SCIENTIFIC AMERICAN

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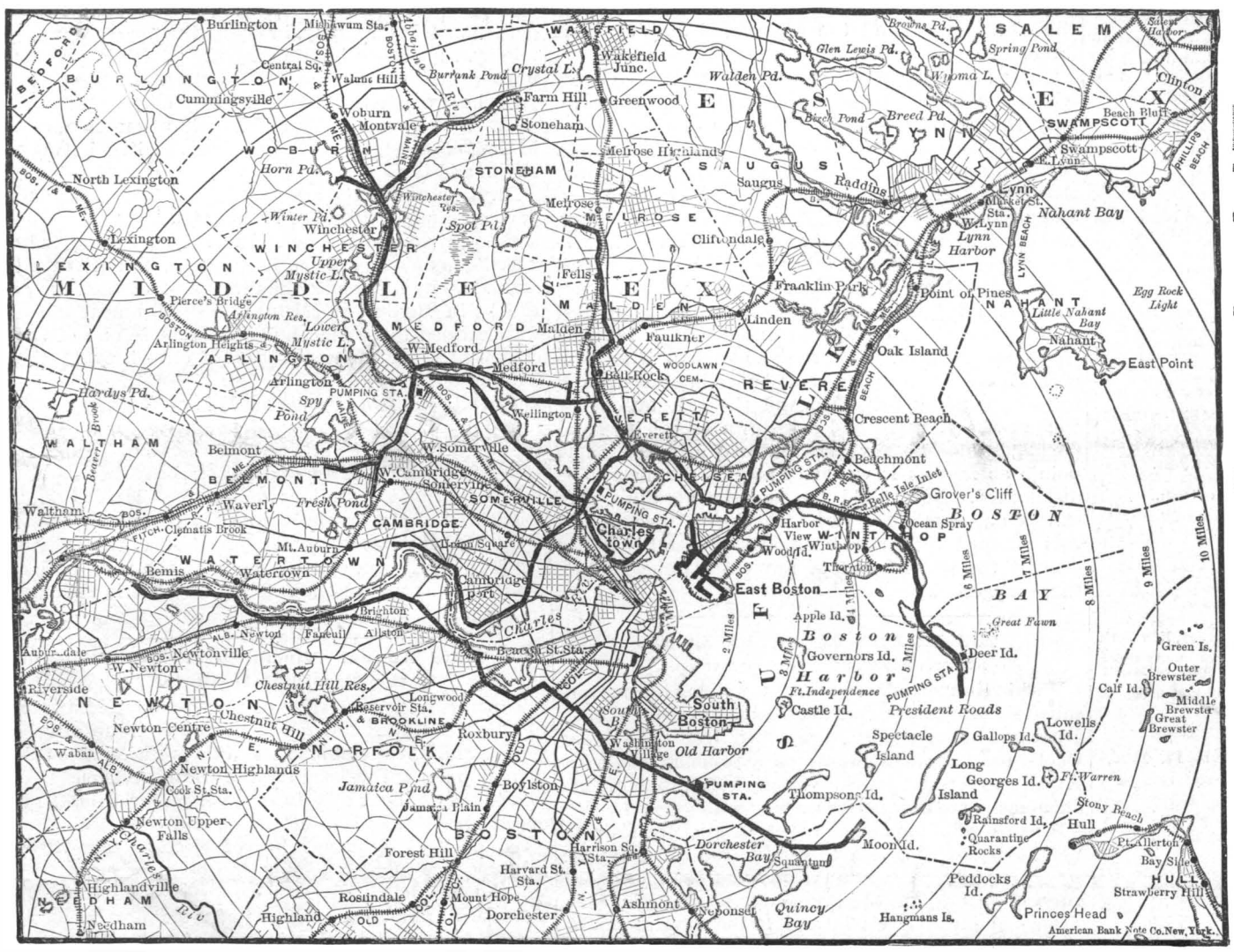
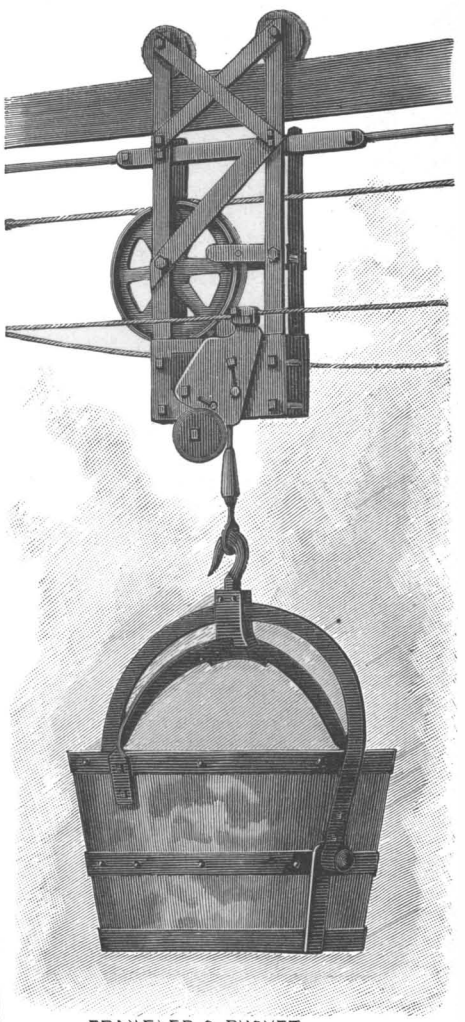


METROPOLITAN SEWERAGE SYSTEM SURROUNDING BOSTON—ROUTE OF MAIN SEWER SHOWN BY HEAVY LINES.



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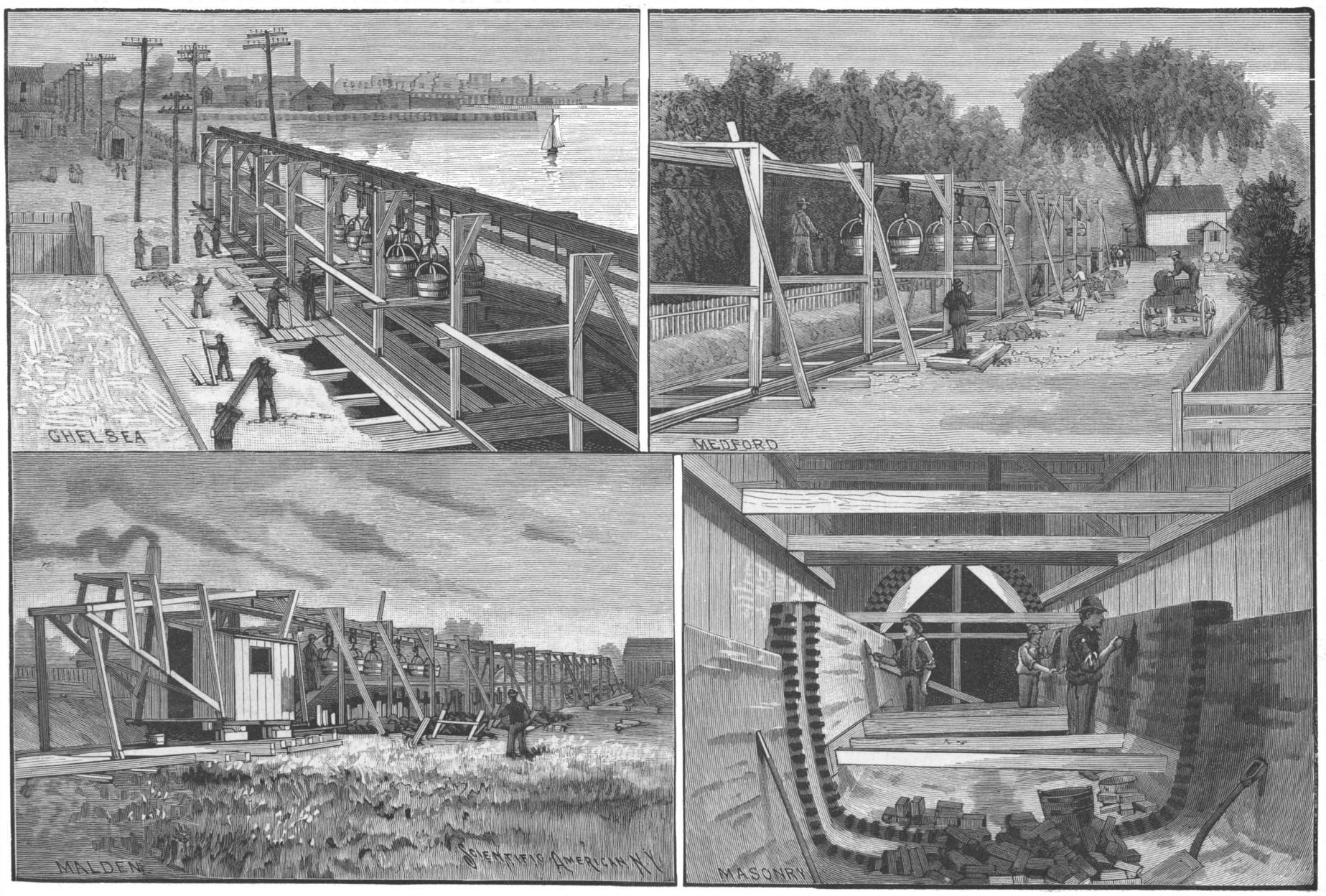

METROPOLITAN SEWERAGE SYSTEM SURROUNDING BOSTON—METHODS EMPLOYED IN CONSTRUCTION—VIEWS IN CHELSEA, MEDFORD, AND MALDEN.—[See page 390.]

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PNEUMATIC TUBES FOR MAIL SERVICE.

"A scheme that will revolutionize the mail service," is the caption of a recent dispatch from Washington referring to transmission by pneumatic tubes. "Proposals," so the dispatch reads, "are now in the hands of Postmaster-General Wanamaker for the establishment of a line between New York and Brooklyn, and in Philadelphia, from the general post office to substations." Systems of small pneumatic tubes have for years been in use in Paris, London, Berlin, Vienna, New York, and other places. They are used chiefly for carrying telegraph messages between local stations. But they have not as yet "revolutionized" the mail service, and are not likely to. The capacity of the tubes is small, and the expense of working them large.

There are other means of securing frequent delivery which may be had for a tithe of the tube expense, if only the already established means of conveyance, such, for example, as is afforded by the street railways, is intelligently utilized. As illustrative we may say that messengers dispatched from the New York general post office to the Brooklyn general office at intervals of fifteen minutes would get the mail to Brooklyn faster than it probably could be distributed throughout that city by the carriers and yet would not cost, so it has been computed, as much as the interest would amount to on a pneumatic service between the two post offices. Following a like plan, if messengers should be dispatched at short intervals to and from the general post office and the sub-stations by way of the elevated and cross-town lines, letters and packages could easily be delivered between these points as fast as it would be possible for them to be distributed. Nor would the cost be anything like that of a pneumatic service. This being the case, it is to be hoped that the Postmaster-General will not commit the government to any costly schemes like those suggested.

THE METEORS OF NOVEMBER, 1892.

BY PROF. DANIEL KIRKWOOD, OF RIVERSIDE.

Within the memory of persons now living the meteors called shooting stars were regarded as gaseous matter generated in the atmosphere. Their true nature was wholly unknown, and works on astronomy made no attempt to account for their origin. Fortunately such phenomena are now better understood.

Persons who happened to be in the open air on Wednesday evening, November 23, had the privilege of witnessing a phenomenon of more than ordinary interest. A brilliant display of celestial fireworks commenced about six o'clock, and lasted several hours. Meteors at the rate of several hundred per hour were watched and counted by numerous spectators. The writer, at early twilight, counted 150 meteors in thirty minutes. Later, a neighbor made the number 700 per hour, and the whole number seen at a single station during the display must have amounted to thousands. How are the phenomena to be accounted for? How frequently do they occur? and When may they be again expected? were questions asked by many observers during the display in Southern California.

Aged persons remember Biela's comet—a telescopic body having a period of six years and eight months, or three periods in twenty years. One of its returns was due in the latter part of 1845. Instead of appearing alone, as on former returns, it was seen as two separate bodies, as far apart as the moon and the earth. The dissolution of this wonderful body had therefore commenced, and the return (in 1852) was accordingly looked for with still increasing interest. It came true to time, but the fragments still further apart. That was the last time it ever appeared *as a comet*. It was due in 1859, 1865 or 1866, 1872, 1878, 1885, and in November, 1892. This process of falling to pieces began, as we have seen, in 1845, advanced from year to year till the fragments became too small to be individually seen. They pass, however, through our atmosphere, become ignited, and are thus rendered visible. In a work entitled "Comets and Meteors," published several years since, it was said of this shower's predecessor: "This cometary mass will be in close proximity to the earth about the last of November, 1892. Another brilliant meteoric shower may therefore be expected at that epoch."* This is the shower just seen, as predicted in 1873. The study of these periodic showers has established many facts in regard to their phenomena—facts now to be found in recent works on astronomy.

DR. ERNST WERNER SIEMENS.

This well known electrician and engineer died December 6, at Berlin, Germany, 76 years of age, having been born at Lenthe, near Hanover, December 13, 1816. He was the elder of the three bothers, Ernst W., Karl Wilhelm, and Friedrich, all of whom have made brilliant records in science. Ernst Werner was educated at the Lubec Gymnasium, and joined the Prussian Artillery in 1834, where his eminent talents soon attracted notice, and having passed through the military schools, gained him the rank of lieutenant in 1837. While still holding this appointment in the army he applied himself with great zeal to the study of practical chemistry and the physical sciences, and became the inventor of the process of electro-gilding, of the differential governor, and of the electric automatic recording telegraph.

As member of a commission of the Prussian General Staff for the introduction of the electric telegraph system in place of the optical telegraphs, he proposed, in 1847, the application of subterranean conductors, insulated by gutta percha, by means of a press invented by him for that purpose, which is still being used in the manufacture of cables. With the help of these insulated wires he succeeded, in the spring of 1848, together with Prof. Himly, in laying the first submarine mines with electric ignition for the protection of the harbor of Kiel from the Danish fleet. In the same year he carried out the first great telegraph line in Germany between Berlin and Frankfort-on-Main, and in the following year the subterranean line between Berlin and Cologne.

Dr. Siemens left the government service in 1850, and devoted himself afterward entirely to scientific studies and to private enterprises. In 1847 he had already laid the foundation of the telegraph works afterward carried on by him under the firm name of Siemens & Halske in Berlin, the celebrated establishment which was destined to become, and at present is, one of the chief centers for the application of electricity to the industrial arts.

The late Emperor Frederick III., of Germany, conferred upon him the patent of nobility. He was also the recipient of many other distinctions and honors.

Dr. Siemens' lectures and papers have been published in the transactions of different learned and scientific societies and in various periodicals.

Dr. Siemens' was an honorary member of the British Institute of Electrical Engineers. At the time of his death he was engaged in building an electric railroad in Berlin.

The Third Annual Mineralogical Exhibition of the Brooklyn Institute.

The mineralogical section of the Brooklyn Institute has had the good fortune to attract a group of collectors who have combined scientific precision with the more popular enthusiasm for beautiful specimens. It has, therefore, been able to make a public exhibit at once instructive and entertaining, and the exhibition given last week by its members of selections from their cabinets was unquestionably one of great merit. It would have delighted the most fastidious, and to the observer its numerous examples of mineralogical association, form, and distribution were of real importance. The large room of the Institute devoted to the meetings of the art section of the institution was well filled with the cases of members of the mineralogical section, in which, with much taste, care, and discriminating arrangement, they displayed the treasures of their separate cabinets. A brief and necessarily imperfect glance at the many interesting exhibits will afford the readers of the SCIENTIFIC AMERICAN some suggestion of the varied and even brilliant exhibit.

Among the first cases to attract the visitor was that of Mr. Charles L. Hatch, of Brooklyn, where a very excellent suite of Paterson minerals were exhibited, taken from the classic Hoxie's quarry, which has contributed almost a new chapter in the study of secondary minerals. Among these was an amethyst group, perhaps the finest secured at Paterson; some of the peculiar quartz pseudomorphs, prehnite; stilbite in process of silicification; datalite in large green crystals; very large apophyllite prisms; cut and polished prehnite, very charming with its mottled and clouded surfaces; a large henlandite, and some laumontite specimens.

Near Mr. Hatch were some striking objects in the exhibit of Mr. J. W. Freckelton, the industrious and painstaking treasurer of the association. Here were interesting sections of stalactites, horizontal and longitudinal, showing their wave-like accretion; lamellar copper-red zincites from New Jersey; large pectalite spheres from Paterson; a handsome calcite, with cleavage seams over its surface; and handsome apophyllites.

Dr. R. W. Raymond showed a wood-copper with reticulated surface, apparently resulting from replacement of ligneous fiber; bright yellow gold most captivatingly inclosed in white quartz, from Mariposa, Cal., and many other admirable specimens. Dr. S. E. Stiles exhibited a pseudomorph of serpentine after actinolite, scattered in green blades over foliated talc, from Tompkinsville, S. I.; and a curious hydrodolomite, from Mott Haven, with pipe-like pustulose projections. Dr. J. H. Hunt displayed a Paterson suite, among which was a large mass of the quartz pseudomorph so characteristic of this locality, coated with quartz, hematite, laumonite, apophyllite, and henlandite—a remarkable illustration of mineralogical differentiation. Dr. Hunt also showed a handsome tourmaline, from New Hampshire, and the radiated rubellite in lepidolite schist from San Diego County, Cal. Wm. Urban had the distinction of exhibiting the largest and most deeply colored prehnite, from Paterson, a really splendid ex-

* Page 88.

ample; and in his case were some very interesting ferruginous stilbites from McDowell & Osborn's quarry at Upper Montclair, N. J.; with remarkable analcites, from Paterson. Mr. Frank B. Jones, of Brooklyn, exhibited a choice selection of cut gem stones, with unique conceits, as tortoises in quartz, alligators in opal, slippers in pagodite, and faces cut in moonstone and labradorite. L. M. De la Mater had a fine suite of English minerals on exhibition, among which some very acutely pointed scalenoluchal calcite was of interest, and a very beautiful sprouting surface of dog-tooth spar, handsomely shaded with iron stains.

Prof. D. S. Martin exhibited a unique collection of salt, from Central New York, with specimens from other American localities; with an instructive map, showing disposition of the salt mines south of Lake Ontario. W. D. Schoonmaker exhibited a very choice and carefully selected group, among which the beautiful rubellite from California, the calcite spherules from Guanajuato, Mexico, the fine English calcites, a tourmaline implanted in quartz from Maine, and a fine blue suffused halite were conspicuous. A. C. Bates gave a very excellent impression of the composite forms of quartz, making from this species alone a capital and instructive display. The crinoidal displacement and replacement in this case was noticeable. J. A. Grenziger had some excellent fluorites and barites, with a notable illustration of velvety pyrite. G. M. Mather had a strong suite of agatized woods. G. O. Simmons an instructive selection of species, among which the malacalite, from Sing Sing, and the spheroidal dolomite, Kremnitz, Hungary, attracted attention. Mr. A. Chamberlain exhibited a very extensive and beautiful suite of gem material, somewhat injured by yellow labels. Geo. L. English showed the delicate and variegated garnet and vesuvianite stone, from Mexico, in slabs; agates of much splendor, from Brazil; a magnificent series of rubellite, from San Diego, Cal.; stibnites, twinned calcites, cut stones, and opal, from Barcoo River, Australia.

F. Braun, the indefatigable collector and investigator, exhibited a long line of pseudomorphs, not all, we should say, beyond question, but nevertheless making one of the most suggestive groups in the exhibit. With these were some very fine fossil species. Mr. Braun's exhibit was very extensive. W. G. Rothe furnished a very elegant suite of minerals, among which intersecting gypsum, from Austria; a huge marble polished ball; aragonite twins, from Sicily; hyalite, quartz with hornblende inclusions, barite with realgar, Bareno orthoclase, coppers twinned calcites, were of especial interest or beauty. J. Walker arranged a case showing geographical or local distribution and association of minerals at Paterson, Tilly Foster mine, Putnam County, N. Y., Franklin Furnace, and Hoboken, N. J. These groups were worthy of especial notice—they were so instructive and suggestive, and conveyed such a sharp impression of the mineralogical facies and spirit, so to speak, of each locality. Mr. A. H. Ehrman, his neighbor, followed a similar plan, showing some glorious canary-yellow willemite, from Franklin Furnace, and some magnetite, with very conspicuous and exquisitely ruled oscillations. Mr. W. Goold Levison had a mica exhibit of great excellence, with a curious and interesting specimen of henlandite on a soft, papyraceous, altered sphere of pectolite. Mr. Chas. Hyde Denison exhibited an amethyst of some size with the quartz pseudomorph, from Paterson; also excellent calcozincite, from Ogdensburg, N. Y., which, with Mr. Hatch's from the same locality, were the best examples of this species in the exhibit. Mr. Denison also showed an interesting combination of calamine and azurite and an example of the so-called masonite, from Natic, R. I., of which two large bowlders were known at this locality, one of which has been built into the foundation of a cotton mill and the second one broken up and distributed in cabinets. Mr. Denison possesses a very fine stilbite, taken at Paterson, and a gossan rock—cellular and fragile quartz—wherein a decomposition of auriferous pyrite has left a precipitate in the rock of native gold and sulphur.

Certainly the thanks of the community are deserved by the mineralogical section of the Brooklyn Institute for their energy and public spirit in making this exhibit, and there can be little doubt, from the extreme interest shown by both lay and scientific visitors, that their efforts are recognized and will be remembered.

L. P. G.

Barley.

Barley as a regular grain crop is but little known in the South. It is, however, one of the standards in various parts of the world, in the old world especially. All over the Pacific coast of North America the grain is extensively grown, taking the place of our Indian corn as an element of food for horses and other live stock on the farm or ranch. The California crop of barley is immense, there being, as a rule, no corn cultivated in that State except on a small scale in a few localities, and then the product is confined almost exclusively to the roasting ear patch. Not one horse in a thousand in California knows what corn is.

It is a little remarkable that our Southern people have so long neglected this valuable grain. It is more valuable as a horse food than corn, and it is far more easily cultivated. There is also more economy in growing barley. With the majority of our Southern farmers corn is one of the most troublesome and expensive of all the grains to cultivate. To grow it successfully requires long and close attention, the season of its culture and harvesting stretching from February to November.

With the same expense of cultivation and labor generally put into a barley crop, the barley will be worth largely more to the Southern farmer than the corn crop gives on our average land, while the period of cultivation and harvesting embraces only a few days each in the fall and summer.

One of the great advantages barley has over corn is that it enables the farmers to dispose of the employment and feeding of hoe hands through the long months of summer. Another advantage lies in the fact that one of the most valuable features of the barley crop comes in the rich pasture, or soiling, which the plant affords in the winter time when green food is scarce and important. Experiments made by some of our most progressive farmers in Georgia in the cultivation of barley show that it can not only be grown with great success as a grain crop here, but those experiments have demonstrated clearly also that it is one of our most valuable plants for soiling purposes.

The season of the year is now approaching for sowing barley. We would advise our planters who have not heretofore had experience in growing the grain to plant a few acres as an experimental crop. The ground should be well prepared, well fertilized and plowed deeply; and then the grain sowed very thickly and harrowed in, leaving the land so that a scythe or mowing machine can easily run over it.—*M. V. M., in Houston Post.*

The Hydrophone.

An ingenious electrical and telephonic apparatus for defending roadsteads, anchorages, and mine fields, by giving warning by visible and audible signals on shore of the approach at night or during thick weather of torpedo boats or other hostile vessels, has just been subjected to experiments extending over several weeks at the mining establishment in Stokes Bay, where it was witnessed in operation by Colonel Vetch, of the War Department, a committee of royal engineers from Chatham, and various officers belonging to the Vernon. The instrument is called a hydrophone, and its inventor is Captain McEvoy, the well-known torpedo and submarine mining expert, formerly attached to the Confederate army.

The hydrophone consists of two parts. One part is placed at the bottom of the water outside the anchorage or mine field at a depth of from five to fifteen fathoms, and the other is fixed in a station on the shore, and the two are electrically connected by cable at distances of from one to five miles. In the present instance the instrument was sunk in seven fathoms and about 300 yards off Fort Gilkicker. The submerged part consists of a bell-shaped iron case, three-quarters of an inch thick, 20 inches in height and extreme diameter, and weighing about 340 pounds. At the top is fitted a sensitive vibrator or diaphragm inclosed in a copper box. It is formed of a plate of ebonite with carbon attachments, and when the case is submerged the delicate mechanism is kept clear of the water by means of the column of compressed air, which is inclosed as in a diving bell. No sooner does a torpedo boat approach within a radius of half a mile or a man-of-war within a mile than the pulsations of her propellers produce a vibratory movement inside the case. These vibrations are transmitted to the station on shore in the following manner:

The electric current from the land battery passes through the vibrating mechanism and also through the apparatus on the shore, in the circuit of which is placed an instrument named a kinesiscope, which is somewhat of the nature of a galvanometer. By means of this the perturbations in the water are communicated to a needle flickering in a graduated arc, and when the oscillations become pronounced the needle is clutched by a magnet at the end of the arc. Contact is thus made, and the vibrations in the submerged case are made visible and audible by means of flashing lights, the firing of a gun, and the ringing of a bell. Telephonic signals are also transmitted through the same current. The whole of these operations were successfully performed in the presence of the visitors.

The idea is that for coast defense a number of hydrophones should be sunk in the approaches to a port or dockyard and connected with a central station, and that, as soon as one of them has given its warning of the neighborhood of an enemy, the information should be communicated to the threatened point by independent cables. It is contended, also, that another field of operations is open to hydrophones in dangerous zones around certain well known headlands that are frequently fatal to shipping in dense fogs. Captain McEvoy would connect a danger zone by means of hydrophones with the nearest coastguard stations. By these means a ship would be warned of the danger it was in by the automatic firing of a gun or flashing of a light.

London Fog.

The smell of London fog is, in fact, that of wood burning. This naturally suggests that if the lighting of fires could be dispensed with, much of the evil might be mitigated. Or if coal fires could be allowed to burn slowly overnight, so as to dispense with morning lighting, the nuisance might—to some extent, at any rate—be avoided. Although all are agreed that fogs and mists constitute a pest which must be got rid of, there remains one compensating advantage which has often been overlooked. It is reasonable to suppose that a fog effects a partial purification of the atmosphere. This is borne out by the fact that when a fog subsides the deposit contains the carbon, sulphur, organic bases, and other injurious and irritating particles which formerly existed in a state of suspension in the atmosphere. Just as water is freed from objectionable suspended matter by the addition of an impalpable powder, or a mixture which gives rise to a fine precipitate, so probably is the air deprived of suspended impurities by the subsidence of the moisture particles in which the impurities become entangled. It is a matter of common observation that the air is remarkably clear after the subsidence of fog or mist. Wind or rain are, however, equally effective and much more agreeable agents in accomplishing this purification. If we cannot get rid of mists while we are beset with the peculiar conditions which characterize the climate of this country, we can at least make an attempt to prevent the emission of those particles into the air which convert that mist into the intolerable and irritating vapor ever known and remembered as London fog.—*Lancet.*

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At the end of every year a great many subscriptions to the various SCIENTIFIC AMERICAN publications expire.

The bills for 1893 for the SCIENTIFIC AMERICAN, the SCIENTIFIC AMERICAN SUPPLEMENT and the ARCHITECT'S AND BUILDER'S EDITION of the SCIENTIFIC AMERICAN are now being mailed to those whose subscriptions come to an end with the year. Responding promptly to the invitation to renew saves removing the name from our subscription books, and secures without interruption the reception of the paper by the subscriber.

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Purifying Black Lead.

The following are four processes which have recently been patented for effecting the purification of black lead, with a view to removing iron and other impurities and obtaining the resulting product in a fine state of division:

(*a*) Pulverized black lead is moistened with concentrated nitric or sulphuric acid, or both. It is next washed till the wash water is free from acid, and then calcined.

(*b*) The black lead may be heated with a solution of bichromate or permanganate and acid, and subsequently calcined.

(*c*) Brodie's process may be employed by substituting nitric for sulphuric acid.

(*d*) The black lead is heated with concentrated nitric or sulphuric acid, scooped out, washed, and calcined.

To obtain a finer product, the black lead obtained at the end of these processes can, if desired, be thrown into water, stirred, scooped off, and dried.

Lubricating Composition.

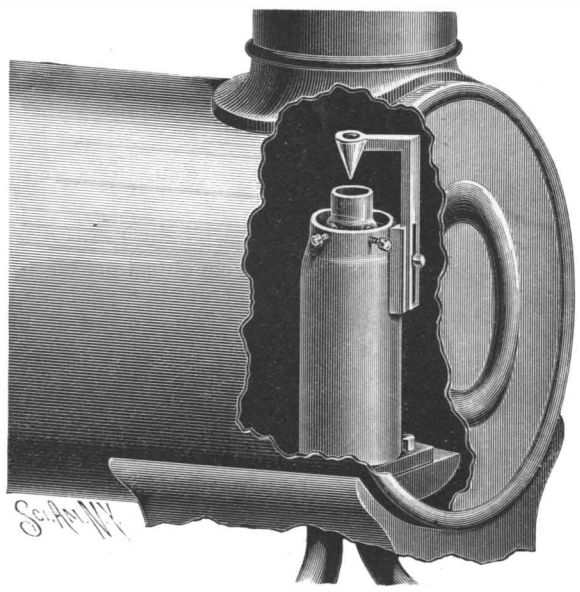
A composition which is designed for use with bearings, commutator brushes, projectile covers, may, it is stated, be prepared by mixing plumbago in excess with wood or other vegetable fiber. The materials are mixed with water, and the plastic mixture moulded under pressure. The mould is so arranged that the water in escaping tends to set the fibers on end with regard to the bearing surface. When moulded the article is dried and impregnated with linseed oil, and the oil finally hardened by the application of heat. The process is patented.

Iodine Soap.

In order to prepare a soap containing iodine it has been suggested to first iodize the fat or fatty matter by heating it with iodine, and then saponifying in the usual way.

AN IMPROVED EXHAUST NOZZLE.

The improvement shown in the illustration is designed to enable a locomotive to use a larger exhaust opening, which may be placed nearer the stack, thus forming a milder and more continuous draught and avoiding much of the back blast on the fire, the milder draught also drawing less sparks through the flues, and facilitating the more complete combustion of the gases in the fire box and flues. The invention has been



UMHOLTZ S EXHAUST NOZZLE.

patented by Mr. Charles W. Umholtz, of Bristol, Tenn. The stand pipe is connected as usual with the exhaust passages from the cylinders, and in its upper contracted end are held set screws engaging lugs projecting from the lower end of a nozzle held in the reduced end of the stand pipe, so as to form a space between the inner surface of the stand pipe and the lower end of the nozzle. Centrally above the nozzle is held an inverted cone secured to an arm sliding vertically in guideways on one side of the stand pipe, the arm being secured at the desired height by a set screw. The cone spreads the exhaust steam passing up through the nozzle, the spreading being increased or diminished by raising or lowering the cone. The use of the larger exhaust permitted by this improvement is also designed to afford relief from back pressure in the cylinders, and it is claimed that the device will effect a material saving of fuel.

THE HENRION DYNAMO.

The machine we illustrate is of French design and manufacture, being built by M. Fabius Henrion, of Nancy. The armature is of the disk type and the three pairs of parallel circuits are coupled together, so that only two pairs of brushes are required. Four or six may, of course, also be used. The frame of the machine is designed so that the top part can be lifted off, allowing the armature to be removed with ease if such a necessity should arise. One of the most interesting points about this machine is the system of lubrication employed. The bearings are kept well oiled by the ring method; the rings, however, are made with numerous perforations, so that they pick up more oil than the usual smooth form. The bearings also contain strainers, so that the machine not only carries its own self-acting lubricator, but also an oil filter for each bearing. These machines are wound for any desired output, and are frequently made to compound up to allow for the loss in the leads. —*Industries.*

Myrabolams.

The myrabolams of commerce consist of a mixture of the fruits of several species of *Terminalia*, the principal being *T. Chebulla*, *T. bellerica* and *T. citrina*. Myrabolams have for a long time been used in this country as a tanning material, and several species, particularly *T. bellerica* and *Chebulla*, are used as medicines in the East. Full descriptions of the uses of the fruits have been given by Hooper, Dymock, and others, and an analysis of the fruits of *T. bellerica* has lately been published.

It has been suggested that commercial myrabolams would form a useful addition to our list of astringent drugs, and it is with a view of ascertaining what bodies, besides tannins, are present, and what advantages this drug possesses, if any, over other astringent substances, that this analysis has been attempted.

Dr. Apery (of Constantinople) has very strongly recommended the use of myroblams in the treatment of dysentery and diarrhœa, and also considers the drug to be cholagogue. He describes its effects in the treatment of dysentery as very remarkable.—*L'Union Pharmaceutique*, 1887.

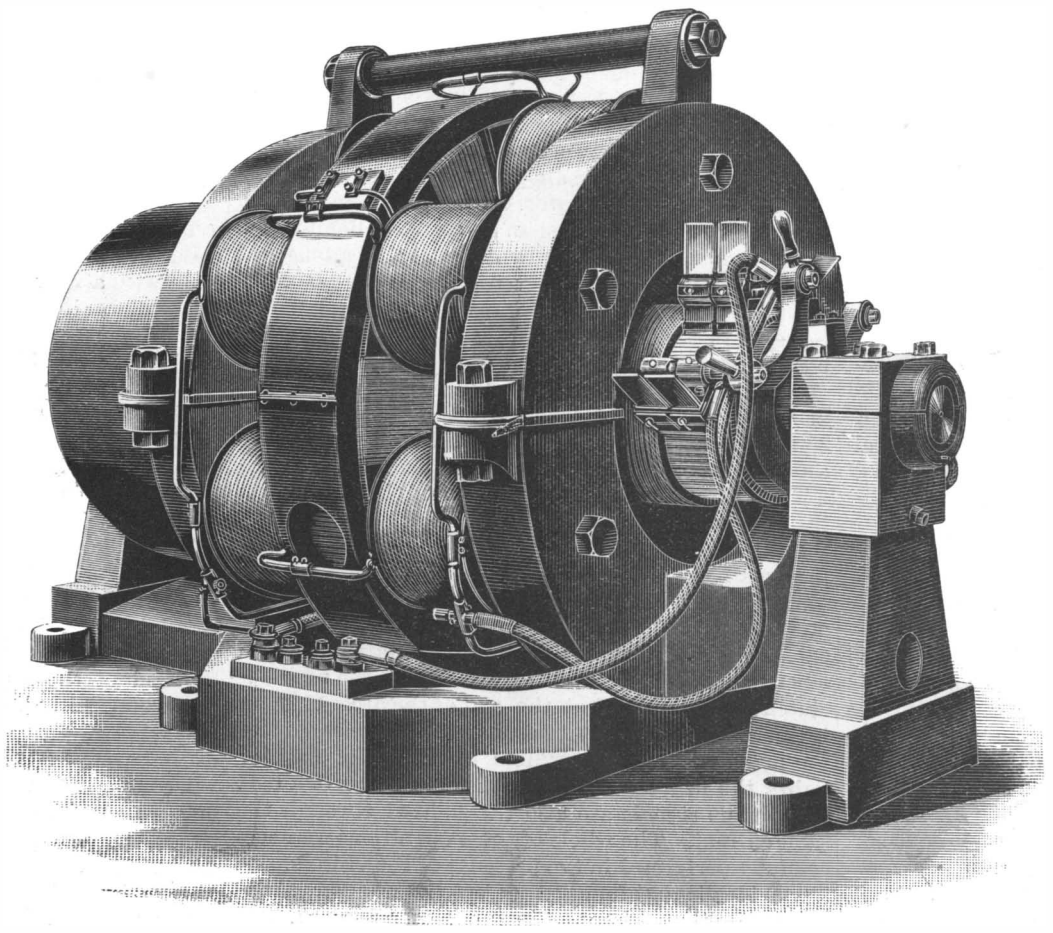
Protection Against Frosts.

The San Francisco *Chronicle*, in speaking of the disastrous freeze of last December and methods to prevent a recurrence of the disaster, says that a Mr. Everest, who was formerly engaged in manufacturing petroleum oils, has been experimenting for several months with other materials for burning in place of tar and brush, and has perfected an apparatus which it is claimed will prevent the frosting of fruit even when the temperature falls as low as 18 or 20 and remains there for several hours. This heating apparatus has been placed throughout Mr. Everest's eighty acre grove at a cost of over $2,000 and is being adopted by several other growers. It will not be patented, and is a simple device that any horticulturist may prepare.

Briefly described, the contrivance consists of a 100 gallon iron cask on each acre filled with oil, from which two pipes run along between the rows of trees, with half a dozen elbows to the acre twenty feet apart, over which are flat sheet iron pans into which oil spatters and burns as it vaporizes. Burning at the rate of one gallon per burner every hour, an intensely hot flame is made, which rises several feet and creates also a dense smoke which acts as a smudge. The cost of the plant is about $25 per acre, and the oil should not cost over $7 an acre in the coldest winter. It is believed that this method will eventually be largely used, not only for citrus orchards, but also in growing winter vegetables wherever there is danger of frost.—*Florida Agriculturist.*

Log Hauling Apparatus.

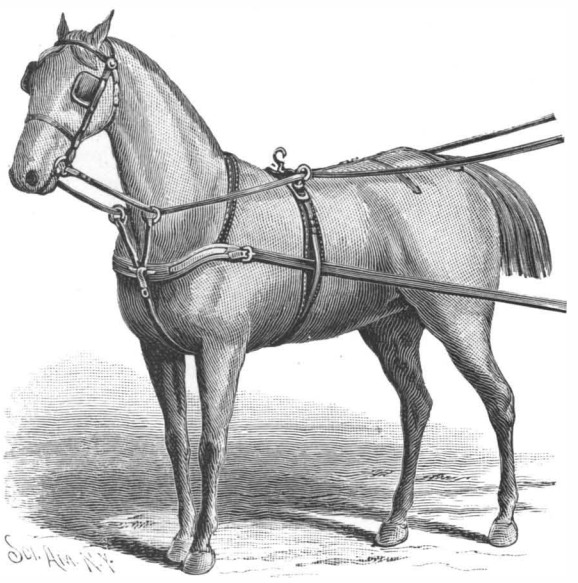
One of the most unique mechanical devices resorted to of late is that for inclined and horizontal log hauling at the Hudson River Paper Pulp Mills. The arrangement consists of an endless detached chain running in a recess at the bottom of a trough, having special links with log teeth every five feet, and passing over sprocket wheels whose centers are a hundred feet apart. The head wheel is twenty-five feet above the foot wheel, and the head end of the chain swings and can be raised or lowered by means of a small winch to suit the depth of the water. The logs are floated to the haul-up and, as they come around the foot wheel, are caught on the teeth of the chain and carried up the incline at the rate of one hundred and twenty-five a minute; on arriving at the top they are discharged into a horizontal log hauler, having head and foot wheel nearly six hundred feet apart, the whole being similarly constructed to the incline haul, the return chain supported by toothed idlers, and a deflecting piece is placed across the horizontal conveyor, by which the logs, elevated by the chain, are thrown out of the trough and rolled over the side up on long skids. Great saving of time and cost is thus effected, twenty-five horse power being employed, though some of the logs are of immense size.



THE HENRION DYNAMO.

AN IMPROVED BREAST COLLAR.

With the collar shown in the accompanying illustration, the pulling strain is designed to be thrown on the animal's shoulder proper, the point of the shoulder



CAIN'S BREAST COLLAR.

being relieved from pressure, thus giving comfort to the animal and permitting walking or running with the greatest ease. The improvement has been patented by Mr. C. T. Cain, of Owensboro, Ky. The collar is connected near its rear ends with the neck strap, and at its ends with the traces, in the usual manner, and within the sheathing of the collar are permanently shaped metallic shoulder plates. The plates are formed of steel or spring brass, so that they will permanently retain their shape and yet yield sufficiently to be perfectly easy to the shoulder, each plate being bent edgewise vertically in one portion, and having its rear end inclined downward and rearward to align with the traces, together with a particular curvature and inclination at the forward end. The collar assumes the same shape as the plates, so that all strain on the point of the shoulder is removed and distributed higher up on the shoulder proper. The collar is left perfectly flexible between the shoulder points where it crosses the windpipe, and thus all liability of choking is avoided, while a much freer shoulder action is permitted than is possible with a metallic bar extending throughout the length of the collar as heretofore. The collar also looks easy and comfortable and is elegant and graceful in appearance.

The Leather Industry.

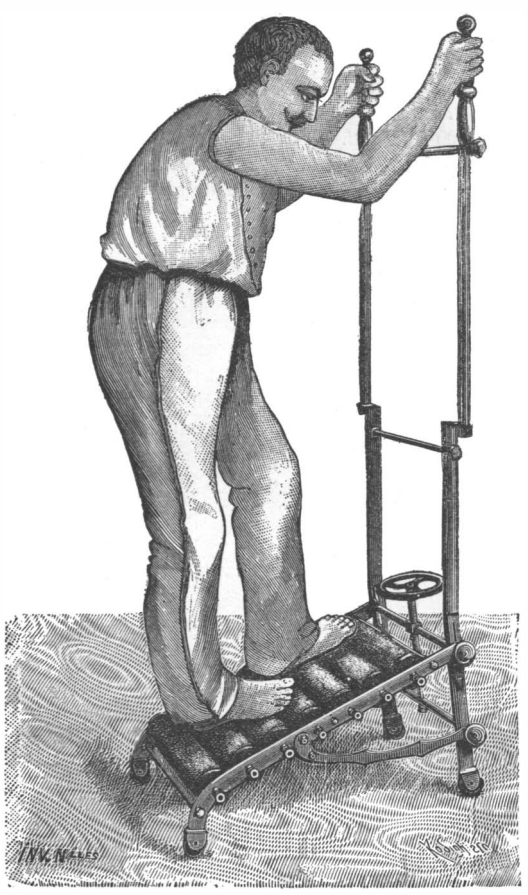
A separate building for shoe and leather exhibits, paid for by subscriptions of those engaged in these trades, is being constructed at Chicago, at a cost of more than $100,000, and this building will contain, says the *Shoe and Leather Reporter*, not only illustrative exhibits, but gems of art. The possibilities of decorating with colored, varnished, embossed, satin, Japanese and Oriental fancy leather will all be tested by experts whose aim will be to excel in this new field. It is likely to open an era of embellishment which will bring leather into more general use in the household. The Japanese leather embossed with the strangely bedizened figures from real life in that country will be an artistic revelation. This material is as thin as paper, but possesses great toughness, and is soft and yielding to the touch. It is being used in European drawing rooms in place of textile fabrics, for inside curtains. This is a new use for leather. The walls of the official rooms will be sheathed with upholstery leather, and ceilings frescoed with appropriate designs. On the walls will hang more than two hundred pictures (full size and original colors), representing the shoes worn in every age.

A CERATE for wounds, cuts, sores, burns, scalds, and the like: Resin, ¼ pound; clarified beef suet, 3 ounces; boil a quarter of an hour; add 2 ounces beeswax; boil for a half hour longer, and allow to set.

THE HYGIENIC TREADMILL.

Gymnastics are much in vogue at the present time, and the apparatus illustrated herewith is intended to assist in the development of muscular force in a similar manner to that obtained by walking or running, without the necessity of leaving the house and of being exposed to the inclemency of the weather. The apparatus illustrated also gives relief to those troubled with obesity, as exercise with it tends to a reduction in weight without the fatigue attendant upon going to and from places where more scientific treatment is administered.

It is composed of an inclined plane formed by a series of rollers kept in place by axles running in the side pieces, which, with the pieces at the end uniting them, form the principal part of the apparatus. The rollers and their mountings rise and fall in a groove in the upright support, which is composed of two uprights fastened together by cross pieces at several places. These upright pieces form the points of support for the persons making use of the apparatus. The



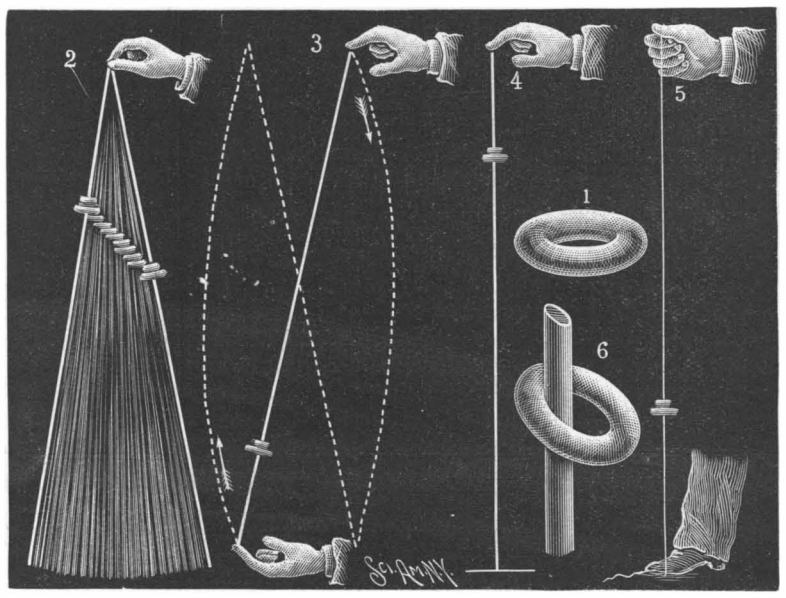
THE HYGIENIC TREADMILL.

rollers are made of wood covered with cloth over stuffing, or covered with rubber, which gives greater purchase for the feet. The method of working is very simple. The person desiring to exercise mounts the rollers, which are set in motion by the weight of the body. By their motion they tend to carry the feet to the lower portion of the apparatus. This can only be counteracted by a brisk movement of the limbs and feet, similar to walking or running, and must be kept up continually, or the feet will be thrown off the apparatus. The amount of the exercise can be regulated by raising or lowering with the screw. The higher the top of the inclined plane, the more violent the exercise. The effect produced by the rapid motion of the limbs is to produce a sensation of heat over the entire body, equivalent to that obtained by running or a long walk.—*Les Inventions Nouvelles.*

ROD AND RING EXPERIMENT.

BY GEO. M. HOPKINS.

A curious result of the combination of the force of gravity and of centrifugal force is illustrated in the annexed sketch. The experiment here illustrated is very simple, requiring for its execution only a rubber umbrella ring and a small rod or smooth string. The ring is placed over the rod and twirled. It keeps up its rotation while slowly descending, and it will persist in maintaining its motion when the rod is swung like a pendulum as shown in Fig. 2. By dextrously turning the rod end for end before the ring completes its excursion, the operation will be reversed and the ring will again travel downward. When the rod is held vertically, as in Fig. 4, the best results are secured. A smooth string answers a very good purpose when strained in the manner shown in Fig. 5, *i. e.*, with the upper end of the string grasped firmly by the hand while the lower end is held to the floor by pressure of the foot.



ROD AND RING EXPERIMENT.

This experiment is capable of some modification; for example, a pure rubber tube may be substituted for the string, or, with a rod inserted in it, it may be substituted for the rod, and a light metal ring may be used instead of the rubber ring.

The explanation of the behavior of the rubber ring will be readily understood by reference to Fig. 6, from which it will be seen that the line of contact between the ring and the rod is oblique; in fact, it corresponds to a portion of the spiral described by the ring in its passage down the rod. The friction due to the pressure resulting from centrifugal force prevents the ring from making a direct line of descent, while its inclined position compels it to take a spiral course down the rod.

The ring rolls by internal contact with the rod, but, to make one revolution on its own axis, it must roll around the rod nearly as many times as the diameter of the rod is contained in the internal diameter of the ring.

SOME OF THE "CHOLERA STREETS" IN HAMBURG.

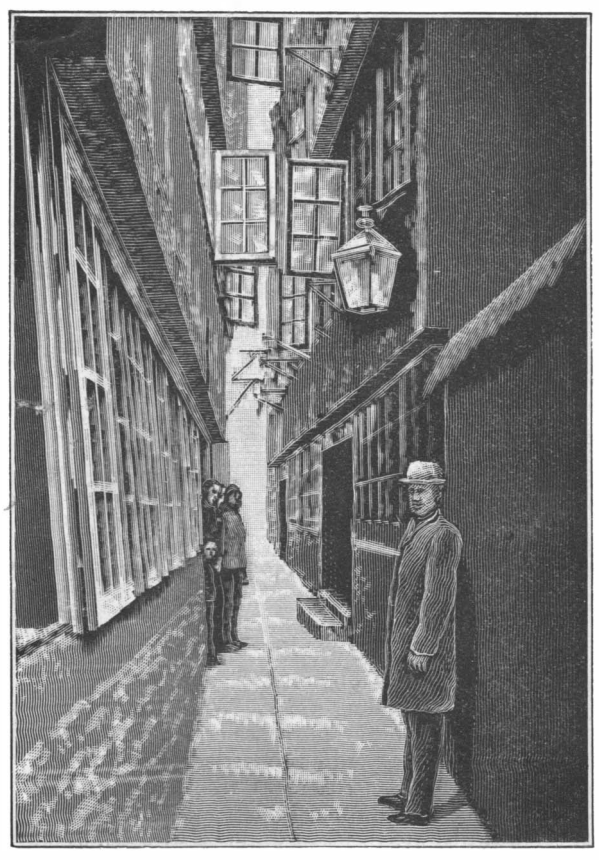
BY ANNESLEY KENEALY.

It was believed in Hamburg during the "terror reign" of the recent epidemic that the coming spring will see a revival of some, at least, of its horrors—that, with the bursting of the new year's buds, the seeds of disease, also having lain dormant during the winter months, will rise again into existence and more or less activity; and it has been decreed that hygienic measures shall be well afoot in order to trample down the noxious growth in summary fashion. But one cannot help fearing that there is in Hamburg soil too suitable for its quickening for this to be an easy task.

Something may be done in the way of temporary sanitation, such as disinfecting, cleansing, and strict supervision of existent conditions; but between this and the springtime there is no time for such radical measures as are needed. Until a fresh water supply can be arranged—and this is a lengthy undertaking—people must continue to drink the Elbe water, which, though it may not now contain cholera germs, is yet so impure that its continued use deteriorates the health and vitality, so that its victims succumb readily to such germs when they do attack. And though the proclaimed "cholera-strassen" be rigorously closed, and their occupants compelled to find other quarters, this is but a drop in the cup, for there are too many such equally unhealthy "strassen" to make it possible for all to be closed without further and most dangerously overcrowding the poor streets into which their evicted tenants must pour.

During the winter building operations must be practically at a standstill, and the spring will be upon us almost before there has been time even to make plans of the new houses which are to rise upon the ruins of the old. Many thousands of persons must, therefore, continue to occupy tenement houses so closely crowded together that one can almost touch hands from the windows of opposite houses; with doorways so low that a man must bend his body to enter; while upon the narrow, ill-paved footway more or less of the refuse of the overfilled houses is thrown.

On one occasion, during my stay in Hamburg, observing a quiet, orderly crowd in one of the main streets, I stood to see its cause. I found it arose from the fact of a number of work people, who, returning from some manufactory, were filing into the narrow street in which they dwelt. This was so constructed that the passage to it ran under part of a tall building



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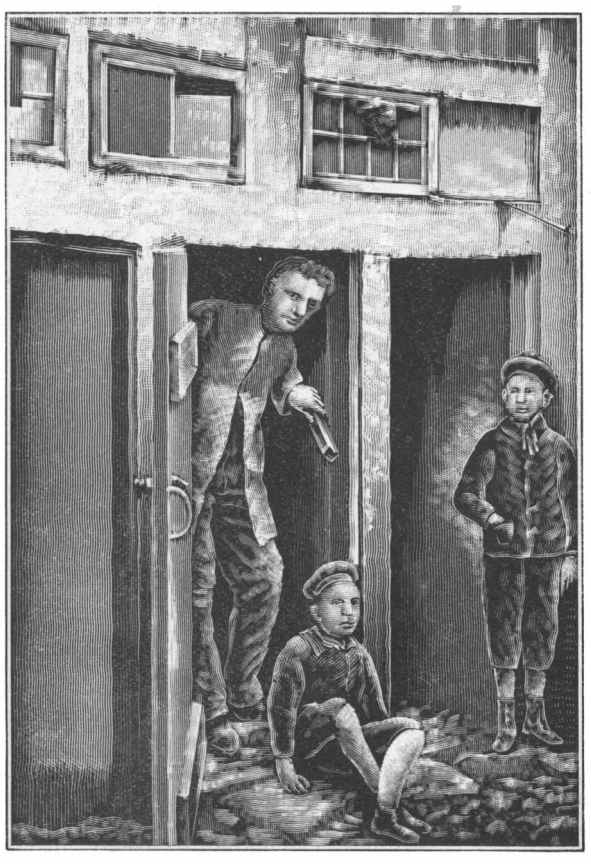

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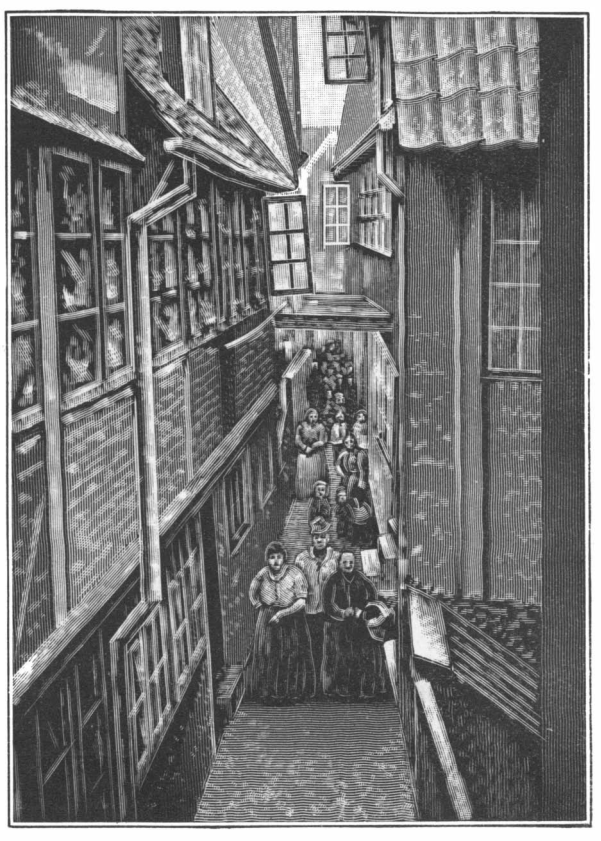


No. 22 NIEDERNSTRASSE.

SOME OF THE STREETS IN HAMBURG.

which blocked the whole upper entrance, leaving only a sort of doorway below, capable of admitting only one person at a time. Inside the street, which was a long and crowded one, two persons could walk abreast; and so they wended their way, turning off singly or in groups into the low, dirty doorways that led to what they called "home."

To beams stretched across from house to house between the upper stories lines were attached, from which many ill-washed, ragged garments drooped—I had been on the point of writing "fluttered," but that would indeed have been an exaggeration of speech in dealing with the powers of the languid air that stagnated there.

The few opened lattice windows almost met across the street, so that close, unwholesome rooms practically ventilated themselves into rooms equally close and unwholesome. That the atmosphere within was better than that outside I should have been glad to believe, but when I noticed sundry sickly-looking, sallow mortals come to the doors and windows and breathe in with evident relief the exhalations of the squalid street, I was bound to conclude otherwise.

And this was only one of many such which will certainly not be a thing of the past by the time the primroses come. A very eminent chemist, in the face of the inherent vitality of disease germs, has characterized disinfectants as dangerous on account of the false security they engender; and certainly any attempt to destroy by means of disinfection the evil factors that must abound in "rookeries" such as I speak of, would exemplify the very dangerous possibilities of the story of disinfectants.

Only the wholesale destruction of these places, and a religious devotion to the flame of their remains, will meet the demands of the case. Until this has been done, and the picturesque, gloomy haunts of disease have given place to the somewhat inartistic highways of sanitation, we may not be surprised if the offended household gods testify their wrath by epidemics like the recent one.

And humanity is so essentially one large family that Dives is infected by the cholera-stricken Lazarus at his gates. Not only this, but Lazarus at the uttermost ends of the earth may, in his primitive ignorance of sanitation, generate a bacillus which shall cross oceans and continents and rivers, and fasten upon Dives of distant race and clime, though he dwell on the very heights of sanitary science. So it behooves us to be wary in this portentous coming spring. Our illustrations are from photographs by E. H. A. Schlitte, Hamburg.—*London Graphic.*

Interesting Power Transmission Plant.

The San Antonio Electric Light and Power Company recently turned on the electric lights in San Antonio Canyon, says the Los Angeles, Cal., *Express*, and everything was found to be in perfect shape for furnishing Pomona and vicinity with light and power. The wires have been run all over the city, and the power house is nearly completed. The power plant is located in the San Antonio Canyon, where there is a minimum flow of 1,300 cubic feet of water per minute, with a head of about 400 feet. The water is brought to the power station through 1,900 feet of 30 inch and 600 feet of 24 inch double riveted sheet iron pipes, which involves a loss of head by friction by 12 feet. The laying of the pipe line necessitated a rock tunnel 1,300 feet in length, as well as several heavy open cuts. The power station is provided with four double-nozzle Pelton wheels, 34 inches in diameter, coupled directly to the armature shafts of as many Westinghouse alternating current generators of 200 horse power each. The wheels run at 600 revolutions per minute. Two exciters are provided, which are also run by Pelton wheels coupled to the shafts in the same manner, 20 horse power each. The current thus generated is carried on two No. 7 bare copper wires seven miles down the canyon to a point where they diverge, one running to Pomona, 15 miles, and the other to San Bernardino, 28 miles. By means of transformers the potential is raised at generating station to 10,000 volts and the current carried at this pressure to sub-stations located just outside the cities named, where, by means of step-down transformers, it is reduced to about 1,000 volts, and then distributed for both light and power purposes. The motors used for power purposes are of the Westinghouse synchronous type. The sub-stations are provided with regulators, by means of which the attendants can regulate the voltage of the distributing circuit independently of the generating plant.

IMPROVED RECORDING PRESSURE GAUGE.

The gauge shown in the accompanying illustrations is designed to register extremely low ranges or variations of pressure, such as those due to one-tenth

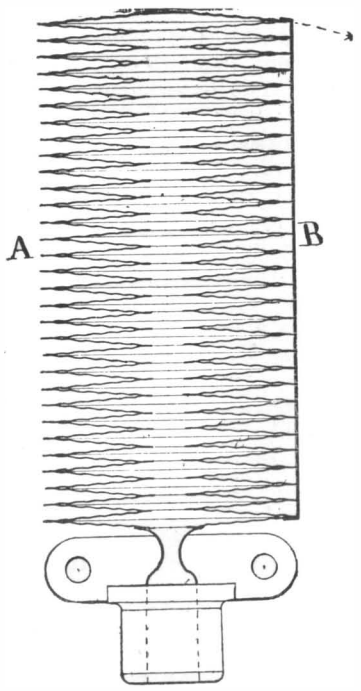


Fig. 1.—DIAPHRAGMS OF GAUGE.

of an inch or so in the head of water, as in the case of illuminating gas in street mains, where the total range rarely exceeds two ounces per square inch, or its equivalent, four inches head of water. For such very low pressure it is necessary to have a very large area for it to act upon, and this is afforded by employing a series of corrugated diaphragms, A, placed as shown in cross section in Fig. 1. The diaphragms are arranged in pairs and joined, as shown, with a continuous opening through the line of centers of the different pairs, thus permitting the pressure to exert itself simultaneously on the interior of every pair, the effect of variations being to produce an elongation of the whole. This arrangement of diaphragms is employed in the construction of certain self-registering barometers, the small motion of the diaphragms being made available by a train of multiplying mechanism. In the gauge the disadvantage of using multiplying devices is entirely obviated by securing a flexible strip, B, along the edges of the diaphragm tube, as it might be called. The effect of applying the flexible strip is two fold: first, it stiffens the diaphragm tube as a whole; and second, it performs the most important function of resisting the tendency of the pressure to elongate it, which naturally results in producing a greatly multiplied lateral motion.

As in the sinuous tube, the motion thus produced by variations of pressure is ample for directly indicating or recording in connection with a moving chart. By the use of a large number of diaphragms, as shown, it is evident that the change of form of each individual member is very slight for complete range of pressure. It follows that none of the diaphragms will be strained to their elastic limit, and all danger of the gauge taking permanent sets will be avoided. In the application of the diaphragm tube to a recording gauge it is mounted on a back as shown in Fig. 2. A recording pen is attached directly to the end of the diaphragm tube, and a clock is provided, as shown, timed to revolve a dial, in the plane of movement of the pen, once in twenty-four hours. In Fig. 3 the gauge is shown complete with chart ready for application. The small graduations on the chart indicate tenths of inches head of water. This form of tube is not limited to recording gauges for light pressures only, but may be used for all ranges if the diaphragms are properly proportioned as to size and thickness of metal.

The successful operation of this gauge was described by Mr. W. H. Bristol, the inventor, at the late meeting of the American Society of Mechanical Engineers. It is manufactured by the Bristols' Mfg. Co., Waterbury, Conn.

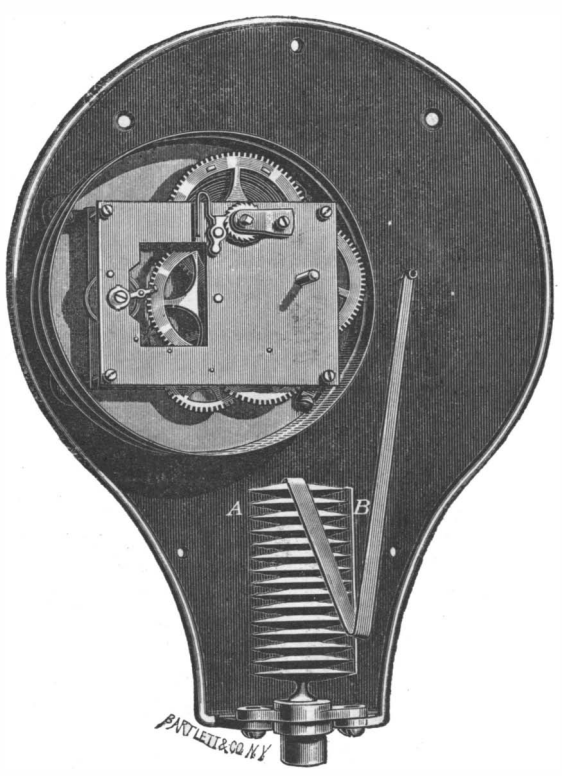


Fig. 2.—INTERIOR OF PRESSURE GAUGE.

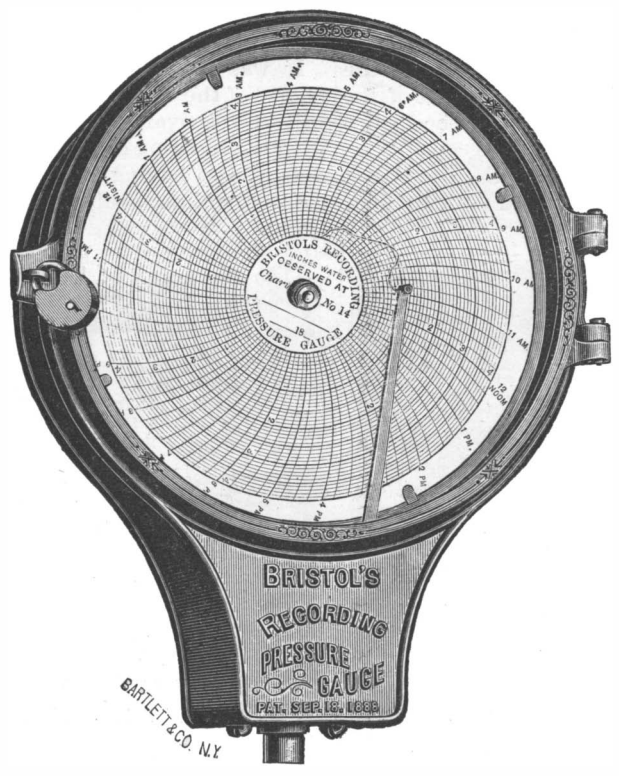


Fig. 3.—PRESSURE GAUGE READY FOR APPLICATION.

Valuable Astronomical Work at Harvard.

Professor Pickering says in his annual report, just issued, that the Harvard Observatory astronomers made a great many interesting astronomical discoveries last year, both in Cambridge and in Peru. They took 2,777 stellar photographs in Cambridge and nearly 2,000 in Peru. The examination of these plates has, as usual, led to the discovery of a large number of interesting objects. Ten variable stars, in addition to the thirty-seven previously announced, have the hydrogen lines bright in their spectra. Seven new variable stars have been discovered this year by means of this property. The number of stars of the fifth type has been increased by eight, making the total number forty-five. The hydrogen line was shown to be bright in the spectra of six stars in addition to those already known. Photographs have been obtained of the spectra of eight planetary nebulæ, showing bright lines. The spectrum of the nebula surrounding some of the stars is unlike that of other gaseous nebulæ. Five stars have been shown to have spectra of the fourth type.

An extensive series of observations was also made upon Mars, and the relative positions of ninety-two points upon the surface were determined by the micrometer. More than forty minute black points were discovered, provisionally designated as lakes. The polar compression of the planet was also measured and appeared to be greater than that indicated by theory, which may be due to an excess of clouds in the equatorial regions. The presence of the dark and narrow streaks, called canals by Schiaparelli, has been confirmed, and various measurements of them have been made. The clouds projecting beyond the limb and terminator have been studied, and their height has been found to be at least twenty miles. Two large dark blue areas have been detected on the planet, and other portions have been noticed to be subject to gradual changes.

Many new double stars were also found south of 30°, between 12h. and 18h. The August occultation of Jupiter was observed both visually and photographically; also the new star in Auriga and Swift's comet. Stations have been established at Mallendo, 100 feet above sea level; at La Joyce, whose elevation is 4,150 feet; at the observing station, 8,060 feet high; and at Chachani Ravine, 16,650 feet high.

New Liquid Glue.

Erich Brand makes an animal glue, which is always ready for use and keeps any length of time, by dissolving 60 kilogrammes of borax in 100 kilogrammes of water, adding to the solution when boiling 4 kilogrammes of 90 per cent calcined potash, and adding this mixture while boiling to 1,450 kilogrammes of hot glue liquor, showing a density of 12° (Baume).

BORO-BORAX is a new preparation, discovered by Jaenicke, which is formed by mixing equal parts of borax and boric acid in boiling water. When the water cools the greater part of the substance crystallizes out. Its antiseptic and therapeutic properties resemble those of boric acid, but it has a neutral reaction and is much more soluble. At ordinary temperature, 16 parts of boro-borax dissolve in 100 of water; at 100° F., 30 parts dissolve in 100 of water; while boiling water dissolves 70 per cent.

Over Ninety-seven Miles per Hour.

Lately we recorded the unprecedented feat performed by engine No. 385 of the Central Railroad of New Jersey, running a mile in 39¼ seconds, or at the rate of 91·7 miles per hour. This engine has again broken the record, like Nancy Hanks, and can justly lay claim to being the fleetest thing on wheels in the world.

On November 18 it made a mile in 37 seconds, and the next succeeding one in 38 seconds. Engineer Henry Beck, who made the previous record with the engine, was at the throttle, and Fireman David Blake was attending to the steam pressure, which was kept at 180 pounds.

Between Columbia Avenue, Philadelphia, and Wayne Junction the 385 ran 40 miles an hour on a spurt. Three minutes were consumed here, and the train then started on its 85-mile run to Jersey City. Before much speed was developed there was a slowdown for Tabor Junction, where the tracks join those of the old North Penn. Road. Between Tabor and Jenkintown the train was flagged, and the grade up hill was 78 feet to the mile; five miles of the distance was covered in four minutes.

There was some fine running between Jenkintown and Langhorne, 13 miles apart. The schedule was 14 minutes. The start was made out of Jenkintown two minutes late, and shortly after the train was under way a mile was made in 44 seconds. Between Somerton and Parkland, a distance of five miles, the longest time for a mile was 42 seconds, the first mile being run in 42, the second in 41, the two following miles in 40, and the last mile of the spurt in 42 seconds. This speed was between 86 and 90 miles an hour. The five miles were made in 205 seconds, which broke all records for a five-mile run, being 87·8 miles per hour.

After passing Neshaminy all previous records were broken, and the 385 reduced her own unsurpassed run of 39¼ seconds for a mile to 39 seconds.

Bound Brook was reached on time, but on pulling out the train was flagged, and when Plainfield was reached was three minutes late.

"Now watch her," said Engineer Beck, as he flew by Fanwood. The mile post was just beyond the station and the chronograph snapped as the engine shot by, and the long split-second hand started around the dial. It was this mile that was covered in less time than was ever traveled in, and when the next mile post shot by in the rear the time on the dial was 37 seconds—97·3 miles per hour. The train flew on with unabated speed and the chronograph was snapped as the next mile post was passed. The time for the two miles was exactly 75 seconds. This made the greatest record for one and two miles, as the performance between Jenkintown and Langhorne did for five miles.

[It is reported that there was no preparation whatever made for the test. "A more unfavorable time could not have been chosen, as the rain poured in torrents during the day and only ceased half an hour before the time scheduled to leave Philadelphia—5:15 P. M."

But is it true that this was an unfavorable time for such a test of speed? In our opinion it was a most favorable opportunity. But for that drenching rain we might not now record this unprecedented performance. The rain wet the rails and the lubricating quality of water acted to greatly reduce the rolling friction of the wheels upon them. The reduction of this friction was the same as an addition of power in the locomotive, and the speed attained in consequence should suggest some thought concerning this form of friction and its action in increasing the resistance of trains.—EDITOR.]—*Nat. Car Builder.*

The Light of Planets.

The question as to whether the light of planets is capable of casting shadows must have, especially during the last few months, been in the minds of many, says *Nature*, and perhaps many observations have already been made, but unfortunately not published. With regard to this question, *L'Astronomie* for November contains two notes, the first of which, communicated by M. Marcel Moye on August 30, relates to the planet Mars. His observations were made just before the meridian passage and in a room where the light of the planet could enter the open window. In this way white paper, invisible in the corners of the room, was easily distinguished when placed on the wall opposite the window, while one could see well the shadows between the fingers of the hand; placing a newspaper in the light of Mars, only the place of the table and the number of the words could be recognized, but not read, as was the case with Jupiter. M. Moye concludes then that Mars certainly casts shadows, less strong than those of Jupiter, but still appreciable.

In the note on the light of Venus, M. Leon Guiot tells us that on August 29, when about to get up to observe Jupiter, he was astonished at the brilliancy of the light that entered his window. Observing his watch, which was hanging on the wall, he was actually able to trace its shadow on the wall, for he says that all was visible as in the light of the moon; one could even read the newspaper. It was about this time that Venus was constantly seen with the naked eye in full daylight.

Cut Nails vs. Wire Nails.

A series of interesting and valuable tests to decide the much controverted question as to the comparative merits of wire nails and cut nails have been made recently at the United States arsenal in Watertown. The relative value of these two kinds of nails has always been a subject for many conflicting and confusing claims on the part of competing manufacturers, and it is a matter on which builders and others interested are far from being satisfied. An agreement was recently reached among some prominent manufacturers to submit the matter to a decisive test which should demonstrate the real facts beyond possibility of argument. The use of the government's testing machine at the Watertown arsenal was secured, and the tests are being made by a committee representing manufacturers in all parts of the country, under the direct supervision of Major J. W. Reilly, commandant of the arsenal.

At the first test the size of the cut nails tested ranged from 1⅛ inch, three penny, 764, to 6 inch spike nails, forty penny and sixty penny, six to seventeen to the pound. Wire nails to correspond as nearly as possible were used. The nails were driven into a well seasoned spruce plank to a depth of precisely four inches. The weight of the nails differed only two grammes, the wire nails 214 and the cut nails 212 grammes.

In the first test a force of 733 pounds was required to draw the wire nail and of 836 pounds to draw the cut nail of similar size. The second wire nail was pulled with 673 pounds and the cut nail with 742. The third wire nail required 675 pounds of pressure, the third cut nail 804, the fourth wire 594, the fourth cut 964. These were the character of the variations of the fifth and sixth nails. The seventh wire nail was pulled with 879 pounds pressure, but 1,200 pounds of force was required to draw out the cut nail of like size. Every care was taken to have the tests strictly fair and accurate. The results from the initial tests were highly satisfactory to the manufacturers and advocates of the cut nail.

The Galveston Deep Well.

An interesting experiment was recently concluded in Galveston, Texas, in the boring of an artesian well over 3,000 feet in depth. The water supply of the city is furnished by 13 artesian wells, varying in depth from 825 to 1,350 feet, but the water is totally unfit for drinking and domestic use. The city concluded to invest $75,000 in order to procure a supply of pure water. The well was started with a 22 inch casing. Inside this casing a 15 inch pipe was sunk to a depth of 870 feet, and inside of this a 12 inch pipe was telescoped to a depth of 1,500 feet. Then a 9 inch pipe was telescoped to a depth of 2,363 feet. A 6 inch pipe was then inserted and a depth of 3,070 feet 9 inches was reached. No water was found nor was any rock penetrated. The contractors have complied with their contract, which was to bore to the depth of 3,000 feet, were paid $76,000, and further work abandoned.

The well is the deepest on the seacoast in the United States, and a description of the different strata pierced by the boring is interesting. From the surface to a depth of 46 feet there was a stratum of gray sand, thence to a depth of 64 feet was a layer of red clay and shells, thence to a depth of 100 feet was a stratum of blue clay, sea shells and fragments of rotten wood. From this to 315 feet sands and sea shells were encountered, and from that depth to the 815 feet level sand and clay were discovered. From the 815 feet level to the depth of 1,288 feet sand, clay, sea shells and decayed wood were found, and from that depth to the 3,070 feet level varying strata of sand, clay and large logs were encountered. At the very bottom of the hole a bed of sea shells was struck. The contractors expended $63,000 before they completed the work.

Matches.

If the worthy gentlemen who control a monopoly of the trade in matches in the United States will give ear to reason, they will improve the quality of their product, even if in so doing they have to sacrifice a tithe of their present profits. Some of the matches now sold are a nuisance because of their unreliability, while others are a constant source of danger to property, if not to life, even in the hands of careful people. A portion of these latter drop a portion of the inflammable composition invariably, and if it happens to light on combustible material, a fire is pretty sure to result. Much clothing has been ruined in this way, and no end of profanity provoked. Another class of dangerous matches is the kind so highly charged with explosive that when struck a part of it flies through the air to a considerable distance, and is likely to do harm to whatever it happens to reach in its flight. At least one instance is known where the sight of an eye was lost through material from one of these percussion matches, to say nothing of less serious hurts and annoyances following their use. The match plays an important part in increasing the fire losses of the country, and will no doubt continue to do so until human ingenuity evolves a substitute for it. But the match makers could decrease its harmfulness in this as in other respects if they desired to do so.—*Insurance World.*

The Canals of Mars.

The late opposition of Mars and the reobservation of the doubling of the canals has brought forward many theories relative to this very curious phenomenon. There seems to be no doubt now, says *Nature*, that this doubling is not due to instrumental deficiencies, or even to an optical delusion caused by the fatigue of the eyes; but that it is a real observed fact, and therefore requires a rigid explanation.

In *Comptes Rendus* (No. 18) for October 31, M. Stanislas Meunier relates another possible cause, and illustrates the phenomenon experimentally. The experiment is as follows: He takes a polished metallic surface and on it traces a series of lines and spots, representing as nearly as possible the Martial surface as seen by us, and illuminates it all by sunlight. He then stretches at some distance (a few millimeters) from it a fine transparent piece of muslin. Looking at the surface through this medium, he finds that all the lines and spots are doubled. A fact observed by M. Schiaparelli is that the canals, when doubled, are not always exactly parallel, and that sometimes there is an "aspect de nebulosité." These and other peculiarities are, according to M. Meunier, reproduced by simply undulating the muslin.

His explanation is that the solar light is reflected from the planet's surface very unequally, that from the continents exceeding that emitted by the deeper parts, seas and canals. Although the atmosphere is a limpid one, we are unable to see its motions; but if, as he says, the aerial envelope includes a transparent veil of fog at a suitable height, a contrast would be produced, as was the case with the muslin, by the production of shadows. This explanation of the phenomena of shades by reflection, if valid, should, of course, hold good for the planet Venus when properly situated, and that it is not observed on the moon is only another proof that our satellite has no atmosphere.

Lengthy Aerial Voyages.

Two very interesting balloon ascensions took place at the end of the month of October. Mr. Mallet started at 6 o'clock in the evening of Sunday, October 23, from the La Villette gas works, in a balloon of 28,660 cubic feet capacity. The aeronaut took an easterly direction and passed over Chalons, Metz, Coblentz and Frankfort. The descent was effected at Wallen, in Hesse (Germany), on the other side of the Rhine. The balloon touched earth in the midst of a snow storm at half past 6 o'clock in the morning of Tuesday, October 25. The trip lasted 36 h. 30 m. No balloon has, up to the present, remained so long in the air.

On Wednesday, October 19, Mr. George Bans started for a voyage of long duration, in a 120,330 cubic foot balloon, in company with Messrs. William Sossa, George Besancon and Louis Baisses. The inflation, as in the former case, was effected at the La Villette gas works. On account of a rain, the start could not be made until seven minutes past ten in the evening. Three batteries of accumulators furnished a brilliant illumination of twenty-five incandescent lamps around the car. The latter carried also an electric lamp, registering barometers, etc. The balloon directed itself toward Pithiviers, Orleans, Chateauroux and Confolens, and landed under excellent conditions at Marsac, near Angouleme, at 5 o'clock in the afternoon of Thursday, October 20. The trip of about 270 miles was effected in 19 h. 13 m.—*La Nature.*

People Who Fall Safely.

A fall, as a rule, injures a drunken man much less than a sober one, because, the controlling power of the mind being rendered nil through intoxication, the body falls as an inert mass, and thus the chances of injury are lessened, for, strange though it may appear, it is no less a fact that the most numerous cases of injury arising from a fall are caused by the effort, voluntary or otherwise, to avert the consequences, thus straining the muscles and tendons. Very rarely are injurious effects from a fall known in a lunatic asylum, for the same simple reason—the mind has no influence over the action of the body. And it is a remarkable and well known fact to those who have to deal with such cases, adds the *Boston Herald*, that whatever injuries are so caused heal much more rapidly than in the case of sane people, the mind having more to do with retarding or assisting nature's efforts than is generally known or realized.

Opening of the Elevated Railway, Liverpool.

The first train on the Overhead Electrical Railway, Liverpool, was run on November 9, carrying the directors and their friends. The trip was very satisfactory, the behavior of the main engines and dynamos being all that was anticipated, and the experiments indicated a very successful issue. The construction of this railway resembles in general appearance that of the Sixth Avenue elevated railway, New York City.

METROPOLITAN SEWERAGE SYSTEM SURROUNDING BOSTON.

BY B. G. UNDERWOOD.

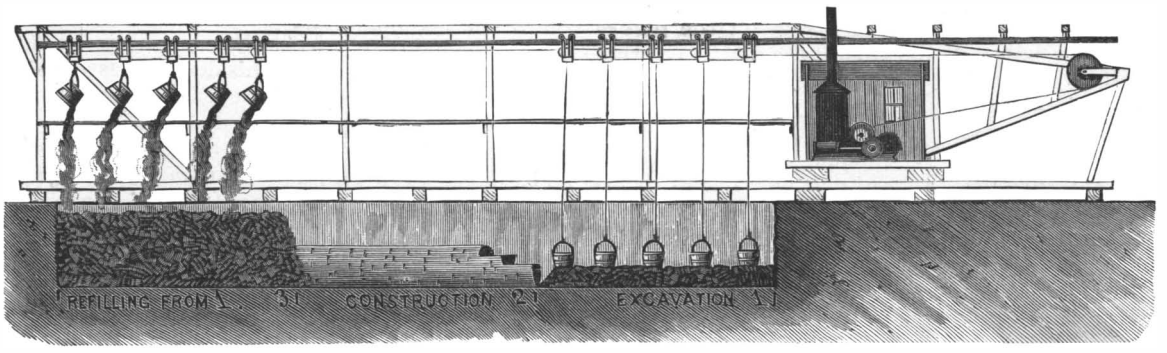
A glance at the map shown on our front page, specially engraved for us by the American Bank Note Company, from data furnished by the Sewerage Commission, shows the magnitude of the work and why it was necessary for the State to appoint a commission to superintend the construction.

The importance of having work of this kind thoroughly done and under an intelligent supervision is very evident, and the cities and towns interested have reasons to congratulate themselves on the high character of the commissioners and the quality of work insisted upon by the chief engineer.

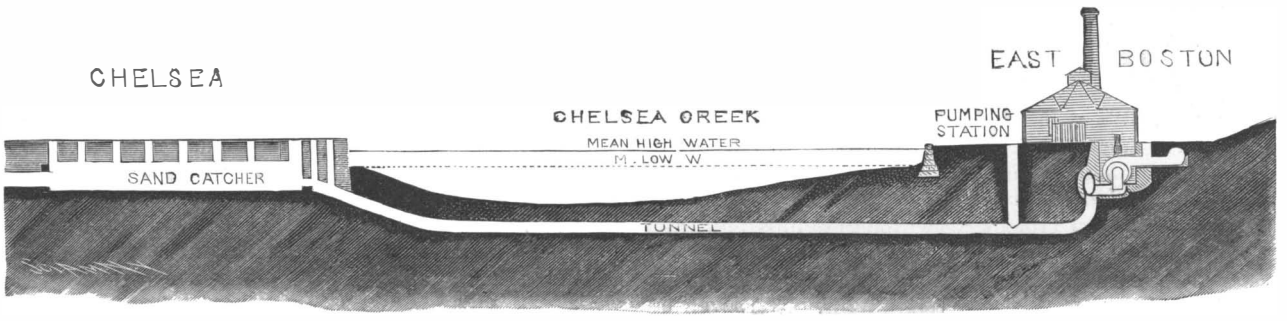
By act of the Massachusetts Legislature, approved June 7, 1889, the governor appointed Hosea Kingman, Tilly Haynes and Robert T. Davis, and later Harvey N. Collison, commissioners to provide for the building, maintenance and operation of a system of sewage disposal for the Mystic and Charles River valleys. Mr. Howard A. Carson, of Malden, was selected chief engineer, and during the past two years the many thousands traveling to and from Boston from the places embraced in the district have been more or less familiar with the methods of sewer construction employed, some of which we illustrate in this connection.

The method recommended by the State Board of Health was that of "discharging crude sewage into a strong tidal current that will convey it to sea, whence it cannot return." After careful examination, Mr. Carson found that the best outlet for the discharge of crude sewage was a little west from the Beacon, which is one-third of a mile south of Deer Island. The outlet at Deer Island Beacon is directly into a tidal current more than fifty feet deep, in which the velocity of more than two and a half miles an hour is much greater than that in the sewer, and the scouring effects of the currents, reversed twice daily, will readily remove everything which the sewer can bring there.

The most distant point is 17½ miles from the outlet, near the line between Stoneham and Woburn. Here the sewer is about 48 feet above low tide and the diameter is 15 inches. The sewer will extend down the valley through East Woburn and Winchester Highlands to the Mystic Valley. Here it will receive two 15 inch branches from Woburn and will continue along the Abbajona River in Winchester to West Medford. The West Medford invert is about 8 feet above low tide and diameter 4 feet 6 inches. Here it will receive sewage from the Alewife Brook branch, and then continue through Medford Center and Wellington to Malden River, with diameters increasing from 4 feet 6 inches to 5 feet. The bottom of the sewer here reaches the level of low tide. Passing under Malden River



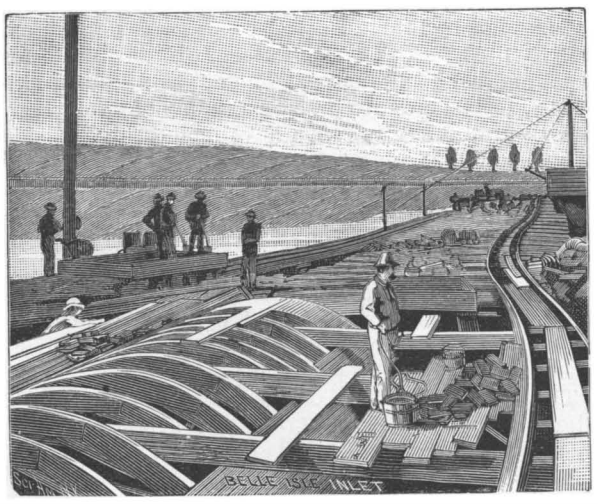
MANNER OF SEWER CONSTRUCTION—CARSON TRENCH MACHINE AT WORK.



SECTIONAL VIEW—CHELSEA AND EAST BOSTON TUNNEL.

by two conduits, the route of the sewer can be traced on the map on front page. The Chelsea River is crossed by two conduits. The siphon under Chelsea River is located between the highway and railroad bridges—see diagram drawing. The ground for the pumping station is of a stable character, there is ample frontage on a navigable river, and the surroundings are such that a pumping station would be unobjectionable. The pumping plant may consist at first of three centrifugal pumps and three compound condensing engines, capable of lifting 160 cubic feet per second 20 feet, this plant to be increased at a later date.

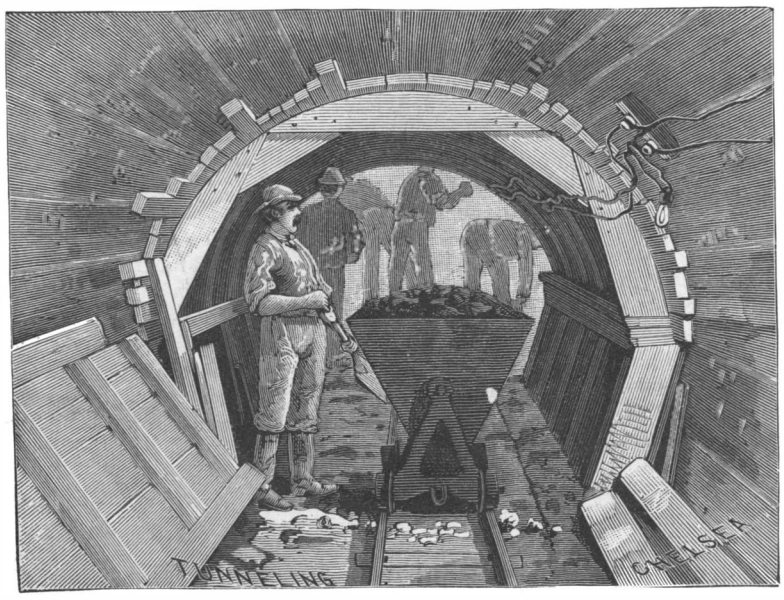
The type of pumping engines will not be decided until next spring, when tenders will probably be invited for different kinds, for this and three other pumping stations. The brick sewer will continue to Addison Street, where it will receive the main intercepting sewer of East Boston. The East Boston pumping station is to be situated here.



The sewage of all the towns through which the main sewer has passed, in fact of all the towns north of Mystic River, is brought to East Boston without pumping.

Of the cities and towns south of Mystic River, the sewage of Arlington and Belmont, of the west ends of Cambridge and Somerville, part of Medford is brought by the Alewife Brook branch and will be pumped a height of about 14·6 feet into the main sewer near West Medford. The sewage from Charlestown, most of Cambridge and Somerville and part of Medford will be brought by the Cambridge branch sewer to a pumping station near the middle of the Mystic River, at Malden Bridge. The sewage is here raised by pumping about 12 feet. The sewage will be conveyed under Mystic River by two conduits; after it has passed the pumping station, the sewage will be conveyed in a brick sewer 6 feet 6 inches in diameter to the main sewer in Everett.

At East Boston the sewage of all the towns except Winthrop is pumped to the height of about 15·9 feet and conveyed in a brick sewer 9 feet in diameter, having its invert about 3·1 feet above low water at the upper end, passing through Breeds Island and Winthrop to another pumping station in Deer Island, a distance of about 5 miles, where the invert is about 8 feet below low tide. Belle Isle Inlet and Shirley Gut are each crossed by inverted siphons.



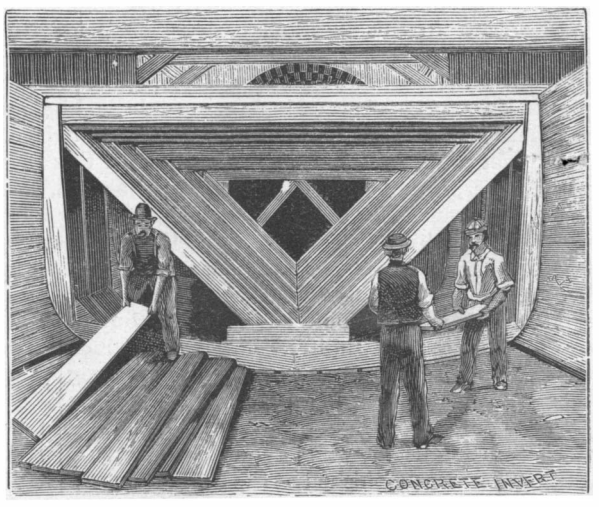
At Deer Island pumping station all of the sewage is to be pumped a height varying with the height of the tide from 10 to 20 feet. It is conveyed along the island 1,000 feet through a sewer 6 feet wide and of varying height, then through two conduits buried on the harbor side of the bar below low water, for 2,000 feet, and rising near the end to about low tide at the outlet. Here, on the north border of the main ship channel, the ends of the conduits will be securely protected from the action of the sea. The bottom rapidly slopes from the ends of the conduits to a depth of more than 50 feet below low tide.

The outlet sewer for the lower valley of Charles River embraces the following places: Waltham Newton, Watertown, Brighton, Brookline, and a part of Boston. The sewage carried in a similar manner as that of the North Metropolitan District to Moon Island, and there discharged into the sea. The following table gives the estimate of population in 1890 and 1930, the cubic feet of sewage per head per day and the cubic feet per second in 1930. The estimate which was published in 1889 was based upon the census of 1885 and earlier years, and was about 10 per cent less than the one finally adopted for construction. The sizes of the sewers have been increased accordingly.

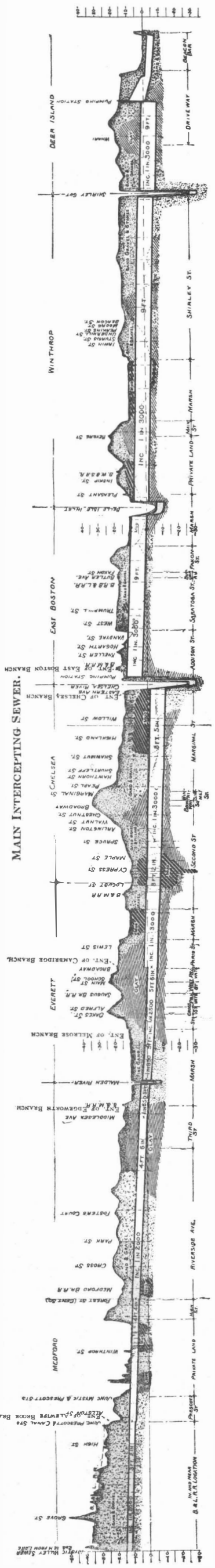
	Population according to U.S. Census.		Estimated Population by Sewage Commission.		Cubic Feet Sewage	
	1880.	1890.	1890.	1930.	Per head per day.	Per second.
Arlington	4,100	5,629	5,000	10,000	30	3·47
Belmont.....	1,615	2,098	1,900	4,000	30	1·39
Cambridge....	52,669	70,028	67,000	130,000	35	52·65
Charlestown..	36,760	45,950	40,900	64 100	30	22·24
Chelsea.....	21,782	27,909	27,800	49,100	30	17·01
East Boston..	28,120	35,150	32,100	56,000	30	19·42
Everett.....	4,159	11,068	7,200	29,000	30	10·01
Malden	12,017	23,031	17,900	52.000	30	18·05
Medford..	7,573	11,079	10,100	22.000	30	7·63
Melrose.....	4.560	8,519	7,000	20,000	30	6·94
Somerville....	24,933	40,152	34,800	82,000	35	33·18
Stoneham	4,890	6,155	6.700	11,300	30	3 92
Winchester...	3.802	4,861	5,000	10,300	30	3·58
Winthrop.....	1,043	2,726	1,900	8,000	30	2 78
Woburn.....	10,931	13,499	13,300	23,500	30	8·16
Totals	218,954	306,854	278,600	571,300	—	210·43

The following is the estimated cost of the North Metropolitan Sewerage System, providing inlets for all towns in previous table and with outlet at Deer Island.....	$4.159.453
Cost of additions to the work up to 1930.....	224,400
Total cost of work up to 1930.....	$4,383,853
The estimated cost of the Charles River Valley System is.....	804.243
Making a grand total for both systems of.....	$5,188,096
The amount expended and liabilities incurred by the sewerage commissioners up to September 30, 1892, for both systems, was, in even figures, about..	$2,600,000

Ground was first broken for the metropolitan sewerage construction in May, 1890. There are now twenty-five gangs at work. Measured by its proportional value, between half and three quarters of the total work has been completed, and about nine per cent more now is under contract. Surveys, studies, and plans have been made for a considerable portion of the remainder, and, unless some unforeseen delay occurs, the whole work may be completed in 1894.



The views which we give on our front page, of the actual construction of the sewers, were taken from photographs, and show what thousands of our readers



have seen in Chelsea, Medford, and Malden, as well as in many other sections of the district. The masonry work, shown at bottom of our front page, will give an idea of the magnitude of the work as well as the concrete invert and the tunneling view on the second page. The view of upper part of centering for sand catcher shows the top of the centers, laggings, etc., and will, perhaps, serve to convey an idea of the immense amount of detail work necessary in a work of this kind. We also give a sketch of the proposed pumping station at East Boston, where the sewer crosses under Chelsea Creek with the sand catcher in position. The diagram as given shows mean high and mean low water levels.

We also show a profile diagram of the main intercepting sewer, showing approximate mean low water of the sea, character of the ground in profile section as judged by soundings and surface indications, and indications of the size and grade of sewer. This diagram is taken from a preliminary report made to the Legislature in 1889. Most of the sewers have been built larger than originally designed, to correspond with the increased population as determined by the census of 1890.

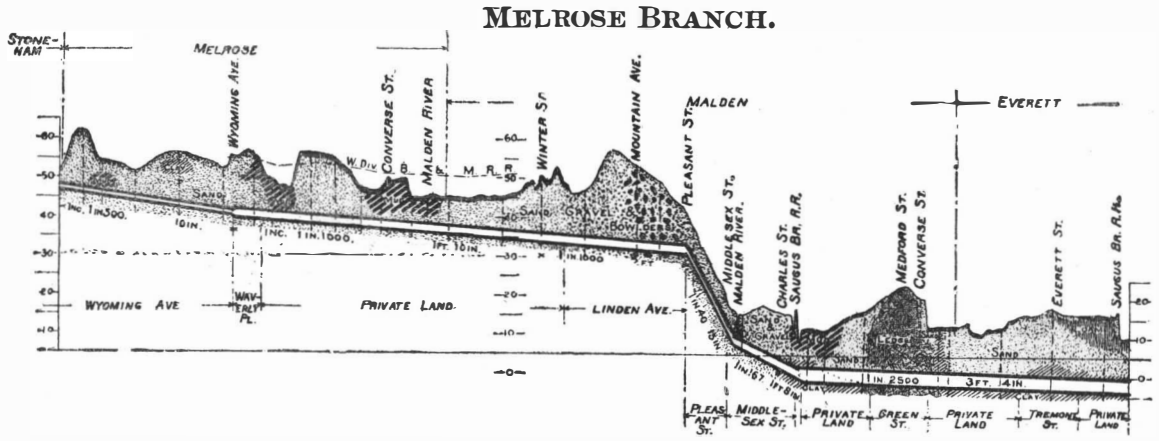
It will be noticed that the Carson trench machine is largely used in the construction of these sewers. A detailed view of the operations of this machine is given on page 390, from which will be seen the comparatively small area of street disturbed during progress of sewer construction when it is used. This machine or one like it is a necessity for many portions of the work, such as crossing the marsh, as shown in view in Malden on front page, where teams could not be used. The detail drawing, supplemented by the other views, explains the system so clearly that we do not think a detailed description necessary.

During the past year about 13,000 tests have been made to aid in selecting such kinds of cement as are best adapted to this work, and pains have been taken to make these tests of a practical character. Greater reliance was placed on those in which sand and cement were mixed in the same proportions as used on the work than on those made with neat cement. All of the briquettes for testing are now placed in tanks where the water is continuously renewed. In addition to tests for indicating the strength of the different kinds of cement, other tests of various kinds have been made, including some to indicate changes in volume which take place under different conditions while crystallization is going on.

The interior cross sections of the metropolitan sewers have not usually differed very much from a circular shape. In the deviation most extensively used the horizontal diameter is about 6 per cent less than the vertical and the invert is flatter than a semicircle. In this shape the area, perimeter and the theoretical velocity, when flowing more than one-sixth full, differ but little from the corresponding elements in a circle having the same height. In actual construction under the conditions that usually obtain on our work this shape is more stable when entirely completed than a circular shape, but more care is required during construction to prevent injury to the invert.

In a number of places the normal shape of the sewer has been considerably and abruptly widened and flattened to pass under culverts, sewers, and other objects whose positions could not be very much changed. These widened and flattened sections may act to some extent as sand catchers. Those that occur on the North Metropolitan system will aid the sand catchers which are required at the siphons. The work is making good progress, and when the extent of ground covered is considered, and the many difficulties encountered, such as crossing railroads, creeks, marshes, etc., etc., we think the residents of the district have good reason to congratulate themselves on the near completion of this system, which will add so much to the comfort and healthfulness of this section.

There are five pumping stations required to lift the sewage so it will flow to the outlets. They are located near West Medford, Somerville, Chelsea, and on Deer Island in the North Metropolitan District, and near Savin Hill in the Charles River Valley District. These stations are all plainly marked on map on front page.



Our thanks are due to the commissioners and chief engineer of the Metropolitan Sewerage Commission for the many facilities granted us in the preparation of this article.

The Astounding Military Force of Europe.

The official data relating to the growth of European armies are set forth in a pamphlet which has just been published in Paris by Captain Molard, of the Military School of St. Cyr.

It appears that in 1870 the soldiers and militia of France nominally amounted to 1,330,000 men, but as is well known, only a fraction of these could be promptly mobilized and turned to account against the Germans. On paper Germany had a slightly smaller force, namely, 1,300,000, but proportionally a much larger could be at once placed in the field. At the same epoch the military establishment of Russia comprised 1,000,000 soldiers, that of Austria 750,000, that of Italy 570,000. Switzerland had 150,000, and Belgium 95,000. Including England, Spain, Portugal, Denmark, Sweden, Norway, and the Balkan States, for which details are not given, the whole of Europe in 1870 could, at the utmost, put 7,000,000 men in active service.

What is the situation to-day? This year the French army has risen to 2,500,000, the Russian to 2,451,000, the German to 2,417,000; the Italian, which now occupies the fourth place, to 1,514,000; the Austrian to 1,050,000; the Swiss to 212,000 and the Belgian to 128,000. In most of these countries the expenditure for military purposes has more than doubled since 1869, and in Switzerland the increase has been much greater. Viewed collectively, Europe now spends more than a thousand millions of dollars annually on her fighting force, which already amounts to 12,500,000.

Such figures, however, give but an imperfect idea of the state of things which will presently exist as soon as the new military laws shall have come into full effect. Then the German army will comprise 5,000,000 men; the French, 4,350,000; the Russian, 4,000,000; the Italian, 2,236,000; the Austrian, 1,900,000; the Swiss, 489,000; and the Belgian 258,000. Altogether, Europe will be able to dispose of not less than 22,000,000 soldiers, or 15,000,000 more than she had in 1869. Such is the price which she has to pay for Germany's seizure of Alsace-Lorraine. It is at least possible that her fighting force might be cut down by two-thirds tomorrow were those provinces restored to France.—*N. Y. Sun.*

An Eye-Opener on Coinage.

Superintendent Allen, of the Butte and Boston Mining Company, of Montana, has sent a letter to the Secretary of the Treasury offering to make any amount of much better silver dollars for ninety cents apiece than are at present in use. Mr. Allen takes the position that counting silver at 85 cents per ounce, the intrinsic value of a silver dollar is only 65·71 cents. He would put in each dollar 400 grains of pure silver, whereas the present dollar only contains 371¼ grains, and he would number and letter each coin, so that the government would not be compelled to redeem duplicates, a safeguard now neglected. Mr. Allen says he would reap a profit in coining while the price of silver was anywhere under 129·29. The letter adds:

"While it has always been possible to recognize counterfeit paper money, the present silver coin can be produced at a profit of 53 per cent, and a coin that cannot be detected. This is true of silver money, whether foreign or American. Now, my proposition is either to withdraw the present silver money before the excess becomes so large that it will bankrupt the government to redeem it, or combine with foreign powers who are equally in danger and make the old standard of value, $1.2929, which will make a coin which cannot be counterfeited without the use of base metal alloy, which is easily detected, and for which the government will never have to pay a face value."

THE conditions required for the profitable feeding of swine are (1) clean, dry, warm quarters, protected from wind and draughts, (2) as much wholesome feed—if grain, preferably *ground* fine—as they will eat clean, three times a day, and (3) free access to a mixture of salt and ashes, to sods or to soil.—*Can. Farm Bull.*

Correspondence.

The Lever in the Bicycle.

To the Editor of the Scientific American:

In your paper of November 19 Mr. Hatcher gives a very nice explanation of how the lever is used in a bicycle.

I would like to add, that with one season's experience I find that a well constructed bicycle will automatically move this lever itself, and that after a limited amount of practice one can, at a moderate rate of speed, ride almost any pace desired without the use of the handle bar.

This I explain as follows, and if any one has a different explanation I would be glad to hear it: Nearly all bicycles are constructed so that the point of the front wheel that touches the ground is in direct line with the pivot on which the front fork and wheel are hung. This brings the greater part of the wheel above and in front of the line above mentioned. When the machine begins to tip, this excess of weight will turn the wheel, and thus right the machine. When the rider wishes to turn he has but to throw himself out of balance in the direction he wishes to go. A. W. HARROUN.

Mason City, Iowa, November 28, 1892.

Engineers in the Navy.

The annual report of the engineer in chief, G. W. Melville, just submitted to Congress, contains some important suggestions as to the need of an enlarged force of engineers to man our new war ships, and the necessity of their being more efficiently aided by engine room petty officers composed of machinists, blacksmiths, boilermakers, coppersmiths, etc. Without entering directly into the long-standing differences between the "line" and "staff" officers, the report throws a strong side light upon such disagreements between the two classes of officers as resulted in the Danforth case, noticed in our issue of December 10, saying on this subject: "Whether or not it is good policy to intrust the full control of sailless ships, every function of which is performed by a machine, to officers who, by education and training, are ignorant of the operation, care, and management of machinery, is a question that is worthy of very serious consideration.

"It has been claimed that the possession of rank and the right to exercise command in their own department is merely a matter of sentiment on the part of the engineer officers. When officers find themselves charged with the maintenance of all the vital parts of a huge and costly war ship, and when the exercise of their prescribed duties involves the direction and superintendence of the labors of one-third or one-half of the ship's crew, they very naturally expect to be clothed with the legal right to perform their duties—a right that is now denied by Section 1,488 of the Revised Statutes of the United States. There is not much sentiment in this, but merely an effort on the part of a class of officials who have to perform military duties involving command and obedience to have their exercise of authority made lawful."

Engineer Melville furnishes a vivid description of the arduous task of an engineer officer who is unfortunate enough to be detailed for duty on the large ships, those of from 5,000 to 10,000 horse power, on which usually there are only one chief engineer and three assistants: "The latter are obliged to stand watch in three watches at sea and often in port—a duty so exhausting that no officer can long perform it efficiently; for he never has a whole night's rest, and when on duty has to withstand a constant, merciless assault upon his physical and mental powers. His post of duty is one of intense heat and villainous atmosphere; to get from one part of his station to another, which he must do very frequently, he must climb up and down narrow ladders, crawl through air locks, explore coal bunkers, etc., all the time in a state of mental anxiety on account of the innumerable casualties, great and small, that are constantly occurring, and for the prompt remedying of which he is strictly accountable; in one watertight compartment some boiler tubes are leaking and the men are in a panic; in another, 100 feet or more away, a feed pump is refusing to work or a thrust bearing is hot; and while hurrying from one scene of danger to another the engineer is liable to receive tidings of trouble in some remote coal pocket, or even be summoned to appear on deck, where he must calmly answer questions regarding the amount of smoke escaping from the smoke pipes, or the necessity for hoisting ashes, wholly unmindful of the disasters which he knows are impending below. So it goes, watch after watch and day after day, until in the course of a week or two the engineer is a nervous wreck, fit for nothing but the hospital; and all because the lack of numbers imposes upon him the work of at least two men."

Mr. Melville thinks the membership of the corps should be increased to not less than 300, and says the only opposition thus far to a bill before Congress providing for such increase has come from some of the officers of the navy, who seem to view with jealous distrust the growing importance of the engineering branch of the service, and see in it an imaginary menace to the supremacy of the positions which they have inherited from naval conditions now obsolete.

Speaking of the difficulty now experienced in obtaining a desirable class of enlisted men for the engineer's force, Chief Melville complains that the machinists have a pretty hard time on shipboard, there being nothing to induce respectable and ambitious men to take such positions. "If a machinist or fireman crawls out of the hellhole where he is on duty to get a breath of fresh air, he may be promptly driven below again or even punished for appearing on deck 'out of uniform,' while the discovery of a speck of dirt anywhere on deck subjects any member of the engineer's force who may have the rashness to be above the fire room gratings to abuse from the boatswain's mates and probable punishment at the mast. That the decks of a man-of-war should be of spotless purity is a tradition handed down from the days of wooden ships and barefooted crews, and is so impossible a condition in these days of coal and iron and steel that it seems a little intelligent consideration would lead to its abandonment. All these unhappy details are different on different ships, but the general results are the same. The useful and self-respecting man, when he finds himself so unfortunately circumstanced, will, in sheer self-defense, leave the service forever."

Sugar in Boilers.

Some two or three years ago a mining engineer in the Yorkshire district, anxious to prevent the incrustation in the boilers at the collieries in which he was interested, tried a mixture of sugar and soda. The proportions were as follows:

	Sugar, lb.	Soda, lb.
Egg-end boilers, 30 ft. x 4 ft. 6 in. diam.	5	2
Lancashire " 30 ft. x 7 ft. 6 in. diam.	7½	3
" " 30 ft. x 8 ft. 0 in. diam.	9	4

He writes recently that he is still using it, and finds it is giving good results. His method is as follows: When the boiler has been cleaned and is ready for filling with water, dissolve the sugar and soda in a bucket and pour it through the manhole. Clean every three weeks. Cane sugar only must be used. Many collieries in Durham have tried it with equal success.—*Markets Review.*

PLATINUM can now be drawn into wire strands so fine that twenty-seven twisted together can be inserted into the hollow of a hair.

RECENTLY PATENTED INVENTIONS.

Engineering.

ENGINE.—James Smith, Dresden, N. Y. This invention is for a device to be applied to the cylinder of a steam engine, consisting preferably of a valve to connect the two ends of a cylinder at a time when the pressure of the live steam on the driving side of the piston is about equal to the pressure on the exhaust side, the exhaust pressure then opening the valve to establish communication between the two ends of the cylinder, whereby the pressure of the live steam after expansion has taken place will never fall below the pressure in the exhaust end of the cylinder. The device is actuated only when the live steam and the exhaust are thus of relatively unequal pressure.

ENGINE REVERSING GEAR.—Joseph O. Des Chapelles, Havana, Cuba. An eccentric disk with a diametrical groove fits in a block on the main driving shaft, there being inclined apertures on opposite sides of the groove, while a sleeve sliding on and turning with the shaft has inclined rods projecting through the inclined apertures of the eccentric disk. By shifting the sleeve, more or less throw can be given to the disk, and thus to the slide valve. The device is simple and not liable to get out of order, and but little power is required to accomplish the shifting of the valve.

UPRIGHT TUBULAR BOILER.—Truckson S. La France, Elmira, N, Y. This boiler has an overflow feed-water jacket to and inclosing the group of upright smoke flues open above, a boiler feed connection supplying the jacket with water, while an outer jacket within the steam space of the boiler incloses the overflow jacket for a portion of its depth, and is open below to supply the water overflowing from the first jacket down to the lower portion of the outer steam chamber of the boiler. The upright fire or smoke flues are thus kept mainly or wholly submerged in the feed water, to protect them without choking the steam space with water, while the circulating and heating capacities of the boiler are improved, and the crown sheet is prevented from injurious exposure should the feed water supply be interfered with.

Mechanical Appliances.

COG WHEEL.—Frank Saxon, Worthington, Minn. This is a compensating cog wheel made in two sections, having spring cushions intervening between them, so that when the wheel is employed to communicate motion suddenly to any portion of the machinery, it will not give to the parts any sudden or injurious shock. When the outer section of the wheel is turned the inner section is not moved until the springs are compressed, after which the force is exerted through the spring cushions. The improvement is especially adapted for use in connection with agricultural or road engines.

BIT BRACE.—Andrew Knudsen, Tucson, Arizona Ter. In this brace the knob is so attached as to exclude dust or dirt, the bearing being made very easy, and means provided for easily attaching and detaching the knob. It has an extensible and adjustable crank, so that a single brace may take the place of several braces of different sizes, and a convenient, nicely finished, and easy handle. The ratchet connection between the brace crank and the bit shank is improved, efficient means being provided for fastening bits of various sizes to the brace, together with an improved construction of the bit-holding jaws. It has been the design of the inventor to improve the entire construction of the brace, that it may be easily adjusted, readily operated, and nicely and strongly finished.

Railway Appliances.

CAR BRAKE.—John W. Neumann and John R. Pflanz, Louisville, Ky. This improvement embraces a drawbar designed to operate the brakes automatically under certain conditions, and one which can also be locked to form a perfectly rigid drawbar, while a combined drawbar and brake-operating rod can be operated while the cars are rounding curves. The brake-operating mechanism can be actuated by hand or automatically, or by both at the same time, compensation being provided for the wear of the brakeshoes and wheels, and means of avoiding jerks when the cars are started.

Agricultural.

PLOW SHARE ATTACHMENT.—James Gilbert, Crystal Brook, South Australia. This invention relates to plows in which movable shares are attached by slipping them onto a foot, the shares being removable as desired, and being made with a shoe or socket, into which the foot is inserted. The shares used with this invention do not contain any such shoe or socket, but are formed of a combination of a flat share or plate and a separate preferably detachable loop, which together form the required shoe or socket. The improvement is to be used with plows in which the foot is projected in the line of progression.

INSECT POWDER DISTRIBUTER.—Christian H. Joosten, New York City. This is a light and simple hand device for blowing the powder upon plants, one portion of the device consisting of a bellows, against a stationary side of which is held the powder receptacle. The amount of powder delivered is regulated by a damper or slide, the knob operating which carries a pointer on a scale indicating the quantity of powder the implement is set to deliver. An agitator is provided to keep the powder in circulation and prevent the formation of lumps in the receptacle.

Miscellaneous.

COMBINATION LOCK.—Edwin Vanwart, Port Madison, Washington. This is a simple lock, designed to be cheaply made, its parts being readily stamped out, and is especially adapted for use on a house door, although it may be used with other articles. Within the case is a sliding locking plate, having transverse recesses with connecting slots and the usual spring and knob operating mechanism, while recessed stationary plates are arranged opposite the locking plate, tumblers having flanges at right angles to their bodies being held in the recesses of the several plates, and a plurality of latches being pivoted on one side of the lock to engage the tumblers. It is not necessary to work the combination to open the door from the inside.

FIRE ESCAPE.—Jonathan B. Stott, Aurora, South Dakota. A rope is suspended on the outside of a building, within convenient reach of those at the windows, the rope passing through a casing in which is pivoted a clamping plate, and attached to the casing is a supporting device consisting of a belt and straps, to be secured aroond a person desiring to descend. A handle extends outward from the casing, by taking hold of which a person who has attached the supporting device to his body may easily clamp the rope in the casing with sufficient force to absolutely control the speed of descent, increasing or diminishing it as desired.

BURGLAR ALARM.—Harry W. Reynolds, Long Branch, N. J. This is a simple device to be arranged adjacent to a door or window, the opening of which automatically closes an electric circuit and causes a bell to ring, the circuit being closed only momentarily, and not being closed at all when the open door or window may be closed.

REVERSIBLE WINDOW.—James Farquharson, Tacoma, Washington. The window frame has on the side of its stiles beads, oppositely located hinges being connected by one member to the beads at the middle of the stiles, and sliding stiles being connected with the other members of the hinges, while a bead fixed to the sliding style at the front extends downward from the hinges. Shoulders are formed on the stiles to form abutments for the rear edges of the beads, and semicircular recesses are formed on the sides of the stiles to form air passages when the windows are closed. By means of this improvement the window may be conveniently raised or lowered, or reversed for cleaning the outside, glazing or painting from the inside.

SASH HOLDER.—Irvin A. Shaw, Kinsley, Kansas. This improvement consists of a stop bead mounted to slide transversely in specially constructed bearings secured on the window frame, springs being concealed in the bearings and pressing the bead to hold the latter in contact with the side rail of the window sash or door. The bead not only forms a guide for the side rail, but also forms a guard for it, as the springs hold the bead firmly in contact with the side rail, preventing the ingress of cold air, or holding the sash in any desired position.

REPEATING AIR GUN.—Elmer E. Bailey, Sinnamahoning, Pa. This is an improvement in guns whose magazine tube is traversed by a small firing tube through which large shot or small bullets are projected by an air blast from a chamber in which air is compressed by a spring-actuated sliding piston. The magazine has a capacity to contain at least one thousand B B shot, and the breech of the small firing tube within the magazine is secured by novel means to a lock frame made in longitudinal recessed halves to hold the loading and air charging and discharging mechanism.

CARTRIDGE.—Jacques A. C. de Latouche, Paris, France. This cartridge has an explosive body to be filled with loose powder, and gas check for the cartridge, comprising a series of washers separated by layers of wax, which when the projectile is fired will lubricate the gun and then fall apart and be thrown out of the gun's trajectory. The bore of the gas check is coated with collodion before the projectile is seated, and when the cartridge is fired the projectile slips readily from its seat and the wax which issues from between the washers serves to lubricate the gun.

HORSE DETACHER.—Henry Leeman, Louisiana, Mo. This is an attachment applicable to any vehicle, whereby a fractious or runaway animal may be readily freed from the vehicle. According to this invention the thills are so connected with the forward axle that they may be readily released therefrom, a vertical shaft actuating racks for the release of the thills, and there being at the top of the shaft a handwheel within easy reach from the driver's seat.

WHIFFLETREE.—Henry McF. Wright, Aspen, Col. This invention provides a singletree and support of simple and durable construction, readily applied, and arranged to prevent detachment of the tree in case the bolt breaks. The improvement embraces various novel parts and details and combinations thereof.

NECK YOKE.—James S. Brown, Eureka, Cal. On the forward end of the tongue is a clevis-like projection, with an upper and lower member and an aligning bolt hole through each, while a central rigidly attached sleeve on the neck yoke has a lug to is acar, with a flat projection fitting in between the members of the clevis-like projection on the end of the pole ferrule, thus forming a special construction and combination of parts covering the pivotal connections uniting the neck yoke with the pole.

HORSESHOEING RACK.—Samuel M. Martin, Sidney, Ohio. This invention covers an improvement on former patented inventions of the same inventor, simplifying the construction and providing a rack that can be quickly and conveniently folded up when not in use. It has forward and rear sections detachably united by pivotal bolts and locking pins, a cross bar connected to the sections where they join, while a locking bar holds the suspending bars in place. The rails can be adjusted to suit various sized animals, and a harness and means of using it are provided for.

VEHICLE POLE.—Thomas B. Cultra, Omaha, Neb. This invention provides a simple and economical construction conveniently adjustable for two or three horses abreast, the center draught being preserved in either case. The device consists of a circle or plate, preferably of steel and with side arms piv-

oted at their rear ends to the axle, and provided centrally and to one side of its center with points for the attachment of the pole, which is detachably connected with the circle or plate, being connected centrally for a two horse team and at one side of the center for a three horse team.

GATE LATCH.—Philip T. Rapson, Bad Axe, Mich. This is a self-locking latch which permits the gate to be swung toward either side of the fence, and when in closed adjustment relieves the hinges from strain. On a back plate secured to the end rail of the gate is pivoted a lock plate with projecting detent pins, the locking plate having an arched top edge with a center notch, and two oppositely curved limbs at its lower edge formed with a center notch, while a check stud at its rear engages the pins on the back plate and an ear on its front face, a bolt tripped by a spring-pressed lever being mounted to slide above the locking plate. The device is of a simple, novel, and efficient character.

LITHOGRAPHIC PLATE.—Franklin F. Haggenmuller, New York City. This is a plate made of zinc, type metal, aluminum, or other metal, or of celluloid, gelatine, etc., and subjected to an embossing process to form on one side a printing stipple ready for the artist to work on, the stipple being uniform, to be readily worked on with the lithographic crayon to produce the desired picture. The improved plate may be very cheaply manufactured, and is intended to take the place of the lithographic stone now generally used.

GLOVE PACKAGE HOLDER.—Richard H. Moore, Great Barrington, Mass. This holder consists of two independent or detached strips or splints to receive the gloves, a spring jaw clamp or clip being placed on across the splints to hold the gloves between them. The improvement is designed to do away with the present inconvenient bindings for glove packages, affording spring binders or cases to hold the gloves in good condition and prevent their becoming shop-worn.

WICK RAISER FOR LAMP BURNERS.—Charles Pabst, Philadelphia, Pa. This is an improvement on a former patented invention of the same inventor, providing a simple and cheap attachment for elevating and depressing a lampwick in a reliable manner. It consists of two parallel limbs, on the ends of which are picker points passing through slots in the wick tube, a pivoted dog on one of the limbs having a hook shoulder interlocking with the edge of an aperture in the burner body through which the limbs and dog are inserted.

METALLIC RIPRAP.—Duncan T. McIntyre, Mattoon, Ill. A practical sheet piling, to protect the banks, shores, and beaches of rivers and other bodies of water from washing or being cut out, is provided by this invention. It consists of inclined metallic sheets resting against the face of the bank, the sheets having rearwardly extending lips punched through from the outer side of the plates, their vertical meeting edges interlocking and being formed into posts at the rear of the structure, the posts being embedded in the bank and thereby avoiding the use of separate posts.

URINAL ATTACHMENT. — George Schoen, New York City. This device comprises a frame to be received in the bowl and a strainer movably held to the frame, facilitating cleaning and providing for properly holding soap or other disinfectant or detergent.

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

NEW BOOKS AND PUBLICATIONS.

THE ROYAL ROAD TO BEAUTY, HEALTH, AND HIGHER DEVELOPMENT. By Carrica Le Favre. New York: Fowler, Wells & Co. 1892. Pp. 85. Price 25 cents.

This is a little tract devoted to vegetarianism, a subject of interest. Many of us, on ethical principles, would desire to be vegetarians, and this plea for it is perhaps something which should be welcomed by us on general principles.

MANNERS AND MONUMENTS OF PREHISTORIC PEOPLES. By the Marquis de Nadaillac. Translated by Nancy Bell (N. D'Anvers). New York and London: G. P. Putnam's Sons. 1892. Pp. xi, 412. Price $3.

This very elegant work brings the subject of anthropology well up to date, as regards its applications to extinct nations. The many finds recently made in different countries of the world are described, with numerous illustrations, some very curious, such as the illustration of the trepanned historic skull in which the appearance of the bone reveals the fact that one trepanning had been done during life and others, presumably for the obtaining of amulets, had been done after death. Fishes and fishing and efforts in navigation find adequate treatment, as well as the other subjects more generally written of.

REPORT OF THE COMMISSIONERS OF FISH AND FISHERIES FOR 1888. Washington, D. C. 1892. 8vo. Pp. 128.

This report contains some very interesting details of the work of the department for the year. The total distribution of eggs, fry and yearlings for the year ending June 30, 1889, amounted to 322,795,830, which is a very creditable showing considering that the appropriations only aggregated $257,000, and this money supports all the stations and the vessels of the department, the Albatross, Fish Hawk and Grampus. The department is a very useful one and has a world-wide reputation.

SHORT TALKS ON CHARACTER BUILDING. By G. T. Howerton, M.S. Illustrated. New York: Fowler & Wells Company. 1892. Pp. iv, 227. Price $1. No index.

This contribution to practical life, with numerous illustrations and short pithy chapters certainly abounds in good advice—advice which, whatever our individual opinions may be, would, if followed, in many cases be productive of much good. The style of illustration, in many cases, presents, on the same page, contrasting pictures of life, with considerable effect in some instances.

LEAVES AND FLOWERS; OR, PLANT STUDIES FOR YOUNG READERS. By Mary A. Spear. Boston, U. S. A.: D. C. Heath & Co. 1892. Pp. ix, 103 Price 30 cents. No index.

This charming work is designed to make the study of botany pleasant to the young. The work, with numerous illustrations and exact botanical information, is written throughout, as nearly as possible, in the form of a story, and, although it is termed plant studies, it really takes the aspect of being rather play than work. It shows how pleasant the path of learning is for the rising generation.

THE FLOOD, THE FACT OF HISTORY. A chronological vindication, and a guarantee of the second advent. By Charles A. L. Totten. New Haven, Conn.: The Our Race Publishing Company. 1892. Pp. xxii, 315. Price 75 cents.

Professor Totten, or Yale College, in this work at last has his say at full length as to bibliological chronology. To say the least, the work is a curious expression of the author's beliefs, and puts into the form of a book the ideas which won for him such notoriety during the last year.

SIMPLE LESSONS IN DRAWING FOR THE SHOP. By Orville H. Reynolds. Published by Debs Publishing Company, Terre Haute, Indiana. Pp. 83. Price $1.

This little work is for the practical draughtsman and gives very good elementary hints as to simple drawing. The practical aspect of the subject is well preserved, and the book will, no doubt, be welcomed by many who are beginning their way to acquire the draughtsman's art.

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

SCIENTIFIC AMERICAN BUILDING EDITION.

DECEMBER NUMBER.—(No. 86.)

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1. Elegant plate in colors, showing a very attractive dwelling at Warberth Park, Pa., erected at a cost of $4,150 complete. Floor plans and two perspective elevations. John Robinson, architect, Germantown, Pa.
2. Plate in colors showing a residence at Springfield, Mass. Perspective views and floor plans. Cost $12,000 complete. Mr. Guy Kirkham, architect, Springfield, Mass. An excellent design.
3. A colonial residence at Newton Highlands, Mass. Perspective view and floor plans. J. W. Beak, architect, Boston. A picturesque design.
4. A pretty cottage erected at Bridgeport, Conn., at a cost of $1,600. Floor plans, perspective, etc. A. M. Jenks, architect, Bridgeport, Conn.
5. A dwelling house erected at Warberth Park, Pa., at a cost of $4,478 complete. Mr. C. W. Macfarlane, architect, same place. A model design. Floor plans and perspective.
6. A "Queen Anne" cottage erected at St. David's, Pa., at a cost of $5,500 complete. A unique design. Perspective elevation and floor plans. F. L. & W. L. Price, architects, Philadelphia.
7. A residence in the "Colonial" style of architecture, erected at St. David's, Pa. Perspective view and floor plans. Cost complete $5,800. F. L. & W. L. Price, Philadelphia, architects.
8. A residence on Golden Hill, at Bridgeport, Conn. Perspective elevation and floor plans. D. R. Brown, architect, New Haven, Conn. An excellent design.
9. A residence recently erected at Springfield, Mass. Floor plans and perspective elevation. Cost $2,490 complete. Mr. A. B. Root, architect, same place. A pleasing design.
10. Picture of Aldworth, Sussex, the home of Lord Tennyson. Portrait of Lord Tennyson.
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Wanted—Engineers and pilots. Twenty licensed engineers and pilots to run small passenger steamers for the summer months of 1893, in connection with the World's Fair. Sober, steady men are invited to write us for further information. Chas. P. Willard & Co., Clybourn and Southport Aves., Chicago, Ill.

The *Engineering Record*, the recognized authority on municipal and building engineering, has recently been enlarged by the addition of a department in which notable industrial plants are regularly described and illustrated, the steam and power plants being a conspicuous feature. Recent publications include the great Ivorydale plant of Messrs. Proctor & Gamble, described in 23 columns and illustrated by 57 drawings. The steam plant at Ivorydale is separately treated in 13 columns and 31 drawings. The new foundry of Henry R. Worthington, at Elizabethport, N. J., 16 columns, 26 illustrations. National Meter Company's foundry and brass finishing shop, Brooklyn, 13 columns, 29 illustrations. Niagara Power Plant (now in process of publication), 6 columns, 6 illustrations. Steam power plant of the Dwight Manufacturing Co., Chicopee, Mass., 9 columns, 7 illustrations. Machinery Hall steam power plant, 8 columns, 6 illustrations. Published Saturdays. 12 cents a copy. The *Engineering Record*, 277 Pearl St., New York.

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.

(4609) I. H. F. asks: What glue, cement or paste is used in covering iron pulleys with paper to prevent the belt from slipping? A. Pulleys that have been in use that are to be papered should be made clean and free from grease by scratching with a file over their entire surface, cleaning with a caustic soda wash and then pickle the surface with hydrochloric acid and water equal parts. Wash with hot water and dry. When its surface will be in the best condition to receive the glue. Use the best light brown glue, which may be tested by its great strength and elasticity when breaking a piece in the hands. Make up the glue in the usual way and when ready mix a tablespoonful of strong decoction of oak bark or tannic acid, hot, to the glue and thoroughly mix. The strongest hardware paper should be used, cut and prepared by previously moistening, so as to allow of it drawing to fit the crown of the pulley. The pulley being slightly warmed, so as not to chill the glue, and temporarily hung, proceed to brush the glue on its surface, putting the paper on at once, drawing it tightly to expel any air and overlapping with glue and paper, until the proper thickness is obtained. To make the best job requires three persons. Upon stretching the paper on firmly depends its best service.

(4610) J. B. asks: What kind and how large a battery is necessary to heat a No. 36 platinum wire? I want to explode a cannon with it. A. One cell of Grenet battery will answer your purpose.

(4611) A. J. W.—Stamp ink is very difficult to remove. Alcohol is the best medium.

(4612) E. R.—In the case of a perpetual motion the Patent Office requires that a working example shall be produced.

(4613) W. R. asks: In the making of the large plunge battery in "Experimental Science" it calls for paraffine. Would beeswax answer as well? A. Yes.

(4614) C. E. L.—As to bringing your matter before the government, we cannot advise without knowing what it is.

(4615) W. G. T. asks for the composition of a cement for incandescent lamp filaments. A. The following is from "Scientific American Cyclopedia of Receipts, Notes and Queries." Take 100 grains carburet of iron (Dixon's stove polish), grind dry to a fine powder, add 10 grains lump sugar, mix well in a mortar, then add 40 grains gold bronze, mix again, then add sufficient water to make a thick paste, and apply it to the junction between the carbon and the platinum wire, allow it to stand for twenty minutes or so, then burn the joint to a cherry red heat by a fine gas flame.

(4616) C. B. A. asks: What is the reaction when oxalic acid ($C_2H_2O_4$) is made by the action of nitric acid (HnO_3) on sugar ($C_{12}H_{22}O_{11}$)? A. $C_{12}H_{22}O_{11}+O_{18}=6C_2H_2O_4+5H_2O$. The O_{18} is derived from the HNO_3; thus $12HNO_3=12NO+6H_2O+18O$. Thus we may write the reaction as follows: $C_{12}H_{22}O_{11}+12HNO_3=6C_2H_2O_4+11H_2O+12NO$.

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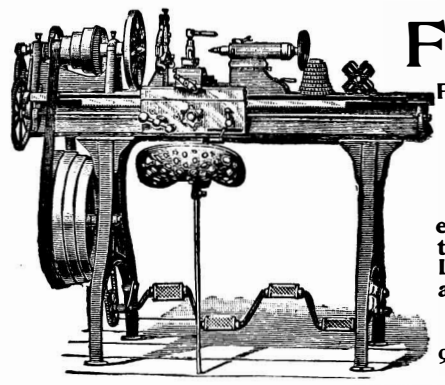

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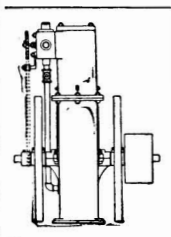

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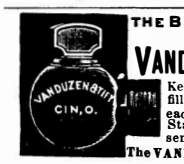

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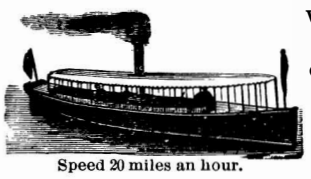

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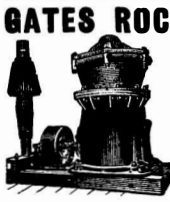

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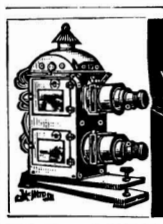

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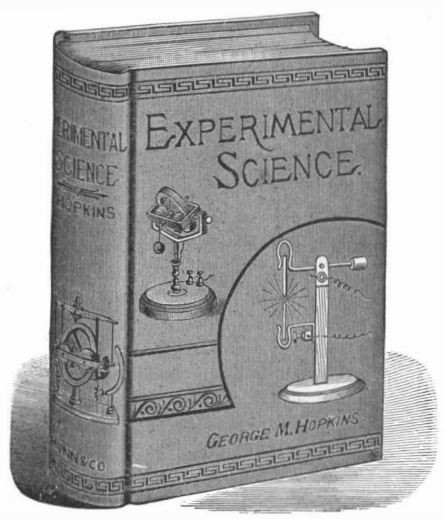

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