is adapted to carry fifty passengers and is capable of carrying a trailer car for fifty persons. For our engravings we are indebted to La Revue Technique.



STEAM CAR OF THE SERPOLLET AUTOMOBILE SYSTEM.

STEAM CAR OF THE PORTE CLIGNANCOURT-BASTILLE LINE.

Wonderful Growth of the Electric Railway in the United States.

These five years have indeed done wonders in the domain of street railroading in this country, and have even set our transatlantic friends to work following our example, says Joseph Weltzer in Scribner's for May. To give some idea of the extent to which electricity has displaced the horse, and, on the other hand, been instrumental in creating new roads, we need only cite the fact that at the present time there are over 850 electric railways in the United States, operating over 9,000 miles of track and 23,000 cars, and representing a capital investment of over $400,000,000. What stupendous figures, when we consider that in 1887 the number of such roads amounted to only 13, with scarcely 100 cars.

AT the present time the Australian aborigines are the lowest known species of humanity. They have little or no reasoning faculties, and their only idea of a higher power is through fear. They are chocolate-colored, wear little clothing, and their weapons are of wood.

Rice for Feed.

Under average circumstances rice is grown at a net cost of $1 per sack of 180 to 200 pounds. There is good demand for it at one cent a pound for feed. It is eaten greedily by all kinds of stock. There are objections to feeding rice whole, but when ground it gives excellent results. The sooner rice is adopted as the staple stock feed, the sooner will this country come into possession of the comforts of good butter, good eggs, best beef, finest pork and fat cattle, horses and mules. When these are once produced steadily there will be a market with reliable demand. It will, moreover, result in a good market for rice, as none but clean, pure rice will be offered on the market. To-day the New Orleans rice market is being crowded with rice much of which can be sold at home for feed at better prices than it will bring on the city market, from the fact that poor grades of rice are a drug on the market.

This season Southwest Louisiana will import 1,000 cars of corn and oats at over one cent a pound cash, and for no better feed than rice, which is shipped to get money to buy corn. Already, says the Jennings Times, many of our best farmers have stopped buying corn or oats, substituting rice at less cost. If all would adopt this practice, supplementing with what corn and oats can be grown on the farm, Southwest Louisiana would save at home annually $100,000 more or less for feed stuffs. Already has the importation of hay been stopped by substituting home-grown hay and rice straw. Now, let farmers and others stop importing grain feed, using rice instead. The demand for rice as feed is growing, and it is doubted by some whether there is enough rice left in this country to supply the demand. Some rice can be fed whole to at least some extent. During harvest rice is fed in the bundle with satisfactory results. Egyptian, or bull, or Japan rice can be sown on old land foul with red rice, and by cutting early all can be saved, making a large yield and excellent feed.—Westlake News.

The Modern Bicycle.

The real miracle is the machine itself, especially the wonderful strength and resistance of the wheels. It would seem absolutely impossible that a wheel thirty inches in diameter, with a wood rim and wire spokes so light that the whole structure weighs only twenty ounces, should sustain without permanent distortion the weight of four men standing on its side, with supports at four points only under the rim, and no hub support whatever. It also seems incredible that a cycle capable of carrying a man of 160 or 175 pounds in weight can be made so light that the whole structure weighs less than 9 pounds. Yet this has been done; even at the roadster weight of 22 or 24 pounds, the cycle carries a greater load with safety than has ever been put on any other vehicle.

The influence of the cycle on social life is already great, and will probably constantly extend, as it provides an outdoor sport and amusement for women which did not previously exist in any form in America. American women are not walkers, but the cycle is perhaps even better suited to woman's use than man's, and seems destined to add an out-door element to the life of woman the world over which was not possible without the "winged wheel."

Our American cycle factories are now equipped with the finest plant which can be constructed, and are fully equal to the best armories—or even superior, as they are the later construction—and the magnitude of the operations and vast numbers of workmen employed warrant any expenditure which promises to cheapen the production or improve the product. But all this was inevitable. Granted the cycle and its great use, the vast cycle factories with their magnificent equipments, marvels of ingenious tool making and wonderful methods of construction were certain to follow.

The miracle of the bicycle lies in its birth, death and resurrection; in its incredible load-bearing power in proportion to weight; in its displacement of the horse as a means of pleasure, and in the selection of its mechanical details of compressed air support, tubular framing and chain driving. All of these are details often before introduced in machines, but never before permanently retained. That these cast-offs are undeniable power savers is convincingly proved by their continued use under human muscle driving power. Finally, the one great achievement of the bicycle is to increase the human powers of locomotion so that the slow-footed man is made one of the swiftest of all running creatures. —Robt. Perkins, Engineering Magazine.

Under the Shadow of Mount Everest.

Mr. Henry Ballantine, author of "Midnight Marches Through Persia," and a more recent book on Nepal, "On India's Frontier," gives a most interesting description of his reception at the Nepal court by the Maharajah. Khatmandu, the capital of Nepal, is on the southern slope of the Himalayas, about 400 miles north of Calcutta, and almost within the shadow of Mount Everest. The traveler found the Maharajah a prince of very decided character and large intelligence, interested in a great deal that was going on in the world outside of his remote kingdom. Mr. Ballantine had with him "a copy or two" of the SCIENTIFIC AMERICAN, one number of which happened to be of the issue of July 30, 1887, containing illustrations of some fine Holstein-Friesian cattle. These the prince much admired, and wished him to have arrangements made at once to get out a few for him. The prince spoke Hindostani, but the pictures of the SCIENTIFIC AMERICAN speak a universal language, and the prince seemed very much interested in looking at all the illustrations which appeared in the papers, but the cattle picture seemed to appeal to him the most of any of them.

Our Debt to Inventors—Shall we Discourage Them?

Dr. R. H. Thurston, director of Sibley College, Cornell University, contributes to the May Forum an able and interesting article under the above title, from which we make a few abstracts:

"In a single generation, it is agreed among statisticians, the inventors have promoted the efficiency of human labor, and have diverted to the use of man such enormous amounts of Nature's energies that production has been increased fifty to seventy-five per cent more rapidly than population, and wealth has been correspondingly augmented. A day's labor produces two-thirds more in agricultural implements, or in carriages, and a half more in machinery, and eighty per cent more in boots and shoes, than in 1860. One dollar has been made capable of buying fifty per cent more of cloth, a quarter more of every kind of staple food; five men do the work of eight, and both wages and the purchasing power of the dollar have increased together. Labor can to-day produce twice as much in a given time, and secure more than twice as large a share of the product, as in the days of the origin of our patent law. In the time of Watt and Fulton, six weeks were required to cross the Atlantic, and the inventor and the mechanic and the engineer now send the steamship across in six, and will soon make the voyage in five days. They transport a ton a mile at sea with the combustion of the amount of fuel represented by a single one of the millions of letters in the modern foreign mail bags. They have reduced the cost of transporting wheat from New York to Liverpool from twelve cents a bushel to four cents, and of meat from absolute commercial impracticability to one cent a pound. They have given the world nearly a half-million miles of railroads, and transport 150,000,000,000 tons a mile each year. Without protection of the inventor's rights to his own absolute creation and brain property, we should to-day not have the aid of the fifty or seventy-five millions of horse power of the steam engines of the world and their equivalent aid—that of three or four times the working power of the whole population of the globe. . . .

"The telegraph and the telephone, those great 'monopolies' so much inveighed against at the moment, have not only presented the world with the grandest illustrations of the helpfulness of modern science in promoting commerce and the industries of production; they promote also, directly and indirectly, and in a thousand ways, the intelligence and culture of the race. Morse and his colleagues among inventors gave the world, as a contribution to education and a stimulus to moral growth, inestimable profit upon all its patrons have paid into the treasury of the telegraph companies—to be redistributed to the world. The telephone, however 'business-like' its management, is a gift from the inventor of vastly greater worth to the world than all the dividends ever declared by the telephone companies. Edison, and Thomson, and the General Electric and the Westinghouse companies, representing contributions to the world of invention and the mechanic arts, as a limited tribute, have given handsome profits to the world of users of their inventions and products. . . .

"The steam engines of James Watt, of Frederick Sickles, of George Corliss, which constitute the foundation of the whole system of modern industries, and furnish, practically, the whole sum of the mechanical power which has built up existing material civilization, were given to us by their inventors in response to the inducements held out to them by the patent law—itself the most important invention of all. . . .

"It has been universally admitted that the United States has owed to the simple and inexpensive and effective action of the patent law system, as well as to the freedom of its political institutions—the two forming units of a whole—the mighty march of its development and civilization. The blessings of the patent law have been inconceivably great.

"But a spirit diametrically opposed to the spirit in which the patent system was conceived and enacted has within a few years sprung up, and its malevolent influence has been promptly seen and felt in the tone of legislation and in the decisions of the courts. The old feeling of indebtedness and of gratitude to the inventor and to the exploiter of inventions has become tempered by criticism and by a caviling spirit, which seeks to deprive these greatest of benefactors of the race of the intellectual property which they create and the material benefits which they, in comparatively slight degree, share with the world. In many ways both legislation and the decision of the courts are curtailing their rights and depriving them of the just share, which was formerly cheerfully granted to them, of the gains made by the world through their inventions. The inventive genius and his wholly beneficent work are now too often looked upon with suspicion, jealousy, and a mean opposition, which are in strange contrast with the grateful and generous spirit which characterized every legislative and judicial act early in the century, and which pervaded the whole people of the United States from the time of Watt to the time of Corliss, of Fulton, of Stephenson, of Howe, and of Morse. . . .

"The killing of the goose that lays the golden egg is contemplated even by 'statesmen' and by the courts with complacency. They would nullify the patent system and put a summary end to this era of progress. They would terminate the period of supremacy of their country in all the industrial arts. . . .

"When the United States loses its regard for the rights and privileges that were justly and fairly accorded to inventors in our earlier life as a nation, and, instead of gratitude and generous reward, gives them grudgingly less than a fair and liberal share of the profits which they so lavishly secure for the world, a long step will have been taken toward that decadence which, historians are accustomed to assure us, inevitably, sooner or later, comes to every people. The immediate and complete repeal of every obstructive law and the inauguration of a new period of good-will and generous encouragement of that highest of industries is the right way and the only way to insure permanence of that growth in material prosperity which has for a hundred years, and until the present moment almost, been the most marked characteristic of our history.

"The promotion of the arts and manufactures by suitably rewarding inventors and providing that they shall be permitted to collect profits, as in all other departments of business, as large as the business will yield, and in due proportion to the value to the country of the invention or discovery, is one of the most important features of an enlightened public policy; and it is the duty of every intelligent and patriotic citizen, and especially of every one in any manner connected with any department of engineering, of manufactures, or of the mechanic arts, to exert every power and to apply all his influence to promote the perfecting of the patent system, to increase the facilities of the Patent Office, and, especially, to insure to the inventor of new and valuable devices a liberal period of possession of the products of his genius."

Canadian Natural Gas Lines.

The Detroit Gas Company has made arrangements with the Ontario Gas Company for a new pipe line between the natural gas fields of Kingsville and Walkerville and a third pipe line across the river to Detroit. Although that city was supplied by only one line last winter, it was considered safer to have three lines than two in case of a break. The expense of constructing the line from Kingsville to Detroit will be $200,000, and it is expected that the work will be finished by next October.

RECENTLY PATENTED INVENTIONS.

Engineering.

STEAM CONDENSER AND OIL SEPARATOR.—Edward Rowe, Indiana, Pa. This is a simple construction more especially designed for condensing exhaust steam from engines, returning the water of condensation to the feed pump, at the same time purifying the water to prevent incrustation of the boiler. The invention consists principally of a series of connected vessels, of which the first receives the steam, and each vessel has air tubes for the circulation of air to condense the steam circulating in the vessel, no water jackets or other circulating devices being necessary. The impurities of the water of condensation are skimmed off in a separate tank to which the water of condensation flows before passing to the feed pump.

Railway Appliances.

CAR FENDER.—Charles E. Montell, White Plains, N. Y. According to this improvement a frame is attached to the car platform, and to this frame is pivoted an auxiliary or receiving frame, there being a bed of yielding material attached to the upper portion of the fixed frame and the outer front portion of the receiving frame. There is a sprocket wheel and chain connection between the two frames, whereby the forward frame may be lowered by the motorman pressing upon a lever. This frame has wheels adapted to travel on the rails or on the surface. When the receiving portion of the fender strikes an object in the path of the car, the object is thrown back into a cushioned section, and the forward portion of the fender rises, forming a pocket which will safely hold a person thus taken up from falling out.

CENTER BEARING FOR RAILROAD CARS.—Samuel Walters, Warren, Pa. This bearing comprises a bottom plate to be fastened to the truck bolster and a top plate to be fastened to the car body, a center pin in the bottom plate engaging the top plate, while a slide or lock bar locks the center pin in position to hold the top and bottom plates in a united position. With this improvement the car body may be conveniently lifted off the truck without lifting the body very high, and accidental displacement of the car truck and body is prevented. The center pin does not pass through the truck bolster, weakening the latter, as is so frequently found in the usual practice.

CONTINUOUS DRAWBAR.—James Seath, Terre Haute, Indiana. This is an attachment for railway equipment which is simple and durable, and capable of application readily to any form of drawbar. Combined with a yielding drawbar having straps attached to its opposite sides is a thimble secured to the straps, a draught rod passed around the thimble being adapted for connection with the draught rod of another coupler, and the thimble having a sliding movement between the members of the draught rod. The device can be used with single or with multiple buffing springs, or it may be used in connection with other spring devices.

CAR AIR PIPE AND STEAM PIPE COUPLING.—Robert L. Munson, Silver City, New Mexico. This inventor has devised an improvement in automatic couplings of the hook and catch type, in which automatic interlocking connection is made and the engaged couplings may be detached from either side or the roof of the car. The improvement provides for the simultaneous coupling of air brake pipes and steam heat pipes, the couplings being engaged or detached as the train is made up or broken up, and dispenses with the usual handling of couplings for the air and steam pipes, thus effecting a saving of time and labor.

Mechanical.

WRENCH.—Frederick J. Bourn and William R. Hale, Gualala, Cal. This is a wrench especially adapted for use on vehicle wheels. It will simultaneously clamp the hub of the wheel and the lock nut of the axle, so that when the wheel is removed the lock nut and its washer will be held in their proper relation to the hub, and will not fall to the ground or be lost, and on being again returned to position the nut will engage with the thread of the axle spindle, thus preventing the soiling of the hands and permitting the quick and convenient oiling or lubricating of the axle.

Mining, Etc.

AMALGAMATOR.—George W. Downs, Port Townsend, Wash. This invention relates to gold-saving apparatus having amalgamating plates, and provides a simple form of portable amalgamator, conveniently operated by hand power, to readily save the float gold in river or beach sand. It comprises a casing with removable sides in which are journaled wheels geared together, each wheel having amalgamating wings so arranged that the sand rolls down from one wing on the next following wing, while a hopper at the top of the casing has a screened bottom discharging on to the upper faces of the wings of the first wheel.

Agricultural.

HAY RAKE.—Isaac G. Lunday, Hubbard, Texas. This invention covers an improvement in revolving hay rakes, and the inventor has devised a rake which is free to move backward without danger of injuring any of the parts, the rake head and teeth turning freely, and whereby, with a simple arrangement of lever mechanism, the ground pressure of the teeth can be instantly regulated. The machine is of simple and inexpensive construction, and the several lever devices are disposed near the driver's seat, facilitating the easy operation of the machine.

Miscellaneous.

BICYCLE ATTACHMENT.—Charles A. Coey, Fairfield, Wash. This is a simple and inexpensive device, applicable to any safety bicycle, enabling the wheel to be run with speed and safety by an inexperienced rider on the rails of an ordinary railway track. It consists of a third wheel, with concave rim, connected with the frame of the bicycle by removable and adjustable braces, constituting a rigid framework for spanning the track, while being very light. The attachment may be quickly applied to or removed from an ordinary bicycle, and when removed may be folded into very small compass.

ROLLER SKATE.—Richard H. Lahey, Canadice, N. Y. A skate which may be readily and firmly attached to the foot, and which affords an elastic and easy support, has been devised by this inventor. It is provided with a ratchet device to prevent the wheels from turning backward, and a brake which is actuated automatically or by a hand line or cord. The foot rest consists of a front portion and a heel portion, the two portions being slidable in relation to each other to enable the rest to be easily fastened to the foot.

TAP AND FAUCET.—Jacob Siebert, Jr., Yonkers, N. Y. This is an improvement in faucet taps designed to be permanently secured in the head of a barrel, and provided with a valve opened by the aid of the faucet introduced into the tap and through which the liquid is to be drawn. The invention simplifies the construction, and provides a tap in which the faucet may be readily inserted, and when the faucet is manipulated to secure it in the tap, the valve of the tap will be simultaneously and automatically opened, the valve being also automatically closed when the faucet is withdrawn. The improvement is also designed to prevent any possible leakage between the valve chamber and the receiving chamber for the faucet.

FLUE STOPPER.—Louis J. Haberkorn and Edward O. Beckman, Chatsworth, Ill. This device comprises a head with a segmental slot, a collar on the inside of the head having one end fixed and at its other end an arm projecting through the slot of the head, with means for locking the arm in the slot. It may be conveniently applied and locked in place in any sized thimble or flue body, effectually preventing smoke from entering a room. It also has a scoop section which will receive the soot which may accumulate in the thimble, and when the stopper is removed the soot will not be spilled upon the floor.

MACHINE FOR RAISING LIQUIDS.—Richard Wegner, Neu-Britz, Germany. This is a siphon apparatus working on the principle that the variations in the volume of air confined in a vessel, in the presence of combustion, are utilized for raising the liquids without the assistance of a plunger or pump. A burner making a constant flame in a closed vessel causes a partial vacuum, and the suction pipe for raising the liquid enters this chamber, while a float-controlled mechanism establishes communication between the interior of the vessel and the outside air when the vessel is filled with liquid to a predetermined level. Another float-controlled mechanism closes the communication when the vessel is essentially empty, and there is an outlet for the discharge of the liquid.

APPARATUS FOR SEPARATING HEAVY FROM LIGHT MATERIALS.—Frank Pardee, Hazleton, Pa. For the separation of coal from slate, and ores and other materials from impurities, this inventor provides a tank with inclined bottom, in which is a dirt receptacle and chute, a frame parallel to the bottom being supported to be swung by means of a belt and pulleys, whereby the heavier material is carried up and delivered into the chute, and the lighter material travels downward. The material is carried through water, and simultaneously subjected in the water to a shaking motion, a traveling motion, and a floating action, to effect the separation.

WIRE FENCE STAY.—Solon M. Thompson, Whitesville, and William H. Bulla, Empire Prairie, Mo. For the staying of the strands in wire fences at points between the main posts, these inventors have devised a novel and simple form of bent wire braces, adapted to be removably connected with a series of fence wires, to hold them spaced apart and stiffened, and also afford ground conductors for electricity. The brace or stay comprises two nearly parallel members connected together at or near their ends and having an eye at each end, each member having lateral loops to receive fence wires, and a locking rod passing through the eyes.

PENCIL SHARPENER.—Oliver J. Lane, Chicago, Ill. The body of this device has a transverse throat or aperture, the upper side or back of the body having side flanges, and a slotted curved bit being pivoted between the side flanges and extending through the throat. A screw extends through the bit slot into the upper side of the back, the head of the screw bearing on the upper convex side of the blade. A pencil of any size may be quickly and properly sharpened with this device.

LAMP WICK TRIMMER.—William Chandler, North Bend, Canada. In lamp wick trimming shears this inventor has devised improvements whereby the shears will retain the charred wick or snuff that has been trimmed off, while the upper blade has a spring action rendering the device more efficient in use, making altogether a superior device which will be cheap to construct. The blades are preferably formed of sheet steel or by drop forging, or they may be cast, and both blades are curved and flanged, the guard flanges extending around the curved outer terminal of both blades.

COMBINATION KITCHEN CABINET.—John Tischer, St. Joseph, Mo. This inventor has combined in one article of furniture a table, safe, flour bin, sifter, kneading board, knife and fork trough, together with a sink, soap box, and various compartments for the storage of pots, pans, etc., to facilitate kitchen work. With this cabinet, all the things required by one working in a kitchen will be at hand, and dishes may be washed and placed in the cabinet without crossing the room or moving away from the tray.

COMBINED COUCH AND STORAGE CHEST.—Robert A. Caruthers and Charles P. Savage, Waco, Texas. According to this improvement the main couch section forms a hinged cover for a hollow body, and this section has wheels to run on suitable tracks connected with the body, and adapted when in closed position to be moved longitudinally in either direction, and projected beyond the end of the hollow body, affording ready access to the interior. The head piece is hinged at one end to the end of the body, the sides of the head section forming a longitudinal continuation of the sides of the body when swung downward on its hinged connection.

SCREEN DOOR.—Albert Schreiner, South Evanston, Ill. This door has a panel attached to its free vertical edge and located at an angle to the door, the panel extending from top to bottom of the door, and a horizontal panel connecting the door and vertical panel at the top, a caster being carried by the vertical panel whereby it may be opened and closed. This screen door is designed to prevent the entrance of insects into the room when the door is opened.

INVALID'S TABLE.—Max Lesser, Duncansby, Miss. This is a simple form of table arranged for convenient attachment to a bed, to permit an invalid to use the table when eating, drinking, reading, etc., without the assistance of a nurse or others. Projecting from a support are vertical rods on which slides an adjustable bracket carrying the table, there being an adjusting mechanism for raising and lowering the bracket and table.

BED.—Alonzo R. Turner, Spragueville, N. Y. According to this improvement the bed bottom comprises two similar series of spring wire sections that cross at right angles, each section having parallel side members and two upright undulating bow springs formed on each end. Supports for each spring section project inwardly from the side rails of the bedstead frame and engage the upper ends of the bow springs for the support of the spring bed bottom.

NEW BOOKS AND PUBLICATIONS.

THEORETICAL AND PRACTICAL AMMONIA REFRIGERATION. By Iltyd I. Redwood. With 25 pages of tables. New York: Spon & Chamberlain. London: E. & F. N. Spon. 1895. Pp. v, 146. Price $1.

Every day the importance of a knowledge of the laws of ammonia ice plants is increasing, and this acceptable little manual is to be recommended as appearing at a good time. It seems to be written throughout in a very practical way, and to be decidedly to the point. Its compact size and moderate price will insure it wide appreciation.

SCIENTIFIC AMERICAN
BUILDING EDITION.

MAY, 1895.—(No. 115.)

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1. Plate in colors, showing a residence at Glen Ridge, N. J., recently erected for W. T. Taliaferro, Esq. Perspective elevation and floor plans. A fine example in the Colonial style. Mr. Chas. E. Miller, architect, New York.
2. Perspective elevation and floor plans of a cottage at Tenafly, N. J., erected for Chas. Vogt, Esq., at a cost of $5,800 complete. Mr. W. L. Stoddart, architect, New York. An attractive design.
3. A dwelling at Kennebunkport, Me. Three perspective elevations and floor plans. A most picturesque residence, with many artistic features. Mr. Henry P. Clark, architect, Boston, Mass.
4. A log cabin chapel recently erected at Black Rock, Conn. Perspective elevation and ground plan. Mr. Bruce Price, architect, New York.
5. A cottage at Park-Hill-on-Hudson, N. Y., recently erected for Geo. L. Rose, Esq., at a cost of $12,000 complete. Two perspective elevations and floor plans. Mr. A. F. Leicht, architect, New York. A well executed design, showing many excellent features.
6. A house at Orange, N. J., recently completed for Thomas L. Smith, Esq. Messrs. Child & De Goll, architects, New York. A pleasing design in the Colonial style.
7. The Yonkers Public School, No. 8, at Bronxville, N. Y. A good example of school architecture.
8. A dwelling of modern design, recently erected for M. Strong, Esq., at Montclair, N. J. Two perspective elevations and floor plans. Cost complete, $6,000. Mr. Christopher Myers, architect, New York.
9. A house at Indiana, Pa. Perspective elevation and floor plans. Cost complete $3,100. Architect, Mr. E. M. Lockard, Indiana, Pa. An attractive design in the Colonial style.
10. A very attractive residence at Montclair, N. J., erected for Frederick S. Gage, Esq. Perspective elevation and floor plans. Mr. E. R. North, architect, Montclair, N. J.
11. View of Capistrano Station, California.
12. Design for a fireplace.
13. The brick power station of the Brooklyn City Railroad Company.
14. Miscellaneous Contents: A State park in the Catskill Mountains.—To prevent the slamming of screen doors, illustrated.—Quarrying by means of fire.—A new lawn sprinkler, illustrated.—Art in metal tile roofing, illustrated.—An improved hot water heater, illustrated.—A macadamized road through swampy land.—Tinners' hardware and roofers' supplies.—Screen doors, illustrated.—Stair finishing, illustrated.—A hoist for use over hatchways, illustrated.—Ventilating the school room.—Gas burning range, illustrated.

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Notes & Queries

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Minerals sent for examination should be distinctly marked or labeled.

(6523) A. H. P. writes: Please answer in SCIENTIFIC AMERICAN if there is an improved paddle which can be used on a stern or side wheel steamboat. I mean some paddle that can go in the water and come out with less resistance than old style stationary paddle on a wheel. I remember a good while ago, in the SCIENTIFIC AMERICAN, of a cut of a sound steamer that was so equipped. A. The feathering paddle wheel is an old device now brought into use in our large sound steamers.

(6524) H. C. P. asks: What is the weight (avoirdupois) of a box 5×8×4 inches of pure gold. Also of the same size, of pure gold dust? Also the length over all of the new steamship St. Louis? A. The weight of the box of gold as stated, 111·44 pounds avoirdupois, of gold dust about ⅜ that amount. The St. Louis is 554 feet over all. See SCIENTIFIC AMERICAN, August 11, 1894, for illustrated description.

(6525) C. S. writes: 1. I have a private telephone line about 2¾ miles long, on which are four instruments or stations; the transmitters are of my own make, as described in the SCIENTIFIC AMERICAN some years ago, called the bipolar telephone; the receivers and magnetic call bells I bought of an electric company. I first put up the line only one mile long, and since adding two more instruments and lengthening the line, the call bells do not respond so readily. Yet the transmission of speech is about as good as before, which is quite satisfactory if talked close into the transmitter. Do you think the instruments would work as well if the line were lengthened one or more miles, and another instrument added? A. The telephones probably would; the bells would not. 2. Would it improve the working of the telephones if the ground wire at the terminals were connected to good ground plates instead of lightning rods as they now are? A. It might, especially as regards the bells. It all depends on how good a ground the lightning rods have. 3. The line comes in contact with a good many branches from trees. Would it improve by trimming the trees so as to leave the wire perfectly free? A. This would tend to improve the service. 4. Would it transmit the sound louder and clearer to add stronger, larger, horseshoe magnets or batteries? A. Not necessarily; it might or might not. The best conditions can only be found by experiment.

(6526) W. M. B. asks: 1. Please mention a good book (late as possible) giving rules for size and length of wire, amount of iron in fields and armature, etc., in constructing a motor or dynamo to be run by given current, or to furnish given current? A. We recommend and can supply Sloane's "Arithmetic of Electricity," $1 by mail. 2. Can two small motors in series, 15 volts 10 amperes each, be run with direct current of 114 volts, and how must I connect same? A. You will require about 7 ohms resistance in circuit with the dynamos. 3. How must I put the red oxide of lead on storage battery plates? What good book treats of such subjects? Is there any solution into which I might put the plates to harden the red lead without injuring its efficiency? A. Make it into a paste with dilute sulphuric acid. Roughen well the surface of the plate. There is no such solution. For storage battery management, we recommend and can supply, "The Management of Accumulators," by Salomons, price $1.50; Reynier's "Voltaic Accumulator," price $3.

(6527) D. J. S. asks if there is any rule by which weight can be ascertained according to the height, viz., if a drop hammer on a derrick weighed 3600 pounds, and has a drop of 15 feet, what would be the weight of the blow? A. There is a definite rule for finding the force of the fall of a weight, as a pile hammer by gravity, or the force of a blow, as with a hand or steam hammer. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 862, on "Impact or the Force of a Blow," in which the details of computation for various percussive forces are described, 10 cents by mail; 3,600 pounds×15 feet=54,000 foot pounds, and if the fall of the weight is arrested within three inches after contact, the impact force equals 54,000×¹²⁄₃=216,000 pounds static load, less the loss by friction of air and slides on the falling weight.

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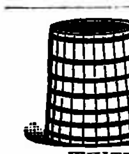

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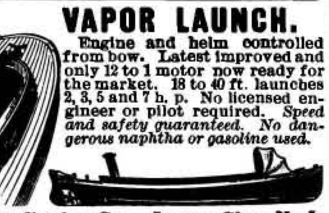

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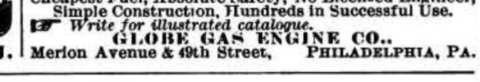

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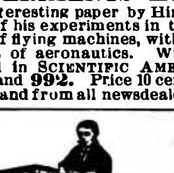

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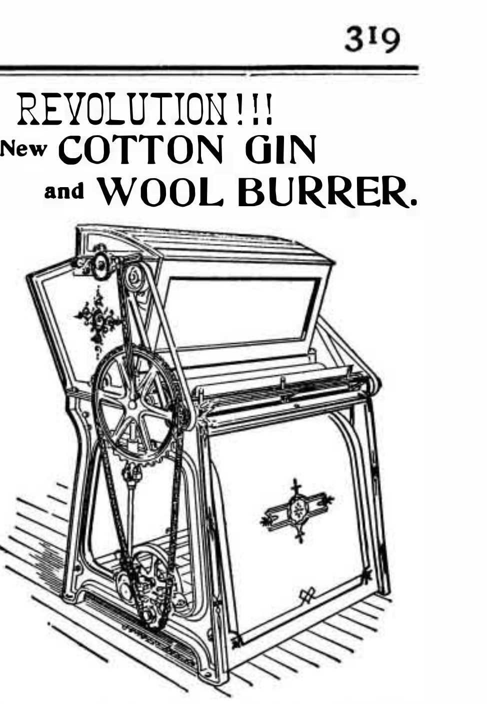

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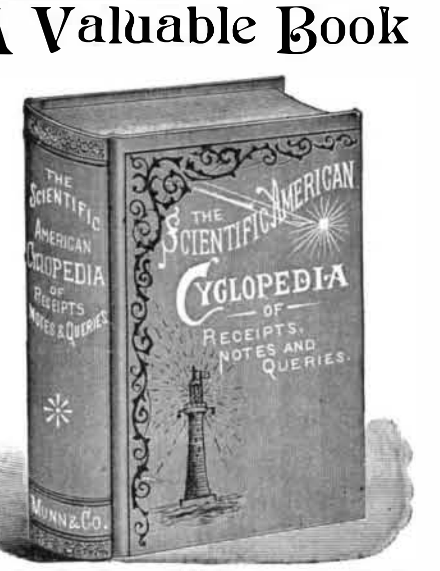

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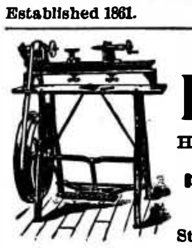

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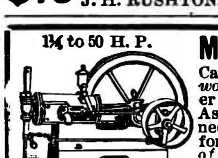

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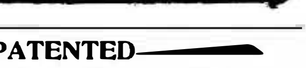

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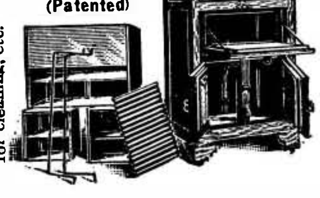

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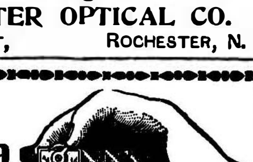

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