SCIENTIFIC AMERICAN

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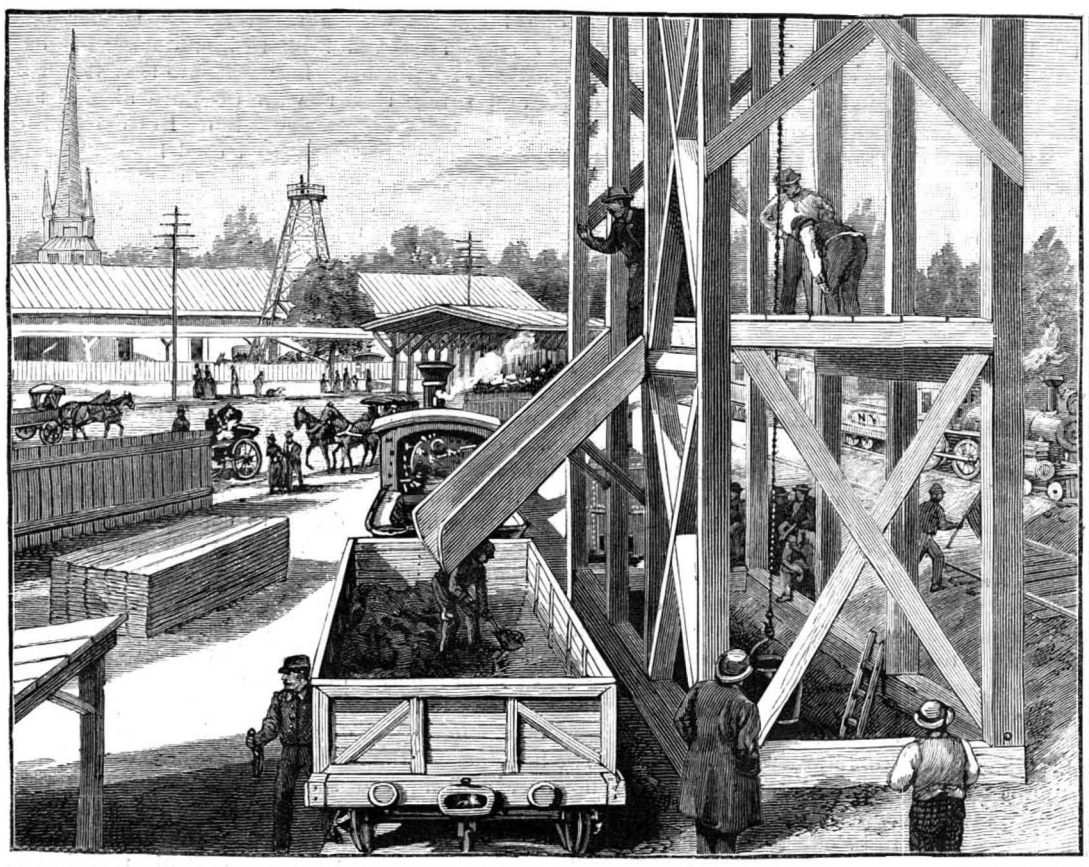

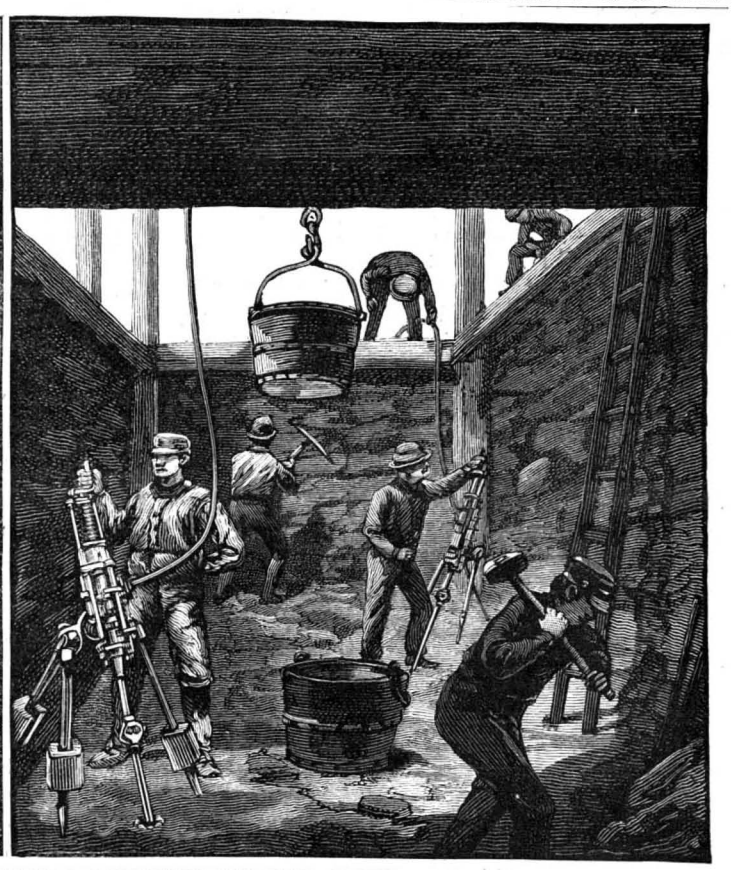

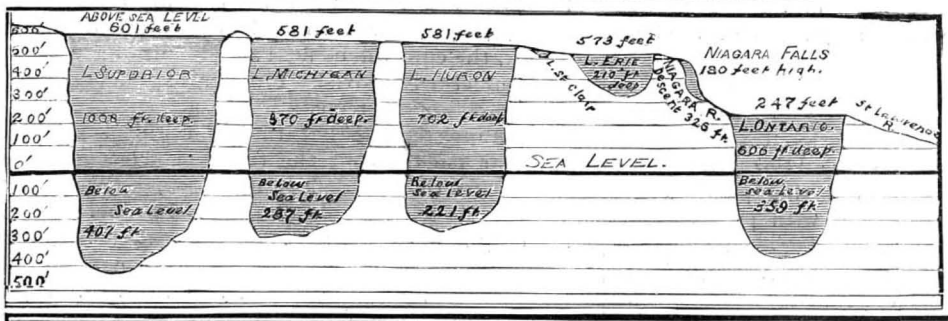

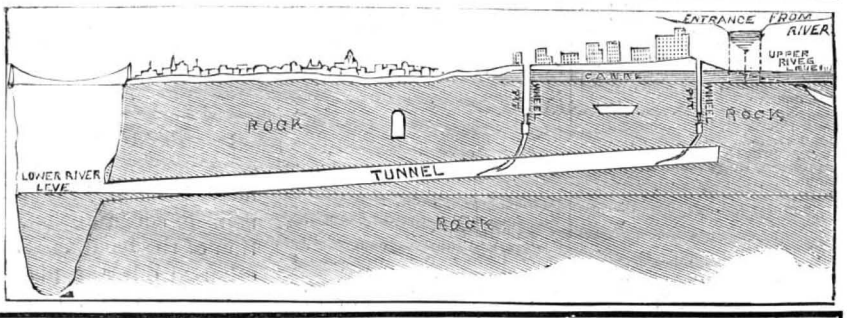

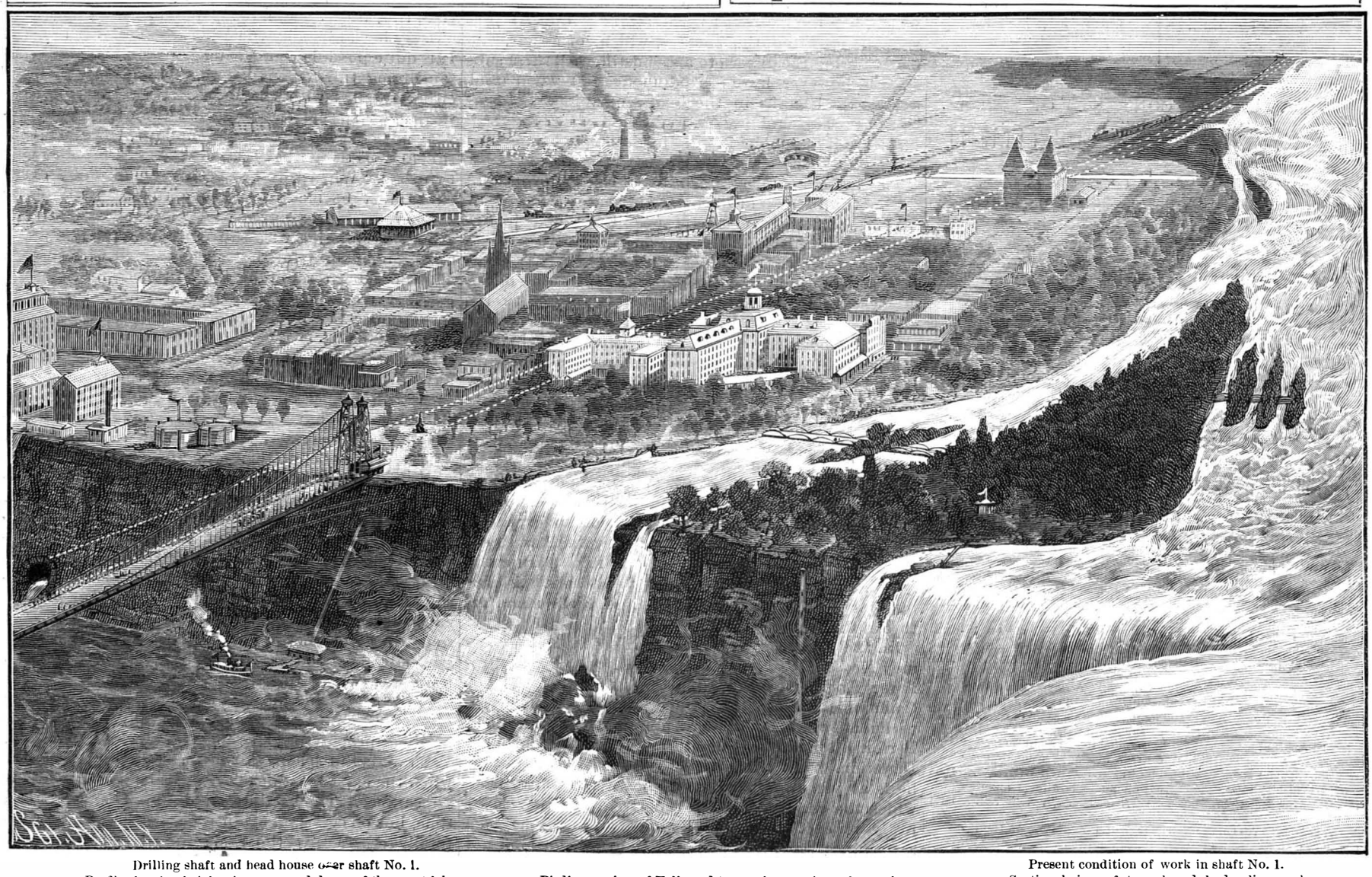

Drilling shaft and head house over shaft No. 1.
Profile showing height above sea and depth of the great lakes.

Bird's eye view of Falls and town, showing line of tunnel.

Present condition of work in shaft No. 1.
Sectional view of tunnel and hydraulic canal.

HYDRAULIC TUNNEL TO UTILIZE THE FALLS OF NIAGARA FOR INDUSTRIAL PURPOSES.—[See page 326.]

Scientific American

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NEW YORK, SATURDAY, NOVEMBER 22, 1890.

Contents.

(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 777.

For the Week Ending November 22, 1890.

Price 10 cents. For sale by all newsdealers.

THE TENNESSEE RIVER IMPROVEMENT.

The wonderfully rich coal and iron region of northern Alabama and southern Tennessee has heretofore been seriously handicapped by the expense of the long railroad haulage required to place its products in the market. Notwithstanding this disadvantage, the new field has attracted large amounts of capital, and is being developed with marvelous rapidity, its products for the past two years having been sold in direct competition with those of the best known establishments of the Pittsburg section. Now, however, there is promise of a more nearly even competition of the Southern iron workers with their Northern brethren in the same line of business, for on November 10 the Muscle Shoals Canals, on the Tennessee River, were declared formally opened, by the United States engineers in charge of that improvement. The entire chain of obstructions caused by these shoals extended over a distance of thirty-six miles in the river just above Florence, before the river enters the State of Tennessee; and although there are still other obstacles to a perfect system of navigation, it may be said that a fairly good means of river transportation is now opened up from the Ohio and Mississippi Rivers as far as Chattanooga. A steamer has already passed through the canals, with freight from Evansville, Ind., and Paducah, Ky., for Chattanooga merchants.

The first surveys in connection with this great improvement were made in 1828, and Congress donated 400,000 acres of land to the State of Alabama to carry out the proposed work, but the canal built in consequence was never properly built, and soon fell into disuse. The present work has been undertaken since the war, on a much larger scale, and there has been $4,000,000 expended upon it since 1872. It consists of eleven locks and an aqueduct across Shoals River 860 feet long and 60 feet wide. A boat drawing five feet of water can pass through the canal.

From Chattanooga to Knoxville, a distance of 189 miles, the Tennessee is now navigable for light draught vessels the greater part of the year, and here also the government has been expending small sums of money during several years to improve the channel, which is obstructed by rock reefs and sand and gravel shoals. With the improvements already completed, therefore, and those certain to be effected in the near future, the products of this richest of all coal and iron regions will be brought within easy reach of the markets of the world.

DR. KOCH'S TREATMENT FOR CONSUMPTION.

In an address before the International Medical Congress, last summer, Dr. Koch said: "For years past I have been seeking means for the therapeutic treatment of consumption, but I began with pure cultivation of the bacillus. I found a number of substances—ethereal oils, tar pigments, mercurial vapor, salts of gold and silver, especially cyanide of gold—some of which, like the last, even when strongly diluted, prevent the growth of the bacillus, which, of course, suffices to bring the disease to a standstill. All these substances, however, have proved ineffectual when used against the bacillus in the bodies of animals. I continued my search, however, and found what I sought," but what it was he had found he declined to name until his experiments were concluded.

The accounts telegraphed from Europe every day during the first half of the month indicate a widespread interest, among all classes of people as well as in the medical fraternity, in this discovery of Dr. Koch, practice under which has already been extensively commenced in Berlin under the personal supervision of the discoverer. Dr. Koch himself takes charge of twelve army hospital sheds; Prof. Bergmann takes the surgical cases among the consumptives in the Zuzelstrasse Clinic; Dr. Cornet, a lung specialist, receives consumptives in a newly founded Albrechtstrasse Clinic; Dr. Levy attends pauper patients, and Dr. Pruhl attends military consumptives. It is said that great numbers of patients are crowding in from all quarters for treatment. The German emperor is said to regard the discovery of Dr. Koch as of very high importance, and that in consequence a bill will be presented to the Reichstag empowering the government to expend a large sum to enable the doctor to devote himself entirely to educating army physicians in preparing the lymph used, and administering it to patients. A large building is being got ready in Berlin for the manufacture of the lymph.

In the *Deutsche Medicinische Wochenschrift* (German *Medical Weekly*) of Berlin, on November 14, Professor Koch publishes an article entitled "Further Communications on the Cure of Tuberculosis and Experiments which Dr. Libbertz and Staff Surgeon Pruhl Performed Relating Thereto under Professor Koch's Direction."* In this article Professor Koch says that he is as yet unprepared to indicate the source from which the curative matter is derived. Neither is he ready to explain the method of preparation. The reason he gives is that the experimental work has not yet been brought to completion. He states, however, that the curative lymph itself can now be obtained from Dr. Libbertz, whose address is 28 Lueneburgerstrasse, Berlin.

The lymph is described as a brownish transparent liquid. It is so prepared as to be proof against deterioration. When, however, it is diluted with water to the necessary degree for use, the matter is liable to decay. It is necessary, therefore, that the attenuations should be perfectly sterilized by heat and preserved in wadding covering, or prepared with a solution of phenol 50 per cent strong. When taken into the stomach, the curative matter proves to have no effect. It must be applied subcutaneously by means of a valveless syringe. The kind of syringe recommended by Professor Koch is one furnished with a small hollow rubber ball. This syringe approved itself to him during his bacteriological experiments. Its merits are that it can be easily and surely rinsed with absolute alcohol and kept in a perfectly aseptic condition. In thousands of cases, he says, where it has been used for subcutaneous injections, not a single abscess resulted. When the curative matter is applied to a patient, the usual course is to inject it under the skin of the back between the shoulder blades and in proximity to the loins. Twenty-five hundredths of a cubic centimeter intensely affected a healthy full-grown man who was subjected to experiment.

Prof. Koch experimented with the fluid upon his own body, and describes the effect. He injected twenty-five hundredths of a cubic centimeter of the fluid under the skin of his upper arm. Three or four hours after the injection was made he experienced a contraction of the limbs and a marked feeling of lassitude. At the same time he felt a desire to cough, together with difficulty of breathing. These symptoms increased rapidly, and, in the fifth hour, he experienced an unusually violent rigor. The shivering lasted for nearly an hour, and was accompanied with nausea and vomiting. The temperature of his body rose to 39·6° Centigrade. After a period of twelve hours the symptoms began to abate, the temperature of the body declined, and on the following day resumed its normal degree. The heaviness of the limbs and the feeling of lassitude, however, continued for some days, during which time the point on his arm at which the injection was made continued to be painful and remained red.

Prof. Koch expresses the belief that his remedy will certainly prove a cure for incipient phthisis. Whether, however, the cure will be final and definite has not, he says, been clearly proved. Further experiments and continued use of the remedy will be necessary to determine this question. What the fluid kills is not the tubercular bacillis, but the tubercular tissue. This fact indicates the well defined limits which the efficacy of the remedy will be able to reach. In other words, it can only influence living tuberculous tissue. It has no effect whatever upon dead tissue, such as decayed caseous matter, necrotic bones, and the like. More than this, it produces no effect upon tissues which have already been killed by the application of the remedy. It is quite possible that such dead tissue may still contain living tuberculous bacilli. These may then be either expelled with the necrotic tissue, or it may be that under special circumstances they may again invade adjacent living tissues. It follows, therefore, that tuberculous tissue that is still living must first be made to decay. When this has been accomplished, every effort must be made to remove the dead matter by surgery.

Persons suffering with tuberculosis of the lymphatic glands, bones or joints have been treated with success. There has been rapid healing in the milder cases and cases of recent development of the disease, while in severer cases the improvement, while slower, has been steady.

Patients with pronounced tuberculosis of the lungs have proved far more susceptible to the remedy than those suffering with surgical tubercular affections. Consumptives have, in almost every instance, manifested a strong reaction on greatly reduced doses. With such patients, therefore, a beginning should be made with doses of two one-thousandth parts of a cubic centimeter, or even with one one-thousandth part. From this small, incipient dose one can advance to such quantities as the patient can easily bear. Consumptive patients who are still fairly strong reach increased doses much more quickly, and favorable results follow with corresponding rapidity. As a general rule, the coughing and expectoration are increased somewhat after the first injections. Then they become gradually less, and in the most favorable cases will ultimately wholly disappear.

In the cases experimented upon under the direction of Prof. Koch the expectorations gradually lost their purulent property and assumed a mucous character. The number of bacilli expelled usually decreases only when the expectorations begin to assume the mucous appearance. The bacilli then disappear entirely for a time, but on occasions again appear until expectoration totally ceases. At the same time the night sweats cease, the patients begin to look better and to increase in weight. Patients who have been treated in the early stages of phthisis have all been freed from mor-

*For complete translation of this paper see SCIENTIFIC AMERICAN SUPPLEMENT, No. 777.

bid symptoms within from four to six weeks, when they may be regarded as healed.

Consumptives with large cavities in their lungs will probably only experience benefit from the new remedy in exceptional cases, though most cases show temporary improvement. Prof. Koch deprecates the mechanical and indiscriminate application of the remedy. He holds that it would be preferable that the treatment should be applied in suitable institutions, where careful observation would be possible.

He says that sufficient experience has not yet been collected regarding tuberculosis of the brain and the larynx and miliary tuberculosis to justify the expression of any opinion in regard to the efficacy of the remedy.

In all cases Prof. Koch emphasizes the necessity of early treatment. Only in incipient stages of disease, he declares, can the remedy fully develop its efficacy.

Arapahoe County, Colorado.

A correspondent in Colorado gives the following pen pictures of the above section of that State: "My last errand was to go east from Denver, 180 miles on the cars, to the Kansas line, with 5,000 ballots. This county, Arapahoe, is 180 miles long from east to west and 30 miles broad. I hired a team and drove back west from the Kansas line to Denver, thus traversing nearly the whole county, distributing the requisite number of ballots to each precinct committeeman. As there were no towns or settlements to exceed 25 in population, seldom that number, and as the committeemen frequently lived miles to the right or left of the direct line for Denver, it made about five days of continuous driving, nearly wearing out the pair of horses and a 'kid' for a driver. There being no fences and only now and then well defined roads, we had to go by the sun and by directions from the natives, camping out when night came at the first settler's sod house that we could get to keep us. These sod houses are great harbors for vermin, such as bedbugs and centipedes, the latter being frequently found in one's shoes in the morning.

"The entire country is a vast dry plain of fertile soil, but without water, particularly during the past two years, during which time no rain worthy of mention has fallen. Crops, therefore, have been very light. Corn is the main reliance. Of this some were fortunate enough to raise a few bushels of 'nubbins,' others only the plain stalks. In the latter case they did not have to bother gathering the corn, showing that 'there is no great loss without some gain.' The settlers live in a plain, economical way, dispensing with butter, eggs, chickens, confining themselves mainly to coffee, sugar, bread, and now and then a few slices of fresh pork. Coal, on account of the long hauls by rail, is very dear—$10 per ton for soft coal. There is no hard coal or wood. It was here for the first time I saw dry cow-chips burned, almost every door yard being ornamented by a large pile that had been gathered up on the prairie and hauled in for winter's fuel. I am told that they are not very durable, lasting only about as long as it takes to gather.

"This part of the country, once defined on the map as the great American desert, is not a very prosperous part of the United States, as is indicated by the hundreds of deserted sod cabins I passed.

"People are fast leaving, satisfied by experiment that the yearly increase of rain is all humbug."

This description of Colorado applies only to the level plains too far east of the Rocky Mountains to be within reach of irrigation from the melting snows, and which comprises about one-third of the area of the State.

Magnesia as a Fertilizer.

The last number of the *Bulletin des Agriculteurs de France* contains an interesting communication by M. Joulie on this subject, which we reproduce here because of the importance attaching to the opinion of this eminent chemist.

The utility of magnesia for cereals and vegetation in general has been long known. To go no further back, Boussingault in 1851 gives in his *Economie Rurale* a table of analyses of the ashes of various plants, in which the column devoted to magnesia contains numbers varying from 10 per cent for hemp seed to 17 per cent for maize. The ashes of wheat contain, according to the same table, 15·9 per cent of magnesia. It has been the custom for the last thirty years in the most elementary lectures to state that the ash of wheat is almost exclusively made up of phosphates, potashes, and magnesia. M. Joulie himself has always given the percentage of magnesia present whenever he has had occasion to publish the analysis of a soil or plant, and the importance of this element, especially for the production of grain, cannot be unknown to any one. This is, therefore, a sufficient reason for agriculturists to go to the expense of adding magnesia to the soil, and including it in the composition of fertilizers, whenever the land in question is insufficiently supplied with it.

M. Joulie is not quite decided as to the exact proportion of magnesia which a fertile soil ought to contain, but he does not hesitate to advise the use of a magnesia fertilizer, whenever the soil contains less than 0·05 per cent, say 2,000 kilos. per hectare (2½ acres), in a layer 20 centimeters thick. In any case he would seldom have to give such advice, for soils which are as poor as this are rare.

The determination of magnesia in soils is somewhat difficult, and the processes given in works on the subject do not usually give exact results. Many soils are therefore set down as deficient in this ingredient which are actually well supplied with it. Speaking generally, magnesia fertilizers are, according to M. Joulie, quite useless. In cases where magnesia is actually deficient, on the other hand, they are of the greatest value. Very remarkable results can then be obtained by putting down 200 kilos. of sulphate of magnesia to the hectare, the cost of this being 11 to 12 francs per 100 kilos. The same object may also be attained by using the residue from the manufacture of chloride of potassium, which comes into the market under the name of kainite, and consists of a mixture of potassium sulphate, magnesium sulphate, and sodium chloride. This material contains 10 to 12 per cent of potash and about as much magnesia. The good results obtained by its use (for any soil) do not establish the utility of the magnesia, because it is always possible that they may be due to the potassium. The efficacy of magnesium sulphate when used alone, however, settles the question even more decisively than would a chemical analysis.—*L'Engrais.*

Report of the Letter Box Commission.

The House letter box commission, which sat at the Post Office Department, at Washington, for ten days in October, has made its report to the Postmaster General. The report was written by Gen. Corse, the chairman of the commission. It discusses in an elaborate manner the necessity for a box for general adoption and the requirements that such a box should possess.

The number of models submitted to the commission was 387. The number of designs 177. The number of communications containing suggestions 200. Sixty-five exhibitors appeared personally before the commission to explain their models.

The report states that the members of the commission had no clear, definite idea as to what the requirements of a box should be when they invited the public to submit models. The invitation was of a general character, lacking in specific information as to the lines on which the box should be constructed. The persons who offered models for acceptance or recommendation were depended upon to furnish the inventive skill for the production of a box which should meet all the necessary requirements, but in this the commission was disappointed. Not a single box of the whole number submitted was thought by the commission to contain sufficient merit to receive the sanction of the department. There were a number of boxes which contained many meritorious points, but all were lacking in some essential requirement. The greater portion of those submitted were clumsy, deficient in neatness and utility, and poorly adapted for the purpose for which they were constructed. Others showed a high degree in their workmanship, but deficient in some point which had not occurred to the makers in planning their designs.

The chief value of the report lies in its suggestions for the future. It recommends a further consideration of the subject, and furnishes the Postmaster General with the data that are wanted in advertising for a box with all the requirements demanded by the service.

The essential requirements of a satisfactory box, as outlined by the commission, are as follows:

It should be of small cost.

It should be neat in appearance.

It should protect the contents against rain, sleet, snow and dust.

It should furnish reasonable security against removal of letters by thieves, and against removal of exterior boxes from doors or walls.

It should be as simple as possible in its manner of operation.

The lid of the box should be so hung as to not require the carrier to open it, or to use more than one hand in depositing the mail.

The box should mar the door as little as possible.

The box should have an attachment of some character for the reception of papers.

It should disclose the presence of mail matter without being opened.

The commission makes honorable mention of a dozen different models, pointing out the excellent characteristics of each, but it is unable to give its unqualified recommendation in favor of any particular box.

A Noiseless Motor.

The new Westinghouse motor, which has been in operation on the Pleasant Valley electric road in Pittsburg, Pa., is causing considerable comment from patrons of the road. They have named it the "Noiseless." One of the officers of the road says: "There is above all the wonderful ease and quietness of operation, which causes the cars to run along with a wonderful smoothness and silence. This noiselessness makes the car at once conspicuous on our line, and people are enabled to converse in an ordinary tone of voice on the car, and the residents along the line are in great praise of it. Noise has been the great objection to all motors, and we have introduced the rawhide pinions on our motors; but even then they are not nearly so noiseless as the Westinghouse motors."

A Great Power Plant.

The great Penobscot River, the largest in Maine, drains 7,400 square miles, a region as large as the State of Massachusetts. From Oldtown to Bangor, a distance of 12 miles, the river falls more than 90 feet, giving several of the finest water powers in the world. These, says the Bangor (Me.) *Industrial Journal*, have mainly been used for the manufacture of lumber, but one of the finest is now to be used for a different purpose. At Veazie, four miles above Bangor, an electric plant has been building during the past year, that, when entirely completed, will be one of the largest in the world. Work on this plant was begun a little more than a year ago, and has continued interruptedly to the present time. Part of the time 200 men have been employed there, their wages averaging $3,000 every fortnight. A vast amount of excavating had to be done before the foundation could be begun. This excavation averaged 7 feet in depth, and a large portion of it had to be blown out of the solid ledge.

The building will be 240 by 52 feet, with a wheel house running the entire length, 23 feet wide, a boiler house 50 by 35 feet, and a tower 48 feet in height from foundation of the front of the building. The main building will be 32 feet high. The upper story will be leased to parties wanting room and power. Fifteen water wheels of 150 horse power each will be placed in this plant and so arranged that they can be run separately or in groups. The power is transmitted to a main shaft, and connected with this will be two alternating machines for incandescent lights sufficient for 3,000 lights, four arc dynamos, and three power generators. About 100 feet in length of the building is completed, seven wheel pits are complete and six wheels are set. These are now in operation and light and power are being supplied to parties desiring either or both.

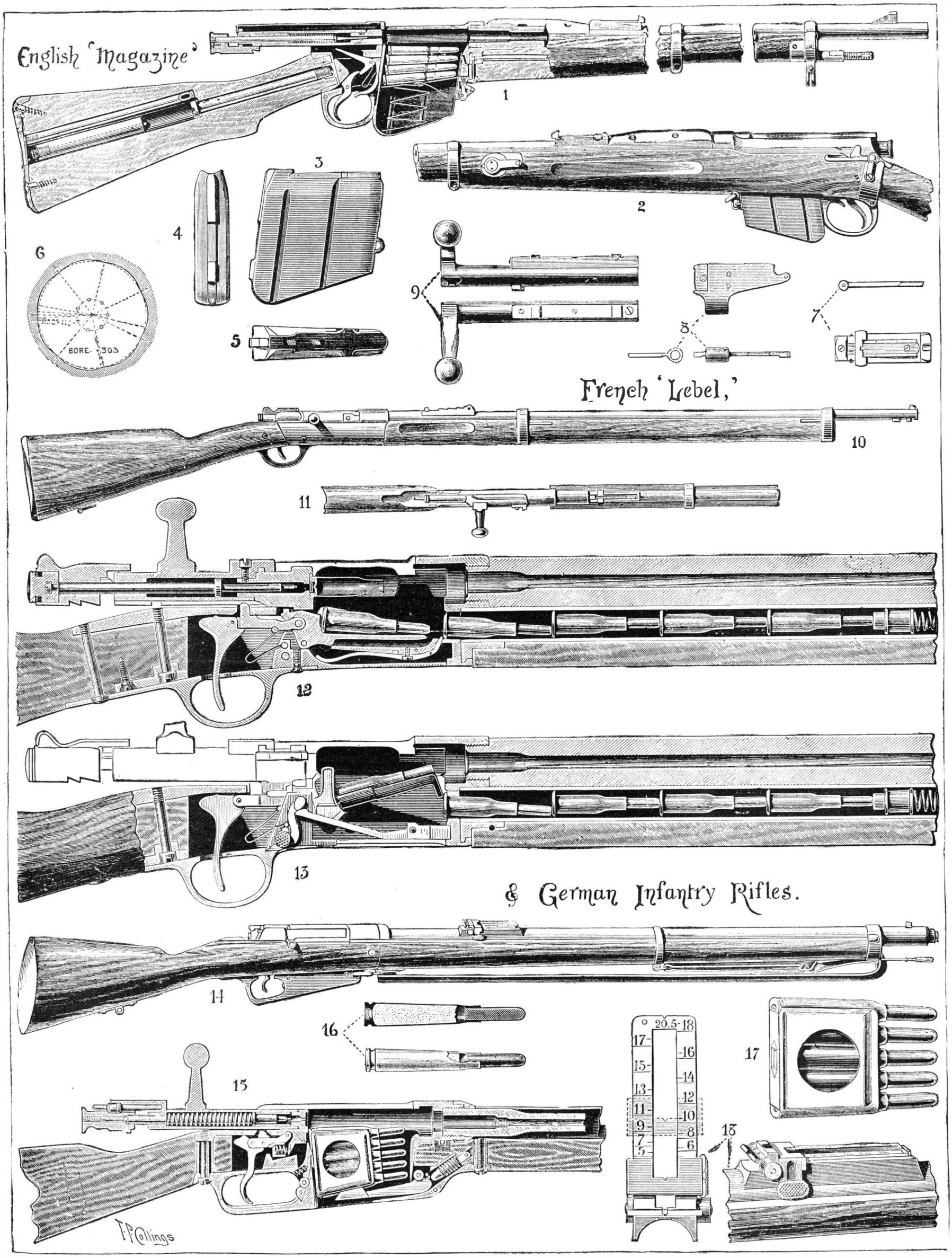
The plant will supply lights for the cities of Bangor and Brewer, power for the electric railway for Bangor and Brewer, and will also pump water for Brewer and Veazie. The ownership of the plant is divided as follows: Three-fifteenths are owned by the Penobscot Water and Power Company, four-fifteenths by the Bangor Street Railway, and eight-fifteenths by the Bangor Electric Light and Power Company. Power for motors will be let by the Electric Light and Power Company. The electric system used is the Thomson-Houston. For pumping water for supplying Brewer and Veazie, Henry R. Worthington, of New York, furnishes the pump with a capacity of 2,000,000 gallons per day. The whole plant is thoroughly and substantially built of brick.

Veazie is finely situated for the establishment of such a plant. The water power is immense. The flow of the river at low water at this point is 146,000 cubic feet per minute, affording 2,500 horse power with a nine foot head. The average horse power would be far more than that. One of the greatest reasons for the rapid introduction of the electric motor is the fact that wherever power is wanted, be it near the river or miles away, it makes no difference to the silent and mysterious agent which, following the wire suspended for its conduction, can convey the force produced by the rush of water over falls and cataracts and use it at points where convenience or inclination dictates.

The Electric Motor's Work.

The New York *Sun* thus speaks of electric power, in which the work of the motor is summed up as follows:

"In some cities, so far has the use of electric motors gone, that it is possible for a man to-day to drink at breakfast coffee ground and eat fruit evaporated by electric power. During the morning he will conduct his business with electrically-made pens and paper ruled by electricity, and make his records in electrically-bound books, his seventh-story office, in all probability, being reached by an electric motor elevator. At luncheon he will be able to discuss sausages, butter, and bread, and at night eat ice cream and drink iced water due to the same electrical energy. He will ride all about the place in electric cars, wear shirts and collars mangled and ironed by electric motors, sport a suit of clothes sewn and a hat blocked by the same means; on holidays ride a merry-go-round propelled by an electric motor, or have his toboggan hauled up the slide with equal facility; be called to church by an electrically-tapped bell, sing hymns to the accompaniment of an electrically-blown organ, be buried in a coffin of electric make, and, last of all, have his name carved on his tombstone by the same subtile, mysterious, all-pervasive, and indefatigable agency. This may sound like a wild and exuberant flight of fancy, but it is simply a faithful statement of the manner in which electricity is being supplied to every one of the necessities and luxuries of life in America."



1. ENGLISH MAGAZINE RIFLE: SECTION AFTER FIRING FOUR BULLETS
2. VIEW OF RIFLE, SHOWING LOCKING-BOLT AND DIAL SIGHT-POINTER "ON"
3, 4, and 5. ELEVATION, END VIEW, AND SECTION OF MAGAZINE
6. ENLARGED VIEW OF BORE IN CROSS-SECTION
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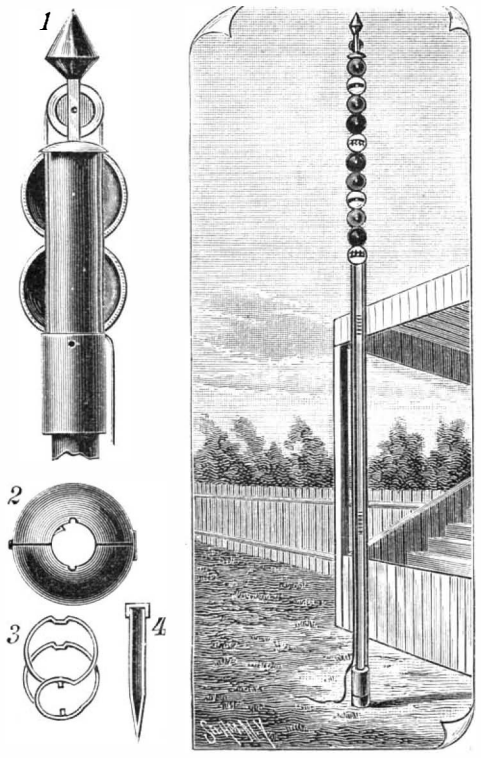
THE NEW ENGLISH, FRENCH, AND GERMAN MAGAZINE RIFLES.

(*From the London Graphic.*)

AN IMPROVED SCORE DEVICE.

The illustration represents a device for keeping the score of base ball and other games in such a manner that it will be constantly within view of all those assembled to witness the game. It has been patented

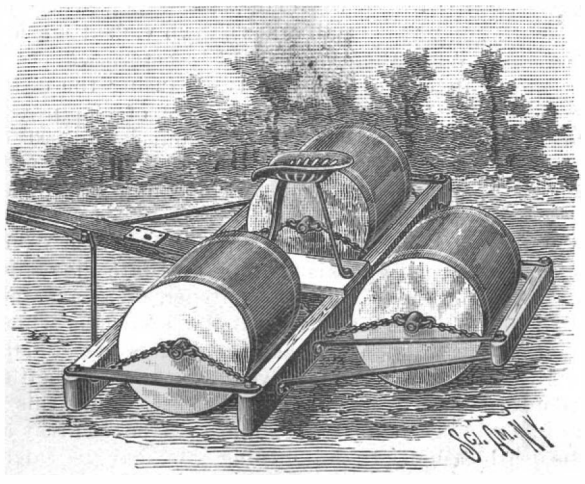


BROWNE'S SCORE DEVICE FOR BASE BALL, ETC.

by Mr. Warren A. Browne, of Hempstead, N. Y. A tubular socket, shown in Fig. 4, is driven into the ground, this socket being adapted to receive a pole, and being provided with a cap to exclude dirt when the device is not in use. The pole, which may be made in sections if desired, supports at its top a pulley, as shown in Fig. 1, a metal sleeve being movable upon the pole by means of a cord attached to the sleeve, passing over the pulley, and thence to the ground. The score is kept by different colored balls, a striped or banded ball indicating a blank when no runs have been made in an inning. The score ball is of tin or sheet metal, bent or pressed to shape in the form of two half sections of a hollow sphere, hinged at one side and with a spring latch at the other side, as shown in Fig. 2, each section having a circular recess at its top and bottom edge, to provide for closing the sections around the pole, and so that it will freely slide thereon. A channel is also provided in these recesses, through which the cord passes, and each ball is provided with a spring adapted to bear with sufficient force against the pole to hold the ball in any position in which it may be left thereon. The different colored balls or blanks, as they are placed on the pole, and drawn up by means of the sleeve and cord, during the progress of the game, are thus held conspicuously in view, as shown in the large figure. A gripper is provided, shown in Fig. 3, for use in case a score ball should be elevated by mistake. The gripper is made of spring wire, bent to form a partial base ring, with circular side pieces or wings adapted to make a spring clasp around the ball. The gripper is attached to the top of the sleeve by means of studs on the inner face of the base ring, which fit in apertures in the sleeve, whereby the gripper may be drawn into engagement with the ball, after which the sleeve is permitted to descend, with the ball held by the gripper.

AN IMPROVED LAND ROLLER.

In the device represented in the accompanying illustration, which has been patented by Mr. Daniel Kint, of Alpena, South Dakota, the rollers are self-adjustingly mounted in the frame to more readily adapt the roller to the ground. This is effected by forming the bearings in which are journaled the axles of the rollers in sets of chains secured between the front and rear

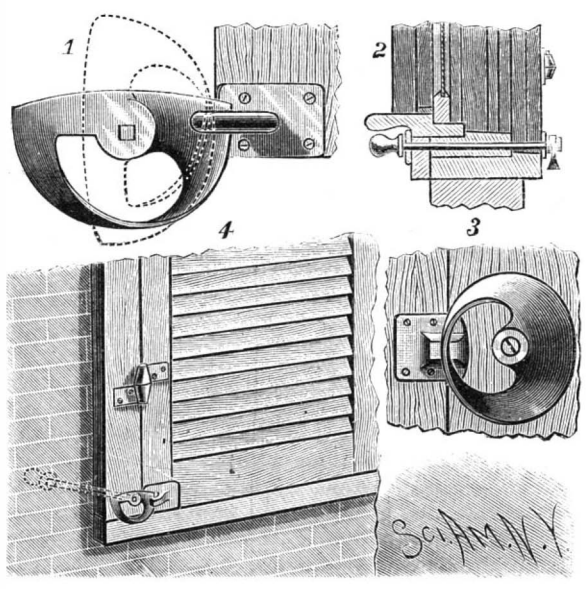


KINT'S LAND ROLLER.

beams of the main frame. Supported from the rear beam of the main frame by suitable braces is a short beam, whereby a third roller is mounted in a similar manner to the rear of and between the two rollers in the main frame, and just behind the driver's seat. With this construction the roller is permitted to swing up or down at either end, according to the nature of the ground, the driver in the seat not being affected by the rollers passing over uneven surfaces, as with the ordinary rollers, while the animals pulling the roller are likewise relieved from the jarring and jerking so commonly experienced when the rollers are mounted in bearings rigidly secured to the frame.

AN IMPROVED SHUTTER WORKER.

The illustration represents an improved device for opening or closing window shutters or blinds from within the building without raising the windows, and whereby also the shutters may be partly or entirely opened and held at any desired point of adjustment. It has been patented by Mr. Edwin T. Keener, of Moberly, Mo. Fig. 1 shows the application of the device with the shutter closed and half open, the latter position being indicated by dotted lines. Fig. 2 is a sectional view through the window frame with the shutter closed, Fig. 4 showing the appearance from the outside, and Fig. 3 representing a modified form of the device. As shown in Fig. 1, a semicircular camhead is employed, having a flattened, band-like rim, which is gradually twisted from one corner, where the rim joins the transverse bar, to the opposite corner, thus converting the rim into a spiral band, the pitch given producing a half turn of its edges. A rocking shaft attached at a right angle to the radial center of this camhead is passed through the wall of the building at such point as will permit the camhead to engage an arm with bifurcated end, the arm being integral with a plate attached to the lower outer corner of the window shutter or blind. The center of the forked end of the arm and of the camhead are in the same vertical plane with the axis of the hinges. By reason of



KEENER'S SHUTTER WORKER.

the twisting form of its rim, a half revolution of the camhead throws the shutter entirely open, or any degree of open adjustment may be effected, as desired. The length of the rocking shaft is proportioned to the thickness of the wall and projection of the shutter by its hinges; but when the shaft is introduced, a washer is placed over its inner end and the knob screwed on until end play is taken up, leaving the shaft free to rotate. In the modified form of the device shown in Fig. 3, a whole turn of the knob and worker is required to open and close the shutter, instead of half a turn, while the fork on the blind projects directly outward.

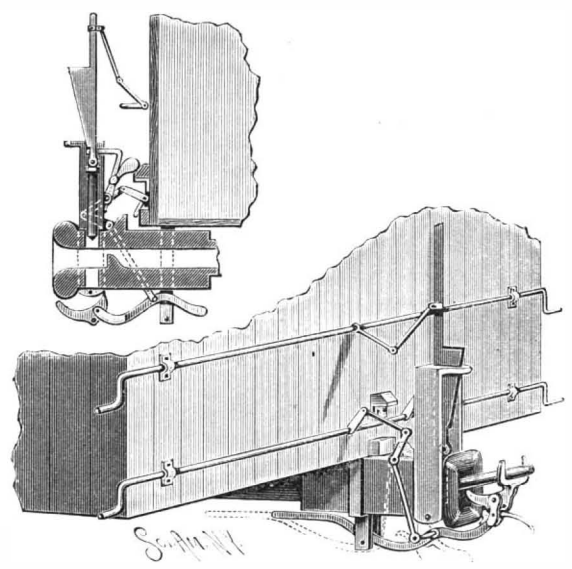
A TOOL FOR SETTING BOILER FLUES.

A boiler flue beader which forms a bead on the inner and outer face of the head plate, and is also adapted to cut off the end of the tube or flue when the latter is longer than necessary, is shown in the accompanying illustration. Fig. 1 is a transverse section of the beading rollers, Fig. 3 showing the operation of beading with the device, and Fig. 2 the cutting off of the end of a tube. On one end of a hollow stem is a head carrying in suitable recesses in its rim beading rollers, which are forced outward to form the bead by means of a tapering spindle, which passes centrally through the stem and the head, the spindle being turned by a handle on its outer end to rotate the beading rollers and force them outward. A block turning loosely on the stem has studs, on which are mounted rollers adapted to engage the outer projecting end of the flue, this block having a polygonal offset adapted to be engaged by a wrench, while a nut screws on the threaded outer end of the stem against the polygonal offset, to hold the beading rollers in contact with the outer end of the flue. To cut off the end of a tube or flue, one of the beading rollers is removed and a cutter put in its place, the cutter having a dowel pin to engage a recess in the block, thus holding it firmly to its work.

Further particulars relating to this invention may be obtained of the patentee, Mr. Benjamin B. Farris, of Rocky Ford, Ga.

AN IMPROVED CAR COUPLING.

The device shown in the illustration, which has been patented by Mr. William C. Brigam, is designed to be

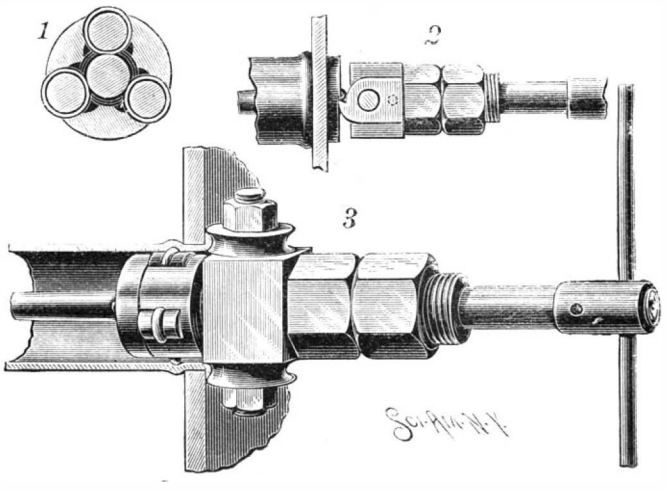


BRIGAM'S CAR COUPLING.

attached to the ordinary drawhead to automatically couple cars of different height, and to be easily operated from the sides or top of the car. The drawhead is attached to the car to have a limited longitudinal movement, and has an internal lug to prevent the link being pushed too far in, while mounted upon and attached to the drawhead is a vertical frame. Pivoted to the upper end of the coupling pin is a rod extending to the top of the car, and this rod has near its lower end a projection sliding in the frame, and which tapers down to a shoulder adapted to rest upon an angular arm, as shown in the sectional view. The vertical rod is pivotally connected by a connecting rod with an arm from a horizontal shaft extending across the end of the car, and having a crank handle at each end, whereby the coupling pin may be raised. Pivoted in the frame upon the drawhead, to the rear of the coupling pin, is an arm with a horizontally extending portion forming a tripping piece adapted to engage the shoulder on the lower end of the vertical rod, holding it and the coupling pin in elevated position, this arm also having a rearwardly extending weight and spring to hold it in position, while fixed to the car, opposite the weight, is a projection, to operate the weight and arm. Suspended in keepers beneath the drawhead is a curved rod, pivoted to the ends of bell crank levers, and there is pivoted in the forward end of this rod a link lifter, the rod being curved in such a manner that it will easily swing beneath the drawhead. The bell crank levers are pivoted at their elbow on a rod engaging lugs on the upper side of the drawhead, and the upper end of each lever is connected by a rod with a crank of a shaft mounted on the end of the car, and having operating crank handles at its ends, whereby the link may be swung upwardly, as shown in the view in perspective. Attached to the tripping bar is a curved extension adapted to engage the link lift, as shown in dotted lines.

For further information relative to this invention address the inventor, or Mr. Charles D. Grace, Bonham, Texas.

A PETROLEUM engine has been introduced in a lighthouse in Scotland for working the siren of the fog signal apparatus recently installed.



FARRIS' BOILER FLUE BEADER.

Interesting Information Concerning Anæsthetics.

At the recent international medical congress, Berlin, Dr. Horatio Wood, of America, delivered an able address on anæsthetics. He showed by charts and experiments that, contrary to the received dictum, chloroform killed by paralyzing the *respiration* as well as that of the heart and that ether killed by paralyzing the *heart* before respiration had ceased. "The safest anæsthetic," he said, "was undoubtedly nitrous oxide. Out of 50,000 administrations only one death had occurred." Dr. Wood regarded ether as safer than chloroform by the ratio of 1 to 3 or 1 to 5. And "the best method of administering ether is by using the inhaler made of cloth stretched across the wire frame which is surrounded by rubber or leather. You want plenty of *fresh air mixed with your ether*."

"The reason chloroform is more fatal is probably on account of its greater specific gravity. It lies in the lungs and mixes slowly with the air and completely poisons the nerve centers before oxygen can gain admission to the blood. Ether is more volatile, and hence less dangerous." Chloroform, he said, was also less dangerous in the hot climates. Probably because it was more readily volatilized.

Dr. Wood cited several authentic cases where the respiration and *circulation* had actually stopped for two minutes and respiration and resuscitation accomplished. He showed drawings of pulsation and respiration, by means of suitable instruments introduced into the carotid and affixed to the chest. The heart had stopped for two minutes and respiration for five minutes, and resuscitation took place.

"Alcohol, either as an injection or given beforehand, is absolutely *unsafe*, and does more harm than good."

"Digitalis, to assist in resuscitating a flagging heart, is *valueless*."

Out of many experiments performed by him, he found that subcutaneous injections of *strychnine* and *artificial respiration* were the great restorative agents. He recounted many instances where recovery occurred after practicing artificial respiration for two, four, eight, and even *twenty-four hours*.

"Use a moderate amount of strychnine, inject if you will saline solutions or ammoniacal solutions into the veins, but use artificial respiration, and you may save most of your chloroform cases."

The Rapid Destruction of our Forests.

According to a government report on the consumption of forest supplies by railroads, about 73,000,000 ties are annually needed for new construction and renewals by the roads of the United States, which is equivalent to about 365,000,000 cubic feet of raw material. The various woods are estimated to be used in about the following proportions: Oak, 45,000,000; chestnut, 3,500,000; pine, 12,500,000; red, white and California cedar, 5,000,000; hemlock and tamarack, 2,500,000; cypress, 1,500,000; redwood, 2,500,000; other kinds, 500,000. Thus oak furnishes about 60 per cent of the supply, and not only from choice trees mainly, but from the young growth, which may make one tie to the tree or one to the cut. For bridge and trestle work 60,000,000 cubic feet of sawed material may be added to the requirement, so that a total of 500,000,000 cubic feet of wood in the shape of round timber for railroad purposes seems to be a reasonable estimate of the annual consumption. This requires the culling of the best timber from probably more than 1,000,000 acres of natural forest lands, and to furnish this amount continually it is calculated that not less than from 10,000,000 to 15,000,000 acres of well managed forest would be required, or with the present absence of management the area to be reserved for the purpose would have to exceed 50,000,000 acres, or more than 10 per cent of the present forest area of the country.

Chief Fernow, of the forestry division, recommends the establishment of experimental tree plantations, to settle as far as possible the various questions regarding forest planting, upon which the opinions of settlers differ so greatly. There is no better method for both gaining and giving information. The chief, therefore, proposes in his annual report to seek the co-operation of the experimental stations now existing in the treeless regions, and that of private individuals who can offer special facilities, in order to establish experimental stations upon a uniform and centrally directed plan, while it would also be desirable to seek the co-operation of the authorities having charge of the military reservations in the West, for a similar purpose. From such stations it would eventually be possible to distribute plant material, as has been successfully done by the California agricultural and forestry stations and elsewhere. A desirable expenditure in the same direction, Mr. Fernow thinks, would be the establishment of a national arboretum at Washington, for the purpose of collecting the timber trees that can be acclimated there. Besides many reasons of expediency, among which the educational character of such an institution in connection with the division is a potent one, the location of an arboretum at Washington recommends itself on account of the climatic conditions, which will admit of growing in the open air a greater range of arborescent plants—from the long leaf pine of the South to the spruce and hemlock of the North and the conifers of the Pacific coast—than at almost any other locality in the East.

NEW HOSE COUPLING.

We give engravings of two forms of patented hose couplings, manufactured by the National Hose Coupling Co., of Pomona, California.

These couplings may be instantly connected or uncoupled without the use of a spanner, and are, therefore, especially adapted for attachment to fire hose, in the use of which even a small fraction of time is often of great importance. The smaller coupling, shown in Fig. 1, is to be used in connection with garden or street washing hose. This form of the coupling is provided with a forked hook pivoted on diametrically opposite sides of one half of the coupling, the hook being cam-shaped and adapted to engage lugs upon the opposite half of the coupling, so as to draw the two parts firmly together, thus compressing the elastic packing contained by the coupling, and insuring a tight joint.

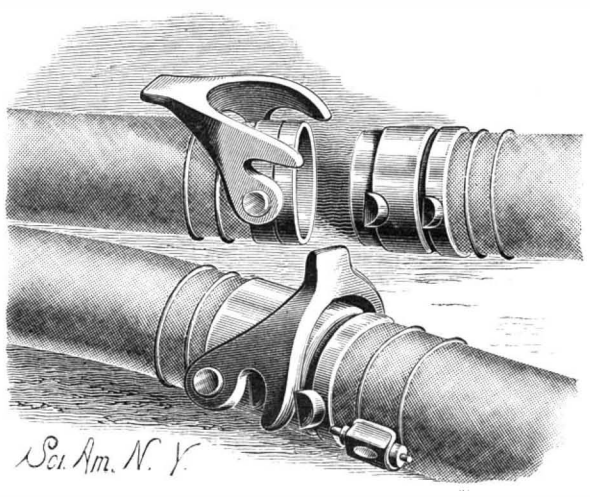


Fig. 1.—GARDEN HOSE COUPLING.

The fire hose coupling, shown in Fig. 2, united and separated, involves the same principle as that of the garden hose, with the addition of a lock or fastener, which holds the double hook firmly in position. This coupling, while it may be instantly united, and quickly separated, is no more liable to accidental separation than the screw coupling. The lock consists of a loop pivoted to the back of the double hook, and adapted to engage a stud projecting from the side of the coupling when the parts are united. A spiral spring surrounding the pivotal pin of the loop automatically throws the loop into engagement with the stud. This loop, which serves as an automatic lock to the hook, also answers as a convenient handle for releasing the coupling.

It will thus be seen that neither spanners nor wrenches of any kind are required for operating the coupling. The cam surfaces of the hook insure a sufficient compression of the elastic packing contained by the coupling to prevent any leakage.

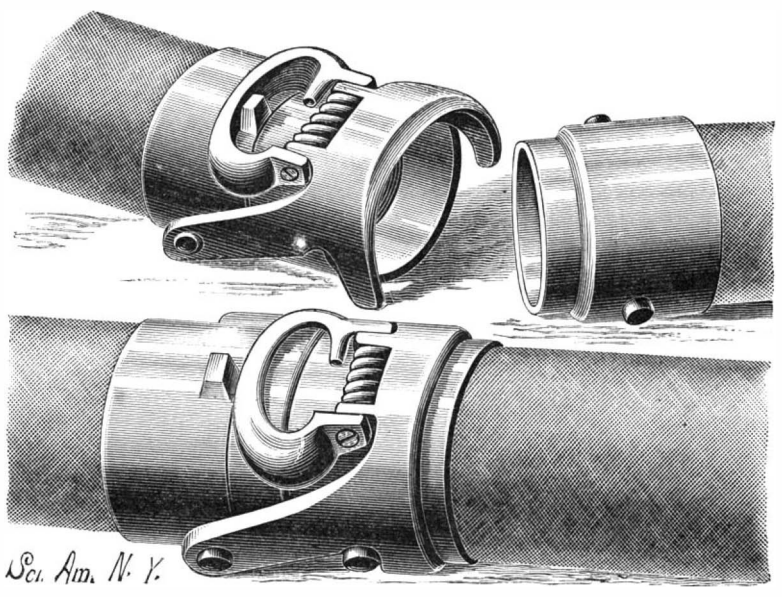


Fig. 2.—FIRE HOSE COUPLING.

For further information in regard to this coupling, and samples, address the National Hose Coupling Co., of Pomona, California.

New Prospects for Gold Mining in California.

Taking for a text the fact that two-dollar auriferous quartz can now be mined and milled in California at a profit, an interesting sermon might be preached therefrom on the possibilities of gold mining in this State. When we commenced this branch of mining in California, quartz carrying free gold to the value of $50 per ton was considered about as low-grade ore as we could then afford to handle, $30 rock being thrown aside as utterly worthless.

So costly then were labor and the other factors of production, so imperfect our machinery and methods, and such our ignorance of the business, that after we had followed quartz mining for a few years, much money having been spent in the interim to promote it, this industry, instead of growing and prospering as was expected, actually went into a decline, and for a long succession of years idle quartz mills and abandoned mines were to be seen all over California.

But at length there came a change; not marked or rapid at first, but a change that in good time served to restore life to this business and finally insure for it a lasting and cumulative prosperity.

Vast and diversified are the material resources of California. Boundless the opportunities presented here for the profitable employment of capital and labor. All our leading home pursuits are destined to undergo early and rapid expansion. There can be no doubt of this. We have already entered on this the stage of our second growth. But on none of these domestic industries does there await such phenomenal growth as that reserved for the business of quartz mining. It is the one thing in which we have the raw material without stint, unexampled facilities for its prosecution and that cannot be overdone.

Who can measure the two-dollar per ton gold-bearing quartz to be found in this State? Who can measure even the extent of our auriferous territory? We know our principal gold belt covers an area of 20,000 square miles or more, besides which we have several minor gold fields whose aggregate area is nearly half as large. We know this whole territory abounds with auriferous quartz veins, but we know little about their extent, because not one in a hundred has yet been exploited to any great depth.—*Mining and Scientific Press.*

Premiums for Railroad Inventions.

The "Verein Deutscher Eisenbahn-Verwaltungen" has offered nine premiums, of a total value of $7,500, for inventions and improvements relating to (1) the construction and mechanical arrangement of railroads; (2) rolling stock and its maintenance; (3) the administration and working of railroads and railroad statistics, as well as important works on railroads. Without restricting the scope of the competition, and without binding the jury in its decisions, it is recommended that competitors should confine themselves to the following subjects:

1. Design and construction of a locomotive boiler which, without increasing its weight, affords safety against explosion, and reduces, at the same time, working expenses.

2. Improvements in the construction of locomotives, especially the valve motion, whereby a better utilization of the steam may be obtained.

3. Proposal and justification of a simpler means of calculating truck hire.

4. The construction of a durable and practicable coupling for steam pipes or continuous brakes without the use of India rubber.

5. The construction of a practical and cheap switch brake.

The competition is limited to inventions and improvements covering the period of eight years extending from July 16, 1883, to July 15, 1891, and works and drawings must be sent in between January 1 and July 15, 1891, to the "Verein Deutscher Eisenbahn-Verwaltungen," Berlin, from which also complete copies of the regulations governing the competition may be obtained.

Tornadoes and Violent Storms.

A special investigation of the subject of tornadoes has been carried on by Prof. H. A. Hazen, of the Government Signal Service, during the past year. Prof. Hazen divided the tornadoes into three classes. First, violent storms causing destruction; third, the most severe tornadoes; and placed in the second class all other known violent storms. While there were about 1,000 tornadoes each in classes one and two, causing the death of 1,071 people, an average of one person to two storms, and a loss of about $23,000,000 in property, yet there were but 58 tornadoes of a very violent character, killing 755 people, and destroying property to the amount of $11,894,700, an average loss of 13 lives and over $200,000 of property to each storm of class three. It appears that in no State may a destructive tornado be expected oftener, on an average, than once in two years, and that the area over which the total destruction can be expected is exceedingly small. In the last eighteen years the death casualties from tornadoes averaged 182 annually. While this is a large number, it does not appear to be as great as the death casualty from lightning. It may be safely assumed that, dangerous as are tornadoes, they are not so destructive to life as thunder storms.

Correspondence.

Filling Glass Jars with Hot Mixtures.

To the Editor of the Scientific American:

In reply to query No. 2435, the plan of Jennie Bierger, given in SCIENTIFIC AMERICAN of November 1, to prevent glass jars and bottles from being broken by filling them with hot materials, is a good one. But a plan more simple and never failing is to place a silver spoon or any other silver instrument in the glass jar or bottle. This method effectually prevents even the most delicate glass from cracking. C. S. DARRACH.

Cumberland, Ind.

What is a Foot Pound?

To the Editor of the Scientific American:

Some four years ago I was called to give expert testimony as a mechanical engineer in a case involving some nice mechanical points. The opposing lawyer, as is quite the custom, sought to belittle my knowledge of mechanics by asking some very elementary questions, among which was, What is a foot pound? To which my answer was, "A pound weight—or thrust—moved through the space of one foot. The lawyer then quickly asked, In what time? To which I answered, any time—an hour, a day, a month, it is without time. I also explained that a foot pound was a unit of power, from which all estimates of work done, or to be done, are calculated, and that time was not mentioned until it was necessary to applicate work in horse power, then 33,000 foot pounds accomplished in one minute was a horse power. In the argument which followed after the evidence was all in, it was claimed that I was in error, that there was no work without time, that a foot pound means a pound raised a foot in a given time. Notwithstanding the fact that I had stated the case properly, I find that there are many well informed persons who I think should know better, who still stubbornly contend that the foot pound means a pound weight raised a foot high in a given time. In despair of ever being free from unjust criticism on this subject by my own efforts, I beg you to write a few lines on the subject in your valuable and widely circulated journal, to the end that your many readers may be correctly informed.

WILLIAM GOLDING.

New Orleans, November, 1890.

[You were correct.

The UNIT OF WORK is one pound lifted one foot high or thrust through one foot against gravity, without regard to time, and is called a foot pound. The impact of a blow, the power of explosives, are all expressed in foot pounds or foot tons, without regard to time. It is the expression of moving force.

The UNIT OF RATE OF WORK, or the unit of measure of power, is one pound lifted one foot in a given time, as one second, or one minute, and by custom a horse power is assigned as a common measure of the rate of work.—ED. S. A.]

Ordinary Actions of Oxygen.

BY GEORGE L. BURDITT.

In the year 1774, philosophers all over the civilized world were astonished by Dr. Priestley's discovery of oxygen. It has rightly been called the most important discovery of that century, and rivaled Newton's discovery of gravitation in the preceding century. Besides forming an epoch in the progress of learning, it put an end to old chemical theories, and at the same time laid the foundation of modern chemistry, furnishing a key to many of nature's secrets. But, while Newton's discovery is unsurpassed in grandeur, Priestley's is more closely connected with earthly affairs.

Oxygen is the most abundant of all the elements. It composes at least one-third of the earth, one-fifth of the atmosphere, and eight-ninths by weight of all the water on the globe. It is also a very important constituent of all minerals, animals, and vegetables. Oxygen may be prepared in a variety of ways. One way is to heat mercuric oxide in a tube or retort. Mercury is soon condensed in the coolest part of the retort, and a gas is liberated, which may be collected over water: $2HgO = 2Hg + O_2$. It was by this method that Dr. Priestley discovered the gas. A supply of very pure oxygen may be obtained by the action of heat upon potassic chlorate. A flask may be used to hold the chlorate, and the gas may be collected in jars over water. When the quantity of chlorate is large, the heat required is apt to soften the glass of the flask in which the chlorate is decomposed. It has been found that metallic oxides, if mixed in a fine powder with the pulverized chlorate in the proper proportions, cause the expulsion of the gas at a much lower temperature, although such oxides do not appear to have experienced any change during the operation. Black oxide of copper or oxide of manganese are the oxides generally used, but the resulting oxygen always contains traces of chlorine. These are the simplest ways of getting oxygen for experiments, although many others exist.

Oxygen is a colorless, tasteless, and scentless gas, a little heavier than air (specific gravity 1·1056), and only slightly soluble in water. It was first condensed to a liquid by Pictet and Cailletet, but the operation was quite difficult. It refracts light the least of any known substance. At ordinary temperatures it possesses weak magnetic properties, but its susceptibility to magnetization is diminished, and sometimes disappears temporarily, at 325°. Oxygen has a strong attraction for other elements, excepting fluorine, and enters into combination with them, forming a great variety of compounds. With some elements it forms gases; with others, liquids; with others, solids. Some of these compounds give up their oxygen with great ease, while others do not. With one set of substances it forms neutral compounds; with others, alkalies; with still others, acids. With some elements it forms nourishing food; with others, deadly poisons. Mingled with one gas, nitrogen, it forms the air we breathe; combined with another gas, hydrogen, it forms the water we drink. It is necessary to the support of all animal life, and hence was called by the old chemists "vital air;" but its action upon the lungs is very violent if breathed undiluted for any considerable time.

The distinguishing feature of oxygen is its great power of supporting combustion. When, by any rapid chemical action, light and heat are produced, combustion is said to have taken place. Heat is usually necessary to start the process, but afterward the heat given out during the process is more than enough to carry it on. In regard to combustion, all bodies may be included in one of three classes:

1. Supporters of combustion; those which, like oxygen, allow bodies to burn freely in them, but do not burn themselves.

2. Combustibles; those substances which, like charcoal, actually burn in a gas of the first class, when raised to the proper temperature.

3. Those bodies which, like sand, iron rust, or earthy bodies in general, neither burn themselves nor support the combustion of other bodies; they may be made red hot, but they do not burn.

The terms "combustible" and "supporter of combustion" are, however, merely relative; for, although hydrogen is ordinarily a combustible, and oxygen and chlorine supporters of combustion, yet these two last mentioned gases are quite capable of burning when surrounded by an atmosphere of hydrogen. All substances which burn in air burn in pure oxygen with greater brilliancy. If a glowing splinter is put into a jar of oxygen, it is lighted and burns with a very bright light. Substances usually considered incombustible may burn violently in oxygen. For instance, take a steel watch spring, coil it into a spiral, tip one end with sulphur and light it, and put the spring into a jar of oxygen. The spring burns with a dazzling light, and scintillates beautifully. The combination of oxygen with other elements is called oxidation, and the products are called oxides. Combustion is the combination of oxygen with another substance; so that oxidation is really combustion, and *vice versa*.

The cases considered above are cases of rapid combustion. At ordinary temperatures oxygen often enters into combination so slowly that the heat liberated is not perceptible (for oxidation always causes heat). This is the case when iron rusts in the air. This is called slow combustion; but this slow combustion is always accompanied by heat. A pound of iron will produce the same amount of heat, whether rusted in air or burnt in oxygen; only in the first case it may take years to develop this amount of heat, and in the second only a few minutes. Under favorable circumstances oxidation may become so rapid as to raise the temperature of a body to its ignition, when it bursts into flame, producing what is known as spontaneous combustion. This is especially the case in machine shops or factories, if piles of tow, used for wiping oil from machinery, or piles of oily iron filings, are left lying about for any length of time. Although the combustible, or body which is burned, may undergo such a complete change of form as to disappear from sight, yet there is no destruction of matter or loss of weight during combustion. When a candle burns, it seems to be completely destroyed, leaving only traces of ash. However, it may be shown that there is no actual destruction of the candle's components, but that they have combined with a certain proportion of oxygen, forming carbonic anhydride and aqueous vapor; and these, although invisible, really weigh more than the original candle, the gain in weight representing the amount of oxygen necessary to produce the change. Metals oxidize more rapidly in a moist than in a dry atmosphere. In the case of iron, the oxidation goes through the entire mass; but with other substances, like lead and zinc, only a coating is formed on the surface, which protects the parts beneath from oxidation.

Slow oxidation is constantly going on around us, although in such a quiet way as to be unnoticed in most cases. Oxygen, existing free in the atmosphere, pervades everything, and shows an irresistible desire to possess everything. The decay of animal and vegetable matter is due to oxygen, which, by its combination with them, breaks them up into simpler substances. It is this slow oxidation which rids the earth, the air, and the sea of their impurities—a sort of smouldering fire which consumes all waste matter. Its slight solubility in water enables it to remove impurities from below the surface of lakes, rivers, etc., thus keeping the water pure. The part played by oxygen in nature is of the greatest importance. It is a sort of keystone in the arch of chemical elements, holding them in their proper places by the vast number of combinations it makes with them.

Of the practical consequences of Dr. Priestley's discovery, Prof. Liebig observes: "Since the discovery of oxygen, the civilized world has undergone a revolution in manners and customs. The knowledge of the composition of the atmosphere, of the solid crust of the earth, of water, and of their influence upon the life of plants and animals, was linked with that discovery. The successful pursuit of innumerable trades and manufactures, the profitable separation of metals from their ores, also stand in the closest connection therewith. It may well be said that the material prosperity of empires has increased manifold since the time oxygen became known, and the fortune of every individual has been augmented in proportion."—*Pop. Sci. News.*

Population of our Principal Cities.

The new census show the population of fifty cities to be as follows:

	1890.		1880.
1. New York	1,513,501	1	1,206,209
2. Chicago	1,098,576	4	503,185
3. Philadelphia	1,044,894	2	847,170
4. Brooklyn	804,377	3	566,663
5. St. Louis	460,357	6	350,518
6. Boston	446,507	5	362,839
7. Baltimore	433,547	7	332,313
8. San Francisco	297,990	9	233,959
9. Cincinnati	296,309	8	255,139
10. Cleveland	261,546	11	160,146
11. Buffalo	254,457	13	155,134
12. New Orleans	241,995	10	216,090
13. Pittsburg	238,473	12	156,389
14. Washington	228,160	14	147,293
15. Detroit	205,669	18	116,340
16. Milwaukee	203,979	19	115,587
17. Newark	182,020	15	136,508
18. Minneapolis	164,738	38	46,887
19. Jersey City	163,987	17	120,722
20. Louisville	161,005	16	123,758
21. Omaha	139,526	63	30,518
22. Rochester	138,327	22	89,366
23. St. Paul	133,156	45	41,473
24. Providence	132,043	20	104,857
25. Indianapolis	107,445	24	75,056
26. Denver	106,670	49	35,629
27. Kansas City (estimated)	105,000	30	55,785
28. Allegheny	104,967	23	78,682
29. Albany	93,523	21	90,758
30. Columbus	90,398	33	51,647
31. Syracuse	87,777	32	51,792
32. New Haven	85,891	26	62,882
33. Worcester	84,536	28	58,291
34. Scranton	83,450	39	45,850
35. Toledo	82,652	35	50,137
36. Richmond	80,838	25	63,600
37. Paterson	78,300	34	51,031
38. Lowell	77,605	27	59,475
39. Nashville	76,309	40	43,350
40. Fall River	74,351	37	48,961
41. Cambridge	69,837	31	52,669
42. Atlanta	65,514	48	37,409
43. Memphis	64,586	54	33,592
44. Grand Rapids	64,147	58	32,016
45. Wilmington	61,437	42	42,478
46. Troy	60,605	29	56,747
47. Reading	58,926	41	43,278
48. Dayton	58,868	47	38,678
49. Trenton	58,488	64	29,910
50. Camden	58,274	44	41,659
Totals	11,284,633		7,750,715

Reduction of Indebtedness in the United States.

According to the new census reports the indebtedness of the nation, as well as of States, counties, and towns, has been greatly reduced within the past twenty years. The following table explains itself:

Net Debt.	1870.	1880.	1890.
National government	$2,386,358,599	$1,942,172,295	$988,175,172
States	352,866,698	227,176,133	152,117,739
Counties	187,765,540	124,027,586	115,224,885
Total	$2,926,990,837	$2,293,376,014	$1,255,517,796
Population	38,558,371	50,155,783	64,200,000

DEBTS PER CAPITA.

	1870.	1880.	1890.
National	$61.88	$38.74	$15.39
State	9.15	4.52	2.36
County	4.87	2.74	1.79

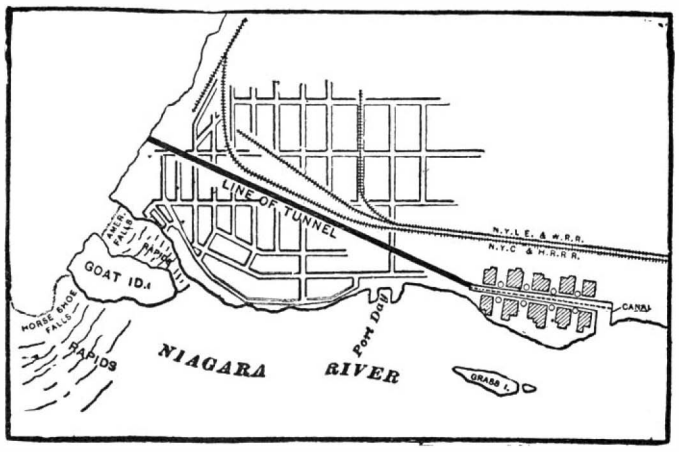
As regards municipal debts, the Philadelphia *Press* says: "In 1866 the aggregate debt of 130 cities was $223,000,000. In 1876 these same cities showed a debt of $644,000,000. In 1880, 858 municipalities only showed a debt of $695,000,000, and according to the forthcoming census the debt of these same 858 municipalities will be $699,500,000; and this with an increase of from 35 to 38 per cent in the population."

UTILIZING NIAGARA FALLS WATER POWER.

Probably no one question has more commonly come up among manufacturers and the more intelligent mechanics of the country, for years past, than the inquiry as to why the great water power of Niagara Falls has not heretofore been harnessed to the machinery of extensive industrial establishments, and made to do work in some degree commensurate with its mighty potentiality. Beyond the feelings evoked in the mind of the casual beholder by the grand and sublime spectacle here presented, there arises involuntarily in the mind of the engineer an almost boundless prospect of magnificent possibilities in the utilization, for the service of mankind, of the tremendous energy which nature here displays. Something has been done, it is true, in the way of using this natural water power, but such employment has been quite infinitesimal in comparison with the grand total offered. A canal three-quarters of a mile long, commencing just above the falls and terminating on the high bank below, has for several years furnished the water to run about a dozen establishments, principally flouring mills, but so incomplete has been the provision for utilizing the full head of the water, that, as it escapes in the tail-race, after passing through the wheels, it has in many cases a fall almost equal to that of the falls proper.

The great obstacle to the further utilization of this power hitherto has been the immense amount of rock cutting, through the hard Niagara limestone, which any complete employment of the great head afforded by the falls would necessitate. This work has now been undertaken by the Niagara Falls Power Company, according to the plans shown in the accompanying illustrations, and with a contemplated investment of over three millions of dollars. A tunnel is to be constructed, of horseshoe shape in cross section, from the water level below the falls to a point about one mile above the falls, this tunnel being at an average depth of about 160 feet below the ground, and some 400 feet from the river, with which it will be connected by surface canals. The tunnel will thus furnish an immense tail-race for the wheel pits, to be sunk below the level of the canals. The tunnel, canals, and wheel pits will all be cut in hard rock, which occurs at no point over ten feet below the surface. The lower end of the tunnel will be beneath the village of Niagara, and it will have a rising grade of seven-tenths of one per cent; its cross-sectional area is to be 490 square feet, which is estimated to be sufficient to discharge the water from wheels adapted to furnish 120,000 horse power. The company will put in turbine wheels in a number of the pits, to furnish power by cable, pneumatic tube, or electricity, and will also lease privileges to customers desiring to make their own wheel pits and put in their own wheels and connections. One of our illustrations shows a plan for the development of a 2,000 horse power, which it is proposd to distribute for various uses. The manner in which the water is led to the turbine wheel, in trunk pipes, is represented according to the usual plan adopted in present water power systems; but the diameter of the wheel pits is shown to be sufficiently large to admit of any preferred method of gearing for the transmission of the power to the surface of the ground. As shown in the sectional view and in the plan of a wheel pit for a large power plant, it will be observed that, in the gradient of the tunnel, and in the ample space left below the wheel, there is a decline given to the tail-race such as is unknown in the setting of the wheels in most places where water power is used, so that there can never be any trouble from back pressure. Although the construction will give a fall of 160 feet from the canals to the tunnel, it is not contemplated to use more than 120 feet head upon the wheels, leaving the remainder for the free discharge of the water.

The work of sinking the first shaft, from which the tunnel will be projected by lateral headings, is shown in our first page illustration, and does not differ from ordinary rock cutting in mines. The company has purchased about 1,300 acres of land, extending along the river shore about two miles, affording docking facilities and furnishing ample room for mill sites and homes for the operatives, which will yet be so far away from and above the falls as not to impair its beauty and grandeur in the eyes of visitors. This is shown in one of the views, exhibiting the line of the tunnel to the first hydraulic canal, other canals being made as required by the development of manufacturing at this point until the capacity of the tunnel to discharge the water used is fully utilized.



LINE OF TUNNEL UNDER TOWN OF NIAGARA TO FIRST CANAL.

The location affords great advantages in the way of transportation facilities, for it is on direct water communication with the ports of all the great lakes and the Erie canal, and side tracks from the leading trunk lines of railway will be run to all the lands and mill sites.

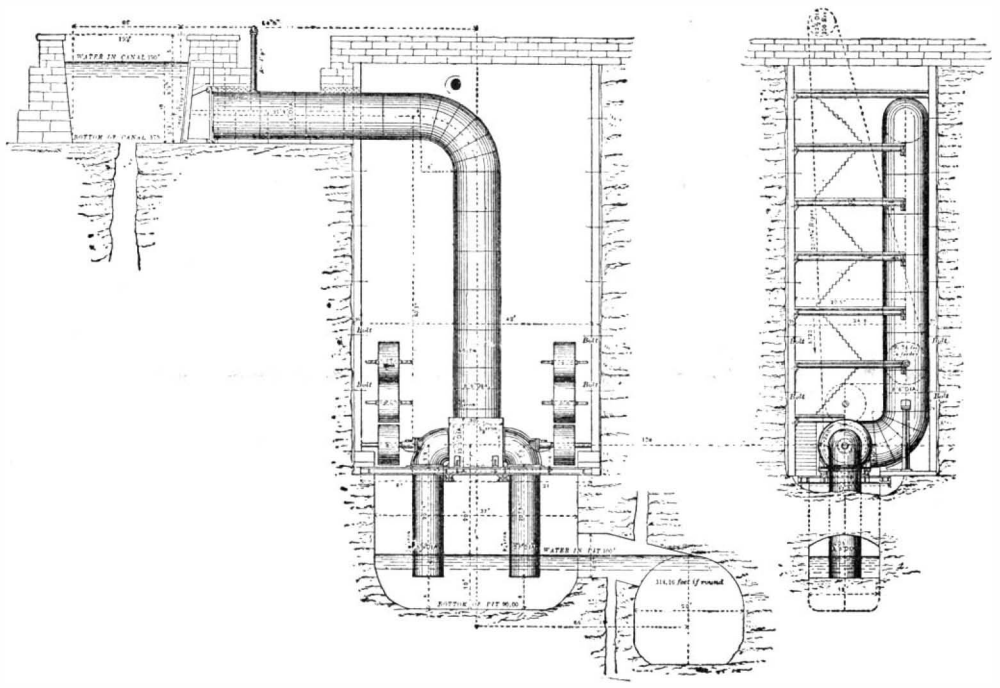
The distinguishing feature of this great enterprise, as compared with all other undertakings by which water power has been utilized for industrial purposes, lies in the utterly inexhaustible supply of water to be drawn from. It is estimated that the tunnel will not take from the river more than four per cent of the water now flowing over the falls, and yet will furnish an amount of power greatly in excess of that now available at Lawrence, Lowell, Holyoke, and Cohoes combined. In all these manufacturing towns, too, it is to be remembered that the water privileges only cover the right to use water for a certain number of hours each day, not contemplating night work, and, even with these restrictions, stoppages from want of water are frequent during the summer months, so that very many establishments have found it necessary to supplement their water power with a steam power plant. At Niagara, however, nature has made a great natural dam, by which all the great lakes, draining a country of more than 241,000 square miles, are formed into mammoth reservoirs, so that there is practically no variation in the height of the river from one season to another. Water can, therefore, be as readily supplied for a day of twenty-four hours as for one of ten hours, there will never be any anxiety about the giving way of dams, and the machinery, once started, need never stand idle.

The Niagara Falls Power Company was incorporated by the New York Legislature in 1886. Its officers are Edward D. Adams, president; Francis Lynde Stetson and Edward A. Wickes, vice-presidents; William B. Rankine, secretary; and George H. Kent, treasurer.

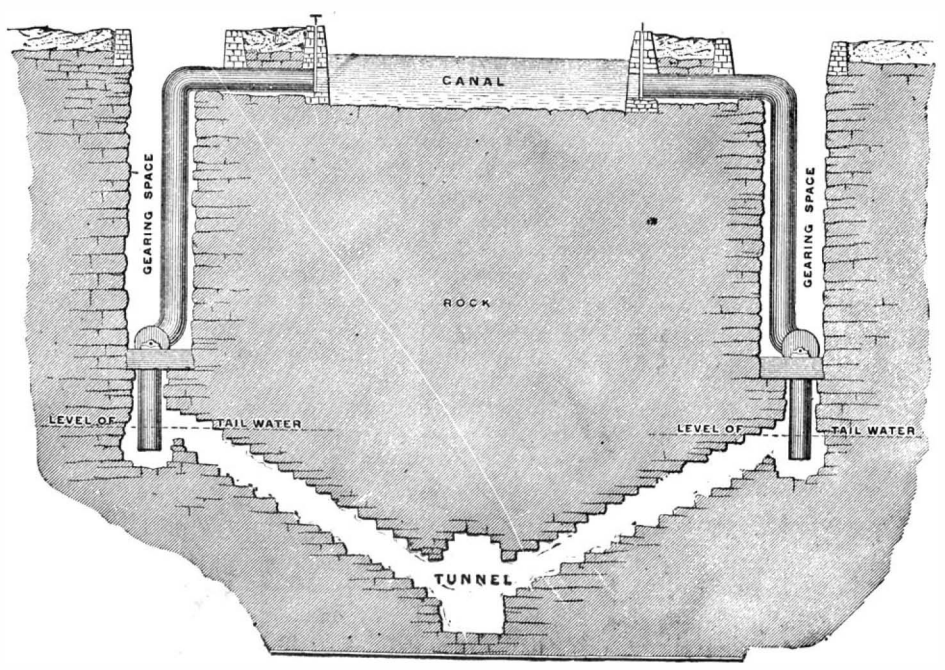
A contract for the work has been made with the Cataract Construction Company, and operations have been commenced upon the tunnel, shafts and raceways.

According to the contract, the first section of the work will be completed and the power ready for use by the first of 1892.

Albert H. Porter is the resident engineer; John Bogart and Coleman Sellers, consulting engineers; and Clemens Herschel, hydraulic engineer.



PROPOSED ARRANGEMENT OF WHEEL PIT AND GEARING TO DEVELOP 2,000 HORSE POWER.



SECTION OF CANAL, TUNNEL, AND WHEEL PITS.

Cocoanut Butter.

The *Kew Bulletin* contains a number of documents describing the preparation of cocoanut butter. The chief of these is a report from the British vice-consul at Berlin, stating that the process of producing an edible fat from the marrow of the cocoanut was discovered about five years ago by Dr. Schlinck, of Ludwigshafen on the Rhine, and has been regularly carried out since 1888 by a Mannheim firm. Factories are also about to be established in Paris and Amsterdam. The article is described as having "at present an unlimited sale." The trade is chiefly with Germany and Switzerland; the sales are steadily on the increase. The supply is about 50 cwt. per day, but the demand is occasionally double this. From a report from the United States consul at Mannheim, who first drew attention in other countries to the product, the number of workmen now employed in the factory is 25, and the price of the butter 6½d. to 7½d. per lb. The nuts are obtained from the South Sea Islands and the African and South American coasts. The butter contains 60 to 70 per cent of fat and 23 to 25 of organic matter, of which 9 to 10 per cent is albumen. It is of a clear whitish color, and hardens at 66° Fahrenheit. It is suitable for cooking, and is not disagreeable to taste or smell. At present it is chiefly used in hospitals and State institutions, but it is rapidly finding its way into the homes of the poor, who are taking to it instead of oleomargarines. It is said to be free from acids and other disturbing elements found in butter, and thus to be easier of digestion. "There are those who do not hesitate to declare this new substitute as healthier and infinitely preferable to the too often bad butter brought in the markets, and not to be named in the same breath with the oleomargarines made too often from the diseased fat of horse and sheep flesh."

The Paper Industry.

Three thousand millions of pounds is the estimated yearly production of paper. The United States has 884 paper mills and 1,106 paper machines; Germany 809 mills and 891 machines; France 420 mills and 525 machines; England 361 mills, 541 machines; Scotland 69 mills, 98 machines; Ireland 13 mills, 13 machines; Russia 133 mills, 137 machines; and Austria 220 mills, 270 machines.

THE NORTON SELF-BALLASTING LIFE BOAT OR YACHT.

The Norton system of construction, adaptable to all classes of vessels needing ballasting, has recently been brought before the public by the trials to which vessels embodying this principle have been subjected. This system consists of a peculiar construction by which a vessel when placed in the water takes in her own ballast, and when taken out of the water at once discharges the ballast. This is done automatically. It is the invention of Captain F. L. Norton, by whom it has been patented.

A series of water tanks are secured along the inner floor of the hull, and extend around the inner bilge between the frames. The upward extensions may reach well above the water line. The tanks are completely sealed except for openings for pipe and valve connections. One series of these openings is made in the upper sides of the main body of each tank, placed on opposite sides of the axis of the ship. There is one opening for each tank. These opening communicate with two air pipes that run fore and aft. The pipes at one end are turned upward and carried through the deck outside of the combing of the hatchways and cabin sides. At this end they are provided with a valve opening upward and normally closed. There is one pipe for each side of the hull, the tanks lying in pairs on each side of the keelson.

The other series of openings are in the bottoms of the tanks, and, without any interposed valves, communicate directly with the sea. Through these openings the water is admitted into the chambers in the hull for ballast.

When out of the water these tanks are empty. When launched, water at once runs in, the air escaping through the deck valves until the lower body of the tanks is filled and the water has risen in the air pipe to the plane of the water line. Water will also rise in the upper extensions of the tanks between the vessel's frames, compressing the air sealed therein. This forms a series of air cushions.

If a heeling stress is applied to the vessel, the water cannot run out, as the air valve, automatically closing, prevents its escape. It acts, therefore, exactly like fixed ballast, with one important exception. The cushioning of the water against the air makes the righting action especially easy, tending to diminish all severe strains, which may become very noticeable in a vessel with fixed ballast. The tendency to oscillation, on righting, is also found to be very slight, the water acting to prevent it, as in the well known rolling tanks.

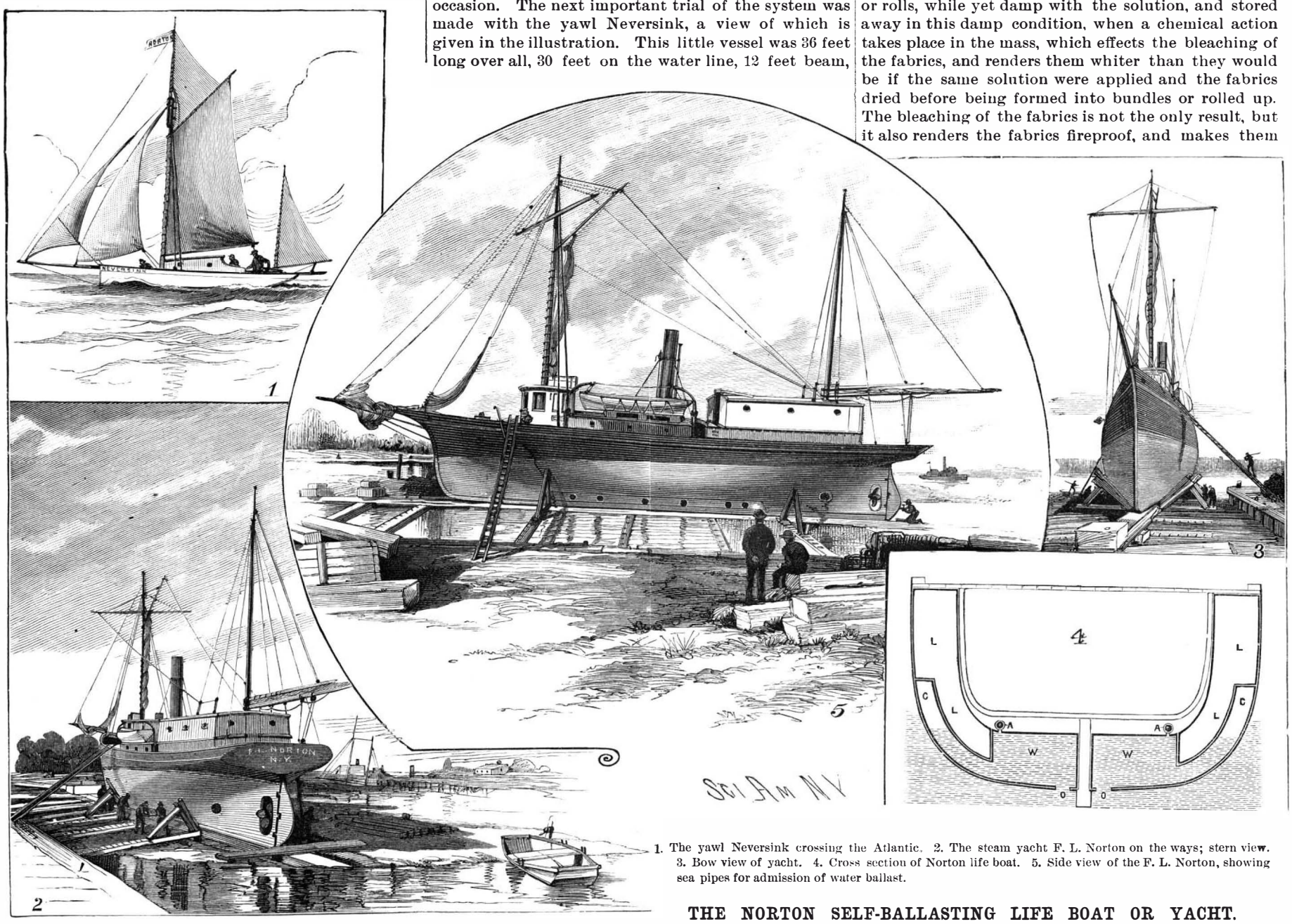
In the cross-sectional view of a vessel, on the right hand side of the illustration, the main features detailed above are shown. W W are two of the water tanks. C C are the upward extensions containing air. At O O are shown the inlet openings, while A A are the air pipes. To make the vessel a life boat, air tanks, L L, are introduced above the ballast tanks.

The system has been subjected to rigid tests. A life boat 26 feet long, 7 feet 3 inches beam, and 3 feet 6 inches deep, was experimented with in 1886, under the auspices of the Danish and German governments. The boat held 48 men, and still preserved 15 inches freeboard. With 14 men on one gunwale, all there was room for, the vessel still preserved 6 inches freeboard on the lower side. It was then filled with water, and 10 men on one gunwale brought it to the water level, when the boat began to empty itself, and actually discharged half the water which had been placed in it. The ballast tanks filled in 35 seconds and emptied in from 10 to 15 seconds. This was with the air valve in action. When this was held open, the action was one-third quicker.

This is but a partial recital of the tests made on this occasion. The next important trial of the system was made with the yawl Neversink, a view of which is given in the illustration. This little vessel was 36 feet long over all, 30 feet on the water line, 12 feet beam, and drew 4 feet 6 inches aft. The mean draught was about 3 feet. She carried about 700 square feet of canvas. Commanded by Capt. Josiah W. Lawlor and with a crew of one and with a single passenger, Mr. Edward S. McKinney, of Elizabeth, N. J., the Neversink successfully crossed the Atlantic. New York was cleared on May 11, 1889, and Boston was reached May 16. On May 20, after a couple of days in harbor, the Neversink sailed for Havre. The run to Havre was made in a little over a month, the harbor being reached at 12.30 p. m. on June 28. The highest day's run was 221 miles. The voyage was a most successful one, and the boat was at once exhibited at the Paris exposition. Canned provisions were principally used. For cooking porous bricks of clay and asbestos soaked in oil were employed. One sea was shipped, coming in over the stern as high as the mizzenmast, but, while it half filled the cabin, the boat came out unharmed.

By the time this reaches our readers the steam yacht F. L. Norton will be on her way across the ocean. It was originally a sailing vessel, and under yawl rig rode out one of the heaviest gales ever known off Cape Hatteras. A compound condensing engine and boilers have been put in by the Pusey & Jones Co. The cylinders are 5½ in. and 10½ in. diameter, and 10 in. stroke. The boiler is tubular and can carry 125 lb. of steam. The hull is 58 feet long over all, 54 feet between perpendiculars, 12½ feet beam, with a mean draught of 6 feet 4¼ in. Toulon, France, is the objective point, where a board of French naval officers are to inspect it. The mean draught as given above is with the ballast chambers filled. When they are empty, the draught is 4 inches less. Without ballast a weight of 986 lb. on one gunwale produced a heeling effect of 8½ inches; with the ballast but 3½ inches depression was produced. There are twelve water compartments, holding 282 cubic feet or about 8 tons of ballast only. The double bottom above the tanks is 32 in. from the garboard strake. Before leaving, the F. L. Norton was inspected by the National Board of Inspection and Survey on behalf of the U. S. government.

The system seems peculiarly well adapted to ship's and shore life boats. Out of water they would weigh no more than ordinary boats, but once afloat would become self-ballasting. No upset has yet been recorded against them.



1. The yawl Neversink crossing the Atlantic. 2. The steam yacht F. L. Norton on the ways; stern view. 3. Bow view of yacht. 4. Cross section of Norton life boat. 5. Side view of the F. L. Norton, showing sea pipes for admission of water ballast.

THE NORTON SELF-BALLASTING LIFE BOAT OR YACHT.

Bleaching and Fireproofing Fabrics.

Any suitable chemical may be used, as, for instance, borax, soda, alum, chloride of sodium, and other chemicals that would have the desired effect. After the solution is applied, the fabrics are formed into bundles or rolls, while yet damp with the solution, and stored away in this damp condition, when a chemical action takes place in the mass, which effects the bleaching of the fabrics, and renders them whiter than they would be if the same solution were applied and the fabrics dried before being formed into bundles or rolled up. The bleaching of the fabrics is not the only result, but it also renders the fabrics fireproof, and makes them softer and more pliable, and thus adds also to their value. As an example of a suitable solution per yard of the fabric, two and a half pounds of chloride of sodium, dissolved in seven and a half pounds of water, has been found to give good results. The invention is particularly applicable to the manufacture of bagging from jute butts, and it will be far superior to that heretofore produced from this article, in that it is lighter in color, as well as much superior in appearance. By applying the solution while the goods are on the calender, it does not come in contact with the spinning and weaving machinery, which would cause them to rust, and by applying it while the goods are on the calender, and just before being rolled up, a very thorough and even distribution of the chemical through the goods is obtained. As before stated, the rolls are stored away as they come from the calender, and in a damp condition, produced by the application of the chemical, and the result is that a chemical action takes place in the tightly rolled goods, which very materially improves the color of the article, and adds much to its value, but practically nothing to the cost of its production.

THE single-rail road system has appeared again. This time it has the advantage of being designed for the use of electric power, and many of the hitherto insuperable difficulties of the system are thus happily avoided.

Bluestone Sidewalks.

Of all the diverse industries in building material there is, perhaps, none larger, yet none about which so little is known as the bluestone industry. New Yorkers walk day by day over the smoothest bluestone sidewalks in the world, yet, if asked where they come from, the majority will say, "I'm blessed if I know." The huge slabs come from the quarries in much the same shape that we see them as sidewalks. The stone known as Hudson River bluestone is the blue, fine-grained, compact sandstone, and the belt of country whence New York gets her slabs is nearly one hundred miles long in this State, stretching from the Helderberg Mountains in Albany county across Greene and Ulster counties, taking in a strip of both Orange and Sullivan counties, and across the Delaware River into Pennsylvania. In Albany and Greene counties the ledge bearing good stone is narrow, as it is also in the town of Saugerties, Ulster county, being found only on the east and east-southeast foothills of the Catskill Mountains, where it is bounded on the east by the older limestone formations and on the west by the conglomerate and quartzose formations of the Catskill range. The belt widens in the towns of Kingston, Woodstock, Hurley, Olive, and Marbletown, in Ulster county, and in them the quarries are widely distributed over the plateau which borders the Catskills on the southeast. To the northwest and in the valley of the Esopus Creek quarries have been worked for forty years, and that part of the town of Hurley known as Jewellville, or West Hurley, has had the best and most profitable quarries. One quarry at West Hurley, known as the Great Lawson Quarry, was worked by Lucius Lawson for more than thirty years. It is asserted that more than $2,500,000 worth of flag and other stone has been taken from that hole. More than fifty acres of ground, in many places to the depth of forty and fifty feet, have been worked over, and the broken stone, or refuse, from the quarry, known as rubbage, has been piled up in banks, in some places an eighth of a mile in length and 100 feet in height.

That probably was not only the most famous but the most profitable bluestone quarry ever opened, and Lucius Lawson, now in the stone business in Chattanooga, Tenn., was once a millionaire. Unfortunate speculations in land and the work of draining the great Beaverkill Swamp, in Ulster county, involved Mr. Lawson to such an extent that a few years ago he failed, and lost not only his quarry, but every dollar he possessed in the world. For many years, while Lawson worked the quarry, the ground was owned by the late General Daniel Tompkins Van Buren, of Plainfield, N. J., and Lawson paid a quarry rent of so much a foot for the stone taken out. General Van Buren received more than $200,000 in percentages, or, as it is called, "quarry rent." From this quarry probably more stone for sidewalks in this city has been taken than from any three quarries in the bluestone belt.

There are quarries along the Hudson River at New Baltimore, and, thence southward, at Coxsackie and Catskill, and near Rondout, but they are not of the typical bluestone, but of the softer gray sandstone of the Hudson River slate formation. The quarries at Palenville and vicinity, West Saugerties, Boiceville, Phœnicia, Woodland Hollow, Shandaken, and Pine Hill are undoubtedly in the Catskill group of rocks. In working the quarries there is much variation in the thickness and nature of the overlying earth and top rock that must be taken off before the good stone is reached. The work of removing the top is called stripping, and the heavier the top the less profitable the quarry. The many openings in the bluestone belt indicate that the whole territory is underlaid with beds of bluestone, but in large areas the stone is of inferior quality, or the thickness of the ledges is not great enough to warrant their working at a profit. The custom is to lease the land at a certain royalty a square foot of stone taken out, which is generally half a cent a foot. Few of the quarries are worked by companies, and fewer still on a large scale. Nearly all are worked by individuals, or by the associated effort of two or three men of small capital, or by the laborers uniting with no capital other than their tools and labor. Generally a loading derrick worked by hand power and a small hand pump form the equipment. At the larger quarries lifting derricks worked by horse power are employed to hoist the stones from their beds, while at the shipping docks loading derricks are used.

In quarrying, the rock is thrown down or broken by the use of common blasting powder until the stratified beds of flat and regular stone are reached. These beds run in regular blocks, being separated by thinner blocks known as cat faces. The large blocks are split apart in convenient sizes by the use of plug and feather wedges, driven in lines of shallow holes. The natural division planes, or joints, are taken advantage of in cutting the blocks. These joints, or seams, are generally vertical, or nearly so, and run in two systems, the one parallel to the strike of the beds or the ledge also, and the other at right angles to the first, and in the direction of the dip of the beds. The former make the successive headers of the quarry, while the latter are known as end joints. Where the blocks are regular and well defined the blocks are readily cut into rectangular shaped sizes for platforms, sidewalks, crosswalks, and curbing stones. The layers of stone range from one inch to three feet in thickness, the top beds being thinner generally than those deeper in the quarry. In working into a hill, bedding planes, or division seams, frequently disappear, and two or more layers merge into one heavy slab. In most cases these thick strata can be split apart along the planes of bedding, and the cap layer is lifted off by means of wedging on the edges. The size of the stone is always determined by the natural joints, and frequently layers sixty feet long, twenty feet wide, and ten inches in thickness are lifted from the beds. The facilities for handling and shipping limit the size, and such monsters are immediately broken into smaller sizes. It is customary to use the thinner stone for town or village sidewalks, while the thicker layers are worked into curbing, crosswalks, window and pier caps, sills, and flagging.

The slabs are sent from the quarries to tide water at various points along the Hudson River, Wilbur, in the city of Kingston, being the principal shipping point. The stone is trucked from three to ten miles over heavy stone tramways built especially for the purpose. In this city a span of horses drawing a load of five tons is a sight, yet on the stone roads from the quarrying districts into Kingston an everyday sight is a span of horses hauling a load of ten or eleven tons, and frequently three horses hitched abreast have taken loads of stone weighing fifteen tons to the dock.

One monolithic monster, now in the yard of Osterhoudt Brothers, at Wilbur, is 20 by 24 feet 9 inches, 10 inches thick, and it weighs several hundredweight over twenty tons. It was quarried about four miles from Kingston, at Sawkill, and is probably the largest stone ever brought safely to tidewater, it being several feet larger and more than three tons heavier than the great stone in front of the Vanderbilt residence at Fifth Avenue and Fiftieth Street, this city, that stone being 15 by 20 feet and 8 inches thick. The monster is so large that it may have to be cut in two for a buyer, as it is larger and wider either way than any sidewalk in America. To cut it will detract from its actual value about 20 per cent. In its present shape it is practically dead money to its owners on account of its immense size. It came very near meeting disaster several times before it was safely removed. Although the quarry is only about four miles from the river, and the road mostly down grade, the truckmen were three days in moving it to tidewater, and during that time three trucks were broken down. Eight horses drew it, although four could have hauled the weight. It was thought safer, however, to have double that number. One side of a toll gate had to be taken down to allow it to pass through, and in crossing the bridge of Esopus Creek at Kingston it had to be turned up on its edge to an inclination of about fifty degrees to clear the side trusses of the bridge.

The bluestone industry gives employment to a vast body of skilled and unskilled laborers. It is estimated that from New Baltimore on the Hudson to Pond Eddy on the Delaware, at least 20,000 men are employed directly in the various branches of the work, not including those employed on railway trains, stone barges, sloops, and canal boats moving the stone from tidewater to market. Ulster county, being the largest producer, employs the most men, and quarrymen, stone cutters, laborers, teamsters, stone measurers, handlers, and machine workers will number at least 7,000. Ordinarily the pay of the men who work at the various branches of the business is good. Stonecutters get from $3 to $5 a day, while the pay of the other branches of skilled and unskilled and machine labor runs from $1.50 to $3.50 a day. When there is a depression in the bluestone trade everything comes to a standstill in the city of Kingston, so badly is business affected.

The stone, after a superficial dressing at the quarries, is stacked or piled at tidewater. Slabs requiring further dressing are taken to the cutting sheds, where they are cut into the various shapes and finely tooled. Large stones are put on large bed planers and planed smooth. Others are put under saws composed of strips of thin boiler iron, under the edge of which is kept a quantity of sharp wet sand, and sawed into slabs of the required sizes. Stone for special purposes is put upon a huge, flat, revolving plate of iron, the surface of which is fed with sand and water, and not only rubbed smooth, but also highly polished. After having been delivered in the city, very little or no work is necessary, except fitting to the various purposes for which it is used. There are, however, many yards in New York and vicinity that buy the stone in the rough and dress it, but less is done every year, owing to labor disturbances, but more to the Union Bluestone Company, a trust which controls the business along the Hudson River front between New Baltimore and Kingston. In 1889, the estimated value of the bluestone product of New York State, with that of Pike and Wayne counties, in Pennsylvania, was $1,800,000, of which fully 75 per cent came from the district between Kingston and Catskill.

In many localities quarries have been worked out, that term being used when the top rock is so heavy that to take it off will not pay. They have been abandoned, but lately a new use has been found for the refuse stone, and a company has been buying rubbage banks. It has been discovered that the argillaceous and often highly silicious nature of the rock makes it highly desirable for macadamizing, and in some of the quarries huge crushers are now used in crushing the refuse. A crusher working on the mountain of rubbage in the great Lawson quarry has a capacity of 300 car loads a day. Immense quantities of the coarser grades are being used in this city for concrete, while much more of the pea coal, or gravel, size is being used in the parks and by private parties for the top dressing of drives and roads.

Among the men who made fortunes in the bluestone business were William B. Fitch, Michael Hallihan, Lucius Lawson, Nathaniel Booth, the Sweeney brothers and James V. Cummings. Hallihan was rich when he died, but Fitch was poor. Nathaniel Booth has lost his property. Lucius Lawson is trying to make another fortune at Chattanooga, Tenn. Perhaps the most notable person ever interested in the traffic and quarrying of bluestone is John Fletcher Kilgore, of Passaic, N. J. He was originally a teamster on the Ulster county plank road, and he hauled stone from his father's quarry to the docks at Wilbur. Kilgore and George Waters, of Kingston, developed the great quarries along the Delaware in the years succeeding the war, and Kilgore has made and spent several fortunes. He controls the Delaware stone traffic.

Portland Cement for Anchoring Bolts.

A writer in the *Polytechnic*, of Troy, N. Y., relates how, during a recent experience in constructing foundations for an elevated railway, solid rock was encountered so near the surface as to necessite anchoring the foundation bolts in it. Some more durable and economic means of accomplishing this than by the use of sulphur or lead was desired, and Portland cement was suggested as being suitable.

A careful investigation failed to find any record showing the adhesive strength of cement in pounds per square inch when used this way. Hence it was decided to make such experimental tests as would give reasonably positive information on this point. For this purpose fourteen holes were drilled in a ledge of solid limestone, seven of them being 1⅜ inches in diameter, and seven of them being 1⅝ inches in diameter, all being 3½ feet deep. Seven ¾ inch and seven 1 inch bolts were prepared with thread and nut on one end and plain at the other end, but ragged for a length of 2½ feet from the blank end.

Four were anchored with sulphur, four with lead, and six with cement mixed neat. Half of each were ¾ inch and half 1 inch bolts, and all of them were allowed to stand till the cement was two weeks old. At the expiration of this time a lever of sufficient power was rigged and all the bolts were pulled, with the following results:

Sulphur.—Three bolts out of four developed their full strength, 16,000 and 31,000 pounds. One 1 inch bolt failed by drawing out under 12,000 pounds.

Lead.—Three bolts out of four developed their full strength, as above. One 1 inch bolt pulled out under 13,000 pounds.

Cement.—Five of the bolts out of six broke without pulling out. One 1 inch bolt began to yield in the cement at 26,000 pounds, but sustained the load a few seconds before it broke.

While this experiment demonstrated the superiority of cement, both as to strength and ease of application, yet it did not give the strength per square inch of area. To determine this, four specimens of limestone were prepared, each 10 inches wide, 18 inches long, and 12 inches thick, two of them having 1¾ inch holes and two of them having 2¾ inch holes drilled in them. Into the small holes 1 inch bolts were cemented, one of them being perfectly round iron and the other having a thread cut on the portion which was embedded in the cement. Into the 2¾ inch holes were cemented 2 inch bolts similarly treated, and the four specimens were allowed to stand 13 days before completing the experiment. At the end of this time they were put into a standard testing machine and pulled. The plain 1 inch bolt began to yield at 20,000 pounds, and the threaded one at 21,000 pounds. The 2 inch plain bolt began to yield at 34,000 pounds, and the threaded one at 32,000 pounds, the strain in all cases being very slowly applied. The pump was then run at a greater speed, and the stones holding the 2 inch bolt split at 67,000 pounds in the case of the smooth one, and at 50,000 pounds in the case of the threaded one.

It is thus seen, says the *Railway Review*, that cement is more reliable, stronger and easier of application than either lead or sulphur, and that its resistance is from 400 to 500 pounds per square inch of surface exposed. It is also a well ascertained fact that it preserves iron rather than corrodes it. The cement used throughout the experiment was an English Portland cement.

MOULD FOR CONSTRUCTING CONCRETE SEWERS AND SUBWAYS.

The annexed engravings illustrate a novel method of rapidly constructing concrete sewers and subways, recently invented by Mr. Ernest L. Ransome, of San Francisco, Cal. The apparatus employed is a movable and adjustable mould formed of sheet metal, preferably steel, rolled to the requisite shape and size, with the edges overlapping, but not riveted or welded. The forward portion, as will be seen by reference to Figs. 1 and 3, slopes gradually from the top to a point on the lower circumference, and is covered by a metal cap riveted at one side only, to allow of contraction and expansion.

Figs. 1 and 2 show the mould with the means for moving, and Fig. 4 is a plan view showing a series of toggle joints attached to the sides of the mould and connected with a rod furnished with a screw by means of which all of the toggles may be moved simultaneously so as to either expand or contract the mould as may be required.

In the construction of all concrete work there are two essentials. There must be continuous construction to insure unity, and every portion of the work must be accessible for tamping. In the construction of a hollow cylinder—especially in a narrow excavation—the convexity of the mould interferes to prevent access to a portion of the tube upon the lower side if the line of construction be vertical.

The effective feature of the Ransome invention is inclining the line of construction to the plane of the tube at such a small angle as to bring every portion of the cylinder within reach, while the constant movement of the mould makes the construction continuous, and insures a perfect bond.

In operating, the mould is placed in position and expanded to the full size required. The concrete is then filled in before and around it, and tamped in place, the tapering front of the mould, as it moves forward, determining the line of construction, and permitting every portion of the tube to be reached and tamped as laid.

The mould may be moved at the rate of say one foot per minute, carrying the construction forward at that speed, and leaving behind a perfectly constructed tube formed about it. By means of the interior mechanism, after any interval of suspension of the work, the diameter of the mould may be slightly diminished, when it is easily moved forward into place, and again expanded to full size and the work resumed.

In loose or sandy soil there is used in connection with the mould a frame termed the "shaper," consisting of a hollow cylinder, the complement of the mould in form, which is placed within the excavation in advance of the mould, but in a reverse position, to hold the earth in place. Thus the pointed end of the mould enters between the side arms of the shaper, and the concrete is laid in the intervening space. The shaper is not shown in the drawing, but will be readily understood.

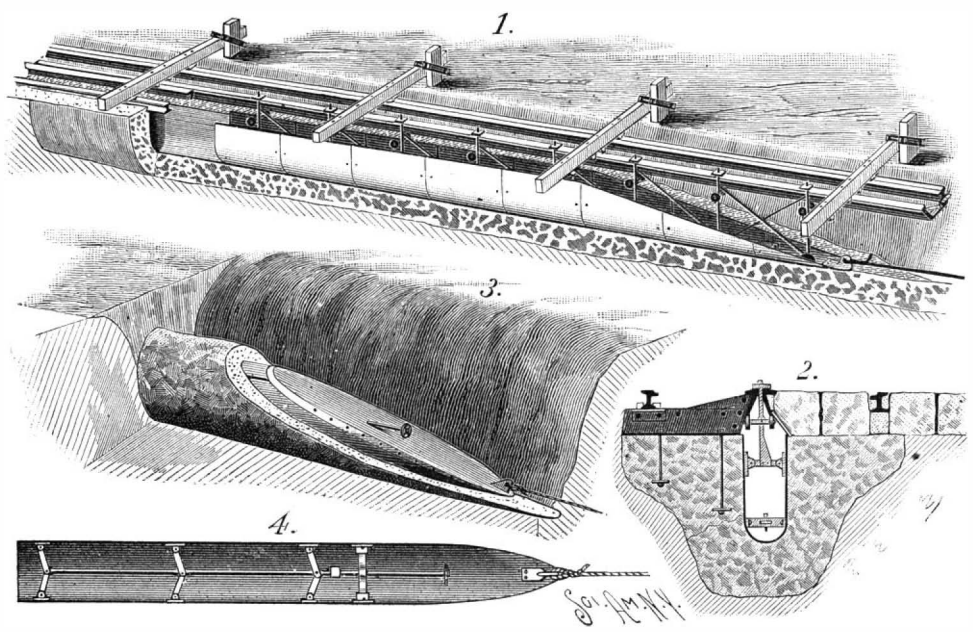
The perspective views, Figs. 1 and 3, and transverse section, Fig. 2, of a cable road in process of construction, by means of Ransome's patent mould, give a clear idea of the mode of procedure with an open mould for subways.

The mould is formed of jointed sections, which give it flexibility for curves. It is of such length as, with the taper of the forward portion, will permit the employment of a number of laborers, and bring the entire construction within reach of the tamping tools.

After digging the trench for the subway, temporary timbers are fastened by iron clamps to the posts which have been firmly set in the ground on either side of the track. From these temporary supports the rails and channel irons are suspended exactly in their proper positions, and there firmly held, while the concrete subway is built up around the mould beneath.

As the mould is moved slowly but steadily forward, it is held rigidly in true position by means of iron rods which pass between the channel irons—as seen in Fig. 1—where one side is cut away for the purpose. A traveling shoe and grooved rollers move along these irons, and prevent the mould from rising or falling.

It is claimed that the rapidity with which a conduit can be laid by this method insures great economy in constructions of this class.



MOULD FOR CONSTRUCTING CONCRETE SEWERS AND SUBWAYS.

THE theory that whisky is necessary in the treatment of pneumonia has received a blow from Dr. Bull, of New York City, who discovers that in the New York hospitals 65 per cent of the pneumonia patients die with alcoholic treatment, while in London, at the Object Lesson Temperance Hospital, only 5 per cent die.

Large Ships of the Ancients.

We moderns are justly proud of the wonderful and magnificent specimens of naval architecture that crowd the great ports of the world. If there is anything new under the sun, a first class ocean steamer, it is believed, is that rarity. In our conceit we recall only the galleys and triremes of the ancients, that scarce ever ventured beyond the coast line, and the small barks in which Columbus and those that followed him conquered a new world and gave commerce its greatest field. But the ancients built many goodly sized craft and made luxury a study on some of them. That much controverted craft, the ark, is an example of bigness. Her tonnage is estimated at about fifteen thousand tons, smaller it is true than that of the Great Eastern. No less an authority than Lindsay thinks that she was simply a raft of stupendous size, having upon it a structure resembling a huge warehouse. As no means of propulsion were necessary this description may be correct. The cargo, however, was unique and probably the largest and must valuable ever carried. The description of the ark, as given in the Scriptures, makes the vessel about 450 feet in length, 75 feet in breadth and 45 feet in depth, proportions similar to those now in use to-day for great vessels.

But as the agnostic is not sure that this life boat of the human race ever existed, and as the materialist is sure she never was built, let us take for example of big ancient vessels some other craft vouched for upon the authority of profane and not sacred writers. The Egyptians, fond of large things and big dimensions, made the big tonnage vessels of ancient times. Ptolemy (Philopator) would have appreciated the Great Eastern. He was fond of building big boats. One of these is said to have been 420 feet long, 57 feet broad, and 72 feet deep from the highest point of the stern. This vessel had four rudders, or what some would call steering oars, as they were not fastened, each 45 feet long. She carried 4,000 rowers, besides 3,000 marines, a large body of servants under her decks, and stores and provisions. Her oars were 57 feet long and the handles were weighted with lead. There were 2,000 rowers on a side, and it is supposed that these were divided into five banks. That this extraordinary vessel ever put to sea is doubted, but that she was launched and used at times, if only for display, several historians are agreed. Another "ship," the Thalamegus, built for one of the Ptolemies, is said to have been 300 feet long, 40 feet broad and 60 feet deep. This was a far more magnificent vessel than any previous one. An Alexandrian historian, Catlixenus, in describing her speaks of her having colonnades, marble stairs and gardens.

Another great vessel, historical by reason of its size, is one built by Hiero, King of Syracuse. Her dimensions are estimated to be large from the description of her cargo and the number of her decks and houses. She is supposed to have been sheathed with lead, and accomplished at least one successful voyage. A full description of her would read somewhat like that of one of our Long Island Sound or Hudson River steamboats. She had three entrances, the lowest leading to the hold, the second to the eating rooms and the third appropriated to the soldiers. There were thirty rooms, each having four couches, for the soldiers; there were fifteen couches in the sailors' supper room, and there were three more cabins, each having three couches. The floors of all these rooms were laid in stone mosaic work. There was also a temple of cypress inlaid with ivory and dedicated to Venus. The mainmast was composed of a single tree, and the vessel carried four wooden and eight iron anchors. As a freight carrier she would rival the largest of our ocean tramps. It is recorded that one or two of the launches belonging to her would carry about eighty tons. This vessel is said to have carried "sixty thousand measures of corn, ten thousand jars of Sicilian salt fish, twenty thousand talents' weight of wool, and of other cargo twenty thousand talents, all of which was in addition to the provision required for the crew." These are the notably big vessels of ancient times, but the supposition is that as rulers, whether king or people, were as emulous in those days as these, other big craft were also built. From the foregoing description the thought is suggested that the first designers of our own river steamboats may have heard of the Egyptian and Syracusan vessels and taken a hint from them in building floating palaces.—*Maritime Register.*

Plumbing and Sanitary Notes.

The proper size of soil and drain pipes under different circumstances has been and is a subject in regard to which there is a wide difference of opinion existing among those competent to offer one. Boards of health, in dealing with the plumbing of tenements, are in favor of 5-inch soil and 6-inch house drains, while others maintain that a 4-inch soil and a 5-inch house drain will be even better than the lager sizes, if for no better reason than that they will be better scoured by every discharge of a properly flushed fixture. Hellyer, the great English sanitary authority, is on the side of the smaller pipe, and in this country Col. Geo. E. Waring is a pronounced advocate in the same line. In a recent issue of the Chicago *Sanitary News*, as quoted in the *Review and Record*, Col. Waring's views on the subject are very clearly expressed, and his experience with pipes of small caliber will probably be interesting to our readers. He tells us that by way of demonstrating to his own satisfaction the efficiency or otherwise of small bore pipes for house wastes, he limited the soil pipe in his own dwelling to 3 inches in diameter. His soil pipe from above the roof to outside the building line is a 3-inch iron pipe which is connected with the street or main sewer by a 3-inch earthen sewer from the building line. He gave it a fall of nearly half an inch to the foot, and the distance outside from the house to the main sewer was 110 feet. On this 3-inch line there are two water closets, a bath tub and a kitchen sink, and though in use for nine years there have not been more than five or six obstructions, mainly due to the presence of the running trap on the main drain. In proving to his own satisfaction the ability of a 3-inch soil pipe and house drain to carry off the sewage and waste matter of a private dwelling of average size, Colonel Waring does not recommend the use of 3-inch pipe, but considers that a 4-inch soil and drain pipe are sufficient for all dwelling houses, a 4-inch pipe being able to carry nearly 80 per cent more than a 3-inch pipe. In the same manner he declares in favor of a 6-inch pipe for street sewers, and cites the result at Memphis, Tenn., San Diego, Cal., Stamford, Conn., and other places where 6-inch sewers are in use. There are, however, circumstances under which he admits a larger pipe should be used.

A New Safety Lamp for Mines.

A rectangular box of ebonite contains accumulators of the Pollak system; it rests upon a metal plate. An ebonite lid serves as support for a glow lamp inclosed in a cylinder of thick glass. The whole is covered with a metal top, fixed closely by means of pins. A leaf of soft caoutchouc, introduced between the top and the box, renders the junction hermetic. Into the lid are inserted rods of an inoxidizable metal, which pass through it and support at their bases contacts of platinum, which meet the platinum contacts of the accumulators, and which have at their summits springs, one of which is in metallic connection with a foot of the lamp. The other foot of the lamp is insulated, and can be brought in contact with a pole of the accumulator by means of a needle introduced into a horizontal channel made in the lid. As the contacts are in the interior of the box and the lid, neither the opening nor the closing of the current can cause an explosion; hence the lamp can be either ignited or extinguished in an inflammable atmosphere. If the system is dismounted, or if the glass globe of the glow lamp is broken, the lamp is extinguished. The model exhibited weighed 1,800 grammes, and gives a perfectly constant light of 0·7 to 0·8 candle power for twelve hours.—*Charles Pollak, in Chem. News.*

NOTE.—Mr. Anton Larsen, the inventor and patentee of the improved dumb waiter illustrated in the issue of November 8, should be addressed at Nos. 413 and 415 East 124th Street, New York City, where his invention is on exhibition.

RECENTLY PATENTED INVENTIONS.

Railway Appliances.

CAR COUPLING.—Joseph L. Stillman, Fresno, Cal. The drawhead has a vertical chamber communicating with a link opening, a vertically sliding spring-actuated link presser and a horizontally sliding spring-actuated abutment, a movable pin support being located above the drawhead and a connection between the support and the abutment, the device coupling automatically and being positive in its operation.

GUARD FOR CARS. — Frederick W. Stutt, Denver, Col. This invention covers a novel construction of frame, designed to be readily attached to a car or the car trucks, by which a car will be effectually guarded at the ends and sides to prevent any one falling beneath the wheels, and designed to move any one falling in front of the car to one side.

FEEDING RACK FOR CATTLE CARS.—Ferdinand E. Canda, New York City. Stowage chambers adapted to carry a large amount of fodder are provided by this invention, such chambers being immediately beneath the car roof and having a trap door at the top, while at the sides they communicate with the manger spaces, providing for the easy delivery of the fodder to the feeding racks.

Electrical.

TELEGRAPH KEY. — William A. J. Kohrn, San Francisco, Cal. Combined with the key is a circuit-closing switch pivoted to the frame of the key and adapted to swing under the anvil tongue in the usual way, a beveled arm engaging a spring projecting downwardly from the key lever to force its rear end upward, closing the circuit at the contact points of the key and between the circuit-closing switch and the anvil tongue.

REGULATOR FOR DYNAMOS, ETC. — Fremont J. Cleaver and George Fassold, Pittsburg, Pa. Combined with an armature formed of a hollow cylinder of non-magnetic material, upon which conductors are arranged connected with a commutator cylinder, is a movable armature core supported within the armature cylinder and commutator brushes connected with the armature core, making a simple and effective regulator for dynamos and motors.

Mechanical.

CALIPER AND CENTERING GAUGE.—William O. Nelson, Baltimore, Md. This is a combination tool for determining diameters and transverse measurements, and consists of a main plate and a sliding plate, which together form a caliper gauge at one end and a centering gauge at the other, which with one adjustment fixes the center of any shaft whose diameter is measured by the caliper gauge.

SHAFT COUPLING.—James Q. Stewart, River Vale, Ind. One shaft section is formed with longitudinally extending undercut or dovetail recesses to which sliding keys conform, while the engaging shaft section has undercut longitudinal recesses to receive the adjacent ends of the keys, and the abutting ends of the two sections have a threaded aperture and threaded extension, whereby the sections may be quickly and conveniently united.

LEAD PRESS.—Christopher C. Tracy, Brooklyn, N. Y. According to this invention, the die block has two seats separated by a division plate, with rotary dies having two inlets for the material, whereby two dies may be used at the same time, thus doubling the capacity of the press, the invention being an improvement on a former patented invention of the same inventor.

Agricultural.

ROLLER FOR LISTED CORN. — Frank J. Clark, Ashland, Neb. This invention covers an attachment capable of application to any roller, consisting of a sectional furrowing ring having a convex exterior and provided with means for securing it to the roller, and designed to effectually smooth the tops of the hills and produce well defined furrows between the hills, thus greatly facilitating the growth of the corn and its cultivation.

Mining, Etc.

ORE CONCENTRATOR, ETC. — Luther Look, Ketchum, Idaho. This invention provides for the separation of precious metals from the gangue and other waste solely by water running over riffles, the riffle table having two peculiarities of construction—first, its ribs having a general diagonal direction, but being curved in the direction of their length, and, second, the upper and lower sides of the diagonally curved ribs being at a right angle to each other, the lower one being shorter than the other.

ORE WASHER.—La Fayette W. Lewis, Milnes, Va. Combined with a fixed support and a cradle held to rock thereon is an ore-receiving trough having a hopper at one end and a gate with a series of outwardly extending pins pivoted at the opposite end, a screen hinged to the gated end of the trough, and an offtake chute beneath the screen, whereby the ore may be quickly washed, screened, and delivered to any desired receptacle.

Miscellaneous.

BEER FAUCET. — John B. Hogan, North Adams, Mass. A plunger or rod is held in the faucet body, on the outer end of which screws a cap in contact with the plunger or rod, to force the latter inward to remove the bung of the keg, the device being simply made, durable, and readily applied.

STRAINER FOR OIL TANKS.—John C. Dilworth, Pittsburg, Pa. According to this invention a filter bag is employed, fitted in the strainer tube and suspended therefrom into the oil tank, the device being designed especially for use with oil tanks containing heavy lubricating oils, to keep the oil free from dust, dirt, etc.

BURGLAR ALARM. — John J. Griffith, San Bernardino, Cal. This invention consists of an inflatable balloon, which may be of the character of the usual toy balloon, and provided with a whistle to be sounded by the escaping air, a valve controlling the exit of the air, and this valve being opened by the falling or disconnection of the balloon from a place to which it may have been attached.

FLOOD GATE. — Eli G. Ivey and Morgan McMichael, Buena Vista, Ga. Combined with a sluiceway in a dam, and a gate adapted to slide therein, is a horizontal lever connected at its down stream end to the gate, a float secured to the lever between its ends, while the other end of the lever is pivoted to a suitable support, the device being designed to automatically regulate the water discharge from the dam and maintain the water at the desired level.

PIN CUSHION, MATCH SAFE, ETC. — Henry Brandt, Brooklyn, N. Y. This is a combination device adapted for a match safe, pin cushion and trap, comprising a box or casing with a lid and hinged bottom, a removable match tray held therein, a removable pin cushion held to the lid, and a bait hook held to the box bottom adapted to a setting stud or lip on the box.

ADJUSTABLE DISPLAY FRAME. — William Standing and Adolph J. Hoenny, St. Louis, Mo. This is a frame adapted for attachment to various sized boxes of goods, to protect and display the goods, the frame being pivoted to the box and overlapping its edges, and being formed of a single piece, with inwardly projecting ears, a vertically movable glass fitting between the ears and the box.

GAME COUNTER. — Arthur E. Arp, Spirit Lake, Iowa. This device is to be used in connection with games of various character, to accurately indicate the total score at all times. Toothed disks having numbers on their faces are held to rotate in a casing to expose their numbers at the front of the casing, the disks being rotatable only in one direction.

BICYCLE. — James W. Montgomery, Chicago, Ill. The saddle frame of this device is adjustable to accommodate riders of different weight, and the pedal levers are adjustable vertically to suit the length of the rider's legs and laterally to regulate the speed of travel. The driving wheel has a spring tire to take up jar, and a brake of novel construction is provided.

ELEVATOR. — Benjamin N. Deblieux, Bay St. Louis, Miss. In this elevator the cages ascend and descend on a series of screw rods turning in unison, thereby assuring rapidity and uniformity of movement and the safety of the passengers. Novel means are provided for arresting the cages at any desired point and for reversing their course.

BOAT PROPELLING MECHANISM.—Seymour Lebenheim, Gloversville, N. Y. At each side of the boat is a skeleton frame carrying stud axles with gear wheels, the inner end of the propeller shaft being provided with a bevel gear, and the mechanism being so arranged that the propeller may be rotated through the medium of crank arms adapted to be operated with a motion the same as employed in rowing.

PRODUCING COLORS ON FIBERS.—Robert Holliday, Huddersfield, England. This is a new method for producing azo colors on cotton or other vegetable fiber, by subjecting the fiber to a mixture composed of oil, a phenolic body, and an alkali, drying the fiber thus treated, and finally subjecting the dried fiber to an azo compound, the invention being an improvement on several former patented inventions in this line.

VINEGAR APPARATUS. — Peter Spink, Covington, Ky. This invention provides for a series of tanks or cisterns so arranged that the vapors arising from one set of tanks will be condensed and saved in another set, in a continuous process for the manufacture of vinegar from low wines, cider, and malt, and for saving and utilizing the acetous and vinous vapors generally lost by evaporation.

CIGAR BUNCHING MACHINE.—Francis A. Schleiff, Francis A. Schleiff, Jr., and Paul Ehmke, New York City. This machine has a horizontally reciprocating rolling table, across the top of which extends an apron, under which is a reciprocating bunching roller, with other novel features, the machine being designed to automatically bunch tobacco fed thereto, compress and roll the tobacco in a binder, and deliver it in proper condition to receive the wrapper.

PAPER BOX.—Martin N. Bailey, New York City. This invention is for boxes designed to hold cigarettes, crayons, etc., and the box has a tray with a lip at one or both ends, the lips dropping to expose the contents as the lips are carried out of the casing, and the lips automatically closing the ends of the box when the tray is restored to its normal position.

CABINET FILE. — John Muhlhauser, Rochester, N. Y. This file has a series of folding rigid tablets capable of a vertical swinging and upward sliding movement on a frame, a skeleton frame hinged to a tablet serving as a rest for sheet music, etc., and as a prop to support one or more tablets, the device retaining in assorted condition any printed matter or written manuscript so as to permit ready access thereto.

BINDING CLIP OPENER. — Harlan H. Ballard, Pittsfield, Mass. This is a novel form of detachable and engaging nippers, the jaws of which are normally held closed by a suitable spring, and the engaging ends of the levers having a peculiarly bent or hooked form, to facilitate the opening of spring binding clips such as are generally used to hold papers, pamphlets, etc., together.

THILL COUPLING.—Julius H. Senden, Lexington, Mo. According to this invention, the clip has an opening through its front wall, beveled from the inner face, and parallel projecting lugs with a flattened connecting pin and elastic block projecting through the opening, a flanged face engaging the bevel, while the thill iron has an oval head turning on the pin and engaging the block when the shafts are horizontal, making an inexpensive thill coupling and an effective anti-rattler.

BLANKET HOLDER. — John B. Whitbeck, Coxsackie, N. Y. This device consists of a yoke of flexible wire to fit the neck of the blanket, and formed of two side pieces having their upper ends made into eyes and pivotally connected together, while their lower ends are pointed to pierce the blanket and adapted to be bent into hooks and eyes, whereby a blanket may be quickly adjusted upon an animal and will be held in its place.

FIRE ESCAPE. — George F. Oehrl, Monongahela City, Pa. This device is mounted upon a truck, and has an extensible body of side-connected lazy tongs sections carrying a platform upon which slides a bridge or gangway to be projected outward from the escape to the window or roof of a burning building, and withdrawn therefrom at will.

MUSIC LEAF HOLDER. — Frederick C. Watson, Gloucester, Mass. This is a device adapted to be readily connected to a music stand to hold the leaves of a music book or sheet music, and has two adjustably connected arms, one of which has a retaining loop holding the device to the stand, while the ends of the arms are bent over and provided with rubber bearing cushions.

CHAIR ATTACHMENT. — Alfred M. Whiteley, Sacramento, Cal. An auxiliary seat is, according to this invention, pivoted between the uprights of the chair back, such seat normally forming a part of the chair back, but being adapted to swing down and be supported above the main seat, the improvement being especially designed for the convenience of children too large for a baby chair and not large enough for an ordinary chair.

COIL HEATED BOILERS.—Peter Rundquist, New York City. This invention relates to improvements in steam regulators for boilers heated by steam coils, where hot water is constantly being drawn and cold water added, and provides a novel form of valve connection and operation designed to regulate the inflow of steam to the boiler in such a manner that the boiler will be kept at a practically even temperature.

COOKING STOVE ATTACHMENT.—James W. Allen, Eureka Springs, Ark. A ventilating device formed of a box or drum is adapted to be set over the stove and connected with the chimney flue by suitable piping, to carry off the odors of cooking and also serve as an evaporator, while combined with this attachment is a portable baking oven, to be set on the stove and inclosed in the ventilating and evaporating box.

GRATE. — William L. Mitchell, New York City. This invention provides a grate bar having a spur on its upper face, cavities at the sides of the spur, and a horizontal end, with other novel features, for stoves, ranges, etc., and in which the basket or fire surface is capable of a downward, backward, upward, and forward motion, the construction being such that each alternate bar when in motion will move to the front, the others moving to the rear.

ASH SIFTER. — George H. Fountain, Plainfield, N. J. Combined with a rotary drum having an opening on one side are two swinging doors for automatically closing the opening, a check rod limiting the inward movement of one door, and thrasher rods being attached within the drum, with other novel features, the invention being an improvement on a former patented invention of the same inventor.

CLOTHES LINE APPARATUS.—John E. Kellogg, Council Bluffs, Iowa. This invention relates to pulley line devices for hanging clothes in the open air, the apparatus being arranged relatively with a wash house to allow a person to operate the line without exposure to rain, snow, or bad weather, and to make the clothes line self-tightening by the weight of the clothes on it.

TRANSOM LIFTER.—James M. Maddox, Birmingham, Ala. This invention is designed to provide a simple and efficient device by means of which a transom may be easily operated from the floor and placed at any desired angle, and by which, also, it can be always locked so that it cannot be operated from the outside of the room.

WASH BASIN ATTACHMENT. — James W. Reid, San Francisco, Cal. This device is also applicable to sinks and other structures, an intermediate chamber being provided between the receptacle and discharge pipe, a leakage aperture communicating with the latter, and a float in the intermediate chamber engaging the plug of the receptacle, to empty the latter and protect it against overflow and freezing, while also affording a trap against a back current of sewer gas.

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

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A COMPEND OF EQUINE ANATOMY AND PHYSIOLOGY. By William R. Ballou. Philadelphia: P. Blakiston, Son & Co. 1890. Pp. xiii, 205. Price $1.

This book, with its numerous illustrations, will form a very valuable addition to the library of students of veterinary surgery, as it is adapted for the use of veterinary schools.

THE CHILDREN OF THE WORLD. By Paul Hayse. New York: Worthington Co. 1890. Pp. 573. Price $1.25.

HEAT. Science and Philosophy of its Production and Application to the Warming and Ventilation of Buildings. By John H. Mills. Volumes I and II. American Printing and Engraving Co., Boston. Pp. 604.

This handsome work, illustrated and admirably bound, is devoted, to a certain extent, to the author's private practice as a developer of heating apparatus for buildings. Much matter in it, however, will be found of value to the general builder.

THE METALLURGY OF STEEL. By Henry Marion Howe. Vol. I. The Scientific Publishing Company, New York. 1890. Pp. xvi, 380. Price $10.

The first volume of this sumptuous work, whether as regards typography, illustrations or tabular subjects, reflects the highest credit upon all concerned. It brings its subject down to the present day, illustrates very fully all details of processes, and criticises the different improvements which have been introduced in metallurgical processes. Our space precludes the possibility of giving it anything in the shape of an adequate review.

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Notes & Queries

HINTS TO CORRESPONDENTS.

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

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

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

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

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

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(2581) S. L. asks: 1. Please give process to bleach litharge and still preserve its properties for use as a glycerine cement. A. It cannot be bleached. 2. To what use is absorbent raw cotton put, the preparation of which appeared in Notes and Queries of your recent publication. A. For treatment of wounds, etc., also for filtering. 3. Is it against the law for any one to call himself a chemist or professor on a preparation without passing any official examination? A. There is no specific law on this subject. Honor alone should suffice to deter one.

(2582) L. E. Y. asks: 1. How many pounds of rock salt to one pail of water to crystallize on woodwork wound with string. How to proceed? A. Put in an excess of salt, constantly stirring until no more will dissolve. Partly immerse the article and let it absorb the solution by capillary attraction. Or immerse the article repeatedly and dry between immersions. 2. Formula for silver plating with battery. What kind of battery gives best result? A. See SUPPLEMENT, No. 310. 3. Where is Vassar College. A. Poughkeepsie, N. Y.

(2583) M. S. L. writes: As to the properties of aluminum. 1. Is it a magnetizable substance? If so, is it comparable to iron? A. No. 2. Is it a good conductor of electricity? A. Excellent.

(2584) A. E. C. asks for two good dentifrices, powdered and liquid. Also what is best to color them with? A. See answer to query No. 2477. As a solid dentifrice use precipitated chalk. Color with carmine, perfume with a little orris root and oil of wintergreen.

(2585) J. L. D. asks: 1. What is sulphureted hydrogen mainly used for? A. In chemical analysis. 2. Will it evaporate from an open bottle with a large neck? A. Yes, rapidly. 3. Is there color enough to it, so that one can see how much there is in a glass jar? A. It is quite colorless. You can test for it with a slip of white paper dipped in acetate of lead solution. 4. Is it always of the same strength or density? A. Yes, if pure at any given temperature.

(2586) S. R. asks for a receipt to dye feathers black and leave a gloss. A. We refer you to Frank's "Ostrich Feather Dyer," $10, for details. In general terms, clean with carbonate of ammonia, wash, and steep overnight in solution of nitrate of iron 7° B., then rinse in water. Boil out equal parts logwood and quercitron and immerse the feathers at a "hand heat." When black, remove and wash in warm water. Dissolve 3½ ounces bicarbonate of potash in 5 quarts of hot water and stir in 17½ ounces of olive oil, shake until it becomes an emulsion. As before, at a gentle heat immerse in this, draw out the surplus moisture between the finger and thumb and dry over a stove, constantly shaking them. Experience and skill are necessary.

(2587) F. H. L. asks: Does the sun give out heat to the earth, or is heat generated by the action of the sun's rays upon the earth? Does heat increase or diminish as we leave the earth and approach the sun, and why? A. The sun's heat is supposed to be transferred to objects by ether waves. These are not considered to be heat, but to be capable of producing heat when they impinge upon matter. The atmosphere being attenuated and thin in the upper regions is less heated than in the more dense portions near the earth. The heating power of the sun is also very great at high altitudes when radiating upon surfaces properly prepared to receive and absorb the heat. The nearer we approach the sun, the more powerful are the radiations or ether waves.

(2588) H. D. B. says: Please inform me through your column of Answers to Queries whether it has been proved or not by experiment that an engine can start more cars when the couplings are made so as to allow no jerk between the cars, or in other words, does the play between the cars help an engine to start a train? A. The proof is of every day occurrence on our leading railroads, where heavy freight trains are stalled when an attempt is made to start on a dead pull, but start easily when producing slack by backing before starting the cars.

(2589) J. B.—The fiber is apparently that of the Indian hemp (*Apocynum cannabinum*). It is well adapted for making twine, and has long been used by our Indians for that purpose and other purposes in which hemp would be used.

(2590) H. S. M. says: I am building a cistern for rain water. Depth about 10 feet, capacity 100 barrels. Cannot keep spring water from working in at the bottom, though it has three separate bottoms, in all about 13 inches hard cement. Please tell me what best course to pursue. A. You should have used Portland cement. The leak will soon stop when the cistern is in use. Fill with water to balance leakage. 2. Does the top part of a wagon wheel move faster than the bottom while in motion? If so, why? A. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 706, for this and kindred subjects.

(2591) F. J. C. asks: What substance put in benzine will make a red light for use for a red torch light? A. There is no such substance. You must use alcohol and color the flame with chloride of strontium.

(2592) T. S. V. asks how to make impression wax that will keep pliable in cold weather. A. Temper paraffine wax with olive oil to suit conditions. Mix a little whiting with it while hot.

(2593) A. H. H. asks: 1. Can you tell me how to transfer prints (such as newspapers) on to glass? A. Varnish glass with gum dammar. Soak print in water. When varnish is nearly dry, rub on the wet print and allow it to dry. When varnish is hard, rub off paper with wet finger. 2. Is there anything that can be put with the chemicals of the blue print process to make the print red or green? A. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 741, for directions for making green and red prints.

(2594) O. F. W. asks what to apply to a German clay blacksmith hearth to keep the clinker from sticking to it, the coal used being sulphurous. A. Wash the brick or clay sides with thick mixture of pulverized chalk and water, allowing it to dry before using.

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