SCIENTIFIC AMERICAN

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. XXIV.--No. 6. [NEW SERIES.] NEW YORK, FEBRUARY 4, 1871. $3 per Annum. [IN ADVANCE.]

UTILIZING WASTE HEAT FROM STEAM ENGINES AND BOILERS.

Mr. J. H. Ellis, of Springfield, Vt., has recently made some interesting experiments in utilizing the heat that escapes in the exhaust steam from engines, and in the smoke from steam boiler furnaces. The apparatus used, and the results produced, are illustrated by the annexed engravings, of which Fig. 1 is a perspective view, and Fig. 2 a vertical section of the arch boilers and chimney flues. He used for the purpose the horizontal tubular steam boiler, A, Fig. 2, twelve inches in diameter and three feet long, with thirteen copper flues, B, one inch in diameter; the fire box, C, being under the boiler, and the smoke returning through the flues. He connected with this boiler an engine, with cylinder 1¾″×2¼″, running 350 revolutions a minute. This engine was geared to a derrick, so that it raised a weight of five hundred pounds five feet in one minute.

For the purpose of using the escaping heat from this engine and boiler, he placed another upright tubular boiler, D, in the flue of the chimney, the base of the flue being enlarged sufficiently for the purpose. This boiler was four feet long and nine inches in diameter, and had seven copper flues, E, 1″ in diameter. A spiral coil of copper pipe, F, was placed inside this boiler, of sufficient length to extend from one end to the other; one end of the coil passing out at the top, and the other end at the bottom of the boiler. The diameter of this coil was 8″, and the diameter of the pipe of which it was made was ¾″. The upper end of this coil was connected with the exhaust pipe of the engine, so that the exhaust steam was compelled to pass through the coil to escape into the atmosphere.

The boiler, D, was filled with the bisulphide of carbon (which boils at about 110° Fah.) and it was connected with another engine, of the same size and style as the one used with the steam boiler, and geared to a derrick in the same manner.

Having raised the pressure in the steam boiler to 45 pounds, the steam engine was started, raising with the derrick a weight of 500 pounds, the exhaust steam passing through the coil of pipe in the bisulphide boiler in the manner described.

In five minutes after the steam engine commenced running, the pressure in the bisulphide boiler went from 0 to 30 pounds to the inch. At this time the second or bisulphide engine was started, geared to a derrick, and commenced raising a weight of 500 pounds in the same manner that the steam engine was doing. The two engines were kept running simultaneously two hours, and during this time the steam engine made 38,000 revolutions, and raised 500 pounds 456 feet, while the bisulphide engine made 44,000 revolutions, and raised 500 pounds 528 feet. The pressure in the steam boiler ranged from 30 to 70 pounds to the inch, averaging about 45 pounds, and the pressure in the bisulphide boiler ranged from 30 to 60 pounds, averaging about the same as that of the steam boiler. The temperature of the smoke on leaving the flues of the steam boiler did not exceed 360 degrees during the trial.

The exhaust steam was perfectly condensed in the coil, and all its latent heat imparted to the fluid that surrounded it; and the temperature of the water discharged from the coil did not exceed 108 degrees, being reduced to that point by the cold bi-sulphide constantly pumped in at the bottom of the boiler around the lower end of the coil. The heat of the exhaust steam being applied at the top of the boiler, a pressure of 60 pounds to the inch was obtained, before the temperature at the bottom of the boiler was raised a single degree. The vapor of the bisulphide of carbon was condensed in a short coil of copper pipe, immersed in a tank of water, and pumped back into the boiler continuously during the trial, with no perceptible loss of the material.

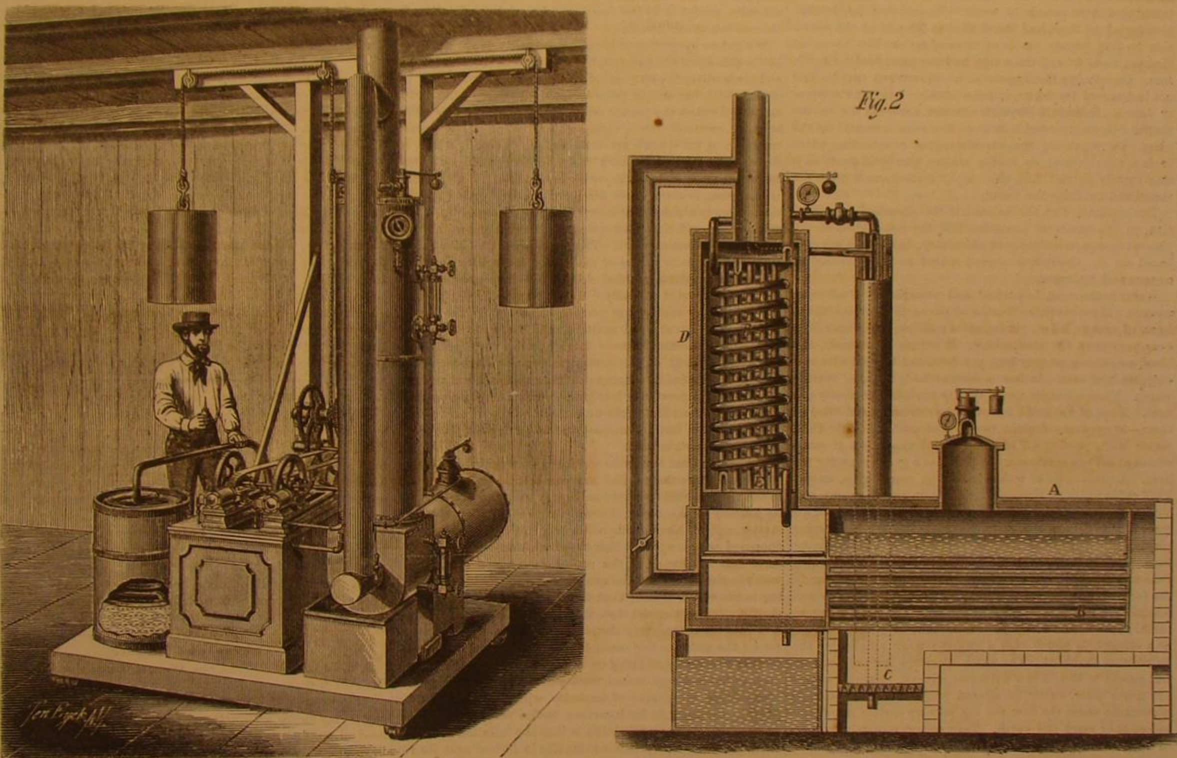
The amount of fuel consumed in getting up steam from cold water and running the engine during the trial, was 5 pounds of wood and shavings, 6 pounds of charcoal, and 12 pounds of anthracite coal; and 60 pounds of water were condensed from the exhaust of the steam engine, in the coil of the bisulphide boiler.

It will be seen by the above statement of facts, made from data furnished us by Mr. Ellis, that the increase of power obtained from a given amount of fuel by the use of the bisulphide boiler was 115 per cent.

Mr. Ellis states that owing to the fact that the engines used had no cut-off valves, and had ports too much contracted to exhaust freely, and also because the amount of friction in the derrick gearing, which was new, was very great, the amount of power developed and useful work performed, was not as much as it would have been with more perfect engines. But as the bisulphide engine labored under precisely the same disadvantages that the steam engine did, the power gained by the use of the former was not affected thereby.

These engines can be seen running, or further particulars in regard to them obtained by applying to Joel A. H. Ellis, Springfield, Vt.

This invention has been secured through the Scientific American Patent Agency by four distinct letters patent. It has also been patented in foreign countries through the same medium.



ELLIS' METHOD OF UTILIZING WASTE HEAT FROM STEAM ENGINES AND BOILERS.

Lumber Trade.

Some idea of the magnitude and importance of the lumber trade in the upper Mississippi and its tributaries may be formed from the following figures: The logs cut last winter measured in round numbers 100,000,000 feet, or 20 per cent less than the yield of the previous year. The stock on hand at the commencement of the season was 30,000,000 feet, about the usual quantity. The St. Anthony manufacture accounted for 110,000,000 feet, 15,000,000 were sent to market by river, and the balance not stacked was sold in Minnesota and Iowa. On the St. Croix and its tributaries, 73,700,000 feet were cut, and this large figure is 40 per cent below the production of 1868–69. With stock on hand 75,000,000 feet old logs, the total at the commencement of the manufacturing season was nearly 150,000,000 feet. Of this amount 40,000,000 was unattainable in the pineries; 75,000,000 was manufactured on the St. Croix, and at Hastings, Redwing, and Lake City, and the balance, 33,000,000, left for exportation. At Black River the logs scaled exceed those of the Upper Mississippi and its tributaries by more than 30,000,000 feet. The Black river is thus at the head of all the districts on the Mississippi river.

Hailstones.—A writer in *Nature* says: "Hailstones are frozen raindrops, and a raindrop falling through a vacuum would of necessity be spherical; but in falling through the air it must tend to assume the form of least resistance, what ever that may be. I was told many years ago of hailstones which had been picked up and found to be of the form of Minié bullets. I do not vouch for the truth of this, but I think it likely; the Minié bullet was, I believe, the nearest approach to the form of least resistance that the inventor was able to arrive at."

THE WATER WE DRINK.

LECTURE BY PROF. CHANDLER, BEFORE THE AMERICAN INSTITUTE.

Water is the sole product of the combustion of hydrogen. The Hindoos and the Egyptians considered water the element from which all bodies are formed. Among the Greeks, six hundred years before Christ, the opinion was defended that water was the first and fontal element of all matter. Aristotle regarded it as one of the four primal elements, and this idea prevailed for more than a thousand years, and the four elements—fire, air, earth, and water—were supposed to be materials from which all matter was formed. It was supposed, however, that these four elements were, to a certain extent, mutually convertible, and there were certain facts which made this appear very possible, at that date. Heat converted water into steam, which to the ancients was equivalent to air; and the frequent evaporation of water from glass vessels seemed to convert the water into earth; so the four elements were mutually convertible.

This idea of the conversion of water into earth prevailed until about 1770, just one hundred years ago, when Lavoisier, the French chemist, applied the balance to the solution of the problem. It had, however, been known that when water was placed in a retort, and evaporated, there remained behind a small quantity of earthy matter. If the water were poured back and distilled a second time, the quantity of earthy matter increased; so the third time, and this continued until the distillation was complete. Lavoisier provided himself with an alembic which was hermetically sealed, and into this he introduced three pounds of water. He repeated the distillation for a long time, and found that at the end of the operation he had twenty drams of mineral water; but he found that the alembic and the water had the same weight as before. On opening the apparatus he discovered that he had not lost any of the water, but the alembic had lost the twenty drams. Scheele, a Swedish chemist, analyzed the earthy matter left, and proved it to be of the same material as the glass. On repeating the experiment of evaporating water from a silver vessel no earthy matter was produced: so it was clearly proved that the earthy matter came from the vessel and not from the water.

The application of the balance to the chemical investigation, in the hands of Lavoisier, laid the foundation of the present system, not simply of chemistry, but of the sciences based on it. Cavendish proved water to be composed of oxygen and hydrogen.

Water is the most important and remarkable of all compounds. It covers three fourths of the earth's surface, in the form of oceans, lakes, rivers, snow and ice. As vapor, it is ever present in the atmosphere. It occurs in animals, the blood containing seventy-nine per cent, and the muscles seventy-five per cent. In fact, a human body is three fourths water. Plants contain from twenty to eighty or ninety per cent. None of the solid rocks are free from it, and some of them—as gypsum—contain twenty per cent. At 212° Fah., water boils, passing off in the form of vapor, but it evaporates at all temperatures. Water has a great capacity for heat. A cubic mile of water, in cooling one degree, warms 3,076 cubic miles of atmospheric air to an equal extent, and a cubic yard of ice, in melting, cools 1,000 cubic yards of air from fifty to fifty-two degrees Fahrenheit. We have water playing the part of an acid, in combination with a strong base. It is in the condition of acid that it attacks the quick lime and slakes it. We have the water again occurring in the form of watery crystallization, in solid substances, which assume a crystalline form when separating from water, as alum, gypsum, and many other materials. We have it again as a solvent, in which case it exerts a weak affinity for the substances involved. The water dissolves not only waters, but gases; in fact, it is a universal solvent. Natural waters are never pure, owing to solvent properties. Atmospheric waters, the snow, the dew, the fog, take up certain impurities before they reach the earth. They absorb a certain portion of oxygen and nitrogen; they wash out the dust floating in the atmosphere, and near the seashore the waters contain common salt. In some cases we find sulphuric acid, and in others ammonia.

WELLS.

Terrestrial waters are still more impure. When the water reaches the surface it is absorbed by the porous strata. The character of a spring will depend upon the strata through which the water has percolated. Our common wells are simply holes dug down through the strata. Water takes the character of the earth through which it has passed. The earth's crust consists of strata, different kinds of rock, sandstone, limestone, and slate. Some of these are porous, others are impervious to water, so that we may have in different points many different kinds of water occurring in as many different layers. In boring an artesian well, we may come across water characterized by salt. At a still greater depth, we may meet water which is quite pure. The artesian well is simply a boring made down through those different strata to reach water of a desired quality. One of the most celebrated of these wells is at Grenelle, Paris, 1,800 feet, or one third of a mile, in depth. As the water which rises in this well has its source at a remote distance, where the porous strata which bring it are more elevated, the water rises eighty feet above the surface. The yield in that well is ninety cubic feet per minute. The temperature is eighty-two degrees Fahrenheit. The deepest well in Europe—at Rochefort—has a depth of 2,276 feet, or more than one half mile. At Louisville, Ky., a well has been bored 2,086 feet deep, and another at Charleston, S. C., 1,250 feet deep—both of these wells being mineral water.

Attempts have been made to obtain fresh water by boring in some of our Western States. In Columbus, Ohio, a well was bored 2,275 feet deep, but no water would come to the surface. At St. Louis, the deepest artesian well that has ever been bored was 3,881 feet, or nearly two thirds of a mile. It was a failure, however, as the water obtained would not rise to the surface. In many other localities these wells have been exceedingly successful. In oases on the desert they have added greatly to the fertility. In Algiers and other localities, they have been bored with great success, sometimes producing natural and at other medicinal waters. At Tours, in France, the artesian well is sometimes closed by leaves which, when finally brought to the surface, are found to come from a region 150 miles distant, the water having come through subterranean channels.

Owing to the solvent power of water, spring and well waters always contain more or less mineral matter. Where the rocks are chiefly composed of silicious minerals, we have very little impurity. In New England, the waters generally contain nearly three or four grains of impurity to the gallon.

WHAT WATER CONTAINS.

We sometimes find in water organic matter derived from the decay of vegetables, and certain gases, oxygen and nitrogen—in other words, air; but the air which is dissolved in water is richer in oxygen than the atmosphere. This seems to be a wonderful provision of nature for the support of those animals that breathe by the means of gills. Fishes derive their oxygen from this gas, which is dissolved in water; and, although its volume is only one twenty-fifth the volume of the water, still the supply is sufficient to support this animal life. In wells we have also nitrates, and ammonia salts, produced by the decomposition of animal matter in the soil round our dwellings.

We get an approximate idea of the quality of spring water by the density of the precipitates contained in it. Pond, lake, and river water is partly supplied by springs, and partly by water which has simply passed over the surface of the earth, and not through the porous strata. Consequently, this water is purer, generally, than spring water. Some of the purest waters that are known are lake waters. There is a lake in Sweden the water of which is found to contain only one twentieth of a grain of impurity in a gallon. Water which is in motion, as river water, often contains suspended impurities, or mud, which it has no opportunity of depositing; but when the stream becomes quiet, the mud is deposited, and the water becomes clear. The waters of the Mississippi river contain forty grains of suspended impurities in a gallon, and it is estimated that 400,000,000 tuns are carried to the Gulf of Mexico annually. By the Ganges, 3,668,000 cubic feet of earthy matter are carried annually to the ocean. In fact, it is by alluvial matter—mud transported in this way—that the entire State of Louisiana has been formed, by the encroachment of this earthy matter upon the waters of the gulf. We find also living organisms—plants and animals—occurring in greater or less quantities. There is a popular idea that you can find these animals in a drop of any water. This is untrue; but by causing the water to pass through a filter we can obtain them.

The waters from our rivers and lakes, on reaching the ocean, evaporate, leave their saline matters behind, and come back in the form of rain or snow; and every time the water makes its journey to the ocean, it carries with it its little cargo of matter, and in this way the ocean becomes salt. It might be supposed on this account that the ocean would become much more salt in time; but the ratio between the quantity of water in the rivers and the quantity of water which is existing in the ocean, is such that the change must proceed very slowly. It is estimated that thirty-six cubic miles of water flow into the ocean every day, but it would take 30,000 years for all the water in the ocean to make the round once, to go back to the land, and bring its cargo of saline matter. Supposing that each gallon of river water which comes to the ocean bring six grains of impurity with it, it would take 36,000 years for it to be increased in the ratio of six grains to the gallon. The probability is that the solution of saline matter took place much more rapidly in former ages than it does now. It is pretty nearly washed out of its dust now, and carried to the ocean. Inland seas which receive rivers of a considerable size, and at the same time have no outlet, become much more concentrated than sea water, owing to the evaporation. We have saline waters in which common salt predominates, some of the most remarkable of which occur in this State at Syracuse, and in the Onondaga salt reservations we have brine from which enormous quantities of salt are manufactured. Nine million bushels have been manufactured in a single year, the impurity consisting, in this case, almost entirely of salt.

At St. Catherine's, in Canada, we have a water which contains large quantities of chloride of calcium and magnesium. There is through the valley of Saratoga a break in the strata. Below the surface of the earth, many hundred feet, is a porous layer of sandstone. This comes to the surface further north, where it receives pure atmospheric air, and this, passing down through the sandstone, dissolves the saline matter, takes up the carbonic acid, and comes up through the earth.

PURIFICATION.

Where water is used for washing, as in woolen mills, in dyeing, etc., it is extremely important that it should be comparatively pure. Various methods have been resorted to for its purification. [The speaker here exhibited a filter, which he said was now coming into use, in which a sponge is made to do the work.] For domestic purposes, the water of hillsides is always the best. Wells are objectionable, as they serve to collect what soaks from the soil, and in these waters nitric acid and decomposed animal substances are almost always found. It is found that the waters of artesian wells contain no oxygen. To make these waters useful they must be brought into contact with the air. River and lake waters are preferable for city supplies. As to the characteristics of good water, first, it should be of low temperature, not over forty-eight or fifty degrees; it should be free from taste, except, perhaps, a slight saline taste, and a slight pungency from the presence of carbonic acid. Transparency is not so important, as water may be considerably colored, and yet be free from injurious ingredients. It is not so much in the quantity of impurity as the quality. Five or six grains of lime or magnesia in water renders it unfit for cooking. For tea and coffee, however, it is found to be an advantage to have a small quantity of lime in the water. A person of delicate taste can detect the presence of lime salts in water when it exists in the proportion of only two grains to the gallon. Certain waters in almost every region acquire a special reputation as tea waters. Old inhabitants in New York remember the famous tea pumps, one of which was situated in Franklin street, where a boy was kept pumping tea water for the neighboring inhabitants. Another was at the corner of Reade and Center streets.

ORGANIC IMPURITIES.

It is the animal organic matter in water which is objectionable, not the vegetable. In many cases living vegetables are our great safeguards. Many lives have been saved by the action of vegetation destroying decomposing animal substances. Soakage from the neighboring dwellings adds organic matter to the water, which has germs of disease. Analysis hardly detects it. Sudden outbreaks of dysentery are produced by this cause. Before New York was supplied with Croton water, it was visited by epidemics believed to have been caused by defilement of the wells then in use. Cholera, although it does not originate from this cause, is chiefly disseminated by impure supplies of water. During times of its prevalence it has been noticed that where fresh water is abundant, no deaths of any consequence occur.

The evil from which we are most likely to suffer is from impregnation of the water from lead. There is hardly any kind of water but has some effect upon lead. Pure distilled water attacks it rapidly; water containing some lime salts attack it less rapidly. When Croton was first introduced, owing to the aqueducts being freshly built, the water was much more impure than at present, and it was then noticed that it had but little effect upon lead, but as the water becomes purer, we are in more danger of its contamination. Several other materials have been suggested as a substitute for lead pipe. Galvanized iron pipes are open to some objections. Glass pipe has been suggested, but the inconvenience of introducing it is a serious objection. The best pipe is that made of tin, surrounded by lead, the water being entirely protected from the lead.

The lecture was illustrated by numerous experiments.

Why Soup is Wholesome.

Physiologically, soup has great value for those who hurry to and from their meals, as it allows an interval of comparative rest to the fainting stomach before the more substantial beef and mutton is attacked, rest before solid food being as important as rest after it. Let a hungry and weary merchant or lawyer rush *in medias res*—plunge boldly into roast beef, and what is the result? The defeat is often as precipitate as was the attack. When the body is weary the stomach must be identified with it, and cannot therefore stand the shock of some ill-masticated, half-pound weight of beef. But if a small plateful of light soup be gently insinuated into the system, nourishment will soon be introduced, and strength will follow to receive more substantial material.

Burns and Scalds.

S. B. Judkin, M. D., of Cuba, Ohio, writes to the *Journal of Materia Medica*:

"I have treated a good many cases of burns and scalds, and to my entire satisfaction. I dissolve white lead in flax seed oil, to the consistency of milk, and apply over the entire burn or scald every five minutes. I have been in the habit of using a soft feather to apply the liniment. I have used this preparation a great many times in the fifteen years of my practice, and have never been disappointed; it gives relief sooner and is more permanent in its effects than any preparation I am acquainted with.

I think that any one testing it will be satisfied. It should be applied often, and a full dose of an opiate will be advantageous if the burn is deep."

Singular Mode of Detecting Fraud.

A lawyer in Providence, R. I., was recently, on behalf of the heirs of an estate, contesting a will which he believed to have been forged. His clients were confident of the justice of their claims; but the instrument was apparently all correct, and the prospect of setting it aside looked very dubious. The pretended will was written under the date of 1855, and bore the stamp, "A. P. Co.—Superfine." No paper but that of the Agawam Company of Mittineague bears this mark. The lawyer conceived the idea of writing to the officials of the Agawam Company for information in regard to the paper, and had the satisfaction of learning that their first paper with that stamp was made and sold in 1860, which proved that the fraudulent will must have been written at least five years after its date. Of course this discovery settled the matter.

THE curious fact, that a needle or other steel wire inserted in a living body will immediately become oxidized, while, if the body be dead, no oxidation will take place, was recently brought to light by Dr. Laborde, of Paris. This is a simple test as to whether death has taken place, and will be available in cases of trance or catalepsy.

THE YEAR AND THE DAY.

Our satellite the moon has this remarkable property, that it turns on its own axis in precisely the same time that it takes in completing a revolution round the earth. The result of this is that men have been known to state, with an air of scientific research, that it does not turn on its own axis at all. But *fiat experimentum in corpore vili*, for, as Herschel remarks, if a man will only walk several times round a stick, with his face always towards it, he will find from the unpleasant sensation of giddiness that he has been rotating on his own axis also.

Now, the earth moves in a most confusing manner round the sun. It rotates on its axis about 365 times while it revolves about the sun; if it were exactly 365 times, the year would be difficult to manage, on account of its not being readily divisible into months or other periods. But it is about 365¼ times, and, to make the confusion worse, it is less than this number by an insignificant fraction, which *will* make itself known in course of years.

If we were to go back to the earliest correct, or moderately correct, notion of the length of the solar year, we should probably find it among the Chinese. But in their case it is impossible to tell what is false and what true. If, however, we are to believe their historians at all, we shall have to allow that in knowledge of this sort they anticipated Europeans by about two thousand years. The Chaldeans and the Egyptians were very early in the pursuit of astronomy, yet quite modern in comparison with the Chinese. In Europe, the Greeks, at an early period of their history, were aware that the revolution, called the solar year, occupied about 365¼ days, but for a long time could not arrive at a more exact determination, and it was not till 140 B.C., that any accurate idea was formed. At that time lived Hipparchus, otherwise "the Father of Astronomy." He pursued the science in Rhodes; and by comparing his own observations of the summer solstice with those taken by Aristarchus about 140 years before, he arrived at a fairly correct result; in fact, whatever inaccuracy there was lay chiefly with Aristarchus. Modern investigations give as the exact time occupied by the earth in moving from a point in the ecliptic to the same point again, 365 days, 5 hours, 48 minutes, 49·62 seconds.

The Romans seem not to have had the advantage of even the imperfect knowledge possessed by the early Greeks; and as our calendar has come down to us directly from them, it will be our object to examine the development of their system. At first the moon was their guide.

Romulus instituted an arbitrary year of 304 days, containing ten months, and commencing with March. Numa, finding that this was so far from the length of the solar year, and that consequently the seasons occurred at different times in different years, added two months, January at the beginning, and February at the end. Here, by the way, we may mention that in 452 B.C. the Decemvirs altered the order, putting February between January and March. Numa's year contained 354 days; and the superstition of the times caused the addition of a day to make it an odd number, which was considered more lucky.

Thus the year became 355 days. This was known to be too short. Numa therefore ordered that every other year a month should be inserted between two days near the end of February, which month should consist alternately of twenty-two and twenty-three days. But notwithstanding this clumsy arrangement, the year was still nearly a day too long, for it was brought up to an average length of 366¼ days. Lastly, this inaccuracy was to be overcome by the omission of one intercalary month in twenty-four years. This was pretty accurate, and might have worked well, but it was left in the hands of the pontifices. Some say that they abused their power over the length of the year to serve political or personal objects. It may have been from ignorance or carelessness; but certainly when Julius Cæsar, as pontifex maximus, examined the state of the calendar, he found that winter months had crept back into autumn, and the heat of summer was raging in the months of spring.

At this period he called to his aid the astronomer Sosigenes, by whose advice the so-called Julian Calendar was framed. The lunar year was abolished, and with it the confusing arrangement of intercalary months. Cæsar ordered that the average length of the year should be 365¼ days; and, to effect this, decreed that every fourth year should contain 366 days, ths others 365, so that there would at first seem to have been very little change from that time till now. But again the pontiffs interfered with the working of it. The Romans had a peculiarity in computing intervals of time which may have caused a mistake in the arrangement of the leap years. They always counted intervals as including the extreme limits; that is to say, they would call the 5th day of a month the 3d before the 7th; we should call it the 2d before it. At all events, the pontiffs, instead of making every fourth year, made every third consist of 366 days. The error thus introduced was gradually corrected by Augustus; it was not large, and therefore he had not to resort to the violent measures of his predecessor Julius, who made the year of his reformation consist of 445 days, which truly was a "year of confusion."

Our months are necessarily of different lengths, but they might be more evenly arranged. They seem to follow no law except that of the little rhyme, which every one is supposed to know. Had we received the Julian system unaltered, this little poem about the thirty and the thirty-one days would never have been needed. The original distribution was such that the months were alternately composed of thirty-one and thirty days in the leap years, and in the other years a day was taken from February, which was always regarded with spite as an unlucky month. Thus, July consisted of thirty-one days, August of thirty. Accordingly, in the time of Augustus, gross adulation caused a day to be taken from February, the poor, unlucky, but ill-used month, and added to the one which bore the emperor's name, merely that his month might not be shorter than July, his predecessor's. The emperor *may* have been gratified by the attention, but it is hard that we should suffer for it.

The Julian method was nearly complete; the year thus established was only 11 minutes 10·35 seconds too long, which amounts to a day in 129 years.

When the Julian Calendar was instituted, the vernal equinox was fixed at the 25th of March; and had it not been for the slight error in the length of the solar year which resulted from the arrangement of Sosigenes, we should probably still have it on that day. As it was, however, the equinox receded; and at the Council of Nice, in 325 A.D., it was settled that the 21st should be distinguished as the day of its occurrence. And here it is remarkable that no correction was made which would prevent further recession, and absolutely fix the equinox on the 21st. The existing calendar was very convenient, simple, and accurate, as far as temporary results; but the error induced must have been manifest; and it must also have been clear that in every four centuries the seasons would be one day out of place.

The necessity of reformation was felt by the Venerable Bede as early as the eighth century; it was subsequently recommended to the pope by the philosopher Roger Bacon; but the first attempt at correction was made in the fifteenth century by Pope Sixtus IV. To assist in this he invited the great astronomer of that time, Regiomontanus; but by the death of the latter, the project was not carried into execution until the accession of Gregory XIII. to the papacy. His system was as follows: The Julian plan of intercalation was adopted, with the exception that the first year of a century should not be a leap year unless it were divisible by 400. Thus the length of the year was brought so nearly to exactitude that in a period of three thousand years the error amounts to less than a day, which is certainly of no great importance. This reformation was made in 1582; and it is a curious coincidence that whereas the Julian Calendar was finally drawn and fully written out by a scribe named Flavius, the Gregorian was published and explained by Clavius.

The reformed or Gregorian Calendar was almost immediately adopted in all Roman Catholic countries, and the seasons were brought back to their original places in the year by the omission of the ten days which had accumulated since the Council of Nice. In Scotland it was adopted in 1600, and in the Protestant States of Germany in 1700. In England the *vox populi* was so strongly opposed to change that no alteration was made until the year 1752; and, indeed, when the change eventually came, it brought with it a most ridiculous outburst of popular ignorance. The 2d of September of that year was followed by the 14th; so that the eleven days, which was the amount of difference between the old style and the new, were omitted in that month; and the lower orders of the nation, under the impression that they had been unwarrantably deprived of something, clamored vehemently but fruitlessly for the restoration of these days. At the present time Russia is the only European country which adheres to the old style.

All things considered, our calendar seems remarkably simple, and, for all human purposes, sufficiently exact; but, in conclusion, we will quote a passage from Herschel's "Astronomy" with reference to the system adopted in Persia;

"A rule proposed by Omar, a Persian astronomer of the court of Gelaleddin Melek Schah, in 1079 A.D. (or more than five centuries before the reformation of Gregory), deserves notice. It consists in interpolating a day, as in the Julian system, every fourth year, only postponing to the thirty-third year the intercalation, which on that system would be made in the thirty-second. This is equivalent to omitting the Julian intercalation altogether in each one hundred and twenty-eighth year (retaining all the others). To produce an accumulated error of a day on this system would require a lapse of five thousand years; so that the Persian astronomer's rule is not only far more simple but materially more exact than the Gregorian."—*Chambers' Journal.*

Spontaneous Combustion.

Instances of spontaneous combustion are so common now-a-days that we cannot help thinking that people are becoming more careless than they used to be, or else they are ignorant of the nature and the causes of this kind of combustion. The latter, we doubt not, is more frequently the case, and this is our reason for taking up the subject here.

Our readers are aware that ordinary burning is nothing but rapid oxidation, or the union of the combustible substance with the oxygen of the air. But they may not all be equally familiar with the philosophy of slow combustion, which is a more gradual oxidation of a substance. The decay of animal and vegetable substances is a process of this sort. When a log of wood rots in the forest, it is as really burned up as when it blazes on the hearth of an old-fashioned fireplace. The carbon and hydrogen which make up the greater part of its bulk are oxidized in the former case, as in the latter, and the products of the combustion—carbonic acid and water—are the same. And it has been proved that the heat generated in both forms of burning is precisely the same; the only difference being, that in ordinary burning it is all set free in a short time, while in decay it is developed so slowly that we do not perceive it.

The rusting of metals is another instance of this slow combustion, the rust being the metal after it is burnt, or oxidized. Heat is generated in this process, as in that of decay; and if the rusting can be made sufficiently rapid (as when a large pile of iron filings is moistened and exposed to the air), the rise of temperature is readily detected. A remarkable case of heat developed in this way occurred in England during the manufacture of a submarine cable, and is described in Rolfe and Gillett's "Natural Philosophy:"

"The copper wire of the cable was covered with gutta-percha, tar, and hemp, and the whole inclosed in a casing of iron wire. The cable, as it was finished, was coiled in tanks filled with water; these tanks leaked, and the water was therefore drawn off, leaving about 163 nautical miles of cable coiled in a mass 30 feet in diameter (with a space in the center 6 feet in diameter) and 8 feet high. It rusted so rapidly that the temperature in the center of the coil rose in four days from 66° to 79°, though the temperature of the air did not rise above 66° during the period, and was as low as 59° part of the time. The mass would have become even hotter, had it not been cooled by pouring on water."

In this case the heat set free caused the oxidation to go on faster and faster; and this is what occurs in spontaneous combustion, which is simply "rapid combustion developed gradually from slow combustion." There is no more common source of such combustion than the oily rags used by painters in their work, or the cotton waste used for wiping machinery. When such substances have become saturated with oil, if they happen to be thrown into a heap, the oil begins to oxidize slowly; but the heat produced makes the oxidation more and more rapid until the mass bursts into a flame. Oils that oxidize readily, like cotton-seed oil, are especially liable to take fire. Oil spilt on dry sawdust has been known to ignite in the same way.

It sometimes happens that hay, cotton, and many forms of woody fiber—as tow, flax, hemp, rags, leaves, spent tan, straw in manure heaps, etc.—when stacked in large quantities in a damp state, take fire spontaneously. Here the oxidation is merely that of incipient decay or fermentation, which is promoted by the dampness. The confined heat accumulates, as in the case of the oily rags or cotton, until it is sufficient to cause rapid combustion. According to M. Chevalier and others, pulverized charcoal, prepared for making gunpowder and stored in heaps, has been known to ignite, when neither oily nor damp; the very slow action of the oxygen of the air upon the charcoal itself being gradually accelerated by the heat produced until it set it on fire.

Whether grain or seeds of any kind be liable to spontaneous combustion is doubtful; though several French savants came to the conclusion that a barn had caught fire from the spontaneous ignition of damp oats stored in it. But, however, that may be, it will be evident from the facts we have given that many fires, involving great destruction of property, have been the result of spontaneous combustion; and it is probable that many conflagrations ascribed to incendiarism have really owed their origin to the same cause.—*Boston Journal of Chemistry.*

Prof. Huxley's Plan of Education.

I conceive the proper course to be somewhat as follows: To begin with, let every child be instructed in those general views of the phenomenon of nature for which we have no exact English name. The nearest approximation to a name for what I mean, which we possess, is "physical geography." The Germans have a better—*Erdkunde* (earth-knowledge, or "geology" in its etymological sense), that is to say, a general knowledge of the earth, and what is on it, in it, and about it. If any one who has had experience of the ways of young children will call to mind their questions, he will find that, so far as they can be put into the category, they come under the head of *Erdkunde*. The child asks: What is the moon, and why does it shine? What is this water, and where does it run? What is the wind? What makes the waves in the sea? Where does this animal live? and what is the use of this plant? And if not snubbed and stunted by being told not to ask foolish questions, there is no limit to the intellectual craving of a young child, nor any bounds to the slow but solid accretion of knowledge and development of the thinking quality in this way. To all such questions, answers which are necessarily incomplete, but true as far as they go, may be given by any teacher whose ideas represent real knowledge, and not mere book-learning; and a panoramic view of nature, accompanied by a strong infusion of the scientific habit of mind, may thus be placed within the reach of every child of nine or ten.

After this preliminary opening of the eyes to the great spectacle of the daily progress of nature, as the reasoning faculties of the child grow, and he becomes familiar with the use of the tools of knowledge—reading, writing, and elementary mathematics—he should pass on to what is in th more strict sense physical science. Now there are two kinds of physical science: the one regards form, and the relation of forms to one another; the other deals with causes and effects. In many of what we term our sciences, those two kinds are mixed up together; but systematic botany is a pure example of the former kind, and physics of the latter kind of science. Every educational advantage which training in physical science can give is obtainable from the proper study of these two; and I should be contented for the present if they, added to our *Erdkunde*, furnished the whole of the scientific curriculum of schools.

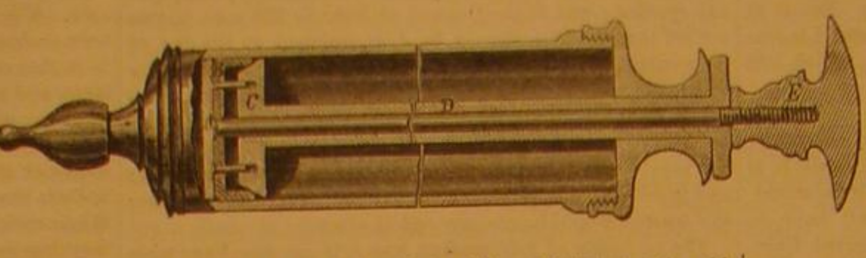
BLACK ink, possessing fluidity, depth of color, and permanency, is still a *desideratum*. The pale inks of the present day, when pure, turn black in time, and are lasting. But the blackness, due to the action of tannic acid in the galls on the iron in the copperas, is inferior in color to the carbon inks of the ancients. A carbon ink of the present day always turns mouldy. What is the secret of making a carbon fluid, free from any disintegrating or perishing ingredient?

IMPROVED EXTERNALLY ADJUSTABLE PACKING FOR PISTONS.

The great difficulty which has always attended the use of pistons is that of keeping them tight. Exposed to constant friction the wear is great, and in addition to this, if soft packing be employed, the result of the friction is to condense its texture and impair its elasticity. Hence the piston which fits the cylinder accurately to-day, must, unless re-adjusted, fit it less accurately to-morrow.

In the use of pumps, syringes, etc., it has been necessary to rearrange frequently the packing, for which purpose it was necessary to take off the head of the cylinder, and often to remove the piston.

By means of the invention, shown in the accompanying engraving, this necessity is avoided, the expansion of the packing being effected without opening the cylinder, by simply turning a nut at the outer end of the piston rod.



The engraving represents the invention as applied to a common syringe, but, with slight modifications in the details, it is applicable to all classes of pistons.

The piston, A, is provided with a cup leather packing, B. This cup leather is expanded by a conical head, C, attached to a sleeve, D. The turning of the knob, E, presses the head, D, down into the cup leather, or relieves it from pressure, according as the knob is turned to the right or left. We need not dwell on the means necessary to adapt this principle to pumps, steam engines, etc., as they will readily suggest themselves to all mechanics.

Under the present system when the leakage of the piston becomes too great to be tolerated any longer, the cylinder is opened and the packing re-adjusted. This requires a considerable outlay of time and labor, and to avoid the necessity for its immediate repetition the piston is packed about as tightly as possible. This results in considerable loss of power by friction, which gradually diminishes until it is succeeded by gradually increasing loss by leakage. Thus friction and leakage alternately operate against economy of power.

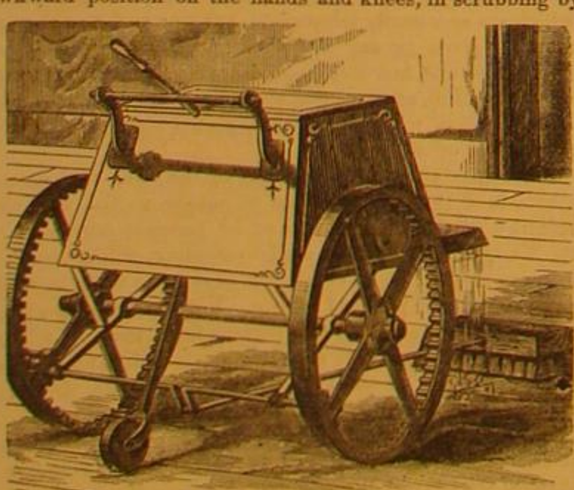
By means of this device it is easy to expand the packing from day to day precisely to the extent required without causing any unnecessary pressure upon the interior of the cylinder. There need therefore be no loss by leakage on the one hand or by unnecessary friction on the other, to say nothing of the time involved in removing the head of the cylinder.

In syringes and pumps in which soft packing is employed an interval of a few days without use is almost certain to be followed by such a shrinking of the packing as to require considerable trouble to get the piston to work. By means of the improved piston this annoyance is entirely overcome. A single turn of the nut renders the packing, however dry and shrunken, perfectly tight.

Patent allowed through the Scientific American Patent Agency, and will issue next week to A. H. Smith. For particulars apply to W. H. Wells, 948 Broadway, New York.

SCRUBBING MACHINE.

Mr. Andrew Irion, of Femme, Mo., has invented a scrubbing machine, of which our engraving is a representation. A tank containing the water made alkaline by soda or soap, is arranged on wheels, as shown. The wheels have teeth on the interior of their rims, which gear with a pinion on a crank shaft, from which motion is communicated through a connecting rod to a large scrubbing brush. The water is sprinkled upon the floor in advance of the brush, the flow being controled by a valve actuated by a hand lever. In use, the hands grasp a horizontal bar, attached to the tank by brackets, and the machine is rolled over the floor or sidewalk to be scrubbed, which imparts a rapid reciprocating movement to the brush. The substitution of the erect posture for the awkward position on the hands and knees, in scrubbing by



hand, renders the work far more easy and cleanly to the operator; and, as a consequence, the work may proceed with greater rapidity. In the cleansing of large open floors, this machine may be used to advantage.

THE disastrous war in Europe has given great impetus to some of our fancy manufactures, as we are now prevented from obtaining French goods. The change is especially noticeable in the artificial flower trade. The annual consumption of these apparently trifling articles is estimated to reach $16,000,000, and the employment to women and girls it affords is a most important consideration.

Spurious Metallic Filling for Teeth.

One of the refinements of the art of deception is described in the following passage, for which we are indebted to the *Dental Cosmos*, of Philadelphia:

"A man called upon the doctor to have a tooth extracted, as he had pain all over the right side of his face, which he located in one of the molar teeth, that had apparently a very nice gold filling. The patient was dismissed without extracting the tooth, as the doctor thought that the pain was due to neuralgia, caused by something else, and treated him accordingly. The patient called again the next day, saying the tooth must come out, as it pained intensely. It was extracted, but no relief was afforded. He called on the following day, and desired to have other teeth removed. The molar tooth that had been extracted was broken open, and found to have been half filled with tin foil and finished with gold. The other fillings were then taken out of the remaining teeth, and found to have been in the same condition, thus making a galvanic battery. The patient was sent to a good dentist to have these fillings renewed with gold. Immediate and permanent relief was obtained."

The name of the ingenious dentist is withheld; had it not been we would have given him and his deeds a most undesirable publicity.

PERPETUAL MOTION.

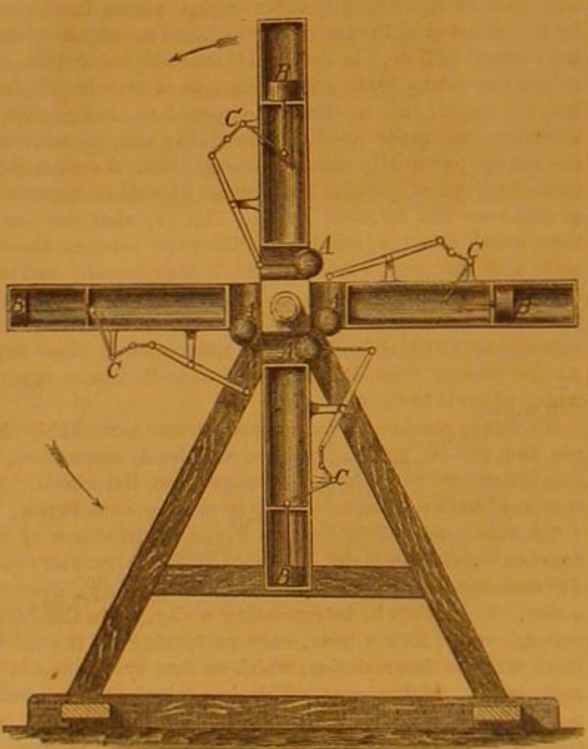
NUMBER X.

CARNOT'S OPINION OF PERPETUAL MOTION.

The celebrated physicist and mathematician, Carnot, has given his opinion on "perpetual motion," as follows:

From what we have observed regarding friction and other passive forces, it may be inferred that perpetual motion is a thing absolutely impossible, when only such bodies are em-

FIG. 22.



ployed as are not acted on by motive power, or any heavy body; for, as these passive forces, which cannot be avoided, are constantly resisting, it is evident that the movement must continally abate; and, from what has been said, it will be seen that, when bodies are not acted on by any motive power, the sum of active force will be reduced to nothing; that is to say, that the machine will be brought to rest when the amount of activity absorbed by friction, since the commencement of the movement, will have become equal to one half of the initial active force; and when the bodies are weights, the movement will terminate when the amount of activity absorbed by the friction equals one half of the initial active force; moreover, one half of the active force existing, if all the parts of the system have a common speed, equals that which is due to the hight of the point where, in the first instance of the movement, was the center of gravity above the lowest point to which it can descend.

It is easy to apply the same reasoning to constructions where springs are used, and generally to all such constructions where, abstracting from friction, the moving force, in order to bring the machine from one position to another, must consume an amount of activity as great as that which is absorbed by the resisting forces when the machine returns from the last to the previous position.

The movement will terminate still sooner, if any percussion takes place, as the sum of active force is always diminshed in such cases.

It is therefore evident, that one must altogether despair of producing what is called the perpetuum mobile, if it be true that all the motive powers existing in nature consist in nothing but attraction, and that it is a general property of this power to be always equal at equal distances between given bodies; that is to say, to be a function that only varies in cases where the distance of these bodies varies itself.

This opinion may be appropriately followed by that of Dr. Lardner, given in the following extract:

There is no mechanical problem on which a greater amount of intellectual ingenuity has been wasted, than that which has for its object the discovery of the perpetual motion. Since this term, however, is not always rightly understood, is will be useful here to explain what the perpetual motion it not, as well as what it is.

The perpetual motion, then, which has been the subject of such anxious and laborious research, is not a mere motion which is continued indefinitely. If it were, the diurnal and annual motion of the earth, and the corresponding motions of the other planets and satellites of the solar system, as well as the rotations of the sun upon its axis, would be all perpetual motions.

To understand the object of this celebrated problem, it is necessary to remember that, in considering the construction and performance of a machine, there are three things involved: 1st, the object to which the machine gives motion; 2d, the construction of the mechanism; and 3d, the moving power, the effect of which is transmitted by the machine to the object to be moved. In consequence of the inertia of matter, the machine cannot transmit to the object more force than it receives from the moving power; strictly speaking, indeed, it must transmit less force, since more or less of the moving force must be intercepted by friction and atmospheric resistance. If, therefore, it were proposed to invent a machine which would transmit to the object to be moved the whole amount of force imparted by the moving power, such a problem would be at once pronounced impossible of solution, inasmuch as it would involve two impracticable conditions: first, the absence of atmospheric resistance, which would oblige the machine to be worked in a vacuum; and second, the absence of all friction between those parts of the machine which would move in contact with one another.

But suppose that it were proposed to invent a machine which would transmit to the object to be moved a greater amount of force than that imparted by the moving power, the impossibility of the problem would in this case be still more glaring; for, even though the machine were to work in a vacuum, and all friction were removed, it could do no more than convey to the object the force it receives. To suppose that it could convey more force, it would be necessary to admit that the surplus must be produced by the machine itself, and that, consequently, the matter composing it would not be endowed with the quality of inertia. Such a supposition would be equivalent to ascribing to the machine the qualities of an animated being.

But the absurdity would be still greater, if possible, if the problem were to invent a machine which would impart a certain motion to an object without receiving any force whatever from a moving power; yet such is precisely the celebrated problem of the perpetual motion.

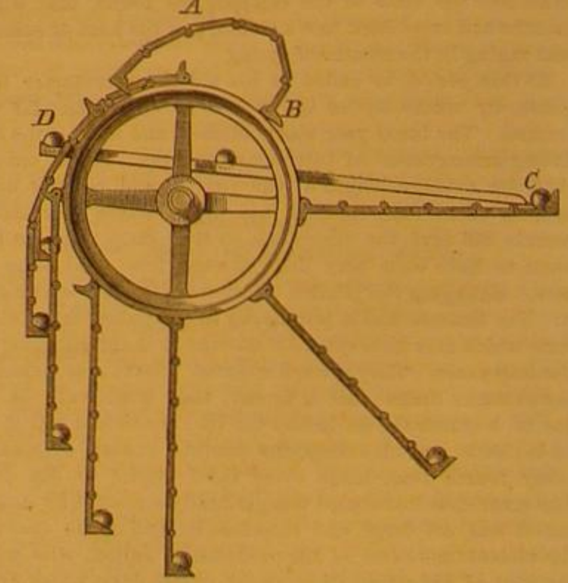
In short, a perpetual motion would be, for example, a watch or clock which would go as long as its mechanism would endure, without being wound up; it would be a mill which would grind corn, or work machinery, without the action upon it of water, wind, steam, animal power, or any other moving force external to it.

It is not only true that such a machine never has been invented, but it is demonstrable that so long as the laws of nature remain unaltered, and so long as matters continue to possess that quality of inertia which is proved to be inseparable from it, not only in all places and under all circumstances on the earth, but throughout the vast regions of space to which the observations of astronomers have extended, the invention of such a machine is an impossibility the most absolute.

Fig. 22 is a drawing of a supposed perpetual motion, which the inventor says will not go, though he has worked at it twelve months. He has now given it up in despair, and vows he will waste no more time upon it. The central weights, A, each weigh one fourth more than the weights, B, at the extremities of the arms. The two sets of weights are connected pairs, each pair being joined by a lever, link, and bell crank, C. The action of gravity in the central weights compels the sliding weights at the ends of the arms to assume the positions shown in the engraving.

Had our correspondent, Mr. Geo. C. Phillips, of Alleghany, Cal., applied a little mathematical calculation to the verification of the truth or falsity of the principle of his device, he might easily have proved that it was a perfect balance, and saved himself twelve months of trouble and expense.

FIG. 23.



The leverage of the outside is exactly counteracted by the leverage of the inside weights.

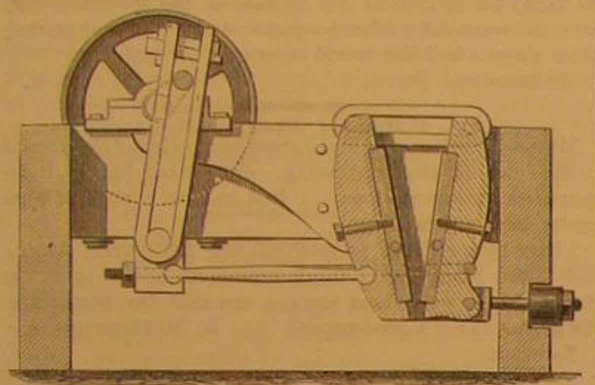
Fig. 23 is a device contrived by Mr. Geo. Linton, of Middlesex, England. The engraving is an end view of a series of vertical wheels, one only being seen. The lever, A, is represented in the act of falling from the periphery of the wheel into a right line. The lever is composed of a series of flat rods, connected by ruler joints, which said ruler joints are provided with a stop, or joggle, to prevent their collapsing at any time more than will bring any one of the rods which compose the levers at a right angle with the rod next to it. This lever is attached to the periphery of the wheel by the hinge joint, B, provided with the shoulder, to prevent its falling into any other than a right line from the center of the circumference of the wheel. The levers are furnished at their outer extremities with a bucket, or receiver, the bottom of which is sufficiently broad to retain the ball, C. The balls remain in the buckets till the buckets come into the position of the lever, D, when they are expected to roll out of the buckets on to the inclined plane, and by their own gravity roll to the other end of the inclined plane, ready to be again taken into the buckets.

QUARTZ CRUSHER.

In machines designed for breaking stones, crushing ores, etc., simplicity is absolutely essential. Pride and poverty are fully as congenial as rude work with complication in mechanism. The parts of such machines should therefore be few and massive, and be so put together that even common laborers may be able to keep them in running order.

Messrs. Varney & Rix, of San Francisco, Cal., have patented a machine which seems, so far as simplicity is concerned, to answer the requirements of the case.

Our engraving is a representation of this machine. The power is transmitted from cranks on the shaft of a heavy fly wheel through a system of powerful links, or toggle bars,



to pivoted jaws, which thus approach each other with great force at each revolution of the fly wheel, compressing the quartz and thus crushing it. The general principle of the mastication of food by the jaws of animals is very nearly approached in this machine.

ACTION OF THE RECIPROCATING PARTS OF STEAM ENGINES, AND ITS INFLUENCE ON THE PROBLEM OF HIGH PISTON-SPEED.

Read before the Polytechnic Club of the American Institute, by Chas. T. Porter.

Your attention is invited to a proposition, which, on its bare statement, will probably strike many persons as absurd. It is, that a reciprocating engine is, with respect to the line of centers, identical with a rotary engine; reciprocation is, in the line of motion, identical with rotation; the reciprocating parts of an engine, at the instant when the direction of their motion is reversed, exert a force, which is precisely the same centrifugal force that would be exerted by them continually if they were revolving with the crank; so that reciprocation may properly be defined to be rotation in a straight line.

I am well aware that the doctrine that the reciprocating parts of an engine exert a force on the dead centers where they are at rest, when their motion in one direction has ceased and that in the opposite one has not yet begun, is rank heresy; as much so as was once the assertion that the earth revolves on its axis. It is, however, equally true. The demonstration of it is quite simple, and I do not doubt that at every step I shall have your entire and cordial concurrence. If we find ourselves on ground not before trodden, we shall nevertheless be sure that it is firm and solid ground.

It may be observed here, that the action which we are to investigate has no *necessary* connection with high piston-speed. Although it is what makes rapid speed practicable, and although a correct understanding of it wholly removes any theoretical objection to the employment of such speed, still it takes place at all speeds, varying only in the amount of centrifugal force developed, according to the law of central forces, namely; directly as the mass, directly as the diameter of the circle when the number of revolutions is constant, inversely as this diameter when the velocity is constant, and as the square of the speed in a given circle.

We know that the motion of a piston controlled by a crank is not uniform, but, commencing from a state of rest, it becomes at the mid stroke slightly in excess of that of the crank-pin, and at the termination of the stroke has been reduced back to nothing. In giving the piston-speed of an engine, we always name its mean speed, found by multiplying the length of the stroke, in feet, into the number of strokes made per minute; but the speed attained at the middle of each stroke is about 57 per cent greater than this, having the same relation to it that the semi-circumference bears to the diameter of a circle.

Let us take, for illustration, the case of a horizontal engine, of 16 in. diameter of cylinder, by 30 in. stroke, the reciprocating parts of which weigh 1200 lbs., and which makes 122·3 revolutions per minute. The mean piston-speed is 611·5 feet per minute, while that reached at the middle of each stroke is 960 feet per minute, or 16 feet per second.

The first question requiring to be answered is: What is the amount of accelerating force, constantly exerted through a distance of 15 inches, that is required to impart to a body of 1200 lbs. weight a velocity of 16 feet per second? We suppose the motion to be without friction, and are inquiring only for the force required to overcome the inertia of the mass. The laws of falling bodies will furnish the answer to our question.

The motion being horizontal, gravity has no effect, either to produce or to destroy it; but a force of 1200 lbs., equal to the weight of these parts, would, by being constantly exerted horizontally through a distance of 16·083 feet, give to them a velocity of 32·166 feet per second, this being the velocity imparted by gravity to a falling body.

But what velocity would this force impart, by acting through a distance of 1·25 feet? The velocity acquired by a body accelerated by a constant force, varies as the square roots of the distances through which the force acts. Thus, a falling body, to acquire a double velocity, must fall through four times the distance, and to acquire five-fold velocity, it must fall through twenty-five times the distance; and so the force equal to their weight, acting through 1·25 feet, would impart to the reciprocating parts a velocity of 8·968 feet per second.

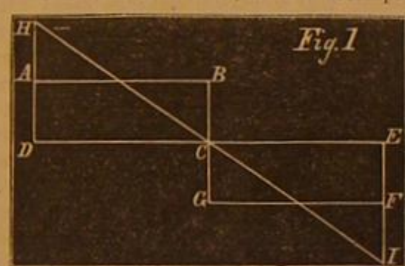
$$\frac{32{\cdot}166 \times \sqrt{1{\cdot}25}}{\sqrt{16{\cdot}083}} = 8{\cdot}968$$

But if 1200 lbs. will give a velocity of 8·968 feet per second, what force will be required to impart a velocity of 16 feet per second? The forces required to impart different velocities by acting through a given distance, must vary as the squares of the velocities imparted. Thus, to give to a body in moving through a distance of 16·083 feet, a velocity of 64·332 feet per second, or double that which gravity would impart, the accelerating force must be equal to four times its weight, and so the force required to impart to a body of 1200 lbs. weight a velocity of 16 feet per second by acting through a distance of 1·25 feet, is 3820 lbs.

$$\frac{1200 \times 16^2}{8{\cdot}968^2} = 3{\cdot}820$$

We have thus completed the first step in our demonstration. There can be no doubt that our piston, crosshead and connecting rod have attained a velocity of 16 feet per second, that this velocity has been imparted to them in moving through a distance of 15 inches, and that they must have been accelerated by a force, supposing it to have been exerted constantly, of 3820 lbs.

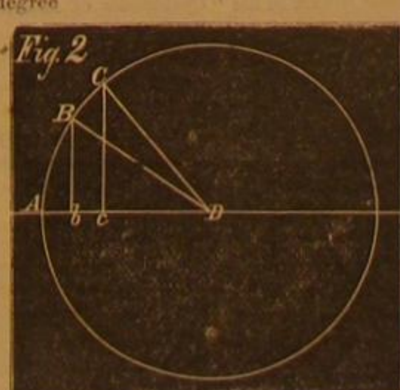
But it is obvious that the force accelerating the motion of a piston cannot be a constant force, because if it were so, then at the middle of the stroke, where acceleration ends, it must cease abruptly, and retardation must commence in the same manner, as would be illustrated by the two parallelograms, A B C D and C E F G, in the accompanying figure.



Now we know very well that, instead of this, acceleration passes at the mid-stroke into retardation, in a manner wholly insensible.

How shall this mystery be explained? There are various methods, more or less abstruse, of reaching the explanation, but there is one that is exceedingly simple, indeed so much so that it is surprising that engineers are not uniformly familiar with it. It is found by almost the mere inspection of the table of versed sines.

The motion of a piston, disregarding the effect of the angular vibration of the connecting rod, is equal to the versed sine of the angle which the crank forms with the line of centers. The versed sine of any angle shows, then, the motion of the piston from the commencement of the stroke. If we take the versed sine of any degree, and subtract from it that of the preceding degree, the remainder will represent the motion of the piston while the crank is moving through the last degree.



Thus, in the above figure, while the crank is traversing the arc, A B, the piston is moving through a distance equal to A b, the versed sine of the angle, A D B, and so on.

The following table, which any one can complete, shows, in the first column, the versed sine, or total piston motion, for the first and last five degrees which the crank passes through while the piston is making a half stroke, and in the second column, obtained by subtraction as above, shows the motion for each one of these degrees.

The motion for each succeeding degree, of course, increases all the way, but in what ratio does it increase? This is the vital question. To answer it, we subtract from the motion for each degree that for the preceding one, and the difference shows the velocity imparted while the crank was moving through the last degree. In this manner we obtain the third column, showing at a glance the velocity imparted to the piston at each degree; and how wonderful is the revelation! The acceleration, at first nearly uniform, diminishes in an increasing ratio, which for the 90th degree is less than $\frac{1}{57}$ that for the first degree, and is just equal to the diminution in the acceleration for the 89th degree, showing how at the end of this degree it ceases altogether.

Degrees.	Versed sine, or total motion	Motion during each 1°.	Velocity imparted during each 1°.	Differences.
1	·0001523	·0001523	·0003046	
2	·0006092	·0004569	·0003046	0
3	·0013705	·0007613	·0003044	2
4	·0024359	·0010654	·0003041	3
5	,0038052	·0013693	·0003039	2
86	·9302435	·0173992	·0000265	
87	·9476640	·0174205	·0000213	52
88	·9651005	·0174365	·0000160	53
89	·9825476	·0174471	·0000106	54
90	1·0000000	·0174524	·0000053	53

The motion during the first two degrees seems to be uniformly accelerated; but if we should go to a sufficiently high place of decimals, we should find the acceleration absolutely greatest on the very dead center.

It will be interesting to compare this diminishing acceleration with the uniform acceleration of the motion of a falling body. The following table represents the latter; decimals are omitted for convenience, but this does not at all affect the table for the purpose of this comparison. The second and third columns are derived from the first by subtraction, in the same manner as above.

Seconds.	Total distance fallen through.	Distance fallen in each second.	Velocity in feet per second imparted during each second.
	ft.	ft.	
1	16	16	32
2	64	48	32
3	144	80	32
4	256	112	32
5	400	144	32
6	576	176	32

If now, at each degree, we draw an ordinate, perpendicular to the line of centers, and of a length proportionate to the acceleration at that degree, we shall find that a straight line connects all their extremities, showing the acceleration to be represented by the right-angled triangle, D C H, Fig. 1. This any one can verify.

It is thus revealed to us, that precisely on the dead center the acceleration of the force of the piston's motion is double its mean acceleration, and the force required to produce it is twice that which would be constantly required; or, in the case we are considering, is 7640 lbs., equal to a pressure of 38 lbs. on each square inch of piston area.

The fact is so important, that it may be well to exhibit it also in another manner. We have seen that the motion of the piston is, for the first two degrees, accelerated in a manner which may be regarded as uniform. The distance moved through by a body uniformly accelerated, increases as the square of the time, as shown in the last table.

If, then, we take the coefficient of the motion for the first degree, ·0001523, and multiply it by the square of the number of degrees traversed by the crank in one second, we shall have the distance which the reciprocating parts would be moved in one second, at their original rate of acceleration, supposing it to be continued uniformly during that time, if the length of the crank equaled 1. This distance is 82·05254 feet, for the crank moves in one second through 734 degrees, and $734^2 \times {\cdot}0001523 = 82{\cdot}05254$. The length of the crank is, however, 1·25 feet, so that the distance moved through would be 102·5 feet. This distance, divided by 16·083, gives the quotient 6·37, which is the accelerating force in terms of the weight of the parts. But $1200 \times 6{\cdot}37 = 7644$, the same result as before.

The second point in our demonstration is now established that on the dead center, where motion begins to be imparted to the piston, it is imparted in double the average ratio, and the force required for this purpose is just twice as great as a uniform accelerating force would have to be, to give to it the velocity that it has at the mid-stroke.

The retardation of the motion of the piston by the crank, bringing it to rest at the end of the stroke, is the reverse of the acceleration, commencing insensibly at the middle, and culminating at the termination of the stroke, and is represented by the triangle, E, C, I, Fig. 1. This, to one who has clearly apprehended the acceleration, must be sufficiently obvious.

We are arrived now at our final proposition, that the resistance offered by the reciprocating parts to this alternate acceleration and retardation is, at its culminating point, the dead center, precisely the centrifugal force that the same weight would exert continually, if it were revolving with the crank pin.

Let us examine this action in the light that has now been thrown upon it. We will suppose the steam to be suddenly shut off, so that the acceleration, as well as the retardation, is effected through the crank. We note, first, this distinction, that while at the mid-stroke acceleration passes when diminished to nothing into retardation commencing at nothing; at the centers, on the contrary, retardation passes at its maximum into acceleration at *its* maximum. A closer examination shows, however, that while, in the first case, the direction of the force changes, in the latter it does not change. This direction must be reversed twice in each revolution, and this reversal takes place at the middle of each stroke, and not on the center. The crank begins, at each mid-stroke to retard the motion of the piston, and opposes to it a continually increasing resistance, retarding it more and more rapidly up to the center line, at which point it begins *by a continuance of the same force*, to urge it in the opposite direction. The strain of the piston on the crank, in either direction alternately, begins insensibly at the mid-stroke, culminates on the center, and diminishes to nothing at the mid-stroke again, and this resistance, at its culminating point, is the centrifugal force which the mass would exert, if it were revolving instead of reciprocating; and at every other point is the horizontal component of that force.

This is readily established. First, the direction of the force is radial. Second, the coefficient of centrifugal force is the decimal, ·000341, which is the centrifugal force (in decimals of a pound), of one pound, making one revolution per minute, in a circle of one foot radius. This coefficient shows the centrifugal force of 1200 pounds, making 122·3 revolutions per minute, in a circle of 1·25 feet radius, to be 7650 pounds.* Third, this identity is practically proved by the fact that the reciprocating parts are balanced, in the horizontal direction, by an equal weight, revolving opposite to the crank, and at the same distance from the center. Fourth, an examination into the nature of the force itself shows that it *is* centrifugal. What is centrifugal force? It is the resistance which a moving body offers to being deflected from a right line, or, as it is radially at rest, its right line of motion being across the radial line at right angles, it is its resistance to being put in motion, towards the center, from a state of rest, and the amount of this motion is the versed sine of the angle, a definition which exactly describes the force under consideration.

But what is the influence of this action upon the problem of high piston-speed?

We see that it makes any engine, in effect, a rotary engine if the steam be shut off, the crank passing the centers under the strain of the centrifugal force of the reciprocating parts. But at ordinary speeds this force is developed only in a small degree, varying from 2 pounds to 10 pounds for each square inch of piston area, and of course the force of the steam is only to this extent expended in overcoming it, the excess becoming, at the instant of its admission, effective against the crank.

Nor, at more rapid speed does it become of marked value, unless considerable weight in the reciprocating parts and a short stroke be employed, since it increases directly as the mass, and inversely as the diameter of the circle, with a given piston-speed. By combining, however, rapid speed and short stroke with considerable weight in these parts, their centrifugal force may be developed to whatever extent we choose; and if this be in excess of the force of the steam, the engine, with the steam turned on, becomes, in effect, a rotary engine. The crank passes the centers under a strain not wholly relieved; the force of the steam does not reach the crank at these points, but is absorbed in the mass, and is afterwards gradually imparted to the crank during the stroke.

It is certainly difficult to estimate too highly the value of this action. By means of it, the shock of the steam on the center may be avoided wholly, or in any degree; the excessively intermittent pressure caused by working steam at a high grade of expansion is transformed, as by magic, into a steady and uniform rotative pressure on the crank; the fly wheel is relieved of its most trying offices, and the shaft from the excessive torsion in alternate directions that is produced by its action; and a smooth and gliding movement is attained, with a closer approximation to uniform motion than the crank has been supposed to be capable of giving.

It is curious to observe how exactly opposite to the truth all the engineering traditions on this subject turn out to be. We have been taught that the reciprocating parts of an engine were passive on the centers, that the great difficulty encountered in the attempt to employ high speed was the necessity of reversing their motion, that they should therefore be made as light as possible, and long strokes should be employed, so that the changes in the direction of their motion might be as few as possible. Now we know that their centrifugal action on the centers is all important to a high speed engine, and that to render this most serviceable we must employ considerable weight and a short stroke.

The field is a very large one; I limit myself to the fundamental principle which I have endeavored to explain. This being established, all theoretical objection to the employment of high speed vanishes. When the dead center is stripped of its imaginary terrors, we must perceive the dawn of a new day in the history of the steam engine.

* This furnishes us a simple rule for calculating this force. Multiply together the weight of the reciprocating parts, the length of the crank in feet, and the square of the number of revolutions per minute, and multiply the product by the decimal ·000341.

Sulphuric Acid from Gypsum.

As is well known, numerous attempts have been made to procure sulphuric acid from the widely-distributed gypsum, or sulphate of lime; but hitherto without success. Some time ago it was stated that dolomite, a mineral consisting of carbonate of magnesia and lime, may be decomposed by gypsum—carbonate of lime and sulphate of magnesia (bitter salt) being produced when they are both mixed as fine powders and lixiviated with water. From the latter the sulphuric acid can be readily separated by chloride of sodium, the concentrated solution of both yielding sulphate of soda and chloride of magnesium. In the *Neue Jahrbuch für Pharmacie*, 1870, page 204, H. Reinsch denies that gypsum can be decomposed by dolomite. He prepared an intimate mixture of the powdered minerals, and treated it for three months with water, allowing the liquid to drop from a filter, but without even obtaining a trace of bitter salt. After this time he kept the mass boiling for three days, the waste of water by evaporation being constantly re-supplied. The filtered liquid, being boiled down, left a yellowish cake, consisting of two thirds gypsum and one third of other salts, as nitrate of magnesia, chloride of magnesium, nitrate of lime, and traces of bitter salt. Hereupon Reinsch made trials in another direction. He mixed two parts of powdered gypsum with one part of carbonate of ammonia, which contains one and a half equivalent of ammonia. Upon being triturated with water, a liberation of gas took place which lasted for several days, and as the liquid was ultimately heated to the boiling point, a very vivid disengagement of pure carbonic acid was produced. By this process, carbonate of lime, and sulphate of ammonia were formed, and part of the carbonic acid of the ammonia salt was disengaged as gas.

The gypsum was completely decomposed. At the ordinary temperature the decomposition takes place without interruption, but slowly, while at the boiling point it becomes very rapid. A very soft carbonate of lime is thereby obtained, which, in large quantities, might certainly be utilized. In order to separate the sulphuric acid from the ammonia salt, it would only be necessary to subject it to sublimation with common salt, and to convert the resulting chloride of ammonia with carbonate of lime into carbonate of ammonia. It is thought probable that this method of producing sulphuric acid may be carried out on a large scale, provided that the carbonate of lime formed during the first decomposition, and the chloride of calcium formed at the second one, can be utilized, of which, according to Reinsch, there cannot be any doubt.

The chloride of calcium, at least, has repeatly been recommended as a means for keeping streets free from dust. In this manner the inexhaustible sources of gypsum could be employed for the manufacture of sulphate of soda, which forms the basis of the fabrication of glass and soda.

Correspondence.

The Editors are not responsible for the opinions expressed by their Correspondents.

Beams and Girders.

MESSRS. EDITORS:—Mr. Severson, in the SCIENTIFIC AMERICAN of Dec. 10, last, criticised me freely on the subject of the strength and strain of beams, etc., which is all right; but I am sorry for the reputation of the profession to which he attaches himself, that he should make so many blunders in so short an article. He evidently does not belong to that class of engineers to which I referred in a former article, for he differs from all of them, in every point he advances.

It will be observed that, on page 307, SCIENTIFIC AMERICAN, Vol. XXIII., I assumed two positions, differing from those advanced by the *Builder*. The first, which was in relation to the strain to which a beam is subjected by a weight laid upon it at different points between the supports, is expressed by the following formula or general proportion:

A varies as BC×CD

in which A is the strain to which a beam is subjected, by a weight laid on it, at any point, and BC and CD are the segments of the beam between this point and the supports. For authority see "Gregory's Mathematics," art. 2, page 402; "Practical Book" of reference, by Chas. Hazlett, and Prof. Hackley, of Columbia College, page 265; "Scribner's Engineer's and Mechanic's Companion," page 129, Note 1.

The second relates to the strength of beams, and is expressed by the following general proportion:

$$S \text{ varies as } \frac{bd^2}{l}$$

in which S equals the strength of the beam, b the breadth, d the depth, and l the length. See "Scribner's Engineer's and Mechanic's Companion," page 127; "King's Notes on Steam," art. 3, page 207; "Gregory's Mathematics, art. 22, page 405; "Mahan's Engineering," first equation on page 387; reports of Du Hamet and M. de Buffon, to the French Government, as given by Robert Stuart in his "Cyclopedia of Architecture," article, "Mechanical Carpentry."

Yet, in the face of all this authority, our friend Benjamin Severson, mechanical and civil engineer, of Washington, D. C., is bold enough to tell us, with regard to the first of the above propositions, that the strain varies "inversely as the distances." And with regard to the second proposition, that "the positive statement of Mr. Pearson appears to be equally erroneous."

Again, in attempting to enlighten us upon the "strain of beams," resulting from a load laid evenly over the whole length, he says: "Under loads thus uniformly applied, the strains increase as the squares of the spans." While all the authorities above quoted unite in telling us that the strain at any point of a beam, resulting from a load thus evenly laid over its entire length, is only the half of that resulting from laying the entire load on that particular point.

Again, in relation to his hypothetical beam, it is no disparagement of the formula that the beam will not support its own weight. It will be seen that the element of weight varies directly as the length, while the element of strength varies inversely as the length, the other dimensions remaining constant, so that it is possible for a beam, having all the strength assigned to it by the formula, to fail of supporting its own weight.

Furthermore, it will be seen by reference to his article on page 372, Vol. XXIII., SCIENTIFIC AMERICAN, that all his deductions are from appearances. He does not give the result of any experiment, or any analytical investigation, or quote any author in support of his sayings. It takes something more than simple appearances to do away the results of profound research for ages. H. C. PEARSONS.

Ferrysburgh, Mich.

Fire Escapes.

MESSRS. EDITORS:—In a late issue of your valuable paper, one who signs himself "Humanity" suggests the idea of an apparatus to save persons from the horrible death of burning alive, as was the case at the burning of the Spotswood House, at Richmond.

The idea is a good one, but instead of a rope basket, as he suggests, two baskets, made of wire, should be used, one inside of the other. The outside one must be made of wire gauze $\frac{1}{30}$-inch mesh, or sufficiently fine to prevent a flame from passing through, yet, at the same time, allowed full circulation of air. The inside basket should be made less than the size of the outside one, allowing from two to three inches space between the two, and of wire $\frac{1}{4}$-inch mesh. Both should be placed on iron frames. To this should be attached a small iron chain, sufficiently long to be used by parties outside of the building, on the ground, in hoisting and lowering. A small pulley block and hook should be attached to the chain.

About the building in several places should be placed iron brackets with rings suspended to hook the blocks to in case of need. The principle of the basket is well understood to be that of Sir H. Davy's miners' lamp. It could be lowered through any amount of flame without the least fear of a person's clothes inside taking fire. These baskets would also be handy for firemen to use in case of fire, provided they were not wanted for other purposes; and the cost of placing them about a building would be merely nominal.

376 Broadway, Boston. M. H.

"Men of Progress."

MESSRS. EDITORS:—I feel I must acknowledge the receipt of the splendid steel engraving. For art and beauty, it far surpasses my expectations. I look on it as a piece of work pretty hard to beat.

I have been striving to establish the SCIENTIFIC AMERICAN in this place; and I think, henceforth, it will speak for itself. I have yet to hear any one say that the SCIENTIFIC AMERICAN is not a good paper. R. M. HUMPHREYS.

Tarentum.

Discovery and Invention.

The genius of the inventor is frequently undisciplined by culture; he is perhaps a workman of slender means and narrow views; hence the overpowering force with which his one idea seizes him. The discoverer, on the contrary, he who enlarges the boundaries of knowledge by important truths, must be both a genius and a scholar, a man of broad views, many-sided, healthy, up to the level of science in his time. Such conditions almost presuppose pecuniary independence. Hence, in reading the lives of the great lights of science—Pythagoras, Archimedes, Copernicus, Newton, etc.—we generally find them men of standing and influence, men who have leisure enough to devote themselves to science, and education enough to bring all varieties of existence within their ken. For want of this thorough scientific training, inventors are continually forced to test every step of their work; and it may be that only after hundreds of failures any success is achieved. Though, as Mr. Smiles says, "the steam engine was nothing until it emerged from the state of theory, and was taken in hand by practical mechanics," it must be remembered, also, that without theory it could never have been thought of, and that ignorance of scientific truths is often the most serious hindrance to practical men in their inventions. If Goodyear had known that oil of vitriol contained sulphur, he might have been able to utilize india-rubber in three years, instead of ten, after he had made that the purpose of his life. He found that oil of vitriol (he did not know it by the name of sulphuric acid) would sometimes produce upon the pure gum the very effect that he wanted, and he wasted time in numerous experiments trying to render that effect permanent, when a chemist would have suspected that the sulphur in the acid was the real agent, and have taken the steps at once that Goodyear took years later.

Perhaps the greatest, the most complete and powerful mind among men, is that of the man who is at once a great discoverer and great inventor. Archimedes, Newton, and Franklin are illustrious examples. The ancients attribute to Archimedes more than forty mechanical inventions, prominent among which is the endless screw, which he thought out while traveling in Egypt, reflecting on the necessity of raising the water of the Nile to points which the river did not reach. He likewise applied it as a pump to clear water out of the holds of vessels, to launching ships, and to propelling them through the water, a use which is still retained. The precision with which he directed his thoughts to the attainment of any desired result is well shown by his detection of the fraud practised on Hiero, King of Syracuse, by a goldsmith to whom the king had intrusted a certain weight of gold to be made into a crown. The king suspected, when he received the crown, that the gold had been adulterated, and he applied to Archimedes for a test. The difficulty was to measure the bulk of the crown without melting it into a regular figure. It was of the proper weight; hence, if any alloy had been substituted for a part of the gold, the bulk would be necessarily increased. Archimedes kept the subject continually in his thoughts, and the conditions of the problem became so clear to his mind that when he stepped into a bath one day, the vessel being full and water flowing over, he comprehended in an instant that the amount of water flowing over was equal in bulk to the body immersed. It followed at once that if the crown would displace more water than an equal weight of pure gold, it had been fraudulently adulterated. Without a moment's delay he jumped from the bath and ran to his own house, crying triumphantly, "Eureka! Eureka!" Yet, notwithstanding his ability in the application of scientific principles, he regarded his inventions as contributing far less to his glory than the additions which he made to speculative truth. "He was half ashamed," says Lord Macaulay, "of those inventions which were the wonder of hostile nations, and always spoke of them slightingly, as mere amusements, as trifles in which a mathematician might be suffered to relax his mind after intense application to the higher parts of the science." He knew the superior value of his purely theoretical pursuits as mental discipline, and as indications of mental power. Hence he requested that his memory should be perpetuated as far as he could determine the manner of it, by his discovery that a sphere is exactly two thirds of its circumscribing cylinder; and, accordingly, a sphere inscribed in a cylinder was sculptured on his tomb.

Before quitting this subject, it may be well to notice the fact that inventions are largely based on the state of knowledge at the time, and are consequently often claimed by several persons who have worked independently of each other. Invention is at once the cause and the measure of civilization. When the world was ripe for printing, printing was accomplished, either by Koster, Gutenberg, Faust, or Schœffer. When the telescope was needed, the telescope must be invented, whether by Hans Lippershey or Galileo. The honors of the steamboat are disputed, and claimed by almost every civilized country under the sun. A want thoroughly felt tends to bring out its supply. It would be interesting to look over the records of the Patent Office, to find out in what year the people of the United States felt most keenly their need of improved mouse traps, and when the imperfection of their coffee mills became a burden. Even in these things, demand regulates supply, and anxiety for perfection in the merest trifles is an indispensable condition of progress.—*Am. Ex. and Review.*

Burning and Unburning.

Abstract of a lecture by Dr. William Odling at the Royal Institution, London.

Dr. Odling began by explaining the first principles of combustion, and showing the simplest methods of lighting a match. When speaking of the old method of obtaining a light by means of flint and steel, he exhibited the "steel mill" once in common use among English miners, to give them just enough light to proceed with their work. It consisted of a little steel wheel driven by multiplying gear, and made to rub against a piece of flint; by this method a continuous shower of sparks could be kept up. He then exhibited the old method of obtaining a light by means of a piece of bent steel, one part of which was allowed to hang down over the knuckles of the left hand, and this part was struck with a piece of flint held in the other hand. With each blow a few sparks were struck off, and these sparks were allowed to fall upon carbonized rags, better known as "tinder;" the tinder at once began to smoulder; this smouldering was increased by blowing; so that at last there was ignition enough to set fire to a splint of wood, the end of which had been previously coated with sulphur. The lecturer remarked that on a cold winter's morning this tedious method of obtaining a light was a very serious thing. He then showed some of the more recent methods of producing flame, and among others he lit the gas jets of the theater of the Royal Institution with sparks of electricity.

The lecturer then spoke of ordinary examples of combustion, such as is seen in gas flames, candle flames, and the household fire; he pointed out that coals, candles, and other substances gradually disappear as they burn, and he asked, "Where do they go to?" An ordinary sperm candle while burning loses in weight about two grains per minute, and it burns down at the rate of one inch per hour. All this burning, however, goes on in common air; exclude the air and the fire soon goes out, as it unites with the one fifth part by volume of oxygen gas contained in common air. To illustrate this Dr. Odling took a very large glass tube, full of air, into which he poured a small quantity of a strong solution of pyrogallic acid and a little caustic potash; thus a solution of pyrogallate of potash was formed. He then closed the end of the tube, and shook up the liquid inside it; consequently, as fresh pyrogallate of potash absorbs oxygen with very great avidity, the solution took up all the oxygen contained in the air in the tube, reduced its bulk by one fifth, and left nothing in the tube but pure nitrogen. This nitrogen, he then proved by experiment, would not support combustion.

Dr. Odling pointed out that, although mercury does not oxidize in the air at ordinary temperatures, it rusts very slowly when it is kept at a high temperature, and then it changes slowly into red oxide of mercury. Dr. Odling applied heat to red oxide of mercury contained in a tube, and thus drove off the oxygen once more; he mixed the oxygen thus made with five times its bulk of nitrogen, then proved by experiment that the resulting mixture had all the properties of common air.

In another experiment he proved that the chief products of the combustion going on in a candle flame were water and carbonic acid gas; a common sperm candle, weighing $2\frac{3}{4}$ ounces, produces in burning no less than $3\frac{1}{4}$ ounces of water, or more than its own weight. The additional weight of the product of combustion is, of course, due to the oxygen taken from the atmosphere.

At the close of this lecture Dr. Odling exhibited the ignition and combustion of the metals—silver, cadmium, zinc, and thallium. A hollow was scooped in the top of the lowermost carbon point of the electric lamp, and in this hollow a piece of silver was placed; when the upper carbon point was allowed to touch the silver, the electrical current quickly raised the silver to boiling temperature, and on separating the points, a broad brilliant arc of vapor of silver played between them. This phenomenon, magnified by the lenses of the electric lamp, was projected upon the screen, forming a beautiful green luminous arc, apparently about six feet long. Cadmium gave a more subdued bluish green light, and the solid oxide was seen to assume curious network forms upon the lower carbon point. Zinc burnt with a purple flame. Thallium gave a magnificent green arc of very considerable length.

Dr. Seyferth's Process for the Purification of Sirups and Molasses in the Manufacture of Sugar.

The juices and liquors employed in the first extraction of sugar from the raw material it is contained in, as well as the sirups resulting from the sugar refining processes, all generally contain a certain quantity of alkaline substances, varying, however, in quantity with the various conditions of the soil on which the beet roots have been grown and the mode of cultivation. The juice of the ripe sugar-cane, however, is at the moment of being squeezed out of the cane slightly acid to test paper. By treating the saccharine juices with milk of lime, several of the bases of the alkaline salts present in the juices are separated from the acids they were at first combined with, and by thus being set free and remaining mixed with the sugar, impede its crystallization. One part of alkaline matter can absorb as many as four parts of sugar; and some kinds of molasses (chiefly from beet root) contain as much as 8 per cent of alkali.

The means hitherto tried to remedy this defect; namely, neutralization of the alkalies by acids, have failed in practice, chiefly for two reasons—first, because the acids have not been applied at such a stage of the process of manufacture as to enable the acids to seize upon the whole of the alkalies; and secondly, because it has never been possible to prevent the injurious effect of even a very slight excess of acid upon the sugar itself; while, moreover, a difficulty is encountered by the very variable quantity of alkali present, whereby the proper quantity of acid to be applied varied every moment, thus rendering its application totally unsuited in any but very skilled hands. Among the acids applied, sulphuric and phosphoric have been most used, but their use could not but be very limited, since even a very slight excess of acid was far more to be dreaded, on account of its highly injurious effects upon the sugar than almost any amount, so to say, of alkalies. Sulphurous acid has been used and recommended in various forms, even as far back as 1810 (Proust), both on account of its activity as acid in saturating alkalies, as well as its power as a bleaching agent, by thus rendering the sugar more white-colored.

Dr. Auguste Seyferth, managing director of the Brunswick sugar (beet root) refinery, has hit upon a plan for the use of sulphurous acid, which (according to the unanimous and unbiased testimony of no less than one hundred proprietors of establishments wherein the processes invented and brought out by the doctor, since September, 1869, are applied) answers the purpose admirably, yielding more produce and of better quality in every respect.

The process alluded to consists essentially in the introduction of sulphurous acid, either in gaseous form, or in very weak aqueous solution, into the vacuum pans. By this arrangement it is possible to bring all particles of the sugar solution (sirup) into contact with sulphurous acid, and to eliminate, by the joint action of heat and vacuum, any excess of the acid, which, however, not only saturates free alkalies and carbonate of lime, but also sets the organic acids, which might be present as alkaline salts, free from these combinations; the sulphurous acid taking hold of the bases they were combined with, while the greater part of these organic acids are volatilized along with the steam, and thus the sulphurous acid promotes the good and ready crystallization of the sugar, while its action as a decolorizer comes also advantageously into play.

The Seyferth process embraces two main operations; namely, the manufacture of the sulphurous acid as gas, or as aqueous solution, and the application of the acid (chiefly in aqueous solution, being more readily manageable) and its introduction into the vacuum pans. The sulphurous acid is manufactured at the works (beet-root sugar manufactories or sugar refineries) by the well-known expedient of burning sulphur in suitably constructed ovens, and carrying the products of combustion, previously cooled so as to condense any vapors of sulphur, into a leaden vessel wherein the gas is met by a suitably arranged current of water so as to become entirely absorbed.

The aqueous solution thus obtained is put into casks, or other suitable vessels, and from these a tube, provided with taps, leads to the vacuum pans, wherein the liquid is sucked simultaneously with the sugar solution. The party in attendance upon the boiling in the vacuum pans, while causing the sulphurous acid to be aspired, takes care to test from time to time (this is done by means of a contrivance technically known as proof-stick) the contents of the pan by applying blue litmus paper, so as to insure the contents of the pan remaining alkaline; but if by a mishap the acid is in excess this is remedied by sucking in a fresh quantity of sugar solution, while a slight increase of the rapidity of evaporation (the turning on of more cold water to the condensers) will rapidly eliminate and volatilize any excess of sulphurous acid, which, when in quantities of 50 to 100 kilos. excess of the weak solution, does not affect the sugar.

The quantity of sulphurous acid solution applied varies from 4 to 8 or from 10 to 15 per cent of the bulk of liquid (sirup) to be evaporated, but these figures are not absolute, but only relative, since experience has already proved that the requirements differ for different localities. The process alluded to is stated to possess, besides the advantages already named (production of better quality and larger quantity of sugar) the good qualities of being applicable at very little cost; to require no inconveniently large space; to be applicable to any already existing manufactory without causing any temporary stoppage of work; and its application is readily learned by the sugar boilers.

According to communications made on this subject by the members assembled at the general meeting of German sugar manufacturers and refiners, at Berlin (last May), and a similar meeting lately held at Prague, this process is highly appreciated, and largely eulogized as an immense improvement in this branch of industry.—*From the London Artizan.*

Sewing and Cooking.

Says the *Journal of Gas-lighting*: A French lady has been calling attention to the deficiencies of the working and lower middle classes in sewing and in cooking. Cooking seems, like music, a gift of certain nations. The French have it in perfection, stimulated by poor food and dear fuel. Italian cookery is atrocious; and German, where unimproved by French contact, greasy and unsavory. It is much to be desired that some of the fervor directed towards making women fit for physicians and barristers were directed to making them good wives and mothers. There may be exceptions, but we have never come across a charity school where even the principles of cookery were taught. While a smattering of superficial knowledge is distributed, the girls never get a good lesson on "the difference between simmering and boiling!" There is no sewing in our workhouse schools to be compared with that turned out of the convents of Belgium and France. Indeed, we should say that in the female orphan asylums round London more attention is paid to a parrot-like instruction in religious phrases than to any useful knowledge. Many of the girls turn out hypocrites; most of them, from the severity with which they are treated, liars; but it is very rare to hear of the manufacture of a good governess or a good domestic servant. The model prize girls are often female samples of Uriah Heeps. There is no reason why cookery should not form part of the daily education of every girl above eight years old who has to get her own living, or whose husband has to get his living. But there is no standard school book on roasting, boiling, stewing, frying, making soups, and cooking vegetables. Mrs. Beeton or Miss Acton could have produced such a manual, if any of the book-publishing religious societies had asked for such a necessity. As to sewing, the art will be found more cultivated in the higher than in the lower middle classes. A widow lady, who had been well trained at home and abroad as a governess, and in that capacity had acted in several noble families, on the death of her husband opened a day school in a district of rich London shopkeepers. One day she received a visit from a very grand lady, the mother of a pupil, and the wife of a thriving shopkeeper. She came to protest against her daughter being taught the art of plain sewing and cutting out body linen. "We are well satisfied," she said, "with Maria Jane's progress in music and other accomplishments, but we keep four servants, and my daughters need never do plain work." The school-mistress at first employed the ordinary common-sense arguments without effect. She added, "When I lived in the family of the Duchess of Blank, my four pupils, the Ladies, &c., were all taught to cut out and sew the garments they presented to the poor. It is my system—I cannot alter it." The name of the Duchess acted like a spell, and the purse-proud dame submitted. Such are the peculiarities of a large class in rich England. It is from the influence of the intelligent women who have been returned to the School Boards, that we anticipate a better system, better teachers, and more useful books in our elementary schools. The example will speedily spread to our many ill-managed school charities, the worst managed being those for girls.

Preservation of Iron from Oxidization.

Among the many processes and preparations for preserving iron from the action of the atmosphere, the following will be found the most efficient in all cases where galvanization is impracticable; and, being unaffected by sea water, it is especially applicable to the bottoms of iron ships, and marine work generally: Sulphur, 17 lbs.; caustic potash (lye of 35° B.), 5 lbs., and copper filings, 1 lb. To be heated until the copper and sulphur dissolve. Heat, in another vessel, tallow, 750 lbs., and turpentine, 150 lbs., until the tallow is liquified. The compositions are to be mixed and stirred together while hot, and may be laid on, as paint, to the iron.

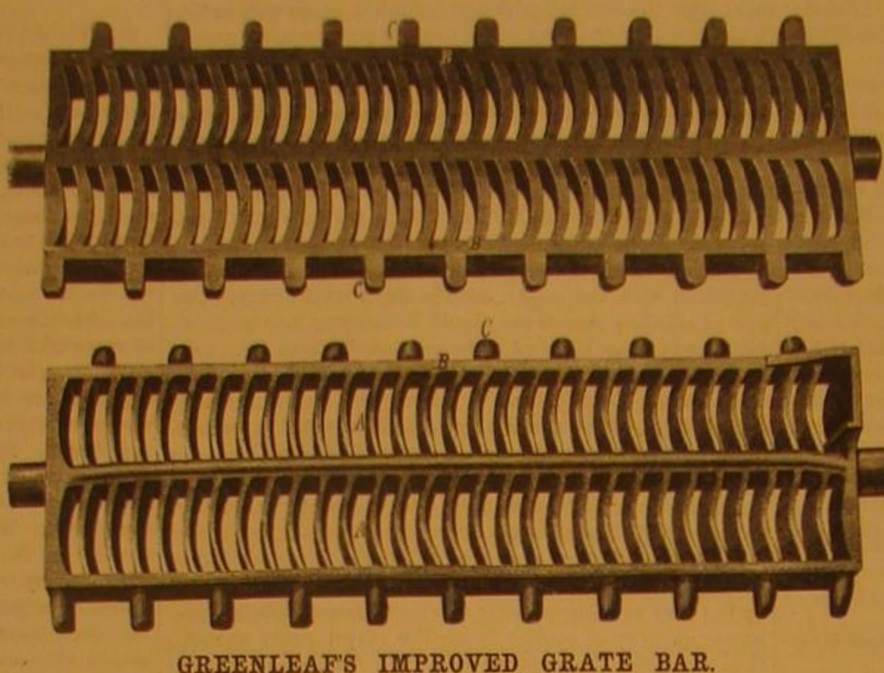
MARINE GLUE.—Mix together, gum sandaric, $\frac{1}{4}$ lb.; gum mastic, $\frac{1}{4}$ lb., and methylated spirit, 8 lbs. When the gums are dissolved, add $\frac{1}{2}$ lb. turpentine, and mix this with a thick hot solution of the best glue (to which a little isinglass has been added to clarify it), and filter through muslin. The marine glue will be impervious to moisture, and will not soften in any ordinarily hot weather.

HOW TO CHOOSE A PUPPY.—Montaigne says: "Sportsmen assure us that, in order to make choice of a puppy from among a number of others, it is better to leave the choice to the mother herself. In carrying them back to their bed, the first one she takes up will always be the best; if we pretend to set fire to the bed on all sides, then the one she will try to rescue first." We would suggest in regard to the latter paragraph, that whoever may test the accuracy of the sportsman's receipt, be careful to not set the bed-clothes on fire in trying the experiment.

THE extravagant tendencies of the present generation suggest to a clergyman the inquiry whether it would not be better to devote half of one's energies to learning to live on a very small income, than to devote all of one's energies in struggling and waiting for a large income?

Improved Grate Bar.

Engineers have become thoroughly alive to the fact that the heating surface of boilers can never work up to its full efficiency without not only the proper amount of grate surface, but also such a construction of the grate that the fuel may be economically consumed. The combustion must not be partial, distilling off the fuel and sending it out of the mouth of the chimney in black volumes of smoke; it must be as complete as possible. Large heating surface avails nothing if the combustion of the fuel be imperfect, and the completeness of combustion depends primarily upon the grate, which must be of such a form that a full draft may be secured, yet be able to retain its form under the effects of heat, and support the fuel properly for the uniform distribution of air to the combustibles used.



GREENLEAF'S IMPROVED GRATE BAR.

A large number of patents have been issued for improvements in grate bars, and still inventions in this field increase and multiply. The demand for grate bars is so large that any bar which can fairly compete with those that have preceded it, is sure of sale, and the manufacture of such bars has grown into a large industry.

Our engravings show the form and construction of a grate bar, for which it is claimed that it effects a large saving in fuel, that it does not warp or twist, that it lasts much longer than the ordinary bar, and that it can be used in any furnace without the trouble and expense of making alterations.

The shape of the grate bar is such that a very large aggregate opening for the passage of air to the fuel is secured, resulting in more perfect combustion and greater rapidity in raising steam than is the case with many forms of grate bar in use.

Nut coal, slack, sawdust, shavings, and tan bark, can be successfully burned upon it, as is attested by those who have used it in the consumption of the combustibles named.

The bar is constructed with horizontally curved cross pieces, A, which act as braces, and in combination with the side plates, B, prevent warping or twisting, under great and unequal exposure to heat.

The grate, formed by the curved arch cross pieces, has a flat, even surface upon the top, so desirable in grate bars, and enables the weight of metal to be reduced, without increased liability of breakage from unequal expansion. The pieces also act as shears in cutting clinkers. It is claimed that actual use has shown that these bars will outlast two or three sets of ordinary bars. The bars, it is claimed, weigh less, per square foot surface measurement, than any other grate bar now in use, and the pieces are so constructed that they may be placed in any furnace without change in the bearing bars.

The exterior projections, C, on the side plates, B, form a series of apertures between the bars, when the latter are placed together in the grate, preventing the formation of blank spaces.

The under edges of the curved cross pieces are cast with a re-entrant curve, as shown in Fig. 2, which reduces their width, so that they do not readily clog up; and the ashes can readily be removed from the interspaces.

We have been shown testimonials in regard to this grate bar, which state that by its use a large saving in fuel has been secured, and also corroborating the claims made in regard to its durability.

Patented, Nov. 16, 1869, by Clements A. Greenleaf. For further particulars, address Greenleaf Machine Company, 319 South Tennessee st., Indianapolis, Ind.

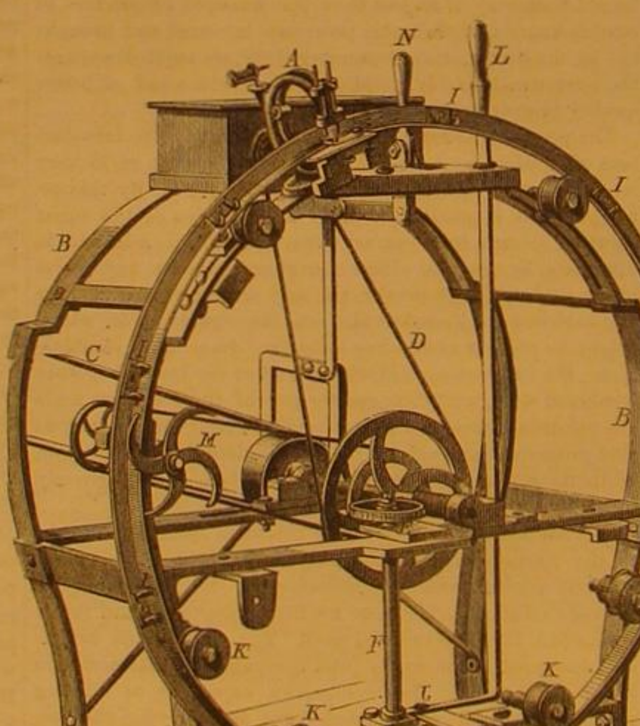
New Composing Machine.

The New York *Tribune* gives an account of a new composing machine, designed to supersede the use of fonts of type in printing. It says; The great feature of the invention is a mechanical device by which ordinary type setting and type distributing are dispensed with, and one hundred types are made to perform the service of a full font set in the usual way. The letters of the alphabet, together with figures, punctuation marks, and combination words, are arranged in regular order in a type-head two inches square, and are operated upon by keys, manipulated as in a piano. When the keys are touched, the type-head moves to its position, and action is had upon whatever letter or figure is touched, the type moving downward a prescribed distance, and making a printed impression on transfer paper. The platen on which the paper is laid is moved backward and forward by a feed-wheel for each impression of the type, and the spaces between the lines are produced by lateral motion by means of a ratchet wheel. In this way one hundred impressions are made per minute, and proofs can be corrected very easily. The impressions are finally transferred to a zinc plate, and printed by an improved lithographic press at the rate of 2,500 impressions per hour. In place of transfer paper a mold of clay or wax may be used to receive indentations, from which a stereotype cast can be obtained of uniform thickness, and ready for the press. The machine is driven with a treadle like a sewing machine, and occupies about the same space. It can be manufactured for $200, and the type-heads for $3 each. Every style of type borders, ornamentation, and also music, can be produced, only requiring one type to represent each character. The type-heads are easily changed, and as many as fifty styles can be employed by the compositor without rising from his seat. As originally patented, the types were arranged on the periphery of a disk or wheel, and the impressions, made upon prepared pulp or clay were justified with difficulty. By the improved machine, impressions are made upon paper, and justification and correction are accomplished without loss of time.

WE are glad to hear that the efforts to supply Nebraska with salt have been successful, and that saline water has been brought to the surface by an artesian well. A party of enterprising men in Lincoln city struck, at a depth of 600 feet, a stratum of sandstone, from which a torrent of salt water came upwards, and shot over eight feet into the air. When the well is tubed, a constant flow may be expected. The value of this discovery will be great, and a proper reward for Dr. Evans' untiring labors in the search. The strength of the saline water is estimated at 80 degrees.

IMPROVED SEWING MACHINE.

The invention which forms the subject of the present article is designed to provide a means for sewing goods together



in a continuous operation, as required in cotton mills, hosiery and bag manufactories, printing mills, and other similar works.

The stitching part of the machine may be of any approved kind of sewing machine now used, and is placed at A, as shown in the accompanying engraving, where it is sustained by the frame, B. The frame, B, also supports a central shaft with pulleys, as shown, which receives motion through the main driving belt, C.

The belt, D, conveys motion from the central shaft to the stitching part of the apparatus, A. Upon the central shaft is cut a screw thread which actuates the worm gear, E, and through it the vertical shaft, F. Upon the lower end of the vertical shaft, F, there is keyed a toothed wheel, G, which meshes into teeth (not shown in the engraving) on the back of the flanged feed-ring, H. This ring is suspended on flanged friction wheels, K, which sustain it vertically and laterally, but leave it free to rotate in the proper direction when actuated by the wheel, G.

At intervals around the flange of the feed ring, H, are placed hooks, I, upon which the edges of the cloth to be sewn are stretched, and are fed to the sewing attachment as the ring revolves in the manner described.

A sliding plate, J, which sustains the lower bearing of the vertical shaft, F, is moved back or forward by the hand lever, L, which throws the toothed wheel in or out of gear with the feed ring, as desired by the operator.

The friction rollers and all the moving parts below the central shaft are covered by a flat plate or shield, not shewn in the engraving, as when in place it conceals the working parts. To prevent the cloth from being carried under this shield, four bent arms, M, are attached to a short pulley shaft driven by a belt from the central shaft. These arms press the cloth off from the hooks on the feed ring, and thus released, it falls down upon the floor which supports the machine.

The hand lever, N, runs the stitching part of the machine into or out of gear, as may be desired.

We are informed by the inventor that this machine has stitched one thousand pieces of cloth, 28 inches wide, per day, with one hand, and it has stitched, in one day, forty-five pieces (of same width) more, with one operator, than was done by two operators with the Willcox & Gibbs sewing machine without the attachment.

Patented through the Scientific American Patent Agency, Nov. 1, 1870. For further information address W. A. Rayer or W. S. Lincoln, patentees, care Willcox & Gibbs, sewing machine manufacturers, 147 Tremont st., Boston, Mass.

A 30-Inch Gage Railroad in Ohio.

The Toledo *Commercial* having stated that the Piqua, St. Mary's and Celina Railroad Company had been incorporated on a capital basis of $400,000, to build between Piqua and Celina, through Miami, Shelby, Auglaize and Mercer counties, Ohio, about forty-four miles, a Piqua correspondent gives us the details of the scheme.

The country along the line is very populous and productive, and the question of an outlet by railway has long been agitated. But the Miami and Erie canal passes through it already; and though inadequate to the wants of the country, there is scarcely warrant for the construction of an expensive road. Last winter, the plan of a narrow-gage road, to cost, fully equipped, less than half a million of dollars, in place of one of the ordinary gage, costing a million and a half, was discussed. The design is identical with that of the Welsh railways, which have been so often described in engineering journals of late. A road of this kind, for trans- porting coal—the only one in this country as yet—is already in operation between Akron and Massillon, Ohio. A system of narrow-gage railways is also projected from Toronto, Canada, as feeders to the wide-gage roads now centering there. We learn that parties interested in the proposed Buffalo and Springfield road are now examining the Canada system, with a view to the adoption of the narrow gage. The Kansas and Denver Pacific Companies also contemplate reaching the mining regions near Denver, and probably at no distant day penetrating the Great Mountain Parks, and perhaps passing over the entire range, by narrow-gage roads, costing only one seventh as much as the present gage, where the latter is practicable. In all these cases the data, showing the entire practicability of these roads, and giving the cost of construction and operation, are such as to reduce the prospects of any such enterprise to a certainty.

To return to the Ohio road. The right of way is to be fifteen feet in place of forty feet; twenty pounds instead of fifty-six pounds iron will be required; the locomotives, weighing six tuns instead of thirty, will draw from ten to twenty loaded freight cars, each having a capacity of two and a half tuns; under freight and passenger cars alike (the latter seating twenty persons) four-wheel trucks will be placed; the ties will, of course, be nearer than on the wide gage; while finally, on account of the lightness of car equipment, in comparison with capacity, and of the central position of the trucks, both higher gradients and sharper curves will be practicable, greatly reducing cost of excavation, and other important items of construction.

In the present instance, the route presents no engineering difficulties—Piqua, thence following the canal to Berlin; thence to Minster, Bremen, and St. Mary's, where it will leave the canal, and make Celina its northern terminus.

The enterprise, which is to be begun in January, is in the hands of able and energetic citizens—among the corporators being Hon. J. F. McKinney, member of Congress elect; William Scott, one of the oldest citizens, and President of the Piqua National Bank; J. G. Young, Cashier of the same; Henry Flesh, a wealthy merchant of the city; Chas. C. Clute an experienced railroad builder, of New York city.—*Chicago Railway Review.*

Additions to Clubs.

For the information of subscribers the publishers of the SCIENTIFIC AMERICAN give notice that they will receive additional names at any time, to clubs already formed, at club rates.

Scientific American,

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT
NO. 37 PARK ROW (PARK BUILDING), NEW YORK.

O. D. MUNN. S. H. WALES. A. E. BEACH.

"The American News Co.," Agents, 121 Nassau street, New York.

"The New York News Co.," 8 Spruce street, New York.

Messrs. Sampson Low, Son & Marston, Crown Building, 185 Fleet street, Trubner & Co., 60 Paternoster Row, and Gordon & Gotch, 121 Holborn Hill, London, are the Agents to receive European subscriptions. Orders sent to them will be promptly attended to.

A. Asher & Co., 20 Unter den Linden, Berlin, Prussia, are Agents for the German States.

VOL. XXIV., NO. 6 . . . [NEW SERIES.] *Twenty-sixth Year.*

NEW YORK, SATURDAY, FEBRUARY 4, 1871.

Contents:

(Illustrated articles are marked with an asterisk.)

*Utilizing Waste Heat from Steam Engines and Boilers 79
Lumber Trade 79
Hailstones 79
The Water we Drink 80
Why Soup is Wholesome 80
Burns and Scalds 80
A Singular Mode for Detecting Fraud 80
The Year and the Day 81
Spontaneous Combustion 81
Professor Huxley's Plan of Education 81
*Improved Externally Adjustable Packing for Pistons 82
*Scrubbing Machine 82
Spurious Metallic Filling for Teeth. 82
*Perpetual Motion 82
Spiritualism and Science 83
Quartz Crusher 83
Action of the Reciprocating Parts of Steam Engines, and its Influence on the Problem of High Piston Speed 83
Sulphuric Acid from Gypsum 84
Beams and Girders 84
Fire Escapes 84
Men of Progress 84
Discovery and Invention 84
Burning and Unburning 85
Dr. Seyferth's Process for the Purification of Sirups and Molasses in the Manufacture of Sugar 85
Sewing and Cooking 85
Preservation of Iron from Oxidization 85
Marine Glue 85
Improved Grate Bar 86
New Composing Machine 86
*Improved Sewing Machine 86
A 30-in. Railroad Gage 86
Additions to Clubs 86
English and American Scientific, Mechanical, and Engineering Journalism 87
Soluble Glass 87
Type-setting Machines 87
The Uses of Habit 87
The Scientific Value of the Central Park 88
The Eclipse Expeditions 88
The Present and the Past 88
Thatch made by Sewing Machines. 89
Obituary—Hon. David Lyman 89
Cryolite and its Uses 89
A Warning to Inventors 89
Annual Meeting of the Society of Engineers and Associates 89
Cheap Hydrogen 89
Sulphurous Acid 89
Novel and Convenient Mode of Using Lunar and other Caustics 89
Ill Effects of Hydrate of Chloral... 89
Phosphate of Lime as a Mordant... 89
Spongio-piline 89
How to Choose a Puppy 89
Not a Bad Idea 89
The Effect of Water Stocks 89
A Remarkable Body of Water 90
Why Mainsprings Break 90
Answers to Correspondents 90
New Books and Publications 91
Queries 91
Recent American and Foreign Patents 91
Business and Personal 91
List of Patents 91

ENGLISH AND AMERICAN SCIENTIFIC, MECHANICAL, AND ENGINEERING JOURNALISM.

To those who have access to the files of English and American periodicals devoted to the above-named subjects, a very striking difference between those published abroad and at home, is apparent. Whether the average English reader peruses the contents of such papers as *The Engineer, Engineering, The Artizan*, etc., or not, it is certain he tolerates in them much that, persistently published in an American journal, would limit its circulation to a very few readers.

England has done much to render science popular with the masses, but this work has been done through books and lectures rather than through her periodical literature devoted to technical subjects. *All the Year Round, Macmillan's Magazine, Chambers' Journal,* and others devoted to general literature, have done vastly more for the enlightenment of the general English public, on matters of science, than all the technical journals put together. The short but interesting (because easily comprehended) articles on scientific subjects, which the periodicals last enumerated have printed, have been many of them models of their kind. They were written with the full appreciation of the fact that to the general reader technical language is an unknown tongue, and that to attempt reaching their understanding through its use, is the hight of absurdity.

What, for instance, could the general reader make of the page after page of mathematical formulæ with which, in a foreign cotemporary, Prof. Rankine sought to dignify the "gay velocipede?" There is not an American journal in existence that would have risked its popularity by the publication of the series of articles referred to.

Similarly, we find in many of the English publications like the one alluded to, prolonged serial discussions so technical in character, and so burdened with mathematics of the most abstruse kind, that we venture to say that not one in ten thousand Englishmen, not to speak of American readers, could read them understandingly in a year's time.

We have no means of knowing what the exact circulation of any of these papers must be, but from our stand-point of view it cannot be large. They seem, however, to be able to hold their heads above water, probably because their advertising columns are so liberally patronized, and because their regular price of subscription is much higher than American readers are willing to pay for the amount of reading matter they furnish.

If there is any one thing our English cousins know thoroughly, it is the value of advertising. Even papers of admittedly limited circulation are enabled to obtain a mass of advertising that makes a struggling Yankee newspaper publisher sigh that he was not born on British soil.

The tone of the discussions in most of the journals under consideration, is unexceptionable, except that to a Yankee reader it is wearisome on account of its length; and it puzzles an American to understand how many of the items can possess even a local interest to any.

If we should gravely inform our readers that the Messrs. Monotone had just successfully cast a bell for a rural church, or that Mrs. Fatpurse had bestowed upon the same edifice a stained glass window, or that the trustees of the village of Schaghticoke had just built a new schoolhouse, or supplied their town with water from a convenient spring; and if we should fill a column week after week with such puerile items, we should soon expect to hear from our correspondents that they did not care to pay for such garbage. Yet this is only (perhaps a somewhat extravagant) sample of what many English journals designed for general circulation treat their readers to in every issue.

A profuseness in letter-writing is also a marked feature of English papers. Everything is fish which comes to their net in this line, provided it is, or can be made grammatically correct. Personal explanations, long preambles, and verbiage are allowed to burden a very small modicum of fact. A correspondent writing a recipe for the relief of corns, and feeling it necessary to relate his sufferings with divers unlucky purchases in the way of boots, would be sure to be permitted to tell his dismal "yarn" without restriction, at least in many English publications we could name.

It would seem that quantity, and not quality, is the aim of the average English correspondent, and that to fill space with printed matter is the ultimatum of publishers of technical periodicals. There are, however, some honorable exceptions to be made in this respect.

A few periodicals in America have imitated the English model, but have never achieved extensive popularity. American readers prefer their mental food cut in thin slices. A single point made and well wrought out in a short article suits them better than exhaustive essays; and facts, rather than theories, are sought by them. Few have leisure to peruse very long essays; and if they have, they prefer them published in book form rather than serially.

SOLUBLE GLASS.

A great many uses have been ascribed to this substance, some of which are obviously absurd. Others which seem rational, have been failures in the hands of most people who have tried them, and we are frequently called upon to explain the causes of failure. This is in all cases difficult. The causes are in many cases obscure, even when ample opportunity is afforded for examination; and as we seldom or never have opportunity to make a thorough examination, we are generally unable to reply definitely and intelligently to such queries.

Our own experiments with this material have not been of the most satisfactory character. In general, we have found that after it has been applied for a longer or shorter period it becomes crumbly, and cleaves off from the surface of wood or iron. We are informed by a thorough chemist that such has uniformly been his experience, and that he thinks soluble glass becomes crystalline in structure when exposed to the action of the atmosphere.

A gentleman has just left our office who purchased some of this material from a dealer in this city, with a view to use it as a protective coating to iron. He says it would not long adhere to the metal. He applied to the manufacturers for directions in correcting his supposed errors in its use, but could get no information by which he could secure any improvement in his results, and consequently he voted "water glass" a humbug.

A clue to these failures is perhaps found in a lecture recently delivered by T. S. Barff, F. C. S., in the hall of the Society of Arts in London. It seems from the observations of Mr. Barff, that soluble glass (silicate of soda or potash) is frequently too alkaline for satisfactory use in painting. The best way to make these silicates is to fuse the component materials together in a reverberatory furnace. When cold they should be put into open vessels of hot water, when an oily liquid is formed, which is a solution of soluble glass. Either of the silicates of potash or soda, will generally be discolored from the presence of organic matter. This will, however, settle to the bottom, if the solution be allowed to stand for some days; when the clear supernatant fluid may be drawn off.

But even then, according to Mr. Barff, the solution is unfit for use in painting, on account of the presence of too much alkali. To remedy this defect, he recommends charging it as much as possible with silica, in the form of white powder obtained from the fluoride of silicon by precipitation with water.

We think it is probable that this alkaline quality would render soluble glass coating less permanent, wherever applied, and as Mr. Barff's experiments point out the way by which the defect may be remedied, a trial of his method could easily be made in any of the general applications of this substance for which it has been recommended.

TYPE-SETTING MACHINES.

The invention of a type-setting machine has justly been considered one of the most knotty problems ever attempted by mechanics. When it is considered how many characters and sorts are comprised in the upper and lower cases of the compositor's desk, and then that the exigencies of modern printing demand the multiplication of these cases, the frequent use of characters not found in the ordinary case at all, and also the fact that all these sorts must be kept unmixed in the cases, it would seem, at first glance, sheer madness to attempt to accomplish by automatic machinery what requires for its present performance intelligence to guide the work at every step. What the printers call "instification," that is, the spacing out of the lines so that they shall be of equal length, also requires that if words or syllables which cannot be divided, cannot be made to go entire into a line, the line must be lengthened by the insertion of spaces between the letters and the word be carried on into the next line.

It is evident that there must be intelligence to guide somewhere, and that if a machine shall ever be made that can be successfully employed to set type, it must require the attention of a compositor at every movement. But if a single motion of the compositor's hand could set in operation mechanism by which all the other movements, now required to place each type, or their equivalent, could be automatically performed the problem would be solved, provided the single movement could be made much quicker than the several movements are now made and the machine could be made sufficiently cheap and durable.

Machines have been constructed approximating these conditions very closely, considering the difficulties to be surmounted; but none have ever yet been able to compete with the living type-setter.

The host of difficulties attending the construction of type-setting machines might be greatly reduced could certain conventionalities of printing be relinquished. We have never been able to see any good reason, other than that "it is the fashion" for dividing words by syllables, or indenting paragraphs. Of course it would look very singular at first to forego these conventionalities, but their omission would certainly simplify the problem of type setting by machinery very much, if not open the way to its complete solution.

It is singular with what tenacity conventionalities like these are adhered to in the arts. We once saw a machine for putting up Seidlitz powders, which would do the work with extreme rapidity, yet the inventor informed us, the powders would not sell, because they were not put up in the way the trade had been accustomed to.

So long as the art of printing is hampered by the conventionalities we have mentioned and many we have not mentioned, there will be little chance for type-setting machines.

The inventor of a machine, an account of which is given in another column, has, we believe, hit upon the right principle in the construction of such machines, namely, that of making impressions of letters in some soft material from which casts can be taken.

THE USES OF HABIT.

There has been much declaiming on the part of a certain school of philosophers against the propriety of allowing the mind to run in a groove; or, in other words, to acquire any particular habit of thought. All habits, say these declaimers, are bad. There are no good habits. No man should do anything from mere force of habit. The effect of habit is to prevent thought and to open the door for error in reasoning. It cramps the mind within limits beyond which it cannot expand, and thus becomes an obstacle to healthy growth.

We regard these views as false in the extreme, and propose to devote a brief space to the presentation of the uses of habit, meaning, of course, good habit.

We assert that all expertness is the result of persistent habit. Perhaps this proposition can be best illustrated by examples of manual expertness. One of the most striking of these examples is the skill acquired in musical execution. At first the beginner finds the process of producing the various tones on an instrument in their proper sequence and length, very slow and painfully fatiguing. But by dint of long and arduous practice, he comes to a point where the fingers move by mere habit, without any sensible effort of his will. Indeed, the habit of doing what he has to do right, becomes so strong, that to attempt to do it wrong, would be almost as painful and tedious as his first attempt to acquire the proper method.

So in the performance of all kinds of mechanical work, dexterity is only to be acquired by habit formed by continuous practice. These facts seem so obvious in connection with manipulation, that it appears strange they should be disputed when applied to mental operations, or moral impulses.

As in manual operations a certain sequence and order, strictly followed, will enable the operator to perform each detail with greater facility and accuracy, and so shorten the time expended in reaching the desired result, as well as make the result more perfect, so a proper method gives rapidity and accuracy to thought. A mind trained to think methodically is a mind which has acquired habits of thought.

This methodical thinking is absolutely indispensable to success in many professions, of which we may cite "law" as one conspicuous example.

But perhaps in no field of study is it of greater importance than in invention, and this brings us directly to the main objection urged against habit in thought; namely, that it is a foe to originality. We take direct issue on this point, and assert that, on the contrary, it is the very basis of originality in so far as originality is useful or desirable.

The originality that is desirable in literature, in invention, in the arts, is employment of elementary principles in new combinations. We may refer to music again for an illustration of this point. The elementary combinations are represented by the exercises upon which the pupil is required to devote his practice. These exercises comprise difficult combinations, elements of composition which, in themselves, are dry and unpleasing, but which, combined in various ways, are formed in the compositions of the great masters. The elements being acquired by practice, the originality appears in the combination of them into new and melodious arrangements.

So in invention, a new device always consists of a novel arrangement of elements previously known. An original thinker, worthy of the name, is one who, while he perhaps explores new fields, employs in his research the facts of previous experience and the methods he has found valuable in former investigations, modified to suit the particular exigencies of the case. Let him throw aside ascertained facts and methodical thought, and he at once degenerates into a framer of baseless theories, which are original only because they are like nothing else.

THE SCIENTIFIC VALUE OF THE CENTRAL PARK.

Twenty years ago, Ambrose C. Kingsland, the Mayor of the city, transmitted to the Board of Aldermen a special message setting forth the limited extent of the places devoted to the public on the island of New York, and urging the importance of prompt action towards the creation of a great park for the moral, scientific, and sanitary benefit of the people. His message attracted much attention and originated the movement which finally ended in the establishment of the Central Park. The Mayor and Street Commissioners were a few years later, created Commissioners of the Central Park, and they associated with them "certain well-known citizens, whose public reputation, peculiar avocations, and cultivated taste, gave assurance that their opinions would possess the force of a clear, unbiased judgment."

Invitations were extended to Washington Irving, George Bancroft, Stewart Brown, and others, and these gentlemen met on the 29th of May, 1856, and organized by electing Washington Irving as President of the Board, and settled the preliminaries for carrying into effect the objects of the commission,

It is not necessary to pursue the history of this important work, as it is fresh in the memory of the youngest inhabitant, and down to a recent period was the pride and glory of our city. Our object is to call attention to the value of the Central Park as an agent in the scientific education of the people. We have before us the thirteen annual reports of the Board of Commissioners of the Central Park, and are gratified to trace in them the progress of public opinion in favor of the establishment of Museums, Zoological Gardens, Historical Collections, and Art Galleries, within the Park, for the instruction as well as the amusement of the people. The Commissioners have all the time recognized the value of such aids to knowledge, and have done all in their power to promote them.

As early as 1861, the Legislature chartered the American Botanical and Zoological Society, and gave the Commissioners of thePark authority to set apart a portion of the grounds, not exceeding sixty acres, for the use of the Society, for the establishment of a Zoological and Botanical Garden; and subsequently the Board, in compliance with the provisions of an act passed March 25, 1862, made to the New York Historical Society, a conditional appropriation of certain grounds about the Arsenal building for the purposes of establishing and maintaining therein, by the said society, a Museum of Antiquities and Science, and a Gallery of Art. It does not appear from the records that either of these societies ever availed itself of the opportunity thus afforded ofobtaining a permanent foothold in the Park, and we fear that this neglect will result in a permanent loss to our community.

The Legislature of the State, at its last session, authorized the Board "to erect, establish, conduct, and maintain on the Central Park, a Meteorological and Astronomical Observatory, and a Museum of Natural History, and a Gallery of Art, and the buildings therefor, and to provide the necessary instruments, furniture, and equipments for the same."

In the meantime we have, in the city, the Lyceum of Natural History, chartered more than fifty years ago, the American Institute, founded forty years ago, and two new societies—the American Museum of Natural History, and the Metropolitan Museum of Art—they occupying, with the Historical Society, pretty much the whole field of letters, arts, and sciences.

So many societies and so many men of many minds, have evidently perplexed the Commissioners of the Central Park, and after waiting more than ten years to see what propositions these various organizations had to make, they appear to have taken the matter into their own hands, and to have had the act of Legislature, above cited, passed, to enable them to go to work on their own authority and in their own way.

The distinguished architects of the Park, Messrs. Olmsted and Vaux, and the efficient comptroller, Mr. Green, have, to our personal knowledge, been in constant communication with the leading thinkers and workers in this country and in Europe.

They have all of them traveled over the continent of Europe for the purpose of studying the construction of museums, zoological gardens, pleasure grounds, and galleries of art, and they have had the advice and assistance of the officers of all the organizations named above; and, as a result, have planned and carried forward the best laid scheme that was ever yet devised for the instruction and amusement of a people. As a part of this scheme, the Commissioners employed Professor B. Waterhouse Hawkins to reconstruct some of the extinct animals of this continent, and to establish a paleozoic museum. Their action in this matter has been highly commended by the scientific societies abroad, and by the unanimous approval of the best minds of our country. It has been said by geologists in England that no one thing has exerted so great an influence upon the study of geology and natural history in England, or has done so much to give popular information upon the origin of the plants and animals on the globe, as the restorations made by Professor Hawkins in the gardens of the Sydenham Palace. As soon as it was understood that this celebrated naturalist had come to the United States, a rivalry at once arose in the large cities to secure his services for their respective parks, but as he first landed in New York, the Central Park Commissioners were so fortunate as to make arrangements to have the work done in our city; and Mr. Hawkins had made considerable progress, when the work was summarily stopped by the new Commissioners, who, having just been appointed, naturally enough did not know what great value the scientific men of the country put upon the success of this particular undertaking. Under the management that has made the Central Park what it now is, there is no question that we should soon have had the best organized Zoological Garden, the most complete Museum of Art and Natural History, to be found in this or any other country. The Commissioners, after a study of many years, were in possession of all the requisite information to enable them to push the whole scheme to perfect success; and under their direction the Park would have become the right hand of our public schools as an aid to amusement, health, and instruction. They ought never to have been removed, and their departure from the conduct of affairs awakens the fear that the artistic and scientific value of the Park may be considered as gone forever.

How long will it take the present Commissioners to acquire as much knowledge of all the details of a great park as was obtained by the gentlemen who have just been removed from office, after a service of nearly fifteen years? Is there such a thing as scientific administration in this country, or must we always be subject to the whims and caprice of the moment? Surely if there were ever a public undertaking requiring knowledge and experience, it is the Central Park; and yet we see old public servants removed, and new men appointed, without any regard to the lessons of the past, or to services already rendered. And as a consequence we read that the work on the Paleozoic Museum is to be stopped, the Zoological Garden to be removed from the site which had been selected after years of study and consultation with experts. And what is to become of the other museums, we do not know, but we may be justified in predicting a foreclosure of the whole concern. What are the names of "the well-known citizens whose public reputation, peculiar avocations, and cultivated taste give assurance that their opinions would possess the force of a clear, unbiased judgment," who are in consultation with the present Board of Public Parks? What artists and men of science are members of the advisory board?

THE ECLIPSE EXPEDITIONS.

So far as heard from, the Eclipse expeditions seem to have been, if not total failures, unsuccessful in doing very much useful scientific work. Bad weather interfered with the operations of nearly all of them. We shall summarize as briefly as possible the news received up to the present date in regard to them.

Our European exchanges inform us that the Oran, Gibraltar, and Cadiz expeditions accomplished very little. The private expedition of Lord Lindsay had better luck, and, being favored by a break in the clouds at just the right moment, obtained, by means of long exposure, two pictures of the corona, and, by means of shorter exposures, seven photographs of the prominences, including one of Baily's beads. The official expedition at Cadiz, under the leadership of Father Perry, detected some bright lines in the spectrum of the corona; also that the light of the corona was polarized. The work of the Gibraltar expedition was spoiled by clouds, and Mr. Buckingham, who went to Estepona, thirty miles north, with a great heavy telescope and portable house for photographic operations, had all his labor in vain, for rain came on during the total phase. Some of the observers near Gibraltar had a glimpse of the total phase, and in that short instant detected bright lines in the spectrum of the corona. The Oran expedition was a total failure, because of bad weather. The expedition to Sicily also could do little, because of the clouds and bad weather; a telegram from Mr. Norman Lockyer says that the American observations of last year are confirmed.

The *Gibraltar Chronicle* publishes communications from a number of private observers on the Rock, one of whom writes:

As the moment of "totality" approached, and the moon's shadow, perceptibly traveling from west to east across the sun's disk, veiled his light more and more, earth and sky began to assume a weird, unnatural aspect; and the effect was so solemn and fascinating that it was with painful anxiety one saw one of the dense clouds, with which the sky was largely covered, moving speedily from the west in the direction of the sun, and threatening to hide the whole phenomenon. Heavy and looming, on it came, and at seven minutes before totality the view was completely lost. It was fortunately blowing hard. The friendly gale soon swept off the interloper, and at about four minutes before the eclipse the brilliant crescent again appeared. At 11h. 34m. 30s. (1½ minutes before totality), the clouds having left a considerable space of pretty clear sky, an extensive halo of deep shadow, with a faintly luminous fringe of prismatic rays, became visible. It was concentric with the sun, and in diameter about one third of the arc between the zenith and the horizon, seemingly about fifty times the apparent diameter of the moon's shadow. This halo, visible only for half a minute, was effaced by another cloud, which again obscured the view. After a minute's breathless anxiety, the "curtain again rose," revealing the longed-for *tableau*, a grand, impressive sight! It presented itself through a rent in the clouds not greater in area than ten times that of the disk of the moon's shadow. That part of the opening which was above the eclipsed orb was clear like the sun at twilight, and in it were visible to the naked eye the planets Venus, Mercury, and half a dozen stars. The remaining part was covered with a thin haze. The moon's shadow appeared to the eye, assisted by a somewhat weak binocular glass, to be a dark circular disk, with an even boundary and of uniform shade. Within the corona, and touching the circumference of this shadow, appeared five or six spots of brilliant carmine, varying in form and size, and at irregular distances apart. Two of these spots, or "red flames," as they are called, on the eastern side of the disk, and at about fifty-five degrees and eighty degrees, respectively, from the vortex, seemed decidedly the largest and most prominent; they were tongue-shaped, and protruded about one sixth the width of the corona. In their neighborhood the corona was brightest and widest. There, too, the rays of the corona appeared to be gathered more distinctly into groups than elsewhere, faint shadows being visible between the groups. The corona consisted of brilliant rays of extremely faint prismatic hues; these rays, at first sight, appeared pretty evenly distributed all round, but closer examination seemed to detect the fact of their being bundles of rays in nearly regular groups. The width of the corona was about one eighth the apparent diameter of the moon's shadow. It was very nearly concentric with the disk of the shadow; its boundary was well defined, but "jagged;" the perimeter, except opposite the two most prominent red flames above mentioned, where the boundary slightly protruded, was circular. It was blowing a gale of wind while these notes were taken, which interfered somewhat with the steadiness of one's sight, either naked or assisted by glasses.

The scientific world will feel great disappointment at the results of these expeditions. It was hoped that the success, of last year in America might be followed with equal success this year in Europe, and that more light would be shed upon the great scientific problem of the sun's constitution, and the origin of solar heat and the mystery of the corona. As it is, another opportunity must patiently be waited for.

The results of Lord Lindsay's expedition will, in view of the failures attending the others, be of double importance. Some substantial results are reported, by Mr. J. Norman Lockyer, of the Sicilian expedition, so that the astronomers will have something to discuss and speculate upon during the interval that will elapse before other observations of a similar character can be made.

So far as we can gather from the news now received, the results obtained seem to indicate that the corona is a real appendage of the sun, not ether made luminous by the sun's light, and whether it shine by its own, or by reflected light, that it is the origin of the green line in the spectrum, which has been supposed by some to indicate the presence of some substance yet unknown to chemistry.

THE PRESENT AND THE PAST.

NO. II.—FACTS OF THE PRESENT—DESTROYING AGENCIES.

As a preliminary step towards the right comprehension of geological history, man must endeavor to realize his own insignificance in the vast scheme of creation. A may-fly coming into perfect existence with the morning sun and perishing before the close of the day, may well imagine, as she reposes for a few moments upon the water-lily, that no change is going on within the plant; she has not seen the gradual growth of stem and leaf, the formation of the bud and its blossoming, nor can she be cognizant of the movements that are in progress within, whereby in a few hours the flower, scarcely less ephemeral than herself, will fade away and perish. Yet the years of the whole human race do not bear as great a proportion to the periods of the earth as the moments of the insect to the days of the lily; and man has remained for thousands of years as unconscious of the mutations around him, as the may-fly is of the vital actions of the growing plant.

The next point with which the student must familiarize himself is, that in Nature there is no such thing as rest and repose; laws alone remain unaltered, but the matter which they control is forever shifting its forms and its combinations. That gases and liquids are forever in motion is easy of comprehension, but you must also unfix all your notions of the stability of solids, you must become vividly alive to the fact that the land and the hardest rocks are undergoing incessant changes; change from without and change from within; mechanical change and chemical change; change of form and change of substance. Both these kinds of change take place alike on the surface and within the crust of the earth; they are intimately blended together and incessantly react on each other. For instance, the chemical action of the atmosphere eats into a rock, mechanical abrasion detaches an eroded fragment; the fragment is mechanically reduced to sand and deposited in the depths of the ocean where chemical action cements many such fragments again into a solid rock.

With mutations taking place at or near the surface, the geologist may make himself familiar by observations in the field or in the laboratory, but with deep-seated actions he must remain more or less in doubt, as the conditions under which they are effected are so different from any that he can see in operation or that he can hope to imitate. For these he must rely upon inferences from circumstantial evidence. But even of most superficial changes, man can only hope to see the full proof in their accumulated effects; for his earliest lessons will teach him that Nature's transformations are often of the slowest. She has infinite time at her disposal, and she uses it without stint; her might and power are none the less therefore. It requires as great an exercise of Omnipotence to build up a continent in a million of years as in the twinkling of an eye; but in the latter case we miss the workings of that infinite foresight which provides that every atom throughout time shall fall at the exact moment into its exact place, and which has peopled the vast past as it has done the present, with an endless succession of living forms, each coming in when required and dying out when its day of service has expired.

Now, let us see what are the most remarkable of these geological changes that are in progress incessantly around us.

It has been a dry summer; the roads are covered with dust; the fields are dried up, and the soil is cracked and pulverized. It is the fall of the year—every plant has been robbing the dry land of some of its constituents, and now that the season of growth is over, its leaves strew the surface. Presently heavy rains will turn the dust to mud, every roadside be but fluid mud, every brook will be foul with it, every river will be dense with sediment, all bound with their common burden on one course onward to the estuary, and thence to the open sea, whose waters will be stained for many a league from shore by the abundance of earthy particles. Leaves and branches, and dead trunks of trees, and the carcasses of animals will mingle with them in the tide.

Then, for awhile, let us leave them and return to the land, where the parched earth and dried, but porous, rock are greedily drinking up the rain as it falls. By and by every crack and crevice will be full of moisture, and every rock will be saturated; then comes the winter's frost, and all the moisture is congealed—with congelation there is expansion, each moistened grain is forced apart from its neighbors, each scale of rock is moved a trifle more from the main mass; for a time icy moisture holds altogether, but with the thaws of spring the bonds are reft—the banks crumble away, mass after mass falls crashing from the precipice, long-weathered blocks are at last reduced to dust, and the earth is strewed with fresh particles, which are swept away in pursuit of those whose course we have already traced.

And again—

"Listen! you hear the grating roar
Of pebbles, which the waves suck back and fling
At their return, up the high strand,
Begin and cease, and then again begin
With tremulous cadence slow, and bring
The eternal note of sadness in."

Those waves are at this same work of change, and, to the ear of the geologist, their "note of sadness" is a wail over the land in time to be no more, the land they themselves are doomed slowly, but surely, to destroy. The pebbles are but fragments of the cliff around in process of destruction; adamantine granite, or soft chalk, or crumbling clay; low banks, or mighty walls of rock, all alike must yield in the end to the incessant battering of the breakers. It is only a question of time. The foundation of the cliff, be it what it may, is slowly sapped; if its material be soft the process of destruction is rapid, and every storm stains the waves for miles and miles with the *débris*; but if the rock be hard, the siege is a protracted one; deep caverns are formed in the cliff, and in every hollow the waters ply their ceaseless task, until at last a portion undermined topples over on to the shore beneath. A pause in the attack occurs, the breakers have to demolish the fallen mass which for a times serves as a breakwater to protect the cliff; slowly, but surely, the largest of the fallen masses are ground down and broken up—the smaller fragments are hurled hither and thither in the heavier storms, until, by constant attrition, they are reduced to more manageable size when they are tossed by the sport of lesser waves. Smaller and smaller they become, and more and more rapidly does the constantly-increasing friction tell upon them, until we hear their grating roar as every swell rolls in upon the beach. But their destruction is not yet complete; each time the pebbles are flung in and sucked back they lose a portion of their substance, the pebbles become fine gravel, the gravel is worn done to sand, which is finally swept away by the tides and currents, to be mingled with that which has been brought down by the river. And when the hungry waves have devoured the fallen mass, they resume their attacks upon the cliff, and thus by slow degrees the land is swallowed up by the sea.

"Why tell us all these common-places? Each one of us has seen or read of these things." Granted, good reader! but have you *thought* of them? have you carried the argument of these commonplace facts out to its legitimate conclusion? For the last three thousand years these phenomena have been going on beneath the gaze of generations of philosophers—yet it is only within the last century that geology has sprung up to interpret their meaning in the Book of Nature. And we venture to say that there are thousands of educated beings at this day who have never thought to ask themselves what becomes of the earth washed away from the hillside. Enough for them if it rested for a few years on its onward course in the plain beneath, where grow their crops; they care not to note that this mud is the wreck of the land they live on; much less do they dream that its particles are

"The dust of continents to be."

Emerson, we believe, somewhere says, "Most persons do not see the sun—at least they have a very superficial seeing." And so it is with the rain and the frost and the waves; we see them, it is true, but how few of us recognize the work they are engaged upon, or endeavor to estimate its magnitude!

THATCH MADE BY SEWING MACHINES.

The difficulty of getting farm laborers capable of putting a good, durable, and waterproof thatch on a rick or building, will, in all probability, disappear, if the following method be adopted: Construct a sewing machine, with two motions, and two needles sufficiently large to carry strong tarred yarn; and the needles must be long enough to go through the required thickness of thatch. The straw is fed to the machine on an endless belt, and the needles, working alternately, stitch the straw into heavy matting. This is rolled up, and applied to the roof, or the rick, until it is covered. The sheets of matting should overlap each other as shingles do, and may be fastened to ricks or stacks with wooden pegs, in the usual way. Fifteen hundred square feet can be made in an hour, and can be applied without the aid of any skilled labor. If properly made and carefully taken off the ricks, it can be used for two or more seasons. This method is simple, and, after the first cost for the machine, is cheap. It is particularly advantageous in use where straw is scarce, as it wastes nothing. And the portability of the thatch in rolls is another recommendation, as thatching frequently is wanted for haystacks at a distance from the homestead.

THE size of the tracts of land under tea-cultivation will be readily conceived when we say that an acre, on which are 1,200 plants, will yield about 1,200 pounds of dry tea yearly. Four pounds weight of green leaves are required to make one pound of dry tea.

OBITUARY.—HON. DAVID LYMAN.

Died in Middlefield, Conn., on Tuesday, Jan. 24th, Hon. David Lyman, a prominent manufacturer and most worthy citizen, whose public and private labors have rendered his life one of continued usefulness, and who will be long remembered as one of those "whose works do follow them." Mr. Lyman had built up an extensive manufacturing business, in the washing and wringing machine line, in Middlefield, and through his efforts in the State Legislature that place became an incorporated town. Towards the close of his life, he became greatly interested in the Air Line railroad enterprise, and his efforts in its behalf are thought to have brought on the attack of typhoid fever of which he died, after a brief illness. In all his social relations, Mr. Lyman was greatly esteemed. His business talents and enterprise were of that rare kind which yield to no obstacle, and his success in life is a brilliant example of what perseverance and integrity can accomplish, when coupled with sound judgment and good sense. He had amassed quite a fortune in his business, and it is said his life was insured to the amount of $80,000.

CRYOLITE AND ITS USES.

There is only one place in the world where this stone is found, and that is in Southern Greenland, at Ivigtuk. On account of its resemblance to frozen water it was called by the early settlers, "ice-stone," or in Greek, "cryolite," just as a magnesian stone, from its resemblance to the foam of the sea, was called meerschaum.

In 1850, Professor Thomsen, of Copenhagen, analyzed the rock, and found that it could be decomposed by lime by fusion or by boiling, and he must thus be regarded as the father of the cryolite industry. He found that pure cryolite was composed of

Fluorine	54·2
Sodium	32·9
Aluminium	12·9
	100·00

After complete decomposition, 100 pounds of the mineral will yield 24 pounds of alumina and 44 pounds of soda—both anhydrous. Large quantities of cryolite are now sent to this country and Europe, and are worked up for the following purposes:

1. Sulphate of alumina, also called concentrated alum, because it contains 14 per cent alumina, against 11 per cent in the ordinary crystallized alum.
2. Hydrate of alumina, as a basis for the manufacture of salts of that oxide.
3. Crystallized and caustic soda.
4. Metallic aluminium.
5. Cryolite fluorspar as incidental product, used as a patent flux.
6. In the manufacture of white glass.
7. Cryolite, oxide of zinc, and quartz for artificial marble.
8. Hot cast porcelain.
9. Hydrofluoric acid.
10. In the analysis of minerals.

It will be seen from the above that the Greenland stone is capable of extensive uses, and it is to be regretted that other deposits of it have not been found in more accessible regions.

A Warning to Inventors.

The New York *Tribune* of the 25th ult., utters the following warning:

"All who have business with the Patent Office or any of the Departments at Washington are warned that they are surrounded by "agents," who do not hesitate to borrow the names of M. C.'s and others to adorn the circulars wherein they spread nets for the unwary. Many of them are arrant swindlers; others simply inefficient and bankrupt, so that money sent them is simply thrown away. Don't mind their begging, hiring, or stealing some M. C.'s frank—that doesn't help the matter a bit. A correspondent suggests that all such agents should be required to procure a license. We are not sure that this would do any good, but we throw out the suggestion."

Annual Meeting of the Society of Engineers and Associates.

The annual meeting of this association was held on the evening of January 26, at No. 9 Lafayette Place, New York. The meeting was designed to be a social reunion only, and no business was transacted. A large number of the most eminent engineers and manufacturers of steam-engine work in New York and vicinity were present. At 9 P.M. the gentlemen sat down to a splendid collation, and the evening was passed in a very pleasant manner. The number present was smaller than would have been the case had the night been less inclement, but notwithstanding the storm, the efforts of Messrs. George H. Reynolds, President, A. S. Cameron, Vice-President, and M. B. Smith, Secretary, with the cooperation of other members, rendered the meeting a complete success.

Cheap Hydrogen.

A correspondent asks the cheapest way of hydrogen gas. We believe the method of Du Motay gives in the SCIENTIFIC AMERICAN, August 27, 1870, to be the best.

Take quicklime, slake it, let it cool, and crumble into a dry hydrate; then mix it with charcoal, coke, or peat, and heat in a retort. The hydrate of lime (slaked lime) gives up the water that was used in slaking it, and becomes quicklime. The water is decomposed into hydrogen and carbonic acid, and these two gases can be separated by passing them through water, or the carbonic acid may be economized by employing it in the manufacture of bicarbonates. The quicklime can be again slaked and used as often as required. In a small way, hydrogen can be made from water by means of zinc and sulphuric acid.

The Effect of Watered Stocks.

Rufus Hatch, of this city, publishes a circular in which he discusses the subject of watering stocks by the process so successfully carried out by Vanderbilt in connection with his railroads. Referring to the capital stock of the Lake Shore and Michigan Southern Railroad, which has been raised from $3,300,000 to $8,750,000, Mr. Hatch declares with great force that "if the State and General Government should impose a tax of one cent a bushel on grain it would create a revolution, and yet Commodore Vanderbilt taxes the producers ten cents a bushel, that an eight per cent dividend may be paid on his watered stock."

This is a very clear illustration of the character of the imposition now being heaped upon the heads of a patient and long-suffering people. These railroad monopolists get possession of some important line of communication, and no sooner is this accomplished than they set about to double the stock, and then, in order to make the earnings pay on the increased stock—which often has no real basis of value—the fares and tariffs are also largely increased, while the people bow their necks in submission. The public would almost mob the man found guilty of watering their mess of milk, but these railroad stock waterers and tax increasers do worse things and escape serious censure. The people seem rather to enjoy the thing than otherwise.

Sulphurous Acid.

The *British Medical Journal* reports the publication, by Professor Gamgee, of a new and convenient mode of using sulphurous acid, the disinfecting qualities of which are universally known. Cold alcohol, the Professor asserts, will dissolve three hundred times its own volume of the gas; and a fluid possessing such powers of concentration cannot but be as efficient as it is portable and convenient. A few drops of the sulphuretted alcohol in the bottom of a trunk, will disinfect any clothing that may be put into it; and fungous germs, such as must in casks, etc., may be destroyed by the use of a very small quantity. The Professor does not tell us the price at which it can be produced; but it must be a very low one, if the new preparation is to supersede permanganate of potash (Condy's Fluid).

Novel and Convenient Mode of Using Lunar and Other Caustics.

The extreme danger of conveying infection on the point of a frequently used pencil of caustic, will recommend this simple device to the medical profession: Take a bundle of splints of wood, similar to lucifer matches; dip the ends in melted caustic, separate them, and allow them to dry. A fresh match of caustic may be used for each application, and a fine caustic point is thus always at hand. Lunar and carbolic acid, and all the solid caustic bodies, may be used in this manner, of which the original suggestion appeared in a London newspaper.

ILL EFFECTS OF HYDRATE OF CHLORAL.—Certain ugly facts concerning the fashionable sedative, hydrate of chloral, will probably diminish the frequency of its use. We have the high authority of Dr. Habershon for the statement that its action on the pneumo-gastric nerve produces bronchial and pulmonary congestion. A fatal case recently happened in Guy's Hospital, London. Another English physician, Dr. Shettle, of the Royal Berkshire Hospital, stated, in his recent lecture to the Reading Pathologic Society, that formiate of soda is frequently produced in the blood by the use of chloral, and that, from its tendency to decompose the blood, it will render hemorrhage very dangerous. Obstetric practitioners will not fail to notice the last fact. As a hypnotic, there is much to be said in its favor. It is powerful and safe, equalling opium in its pain-relieving power. But like all anesthetics, the continued use of it is sure to be hurtful; and if it aid congestion it were better for a patient to suffer weeks of sleeplessness than to habituate himself to its use.

PHOSPHATE OF LIME AS A MORDANT.—Dr. Reimann has lately communicated the following, which will correct a very erroneous impression as to the use of phosphate of lime as a mordant: A thick, sirupy solution of phosphate of lime (boneash) in hydrochloric acid having been recently recommended as a mordant to be used after a previous sumaching of the goods, I find that, according to my experience, the phosphate of lime solution is altogether superfluous, since a sumaching with 4 lbs. of sumac to 20 lbs. of cotton is of itself a sufficient mordanting to fix aniline colors excellently. The application of the phosphate of lime solution as a mordant for cochineal colors upon cotton, is equally superfluous.

SPONGIO-PILINE is the name of a very ingenious contrivance, recently introduced abroad, which may be used either as a poultice or as the means of fomentation. It consists of wool and small particles of sponge, apparently felted together, and attached to a skin of india-rubber. It is about half an inch in thickness. It will be found of great value and convenience for either of the purposes referred to. It retains heat for a considerable time, and vinegar, laudanum, camphor, hartshorn, etc., can be, by its means, placed on the skin, accompanied by heat and moisture, much more readily, and with greater cleanliness, than by means of ordinary poultices.

CHEESE, MILK, AND BUTTER contain caseine in large proportions. This important member of the organic chemical world is a powerful counteragent to lead in the human system, and may be freely taken in all cases of lead poisoning with great benefit. Lead colic, an unfortunately common disease among workmen employed in white-lead factories, may be entirely prevented by the free use of pure milk as a daily beverage.

A REMARKABLE BODY OF WATER.

From the American Journal of Microscopy, by Prof. J. P. Stelle.

From an Oregon paper I take the following relative to a remarkable body of water known to exist in the Cascade range of mountains:

"This lake rivals the famous valley of Sinbad the sailor. It is thought to average two thousand feet down to the water, all round. The walls may be reported as entirely perpendicular, running down into the water and leaving no beach. The depth of the water is unknown, and its surface is smooth and unruffled, as it lies so far under the surface of the mountain that the air currents do not affect it. Its length is estimated at twelve miles and its breadth at ten. There is a beautiful island in its center, with luxuriant trees upon it. No living man has ever yet reached the water's edge, and it is not probable that any ever will. It lies silent, still, and mysterious in the bosom of the "everlasting hills," like a huge well scooped out by the giant genii of the mountains in the unknown ages of long ago, and all around it, great primeval forests an eternal watch and ward are keeping."

Remarkable as this body of water may seem, it is by no means the most remarkable one on our continent. I write this in Central Florida, where I have just examined a body of water which certainly excels the great sunken lake of the Cascades in very many particulars. As nothing has yet been published concerning it, I have concluded to give our readers of the *American Journal of Microscopy* a brief account of what I saw, believing that it will not prove wholly uninteresting, even to them.

In company with an experienced guide I reached the little lake in question at about the hour of ten in the morning. How large it was I could not tell, but I judge it must be of considerable size, from the fact tha t I could not see across it, although enjoying a kind of b ird's-eye view from a location some distance above the level of the water.

Seeing nothing unusual about the place, I was on the point of expressing my disappointment to the guide, when he, having read my thoughts, cut all short by asking that I make a careful survey of the water, remarking, at the same time, that while there was really nothing extraordinary about the lake itself, it was strangely and wonderfully inhabited.

I turned my attention to the water, and was soon convinced that I had, undoubtedly, met with a phenomenon, for it was so clear, so very transparent, that I could see through it in every direction with as much apparent ease as if it had been the atmosphere itself. Presently I saw one of the inhabitants hinted at, a little creature of a light brown color, looking, as it glided here and there, through the pure element, not unlike a common chimney swallow. Then came another, and another, and another, until all the waters of the lake seemed to be thickly swarming with them. They were very busy and very swift in their motions, darting, whirling, and angling with the greatest ease and the most charming grace; the guide said that like birds of the air they were in quest of their prey, feeding upon animals too small to be seen by us from our standpoint.

Suddenly, while I was gazing in wonder upon these strange creatures, a new actor appeared in the person of a larger animal, about the size, shape, and color of a huge muskmelon. He was quite transparent, so much so that I could see through and through him as plainly as if he had been a glass jar; and as he moved leisurely about I noticed that he was catching and devouring the little "swallows" without mercy. His interior, which seemed to be a huge cavity—nothing more—was literally filled with them, some still alive and swimming about in their strange prison. The entire mass held within his gigantic stomach kept up a rapid whirling round and round in one direction, from which I inferred that he had no regular digestive organs, but simply *wore* out his food; that is, reduced it by friction to a proper condition for his sustenance.

Scarcely had I got fairly interested in this extraordinary animal when along came something which looked, with its slim, arching neck, very much like a swan. Its course was so directed that ere long it was brought into contact with the "musk melon," and a fight was the consequence. It was a short fight, however, for neither of the parties seemed to relish the business, so they separated and struck off in opposite directions. A little distance, and the "swan" met another of its own kind, and they commenced billing and cooing like two mated doves; but their pleasures were destined to be of short duration, for just at that instant a large and hideous looking creature, with great horns and glaring eyes, pounced upon them from a covert hard by, seizing them both. A terrible struggle ensued, in the course of which one of the "swans" made its escape, but the monster gripped the other fiercely by its slender neck until it ceased to struggle, after which he settled down with it to the bottom of the lake, and very quietly began converting it into a meal.

About this time I noticed a second monster equally as frightful in appearance as the one just referred to, though evidently of a different species. He was moving along on the bottom of the lake, and, unless his course were changed, would pass very near the other. The first monster's treatment of the "swans" had made me his enemy, so I was well pleased with the turn affairs showed a prospect of taking; I desired that his banqueting should be disturbed. And it was. The new comer found him, and went in for a share of the prey. A battle, the most frightful that I had ever before witnessed between two living creatures, immediately commenced. They seized each other and rolled over and over in a real death struggle, for several minutes, in the course of which they actually tore each other limb from limb. Finally, one of them yielded up and died, after which the other, with but two legs left out of six, dragged itself slowly away. And another instalment of animals, some like gigantic leeches, and others like Oriental turbans, and all effecting locomotion by stretching and pulling themselves into every conceivable shape, settled down and fell to regaling themselves upon the carcasses. They were, doubtless, the vultures of this remarkable body of water.

Half a day or more was spent by me in watching the inhabitants of this Florida wonder. In the course of that time I saw very many strange sights—more than I could hint at in a short article like this. Besides, a written description could convey but a faint idea of the reality; one must see for himself before he can appreciate. Every reader of this *Journal* who has not already examined the remarkable body of water under consideration should do so without fail before he dies, for it will give him new ideas attainable from no other source. If he cannot make it convenient to come all the way to Florida for that purpose, let him arrange to see the lake at home. A good microscope with a drop of impure or stagnant water upon the stage will enable him to have the same kind of lake at any locality he may select.

SPIRITUALISM AND SCIENCE.—We have received several communications on this subject. Both sides have had a fair hearing—two articles each—and we decline to continue the discussion at the present time.

WHY MAINSPRINGS BREAK.—The controversy upon this subject has exhausted its interest, and we propose to drop the discussion.

In the five largest libraries in Paris are contained 1,450,000 volumes and 87,000 manuscripts.

Answers to Correspondents.

CORRESPONDENTS who expect to receive answers to their letters must, in all cases, sign their names. We have a right to know those who seek information from us; besides, as sometimes happens, we may prefer to address correspondents by mail.

SPECIAL NOTE.—This column is designed for the general interest and instruction of our readers, not for gratuitous replies to questions of a purely business or personal nature. We will publish such inquiries, however, when paid for as advertisements at 1·00 a line, under the head of "Business and Personal."

All reference to back numbers must be by volume and page.

TO TAN SHEEP'S PELTS WITH THE WOOL ON.—Let B. F. P. wash the pelts in warm water, and remove all fleshy matter from the inner surface: then clean the wool with soft soap, and wash clean. When the pelt is perfectly free from all fatty and oily matter, apply the following mixture to the flesh side, viz: For each pelt take of common salt and ground alum, one quarter of a pound each, and one half an ounce of borax; dissolve the whole in one quart of hot water, and when sufficiently cool to bear the hand, add rye meal to make it like thick paste, and spread the mixture on the flesh side of the pelt. Fold the pelt lengthwise, and let it remain two weeks in an airy and shady place; then remove the paste from the surface, wash, and dry. When nearly dry, scrape the flesh side with a crescent-shaped knife. The softness of the pelt depends much on the amount of working it receives.—J. S., of Minn.

CHEAP FURNITURE VARNISH.—In reply to Query No. 2, page 9, present volume, the following recipe, I think, will answer. For a cheap article it is a good one. Take of the best raw linseed oil, 1 gallon, and boil it an hour; then add 2 pounds light colored rosin, finely powdered, stirring it thoroughly until dissolved; then take it from the fire, and add one pint spirits of turpentine. It shoutd be strained before using, and kept from the air, and care also should be used, in making it, to prevent its taking fire.—B. E. W., of N. J.

CEMENT FOR LEATHER BELTING.—Let B. B. G. take of common glue and American isinglass, equal parts; place them in a boiler and add water sufficient to just cover the whole. Let it soak ten hours, then bring the whole to a boiling heat, and add pure tannin until the whole becomes ropey or appears like the white of eggs. Apply it warm. Buff the grain off the leather where it is to be cemented; rub the joint surfaces solidly together, let it dry a few hours, and it is ready for practical use; and if properly put together, it will not need riveting, as the cement is nearly of the same nature as the leather itself.—J. S., of Minn.

FILTER FOR RAIN-WATER CISTERN.—There is no better filter for a rain-water cistern, than a wall of soft-burned bricks, built up within it. I have one twenty inches square in the center of my cistern, from which the pump draws. It may be built in one corner as well. The water percolates through the substance of the bricks, which detain every impurity, except such as are chemically united with the water.—N. D., of Me.

BARKER'S MILL.—The cause of motion in Barker's mill is the pressure that there is on every part of the inside of the arms except where the orifices are; this destroys the equilibrium, and hence the motion. The recoil of a gun when fired, the rising of a skyrocket, and many other motions are due to the same cause. It would be difficult for "Curious" to calculate the speed of the water in the arms, since the centrifugal force generated in the machine would cause an increased flow of water.—L. G. M., of Ark.

OUT-DOOR GILDING.—If N. M. will take unruled writing paper, and wax it, he will solve his problem. Let him first put on his size, then take his book of leaf, and laying it on any convenient surface, slip his waxed paper into the gold leaf, pressing it down with the hand so as to bring the waxed surface in contact with all parts of the leaf, then he may withdraw the paper and the leaf will adhere to it, so that he may almost defy a hurricane.—W. L. T., of Conn.

F. F. F., of Cal.—The explosive material in gun caps is composed of the following constituents, several of which are carefully made compounds, and dangerous to handle: Chlorate of potash, 26 parts, niter 30 parts, and fulminate of mercury 12, sulphur 18, ground glass 14, gum 1. Two to three grains of this composition are applied to the bottom of each cap.

A. R. S., of Ohio.—With cylinders of the same length and everything else, except the diameters of the cylinders, being equal, the same amount of steam used non-expansively will do the same work.

C. P., of Pa.—Crucibles for melting brass, gold, and other metals requiring a high heat, are generally made of plumbago, or graphite, commonly called black lead, mixed with clay. "Hessian crucibles" are also used; they are made of very refractory clays.

G. W. R., of Pa.—Your plan for boring out segments of cylindrical rings is impracticable. We shall shortly publish a correct way of doing this, with an engraving, and then drop the subject.

W. F. S., of Ind.—We should be glad to hear from you more at length on the subject of wooden railroads. Facts relative to this subject are valuable.

J. P., of Md.—An examination of the mineral you send shows that it is the hematite ore of iron. If plentiful it is of course valuable

H. F., of Ind.—We refer you for the information you seek to "Bacon's Revision of Porter's Treatise upon the Steam Engine Indicator," published by D. Van Nostrand, New York.

F. E. H., of Mass.—It is the impurities in coal that melt and form cinders. Bituminous coal will, however, often cake when allowed to cool before it is wholly consumed. Such cakes are not cinders, properly speaking.

P. P., of Pa.—If you will submit the drawing of the tool you would use to turn a plunger for the segment of a hollow, cylindrical ring we will give it careful examination, and, if deemed worthy will publish.

N. H. E., of N. Y.—We do not wish to discuss the subjects of leveling and balancing millstones any further at present.

O. W. C., of Mo.—Davies' Practical Mathematics, published by A. S. Barnes & Co., of New York, contains rules for measuring bricklayers', plasterers', and carpenters' work.

Business and Personal.

Charge for Insertion under this head is One Dollar a Line. If the Notices exceed Four Lines, One Dollar and a Half per Line will be charged.

Queries.

[We present herewith a series of inquiries embracing a variety of topics of greater or less general interest. The questions are simple, it is true, but we prefer to elicit practical answers from our readers, and hope to be able to make this column of inquiries and answers a popular and useful feature of the paper.]

1.—Removing Incrustation by the Use of Potatoes.—A correspondent says that potatoes are a good solvent for mud and scale in steam boilers, but gives no data for use. I would like to know in what quantity? and how long after putting in before the boiler should be blown off, etc.?—H. A. H.

2.—Removing Chimney Stains.—How can I remove the stain and smell of creosote, caused by the condensed empyreumatic oil which has trickled down and soaked into the plaster wall below the stove-pipe hole in a chimney?

3.—Japanning Cast Iron.—How can I japan cast iron so that it will have the color of russet leather?

4.—Paper Percussion Caps.—How are paper percussion caps made, and what is the fulminating material used therein?—F. F. F.

5.—Saws and Saw Steel.—Is saw steel welded up after rolling, or is it welded up in large pieces and afterwards rolled? Are hand-saw blades cut from sheets, heel and point alternately? and what is the reason that such saws are often thicker at the point than at the heel?—A. R. S.

6.—Restoring the Color to Gold after Soldering.—How is the color of gold restored after hard soldering?—R. K.

7.—Shoe Blacking.—I wish a good recipe for a varnish or blacking for boots and shoes.—W. H. P.

Recent American and Foreign Patents.

Under this heading we shall publish weekly notes of some of the more prominent home and foreign patents.

Corn Dropper.—J. H. Gross, Niantic, Ill.—This invention relates to improvements in corn dropping and check marking machines, and consists in the application to a pair of runners of a pair of star wheels, a dropping slide, and a check marking device, whereby the star wheels derive the rotary motion by the points coming in contact with the ground as the runners are drawn along and actuate the dropping slide and the marker, the whole arrangement being very simple, cheap, and efficient.

Mill-stone Balance.—John Walch, Galena, Ill.—This invention relates to improvements in balancing apparatus for mill stones, and consists in a frame made in two parts, having lugs for attachment to the upper and lower edges of the hoop of the mill stone, and clamping bolts, connecting them together and clamping them on the hoop; on which frames are arranged a pair of weights to be adjusted to or from the plane of the point of suspension of the stone. Three of these frames are to be attached to the hoop, and adjusted.

Gates.—L. W. Sebley, Ames, Iowa.—This invention relates to improvements in gates, and consists in an improved arrangement of means for opening and closing the gate by the action of the wheels of a vehicle coming in contact with levers at the side of the gate.

Pump.—G. H. Laub, West Lebanon, Ind.—This invention relates to an improved manner of attaching metal barrels, for the valves to work in, to wooden pipes, for detaching and removing the barrels when required for cleaning or repairs.

Bark Mill.—G. E. Palen and F. P. Avery, Tunkhannock, Pa.—The object of this invention is to improve the machines for grinding bark in such manner that they can be adjusted to any extent, readily repaired, and perfect in their operation.

Gang Plow.—J. R. McConnell, Marengo, Iowa.—This invention has for its object to furnish an improved gang plow, which shall be so constructed and arranged that it may be conveniently adjusted to work at any desired depth, or to cut a narrower or wider furrow, as may be desired.

Treatment of Fruit Trees.—William J. Everett, Mahony City, Pa.—This invention relates to a new and useful improvement in the treatment of fruit and other trees, for preserving them from the ravages of worms, grubs, and insects.

Bee Hive.—David H. Swartz, Lancaster, Ohio.—This invention has for its object to furnish an improved bee hive, which shall be so constructed as to protect the bees from moths and ants, and which shall at the same time be simple in construction, and will enable the bees to be conveniently controled.

Mill-stone Driver.—John J. Tomlinson, Bazeman City, Montana.—This invention relates to a new and useful improvement in drivers for mill stones, by means of which the running stone adjusts itself to the bed-stone, and to the resistance when the latter is out of level, or when the spindle is out of "tram," or varies from a line peruendicular with the face of the bed.

Tray Holder.—Obed Fahnstock, Indianapolis, Ind.—This invention relates to a new and improved holder for trays, by which to carry them on one arm; and it consists in a plate provided with handles for supporting and carrying it on the arm, on which plate suitable holding devices are placed at the top to hold the tray.

Belt Tightener.—G. W. Runk, Franklin, La.—This invention relates to a new apparatus for clamping belts while the same are on the pulleys, and for stretching the same so that they may be tightened.

Water Cooler.—Abel Putnam, Jr., Saratoga Springs, N. Y.—This invention relates to a water cooler having two separate compartments, one to contain water and the other ice, the annular water space being exterior to the ice compartment, and each chamber having an opening of its own.

Cast-iron Barrel.—Abel Putnam, Jr., Saratoga Springs, N. Y.—This invention consists of a cast-iron barrel, provided with a porcelain lining, and one solid and one detachable head.

Household Implement.—E. H. Schmults and Jacob Baker, New York city.—This invention relates to a new instrument which can be used for picking and breaking ice, opening all kinds of bottles, and lifting kettles, stove plates, etc.

Gate.—W. G. Franklin, Shelbina, Mo.—This invention has for its object to furnish an improved gate, which shall be so constructed and arranged, that, when opened, its forward end may swing up from the ground, to pass over snow or other obstructions, and which shall be simple in construction and inexpensive in manufacture.

Portable Escritoir.—W. G. Mitchell, Holliston, Mass.—This invention has for its object to furnish a simple, convenient, and inexpensive escritoir, which shall be so constructed and arranged that, when opened up for use, it may serve as a smooth and firm writing table, and when closed for transportation, may be folded up into small compass, and at the same time serve as a receptacle for paper, pens, inkstand, stamp box, etc.

NEW BOOKS AND PUBLICATIONS.

The Photographer's Friend. An Illustrated Quarterly Magazine, devoted to the Photographic Art. Published at 103 West Baltimore Street, Baltimore, Md. G. O Brown, Editor.

We have received the first number of this magazine, and find in it a great deal of matter, of value to persons interested in photography. Under the caption of "The Great Quartette," are given the formulas and methods of working of four of the most distinguished photographers of this country Messrs. Sarony, Kurtz, Gurney, and Fredricks. This is certainly information worth having, and it is greatly to the credit of the gentlemen named that they have been willing to give the trade the benefit of their large experience. Accompanying the first number is a fine photograph of Mrs. Scott Siddons, by Sarony, which, in the management of drapery and control of light, could not easily be excelled. Photography under such treatment ceases to be a trade, and is elevated to the dignity of an art. No one but a first-class artist which could produce such a picture. There is a little over-exposure in the editorial management of the journal that needs toning down in the printing, but all this will improve with time and experience.

The Kidney.

This pamphlet of 44 pages treats practically of the structure, functions and diseases of the kidney, Bright's disease, and the urine, its constituents chemical tests for the various diseases, their symptoms, and treatment, adapted to popular comprehension. By Edward H. Dixon, M.D. J. S. Redfield, Publisher, No. 140 Fulton street. Price, 25 cents.

Official List of Patents.

ISSUED BY THE U. S. PATENT OFFICE.

FOR THE WEEK ENDING JAN. 24, 1871.

Reported Officially for the Scientific American.

SCHEDULE OF PATENT FEES

On each Caveat	$10
On each Trade-Mark	$25
On filing each application for a Patent, (seventeen years)	$15
On issuing each original Patent	$20
On appeal to Examiners-in-Chief	$10
On appeal to Commissioner of Patents	$20
On application for Reissue	$30
On application for Extension of Patent	$50
On granting the Extension	$50
On filing a Disclaimer	$10
On an application for Design (three and a half years)	$10
On an application for Design (seven years)	$15
On an application for Design (fourteen years)	$30

For Copy of Claim of any Patent issued within 30 years $1
A sketch from the model or drawing, relating to such portion of a machine as the Claim covers, from $1
upward, but usually at the price above-named.
The full Specification of any patent issued since Nov. 20, 1866, at which time the Patent Office commenced printing them .... $1·25
Official Copies of Drawings of any patent issued since 1836, we can supply at a reasonable cost, the price depending upon the amount of labor involved and the number of views.
Full information, as to price of drawings, in each case, may be had by addressing

MUNN & CO.,
Patent Solicitors, 37 Park Row, New York.

111,102.—Charger for Shot Pouches.—Thomas W. Allen Waterbury, Conn.
111,103.—Children's Carriage.—Rodney C. Britton, Springfield, Vt.
111,104.—Baggage Truck.—William Hammond Brown, Bangor, Me.
111,105.—Automatic Lubricating Cup.—James A. Bryan and William Stainfield, Kent, Ohio.
111,106.—Pruning Shears.—John Calder, Macedon, N. Y.
111,107.—Bee Hive.—Albert Claypool, Weston, Ohio.
111,108.—Parlor Bedstead.—Francis E. Coffin, Boston, Mass.
111,109.—Sleigh Brake.—Eustace J. Cooper, Mineral Point, Wis.
111,110.—Steam Lubricator.—Daniel Currie, Belleville, Ill.
111,111.—Type casting Machine.—William Wallace Dunn, San Francisco, Cal.
111,112.—Governor for Electro Motors.—Thomas A. Edison, Newark, N. J., assignor to himself, Elisha W. Andrews, George B. Field, and Marshall Lefferts, New York city.
111,113.—Machine for Cutting Paper Collars.—Alfred L. Elliot, Boston, assignor to himself and Edwin A. Eaton, Winchester Mass.
111,114.—Flux for Welding Steel of High and Low Grades.—John Farrel, New York city.
111,115.—Truss.—Alexander Folleau, San Francisco, Cal. Antedated January 13, 1871.
111,116.—Steam-boiler Feeder.—Lucus Foote, North Fairfield, Ohio.
111,117.—Burial Case.—Patrick H. Griffin, Albany, N. Y Antedated January 7, 1871.
111,118.—Thill Coupling.—Collins W. Griffith, Cincinnati Ohio, assignor to himself and Charles H. Mackintosh, Strathroy, Canada.
111,119.—Back-pad Press.—Edwin W. Harlow, Hastings Mich.
111,120.—Pump.—Patrick Harvey, Chicago, Ill.
111,121.—Evaporator.—Richard Hawley, Jr., Detroit, Mich.
111,122.—Feed-trough Guard.—Edwin Hovenden, Bushnell, Ill.
111,123.—Railway-car Coupling.—Lewis Huddle and Jacob K. Huddle, Tiffin, Ohio.
111,124.—Gate.—Robert Henry Hudgin, Fairfield, Canada.
111,125.—Harrow and Cultivator.—James F. Jaquess, Commerce, Miss.
111,126.—Ash Screen.—Edward C. Jenkins, Jr., Worcester, Mass.
111,127.—Car Spring.—James Leland, Springfield, Mass.
111,128.—Method of Securing Joints of Frames, etc.—Charles F. Linscott (assignor to Edward S. Torrey and Joseph Torrey) New York city.
111,129.—Sewing Machine.—T. A. Macaulay, New York city.
111,130.—Gathering Attachment for Sewing Machines.—William A. Mack, Norwalk, Ohio.
111,131.—Sawing Machine.—James D. Matthews, Niles, Mich.
111,132.—Grain Drill.—Daniel E. McSherry, Dayton, Ohio.
111,133.—Compound for Preserving Drain Tiles, Bricks, etc.—Edward Milner, Marquette, Mich., assignor to Charles H. Mackintosh, Strathroy, Canada.
111,134.—Meter.—Charles Moore (assignor to José F. DeNavarro), New York city.
111,135.—Chair Clamp for Railway Rails.—Wm. Morehouse, Buffalo, N. Y.
111,136.—Machine for Upsetting Iron.—Martin L. Munger and Corodon D. W. Gibson, Grand Blanc, Mich.
111,137.—Boot Stretcher.—Isaac M. Myers, San Francisco, Cal.
111,138.—Hay Rack.—Franz Louis Nagler, Irving Township, Mich.
111,139.—Corn Sheller.—Franklin Nelson (assignor to himself and Joseph Maseth), Wyandotte, Mich.
111,140.—Clamp for Carriage Seats.—Henry J. Northrup, Lansingburg, N. Y.
111,141.—Machine for Pressing Fabrics.—George H. Nussey and William B. Leachman, Leeds, England.
111,142.—Obtaining Madder Extracts.—Alfred Paraf (assignor to Edward S. Renwick, trustee), New York city. Antedated December 29, 1870.
111,143.—Water Meter.—Webster Park, Norwich, Conn.
111,144.—Anchor.—Gurney C. Pattison, Baltimore, Md.
111,145.—Anchor.—Gurney C. Pattison, Baltimore, Md.
111,146.—Tube Extractor.—Isaac S. Peters, Marshall, Mich.
111,147.—Machine for Grinding Hand Saws.—Edwin S Piper, Rochester, N. Y.

111,148.—COMPOSITION FOR COATING WOODEN STRUCTURES, TO PROTECT THEM AGAINST FIRE.—Anthony Pirz (assignor to himself and Henry Torstrick), Long Island City; N. Y. Antedated January 7, 1871.
111,149.—TOY CARRIAGE.—Frederick W. Porter, Springfield, Vt.
111,150.—HORSE HAY RAKE.—Samuel Rockafellow, Moline, Ill.
111,151.—ASPHALTIC PAVEMENT.—Samuel R. Scharf, Baltimore, Md., assignor to himself and Hugh M. Funston, New York city.
111,152.—COUPLING FOR SHAFTINGS.—Scott A. Smith (assignor to Cresson & Smith), Philadelphia, Pa.
111,153.—SIZING MACHINE.—Albert H. Sturgis (assignor to himself and Joseph A. Pierce), Lewiston, Me.
111,154.—FURNACE FOR STEAM BOILERS.—Morse K. Taylor, United States Army.
111,155.—MANURE RAKE ATTACHMENT FOR PLOWS.—Marinus Van Duine and Jan De Jonge, Zealand, Mich.
111,156.—COFFER DAM.—John E. Walsh, New York city.
111,157.—COFFER DAM.—John E. Walsh, New York city.
111,158.—PLOW COLTER.—Seth Way, La Porte, Ind.
111,159.—STEAM GENERATOR.—Samuel West (assignor to Elmwood Mining and Manufacturing Company), Elmwood, Ill.
111,160.—SERVING REEL.—Joseph Henry Westcott, Medford, Mass.
111,161.—MOP HEADS.—Henry H. Wetmore, Barre, Vt. Antedated January 12, 1871.
111,162.—WINDOW PROTECTOR.—William K. Winant, Rye, N.Y., assignor to himself, William Wilmot Kissam, and Emily Winant.
111,163.—GRAIN DRIER.—Levi Abbott, Lewiston, Me., and Joseph A. Sherburne, Boston, assignors to themselves and Earl W. Johnson, Boston, Mass.
111,164.—SAW.—Emanuel Andrews, Williamsport, Pa.
111,165.—EARTH SCRAPER.—Asher S. Babbit (assignor to Babbit, Hinckley & Co.), Keeseville, N. Y. Antedated January 14, 1871.
111,166.—CONCRETE FOR PIPES, TUBES, BUILDINGS, ETC.—Thomas J. Barron, Brooklyn, E.D., N.Y.
111,167.—HOLLOW AUGER.—Aaron Bauman and Orin O. Witherell, Toledo, Ohio.
111,168.—ATMOSPHERIC PRESSURE ATTACHMENT FOR DENTAL PLATES.—John B. Beers, San Francisco, Cal.
111,169.—LIQUID COMPASS.—John Bliss and George H. Bliss, Brooklyn, N.Y.
111,170.—CAR COUPLING.—Joseph Boothroyd, Michigan City, Ind.
111,171.—COAL BOX.—Timothy S. Bozart, Jr., Indianapolis, Ind.
111,172.—RAILWAY-CAR TRUCK.—Louis D. Boyce and George H. Jones, Rochester, N.Y.
111,173.—COLLAPSING CORES.—Anthony T. Brodie and Robert B. Smith, Pittsburgh, Pa.
111,174.—GAS GENERATOR.—John Butler, New York city.
111,175.—APPARATUS FOR CARBURETING AIR.—Henry Albert Chapin, New York city.
111,176.—SCOURING, WASHING, AND WRINGING MACHINE.—William H. Churchman, Indianapolis, Ind.
111,177.—DIE FOR MAKING FELLY PLATES.—Allison N. Clark, Plainville, Conn.
111,178.—HAT.—James W. Corey, Newark, N. J.
111,179.—FLUID METER.—Robert Creuzbaur, Williamsburg, N.Y.
111,180.—VARIABLE CUT-OFF FOR STEAM ENGINES.—William B. Cross, Sacramento, Cal.
111,181.—SPOKE-TENONING MACHINE.—Godfrey E. Culp and Matthew Flaig, Lockhaven, Pa.
111,182.—FURNACE FOR BURNING SMALL COAL OR CULM.—Alfred Dart, Carbondale, Pa.
111,183.—WINE PRESS.—George L. Davenport and Charles G. Case, Davenport, Iowa.
111,184.—REMOVABLE CAR-SEAT BACKS.—Peter F. Duchemin, Somerville, Mass.
111,185.—TREATING FRUIT TREES TO PREVENT THE RAVAGES OF INSECTS, ETC.—Samuel J. Everett, Mahoney City, Cal.
111,186.—TRAY HOLDER.—Obed Fahnestock, Indianapolis, Ind.
111,187.—PIPE COUPLING.—John P. Fink, Mechanicsville, Pa.
111,188.—HOISTING APPARATUS.—Henry Flad and J. B. Eads, St. Louis, Mo.
111,189.—WATER CLOSET.—Charles Frankish, Chicago, Ill. Antedated January 14, 1871.
111,190.—GATE.—W. G. Franklin, Shelbina, Mo.
111,191.—STEAM BOILER.—John L. Frisbie (assignor to M. T. Davidson), Brooklyn, N. Y.
111,192.—STEAM RADIATOR.—John L. Frisbie (assignor to M. T. Davidson), Brooklyn, N. Y.
111,193.—CASTER.—F. A. Gardner, Danbury, Cond.
111,194.—PEN HOLDER.—Alfred M. George, Sand Fly, Texas.
111,195.—MEDICAL COMPOUND FOR THE CURE OF RHEUMATISM.—Rebecca Gilkinson, New York city.
111,196.—SPRING-CATCH FOR DOORS.—William Glue, Muskegon, Mich. Antedated January 14, 1871.
111,197.—MACHINE FOR SEWING BOOTS AND SHOES.—Chas. Goodyear, Jr., New Rochelle, N. Y.
111,198.—COMPOUND FOR REMOVAL OF SCALE FROM STEAM BOILERS.—Wm. T. Grant, Neelyville, Ill.
111,199.—BASTER-GUIDE FOR SEWING MACHINES.—Franklin T. Grimes, Liberty, Mo.
111,200.—CORN DROPPER.—Jacob H. Gross, Niantic, Ill.
111,201.—GATE.—John K. Harris, Springfield, Ohio.
111,202.—HAND CORN PLANTER.—James M. Harrison, Spartanburg, Ind.
111,203.—BEER COOLER.—Carl W. Haug (assignor to himself and Henry Bunz), New York city.
111,204.—BEEHIVE.—Henry L. Heckman, Brooklyn, Iowa.
111,205.—COCK.—Wm. H. Hedges and M. E. Campfield, Newark, N. J.
111,206.—MACHINE FOR CUTTING AND DRESSING STONE.—Jacob Hedrick, William Tash, and Henry Kreidler, York, Pa.
111,207.—BOX OPENER.—Thomas B. Henkle, Knightstown, Ind.
111,208.—VEGETABLE CUTTER.—David W. Hersey, Pembroke, Me.
111,209.—FOLDING CHAIR.—Francis March Holmes, Boston, Mass.
111,210.—BRICK MACHINE.—Erwin C. Hubbard, Green Bay, Wis.
111,211.—RAILWAY CAR WHEEL.—Lewis B. Hunt, New York city.
111,212.—OPERATING CUTTER FOR STEAM PLOWS.—Oliver Hyde, Oakland, Cal.
111,213.—ELASTIC TIRE FOR TRACTION ENGINES.—Oliver Hyde, Oakland, Cal.
111,214.—MANUFACTURE OF LEATHER.—S. B. Jenks and F.A. Holcomb, Grand Rapids, Mich.
111,215.—COMBINED FEED-WATER HEATER AND CIRCULAEOR. E. L. Jones, Memphis, Tenn.
111,216.—DIE FOR ORNAMENTING SHEET METAL.—Charles Kaufman, Oconomowoc, Wis.
111,217.—POTATO PLANTER.—Hiram J. Kent, Palmyra, N. Y.
111,218.—DEVICE FOR BENDING WOOD.—Edward Lacey, Chicago, Ill.
111,219.—PUMP.—G. H. Laub, West Lebanon, Ind.
111,220.—TOOL FOR CUTTING OFF PIPES IN OIL WELLS.—J. H. Luther, Petroleum Centre, Pa.
111,221.—TOOL FOR CUTTING OFF AUGER STEMS IN OIL WELLS.—James H. Luther, Petroleum Centre, Pa.
111,222.—EMBALMING.—Benjamin F. Lyford, San Francisco, Cal.
111,223.—GRATE BAR.—Joseph T. Marshall, Wilmington, Del.
111,224.—CAR COUPLING.—John Mayben, Milroy, Pa.
111,225.—STOVE-PIPE SHELF.—James McCallum (assignor of one third of his right to H. E. Gillam), Rochester, N. Y.
111,226.—GANG PLOW.—John R. McConnell, Marengo, Iowa. Antedated January 18, 1871.
111,227.—PUMP.—John H. McGowan, Cincinnati, Ohio.
111,228.—COMBINED GANG PLOW AND CULTIVATOR.—J. A. Medaris, Sullivan, Ind.
111,229.—BRACE FOR CARRIAGE AND OTHER SPRINGS.—L. C. Miller, Humphrey, N. Y.
111,230.—FOLDING DESK.—John Milwain, Nashville, Tenn.
111,231.—PORTABLE ESCRITOIR.—W. G. Mitchell, Holliston, Mass.
111,232.—BUGGY SEAT.—E. T. Mithoff and J. W. Dann, Columbus, Ohio.
111,233.—FLUID METER.—Charles Moore (assignor to Wiiliam Tobin), New York city.
111,234.—LIQUID METER.—Charles Moore (assignor to William Tobin), New York city.
111,235.—MEASURING ATTACHMENT FOR PACKAGED FABRICS.—Edward Morgan, Washington, D. C, assignor of two thirds of his right to J. F. McKee, Fort Smith, Arkansas, and Charles Fair, Philadelphia, Pa.
111,236.—BODY LININGS FOR LADIES' DRESSES.—Schamu Moschcowitz, New York city.
111,237.—LAMP.—Rufus Nutting, Randolph, Vt.
111,238.—GATE.—Patrick O'Neill, Murfreesborough, Tenn.
111,239.—BARK MILL.—G. E. Palen and F. P. Avery, Tunkhannock, Pa.
111,240.—SPADE.—Harrison Parkman, Philadelphia, Pa.
111,241.—STOP VALVE.—John Paterson, Troy, N. Y.
111,242.—STOP VALVE.—John Paterson, Troy, N. Y.
111,243.—DRAWER PULL.—C. H. Pierpent (assignor to himself and P. J. Clark), West Meriden, Conn.
111,244.—PLOW.—Joseph Pinkham, New Market, N. H.
111,245.—BOOT CRIMPER.—William Polsgrove, St. Thomas, Pa.
111,246.—CONNECTOR FOR TELEGRAPH WIRES.—G. B. Prescott, New York city.
111,247.—PLOW.—J. P. Pritchard, Conn Valley, Cal. Antedated Jan. 14, 1871.
111,248.—MACHINE FOR CUTTING SCREW THREADS ON BOLTS. S. W. Putnam, Jr., Fitchburg, Mass.
111,249.—STAIR ROD FASTENING.—Emil Rath (assignor to Moritz Krickl), New York city.
111,250.—CULTIVATOR.—W. B. Read, Gallatin, Tenn.
111,251.—MACHINERY FOR TRANSMITTING AND DISTRIBUTING MOTIVE POWER.—James Richmond, Lockport, N. Y.
111,252.—HAY LOADER.—J. P. Rideout, Bowdoinham, Me.
111,253.—SETTING STONES, ETC.—William Riker, Newark, N. J.
111,254.—CARD FOR MARINERS' LIQUID COMPASSES.—E. S. Ritchie, Brookline, Mass.
111,255.—CATTLE STANCHION.—J. A. Rosback, Hermon, N. Y. Antedated Jan. 18, 1871.
111,256.—CULTIVATOR.—H. M. Rose, Clinton, Ill.
111,257.—BELT TIGHTENER.—G. W. Runk, Franklin, La. Antedated Jan. 14, 1871.
111,258.—MOWING MACHINE.—G. T. Savary, deceased (N. J. Savary, administratrix, assignor to J. N. Pike), Newburyport, Mass.
111,259.—LATH MACHINE.—Chas. Schleicher, Louisville, Ky.
111,260.—ICE PICK AND HOOK.—E. H. Schmults and Jacob Baker, New York city.
111,261.—RAILWAY SWITCH AND SIGNAL APPARATUS.—Adolph Schnabel and Theodore Henning, Bruchsal, Grand Duchy of Baden.
111,262.—LIQUID METER.—H. C. Sergeant, Newark, N. J., assignor to J. F. De Navarro, New York city.
111,263.—BURIAL CASE.—F. B. Shearer, Columbus, Ohio.
111,264.—APPARATUS AND PROCESS FOR CANNING AND PRESERVING MEATS, FRUITS, VEGETABLES, ETC.—N. H. Shipley, Baltimore, Md.
111,265.—ROCK DRILL.—Henry Shoemaker and John Shoemaker, Putneyville, Pa.
111,266.—GATE.—L. W. Sibley, Ames, Iowa.
111,267.—PLASTER FOR WALLS.—B. R. Smith and J. C. Harris, Philadelphia, Pa.
111,268.—LIQUID METER.—W. E. Snediker (assignor to J. F. De Navarro), New York city.
111,269.—STEEL GLASS CUTTER AND KNIFE.—Thelesphore Spénard, Coaticooke, Canada.
111,270.—BOLSTER AND PILLOW.—Timothy S. Sperry, Chicago Ill.
111,271.—BURIAL CASKET HANDLE.—Clark Strong, Winsted, Conn.
111,272.—HARVESTER.—Henry Stuckey (assignor to A. C. Stock), Bucyrus, Ohio.
111,273.—BEE HIVE.—David H. Swartz, Lancaster, Ohio.
111,274.—LAMP BURNER.—Alvin Taplin, Forestville, assignor to the Bristol Brass and Clock Company, Bristol, Conn.
111,275.—SHUTTLE FOR SEWING MACHINE.—E. C. Thaxter, Providence, R. I.
111,276.—SEWING-MACHINE MOTOR.—William C. Thornton and James D. Cooley, Hillsville, Va.
111,277.—MILLSTONE DRIVER.—John J. Tomlinson, Bozeman City, Montana Territory.
111,278.—LOOM.—Hamilton E. Towle, Newark, N. J.
111,279.—REIN SUPPORTER.—Ross Townsend, Liberty township, Ohio.
111,280.—ICE MACHINE.—David K. Tuttle and Orazio Lugo, Baltimore, Md. Antedated January 7, 1871.
111,281.—SALT CELLAR.—John T. Walker, Brooklyn, N. Y.
111,282.—MILLSTONE BALANCES.—John Walsh, Galena, Ill.
111,283.—BEE HIVE.—William Wambach, Indianapolis, Ind.
111,284.—NUTMEG GRATER.—Dewitt C. Warner, Chicago, Ill.
111,285.—ELEVATOR.—John Jacob Weber, St. Clair, Pa.
111,286.—LUBRICATOR FOR RAILWAY-CAR AXLES.—Isaac P. Wendell (assignor of one half his right to S. P. M. Tasker), Philadelphia, Pa.
111,287.—LUBRICATOR FOR RAILWAY-CAR AXLE-BOXES.—Isaac P. Wendell (assignor of one half his right to Stephen P. M. Tasker), Philadelphia, Pa.
111,288.—GAS-GENERATING AND BLAST-HEATING APPARATUS FOR METALLURGIC AND OTHER PURPOSES.—James D. Whelpley and J. J. Storer, Boston, Mass.
111,289.—BEE HIVE.—Asbury Wilkinson, Greensburg, assignor to himself and William T. Gibson, Indianapolis, Ind.
111,290.—FLOOR-BOLTING REEL.—Allison L. Williams, Orth, Ind.
111,291.—ROACH AND BUG TRAP.—Thomas Williams, Tompkinsville, N. Y.
111,292.—APPARATUS FOR MAKING ICE AND COOLING.—Franz Windhausen, Brunswick, Germany, assignor to Louis Schneider, C. T. Buddecke, and John A. Blaffer, of New Orleans, La.
111,293.—ICE MACHINE.—Franz Windhausen, Brunswick, Germany, assignor to Louis Schneider, C. T. Buddecke, and John A. Blaffer, New Orleans, La.
111,294.—CAR STARTER.—Finley J. Wright and Livingston W. Wandell, New York city. Antedated January 21, 1871.
111,295.—PAINT FOR SHIP'S BOTTOMS.—Isaac J. Wyman, New York city.

REISSUES.

4,237.—CONSTRUCTION OF ELECTRO-MAGNETS.—Henry M. Paine, Newark, N. J., assignor by mesne assignments to the Paine Electro-Magnetic Engine Company.—Patent No. 103,231, dated May 17, 1870.
4,238.—RAILWAY CAR TRUCK.—William Petit, Philadelphia, Pa.—Patent No. 38,980, dated June 23, 1863.
4,239.—COMPOUND TO INCREASE THE FRICTION BETWEEN BELTS AND PULLEYS.—Louis F. Robertson, New York city.—Patent No. 104,356, dated June 14, 1870.
4,240.—PASSENGER FARE BOX.—John B. Slawson, New York city.—Patent No. 17,899, dated July 28, 1857; reissue No. 550, dated May 4, 1858.
4,241.—RAILROAD-CAR SEAT AND COUCH.—Theodore T. Woodruff, Philadelphia, Pa.—Patent No. 16,159, dated December 2, 1856; reissue No. 1,439, dated March 17, 1863; extended seven years.

DESIGNS.

4,588.—HEATING STOVE.—Nicholas Brayer (assignor to "Equitable Co-operative Foundry Company)," Rochester, N. Y.
4,589 to 4,601.—CARPET PATTERN.—Jonathan Crabtree (assignor to Leedom, Shaw & Stewart), Philadelphia, Pa. Thirteen Patents
4,602 and 4,603.—BOX FOR TOPS OF BUREAUS.—Daniel A. Hall and David Garrison (assignors to Swan & Clark), Philadelphia, Pa. Two Patents.
4,604.—SEWING-MACHINE STAND.—Henry Loth, Philadelphia, Pa.
4,605.—FRAME OF SCHOOL DESKS.—Albert E. Roberts, Des Moines, Iowa.
4,606 to 4 609.—BOX FOR THE TOPS OF BUREAUS.—Baxter & Swan, Philadelphia, Pa. Four Patents.
4,610.—BED QUILT.—Francis C. Van Horn, Camden, N. J.
4,611.—COOKING STOVE.—Nicholas S. Vedder and Francis Ritchie, Troy assignors to Russell Wheeler, Utica, N. Y.
4,612.—FENCE CAP.—George W. Young, St. Louis, Mo.

TRADE MARKS.

143.—AVERILL CHEMICAL PAINT.—Averill Chemical Paint Company, New York city.
144.—CORN PLANTER.—James Selby & Co., Peoria, Ill.
145.—LUBRICATING OIL.—Warfield & Co., Rochester, N. Y.

Receipts—When money is paid at the offic for subscriptions, a receipt for it will be given; bu' when subscribers remit their money by mail, they may consider the arrival of the first paper a *bona-fide* acknowledgment of their funds.

City Subscribers.—The SCIENTIFIC AMERICAN will be delivered in every part of the city at \$3·50 a year. Single copies for sale at the News-stands in this city, Brooklyn, Jersey City, and Williamsburgh, and by most of the News Dealers in the United States.

Subscribers—Who wish to have their volumes bound, can send them to this office. The charge for binding is \$1·50 per volume. The amount should be remitted in advance, and the volumes will be sent as soon as they are bound.

Advertisements.

Advertisements will be admitted on this page at the rate of **\$1·00** *per line for each insertion. Engravings may head advertisements at the same rate per line, by measurement, as the letter-press.*

No
LIVE MECHANIC
Can afford to be without some of
BAIRD'S
BOOKS
FOR PRACTICAL MEN.

My new and enlarged Catalogue of PRACTICAL AND SCIENTIFIC BOOKS, 82 pages, 8vo., will be sent, free of postage, to any one who will favor me with his address.

HENRY CAREY BAIRD,
Industrial Publisher, 406 Walnut St.,
PHILADELPHIA.

HARDWOOD
Boards and Veneers.

Especial attention is called to our
HUNGARIAN ASH, FRENCH BLACK WALNUT, AMBONIE, THUYA, AND TULIP WOOD,
Just to hand and unusually choice.
Also on hand, our usual complete assortment of
PLANKS, BOARDS, AND VENEERS.
GEO. W. READ & CO.,
Nos. 168, 170 and 172 Center st., New York.
Factory, Nos. 291 Monroe st., and 398 Madison st.
Send for catalogue and price list.

FOR SALE.—A full collection of U. S. Cents from 1793. Also, Silver and Copper Coins, and a number of valuable autographs. Will be sold separately or all together. Address
FRANK KENNEDY, Hagerstown, Md.

Evidence Accumulates

THAT no Baking Powder can stand the test of a careful chemical analysis like DOOLEY'S YEAST POWDER. Although subjected to the most critical analyzation, no ingredients could be found entering into the composition but such as are perfectly pure and nutritious. This accounts for the entire and uniform satisfaction given by DOOLEY'S YEAST POWDER in the culinary department. It is the cheapest, best, and most reliable Baking Powder known, and is recommended upon its merits alone. Your Grocer keeps it.

FOR SALE CHEAP.

ONE 25 HORSE POWER BEAM STEAM ENGINE, in good order; also, BOILERS. For particulars apply to HENRY SEYMOUR & CO.,
52 Beekman st., New York.

PAGE'S
Patent Tanned Belting

Runs 25 per cent more machinery, is nearly twice as strong, and wears 50 per c. longer than any other. Send for circular containing price lists and discounts.
Page Brothers, Sole Manuf'rs, Franklin, N. H.

L. W. Pond---New Tools.
EXTRA HEAVY AND IMPROVED PATTERNS.

LATHES, PLANERS, DRILLS, of all sizes; Vertical Boring Mills, ten feet swing, and under; Milling Machines, Gear and Bolt Cutters; Hand Punches and Shears for Iron.
Office and Warerooms, 98 Liberty st., New York; Works at Worcester, Mass.
A. C. STEBBINS, New York, Agent.

Newspaper Advertising.

A Book of 125 closely printed pages, lately issued, contains a list of the best American Advertising Mediums giving the names, circulations, and full particulars concerning the leading Daily and Weekly Political and Family Newspapers, together with all those having large circulations, published in the interest of Religion, Agriculture, Literature, etc., etc. Every Advertiser, and every person who contemplates becoming such, will find this book of great value. Mailed free to any address on receipt of 25c.

GEO. P. ROWELL & CO.,
Publishers, No. 40 Park Row, New York.

The Pittsburgh (Pa.) Leader, in its issue of May 29, 1870, says:
"The firm of G. P. Rowell & Co., which issues this interesting and valuable book, is the largest and best Advertising Agency in the United States, and we can cheerfully recommend it to the attention of those who desire to advertise their business SCIENTIFICALLY and SYSTEMATICALLY in such a way: that is, so as to secure the largest amount of publicity for the least expenditure o money."

P. BLAISDELL & CO.,

BUILDERS OF A NEW PATTERN 12-in. Swing Lathe, designed for Sewing Machine Works, the "Blaisdell" Patent Drill Presses and other first-class Machinists' Tools Jackson street Worcester, Mass.

L. L. SMITH, 6 Howard st., New York.
Nickel Plater.

First Premium at the Fair of the American Institute, 1869. Licenses (under the Adams Patents), granted by the U. N. Co., 17 Warren st., New York.

Canadian Inventors,

Under the new Patent Law, can obtain patents on the same terms as citizens.
For full particulars address
MUNN & CO.,
37 Park Row, New York.

SCHLENKER'S PATENT
BOLT CUTTER
NEW INVENTION. ADDRESS,
HOWARD IRON WORKS, BUFFALO, N.Y.

PAT. SOLID EMERY WHEELS AND OIL STONES, for Brass and Iron Work, Saw Mills, and Edge Tools. Northampton Emery Wheel Co., Leeds, Mass.

McNAB & HARLAN, Manufacturers of Wrought Iron Pipe and Fittings, Brass Cocks, Valves, Gage Cocks, Whistles, Water Gages, and Oil Cups, Harlin's Patent Lubricator, Plumber's Brass Work, Getty's Patent Pipe Cutter, Getty's Patent Proving Pump and Gage. No. 86 John st., New York.

EMPLOYMENT.
\$250 A MONTH with Stencil Dies. Samples free. Address
S. M. SPENCER Brattleboro Vt.

THE
Tanite Emery Wheel.
Does not Glaze, Gum, Heat, or Smell. Address
THE TANITE CO.,
Stroudsburg, Monroe Co., Pa.

RUMPFF & LUTZ,

IMPORTERS and Manufacturers of Aniline Colors and Dyestuffs, Colors for Paperhangers and Stainers. Reliable recipes for Dyeing and Printing on Silk, Wool, and Cotton. All new improvements in the art of Dyeing, and new Colors are transmitted to us by our friends in Europe, as soon as they appear.
42 Beaver street, New York.

IRON PLANERS, ENGINE LATHES, Drills, and other Machinists' Tools, of superior quality, on hand, and finishing. For sale low. For Description and Price address NEW HAVEN MANUFACTURING CO New Haven, Conn.

FOR CIRCULAR OF TREMPER'S PATENT VARIABLE CUT-OFF, for high and low pressure Steam Engines, address
PUSEY, JONES & CO., Wilmington Delaware.

Trade-Mark Patents.

MUNN & CO. desire to call the attention of manufacturers and business men generally, to the importance of the law of patents, as applied to trade-marks for business purposes.

Any person, firm, or corporation, domiciled in the United States, or in any foreign country affording similar privileges to citizens of the United States, can obtain the right to the exclusive use, for THIRTY YEARS, of any TRADE-MARK, consisting of any new figure, or design, or any new word, or new combination of words, letters, or figures, upon their manufactures.

This protection extends to trade-marks already in use or any length of time, or about to be adopted.

Full information on this important subject can be obtained by addressing
MUNN & CO.
37 Park Row, New York.

UNION
Spoke Works.

SPOKES, RIMS, AND PLOW HANDLES. All goods warranted seasoned, and of the best quality. JOHN G. DAVIS & SON,
Southwest cor. of Leopard and Otter sts., Philadelphia.

IRON STEAMSHIP BUILDERS.
NEAFIE & LEVY,
PENN WORKS,
MARINE ENGINES, BOILERS, ETC.,
PHILADELPHIA, PA.

FOR CIRCULAR ILLUSTRATING A NEW and greatly improved TURBINE WHEEL, believed to be the best and cheapest in the market, apply to
PUSEY JONES & CO.,
Wilmington Delaware.

London..................48 Cannon street.
H. KOHNSTAMM,
MANUFACTURER OF
ULTRAMARINE,

And Importer of English, French, and German Colors, Paints, and Artists' Materials, Bronzes, and Metals. No. 100 Chambers st. bet. Broadway and Church st., N. Y.

SECOND-HAND ENGINES AND BOILERS for sale, 8 to 12 H. P. Address
C. A. DURFEY, Titusville, Pa.

WATER-PROOF
BUILDING PAPER

(No TAR), for Roofing, Sheathing, Ceilings, Oil-cloths, Shoe Stiffenings, Tags, Trunks, Cartridges, Blasting, Pass-book Covers, Grain and Flour Bins, etc., for sale by
HUNTER & POSTLEY,
Paper Warehouse, 59 Duane st., New York.

THE WOODWARD STEAM-PUMP MANUFACTURING COMPANY, Manufacturers of the Woodward Pat. Improved Safety Steam Pump and Fire Engine, Steam, Water, and Gas Fittings of all kinds. Also Dealers in Wrought-Iron Pipe, Boiler Tubes, etc. Hotels, Churches, Factories, & Public Buildings heated by Steam, Low Pressure. Woodward Building, 76 and 78 Center st., cor. of Worth st. (formerly of 77 Beekman st., N. Y. All parties are hereby cautioned against infringing the Pat. Right of the above Pump. G. M. WOODWARD, Pres't.

ENGINEERING, MANUFACTURING and BUILDING.—**\$8.00** a year will procure the three best industrial journals in the country, viz: THE TECHNOLOGIST, VAN NOSTRAND'S ENGINEERING MAGAZINE, and the SCIENTIFIC AMERICAN. For specimen copy (free) of THE TECHNOLOGIST, containing Club Rates, address THE INDUSTRIAL PUBLICATION CO.,
176 Broadway, N. Y.

THE THOMAS IRON WORKS, Worcester, Mass., are selling the handles Lathes and Drills in the market, cheap.

BUILDING PAPER
OF THREE GRADES.
SHEATHING BOARD,
For outside of Studding, under Clapboards. A non-conductor of cold, heat, and dampness.
PREPARED PLASTERING BOARD
a cheap and perfect substitute for lath and plaster; makes a smooth, substantial wall, at less than half the usual cost.
DOUBLE THICK ROOFING,
Made entirely of Wool Felt, a cheap and perfect article.
Sample and Circulars sent free, by
ROCK RIVER PAPER CO.,
Chicago; or,
B. E. HALE,
22 & 24 Frankfort street, N. Y.

DRILLS
DIAMOND POINTED
STEAM DRILLS.

FOR ALL KINDS OF ROCK DRILLING, Mining, Quarrying, Tunneling, Railroad Grading, Well Boring, Prospecting, etc. Fifty to Seventy-five per cent of cost and time of hand labor saved. "Test Cores," in form of solid cylinders of rock or mineral taken out of mines from any depth not exceeding one thousand feet, showing true value, stratification, etc. No percussion. Never require sharpening. FIRST PREMIUMS awarded in both America and Europe. Illustrated Circulars sent on application. Beware of Infringements.
SEVERANCE & HOLT,
Proprietors and Manufacturers,
Office 16 Wall st., New York.

Reynolds'
TURBINE WATER WHEELS.
The Oldest and Newest. All others, only imitations of each other in their strife after complications to confuse the public. We do not boast but quietly excel them all in staunch reliable, economical power. Beautiful pamphlet free. GEO. TALLCOT, 96 Liberty st., New York.
Gearing, Shafting.

BEST DAMPER REGULATOR for Steam Boiler. Send for Circulars. Agents Wanted. MURRILL & KEIZER, Baltimore, Md.

WIRE ROPE.
JOHN A. ROEBLING'S SONS,
MANUFACTURERS, TRENTON, N. J.

FOR Inclined Planes, Standing Ship Rigging, Bridges, Ferries, Stays, or Guys on Derricks & Cranes, Tiller Ropes, Sash Cords of Copper and Iron, Lightning Conductors of Copper. Special attention given to hoisting rope of all kinds for Mines and Elevators. Apply for circular, giving price and other information. Send for pamphlet on Transmission of Power by Wire Ropes. A large stock constantly on hand at New York Warehouse, No. 117 Liberty street.

American Saw Co., Manufacturers of

And Perforated Circular, Long, and Hand Saws. Also Solid Saws of all kinds. No. 1 Ferry st., cor. Gold street, New York. Branch Office for Pacific Coast, No. 606 Front street, San Francisco, Cal.

THE
Allen Engine Works.
THE ALLEN ENGINE.

Fourth avenue and 130th and 131st sts., New York city Manufacturers of
Porter's Governor,
The Allen Boiler, and
Standard Straight Edges, Surface Plates, and Angle Plates.
Four first premiums were awarded to us at the Fair of the American Institute, 1870.
Send for our illustrated circular.

PATENT COLD ROLLED SHAFTING.

The fact that this Shafting has 75 per cent greater strength, a finer finish, and is truer to gage, than any other in use, renders it undoubtedly the most economical. We are also the sole manufacturers of the CELEBRATED COLLINS PAT. COUPLING, and furnish Pulleys, Hangers, etc., of the most approved styles. Price Lists mailed on application to JONES & LAUGHLINS,
120 Water street, Pittsburgh, Pa.
☞ Stocks of this Shafting in store and for sale by FULLER, DANA & FITZ, Boston, Mass.
GEO. PLACE & CO., 126 Chambers street, N. Y.

Patents on Designs.

Citizens and aliens can now secure design patents for three and a half, seven, and fourteen years. The law on this subject is very liberal. Foreigners, designers, and manufacturers, who send goods to this country, may secure patents here upon their new patterns, and thus prevent other makers from selling similar goods in this market.

These patents cover all novelties of form or configuration of articles of manufacture.

For further information address
MUNN & CO.,
No. 37 Park Row, New York.

SAW MILLS.

MORRISON & HARMS' IMPROVED MULEY Saw Hangings are the best in the world.
MORRISON & HARMS, Allegheny City, Pa.

A. S. & J. GEAR & CO., Boston, furnish every description of Wood and Iron Working Machinery and Supplies. The best in use, regardless of maker, at lowest possible rates.

☞ T. V. Carpenter, Advertising Agent. Addres hereafter, Box 773, New York city.

Harrison *Safety Boiler.*

First-class Medal, World's Fair, London, 1862.
And American Institute Fair, New York, 1869.
Over 1,000 Boilers in Use.

Weston's Patent Differential
PULLEY BLOCKS.

75,000 IN USE.
Address
HARRISON BOILER WORKS,
Philadelphia, Pa.
or, **JOHN A. COLEMAN**, Agent,
110 Broadway, New York, and 139 Federal st., Boston.

DOYLE'S
PATENT DIFFERENTIAL
Pulley Blocks.

The celebrated **Doyle Blocks** have taken premiums over the differential Blocks of all other makers at every Fair where they have been exhibited at the same time. WHEN YOU BUY, SEE THAT THE BLOCKS ARE MARKED J. J. DOYLE. Pat. Jan. 8, 1861. All others are infringements.
SAMUEL HALL'S SON & CO.,
SOLE MANUFACTURERS.
229 West 10th street, New York.

HEAVY CASTINGS For Forge and Mill Work. The M. & T. SAULT CO. Steam Engine Builders & Founders, New Haven, Conn.

Swain Turbine.

"Our Low-Water Wheel from this on"

WILL DO TEN PER CENT MORE WORK on small streams, in a dry season, than any whee ever invented. Gave the best results, in every respect, at the Lowell Tests.
For Report of tests at Lowell, with Diagrams and Tables of Power, address
THE SWAIN TURBINE CO.,
North Chelmsford, Mass.

Working Models

And Experimental Machinery, Metal, or Wood, made to order, by J. F. WERNER 62 Center st. N.Y.

SELECTED Sperm Oil.—Warranted strictly Pure. For Sewing Machines and all fine machinery n bottles, cans, bbls., casks. W. F. Nye, New Bedford, Mass

WOOD'S HOUSEHOLD MAGAZINE contains in every number one complete prize story valued at \$100. Forty pages of other matter. Yearly \$1. Sold by news dealers at 10 cents per copy. Splendid Premiums. \$500 cash to be awarded for prize clubs. Specimen copy free. Address
S. S. WOOD, Newburgh, N. Y.

Machinists' Tools.
NILES TOOL WORKS,
CINCINNATI, OHIO,

HAVE ON HAND ENGINE LATHES, 14, 18, 22, and 26 inches swing; IRON PLANERS, BORING and TURNING MILLS, GRAY'S PAT. UNIVERSAL RADIAL DRILLING MACHINES, CAR-WHEEL BORERS, AXLE LATHES, and other first-class Iron Working Machinery, at moderate prices.

CELEBRATED
25° TO 29° GALENA OILS.
ENGINE, CAR and MACHINERY OILS.
☞ Petroleum reduced to a desired gravity by Whale Oil admits of no superior as a lubricator. All oils warranted as represented. GALENA OIL WORKS, Franklin, Pa. CHAS. MILLER, Manager. R. H. AUSTIN, Pres.

GRINDSTONES. FOUNDED IN 1810. J. E. MITCHELL, Philadelphia, Pa.

Scientific American
For 1871.
TWENTY-SIXTH YEAR.

EVERY NUMBER is printed on fine paper, and elegantly illustrated with original engravings, representing
New Inventions, Novelties in Mechanics, Manufactures, Chemistry, Photography, Architecture, Agriculture, Engineering, Science, and Art.

Farmers, Mechanics, Inventors, Engineers, Chemists, Manufacturers, and People of all Professions or Trades will find the
SCIENTIFIC AMERICAN
of great value and interest.

The Editors are assisted by many of the ablest American and European Writers, and having access to all the leading Scientific and Mechanical Journals of the world, the columns of the SCIENTIFIC AMERICAN are constantly enriched with the choicest Information.

An Official List of all the Patents Issued is published Weekly.

The Yearly Numbers of the SCIENTIFIC AMERICAN make two splendid Volumes of nearly ONE THOUSAND PAGES, equivalent in size to FOUR THOUSAND ordinary book pages.

SPECIMEN COPIES SENT FREE.

TERMS—\$3·00 a year, \$1·50 half year; Clubs of Ten Copies for one year, at \$2·50 each, \$25·00,

With a SPLENDID PREMIUM to the person who forms the Club, consisting of a copy of the celebrated Steel Plate Engraving, "Men of Progress."
Address
MUNN & CO.,
PUBLISHERS OF THE SCIENTIFIC AMERICAN.
37 Park Row, New York.

THE "Scientific American" is printed with CHAS. ENEU JOHNSON & CO.'S INK. Tenth and Lombard sts. Philadelphia, and 59 Gold st. New York