SCIENTIFIC AMERICAN

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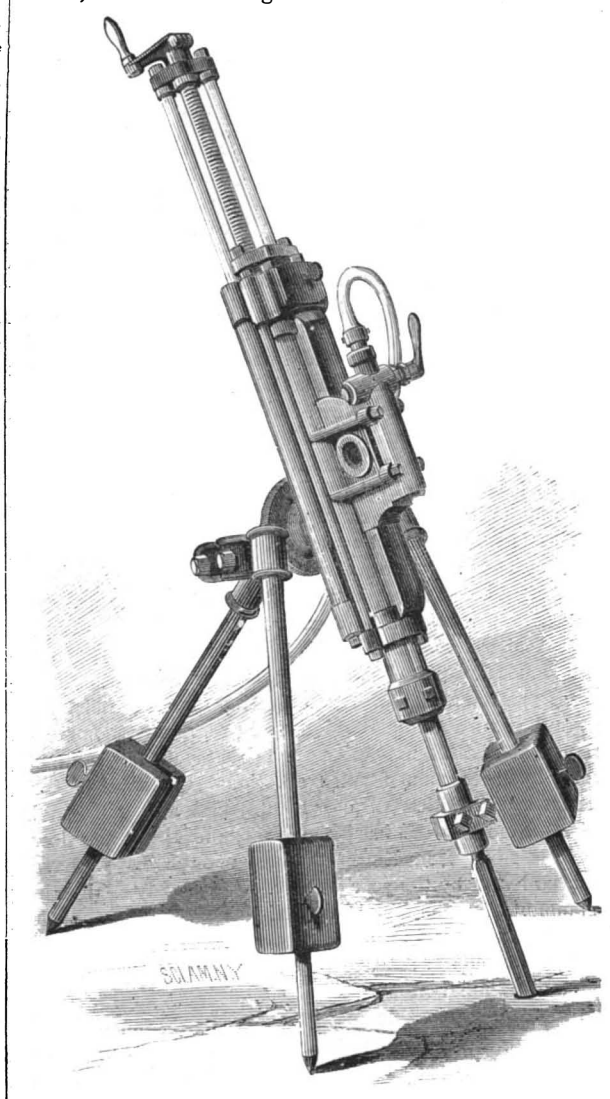
AMERICAN INDUSTRIES.—No. 63.

THE MANUFACTURE OF POWER DRILLS FOR MINING, EXCAVATING, ETC.

Although mining, tunneling, etc., have been of more or less importance, as calling for the labor of large numbers of men, in all ages and in nearly every quarter of the globe, it is only within a few years that the tools and appliances with which such work can be prosecuted have shown any great improvement over those employed in early times. After the use of gunpowder for blasting purposes had been commenced, it seemed for a long period as though there was a complete cessation of all idea of improvement in this direction, until the comparatively recent introduction of the power drill in connection with more powerful explosives. It is not too much to say, however, that from these two causes, but more particularly from the introduction of the power drill, the past twenty years has shown greater improvement in the means and appliances for the rapid and economical prosecution of this class of work than all the years that had gone before. Besides this, also, many projects which were heretofore entirely impracticable have been brought well within the scope of modern engineering ability, and mines which could never have been made to pay under the old system of hand drilling are now contributing to the substantial wealth of the world.

The power drill may be worked with either compressed air or steam, but in many cases, from the location where the drill is operated and the inconvenience attending the getting rid of the exhaust steam, it would be only at a great disadvantage that steam could be employed, while the circulation of pure fresh air provided by the working of the drill with compressed air affords a most valuable result in the way of ventilation for the shafts of mines, in tunnels, and all kinds of ordinary underground work. The manufacturers of the Rand Little Giant rock drill, of the practical working of which we present illustrations on this page of the paper, are also manufacturers of an improved air compressor for use in connection therewith. They have recently furnished the most powerful air compressing plant employed in mining in the world, and it is now in successful operation at the Calumet and Hecla mines on Lake Superior. These compressors furnish cool and perfectly dry air, the last particular being absolutely essential in cold climates or at great elevations.

The requirements for a perfect rock drill are numerous, but it should first of all be simple in construction and strong in every part, the parts, as far as possible, being so arranged that any broken or worn portion may be easily removed and a new part substituted without causing delay in the work. It should occupy but little space, with the striking part relatively of great weight, and to give the blow directly, so that only the piston should feel the shock of concussion. Of course the piston must be so arranged as to make a variable stroke, so that no damage will result from the sudden removal of resistance, which often occurs in boring through rocks of different density, or where flaws or breaks occur. Such a machine, if disconnected from frame or carriage, should be as light as possible, and so arranged that it may be readily put up and taken to pieces.



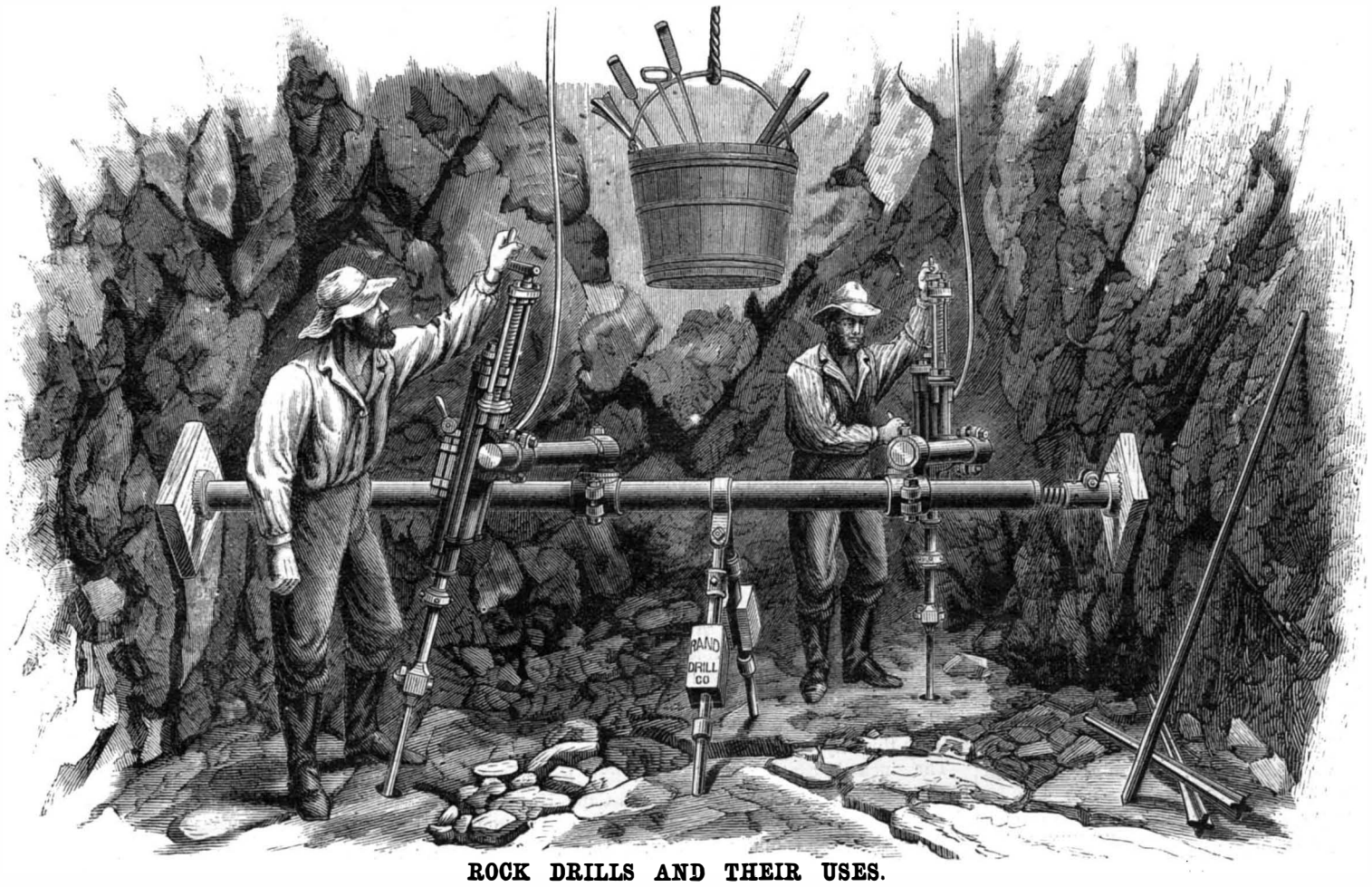
THE RAND ROCK DRILL

The Rand Little Giant rock drill is the result of many years of experiment for the attainment of these ends, and from the testimonials of some of our largest mining companies who are using the drills and compressors of this company with the utmost satisfaction, it is believed that success has been practically attained. The first point to notice in the construction of this machine is its simplicity, there being no connecting rod or other device outside the steam chest and cylinder to get out of order, the valve being thrown in the same direction the piston is moving, and the port remaining open until the full stroke has been made. The lever for operating the valve is placed in a recess between the ends of a double-headed piston, and is struck at the ends as the piston reciprocates, the arm of the lever driving the valve. The valve is of steel, and the whole mechanism is so simple and direct that there is never any difficulty in running at any desired speed, as high as 600 to 700 double strokes per minute having been made, the double stroke meaning the forward and backward motion of the piston.

In the working of this drill the full force of the compressed air or steam is brought to bear directly at the point where the stroke is delivered. The piston rod enters the piston on a taper, and the rotation bar, which is nearly triangular in cross section, is made very strong; the ratchet wheel for rotating is proportionately large, and the teeth strong. This piston is hardened and then ground to a perfect fit on an emery wheel.

These drills are used either mounted on a tripod or attached to a vertical column or a horizontal duplex swivel-jointed bar, according to the location in which the boring is to be performed. In vertical work, either the horizontal bar or the tripod may be used, the former, however, only between comparatively narrow side walls, against which the bar can be made firm. The legs of the tripod are arranged to telescope, so that they can be lengthened or shortened at will, thus allowing holes to be bored in very difficult places and at almost any angle. The column, with an arm, is particularly advantageous in all kinds of tunnel work, and the horizontal bar is more especially advantageous in shaft sinking. The latter is one of the most valuable inventions which has been brought out for some time. It allows two drills to operate simultaneously at any angle by means of the supplemental jointed bars. The rapid blows given by the drills upon the solid rock cause great vibration; this would tend to loosen the bar by turning the jack screw in the nut; to prevent this a lock nut is used, which keeps the screw in place and prevents any loosening of the bar after it is once set up. It can be readily adjusted, the arms folded parallel to the bar, with the drills mounted upon them, and

[*Continued on page* 402.]



ROCK DRILLS AND THEIR USES.

Scientific American.

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Contents.

(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 260,

For the Week ending December 25, 1880.

Price 10 cents. For sale by all newsdealers.

THE LAST NUMBER.

This issue closes another volume of this paper, and with it several thousand subscriptions will expire.

It being an inflexible rule of the publishers to stop sending the paper when the time is up for which subscriptions are prepaid, present subscribers will oblige us by remitting for a renewal without delay, and if they can induce one or more persons to join them in subscribing for the paper, they will largely increase our obligation.

By heeding the above request to renew immediately, it will save the removal of thousands of names from our subscription books, and insure a continuance of the paper without interruption.

The publishers beg to suggest to manufacturers and employers in other branches of industry that in renewing their own subscriptions they add the names of their foremen and other faithful employes. The cost is small, and they are not the only ones that will derive benefit. The benefit to the employe will surely reflect back to the advantage of the employer. The hints, receipts, and advice imparted through our correspondence column will be found of especial value to every artisan and mechanic, as well as to students and scientists.

For terms, see prospectus.

EIGHTEEN HUNDRED AND EIGHTY.

With this issue the year's work of the SCIENTIFIC AMERICAN comes to an end. If anything signally memorable has happened or been done during the year, anything calculated to give 1880 especial prominence in the calendar of the second millennium of the Christian era, our point of view is too near to enable us to discern the fact or perceive the event in its true relations to the present and the future. At this moment the year seems to be an ordinary average year in every respect, a year signalized by no exceptional achievements in any sphere of human activity. Nevertheless it has been a highly satisfactory year, certainly to all Americans.

The promises of increased business prosperity and general industrial activity, so apparent at the beginning of the year, have been amply fulfilled. The crops have been good, in most respects above the average. Our mines and factories have been made to yield more than their customary products. Labor has been abundant and wages fairly good. Our internal commerce was never in a condition of greater activity; canals and railways have been crowded with freight, and the passenger traffic has equaled, if it has not surpassed, what is usual. The largely increased work of the Post Office Department and of the competing systems of electric telegraph bears abundant evidence of progressive commercial and industrial prosperity. The relatively few failures among business men furnish additional evidence of the satisfactory condition of our commercial and industrial affairs. Foreign trade has been active, and the steady flow of gold this way from Europe is proof enough that we have not been losers by the year's traffic. The steady decline in the amount of ocean freight carried in American bottoms is the one dark spot in the otherwise bright picture. The coming year should see a decided turn of the tide in this branch of national effort.

Of the purely scientific achievements of the year the most promising is probably the photophone of Messrs. Bell and Tainter, since it opens up a new line of investigation from which practical results of great utility can scarcely fail to flow. In other departments of scientific investigation there has been a reasonable measure of progress, but no signally important discoveries. A vast multitude of small advances have been made in a thousand different directions, advances whose significance may not yet be fully apparent; yet at this moment we fail to recall any that are likely ever to rank among era-making discoveries or achievements.

In the applications of electricity considerable progress has been made. The practical substitution of dynamo-electric machines for galvanic batteries in telegraphing is a decided step in the direction of economy. Recent improvements in harmonic telegraphy, and in devices for rapid telegraphing, promise to add materially to the usefulness and cheapness of electric communication. The development of telephone lines and telephonic exchanges has gone on with considerable rapidity. We fail to discover, however, any marked improvement in the character of the service. There seems also to be a decided lull in the work of improving the range and efficiency of the telephone itself. Has the limit been reached in this direction? It was reported a few weeks ago that the problem of telephoning through considerable lengths of submerged cable had been solved in England, but nothing seems to have come of it. Equally disappointing have been the promises so often made of the speedy connection of distant cities; that is, cities from one to two or three hundred miles apart, by means of the telephone. Quite a number of new telephones have been patented during the year, but as yet they have given no evidence of superiority.

Though not a product of the year, the electric railway has shown signs of real progress, and possibly great utility since the year began. The same may be said of the electric light. The use of lamps employing the voltaic arc has been steadily extended. In several American towns they have been successfully introduced for public lighting; and preparations are making for their speedy trial on a considerable scale in this city.

The incandescent lamp of Mr. Edison has been practically tested during a voyage around Cape Horn, on the steamer Columbia, and by continuous use at Menlo Park. The Maxim lamp is doing good service in the Equitable Building in this city, and good reports are received of the working of the Sawyer lamp in one or more public buildings in Philadelphia. Before the coming year is done with, we may expect to see one, perhaps several, forms of the incandescent lamp in pretty general use in the business part of our city.

Among the larger engineering operations and undertakings of the year mention may be made of the rapid progress of the railways which are pushing across the continent to make new connections between the Atlantic and the Pacific; the junctions of the two sections of the St. Gothard Tunnel; the revival of the Hudson River Tunnel project, and its prosecution in the face of difficulty and disaster; the completion of the preliminary work in connection with the proposed tunnel under the British Channel, and the beginning of what claims to be a serious attack upon the main work; the railway up Vesuvius; the rapid progress of the great East River Bridge; the successful transference of Cleopatra's Needle from Egypt to Central Park; the laying of several new and important Atlantic and other ocean cables: the final acceptance of the Panama route for the proposed ship canal, and the vigorous prosecution of that work (on paper) by De Lesseps; the theoretical development of Capt. Eads' plan of a ship railway at Tehuantepec.

In naval architecture we have the completion of the Czar of Russia's huge novelty the Livadia, and the launching of the Italian war ship Italia, the largest, most powerful, most heavily armed and armored floating fortress in the world. By contrast mention may be made here of the completion of the loftiest and one of the most beautiful and costly of temples of worship, the Cathedral at Cologne, after centuries of intermittent construction.

The dephosphorizing processes by means of which the immediate conversion of certain refractory iron ores into steel has been made possible, are not new; but not until within a few months have they proved to be practical and economical on a large scale.

The De Bay propeller is not new; but not until this year has it been tried on a vessel large enough to furnish an assured demonstration of its superior value and efficiency. In like manner the Perkins system of steam boilers belongs to a period earlier than the past twelvemonth; but it was left to the recent successful voyages of the Anthracite across the Atlantic Ocean to illustrate if not to demonstrate the advantages of high-pressure steam for seagoing vessels. We recall no radical improvements made this year in machinery for the artificial production of ice; yet the scarcity of ice due to the unusual openness of last winter has given a remarkable impetus to the construction and use of such machinery.

It was our purpose to speak in this connection of the very creditable records made by American arts and industries in the international competitions at Sydney, Australia; at Berlin, in connection with fish and fisheries; at Cincinnati, in the Millers' Exhibition; at the exhibition of sheep and wool in Philadelphia; but there is no room for it here, and probably no need, for they are fresh in every mind. There is no room either, and possibly no occasion, for saying much about our work in the past or our intentions for the future. The steady annual progress which the SCIENTIFIC AMERICAN has made for nearly two score years is the best guarantee that no pains will be spared to make the paper more and more worthy of the large and increasing favor bestowed upon it by an intelligent and highly appreciative public.

ELECTRIC LIGHTS IN BROADWAY, NEW YORK.

Last year the New York Board of Aldermen passed a resolution requesting the Gas Commission to cause experiments to be made with electric lights, with a view to testing their adaptablity for lighting streets, avenues, parks, and squares. No action was taken by the commission until recently, when permission was granted to the Brush Electric Light Company to test their system at their own expense on Broadway, from 14th to 34th street, a distance of a mile. The posts for the new lamps are now being set up, and it is promised that the lights will be in operation by Christmas. The iron lamp posts are twenty feet high from the base to the foot of the lamp. Their upper portions are supplied with projecting teeth, which are intended to be used as steps by the men assigned to keep the lamps in good condition. The lamps are constructed in accordance with the Brush patent, being from four to five feet in height and surmounted with an iron hood.

The whole number of lamps will be twenty-two; the wires will be carried from the top of one post to the top of the next for the present, or until the city decides to adopt the system, when they will be sunk under ground. Each lamp will, it is promised, give a two thousand candle power light, equal to about one hundred gas lamps.

The central station will be at No. 133 West 25th street, where the Corliss engines and boiler which operate the electric generators have been placed. About twenty-five horse power will be required for the twenty-two lamps, and one wire will convey the current to the entire series. It is promised that the light will be much cheaper than gas light of equal power. The success of the Brush system elsewhere reduces this experiment to a test of cost and the ability of the lamps to satisfy the requirements of the public eye.

THE SCIENTIFIC AMERICAN FOR 1881.

A new year—the thirty-seventh since the publication of the SCIENTIFIC AMERICAN began—will be entered upon with our next issue.

It is gratifying to believe that, during all these years of varying national prosperity, there was never one that opened with broader or more substantial grounds for expecting the largest measure of national well-being—the largest activity in all the useful arts, under the most favorable conditions for success—than are promised for the year about to begin.

Never in their history have the United States presented so cheerful and hopeful an aspect; and in common with all other worthy American institutions the SCIENTIFIC AMERICAN enjoys a bountiful share of the general prosperity. Manufacturers, merchants, farmers, artisans—indeed all classes of men to whom this paper is addressed, are busily employed and are making money; and the number who regularly look to its pages for information, suggestion, or entertainment, is larger than ever before. With such abundant and hearty support, the proprietors can confidently pursue their set policy of striving continually to increase the usefulness of the paper to its readers and advertisers. Having no rivals in this field the only competition they can enjoy is in a constant endeavor to surpass their own best achievements. Whoever will take the trouble to compare this volume just finished with any that has preceded it, cannot fail to be impressed with the manifest fact that the publishers' policy has not been altogether fruitless of results calculated to make the SCIENTIFIC AMERICAN increasingly worthy of the popular favor bestowed upon it.

The SCIENTIFIC AMERICAN SUPPLEMENT will continue to put within easy reach of American readers the best contributions to the practical literature of the sciences and industrial arts that the public journals afford, besides a large amount of original matter of special value to scientific and practical men. As heretofore, a full table of contents of each issue of the SUPPLEMENT will be printed in the corresponding issue of this paper, in which every reader of the SCIENTIFIC AMERICAN is kept informed of all important papers bearing on the subjects or industries he is specially interested in, should he not feel able to subscribe to both papers. Scarcely a week passes in which the SUPPLEMENT does not contain special articles worth more than the year's subscription to readers interested in the subjects treated. The ample pages of the SUPPLEMENT enable us to present full details pertaining to topics discussed with working drawings where such illustrations are useful.

SITE OF THE NEW YORK FAIR OF 1883.

The Executive Committee of the World's Fair of 1883 have at length agreed upon Inwood as a site. The tract selected lies in the extreme northern part of New York city, eleven miles from the City Hall, and has a mile frontage on Broadway or King's Bridge Road, and a mile frontage on Harlem River. It contains 250 acres, the free use of which the owners have offered to give to the Commission for the purposes of the Fair. The ground is already served with gas and Croton water, and is level or gently undulating. The water along the Harlem front is from 18 to 40 feet deep at low tide. There is also an admirable water front along the Hudson river, which is separated from the Fair site by a ridge, in which is a convenient depression for a railway for passengers and freight. The least distance to the Hudson, where abundant docking privilege has been secured, is 1,400 feet, and the exhibits from foreign ports can be landed at Inwood pier, within half a mile of the grounds. The only objection to the site is its distance from the lower part of the city. The means of access to it, however, are the best. Its drives are park roads. The old track of the Hudson River Railroad passes one side, the new track lies just across the Harlem. It is nearer than any other site proposed to all the other railroads tributary to New York except the Long Island Railroad. The Western lines terminating at Jersey city can deliver their passengers at the grounds by means of ferryboats. All the elevated roads can readily be called into requisition in carrying passengers, and the facilities for water transit and the accommodation of shipping are abundant. The ground is ample, naturally drained, and well suited to the needs of the fair; and the location is one of the most beautiful in New York. It has many historic associations, the site being bounded on the east by Harlem River and heights, on the south by Fort George, formerly Fort Clear View; on the southwest and west by Forts Washington, Nelson, and Tryon, and on the north by Inwood Hill.

COMPRESSED AIR AS A MOTIVE POWER.

It is very well known that in the matter of the consumption of fuel, the most economical steam locomotive compares very unfavorably with first-class stationary engines, the difference being so great as to admit of allowing a large margin for loss in applying the power of stationary engines to the propulsion of trains.

The use of electricity for this purpose has its advocates, and wire rope transmission is believed by some to meet the requirements for short lines, but among the various practicable methods of applying power from a fixed source to the propulsion of trains, nothing has been developed thus far that promises better than compressed air. It is cleanly, safe, and free from the many objections raised against steam, and seems in every way adapted to railway purposes, especially on short routes and for underground roads.

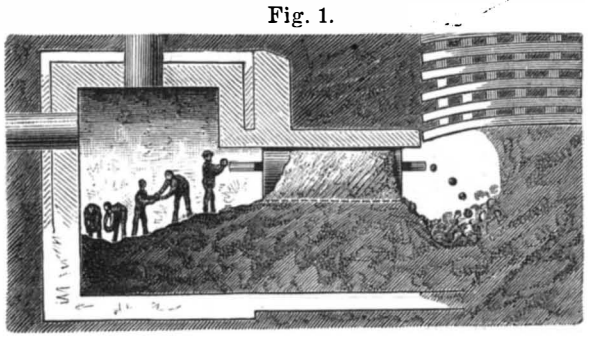
A new method of using compressed air, and a novel locomotive for carrying out the method, is being introduced by Mr. R. Ten Broeck, who is located at the Windsor Hotel, in this city. The new system is the invention of a well-known English engineer, who has studied the capabilities of compressed air as a motive agent, and has devised machinery for utilizing it to the best advantage.

PROGRESS OF THE HUDSON RIVER TUNNEL.

The crib-work of the river bulk-head, which has been the source of so much delay in the prosecution of the tunnel under the Hudson River, is again giving trouble.

As a matter of prudence the work on the north tunnel, which was in no way injured by the influx of water, has been suspended until the south tunnel can be carried past the crib-work. This tunnel had been driven as far as the inner edge of the crib-work when the fatal break occurred; and when the water had been pumped out after the sinking of the caisson and the work of tunneling began again, it

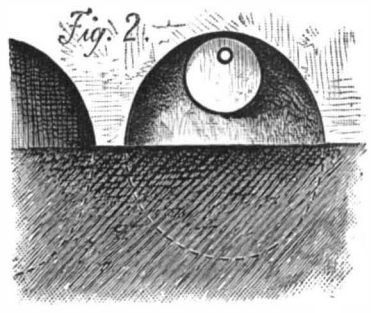
Fig. 1.



was discovered that the inrush of water through the loosely constructed crib-work had not only washed out much of the earth which had filled the spaces between the timber and stones, but had excavated the large hole shown in our engraving. Two serious hinderances were thus placed in the way of the work: the absence of support for the timbers of the crib on their original inclination caused them to drop below the upper line of the tunnel, necessitating their removal before the tunnel shield could be pushed forward, and the washing away of the protecting silt allowed the water to flow in, and the compressed air of the tunnel to escape.

The cavity was discovered by sounding. Instead of clearing out the original tunnel at once, a small pilot tunnel, six feet in diameter, was first driven through the washed-in silt almost to the cavity. Then a six inch tube was thrust through the remaining wall of silt, and an attempt was made to pass through the tube a sufficient quantity of mud-balls to fill the opening. It was thought that this had been accomplished, and the mud wall was removed only to discover a leak through the crib that defied the usual means of stoppage by the use of bags of bran and the like. At this stage of the work the recent serious inflow of water occurred, compelling a change in the plan of procedure.

Fig. 2.



The new plan involves the construction of a movable bulkhead fitting the pilot tunnel like a piston. This is to be driven forward by means of a jack-screw, placed as shown in our engraving, until the inner edge of the crib-work is reached. Meantime through a 3½ inch tube piercing the piston bulkhead, balls of mud are to be forced by the pressure of the air, until the opening under the crib is completely filled. When this has been done, the work of excavation can be narrowed to a small area, the obstructing timbers removed in detail, and any considerable leakage prevented by pushing forward foot by foot the iron shield of the tunnel. The troublesome cribwork being safely passed, and the second tunnel-heading fairly under the river, the work on both tunnels can go on unhindered.

THE SPREAD OF DIPHTHERIA.

The unusually large number of fatal cases of diphtheria, now occurring in this city and Brooklyn, and in many in rural districts as well as in our larger towns, call for especial care and intelligence in preventing the generation and spreading of this terrible disease. The following statement of the symptoms of the disease, and the precautions to be taken where it prevails, is being distributed by the Health Department of this city. Everybody should read it and attend to its warnings.

Cleanliness in and around the dwelling, and pure air in living and sleeping rooms, are of the utmost importance where any contagious disease is prevailing, as cleanliness tends both to prevent and mitigate it. Every kind and source of filth around and in the house should be thoroughly removed; cellars and foul areas should be cleaned and disinfected; drains should be put in perfect repair; dirty walls and ceilings should be lime-washed, and every occupied room should be thoroughly ventilated. Apartments which have been occupied by persons sick with diphtheria should be cleansed with disinfectants, ceilings lime-washed, and wood work painted; the carpets, bed clothing, upholstered furniture, etc., exposed many days to fresh air and the sunlight (all articles which may be boiled or subjected to high degrees of heat should be thus disinfected); such rooms should be exposed to currents of fresh air for at least one week before reoccupation.

When diphtheria is prevailing, no child should be allowed to kiss strange children nor those suffering from sore throat (the disgusting custom of compelling children to kiss every visitor is a well-contrived method of propagating other grave diseases than diphtheria); nor should it sleep with nor be confined to rooms occupied by or use articles, as toys, taken in the mouth, handkerchiefs, etc., belonging to children having sore throat, croup, or catarrh. If the weather is cold, the child should be warmly clad with flannels.

When diphtheria is in the house or in the family, the well, children should be scrupulously kept apart from the sick in dry, well-aired rooms, and every possible source of infection through the air, by personal contact with the sick, and by articles used about them or in their rooms, should be rigidly guarded. Every attack of sore throat, cough, and catarrh should be at once attended to; the feeble should have invigorating food and treatment.

The sick should be rigidly isolated in well-aired (the air being entirely changed at least hourly), sunlighted rooms, the outflow of air being, as far as possible, through the external windows by depressing the upper and elevating the lower sash, or a chimney heated by a fire in an open fireplace; all discharges from the mouth and nose should be received into vessels containing disinfectants, as solutions of carbolic acid or sulphate of zinc; or upon cloths, which are immediately burned, or if not burned, thoroughly boiled or placed under a disinfecting fluid.

PETROLEUM FOR HARBOR DEFENSE.

A correspondent in York, Pa., Mr. D. K. Naell, suggests the use of burning petroleum for repelling hostile fleets from harbors like those of Baltimore, Philadelphia, and New York. A hundred thousand barrels of oil poured upon an out-flowing tide would cover a large area of water, and when set on fire would sweep a fleet with a torrent of destruction that nothing could resist. When a stream of burning oil ran down the Allegheny River last winter the flames sometimes leaped up nearly a hundred feet, and threw out lateral tongues of fire terrible to see. Such flames around an iron-clad fleet would asphyxiate all on board.

Another plan would be to link together long lines or rafts of oil barrels and send them against the fleet by small swift steam launches that could be steered by electricity from the shore. The barrels could be exploded and the oil fired by the same agency at the proper moment; and, if necessary, line after line of the fire rafts could be drifted or driven against the enemy until every vessel was destroyed. Such an application of floating fire might also be used to protect a system of torpedoes in a ship channel, by making it impossible to operate any counter system for exploding or removing the torpedoes by men in small boats.

Obviously this plan would not do to rely upon generally; though in certain emergencies it might be resorted to with terrible effect.

A Cup of Tea.

In a recent lecture by Mr. G. R. Tweedie, F.C.S., London, on "A Cup of Tea," the speaker divided his subject into four sections—the tea, the water, the milk, and the sugar. The lecturer first drew attention to tea drinking with every-day life, and showed that the principal components of tea were theine and the essential oil of tannin, which latter possessed astringent properties. He informed the audience that the best time to take tea was about three hours after dinner or any other heavy meal, and deprecated in the strongest terms the excess to which tea drinking is carried by some people, asserting that such a practice induced a nervous disorganization and impeded digestion. He showed that the sole difference between black and green tea was one of preparation, and that both kinds could be obtained from the leaves of the same plant. After asserting that the adulteration of tea had very much decreased of late years, which the tea drinking public will be glad to know, the lecturer proceeded to treat of the various kinds of shrubs grown in different parts of the world and the countries where the different kinds of teas were consumed, the lecturer came to the consideration of the milk, its value as a nutritive agent, and referring to its adulteration he made the astounding assertion that in London alone every year no less than £70,000 was spent on water which was sold as milk. Passing on to regard the sugar, the lecturer denied the common error that sugar was injurious to the teeth, bringing forward as an example the negroes of Jamaica, who, he said, though they were the greatest eaters of sugar in the world, were proverbial for their beautiful teeth.

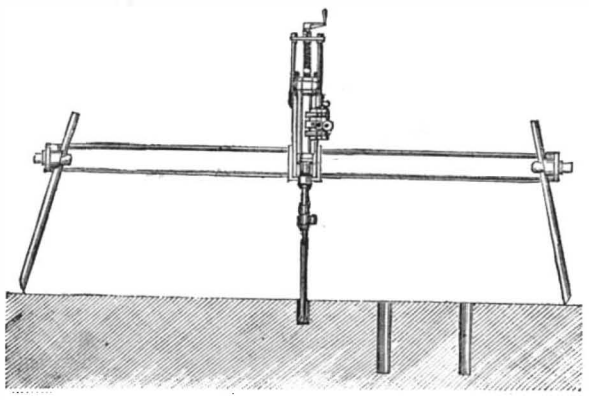
AMERICAN INDUSTRIES.

[*Continued from first page.*]

the whole plant lowered to its place in the shaft by the hoisting rope. By the use of rock drills mounted in this manner great economy is effected in the sinking of shafts, the work being done at half the cost and in one quarter of the time as against hand labor.

For rock drilling under water, where the work is to be done from the surface and not by tunneling from a sunken shaft, it is usual to anchor a platform or scow over the site of the proposed work. The company have an improved description of drill scow for this class of work, in which the drills, instead of passing through the vessel as formerly, are placed at the ends, and suitable mechanism is provided for raising and lowering them in a vertical line. The bits extend down through tubes attached to movable carriages. The scow is lifted bodily out of the water, if necessary, by spuds forced down against the rock, thus forming a firm stationary platform. One of these scows was used in deepening the St. Lawrence River near the mouth of the Lachine Canal, where the cutting amounted to 9 feet of rock under 9 feet of water, in order to make a clear channel of 18 feet in depth. Four Rand drills, of 5 inches diameter, were employed, and during 1878 and 1879 the scow worked on an average six months per year, removing in that time about 45,000 yards of rock.

These drills are regularly rated, as to size, from No. 0, which weighs 150 lb., and bores holes from ½ inch to 1 inch in diameter, to No. 6, which weighs 900 lb. and drills 3 to 4 inch holes 30 feet deep. These are intended to cover



DRILL MOUNTED FOR QUARRY WORK.

all ordinary classes of boring, from the lightest plug and feather work to the heaviest bores required in deep cuts, railroad tunnels, mining, and submarine drilling, the size of the drill and the speed at which it should be run differing according to the location and the quality of the rock that is to be operated on. The heavier the drill the slower are the strokes generally, but experience has shown that several other conditions must govern in regulating the speed at which the drill is worked, so that while the rock is fractured and the hole bored without quick destruction of the bits the water will wash out the *débris*. The machine drill is far less destructive of bits than hand drilling, for the piston end of the drill is never damaged, as is the hand drill, by the blows of sledges; but yet it has until lately been assumed that in some classes of work hand drilling was the most advantageous. In regard to this point some recent testimony from an iron mining company on Lake Superior is of practical value. The agent in charge says that with these drills "we have no difficulty in drilling the hardest quartz or jasper, though we never before have been able, with power drills, to do as well as men could do with hammers in such ground." Besides the abundant proofs of superior efficiency and economy in the working of the Rand drill with the Rand air compressor, which have been afforded in practical experience, the company have had made a series of scientific tests, in which the speed of the drill and the consumption of air at different temperatures, and all the conditions governing the work, were accurately determined. The blows given by the drill were received by a mass of iron, a blunt-headed rod being used instead of a pointed drill. The maximum stroke of the piston was 6¾ inches, and the average stroke during these experiments was 6 inches. The indicator diagrams were taken from the drill cylinder at speeds varying from 111 to 298 double strokes per minute, and at pressures of from 12·5 to 26·5 lb. per square inch above the atmosphere, the piston of the drill being proved practically tight before commencement. When not striking the speed of the drill was controlled by the throttle valve, but for the other runs the throttle valve was pinned wide open, and a constant pressure maintained in the reservoir. The principal results shown by the diagrams are as follows:

No. of Diagram.	1.	2.	3.	4.	5.	6.
Pressure in reservoir, per sq. in..	....	12·5	26 5	....	12·5	26·5
No. double strokes per minute ..	135	200	298	135	208	298
Scale of indicator springs	1/12	1/12	1/24	1/8	1/12	1/24
Mean effective pressure, pounds per sq in	5·78	8·54	13·6	6·66	8	11·5
Ratio of pressure in cylinder working to pressure in reservoir	.. .	0·95	0·89	....	0·98	0·89
Fraction of stroke completed to exhaust	0 87	0·85	0 76	0·72	0·73	0 76
Fraction of stroke completed to cushion	0·71	0·81	0·78	0·84	0 83	0·70

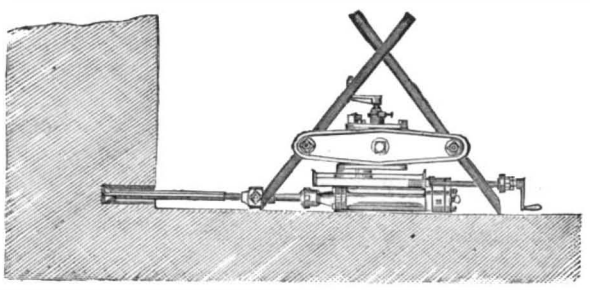
Reducing the results obtained in ten experiments, the following facts were obtained:

No. of Experiment.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
Pressure in reservoir	15	20	25	30	35	40	45	50	55	58
Double strokes per minute	225	259	280	309	333	348	395	415	429	452
Temperature reservoir deg. Fah..	75	82	85	90	100	105	130	135	150	160
" valve chest, " ..	70	70	70	70	71	75	80	80	80	80
" exhaust, " ..	57	52	48	46	44	43	43	44	44	44
Velocity of air in the exhaust pipes	246	358	510	724	850	1,012	1,250	1,484	1,690	1,788
Cubic feet air exhausted per m. at exhaust temperature and atmospheric pressure	22·3	32 3	46·1	65·4	76·8	91·4	112·9	134·1	152·7	161·5
Probable equiv. of air exhausted at reservoir pressure and temperature	10·4	12·2	14 5	17·9	18 7	19·2	20·0	20·8	21·9	23·2
Cubic feet of air used per minute, calculated from piston displacements	11 1	12·8	13·9	15·3	16·5	17·2	19·6	20·5	21·2	22·4

The air compressor which the company have built for use especially with their drills, but no less desirable for all other work for which compressed air may be needed, has met with general favor. Its cylinder is composed of three shells, forming two annular spaces around the working cylinder; the outer space affords a passage for the air after compression, and a vessel for collecting any moisture there might be in the air, while the inner space forms passages for the water used in cooling. The heads of the cylinder, as also the piston and piston rod, are hollow, with passages for water for cooling. In this way the heat caused by the air compression is effectually got rid of. Self-lubricating piston rings are used, reducing friction to a minimum, and only cool dry air is furnished.

The drills and air compressors of the Rand Drill Company have been long enough in use to have their merits abundantly attested, as they are in the most flattering terms by some of the most extensive and successful mining companies in the country. In California, Colorado, Nevada, Utah, and in the whole Rocky Mountain region, in the Lake Superior mining districts, in Pennsylvania, New Jersey, and New York State, they have in many cases furnished the entire working machinery, and in all the different classes of mining work, as well as in tunneling and excavating of every description, their simplicity of construction, non-liability

ROCK DRILL WITH COLUMN.



QUARRY MACHINE.

to get out of repair, the amount of work they will do, and the economy of their operation, the machines have recommended themselves to practical men everywhere.

The New York office and salesroom of the company is at No. 21 Park Row.

WESTERN SIDEWHEELERS.

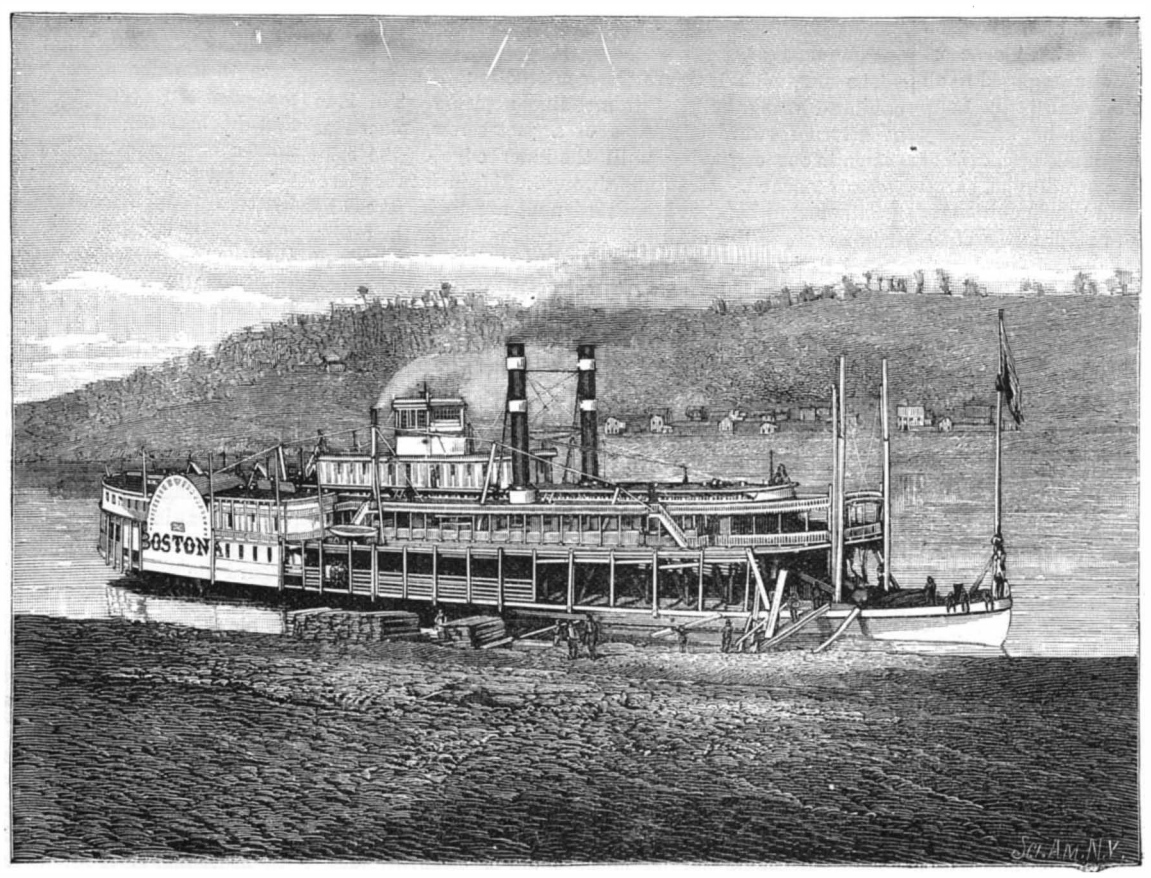
The illustration is not only an accurate delineation of one of the most remarkable steamers ever built, but it may be taken as a representative of the general appearance and detail of the Western river steamers as a class. The wheels in these boats are always abaft midship, and the boilers are located on the lower (main) deck amidships.

The Bostona, shown in the engraving, was built at Cincinnati, in 1879, to ply on the Ohio between that city and Huntington, W. Va., the western terminus of the Chesapeake and Ohio Railway. She measures 302 feet long, 43½ feet beam, 6 feet hold, and carries 1,000 tons freight, yet with steam up and fuel aboard, draws only *slightly over two feet.* She has complete accommodations for about 200 passengers. There are four steel boilers, 30 feet long, 47 inches in diameter, with six return flues each; *two engines*, horizontal, high pressure, 25 inches diameter, and 8 feet stroke. The wheel shafts are located 98 feet from the stern.

As this trade demands that the freight be handled as quickly as possible, all cargo is carried on deck. This brought about an ingenious arrangement, by which the fuel box, which heretofore had encumbered considerable space on deck, was done away with and the unused hold utilized. A double railway track is laid throughout the length of the steamer's hull, on which are a number of small cars containing the fuel.

By the shifting of these coal cars the steamer is trimmed even when running light.

H. L. BRIDWELL.
Hillsboro, Ohio.



THE LIGHT DRAUGHT STEAMER BOSTONA."

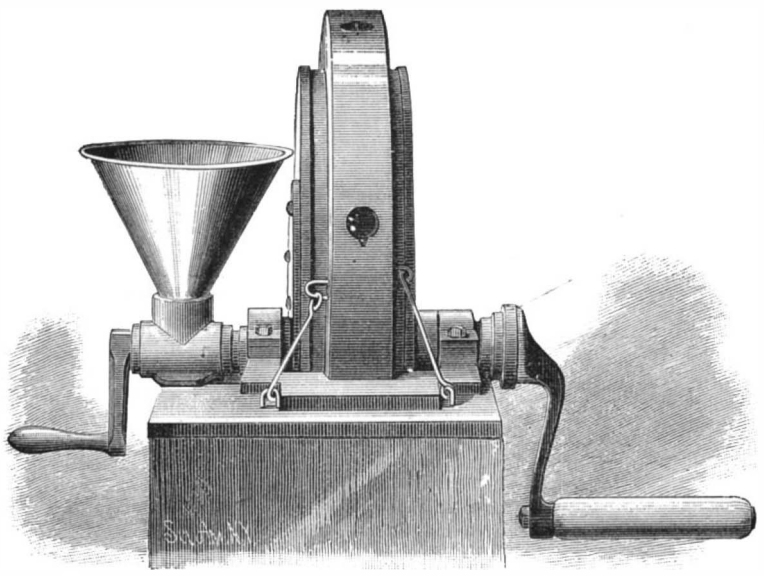
NEW GUN OF REMARKABLE POWER.—Sir W. Armstrong & Co. have lately produced a five ton (95 cwt.) gun that discharges a 120 lb. projectile with a velocity of 2,064 feet per second, which is equal to 3,545 foot tons of stored up energy, or 746·3 foot tons per ton weight of gun

NEW POLISHING MACHINE.

We give an engraving of an improved machine for polishing knives and other similar articles, recently patented by Mr. M. R. Chase, of Warren, R. I. The machine consists of two disks of yielding material having radial grooves in their adjacent faces for conveying the polishing powder from the tubular shaft outward. These disks are inclosed by a circular casing having openings through which the articles to be polished are thrust. On one side of the machine there is a crank for turning the polishing disks, and upon the opposite side there is a smaller crank for turning a worm which carries the polishing material from the hopper into the shaft, whence it passes through lateral holes to the radial grooves in the polishing disks. To render the grooves more effective in feeding the polishing material they are slightly curved, and the grooves of one disk alternate with the grooves of the other. By this arrangement all of the polishing surface is utilized and the best distribution of the polishing powder is insured.

The polishing material used with this machine consists of any suitable polishing powder mixed with cork sawdust and moistened with soap and water. The powder thus prepared, when dry and evenly distributed on the polishing disks, forms a soft pliable surface, which is very effective in polishing all parts of the surface being operated on.

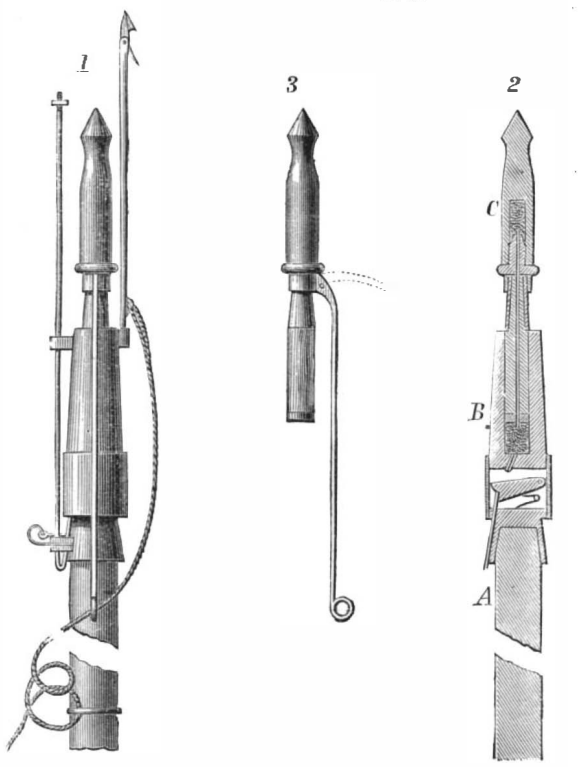
The pressure between the disks may be easily regulated, and only a few turns of the machine are required to give a knife a fine polish. The machine may be run by hand or foot or by any other convenient power.



CHASE'S POLISHING MACHINE.

IMPROVED BOMB LANCE.

An improved bomb lance, patented by Mr. E. Pierce, of New Bedford, Mass., is shown in the annexed engraving.



PIERCE'S BOMB LANCE.

Fig. 1 is a side elevation, Fig. 2 is a longitudinal section, and Fig. 3 shows the bomb lance detached from the gun.

The invention consists of a gun mounted on a suitable shaft and adapted to the bomb lance shown in Fig. 3. The gun has a lock which is operated by impact against the body of the whale. The bomb lance has a cavity for receiving a charge of powder, and is provided with a wooden staff through which a fuse passes. The staff of the lance is received by the gun barrel. On throwing the lance the lock of the gun is released and the gun discharged as the point of the lance touches the body of the whale; the fuse of the lance is at the same time ignited, so that immediately after the lance enters the body of the whale its charge of powder is exploded, killing or injuring the whale. The bomb lance is provided with a rod having an eye in the end for receiving the line.

The Rarity of Food Adulterations.

In awarding the prizes offered by the National Board of Trade a year ago, for essays in relation to the adulteration of food, the committee makes the gratifying announcement that none of the competing essayists produce any definite or satisfactory evidence as to the widespread existence of very dangerous adulterations in this country. Such dangerous adulterations appear to be mainly in the form of poisonous colors or coloring matters, as, for instance, in confectionery, and even these are rare. The question of the adulteration of food, with, perhaps, the exception of milk, should therefore be considered not so much from a sanitary standpoint as from that of commercial interests, as being in the nature of a fraud, in aiding the sale of articles which are not what they are represented to be. The committee is of the opinion that there is much more danger to health and life in this country from adulterated drugs than from adulterated food, and that any legislation which is to deal with the one should also deal with the other. A Board of Health is recommended for each State, and both State and national legislation on the subject of adulteration is deemed desirable. The committee will endeavor to prepare and place in the hands of the President of the National Board of Trade, as soon as possible, drafts of acts prepared in accordance with the general principles contained in its report.

NEW CISTERN FILTER.

The engraving shows a filter designed to secure in any given cistern space a more thorough removal of suspended matter than is effected in the ordinary cistern filters, to eliminate from the water matters harmful to health by a process which depends mainly on the concentration of atmospheric oxygen and in part by oxygen dissolved in water.

The process of oxidation is carried on during the passage of the water through a finely divided and aerated filter bed, the aeration of which takes place during fair weather.

The filter bed in which the oxidation and aeration take place is not constantly submerged, as are those now used, but is open to air pressure, to the action of light and heat in summer, and to the disinfecting, cleansing, and healthful influence of cold and frost in winter, agencies essential to secure good water.

A tonic or mineral quality can be given to the water by the introduction of iron filings or small scraps of iron in the filter bed, when desirable.

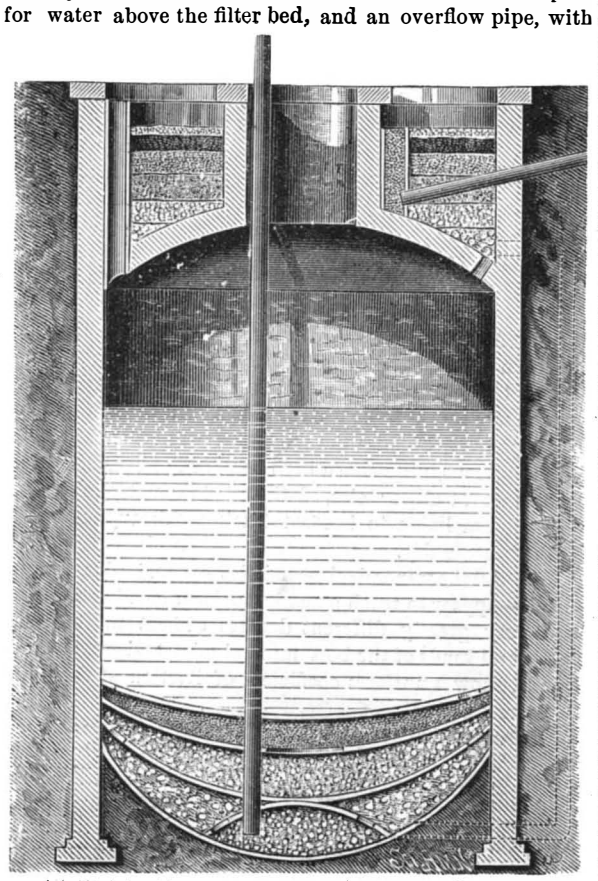
The engraving is a vertical section of the filter, with its walls extending from base of arch to ground surface. It has on its arch a main aerated filter bed, and on its bottom four more filter beds. In the main aerated filter bed there are six layers, as follows: First, gravel stones or pebbles at the bottom, to allow free drainage; second, a layer of coarse gravel; third, one of finer gravel; fourth, one of sand; fifth, one of coarsely granulated charcoal and fine sand; sixth, one of small pebbles on top, to keep charcoal in place and allow it to dry out between showers in fair weather. There is a space for water above the filter bed, and an overflow pipe, with top below outer cistern wall, is provided to take water not passing through the main filter by a direct passage into the cistern; there is also a pipe to allow water discharged from conduit pipe, to come from main aerated filter bed to its surface, and then spread over it. Through the arch there is an opening to carry the water into the cistern after it has passed through the filter bed in a circuit around the man-hole.

The arrangement and composition of the four filter beds on the bottom of the cistern are as follows:

The hemispheroidal filter on bottom of cistern is composed of granulated granite, or limestone, or cleanly-washed pebble stones. This is gravel concreted an inch thick, and perforated, before concrete sets, with twenty-five to fifty small holes midway between its base and top. Around this there is a filter bed made of coarse gravel and gravel concreted in form of an inverted arch, with fifty to seventy-five small holes near its outer edge, and above this there is a filter bed made of fine gravel and gravel concreted in form of an inverted arch, with a twelve inch opening at the center. The upper filter bed is made of closely compacted clean and sharp sand, and concreted with gravel an inch or more in thickness, with fifty to seventy-five small holes near its outer edge.

It will be noticed that the water is filtered as it enters the cistern, and filtered again as it is pumped out.

This invention was lately patented by Mr. Samuel Day, of Ann Arbor, Mich.



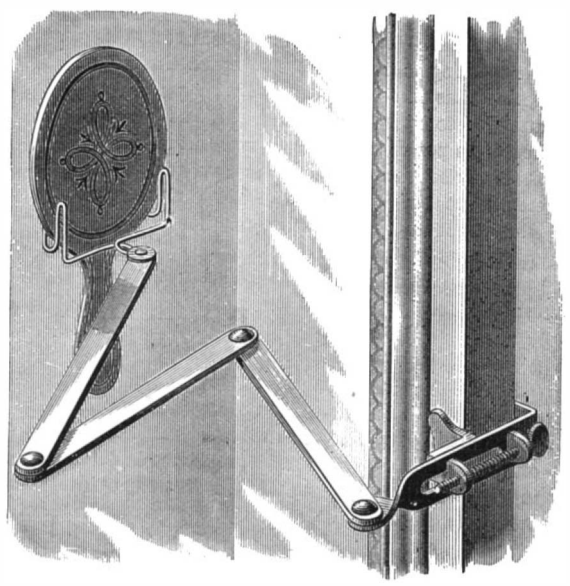
DAY'S CISTERN FILTER.

A Steel Steamboat for Venezuela.

A steel steamboat in sections was recently sent from this port to Lake Maracaibo, to be used in the transportation of coffee and other products of Northern Venezuela. The Zulia and other rivers of that fertile basin are apt to be very shallow during the dry season, making transportation by the river craft there in use not only uncertain but expensive. The design is to substitute therefor a fleet of steamboats, of which the one lately sent is a pioneer.

HAND MIRROR HOLDER.

The engraving shows a simple and very convenient device for holding a hand mirror when it is desirable to use both hands in making the toilet. The bracket is readily clamped to the frame of the mirror, and may be extended sufficiently for ordinary purposes.



HAND MIRROR HOLDER

This invention was recently patented by Messrs. Webb & Myrick, of Stockton, Cal.

AGRICULTURAL INVENTIONS.

A check row corn planter, so constructed as to drop the seed at uniform distances apart, and at the same time mark the position of the hills, so that the planting can be done in accurate check row, has been patented by Messrs. Alfred A. McIntosh and Lysander J. Lishness, of Pontiac, Ill.

Mr. Edson M. Gaskill, of Edenton, Ohio, has patented a churning machine so constructed that it will be operated by giving oscillating movements to the chair upon which the operator sits.

An improved manure fork has been patented by Mr. George P. Ruhle, of Swengel, Pa. This invention relates to certain improvements on the combined scraper and fork for which Letters Patent No. 223,390 were granted to the same inventor January 6, 1880, and it has particular reference to the construction of the fork.

An improved check row corn dropper, or device for automatically planting corn in perfect check rows, has been patented by Mr. Alonzo J. Simmons, of Pana, Ill. It comprises the following features: Means for rendering the distance between the hills dropped uniform and independent of the rough character of the surface of the soil; in a peculiar mechanism for converting the rotary movement of the driving shaft into the reciprocating movement of the seed slide; and in the peculiar construction and arrangement of the marking devices.

How Bandannas are Dyed.

For a long time the once fashionable bandanna handkerchiefs imported from India were a great puzzle to Western dyers. The white spots on a uniformly dyed red ground were produced by tying up the cloth at those parts so tightly that when the handkerchiefs were dipped into the dye, the latter could not penetrate the protected parts. When the cloth was dyed and the tyings loosed, the white spots revealed themselves.

When the "discharge process" of figuring dyed cloth was invented by Koechlin it was at once adopted by a Glasgow house, and so successfully worked as to produce goods exceeding in beauty the famous bandannas of India. Several other Glasgow firms turned their attention to the production of bandannas, and the city and its neighborhood has since enjoyed almost a monopoly of this branch of manufacture. The cloth intended for bandannas is dyed of a uniform color—most commonly red or blue—and a dozen pieces are laid one over another and wound upon a roller. This roller is placed upon bearings behind a press of peculiar construction. The press consists of a bed plate mounted on hydraulic gear, and an upper plate or "platen." The printing, if we may so call it, is done by means of two stout plates of lead fixed to the upper and lower plates of the press respectively. If the design is to consist of, say, white spots on the colored ground, the exposed surfaces of the lead plates have cut into them a series of depressions corresponding to the size and number of the spots desired. These have to be securely placed, so that when the two plates are brought together the depressions in the one shall fall exactly over those of the other. All being ready, the pressman takes hold of the end of the twelve-fold web of cloth and lays it on the lower plate. The plates are then brought together with a pressure of two or three hundred tons. It will be noted that now the whole body of the cloth is tightly pinched, except those parts which come between the depressions in the plates. Communicating with each of these depressions are openings through the upper plate, and channels leading thereto. When the pressure is fully on, a tap is opened, and a stream of bleaching liquid flows along the channels in the upper plate, and finds its way by the aperture to the cloth, through which it passes, and makes its exit by openings in the depressions of the lower plate. To quicken the action of the liquid and cause it to penetrate the exposed parts of the cloth thoroughly, a force pump is employed. As the liquid passes through the cloth it dissolves the connection between the mordant and the coloring matter, and carries off the latter, leaving the parts it has come into contact with purely white. A press attended to by one man is capable of producing 700 handkerchiefs per day. There is no limit to the variety of forms that may be given to the cleared spaces, and many beautiful effects are produced by printing various colors into these. The effect of the adoption of this process of producing bandannas was (it need scarcely be said) to reduce the cost enormously, and consequently bring them into greatly extended use.

The Mikania Guaco as a Remedy for Snake Bite.

In South America, under the name of "guaco," several plants enjoy a considerable reputation as remedies against snake bites. Most of them are species of *Aristolochia*, but one, the *Mikania guaco*, is a composite plant. Notwithstanding this reputation, very little trustworthy evidence has been published as to the real efficacy of any of them, and an attempt made by Dr. Schomburk a few years since to introduce the *Mikania guaco* into South Australia, with a view of clearing up the doubt, does not appear to have led to a definite result. In a letter, however, recently received by the Director of the Royal Gardens at Kew, from Mr. Robert B. White, of La Salada, New Granada, the writer gives his personal testimony as to the value of the remedy, and some other information which, by the courtesy of Mr. Thiselton Dyer, are made available for the readers of this journal.

Mr. White says the *Mikania guaco* is the true "guaco," and forms the basis of all the preparations of the snake bite doctors of the district. There are two varieties, one with green stems, the other, called "morado," with purple, the latter being the most prized. There are several species of snakes in the country whose bite is deemed mortal, some of them killing in a very few hours, but Mr. White, who has lived in the Choco and other snake infested regions many years, testifies that the guaco, properly and promptly administered, is a cure for the bite of the most venomous.

In cases of snake bite, when the guaco leaves can be obtained fresh, an infusion in sugar water is made, in the proportion of one leaf to a large cupful, and this quantity is given hot every hour. It is said to stop the vomiting usually occurring. The leaves are also preserved by bruising and placing them in alcohol, and of the tincture thus formed a teaspoonful is administered every half hour for one hour and a half, and then every hour, and afterward the dose is gradually diminished. Hot poultices of the bruised leaves and stem of the plant are applied to the wound, taking care not to use sufficient heat to drive off the volatile principle of the plant. If there be swelling and pain the limb is fomented with hot water to which some tincture of guaco has been added.

The *Mikania guaco* is described as growing from seed in any good soil where there is a temperature of 24° to 25° C., and would appear to be a plant deserving of physiological and chemical experiments to determine its true character. It is worthy of note that it was at one time said to be the source of condurango.—*Pharmaceutical Journal.*

Oil Lubricants.

The experimental investigations undertaken two years ago by the Boston Manufacturers' Mutual Insurance Company, with a view to the abatement of the losses from fires occasioned through oils, has been attended with much success. Mr. Edward Atkinson, the president, in a recent circular estimates a saving already of $180,000 a year. Much new and useful information has also been gained. He says:

Another result of this work has been the invention of the machine on which we can now ascertain the anti-frictional properties of any oil with absolute certainty, and by the use of which we have obtained measurements of the coefficient of friction with an accuracy and uniformity that have never been approached before. The results of Mr. Woodbury's experiments presented by him at the recent meeting of the American Association for the Advancement of Science have been accepted as a long step in advance of anything ever attained before.

One issue of these experiments may perhaps be to settle some points in respect to the power required or power saved by the use of the different kinds of spindles and bobbins now in use. Our machine having been adjusted in velocity and other conditions to those of a Sawyer spindle operating at 7,600 turns per minute, under a band tension of four pounds, it appeared that the difference in power required to overcome the resistance of the parts varied as follows:

The resistance or power required to operate the frictional machine at 100° Fah., when lubricated with Downer Oil Company 32° extra machinery oil, amounted to 756; and under the same conditions, with the exception of the substitution of neatsfoot oil as a lubricant, the resistance amounted to 2,427, or three and twenty-one hundredths times as much.

In respect to the same oil at different degrees of temperature in the bearing, the resistance at 50° is about 75 per cent in excess of that at 75° Fah.

In respect to the best oil and the poorest lubricant at 100° Fah., the difference is 321 per cent.

In respect to a difference of pressure varying from 1 lb. to 5 lb., the difference is 229 per cent.

By means of experiments applied to a small Sawyer spindle frame, which could not be reduced to such precise accuracy, but which marked the great variations in power, according to the greater or less tension of the bands, other results were reached of the same general character, fully confirming the above conclusions.

The general conclusions reached are, therefore, that although as a matter of course there must be a marked difference in power needed between a well planned and constructed and a badly planned and constructed spinning frame, yet, when it is a question between two well constructed frames, varying only in the weight of the spindles within the ordinary limits of modern practice, or in the length of the spindles and the position of the bearings, or in the solid or open construction of the bobbin, or in the presence or absence of a chamber at the top of the bobbin—the greatest differences in these details do not make as much difference in the power required as may be made in the adjustment and tension of the bands, or in the quality and condition of the oil; and hardly as much as may be made by variations in the temperature and condition of the atmosphere and of the machine, or in the quality and condition of the stock in use. The uniform tension of the band appears to be the factor of the greatest importance, and the structure of the bobbin of the least, provided the spindle is long enough and heavy or stiff enough to keep the bobbin true, and to prevent it from springing under the varying conditions of the atmosphere.

In respect to the best quality of oil to be used on spindles—that is to say, the best oil to be used on light bearings at very high velocity—a few simple rules may now be laid down dogmatically, so far as rules are to be made by experiments on a single machine, or from laboratory experiments:

1. A mineral oil that flashes at less than 300° Fah., does not possess the best qualities for lubrication, and is unsafe in proportion to the lesser degree at which it flashes.

2. A mineral oil that evaporates more than five per cent in ten hours, at a heat of 140° Fah., is hazardous in proportion to the increased percentage of volatile matter, and is also more unfit to be used as a lubricant the more rapidly it evaporates; because the remainder will either become thick and viscous, requiring a high heat in the bearing to make it operate at all, or else, if the oil does not contain such a residuum liable to become thick and heavy, it will leave the bearing dry.

3. All the mineral oils—and also sperm, lard, and neatsfoot oils—appear to reach a nearly uniform coefficient of friction at very greatly different degrees of heat in the bearings. Several kinds of the best mineral oils, and sperm and lard oils, show a uniform coefficient of friction at the following degrees of heat:

Temperature at which the coefficient of friction is the same.

Downer Oil Co., 32° Machinery (an exceedingly fluid oil)	76° F.
" " Light Spindle	105° F.
" " Heavy Spindle	125° F.
Various samples of Sperms	96 to 114° F.
Leonard & Ellis Valvoline Spindle	127° F.
" " White Valvoline Spindle	122° F.
" " White Loom	111° F.
Olney Bros. German Spindle	112° F.
" " A Spindle	107° F.
Neatsfoot	170° F.
Lard Oil	180° F.

4. Lubrication seems to be effective in inverse ratio to viscosity—that is, the most fluid oil that will stay in its place is the best to use. Lard oil heated to 130° lubricates as well as sperm at 70°, or the best mineral oil at 50°. But of course it is a great waste of machinery to work oil of any kind up to an excessive heat; and there must be the least wear in the use of oil that shows the least coefficient of friction at the lowest degree of heat.

5. The quantity of oil used is a matter of much less importance than the quality. The mill that saves gallons of oil at the cost of tons of coal, or dollars of repairs, plays a losing game. Mr. Waite's experiments on very heavy bearings at Manchester go far to prove that a considerable quantity of thin, fine oil keeps the bearing much cooler, and requires less power, than a smaller quantity of thick, viscous oil. Here let it be observed, that a superstition that prevails in favor of using castor oil to cool a hot bearing, is without any warrant. No vegetable oil is fit to use as a lubricant; and castor oil is the worst of all, because the most viscous. If used, it will surely set the mill on fire, as it did in the only case of which we have a record.

6. The rule of best lubrication is to use an oil that has the greatest adhesiveness to metal surfaces, and the least adherence as to its own particles. Fine mineral oils stand first in this respect, sperm second, neatsfoot third, lard fourth.

7. Cast iron holds oil better than any other metal or any alloy, and is the best metal to use for light bearings, perhaps for heavy.

8. It has been proved by Mr. Waite's experiments that a highly polished bearing is more liable to friction than a surface finely lined by filling. The lines left by the file serve as reservoirs for the oil, while the high polish leaves no room for the particles between the metal surfaces.

So far as laboratory experiments may serve as a guide in practice, it therefore appears that fine mineral oils may be made to serve all the purposes of a cotton mill, and such is the practice in some of the mills that show the very best results in point of economy.

Next, that the best animal oil to mix with a fine mineral oil, in order to give it more body, is sperm oil; this, again accords with the practice of many of the mills in which the greatest economy is attained.

Lard and neatsfoot oil are used to give body to mineral oil in some of the best mills; but the results of our work seem not to warrant this practice, unless there is some peculiarity in the machinery that makes it more difficult to keep a less viscous or tenacious oil on the bearings.

All the mixed oils sold under fancy names we believe must of necessity consist of certain proportions of the oils heretofore named, as none of the vegetable or fish oils are fit to be used, and there are no other animal oils that can be had in any quantity.

It appears that all varieties of mineral oils are or have been used in print cloth mills, and are all removed in the process of bleaching, as practiced in print works.

All mineral oils stain more or less, and give more or less difficulty to the bleacher when dropped upon thick cloth, or cloth of a close texture. On this point we have been able to establish no positive rule; but as very many kinds are and have been used in mills working on such cloths and are removed, we are inclined to the belief that this question is not of as great importance as it has been assumed to be.

Getting Rich at the Rate of $2,300,000 a Day.

That the people of this country are relatively well off, notwithstanding their expensive ways of living, is pretty well known. Just how rich we are, and whether we are rapidly growing richer, or merely holding our own, probably few can tell. Mr. T. M. Coan has been looking up the statistics of these matters at home and abroad, and offers the following figures in *Harper's Magazine*. In answer to the question, Where do we stand as to total valuation of the national wealth? he replies:

We stand near the head of the list—third on the list of all the Western nations. The United Kingdom of Great Britain and Ireland heads the list with a capital valuation of $44,400,000,000; then comes France with $36,700,000,000; the United States with $32,000,000,000; Germany with $23,000,000,000; Russia with $15,000,000,000 and the Low Countries with $11,150,000,000 of capital collectively. These are the valuations made by those countries of their entire resources. What is the average annual income per inhabitant in various countries? We come to the front in this comparison. The average annual income in the United Kingdom is $165; in the United States, $165 also; in the Low Countries, $130; in France, $125; in the British Colonies, $90; in Germany, and also in Scandinavia, $85. In this reckoning Russia, with her ninety millions of people, is out of sight as yet; she will not be very long.

On the score of annual accumulation our case is even better, relatively far better. The annual accumulation of wealth in Germany is $200,000,000; it is $325,000,000 in the United Kingdom; $375,000,000 in France, in the United States it is $825,000,000! Our increase of national wealth since 1850, says a good English authority, would be enough to purchase "the whole German Empire, with its farms, cities, banks, shipping, manufactures, etc. The annual accumulation has been $825,000,000, and therefore each decade adds more to the wealth of the United States than the capital value of Italy or Spain. Every day that the sun rises upon the American people it sees an addition of $2,300,000 to the wealth of the Republic."

MISCELLANEOUS INVENTIONS.

An improved bob sleigh has been patented by Mr. Charles R. Walkley, of Churubusco, Ind. This invention consists in a novel construction of the knee, and the arrangement thereof with relation to the runner and the bolster, and of the runner with relation to the knee and to the draught bar, whereby provision is made for enabling the runners of each pair to move independently.

An improvement in underground telegraph lines has been patented by Mr. Stephen D. Field, of New York city. The object of this invention is to prevent the accumulation of and to remove moisture from underground tubes containing telegraph wires, and thereby insure the insulation of the wires. The invention consists in the combination, with a system of underground tubes, of mechanical means for maintaining a circulation of dry air and drying or condensing chambers for relieving the air of moisture.

An improved boat plug which is simple, self-acting, and reliable, has been patented by Mr. Lewis H. Raymond, of New York city. The invention consists of a plate attached to the bottom of the boat over an aperture, and provided with a perforated neck having an external thread to receive a cap on the upper side, and with a hinged valve on the bottom side, this valve being protected by a suitable cage.

An improved baker's oven has been patented by Mr. George Brake, of Lansing, Mich. This invention is an improvement on the baker's oven for which Letters Patent No. 215,088 were granted to the same inventor May 6, 1879.

Mr. James Lidstone, of Farmington, Me., has patented an improved steam cooker for cooking meats, vegetables, etc. The novelty consists in the arrangement of parts whereby the steam and odors of the cooking food are conducted from the several compartments of the cooker into the fire space below, and thereby prevented from escaping into the room.

An improved apparatus for balancing or adjusting the running millstone upon its spindle has been patented by Mr. James Comerford, of Rathdrum, Ireland. This improved balance consists of a ring fixed in the eye of the stone by three or more radial set screws, and connected to the universal joint or other bearing on the cock head of the spindle, the ring being sufficiently smaller than the eye to admit of the stone being shifted by means of the set screws in any direction radial to the spindle, with which the ring remains concentric. The stone is supported on the ring by an inwardly projecting flange or lugs on a lining or a set of legs fixed in the eye and rising through it (more or less) toward the back of the stone, it being generally preferred that the ring should be high up in the eye, so that the bearing on the spindle may be at or above the center of gravity of the stone, although it is not limited to this position.

Mr. George Oliver, of London, England, has patented improvements in the apparatus for use in gymnastic or theatrical performances for which two applications for Letters Patent in the United States were filed by the same inventor on the 19th day of June, 1880; the invention consists in the combination, with the springs and the wire by which the performer is raised, of a drum and brake interposed between the springs and the wire for the purpose of taking up the slack of the wire after the performer has received an upward impetus from the springs, and of retaining the performer at any height to which he may be raised and checking his descent.

An improved self-inking stamp, which is simple, convenient, and effective, has been patented by Mr. Louis K. Scotford, of Kansas City, Mo. The invention consists in a self-inking hand stamp mechanism by which the die is pressed against the ink pad when the handle is raised, and is oscillated by depressing the handle.

Mr. James V. Pomeroy, of Boulder, Col., has patented a process of amalgamating ores containing gold and silver, which consists in introducing chlorine gas or chloride of lime with an acid into the pulverized ore with the mercury.

An improved eyeglass has been patented by Mr. Gideon C. Hilpert, of Hill, N. H. The object of this invention is to provide eyeglasses that are adjustable upon the nose in a straight horizontal line instead of with the rolling motion common in other eyeglasses. The improvement consists in lenses connected with each other by means of a straight rod, and adjustable with respect to each other by means of a spiral spring encircling the rod.

An improved can opener, so constructed that it can be readily adjusted to cut larger or smaller openings as required, has been patented by Messrs. George A. Snow and Franklin L. Coe, of New York city.

A wrench especially adapted to the unscrewing of bolts and nuts where but little room is given for the movement of the wrench handle, has been patented by Mr. Leslie P. Hiatt, of Peru, Iowa.

A device for preventing the lateral vibration of a circular saw while running, has been patented by Mr. Clarence A. Sherman, of Plover, Wis. The invention consists of a pair of laterally adjustable guide arms and guides fixed on an adjustable bar that passes laterally through a centrally mortised sliding block, which together with its attachments are held in place by means of a cam-operated bar.

Mr. Jacob R. Scott, of Nyack, N. Y., has patented a machine for sewing boots and shoes that will meet the peculiar requirements of that class of work without complicated mechanism; and the invention consists, specially, in the mechanism for tightening the stitch, whereby the layers of leather are tightly drawn together, and also in the looping mechanism for forming the stitch.

An improved lathe tool has been patented by Mr. Joseph V. Hoffman, of Raritan, N. J. The object of this invention is to prevent the springing of the work and the chattering of the cutting tool when a shaft or other piece of work is being turned, faced off, or centered in a lathe.

Messrs. Stephen H. French and William J. Maltby, of Belle Plain, Texas, have patented a vehicle wheel whose spokes may be adjusted radially outward, and also forced tightly together around the axle box to compensate for shrinkage.

An improvement in the class of wardrobe bedsteads has been patented by Mr. Ernest N. Doring, of New York city. It consists in the construction of the stationary and folding parts which adapt them to close together and in the means for connecting and balancing the folding part.

James C. Watson.

James C. Watson, Professor of Astronomy in the Wisconsin State University and Director of the Washburn Observatory, died at Madison, Wisconsin, November 23. For a week or more Professor Watson had been suffering from a severe cold contracted while superintending the construction of a large addition to the observatory and a new solar observatory which he was constructing at his own cost. He was better the day before his death, and unwisely exposed himself to chill, which in his exhausted condition he was unable to withstand.

Professor Watson was born, in 1838, at Elgin, Canada, of American parentage; and when he was still a child his parents returned to the United States, settling in Ann Arbor, Mich. At the age of fifteen he entered the State University at that place, and took his first degree at the age of nineteen. Two years later he was elected Professor of Astronomy and Instructor in Mathematics in the university where he had studied, and rapidly rose to eminence as an original discoverer and contributor to scientific periodicals.

In the course of his connection with the university he added twenty-three planets to the list of those already known, besides the more important discovery of the planet Vulcan. For these contributions to the world's knowledge he received, in the year 1870, the award of the gold medal of the French Academy of Sciences; was made member of the National Academy of Sciences in 1867; the American Philosophical Society in 1877; of the Royal Academy of Sciences, of Italy, in 1870; and in 1875 Knight Commander of the Imperial Order of the Medjidich, of Turkey and Egypt. The University of Leipsic in 1870, and Yale College in 1871, conferred upon him the degree of Ph.D.; and Columbia College, in 1877, the degree of LL.D. He was also appointed Judge of Awards at the International Exhibition of 1876.

Professor Watson was also repeatedly called upon to take charge of government expeditions for astronomical observation. In this capacity he went to Mount Pleasant, Iowa, in 1860, to observe an eclipse of the sun; to Carlentini, Sicily, in 1870, for a like purpose; to Pekin, China, in 1874, to observe the transit of Venus; and to Wyoming Territory, in July, 1878, where, during the solar eclipse, he discovered the planet Vulcan, and satisfied himself of the existence of another unknown planet of lesser magnitude.

In 1879 Professor Watson left Ann Arbor to take charge of the new observatory of the Wisconsin State University at Madison. The private solar observatory which he was building at the time of his death, was on a plan suggested long ago by Bacon, but never tried. A cellar twenty feet deep had been sunk below the surface of the ground at the bottom of the first hill slope, in front of the entrance of Washburn Observatory. Over this a fine stone building was being erected at the top of the hill, which is about sixty feet above the bottom of the cellar. Powerful reflectors were to have been placed to throw rays of light down a long tube which ends in the cellar, where the observer would be stationed.

Professor Watson believed that in this way better observations of the sun could be taken than ever heretofore obtained. All these projects and plans for the future are, however, brought to their end by his untimely death.

Among his best known publications are a "Popular Treatise on Comets," published in 1860; "Theoretical Astronomy," 1868; "Report on Horological Instruments," 1878; and "Tables for the Calculation of Simple and Compound Interest and Discount," 1878. Since 1872 he has been president of the Ann Arbor Printing and Publishing Company, and for several years has been actuary of the Michigan Mutual Life Insurance Company.

Extension of Telephonic Facilities.

The American District Telegraph Company, in this city, have recently placed in a number of their offices telephones for public use. By means of this extension of facilities parties who wish to talk with subscribers of telephone exchanges in New York City, Brooklyn, Jersey City, Newark, Paterson, Elizabeth, Orange, Yonkers, and Coney Island, can do so under certain restrictions for five minutes, on paying a fee ranging from twenty to forty-five cents, according to distance. The next improvement will be the establishment of telephone stations, through which conversation may be had by appointment with non-subscribers.

Thomas S. Hall.

Mr. Thomas S. Hall, inventor of the automatic electric railway signals bearing his name, and in use on many of the railways of this country, died at Hartford, Conn., Dec. 1, at the age of 52 years. Mr. Hall was a man of great force and persistence, and his inventions have done much to diminish the hazards of railway travel.

The St. Gothard Tunnel.

The Geneva correspondent of the London *Times* writes, under date November 3: "The 94th monthly report of the St. Gothard Railway Company, which has just been presented to the Federal Council, bringing the history of the undertaking to September 30, contains details which, in view of its approaching completion, are more than ordinarily interesting. As for the great tunnel, the enlargement of the upper part is complete over a length of 14,872 meters. There remain now only 40 meters to be enlarged. The excavation is finished and continuous for a distance of 9,530 meters. The completed masonry of the roof measures 13,057 meters; of the west side, 9,830; and of the east side, 9,891; and the length of tunnel entirely finished, with aqueducts, rails, and niches, is reckoned at 9,300 meters, about two-thirds of the whole. The average number of men employed inside the tunnel during the month of September was 3,031. The total outlay on the tunnel to the date in question was estimated at 49,853,545f. The mean maximum temperature of the tunnel was 87° Fah., the mean minimum 85°. The average daily consumption of dynamite was 235 kilogrammes, of oil 578. Good progress is being made with the lines of approach. Between Immensee and Lugano there are five stretches which, taken one with another, are completed, as touching excavations and embankments, in the proportion of 72 to the 100; as touching masonry and rail laying, 67 to the 100. The average monthly rate of progress is about 6 per cent. Of the forty-nine smaller tunnels, thirty-four are pierced and several quite finished. The outlay on the lines of approach to September 30 reached a total of 32,781,000f. The average number of workmen employed in the making of these lines is 13,420. It results from the foregoing particulars that, should no unforeseen delays occur, the St. Gothard line in its entire length can hardly fail to be ready for traffic in the first half of next year. Meanwhile, the differences between the company and the contractors for the great tunnel are being fought out before the Federal Tribunal. The contractors, while expressing their intention to have the tunnel completely finished by the end of April next, contend that, but for the company's sins of omission and commission, it would have been finished 780 days before that time. For this loss of time they claim heavy compensation. The company, on the other hand, disclaim all responsibility for the delays in question, and demand the enforcement of the penalty stipulated in the contract—£200 for every day beyond October 1, 1880, by which the completion of the undertaking is protracted."

Rain Not Produced by Cannonading.

To the Editor of the Scientific American:

Your issue for November 27 has a notice of an invention for causing rain, with a satisfactory engraving of the inventor bringing down a heavy shower simultaneously with the explosion of his patent dynamite balloon. The inventor assumes that it is "well known" that cannonading is always followed by rain.

Now I don't know how that comes to be so "well known" by people who never witnessed the effects of heavy cannonading, and I think it is time that they should know that it is not the case. It may rain after a heavy cannonade, or may not, or may rain just before the cannonade. The cannonade has no effect whatever. The cannon explosions in a battle exceed the explosion in the inventor's patent balloon twenty thousand times or more, and if the former does not cause rain, the patent balloon will not do it.

I was at the battle of Shiloh, which lasted two days, April 6 and 7, 1862. The cannonade was as rapid as the strokes a man could give a base drum with two drum sticks, and it was continuous, to say nothing of the musketry fire, which was not a roll or rattle at all, but a continuous, even roar. What was the effect on the weather? It rained before the action opened, and rained all the first day and night. The second day of the battle was clear and sunny, and so were several succeeding days.

The battle of Corinth was fought in a dry, hot spell, October 3 and 4, 1862. There had been no rain for two weeks. This was a good chance to test the thing. The cannonading was heavier than at Shiloh, and lasted for ten hours. It was a perfect hell on earth. No rain followed the battle. The dry hot weather continued for two weeks more.

The two battles of Lookout Mountain, November 24, 1863, and Missionary Ridge, November 25, which followed each other, were not followed by rain. The night after Missionary Ridge was one of the clearest and loveliest moonlight nights I ever saw. The next week was also clear, except a very light shower the second day after. Very few of the battles of the Atlanta campaign were followed by rain, and in such as were, it would have come anyhow. If there is a popular delusion that heavy cannonades cause rain, it might as well be dispelled, as experience shows there is not the slightest foundation for the notion.

Cincinnati, Nov. 22, 1880. ANDREW VAN BIBBER.

Sewing Machine Motors.

That there is a large field for a good practical sewing machine motor cannot be denied; but, like perpetual motion, many have tried the "perplexed thing," but failed. A motor, to be practical and popular, must be a part and parcel of the sewing machine—not a heavy, cumbersome contrivance that costs more, and occupying more space, than the sewing machine itself. How it is to be accomplished must be left to the inventive genius of the country, which in time may solve the question. Of course these remarks refer to motors for family use. For factories and workshops, water and steam solve the question.

So far the best motor for sewing machines is the common treadle. Such devices as those which imprison one hand in their operation are useless—as far as practicability and usefulness are concerned. A person might as well have but one arm, as it leaves but one hand to direct the work. Whenever a sewing machine motor is invented that will do the ordinary work of a family, without the aid of steam, water, or electricity, and run a reasonable length of time without replenishing the power exhausted, a step will have been made toward solving this question. But, where more power is expended in storing up what is wanted for use than it takes to operate the machine for a given period of time, such devices are worse than useless—they are time lost. We expect, yet, to see this problem solved.—*The Sewing Machine Journal.*

A Fossil Human Skull.

Dr. T. G. Horn, of Colorado Springs, Colorado, favors us with a photograph of "a petrified human skull," picked up near Gothic, Gunnison County, Colorado. The doctor says that the skull has been examined by quite a number of the medical profession, and all pronounce it the greatest curiosity ever discovered. Every bone, suture, and outline is perfect. As shown in the photograph the posterior half of the skull seems to justify the description; the forepart is less clearly exhibited. The jaw is gone, and a mass of stone resembling a hot spring deposit obscures the facial outline.

No account is furnished with regard to the conditions under which the skull was found, so that no estimate can be made of its probable age. If found in connection with hot spring deposit, it might easily be quite modern. On the other hand, it may be the skull of an "original settler," ancient enough to have used the implements found in the inter-glacial or pre-glacial gold gravels.

A NOVEL STEAM CARRIAGE.

A great many steam wagons and carriages have been devised and built for transporting loads on our ordinary highways without tracks, but although some of the devices were masterpieces of ingenuity, the practical results obtained were never perfectly satisfactory. Walter Hancock, the most persistent of inventors and constructors in this line, built a steam phaeton in 1838, and obtained a maximum speed of 20 miles and an ordinary speed of 10 miles per hour. Within the last few years the interest in steam wagons has been renewed, and some very successful experiments have been made with them, the trip by M. Schmid, M.E., who traveled from Zurich to Paris, in 1878, on a self-propelling steam fire engine of his construction, being an example. A steam carriage, invented and built by the French engineer Bollé, of Le Mans, and exhibited at the Paris Exhibition of 1878, was an object of more than ordinary interest. Its speed was said to surpass that of any ordinary vehicle drawn by horses. The inventor named his carriage "La Manselle," in honor of his native city Le Mans.

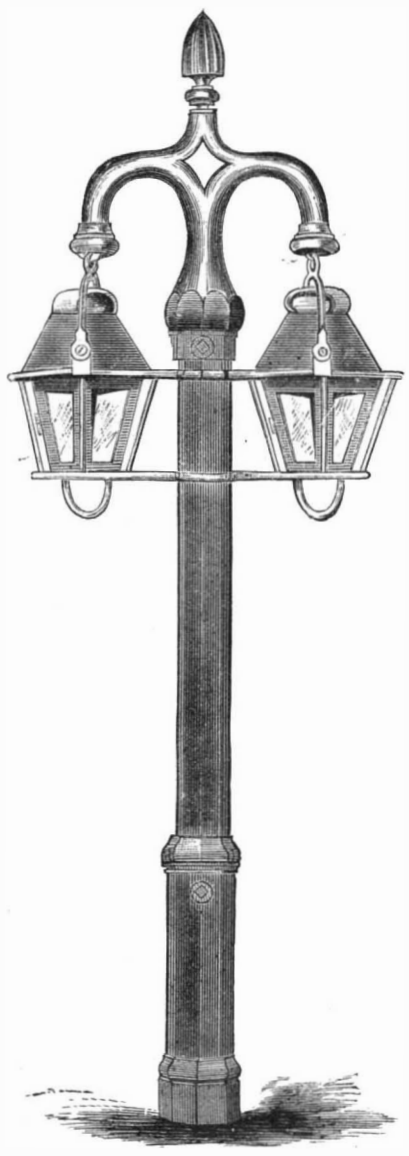
This carriage is shown in the annexed cut, taken from the *Leipziger Illustrirte Zeitung*. The casing in the front part of the carriage contains the driving engine, which is controlled by the engineer seated above it, who also operates the steering gear and the powerful brake levers. The rear axle is driven by spur wheels and chains. The boiler is placed above the rear axle, the coal bins are at each side of the boiler, and the water truck is below the seat of the engineer. Experimental trips have been made with one of these carriages on the road from Berlin to Charlottenburg. The average speed attained, according to the above authority, was 18 miles per hour, but a maximus of 22 miles per hour was reached. Coke was used as fuel, which produced but very little smoke, about 8½ to 10 pounds being consumed per hour. The carriage rounded the curves in an excellent manner, and the entire experiment proved most satisfactory.

TRIAL TRIP OF THE NEW STEAM CARRIAGE AT BERLIN.

BURTON'S IMPROVED STREET LAMP.

The engraving shows a lamp for lighting streets, parks, and other places where gas lamps are not used. It is a novel arrangement, and has the advantage of simplicity and cheapness.

Projecting from an opening in the cap there are one or more downward curving hollow arms, carrying a series of chains; these chains extend into the base, where their inner



BURTON'S IMPROVED STREET LAMP.

ends are attached to a weight or counterbalance, their outer ends being secured to the sliding lamp frame. There is a pin or bolt threaded to work in a nut at the top of the base; its inner end is shaped to fit a groove in the weight, and forms a key or stop to secure the lamps at any desired elevation. When the key bolt is withdrawn the lamps may be readily raised or lowered by sliding the frame on the post, the chains running freely through the arms, and the weight rising and falling in the body of the post. The weight need not necessarily be made fast by the key or bolt, as the weight counterbalances the lamps so that they will remain in any desired position.

The post is made of cast iron, in two parts, firmly united by a set screw at the top. The weight weighs 20 pounds, and is secured to the bail of the cage by a three-quarter inch chain. The sliding frame is of cast iron, of sufficient strength to hold and guide the lamp along the body of the post. The lamp is well made of the best material, and may be adapted to either kerosene or gasoline.

With this post the inconvenience of carrying a ladder is avoided, and there is no danger of dropping the chimney or spilling of oil. After the lamps are once filled, a small crooked handle, which is furnished with each post, is all that is required to equip the lamp-lighter for his evening journey to light the streets for one month. All that is required is to draw the lamp down, trim, and light it; a slight push upward replaces it, when it remains in the proper position.

This lamp has been manufactured and sold extensively for the past two years, and we are informed that it is meeting with great favor in the New England States. It has been patented in the United States and in Canada. It was awarded a silver medal at New England Fair, 1878. For cities, towns, surburban villages, and private use, and for other purposes where outdoor lighting is required, it fills a great want.

Further information may be obtained by addressing the inventor, Mr. Geo. D. Burton, New Ipswich, N. H.

ENGINEERING INVENTIONS.

Mr. William H. Weeks, of Dartmouth, Nova Scotia, Canada, has patented a device for the safe and economical burning of liquid hydrocarbons under boilers, evaporators, etc., whereby the combustion is made perfect and the control over the flame absolute.

Mr. Orlando S. Emerson, of Elkhart, Ind., has patented improvements in steam valves. These improvements relate to puppet valves which have heretofore been constructed with an adjustable lip, fitted for movement by a screw ring to adjust the lip, and held in place by screw pins entering notches in the ring. In such valves the screw pins become loose or are jarred off, so that the adjustment is unreliable, The object of this invention is to avoid these difficulties. The invention consists in a spring pin used in place of a screw for retaining the adjustable lip in place.

An improved egg beater has been patented by Mr. George A. Schmidt, of New York city. The object of this invention is to provide an effective and durable device designed especially for use by confectioners, bakers, hotels, etc., when a large number of eggs are to be beaten at a time.

A machine for grinding mower and reaper knives has been patented by Mr. Charles Askew, of Madison, Wis. The invention consists in a novel rest and carrier for the sickle bar and combination and arrangement thereof with relation to the grindstone, whereby provision is made for adjusting the sickle bar to the grinding surface.

Messrs. Leonard A. Cooper and Oliver F. Bostwick, of Atchison, Kan., have patented a combined listing plow and seed planter, so constructed as to open the ridge or clear a space for the row of hills, open a furrow to receive the seed, drop the seed, cover the seed, and roll down the soil. It is simple and readily adjusted and controlled.

An improved injector and condenser has been patented by Mr. Gaspare Mazza, of Turin, Italy. The invention consists in combining a boiler pipe, cones, and connected eccentrics having different throws with a feed water pipe and a steam inlet pipe having a cock.

An improved steam engine governor has been patented by Mr. Walter E. Crane, of Alma City, Minn. The object of this invention is to dispense with all devices depending on centrifugal action or the force of gravity for their operation in the regulation of the speed of steam engines or other motors. The invention consists in a governor wherein the straight line movement for regulation of speed is obtained by the variations in speed between mechanism operated by the engine and mechanism moved by a separate motor at a regulated speed.

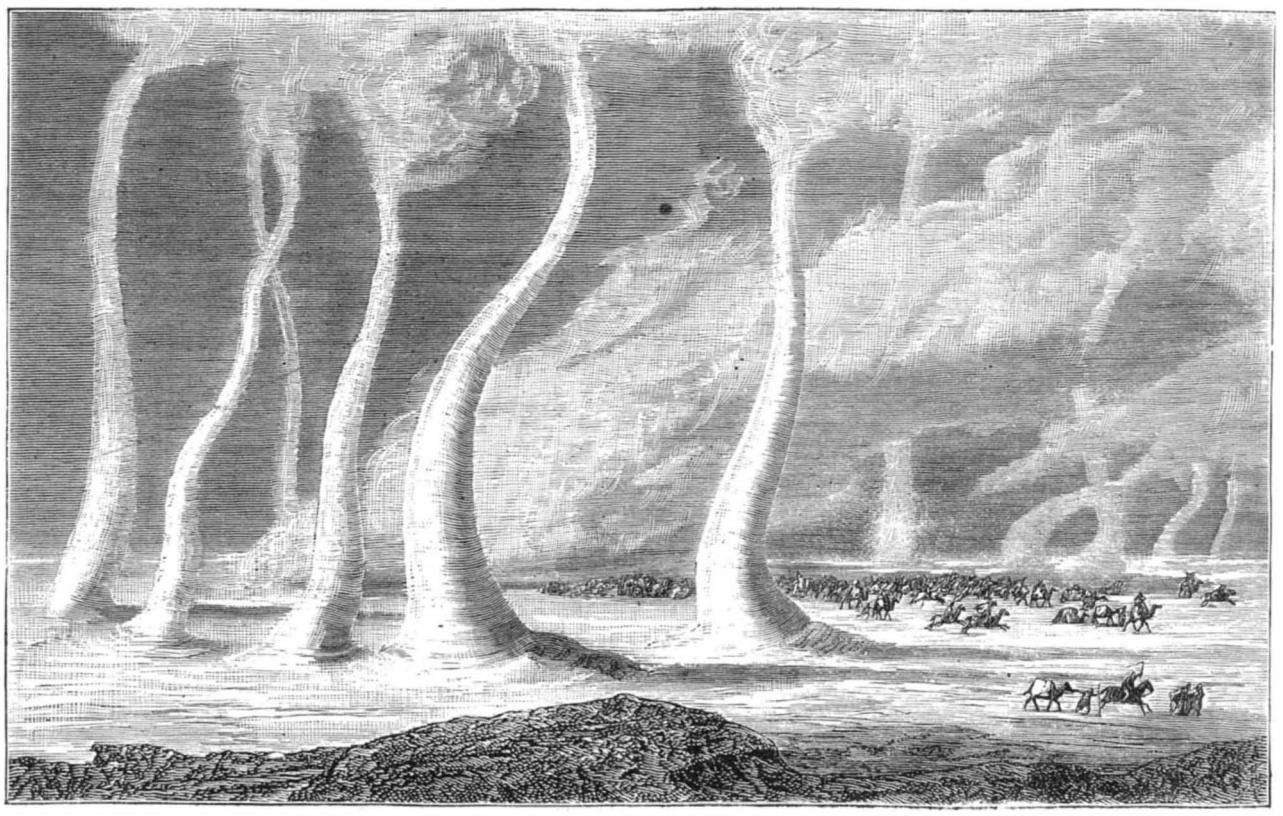
Mr. Alexander C. Lewis, of Fayetteville, Ark., has patented an improved rotary engine of the class in which a rotary valve is employed. The novelty consists in a combination of parts which cannot be clearly described without engravings.

SAND AND WATER SPOUTS.

It is a well known fact that all atmospheric changes, winds, thunder storms, tornadoes, etc., originate in changes of temperature; and sand and water spouts are also due to the same cause.

The annexed engravings, showing sand and water spouts, are taken from "Die Erde und ihr organisches Leben. Dr. Klein und Dr. Thomé. Stuttgart: Spemann."

Sand and water spouts are formed when the air rises upward and assumes a rotative movement. It then draws upward the bodies or liquids over which it rises, and moves forward, retaining its longitudinal axis. In many cases these spouts occur during thunder or showers, then clouds and rain descend to unite with the upward moving spouts, as is shown in the representation of the water spout. The mariner can in most cases avoid the water spouts, but the sand spout destroys everything in its path, uprooting the largest trees, demolishing strong buildings, carrying the *débris* upward and distributing it over large areas. As these spouts always appear simultaneously with thunderstorms, they have been attributed to the action of electricity. But as whirlwinds are often produced, for instance above fires or on a small scale at almost every corner on a windy day, without the co-operation of electricity, it will be safe to say that electricity is generated by the action of the whirling and rising air.



SAND SPOUT.

Dr. Th. Reye has shown, by careful calculations, that an unstable equilibrium necessary to the formation of spouts or whirlwinds exists only when the decrease in temperature is 3·42° C. (6·16° F.) for every 325 feet of vertical distance. In this case the ascending column of air being considerably lighter than the air into which it passes, the air ascends with great rapidity.

If the ascending air passes into a layer of air that is so cold as to condense its moisture, the heat will be liberated, and that will expand the ascending air. The unstable equilibrium also causes the upper layers of air to sink into the lower layers; in this case descending spouts are produced.

Generally the air that enters into the column of rarefied air from the side produces the rotative movement. The condensation of the vapors produces rain, and a sudden contact with cold air may produce snow or hail, all accompanying the spouts.

In the engravings the spouts are grouped rather closely in order to show the various forms to the greatest advantage. The spouts, as a rule, do not approach each other nearer than half a mile.

Measurement of Railways.

Measurements for mile posts have been made recently on the New York, Pennsylvania, and Ohio Railroad over its whole line in a somewhat novel way, says the *Railroad Gazette*. A velocipede hand car, with a four foot wheel, was fitted with a revolution counter, and after determining carefully the number of revolutions per mile, the distances were rolled off by running it over the track. There was found to be a slight irregularity in the measurement, owing to the play and coning of the wheels, but the error was far within the limits of ordinary careful chaining and very much more rapid as well. Thirty-five to forty miles per day were made without much difficulty under the interruption of a heavy traffic, setting a stake every quarter mile—the quarter-mile points being marked with a small stone for convenience of employes It was judged from the result that a still better way, especially if stakes were to be set only at every mile or half mile, would be to put the counter on an engine. As six miles an hour was made with the hand car, setting stakes every quarter mile, there should be no difficulty in making ten or fifteen miles with a locomotive, which might thus be able to make an ordinary freight run, without too many "lay outs." This very method, by the way, was used, we believe, by the government inspectors on the Pacific railroads, or some of them, to measure off the length of their subsidy bills, and certainly it is vastly more accurate than the chaining which preceded them, or, in fact, any but the most careful and accurate measurements with corrections for temperature. Measuring wheels for ordinary surveying purposes, working on the same principle as the above, have long been in use.

RECENT INVENTIONS.

An improved device, whereby the wind wheel may be thrown from a vertical to a horizontal position, has been patented by Mr. Adam W. Haag, of Fleetwood, Pa. The invention consists in journaling the horizontal axle of the wheel in a box that swings on trunnions and is adjustable in a vertical plane.

An improvement in that class of devices that are designed for releasing a horse instantly from the vehicle to which he may be attached, has been patented by Mr. Whitefoord S. Martin, of Maybinton, S. C. An iron rod is attached to each end of the whiffletree and extends forward a short distance alongside the shafts or thills. The short leather traces are attached to the front ends of these rods by means of keys or eyebolts, which may be withdrawn, for the purpose of releasing the horse from the vehicle, by means of cords or straps that pass through a ring on the crupper or back strap of the harness, and extend back over the dasher of the vehicle, so as to be easily accessible to the driver.

A billiard table cushion of improved shape has been patented by Mr. Samuel May, of Toronto, Canada. The invention consists of a rubber billiard table cushion having a broad steel ribbon embedded in the rubber and running longitudinally through the entire length of the cushion, and extending from a socket in hard rubber at the bottom of the cushion upward in the elastic rubber to a point above where the ball comes in contact with the cushion.

A simple and durable device, by means of which the rain water flowing through the rain water conductors to the cistern may be cut off and made to flow in another direction when the cistern is full, has been patented by Mr. John Straszer, of Manchester, Mo.

Mr. Jean M. Berger, of St. Etienne, France, has patented improvements in magazine fire-arms of that class in which the magazine is in the nature of a supplemental cylinder or barrel just beneath the firing barrel, and from which the cartridges are projected as fast as they are used up by the expansion of a spiral spring within, having a cartridge pusher on its end.

A device to be attached to a vehicle for the purpose of equalizing the draught of three or four horses, has been patented by Mr. Herman E. Schmidt, of Rapidan, Minn. The invention consists of several bars or levers for carrying the double and single trees, arranged upon the tongue or pole of the vehicle in such a manner that the draught or pull of one horse on the long arm of the main lever will equalize the draught of two or three horses at the short arm.

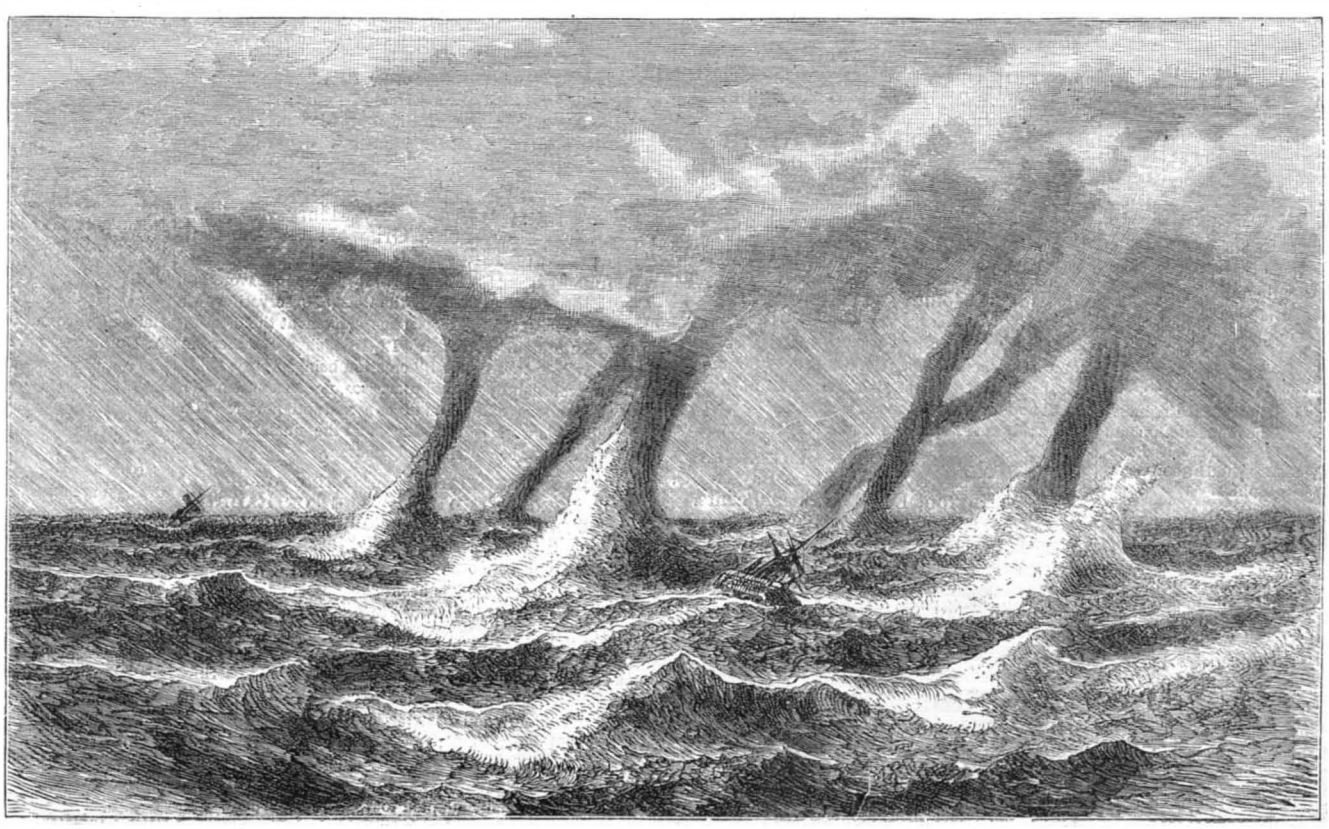
Mr. William J. Dawson, of Lawrence, Kansas, has patented an improvement in the front running gear of wagons which permits of the independent lateral oscillation of the body.

Messrs. Jules Schmerber and Charles Schmerber, of Paterson, N. J., have patented a process for obtaining a plastic compound by the treatment of the nitro-derivatives of cellulose, dextrine, and glucose mixed with gums, balsams, or pigments, which consists in first treating the material while in a wet state with a liquid solvent, then reducing the product to a semi-liquid form by heat, then grinding and mixing the semi-liquid mass, and finally drying the compound to a plastic consistency.

Mr. Claude Varlot, of Grenoble, France, has patented an improved lacing staple which can be firmly attached to the leather or other material, and permits of lacing without passing the lace or string through apertures in the article to be laced.

Mr. Heinrich Baum, of Höchst-on-the-Main, Germany, has patented a red coloring matter, formed by subjecting the diazo compound derived from amidoazo-benzole to the action of disulphobetanaphtholic acid.

An improved fire-escape which is simple, safe, and reliable, and does not deface the building to which it is attached, has been patented by Mr. Felice Tocci, of New York.



WATER SPOUT.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

Wanted—Superintendent for six thousand spindle cotton yarn mill. State salary and references Rosalie Yarn Mills Natchez Miss.

Astronomical Telescopes, first quality & low prices, Eye Pieces, Micrometers, etc. W. T. Gregg, 75 Fulton St., N.Y.

Hotchkiss' Mechanical Boiler Cleaner, 84 John St., N Y. will keep your boiler free from all sediment or mud · prevents scale; no cost save first. Engineers make 10 per cent selling other parties than employers. Circular on application.

Notice.—Alden Crushers & Pulverizers manufactured & sold only by patentee. Farrelly Alden, Pittsburg, Pa.

Use Vacuum Oil Co.'s Cylinder Oil, Rochester, N. Y.

Samples of Asbestos Liquid Paints, Roofing, Roof Paints, Steam Pipe and Boiler Coverings, Steam Packing, etc., will be sent free on application to the H. W. Johns M'f'g Co., 87 Maiden Lane, New York, sole manufacturers of genuine Asbestos materials.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.

A perfect Mowing Machine is an absolute necessity to a farmer. The best made is the Eureka. It has the lightest draught, and will cut at least one-third more grass per hour than any other mower. Simple in construction and durable. Prices reasonable Send for illustrated catalogue to Eureka Mower Co., Towanda, Pa

Wren's Patent Grate Bar. See adv. page 397.

Exporters of Machinery for Plantations. Sugar Machinery. Coffee Huller and Cleaners Information and estimates on all classes of American machinery and patented devices. Agricultural Implements and Hardware Jos. H. Adams & Son., 283 Pearl St., New York.

Stereopticon for Sale. See adv. last page.

Steam Cylinders bored from 3 to 110 inches. L. B. Flanders Machine Works, Philadelphia, Pa.

For Sale.—A Berryman Patent Heater, very little used · cost $200: will sell for $50, f. o. b. Davis & Watts. Baltimore, Md.

Every Machinist and Manufacturer in the country should send to G. B. Grant, Boston, for his list of gears.

Wanted—To hear from an Engine and Mach'y Manuf. Co. to whom the services of an energetic young man, with experience and some capital, would be an object. J. B. R., Box 773, New York.

Improved Speed Indicator Accurate, reliable, and of a convenient size Sent by mail on receipt of $1.50. E. H. Gilman, 21 Doane St., Boston, Mass.

The Mackinnon Pen or Fluid Pencil. The commercial pen of the age The only successful reservoir pen in the market. The only pen in the world with a diamond circle around the point. The only reservoir pen supplied with a gravitating valve; others substitute a spring, which soon gets out of order. The only pen accompanied by a written guarantee from the manufacturers. The only pen that will stand the test of time. A history of the Mackinnon Pen; its uses, prices, etc., free. Mackinnon Pen Co 200 Broadway, New York.

Fragrant Vanity Fair Tobacco and Cigarettes. 7 First Prize Medals—Vienna, 1873 · Philadelphia, 1876; Paris, 1878 · Sydney, 1879—awarded Wm S. Kimball & Co., Rochester, N. Y.

Superior Malleable Castings at moderate rates of Richard P Pim Wilmington, Del.

Wood Working Machinery of Improved Design and Workmanship. Cordesman, Egan & Co., Cincinnati, O.

The "1880" Lace Cutter by mail for 50 cts.; discount to the trade. Sterling Elliott, 262 Dover St., Boston, Mass.

The Tools, Fixtures, and Patterns of the Taunton Foundry and Machine Company for sale, by the George Place Machinery Agency, 121 Chambers St., New York.

Improved Rock Drills and Air Compressors. Illustrated catalogues and information gladly furnished. Address Ingersoll Rock Drill Co., 1¼ Park Place, N. Y.

Experts in Patent Causes and Mechanical Counsel. Park Benjamin & Bro., 50 Astor House, New York.

Corrugated Wrought Iron for Tires on Traction Engines etc. Sole mfrs., H Lloyd, Son & Co., Pittsb'g, Pa.

Malleable and Gray Iron Castings, all descriptions, by Erie Malleable Iron Company, limited, Erie, Pa.

Power, Foot, and Hand Presses for Metal Workers. Lowest prices. Peerless Punch & Shear Co., 52 Dey St., N.Y.

Recipes and Information on all Industrial Processes. Park Benjamin's Expert Office, 50 Astor House, N Y.

For the best Stave, Barrel, Keg, and Hogshead Machinery, address H. A. Crossley, Cleveland, Ohio.

National Steel Tube Cleaner for boiler tubes. Adjustable, durable. Chalmers-Spence Co., 40 John St., N. Y.

The Brown Automatic Cut-off Engine; unexcelled for workmanship, economy, and durability. Write for information. C. H. Brown & Co., Fitchburg Mass.

Gun Powder Pile Drivers. Thos. Shaw, 915 Ridge Avenue, Philadelphia, Pa.

Best Oak Tanned Leather Belting. Wm. F. Forepaugh, Jr., & Bros., 531 Jefferson St., Philadelphia, Pa.

Stave, Barrel, Keg, and Hogshead Machinery a specialty, by E & B Holmes, Buffalo, N. Y.

Diamond Tools. J. Dickinson, 64 Nassau St., N.Y.

National Institute of Steam and Mechanical Engineering, Bridgeport, Conn. Blast Furnace Construction and Management The metallurgy of iron and steel. Practical Instruction in Steam Engineering, and a good situation when competent. Send for pamphlet.

Clark Rubber Wheels adv. See page 381.

Downer's Cleaning and Polishing Oil for bright metals, is the oldest and best in the market. Highly recommended by the New York, Boston, and other Fire Departments throughout the country. For quickness of cleaning and luster produced it has no equal Sample five gallon can be sent C. O. D. for $8. A. H. Downer, 17 Peck Slip, New York.

The "Fitchburg" Automatic Cut-off Horizontal Engines The "Haskins" Engines and Boilers. Send for pamphlet. Fitchburg Steam Engine Co., Fitchb'g, Mass.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Presses, Dies, and Tools for working Sheet Metal, etc. Fruit & other can tools. Bliss & Williams, B'klyn, N. Y.

Eclipse Portable Engine. See illustrated adv., p. 382.

The Student's Illustrated Guide to Practical Draughting. By T. P. Pemberton Sent on receipt of price, $1. Address T. P. Pemberton, 5 Dey St., Room 13, New York.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, importers Vienna lime, crocus, etc Condit, Hanson & Van Winkle, Newark, N. J., and 92 and 94 Liberty St., New York.

For Yale Mills and Engines, see page 381.

Wright's Patent Steam Engine, with automatic cut off. The best engine made. For prices, address William Wright Manufacturer, Newburgh, N. Y.

Machine Knives for Wood-working Machinery, Book Binders, and Paper Mills. Also manufacturers of Soloman's Parallel Vise. Taylor Stiles & Co., Riegelsville, N.J.

Rollstone Mac. Co.'s Wood Working Mach'y ad. p. 366.

Steam Engines, Boilers, Portable Railroads, Sugar Mills Atlantic Steam Engine Works, Brooklyn, N. Y.

Blake "Lion and Eagle" Imp'd Crusher. See p. 397.

Apply to J. H. Blaisdell for all kinds of Wood and Iron Working Machinery. 107 Liberty St., New York. Send for illustrated catalogue.

4 to 40 H. P. Steam Engines. See adv. p. 381.

The Chester Steel Castings Co., office 407 Library St., Philadelphia, Pa., can prove by 15,000 Crank Shafts, and 10,000 Gear Wheels, now in use, the superiority of their Castings over all others. Circular and price list free.

Brass & Copper in sheets, wire & blanks. See ad. p. 397.

The Improved Hydraulic Jacks, Punches, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

For best Indirect Radiators, see adv., page 397.

Eagle Anvils, 10 cents per pound. Fully warranted.

Gear Wheels for Models (list free): experimental and model work, dies and punches, metal-cutting, manufacturing, etc. D. Gilbert & Son, 212 Chester St., Phila., Pa.

The best Truss ever used: Send for descriptive circular to N. Y. Elastic Truss Co., 683 Broadway, New York.

H. A. Le's Moulding Machines, Worcester, Mass.

Pays well on small investments.—Magic Lanterns and Stereopticons of all kinds and prices. Views illustrating every subject for public exhibitions and parlor entertainments. Send stamp for 116 page catalogue to McAllister, M'f'g Optician, 49 Nassau St., New York.

New Economizer Portable Engine. See illus. adv. p. 397.

For Shafts, Pulleys, or Hangers, call and see stock kept at 79 Liberty St., N. Y. Wm. Sellers & Co.

Wm. Sellers & Co., Phila., have introduced a new injector, worked by a single motion of a lever.

Saw Mill Machinery. Stearns Mfg. Co. See p. 397.

Skinner & Wood, Erie, Pa., Portable and Stationary Engines, are full of orders, and withdraw their illustrated advertisement. Send for their new circulars.

Ore Breaker, Crusher, and Pulverizer. Smaller sizes run by horse power. See p. 397. Totten & Co., Pittsburg.

Bracket Woods.—Wm. E. Uptegrove, Saw Mills, 463 East 10th St., New York, offers to the trade a choice stock of these woods. Send for price list.

Houston's Sash Dovetailing Machine. See ad., p. 397.

NEW BOOKS AND PUBLICATIONS.

LEARNING TO DRAW; OR, THE STORY OF A YOUNG DESIGNER. By Viollet-Le-Duc. Translated from the French by Virginia Champlin. New York: G. P. Putnam's Sons. $2.

A story with a purpose, the purpose being primarily to contrast the conventional method of teaching the art of drawing and incidentally everything else with a method that may fairly be called rational. A secondary purpose of the book is evidently to enforce the important truths that industrial art is worthy of high honor, and that its advancement is not likely to be much helped by would-be cultivators of "high" art, or art for its own sake.

SUNLIGHT AND SHADOW; OR, GLEANINGS FROM MY LIFE WORK. By John B. Gough. Hartford: A. D. Worthington & Co. 8vo, cl., pp. 542. Price (by subscription) $3.25.

Probably no man living has been seen and heard by so many as John B. Gough; and it would be safe to say that no other man living could find ready made so comprehensive and eager a market for the printed story of his life's work. The book is eminently characteristic of the man.

THE UNITED STATES BLUE BOOK; COMPILED FROM OFFICIAL SOURCES. By J. H. Soulé. 75 cents. Washington, D. C.: J. H. Soulé.

A register of Federal officers and employments in each and every State and Territory in the United States, with their salaries and emoluments, with much other information relative to public officers and employments.

THE HOME WORLD. A MONTHLY MAGAZINE FOR THE HOME. Edited and published by Rev. Elijah C. Baldwin. New Haven, Conn. $2 per annum. 8vo, pp. 64. Vol. 1. No. 1.

This new venture proposes to make a specialty of home affairs, cultivating the whole field of home interests, social life, health, domestic comfort and thrift, moral and mental advancement, and the like. It comes with a tidy make up and a wholesome table of contents.

DIAGRAM FOR FINDING DISTANCES AND HEIGHTS. By H. von Bayer, C. E. Washington, D. C. Price 40 cents.

The object of this diagram is to enable seamen to readily and easily make use of the heights of prominent coast marks, as commonly set down on sailing charts, in determining their ship's position. It has been approved by the Navy Department and adopted for use on all United States Government vessels. Its simplicity and handiness would seem to make it especially serviceable to our merchant marine.

LYRA BICYCLIA: FORTY POETS ON THE WHEEL. By J. G. Dalton. Boston. Published for the author. Sold by Hall & Whiting, 32 Bloomfield street. 60 cents.

A book of verses anent the bicycle, mostly parodies. Enthusiastic riders of the machine may possibly find some of them amusing.

DIPHTHERIA: ITS CAUSE, NATURE, AND TREATMENT. By Rollin R. Gregg, M.D. Buffalo, N. Y.: Matthews Bros., and Bryant.

Dr. Gregg combats the fungus theory of diphtheria, holding that the supposed bacteria found in diphtheritic exudation are non-living particles of fibrin in various stages of coagulation and disintegration. The fibrin so thrown off is not a cause of the disease, but the result of an effort of the system to expel the excess of fibrin in the blood, an excess brought on by a waste of albumen, the real cause of the physiological disturbance. According to Dr. Gregg, diphtheria is a form of albuminuria, allied to Bright's disease and also to consumption of the lungs, the waste of albumen throwing the constituents of the blood into disproportion, the resulting excess of fibrin, salt, etc., acting poisonously like any other foreign matter in the blood. Where the disease seems to be sudden and violent its malignancy is attributed to the circumstances that the system has previously been subjected to a serious loss of albumen through colds or other causes pr ducing an excessive excretion from mucous surfaces. Local treatment is deprecated, particularly harsh measures likely to irritate the mucous membrane of the fauces. The positive treatment advised is as amazing as the reported results of such treatment. For a virulent "constitutional disease" to yield invariably to single doses of lycopodium, 6,000th potency, or lachesis, 2,000th, is quite miraculous. Yet by following the practice indicated, avoiding all local treatment, young practitioners are assured by Dr. Gregg that they can save all their cases of this terrible disease.

PARACENTESIS OF THE PERICARDIUM. A CONSIDERATION OF THE SURGICAL TREATMENT OF PERICARDIAL EFFUSIONS. By John B. Roberts, A.M., M.D. Philadelphia: J. B. Lippincott & Co.

A valuable monograph on an operation rarely performed and on which very little has been written. A very careful search discovers sixty recorded cases in Europe and America, the table collated by Dr. Roberts giving the name of the operator in each, the date, sex, and age of patient, mode and site of operation, results, etc. The record, Dr. Roberts concludes, fully justifies the adoption of the operation into the family of accepted surgical procedures.

THE SCIENTIFIC ENGLISH READER. By Dr. F. J. Wershoven. Leipsic: F. A. Brockhaus.

In this work Dr. Wershoven has carried out an idea which we should like to see adopted by some intelligent maker of German readers for English students. He has brought together some forty or more selections from standard scientific English writers in the departments of physics, chemistry, and chemical technology, giving in footnotes the German equivalents for all the technical terms and expressions used, and for a large number of related terms. The book thus furnishes a valuable technical vocabulary for English readers of German works of science.

SURGERY IN THE PENNSYLVANIA HOSPITAL. By Thos. G. Morton, M.D., and William Hunt, M.D., with papers by Drs. John B. Roberts and Frank Woodbury. Philadelphia: J. B. Lippincott & Co.

Since the foundation of the Pennsylvania Hospital in 1752, its medical officers have recorded more or less fully nearly all the operations performed, with notes of the more interesting cases received. Since 1873 full clinical notes of all cases have been kept. The vast amount of valuable material thus accumulated has now been digested by the surgeons and physicians of the hospital, and published in handsome style by direction of the liberal managers of the institution. The cases are classified according to their nature; and in many instances the progress made in surgical means and methods, during the period covered by the hospital records, has been critically reviewed. The work is illustrated by nearly a hundred engravings and phototypes. It is a positive addition to the literature of surgery, and is in every way a credit to the institution, the results of whose benevolent work and professional experience it summarizes.

A PRACTICAL TREATISE ON NERVOUS EXHAUSTION (NEURASTHENIA), ITS SYMPTOMS, NATURE, SEQUENCES, TREATMENT. By George M. Beard. Second Edition. New York: William Wood & Co.

The value and timeliness of Dr. Beard's essay are well attested by the call for a second edition within a month after the publication of the first edition. The only novel feature of the new issue is a cleverly written preface giving the author's answer to the question; "What Constitutes a Discovery in Science?"

WAS MAN CREATED? By Henry J. Mott, Jr. New York: Griswold & Co. 8vo, cl., pp. 151.

In this expanded lecture Dr. Mott has endeavored to set forth briefly yet broadly the lines of observation and deduction by which science has arrived at the idea of man as a natural growth. Its title should rather be "How Man was Created," creation being regarded as a slow evolution by natural processes, not as a spasmodic or miraculous exhibition of supernatural power. The publisher's work is well done, and the numerous illustrations have been judiciously chosen.

FIELD ENGINEERING. A HAND BOOK OF THE THEORY AND PRACTICE OF RAILWAY SURVEYING AND CONSTRUCTION. By William H. Searles. New York: John Wiley & Sons.

The author's aim has been: To present the general subject of railway field work in a progressive and logical order; to classify the problems of railway engineering so that they may be easily referred to; to discuss all the main practical questions of railway engineering, avoiding matters non-essential, etc., employing throughout a uniform and systematic notation easily understood and remembered; to express the resulting formula of every problem in a shape best adapted to convenient numerical computation, and to furnish a larger variety of tables especially adapted to the wants of field engineers than has heretofore been published. The manner in which these purposes have been carried out is in keeping with the author's high professional reputation. Many of the thirty odd tables are original, and most of the others have been recalculated or enlarged.

A HISTORY OF THE JETTIES AT THE MOUTH OF THE MISSISSIPPI RIVER. By E. L. Corthell, C.E., Chief Assistant and Resident Engineer during the construction. New York: John Wiley & Sons.

Our high opinion of the purpose and character of the great undertaking which Captain Eads and his associates have brought to successful issue at the mouth of the Mississippi has been repeatedly expressed during the progress of the work. It is gratifying, now that the victory over physical, financial, and professional obstacles has been grandly won, to have the history of the complex struggle so worthily recorded as it is in this volume by Mr. Corthell. Though it appeals directly and professionally to engineers, the work has a wider range of interest and should find a place in the library of every man who cares for the development of the resources of his native land or admires American boldness, energy, pluck, and endurance in the prosecution of works of utility. These attributes of American manhood never had a more commendable object, nor were ever exhibited on a more heroic scale, than in the opening of the Mississippi to commerce.

N. W. AYER & SON'S AMERICAN NEWSPAPER ANNUAL FOR 1880. Philadelphia: N. W. Ayer & Son, Newspaper Advertising Agents. 8vo, pp. 616.

A remarkably well-made catalogue of American newspapers, giving their names, frequency of issue, politics, or other distinguishing features, date of establishment, (approximate) circulation and advertising rates, together with statistics of population, political majorities, etc., of the State, county, and town of publication of each. Special lists are also given of class journals. The catalogue includes 10,674 periodicals, of which the new England States have 818, New York 1,241, other Middle States 1,267, Southern States 1,730, Western States 4,855, Territories 190, Canadian provinces 574.

THE COMPEND OF ANATOMY. FOR USE IN THE DISSECTING ROOM AND IN PREPARING FOR EXAMINATIONS. By John B Roberts, A.M., M.D. Philadelphia: C. C. Roberts & Co.

A concise statement of the more important facts of human anatomy. The descriptions are clear, though necessarily brief, and the matter is well arranged, Gray being followed for the most part.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) T. W. F. writes: After cutting down a large pine tree I counted 124 rings. How old does this make the tree? Some claim that one, and others say that two rings are made each year, and some that none are made the first ten years in the growth of the tree. A. One ring is formed each year. The tree is 124 years old.

(2) W. H. C. asks: What will dissolve rubber and evaporate readily so that it can be used in mending rubber boots? A. Cut the rubbber, gum rubber (common vulcanized rubber cannot be used), into thin shreds, digest it in a corked bottle with eight or ten times its weight of warm benzole. Shake the bottle occasionally, and after several hours add more of the solvent if necessary.

(3) C. D. A. asks how to remove the bone from the inside of a buffalo's horn. A. The bone may be loosened by soaking the horn in soft water for some time.

(4) C. G. H. asks: What will remove the stain of nitro-muriatic acid from dark woolen goods. A. Nothing—aqua regia destroys the coloring matter.

(5) G. L. K. asks: In what way can wood be prepared to prevent worms from working in it in salt or sea water? A. Impregnate with creosote water or the "heavy oil" from coal tar distillation.

(6) J. M. asks how rosin oil and spirits of rosin are made. A. Heat the rosin in a metal retort provided with a large condenser. The rosin yields about 74 per cent of liquid distillates. The first portions are yellow, strong smelling, and mobile, called essence of rosin or rosin spirit. Later in the distillation a viscid fluorescent oil (pinolin) passes over. This is called rosin oil.

(7) J. F. asks how steam gauge dials are plated, and what kind of black cement is used in filling the figures. A. Electroplate with silver and immerse for a few moments in a mixture of equal measures of water and nitric acid, to frost; rinse in running water, dry in hot sawdust, when thoroughly dry use a soft brush to clean and burnish the parts required to be bright. For filling the figure mix fine oil asphaltum with a sufficient quantity of ivory black in impalpable powder.

(8) S. W. P. asks (1) how to toughen a lithogram so that the surface will not peel or rub off. A. Use less water and more glycerine, or expel the excess of water by heating for some time over the water bath. 2. Is there any chemical which will aid in removing the writing? A. No chemical aid. Try the addition of a small quantity of soap to the composition.

(9) S. F S. asks how to treat sails so that they will not mildew. A. Impregnate with strong hot soap suds, press out the excess, and immerse in strong alum water or in weak lead acetate solution, rinse and repeat the soap, if necessary.

(10) E. S. F. asks for a receipt for making a green ink. A. Dissolve one of the soluble coal tar (aniline) greens in hot water to proper shade and add a few drops of clove oil.

(11) E. E. C. writes: We are running a saw mill composed of one 72-inch circular saw, one muley saw, one gang carrying 42 saws, besides edgers, butting saws, lathe mill, etc. We have seven two-flue boilers, 42 inches by 22 feet; engine, 24x28, running 95 revolutions with 80 to 90 lb. of steam; main driving pulley is eleven feet in diameter. When the saws are all in the cut the mill lags and the motion of the engine drops down as low as sixty. Now, what I want to know is this: can we increase our power by running the engine to 120 revolutions, reducing the diameter of the driving pulley in proportion to offset the increase motion? Can we do it without increasing our boiler surface? How much would the power be increased if such a change were made? A. Your power would be increased in proportion to the increased speed of the engine, provided you have boiler sufficient to maintain the pressure. The demand for steam will also be increased in proportion to the increased speed of the engine.

(12) J. C. writes: Take a given quantity of the atmosphere at its normal pressure, say at 40° Fah., then raise the heat 300°; what would be its volume? or if confined in an air-tight vessel, what pressure would it show on pressure gauge? A. The increase of volume or pressure would be about 1-480 part for each degree of increase of temperature.

(13) M. M. M. asks: 1. Are engineers required to have a license to run an engine in a factory isolated from other buildings, in Iowa? A. It depends upon the law of the State, or municipal regulations, if in a city. 2. If so, is the law requiring it a State or United States law? A. State or municipal. 3. Where and to whom in Iowa must application for a license be made? A. The law should give you this information.

(14) W. H. L. asks: What is the material and how prepared and used, that anatomists use for injecting the veins and arteries of the cadaver to make them stand out bold and clear and appear as if they were full of blood as in life? A. Chloride of zinc, arsenious acid, and mercuric chloride in aqueous solution have been used most successfully.

(15) E. H. B. writes: Some time since the SCIENTIFIC AMERICAN referred to the danger of lead poisoning from the use of improperly prepared "granite ware," and in the manufacture of citric acid. 1. How can I apply some simple test to detect the presence of lead in the juice of acid fruit or vinegar pickles cooked in such ware? A. Mix a small sample of the suspected liquid with some freshly prepared sulphureted hydrogen water (strong). A black precipitate or coloration indicates lead. 2. I have used citric acid in place of lemons very much this summer, but fear it was harmful. In what way would the lead affect the system if present? A. When taken in any considerable quantity it produces violent spasmodic colic.

(16) R. T. asks how to clean the wool on a sheep's skin and how to cure the skin? A. Nail on a board stretched, wool out, and scour with good soap suds and fuller's earth until properly cleansed. Then rinse thoroughly in hot water, and comb. Nail, wool down, stretched taut on a board, rub in plenty of salt, stand in warm place, and finally scrape off the softened inner membrane with a blunt knife. Then rub in plenty of moist alum powder, and let it stand several days or a week in a dry place. Soften, if desired, by rubbing with hot flour paste and the yolks of a few eggs, or with plenty of oil.

(17) J. A. C. writes: I have a piece of ordinary steel, one and a half inches in length, half inch wide, and one-sixteenth inch in thickness. Now, I wish to temper half of its length and not temper the other half. How am I to proceed? A. Harden throughout, then place half of its length in a vise having smooth jaws, or between two heavy blocks of iron, which must touch both sides of the steel. Now temper the protruding end by applying a gas or alcohol flame, or by means of blacksmith's tongs made hot.

(18) J. W. G. writes: 1. I have a battery of two flue boilers set in the usual manner, the furnace walls extending up to the water line. Would it be any advantage to extend the furnace walls higher and let the hot air and gases extend nearly or quite around the boilers before returning through the flues? Wouldn't it to some extent superheat the steam? A. It would tend to superheat the steam, but would be likely to damage the boilers in a short time. 2. My engine is 16x24 cylinder, slide valve cutting off at one-third of the stroke, making 75 revolutions; the exhaust port is cut out what is called line and line. Would it be any advantage to give the exhaust a little lap, and if so, how much? A. You cannot cut off with an ordinary slide valve so short as one-third with advantage. As a rule exhaust lap is not advantageous in a quick running engine.

(19) J. H. C. writes: We have two batteries of boilers, 42 inches diameter, 22 feet long; one battery is covered over the top, the other is not covered; and we have had considerable trouble with this set of boilers cracking the sheets through the seams of the underside or belly of the boilers. I claim it is due to the difference of expansion between the top and bottom of the boilers on account of the top of the boilers being exposed to the air. What are your views? A. We do not think your trouble arises from the difference of expansion, as there are hundreds, if not thousands, so set that are not covered. It is probably due to poor iron, or careless firing when the boilers are cold. Still it is a good plan to cover the boilers.

(20) G. W. D. writes: I have an excellent water power with 30 feet head, located 4 miles from a railroad. I propose to utilize it for manufacturing purposes, but find some difficulty in deciding whether to build the factories at the dam, or on the railroad; the latter plan would save the labor and expense of hauling the raw materials—grain and wool—and manufactured goods to and from the depot and mills. I am considering the question of transmitting the power from the dam to the railroad, either by wire rope, compressed air, or electricity, and shall thank you for such light as you can throw upon the subject, whether it would be advantageous, and, if so, which system would be most effective and economical? The ground is perfectly level. A. Of the modes named, wire rope would probably be the cheapest and easiest maintained; although, if you have a surplus of power at the dam, electricity might be used to advantage.

(21) G. E. T. writes: Please state formula for mixing the alloy used in bronze butts, door knobs, and other similar articles of hardware. A. Copper, 89; tin, 8; zinc, 3.

(22) A. A. asks how to remove nitric acid stains from dark clothes. A. Nitric acid, if strong, or if permitted to remain long in contact with the fabric, destroys the coloring matter. Ammonia water, if used immediately after the contact, will prevent this action and restore the color.

(23) L. P. asks (1) how to make a solution to plunge small brass articles in to give them a light red color. A. You might try a bath of thin alcoholic shellac suitably colored with aniline red. We know of nothing that will give the metal itself a bright red color. 2. What is the best lacquer for polished brass and how is it applied? A. 1. Seed lac, dragon's blood, annato, and gamboge, each 4 oz.; saffron, 1 oz.; spirit of wine, 10 pints. 2. Alcohol 1 pint; turmeric, 1 oz. (powder); annatto 2 drs.; saffron, 2 drs.; agitate occasionally for a week, filter and add seed lac 3 oz., and let stand for two weeks with occasional agitation. Keep well stoppered. 3. Is there a cheap way to gild small articles; if so, how? A. If the work is small coat with the lacquer properly thinned, and dry in an oven at about 250° F.

(24) J. D. H. writes: I am engaged in the business of preparing and gilding wooden mouldings, and my preparer is very much troubled with pin holes caused by the formation of small bubbles of gas immediately after the application of each coat of the preparation. I have been told that the addition of a little oil to the mixture (of whiting, china clay, glue, and water) would cure the evil, but this remedy does not seem to be reliable. Any information tending to give relief in this respect will be gratefully received. A. The imperfections are probably due to the sizing used in the first coating. Add to it a few drops of ammonia before using. You will find a good article on the subject, on pp. 301 *et seq.*, Spon's "Workshop Receipts."

(25) J. E. M. asks how to make an analysis of phosphate to find the percentage of ammonia, soluble and precipitated phosphoric acid, insoluble phosphoric acid and potash. A. Consult Fresenius' "Quantitative Chemical Analysis."

(26) W. M. B. asks how to clean and whiten engravings which have become dirty by hanging in a smoky room. A. Moisten with a strong clear solution of chloride of lime until white, then soak in running water. Steep for half an hour in water containing a very little hyposulphite of soda to neutralize any trace of adhering, bleach and dry between bibulous paper under pressure.

(27) C. W. H. asks: How is commercial French mustard prepared? A. The following is M. Lenormand's recipe: Flour of mustard, 2 lb.; fresh parsley, chervil, celery, and tarragon, of each, ½ oz.; garlic, 1 clove (or head); 12 salt anchovies (all well chopped); grind well together, add salt 1 oz., grape juice or sugar to sweeten, and sufficient water to form the mass into a thin paste by trituration in a mortar. When put into pots a red hot iron is momentarily thrust into the contents of each, and a little wine vinegar poured upon the surface. 2. Also how is chow-chow made? A. Chow-chow, as usually prepared, is a mixture of various pickles, cucumbers, cauliflower, onions, etc., chopped and mixed with mustard and a small quantity of vinegar.

(28) C. K. L. asks: What is the best and cheapest way to store up or accumulate power? A. Depends upon the purpose; the hydraulic accumulator is the best for many purposes. 2. How can the stickiness be taken from adobe or clay soil so as to make it loamy and easy to plow? A. The addition of sand alone can accomplish this.

(29) G. L. L. asks how to plug leaky boiler tubes. A. If the leak is near the head, fit and drive in a short ferrule; if the leak is in the body of the tube where you cannot bolt a band around it, take it out and put in a new tube.

(30) D. D. asks: 1. How far will a siphon draw water perpendicularly, when there is no limit to the discharge? A. If the pipe is perfectly tight it will draw 20 to 22 feet. 2. How much lower should the discharge end be than the other to get the siphon started after it is filled with water? A. A very small difference in height of the two ends will discharge water, but the greater the difference the greater the quantity discharged in a given time.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

G. D. M.—1. An impure clay—some of this would probably make good brick. 2. Kaolin containing much silica and some lime carbonate—useful in the manufacture of pottery. They are of sedimentary origin, not suitable for building purposes. Consult Dana's Geology.—A. C. R.—It is composed chiefly of infusorial silica—not derived from any mill waste.—A. F. McC.—The rock contains no precious metals.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

November 23, 1880,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1866, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired and remit to Munn & Co., 37 Park Row, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications not being printed, must be copied by hand.

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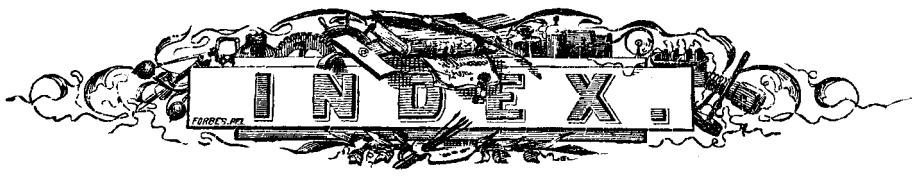

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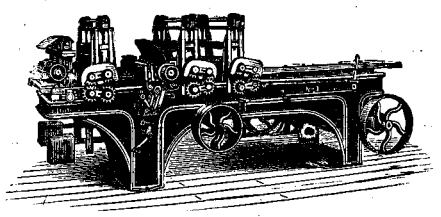

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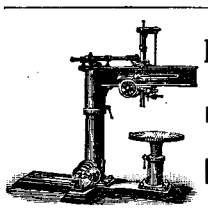

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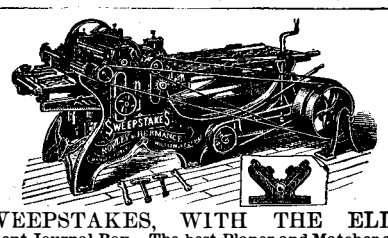

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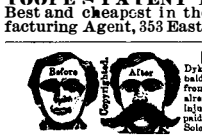

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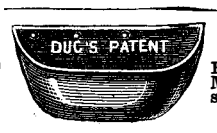

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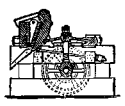

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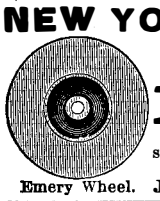

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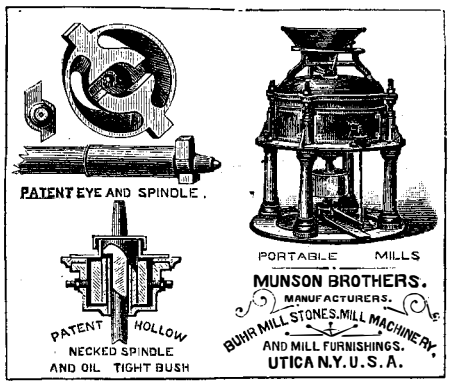

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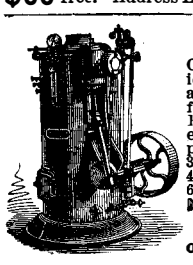

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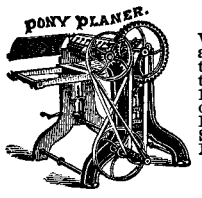

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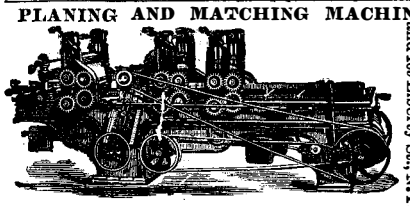

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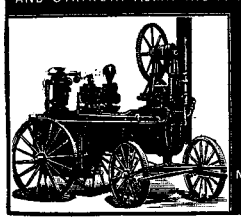

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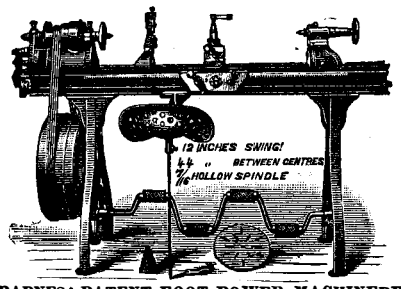

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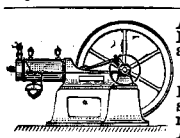

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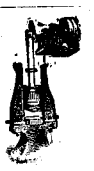

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