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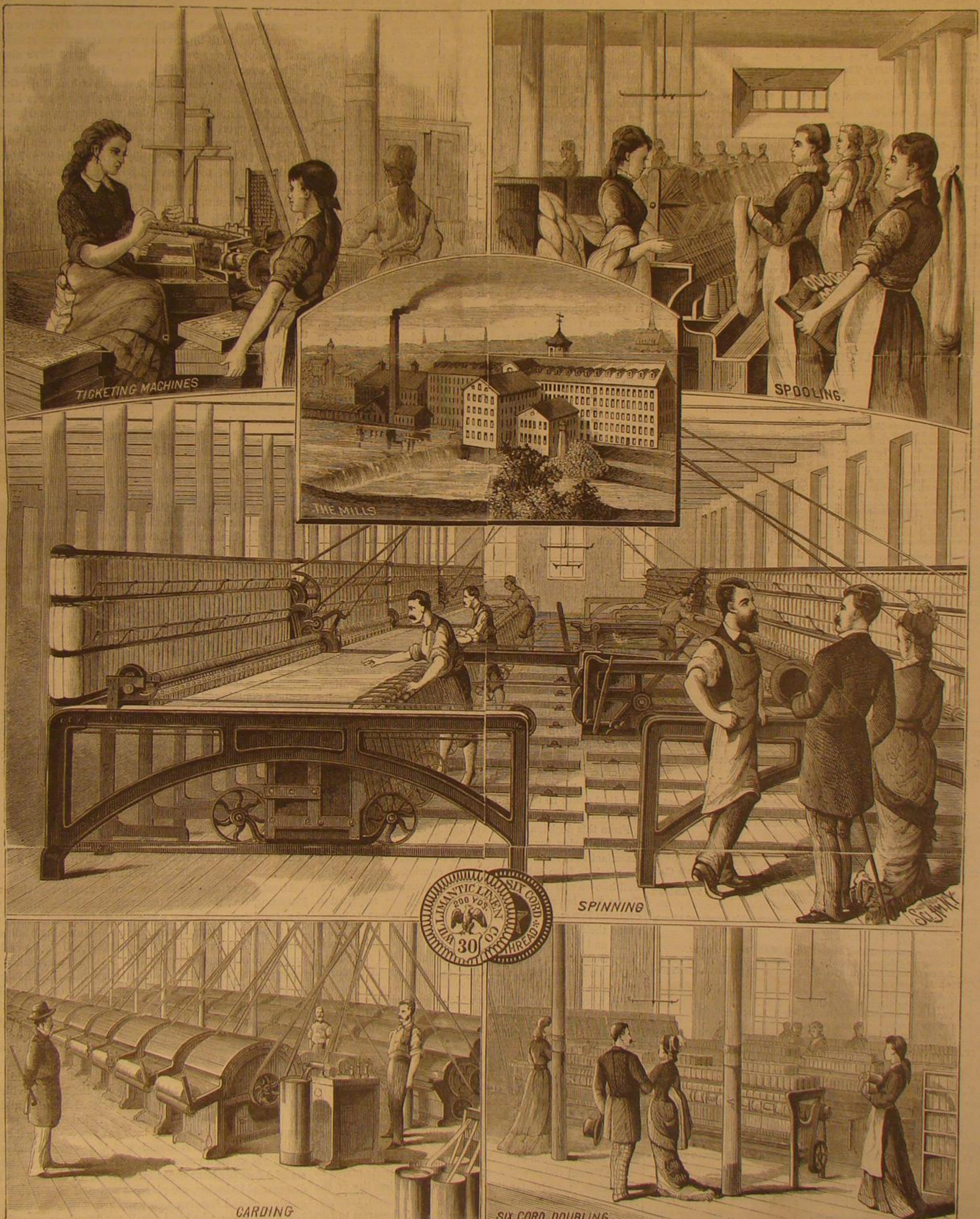

MILLS OF THE WILLIMANTIC LINEN COMPANY.—[See page 357.]

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Contents.

(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 205.

For the Week ending December 6, 1879.

Price 10 cents. For sale by all newsdealers.

THE TRADE MARK DECISION.

The three cases of the United States against Emil Steffens, Adolph Witteman, and W. W. Johnson—all prosecutions for violations of the trade mark laws embodied in sections 4,937 to 4,947 of the Revised Statutes—were decided by Justice Miller in the United States Supreme Court, at Washington, November 17. The lower courts had been divided in opinion as to the constitutional power of Congress to legislate on this subject. It was maintained by counsel who sought an affirmative answer to the question that two clauses in the Federal Constitution furnish sufficient warrant for the legislation in dispute, namely, the 8th clause of section 8, article 1, which provides that Congress shall have power to pass laws to promote the progress of science and the useful arts by securing for limited times to authors and inventors the exclusive right to their inventions and discoveries; and the third clause of the same section, empowering Congress to regulate commerce between the States and with foreign nations. The court declared the attempt to identify trade marks with works of authorship and invention to be surrounded by insurmountable difficulties. If the symbol, however plain, simple, old, or well-known, had been first applied by a claimant as his distinctive trade mark, he could by registrations secure the right to its exclusive use. While such legislation might be a judicious aid to common law on the subject of trade marks, and within the competency of legislatures whose general owners embraced that class of subjects, the court was unable to find any such power in the constitutional provision concerning authors and inventors.

With regard to the argument that a trade mark is used to identify a particular class or quality of goods, and that as so used it is a valuable aid or instrument of commerce, and comes within the scope of the constitutional provison cited, the court held that the clause quoted does not bring within the control of Congress every species of property which is the subject of commerce, or which is used in commerce (Wallace *vs.* Louisiana, 8 How. 73; Paul *vs.* Virginia, 8 Wall. 168), and that the legislation in question did not limit the use of trade marks to inter-state or international commerce, as it should do if based on the constitution or provision quoted in its support. If it referred to all trade and to commerce between all points, it was obviously an exercise of power not conferred upon Congress. That this was the purpose of the legislation in question seemed, in the opinion of the court, to be evident. It contemplated the establishment of a universal system of trade mark registration for the benefit of all who had already used a trade mark, or who wished to adopt one without regard to the character of the trade to which it was to be applied or to the locality of owner. Such legislation was, in the opinion of the court, in the excess of Congressional power. It had been urged that if Congress had power to regulate trade marks used in commerce with other nations and among the several States, its legislation, so far as it related to that class of cases, should be held valid; but to this the court held two objections: First, that there was nothing to show that the trade marks in the three causes under consideration were used in that kind of commerce; and, second, that it was not within judicial province to give the words used by Congress a narrower meaning than they were manifestly intended to bear. To do so would be virtually to make a law which would be only partial in its operation, and which would complicate rights which parties would hold in some instances under acts of Congress and in others under State law. The question of the treaty-making power of the General Government over trade marks, and the duty of Congress to pass any laws necessary to carry such treaties into effect, was left untouched. The only question in the three cases under review was whether the statutes of 1870 and 1876 could be upheld in whole or in part as valid and constitutional, and that the court answered in the negative.

From this decision many have hastily inferred that no protection remains for the property rights of merchants and manufacturers in trade marks, and no means of preventing the markets from being flooded with spurious wares bearing well-known and respected labels. But such is not the case. Those who have been using trade marks have acquired a common law right to them; and in case they are counterfeited their owners can at once bring suit at equity to restrain and to recover damages in the courts of any and every State where the infringement occurs; or in the United States courts in case the litigants are citizens of different States.

The advantages of the laws which have been declared unconstitutional lay simply in their enabling all suits for infringements of trade marks to be brought in United States courts, and in providing for a formal registration of trade marks by the Patent Office, the certificate of which was accepted in all the courts of the country as prima facie evidence of ownership. Another advantage of such registration arose from the facility it afforded for determining whether a desired trade mark had been previously adopted by another, thus preventing unintentional infringements.

It is proper to add that this decision does not in any way affect the protection of trade labels by copyright.

The Patent Office will continue to register trade marks as heretofore, notwithstanding the unconstitutionality of the laws upon which such registration has been based, trusting, doubtless, to prompt action on the part of Congress to furnish the necessary legislation for the permanent continuance of the work. Should this fail, Congress will no doubt provide by appropriate legislation the means for returning the fees received for the 8,000 or more trade marks thus far registered.

A WESTERN TOW-BOAT.

The Pittsburg coal firm of W. H. Brown & Co. have just completed and added to their fleet of tow-boats the Harry Brown, a typical Western river tow-boat, being the most powerful and complete high pressure craft of its kind afloat. The peculiar and hazardous conditions which attend the safe delivery at New Orleans of a "tow" (from 200,000 to 500,000 bushels) of Pittsburg coal cannot be fully shown here, nor are they likely to be clearly comprehended by any but river men. The first 500 miles below Pittsburg comprises a succession of tortuous windings, of shoals and "riffles," and bars and counter-currents. To successfully run this gauntlet with a cumbersome, deeply laden tow, containing tens of thousands of tons of coal, boats of the Harry Brown type are required, with light draught and enormous steering as well as propelling power. Their pilots must have absolute control over a rigid mass that often takes up all the available water in the channel, both as to width and depth. To render this possible the Western river man places his boat behind his fleet of coal-laden boats and barges, and by means of great hawsers binds the whole mass of a score of craft into a solid "tow."

On the Ohio and Mississippi rivers the Hudson River or canal system of towage would be utterly useless. Hence in the Harry Brown's construction features unintelligible to Eastern boatmen may be noted. Her dimensions are as follows: Length on deck, 210 feet; beam, 42 feet, over all, 52 feet; hold, 5½ feet. Engines, one pair, high pressure, 26 and 7/8 diameter of cylinders, 10 feet stroke. Seven steel boilers, 40 inches diameter and 28 feet long, furnish the necessary steam, at 170 pounds pressure, test pressure of boilers being 260 pounds hydraulic. An auxiliary or "nigger" boiler, 38 inches by 10 feet, supplies steam for engines operating capstans, etc. The wheel, located at the stern of the boat, is 26 feet 4 inches in diameter, length of buckets, 32 feet, each bucket or paddle being 32 inches in width. The wheel shaft, upon which the greatest strain is brought to bear, and upon which the safety of boat and tow depends, is a special feature of the Harry Brown, being the first wrought steel shaft ever imported and used upon a river tow-boat. It is of crucible steel, from the works of Krupp, at Essen, and weighs alone 20,600 pounds; with flanges, etc., 40,000 pounds; and cost 13 cents per pound delivered in New York. Its dimensions are: Length, 36 feet 7 inches; diameter at journals, 13 inches; in center, 15 inches. Rudders, four in number; one pair, balanced, 25 feet long; one pair, wing, 14½ feet long; actuated by steering wheel, 12½ feet in diameter, with 16 inch barrel.

Ready for business the Brown draws only 3 feet 4 inches forward and 3 feet aft, a great desideratum, enabling her to return to port during a season of low water. In service, and to maintain steam at 170 pounds, the boilers will evaporate 5,000 gallons of water per hour, and the engines evolve 1,750 horse power. This boat, with a favorable stage of water—9 to 12 feet at Pittsburg—is expected to take to New Orleans and other Southern ports from 28 to 30 loaded coal boats, say 600,000 bushels, or the total output of 6 acres of a 4½ foot vein of Pittsburg coal. Such a tow measures 850 by 200 feet, and reduced to tons of 2,000 pounds, contains 22,800 tons. A loaded coal boat draws from 7½ to 8 feet, a barge from 6 to 7 feet. The former's load is 23,000 to 25,000 bushels, the latter 12,000 to 13,000 bushels.

In the Harry Brown is embodied every feature that long experience could suggest or money procure to make her the model of her class. At present prices for iron, etc., she could scarcely be built for $60,000, though her actual cost was $50,000.

THE GREAT GAS WELL AND CARBON FACTORY AT MURRAYSVILLE, PA.

About a year ago, in boring for oil at Murraysville, near Pittsburg, Pa., the boring tools tapped an extraordinary vein of natural gas. The flow was estimated at about 50,000 cubic feet per hour. Recent measurements show that instead of decreasing, the present flow is fully 10,000 feet per hour greater than the first estimate, while the pressure at the mouth of the well is 90 pounds per square inch. This enormous quantity of natural fuel has, up to this time, been mostly wasted, but will soon be utilized for the manufacture of carbon black, or "lamp" black, as it is more commonly called.

A Pittsburg firm, Messrs. Sherriff & Hazely, are at work upon a contract for the machinery and fittings of what will probably be the largest carbon black factory in the world. The appliances for collecting the soot from the Murraysville gas are the following: Near the well is erected a frame building, 300 by 175 feet, and into it the gas is led in four parallel lengths of 250 feet each, of 2 inch gas pipe. Along the sides of these are fitted short branches of ⅛ gas pipe, terminating in a slight upward curve and tipped with ordinary gas burners of 6 foot per hour capacity. Above these burners, at a distance of 10 inches, are placed a series of cast iron plates, contiguous and forming a smooth surface whereon the carbon black is deposited. A small car traveling on rails laid between burners and plates, and furnished with a scraping device, plies forward and back every ten minutes during the twenty-four hours. This carriage is propelled by steam power, operating through wire rope and suitable gearing, drums, etc. The smoke or carbon black is scraped into pans hung upon the car, and these are dumped at each end of the route into receptacles, which are in turn emptied and deposited in the purifying and packing house. After simply removing cinders, etc., by passing through sieves, the soot is ready for the market. The daily product of this plant will be ½ pound carbon black per burner, *i. e.*, 2,000 pounds, there being 4,000 burners. Another plant of 4,000 burners is to be erected, the 8,000 burners to turn out two tons of carbon black daily. There will then still be 12,000 cubic feet of gas go to waste hourly, sufficient to light a good sized town. The owners of the Murraysville gas well refused $20,000 for it from the Edgar Thomson Steel Works, of Pittsburg, who wanted to connect the well with their works by a gas main, about 15 miles in length.

The phenomenon of an invisible gaseous substance issuing from the earth made visible, condensed into solid form, and packed up for market is strikingly illustrated in this establishment. The gas as it issues from the ground is unseen, but a given volume of it is found by chemical analysis to consist approximately (we do not mean to say absolutely and exactly) of twenty-four parts by weight of carbon and four parts of hydrogen; in other words, a quantity of the gas that weighs 28 pounds is made up of 24 pounds of carbon and 4 pounds of hydrogen. This hydrogen seems to have the power of imprisoning and concealing the carbon from human view. But carbon is carbon, whether in this gas or existing in the carbonic acid that gives pungency and effervescence to the soda water we drink, or in the lamp flame imparting its brilliancy, or in the sparkling diamond, the hardest of substances and the purest form of carbon.

The carbon that comes up in the gas well is rendered visible by separating the hydrogen from it, which is done by the heat of the flame. The hydrogen contained in the gas is burned up by uniting with the oxygen of the air, but only a portion of the carbon is burned; the unconsumed portion of the carbon, liberated by the burning of its hydrogen, rises up against the plates, where its sticks fast until scraped off as described.

NEW YORK ACADEMY OF SCIENCES.

The Chemical Section of the New York Academy of Sciences met Monday, Nov. 9, Prof. Newberry in the chair.

Mr. Kunz exhibited a specimen of fluorspar, one half of which was of an amethyst tint, and which had been fashioned into a rude ornament. It was found near Elizabethtown, Harden county, Ill., where fluorspar occurs in immense deposits.

He also exhibited a rock crystal pitcher of exquisite workmanship. It was made of an unusually large piece of crystal, and is without a flaw. Messrs. Tiffany & Co., to whom it belongs, value it at about six hundred dollars.

The paper announced for the evening was on the

ADULTERATION OF FOOD,

by Prof. A. R. Leeds, of the Stevens Institute of Technology, who had undertaken the investigation of a large number of articles of domestic consumption as a part of the work devolving upon him by his connection with the New Jersey Board of Health.

Prof. Leeds prefaced his remarks by the reassuring statement that many of the fears awakened in the public mind by the discussions in the newspapers concerning the deleterious or even poisonous character of various substances said to be used in the adulteration of many articles of food are entirely groundless, and that the most searching analyses in his own laboratory failed in nearly all cases to reveal their presence, although the articles tested were for the most part purchased at the meanest shops, whose custom consisted of the poorest class of the community. The adulterations found consisted mostly of substances harmless in themselves and used for the purpose of increasing the weight or bulk of the articles sold. Such adulteration must of course be branded as fraudulent; but while it is an offense against public morality, it is not one against public health. The following are some of the articles examined.

It has been objected to by some that bread is adulterated with potatoes, but this addition, so far from being injurious, actually improves the quality of the bread. A few samples of bread contained very small quantities of alum, said to be used for the purpose of making it whiter and lighter. Some contend that a very little alum is not injurious because it is rendered inert by the phosphate of lime contained in the flour, and also by the acids of the gastric juice. Not the slightest trace of copper was revealed in the bread examined by the most searching methods of analysis. Saleratus was found in nearly all cases to consist, as it should, of perfectly pure bicarbonate of soda; but cream of tartar was found to be adulterated in some cases as much as sixty per cent. with terra alba. Baking powders, which should consist of bicarbonate of soda and cream of tartar in suitable proportions, kept from combination by the admixture of a little starch powder, were found to vary greatly in the amount of their effective constituents. All the sugars examined were found to be perfectly free from all injurious substances, while the cheaper grades of sirups contained considerable glucose, a substance much inferior in sweetening power to cane sugar. No trace of strychnine, cocculus indicus, or other poisons popularly supposed to be used in the manufacture of liquors, beers, etc., were discovered. No sulphuric, nitric, or hydrochloric acids were found in vinegar. All the samples examined derived their activity from acetic acid, of which, however, they contained different proportions. In other words, some of them were more or less diluted with water. None of the samples of milk examined were found to contain any more serious adulterant than water. A diligent search was made to find brightly colored cucumbers whose tint would seem to indicate that copper had been used to make them more attractive; in none of them, however, was even the faintest trace of copper found to be present. Canned goods were found to be free from all deleterious substances. Spices procured from various sources differed greatly in strength, and all contained foreign substances increasing their bulk and diluting their pungency. Different samples of teas examined chemically and under the microscope revealed the fact that they were adulterated by leaves of other plants to a very great extent. Some of the cheapest kinds, selling (say) for 35 cents a pound, contained no tea leaves whatever. Candies were found to be much more free from injurious substances than the public has been led to believe. Many of them contained a large admixture of glucose, but the coloring matters used were comparatively harmless. In some of them aniline colors were used, which, although poisonous, cannot be fairly so-called in the very minute quantities necessary to color candy.

Prof. Leeds also examined green wall papers for arsenic, and exhibited several tubes containing arsenic extracted from them. These papers must be condemned as highly injurious, especially as the arsenic is but loosely applied to the surface and is easily diffused through the air, whence it finds its way into the lungs. One specimen of arsenic shown was extracted, curiously enough, from a little green Christmas tree candle.

He concluded his paper by remarking that three things were necessary to keep the practice of adulteration in check: a strong public sentiment kept aroused by the public press; the enactment of stringent laws; and the appointment of competent persons to execute them.

Mr. Kunz remarked that a firm in New York city made a fortune by selling cocoanut shells to the manufacturers of spices, who ground them up to increase the bulk of their products.

Capt. Blake stated that it was perfectly impossible to buy pure tea at 35 and 50 cents a pound, seeing that a good article costs $1 a pound at Fouchow. C. F. K.

The New York Academy of Sciences met Monday evening, November 17, President Newberry in the chair. A large number of minerals was exhibited, among which a rough diamond from Brazil and a diamond crystal from South Africa attracted much attention. They were shown by Mr. Kunz, expert in gems at Tiffany & Co.'s. The first paper of the evening was on some

RECENTLY DISCOVERED CAVES,

by Prof. Newberry. A great many caves having been discovered in this country within the last few years, it may not be wholly devoid of interest to those who have not made them the subject of special study, to describe the method in which they were formed. An excellent illustration is furnished by the triangular plateau of Central Kentucky, which, like all the formations abounding in caves, consists chiefly of limestone rock. This rock, by its numerous fissures and joints, as well as by its solubility in water charged with carbonic acid, is peculiarly liable to be attacked by the action of rain water, which always contains a small percentage of carbonic acid. The surface of this plateau is always dry, and no rivulet or brook is found upon it. The rain almost immediately finds its way to the underground channels which previous rains have hollowed out, and continues the work of excavation. At first the natural joints or seams of the rock are widened into fissures, and then, where some portions are more soluble than others, these fissures are further hollowed out into caves, some of them twenty and thirty and even more feet long, whose ceilings and floors are adorned with beautiful stalactites and stalagmites deposited from solution as the water containing carbonate of lime slowly filters in and evâporates. In this way immense tracts of country, where limestone is the principal formation, are literally honeycombed with subterranean caves. The Mammoth Cave itself is a member of such a system of caves. In many cases, especially in the region of the Upper Missouri, and between the Rocky Mountains and the Sierra Nevada, the same volcanic action that upheaved the limestone also brought up from below springs containing metallic substances in solution. These substances were then deposited in the fissures of the rock and also on the walls and floors of the caves. The most common are ores of iron, such as limonite, and of lead, such as galena. Many fortunes have been made and lost again by those who made it their business to explore these limestone regions for caves containing lead. The method followed is that of simply sinking wells at intervals and examining the excavated minerals. In this connection Dr. Newberry told an amusing story of an enterprising individual who had spent several fortunes acquired in this way. When at length his purse was nearly exhausted, he spent his time driving around the country to examine the wells dug by others in the hope that his superior experience would enable him to recognize signs of mineral deposits which had escaped the eyes of others. He succeeded in purchasing an unpromising looking well for a hundred dollars, and, upon exploring it, he found sufficient indications to warrant him in buying up considerable land around. When he had established his title, he descended his well alone to continue his search. To his great surprise, he struck a passageway leading into a cave that contained thousands of tons of lead ore. He jumped down into it, stuck his candle into the sand, and began to reflect how he could apply his new fortune to a better purpose than his former ones. His pleasant reverie was, however, brought to a sudden close. His last candle went out, and he was left in darkness so dense that he could not find the hole through which he had entered. After many fruitless attempts he finally thought of the following very sensible method. As he tried each spot along the walls of the cave by raising his pickax above his head and feeling his way with it, he marked the place with a stone. He finally regained the upper regions hungry and faint, after an imprisonment of forty-eight hours. Notwithstanding his good resolutions, the new fortune did not last much longer than the old ones.

The caves found between the Rocky Mountains and the Sierra Nevada, in the region of the lost mountains, so-called because short mountain chains rise there at intervals from a perfectly level surface, are distinguished by the fact that they contain the precious metals associated with iron and lead: gold with iron pyrites and silver with galena. The celebrated Emma mine and the Eureka are examples of this kind of deposit. The fluctuations in the value of mining stocks of this kind depend upon the beautiful uncertainty as to the continuity of the deposit. It may "pinch out"—that is, become so insignificant at any time that it will not pay to work any longer; and then again it is just as likely that new openings into rich deposits may be found.

The next paper was on a new proof of the

SUBSIDENCE OF OUR COAST,

by Prof. G. S. Martin. He exhibited specimens of peat that had been washed ashore at Long Island. They were similar to those found by Scudder on the Nantucket beach, and by Dall at Nahant. Their appearance indicated that they had been burrowed into to such an extent as to cause them to be broken by the action of the waves and detached from ancient peat bogs, whose edges crop out along the coast under the surface of the sea. These bogs, which belong to the period of glacial, or perhaps to that of terrace, elevation, thus furnish an additional evidence of the subsidence of portions of our coast extending through long periods of time.

C. F. K.

The American Institute of Architects.

The thirteenth annual convention of the American Institute of Architects began in this city, Nov. 19, nearly all the chapters being represented. In his annual address, President Walter spoke very hopefully of the influence exerted by the organization in raising public opinion to a higher level in all matters pertaining to architecture. Works of recent date exhibit, he said, a freshness in their architectural handling that seems to indicate the advent of a new era in the art of design. The manifest tendency of architects to break away from the trammels of conventional rules, and to make style subservient to the spirit of the age, indicates a progress in the development of independent thought hitherto unknown. Architecture, both in this country and in Europe, is obviously in a transition state. What may be the result remains to be seen; if, however, architects are careful to design their works on true æsthetic principles and in conformity with the science which underlies the art, it is not likely to be regretted that they show a disposition to do their own thinking. Classic forms and combinations are everywhere yielding to more ornate compositions bearing the names of fashions of building having no trace whatever of paternity, either ancient or modern. Particular stress was laid upon the claims of domestic architecture, particularly with reference to improvements in processes for warming and ventilating dwelling houses, the disposition of sewer gas, drainage, and other sanitary questions.

THE NATIONAL PUBLIC HEALTH ASSOCIATION.

The annual convention of the American Public Health Association took place at Nashville, Tennessee, Nov. 18. Over two hundred members were present at the first session, including nearly all the leading sanitarians of the country. The programme announced some weeks since in this paper contained many subjects of interest and importance to the whole country; and there is reason to expect large public benefits to flow from the united attention brought to bear upon the great questions of public sanitation treated in the numerous papers and discussed by the members.

THE description of Ward's steam generator, on page 323, of current volume, states that the generator furnishes steam to a single engine. Mr. Ward informs us that it supplies steam for two engines, 9¾ cylinders, 36 inch stroke, making 35 revolutions per minute.

A Ban on Inflammable Goods.

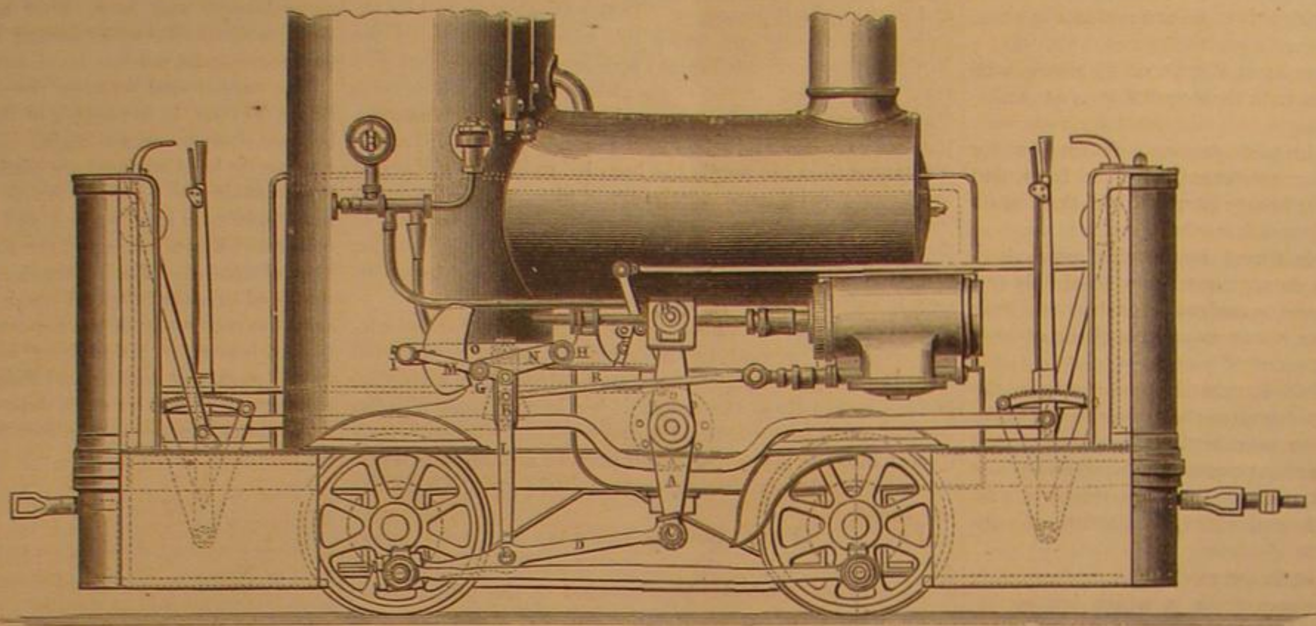
In consequence of recent disclosures the directors of the North German Lloyd's Steamship Company have decided to refuse transportation on their vessels to the class of heavy French silks which are so weighted with chemicals and oils as to cause danger of spontaneous combustion.

A HANDSOME TRIBUTE.—The Lords of the British Admiralty have given orders for the making of a handsome piece of furniture from the timbers of the old Arctic exploring ship Resolute for presentation to Mrs. Grinnell, the widow of the late Henry Grinnell, of New York, who fitted out at his own expense two expeditions for the search of Sir John Franklin.

NEW TRAMWAY MOTOR.

The accompanying engravings represent a very successful little motor used in propelling tramway cars. In the month of March, 1877, sixty-five locomotives of this style were in use in Strasbourg, Hamburg, Geneva, Paris, Milan, Rome, Madrid, and Turin. It is stated that trials made with this and other locomotives in Berlin, Cologne, Porte, etc., resulted in a victory for the Brown locomotive.

The movement of this machine is very quiet and regular, the mechanism is simple, and the locomotive can be attended to by a single person. The exhaust makes little noise, in fact is hardly perceptible. The gentleness of the action is due to the transmission of the motion by the lever, A, which gives a perfect equilibrium to the moving parts. There are controlling levers at both ends of the locomotive, so that in whatever direction the train moves the engineer can always sit in front. The fire box is furnished with an inclined grate, upon which the descent of the coal is very regular. A single charge of coal lasts about one hour.

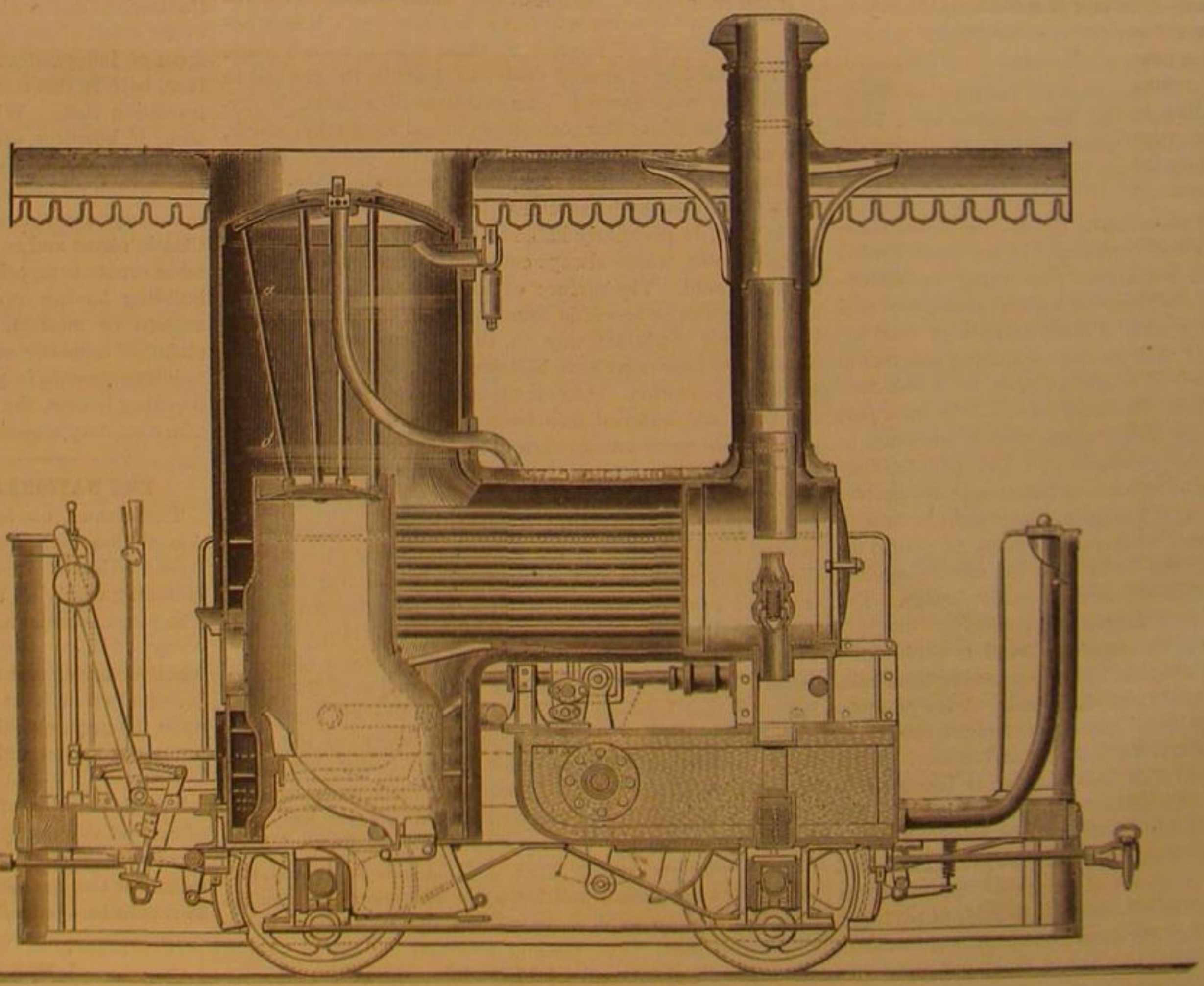


NEW TRAMWAY MOTOR.

The boiler is of the style generally used in small locomotives, but the vertical part is so large that the level of the water can vary about nineteen and a half inches, which corresponds to about seventy-five gallons. The boiler is filled at the station, and the engineer need not waste time during the trip to refill the boiler, and it is therefore possible for a single person to run the engine, as has been proved at Strasbourg. The distribution of the steam in the cylinders is obtained by means of peculiar mechanism which receives its motion directly from the crank. By this means the expansion can be regulated to any desired degree. With a boiler pressure of 150 lb., the steam may be cut off early in the stroke. In Strasbourg and Beziers, where the grade is from one to one and a quarter inches, these machines draw four cars with 200 to 250 passengers. In order to diminish the noise of the exhaust steam it is allowed to pass into a vessel situated between the cylinders and containing water. The pressure in this vessel is almost constant, which causes the steam to escape continuously and with noise. The chimney consists of two sheet iron cylinders, between which there is a packing of mineral wool, which prevents all vibration.

The steam passes from the vessel between the cylinders into a series of short tubes placed in the chimney. At every stroke of the piston a good draught is obtained, which superheats the smoke and gas, and makes it invisible at the top of the chimney.

If the normal atmospheric temperature is higher than 50°, this method will answer, but in winter a surface condenser, over which the steam passes after leaving the cylinder, is required. The axle boxes are constructed so that the smallest curves can be turned without difficulty.



TRAMWAY MOTOR—LONGITUDINAL SECTION.

A coat of gum copal varnish applied to the soles of boots and shoes, and repeated as it dries until the pores are filled and the surface shines like polished mahogany, will make the sole waterproof, and it lasts three times longer.

Where did the Israelites Cross the Red Sea?

This query, some explorer has suggested, may be solved with our present appliances for fathoming depths. The *Christian at Work*, alluding to the subject, says that three or four theories prevail as to the spot the crossing was made.

The Arabs say several miles south of Suez, between the promontory of Atakah and Ayan Musa, where the Red Sea is about ten miles wide. This view is strengthened by the Bible reference to the walls of water on both sides of the army, but, as Dr. Schaff says, "it is impossible that six hundred thousand armed men, with women and children, and their herds of cattle, could have crossed so great a distance in one night without a prodigious accumulation of miracles." Another theory places the crossing at the head of the gulf, a little north of Suez. Here is a shoal channel, four miles long and less than half a mile wide, in which there are several islands and sand banks, bare at low water. The Israelites might easily have crossed here; indeed, so strong is the tide that a strong east wind—such as we are told Jehovah caused to "blow all the night"—would have made the walls of water of which the Bible speaks. This place is generally favored by modern biblical critics. The reader will recall the fact that it was here that Napoleon, deceived by the tidal wave, attempted to cross in 1799, and, in his own words, nearly became a second Pharaoh. As we have said, it is not likely that any of the rusty old chariots, nor so much as a broken axle or harness buckle, will ever be brought to light. Possibly some papyrus may be found with a private record of the wonderful event. But the search for this would be about as uncertain as the hunt after the precious stones that Aaron wore in his breastplate.

Proposed River between Manchester and Liverpool.

A meeting has been held in Manchester for the purpose of considering the expediency of the proposal for the construction of a tidal navigation for seagoing steamers between Manchester and Liverpool. At this meeting Mr. Hamilton Fulton, the engineer, explained the nature of the proposal, and stated that the length of the channel between Manchester and Liverpool would be about 36 miles. The minimum width of the navigation would be 200 feet, and the minimum depth at low water spring tides would be 10 feet, or about 2 feet more water than exists at low water over the bar at the mouth of the Mersey. A basin would be provided at the Manchester end of 81 acres with 16,000 lineal feet of well constructed wharves, and all requisites for shipping accommodation on a large scale. The estimated cost of the undertaking is £3,500,000. Mr. George Hicks, of Manchester, presented a statement as to the probable revenue, which, if realized, would give a large return upon the proposed outlay.

Owing to the inability of several members of Parliament and others to attend, the further consideration of the subject was adjourned.—*Warrington Guardian.*

Crushed by an Anaconda.

One of the most intrepid wild beast tamers in Europe, Karolyi, a Magyar of colossal stature and extraordinary physical strength, has recently fallen a victim to a dread contingency of his perilous profession. He was performing before a crowded audience in Madrid the other day one of his most sensational feats, which consisted in allowing a huge boa constrictor, over twenty feet in length, to enfold his body in its tremendous coils, when suddenly a piercing cry escaped him, which was greeted by the public with a round of applause, under the supposition that its utterance constituted a part of the performance. It proved, however, to be the outcome of a strong man's death agony. The gigantic snake had tightened its coils and crushed poor Karolyi's life out of him with one terrific squeeze. As his head fell back and his eyes became fixed in a glassy stare, the plaudits died away and were succeeded by the stillness of utter consternation. The snake and its lifeless victim swayed for a second or two of inexpressible horror and then toppled over on the boards of the stage; but the boa did not in the least relax his grip upon the corpse, which remained for more than an hour imprisoned in its hideous thraldom, nobody daring to approach the lithe monster, of whose powers such appalling proof had been given. At length it occurred to one of Karolyi's attendants to place a bowl of milk in a cage within sight of the mighty serpent, which slowly unwound itself from the dead body and glided into its den, irresistibly tempted thereto by its favorite dainty. A post mortem examination of the unfortunate athlete's remains discovered no fewer than eighty-seven fractures of his bones effected by the constriction of the serpent's coils.

HINTS TO THE YOUNG STEAM FITTER.

BY WILLIAM J. BALDWIN.

The low pressure gravity circulation is at present very much used in the steam heating of private houses, churches, and schools. Its principal merits, when well done, are: It is safe; it is noiseless; the temperature of the heating surface is low and uniform; all the water of condensation is returned into the boiler except a very small loss from the air valves; it is easy to keep the stuffing boxes of the heater valves tight; and it is no more trouble to manage than a hot water apparatus.

There are four systems of low pressure steam piping, whose principal features are:

1st. Main distributing pipes and distributing risers, with corresponding return mains and risers (see Fig. 1, at A).

2d. Main distributing pipes and distributing risers, with a corresponding return main and a separate return riser for every coil or heater, the return risers not to be connected to each other until they are below the water line (see Fig. 1, at B).

3d. Main distributing pipes and distributing risers, with corresponding return mains and no return risers, the distributing riser carrying the water of condensation back through a relief to the main return pipe on the floor of basement (see Fig. 1, at C).

4th. (The single pipe job always a small one.) A single pipe for every heater, run directly from the top of the boiler to the heater, rising all the time in the direction of the heater, and of size sufficiently large that the steam passing to the heater to supply the loss from condensation will not interfere with the condensed water returning along the bottom of the pipe.

NOMENCLATURE.

The same names always apply to the same part of the circulation, no matter what the system. The word circulation means the whole distribution of pipe in any one job.

The Main Steam or Distributing Pipe.—The nearly horizontal live steam main, generally near the cellar ceiling (a′ a″ a‴).

The Main Return Pipe.—The nearly horizontal pipe on the floor, or thereabouts, of the cellar, for carrying the condensed water back to the boiler, b′ b″ b‴.

The Steam Riser.—The pipe that carries the steam from the main distributing pipe to the radiators (c′ c″ c‴).

The Return Riser.—The pipe that carries the condensed water from the radiators to the main return (d′ d′).

The Steam Riser Connection.—The pipe that joins the main distributing pipe and steam riser (e′ e′).

The Return Riser Connection.—The pipe that connects the return riser with the main return pipe on the floor, and which has one or more T's in it below the water line to receive the steam riser relief (f f).

The Steam Riser Relief.—The pipe that connects the bottom of the steam riser with a T in the bottom of the return riser connection or main return pipe below the water line, to carry the water that runs down the steam riser into the return riser connection or main return pipe (g g).

Main Relief Pipes.—Connections between the main steam and return pipes, to throw the water carried from the boiler, and what is condensed in the main steam pipe, into the return main, also as an equalizer of pressure in the system (h).

Radiator Connections.—The pipes which run from the risers to the radiators, both steam and return, usually no longer than is necessary to get spring enough for the expansion of the risers (i i).

A Relay.—The jumping up of a main steam pipe, with a main relief at the lower corner. This is to admit of keeping the main steam pipe near the line of the risers and the ceiling, and above the water line when the main lines are long (j).

Pitch.—Is the inclination given to any pipe, and in the steam mains of a low pressure apparatus should be down and away from the boiler (except in system No. 4), and if possible toward the boiler in the main return. (When the water and steam run in the same direction through pipes one source of noise is prevented.)

Water Line.—The general level of the water in the boiler throughout the apparatus. In some cases, where the boilers are at a distance, or in a sub-cellar, and the fitter wishes to gain the advantages of having returns and reliefs coming together below water, he makes an artificial water line by raising the main return pipes higher than his connections before he drops to the boiler. It is also necessary to bring a relief from the main steam pipe to this raised part of the return to prevent siphoning into the boiler.

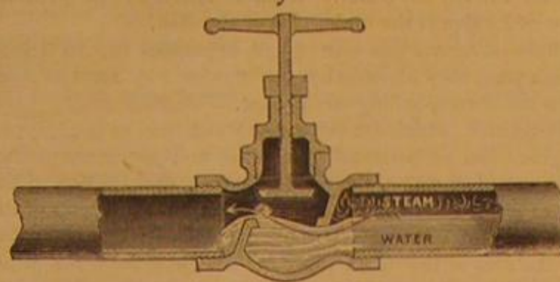
HOW A BUILDING IS PIPED.

The steam-fitter should commence his work in a new building early, and architects and parties paying for the work should see that the contract for steam heating is let when the mason and carpenter work is let.

The risers are the first work done in a new building that proceeds in the ordinary way. If the builder and steam-fitter have an understanding at the commencement of the work, the former can leave the proper recesses in the walls exactly where the steam-fitter wants them. This will save much work to the fitter, and prevent the mutilation of the walls and be no expense to the mason.

Fig. 2.

Fig. 3.



POSITION OF VALVE.

When the walls are up, the joists in their places, and the roof boards or roof on, the steam-fitter should then put up his risers.

If the building has not more than three floors to be heated it will do to rest the risers on a support at the bottom of the recess, but in higher buildings the risers should be suspended by the middle, so that the expansion may be divided. By allowing the riser to go both up and down from the middle the steam-fitter will be able to get along with shorter radiator connections, and will avoid the deep cutting of the floor joists.

The steam-fitter should avoid as much as possible taking two heaters from the same steam connection on a floor, and if it is unavoidable he should drop his returns down and bring them into the return riser some distance apart; or, better still, he should run them separately down below the water line (system No. 2), as it will prevent one heater from taking the air from the others.

If the risers are on the side of the room so that their outlets look between the joists, it is best to keep the T's about half way between the laths and the flooring, as this admits of nippling up, and leaves room for crossing the pipes, if required, below the floor. But if the outlets come at the side of the joists care must be taken that the T's come in the exact place. In a building with the risers resting on the bottom and all the expansion upward, the top outlet must be the lowest from the top of the joist, but only low enough to come within ¾ of an inch of the floor when expanded to their utmost; so also with the rest of the T's, according to their distance from the bottom of the riser.

With low pressure steam, the steam risers should be large. The general practice with steam-heaters is to reduce one size of pipe for each floor. This rule is not arbitrary, but as architects' specifications usually call for it there are no objections, provided the pipe is large enough.

In system No. 1 the return riser is generally one size smaller than the steam riser, but it should never be smaller than a ¾ of an inch pipe.

In system No. 2, where many return risers are brought down in the same place, a 1 inch pipe for large heaters and a ¾ pipe for small ones are usual.

When the risers are all in the outlets should be plugged up with pieces of pipe, a foot or so in length, instead of the ordinary plug, as the latter is often difficult to get out when the plastering is done.

The risers should then be tested with cold water to from 100 to 200 pounds per square inch; this will prove if there are any cracked fittings or split pipe, and will save much time and annoyance when steam is gotten up.

The best way to cover a riser recess is with a board. Have grounds put on before the plastering is done, and screw a panel on afterward. Some architects require the recess to be plastered over, using slate or coarse wire cloth to hold the plaster. The latter makes the best work, as the heat from the riser will not crack it.

When automatic air valves are to be used on the steam heaters, a ⅜ inch pipe should be run in the riser recess, with an outlet at each floor to receive the air valve connection. The lower end of this air and vapor pipe should be taken to the nearest sewer outside of the sewer traps.

At this stage of the work, and before the floors are laid, the radiator connections should be run and firmly fastened in their places, making due allowance for the thickness of the furring on the walls, the plastering, and the baseboard. The radiator connections are usually run 1 inch or 1¼ inch for the steam connection, with a corresponding ¾ or 1 inch pipe for the return, according to the size of the heater; one and a quarter inch steam being enough for a radiator of 150 square feet of heating surface at low pressure, with a main of sufficient size.

When the radiator valves are threaded right-handed the elbows on the ends of the connections may be left-handed, to admit of connecting by a right and left hand nipple below the valve and between the valve and elbow, or *vice versa*.

When both valves are at the same end of the radiator, it is better to have the right and left nipples between the valves and the radiator. With this arrangement both valves of the radiator can be connected simultaneously, and the movement of the radiator will be in the direction of the valves. It also admits of the disconnection of a heater, after simply closing the radiator valves.

When the radiators are to be connected by any of the foregoing plans the connections can be firmly fastened, but not confined at their ends, that they may come in their exact places through the floors. The free ends of the connections should be closed with pieces of pipe long enough to come above the floors when laid. The air pipe should also be run at the same time and brought through the floor in close proximity to the position the air valve will occupy on the heater.

At this stage of the work the steam-heater usually waits until the floors are laid, plastering done, partitions set, and the basement graded.

Steam Mains.—Nearly all the success of the apparatus depends on its steam mains, their sizes, and how they are run.

A job has never yet been spoiled by having its steam mains large; still there should be a limit to their size, to prevent unnecessary expense and to keep the condensation and radiation of the distributing pipes at a minimum consistent with the actual requirements of the heating surfaces.

The size of steam mains depends on the pressure of steam to be used, the distance it is to be carried, the temperature of the exposure of the heating surfaces, and their extent. But as it is not my intention here to speak of steam used expansively, I shall endeavor to give sizes only for direct-return or gravity circulation apparatus.

Gravity circulation apparatus are of two kinds, low and high pressure. The low pressure apparatus depends on the difference of level of water in the return risers and the boiler for a circulation, irrespective of the steam pressure at any part of the distributing pipes; but the maximum pressure of steam to be carried must never exceed the equivalent of a difference in level of water between the water line of the boiler and the lowest part of the distributing main.

There is another condition under which this system will

Fig. 1

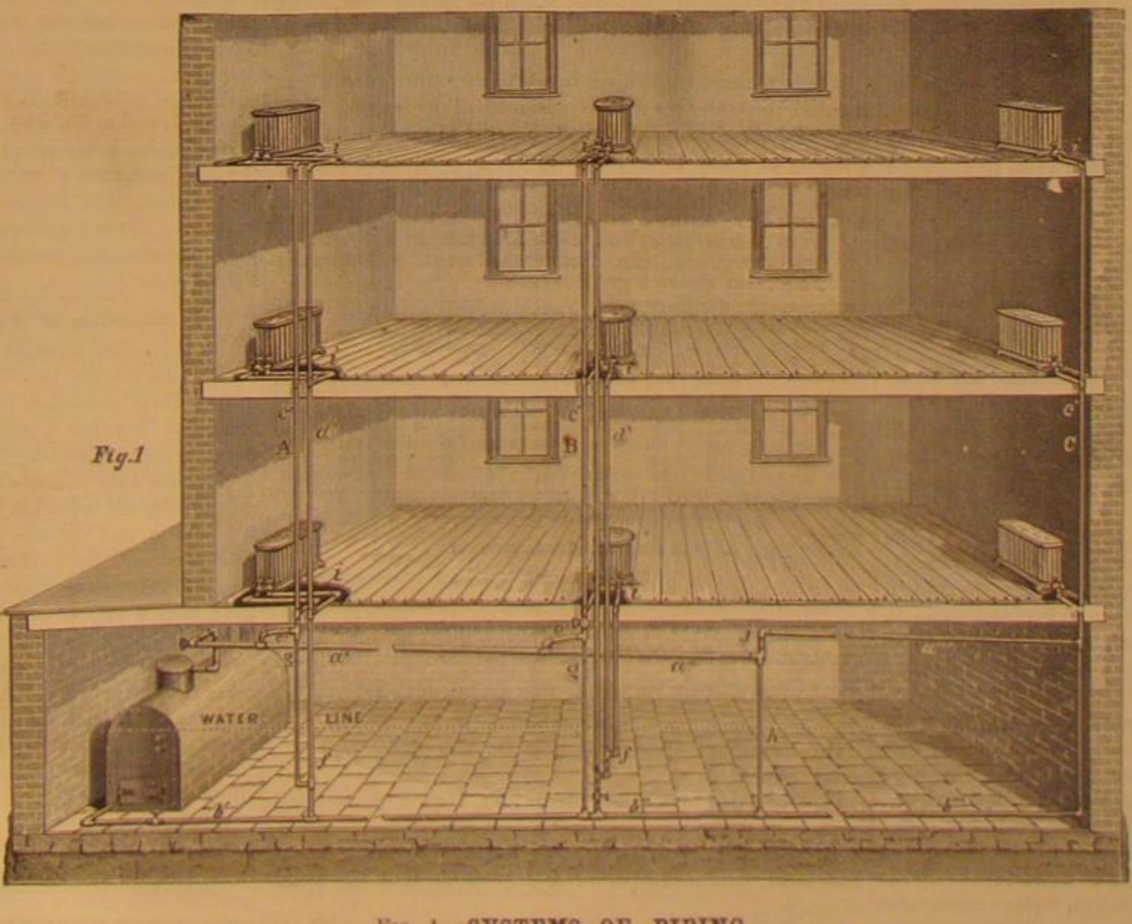


FIG. 1.—SYSTEMS OF PIPING.

work, and that is an increase of pressure sufficient to nearly establish a pressure throughout the apparatus, the difference in pressure at any part of the apparatus not to exceed the equivalent of a head of water between the water line in boiler and the lower part of the steam main. It is then a high pressure gravity circulation.

A well arranged gravity circulation should be made to work at any pressure, for with its heating surface properly proportioned it can be made to meet the exigencies of fall, winter, or spring weather by simply carrying a pressure suitable to the occasion.

To have the water of condensation return directly into the boiler under all conditions and pressures, the main pipes must be large enough to maintain the pressure of the boiler to within 1 or 1½ pounds in every part of the apparatus, and the water line of the boiler should be not less that 4 feet from the bottom of the horizontal distributing mains, at their lowest part, and that only in short mains, such as the generality of city business buildings and blocks. In large public buildings and others that have their boilers in outhouses, the difference between the boiler line and the mains should be all it is possible to get.

A main should not decrease in size according to the area of its branches, but very much slower, and should be rated by the heating surface and the distance it is to be carried. Neither should the main at the boiler be equal to the aggregate size of all its branches—an expression very much in vogue in specifications for steam heating.

Mains which have given the best results leave the boiler of sufficient size (calculated from practical results), and are reduced very slowly, if at all, until very near the end.

The area of the cross section of a 1 inch steam pipe is taken as unity for the sake of easy calculation in the rating of steam pipes, and the area of a 1 inch pipe in the main, at the boiler, to each 100 square feet of heating surface, mains included, is deduced from the size of the mains and heating surfaces of some of the best heated buildings in the United States, and has been the writer's rule for some years.

When the main steam pipe leaves the boiler it should, if possible, be carried high up at once, and have the stop valve at the highest part in the pipe, so that condensed water cannot lodge at either side of it when shut. This will prevent cracking at this part of the pipes when the valve is opened. If this arrangement cannot be carried out, and the valve has to be nippled on the dome of the boiler, or if there are several boilers and they have to be made interchangeable with regard to their use, there should be a relief of large size in the main, just outside the valves.

It is well to mention here that a relief which leaves the steam pipe must be brought into the return pipe in a position corresponding exactly to where it leaves the main; that is, when it comes from the outside of the main stop valve it should be taken to the outside of the main return valve. Otherwise, if an attempt is made to shut off, and both valves are closed, the water will back up and fill the apparatus. So also with all branch risers or connections; if there is a valve in the steam part, there must also be one in the return, and reliefs must leave the steam pipe and enter the return on corresponding sides of the respective valves.

From the highest point the main steam pipe should drop slowly as it recedes from the boiler (1 inch to 10 feet being a good pitch), that the course of the steam and the water may be in the same direction.

A main steam pipe should not run very close to the wall up which the risers go. There should be room enough for a riser connection 2 or 3 feet, and when the mains are long and the expansion much the distance should be increased.

The T's in the main, for the riser connections, are better turned up than sidewise, as by nippling an elbow to them you can get any desired angle, and should the measurement for the main be a little out it will make no difference. This arrangement also makes a good expansion joint if the mains have much travel.

Where the pipe reduces in size it is well to put in a relief in the lower side of the reducing fitting, as the water that is pocketed there by the large pipe pitching in the direction of the smaller one may be the cause of cracking and noise in the pipe. Some steam-heaters use an eccentric fitting in reducing, which brings the bottom of the pipe on the same line and makes nice work.

When it is necessary to have stop valves to the risers the steam-fitter often places them in the riser connections, with a valve also in the riser relief. This arrangement requires three valves, and also stops the local circulation and equalization of pressure.

It is better to use only two valves, one to the steam and one to the return riser, and place them a few inches up the riser, above the riser connection, which brings them also above the steam riser relief, saving a valve and lessening the chances for noise in the pipes.

In system No. 2, where the returns are carried down separately and collected together below the water line, the return valve should be below all such connections, and the steam riser relief should have a separate connection with the main return and have no valve. Straightway valves are best for risers.

The extreme end of a steam main should be connected by a relief with the main return, being in fact a continuation of the main down and into the return.

Stop valves in main steam pipes are either globe, angle, or straightway. When a globe valve is used it should be turned with its stem nearly horizontal, as shown in Fig. 2. The reason for this is obvious, when we consider that the water of condensation in any pipe runs along the bottom of it. When a globe valve is turned up, as in Fig. 3, the water in the pipe has to half fill it before it flows over the valve seat to pass along in the pipe. Not so when the valve is on its side for then the side of the opening of the valve seat is as low as the bottom of the pipe.

Neither should the stem of any valve be quite down to the horizontal position when it can be avoided. It should be raised enough (10 degrees) to prevent water from collecting in the threads of the nut and stem, and being forced out, by the pressure of the steam, through the stuffing box, making a constant dropping of water, which is almost impossible to hold with ordinary packing. Not so with dry steam; it can be held.

Globe or angle valves should be so turned in a heating apparatus that by simply closing the valve to be packed and its corresponding valve in the return, or *vice versa*, and waiting for the steam to cool down, the stuffing box or gland can be removed without the escape of steam. To do this it is necessary to have the pressure side of every pair of valves turned toward the boiler. What is meant by the pressure side of a valve is the under side of the disk.

Main Return Pipes.—In small apparatus (up to 3 inch steam pipe) they are usually run one or two sizes smaller than the corresponding steam pipe.

In returns, which are below the water line, or are trapped to give them an artificial water line and are consequently always full of water, there are no currents but the flow of the water toward the boiler. This style of return admits of the smallest piping, but good practice has placed it at one quarter the area of the steam pipe, for all conditions, for apparatus with larger than 3 inch steam pipe.

In dry returns—*i. e.*, which have no water line—there are local currents, often going in contrary directions, the water gravitating toward the boiler, the steam flowing to the heaters, and the air, the greatest source of annoyance to the steam-heater, going every place and any place except out of the air valve. This style of return is not much used, but in cases where there is no basement it cannot always be avoided.

One half the area of the steam pipe has been found in practice to give good results in dry return pipes.

Check valves are generally used in return pipes where they enter the boiler. Some steam-heaters leave them out on account of the back pressure they cause to the return water, but the practice is very much to be condemned when two or more boilers are connected, as an inequality in draught or the cleaning of a fire will make a small difference of pressure between boilers, causing the water to run from one boiler to another through the return pipes.

Check valves of large area in the opening, with a small bearing on the seat, can be made that will not give more than a quarter of a pound back pressure. If the valve is not ground and cleaned frequently when the job is new, there will be nothing but the actual weight of the disk to overcome.

It is sometimes convenient to reduce a return pipe where it enters the boiler for a short distance of its length. This may be done to a limited extent, bearing in mind the actual quantity of water to be admitted to the boiler in a given time.

A TABLE OF LINEAR EXPANSION OF STEAM PIPES (TO WITHIN 0·01 INCH) FOR EACH 100 FEET IN LENGTH, AT TEMPERATURES AND PRESSURES MOST FREQUENTLY REQUIRED BY THE STEAM-FITTER.

Temperature of weather when pipe is fitted.	Length of pipe when fitted.	Length of pipe when heated to 215° or 1 lb. steam.		269° or 25 lb. steam.		301° or 50 lb. steam		342° or 100 lb. steam	
Degrees Fah.	Feet.	Ft.	Ins.	Ft.	Ins.	Ft.	Ins.	Ft.	Ins.
0	100	100	1·80	100	2·26	100	2.53	100	2·88
32°	100	100	1·54	100	1·98	100	2·26	100	2·61
64°	100	100	1·20	100	1·73	100	2·	100	2·35

Astronomical Notes.

Observatory of Vassar College.

The computations in the following notes are by students of Vassar College. Although merely approximate, they will enable the observer to recognize the planets. M. M.

POSITIONS OF PLANETS FOR DECEMBER, 1879.

Mercury.

On December 1 Mercury rises at 8h. 37m. A.M., and sets at 5h. 26m. P.M.

On December 31 Mercury rises at 5h. 47m. A.M., and sets at 3h. 6m. P.M.

Mercury should be looked for during the last week of December, before sunrise, a few degrees north of the point of sunrise.

Venus.

Although less brilliant than in November, Venus will be very beautiful in the early morning through December.

On the 1st Venus rises at 3h. 9m. A.M., and on the 31st at 3h. 54m. A.M.

It will be at its greatest western elongation on the 3d. On the 10th of December Venus and the narrow crescent of the waning moon will rise nearly at the same time, Venus being north of the moon. A telescope of three inches aperture will show that the disk of Venus, like that of the moon, is seen only partially enlightened by the sun. It will be half illuminated in December.

Mars.

Mars was in its best position in November, but it will be more likely to be observed in December, as it comes to the meridian during the evening and precedes the beautiful group of the Pleiades.

On December 1 Mars rises at 3h. P.M., and sets at 5h. 8m. the next morning.

On December 31 Mars rises at 59m. after noon, and sets at 3h. 13m. the next morning.

A small telescope will show peculiar markings upon Mars; it is, however, less interesting then Jupiter and Saturn, as its newly discovered moons can be seen only by means of the largest telescopes.

On the evening of December 23 the moon will be seen to draw near to Mars, and after midnight to pass east of the planet, Mars being about 3° lower than the moon in altitude.

Jupiter.

Jupiter is still the great light among the planets, yet is setting earlier, and is perceptibly more remote from us.

On December 1 Jupiter rises at 26m. after noon, and sets at 11h. 7m. P.M.

On December 31 Jupiter rises at 10h. 38m. A.M., and sets at 9h. 31m. P.M.

If we take the hours from 8 to 10 P.M. for observing Jupiter we shall not see the first satellite during a part of that period on the 5th, 14th, and 21st, because it is behind the planet; it is unseen because in transit across the planet, December 6 and December 13; on the 30th it reappears from the shadow, having been eclipsed.

The second satellite, the smallest, is not to be found at some part of the period from 8 P.M. to 10 P.M., because behind the planet December 1, and in transit across the planet December 10 and 17.

The third satellite reappears from transit December 9, and disappears December 27, by passing into the shadow of Jupiter.

The fourth satellite will not be seen on the evening of December 31, because in Jupiter's shadow. The moon will pass east of Jupiter on the evening of December 18.

Saturn.

With a powerful glass Saturn is even more interesting than Jupiter; with an ordinary glass its ring and the two larger satellites can be seen.

On December 1 Saturn rises at 1h. 51m. P.M., and sets at about the same hour the next morning.

On December 31 Saturn rises at 11h. 53m. A.M., and sets 3m. after midnight.

Between December 18 and December 24 the moon passes Jupiter, Saturn, and Mars by its motion in orbit; it passes Saturn before noon of the 21st. On the evening of the 20th Saturn will be east of the moon; on the evening of the 21st Saturn will be west of the moon.

Uranus.

On December 1 Uranus rises at 11h. 27m. P.M., and on the 31st at 9h. 29m. P.M.

Uranus is near the star Lambda Leonis, 2¼° nearer the horizon when that star culminates, or between 4 and 5 A.M. during December.

Neptune.

Neptune comes to the meridian at 9h. 50m. P.M. of December 1, and at 7h. 50m. December 31.

Its position is not much different from that of Mars. On the 1st Neptune is 4° south of Mars, and passes the meridian 14m. earlier. On the 31st Neptune is 15m. earlier than Mars in coming to the meridian, and 5° south of Mars. Only a powerful glass will enable the observer to distinguish it from a fixed star.

Relation of Masters and Apprentices.

We have often thought that if masters properly comprehended the relation they sustain to their apprentices and employes, their pecuniary interest would not only be greatly enhanced, but that a positive good would be rendered to every branch of industry in which they are engaged.

The first duty of a master should be to present in himself an example for imitation in the elements of industry, morality, system, and the other attributes which constitute a superior mechanic or workman. They should, moreover, observe and study the dispositions and minds of their apprentices, with a view of conciliating their regard and confidence, and through this means to establish a free and familiar intercourse, and render the task of instruction and development more simple and easy. As the apprentice advances in knowledge and skill, suitable evidences of appreciation and encouragement should be given them. This will stimulate their ambition and exertion, and create among them a worthy spirit of emulation.

Where the character of an apprentice is such as to require a tight rein upon his actions, and the deprivation of privileges, and other suitable punishments for idleness and misconduct, care should be observed that these curbs and punishments do not descend into such acts of tyranny as will destroy the spirit and ambition of the youth, and render him obstinate, unruly, and beyond all future influences of excellence and good. Besides a thorough instruction in his trade or profession, and a sound and healthy education to otherwise render him fit for his social position in life, it should be the aim of a master to instill into his pupil all the scientific and other knowledge possible, even should such knowledge have no direct bearing upon the business or trade in which he is engaged. Such acts of interest, kindness, and confidence as these, and others of a corresponding character, cannot fail to produce the most marked beneficial results upon the interests of the master, and the happiness and future of the grateful apprentice.

AMERICAN INDUSTRIES.—No. 25.

THE MANUFACTURE OF SPOOL COTTON.

The manufacture of spool cotton requires machinery and processes so elaborate and so expensive, that the industry cannot be profitably conducted except on a very large scale. For this reason the making of the spool cotton used in this country is mainly confined to a few large factories, and we are informed that there is but a single company in America that makes all numbers of six-cord sewing cotton from the raw material. This is the Willimantic Linen Company, whose works we illustrate.

The company began business in the manufacture of linen; being deprived of flax by the breaking out of the Crimean war, they turned their attention exclusively to cotton thread, but the original style of the firm was retained.

The business offices of this company are located at Hartford, Conn.; the works are at Willimantic, on the river of the same name, about 125 miles from New York and 90 miles from Boston, on the New York and Boston Air Line Railroad. Two other railroads—the Hartford and Providence and the New London Northern—pass through the place, and hundreds of their passengers every day catch sight of the great, gray, six story mills of the thread company, built up of granite quarried out of the very ground on which they stand; and see, too, the rows of neat and comfortable tenements ranged along the streets. There are four large mills, picturesquely set upon the east bank of the river, and stretching, with their surrounding grounds, over a space of three quarters of a mile. The buildings and grounds are noticeably clean and orderly in appearance. By a series of dams, aided by a sharp natural fall, a force of fifteen hundred horse power is secured from the river for the factories. In these mills, as we learn from the elaborate description of them in *Scribner's Monthly*, to which we owe much of the information here given, more than a thousand work-people—women and men, and girls and boys—are kept constantly busy at the various labors that combine to make thread.

The first operation in the preparation of the raw material for spinning is to run it through a machine called a "picker," which cleans about a thousand pounds a day.

The picker picks or beats out the dirt and seeds, and the cleaned cotton rolls out of the machine in laps, which are carried to the carding room, shown in one of the lower views in the engraving on the first page. The carding machine arranges the cleaned fibers parallel to each other, and delivers the cotton in a thin, narrow ribbon. After this operation the strand is run between sets of rollers, one set revolving faster than the other. This is called "drawing," and it is one of the most important parts of thread making. If one set of rollers, for instance, turns ten times as fast as the other, the strand that passes out between them is, of course, ten times lengthened and ten times as fine as the original. This is a "draught of ten," as it is called. The drawing may be in any ratio, and any number of strands may be run together into one at the same time that that is drawn. Five strands, for example, drawn with a draught of ten, would make a new strand half the size and ten times as long. This process of uniting strands is called doubling, and the doubling, running together, drawing down, and reuniting and redrawing are carefully watched, so that the size of the strand and the amount of work on it may be at any time known. The operation is repeated again and again; but all this doubling is not done without interruption. After the first few drawings, the long white ribbons of cotton which, in this condition, are called "slivers," are passed through another machine, which combs them again to remove all foreign substances; it also takes out all of the short fibers, leaving only the longer fibers to be worked into thread. The short fibers which are removed are sold for other manufactures. After combing, the sliver is doubled and again reduced in size, and then twisted for the first time in the roving frames and wound upon large spools, and it is afterward drawn and twisted in two separate machines before it is carried to the spinning mules.

The room in which the spinning is done is represented in the larger view in the engraving. In each of these machines there are several hundred spindles, which revolve very slowly as they are carried forward by the carriage in winding the thread on the spindle, but revolve with great speed as the carriage draws back in the operation of spinning. The spinning mule is entirely automatic in its action. The marvel of it all is the mathematical precision with which it begins, stops, and reverses, and the care with which it suitably varies its work each time to the needs of its case. The mule is all the while attended by a barefooted and lightly-dressed man or boy, whose business it is to unite such strands as accidentally part. On these mules the yarn is made of any size that is required. It is at Willimantic spun down to a fineness that rivals even the spider's web.

From the spinning mules the cops go to the cop winders, where two strands are wound together on a single spool. These two strands are twisted in a machine in which the bobbins revolve at a speed of about 5,000 revolutions per minute, and the thread is wound on the bobbins by a simple differential arrangement, which accommodates itself to the increasing diameter of the bobbin. Three of these double strands are twisted together, forming the well-known six cord spool cotton.

The spools from the twisting machines are conveyed to reeling machines, which form banks suitable for bleaching, dyeing, etc.

During every step in the progress of the cotton, from the raw state to the finished thread, it is repeatedly examined by experts, and if at any stage it is not in all respects up to the standard it is rejected and never finished. Delicate instruments, which are used in testing the thread, are to be seen in all departments of this immense establishment. It is only by continually and closely watching the various steps in the manufacture of thread, that a uniformity in quality is secured.

It is established by all spinners that 7,000 grains shall be a pound in cotton, and that yarn of which 840 yards weigh this pound, shall be number "1." Every now and then, therefore, all through the mill, a very accurately gauged reel, or some similar instrument, is used to measure off an even fraction of 840 yards. The measurer may be careless in taking off his sample, but that makes no matter. At exactly the right point the reel breaks the strand and calls attention to the fact by ringing its signal bell. Then this sample, say 120 yards or one seventh of "a hank," is weighed on scales also gauged to show the most delicate variations. If the yarn or roving is number one, and weighs one-seventh of 7,000 grains, it is exactly correct; if 120 yards of No. "30," for instance, were being sampled, it should weigh one-thirtieth of one seventh of 7,000 grains. Every time a variation appears, the cotton is made to thicken up or thin out as is needed. This testing is done repeatedly, and the results are recorded in books kept for the purpose, so that the course of any of the cotton on its three weeks' cruise of three thousand miles through the factory, can always be traced and faults found and corrected at once. Nothing more impresses one with the wonderful accuracy of the process than to watch one of these testings, note the exact measurement of the sample, and rigidly careful weighing, and see the gravity with which the overseer marks down the pettiest variations to the 28,000th of a pound! It all tells upon the thread, and making it correct through all its processes guarantees it correct, of course, when finished.

After the thread is made the work on it is by no means finished. To prepare it for market it must be inspected, washed, bleached, dried, perhaps dyed, spooled, and boxed, and the spools and boxes are also made in the factory.

After the operations already described the hanks of thread are placed upon reels and transferred to large spools in the department represented in one of the upper views. The thread is then conveyed to the winding machines which take the spools, and, holding them between centers, revolve them, start the thread, wind it back and forth with the utmost precision, making allowance for the beveled ends, stop when the required 200 yards are wound, nick the spool, put in the thread, cut it off, and release the spool, all without attention. All that is required of the attendant is to see that thread is supplied, and to keep the hoppers full of spools.

One of the most interesting machines in this establishment is the machine for ticketing the spools. One girl supplies it with sheets of printed labels, and another feeds it with spools; it does the rest automatically. Provided with the labels, it cuts out, pastes, and fastens the proper mark for each end of the spool, and prepares a hundred spools a minute. The machine does the work of many girls, and it never tires.

The winding machine, the ticketing machine, and the automatic spool-making machine—inventions belonging to the Willimantic Company—are so essential to the thread business that the privilege of using them is rented by other manufacturers.

Everybody knows the sizes of thread. Every seamstress knows whether she wants No. 30 or 60 or 120, and knows, when she hears the number, about what is the size of the strand alluded to; but how the numbers happen to be what they are, and just what they mean, not one person in a thousand knows. It is a simple matter to explain. The standard of measurement is the same already recited. When 840 yards of yarn weigh 7,000 grains (a cotton pound), the yarn is No. 1; if 1,680 yards weigh a pound it will be No. 2 yarn. For No. 50 yarn it would take 50x840 yards to weigh a pound. This is the whole of the yarn measurement. Thread measurement rests on it. The early thread was three-cord, and the thread took its number from the number of the yarn it was made of. No. 60 yarn made No. 60 thread, though in point of fact the actual caliber of No. 60 thread would equal No. 20 yarn, being three 60 strands. When the sewing machine came into market as the great consumer, unreasoning in its work and inexorable in its demands for mechanical accuracy, six-cord cotton had to be made, as a smoother, rounder product. As thread numbers were already established, they were not altered for the new article, and No. 60 six-cord and No. 60 three-cord are identical in size as well as number. To effect this, the six-cord has to be made of a yarn twice as fine as the three-cord demands. The No. 60 six-cord would be six strands of No. 120 yarn. To summarize: yarn gets its number from the arbitrary formula that 840 yards weigh 7,000 grains. Three-cord spool cotton is the same number as the yarn it is made of. Six-cord spool cotton is made of yarn that is double its number.

As simple a thing as thread seems to be, the Willimantic Company makes 1,200 different kinds, and it takes 10,000 dozen spools to hold each day's product.

THE St. Gothard tunnel makes steady progress, no less than 3,000 workmen being engaged upon it. Nearly 10 tons of dynamite are used per month.

MISCELLANEOUS INVENTIONS.

Mr. A. Edward Barthel, of Detroit, Mich., has invented a hammerless self-cocking and rebounding firearm, the improvements being applicable to shotguns, rifles, or revolvers, either single-loaders or magazine arms.

Mr. Zebina M. Hibbard, of Brooklyn, N. Y., has patented a trace fastener provided with a screw stem that works in the threads of the ferrule, and is provided with a shoulder that fits within a rabbet of the ferrule.

Mr. Simeon Garratt, of Columbus, O., has patented a self-acting car coupling, which will couple high or low, which, when running, will only come apart by the use of the lever, but which will immediately separate should the cars run off the track.

An improved adjustable harness pad has been patented by Jacob Johnson, of Ashland, Neb. The object of this invention is to provide a harness pad which may be adjusted to the back of a horse of any shape or size.

An improved bale tie, patented by Mr. William H. Roane, of Pine Bluff, Ark., consists of a rectangular plate, having opposite edges bent over toward the outside, forming flanges or lips, through one of which is made a transverse rectangular slot in line with the outside of the plate, while the other is provided with a similar slot, and with an opening through from the edge of the lip or flange.

An improved spark arrester, patented by Messrs. Silas Byram, of Middletown, Ind., and William R. Hansford, of Hicksville, O., consists of two pipes set one within the other, with an annular space between them, the inner pipe being constructed in vertical sections, with lower edges inclined or drawn inward that are held apart by lugs or straps extending from one to the other, while fixed in the longitudinal axis of each section is a conical deflector, and encircling each section is an annular flange whose diameter is the same as the internal diameter of the outer pipe.

An improvement in candlesticks, patented by Mr. Andrew J. Smith, of Ukiah City, Cal., consists in providing a slitted match box rising up in the candle holder from the bottom of base.

Mr. John Henry Hettinger, of Bridgeton, N. J., has invented an improved can cover, which is simple, readily adjustable, and efficient, and may be used for cans and jars, paint cases, etc. It may also be applied to barrels, boxes, or cases of wood, as well as of metal, by only changing the material of which it is constructed.

An improvement in electric speaking telephones has been patented by Mr. Frank P. Mills, of Ishpeming, Mich. The object of this invention is to increase the sensitiveness of speaking telephones and the resulting effects by a new arrangement of the permanent magnet and the armatures thereof; and it consists, essentially, of a circular or cylindrical magnet surrounding the helix, the poles of which are brought close together, but insulated from each other by a peculiar arrangement and construction of armatures.

Mr. Oscar Kleinberger, of New York City, has patented a suspender having its ends formed of braid or cords which cross and overlap each other two or more times, and are fastened together at their junctions by threads or cords, thus forming a series of button holes or loops of like size.

Mr. Charles P. Blatt, of Elizabeth, N. J., has patented a simple and effective device for keeping beer and other liquids when "on tap" cold and supplied with common air or carbonic acid. It consists of a box or cabinet containing an air-tight chamber, an ice chamber, and a place for the barrel or other vessel containing the liquid.

Messrs. Hartwell A. Crosby and George F. Thompson, Jr. (administrator of Michael W. Thompson, deceased), of St. John, N. B., have patented an improved sash stop and lock. The object of this invention is to provide a more simple and durable sash stop and lock than those now in use. To close a window provided with this device, one has only to reach up and pull down on the thumb piece. If the window is partly open and it is desirable to raise it higher, it is only necessary to push it up, and the pawl will hold it at any point.

An improvement in riding plows, patented by Mr. Alfred Belchambers, of Ripley, Ohio, consists in a riding attachment composed of a frame mounted on wheels and drawn behind the mouldboard.

Commercial Enterprise.

Our English contemporaries seem to be awakening from their lethargy and to realize the cause for the depression in trade among their manufacturers.

Acute observers of the "spirit of the age," says one of the foremost trade journals of England, must have noticed the inborn love of conservatism, and the desire to follow in the footsteps of our fathers or predecessors that distinguishes us from our Continental neighbors and our American cousins. Progression in this country is usually the result of competition, or the force of circumstances, frequently impelling our ironmasters and our colliery owners to move with the times, and the steady-going British manufacturer to remodel his plant, improve his patterns, print his catalogues, and advertise his productions.

There can be no question that in many departments of trade the English name was at one time pre-eminently conspicuous, and our foreign rivals had to be content to follow the lead we were setting them. But, in too many cases now, the position is reversed, and "Jack is as good as his master."

It is unfortunate that such should be so, but a great deal of the present depression in trade is to be attributed to the apathy of British traders. After being over-credulous for years they are now becoming over-cautious, and improvements or investments which show a good chance of being remunerative are either neglected altogether or postponed to an indefinite period.

The Wagon Hardware Trade.

Pittsburg seems to be a "head center" for the trade in wagon hardware. A recent article in these columns gave our readers an idea of the extent of the wagon and carriage building trade in the United States. A Pittsburg firm, Messrs. Lewis, Oliver & Phillips, employ about 700 men upon wrought iron wagon fittings. They control nearly 100 patents, covering the devices used and the processes for turning out the different parts by machinery. The firm make the necessary fittings for 90,000 wagons per annum, supplying the following wagon-making concerns: Studebaker, of South Bend, Ind.; Milburn, of Toledo, O.; Schuettler, of Chicago; Baine, of Kenosha, Wis.; Austin, Tomlinson & Webster Co., of Jackson, Mich.; Moline Wagon Co., Moline, Ill.; Kansas Manufacturing Co., of Leavenworth, Kansas, and others.

ARTIFICIAL HAYMAKING.

On these islands, says the London *Graphic*, where farmers suffer far more often from excess of moisture than from excess of sunshine, and where crops, which up to the last moment have promised well, are often seriously injured by wet during the process of gathering in, a successful method of artificial drying without the aid of the sun's rays would be an immense boon. For many years Mr. W. A. Gibbs, of Gillwell Park, Chingford, Essex, a gentleman engaged in mercantile pursuits in the city, and also, we may venture to observe, favorably known among the poets of the day, has also devoted much attention to this hay-saving problem. By slow degrees he invented a really practicable process, which is thus described:

"Streams of hot air from the mouth of a hot blast fan, connected with a portable engine, are directed upon masses of wet hay or grain laid in open troughs, and brought in turn, by occasional lifting of forks, under the direct action of the air. By increasing the temperature of the blast it was found that the drying process could be proportionately expedited. Eventually the scheme was perfected by bringing the hot blast fan to bear upon a shed divided into two compartments by an iron partition, and having a space between the iron floor and the ground. Hot air, supplied from the hot-blast fan by means of a duct from an underground furnace, communicates with thirty-two conical perforated tubes on the floor, on which are spiked the wet corn sheaves. These tubes of course are used only for grain. The crowning success of the whole process is an atmospheric hoist, worked by the same engine as the hot blast, which elevates and sends up to the top of a stack, 22 feet high, as many as 960 sheaves per hour."

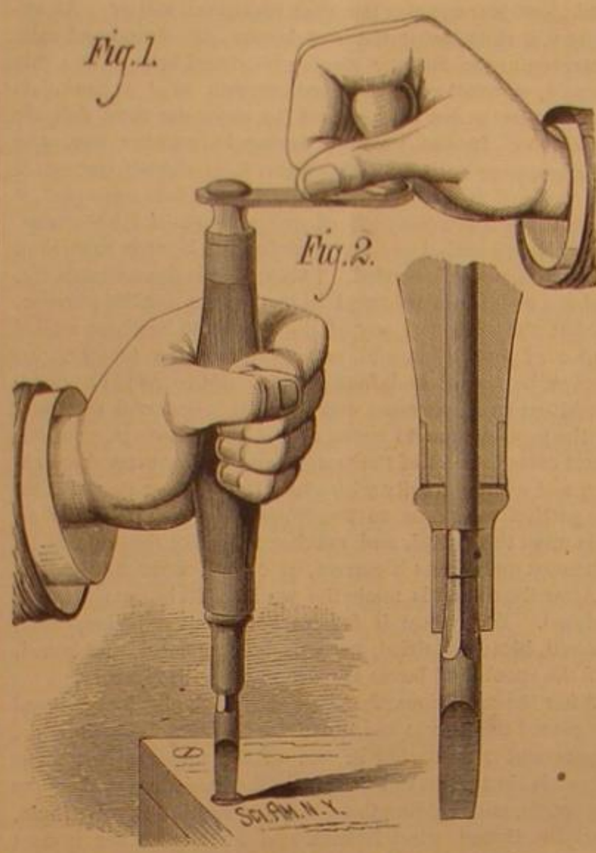
This year, owing to the unprecedented wet summer, Mr. Gibbs' invention has come to the front and been recognized by practical men as one of extreme value. He says, in a letter to the *Field*: "On Tuesday in last week I lent one of my hay driers to Mr. Ashcombe, of Sewardstone, a practical farmer of long experience and large 'holding.' He started it at 9 A.M., and in ten hours had dried and stacked the produce of ten acres, estimated at one and a half loads per acre. The total cost was £5 10*s.* for the ten acres, rather less than it would have cost to make the hay in the field, had that been possible. The hay was made from unripe, rank, weedy grass which had been perpetually rained upon; Mr. Ashcombe and his men were inexperienced in the use of the machine, and had no help from me; the hay drier was wholly uncovered, and heavy showers fell on the hay while it was being dried." Yet, in spite of these unfavorable conditions, the result was a complete success. Already several leading agriculturists, among whom is the Duke of Sutherland, have purchased these machines. The price of the large size is £350, but cheaper forms for small holdings, ranging from £50 to £90, are in use, and have done good service.

AN IMPROVED SCREW DRIVER.

The engraving given herewith represents an improved screw driver recently patented by Mr. George Abrams, of Philadelphia, Pa. It consists of a handle through which extends a shaft, having on the upper end a crank and upon the lower end a socket for receiving the screw driver bit.

Fig. 1.

Fig. 2.



ABRAMS' CRANK SCREW DRIVER.

With this tool screws may be inserted and removed with much greater facility than with the ordinary form of screw driver, as the motion is a continuous rotary one instead of intermittent.

If desired the screw driver bit may be removed and a drill or boring tool inserted in its place.

MECHANICAL INVENTIONS.

Messrs. Jacob W. Cagle and Joshua W. Nichols, of Greenville, S. C., have patented an improved press for baling cotton, hay, straw, rags, bagging, hemp, etc. It is simple in construction, convenient, rapid, and powerful in operation. It consists of certain novel features which cannot be fully described without an engraving.

An improvement in skiving machines has been patented by Mr. Charles E. Langmaid, of Stoneham, Mass. It consists in a vibrating knife that is hung upon the bed and used in connection with the usual clamps or rolls for feeding the material, and operated by mechanism, whereby the cutting is done with greater facility than heretofore, and the machine may be used for the finest work.

Mr. William H. Silsby, of Chico, Cal., has patented an improved grain separator of that class in which the grain is thrashed and immediately separated from the straw by endless belts. It consists in a peculiar arrangement of parts which cannot be readily described without an engraving.

Mr. John M. Whitney, of Mount Pulaski, Ill., has invented an improved windmill and pump for use in supplying water for stock and other purposes. It is so constructed that the wind wheel may be in operation so long as the wind blows with sufficient force, while the pump will operate intermittently, or only at such times as the tank or trough is empty, or nearly so.

Mr. William F. Rundell, of Genoa, N. Y., has patented an improvement in mowers, which consists, first, in the construction and arrangement of a clutch for connecting the main shaft with the driving gear; second, in the peculiar arrangement of the gauge wheel for the inner end of the cutter bar with respect to the cutter bar and carrying frame; third, in the peculiar form of joint connecting the outer end of the pitman to the cutter bar; and fourth, in the peculiar construction and arrangement of the draught attachment.

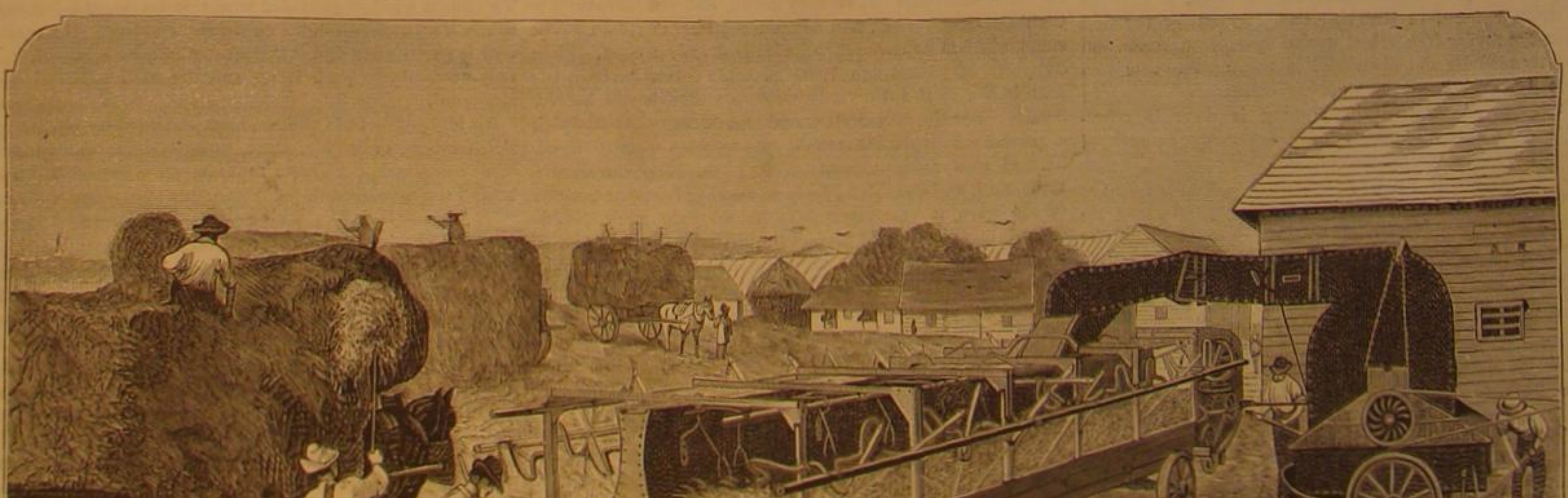
The New Cunard Steamer.

Mr. John Burns, one of the proprietors of the Cunard Steamship Company, writes to the London *Times*:

"It may interest the public to know that my partners and I have just concluded a contract with Messrs. James and George Thomson by which that firm is to build on the Clyde, for our fleet, a screw steamship the size of which will be exceeded only by that of the Great Eastern, while the speed will be greater than that of any ocean steamer afloat. This new vessel will be of 7,500 tons and 10,000 horse power, her dimensions being 500 feet in length, 50 feet in breadth and 41 feet in depth, propelled by inverted direct acting compound engines, with three cylinders and seven oval tubular boilers, having thirty-eight furnaces and 1,000 feet of effective fire grate surface. She will have an extra promenade deck, and will practically be a five decker, being fitted for 450 first class and 600 steerage passengers, with accommodation for a crew of 200 officers and men. Her cargo capacity will be equal to 6,500 tons, with 1,700 tons of coal and 1,000 tons of water ballast, having a double bottom on what is called the 'longitudinal and bracket system.'

"This vessel has been designed, after lengthened consideration, to meet the requirements of our traditional service, and we have adopted in every detail of the ship and engines the most advanced scientific improvements compatible with the safe working of so great a vessel. Among the important matters into which we have crucially inquired has been that of the employment of steel instead of iron, and after a practical and thorough examination into the merits of both materials we have adopted steel for the hull and boilers, but under a provision so stringent that every plate, before acceptance, will undergo a severe and rigid test by a qualified surveyor appointed and stationed at the steel manufactory for that special purpose, and that the manipulation of the steel by the builders shall be subject to an equally careful supervision by qualified engineers of our own appointment. The steel is to be made on the Siemens-Martin process, and all rivets as well as plates throughout the ship are to be of steel. The name of the new vessel is to be the Sahara, and she is to be ready for sea in March, 1881."

The prize of $100 offered by Stillman B. Allen, of Boston, to the boy of York county, Maine, who should raise the greatest amount of corn on one-eighth of an acre this year has been awarded to Joseph Milliken, Jr., of Biddeford, who raised 1,404 pounds.



CURING HAY IN WET WEATHER BY AID OF ARTIFICIAL HEAT.

THE IBEX.

Of the genus *Capra*, which includes several species, the ibex or steinbok is a familiar and excellent example.

This animal, an inhabitant of the Alps, is remarkable for the exceeding development of the horns, which are sometimes more than three feet in length, and of such extraordinary dimensions that they appear to a casual observer to be peculiarly unsuitable for an animal which traverses the craggy regions of Alpine precipices. Some writers say that these enormous horns are employed by their owners as "buffers," by which the force of a fall may be broken, and that the animal, when leaping from a great height, will alight on its horns, and by their elastic strength be guarded from the severity of a shock that would instantly kill any animal not so defended. This statement, however, is but little credited.

To hunt the ibex successfully is as hard a matter as hunting the chamois, for the ibex is to the full as wary and active an animal, and is sometimes apt to turn the tables on its pursuer, and assume an offensive deportment. Should the hunter approach too near the ibex, the animal will, as if suddenly urged by the reckless courage of despair, dash boldly forward at its foe, and strike him from the precipitous rock over which he is forced to pass. The difficulty of the chase is further increased by the fact that the ibex is a remarkably endurant animal, and is capable of abstaining from food or water for a considerable time.

It lives in little bands of five or ten in number, each troop being under the command of an old male, and preserving admirable order among themselves. Their sentinel is ever on the watch, and at the slightest suspicious sound, scent, or object the warning whistle is blown, and the whole troop make instantly for the highest attainable point. Their instinct always leads them upward, an inborn "excelsior" being woven into their very natures, and as soon as they perceive danger, they invariably begin to mount toward the line of perpetual snow. The young of this animal are produced in April, and in a few hours after their birth they are strong enough to follow their parent.

The color of the ibex is a reddish brown in summer, and gray-brown in winter; a dark stripe passes along the spine and over the face, and the abdomen and interior faces of the limbs are washed with whitish-gray. The horns are covered from base to point with strongly marked transverse ridges, the number of which is variable, and is thought by some persons to denote the age of the animal. In the female the horns are not nearly so large nor so heavily ridged as in the male. The ibex is also known under the name of bouquetin.

THE IBEX.

Preservative of the Dead.

The United States Consul-General at Berlin, Mr. Kreismann, has communicated to the Department of State a new process patented in Germany for preservation of the dead. The liquid used is prepared as follows: In 3,000 grammes of boiling water are dissolved 100 grammes of alum, 25 grammes of cooking salt, 12 grammes of saltpeter, 60 grammes of potash, and 10 grammes of arsenic acid. When cool it is filtered. To 10 liters of this liquid 4 liters of glycerine and 1 liter of methylic alcohol are added. The process of embalming is by saturating and impregnating the bodies with it. From 1½ to 5 liters of the liquid are used for a body.

Volcanic Products at the Bottom of the Pacific.

The Abbé Renard and Mr. J. Murray communicated to the Geological Section of the British Association, at Sheffield, the results of an examination of the materials brought up by the Challenger's instruments from the bottom of the central Pacific. The area from which the materials submitted to the Abbé Renard were derived extends from the Sandwich Islands to 30° S. lat., having the Low Archipelago approximately in its center. Volcanic matter was found to play an important part in the formation of the bottom, being present in the form of lapilli and ashes distributed in great abundance in the "red clay," of which we have heard so much. The lapilli nearly all belong to the basaltic type, passing from felspathic basalt to allied rocks, in which the vitreous base acquires greater and greater development, until it almost entirely displaces the crystalline constituents of the basalt, when the fragments become mere glassy rocks of the basic series, generally containing some crystals of peridote, innumerable crystallites, the latter sometimes grouped in opaque granules, sometimes arranged regularly around the peridote microlites. From the forms of these volcanic fragments, which are often coated with manganese, their association with volcanic ash, and their lithological constitution, they cannot be derived from submarine flows of lava. They are rather incoherent volcanic products, or lapilli, the accumulations of which in the Pacific form a series of submarine tuffs.

One of the most remarkable facts, brought to light by these soundings in the Pacific, is the large share taken in the formation of these sedimentary deposits by palagonites, perfectly identical in lithological characters with those of Sicily, Iceland, and the Galapagos islands. Many are in fact glasses of the basic series, either consisting of sideromelane, or decomposed into a red resinoid substance. The small lapilli of two or three inches in diameter are cemented by zeolites, showing the crystalline forms of christianite. The presence of these readily alterable basic glasses at once reveals the source of the clayey matter with which they are associated, as wherever rocks of this type occur their decomposition into clay is observable.

Among the minerals present in the volcanic ash are rhombic tabular crystals of plagioclase, augite, magnetite, and a little sanidine or hornblende. It is singular that quartz grains are practically absent, in striking contrast to coast deposits. This fact, however, is not so unexpected as the formation of zeolites in the free state. Minute fibrous radiated spherules are formed in the mud, possessing the crystallographic characters of christianite.

Besides these zeolitic spherules, other crystals of the same kind occur in the form of minute prisms, and in such prodigious numbers that they make up about one third of the red clay. These and the zeolitic spherules are regarded by the authors as belonging to one mineral species, and they remark that the formation of these and of the red clay in which they are developed is easily understood if we bear in mind the lithological nature of the basic tuffs and of their products of decomposition.—*Nature.*

NATURAL HISTORY NOTES.

The Beheading of Flies by a Western Plant.—In the *Bulletin de la Société Botanique de France* (vol. xxiv.), says Professor Asa Gray, there is an account by M. J. Poisson of his observations upon *Mentzelia ornata* as cultivated in the Jardin des Plantes, Paris, and the very singular mode in which it causes the destruction of flies. It is so curious that the essential points of M. Poisson's communication are here recapitulated, in the hope that observations may be made in this country, either by the few who are able to cultivate this ornamental plant with success, or by those who can examine it in its native stations. It is well known that the roughness of this and some related *Loasaceæ* is owing to the stiff bristles of the surface being provided with an armature, at certain points along their length, of retrorse barbs. There are three or four whorls of these barbs, and four or five barbs to each whorl, on the larger bristles; in the smaller there is only a terminal whorl of barbs, in the manner of a glochidiate bristle. Mixed with these harpoon-like bristles are some soft ones, tipped with a capitate gland, which secrete a viscid matter attractive to insects. It appears that flies so attracted thrust in their proboscis between the thickly-set glochidiate bristles to feed upon the secretion of the glands between and below. The retrorse barbs interpose no obstacle to this; but when the proboscis is withdrawn, its dilated and cushion-like tip catches in the barbs, and holds all fast. The harder the backward pull, the firmer and more extensive the attachment to the sharp barbs. The wounded and impaled organ becomes congested and swollen, and the insect is seldom able to disengage it. Especially is this the case with the larger flies. Some perish by exhaustion; but more of them, passing round and round in a circle, and in one and the same direction, come to an end by twisting off their heads. Insects too small to be impaled on the barbs are held fast by the viscid secretions of the glands, and likewise perish. In these respects the arrangement comes under the head of those recently illustrated by Kerner, for the exclusion of unwelcome guests from the blossoms. And this may be extended to the flies also, which might reach the blossom on the wing, but are attracted rather to the glands beneath, to their own destruction. Professor Gray requests those who have good opportunities of obtaining *Mentzelia ornata*, and its much more common relative, *M. nuda*, both of which occur in the Western prairies and plains, to investigate the matter and ascertain whether this charge of cruel behavior is well founded.

Cactus Spines.—The spines must, says Moseley in his "Notes of a Naturalist," be a most efficient protection to the cactus from being devoured by large animals. "I have often noticed that if one approaches one's hand slowly toward some of the forms with closely set long spines, doing it with especial care to try and touch the end of one of the spines lightly without getting pricked, one's hand always does receive a sharp prick before such is expected, the distance having been miscalculated. There seems to be a special arrangement in the color of the spines in some cases, possibly intended directly to bring about an illusion, and cause animals likely to injure the plant to get pricked severely before they expect it, and thus to teach them to shun the plant. While the greater length of the spines next the surface of the plant is white, the tips are dark colored or black. The black tips are almost invisible as viewed at a good many angles against the general mass as a background. The spines look as if they ended where the white coloring ends, and the hand is advanced as if the prickles began there, and is pricked suddenly by some unseen black tip. The experiment is easily tried in any cactus house at home."

Hybrid Shad.—Mr. Seth Green has recently called attention to the fact that it has been customary for the last four years at the shad hatching works on the Hudson River, whenever an opportunity offered, to impregnate the spawn of the shad with the milt of the white bass. He says that these eggs have hatched out in quite as large a percentage as those impregnated with the shad milt. The young fish look very much like small shad, but their actions are so entirely different that they are readily distinguishable while in the hatching boxes. The attention of fishermen and others is particularly called to the fact that such hybrids now exist in the Hudson, and they are requested if any such be caught to make known the fact through the papers or otherwise, describing as particularly as possible the appearance, characteristics, etc., of the strange fish.

Correspondence.

EDISON'S ELECTRICAL GENERATOR.

To the Editor of the Scientific American:

The letter of Mr. Upton, on page 337, is far from being satisfactory, at least to myself, for it tends to frustrate the realization of the plans I had suggested of relieving Mr. Edison from the appearance of having put forth a preposterous claim for his electric generator. It has almost brought me into the thick of a controversy; I barely escape and reserve my valor for another day. I protest that up to this time I do not know that there is any disagreement between Mr. Edison and myself. Mr. Upton is indeed Mr. Edison's assistant, and his letter purports to be authorized, and yet I cannot find anywhere irrefragable proof that Mr. Edison is the author of the preposterous claim, or that he ever indorsed it. I believe it is best, indeed, as I did in my article on page 305, to assume, until its falsity is proved, that Mr. Edison in the matter of that preposterous claim, or anything else, has not treated with indignity the revered memories of Ohm, Faraday, and the other fathers of electricity. Mr. Edison, like myself, appears to love peace and quietness, and perhaps the guilty author of that preposterous claim will never be discovered and punished. The disagreement which so far is developed is between Mr. Upton and myself only, and it will not long continue if he will take my advice.

The matter in Mr. Upton's letter which is offered as especially pertinent to the preposterous claim is comprised in the two following sentences:

1. "The writer of the article (on page 242) simply stated that the machine was so constructed that when used at its normal capacity the exterior resistance shall be nine times as great as the internal, so that ninety per cent of the power of the current could be used outside."

2. "Yet all that was claimed in the article (page 242) was perfectly true, and has been carefully verified."

I have not been able to satisfy myself as to what are the intent and meaning of sentence 1. I cannot find out what "normal capacity" is. I cannot find out what the thing is which was simply stated; why did not Mr. Upton state it simply? Among various theories of the intent of sentence 1 which I have worked out, the most plausible is, that the sentence is a device like those terrible engines which Knickerbocker, in his history of New York, relates were employed by the ponderous Dutch warriors. This theory derives confirmation from the fact, which appears on page 308, that Mr. Upton found it a fair thing to fire, without warning, at short range, and point blank, hot shot of Calculus (!) right into a gentleman by the name of Weston.

But sentence 2 is direct, explicit, and emphatic. It is so admirable in its way that I quote it again: "Yet *all* that was *claimed* in the article was *perfectly* true, and was *carefully* verified." Now, as nothing was claimed (on 242) but what is covered by the preposterous claim, this latter is signed, sealed, and indorsed; it is represented as having been verified; it is reasserted strenuously. Did Mr. Upton pen that sentence, with the demonstration on page 305 before his eyes?

I reproduce, from page 242, the preposterous claim: "Mr. Edison claims that he realizes ninety per cent of the power applied to this machine in effective external current," and thereupon soon follows the explanation that the great economy is due to the employing of a resistance ratio of 1 : 9. For the demonstration of the fallacy of this I refer to page 305.

I might stop here, far I have said all that is required concerning the matter of the preposterous claim. Mr. Upton introduces several other and extraneous things which are calculated, like that sentence 1, to befog and lead astray the hasty reader, and I shall therefore briefly notice them. The larger part of the letter is devoted to remarks which are aimed more or less directly at myself personally. The general effect of these is substantially that of the trite retort, you're another; but I meet them in detail by pointing out that a part are intended to show that I had overlooked something important, and the rest that I use technical terms ignorantly and recklessly.

1. After a very ingenious prelude, in which I am made to take a rather funny part, the following climax is reached: "It seems never to have occurred to the doctor that it is in the power of the maker of the machine to exert this 'moral suasion' on the wire covering the armature, so that it shall be more effective and redouble its exertion when greater resistance is offered for it to overcome." Mr. Upton is correct; it really never did occur to me. But feeling that such a confession, on account of its brevity, is rather weak, I append the remarks of one whose opinions are worth their weight in diamonds, and are the delight of the world: "If so be ye overhaul yer masheen, tack on yer armycheer a leetle more wire, and make them irons, which ye call magnets, a leetle heftier, why then yer masheen will be bigger; and howbeit ye do these things, why ye'll have a bigger masheen. Bigger, did I say? No! Why? For the bearings of the obserwation is in the application on it." This is perhaps one of Bunsby's greatest efforts.

2. Mr. Upton neatly gets round to the remark that I deliberately state that current and foot pounds are the same, that energy is directly proportional to the current, etc., and he corrects and instructs me by remarking that "foot pounds are always measured by the square of the current," etc. Moreover, he says: "Dr. Seeley's distinction of outside from inside current seems to me ridiculous." Mr. Upton, no doubt, made himself quity merry at the discovery of all these blunders of mine. Now I reply: Mr. Upton would not have discovered those blunders unless he had been looking for them; the wish is father to the thought. I do not think anybody else has found them, or is likely to find them. When we are obliged to write in the telegramic style, as we are when limited as to time and space, we spontaneously take up abbreviated expressions which hypercritics might object to. Thus we may use the letter C for current or strength of current or energy of current, and no one but the hypercritics will misunderstand or complain unless some positive ambiguity results. Life is too short to write with a view of satisfying the hypercritics. I might quote many precedents for the expressions I used, but I content myself with a single one, for the reason that it is from an authority which, I am sure, Mr. Upton greatly respects; the authority, please understand, is not Mr. Edison: possibly it is Mr. Upton himself. If Mr. Upton will turn to page 242 he will find thereon the preposterous claim as originally propounded, and he will observe that the last two words are "external current." How is it now? Will Mr. Upton ever again say, "the distinction of outside from inside current seems to me ridiculous?"

After finishing my case, Mr. Upton goes on: "In conclusion, I may state that the methods which are employed for testing Mr. Edison's machines were fully described in a paper read by me (in August) at the Saratoga meeting of the American Association. At that time (in August), as now, full results were withheld until Mr. Edison was fully satisfied with the performance of the machine." I find in this pretty plain evidence that Mr. Edison did not—and this I have contended for from the first—put forth the preposterous claim. He had full tests in August as well as on October 11th, and of course he knew that he did not realize that 90 per cent; if he had realized it, he would have been fully satisfied with the performance of his machine, for his machine would be the greatest invention of all time.

Mr. Upton concludes by mentioning that Mr. Edison hopes soon to have a machine with a resistance ratio of 1 : 20. I trust this is not quite true. It would be almost a public calamity if Mr. Edison should employ his great talent on such a puerility. I quote again: "His machine is so made that it would be impossible to use it with the same resistance outside as inside, as it would heat the wire on the armature so as almost to burn it, by carrying a current so much in excess of that for which it was intended." The truth of this must be evident to any one who is a tolerable expert on machines; but I quote it as further evidence that Mr. Edison is not the author of the preposterous claim, and to raise the query whether we cannot relieve Mr. Upton also from suspicion.

A few weeks since (suppose) the startling announcement was made in the papers that X, a dear and distinguished friend of mine, had lifted himself over a tall fence by pulling on his boot straps. Many respectable people, influenced mainly by their exalted and often proved faith in the ability of X, accepted the announcement as true; for my friend was an eminent authority and exceedingly expert in the matters relating to the alleged achievement. The hopeful people at once began speculations on the applications of X's discovery to rapid transit and other great projects. The larger part of the community, however, remembering something of the little lessons in natural philosophy of their school days, denied the claims set up for X, and they scoffed at him. At this juncture it seemed to me a proper thing and a duty towards a friend and to the public to make an explanation. I said that the feat proclaimed was really an impossibility, that it was a contradiction of the law of action and reaction; that the pulling up on the boot strap would be precisely balanced by the pressing down of the feet in the boots, etc.; that my friend was of too good sense to claim impossible performances; that the announcement was an exaggeration, or came from a wicked partner, etc. My explanation was calculated to pacify the scoffers and to make all lovely again. My friend had no call to say anything, unless to indorse my explanation or to turn the whole affair into mild but pleasing entertainment by relating how the announcement originated in a little badinage of his, in which he proposed to lift himself over the fence, by pulling on the boot straps of his carriage after slinging them over a pulley, etc. But the affair is going to terminate differently and sadly. For a gentleman by the name of Z, who is an assistant (some say a partner) of X, has written a letter to the public which purports to be authorized by X, in which the original claim is reasserted and enlarged. Mr. Z says: 'Spring, at its normal capacity, is the pleasantest season of the year. X never denied Newton's laws. Yet all that was claimed in the papers was perfectly true, and has been carefully verified. X has positively lifted himself over a fence ten feet high, and it may be mentioned that he hopes to lift himself over a fence 20 feet high. There are doors in the fence, but they have patent locks on them. (What does this mean?) This S isn't much of a doctor, and I wouldn't trust him with a sick cat. He spells Jerusalem with a G, and his name is mentioned in connection with a neighbor's hen roost." This letter of Z's is a great trouble to us, but I protest and persist that X is innocent. No one can foretell what is to come out of all this embarrassment.

But all this is supposition. Perhaps it isn't apropos of anything. "The bearings of an obserwation is in the applications on it."

CHARLES A. SEELEY.

A Note from Mr. Edison.—The Hughes Microphone and the Blake Transmitter.

To the Editor of the Scientific American:

In reference to the communication from T. D. Lockwood, which appeared in the SCIENTIFIC AMERICAN (No. 21), November 22, 1879, regarding the carbon telephone, I wish to say that his statement that the scientific men of Europe have supported the claim of Hughes that the microphonic action is different from the carbon telephone, is absolutely false, and as a fact just the contrary is the case. Also that the Patent Office has declared that the Blake transmitter filed in the Patent Office in 1879 infringes several of my patents filed in 1877. In fact there is not the slightest difference between the carbon transmitter and the so-called Blake transmitter, except in size of parts and delicacy of adjustment.

T. A. EDISON.

Menlo Park, N. J., November, 1879.

CROSS-BREEDING AMONG FISH.

Mr. Robert B. Roosevelt, so well known in connection with fish breeding, is responsible for some surprising assertions with regard to the inter-crossing of distinct species of fish. Some two years ago the eggs of a shad were placed in a pan of fresh water which could not have contained any milt of the male shad. This done, the eggs were mixed with the milt of a striped bass and they were immediately fertilized. They were then placed in the shad-hatching boxes, and fully 10,000 young cross-breeds were the result. They were turned into the river at the proper time, and it is not yet time for them to return, if they follow the customs of their mother.

That the hybrids are likely to thrive and breed is thought probable after the perfect success that has followed the crossing of the California salmon and the common brook trout. Mr. Roosevelt says: "We have crossed fifteen or twenty different breeds, and all successfully, and I can assure you that the result is a strong argument in favor of Darwinism, for it shows that all fish may possibly have grown out of one or two varieties. This would account for what is called the 'land-locked salmon' which is found in lakes having no communication with the sea. The object of this crossing and breeding is to improve the fish, just as they cross neat cattle and horses, and even fruits and flowers. The result will be to make fish food plenty, and to add a large number of 'queer fish' to the number already in existence."

THE INTERNATIONAL DAIRY FAIR.

The second annual International Dairy Fair in this city, to be opened in the American Institute building, December 8, promises to be the largest and finest exhibition of the kind ever held in this country. Nearly three thousand entries have already been made by intending exhibitors, and ten thousand dollars will be given as premiums. It is expected that at least 300 specimens of fine cattle will be exhibited, representing the most celebrated herds in the country. Especial attention will be given to this department of the fair. In addition to many novelties there is promised an elaborate comparison of the methods of butter and cheese manufacture as employed a hundred years ago and to-day in our best factories.

STEAM TOWING ON THE ERIE CANAL.

The first through tow on the Erie Canal from Buffalo to Rochester, by the steam cable towing system, arrived at the latter city, November 18. The tow consisted of five canal boats, carrying 1,200 tons of grain. The distance, 96 miles, was covered in 39 hours, a saving of 23 hours as compared with horse power. It is expected that the cable system will be completed the entire distance from Buffalo to Troy, 345 miles, shortly after the reopening of navigation in the spring. The existing canal boats will be used without alteration, and the boats will yield a larger revenue owing to the saving of time on each trip. The traffic of the canal this year has been unusually great, and it is expected that the new system will largely increase its capacity.

New Military Projectile.

Experiments have recently been carried on at Grenoble to test the efficacy of a new apparatus, made by M. Lamarre. The invention consists of balls to be projected by guns of a fortress for the purpose of throwing a strong light on the enemy's position during the night; the principal object being to prevent the digging of trenches or the performance of other military operations. Shortly after leaving the cannon, the Lamarre fire ball discharges a light sufficiently bright, and lasts long enough, to enable guns to be pointed at the works. The projectile is, moreover, provided with a grenade, which explodes after a certain time, and is designed to keep the enemy's troops away and prevent them from putting out the unwelcome light.

GLASS TUBING.

The manufacture of glass tubing is surprisingly simple. The glass blower takes a small quantity of melted glass from the pot with his blowing tube, rolls it slightly on a marble slab to give it a cylindrical form, he then adds a small quantity of glass from the same pot, and blows the enlarged mass while rolling it, taking great pains to keep the shape cylindrical. If tubes of large caliber are required, the inside diameter of the cylinder is enlarged, and the glass is allowed to cool slightly before drawing. For tubes of very small caliber, such as thermometer tubes and other capillary tubes, the internal diameter of the cylinder is decreased and the glass is used very warm.

In making a piece of glass tubing the assistant places a ball of glass against the end of the glass cylinder by aid of his blowing tube. Now the men, each holding an end of the glass cylinder by means of their blowing tubes, begin to separate, walking backward. The cylinder is thus lengthened, and at the same time made smaller in diameter, and the diameter, of course, depends upon how much the tube is drawn out.

When the tube has attained the right size it is generally too warm and soft to admit of laying it down without destroying its shape; it is therefore cooled by means of a fan, as shown in Fig. 1. When it becomes sufficiently cool it is laid upon a series of equidistant parallel wooden blocks of uniform height, where it remains until it becomes cold. It is then cut into lengths with a diamond or a file. If the tubes are to resist great pressure or changes of temperature, they are annealed with great care. They are sometimes plunged into boiling linseed oil and slowly cooled.

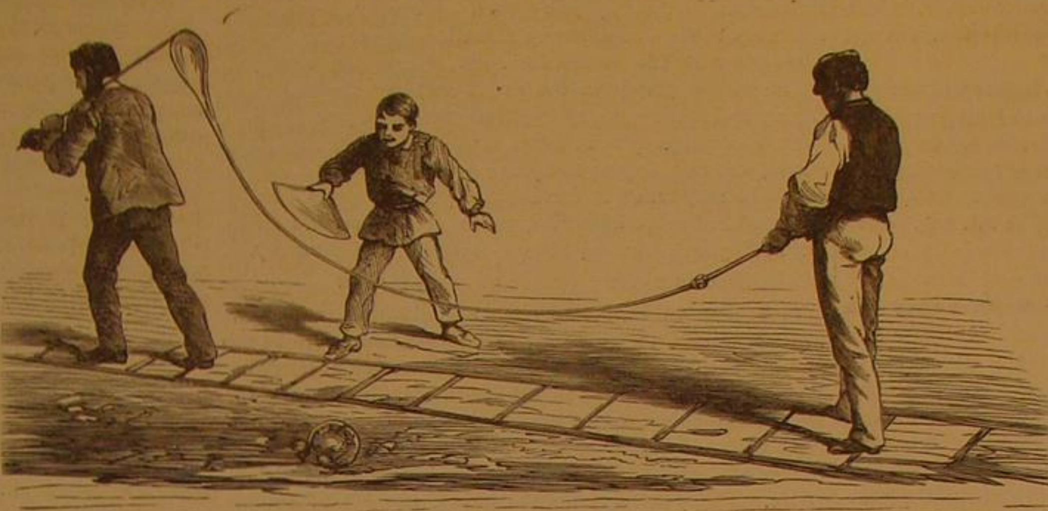


FIG. 1.—COOLING GLASS TUBES.

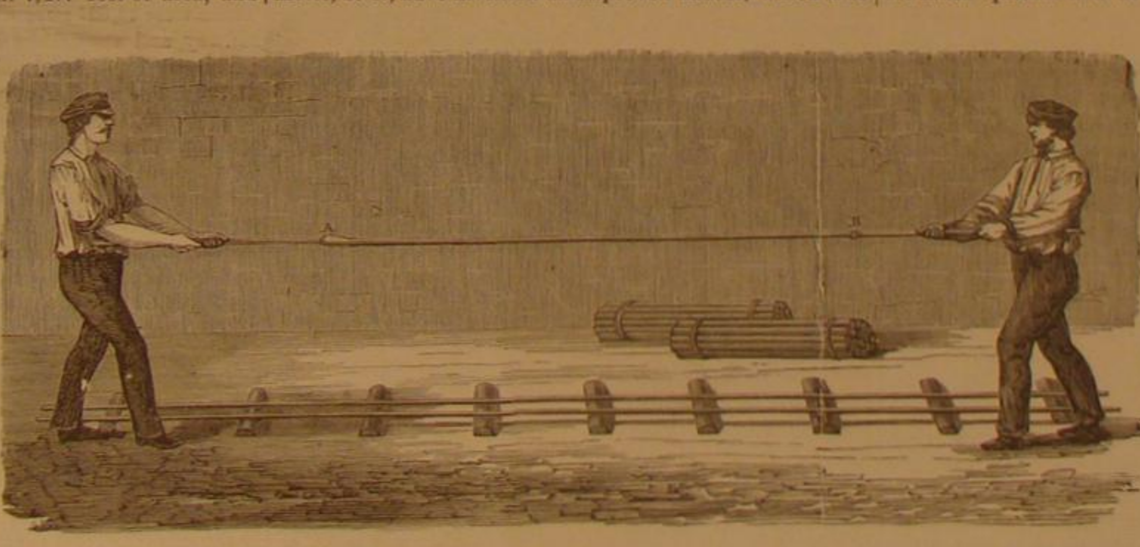


FIG. 2.—DRAWING GLASS TUBES

Reading Room of the British Museum.

The dome of the British Museum reading room, in which the electric light is now used, is 140 feet in diameter and 106 feet high. In this dimension of diameter it is only inferior to the Pantheon of Rome by 2 feet; St. Peter's being only 139; Sta. Maria, in Florence, 139; the capitol at Washington, 135½; the tomb of Mahomet, Bejapore, 135; St. Paul's, 112; St. Sophia, Constantinople, 107, and the Church at Darmstadt, 105.

The new reading room contains 1,250,000 cubic feet of space; its "suburbs," or surrounding libraries, 750,000. The building is constructed principally of iron, with brick arches between the main ribs, supported by twenty iron piers, having a sectional area of 10 superficial feet to each, including the brick casing, or 200 feet in all. This saving of space by the use of iron is remarkable, the piers of support on which the dome rests only thus occupying 200 feet, whereas the piers of the Pantheon of Rome fill 7,477 feet of area, and those of the tomb of Mahomet 5,593 feet. Upwards of 2,000 tons of iron have been employed in the construction. The weight of the materials used in the dome is about 4,200 tons, namely, upwards of 200 tons on each pier.

The uprights or standards of the bookcases in the British Museum reading room are formed of wrought iron, galvanized and framed together, having fillets of beech inserted between the iron to receive the brass pins upon which the shelves rest. The framework of the bookcases forms the support for the iron perforated floors of the gallery avenues, and which are generally 8 feet wide, the central 6 feet being appropriated to the perforated floor, and the remainder being a clear space between the back of the books and the flooring, by which contrivance the light from the skylights (in all cases extending to the full width of the avenues) is thrown down the back of the books on each story, so that the lettering may be easily discerned throughout the book ranges. The shelves are formed of iron galvanized plates, edged with wainscot and covered with russet hide leather, and having a book fall attached. They are fitted at each end wih galvanized iron leather, covered, and wadded pads placed next the skeleton bookcase framing, to prevent injury to the binding when the books are taken out or replaced. Between these pads the skeleton framing of the cases forms an aperture by which a current of air may pass and ventilation be kept up throughout. The shelves rest upon brass pins, the holes for which are pierced at three quarters of an inch apart from center to center; but by a contrivance in cranking the shaft of the pin, which may be turned upward or downward, this interval is practically halved, and the position of the shelves may be altered three-eighths of an inch at a time.

The reading room contains three miles lineal of bookcases, eight feet high; assuming them all to be spaced for the averaged octavo book size, the entire ranges form twenty-five miles of shelves. Assuming the shelves to be filled with books, of paper of average thickness, the leaves placed edge to edge would extend about 25,000 miles, or more than three times the diameter of the globe!

Slag Roller Covering.

Mr. Franz Buttgenbach, the well known metallurgist, gives the following method for the utilization of blast furnace cinder as an insulator for steam pipes, etc.: Mix 150 parts of cinder dust, 35 parts by weight of fine coal dust, 250 parts of fire clay, and 300 parts flue dust, with 10 parts of cow's hair, add 600 parts of water into which 10 to 15 parts of raw sulphuric acid has been poured, and make a stiff dough of the whole. This is thrown in small amounts upon the warmed pipe, hardening rapidly. Upon this rough coat a second, third, etc., is laid, according to the thickness which is to be used. By the action of sulphuric acid gypsum is formed, and the silica, rendered free, hardens. The mass becomes as hard as porcelain, and is still porous. It adheres firmly, and never cracks. Mr. Buttgenbach states that he has tested its merits by ten years' use, and has found it to meet all requirements.

AGRICULTURAL INVENTIONS.

An improvement in sulky-plows has been patented by Mr. William J. Meharry, of State Line, Indiana (Sheldon, Illinois, P. O.). The object of this invention is to furnish an improved sulky attachment for plows, which shall be simple in construction, may be readily attached to any ordinary plow, will materially lighten the draught, and will allow the plow to be readily controlled.

Messrs. John J. Howell and Osnel H. Wienges, of Fort Motte, S. C., have invented an improved handle, which is so constructed that it may be applied to hoes, rakes, and other similar garden and farm implements, and which may be easily and quickly detached from one implement and attached to another, and when attached will hold the implement firmly and securely.

An improved farm gate has been patented by Mr. George Johnson, of Waucousta, Wis. This is an improvement in the class of horizontally swinging farm-gates, which have suitable attachments for holding them at different elevations for the purpose of avoiding snow or other obstruction, while being opened or closed. The invention relates to the construction of the attachments or devices which hold the gate in different vertical adjustments.

NEARSIGHTEDNESS AND THE COLOR OF THE EYES.—M. Nicaté stated, at the meeting of the French Society for the Advancement of Science, that as one of the results of his examination of 3,434 eyes in relation to myopia, at Marseilles, this defect was observed far more frequently in light than in dark eyes, blue and gray eyes furnishing 18 per cent, and black and brown eyes only 11·27 per cent.

Purifying Gelatine.

Impurities in gelatine may be classified under two heads—mechanical and chemical—the latter being far more difficult to remove than the former, inasmuch as they are more or less in combination with the material itself. Fortunately they do not appear to exert the same injurious action on the emulsion as the mechanical, which, although simply in a state of suspension, are yet exceedingly difficult to remove by simple filtration, especially after the emulsion is formed, as many of them are in quite as fine a state of division as the bromide itself; hence it is clear that any means which may be adopted to remove the one will also remove the other.

The mechanical impurities in gelatine principally consist of lime in the form either of the sulphates, carbonates, and phosphates, fat or grease, sometimes animal fiber, and always that very indefinite compound "dust." This latter impurity is generally present in considerable quantity owing to the sheets or flakes, while in the jellied form, being exposed on nets of string or wire in a strong current of air to dry, when, as a matter of course, any dust that comes in contact with them adheres and dries into the gelatine. In some of the English manufactories wire nets are employed, but on the continent those made of string are principally in use, and fibers of that material adhere to and are detached with the gelatine. It is said that these nets are greased to prevent the flakes from sticking. If this be the case it will account for some of the fat generally present in gelatine. We are told that it is the custom with some of the continental manufacturers to wash the surface of the sheets of their finest kinds with warm water after they are dry so as to remove the extraneous surface matter.

Although, as we have said, it is almost impossible to remove the insoluble matter by mere filtration, owing to the viscousness of the solution, yet it may be entirely eliminated by adopting the process commonly employed in the culinary art for clarifying jellies. This consists of mixing with the solution of gelatine some albumen of white of egg, and then raising the temperature sufficiently high to coagulate the albumen, which in coagulating imprisons the insoluble particles. The whole is then put into a flannel bag, and suspended in front of a fire, when the solution passes through perfectly clear and transparent, even if an opaque sample of gelatine have been used, and at the same time all fatty particles will be retained by the coagulated albumen. In practice, however, it will be found very difficult to treat successfully thick solutions in this way, as they will not pass through the strainer in the same manner as thin ones, such as are used for jellies, and also that strong solutions set much quicker and at a higher temperature than weak ones, so that some other plan must be adopted to avoid the necessity of filtering the solution if a strong one require purification.

The method we have employed with perfect success does not require filtration at all, yet the solution is rendered perfectly bright and transparent, and free from all solid particles as well as fatty matters. For this purpose the gelatine to be purified is placed in cold water until it has become swollen. It is then transferred to a beaker placed in a water bath heated to a temperature of 110° Fah.—not higher—until it is dissolved; then some well-whisked white of egg is stirred in. The proportion we have used has been two ounces of albumen to each four or five ounces of dry gelatine. Now, with a whisk, or, better still, one of the American egg beaters, convert the whole into froth. To do this easily it may be necessary to heat the solution somewhat, so as to render it more limpid; but care must be taken that it does not rise beyond 120° Fah., otherwise the albumen will be coagulated before its time. After the whole is converted into froth the temperature of the water bath must be quickly raised to nearly boiling point, and then allowed to remain undisturbed for some time.

As the albumen coagulates it will rise to the surface of the solution, carrying with it all the solid impurities, leaving the lower part quite clear. This may take some little time, according to the strength of the solution; but the temperature must be maintained until it is clear. It may then be allowed to cool, and the whole turned out (which may be easily done by placing the beaker in water for a few seconds and then inverting it), and the top part cut off and rejected. The other part may then be used direct for the emulsion, or it may be cut into thin slices and dried in an atmosphere free from dust, and preserved for future use. The drying may be much facilitated by digesting the thin slices in strong alcohol, so as to displace the greater part of the water before commencing to dry, and by this means the chances of its becoming contaminated with dust will be much reduced.

The object of converting the greater part of the solution into froth is this: If the albumen was simply stirred in and then coagulated it would remain in suspension, owing to the density of the solution; but, when the whole is converted into froth, the air bubbles as they rise to the surface carry the coagulated albumen, together with its imprisoned impurities, before it. As an example of the efficacy of this method of purification we may mention that we once mixed some gelatine with a solution of Indian ink which had been passed through filtering paper, and then treated it in the manner described, the result being that the whole of the coloring matter was removed with the albumen, which floated on the top like soot, while the lower portion was not only transparent, but perfectly devoid of color.

This experiment not only proves the efficiency of the process, but also shows that it is impracticable to purify the emulsion with albumen after it is made, as has been suggested, for the purpose of removing the coarser particles of bromide, because the whole would be removed in the same manner as the coloring matter of the Indian ink was.—*British Journal of Photography.*

Letters Patent.—How and in What Manner they can be Taken Out.

In this age of improvements and inventions the subject of patents is of great interest. The laws which govern patents are among the most important on the statute books looking to the protection of industries, as they grant inventors, their heirs and assigns, the exclusive right for a specified period to new discoveries and inventions of a novel and useful character. Every invention or discovery to be patentable must possess the merit of either novelty or utility. A patent will not be granted to an applicant for an article discovered and invented by another, but inventors will not prejudice their rights by allowing the public sale of that invention for two years before applying for a patent, and a valid patent will not be issued in case this use extends over a longer period. A "prior invention" does not hold good, if the party has simply conceived the idea of the thing patented; it is necessary that it should be reduced to a practical form or complete invention before a claim can be established. Whoever restores an abandoned or lost art or invention may obtain a patent for it.

An invention patented in a foreign country can receive a patent in the United States, if it has not been in public use two years prior to the application, but the American patent will not continue beyond the time granted by the foreign patent. In determining

WHETHER AN INVENTION IS NEW,

it is only necessary to ascertain if it is different from anything previously patented. In deciding the question of novelty it is necessary to decide whether an invention is really novel, or whether it consists in a double or analogous use of something already known. For instance, a patent will not be issued to a person who first applies to railroad cars a kind of a wheel previously used for other conveyances. Neither can the discovery of a principle, a natural law, scientific truth, or property of matter be a subject of a patent. But whoever makes a new and useful application of any of these things by embodying the principle of the law in mechanism, or describing a new process by which the discovery may be of practical utility, may obtain a patent for his invention, which consists not in the abstract principle, but in its practical application.

Persons wishing to obtain letters patent usually apply to a solicitor of patents or attorney, and furnish him with a model of the invention desired to be patented, except in cases of designs, compositions, and processes. The petitioner takes oath that he believes himself to be the original and first inventor of the invention, and that, to his knowledge, it has not been known or used before. Accompanying this petition and oath must be a model of the invention if the case will admit of it, with drawings and specifications. The application must be signed by the inventor unless he is dead, when it must be signed by his executor or administrator. The specification is a full description of the invention, in writing, and the manner and process of making and using it. The description is followed by the claim, in which the applicant must particularly specify the part, improvement, or combination which he claims as his own invention and discovery. Where there are drawings the specification must refer by letters and figures to the different parts. In the case of the composition of matter, specimens of the composition and of the ingredients sufficient in quantity for the purpose of experiment must accompany the application.

THE CHIEF OBJECTS OF THE SPECIFICATIONS

Are to make known the precise nature of the invention, and to enable the public from the specification itself to practice the invention after the expiration of the patent. The object of the claim is to fix with accuracy the extent of what is claimed as new. It is sometimes fatal to a claim to call an invention a machine when it is a process, and it is of the utmost importance to the inventors that the specifications are plain. The petition, oath, model, specification, drawing, etc., are forwarded to the Patent Office at Washington by the solicitor or attorney. The Patent Office, as those who have seen it are well aware, is one of the most notable buildings in the nation's capital, as it is one of the most important. Here are preserved all records, books, models, drawings, specifications, etc., pertaining to patents. The office is under the supervision of the Secretary of the Interior, but the Commissioner of Patents is the chief in charge of the office. The officers consist of a commissioner, assistant commissioner, and three examiners-in-chief, besides one chief clerk and examiner in charge of interferences, and a host of primary examiners. These primary examiners are men versed in some special department of mechanics, etc., and models, drawings, specifications, etc., are given to them for examination, with due reference to their special qualifications.

If an applicant is dissatisfied with a decision, he can be heard by the board of examiners-in-chief, and then, if still dissatisfied, before the Commissioner on appeal. Appeals from the Commissioner can be taken in all cases, except interferences, to the Supreme Court. Where an inventor is not ready to file a complete specification, and desires further time, but wishes to secure his right, he can file a caveat, which will be placed in the secret archives of the Patent Office; and if there be any application within a year for anything which appears to interfere with his claim, he shall have notice, and may appear and prove priority; and by a second caveat he may renew it for another year. Patents can be procured in foreign countries, and a great many are taken out in England, Canada, France, Belgium, and Germany.

THE PATENT OFFICE IN WASHINGTON

Is more than self-supporting, and to-day is said to have at least $1,000,000 to its credit. Last year there were 20,260 applicants for patents, and 12,354 patents were granted, besides 1,455 trade marks and 492 labels. Of the patents, 832 were held for the final payment of dues. The cost of obtaining a patent is usually about $60, $25 of this amount being the fee of the solicitor and the balance is paid at the Patent Office. The State receiving the largest number of patents per capita last year was Nevada, but usually the order is as follows: Massachusetts, Connecticut, Rhode Island, New York, and the District of Columbia. It is to be expected that Massachusetts and Connecticut will stand at the head of the list. The intuitive ingenuity of the Yankee is constantly designing something new and exploring the labyrinths of science and art in its efforts to lighten the labor of man, and it will be a long time before he can be ousted from his position at the head of designers and inventors.—*Boston Globe.*

Fire Losses.

The statistics of fires for the month of September show that the losses by fires reported in the United States amounted to $5,349,300, and in Canada to $264,800. Of the United States loss, the insurance companies paid $2,298,200, and of the Canadian loss $165,000, or less than one half. The loss for the corresponding month of last year was $790,500 less than the aggregate amount above given. This total loss of $5,349,300 was distributed, says the *Fireman's Journal*, generally throughout the States and Territories, New York State suffering the most severely, her loss being $767,700; Illinois comes next, with a loss of $439,600; Iowa lost $322,500, and Massachusetts $281,600. Dakota had an exceptional fire at Deadwood, where the loss was $1,070,000, which is not included in the classification of average losses. For the nine months ending with September, the recorded losses of the United States amounted to $61,150,100, and in Canada to $6,014,800—an aggregate of $67,164,900. The aggregate losses for the same period last year were $50,626,500, showing a gain for 1879 of $16,538,400. Should the last three months of the year only equal for each the loss of September, the recorded loss for the year will be $84,007,200. But it is estimated that one third of the actual losses are not recorded, so that the estimate heretofore made that the annual loss by fire is $100,000,000 is not far out of the way.

The statistics for the past ten years show, excepting great conflagrations, a yearly increase in the fire losses of the country. This is positive demonstration that the means for controlling fires have not kept pace with the building operations of the country. Including the great conflagrations, the fact becomes apparent that improvement in fire extinguishing machinery has not kept pace with the latest methods of construction. As a matter of fact, the means for fighting fires in the seven, eight, or nine story buildings of modern times, constructed of the most inflammable material, are no better than they were twenty years ago, before the era of tall buildings, and when better methods of construction prevailed. The steam fire engine is the only real advance in fire extinguishing machinery that has been made within the present generation, and the capacity of these has not been increased to accord with the modern style of architecture. Machinery that is equal to fighting a fire in a three story building is wholly ineffectual when the flames are raging a hundred or more feet above the street level. That our engines have not greater capacity is not the fault of the manufacturers. The demand has been for light engines that could be quickly drawn to a fire, rather than for those of great capacity in throwing water. As a matter of fact, the light engines are more serviceable three times out of five. It is only in those cities where tall buildings are numerous that more powerful engines are required, and in those greater importance is laid upon the ability of the lighter ones to get quickly to a fire and put it out before it gets headway, than upon great volumes of water to suppress one that is well agoing. Preventions of conflagrations, rather than their extinction, is relied upon. This would be all well enough if it could always be trusted. But conflagrations will come in spite of every precaution, and, in such an emergency, the engine that can throw the greatest volume of water steadily for all the time required is the best one.

But to return to the statistics, which show an annual waste of $100,000,000 of property every year. This amount of actual values, the product of the people's industry, is thrown away yearly. There is no return for it in any shape. Insurance companies may make good individual losses, but the money must come from the pockets of other individuals, and, eventually, is paid by the producing classes. It would be far better if we could take $100,000,000 a year in new, crisp, greenbacks from the National Treasury and burn them up, if by that means we could save for business purposes the property destroyed by fire. But suppose Congress should appropriate this sum of money to be burned up every year—what a howl of indignation would be raised by the taxpayers of the country! How they would denounce the wastefulness of our legislators, and how quickly they would relegate them to private life. But would it be any worse for Congress to thus squander the substance of the nation than it is for the careless and wasteful taxpayers to do it? The waste is the same, and careful and prudent taxpayers are forced to contribute to make up the losses of those who are neither the one nor the other. What we want is better legislation to control the erection of buildings, and legislation to prevent insurance companies from encouraging incendiarism by paying more for property that is destroyed by fire than it was worth while standing. In other words, the payment of losses by insurance companies should be restricted to two-thirds the value of the property destroyed. With such a law in force, property owners would be compelled to carry one-third of the risk themselves, and this would destroy all motive to incendiarism, and induce prudence and care in the management of property. Such a law enforced rigidly in every State would reduce our fire losses more than fifty per cent the first year.

Telegraphy in France.

By the end of the present year, of 87 chief towns of departments, only 26 will not be provided with direct telegraphic communication with Paris. These 26 towns communicate through intermediate offices. The total number of direct wires from the French capital to provincial centers is 113, and several of these centers have more than one such wire. Thus, Amiens has 2; Bordeaux, 3; Marseilles, 4; Montpellier, 2; Nantes, 2; Toulouse, 2; Trouville, 2; and Versailles, 39. Twenty-five of these lines are subterranean. As regards direct wires to foreign centers, Paris has one to Amsterdam, one to Antwerp, one to Basle, three to Berlin, one to Berne, one to Bergeux, three to Brussels, one to Cologne, one to Florence, one to Geneva, nine to London, one to Metz-Hamburg, one to Milan, one to Mülhausen, one to Rome, one to Strasbourg, one to Turin, and two to Vienna. There is also a direct submarine wire from Marseilles to London.

The Telegraphic System of the World.

The system of telegraphs in Europe comprised, at the end of 1877, 268,809 miles of lines, and 769,768 miles of wires. There were 19,627 government telegraph stations, and 12,708 railway and special stations. The number of employés amounted to 61,984, and the number of instruments to 41,708. The number of paid messages was, in round numbers, 86,000,000, of which 20,000,000 were international dispatches. The number of other telegrams forwarded amounted to about 7,000,000. M. Newman Spallart gives the following statistics for the other parts of the world. In America (1875 to 1877), 114,157 miles of wires; 8,756 stations; 23,000,000 telegrams. In Asia (1875 to 1876), 24,521 miles of wires; 489 stations; 2,300,000 telegrams. Australia (1875), 23,582 miles of wires; 689 stations; 2,500,000 telegrams. Africa (1874 to 1876), 8,148 miles of wires; 196 stations; 1,200,000 telegrams.

A New Colorado Mining Tunnel.

The Boulder *News and Courier* says: "A tunnel has recently been started at the base of Seaton Mountain, about one mile from Idaho Springs, having a course north 24° east. It cuts at right angles all the lodes, and some of them at a depth of 2,300 feet. Thirty-seven already discovered will be cut by this tunnel, many of them well and favorably known by their rich and abundant production of ores. Of these, the projector of the enterprise has secured thirty-four lodes, and arranged for the purchase of the balance when desirable, thus wisely avoiding any possibility of dispute over titles, surface claims, or side lines in the long hereafter. This tunnel, christened the 'Idaho,' is considered in many respects the largest and best constructed tunnel in the country for mining uses. Bed rock was reached at a distance of 48 feet, at which point the first lode was cut, the vein matter assaying well. Very strong and promising mineral veins have been cut within each successive 25 feet since reaching solid rock. This tunnel, if continued on its course, will reach Black Hawk at a distance of three and a half miles."

MEN of science, students, inventors, and every other class of persons desirous of keeping up with the times should become regular subscribers to this paper. They will find it a paying investment, for the SCIENTIFIC AMERICAN not only contains a record of all the important discoveries and inventions of this country, Great Britain, and other English speaking countries, but translations from the French, German, and other foreign scientific and industrial publications, nearly all of which are received regularly at this office.

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.

☞ The publishers of this paper guarantee to advertisers a circulation of not less than 50,000 copies every weekly issue.

NEW BOOKS AND PUBLICATIONS.

VAN NOSTRAND'S SCIENCE SERIES. New York: D. Van Nostrand. Price 50 cents.

Numbers 45 and 46 of these reprints are respectively: Thermodynamics, by Henry T. Eddy, C.E. Ph.D., of the University of Cincinnati; and Ice Making Machines, translated from the French of M. Ledoux, mining engineer. The former aims to give a brief and logical exposition of the fundamental and simplest applications of thermodynamics; the latter discusses theoretically the conditions of effective working of the three classes of ice-making machines.

RESUME OF YELLOW FEVER. (Quarantine and Home Sanitation.) By A. Clendinen, M.D.

Abstract of report by Dr. Clendinen, as chairman of Committee of Intelligence, District Society of Bergen County, New Jersey, first printed in the Transactions of the State Medical Society. The author has brought together a good many facts in the history of yellow fever, which he finds well described by Hippocrates, 2,240 years ago. He does not believe that the disease is always imported, and denies the efficacy of quarantine to prevent its occurrence when local conditions are favorable.

A CATECHISM OF THE MARINE STEAM ENGINE. By Emory Edwards. Illustrated. Philadelphia: Henry Carey Baird & Co. 12mo, 374 pages. Price $2.

Offered as a practical work for practical men, especially for young and inexperienced engineers, mechanics, and firemen, who wish to adopt marine engineering as a profession. For such men it is likely to prove very serviceable. They will at least find no trouble in understanding what the author has to say, his language being admirably simple, direct, and free from mathematical or scientific affectation.

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) O. R. writes: Your recipe on shoe dressing is very good. I find that the different ingredients give a good black liquid, which makes the leather smooth, soft, and black, but without gloss. Can you inform me how to obtain a gloss? A. Increase the percentage of shellac and ammonia.

(2) H. C. asks how much fall would be required in a ditch to carry the water three miles an hour, provided the ditch is straight. A. The flow of water in the ditch would depend upon the character of the soil and smoothness of the surface. 2. Could you refer me to some reliable work that treats on running water and ditching, etc.? A. "Fanning on Water Supply Engineering" is a good work.

(3) "Atlas" asks how to mount maps on cloth, and best kind of paste and fabrics for purpose. A. Stretch smooth factory cloth upon a frame and coat it with glue size. Before this dries, apply a strong flour paste to the back of the map and lay it smoothly on the cloth. Let it remain until perfectly dry. If the map is to be varnished, apply two or three coats of isinglass size, and after it becomes thoroughly dry flow on a coat of varnish consisting of balsam of fir diluted to the proper consistency with turpentine.

(4) J. P. asks: 1. Can a current of electricity be generated by an electro-dynamic machine, without the use of either a battery or permanent magnets to charge the machine with? A. Yes; see SUPPLEMENT, No. 161. 2. What is the electromotive force of the Grenet battery when first connected? How long after it is put in action will it maintain its strength, and to what extent will the force of current decrease? A. 1·095 volt. The strength of the current diminishes quite rapidly if the battery is allowed to remain in action any considerable length of time continuously. It is not adapted for a continued use, but where a strong current is required occasionally for a few minutes at a time it answers a good purpose. 3. What form of battery best combines strength of current, constancy, and economy? A. Bunsen's, or some of its modifications.

(5) E. M. C. asks: Is there an easy way of distinguishing between 8vo, 12mo, 16mo, 18mo, and other sizes of books, by those not practical printers, and what is it? A. Count the pages between printers' signatures (letters or figures) at the foot of pages.

(6) O. M. S. asks: Is a lightning rod supported upon large insulators and having no ground connection, supported by any scientific authority that you know of? A. No.

(7) J. S. B. writes: The yachts in use here, of which there are many, are built on a flat model. They are very broad beam, the beam in some cases being about 2-5 of the length, and usually light draught. They are without keels, but furnished with center boards. Now, I am thinking of building a yacht, upon a deeper and narrower model, with keel. How will the two compare for speed? And how would it do to make the keel in latter model in whole or part of iron, heavy enough so that ordinarily no other ballast will be needed? My object in this is to bring the center of gravity as much below the water line as possible, as it seems to me that by so doing we would be able to sail closer to the wind without going over. Would my plan have that effect? A. The mere form of midship section does not determine the best model. What you propose would probably be fastest in deep water and strong winds, but the light draught fastest in light winds. The iron keel is good and should be heavy; do not make your cross section too full below.

(8) F. M. D. asks what is the horse power of an engine of 6½ inch cylinder, 14 inch stroke, 70 lb. pressure, 180 revolutions. I am running an engine of that size, there has been quite a dispute about it. One man said it was a four horse, another said 20. I think it about an 8 horse. A. If you are working 70 lb. pressure on the piston, whole stroke, the available power is about 24 horse power. By actual calculation it is 32 horse power; deducting 25 per cent for friction and other losses, leaves 24 horse power.

(9) "Inventor" writes: I want to connect an engine or engines to a shaft running 390 or 400 revolutions per minute; how small ought the cylinders to be to give me 8 or 9 horse power, and what size upright tubular boiler will furnish steam? Can I run the engines with success? How many engines are necessary? A. A 6 inch cylinder and 8 inch stroke will give you the power you want. A vertical tubular boiler should have at least 220 feet heating surface. To run at such high speed successfully, everything must be well proportioned and nicely fitted.

(10) J. F. asks: What is the best method of easily and economically separating in large quantities of salt water, the calcium magnesia, etc., so that the salt will remain pure? A. There are three methods employed for separating salt from calcium magnesia, etc.: *a*, by evaporation of the water by aid of the sun's heat; *b*, in winter by freezing; *c*, by artificial evaporation. The first method is generally used on the coast lines of southern Europe. The arrangement of the salines or salt gardens is as follows: On a level sea shore is constructed a large reservoir, which by a short canal communicates with the sea, care being taken to afford protection against the inroads of high tides. The depth of water in these reservoirs varies from 0·3 to 2 meters. The sea water is kept in the reservoir until the suspended matter has been deposited, and is then conveyed by a wooden channel into smaller reservoirs, from which it is conducted by underground pipes to ditches surrounding the salines, where the salt is separated from the water. The salt is collected, placed in heaps on the narrow strips of land which separate the ditches from each other, and sheltered. As these heaps are left for some time, the deliquescent chlorides of magnesium and calcium are absorbed in the soil, consequently the salt is comparatively pure. If the salt water is derived from salt wells or springs, the brine is immediately boiled down. This boiling generally requires several weeks, the scum being removed and the soda and calcium sulphates deposited removed with perforated ladles. As soon as a crust of salt is formed on the surface of the liquid a temperature of 50° C. is maintained. At this stage the salt is gradually deposited at the bottom of the pan in small crystals, and being removed, is put into conical willow baskets, which are hung on a wooden support over the pan to admit of the mother liquor (which contains the greater part of the magnesium and calcium chlorides) being returned to it. Finally, the salt is dried and packed in casks.

(11) G. S. T. writes: A reservoir is 60 rods distant, descent 40 feet. One pipe of 1¼ inch bore contracted to ¾ inch just at the lower nozzle, the other pipe of 1½ inch bore for 20 rods, 1 inch bore for the next 20, and the last 20 rods of ¾ bore. Which of the above will convey more water? A. In a 1½ inch pipe contracted just at the outlet the friction will be least.

(12) T. M. J. asks: 1. Will the water, if conveyed to the boiler in a 2 inch pipe, force itself into the boiler against a greater steam pressure than (say) in a ½ inch pipe? A. No. 2. In "Peck's Natural Philosophy" there is an illustration of how a cask was bursted, by filling the cask with water from the top of a tube 34 feet long. Will the heavier weight of water in a large pipe not add materially to pressure per square inch at the lower end of the pipe? A. No. 3. Could I overcome any resistance in the boiler by letting the water into the boiler through a funnel or a small hole on the principle of an injector? A. You cannot, unless you use an injector.

(13) J. R. H. asks: 1. Can exhausted steam be used to heat up a workshop? A. Yes. 2. In what way does it affect the working of an engine? A. Produces a little back pressure on the piston. 3. And what per cent of power is lost between exhausting through a pipe 20 feet long, and one 120 feet long? A. Difference is not appreciable if pipe is large.

(14) G. E. T.—You will find directions for making batteries in SUPPLEMENTS, Nos. 157, 158, and 159.

(15) W. H. B. asks, Does the microphone strictly magnify the sound or only transmit it? A. It merely transmits it.

(16) C. K. M. asks: 1. What is the best method of magnetizing a rat tail file 15x½? A. Inclose the file in a helix made of about 50 feet of No. 16 insulated wire, and connect the helix with 4 or 6 cells of carbon battery. 2. Can I magnetize it with an ordinary Daniells battery, by wrapping it with insulated copper wire? A. Yes, by using 6 or 8 cells.

(17) S. G McM. asks: 1. Will a etlephone that is constructed as described in SUPPLEMENT, No. 142, work when the coil is made of No. 30 wire? If not, will it with No. 32? A. No. 30 wire is too coarse. No. 32 might answer, but the results would not be satisfactory. Use No. 36. 2. What size should the connecting wire be if made of copper? A. No. 18 will do.

(18) A. S. B. asks: How can I take grease out of marble? A. Mix sal-soda with two parts of quicklime in powder, moisten the mixture with soft cold water, coat the marble with this, and let it remain twelve hours. Then wash with water and a little soap if necessary.

(19) J. D. asks: How can I make an alloy of copper which will attach itself to glass, metal, or porcelain? A. 20 to 30 parts finely blended copper (made by reduction of oxide of copper with hydrogen or precipitation from solution of its sulphate with zinc) are made into a paste with oil of vitriol. To this add 70 parts of mercury and triturate well; then wash out the acid with boiling water and allow the compound to cool. In ten or twelve hours it becomes sufficiently hard to receive a brilliant polish and to scratch the surface of tin or gold. When heated it becomes plastic, but does not contract on cooling.

(20) A. L. C. asks why a piece of paper cannot be blown off the end of a tube if it is simply placed over the tube at one end with nothing to fasten it. A. This phenomenon occurs only when the tube has a flange or its equivalent around the discharge opening. The adherence of the paper to the end of the tube is due to a vacuum formed on the surface of the card by the lateral discharge of air. This subject is fully treated in an article on the ball puzzle in SUPPLEMENT, No. 51.

(21) A. H. asks: Where on the globe will the new year 1880 be greeted or welcomed first? A. In New Zealand most probably; possibly a little earlier at some English missionary station in Polynesia. Eastern Siberia is ruled out of the reckoning by the Russian calendar; and our Alaskan islands by their taking their time from San Francisco.

(22) L. P. B. writes: I wish to know what gives the kind of ink used with the hectograph the peculiar bronze luster? A. The ink consists of a strong solution of aniline violet, which crystallizes on the paper in drying.

(23) W. C. B. asks what will remove iodine from marble. A. Try strong aqua ammonia.

(24) A. B.—Laboulbène recommends for the preservation of insects in a fresh state plunging them in a preservative fluid consisting of alcohol with an excess of arsenious acid in fragments; 1½ pint alcohol will take about 14 troy grains of arsenic. The living insect, put into this preparation, absorbs about 3-1000 of its own weight. When soaked in this liquor and dried, it will be safe from the ravages of moths, *Anthrenus* or *Dermestes*. This liquid will not change the colors of blue, green or red beetles if dried after soaking from twelve to twenty-four hours. *Hemiptera* and *Orthoptera* can be treated in the same way. The nests, cocoons, and chrysalids of insects may be preserved from injury from other insects by being soaked in the arseniated alcohol, or dipped into benzine or a solution of carbolic acid or creosote.

(25) W. H. M. asks (1) whether methyl chloride is an article of commerce and whether it is expensive. A. No; it is a colorless gas at ordinary temperatures and pressure; it is condensable to a liquid at minus 22° C. To keep it in the liquid form it must be stored in very strong and hermetically sealed vessels. 2. Would it be necessary to produce pressure with the article, before evaporating, to produce a low temperature? If so, how much; if not, how low might the temperature be reduced by the use of an air pump to produce a vacuum and beginning at normal temperature and pressure? A. Exposed to the air it (the liquid) evaporates with great rapidity, its temperature falling below 0° F.; in vacuo this evaporation of course proceeds more rapidly than in air, and hence the reduction of temperature is greater. The greater the amount of liquid evaporated in a given time the lower the temperature attainable. 3. How large a quantity of methyl chloride should be used to produce appreciable results? A. Six ounces.

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

C. W.—The substances you send for examination are as follows: 1. Red sandstone. 2. Calcite. 3. Hedenbergite. 4. Artificial. 5. Red granite. 6. Graphite in calcite. 7. Epidote. 8. Satin spar in dolomite. 9. Coccolite. 10. Dolomite. 11. Quartzite. 12. Hornblende. 13. Clinochlore. 14. Chlorite. 15. Natrolite. 16. Spodumene. 17. Calcite. 18. Iceland spar. 19. Limonite. 20. Decomposing feldspar.—O. E. C.—The sample is an impure Berlin blue containing alumina (from the alum used in its manufacture).—N. C.—The rock consists of serpentine, hornblende and quartz with copper and iron sulphurets (chalcopyrite and pyrite).—E. E.—The rock is a talcose slate. Some of it would doubtless answer very well for furnace linings if it can be worked economically.—H. S.—Amygdaloid trap, semi-decomposed—it contains opal quartz.—R. G. V.—No. 1 is rutile—titanic acid—oxygen 39, titanium 61—100. No. 2. Titaniferous sand, mennaconite. No. 3. Ferruginous quartz containing crystals of rutile and iron pyrites, also probably gold.—W. K.—The quartz contains nothing of value.—G. W. K.—It is clear quartz rock. Useful for glass making.—O. B.—The iron ore is hematite of excellent quality.—J. C. M.—No. 1. Gypsum, lime sulphate. No. 2. Calcite, lime carbonate. No. 3. Malachite and azurite, carries traces of silver. No. 4 Contains clay, sand, and lime phosphate.—J. M. F.—It is the *mutilla occidentalis*, quite common in the Southern States.

COMMUNICATIONS RECEIVED.

On Ice Yachts. By J. E. K.
On Improvements in Telephones. By T. L. W.
On Measuring the Uneclipsed Portion of the Sun's Diameter. By L. L.
On a Curious Bone Formation. By E. L. W.
On the Great Wheat Belt of the United States. By J. W. B.
On Patent Temperance Reform. By L. J. F.
On New Motive Power. By W. M. M.
A Theory of the Tides. By W. B., Jr.
On Sailing Ice Boats. By H. R. B.
On Paraffine in Oil Wells. By D. F.
On the Velocity of Ice Boats. By P. F. S.
On Small Steamers. By J. A. W.
The Law of Dust Explosions. By A. D.
On the Speed of Ice Boats. By T. S. S.
On Making Copying Ink. By C. F. L.
On Explosion of Dynamite. By N. R.

[OFFICIAL.]

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FOR WHICH

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November 4, 1879.

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, 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.

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