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THE ALBION BOILER.

This boiler consists of a shell, fifteen feet high and fifty-four inches in diameter, suspended vertically by four wrought iron brackets, placed equidistant near the top of the shell, and resting on the brick casing, inclosing the shell in a complete oven. The shell is invested on five eighths of its circumference with three lengths of outside circulating tubes of two inches diameter, the outer and inner rows of which run at an angle of about five degrees from the vertical line in one direction, while the tubes of the middle row cross them at the same angle in the opposite direction; these three systems of circulating tubes are respectively 13 feet 10 inches, 12 feet 10 inches, and 11 feet 10 inches in length, having 23 tubes in each set. In addition to these sixty-nine outside tubes, carrying the heated water from the bottom to the top of the boiler, there are seventy-five inside flues, of two and a half inches diameter, and of an average length of ten feet, running from the top of the boiler into a sheet which forms the top of the smoke box chamber, and carrying the products of combustion from the top of the oven, through the boiler, into the chimney, about five feet above the fire place.

Directly under the head of the boiler and top flue sheet are placed three inside tubes running across, and each connecting with two of the outside circulating tubes, which are perforated with small holes on the upper surface, so as to throw water against the underside of the head or top flue sheet, and upon the flues inside the boiler.

This construction will be readily followed in the annexed engravings, Figs. 1 and 2 showing the interior of the boiler in perspective and section, and Fig. 3, in plan.

The products of combustion rise up the outside of the shell, around the circulating tubes, then from the top of the oven descend through the flues inside the boiler, to the smoke box chamber, and thence rise up along one fourth of the outside of the shell to the stack immediately above it, the draft in which is regulated by a self-acting damper.

The water is carried about four and a half feet below the top of the boiler, and the interposition of the smoke box chamber compels the rapid circulation of the heated water through the outside tubes, which inject it against the head of the boiler and the flues inside, which, to some extent, superheat the steam, as the products of combustion are practically exhausted before entering the chimney. The total amount of heating surface is 1,150 square feet.

On May 29, 1873, Mr. H. Robinson, steam engineer, of Boston, made a careful trial at the Albion Print Works, Conshohocken, Pa., of twelve hours evaporation with this boiler, which, with feed water at 75° Fah. and steam at 53 pounds pressure, we are informed, resulted in the actual evaporation of 10,231 pounds of water for each pound of combustible. Compared with other experiments, where the water is taken at 212° Fah. and evaporated at 212°, the result of the Albion boiler is equal to 11,937 pounds of water from and at 212° Fah. for each pound of combustible consumed. This trial was made with a clean grate, the fire having been extinguished several hours, and a fresh fire started.

On the 17th June, 1873, a second trial was made by Mr. W. Barnett Le Van, of Philadelphia, assisted by Mr. H. S. Robinson; this was the trial of the Albion boiler in actual practi-

cal work, and was continued for eight hours, including the dinner hour, when the works were stopped. The fire was taken at a certain thickness, and at the termination of the trial was left in the same condition as at the commencement. This second trial showed as an actual working result the evaporation of 9,585 pounds of water, at 78° Fah., by one pound of coal consumed, being equal to the evaporation of 11,195 pounds of water from and at 212° Fah., for each pound

as the works were stopped and much heat was lost up the chimney; and this test being intended for practical daily work, the flues had not been specially cleaned out. It shows nevertheless a very large evaporation per square foot of heating surface and per pound of fuel consumed.

This boiler, we learn, has been in satisfactory operation at the Albion Print Works for upwards of three years. Four boilers are in use at that establishment. The circulation is claimed to be as nearly perfect as possible while the space occupied is small, and the method of exhausting the heat compact and complete. The boilers, it is also stated, have always been entirely free from scale, and kept in order without expense.

For further information as to terms and price, apply to J. Eberhardt, agent, Albion Print Works, Conshohocken, Montgomery county, Pa.

Development of Heat by Friction of Liquids against Solids.

The energetic absorption of a liquid by a porous body is accompanied by an elevation of temperature, probably resulting from the friction of the liquid against the interior of the capillary canals against which it passes. M. Maschke gives, in *Les Mondes*, numerous measures of this increased temperature, obtained by causing amorphous silica to absorb various liquids. Among the cases considered were: Amorphous silica first wet and then dried at a moderate temperature so as to contain no more than 29.8 per cent of water, treated with water; silica at 18 per cent water, with water; silica dried, with water; silica calcined, then exposed to moist air (22.68 per cent H₂O), with water; silica calcined, then exposed to very humid air (28.24 per cent H₂O), with water; silica calcined and cooled with sulphuric acid, treated sometimes with water, or benzine, almond oil, concentrated sulphuric acid, or alcohol. The experiments lasted

each from 10 to 45 minutes, the thermometers, suitably arranged, showing the increase of temperature at their close. The investigator operated at a normal temperature of about 60° Fah. The elevation observed varied in the majority of cases from 1.8° to 14.4° Fah. In calcined and dry silica, treated with concentrated sulphuric acid, the thermometer rose from 63° to 92.6°. In one part of calcined silica mixed with 3.2 parts of alcohol, the increase was from 53.4° to 78.8°. Quartz or powdered glass, treated in the same manner as the silica, gave no appreciable increase of heat.

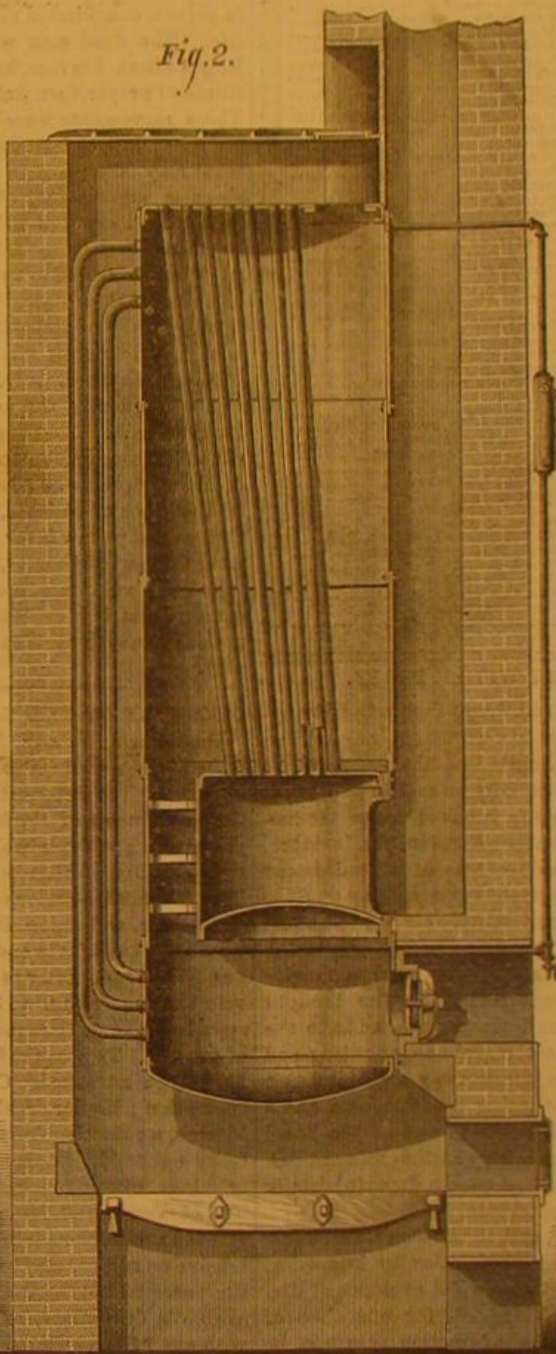
A MASS CONVENTION OF MILLERS.—The first annual meeting of the Millers' National Association is to be held at St. Louis, Mo., on June 3rd. All persons interested in the milling business are invited to attend. A large attendance is expected; and by the interchange of opinions, addresses, etc., much valuable practical information will doubtless be elicited.

PRESERVING WOODEN TAPS FOR CASKS.—The articles should be plunged in paraffin heated to about 248° Fah. until no air bubbles rise to the surface of the melted material. They are then allowed to cool, and the paraffin is removed from the surface, when nearly congealed, by thorough rubbing. Taps thus treated, it is said, will never split or become impregnated with the liquid, and may be used in casks containing alcoholic liquors.

Fig. 1.



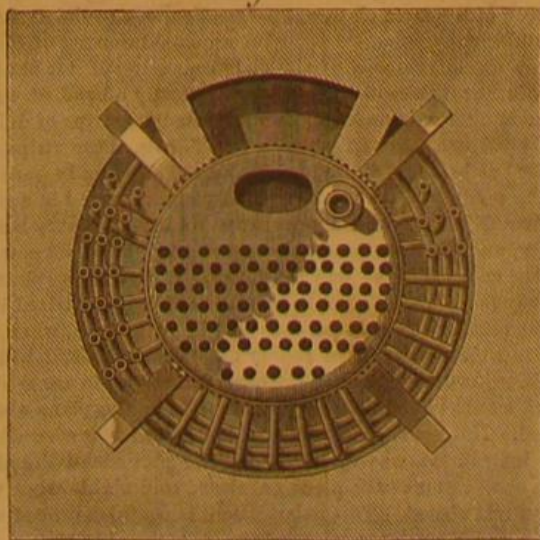
Fig. 2.



THE ALBION BOILER.

of combustible consumed, being about six per cent less than on the former occasion, no doubt due to the fact that the interruption of the dinner hour occasioned a very material loss,

Fig. 3.



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MUSCULAR MOVEMENT WITHOUT LIFE.

"We find no motion in the dead," says the first of Tennyson's "Two Voices," clinching his argument as with an axiom. The converse of the proposition, that where there is motion there must be life, is equally an article of popular belief. Especially is conscious life inferred when the motion imitates voluntary movements. A coffin, for instance, is opened for a last look at the features of a dead friend before the remains are removed from the receiving vault to the grave, and the body is found completely turned over; or the hands, no longer crossed upon the breast, expressing "long disquiet merged in rest," are so displaced as to give unmistakable proof of continued motion. The thought that life must have directed such movements adds to the pangs of bereavement the keenest regret and anguish; and too frequently the mourner has borne away a self-inflicted brand of Cain. The idea of returning consciousness and a second death within the coffin in consequence of too hasty burial is too horrible to contemplate; and the faintest suspicion that one has been the cause of such a dreadful fate to another is full of unutterable bitterness.

To those afflicted in this way, and those who fear such a fate for themselves, it must be a consolation to know that muscular movements are by no means valid evidence of life. We do find motion in the dead. Indeed, for one class of muscular actions, at least, arrest of motion seems to be rather an accidental than a necessary attendant of death.

The persistence of motion in decapitated snakes, turtles, and other low forms of life is familiar to every one. It is commonly explained by the relatively large nervous ganglia, independent of the brain, of such creatures. But it appears that many if not all muscles may contract without that stimulus of nervous action, with which alone we associate the possibility of conscious life. A striking illustration is given by Dr. Brown-Séguard in the case of two decapitated men. The arms were cut off; and for thirteen or fourteen hours, their muscles contracted in response to irritation by galvanism or mechanical stimulants. After that length of time, all signs of life had disappeared. He then injected the blood of a man into one of the arms and the blood of a dog into another. Local life was restored in both; the muscles became irritable, and the strength of contraction, extremely powerful. In the arm in which human blood had been injected, the contraction was stronger than during life; yet the nerves remained quite dead.

On another occasion the same observer kept the eye of an eel, removed from the body, at a temperature of about 36° to 40° Fah., for a period of sixteen days. By that time the eye was in almost complete putrefaction, yet the iris contracted when exposed to light. Nervous action was impossible, and muscular fibers themselves were considerably altered; yet they acted.

It is in connection with the rhythmical movements of the heart and other organs, however, that the most striking proofs of muscular action independent of the nerve centers, are found. The diaphragm, for example, may be separated com-

pletely from the spinal chord without interruption of its rhythmic action. Similarly the heart of a dog has continued to beat for forty-eight hours after its removal from the animal, and there is recorded the case of a man at Rouen whose heart was found to beat for thirty-six hours after the death of the body by decapitation. "I dare say," observes Dr. Brown-Séguard, "that the great cause why we see those organs stop at death so quickly is that the phenomena of arrest of their activity have taken place at the time of death," the phenomena of arrest, we may add, being quite independent of the cessation of life. Other observers have demonstrated the rhythmic action of numerous other organs in man and the lower animals: motions that persist after, not death merely, but the entire separation of the parts from the rest of the body. Indeed Dr. Brown-Séguard claims to have found that rhythmical motion is a common property of all contractile tissues, but one which shows itself only under certain conditions, different from the ordinary circumstances of life.

Still more remarkable is the fact that motions closely mimicking voluntary movements can go on in the absence of conscious life.

Dr. Séguard mentions a case in which he was called to see a man who was thoroughly dead of cholera, yet who persisted in certain complicated movements distressingly suggestive of life. The dead man would lift up his two arms at full length above his face, knit the fingers together as in the attitude of prayer, then drop the arms again and separate them. These movements were repeated many times, with decreasing force, until at last they ceased. To persons not knowing what may take place in the human body after death, these singular movements, observes the Doctor, must certainly have looked as if the will power had been directing them. In fact the family and friends all thought the dead man alive, and many tests had to be applied to convince them that death had really taken place.

It is worthy of notice in this connection that it is generally with the victims of cholera and other sudden and violent diseases that *post mortem* movements are most common, and consequently the suspicion of premature burial most likely to arise. That such movements are wholly independent of life was demonstrated beyond a doubt by Dr. Dowler, of New Orleans, who adapted the heroic expedient of cutting off the limbs of patients, dead beyond hope of recovery from cholera and yellow fever. Notwithstanding their separations from the nervous center, the amputated limbs continued their seemingly voluntary movements. Whatever may have caused them, it is evident that these imitations of life were not due to anything that could be associated with consciousness.

DISCOVERY OF THE CAUSE OF THE ZODIACAL LIGHT.

Professor Arthur W. Wright, of Yale College, communicates to the *American Journal of Science and Arts* a valuable paper on "The Polarization of the Zodiacal Light," in which the experiments of the investigator are detailed, and results given which will probably set at rest the moot question as to the nature of that celestial phenomenon. The zodiacal light is a faint nebulous radiance, which, at certain seasons of the year, and especially within the tropics, is seen at the west after twilight is ended, or in the east before it has begun. The luminosity is conical in shape, the breadth of the base varying from 8° to 30° in angular magnitude, and the apex being sometimes more than 90° in rear of or in advance of the sun. To account for this appearance, several theories have been advanced. Cassini believed it a lenticular solar emanation; Kepler considered it the sun's atmosphere, and Maeran, a reflection from the latter stretched out into a flattened spheroid. Laplace declared the phenomenon to be a nebulous, rotating ring, situated somewhere between the orbits of Venus and Mercury; and Chaplain Jones, U.S.N., whose examinations into the subject have been the most extensive on record, also believed it a nebulous ring, but continuous, and not located as stated by Laplace. Professor Wright's deductions, as will be seen, fail to agree exactly with any of these views.

But few attempts, it appears, have ever been made to determine whether or not any portion of the light is polarized, and up to the present time, knowledge on the subject has been uncertain and contradictory, pointing either to the idea that the rays are not polarized at all, or that the proportion of polarized light is so small as to render it nearly impossible to be detected. Professor Wright, becoming convinced that the difficulty should be ascribed to the imperfections of the instruments employed, constructed a new apparatus, consisting of a quartz plate, cut perpendicularly to the axis and exhibiting, by polarized light, an unusual intensity of color. It is a macle, the body of the plate consisting of left handed quartz, through which passes eccentrically a band of right handed quartz, bounded by two intermediate strips of different structure. Placed between two Nicols, these strips appeared as bands of color, upon dark or light ground according to the turning of the prisms. This plate, mounted in a tube with a Nicol, formed a polariscope of extraordinary sensibility, and the first favorable opportunity to test its powers on the zodiacal light was improved. It was almost immediately found to indicate the existence of light polarized in a plane passing through the sun; and in no instance, when the sky was clear enough to render the bands visible, did their position, as determined by the observation, fail to agree with what would be required by polarization in the plane above noted. Not the slightest trace of bands was ever seen when the instrument was directed to other portions of the sky. The observations took place on clear, cold nights when the moon was absent. The polarization, it was also proved, did not arise from faint vestiges of twilight, the reflection of the

zodiacal light itself in the atmosphere, or from impurities in the latter.

Further experimenting was at once proceeded with to determine the percentage of light polarized, and it gave, as the mean of numerous determinations, the angle 36° 6' corresponding to a proportion of 16 per cent; 15 per cent, Professor Wright thinks, may be safely taken as the true value.

The fact of polarization implies that the light is reflected, either wholly or in part, and is thus derived originally from the sun. No bright lines were found in the spectrum, nor could any connection be traced between the zodiacal light and the polar aurora. This is important, as excluding from the possible causes of the light the luminosity of gaseous matter, either spontaneous or due to electrical discharge. Further, it cannot be supposed that the light is reflected from masses of gas or from globules of precipitated vapor, as the latter, in empty space, must evaporate, and the former expand to too low a density to produce any effect on the rays of light. Hence, Professor Wright concludes that the light is reflected from matter in the solid state, from innumerable small bodies revolving about the sun in orbits, of which more lie in the neighborhood of the ecliptic than near any other plane passing through the sun. These meteorites, which are in all probability similar in character to those which fall upon the earth, must be either metallic bodies or stony masses. If we accept Zöllner's conclusion, that the gases of the atmosphere must extend through the solar system, though in an extremely tenuous condition in space, the oxidation of metallic meteoroids would be merely a question of time. They would thus become capable of rendering polarized the light reflected from the plane, and the same effect would be produced by those of stony character. In order to ascertain whether the proportion of polarized light, actually observed, approached in any degree what might be expected from stony or earthy masses of a semi-crystalline character, with a granular structure and surfaces more or less rough, a large number of substances were submitted to examination with a polarimeter; and the results showed that, from surfaces of this nature, the light reflected has in general but a low depth of polarization, not greatly different in average from that of the zodiacal light.

The nature of the phenomenon, as discovered by Professor Wright, may therefore be summarized as follows: It is polarized in a plane passing through the sun, to the amount of about 15 per cent. The spectrum is the same as that of sunlight, except in intensity. Its light is derived from the sun reflected on solid matter, which consists of small bodies revolving about the sun in orbits crowded together toward the ecliptic.

A PROPOSED TESTING LABORATORY.

Professor R. H. Thurston, of the Stevens Institute, has suggested a really excellent idea, which will be of great benefit to the entire country. He proposes, in a letter to the trustees of the above named college, a copy of which we have recently received, to establish a department "to be devoted especially to experimental investigations having a direct and practical bearing upon questions arising in the course of regular business." That is, a testing laboratory is to be organized, to which manufacturers, for instance, may send material which they propose to purchase, and have its value, properties, etc., carefully determined; and where officers of railroads may obtain dynamometric determination of the resistance of trains, efficiency of locomotives, and value of fuel and lubricants; and where iron and steel makers may find a recognized authority which will afford them full and accurate knowledge regarding the chemical constitution, physical structure, etc., of their products. These are but a few of the very manifest uses for which such an establishment could be employed by the business community with the greatest benefit, and we doubt not but that the reader will be able from his individual experience to suggest many others.

It is designed to comprise the most powerful testing machines, the most delicate instruments, and the best forms of apparatus, to be under the direct control of a very able body of scientists. Professor Thurston himself, we notice, volunteers to assume the direction, and to carry out the details of the organization. This is decidedly a case of the right man in the right place, and the trustees of the Stevens Institute, in their ready acceptance of Professor Thurston's views and offers, evidently are impressed with the same belief.

These gentlemen, in their reply, promise to accord all necessary space, and to render every assistance in their power. As the originator of the scheme says that there will be no difficulty in securing sufficient capital, from business men to be benefited by it, to purchase the necessary outfit, or even to create such an endowment as would insure the independent support of the laboratory, we may regard the enterprise as an accomplished fact, requiring only the time necessary for its practical establishment to place the community in full possession of its advantages.

HON. DAVID A. WELLS AND THE FRENCH INSTITUTE.

We notice with much gratification the elevation of Hon. David A. Wells to the vacancy in the list of foreign associates of the French Institute, caused by the death of John Stuart Mill. Membership in the Institute is regarded throughout Europe as one of the highest distinctions to be labored for by literary and scientific men, and only a very limited number of persons, who must have become distinguished in science, literature, or art, are admitted to its councils. The honor, in the present instance, is enhanced by the fact of Mr. Wells being chosen as the peer of the great thinker lately deceased; and that it is a well merited one, need not be told to the many who are familiar with his learned and able writ-

ings. The latter have long been held in the greatest esteem by the first political economists in France and England. Of his reports on local taxation, to the legislature of this State, one hundred thousand have been printed in England and distributed throughout Europe. Soon after the German war, the French legislature caused Mr. Wells' report on taxation of 1869 and his New York report of 1870 to be translated and printed as public documents.

FROM CHAOS TO CORAL.

Many of our readers doubtless have noted, perhaps during the study of experimental chemistry, that silver when melted and afterward allowed to solidify in an earthen crucible will, as it cools, assume a brisk effervescence. The mass bubbles and swells; small particles are thrown out of the pot, and, in fact, a miniature volcanic eruption is reproduced: to complete the resemblance to which, the silver, when solid, appears covered with little cones pierced at the center, simulating the form of volcanoes. This phenomenon, however, we can easily account for from the knowledge that gases are absorbed not only by liquids at the ordinary temperature, but by melted bodies. The silver absorbs oxygen, which it abandons on cooling; the more sudden the latter, the greater the disengagement of the gas; while, on the other hand, if the metal be allowed to get cold slowly, the oxygen escapes insensibly and hardly disturbs the surface. Melted litharge also absorbs oxygen, and similarly abandons it. A like absorption takes place in the combustible gases which are found in the furnaces for melting metals, and recent investigations in France have proved that cast iron after cooling retains a notable quantity of gas, especially of carbonic oxide and hydrogen.

While, however, totally melted bodies absorb gases and reject them at the moment of cooling, the same bodies, when simply softened by the action of heat (though absorbing gases as before), retain the gases after becoming cool, and give them off slowly under the influence of a new elevation of temperature and of an almost perfect vacuum. These facts are not only very curious, but are of considerable importance from a geological point of view.

Volcanoes, it is known, when in eruption emit various gases: first hydrochloric acid, sulphuric acid, and hydrosulphuric acid; later, the carburetted hydrogens predominate; and finally appears a disengagement of carbonic acid, which lasts for centuries. The volcanoes of Auvergne, in France, have been extinct for thousands of years, and yet springs charged with carbonic acid are abundant in the vicinity. There are other well known instances, such as the celebrated Dog Grotto, near Naples, so called from the practice of lowering unhappy dogs into its depths to see them overcome by the deleterious gas, and the *Guevo Upas* or poisonous valley of Java, where the atmosphere is so deadly that the soil is said to be covered with the bones of animals and of men who have died from its effects: in both of which the discharge of gas has existed from time immemorial. Humboldt counted 407 volcanoes on the earth, of which 235 only were active. This latter number has since been increased to 270, of which 190 are on the islands or shores of the Pacific. The majority of volcanoes are situated near the great fracture which extends along the coast of the American continents, and is prolonged to Kamschatka, to Japan, and as far as Java and Sumatra; others are located in New Zealand, New Britain, the New Hebrides, New Caledonia, and, in the antarctic regions, Mounts Erebus and Terror. The quantity of carbonic acid disengaged by these vast furnaces is enormous. Boussingault estimates it at 95 per cent of their entire gaseous emission, and this has been verified by Bunsen in investigations upon the emission of Mount Hecla. Here then is an immense and apparently inexhaustible series of reservoirs, which forms the source of a large amount of the carbonic acid in the world. It remains to examine how this supply was generated, and the theory which has been proposed is readily followed.

When the earth cooled down from its molten state, the various substances, which were maintained separate by the excessive temperature, became united according to their respective affinities: hydrogen and oxygen formed water; oxygen and carbon, carbonic acid; chlorine and sodium, sea salt, and so on. The incandescent rocks, however, while still liquid, found themselves in contact with a dense atmosphere containing various gases, which they absorbed in exactly the same manner as we have stated the silver and litharge to act as regards oxygen, and iron, in reference to carbonic oxide and hydrogen. Further, it was possible that these rocks should become charged in a greater degree with carbonic acid than with other gases existing in the atmosphere, through the action of a relative affinity, just as the melted silver absorbs oxygen instead of nitrogen, though both are present in the same atmosphere. As commotions on the surface of the globe were frequent in its transition state, the rocks were perpetually changing places. Vast masses would be engulfed, to be replaced by others rising from the depths, and so an incredible quantity of carbonic acid became occluded in their substance. As these rocks solidified, the carbonic acid slowly escaped; and if, as is proved, with reasonable probability, there still exists in the interior of our globe an incandescent mass which is constantly cooling, here then is the source of the disengagement of the gas which, escaping through the volcanic apertures, mingles with our atmosphere.

It is curious, in thus tracing the part which the extinct volcanoes play in the economy of our globe, to note how perfectly the migration, which the carbonic acid that they evolve may assume, illustrates the truth of the indestructibility of matter. First found in the primitive atmosphere of our earth, it became absorbed by the incandescent rocks, and re-

mains buried in their depths for thousands of years. Little by little, however, as its captors become colder, it makes its way from its subterranean prison, and escapes into our atmosphere. Its liberty is, however, of short duration, for the rain again seizes it and carries it perhaps to the rivers, and the latter to the sea. From the water it is wrested by lime to form a carbonate, which minute animalcules—the coral insects, working tirelessly century after century—build first into a reef and then into an island, forming perhaps the nucleus of a new continent, to be completed in the ages far in the future.

ART AMONG THE ASHANTEES.

The thousand ounces of gold gathered in such haste by King Koffee, as the first instalment of the indemnity demanded by his English conquerors, furnish many curious and striking illustrations of the artistic development of the native goldsmiths. Their skill in working gold—which appears to be the most common metal of the country—seems, indeed, to be fully equal to that of the best European artists, while their fertility in invention is simply wonderful.

Among the larger articles brought away by the English is a human head of massive gold, nearly five pounds in weight: a ghastly object, apparently representing the head of a victim gagged for sacrifice. Of a more pleasing character, and more to be preferred as works of art, are two heavy golden griffins, said to have been broken from the King's chair of state. There are besides, many badges of office of different styles, some of them massive fibulae of wrought gold, like those worn by the heralds sent by King Koffee to treat with the English commander, others of various patterns according to the office of the wearer. That of the King's chamberlain, for example, is distinguished by padlock and keys; the butler's, by cups and bowls, all of solid metal, and, for the most part, castings of exquisite design.

In addition to these great badges, each of which contains many ounces of pure gold, there are fetish caps ornamented with gold in *repoussé* work, the golden tops of umbrellas and sticks of office, grotesque lions for the heads of scepters, golden jaw bones, thigh bones, and skulls, a large sacrificial knife with a golden handle, and many indescribable objects which doubtless served their purpose in the fantastic ceremonies of fetish worship.

Smaller in size but not inferior in workmanship is an infinite number and variety of objects of native design, besides numerous imitations of the gold work of other nations and ages: bracelets, some so heavy as to be a burden, others of exceeding lightness and delicacy: necklaces, chains, pendants, brooches, and rings of curious yet beautiful shape.

The imitated articles give a striking indication of the skill with which the native workmen copy everything that comes to them from the outer world. Thus there are golden padlocks, buckles, bells, and even watch keys, whose use must have been unknown. Not the least curious are several copies of reliquaries, left, perhaps, by Roman Catholic missionaries in that benighted land, and reproduced in gold by the native workmen, with a faithfulness and delicacy which a Chinese might envy. Among the brooches, pendants, badges, rings, and so on, there are forms which are almost facsimiles of early Indian ornaments; others approach Egyptian styles: still others, Scandinavian and Anglo-Saxon types. The whole world, in fact, has been laid under tribute and the relics hoarded in this out-of-the-way region.

Some of the articles are quite new, and still have clinging to them the fine red loam in which they were cast. Others are old and worn, and bear traces of frequent patchings and solderings. One of the most remarkable of the ancient pieces is a finely chased seal ring, the signet being made of an ancient Coptic coin. Two other rings were evidently copied from early English betrothal rings. Some of the necklaces and chains are formed of beautiful shells reproduced in gold, while others represent seeds and fruit. In every case, the design is individual and the beauty of the workmanship refreshing to see, in contrast with the machine-made jewelry worn by modern civilized belles.

The most noteworthy object in silver brought from Ashantee is an enormous belt or baldrick, to be hung over the neck by a massive chain, crossing the breast diagonally. From the belt depend seven or eight silver sheaths for knives, the use of which it is not difficult to imagine.

BURIAL IN THE SEA.

The disposition of our dead is a problem so important that any contribution towards its solution should be welcomed. Ordinary inhumation is manifestly objectionable on sanitary grounds. The pollution of the air we breathe and the water we drink is enough to condemn the practice in densely populated countries. The Italian suggestion of casting the bodies into one common charnel house, hastening decomposition by caustic alkalis, is repulsive; the mingling of the good and the bad, the rich and the poor, offends our moral and social tastes; and then too we fear some one in this utilitarian age would propose, and some agricultural legislature carry out, the idea of using the compost as a fertilizer. The best modification of separate burials in the earth is the use of hydrated oxide of iron to assist the destruction of the body; but even this is not entirely free from the hygienist's objections. In spite of the utmost precautions (which in practice would seldom be carried out), the air and water would be more or less contaminated. The pagan plan of cremation has something in its favor, but much against it. The establishment of furnaces for the conversion of our departed friends into gases and ashes is too infernal to be

popular; and we are not so sure that the atmosphere would be any the better for breathing or smelling, should the practice become general.

To those who object to earth burial for the sake of the living, and to the roasting process on other grounds, we now propose a third method, which certainly has the merit of escaping the disadvantages of the other two. We mean burial in the deep sea, which, for the want of a better word, we will call thalattaphy. Let a steamer for the purpose—a floating hearse—transport the dead at least a hundred miles from land and commit them to the depths. The coffin, whether of metal or wood, should be perforated with small holes and weighted. Is any one shocked? We doubt if he can tell why. Banish the idea of sharks; they belong to the coast. The deep sea fauna is made up of low and harmless forms of life—sponges, rhizopods, diminutive molluscs, and the like. The dead would never pollute anything of which the living partake. Do you prefer to commit the relics of your departed friends to their "kindred elements"? It is far more appropriate to lay them in the bosom of the ocean than to inter them in the land—dust with dust; for the average man consists of 88 lbs. of water to 66 of solid matter. Nor need any one be troubled about the resurrection; for we are assured that "the sea shall give up its dead." We say then, especially to the great maritime cities like New York and Boston, London and Liverpool, away with patent furnaces and crowded cemeteries, and find rest in the unlimited burial place which Nature has provided. J. O.

REGULATING THE SPEED OF AN ENGINE.

We have received a neat little pamphlet* from the J. C. Hoadley Company, of Lawrence, Mass., giving the results of experiments in regulating the speed of an engine, first by means of a variable cut-off, second, by throttling the steam, controlling mechanism being actuated in each case by the governor. It is scarcely necessary to say that the results are largely in favor of the variable cut-off. It is easy to understand why this should be so.

When a cut-off is employed, steam of nearly the boiler pressure is admitted to the cylinder; and the admission valve being closed before the piston has completed its stroke, only a portion of a cylinder full of steam is used. On the other hand, when the steam is throttled, its pressure is reduced before admission, and a cylinder full of steam is required. In the pamphlet referred to, quite a number of comparisons are given, and statements are made in regard to the amount of coal and water required for horse power per hour in each case. There is no account of the manner in which the experiments were conducted, nor is it stated whether they were made by members of the company or by disinterested experts, both of which facts will tend to lessen their value, in the opinion of many. There is little doubt, however, of the truth of the principal statement, that under ordinary circumstances an engine with a variable cut-off will be more economical than one in which the valve is arranged to cut off at a fixed point, all regulation being effected by throttling the steam.

THE MAGNETIC EQUIVALENT OF HEAT.

There has recently been devised, by M. Cazin, in France, a thermomagnetic differential apparatus, by means of which, it is stated, the absolute quantity of heat engendered by magnetism may be measured; in other words, the magnetic equivalent of heat may by its aid be determined. The investigator, after observing the thermic effects of magnetism on the core of a rectilinear electromagnet, around which the wire is rolled in alternately opposite directions, so as to produce several poles, enunciates the following law: "When the alternate spirals, constructed by the wire, have the same dimensions, and when they divide the magnet into several equal portions (*concamerations*), the quantities of heat created in the iron core at the opening of the voltaic circuit are inversely proportional to the squares of the number of divisions, the other circumstances not changing." For example, four similar bobbins are disposed around a cylindrical iron tube at equal distances apart, the tube extending a short length beyond the outer coils. In establishing the communications, there is obtained, with the same total length of wire and the same total number of points, one, two, or four divisions: the quantities of heat decrease as the numbers, $\frac{1}{16}$.

In order to measure this heat, M. Cazin has constructed a kind of differential air thermometer, in which air reservoirs are used. Two or three thousand interruptions of the electric current produce, with an ordinary battery, a calorific effect very plainly measurable. By dividing the pressure observed by the number of interruptions, and making a small correction analogous to that employed in calorimetry in taking account of the cooling action of adjacent bodies, the thermic effect of the magnetism is obtained.

RECENT BOILER EXPLOSION.—A correspondent in Lexington, Ky., sends us an account of a boiler explosion in that place. Considerable damage was done to the building in which the boiler was situated, and two horses were killed. The boiler was quite old, and the steam gage was very defective, according to our correspondent's statement; so it seems quite probable that the explosion occurred from excessive pressure. A steam gage that shows 45 pounds pressure, when the actual pressure is 100 pounds per square inch, with a so-called safety valve to correspond, and a careless and ignorant man in charge of the boiler, offer very favorable conditions for an explosion.

*Comparative Economy of Regulation, by Variable Cut-Off and by Throttling Valve, as Exemplified by Indicator Diagrams from engines built by the J. C. Hoadley Company, Lawrence, Mass.

DEVICE FOR PREVENTING HORSES FROM CRIBBING.

Cribbing by horses is a peculiar habit, or perhaps disease, which seemingly impels the animal to gnaw its manger, seize hold of objects with its teeth, and, by the action of the larynx, to suck in air until a very uncomfortable as well as unsightly condition is the result. In the invention represented in our engraving, Mr. A. Stillwell, of Dwaar's Kill, N. Y., supplies a mechanical arrangement which, he considers, will prevent the difficulty.

The device is suitably secured to the headstall by a metallic strap, A, on which are formed arms, B and C, at right angles. With the latter connects a bent lever, D, the inner end of which, terminating just forward of the larynx of the animal, is provided with a number of sharp spurs. Attached



to this lever are curved bars, E, the inner extremities of which extend to the same point, and have semicircular flanges which, rising above the spurs, prevent the latter from pricking the horse so long as the animal remains quiet. The moment, however, the cribbing action distends the larynx, the latter, expanding, presses upon a cross, F, which, being pivoted to the curved bar, E, and also to the arm, C, pulls on the short arm of the lever, D, thus lifting the points, which punish the horse until he desists. The machine is made of iron or other suitable material, and weighs some six ounces.

Hints for the Care of Horses.

At a recent meeting of the Farmers' Club of the American Institute in this city, Mr. G. W. Johnston read a paper on "The Horse," in which we find a number of valuable hints regarding the management and care of that most useful of our dumb servants. With reference to balking, the speaker said that horses frequently resist because they fail to understand what is required of them; or it may occur from overloading sore shoulders, or being worked until exhausted. The latter is especially the case in young animals. The vice can only be corrected by kindness and gentle treatment, and it is recommended, when the horse attempts it, to jump out of the wagon, and pat and reassure him by a kind word, carefully examine the harness, and then get in again as if expecting him to go. This will generally prove effectual.

Mr. Johnston says that the French are the best authorities on the dieting of horses, and that they hold that, under all circumstances in the giving of food, age and condition should be taken into consideration. Small fodder is better than hay for old horses, as it is more easily masticated and swallowed. When a horse is working hard, his main food should be oats. If he works but little, hay alone will answer. For a saddle or a light carriage horse, half a peck of good oats and thirteen pounds of hay are sufficient. The hay should be wet with salt water—a teaspoonful of salt to a bucket of water. Oats possess more nutritious matter for making flesh than any other kind of food; but a small quantity of mown grass should always be given in the spring to horses not kept in the pasture. A horse should have river water rather than well or spring water, as the latter is cold and hard, while the former is sweet and comparatively warm. One bucket morning and night, or, what is better, a half bucket at four different times a day, is the proper quantity. If a horse refuses food after drinking, he should be allowed to rest, as the refusal is always evidence of exhaustion.

The stable should always be well drained and sufficiently lighted, because the vapors from a damp, putrid floor, and the sudden change from darkness to light, will almost certainly cause blindness. Let proper openings be made, just under the ceiling, to permit the hot foul air to escape, and free ventilation be allowed, at the bottom of the walls, to admit fresh air, for impure and confined air causes broken wind. The fresh air should enter through a number of

small holes, rather than through large ones, such as an open window, as there is less danger from drafts, which cause chills and colds. The temperature of a stable should not be over seventy degrees in summer, nor under forty-five degrees in winter. Extremes of heat or cold are equally bad. Use a hot, close, and foul stable if you wish to kill your horse. By such means glanders, inflammation, incurable cough, or disease of the lungs is sure to follow. Another very important matter for consideration of the farmer is

THE MANNER OF SHOEING HORSES.

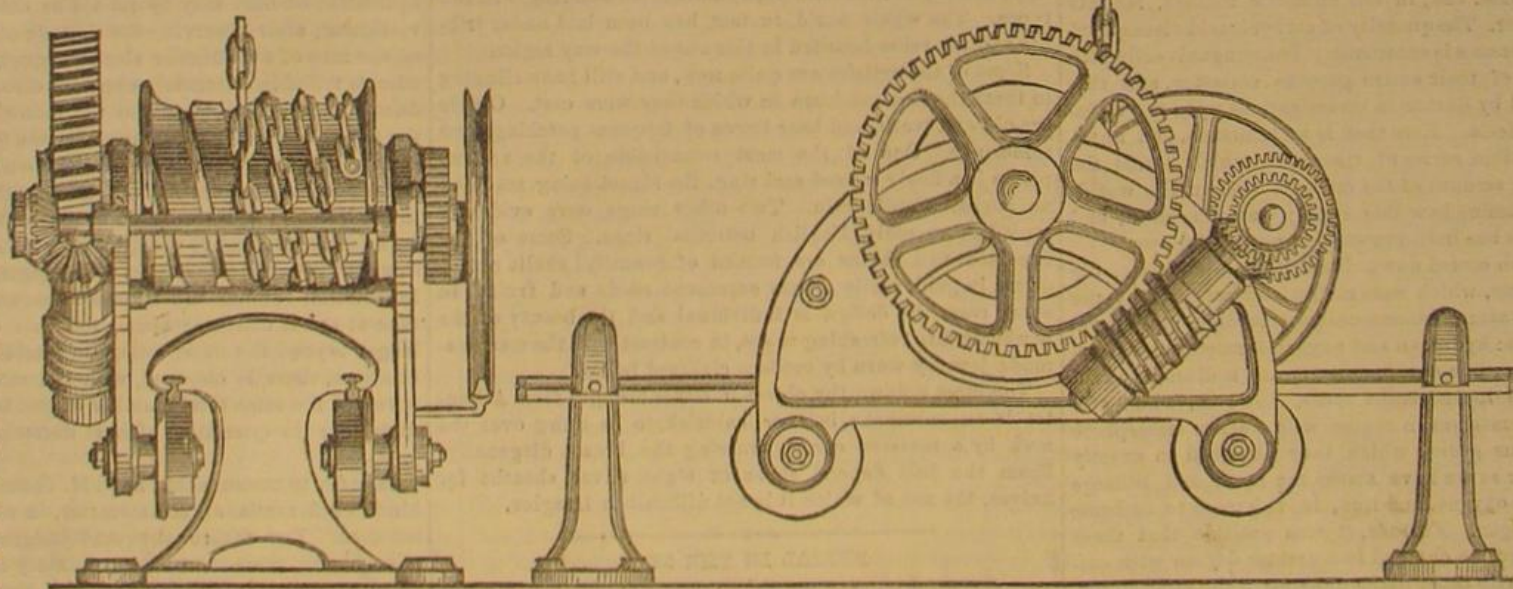
Although this subject has engaged the attention of mankind from the earliest ages, in consequence of its importance, it is wonderful how little we have yet realized in the way of securing a covering for the horse's hoof which shall answer the purposes required. Many scores of different shoes have been designed by persons ready to vouch for their excellence, but they have generally been false in theory. Of the many methods of horse-shoeing, that known as the Goodenough system seems alone to be founded upon correct principles. The frog must be preserved, or eventually the foot will be ruined. The light of reason is beginning, in this respect, to slowly dawn upon the rising generation of blacksmiths. Let us hope, for the horse's sake, that that instrument of torture, the old bar shoe, may soon be brought to mind only with memories of the Inquisition.

Camphor Water.

The Pharmacopœia directs that the camphor, reduced to a pasty mass with alcohol, be rubbed with the carbonate of magnesium and water, and filtered. In making camphor water, I discard the use of alcohol entirely. With a few drops of ether, I reduce the necessary quantity of camphor, in a mortar, to an impalpable powder in a few moments. The ether evaporates instantly and is not open to the same objection as alcohol, that of contaminating the resulting medicated water by its presence. I then rub the powdered camphor with the magnesia and a part of the water, and pour the liquid through a funnel sieve into a bottle of the requisite size, returning to the mortar the lumpy portions that at first refuse to pass through the sieve, and rubbing them with more of the water. If the resulting milky liquid be now thoroughly agitated, and filtered immediately, the camphor water will be found to be decidedly stronger than many specimens, made by the ordinary process, that have stood some time and received occasional agitation before filtering; and if it be allowed to stand in the stock bottle, occasionally agitated, and filtered off when wanted for use, its superiority to that made in the official way will be perceived to be unquestionable. In making large quantities of camphor water, the powdered camphor might first be passed through a tolerably fine sieve, dry.—*Franklin T. Hartzell, G. P.*

OVERHEAD TRAVELING CRANE.

We illustrate herewith a very convenient and compact form of traveling crane constructed by the company (at Chemnitz) which succeeded the well known German mechanic Constantin Pfaff, and exhibited by them at the Vienna Exposition. The crane, for the illustration of which we are indebted to *Engineering*, runs upon a pair of light rails, suspended from the roof of the shop. The motion is transferred from the

**OVERHEAD TRAVELING CRANE.**

driving pulley through gearing to the bevel wheels, and thence to the worm which actuates the chain drum. The crane is intended to lift and transport weights up to 2½ tons.

LINSEED OIL.—Linseed oil is obtained from flaxseed, by grinding the same under heavy stones, set on edge and made to revolve on beds of stone. Attached to the edge stone are scrapers which throw the seed into the circular track of the roller. The ground seed is placed in strong, woven woolen bags, which bags are covered with mats made of horse hair and sole leather, of a proper and sufficient width to protect the bags in the operation of pressing. These mats with their contents are subjected to an immense hydraulic pressure, and the expressed oil flows off into large iron tanks, where it is allowed to settle. What remains in the bags after the pressure is known as oil cake. About 8,000,000 gallons of linseed oil are used annually in the United States.

IMPROVED MIXING SPOON.

If temperance agitations were not so fashionable just at present, we should innocently write that this invention is peculiarly adapted for mixing drinks; but as in some portions of the country, the latter operation, fortunately for the inhabitants, bids fair to become one of the lost arts, we restrict ourselves to the observation that the device is most suitable for combining medicines, compounds less agreeable to take, perhaps, in the beginning, but sometimes—not always—more beneficial in the end.

It is an ordinary good sized spoon, the bowl of which is made with a number of perforations and provided with a projection, A, which catches upon the edge of the vessel in which the mixing is to be done, thus holding the implement



securely in place. The sugar or other material is placed in the bowl, and the medicines or other liquids to be added are dropped or poured in, in succession, percolating down through the perforations. Mr. William S. Clark, of Ishpenning, Marquette county, Mich., patented the device through the Scientific American Patent Agency.

How Thermometers are Made.

L. C. Weldin describes, in the *Polytechnic Bulletin*, the method of making thermometers at the Tower Manufacturing Company's establishment, Chester, Pa.:

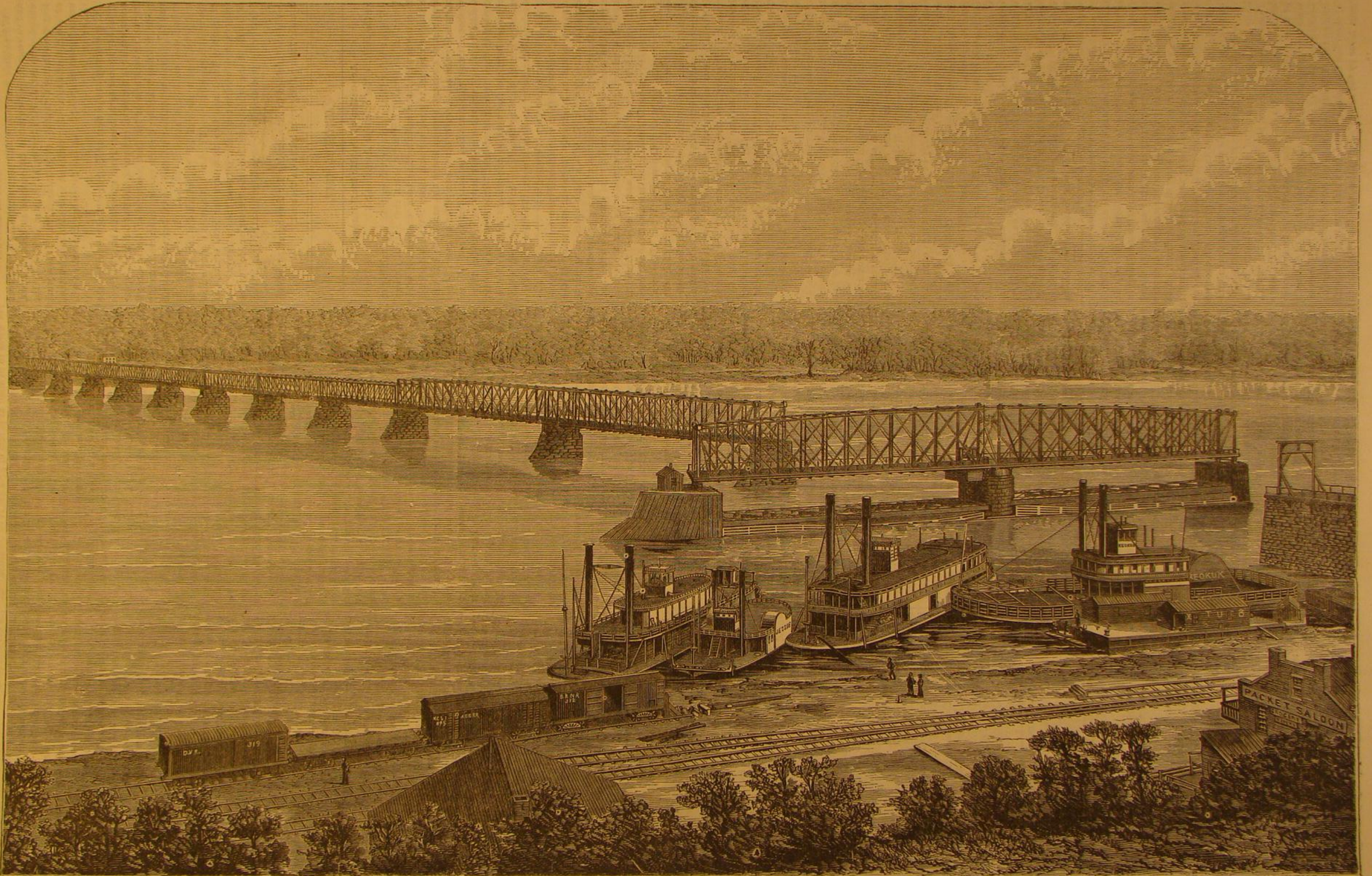
The glass tubes, as received, are about a yard long. A boy nicks them with a hard steel knife, and breaks them into the lengths required. The bores, which are flat, are compared, by means of a lens, with those of ten standard sizes, and the tubes assorted accordingly. They are then passed to the blowpipe table. Each glass blower has a foot bellows, and uses an oil lamp. Melting the glass at one end of a tube, he blows it into a bulb by pressing the sides of a hollow india rubber ball attached at the other, proportioning the size of his bulb to the bore of the tube, and ascertaining the size by using a pair of callipers. While the bulb is yet hot, the tube is inverted in mercury, which, as the bulb cools, rises and partially fills it. The tube is then withdrawn and a short india rubber tube attached at its open end. Into this mercury is poured; that in the bulb is boiled to expel the air, which rises up through the mercury in the india rubber tube, and an atmosphere of the vapor of mercury now fills the glass tube and bulb. As this condenses, the mercury in the india rubber tube takes its place,

when this tube, with any mercury remaining in it, is removed. The bulb is now warmed, and the open end of the glass tube hermetically sealed.

The bulb and a portion of the tube are immersed in melting ice, and the height of the mercury marked; they are then transferred to a bath at 63° Fah., and the height marked; next to a bath at 93° Fah., and the height again

marked. The lengths of the three spaces of thirty degrees each are now carefully measured. If they are exactly equal, the bore of the tube is assumed to be uniform, and the degrees laid off on the brass scale of the thermometer are all made of the same length. If the spaces of thirty degrees each are not found to be exactly equal, then, by means of a highly ingenious dividing engine, the degrees on the scale are made to increase in length as the caliber of the tube diminishes. When the plate has been divided, and the figures and letters punched, it is passed, laterally, between rollers, to remove the burr left by the tools. Were it rolled lengthwise, the accuracy of the dividing would be impaired. The plate is then silvered and lacquered, the glass tube attached, and the whole slid into the well known japanned tin case. The establishment turns out two hundred dozen thermometers a week.

THE wine crop in the United States is 20,000,000 gallons.



ROAD AND RAILWAY BRIDGE OVER THE MISSISSIPPI, AT KEOKUK, IOWA.

THE KEOKUK AND HAMILTON BRIDGE.

We publish herewith a full page engraving of the road and railway bridge over the Mississippi at Keokuk, Iowa, designed by Mr. J. H. Linville, C. E., and erected by the Keystone Bridge Company, of Pittsburgh, Pa. It is a work of the highest engineering skill and most solid construction, and of great magnitude, as the following dimensions will show:

Commencing at the west or Keokuk end of the bridge, the spans are located as follows: Pivot span, total length of one truss, center to center of end posts, 376 feet 5 inches; opening under each arm of 160 feet measured on the square; 2 spans, 253 feet 6 inches; 8 spans varying in length from 148 feet 4 $\frac{1}{8}$ inches to 161 feet 7 inches; total length, backwall to backwall on bridge seats, 2,192 feet. It is a through bridge built on a skew of 17° 15', with a distance between the two trusses of 21 feet 6 inches. It carries a single line of railway track and two tramways for local traffic, the track being placed in the center between the tramways. On each side of the bridge, outside of the trusses, are footwalks 5 feet wide protected by light and substantial iron lattice railings.

We are indebted to *Engineering* for the engraving, which is made from photographs taken on the spot.

Correspondence.

Acoustics of Public Buildings.

To the Editor of the *Scientific American*:

There are few things more provoking than the inability to hear a public speaker distinctly, when that inability arises from the fact that the building has been constructed with little or no regard to good acoustic effect. We are inclined under such circumstances to blame the architect; but unfortunately the architect is often compelled to consult the wishes of those who come not to hear, but to see. In no public buildings are the simplest laws of acoustics more neglected than in our churches. This arises in a great measure from the fact that, at the present day, an effort is made in church building to imitate in architectural effect the large churches of the middle ages. The fact that these grand old structures were not erected to be filled with a single voice, but to raise a monumental pile for great ceremonies, seems to be entirely forgotten; and many of the churches of today are built with a high apsis, in which is placed the speaker's desk instead of the high altar of earlier days. The nave is lofty and, by its groined arches and hooded windows, gives ample opportunity for the sound of the speaker's voice to be echoed and re-echoed from its numerous surfaces until it falls upon the ears of the audience in indistinct and unintelligible sounds. When these great errors in church architecture have been committed, the question arises: Is there any remedy by which the acoustic properties can be improved? Plain and parabolic sounding boards have been introduced, but with very indifferent results. Drapery has been festooned about the sides and bases of the arches with no better (and with very unsightly) effect; and until quite recently, no really successful method has been devised by which the difficulty could be overcome. The Rev. Joseph P. Taylor, formerly rector of St. Paul's Church, Brunswick, Me., ascertaining that his audiences were greatly troubled to hear him distinctly, on account of excessive reverberation, gave the subject careful investigation and study, and conceived the idea of overcoming the difficulty by the introduction of screens of very fine wire beneath the ceiling, at a proper angle and at such a distance from the pulpit as would best intercept the sonorous wave, and thus prevent its striking the reflecting surface with sufficient force to cause echo. The same device was subsequently employed by Mr. Taylor in the Brown Memorial Church, Baltimore, where a very bad echo or reverberation existed; and the testimony of prominent men connected with the church is that the cure is complete. The Asylum Hill Congregational Church, of Hartford, Conn., is a fine gothic structure, built of Portland stone after the style of architecture of the middle ages. It has an apsis of 17 feet depth and 52 feet high. The point of the arch of the nave or clerestory is 54 feet above the floor of the audience room, and is ornamented with hooded windows. The organ gallery, at the end of the church opposite the apsis, extends over the vestibule to the front of the central tower, and is some 25 feet deep. When this church was completed, its architectural effect was beautiful, but it was found impossible to understand the speaker in some parts of the audience room. A parabolic sounding board was introduced, back of the speaker's desk which was situated in the apsis. The effect of this contrivance was to benefit the hearing directly in front of it, but was of little or no service to those sitting in the side seats. Subsequently an organ was purchased and put in the apsis, nearly filling it, and the speaker's desk was placed on a platform extended some 8 feet in front. The front of the organ gallery at the opposite end of the church; was provided with a skeleton gothic window, that is, one with the frame and tracery, without any glass. (The organ gallery is unoccupied.) This was done to break the column of sound which was found to vibrate in this gallery independently of the great column of sound in the audience room. These changes improved the hearing qualities of the church, but in certain localities the old difficulty remained, and some of what would ordinarily be the best sittings in the house were very undesirable, from the great difficulty of distinctly hearing the words of the speaker. Various devices for overcoming this difficulty have been suggested, and investigation of them has been made. The one which was regarded with most favor by the society's committee was the introduction

of wires to be used at points of greatest reverberation. Mr. Taylor was invited to examine the audience room of the church and decide as to the ability of his method to accomplish the end desired. The diagnosis of the case was interesting. A speaker was placed in the desk and the two or three persons composing the audience distributed themselves within the limits of greatest reverberation. The effects of the speaker's voice at different angles and at different elevation was carefully noted, and the source of the reverberatory waves traced out. This having been done, the mode of applying the remedy was decided upon. There is no undeviating rule that can be laid down, but every case must be examined and the remedy introduced in accordance with the peculiar circumstances involved. In some cases, the wires are strung across the groined arches high up in the nave. In others, they are placed across the arches leading to the transepts. In the Asylum Hill Congregational Church, it was found necessary to separate or divide the groined arches and hooded windows of the clerestory from the audience room below. The wires are of very small gage, and do not disfigure the church in the least. A stranger would not notice them unless his attention were particularly directed to them. The result of the experiment is most satisfactory, and the hearing is equally good in all parts of the house, provided that the preacher speak with sufficient strength and distinctness for an audience room so large. Mr. Taylor's patent is entirely different from the plans of some who have made use of wires to overcome acoustic defects. These have usually consisted of wires of large gage, distributed from four to eight feet apart, being very unsightly and producing but indifferent results. His plan is what he terms a "break sound." The wires are so placed as to receive the sound wave before it reaches the reflecting surfaces which cause the reverberation. The sound impinges against the wires; its force is broken, and it has no power to produce an echo or reverberation from the surfaces beyond, nor is the sound reflected back by the wires to the audience. It is simply broken, and its force is taken up by the wires which, by inaudible vibrations, convey it away. If a sounding board or sonorous reflector were placed in the same position, an unpleasant reflection of sound would be the result; and if drapery were used, the sound would be dead and muffled. Having made trials of all these devices, we can say that the wires alone accomplish the end sought, and they are adapted to all kinds of public buildings where difficulty in hearing is experienced. I have given you a full and lengthy account of our experiments because I am aware that there are many public buildings and churches in the country which are beautiful in their architecture, but have acoustic defects that sadly eclipse other attractive features, and I am also aware that the *SCIENTIFIC AMERICAN* is a paper to which people look for such information.

Hartford, Conn.

J. M. ALLEN.

The Relative Attraction of the Earth and the Sun.

To the Editor of the *Scientific American*:

It appears that I have not been explicit enough in my communication on the above subject, published on page 245 of your current volume, and have used too few words in disposing of Captain Ericsson's iron ball floating in a bath of mercury; consequently he labors under the impression that I do not understand his apparatus. I understand it only too well, so well indeed as to know that even the attraction of the rising or setting moon can never affect such an arrangement, which, according to Captain Ericsson's ideas, it ought to do, if only its sensitiveness were slightly increased. In order to show this, we will take Captain Ericsson's data, given on page 164: Mass of sun=314,760, the earth being 1. As the mass of the moon is 0.0125 or the 80th part of that of the earth, the sun's mass surpasses that of the moon: $314,760 \times 80 = 25,180,800$ times; and the force of gravitation being inversely as the square of the distance, and directly as the mass, the sun's attraction is relatively equal to $25,180,800 : 400^2$, nearly 157 times that of the moon. The attractive force on Captain Ericsson's iron ball is, according to his calculation, for the sun equal to 748.6 grains, and thus for the moon $748.6 : 157 = 4.9$ grains. If, therefore, the arrangement were only a little improved, so that the ball were movable by a little less than 5 grains, in place of 8, the moon would affect it. But that this can never be the case, with any contrivance of this kind, however delicately it may be constructed, even if it could be moved by a single grain, is due to the fact that the circumstances are totally different in the cases, first where the ball and the bath in which it floats are both affected by changes in the direction of gravitation, and second, if the ball alone is acted upon by some mechanical contrivance. The cause of the ball being always balanced under various conditions of gravitation, as I stated on page 245, is that the attractions of the sun and moon act simply in such a way as to shift the center of terrestrial attraction towards them, according to the law of composite forces. This shifting of the center of attraction induces changes in the ocean level, and thus is the cause of the tidal waves. Therefore the rising or setting sun or moon, in shifting the earth's center of attraction eastward or westward, will not only act on the floating iron ball, but change equally the level of the mercury, and so keep the ball at rest; while, according to Captain Ericsson's ideas, it should slide over the unaffected mercurial surface, as down an inclined plane, towards the side on which the sun or moon is situated.

Surely the lunar attraction is not neutralized by centrifugal force, because the earth does not revolve around the moon, and any lunar attraction therefore must manifest itself to its full amount.

That the solar attraction is, for the greater part, neutralized by the centrifugal force of the earth in its yearly orbit,

is evident from the fact that, notwithstanding that the attraction of the immense solar mass surpasses that of the moon on our earth's surface 157 times, the solar tidal wave is smaller than the lunar tidal wave; but the existence of the solar tide wave is a better argument in proof of the effects of solar attraction than can be drawn from any such experiment as the one in question.

The amount of this solar attraction, manifested in the solar tidal wave, enters, as is well known, into the calculation of the times and relative heights of the spring and neap tides; it has been laid down on geometrical principles that the change in the moon's gravity, due to the sun's action, is expressed by the formula $\frac{M}{D^3} \times \gamma(1-3\cos^2\phi)$ in which M is

the sun's mass, D its distance expressed in the earth's radii, γ the distance of the particle from the center of the earth, and ϕ its elongation from the sun as seen from the earth's center. The same formula is applicable to the moon; and as $\gamma(1-3\cos^2\phi)$ may be taken equal for both, we find, if we call the moon's mass and distance m and d , that their attractions, in regard to raising the tidal wave, are as $\frac{M}{D^3} : \frac{m}{d^3}$, showing that the power to raise the tides is in direct proportion to the mass, and inversely as the cubes of the distances. If now we give the quantities the proper values, taking, for simplicity's sake, the moon's distance as $\frac{314,760}{400^3} = \frac{0.0125}{1^3} = 24$, showing how many times

the moon's attraction surpasses that of the sun.

This calculation gives results perfectly in accordance with the observation that the mean height of the solar tidal wave is to the lunar as 3:7, while the whole theory of the tides (aqueous and atmospheric) proves that the solar attraction on our rotating and revolving globe is only neutralized by the centrifugal force when we consider the earth as a whole, but that this is by no means the case for the different particles in its mass, especially not for those near or upon its equatorial surface.

P. H. VANDER WEYDE.

New York city.

Solar Attraction and Centrifugal Force.

To the Editor of the *Scientific American*:

With surprise I read the communication of Captain Ericsson (page 291, current volume), in which he concludes that Dr. Vander Weyde does not understand the principle of his apparatus for showing the neutralization of solar attraction and centrifugal force. Though Captain Ericsson, in his communication of March 14, proved to be master of the subject, he evidently overlooked one point, or else he would not have mentioned the experiment with the iron globe.

Though solar attraction does balance the orbital centrifugal force while the sun is rising, it will not do so three hours afterwards, when a pendulum will be slightly deflected towards the sun, while the floating globe will not move. True, the globe is attracted towards the sun somewhat more than it is repulsed by centrifugal force, and consequently would move towards the sun, if the mercury were not under the influence by virtue of which its surface leaves the true horizontal direction, rising slightly at the side nearest to the sun. If the mercury only were attracted, not the iron, the globe would seek the lowest level and retreat from the sun. These two tendencies upon the globe will perfectly balance each other, and in no position of the sun can any result be obtained by the experiment. To prove my assertion of the inclination of the level of liquids when the sun occupies an angular position, I refer to the solar tidal wave. The water in a straight line with the sun being higher than that at right angles, there must be an inclined level at intermediate points of the ocean.

As the experiment does not show a difference between solar attraction and centrifugal force when it actually exists, it cannot demonstrate a neutralization of those forces.

In addition to what was said on the question, it may be interesting to state that the moon, though much smaller than the sun, by her nearness causes about three times greater variations of gravity during her apparent diurnal motion, than the sun, as may be found by repeating Captain Ericsson's calculation, with reference to the moon.

Philadelphia, Pa.

HUGO BILGRAM.

Drying Peat.

To the Editor of the *Scientific American*:

A kiln of condensed peat has recently been dried by evaporation in forty-eight hours, upon the principle and system for which a patent was obtained through your agency. The heat requisite was carefully noted from a thermometer in constant use during the process, and found to average only 85°. Two other appliances, embraced in my system, could not be used at this time, but, when used, will shorten the time to thirty-six or forty hours only. The important question of artificially drying peat is therefore solved, at the same time preserving economy of labor and fuel, and the system is susceptible, as to quantity, of almost indefinite extension.

Rome, N. Y.

W. E. WRIGHT.

TURPENTINE.—Venice turpentine is obtained from the larch, and is said to be contained in peculiar sacs in the upper part of the stem, and to be obtained by puncturing them. It is a rosy liquid, colorless or brownish green, having a somewhat unpleasant odor and bitter taste.

Oil of turpentine is the most plentiful and useful of oils. It is obtained in this country from a species of pine very plentiful in the Carolinas, Georgia and Alabama. The tree is known as the long leaved pine (*pinus Australis*), and is found only where the original forest has not been removed.

USEFUL INFORMATION ON STEAM POWER.

Careful experiments by Favre, Silbermann, and others have shown that a pound of good coal will liberate during complete combustion 14,000 or 15,000 units of heat, each unit being equivalent to 772 foot pounds. The

MECHANICAL EQUIVALENT OF THE HEAT

developed by the combustion of a pound of coal is, therefore, say $14,500 \times 772 =$ over 11,000,000 foot pounds. A horse power is always assumed to be equal to 33,000 foot pounds per minute, or 1,980,000 foot pounds per hour. So the combustion of each pound of coal per hour liberates heat enough to develop $11,000,000 \div 1,980,000 =$ say 5 horse power; and in a perfect steam engine the consumption of coal would be about at the rate of one fifth of a pound per hour for each horse power developed.

The greatest economy obtained in ordinary continuous working may be taken at from 3 to 4 lbs. of coal per indicated horse power with non-condensing engines, and from 2 to 2½ lbs. with condensing engines. A consumption as little as 1½ or 1¼ lbs. per indicated horse power has been reported in the case of compound condensing engines, and such results are quite possible. But a consumption of 2 lbs. is as little as can yet be counted on with certainty. The manufacturer, in choosing an engine, would do well to look with some little doubt on promises of a better result than this, and he may feel satisfied if the engine he buys shows itself capable of working with that degree of economy. A consumption of 4 lbs. of coal per indicated horse power per hour means a loss of nineteen twentieths; and 2 lbs. per indicated horse power, a loss of nine tenths of the power theoretically due to the coal. There is, therefore, ample room for improvement, even upon the best of modern steam engines.

The conditions necessary to

ECONOMY IN THE STEAM ENGINE

are: 1st. The complete combustion of the fuel in the furnace. 2d. The transfer of all the heat generated to the water in the boiler. 3d. The passage of the steam through the engine without loss of heat, except such as is converted into motive power, and the conservation of the heat remaining in the steam on its leaving the cylinder. 4th. The absence of friction in the working of the engine. Let us see how these conditions are fulfilled in a good modern steam engine.

As to the

COMBUSTION OF THE FUEL,

with the best coal and most careful stoking, a quantity of the coal falls through the fire bars, either as unburnt coal or ashes. Another portion goes up the chimney unconsumed in the form of smoke and soot; and a further quantity, half consumed in the form of carbonic oxide. The loss from the causes may amount to from 2 to 20 per cent. It all arises from wrongly constructed furnaces and bad stoking, and it may nearly all be avoided.

As to the heat generated, most coal contains a greater or less quantity of moisture, and the evaporation of this moisture causes the first loss of heat. Radiation from the furnace causes a further loss. But the great causes of loss are the admission into the furnace of a large quantity of useless air and inert gases, and the escape of these, with the actual products of combustion, up the chimney, at a very much higher temperature than that at which they entered the furnace. Air is composed of about one third oxygen and two-thirds nitrogen. The oxygen only is required to effect the combustion of the fuel, and the useless nitrogen merely abstracts heat from the combustibles, and lowers the temperature of the furnace. About 12 lbs. of air contain sufficient oxygen to effect the combustion of 1 lb. of coal, but owing to the difficulty of bringing the carbon into contact with the oxygen, the quantity actually required to pass through the furnace is from 18 lbs. to 24 lbs. of air per pound of coal burnt. The surplus air passes out unburnt, but its presence in the furnace lowers the temperature subsisting there, and abstracts a portion of the heat generated. And whereas the whole of the air enters the furnace at about 60° Fah., the unconsumed air and the products of combustion leave the flues at from 400° Fah. to 800° Fah. The total loss from these causes is from 20 to 50 per cent. In other works, whereas each pound of good coal burnt is theoretically capable of evaporating about 15 lbs. of water, in good practice it evaporates but 9 or 10 lbs., and in ordinary practice but 6 or 8 lbs. of water.

There are difficulties in the way of abstracting all the heat from the furnace gases: first, because with natural or chimney draft, the gases require to pass into the chimney at not less than 500° Fah., in order to maintain the draft; and secondly, because the transmission of heat from the gases to the water, when the difference of their temperatures is small, is so slow that an enormous extension of the surface in contact with them becomes necessary in order to effect it. But by having energetic combustion and a high temperature in the furnace, the quantity of air actually required may be much reduced; by suitable arrangements for admitting air and feeding coal into the furnace, the proportions of each may be suitably adjusted to each other; and by a liberal allowance of properly disposed heating surface, the temperature of the reduced quantity of furnace gases may be reduced to that simply necessary to produce a draft, in a furnace with natural draft, or to about 400° Fah. or less, in a furnace where the draft is obtained from a steam jet or fan. Under these conditions an evaporation of from 10 to 12 or more lbs. of water, per pound of good coal burnt, may be expected.

As to the heat in the steam amongst the minor causes of loss are radiation from the boiler, steam pipes, and engine (most of which can be prevented by carefully lagging with a good non-conductor of heat), blowing off, and leakage. A greater loss arises from initial condensation in unjacketed

Cylinders, nearly prevented by using a properly constructed steam jacket. But the great loss arises from the escape of the steam into the atmosphere, with only a portion of its heat utilized. This, of itself, leads to another great loss, of from 40 to 60 per cent.

The use of high pressure steam, high rates of expansion, and of an efficient feed water heater, is conducive to economy, but no practicable means have yet been devised whereby the whole heat may be saved; and the removal of this source of loss in the working of the steam engine offers one of the most promising subjects for inventive genius.

In a good modern steam engine, the coal used is thus approximately disposed of:

Lost through bad stoking and incomplete combustion.	10.0
Carried off in the chimney gases.	30.0
Carried away in the exhaust steam.	50.0
Utilized in motive power (indicated).	10.0
	100.0

ENGINE FRICTION.

A further loss of useful effect ensues from a portion of the motive power actually developed being absorbed in driving the engine itself, and the useful power of the engine is reduced from this cause by from 5 to 25 per cent. The use of equilibrium valves, ample bearing surfaces, careful lubrication, and cleanliness go far to lessen the friction, as well as to increase the working life of a steam engine; but in selecting an engine, it is as well to bear in mind this source of loss, as injudicious improvements, introduced for the attainment of increased economy, may defeat this subject through the excessive power required to drive them.

For engines with cylinders less than 6 or 8 inches in diameter, the simple high pressure non-condensing arrangement should be adhered to, as it makes for small powers the most economical as well as the cheapest engine. The boilers for the smaller powers can be heated by gas instead of by coal, and the cleanliness and convenience of the arrangement quite counterbalance the slight increase of expense. When also the trouble of attending often to the water level is objected to, a boiler of large capacity should be provided. Non-condensing engines with cylinders above 8 inches in diameter should always be provided with expansion valves, steam-jacketed cylinders, and feed water heaters; and the exhaust steam of non-condensing engines should always be used to urge the draft. Condensers cannot well be used for portable engines or engines requiring removal; but fixed engines, having cylinders larger than about 10 or 12 inches, should be fitted with either surface or jet condensers. The jet condenser is less costly and nearly as efficient as the surface condenser, under ordinary circumstances; but when the water from which steam is made contains much impurity, surface condensation is to be preferred. For seagoing purposes, engines are now very generally made on the compound system, and some very good results have been obtained from such engines. Their use for land purposes also is becoming very general, and for large powers the compound engine is to be recommended. But it should be borne in mind that, whereas a compound engine must be both designed and constructed with the greatest skill and care, in order that it may work with greater economy than a good ordinary engine, a bad compound engine may easily be much more wasteful than even a bad ordinary engine.

The unmistakable tendency of modern steam engineering is towards much

HIGHER PRESSURES OF STEAM

than those hitherto used. A pressure of over 100 lbs. per inch means the supercession of what may be termed large capacity boilers. High pressures are as safe as low pressures, provided the boilers are suitably designed to withstand them. But the construction of high pressure boilers should be confided to none but competent engineers; and those who intend putting up new boilers should recollect that the boiler maker who uses the best quality of plates and workmanship is not likely to send in the lowest tender. His boiler may, nevertheless, be the cheapest. For land purposes and moderate pressures, the Cornish boiler will continue to be used. For higher pressures, a modification of the French or elephant boiler is better, and the multitubular boiler is also to be preferred. The enormously thick plates found necessary in some modern marine boilers lead to most serious inconvenience, and it becomes essential to stipulate that steam shall not be got up in less than several hours. Many attempts have been made to use tubulous boilers for very high pressures, but as yet without any marked success. A good boiler of the kind, however, is a great desideratum.

The actual, or useful, or

DYNAMOMETRICAL HORSE POWER

is the net power of the engine, after allowing for friction, etc., and this alone is the power with which users of steam engines are concerned. In small engines the useful power can be ascertained accurately by the application of a friction brake or dynamometer. The dynamometer, however, cannot be conveniently applied to large engines, but the indicated power, less an allowance for friction, gives the actual power near enough for most practical purposes.

In comparing the prices of different engine makers, it is very necessary to look at the actual power an engine exerts, not to the nominal power, or to the size alone of the cylinder. A nominal horse power means anything from 1 to 8 actual horse power; and of two engines of the same size and general construction, one may not only develop much more power than the other, but may do so with a less consumption of fuel per actual horse power.

COAL

varies so much in quality that the consumption of a certain

weight per horse power is not in itself sufficient to show the economy with which an engine works. When an engine consumes so little as 2 lbs. of coal per horse power, we know that the coal used must be of good quality, and that the engine is an economical one. But the consumption of three or four times that weight of coal per horse power does not necessarily prove the engine to be a bad one, because the coal used may be but one third or one fourth as good. Generally, no doubt, the best coal is also the cheapest; but when an inferior quality is used, and it is desired to test the efficiency of a steam engine, an analysis by a competent chemist will show the relative heating value of the fuel, compared with that of standard quality. The best steam coal is capable of generating sufficient heat to evaporate about fifteen pounds of water, from and at 212° Fah., per pound, properly burnt. The same coal after a long sea voyage or long exposure to weather often loses much of its calorific power, owing to its partial decomposition, pulverization, absorption of moisture, and other causes. Other kinds of coal contain a large percentage of incombustible matter, and knowing its chemical composition will alone enable one to judge of its comparative theoretical efficiency. Anthracite coals give the best result in generating steam, but bituminous coals may be burnt with a high degree of efficiency under suitable arrangements.

After the engineer has done all he can to attain economy, much of the result remains in the hands of the steam user. A reduction of ¼ lb., of coal per indicated horse power, under 2 lbs. can only at present be effected by the greatest skill on the part of the engineer, while a careless or unskillful stoker may easily counteract all the engineer's ingenuity. The use of a high class steam engine involves the necessity of employing an intelligent, careful attendant: not that the work is more difficult, at any rate, with good coal, nor is it so laborious, as less coal has to be thrown into the furnace for a given power.

Clean fire bars, an evenly spread grate, preliminary coking on the dead plate, and the exercise of some little intelligence in the admission of air and regulation of the draft, are the main points to be attended to by the stoker, and these cannot be said to involve an unreasonable amount either of labor or vigilance. A self feeding grate is conducive to economy, especially when the coal is small or of inferior quality. Its use lessens the stoker's labor considerably, and it is not easy to find a reason for its comparatively limited adoption.—Henry Northcott.

Aversion to Manual Labor.

The practice of educating boys for the professions, which are already overstocked, or for the mercantile business, in which statistics show that ninety-five in a hundred fail of success, is fearfully on the increase in this country. Americans are annually becoming more and more averse to manual labor; and to get a living by one's wits, even at the cost of independence and self-respect, and a fearful wear and tear of conscience, is the ambition of a large proportion of our young men. The result is that the mechanical professions are becoming a monopoly of foreigners, and the ownership of the finest farms, even in New England, is passing from Americans to Irishmen and Germans. Fifty years ago a father was not ashamed to put his children to the plow or to a mechanical trade; but now they are "too feeble" for bodily labor; one has a pain in his side, another a slight cough, another "a very delicate constitution," another is nervous; and so poor Bobby or Billy or Tommy is sent off to the city to measure tape, weigh coffee, or draw molasses.

It seems never to occur to their foolish parents that moderate manual labor in the pure and bracing air of the country is just what these puny, wasp-waisted lads need, and that to send them to the crowded and unhealthy city is to send them to their graves. Let them follow the plow, swing the sledge, or shove the foreplane, and their pinched chests will be expanded, their sunken cheeks plumped out, and their lungs, now "cabined, cribbed, and confined," will have room to play. Their nerves will be invigorated with their muscles; and when they shall have cast off their jackets, instead of being thin, pale, vapid coxcombs, they shall have spread out to the size and configuration of men. A lawyer's office, a counting room, or a grocery is about the last place to which a sickly youth should be sent. The ruin of health is as sure there as in the mines of England. Even of those men in the city who have constitutions of iron, only five per cent succeed, and they only by "living like hermits, and working like horses"; the rest, after years of toil and anxiety, become bankrupt or retire; and having meanwhile acquired a thorough disgust and unfitness for manual labor, bitterly bemoan the day when they forsook the peaceful pursuits of the country for the excitement, care, and sharp competition of city life.—M., in *What Next?*

Artificial Alizarin in Printing.

Hitherto artificial alizarin has been chiefly used as a steam color, but it can also be employed like garancin and *fleurs de garance*. To prepare the dye beck, chalk to the extent of 1 per cent of the alizarin paste to be employed is stirred into the beck, which is heated to 190° Fah. The goods, previously printed with the mordants, aged, dunged, and washed, are unwound into the beck, and heated quickly to a boil. The dyeing is complete in ten minutes. The alizarin in the spent bath, in combination with the excess of chalk, is precipitated with hydrochloric acid, and recovered from the precipitated thus formed. The dyed pieces are washed in warm and cold water, and then three times, using each time ¼ lb. soap per piece: the two first soap baths at 145° and the third at 190° Fah. They are then placed in a weak solution of chloride of lime for half an hour at 88° Fah., washed again, dried, and finished.—*Farber Zeitung*.

IMPROVED PICKET FENCE.

In many sections of the country, and especially upon the prairies of the West, it is difficult to obtain long fencing timber, and hence the expense of building and maintaining proper fences constitutes no small item in the farmer's expenses.

The invention which is represented in our engraving is a novel construction of fence, which may be made of proper rails, short split timber, small poles, limbs of trees, and similar rough wood, very readily by any one at all skilled in ordinary farming operations. It is composed of two sizes of posts, the shorter ones, A, Fig. 1, resting upon the ground, and the longer ones, B, ranged at intervals, connecting at their upper ends with a straight line of wire. The latter is extended between fixed posts, C, which are driven in or firmly anchored to the ground, as shown in the engraving, and located some fifty yards apart. The posts, long and short, are arranged in panels and connected together by fence wire, woven in between them. They brace in alternate directions, thus giving the fence a zig zag base (Fig. 2) and straight top, the former giving it sufficient stability to resist wind as well as forcing by stock and currents of water.

The inventor proposes to make the longer pickets six feet apart at the top and seven feet apart at the bottom, which will give the fence a proper base when set up, but when stretched flat upon the ground will render it circular in form. The panels may then be rolled into bundles and transported like bales of cotton or similar packed material. One hundred feet of fence, it is stated, will weigh about five hundred pounds. The material suitable for the purpose, we are assured, need not cost over one fourth that of the common rail fence, and the wire is worth about fifty cents per rod.

Patented through the Scientific American Patent Agency, October 14, 1873. For further particulars relative to purchase of rights, etc., address the inventor, Mr. R. H. McGinty, Moulton, Lavaca county, Texas.

IMPROVED WORK HOLDER FOR LATHES.

There are few mechanics accustomed to using the lathe who will not recognize at a glance the utility and convenience of the ingenious attachment to that tool, represented in the annexed engravings. Its object is to hold small articles in the lathe while being acted upon by a revolving cutter turning upon centers; and it is secured to the carriage in the same manner as the ordinary cutting instruments. The inventor does not aim to supersede the expensive shaping machines common in use in large shops, but offers an apparatus, the cost of which will be within the means of every mechanic, and which may form a handy substitute for the more cumbersome contrivances devised to perform in a lathe the work of milling machine and planer on a reduced scale. The device is adapted to fluting taps, slabbing studs, nicking screws, and other similar work, in great variety; and by the aid of gear-cutting attachments, gears, circular cutters, and the like may be formed.

The three combinations of the invention are shown in our engraving. In Fig. 1 the work is so held as to extend across the bed of the lathe at right angles to the arbor. In Fig. 2 the cutter acts perpendicularly downwards, as in the case of nicking the screw head shown, while in Fig. 3 the axis of the article under operation is parallel to that of the lathe. A, in all the figures, is the bar, which is clamped in the ordinary manner in the tool post. B is the clamping band which secures the tool. These parts remain the same in all the adjustments of the instrument, the only portion changed being the jaw, C, and its arm, D, in manner and

for the purposes below set forth. The bar, A, is provided at one end with a vertical groove, E, Fig. 1, in which slides a tongue formed on the arm, D. The top of the latter is turned over the portion just described, and is provided with a screw, F (all figures), which turns down upon the top of the bar. G is another screw bolt which passes through a slot in the end of the bar, A, and enters the jaw, C, holding the tongue of the latter in the groove, and sliding up and down in its slot. It will be seen that, by loosening the screw, G, the jaw, C, may be set at any desired elevation, and then, by clamping

upon the bar, A. The lower part of the band, B, is enlarged so as to permit the insertion of larger articles than would the portion sliding upon the jaw, C, and is strengthened by the rib, I.

By examining the three engravings, the reader will understand that the difference in the form of the instrument lies simply in the construction of the jaw, C, and arm, D, necessitating three separate pieces, either of which may be used in connection with the bar and clamp, according to the kind of work to be operated upon.

In Fig. 1 a tap is being fluted, in Fig. 2, a screw nicked, and in Fig. 3, a square head formed upon the tap. Any one who has ever attempted to flute taps on a planer is well aware that the tool jumps along from thread to thread, and the result is at best anything but satisfactory. By this device the tap can be turned and then fluted on the same lathe, thus necessitating no interruption of either planer or slabbing machine.

The entire tool consists of seven pieces in all: one bar, three jaws, two bands, and a wrench, and is capable of holding round, flat, square, half round, and three cornered articles, from 3-16 to 1 1/4 inches in diameter, and of any length. The material is malleable iron, with hardened steel screws.

The tool seems to be a valuable device, and one, from its many and nice adjustments, not only useful to mechanics but to inventors who are working upon the construction of new models. It is quite small in size, and hence occupies but little space, while its cost is but \$5. We have examined some specimens of its work, which appear excellently well done. Premiums were awarded to the tool at the American Institute Fair of 1873, the Buffalo Fair, and various other expositions throughout the country.

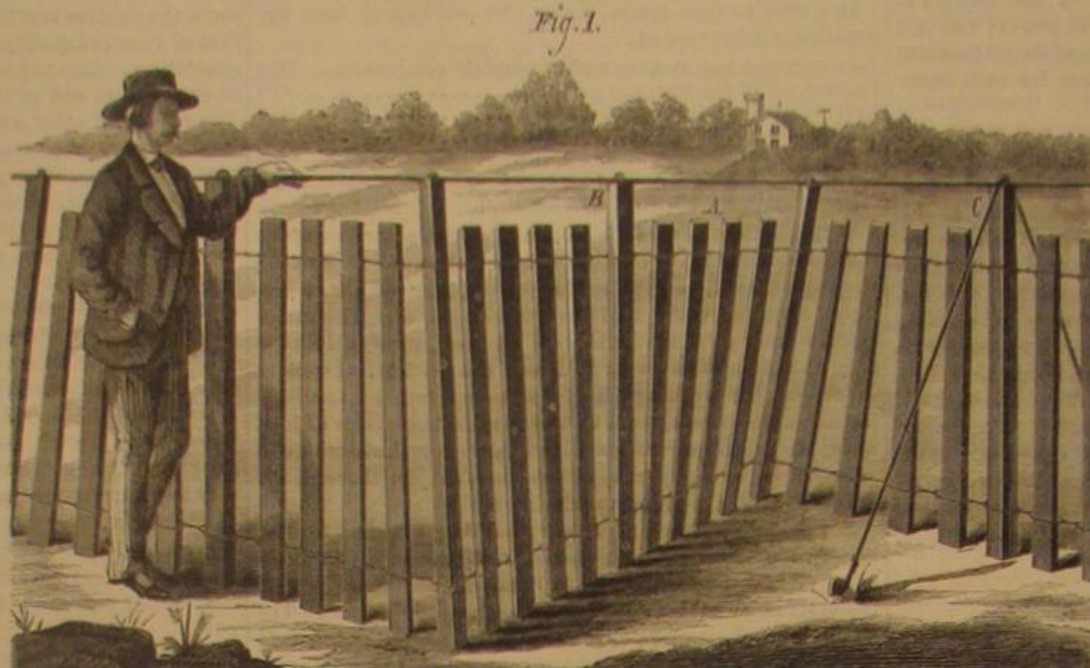
Patented October 22 and December 31, 1872. For further particulars address the inventor, Mr. William P. Hopkins, Lawrence, Mass.]

Iceland's Millennial.

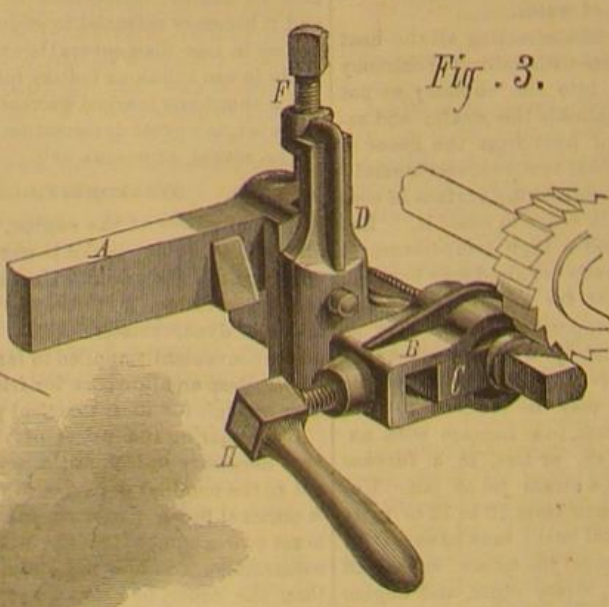
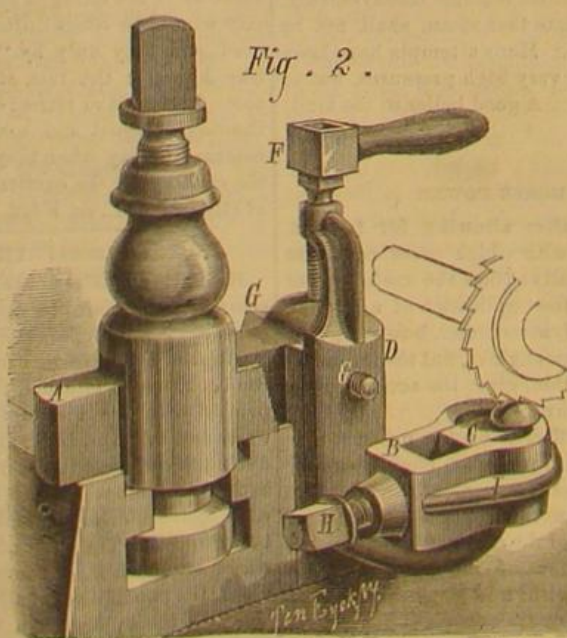
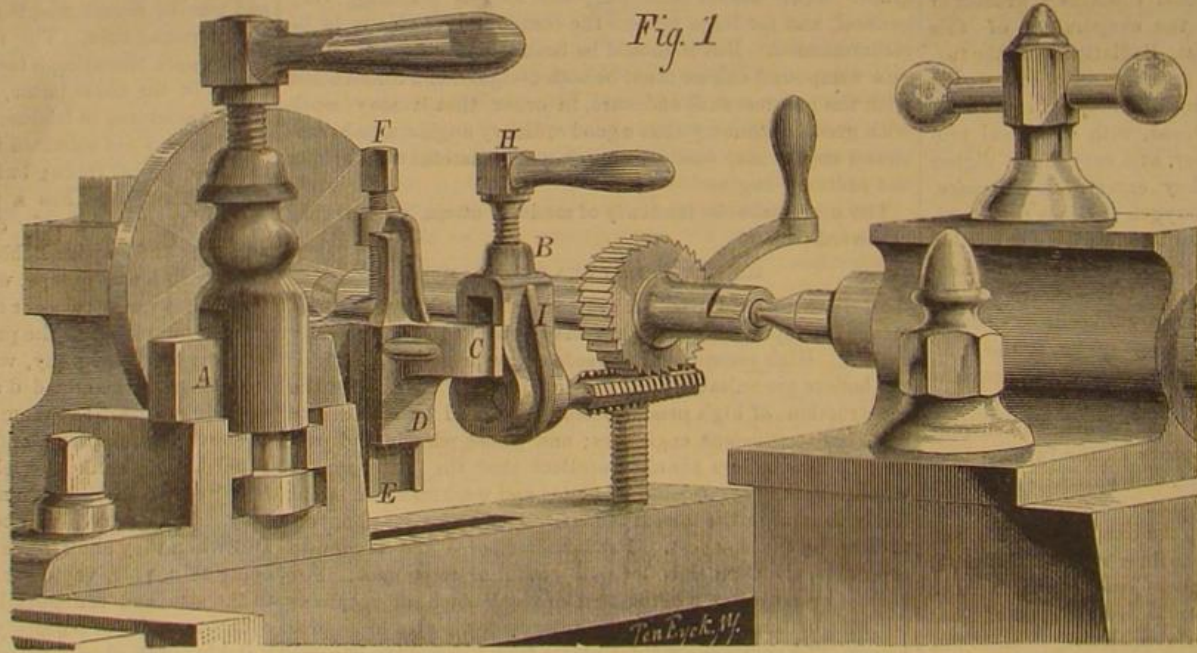
Perhaps no country more uninteresting than Iceland exists in the world. Situated in a high northern latitude, at about 160 miles from the Greenland coast, it is little more than a mass of volcanic rock which natural convulsions have upheaved into mountain ranges. The inhabitants, however, are a cultivated and refined race, and strongly devoted to educational pursuits. Libraries exist in considerable numbers, and are connected with every church.

Just ten centuries have now elapsed since the island was settled by Europeans; and Iceland proposes, during the coming summer, to celebrate her millennial birthday by a grand meeting on the plain of Thingvalla, near Reykjavik, the capital city. The object is not only to commemorate the lapse of a thousand years of national existence, but also the granting of a new constitution by Denmark, in which the independence of the island is guaranteed; and it is intended to devote such proceeds as the affair may yield to the enrichment of the national library. Messrs. Longfellow and George W. Curtis have recently suggested that a gift of books from the American people would be a very appropriate contribution; and it is announced that all who may desire to send volumes can have them transported by the Geographical Society, Cooper Union Building, in this city, or the Pennsylvania Historical Society, Philadelphia, Pa.

A COMPOSITION FOR COVERING HOUSE ROOFS.—Take one measure of fine sand, two of sifted wood ashes, and three of lime, ground up with oil. Mix thoroughly and lay on, with a painter's brush, first a thin coat, and then a thick one. This composition is not only cheap, but it resists fire well.



McGINTY'S PICKET FENCE.



IMPROVED WORK HOLDER FOR LATHES.

CURIOUS PLANTS.

There is little to our minds interesting in a garden filled with roses, lilies, fuchsias, heliotropes, and passies, or any other simple selection of the flowers that every one knows. True, their fragrance is always delicious, and their beautiful colors never pall upon the eye; but while we should perhaps stop for seconds to admire the gorgeous hues of a cluster of tulips or to enjoy the perfume of a bed of violets, we would certainly give minutes, and many of them, to watching the shrinking of the leaves of the sensitive plant or to examining the strange forms of the aloe or cactus.

In the one case we admire a flower which we know is beautiful, doubtless far more so than the odd plant which attracts our closer attention; but with the one we have always been familiar, and the gratification it affords us is simply to the senses of sight and smell; the other presents the charm of that greatest of wonders, a new variety of Nature, and arouses a deeper and more intellectual interest, which holds us enchained until we have gratified the curiosity which leads us to new stores of knowledge. For this reason, we think that no garden should be without some odd or queer plant, in the growth and development of which new marvels will be daily unfolded. Of course there are hundreds of species well known to the professional floriculturist, but of which the amateur gardener is comparatively ignorant; and from these, selections may be made which will render one's flower beds a museum of strange and beautiful forms, which will make them a constant source of pleasure and interest.

As specimens of these odd freaks of Nature, the annexed engravings represent plants which, we think, will prove something novel even to the skilled gardeners in this country. We extract the illustrations from that excellent periodical, the *English Garden*. In Fig. 1 is shown a noble sub-tropical plant, called the *Wigandia caracasana*. Its broad leaves are of a fresh green color and very luxuriant, rendering it a beautiful ornament for lawns. It rarely flowers, but produces a large scapoid inflorescence at the top of a thick fleshy stem. The plant grows quickly in warm soils, and attains a height of from six to seven feet in a single season. It is easily propagated in the spring by means of cuttings; and if the thick roots are cut off in the autumn, a large proportion of them will form young plants when set out in light sandy earth.

In our second figure is represented one of the hardest of the ferns, the *Dicksonia antarctica*. The trunk varies considerably in thickness, and in its native country, Aus-



FIG. 2.—DICKSONIA ANTARCTICA.

tralia, attains a height of thirty feet or more, bearing at its summit a magnificent crown of dark green lance-shaped fronds, from six to twenty feet long, beautifully arched and becoming pendulous with age. The crown itself is frequently ten or twelve feet across, and is ever-green.

In Fig. 3 is another queer but very differently appearing plant, coming from high latitudes in Mexico, and called the *mammillaria sulcolanata*. It grows from five to six inches high. At the base of the mammal is a dense forest of white wool which disappears as the plant gets old. Its flowers are yellow, and one inch and a half in width. They have short bell-shaped blossoms, which rarely protrude beyond the spines, and are produced in whorles.

A very curious plant, known as the *ataccia cristata*, shown in Fig. 4, is a native of the islands of the Malay-an archipelago. The underground portion consists of a short and conical root stock, marked with the scars of former leaves, and here and there throwing up some small tubers, by the removal of which it is easily multiplied. The actual roots consist of a few coarse fibers. From the crown of the root stock rise three or four handsome and dark green leaves, and in the midst is a stout

scape, like that of a hyacinth, twelve to eighteen inches in height, bearing on the summit a unilateral umbel of from twelve to twenty brownish purple flowers. With these are many more that are abortive, attenuated to a length of at least twelve inches, and hanging down like thin straight hair, a lock upon each side, while back of all stand up two enormous vertical bracts, and two smaller ones, flattened out and of a cadaverous greenish purple hue. The whole thing is so weird and gipsy-like that one almost starts at the supernatural mockery. It is easily propagated from its tubers.

The *echinocactus myriostigma* (Fig. 5) may be described as a civilized cactus, inasmuch as it has laid aside its spines



FIG. 1.—WIGANDIA CARACASANA.

and other asperities, and put on an elegant attire, bespangled with silver. This little gem (from Mexico) has generally five deep angles, though sometimes they number seven or eight; at the apex, on the margins of the angles, are borne a quantity of silky, yellow, star-like, sessile flowers, which open du-



FIG. 3.—MAMMILLARIA SULCOLANATA.

ring sunshine, and close about four o'clock in the afternoon. They keep expanding for four or five days in succession, according to the intensity of the sunlight, and they last longest when least exposed: the blossoms begin to open in June and continue expanding, at intervals, until October, during which period a good plant will bear from ten to twenty blossoms,



FIG. 4.—ATACCIA CRISTATA

one inch and a half in diameter. The ground color of the plant is dark green, and its whole surface is thickly and regularly beset with white star-like scales, which give it a very beautiful appearance, especially under a microscope. Its culture is in no way different from that under which other *echinocacti* thrive, but it must, says Mr. Croucher, not be subjected to a temperature below 40°, otherwise it will be sure to suffer more or less from cold, and will not flower satisfactorily.

In a future issue we shall present engravings of several other curious plants and flowers, which will doubtless prove as interesting as those above described.

A Hunter's Parrot.

A correspondent of the *Little Rock (Ark.) Gazette* sends that paper the following account of a common poll parrot, which, it is claimed, has not only been trained to hunt, but which has learned to take a great delight in the chase. The owner and trainer of this hunting parrot is a boatman, who formerly plied between Little Rock and New Orleans, but who some years since gave up the business of boating and has since led the life of a hunter, living in a snug cabin at the junction of Big Mammelle Creek with the Arkansas river. This hunter hermit, whose name is Nathan Lask, brought with him from New Orleans, on making his last trip to that city, a fine young parrot, to which he soon became more attached than any other thing on earth. Seated upon his shoulders, the parrot attended him in all his walks. To train the bird and talk to it was almost his sole occupation. With the careful training of so loving a master, added to its great natural talent for imitating all manner of cries of birds and animals, this bird has become a marvel of cunning and a great wonder in its way. Taken into the hills bordering Big Mammelle Creek, and the signal being given at intervals, it utters the cry of the turkey so perfectly as to deceive the oldest and most astute gobbler that ever strutted. On being answered by a gobbler, the parrot proceeds to lure him to death in the most fiendishly coquettish manner imaginable. Seated on his master's shoulders, charily and coyly the parrot replies. Once he has fully attracted the attention of the vain and anxious gobbler, often allowing him to call in a fretful tone twice or thrice before deigning to answer; he then, in a few low and tender notes, lures the proud bird of the forest within range of the hunter's deadly rifle. Seeing the turkey struggling in the agonies of death fills the parrot with the most fiendish de-

light, to which he gives utterance in a succession of blood-chilling "ha has," in all manner of diabolical tones and keys. Should the hunter miss his aim, however, the parrot ruffles his feathers, croaks and scolds, pulls his master's hair, and long refuses to be pacified. Duck hunting in Forche and Meto Bayous is, however, the parrot's chief delight. Seated in the bow of his master's boat, snugly ensconced in



FIG. 5.—ECHINOCACTUS MYRIOSTIGMA.

a patch of tall bullrushes, the parrot bursts forth into such a "quack, quacking," and general duck gabble that there seems to be in the vicinity a whole flock of these birds, all enjoying themselves immensely. Thus are many passing flocks of ducks lured within range of the gun of the hunter. Geese are in the same way called up by the parrot; also many other wild fowl and even deer, as the bird imitates the plaintive bleating of a fawn or doe to a nicety. No money would buy the bird, and Nat. Lask, seen strolling through the woods, gun in hand and with his almost inseparable companion seated on his left shoulder, seems a second Robinson Crusoe. Although so perfect in his imitations of all manner of birds and animals, the parrot is not a great talker; indeed, his vocabulary is limited to a few words and one or two short phrases. He will sometimes sing out: "Nat, you lubber," and when Dan Lanagan (a brother boatman of Nat's, living at the head of Bayou Forche, and almost his only visitor), in his dug out, is seen paddling in toward the mouth of Big Mammelle Creek, the parrot—whose name, we forgot to say, is Bobby—will shout, "Lanago, ahoy! Lanagan, a hoy!" The moment Bobby sees his master take down his gun, he is in a great utter. He cocks his head on one side, his great red

eyes sparkling with delight, and, in a low, inquiring tone, says: "Turkey? turkey?" "No, Bobby," Nat will perhaps say, "not turkey today." Bobby cocks his head the other way and softly says: "Quack, quack, quack?" "Yes, Bobby," says Nat, "quack, quack!" Bobby then bursts into a loud "ha, ha, ha!" and cries, "Nat, you lubber, quack, quack, quack!" Then he ha has till the whole cabin rings again.

THE FLOW OF SOLIDS AND ITS EFFECT UPON THE STRENGTH OF MATERIALS.

BY PROFESSOR H. H. THURSTON.

One of the most important properties of metals is that which has been carefully and skillfully investigated by M. Tresca, the distinguished "Sous-Directeur du Conservatoire des Arts et Métiers," and by him called the flow of solids. The important modification produced in the strength of materials by this action is not generally recognized, and has not been considered by standard authorities on this subject.

Professor Henry proved long ago that liquids, which were previously regarded by all, and which are still regarded by many, as destitute of all cohesion, are actually endowed with considerable attractive force, their molecules clinging to each other with a tenacity probably nearly, and perhaps quite, equal to that of ice. The total absence of the force of polarity, which gives the property of solidity, and the perfect freedom from true friction, observed in fluids, prevent the casual observer from detecting the existence of this attraction, and it can only be measured by ingenious artifice and skillfully conducted experiment. In solids, the force of polarity prevents the occurrence of such intermolecular movements, and enables cohesive force to be observed and appreciated; but it is evident that, so long as the power of changing interatomic distances by flow remains, the maximum cohesive resistance of the material cannot become a measure of its tenacity.

It has recently been found that any distribution of material which aids polarity in resisting the tendency of particles to slide among each other, under the action of any straining force, causes a power of resisting external forces to become evident, higher than is noted where the form is such as to permit flow. The real resistance to fracture offered by any piece, as a bolt, for example, is determined by the relative and absolute values of cohesive force and polarity, and the form of the piece, and is not, as has been so generally supposed, a simple measure of the cohesive strength of the substance.

It was shown sometime since, in an illustrated article published in the *Railroad Gazette*, that a piece of boiler plate having rivet holes, whether punched or carefully drilled, was actually weaker per square inch of breaking section than when solid. It has long been known to engineers that short specimens of materials, subjected to test in the standard form of testing machine, exhibited higher tenacity than long specimens of the same material with a uniform cross section. This phenomenon has recently been studied by Mr. C. B. Richards, at Hartford, and by Commander Beardlee at the Washington Navy Yard, and the results obtained are very similar.

The standard short specimen gives, almost uniformly, about twenty per cent higher resistance to fracture by tensile force than the long specimen, which has a uniform cross section for a length of several times its diameter.

A metal which exhibits a tenacity of 60,000 pounds per square inch when tested in the first form, the minimum area occurring at a single point, will usually resist with a force of but about 50,000 pounds when tested in the form of a long bolt. It is therefore very important to know in what form a specimen of metal has been tested when its so-called tenacity is stated.

The majority of experiments hitherto made and quoted in books and periodicals have been made with short specimens. We are consequently very liable to be led to expect more of our materials than they are really capable of sustaining.

It may be inferred, from what is above stated, that, in construction, we should always be careful to design the parts exposed to strain in such manner that their form should aid in giving resisting power by preventing, as far as may be, a flow of particles and consequent stretch or distortion. This is correct when dead loads are to be carried.

Another inference would be that one large piece is less liable to yield under the attacking force than several small ones of equal total section. It is, however, to be remembered that small pieces are usually better worked and are less affected by internal strain than are large pieces. This is particularly the case with iron and steel, which are far more liable to this last kind of fault than are the other metals. Where the piece is to resist blows, or to sustain live loads, it need hardly be said, it should never be given a contracted section if it can possibly be avoided.

Since the damaging effect of a blow is measured by the product obtained by multiplying the weight of the striking body into the height from which its fall would have given it its striking velocity, and since the resisting power of the piece receiving the blow is measured by the product of the strength of the material into about two thirds the distance it will stretch before breaking, it is seen that the proper method of forming the resisting piece is that which gives it the best opportunity to stretch to a maximum extent before breaking. This is done by making the greatest possible length of uniform section and seeing that all other portions are somewhat larger.

Thus the best bridge builders in this country make the

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long bolts, which are used as braces, of uniform sectional area from end to end, except at the very extremities, which are upset for a distance equal to the required length of thread to be cut on them, and this enlarged portion at each end is given such size that the diameter at the bottom of the thread, when cut, shall be somewhat greater than that of the body of the rod.

The amount of flow of the metal is determined by the character of the metal. Hard wrought iron and tool steels, for example, exhibit it less, and are consequently more ductile and resilient, than soft iron and low steels, while the latter are weaker metals than the former. Cast iron is both weak and non-resilient, and is therefore not well fitted to sustain either dead or live loads. The harder metals are not less affected by shape, in their power of resisting shock, than are the softer grades, and where it becomes necessary or advisable to make use of them under such circumstances, the same care should be taken to avoid concentrating the straining action on a short portion, or upon a single plane of cross section.

It often happens in designing machinery, that pieces are necessarily made of such shape as to be liable to injury from the cause here considered. Should this danger appear serious, the designer might be justified in changing his whole plan to avoid such risk.

A connecting rod, as usually made, is an illustration of a piece unfitted by its shape to bear a blow. The less the taper of the rod, the less is its liability to yield to shock. To secure in any given case a form of rod that shall best combine power of resisting shock with maximum endurance under heavy strain is often an important problem. The spring of the rod will often take up excessive strains, due to accidental and excessive blows caused by the piston striking upon water in the cylinder or by other exceptional occurrences.

The body of a piston rod being of uniform section, it is well fitted to meet either static or dynamic compressive stress, but it is so seriously weakened at each end by the taper given it in fitting it to piston and crosshead, and by the slots cut through it, that it is usually quite unfit to offer maximum resistance to shock in tension.

To resist perfectly steady strain, therefore, and to carry dead loads, we should always select the strongest material, rather avoiding ductility, and, where the minimum section occurs, make that as short as possible and of such form as shall best resist flow and change of shape.

To resist percussive action and to sustain live loads, we should select that material which is at once the strongest and most ductile, avoid brittleness as certain to produce danger, and make the piece of such form as shall allow the greatest possible stretch before breaking.

Where two materials have products of strength into elongation which have the same magnitude we would select the most tenacious. Where two materials are equal in other respects, we would select that which has least density, since it is less likely to produce a concentration of the effect of the shock near the point at which the blow is struck.

STEVENS INSTITUTE OF TECHNOLOGY.

Plant Trees.

Mr. Reuben Shelmandine, of Jefferson, N. Y., is evidently a philanthropist, and he proves his love for mankind in general by issuing a proclamation to farmers. Why he should embody a number of very useful hints about transplanting trees in this highly official document, we cannot explain. Suffice it that the writer says that he has had an experience of twenty years on a farm, and "not on a side walk," and that his remarks are practical. Transplant, he says, finest or standard fruit trees, some in the fall and some in the spring, until you have from 10 to 50 trees growing. No tree should stand nearer a building than twenty feet, and the trees should be about twenty feet apart throughout the entire grove or orchard. Establish forest trees along the road and the front yard, and fruit or forest trees on other sides of the house. Sugar maple, commonly named hard maple, is preferable of forest trees, and thrifty, hardy apples or pears, or both, of the standard (not dwarf) kinds.

Ornamental trees should be trimmed during the first few years, leaving the main shoot to form the trunk of the tree, in order to have the branching lower limbs of the final tree from six to seven feet from the ground. The land in such an orchard grove can be cultivated for all ordinary crops, including a garden, by plowing shallow and carefully near the trees.

It is suggested that the first ten trees be planted on the south side of the house, if none be there already.

If a wind break is wanted on the west, northwest, or southwest, plant as near together as possible and have a part of the trees evergreens, to complete the thicket. The forest and fruit trees, arranged about twenty feet apart, as above described, will be estimated by the owner or other persons at the expiration of five years from the time of planting to be worth at least five dollars each, and at the expiration of ten years at ten dollars each, with an increasing value thereafter.

Inventions Patented in England by Americans.

(Compiled from the Commissioners of Patents' Journal.)
From April 14 to April 16, 1874, inclusive.

- BOILER AND FURNACE.—D. Hershaw, Higham, Mass.
- HORSE COLLAR LINING.—D. Curtis et al., Madison, Wis.
- LEATHER DRESSING MACHINE.—J. M. Callier, Salem, Mass.
- NEEDLE.—W. Traube, Louisville, Ky.
- PUMP.—W. D. Baxter, New York City.
- TEMPERING APPARATUS.—G. F. Simonds, et al., Boston, Mass.
- WASHING MACHINE, ETC.—E. Marshall, Toia, Kansas.

DECISIONS OF THE COMMISSIONER OF PATENTS.

PATENT TOBACCO BAG.—JAMES D. CULP.—Appeal.

[Appeal from the decision of the Board of Examiners-in-Chief in the matter of the application of James D. Culp, for patent for improved Tobacco Packages.—Decided April 15, 1874.]

LEGGETT, Commissioner.

Applicant claims—

1. The use of elastic knit or loosely woven tobacco sacks, substantially as herein described, for packing tobacco.
2. As a new article of manufacture, elastic tobacco sacks made of knit or loosely woven fabrics, substantially as herein set forth and described.

Heretofore sacks for containing small quantities of granulated tobacco, to be sold at retail in small packages, have been made of woven fabric, pieces being cut out, folded, and sewn at one side and one end to form the sack.

In packaging the tobacco it is pressed into a metallic tube, over the end of which the bag is slipped to receive the tobacco as it is forced out of the tube.

Applicant proposes to knit long tubes of the diameter of a tobacco package and cut them into suitable lengths to form tobacco sacks, and merely sack is admitted, but the Board hold that, as it is common to knit tubular fabric for stockings and hose, and to knit into proper lengths and sew up one end, there is no invention in making a tobacco sack in this manner.

The following points are made by the applicant against the soundness of this opinion. He says his sack can be manufactured with less expense than the old sack, because it requires less sewing. But this advantage is due solely to the method employed in its manufacture, which, broadly considered, is old. Laying aside the method, which, although it has never been employed before to make tobacco sacks, has been used to make purses and stockings, and considering the alleged qualities and advantages of the finished article, it is said, first, that on account of its elasticity it will readily fit the metallic tube, even if there is some variation in its size, and thus the waste of misfitting sacks, which occurs in the use of the unyielding woven fabric, is avoided; second, the danger of giving way at the side seam, which is incident to the sacks at present employed, is obviated; third, and more important, the sacks adapt themselves to the size and shape of the packages, requiring nothing but the drawing string to snugly close their mouths for the reception of the revenue stamp, and the ordinary seam across their bottoms to smoothly close them, while the common cloth bags require extra sewing and pressing after the tobacco is put in them.

That the sack, for the use contemplated, is a new and superior one is clear and it is the object of the law to promote the production of new and improved articles for the use of the public.

Very little analogy appears between a stocking or purse and a sack for a tobacco package.

Decision of the Board reserved and a patent allowed to the applicant.

RIGHTS OF EMPLOYERS AND EMPLOYEES TO INVENTIONS.

GILBERT, AND CLARKE, BONZANO & GRIFFEN.—INTERFERENCE.—ELEVATED RAILWAY PATENT.

[Appeal from the decision of the Board of Examiners-in-Chief in the matter of the interference between the application of Rufus H. Gilbert, and Clarke, Bonzano & Griffen, for patent for improvement in Elevated Railways.—Decided April 16, 1874.]

LEGGETT, Commissioner.

The invention in controversy is an elevated street railway. Such a means of transit in large cities has long been a project of absorbing interest to the applicant, Dr. Gilbert.

With such a scheme more or less developed in his mind, he went to the firm of Clarke, Bonzano & Griffen, at Phoenixville, Pennsylvania, distinguished engineers and bridge builders, to enlist their skill and services in its practical furtherance. It is admitted that the widespread reputation of this firm as engineers and bridge constructors led to those business transactions between the parties from which this controversy springs. Dr. Gilbert freely communicated to them his ideas and plans, as far as he had perfected them, and that they were prompted to the consideration of the subject by his suggestions, cannot be doubted. How far he had matured the structure of the device in his own mind is somewhat uncertain. It is clear, however, that he had not perfected all the details, and probably could not have done so. But that he had conceived all the essential parts, and had supporting columns, an arch of some kind properly supported, and a track bed properly supported and far enough beneath to admit of the passage of steam cars under the arch, all of sufficient strength for the purpose contemplated, is certain. The very conception of the idea of an elevated steam railway over the center of a street, which would not obstruct travel, must have suggested this much, especially when a transition was made from the pneumatic structure which he had already planned and pictured. Evident sketches made in the course of the conversations were accordingly made, and they were not intended to establish the existence of the general idea of the structure embodying the invention claimed. There is sufficient proof to carry conviction without them.

Gilbert needed and sought the practical suggestions and instructions of skilled mechanics and engineers. They could and did tell him that a gothic arch would not do. They probably told him, as all other engineers would have told him, that he must provide for expansion and contraction, and without making any invention they could readily suggest how it should be done. They no doubt informed him also with reference to the strength of the material, and how braces and diagonal and vertical tension rods could be advantageously employed. Whether these were suggested by him or by them is immaterial. All this and much more any practical bridge builder would inform an inventor for the furtherance of his general plan, and it is perfectly legitimate for him to invoke such aid.

It is not to be understood that the aid suggested may always be sought without jeopardizing inventions, because, in fact, an inventor can seldom perfect his conceptions without them.

As to what transpired at the interview of Foster and Gilbert with the firm of engineers upon whom they called and whom they consulted, among the somewhat conflicting accounts the following testimony of Foster appears to be a conscientious and reliable summary. He says, in substance, pencil sketches were made to illustrate the requirements of the contract by Dr. Gilbert and himself; some were also made by Mr. Bonzano and Mr. Griffen. They were illustrative of detail and arrangement. Illustrative suggestions were made by all the parties present, none of which he could fix upon one or the other. The consultation here indicated was such as would naturally take place at such an interview. It does not go to show that Clarke, Bonzano & Griffen were inventors. The prospect of a contract to build for the Gilbert Railway Company was sufficient to induce them to do so, and the services sought of them by Dr. Gilbert. That was doubtless the consideration upon which they acted for him at his request. He presented the idea of the invention and they promptly assisted to render it practicable, because of the inducement of ultimate profit to be derived from it as employees in the line of their profession.

The relation of employer and employee was essentially established between the parties. That being the case, admitting all that is claimed to have been suggested by Clarke, Bonzano & Griffen, I cannot see that they have any claim to independent inventorship.

Decision in favor of Gilbert.

DECISIONS OF THE COURTS.

United States Circuit Court—District of Massachusetts.

PATENT ELASTIC FABRIC.—WILLIAM SMITH VS. THE GLENDALE ELASTIC FABRIC COMPANY.

[In equity.—Before Shepley, Judge.—Decided February 13, 1874.]

The previous production to a limited extent of goods resembling those fabricated by the plaintiff's process, and by means somewhat similar, held to have amounted to no more than abandoned and unsuccessful experiments, and not to impeach the validity of his patent.

SHEPLEY, J.:

This is a bill in equity founded on alleged infringement of letters patent reissued to the complainant, numbered, respectively, 2,843 and 2,844.

Ferdinand Doebly and Henry G. Gurney, witnesses in behalf of the defendant, testify to the use of looms with stationary warps before the date of complainant's invention. Neither of them drew or made a model of the looms to which they testify, nor do the witnesses themselves or any experts in the case testify that the mechanism described by them was substantially like that described by the complainant in his specification. In the case of Gurney only a trifling quantity of the elastic web was made in the loom described by him. It is not easy to determine from the testimony how much of the product which Doebly says was made before his father was made on the loom with stationary warp. I think they are to be regarded in the light of abandoned, and, judging from the specimens of the work filed as exhibits in the case, as unsuccessful, experiments before the date of complainant's invention. There is considerable testimony in the case tending to show that the elastic webbing can be well made by the use of a rising and falling rubber warp. Machinery operating in that way is open to be used without infringing the complainant's patent. The fact that respondents prefer to use the mechanism patented by complainant is evidence that there is sufficient utility in the invention to support a patent.

Decree for complainant.

[T. A. Jencks and L. Scott, for complainant.
Benjamin Dean, for defendants.]

United States Circuit Court—District of Massachusetts.

WADE H. HILL et al. vs. G. H. WHITCOMB et al.

[In equity.—Before Shepley, Judge.—Decided February 13, 1874.]

The Court held as follows:

Shepley, Judge:

The Allen Manufacturing Company, being the owners of the rights secured by three different letters patent of the United States, for the invention of Edwin Allen in improvement in printing presses, on the 1st of February, 1871, entered into a certain contract with the complainants. This bill is brought to enforce the rights of the complainants under that contract.

The contract begins with a recital that the Allen Manufacturing Company are the owners of a patent automatic envelope printing press, which they styled a patented automatic envelope printing press. In the organization of which were included the inventions secured. "The exclusive right to use and vend said presses in the county of Worcester and in the State of Rhode Island" is granted to Hill, Devoe & Co., the complainants, the Allen Manufacturing Company reserving for themselves "the exclusive right to manufacture said presses."

The second clause provides that the company shall, within a reasonable time, supply all presses ordered and received by them, and shall covenant to protect and defend the complainants in the exclusive use and enjoyment of the said automatic envelope printing presses in the territory aforesaid.

The fourth clause provides for the payment by complainants of the sum of one thousand dollars for each press ordered and received by them, and of a royalty of one dollar per day on each press on which envelopes can be printed of size No. 5 and corresponding royalties for other sizes. "When said parties of the second part shall be protected in the exclusive use and enjoyment of them according to this agreement."

The fifth clause contains provisions concerning the sale by complainants to other parties not material to the subject-matter of this inquiry. It is provided in the sixth clause that complainants shall have the exclusive right in said territory to use any and all improvements upon said presses, which shall hereafter be made, and which shall be owned by or under the control of said parties of the first part, and shall have the right to adapt said improvements to all presses purchased by them before the date of said improvements.

The complainants were, therefore, not grantees of an exclusive right under the patents, or any of them, to the whole or any specified part of the United States. They were licensees with the right of using and vending to others to be used, within the specified territory, such presses embodying the patented inventions as they might purchase of the Allen Company, which owned the patents, and having complied with that license a grant of the exclusive right to use, rent, and vend said presses in the specified territory upon the prescribed conditions, and a covenant for protection in "the exclusive use and enjoyment of said automatic printing presses aforesaid and of the improvements aforesaid."

Such a contract clearly gives the licensee no right of action for an infringement of the patent. To enable the purchaser to sue, the assignment must undoubtedly convey to him the entire and unequalled monopoly which the patentee held in the territory specified, excluding the patentee himself as well as others. Any assignment short of this is a mere license, and the legal right in the monopoly remains in the patentee, and he alone can maintain an action against a third party who commits an infringement upon it.

Even when a suit at law will lie for the infringement of a patent, proceedings in equity may usually be maintained, as affording a more practical and efficient remedy.

No one can maintain a suit for the infringement of a patent except the patentee, or an assignee who owns the entire right in it for a specified territory, exclusive of the patentee himself.

The owner of the exclusive right to use a patented article, and to sell it within a specified territory, but not the right to manufacture it, is a mere licensee, and cannot maintain on any action for infringing the patent.

The parties who own the exclusive right to use and sell a patented invention within a specified territory, with a guaranty for its enjoyment from the patentees, cannot maintain a bill for an injunction and for an account against the patentees and parties who, with knowledge of the contract, have purchased the arrangement from them without the territory, and are using it within it.

The federal courts have no jurisdiction over a suit brought to enforce such a contract against the patentees, and the purchasers from them, where all the parties are citizens of the same State.

[Counsel: Breteau and James S. Holmes, for complainants; George S. Hildard, James E. Maynard and M. F. Dickinson, for defendants.]

United States Circuit Court--District of California.

PATENT AMALGAMATING PAN.—COOLIDGE vs. MCCOY.—INFRINGEMENT.

[Decided March 5, 1874.]

In a patent for an amalgamating pan, a claim for "constructing and placing the shoes and dies upon upper and nether disks obliquely at about the angle as described, together with the beveled bars B B B, etc." is a claim for the shoes and dies in combination with the bars.

The claim is not infringed by using the shoes and dies without the bars, although it should be shown that the bars are of no use in the combination.

Sawyer, Circuit Judge, delivered the opinion of the court.

We have examined the specifications annexed to the patent very carefully, and it is very plain to our minds that the patent is for a combination of several elements or parts. The petitioner commences by describing the drawings, and then states as follows:

The nature of my invention consists in the arranging of shoes and dies having grooves or channels cut obliquely from the circumference to the center, terminating in a line of a radius to the center or axis. My invention also relates to beveled bars placed between each die and partially filling the grooves, for the purpose of keeping the ore near the same as they pass each other.

Then he describes how the dies are fixed to the disks, and tells us how other dies have been used in a different arrangement; points out how the beveled bars are arranged in connection with the other parts; describes their operation, and concludes with the claim, which is in the following words:

I do not claim broadly the use of shoes and dies for the purpose of reducing amalgamating ores, for these are well known and used. What I do claim, however, and desire to secure by letters patent, is constructing and placing the shoes and dies upon upper and nether disks obliquely at about the angle as described, together with the beveled bars B B B, etc., substantially as described, and for the purposes set forth.

There is nothing to show that this combination was made or sold by the defendant, or that he has made portions of it and sold them to other parties, with the knowledge that they were to be used in connection with the "beveled bars" for the purpose of making up a single complete machine.

The court thereupon advised the jury to return a verdict for the defendant, which was accordingly done.

Lewis & Deal and *Beatty*, for plaintiff.

Williams & Bizer, for defendant.

United States Circuit Court--Southern District of New York.

PAPER BAG MACHINE PATENT.—THE UNION PAPER BAG MACHINE COMPANY et al. vs. GEORGE L. NEWELL et al.

[Blatchford, Judge.]

By the first section of the act of July 8, 1870, (16 U. S. Statutes at Large, 208), it is provided that in a suit in equity for relief against an alleged infringement of letters patent, certain specified defences may be pleaded and proofs of the same may be given upon certain specified notice in the answer of the defendant, and with a certain specified effect. Among the defences specified in the section are that the patentee was not the original and first inventor or discoverer of any material and substantial part of the thing patented, and "that it had been in public use or on sale in this country for more than two years before his application for a patent, or had been abandoned to the public." As to notice in the answer, the section requires that, in giving such notice as to proof of previous invention, knowledge, or use of the thing patented, the defendant shall state in the answer "the names and residences of the persons alleged to have invented or to have had the prior knowledge of the thing patented, and where and by whom it had been used." As to the effect specified, the section provides that "if any one or more of the special matters alleged shall be found for the defendant, judgment shall be rendered for him with costs."

This is a suit in equity for relief against an alleged infringement by the defendants of letters patent of the United States granted to Benjamin L. Binney, assignee of E. W. Goodale, as inventor, September 12, 1865, for a machine for making paper bags. The bill was filed August 12, 1872. The answer was filed July 7, 1873. The replication was filed August 23, 1873. The plaintiffs commenced taking proofs for final hearing by the examination of witnesses, orally, before an examiner, under the 6th rule in equity, as amended, and by the putting in of documentary proofs, on the 25th of October, 1873. The plaintiffs read their case on the 6th of November, 1873. The defendants, so far as appears, have taken no proofs for final hearing. On the 26th of November, 1873, this court, after a full hearing of both parties, granted a preliminary injunction restraining the defendants from infringing the patent by using the invention described and claimed in the first claim thereof.

The answer of the defendants sets up, in general terms, a denial that E. W. Goodale was the original and first inventor of what is claimed in the patent or of any substantial or material part thereof, and a denial that the same was not known or used before, or that it was not, at the time of the application for letters patent, "in public use or on sale" and "abandoned to the public" and a denial that the said alleged invention and improvements contained in said letters patent were in public use and on sale for more than two years prior to the date of said application for letters patent. But the answer does not state the name or residence of any person whom it alleges to have previously invented or to have had prior knowledge of the thing patented, nor does it state where or by whom the thing patented had been previously used, nor does it set up any defence of the abandonment of the invention to the public by E. W. Goodale as inventor. Under the state of facts the defendants, not having obtained any leave to amend their answer or any extension of the time for taking proofs, which has expired by the lapse of time, now apply to the court, on affidavits to dissolve the injunction referred to. The affidavits seem to be intended, so far as they relate to defences authorized by the first section of the patent law, to raise the defence that the invention covered by the first claim of the patent was, with the consent and allowance of E. W. Goodale, in public use at Clinton, in Massachusetts, for more than two years before the application for the patent was made, and perhaps the defence that E. W. Goodale was not the original and first inventor or discoverer of what is covered by the first claim of the patent. The plaintiffs take the objection as a bar to the hearing of the application, so far as it rests on said defences, that, inasmuch as the defences attempted to be set up in the affidavits could not be availed of by the defendants in the taking of proofs for final hearing, both because the proofs are closed and the case is ready for final hearing, and because also the defendants have laid no foundation in their answer for putting in any proof to sustain such defences, such defences cannot be availed of to dissolve the injunction granted. This objection must prevail. No ground is shown in any other respect for dissolving the injunction.

In order to avoid any implication that the defences sought to be set up in the affidavits as defences under the first section would, on the papers put in on both sides on the application, be regarded as made out to such an extent, at least, as to warrant the dissolving of the injunction or to have required the withholding of the injunction when originally granted, it is proper to say that no examination of the affidavits has led me to the conclusion that such result would follow from a consideration of the fact established by such papers.

The motion to dissolve the injunction is denied.

[Counsel: Harding and Horace Binney, Jr., for complainants; George F. Norton, for defendants.]

United States Circuit Court--District of New Jersey.

WETHERILL et al. vs. THE NEW JERSEY ZINC COMPANY.

McKenna, Circuit Judge:

At a final hearing of this case it was adjudged that the defendants had infringed letters patent granted to Samuel Wetherill, on the 13th of November, 1855, and extended for seven years, for a process for making white oxide of zinc, and they were perpetually enjoined "from the further constructing, using, or selling in any way or manner, directly or indirectly, the said patented improvements or any part or parts thereof." They are now alleged to have violated this injunction, in the use of a process substantially the same as Wetherill's, or at least embracing its essential features, and a motion has been made for an attachment against them for contempt.

The characteristic features of Wetherill's process were stated to consist in the employment of a thin bed fire of chestnut coal and of a superincumbent layer of pulverized ore and pea coal of the approximate thickness of three inches, the enforced passage of atmospheric air in numerous jets

through the mass, by which its combustion is maintained, the vaporization of the zinc and its oxidation in the furnace above the charge, when the zinc in the ore is expelled, and the repellition of the process. In the blast furnace—to which alone, as a prior device, it is necessary to refer—the fuel and ore are not commingled, nor is the charge spread in a thin layer, and when its working is begun it must necessarily be continued without interruption until the furnace is blown out. In all these particulars the Wetherill process is different. The bed fire consists of fuel in a commingled form; so also does the charge of mingled ore and carbon. The charge is spread in a layer of the maximum depth of eight or nine inches, and through it is diffused a blast of air, not only to keep up combustion, but to supply the vaporized zinc with sufficient oxygen in the furnace chamber to convert it into white oxide, and when the metallic zinc is expelled from the ore, the scoria or slag is removed and the process repeated. It is thus an alternating process, inasmuch as it is susceptible of temporary suspension and repetition, whereby it is distinguishable from the operation of the blast furnace, which is continuous and incapable of interruption.

The process used by the defendants is claimed to differ essentially from Wetherill's, first, in the character of the charges employed, and, second, in the continuity of their treatment; and upon the determination of these facts the result of the present application depends.

The defendants introduce a supplemental blast into the furnace chamber above the charge. No such blast is used in the Wetherill process, and the proof at the final hearing of the cause demonstrated that the results were perfect without it. Now, if the means employed by the defendants to supply the charge with air beneath it operate less efficiently than Wetherill's, although they are identical in function and mode of operation, does it follow that a necessary supplement of air in one case and not in the other renders the processes different? We think clearly not. But in point of fact the oxidation of the zinc fumes is effected by the lower blast in the defendant's method as in Wetherill's. This is the import of Mr. Benwick's testimony, who says that vapors fit to go to the collecting chamber were coming off the charge before the supplemental blast was turned on. But in view of the preponderating weight of the proofs taken before the final hearing, if the product is not perfect without this additional supply of oxygen, it must be ascribed to the defective application of the lower blast, and not to any essential difference in the character of the method of introducing it.

We are therefore drawn to the conclusion that a preliminary bed fire, or thin charge of commingled ore and carbonaceous matter, and the enforced passage of the air in numerous jets through the mass, by which its combustion is maintained and vaporization and oxidation of the zinc above the charge, when it is expelled from the ore, are effected, are features common to both Wetherill's and the defendants' methods.

We are satisfied that the method complained of is, in substance and character, the same with the method pursued by the defendants before the injunction, for the use of which they were adjudged to be infringers.

A billable attachment must, therefore, be awarded against the president of the defendant company, upon whom the injunction was served, and who is shown to have devised and practiced the transgressing process.

Recent American and Foreign Patents.

Improved Gas Regulator.

Joseph Adams, Washington, D. C.—This invention relates to that class of regulators in which the pressure of the gas acts upon a flexible diaphragm to which is attached a valve that opens or closes as the gas is turned on or off from the burner, or as the pressure varies from the street mains; and it consists in a new and improved arrangement, in which the valve is made more sensitive to the pressure of the gas by means of a balloon-like arrangement of thin metal in the diaphragm that opens down through the valve, and, being constantly filled with gas, counteracts, by its buoyancy, the weight of the valve, and hence makes the diaphragm, as connected with the valve, more sensitive to the pressure of the gas.

Improved Hydrant.

John Thomas Davis, Washington, D. C.—This invention is designed to provide novel means calculated to facilitate the operation and manipulation of hydrants, while they are also effectually prevented from freezing in the severest temperature of the winter.

Improved Saw Mill.

John N. Hall, Central City, Col. Ter.—The features of this invention are: An improved apparatus for adjusting the ends of the log as it rests upon the head blocks; for adjusting the log for slabbing; for automatically moving the log laterally toward the saw after each cut, or from the saw when necessary; and for operating the log carriage.

Improved Velocipede.

Friedrich C. Scharff, Chillum, O.—This is a perambulator to be used by grown-up persons and children for the conveyance of parcels. The horizontal frame is supported on the crank axle, to which the driving wheels are keyed. The middle part of the frame has a seat. Upward and downward extending standards are cast to form the bearings for crank shafts, by which the motive power is transmitted from hand cranks of the uppershaft to the driving wheel. These shafts, as well as the axle of the driving wheels, are provided with double cranks, one crank on each shaft being under right angles to the other. The crank rods connect the upper driving shaft with the lower crank shaft, and suitable rods connect the lower shaft with the crank axle of the wheels, transmitting thus the driving power to them. The lower shaft is also provided with radial arms and weights, which serve the purpose of a fly wheel, and assist transmission of power. There is also a guide wheel, readily covered.

Improved Portable Feather Renovator.

Ahner B. Hutchins, Brooklyn, N. Y.—There is a perforated plate for distributing the steam throughout the mass of feathers contained in a cylinder. A jacket surrounds the cylinder, to confine the steam for drying off the feathers, and there is a flexible tube for discharging the feathers from the cylinder into the sack. The jacket is arranged to form the bottom, sides, and top of the truck body; also a protecting case for the steaming cylinder. The steam pipes are provided with cocks, controlling the steam so as to let it into the cylinder, first for steaming the feathers, and afterward into the jacket for drying them off.

Improved Breech Loading Fire Arm.

Joseph C. Dane, La Crosse, Wis.—This invention relates to means whereby the barrel or barrels of a breechloader may be conveniently locked to and unlocked from the stock, and consists in a slide that forms both a part of the trigger guard and a part of the mechanism for operating the key.

Improved Paper Box Machine.

William Gates, Frankfort, N. Y.—A roll of paper or straw board is placed on a spindle supported by arms, and its end is carried under a slitting cylinder where slits are cut by spring cutters. The paper is carried from the slitting cylinder upward, and under the pasting roller, whence it is carried to the platen, the face of which is provided with small points, which hold the paper in place over the mold ready for the plunger. Each plunger is preceded by a knife, which cuts off the paper for the box. The plunger forces the paper into a recess, and doors are then forced against its sides, forming the box. The parts are then firmly pressed together by suitable mechanism.

Improved Painter's Pail.

Francis C. Landon, Josiah Smith, and James H. Flood, Southold, N. Y.—This is an improved painter's pail, so constructed as to enable the painter to take up the ladder with him paints of different colors, and a large and a small brush for each color, with the same facility that he now takes paint of a single color. It consists of a tray having a cover provided with holes not unlike a table castor, into which two or more paint buckets may be set. Receptacles are provided for brushes, etc., and the whole is suitably suspended.

Improved Car Starter.

William Gullfoyle, New York city.—This invention consists of double drums with central or side ratchet wheels, which are keyed to the axles of the car wheels, and encircled by metallic springs or bands lined with leather, one end of said bands being connected to a heavy elliptic or other shaped spring, the other to a chain which passes over a windlass roller and pulley to the brake shaft. Loose bands or shoes of the drums take off the friction and wear from the connecting bands, and preserve the same thereby.

Improved Device for Cleaning Bottles, Barrels, etc.

John C. G. Hüffel, New York city.—This invention consists of a tubular standard having a perforated cylindrical extension tube, which is inserted into the bottle or barrel till the projecting stem of a conical valve at the base of the extension tube is carried down by the pressure thereon, opening the valve and forcing the water instantly through the perforations to the inside of the barrel. The pressure of the water closes the valve as soon as the object to be cleansed is raised from the valve stem, and thereby the supply cut off. This is a very ingenious contrivance for accomplishing the object designed for it.

Improved Sewing Machine Table and Cabinet.

Harriet B. Tracy, New York city.—This invention consists in combining with a sewing machine table a set of drawers, which are pivoted at the front corner in such a manner as to enable the same to be turned beneath the body of the table top when not in use, and to be turned in an outward direction therefrom to bring the drawers in prolongation of the end of table, in order to form an extension of the latter for supporting work. The invention further consists in applying to the bottom of the drawer frame, hinged legs which can be turned down to rest on the floor for relieving the hinges of the drawers from all strain, the bar being also hinged so as to enable the same to be turned up against the drawer frame, in order to enable the latter to clear the base of the table or cabinet and the treadle. At the upper edge of the drawer frame is a hinged bar carrying a hinged leaf, which is adapted to be turned against the edge of the table top for forming a flush surface, and to be turned in an outward direction from the drawers to form an extension leaf. There are two pivot plates for sustaining the leaf of the drawer frame in an extended position, said plates being adjustable vertically.

Improved Device for Burning Hydrocarbons.

George W. Rumlill, Lima, Peru.—This invention consists of an air blower (in combination with a boiler having the oil delivered into the furnace in spray by a steam jet) to be used for producing a jet before steam is raised. The blower is connected with the boiler, or to the steam pipe leading to the injector. This is an apparatus for regulating the delivery of the oil into the furnace, and for shutting it off altogether and letting it on, so arranged that by turning the screw the steam pipe will be shifted forward and back to open or close the annular space between its nozzle and that of the oil pipe. This device for burning hydrocarbons has been in successful operation for some time, and further information may be had concerning it by addressing J. G. Holbrook, Guardian Mutual Life Insurance Company, 231 Broadway, New York city.

Improved Rotary Engine.

Josiah C. Hamilton, Ashtabula, O.—The steam enters alternately from the cut-off valve to sliding abutment valves, and from them to the piston by a top slot on one side and a bottom slot at the other side, and *vice versa* when reversed. This, with the action of a sliding tube which controls the exhaust, causes the effective rotation of the shaft at any point of the piston, and without dead points.

Improved Frame for Cultivators, Scrapers, etc.

John W. Habb, La Grange, Tex.—This invention consists in so constructing the running gear of a two wheeled vehicle, that it may be conveniently applied to the several purposes. The axle is bent four times at right angles, giving it a crank form, and may be turned down to bring its side parts into a horizontal position, or turned up to bring its side part into a vertical position without changing the position of the cross beam. It may be locked in place, when turned up, by a button, which may be turned over the side part. The plows can be raised and lowered by simply loosening the nuts and bolts. The lower parts of the standards are curved to give any desired pitch to the plows. By attaching a marking plow to each end of the cross beam, two rows, six feet apart, may be marked at a time. By attaching a third plow to the center of the cross beam, three rows—three feet apart, may be marked at a time. A scraper plate is bolted to the forward side of the cross beam, and is intended for use in covering cotton, corn, and other seeds, for filling up inequalities in the surface of the ground, to move the soil loosened by the plows in roadmaking, and for other similar uses. By suitable construction, should an obstruction be encountered, a very slight rise of the rear end of the machine will change the line of draft so that the draft upon the machine will raise the axle into a vertical position, raising the plows, harrow, scraper, or whatever may be attached to the cross beam, and enabling them to pass over the obstruction. The machine can be used as a cart without detaching the plows, scraper, or harrow that may be attached to it, by simply raising the axle into a vertical position.

Improved Car Coupling.

Alexander Crocker, La Crosse, Wis.—This invention consists in a novel mode of constructing a two part coupling link so that the two sections cannot come apart (as long as the conjoined cars remain on the track), nor turn on each other; but if one runs off an embankment or bridge and turns over, a wooden pin may be at once broken, one section turned on the other, and the two separated.

Improved Automatic Car Coupling.

Erzs N. Gifford, Cleveland, Ohio.—This invention relates to car couplings that are bifurcated and operated by the pressure of the link, and consists in making enlargements on the coupling pin to prevent it from rising or falling when upheld; in reducing the pin at a certain part to enable it to be reversed; in providing the drawhead with side projections and the buffer head with an incline, to hold up the coupler; and finally, in making a short upward incline on the coupling pin, to receive the advancing link and facilitate the tripping operation.

Improved Jump Seat for Carriages.

John A. Heans, Bel Air, Md.—This invention consists in the improvement of the ordinary jump seats of carriages, by causing the rear seat to turn forward and backward to be supported in both positions by the same side handle, and to allow said support to set well forward and the bolt to go up through the seat without running into the end panels.

Improved Hand and Foot Power.

John J. Kimball, Naperville, Ill.—This is an ingenious combination of levers, so arranged that the operator, by throwing his weight alternately upon his heels and toes, and, at the same time, alternately pushing and pulling upon the levers, can give a steady and uniform motion to the shaft and through it to the machine to be driven.

Improved Car Coupling.

Jacob F. Barber, Elko, Nevada.—This automatic car coupling consists of a stationary lower jaw with hinged upper spring jaw, which is provided with a pivoted hook and yoke for coupling the slotted arrow or other shaped link, and lifting the same for uncoupling, so as to detach it from the hook ends of the jaws. The pivoted jaw and hook are connected, by a chain, with suitable mechanism to raise them and uncouple the link.

Improved Belt Tightener.

Charles L. Work, Cincinnati, Ohio.—This is a simple and convenient device for tightening belts easily and quickly, and without removing them from the pulleys. A block, which is secured clamped to one extremity of the belt, carries a rack parallel in direction to the latter. On this rack travels (by means of a cog and handle) a second block, which is secured to the other end of the belt. By running the sliding block forward, the two ends are brought together and the belt tightened, when it can, through its portion between the blocks, be cut and released.

Automatic Machine for Retouching Photographic Negatives.

Alfred S. Johnson, Waupun, Wis.—This invention consists of automatic mechanism to be worked by spring power or other means, a pencil holder, a cam or other equivalent device, and one or more springs, so combined and arranged that a reciprocating motion may be imparted to the pencil to cause it to strike blows on the negative with its point in quick succession, for the employment of mechanical means in substitution of the hand process always heretofore employed for this purpose.

Improved Fire Shovel.

John B. Firth, Brooklyn, N. Y.—This is a durable coal shovel, which may be stamped of two parts, in such a manner that not only a stronger connection of handle and shovel is produced, but also the double use of a shovel and stove lid lifter be obtained. The invention consists in so cutting the back of the shovel, and lapping the edges over each other, that a strong connection of two thicknesses, with two rivets only, is obtained.

Improved Lumber Carrier.

Esau Tarrant, Muskegon, Mich.—This invention proposes the construction, in lumber yards, of long tracks, between which are numbers of transverse rollers. The planks are laid upon the latter, and held against them by passing under other rollers, disposed at intervals, held in spring bearings. Each plank passing between the rollers will be pushed against the one ahead of it, and that one against the one ahead of it, and so on to any extent, so that they can be carried by this plan to any distance that may be required.

Business and Personal.

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Iron Planers, Lathes, Drills, and other Tools, new and second hand. Tully & Wilde, 20 Platt St., N.Y.

The finest Machinery Oils, combined from Sperm, Tallow and Lard, suitable for all machinery, are now being furnished to consumers at from 40 to 75 cents per gallon, by Wm. F. Nyc, New Bedford, Mass. His famous Sperm Sewing Machine Oil received the highest award at the Vienna Exposition.

Amateur Astronomers can be furnished with good instruments at reasonable prices. Address L. W. Sutton, Box 218, Jersey City, N. J.

Microscopes, Spy Glasses, Lenses. Price List Free. McAllister, Optician, 49 Nassau St., N. Y.

For Sale—Several Sewing Machines of different sizes, cheap; also, a second hand Press. Write, for particulars, to A. Davis, Lowell, Mass.

Removal—L. & J. W. Feuchtzwanger, of 53 Cedar St., have removed to 180 Fulton St., two doors above Church St., New York.

Chemicals, Drugs, and Minerals imported by L. & J. W. Feuchtzwanger, No. 180 Fulton St., removed from 53 Cedar St., New York.

Steam Whistles, Valves, and Cocks. Send to Bailey, Farrell & Co., Pittsburgh, Pa., for Catalogue.

For Surface Planers, small size, and for Box Corner Grooving Machines, send to A. Davis, Lowell, Mass.

The "Scientific American" Office, New York, is fitted with the Miniature Electric Telegraph. By touching little buttons on the desks of the managers, signals are sent to persons in the various departments of the establishment. Cheap and effective. Splendid for shops, offices, dwellings. Works for any distance. Price \$5. F. C. Beach & Co., 263 Broadway, New York, Makers. Send for free illustrated Catalogue.

For best Presses, Dies and Fruit Can Tools, Bliss & Williams, cor. of Plymouth & Jay, Brooklyn, N. Y.

All Fruit-can Tools, ferracuta, Bridgeton, N. J.

Brown's Coal-yard Quarry & Contractor's Apparatus for hoisting and conveying materials by iron cable. W. D. Andrews & Bro., 414 Water St., New York.

For Solid Emery Wheels and Machinery, send to the Union Stone Co., Boston, Mass., for circular.

Lathes, Planers, Drills, Milling and Index Machines. Geo. S. Lincoln & Co., Hartford, Conn.

For Solid Wrought-iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

Temples & Oilcans. Draper, Hopedale, Mass.

Hydraulic Presses and Jacks, new and second hand. E. Lyon, 470 Grand Street, New York.

Peck's Patent Drop Press. For circulars, address Milo, Peck & Co., New Haven, Conn.

Small Tools and Gear Wheels for Models. List Free. Goodnow & Wightman, 23 Cornhill, Boston, Mass.

The French Files of Limet & Co. are pronounced superior to all other brands by all who use them. Decided excellence and moderate cost have made these goods popular. Homer Foot & Co., Sole Agents for America, 30 Platt Street, New York.

Mining, Wrecking, Pumping, Drainage, or Irrigating Machinery, for sale or rent. See advertisement. Andrew's Patent, inside page.

Two 50 H. P. Tubular Boilers for Sale (Miller's patent) very low, if applied for soon. Will be sold separately or together. Complete connections and pump. Holtske Machine Co., 279 Cherry Street, New York.

Lovell's Family Washing Machine, Price \$5. A perfect success. Warranted for five years. Agents wanted. Address M. N. Lovell, Erie, Pa.

Buy Boulton's Paneling, Moulding, and Dovetailing Machine. Send for circular and sample of work. B. C. Mach'y Co., Battle Creek, Mich., Box 277.

Price only three dollars—The Tom Thumb Electric Telegraph. A compact working Telegraph apparatus, for sending messages, making magnets, the electric light, giving alarms, and various other purposes. Can be put in operation by any lad. Includes battery, key and wires. Neatly packed and sent to all parts of the world on receipt of price. F. C. Beach & Co., 263 Broadway, New York.

Engines, Boilers, Pumps, Portable Engines Mechanics Tools. I. H. Shearman, 45 Cortlandt St., N. Y.

Automatic Wire Rope R. B. conveys Coal Ore, &c., without Trestle Work. No. 41 Broadway, N. Y.

A. F. Havens Lights Towns, Factories, Hotels, and Dwellings with Gas. 51 Broadway, New York.

Best Philadelphia Oak Belting and Monitor Stitches. C. W. Army, Manufacturer, 501 & 503 Cherry St., Philadelphia, Pa. Send for circular.

Rue's "Little Giant" Injectors, Cheapest and Best Boiler Feeder in the market. W. L. Chase & Co., 91, 93, 97 Liberty Street, New York.

A Superior Printing Telegraph Instrument (the Seiden Patent), for private and short lines—awarded the First Premium (a Silver Medal) at Cincinnati Exposition, 1871, for "Best Telegraph Instrument for private use"—is offered for sale by the Merchants' Mfg and Construction Co., 50 Broad St., New York. P. O. Box 496.

Dean's Steam Pumps, for all purposes; Engines, Boilers, Iron and Wood Working Machinery of all descriptions. W. L. Chase & Co., 91, 93, 97 Liberty Street, New York.

Steam Fire Engines—Philadelphia Hydraulic Works, Philadelphia, Pa.

Bone Mills and Portable Grist Mills.—Send for Catalogue to Tully & Wilde, 30 Platt St., New York.

For descriptive circulars, and terms to Agents of new and saleable mechanical novelties, address James H. White, Newark, N. J., Manufacturer of Sheet and Cast Metal Small Wares.

Emerson's Patent Inserted Toothed Saws, and Saw Swage. See occasional advertisement on outside page. Send Postal Card for Circular and Price List. Emerson, Ford & Co., Beaver Falls, Pa.

Hand Fire Engines, Life and Force Pumps for fire and all other purposes. Address Rumsey & Co., Seneca Falls, N. Y., U. S. A.

The best Horse Power for the Workshop or Farm—Machines for Threshing, Cleaning Grain, and Sawing Wood. Descriptive circular, price, &c., free. A. W. Gray & Sons, Middletown, N. Y.

Protect your Buildings—Fire and Water proof! One coat of Gilkes' slate roofing paint is equal to four of any other; it fills up all holes in shingle, felt, tin or iron roofs—never cracks nor scales off; stops all leaks, and is only 10c. a gallon ready for use. Roofs examined, painted and warranted. Local Agents wanted. Send for testimonials. N. Y. Slate Roofing Co., No. 6 Cedar St., N. Y.

Millstone Dressing Diamond Machines—Simple, effective, economical and durable, giving universal satisfaction. J. Dickinson, 64 Nassau St., N. Y.

Teleg. Inst's and Elect'l Mach'y—Cheap Outfits for Learners. The best and cheapest Electric Hotel Annunciator—Inst's for Private Lines—Gas Lighting Apparatus, &c. G. W. Stockly, Secy., Cleveland, Ohio.

Hoisting Engines, without brakes or clutches: one lever operates the engine, to hoist, lower, or hold its load; simple, cheap, durable, effective. Two hundred of these Engines now in use, from the little "Ash Hoister," on steamships, raising 300 lbs., up to the Quarry and Mine Hoister, raising from 4,000 to 60,000 lbs. Send, for references and circular, to the Lidgerwood Man'g Company, Office 165 Pearl St., New York City.

For Peabody's Improved Cotton Seed Hüllers, address G. H. Peabody, P. O. Box 512, N. Y. Pr. \$50.

Perpetual Motion Water Wheels; self-supplying and does work. $\frac{1}{2}$ State Interests for sale. A. T. Peck, Danbury, Conn.

Iron Roofing—Scott & Co., Cincinnati, Ohio.

Waterproof enameled papers—all colors—for packing Lard and other oily substances, Chloride of Lime and similar chemicals, Cartridges, Shoe Linings, mending Plants, wrapping Soaps, Smoked or Dried Meats and D-sticated Vegetables, Wall Papers, Shelf Papers, and all applications where absorption is to be resisted. Also, waterproof Tia Substitute for outdoor Show Cards. Samples on application. Crump's Label Press, 75 Fulton Street, New York.

L. L. Gibson, Colorado Springs, Colorado, wishes to purchase a lot of sea shells, for picture frame work.

Keuffel & Esser, largest Importers of Drawing Materials, have removed to 111 Fulton St., N. Y.

Ice Machine Wanted, that can make from 100 to 200 lbs. per hour, at a cost of not more than one or two cents per lb. Price of Machine to be less than \$2,000. (We have steam power.) Address Wm. C. Brown, Box 25, Tampa, Fla.

Wanted—A Situation as Draughtsman under instructions. No objections as to locality. Address B. Adriano, 88 John Street, New York.

For sale cheap—Patent Right, Lamp Bracket for Sewing Machine. Address Ludwig M. N. Wolf, Collinsville, Conn.

Rights for Sale—Of the most Simple, Durable, and Cheap Thill Coupling. Large Profits. Also, Patent for valuable Iron Bender for Sale, or on Royalty. Address Sam'l Pennock, Kennett Square, Pa.

Portable Engines 2d hand, thoroughly overhauled, at $\frac{1}{2}$ Cost. I. H. Shearman, 45 Cortlandt St., N. Y.

Vertical Tubular Boilers, all sizes. Send for reduced price list to Lovegrove & Co., Phila., Pa.

To Manufacturers—Parties wishing a small article in iron to make, can secure the sole right to an article of real merit, for a small amount, cash. Patent recently granted. Address Lewis Geisler, 410 East 19th Street, New York.

Wanted, by a young man well acquainted with steam engines, a situation where he can get the practice he needs to be an engineer. Address A. M., 142 Nassau St., cigar store, New York.

Partner wanted, with \$3 to \$5,000, in an old established, paying business, and to build and introduce a newly patented machine for cutting hoops, chair splints, fruit and band box material, &c. Address Goulding & Powers, 123 Main St., Louisville, Ky.



W. B. C. will find directions for painting outdoor work on p. 247, vol. 28.—H. W. C. Jr. can cement wood to glass by following the directions for aquarium cement on p. 90, vol. 30.—A. R. is informed that polishing shirt bosoms is described on p. 27, vol. 30.—Q. V. will find directions for making gold ink on pp. 43, 55, vol. 30.—J. R. will find instructions for repairing rubber garments on p. 233, vol. 30.—W. D. F. will find the process of janspanning castings described on p. 123, vol. 29.—E. E. should apply to a pump manufacturer.—A. F. F. will find simple tests for strap detailed on p. 171, vol. 30. There is little or no foundation for many of the sensational stories about the manufacture of this article.—A. B. D. will find a recipe for aquarium cement on p. 90, vol. 30. As to blowpipe manipulation, see p. 156, vol. 25.—A. H. M. will find directions for finishing walnut furniture on p. 218, vol. 25.—P. J. H. can tin small castings by following the directions on p. 91, vol. 26.—J. S. P. will find a description of making lamp black (carbon) on p. 21, vol. 28.—M. can use hard tallow for lubricating his paper cutting knives.

J. K. asks: What is coffee, chemically? Are there not chemicals that could be substituted for coffee, that would have the same taste and be cheaper? A. Raw coffee has been analyzed with the following result, in 100 parts: Woody fiber 34, fat and volatile oil 10 to 13, glucose, dextrin, and vegetable acid 15.5, free caffein 0.8, ash 6.7. The caffeic acid, modified by roasting, is supposed by chemists to afford the greater portion of the flavor and peculiar properties of coffee. There are many so-called substitutes for coffee, but nothing like the genuine article.

J. K. asks: 1. Is there a stone that will draw the poison from the bite of a mad dog, and thus cure or prevent hydrophobia? A. No. 2. What is the medicinal virtue of the so-called bloodstone (*Sapla haematitica*)? A. An unfounded superstition. 3. What are the principal differences between the austral and boreal poles of a compass needle, and how can the peculiar properties of each pole be made manifest? A. The principal difference is that they are attracted by the poles of the earth which have the opposite polarities.

C. D. F. asks: Why is it that, to a magnet which has become weakened, weights may be added until its full power is reached? A. It is probably due to the molecules becoming more highly polarized under the influence of the directive force.

E. G. A. asks: 1. What is the color of gold dust, as discovered in the sand of a river? A. Yellow. 2. What is the color of platinum when discovered in sand? A. Silver white. 3. What is the most simple and effectual way of separating gold from sand? A. By washing away the sand and earth in a pan. The fine particles of gold settle at the bottom. 4. Is the valley of the Allegheny river considered as a part of the coal regions of Pennsylvania? A. It is considered as belonging to the lower coal series.

C. R. asks: 1. Can the alkali of the great beds of Nevada and California be used as a fertilizer to advantage? A. Some of these deposits might be experimented on with advantage. 2. How can I get a small quantity forwarded to New York? A. Apply to Agricultural Bureau, Washington, D. C.

E. C. T. asks: 1. How can I construct a battery (Smee's pattern) of zinc and carbon? A. Smee's battery consists of a thin plate of platinum silver, suspended between two plates, or one plate bent double, of amalgamated zinc, and the whole immersed in dilute sulphuric acid. Bunsen's battery consists of a cylinder of compact coke immersed in strong nitric acid, contained in a porous vessel, and another cylinder of amalgamated zinc immersed in dilute sulphuric acid, exterior to the porous vessel, and the whole contained in a strong glass vessel. 2. Will a 2 inch object glass of 56 inches focus show the colors on the planet Mars? A. It probably would, but you could not use the full aperture unless the glass were achromatic. 3. What are the distances between object glasses and eye pieces from twenty-four inches focus up to eighty inches? A. The distance of the eye piece from the object glass is equal to the sum of the focal distances of the two. 4. What is the value of a pound in English money compared with currency of the United States? A. About \$5.56. 5. What are the duties on scientific instruments, such as microscopes, etc.? A. It depends upon the materials of which they are constructed.

F. G. N. asks: What is the best kind of varnish for covering the inside of a silver plating vat? A. Use copal varnish dissolved in turpentine.

J. W. asks: 1. How are porous cells made? A. Porous cells are made of unglazed earthenware. 2. How is the thing that you pull out of an electric machine for giving shocks, to regulate it, constructed? A. By two rods running to a point at one end and terminated by balls at the other. They slide through holes in brass caps, which are fastened on the tops of insulating columns, the caps being provided with clamping screws to fix the rods at any desired distance.

W. H. S. asks: What acids are said to mix with water and linseed oil, so that they will not separate? A. Probably muriatic and nitric acids. We cannot tell the quantities unless we know for what this mixture is used.

M. S. J. asks: How is carmine made? What is the meaning of the numbers No. 12, No. 30, No. 40, by which the quality is known? Is there any better than No. 40, or poorer than No. 12? Where are they made? A. Carmine is a beautiful red pigment prepared from the cochineal insect. The insects are found upon the cactuses of Mexico and Africa, and when matured are brushed off the plants and dried by artificial heat. There are many processes for the preparation of carmine, but success principally depends upon the use of the purest materials and the exercise of care, skill, and patience. The following is an English process: Cochineal 1 lb. and carbonate of potash $\frac{1}{2}$ oz. are boiled in 7 gallons of water for 15 minutes. The vessel is then removed from the fire and 1 oz. powdered alum added. The liquor is then well agitated and allowed to settle for 15 minutes. The clear liquor is then decanted into a clean vessel and 100 grains of dissolved in water 1 pint (and strained) added. As soon as a coagulum forms on the surface the heat is removed, the liquor strongly agitated with a bone or silver spatula, and then allowed to repose for 20 or 30 minutes. The deposited carmine must be drained and dried. Carmine is made in Europe. The numbers refer to the different qualities, from the best or that of the richest and brightest hue to those of inferior shades.

J. E. G. asks: How can I separate very fine float gold from quicksilver without using a retort? A. You can remove the mercury after amalgamation by digesting it in an excess of cold dilute nitric acid. The gold will remain unaffected. The mercury, however, will be lost.

N. N. asks: 1. What kinds of wood are used in the manufacture of paper? Can pine, spruce, hemlock, oak, chestnut, and white wood be used? A. All soft woods are used for paper making, such as the trembling poplar, linden, aspen, fir, etc.; the pine is of too resinous a nature to be of much value. 2. What is the process of reducing the wood to pulp? A. See p. 272, vol. 29. 3. Can it be made into white paper? A. The finest woods are used for writing paper. 4. If so, what is the process of bleaching? A. A jet of chloric water under pressure.

S. H. B. asks: How can a polish be given to Iceland spar or selenite, perfect enough for optical purposes? A. With oxide of tin used wet, on a bed of white wax.

C. R. A. asks: Is the bismuth of commerce a metal much used? A. It is largely used for type and stereotype metal. Newton's fusible alloy, which is used as a soft solder by pewterers, consists of bismuth 2 parts, lead 1 part, and tin 1 part.

R. J. H. asks: 1. Does electricity occupy space? A. It does not occupy space. 2. Is lightning fire produced by electricity, or is it electricity itself? A. It is the particles of the air rendered luminous by the passage of the electric fluid. 3. Does it take a smaller charge of electricity to send a dispatch across the Atlantic cable than it would to send one 25 miles on land? A. No. 4. Would a battery of six guns send the noise any farther than one gun? A. There would be a greater probability of the noise being quenched by obstacles and disturbing causes in the case of six guns. 5. Does the noise travel any faster from the six guns than it does from one? A. No. 6. Will not a too heavy charge of electricity going through the cable generate gas and cause it to burst? A. No. 7. Is electricity a gas, or do vibrations of the wire send the message? A. It is a motion transmitted from particle to particle of the wire.

H. C. H. asks: Can you give me a rule for finding the velocity with which water will flow through a hole in a vessel submerged to any given depth? A. See article on "Friction of Water in Pipes," p. 48, vol. 29. The effective head will be the difference between the height of water above the orifice, within and without the discharging vessel.

P. D. R. asks: 1. What are three or four of the best conductors and non-conductors of heat? What metal will transmit heat and cold the quickest? A. Silver will conduct most readily, and then gold, copper, zinc, iron, and tin, in the order mentioned. Feathers, powdered charcoal, sawdust, woolen goods, sulphur, are among the best non-conductors. 2. Why is it that a spoon in a glass jar or tumbler prevents its being cracked or broken when hot water is poured therein? A. Any effect it might exert is due to the rapid absorbing and conducting power for heat, which would diminish the amount of heat which could operate upon the containing vessel.

F. asks: How can I clean very hot brass? I have some brass pipes (with live steam in them) that have to be polished. What is the best way to clean brass, warm or cold, so that it will keep its polish for some time? A. It will be difficult to clean the brass work in such a manner that it will continue bright for any length of time, unless it is covered with a lacker.

E. E. M. asks: Can you give me a recipe for making a wash that will kill sheep ticks in lambs and not be injurious to the lambs? A. Try powdered sulphur.

S. J. says: I have a few gallons of lubricating oil. What can I mix with it to make axle grease? A. Try adding tallow or lard to it, until it thickens sufficiently for use.

E. T. H. asks: What alkali and acid (used to inflate the bags for raising wrecks) is spoken of in "Scientific and Practical Information," in No. 16? A. Carbonate of soda and muriatic acid. 2. What is glass etching, and how is it done? A. By mixing powdered fluor spar and strong oil of vitriol to a thick paste in a leaden vessel, and allowing the vapor arising from the mixture to come in contact with the glass where it is left unprotected by a thin coating of beeswax.

C. B. L. asks: 1. What causes the report of a gun? One friend says that it is the air rushing back into the gun barrel after the discharge, and another says that, when the gun is fired off, the force of the powder cleaves the air, and, coming together with the great force which it possesses, causes the report. A. Sound being propagated by waves, any cause which puts the air in vibration gives rise to a sound, more or less loud according to the intensity of the disturbing force. The report of a gun is due to concussion, a sudden striking of the air, as it were, and the propagation of sound waves. 2. What causes thunder? A. Thunder is the report from a flash of lightning, and is accounted for in the same way as above. Your specimen seems to be a thin film of oxydized oil or gelatin colored with Prussian blue.

C. K. asks: Is not a car wheel by which the difficulty of running on curves may be obviated a desideratum? A. If you mean a wheel so constructed that the train will experience no greater resistance on a curve than on a straight track, we answer: Yes.

W. J. E. asks: 1. What is the best method of keeping steam boilers clean and preventing scale within the boiler? A. See p. 116, vol. 30. 2. Will the cut-off valve, cutting off the steam at $\frac{3}{4}$ stroke, afford the same power as the flat valve engine, the dimensions of both engines being the same? A. For that point of cut-off, it is hardly necessary to have a separate cut-off valve.

H. C. asks: 1. What should be the diameter, width of blade, and pitch of a three bladed propeller for a boat 25 feet long and of 6 feet beam, to get a speed of 6 miles an hour? The engine is of 2 horse power. A. The engine is not large enough for that speed. 2. Can a propeller be made of boiler iron? A. Yes.

R. C. M. says: I have a 2 horse power vertical boiler, of which I want to take out the flues and clean out the shell; how can I do it without damaging them? A. If you mean without spilling them for use in the same boiler, we do not think that it can be done.

N. L. asks: 1. Does wood shrink endwise? A friend says that boards on a fence, if put on green, would shrink endwise so as to draw them off the posts. A. The shrinkage, if any, is exceedingly slight. 2. How should a pulley be turned to keep the belt straight, with an angular or a curved face? A. Make the axes of the two pulleys parallel. 3. I lately had occasion to repair a cupola fan with four half diamond paddles. After it was done, we tried it, closed up the holes so that no air could pass out of the fan, gave it the regular speed, and opened the pipe so that the fan threw out the wind. To our surprise, the speed decreased nearly one half. Why was it? A. It had more work to do in the latter case.

I. asks: 1. Please give a brief description of the Gunther's scale (3 feet long), and tell the significance of the legends "Les," "Rum," "Cho," "Sin," "Tan," "St," etc. A. On one side is a scale of 24 inches, divided into tenths of an inch. Below this, on the left, is a scale of inches and half inches, divided into hundredths. On the right are scales for laying out a vessel's track by departure and distance. They are used with small quadrants, which can be drawn by the navigator, with a radius of two or three inches. The scales for these quadrants are in the middle. On the left is the scale for the 2 inch quadrant, which has the rhumbs (or chords for the compass divided into parts of $11\frac{1}{4}$ each), chords, sines, tangents, and semi-tangents. On the right is a scale for the 3 inch quadrant, with leagues (30 to an inch) rhumbs, middle latitudes, and chords. On the other side are logarithmic scales for the sines and tangents of degrees; and lastly, scales of meridional and even parts, for a chart on Mercator's projection. The use of the scale is described very fully in Bowditch's "Navigation." 2. In a globe or sphere revolving on its axis, is there not a line of particles, however minute, that is in itself immovable, while all the other particles revolve around it? A. Yes, if you can conceive the line of particles to have a single dimension. 3. Would a railroad bridge across the Atlantic be possible and practicable? A. It has been proposed by some engineers. Past experience would not justify a positive opinion for or against the project.

W. F. McD. asks: Should the bed of a vertical drill stand perfectly level? If the drill stands at an angle of 15°, will it make as true a hole as if it were level? Does the rule applying to the vertical drill also apply to the horizontal drill, lathe, and planer? A. If all the moving parts are truly fitted, the tools may stand in any position.

L. D. B. asks: With what sort of tools are screws made on the softer woods? I have no trouble in chasing a screw by hand on boxwood, but a many-toothed chaser does not do for soft woods. A. Try an ordinary tool and use with high speed.

L. D. H. says: 1. I have heard that salt water will not freeze, and that ice in salt water is perfectly fresh. A. It will freeze if the water is motionless and the cold is sufficiently intense. 2. How does the salt separate? A. In freezing, water crystallizes, and the crystals of ice, in forming, reject the particles of dirt and impurities. As to transmission of power by ice, see p. 339, vol. 28.

D. H. W. asks: 1. Is there any process by which I can plate steel springs without removing the blue coloring? A. Try rubbing with weak muriatic acid, and then wiping clean with water and drying. 2. What is the best way of taking the coloring off? Is there any way of covering them with copper (without battery), so that I can plate them with silver? A. Immerse the steel springs, after being freshly cleaned as above, in a bath of solution of blue vitriol.

D. P. W. asks: Does ice sink in the spring? Pilots on the Mississippi say that it does not break up and float away, but that it sinks out of sight. I think that water forms or falls on the surface of the ice, thus making it appear to sink. A. Your explanation is correct.

P. H. C. says: It is a popular belief among the mass of farmers that the influence of the moon has an important bearing upon various young plants as they happen to come forth either in her light, as full moon, etc., or in her wane. This idea is ridiculed and entirely disbelieved by what are called the most intelligent and scientific farmers. Is it not a fact that the light of the full moon on a young plant just come forth would have some effect on it, different from the darkness which prevails in the moon's absence, and do not these tender plants require extra sleep, as an infant does? And in the absence of it, does it not essentially change their character and production? A. When the moon is shining, the clouds are wholly or in great part absent, and the effect of the absence of clouds becomes very evident when a thermometer is placed in the focus of a silvered mirror and turned towards the unclouded sky. The thermometer falls with great rapidity, its heat being radiated out into the abysses of space, which are estimated to have a temperature vastly below the zero of our thermometric scale. When a cloud passes between the mirror and the sky, the thermometer rises rapidly, the loss of heat being interrupted. The cloud acts like a woolen blanket, preventing the escape of heat. Now what the thermometer is in this experiment, so in nature is the plant. On a moonlight (cloudless or partly clouded) night, it may radiate so much heat that injury may arise to its tender organization. The Earl of Rosse's great telescope has detected the heat radiated by the moon, but it is an incredibly minute quantity, and can have no effect on vegetation.

E. L. S. asks: How can I construct a blow-pipe? Illuminating gas is not to be used, and the atmospheric air is to be supplied by some arrangement worked with the foot. A small blacksmith's bellows may be used, and fastened between the legs of a table, with weights on the upper chamber, and a treadle playing against the lower chamber, so as to give the requisite pressure. A pipe leading from the nozzle of the bellows, through the table top, is made to end in a tapered jet, so mounted that its direction may be altered at pleasure. The jet plays a short distance above the wick of an ordinary lamp.

Y. M. C. A. asks: What are the chemical ingredients and proportions of the same in what is known as slag, the kind that runs from a wrought iron puddling or heating furnace? A. Composition in 100 parts of samples from puddling furnace: Iron 54.35, oxygen 16.87, silica 8.82, phosphoric acid 7.29, sulphur of iron 7.07, lime 4.10, oxide of manganese 0.78, magnesia 0.28. Total 99.62.

W. H. N. asks: 1. What is type metal composed of, and what are the proportions? A. Type metal is composed of lead with $\frac{1}{4}$ or $\frac{1}{5}$ of its weight of antimony, or lead 3 parts, tin 1 part, antimony 1 part, or lead 15 parts, tin 1 part, antimony 4 parts. 2. Can you give me a recipe for an ink that shows plainly when written with, but fades entirely away a short time afterward? A. A solution of chloride of cobalt.

B. & J. say: In trying to make a zinc casting in a plaster mold, on pouring in the zinc it spluttered so that it would not stay in the mold. Then we tried a wooden mold, but found it to be full of air holes. Next we tried a sand mold, but this also was full of air holes, and lastly we tried another plaster mold, and after standing over the stove all day, we found that the zinc spluttered same as before. We thought all the dampness had been dried out, but there was something wrong. In looking at some zinc castings, we found they looked very smooth. We melted scrap zinc. Will you inform me what was the matter, and how to cast zinc? A. The difficulty has been that the plaster molds have given off moisture, even the warmth of the stove has not prevented it. The wooden molds of course formed gases in contact with the molten metal. The sand has not been dry enough. We have never experienced any difficulty. Molders' sand, just moist enough to work, is used. Castings, as bright as silver, may be obtained in this way, even with common scrap zinc. To be more sure, vent holes may be punched with a wire, and the mold may be still further dried, but these precautions are hardly necessary.

J. A. W. says: In running printing power presses on highly calendered, dry paper, we are at times very much troubled by the paper becoming charged with electricity in its passage through the press. Can we get rid of it, or prevent said paper from becoming so charged? A. In the *Times* newspaper office in this city they obviate similar trouble from electricity by attaching lightning rods to the printing press. The rods extend down into the earth.

H. B. S. asks: Why does ice form upon the bottoms of rivers, where the water passes at three or four miles per hour? The ice seems to form in clear cold weather, and can be seen to rise during the day, bringing with it gravel stones of considerable size. A. It will be found, we think, that in these cases the temperature of the water is below the freezing point, and that if the motion of the water were arrested it would speedily become covered with a thick sheet of ice. Now ice is formed by the union of innumerable small detached crystals, which unite together, and, being lighter than water, float upon the surface and are carried off, while those crystals, which in the process of formation freeze fast to the stones at the bottom, and form points of attachment for still other crystals, remain there until the buoyancy of a large mass of them eventually carries them up to the surface.

W. T. R. asks: 1. What are the acids used in Daniell's battery, and what is the proportion of acid and water? A. Saturate as much water as will fill the cells with powdered blue vitriol, and add one eighth of the bulk of this liquid, of oil of vitriol. 2. How many cells should I use for plating small articles, such as spoons, etc? A. Two are amply sufficient. 3. How can I tell when the current is passing? Should it be strong enough to be felt by holding the wire? A. By the fact that metal is being deposited upon the mold to be electroplated. 4. Is there a liquid blue vitriol, or must it be made by dissolving the crystals in water? A. By dissolving the crystals.

T. A. says: 1. I read of a new material called Parkesine (from the inventor, Mr. Parkes), composed chiefly of collodion, castor oil, and chloride of sulphur. Was this material patented? A. Yes. 2. How is the chloride of sulphur prepared? A. By passing chlorine gas, properly dried, over sulphur heated in a retort, and condensing the volatile chloride of sulphur thus formed.

E. R. asks: 1. How is the double sulphate of nickel and ammonia used for a bath? A. See p. 91, vol. 59. 2. Are the two salts mixed with distilled water? Will the nickel dissolve in the bath? A. The double sulphate of nickel and ammonia is one salt, not two. Use enough to make a strong solution in the distilled water. The nickel plates will dissolve. 3. How long after mixing is it till it is ready for plating? A. At once.

J. D. M. says: Professor Stillman, in his "Principles of Philosophy," p. 292, gives Faraday's third law of electrolysis as follows: "The oxidation of an atom of zinc in the battery generates exactly so much electricity as is required to resolve an atom of water into its elements. Thus 5.43 grains of zinc dissolved in the battery occasions the electrolysis of 2.35 grains of water. But these numbers are in the ratio of 23:9, the equivalents of zinc and of water." 1. Now does this mean that the dissolution of 5.43 grains of zinc in each cell or couple of the battery is required to occasion the electrolysis of 2.35 grains of water, or does it mean the sum of the several amounts of zinc dissolved in each cell or couple of the battery (making in all 8 43 grains) causes the electrolysis of 2.35 grains of water? A. For every 5.43 grains of zinc dissolved in the battery, whatever the number of cells, 2.35 grains of water are electrolyzed; so that the amount of water decomposed is found by adding the amount of zinc consumed in all the cells together and dividing by $\frac{8.45}{2.35}$.

In the electrolysis of water with a Grove's oxygen and hydrogen gas battery, of 10 cells, are the quantities of oxygen and hydrogen liberated by the current equal to the respective amounts absorbed by the act of combination in each cell of the battery, or are they equal to the whole amount absorbed in the 10 cells collectively? A. The quantity of oxygen and hydrogen liberated by the electrolysis of water is proportional to the whole amount of zinc consumed in the battery, whatever the number of cells.

W. D. S. asks: Will ripe fruit keep in a vacuum or partial vacuum, such as can be obtained with an air pump, without preparation of the fruit or putting anything in to preserve it? If it will keep, what is the reason that fruit is not put up in this manner? A. Fruit contains germs of decay, which must first be destroyed, otherwise the formation of a vacuum about them will not suffice to preserve the fruit.

S. G. N. asks: 1. Will it be cheaper for me to make my own pure silver anodes for silver plating from coin silver, or to buy them from a silversmith? A. It will probably be cheaper to purchase it. 2. How is the quantity of electricity measured, and how the intensity? A. They are determined by the galvanometer. The intensity of a current is directly proportional to the tangent of the angle of deflection, provided the dimensions of the needle are sufficiently small as compared with the diameter of the circuit. The relation between the intensity and the quantity is that the former is the quantity of electricity which in any unit of time flows through a section of the circuit. 3. How large must a copper wire be for a Bunsen battery, consisting of two 1 gallon cells? A. A wire the 1-10th of an inch diameter is sufficiently large. 4. Are Daniell's batteries suitable for silver plating? A. They can be employed. 5. Should melted zinc be stirred while on the fire? A. There is no advantage in so doing.

J. F. W. asks: What will remove champagne stains and grease spots from a black velvet coat? A. Rub the stains first with ammonia and afterwards with benzine.

J. H. P. says: My hydrogen lamp does not quite meet my expectation. The gas has no effect upon the sponge till I blow upon it with my mouth, when in a second or two the sponge turns red and ignites the gas. A. The platinum sponge causes the union of the hydrogen with the oxygen of the air by what is known as "contact action," or the power which a clean surface of platinum has of condensing gases upon its surface, and thus bringing them within the range of their mutual attraction, and causing combination or combustion. By exposure to the air the surfaces become dry. Heating for a moment with the tip of a flame is the best mode of restoring the activity.

A. S. B. says: Please give me the process of calcining gypsum, and state the required heat. A. Gypsum is calcined in an oven or kiln. It is built of walls of strong masonry, spanned by a flat arch. In this room is placed the gypsum only, the fire being lighted in a series of small chambers in the lower part of the room; brush wood is the best fuel. Or the kiln may be divided unequally by an arch about one foot from the floor, the gypsum being introduced into the upper part. The under part is in connection with the flue of a furnace, the flames from which, driven by a draft, are carried to play upon the lower part of the arch, the hot air and gases passing into the upper rooms. The aqueous vapor escapes through the roof of the kiln.

S. T. W. says: In reply to correspondents who ask how to season wood and to prevent its warping: Strip off bark, and bury about one foot deep in the spring, leaving in the ground for six months, and you will find no difficulty. This was the only way by which we could season the sapidillo or mountain mahogany in the Sierra Nevada, it being one of the hardest and most brittle kinds of wood known. I have two canes now of Lala wood, nearly as heavy as iron. In company with three others I cut them on July 4, 1873. The tree was cut at an elevation of 10,000 feet; it grows very slowly, and seldom to over four inches diameter and 10 or 12 feet high. It flowers in June, usually, in favorable localities, having a small, pale pink and fragrant flower.

W. R. A. R. says: In reply to W. W., who asked for a recipe for gliding without a battery: Dissolve 20 grains chloride of gold in a solution of cyanide of potassium, 1 oz. to 1 pint pure water. Put the solution of cyanide of gold in a glass or porcelain jar; place in it the articles to be gilded in contact with a piece of bright zinc, in the solution near them; the process will be hastened by a gentle warmth. If the gold is deposited on the zinc, rub a little shellac varnish on it. The chloride of gold may be prepared by dissolving gold in aqua regia in the proportions of 16 grains gold to 1 oz. acids.

D. M. says: In reply to C. L. C.'s enquiry for a cheap instrument to foretell a storm by pressure: The baroscope of Babinet will answer your needs; it may be constructed thus: Take any bottle; pour colored water into it, about one fourth of the quantity the bottle will hold; insert in it a glass tube, from three to four feet long and passing straight through the stopper, which must also be airtight. Let a paper index, divided according to any scale of division, say into inches and fractions of an inch, be glued to the glass tube. Blow into the glass tube, so as to cause the water to ascend the tube a few inches, say 10 inches, and the instrument is constructed. The bottle must be placed in another vessel, and protected by sawdust, or some other material, from the influence of changes in the temperature of the atmosphere. This very sensible instrument records faithfully any change in the density of the external air, and the approach of a storm will infallibly be indicated by a sudden rise of the water in the glass tube.

G. L. W. says: In answer to M. B. A., who asked how to remove tallow and white lead from machinery: Use turpentine, and rub it in well.

G. H. M. says: In reply to several correspondents who ask how to cut glass jars: Fill the jar with lard oil to where you want to cut the jar; then heat an iron rod or bar to red heat, immerse it in the oil; the unequal expansion will check the jar all round at the surface of the oil, and you can lift off the top part.

J. A. O. says: Allow me to add to the list of railway bridges across the Mississippi river, given by you on p. 292 in reply to J. M., the following: Louisiana, Mo., St. Paul, St. Cloud, and Brainard, Minn., making a total of fifteen.

C. B. L. says: In reply to several correspondents who asked how to remove tattoo marks from the skin: Blister the part with a plaster a little larger than the mark; then keep the place open for a week with an ointment; finally, dress it to get well. As the new skin grows, the tattoo marks will disappear.

S. P. N. says: In explanation of the excellence of the plank, and the means by which it was produced: "I am a farmer, and sometimes have occasion for a tight trough. In making it, I joint up the plank and then, with a wide punch, set down a groove about 1-16 inch deep the whole length; then take off two or three shavings more, and put the trough together. When the wet gets into that joint the groove swells out again just the thickness it was at first, and of course two or three shavings thicker than the plank, and so closes all up tight. Wood can also be ornamented by punching down carefully in patterns, planing off a little, and then wetting; the parts punched down show in relief above the planed surface and make quite a puzzle."

M. S. T. says: In answer to M. B. A., who asks how to remove tallow and white lead that has been applied to polished parts of machinery to prevent rust: Try a concentrated solution of caustic potash, scrubbing with an old scrubbing brush. It answered in a case somewhat similar to yours.

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

Y. N.—It is yellow hematite, and contains about 25 per cent of oxide of iron.

E. G. A.—The grains are mica, and the rock is granite.

J. E.—Both are pyrites, and are not valuable.

C. S.—A very beautiful specimen of galena, or sulphur lead.

W. F. H.—Your specimen is impure crystallized limestone. It may be used in making caustic lime.

J. W. H.—The mineral is sulphide of iron. If a small percentage of nickel is present, it will require a more extended examination than could be given in a preliminary analysis, to determine it.

A. L. asks: Can you give me a recipe for making artificial honey?—**J. T. asks:** What kind of paint should I apply to terra cotta window caps, etc., to protect them from the weather?—**W. D. M. asks:** How can I harden the brains and other organs of animals, so that I can take plaster casts of them?—**A. J. F. asks:** Is it possible to make an alloy by fusing glass and the metal together?—**A. F. asks:** What can I put on paper muslin to prevent the paint spreading?—**J. H. asks:** How can I make chewing gum and stencil paste?—**D. H. S. Jr.** proposes to put bolting cloth on a reel in strips, packing the upper edge to the outside face of a rib, and the lower edge to the inside face of the next rib below; so that the flour shall not slide against the rib and be carried up thereby, but shall slide off the edge of one piece of cloth and on to the next, falling the thickness of a rib only. Will this plan work well?—**J. W. T. S. asks:** What will cure chickens affected with a disease called the chicken cholera, and what will prevent them from catching the disorder?—**C. H. R. says:** You credit James Bogardus with the invention of the "ring flyer." Can you inform me when and where the invention was made, and give me any details of when the first ring spinning frame was put in operation, and if it is in existence now?—**E. T. C. says:** Some wagon makers hold their hubs till soft and drive the spokes while the hubs are hot; others boil the spokes; others have both as dry as possible. What is the best method?

COMMUNICATIONS RECEIVED.
The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On a Column for Boys. By D. W. H.
On the Mississippi Overflow. By H. S.
Also enquiries and answers from the following:
P. H. B.—M. J. T.—S. M.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Several correspondents request us to publish replies to their enquiries about the patentability of their inventions, etc. Such enquiries will only be answered by letter, and the parties should give their addresses.

Correspondents who write to ask the address of certain manufacturers, or where specified articles are to be had, also those having goods for sale, or who want to find partners, should send with their communications an amount sufficient to cover the cost of publication under the head of "Business and Personal," which is specially devoted to such enquiries.

[OFFICIAL]
Index of Inventions
FOR WHICH
Letters Patent of the United States
WERE GRANTED IN THE WEEK ENDING
April 21, 1874,
AND EACH BEARING THAT DATE.
(Those marked (r) are reissued patents.)

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Bale tie, cotton, E. H. Stafford.....	150,096
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Blinder, temporary, A. A. Goldsmith.....	150,078
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Brick machine, H. Martin.....	150,065
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Brush, whitewash, E. D. Van Horn.....	150,110
Brushes, manufacture of, E. Clinton.....	149,892
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Clutch, friction, T. Symonds.....	150,108
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Grain dryer, W. J. Demuth.....	150,092
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Hammer, C. Bilsatz.....	149,912
Harness saddle, J. Maclure.....	149,875
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Lantern, signal, J. C. McMullin.....	149,842
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Lubricating compound, Cook <i>et al.</i>	149,996
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Paper for artificial flowers, F. E. Vacquerel.....	149,936
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Pitcher, metal lined ice, J. D. & J. H. Dale.....	150,001
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Plow, J. W. Lowe.....	150,062
Plow, sulky, J. C. D. Harrison.....	150,034
Flowshare, J. C. F. Scheock.....	150,067
Plumber's joint, I. F. Van Duzen.....	150,109
Press, J. Gramelspacher.....	149,936
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Press, cotton, W. H. Burgess.....	149,968
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Press, tobacco, McGraw & Davis.....	150,068
Presses, hydraulic cotton, S. Bughes.....	150,044
Press pressure gage, Weston & Depnis.....	150,115
Printing press, A. E. Lazell.....	149,870
Propeller, screw, M. B. Atkinson.....	149,969
Pruning implement, E. E. Farrington.....	149,848
Pulley block, F. C. D. McKay.....	149,941
Pump, J. H. Crocker.....	149,841
Pump, G. W. Robangh.....	149,908
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Rein holder, J. H. Byers.....	149,917
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Sash holder, A. B. King.....	149,935
Sash line, metallic, G. Hookham.....	150,040
Saw, circular, I. Hogeland.....	149,932
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Sewing machine quilter, M. Dewey.....	150,003
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Slippers, adjustable insole, Cole & Cundiff.....	149,903
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Soda and potassa, sulphates of, Hargreaves <i>et al.</i>	149,859
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Stocking supporter attachment, C. Weston.....	150,116
Stone, splitting, P. Crogan (r).....	5,824
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Stove, cooking, J. B. Hyde.....	150,048
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Stove pipe elbow, S. Smith.....	149,958
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Stove, grate for heating, J. Q. C. Searle.....	150,084
Straw cutter, H. E. Moon.....	149,877
Sugar, centrifugally draining, A. Feaca.....	150,012
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Thill coupling, E. G. Smith.....	150,091
Thrashing machine, J. H. Booz.....	149,961
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Tile machine, S. E. Todd.....	149,962
Tobacco plug, D. Eaton.....	150,038
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Vehicle wheel, P. Gendron.....	150,071
Violin bow rosiner, T. H. Hathway.....	149,978
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Watch case spring, I. C. Cowles.....	149,839
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Wheelwright machine, M. C. Buffington.....	149,981
Wheelwright machine, M. C. Buffington.....	149,986
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Wood panel templet, L. M. Hills.....	150,099
Wrench, W. H. Crittenden.....	149,840
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Yarn, sizing and dressing, Lancaster & Bullough.....	150,058

APPLICATIONS FOR EXTENSION!
Applications have been duly filed and are now pending for the extension of the following Letters Patent. Hearings upon the respective applications are appointed for the days hereinafter mentioned:

- 29,728.—MOWING MACHINE.—A. B. Allen. July 8.
- 29,729.—SCHOOL GLOBE.—J. R. Agnew. July 8.
- 29,730.—STOVE GRATE.—D. H. Nation. July 8.
- 29,731.—FLOUR CHEST.—I. R. Shank. July 8.
- 29,732.—WATER WHEEL.—J. W. Trux. July 8.
- 29,733.—GRAIN SEPARATOR.—A. J. Vandegrift. July 8.
- 29,734.—CABLE RELIEVER.—J. Bingham. July 8.
- 29,735.—THRASHING MACHINE.—I. Hart. July 15.
- 29,736.—LATHIE.—B. D. Whitney. July 22.
- 29,737.—REAPER AND MOWER.—A. A. Henderson. July 29.
- 29,738.—REAPER, RAKE AND MOWER.—A. A. Henderson. July 29.

EXTENSIONS GRANTED.
27,973.—PRINTING PRESS.—F. O. Degener.
28,004.—RAILROAD CAR AXLE.—J. Montgomery.
28,027.—METAL CUTTING MACHINE.—J. Waugh.
28,043.—TEMPLE.—J. H. Woodward.

DISCLAIMER.
27,973.—PRINTING PRESS.—F. O. Degener.

DESIGNS PATENTED.
7,382 to 7,385.—CUTLERY HANDLES.—C. L. Butler, Greenfield, Mass.
7,386.—DRAWER PULL.—J. Girard, New Britain, Conn.
7,387.—BILLIARD TABLE.—F. E. Held, Chicago, Ill.
7,388.—VAULT COVERS.—W. O. Hickok, Jr., Harrisburg, Pa.
7,389.—TEA CADDIES.—A. R. LINN *et al.*, Detroit, Mich.
7,390 & 7,391.—OIL CLOTHS.—C. T. Meyer *et al.*, Bergen, N. J.
7,392.—VEHICLE HUB BOND.—R. Rowe, Brentwood, N. H.
7,393.—HANDLE SOCKETS.—W. M. Smith, W. Meriden, Ct.

TRADE MARKS REGISTERED.
1,727.—BITTERS.—S. E. Clapp, Boston, Mass.
1,728.—CONDITION POWDERS.—B. Doble, Philadelphia, Pa.
1,729 & 1,730.—ISINGLASS.—Howe & French, Boston, Mass.
1,731.—TOILET ARTICLES, ETC.—Lazell *et al.*, N. Y. city.
1,732.—SHIRT STUDS, ETC.—C. L. Potter, Providence, R. I.
1,733.—SAWS.—Wheeler & Co.'s Mt'g Co., Middletown, N. Y.
1,734.—MINCED MEAT.—Van Camp & Son, Indianapolis, Ind.
1,735 & 1,736.—CANNED EDIBLES.—Van Camp & Son, Indianapolis, Ind.

SCHEDULE OF PATENT FEES.

On each caveat.....	\$10
On each Trade Mark.....	\$25
On filing each application for a Patent (17 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 (3 1/4 years).....	\$10
On application for Design (7 years).....	\$15
On application for Design (14 years).....	\$30

CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA.
APRIL 17 to APRIL 27, 1874.

3,329.—R. Barclay, Paris, Brant county, Ont. Improvements on escapements for clocks and watches, called "Barclay's Clock and Watch Escapement." April 17, 1874.

3,330.—W. Perry, Jr., Montreal, Can. Combined chemical and water fire engine, called "Perry's Hand Chemical and Water Fire Engine." April 17, 1874.

3,331.—I. C. Tallman, Montreal, Can.—Improvements on beer and milk refrigerators, called "Tallman's Beer and Milk Refrigerator." April 18, 1874.

3,332.—I. C. Tallman, Montreal, Can. Improvements on churns, called "Tallman's Churn." April 18, 1874.

3,333.—I. C. Tallman, Montreal, Can. Improvements on Milk Safes, called "Tallman's Milk Safe." April 18, 1874.

3,334.—C. E. and Z. B. Grandy, Stafford Spring, Folland county, Conn., U.S.—Improvement on saw sets, called "Grandy's Saw Set." April 24, 1874.

3,335.—T. Houlding, Ipswich, Essex county, Mass., U.S. Improvements in combined hay rake and spreader, called "Houlding's Improved Hay Rake and Spreader." April 24, 1874.

3,336.—R. H. Thurston, Hoboken, Hudson county, N. J., U.S. Improvement in automatic testing machines, called "Thurston's Autographic Testing Machine." April 24, 1874.

3,337.—J. Kirkpatrick, Hamilton, Ont., assignee of A. Paraf, New York city, U.S. Improvements on purifying and separating fats, called "An Improvement in Purifying and Separating Fats." April 24, 1874.

3,338.—N. A. Asselstine, Earnestown, united counties of Lennox and Addington, Ont. Improvements on portable fences, called "Asselstine's Portable Fence." April 24, 1874.

3,339.—G. Payzant, Chicago, Cook county, Ill. Improvements on table leaf supporters, called "Payzant's Table Leaf Support." April 24, 1874.

3,340.—G. A. Martin, Bolton Center, Broome county, P. Q. Improvements on machine for cutting veneer, called "Martin's Veneer Cutting Machine." April 24, 1874.

3,341.—P. Keen, Upper Wharf, Shad Thames, Surrey county, Eng., and J. Dence, London, Eng. Improvements on machinery or apparatus for raising or elevating corn, mineral, coal, gravel, sand, or other materials, applicable for discharging or loading vessels, dredging, pumping, and other similar purposes, called "Keen & Dence's Improved Radial Elevator." April 24, 1874.

3,342.—I. A. Blake, New Haven, New Haven county, Conn., U.S.—Improvements in stone crushers, called "Blake's Improvement in Jaw Plates." April 24, 1874.

3,343.—I. A. Blake, New Haven, New Haven county, Conn., U.S., and S. L. Marsden, same place. Improvements on a machine for breaking stone, called "Blake & Marsden's Improvement in Stone Crusher." April 24, 1874.

3,344.—D. A. Johnson, Boston, Suffolk county, Mass. Improvement on device for preventing horses from straying or running away, to be used as a substitute for a weight of hitch strap, called "Johnson's Device for Preventing Horses from Straying or Running Away." April 24, 1874.

3,345.—L. H. Dietrich, Galt, Waterloo county, Ont.—Improvement on saw handles, called "Dietrich's Combination Saw Handle." April 27, 1874.

3,346.—A. Bingham, Hamilton, Wentworth county, Ont. Improvement in machine for cutting circular pieces out of tin, sheet metal, and other materials, called "Bingham's Adjustable Circular Chisel." April 27, 1874.

3,347.—C. B. Leekie, Hamilton, Wentworth county, Ont. Composition of matter to be used for washing purposes, called "Leekie's Washing Crystal." April 27, 1874.

3,348.—T. De Cen, Houghton, Norfolk county, Ont. Machine for washing and cleansing soiled clothing, called "De Cen's Suction Washing Machine." April 27, 1874.

3,349.—W. Wade, Morpeth, Kent county, Ont. Improvement on self car couplers for coupling and uncoupling cars, called "Wade's Improved Self Car Coupler." April 27, 1874.

3,350.—T. Leonard, Cleveland, Cuyahoga county, O., U.S. Improvements on a machine for making railway car coupling pins, called "Leonard's Machine for Making Railway Car Coupling Pins." April 27, 1874.

3,351.—W. Heaton and J. W. Sabin, Akron, O., U.S. Improvements on rubber packing for piston rods, valve stems, pumps, and presses, called "Heaton's Concave Rubber Packing." April 27, 1874.

3,352.—E. R. Shorey, Mapepee, Lennox and Addington counties, Ont., and R. A. Shorey, same place, assignees of A. O'Dell, Boumanville, Durham county, Ont. Improvements on washing machines, called "The Royal Canadian Washer." April 27, 1874.

3,353.—T. B. Worrell, Philadelphia, Philadelphia county, Pa., U.S.—Improvements on bank locks, called "Worrell's Bank Lock." April 27, 1874.

3,354.—T. B. Farr, Woodbridge, York county, Ont. Improvements on the "Raymond" and similarly constructed sewing machines, called "Farr's Improved Raymond Shuttle Sewing Machine." April 27, 1874.

3,355.—W. T. Bunnell, Ottawa, Carleton county, Ont. Improvements on washing machines, called "Bunnell's Improved Washing Machine." April 27, 1874.

3,356.—T. A. McMartin, Montreal, Montreal Dist., P. Q. Improvement on apparatus for raising water, excavated earth, or ore, or other goods or materials, called "McMartin's Single Stroke Lever Elevator." April 27, 1874.

3,357.—C. Parker and D. W. Parker, Meriden, New Haven county, Conn., U.S. Improvements on claw hammers, called "Parker's Hammers." April 27, 1874.

3,358.—T. W. Strange, Bangor, Penobscot county, Me., U.S. Improvements on churns, called "Strange's Dominion Churn." April 27, 1874.

3,359.—H. S. Davis, Camden, Camden county, N. J., U.S. and S. Pancoast, Hamilton, Wentworth county, Ont. An improved guard for interfering horses, called "Davis' Improved Guard for Interfering Horses." April 27, 1874.

3,360.—T. Good, Toronto, York county, Ont. Improvements in street culverts and waste water drains, called "Good's Improved Culvert and Drain." April 27, 1874.

3,361.—T. W. Davis, San Francisco, San Francisco county, Cal., U.S.—Improvements on fastening seams, called "I. W. Davis' Fastening for Seams." April 27, 1874.

3,362.—J. Desmond and A. L. McMillan, Chatham, Kent county, Ont. Improvement in steam engine pistons, called "Desmond & McMillan's Improved Piston." April 27, 1874.

3,363.—W. Elliot, Sullivan, Grey county, Ont. Improvements in millstone running gears, called "Elliot's Millstone Gear." April 27, 1874.

3,364.—H. P. Manley, Potsdam, St. Lawrence county, New York city, U.S. Improvements on machines for renovating feathers, called "Manley's Feather Renovator." April 27, 1874.

3,365.—D. H. Iseminger, Heyworth, McLean county, Ill., U.S. Improvements on saw sharpening machines, called "Iseminger's Saw Sharpening Machine." April 27, 1874.

3,366.—G. F. Simonds and J. A. Forson, Fitchburg, Worcester county, Mass., U.S. Improvements on tempering saws, etc., called "Simonds & Forson's Improved Method of Tempering to Form." April 27, 1874.

3,367.—E. J. Devens and H. M. Jones, Coldwater, Branch county, Mich., U.S., assignees of D. Duesler, same place. Improvements on grain cradles, called "Duesler's Grain Cradle." April 27, 1874.

3,368.—H. Carter and D. Stewart, Aylmer, Elgin county, Ont. Improvements on fly traps, called "Carter's Fly Trap." April 27, 1874.

3,369.—H. K. Barnes, Rock Stream, Yates county, N. Y., U.S. Improvement on hoes, called "The Barnes Hoe." April 27, 1874.

3,370.—A. D. Cole, Toronto, York county, Ont. Improvement in turbine water wheels, called "Cole's Improved Dominion Turbine." April 27, 1874.

3,371.—W. Ellwood, Hamburg, N. Y., U.S. Tyre upsetter, called "Bowden's Tyre Upsetter." April 27, 1874.

3,372.—D. Perrin, McGregor, Clayton county, Iowa, U.S. Improvement on cutters for tonguing and grooving lumber, called "Perrin's Cutter for Tonguing and Grooving Lumber." April 27, 1874.

3,373.—T. Hall, Keene, Cheshire county, N. H., U.S. Improvement on steam boilers, called "Hall's Improved Steam Boiler." April 27, 1874.

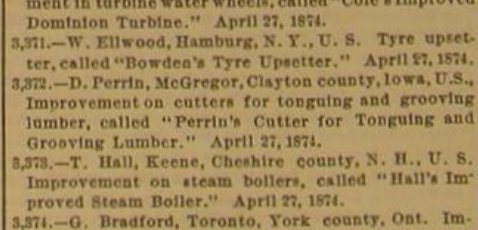
3,374.—G. Bradford, Toronto, York county, Ont. Improvements in oil bearings, called "Bradford's Improved Self Oiling Bearing." April 27, 1874.

3,375.—W. G. Rawbone, Toronto, York county, Ont. Improvements on breech loading cartridge crossers." April 27, 1874.

3,376.—J. M. Dick, Buffalo, Erie county, N. Y., U.S. Improvement on wool drying machines, called "Dick's Wool Drying Machine." April 27, 1874.

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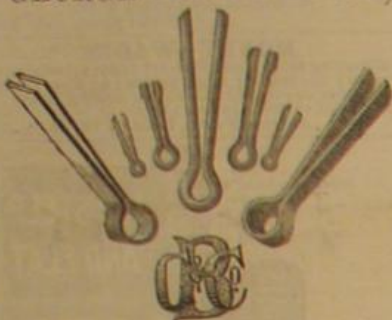
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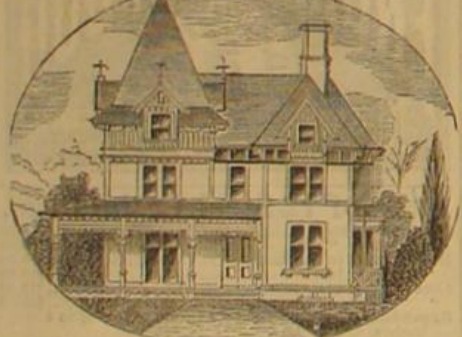


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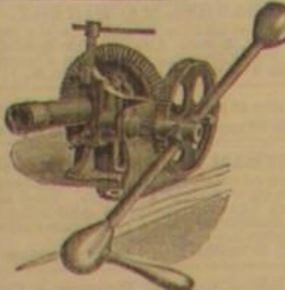


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NEW YORK, MAY 30, 1874.

\$3 per Annum.
IN ADVANCE.

IMPROVED ROAD AND FARM LOCOMOTIVE.

The traction engine and train of wagons which we illustrate are the manufacture of Messrs. Aveling & Porter, of Rochester, England, and were awarded the prize medals for Progress and Merit at the Vienna Exposition of last year. The steam road rollers, built by the same eminent firm, were also awarded similar medals for Progress and Merit.

Since the very important experiments with road engines at Paris, in 1867, and Wolverhampton, England, in 1871, their value, as substitutes for animal power, as feeders for railroads, as pioneers in new districts, and eventually as superseders of horse-drawn portable engines, is becoming generally and intelligently recognized. The number of these engines built up to this time, by Messrs. Aveling & Porter, exceeds one thousand, and the trade is rapidly developing.

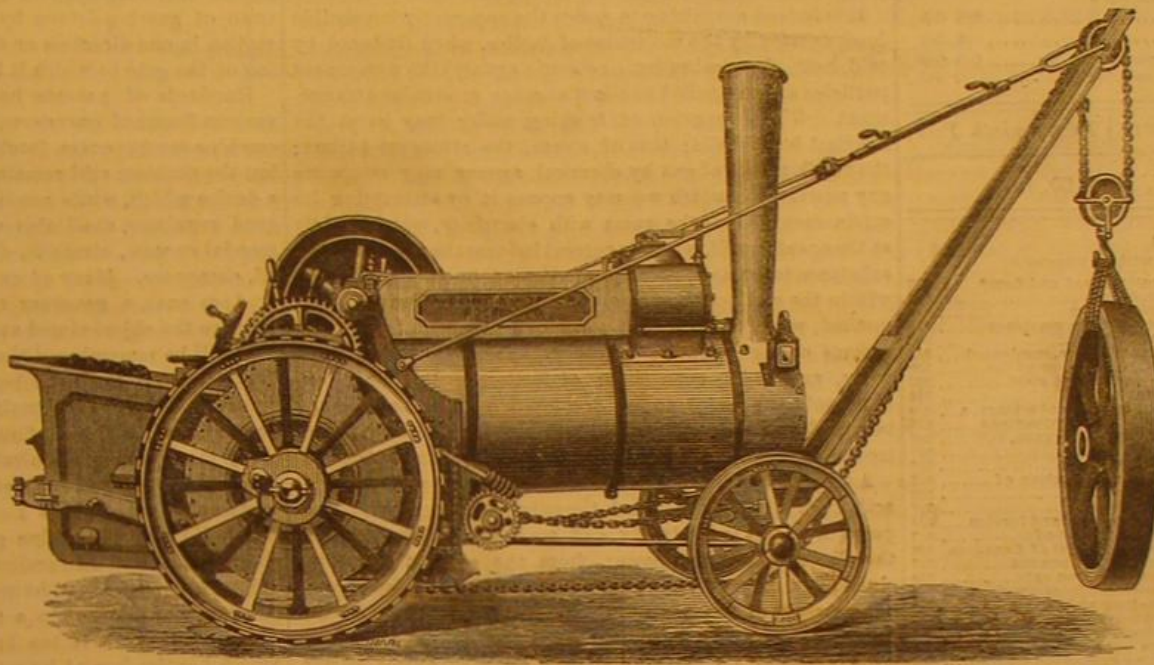
The economy in the cost of removal of heavy material, in certain localities, is certainly very great, and the manufacturers claim that the cost does not exceed one third that of doing the same work by horse power. The variety of uses to which the engine can be applied, such as thrashing grain, hauling farm produce, plowing by direct traction, pumping, sawing, etc., materially add to its usefulness, and make it applicable for different kinds of work all the year round.

The engines are very strongly and simply made, and manifest the greatest care in their construction. The facility with which they are guided and driven, both operations being performed by the same man, exhibits much progress and ingenuity. The simplicity of the machines enables them, it

or coal. Their economy in this respect is stated to be very great. At the Wolverhampton trials an Aveling 10 horse engine, fitted with a single slide and ordinary link motion, indicated 35 horse power with a consumption of three and one fifth pounds of coal per horse power per hour.

The following testimony of Mr. D. Brennan, the President of the Telford Pavement Company, of Orange, N. J., who has two of these road locomotives, is given, as showing their value for hauling purposes: "We have used, for hauling stone, one of the Aveling & Porter 6 horse power traction engines, purchased of you, and with very satisfactory results. We hauled with this engine (with engine-r and one assistant) about 75 tons per day, a distance of a mile and a quarter, over a new road. There is no doubt that even better results can be obtained at longer distances, where the delays of loading and unloading are not so frequent, especially if on a good road. We consider that these engines will do hauling for one third the cost of the same work done by horses, at \$5 per day for for team and driver, hauling one and a half tons at a load; and we are making preparations for a more extensive use of them in the future."

The smaller engraving shows one of the ordinary road locomotives fitted with a crane to lift two tons. It has iron



AVELING & PORTER'S ROAD AND FARM LOCOMOTIVE AND WAGONS.

wheels, fitted with compensating motion to its drivers, to enable it to turn very sharp corners with facility. It is also driven and steered by one man. Crane engines similar to this, and built by the same firm, were used at the Vienna Exposition during the erection of the building, and did a vast amount of excellent work in unloading and removing the heavy packages of merchandise as they arrived on the grounds.

Mr. W. C. Oastler, 43 Exchange Place, New York city, is Messrs. Aveling & Porter's agent in the United States.

Scientific American.

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PRESSURE NOT A MOTIVE POWER.

The error of confounding mere pressure with energy available to produce power is the main origin of the majority of attempts at perpetual motion, and even sometimes causes, among confused minds, exaggerated expectations about the effects to be obtained from mechanical contrivances.

We consider the alleged discovery or invention of Mr. Keely, described on page 273 of our current volume, to be a case of the latter class. He is said to develop, by means which he carefully keeps secret, a gas under enormous pressure; and by the exhibition of this pressure, he has induced a few engineers (who should know better) to testify not only in regard to what they see, but to make inferences as to the enormous power to be expected from such an exhibition. They forget that this pressure cannot be utilized without letting it off; and that the great problem in producing motive power is not simply to originate a great pressure, but to generate it abundantly, cheaply, and as fast as it is consumed in the production of motion.

Fifty tons weight supported by three small blocks of one cubic inch each, will exert on each a pressure of some 33,000 pounds to the square inch; but this mere pressure of 33,000 pounds is not a horse power; it only becomes so if we cause the 33,000 pounds to descend one foot per minute, and if, at the end of this descent, it can only be restored by lifting the weight back to its original height.

A wound-up spring is perfectly equivalent to a weight; it may exert a certain pressure, large in proportion to its size and strength; but unless it is allowed to unwind, it cannot produce motion or power; and the exhibition of a spring pressing with a power of 12,000 pounds on one square inch of material does not prove the possession of a principle of motive power, unless we can wind up the spring as fast as the power is expended.

It is the same with compressed air or gases; they are in fact nothing but wound-up springs; with the difference, however, that, in place of needing mechanical power to wind them up, we may use, for their development under confinement and consequent pressure, either heat, chemical agencies, or electricity.

The steam and hot air engines are illustrations of

of the first case; expenditure of heat keeps up a continuous generation of steam from water, supplying the loss as fast as necessary; or it expands confined air continually, and so increases the pressure which, when moving the engine, is necessarily released. The chemical fire engine and the so called fire annihilators are illustrations of the second class; the action of an acid on a carbonate (both in water, but kept separate until needed) develops carbonic acid gas, which is set free with such energy that the water may be forcibly ejected with the gas and made useful as a ready substitute for a fire engine.

The pressure which it is possible to generate in this way is something enormous, and has more than once given rise to serious accidents by the explosion, or rather the bursting, of the vessel in which the pressure was generated. It is now twenty years since Natterer, of Vienna, with a very powerful condensing apparatus constructed on the same principles, attempted to liquefy the four gases which thus far have resisted all attempts at liquefaction, namely, nitrogen, oxygen, hydrogen, and oxide of carbon; but he did not succeed, notwithstanding that he carried the pressure to nearly 3,000 atmospheres, or 45,000 pounds to the square inch.

It is indeed surprising to notice the apparently irresistible force exerted by the molecules of bodies, when (induced by cold, heat, chemical action, or electric agency) the component particles are compelled to adopt another molecular arrangement. The expansion of freezing water may burst the heaviest bombshells; that of steam, the strongest boilers; the development of gas by chemical agency may overcome any power with which we may oppose it by attempting its confinement. It is the same with electricity, which, subtle as the agent is, will, when its current induces the change of any substance into gases, serve to produce a tremendous pressure within the walls of the vessel containing the substance. This method, we anticipate, will yet prove available for investigations on the behavior of divers substances under pressures, surpassing even those of Natterer. For such experiments the water to be decomposed is to be confined in a sufficiently strong vessel, in which are also the electrodes conducting the decomposing electric current.

As, in the invention of Mr. Keely, the heat and chemical action are said to be excluded, the only other agent which appears to be left is electricity, and we therefore suspect that the alleged enormous power, from the electric forces included in a drop of water, is in fact nothing but the enormous pressure of the gas developed, from water under confinement, by a galvanic current, or the induced current from a magneto-electric machine, driven by mechanical power. The pretence that the pressure is developed by a mechanical device, requiring little power, may be true, but that the power obtained from the pressure can possibly surpass that of the power employed is absurd and its application to motive power is simply a phantom.

GOVERNORS FOR PRIME MOVERS.

The use of a governor is to preserve a perfectly regular speed in the engine, water wheel, or other prime mover to which it is attached, by varying the supply of steam, water, or other motor, as the work of the machine varies. The ordinary form of fly-ball governor answers its purpose very well in most cases. It has the defect, however, of requiring the use of heavy balls, and of demanding a somewhat wide range of action where it has any considerable force to overcome. It also is not perfectly isochronous, that is, it will not compel the engine to "come to speed" with precision, under all variations of load and steam pressure. The Porter governor, in which the balls are loaded down by a heavy weight on the spindle, and which is thus enabled to run at a much higher speed, is a modification of the standard form, and is prompt in action and much more powerful. These are the advantages which have brought it into use so extensively in Europe. In this country, the Pickering governor, in which the same object is accomplished by carrying the balls on stiff steel springs, has come into use quite largely as possessing similar advantages.

The only isochronous governors which are used to any extent in the United States are the Huntoon governor and its modifications, in which a screw, rapidly rotating in a closed tank containing oil or water, exerts a force in the line of its axis which is made use of in operating the throttle valve. While the engine is at speed, no movement of the valve occurs; but should the speed diminish, a weighted arm forces back the screw, and the valve opens. It will continue to open until the engine comes up to the proper speed again, whatever the conditions as to the load or steam pressure. Should the speed exceed that intended, the screw acts more energetically upon the liquid in which it works, and the increased effort is sufficient to overcome the resistance of the weighted arm and to close the valve until the proper speed is again acquired. In Europe, the same object is accomplished by some builders by the use of the parabolic governor, which is so arranged that the balls move in a parabolic instead of a circular arc. It can be shown by a mathematical argument, which cannot be given here, that this produces the effect of isochronism: that the governor will remain without affecting the throttle valve at only one speed, the one for which it has been proportioned and speeded. The late Professor Rankine invented a very neat governor of this class, which is perfectly isochronous.

In a friction governor invented by Professor Thurston, and designed by one of his pupils, the same result is attained by making use of the varying friction of blocks pressed against a drum by centrifugal force. When above or below speed, the valve is compelled to move in the proper direction until the engine is brought to speed, or until the valve has been either entirely closed, or is wide open. Siemens' governor is also a friction governor, but somewhat

different from the latter in its general arrangement, and entirely different in details. The Pitcher hydraulic regulator, which was much used some years ago on engines fitted with the Sickles cut-off valve gear, was a pump which forced water into a chamber, having an orifice fitted with a plug which was capable of adjustment to give any desired size of opening. Above the chamber, and communicating with it, was a pump plunger connected with a throttle valve. When the engine ran above speed, the orifice was not of sufficient capacity to discharge the water as fast as it was pumped into the chamber, and the second plunger was forced up, closing the throttle valve. When the speed was less than that proposed, the water issued from the chamber more rapidly than it was forced in, and the plunger, which was attached to the throttle, fell, opening the valve. This was another of the isochronous class of governors.

None of these regulators have sufficient power to overcome any serious resistance or to act through any considerable distance. Water wheel regulators, consequently, are usually of a different construction from those above described. In the best of the common forms, the fly ball governor is employed to move a clutch which engages a train of gearing driven by the water wheel, and puts it in motion in one direction or the other, as the opening or closing of the gate to which it is connected is necessary.

Hundreds of patents have been issued to inventors of various forms of governors, in which it has been attempted to combine sensitiveness, isochronism, and strength of action, but the problem still remains unsolved. What is wanted is a device which, while combining these three requisites of a good regulator, shall also combine the requisites for commercial success, strength, durability, simplicity, and, above all, cheapness. Many of our best mechanics have tried to produce such a governor and have failed, but we cannot suppose the object aimed at entirely unattainable.

It will be remembered that our special Vienna correspondent described the next best form of steam engine to our standard drop cut off engine as a plain, neat, beautifully proportioned, and well finished English engine, having a plain three-ported slide valve, with the Meyer expansion valve riding on the back of the main valve—just such an engine as is sold in New York by the agents of some of our best builders. This valve gear is well fitted to produce a sharp cut-off and an excellent distribution of steam. The point of cut-off must, however, be adjusted by hand, and the governor attached to a throttle valve in the steam pipe, because this work is too heavy to be done by the governor without entire loss of its sensitiveness and efficiency.

Putting the throttle valve in the steam pipe, as a regulating valve, is always avoided, if possible, by good engineers, because, by throttling the steam, a loss of efficiency occurs. It is always preferred to regulate the engine by so attaching the governor that, as in the best drop cut-off engines, it shall determine the point of cut-off. We gave the reasons for this preference in our issue of May 23, on page 321 of our current volume. The invention of such a governor, which we have described as one of the wants of the time, would enable this simplest, and in other respects most satisfactory, style of engine to compete with the most expensive forms in the market in perfection of regulation and in economy of steam. It would thus confer a great benefit upon steam users and, consequently, a great pecuniary reward upon the inventor. Such a governor would find many other applications, and would displace, not only the ordinary steam engine governor, but, in many instances, it would probably take the place of the water wheel or disengagement governor.

WHY DO PLANTS ABSORB OXYGEN DURING THE NIGHT?

When a number of freshly gathered and healthy leaves are placed during the night under a bell glass of atmospheric air, they condense a portion of the oxygen; the volume of the air diminishes, and there is a quantity of free carbonic acid formed, generally less than the volume of oxygen which has disappeared. If the leaves which have absorbed this oxygen during their stay in the dark be now exposed to the sun's light, they restore it nearly in equal quantity, so that, all corrections made, the atmosphere of the bell glass returns to its original composition and volume.

Leaves in general have the same effect when they are placed alternately in the light and in the dark there is however a very obvious difference in the intensity with which the phenomenon is produced, according to the nature of the leaves. The quantity of carbonic acid formed during the night is so much the less, as the leaves are more fleshy, thicker, and therefore more watery. The green matter of fleshy leaved plants, of the *cactus opuntia*, to quote a particular instance, does not produce any sensible quantity of carbonic acid in the dark: but these leaves condense oxygen and exhale it again like those which are less fleshy when they are brought into the sun, after having been kept for some time in the dark. De Saussure applied the names of inspiration and expiration of plants to these alternate effects being led by the analogy—somewhat remote, it must be confessed—which the phenomenon presents with the respiration of animals.

The inspiration of leaves has certain limits; in prolonging their stay in the dark, the absorption becomes less and less; it ceases entirely when the leaves have condensed about their own volume of oxygen gas. And let it not be supposed that the nocturnal inspiration of leaves is the consequence of a merely mechanical action, comparable, for example, to that exerted by porous substances generally upon gases. The proof that it is not so is supplied by the fact that the same effects do not follow when leaves are immersed in carbonic acid, hydrogen, or nitrogen. In such circumstances, there is no

appreciable diminution of the atmosphere which surrounds the plant. The primary cause of the inspiration of oxygen by the leaves of living plants is, therefore, of a chemical nature. With the facts which have just been announced before us, it seems very probable that, during the nocturnal inspiration, the carbonic acid which appears is formed at the cost of carbon contained in the leaves, and that this acid is retained either wholly or in part, in proportion as the parenchyma of the leaf is more or less plentifully provided with water.

A plant that remains permanently in a dark place, exposed to the open air, loses carbon incessantly; the oxygen of the atmosphere then exerts an action that only terminates with the life of the plant: a result which is apparently in opposition to what takes place in an atmosphere of limited extent. But it is so, because in the free air the green parts of vegetables can never become entirely saturated with carbonic acid, inasmuch as there is a ceaseless interchange going on between this gas, and the mass of the surrounding atmosphere; there is, then, incessant penetration of the gases, as it is called. There is a kind of slow combustion of the carbon of a plant which is abstracted from the reparative influence of the light.

The oxygen of the air also acts, but much less energetically, upon the organs of plants that do not possess a green color.

The roots buried in the ground are still subjected to the action of this gas. It is indeed well known that, to do their office properly, the soil must be soft and permeable, whence the repeated hoeings and turnings of the soil, and the pains that are taken to give access to the air into the ground in so many of the operations of agriculture. The roots that penetrate to a great depth, such as those of many trees, are no less dependent on the same thing; the moisture that reaches them from without brings them the oxygen, in solution, which they require for their development. It is long since Dr. Stephen Hales showed that the interstices of vegetable earth still contained air mingled with a very considerable proportion of oxygen. The roots of vegetables, moreover, appear generally to be stronger and more numerous as they are nearer the surface. In tropical countries, various plants have creeping roots which often acquire dimensions little short of those of the trunk they feed.

If a root detached from the stem be introduced under a bell glass full of oxygen gas, the volume of the gas diminishes, carbonic acid is found, of which a portion only mingles with the gas of the receiver, a certain quantity being retained by the moisture of the root.

The volume of the gas thus retained is always less than that of the root itself, however long the experiment may be continued. In these circumstances, whether in the shade or in the sun, roots act precisely as leaves do when kept in the dark. Roots still connected with their stems give somewhat different results.

When the experiment is made with the stem and the leaves in the free air, while the roots are in a limited atmosphere of oxygen, they then absorb several times their own volume of this gas. This is because the carbonic acid formed and absorbed is carried into the general system of the plant, where it is elaborated by the leaves if exposed to the same light, or simply exhaled if the plant be kept in the dark.

The presence of oxygen in the air which has access to the roots is not merely favorable; it is absolutely indispensable to the exercise of their functions. A plant, the stem and leaves of which are in the air, soon dies if its roots are in contact with pure carbonic acid, with hydrogen gas, or nitrogen. The use of oxygen, in the growth of the subterranean parts of plants, explains why our annual plants, which have largely developed roots, require a friable and loose soil for their advantageous cultivation. This also enables us to understand why trees die when their roots are submerged in stagnant water, and why the effect of submersion in general is less injurious when the water is running, such water always containing more air in solution than that which is stagnant.

MILK AS A DIET AND ITS EFFECT ON THE SYSTEM.

There is considerable difference of opinion on the subject of a milk diet. It is surrounded with a mass of whims, of prejudices, and of mistaken ideas, which are based more on individual fancies than upon certain fact. To one a glass of milk imbibed is believed to be a sure provocation of a bilious attack, to another, a disordered stomach, to a third, drowsiness, and so on, through such a category of simple though disagreeable ailments that we look aghast at the farmer who drains cup after cup of the fresh pure liquid, time and again during the day, and wonder at the resisting powers which his organization must possess. The truth is, however, that milk is not unwholesome. On the contrary, it contains good substantial bone, muscle, flesh, and brain producing substances, which, assimilating, quickly act rapidly in building up the body. Naturally, we assert, it is nourishing; that it does bring on certain troubles is nevertheless true, but the cause is in the individual stomach, not in the milk, provided, of course, the latter be fresh and sweet. The *Commercial Advertiser* of recent date has some excellent remarks on this subject which are well worthy of repetition. "Milk diluted with one third lime water," it is said, "will not cause any one biliousness or headache, and, if taken regularly, will so strengthen the stomach as to banish these disorders.

"It may be taken with acid of some kind when it does not easily digest. The idea that milk must not be eaten with pickles is not an intelligent one, as milk curdles in the stomach nearly as soon as it is swallowed. When milk is constipating, as it is frequently found to be by persons who

drink freely of it in the country in summer time, a little salt sprinkled in each glass will prevent the difficulty. When it has an opposite effect, a few drops of brandy in each goblet of milk will obviate its purgative effect. As milk is so essential to the health of our bodies, it is well to consider when to take it, and how. It is a mistake to drink milk between meals, or with food at the table. In the former case it will destroy the appetite, and in the latter it is never proper to drink anything. After finishing each meal a goblet of pure milk should be drank; and if any one wishes to grow fleshy, a pint taken before retiring at night will soon cover the scrawniest bones. In cases of fever and summer complaint, milk is now given with excellent results. The idea that milk is "feverish" has exploded, and it is now the physician's great reliance in bringing through typhoid patients, or those in too low a state to be nourished by solid food."

Our contemporary, we notice, says that the persons with whom milk does not agree are the very ones who require it, and whom it would probably regenerate, did they so prepare it as to make it palatable and suitable to their particular constitutions. Not exactly, we think. It should be remembered that "what is one man's meat is another man's poison" is a very frequent case; and while, as we have above pointed out, milk may in perhaps a majority of instances be rendered agreeable to the stomach, still there are certain organizations which persistently refuse it in spite of any assisting admixture. A similar illustration may be found in the case of wine; and we know of instances where persons, of otherwise strong digestion, are utterly unable to drink half a gill of even the purest grape juice without experiencing the same bilious and other derangements which many ascribe to milk. It is a fact, however, that for individuals troubled with dyspepsia, weak stomach, and kindred ills, milk has wrought remarkable and unexpected benefit, and the diet has in cases among our own acquaintances resulted in great relief.

Milk drinking, particularly in this city, has during late years received an unusual impetus through the establishment of dairies, or restaurants where the bill of fare is confined to a few simple articles of farinaceous food and to generous bowls of milk and cream, retailed at very moderate prices. The idea, we believe, originated some five years ago in a small baker's shop, in one of the little down town streets, which had a monopoly of the business for some time, making large receipts. Others, being attracted by the gains, embarked in the business, and now the dairy is as much a fixture in New York city as the more pretentious restaurant. As a matter of curiosity, we recently inquired of the manager of the largest of these establishments as to the people who patronize the diet, and the effect of the increased demand upon the supply. His customers, he told us, comprised every class; the rich banker perches on the high stool beside his errand boy. Clergymen, lawyers, merchants, editors, men whose reputation is worldwide, throng into the doors, proving that, even if this sudden increase in milk drinking be merely a popular mania, it is nevertheless one which has affected all alike.

The milk for the city is brought principally from Westchester and Dutchess counties in this State, and the neighboring counties in Connecticut. In the dairy above referred to, the stocks of several large farms are required to produce the necessary amount. Twelve hundred quarts in cool weather, and upwards of eighteen hundred quarts when the mercury makes excursions into the nineties, are daily consumed by an average of twenty-five hundred persons in the single establishment. This milk is sold at about ten cents a quart, realizing a fair profit.

The greater portion of the milk used in the city does not come direct to the seller, but goes through the same handling, by four or five "middle men," as the often doubtful fluid retailed by the peripatetic milkman. The farmer, for instance, binds himself to supply a certain number of cans to the contractor for a definite period, usually six months, at the price of about 33 to 42 cents per can in summer or 45 cents in winter. The contractor receives the filled vessels from a collector, who gathers them from the different farms and deposits them at the railway stations. Under charge of the latter, they are transported in early trains to the city and sold at the depots to milkmen and dairy keepers at an advance of about five cents per can. The milkmen supply families and grocers with the commodity, plus another profit which brings its cost to the consumer, as above stated to about ten cents per quart.

As to the quantity of milk daily consumed in New York, it is difficult to obtain any precise figures; but it is estimated that the supply does not fall short of two million quarts every twenty-four hours. This on a rough calculation is the produce of some thirteen thousand cows and an average of something over two quarts *per diem* to every soul of the population.

THE RESPIRATION OF OXYGEN.

According to the older notions in regard to the provision of Nature for the sustenance of life, the surrounding conditions have been expressly arranged for the benefit of all living creatures, so as to secure not only their existence but their welfare and comfort. According to late ideas, however, as the different living creatures were evolved under previously existing conditions, the mode of their development was such as to accommodate the different organisms to these conditions; and when the conditions changed, a corresponding change occurred in the creatures themselves: those not adapted to the changed conditions perishing, and those most fit for the new era surviving and propagating their species. We will illustrate this by an example: In our atmosphere, the oxygen is diluted with very nearly four times its amount of nitrogen, and all the air-breathing animals,

including man, have become adapted to these conditions. If the amount of oxygen became less, a corresponding change would occur in the respiratory system, as is illustrated in the high lands of South America, where, by reason of the rarefied atmosphere, the amount of oxygen inhaled at each respiration is less than near the ocean level; and as a consequence, the human lungs are more developed there, and the inhabitants are remarkable for their largely developed chests, allowing them to make up by quantity for the quality of the inspired air. The reverse is also the case; it has been found that the effect of the compressed air (on those workmen whose constitutions allowed them to withstand the pressure and labor for some length of time in the caissons for the foundations of the Mississippi bridge at St. Louis, Mo., and the East river bridge, New York) was to narrow the volume of the chest, while deep respirations of the highly compressed air were painful.

Now comes an interesting discovery of M. P. Bert, who finds that it is not alone the pressure which is hurtful to the system, which can soon accommodate itself to it, but chiefly the concentration of the oxygen, which even acts like a most violent poison when inhaled pure, under a pressure of three or four atmospheres; consequently when (under a pressure of some 90 or more pounds to the square inch) an amount of oxygen surpassing the normal quantity some six or more times is inhaled at every respiration, its hurtful effects manifest themselves, one of them being a very great increase in animal heat, with a disturbed pulse; this, of course, adds largely to the discomfort. This fact suggests that men who have to submit to conditions of greatly increased atmospheric pressure would be relieved and benefited by inhaling an artificial atmosphere containing less than the normal amount of oxygen, 10 per cent oxygen to 90 of nitrogen for two atmospheres pressure; 5 per cent oxygen and 95 nitrogen for four atmospheres, and so on. The value of this suggestion is strengthened by the French physicist De Fonvielle, who maintains that the discomfort experienced by travelers on high mountain peaks, or by aeronauts when ascending to high altitudes, is not so much caused by the diminished atmospheric pressure as by the want of oxygen, which, in that rarefied condition, is not given to the lungs in sufficient quantity. He suggested, therefore, the inhalation of pure oxygen at those high altitudes; and two balloonists, Sivel and Croce-Spinelli, have verified this theory during a recent ascent in the balloon *Etoile Polaire*. M. Croce-Spinelli, when he had reached a height of 16,400 feet, experienced a strong feeling of suffocation; he then resorted to the inhalation of pure oxygen (enclosed in a large rubber bag with which he was provided), and became not only relieved, but recovered his normal condition of perfect comfort. The effect on the pulse was remarkable: while below it was 86 beats per minute, it rose, at a height of 16,000 feet, to 140; when oxygen was respired, it descended at once to 120.

The published account of this ascent adds the following: "When not using the respirator, the skies appeared to the observers quite dark; but when freely respiring the oxygen, the blue color of the heavens was restored." As the blue color of the sky is due to the refraction of the solar light in the atmosphere, it is an objective phenomenon, and cannot be seen at such high altitudes, where there is little of the atmosphere (and that little very rarefied) left above the observer. The statement that the blue color was restored by the inhalation of the oxygen would infer that the hue is subjective and due to the condition of our eyes, induced by breathing the gas.

In regard to the height which travelers are able to attain, we may state that Alexander von Humboldt, in his ascent of Chimborazo, was compelled to stop at a height of 16,000 feet, at which point he had to give up from suffocation; but in late years the brothers Schlagintweit ascended the Himalayas, and slept all night in bivouac at a height of 19,200 feet, and later ascended the peak Ibi Gamin, 22,200 feet high.

The English astronomer Mr. Glaisher claims that he has ascended to a height of 26,000 feet without feeling any discomfort, and that only when reaching 32,000 feet he experienced any very serious feeling of suffocation. No doubt, different constitutions are differently affected; some are unable to resist diminished atmospheric pressures, others increased pressure. We met even last summer a consumptive individual on Mount Washington (which is not much over 6,000 feet high), who stated that he felt such a feeling of suffocation that he was obliged to hasten down on the same day.

THE AMERICAN SOCIAL SCIENCE CONGRESS.

The American Social Science Congress will hold its annual session in New York city, commencing on May 19 and terminating on May 23. The title of this institution is broad enough to cover a vast field of useful knowledge, and the subjects for investigation are very numerous and interesting. Mr. George W. Curtis will preside, and papers by Rev. Dr. Woolsey on exemption of private property from capture at sea, by Mr. W. C. Flagg on the farmers' movement, by President Gilman on California, by Hon. D. A. Wells on taxation, by Professor Peirce on ocean lanes for steamship navigation, by Mr. G. G. Hubbard on railroads, and by Professor Sumner on the Finance Department, will be read. Many other papers relating to public health, penal institutions, charity, and kindred subjects are promised, and the Boards of Health and Public Charities will probably be in session on the same days.

The bill before Congress for the grant of national aid to the extent of three millions of dollars in behalf of the Centennial Exhibition has been defeated.

New Eighty-one Tun Gun.

Only two years ago the sobriquet "Woolwich Infant" was playfully applied to a gun which had just been constructed in the gun factories of the Royal Arsenal at Woolwich, of the then unprecedented size of thirty-five tons. Recent events have, however, proved that the name was by no means ill chosen, for a decision has been arrived at which will necessitate our viewing this gun actually in the light of a mere baby, a series of monstrous successors having been designed which will put its nose out of joint altogether. The first four of these, which are intended to form the armament of the future ironclad Indefatigable, will be proceeded with so soon as the experimental one, which is the subject of the present paper, has been completed and proved.

The new gun will, it is expected, be of a weight slightly over or slightly under eighty one tons. Its total length, including the plug screwed in at the breech end, 27 feet; the length of bore, 24 feet; the caliber will, in the first instance, be 14 inches, but ample provision is made in the thickness of the steel tube to increase that figure to 16 inches, if deemed desirable. The rifling has not as yet been decided on, but will be a matter for consideration as the gun approaches completion, by which time the result of the present series of experiments with the $\frac{3}{8}$ tun gun will doubtless have thrown considerable light upon this vexed question. The trunnions are to be 16 inches in diameter. The internal construction is similar to that of the 10 inch gun and upwards, except that the chase is divided into three portions instead of two.

The accompanying engraving will give some idea of the appearance of the proposed gun, and exhibits the grandeur of its proportions as compared even with those of its colossal predecessor. The 7 inch gun is also shown as demonstrating the immense advance that has taken place in modern artillery during the past eight years. When we consider that it was positively stated, when the 7 inch gun was produced, that we had attained the highest point we should ever reach in weight of metal, it seems almost incredible that in less than a decade we should be in possession of artillery twelve times as heavy. One is almost tempted to pervert the Latin proverb, and exclaim: "*Tempora mutantur et arma mutantur in illis.*"

Neither the weight of projectile nor quantity of powder to be contained in the cartridge for the 81 tun gun has been positively fixed, but the first will probably range between 1,000 lbs. and 1,200 lbs., while the second may be estimated at about one sixth of that amount. In the following calculations as to the probable energy of the new gun, or force of impact of its projectile, at the various ranges specified, three weights of shot or shell are respectively dealt with of 1,000 lbs., 1,100 lbs., and 1,200 lbs. An initial velocity has been assumed in all cases at the muzzle of the gun of 1,300 feet per second. It would possibly be considerably greater, but we desire to be within the mark. Working by the well known formula:

$$\text{The energy in vis viva in pounds} = \frac{WV^2}{2g}$$

where W = weight of projectile in lbs.,
V = velocity in feet,
g = force of gravity (32.2),

we find at the muzzle for the 1,000 lbs. projectile a blow of 11,715 foot-tuns, for the 1,100 lbs. projectile one of 12,886 foot-tuns, and for the 1,200 lbs. projectile the terrific force of 14,058 foot-tuns! These forces would, of course, be considerably enhanced by the higher velocity which would doubtless be obtained. When we compare such energies with those of the 35 tun and 7 inch guns, namely, 8,404 and 1,855 tons, respectively, the latter sink into utter insignificance.

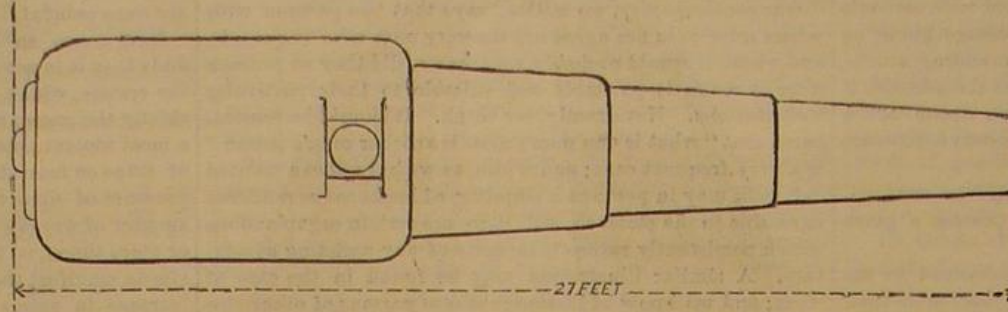
The actual penetrating powers of the 81 tun gun, as distinguished from the striking or racking powers, can only be decided by experiment. With the earlier natures of heavy ordnance, such as the 7 inch and 8 inch, a rough rule gave the penetrative or punching power as 1 inch in excess of the diameter of the projectile. Thus the 8 inch gun would penetrate armor 9 inches thick at a moderate distance. But as we ascend the series, this power develops itself in an increasing ratio, the 10 inch gun piercing armor of 12 inches in thickness, but not going through the backing; while the 12 inch gun of 36 tons easily pierces 14 inches armor and backing, and only is arrested by the latter after going through 15 inch targets. Hence we may reasonably estimate the power of the gun now under consideration as capable of penetrating at least 19 inches or 20 inches of armor plates and their backing, at a distance of, say, 500 yards. We are aware, of course, that by increasing the diameter of the bore to 16 inches, the charge remaining the same, a loss of penetrative power would result, but we anticipate that (by employment in making up the cartridges of the slow-burning $\frac{1}{4}$ inches or 2 inch cubes of pebble powder, some of which have been manufactured at Waltham Abbey, and with which good velocities and low pressures were obtained in recent experiments with the 38 tun gun at the proof butts), as the caliber is increased, so the charge may be increased in proportion. That the 81 tun gun will ultimately have a caliber of certainly 15 inches, we little doubt.—*The Engineer.*

THE POLAR CLOCK—THE TIME OF DAY SHOWN BY COLORS.

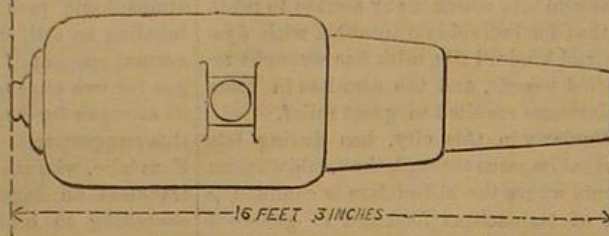
One of the most beautiful practical applications of the polarizing instrument is presented in Sir Charles Wheatstone's polar clock, shown in our engravings and described in the following passage by the inventor:

"At the extremity of a vertical pillar is fixed, within a brass ring, a glass disk, so inclined that its plane is perpendicular to the polar axis of the earth. On the lower half of this disk is a graduated semicircle, divided into twelve parts (each of which is again subdivided into five or ten parts), and against the divisions the hours of the day are marked, commencing and terminating with VI. Within the fixed brass ring, containing the glass dial plate, the broad end of a con-

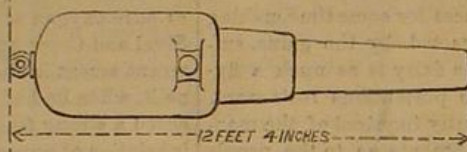
81 TUN GUN. PROJECTILE 1,200 LBS. CARTRIDGE 200 LBS.



35 TUN GUN. PROJECTILE 115 LBS. CARTRIDGE 110 LBS.



7 TUN GUN. PROJECTILE 700 LBS. CARTRIDGE 30 LBS.



cal tube is so fitted that it freely moves round its own axis; this broad end is closed by another glass disk, in the center of which is a small star or other figure, formed of thin films of selenite, exhibiting when examined with polarized light strongly contrasted colors; and a hand is painted in such a position as to be a prolongation of one of the principal sections of the crystalline films. At the smaller end of the conical tube a Nicol's prism is fixed so that either of its diagonals shall be 45° from the principal section of the selenite films. The instrument being so fixed that the axis of the conical tube shall coincide with the polar axis of the earth, and the eye of the observer being placed to the Nicol's prism, it will be remarked that the selenite star will, in general, be richly colored; but as the tube is turned on its axis the colors will vary in intensity, and in two positions will entirely disappear. In one of these positions a smaller circular disk in the center of the star will be a certain color (red, for instance), while in the other position it will exhibit the complementary color. This effect is obtained by placing the principal section of the small central disk 23½° from that of the other films of selenite which form the star. The rule to ascertain the time by this instrument is as follows: The tube must be turned round by the hand of the observer until the color star entirely disappears while the disk in the center remains red; the hand will then point accurately to the hour. The accuracy with which the solar time may be indicated by

Fig. 1.

Fig. 2.



WHEATSTONE'S POLAR CLOCK.

this means will depend on the exactness with which the plane of polarization can be determined; one degree or

change in the plane corresponds with four minutes of solar time.

"The instrument may be furnished with a graduated quadrant for the purpose of adapting it to any latitude; but it is intended to be fixed in any locality, it may be permanently adjusted to the proper polar elevation and the expense of the graduated quadrant be saved; a spirit level will be useful to adjust it accurately. The instrument might be set to its proper azimuth by the sun's shadow at noon, or by means of a declination needle; but an observation with the instrument itself may be more readily employed for this purpose. Ascertain the true solar time by means of a good watch and a time equation table, set the hand of the polar clock to correspond thereto, and turn the vertical pillar on its axis until the colors of the selenite star entirely disappear. The instrument then will be properly adjusted.

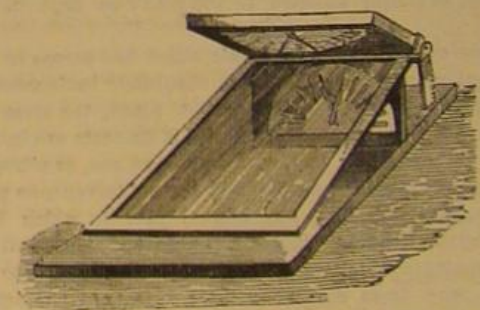
"The advantages a polar clock possesses over a sun dial are: 1st. The polar clock being constantly directed to the same point of the sky, there is no locality in which it cannot be employed, whereas, in order that the indications of a sun dial should be observed during the whole day, no obstacle must exist at any time between the dial and the places of the sun, and it therefore cannot be applied in any confined situation. The polar clock is consequently applicable in places where a sun dial would be of no avail: on the north side of a mountain or of a lofty building, for instance. 2d. It will continue to indicate the time after sunset and before sunrise, in fact, so long as any portion of the rays of the sun are reflected from the atmosphere. 3d. It will also indicate the time, but with less accuracy, when the sky is overcast, if the clouds do not exceed a certain density.

"The plane of polarization of the north pole of the sky moves in the opposite direction to that of the hand of a watch; it is more convenient therefore to have the hours graduated on the lower semicircle, for the figures will then be read in their direct order, whereas they would be read backwards on an upper semicircle. In the southern hemisphere the upper semicircle should

be employed, for the plane of polarization of the south pole of the sky changes in the same direction as the hand of a watch. If both the upper and lower semicircles be graduated, the same instrument will serve equally for both hemispheres.

"The following is a description of one among several other forms of the polar clock which have been devised. This (Fig. 3), though much less accurate in its indications than the preceding, beautifully illustrates the principle.

Fig. 3.



SELENITE POLAR CLOCK.

"On a plate of glass twenty-five films of selenite of equal thickness are arranged at equal distances radially in a semicircle; they are so placed that the line bisecting the principal sections of the films shall correspond with the radii respectively, and figures corresponding to the hours are painted above each film in regular order. This plate of glass is fixed in a frame so that its plane is inclined to the horizon 38° 33', the complement of the polar elevation; the light, passing perpendicularly through this plate, falls at the polarizing angle, 56° 45', on a reflector of black glass, which is inclined 18° 13' to the horizon. This apparatus being properly adjusted, that is, so that the glass dial plate shall be perpendicular to the polar axis of the earth, the following will be the effects when presented towards an unclouded sky: At all times of the day the radii will appear of various shades of two complementary colors, which we will assume to be red and green, and the hour is indicated by the figure placed opposite the radius which contains the most red; the half hour is indicated by the equality of two adjacent tints."

A CORRECTION.—An accidental error exists in the description of the bolt cutter of the Wood and Light Machine Co., which appeared on the first page of our issue of May 9. The beginning of the detailed reference should read: "A is the face plate of the die holder," etc. Instead of the following sentence should appear: B is the head, caused to revolve by proper mechanism, through which passes a mandrel, moving freely back and forth, in the spindle, C.

THE green color of the boron flame may be very well shown by boiling a mixture of boric acid, alcohol, and sulphuric acid, and igniting the vapor.

HYDRAULIC RIVETING MACHINE.

It is now no unusual thing to have boilers in use at sea with plates of one inch and even upwards in thickness. Such boilers require to be constructed with rivets of sizes that cannot be satisfactorily set up by mere manual labor; and of late years, after many applications of steam and gearing for this purpose, hydraulic power has been employed with the best results.

The first thing that strikes an observer of this new process, is the entire absence of that most deafening noise, the usual accompaniment of ordinary riveting; and a little further attention will show that this absence of noise is its least merit. By the quiet, steady pressure, rivets are enlarged throughout their length, and fill up all roughness or irregularities inside the punched holes they enter, so that they remain firmly fixed, even when one or both of the heads are cut off, and must be drilled out altogether should it ever be necessary to remove them. The pressure not only forms heads on the rivets, and effects the above named compression, but it holds them up, and the plates also, close together, until the former are sufficiently cooled to bear the strain, and even draws the plates closer together by subsequent contraction.

Our illustration shows Messrs. McKay and MacGeorge's patent hydraulic riveter, which has been for some time in use at the Millwall Docks Engineering Works, London. This machine is one of the most powerful of its class, and gives a pressure of 60 tons upon the rivet, an amount abundantly sufficient for the largest class of boiler work hitherto required for marine engines. Above the machine stands a powerful traveling crane, from which boilers are suspended over it, their (ordinary) horizontal axis, of course, then being in a vertical position. Circular seams of rivets are brought to the machine by the simple process of turning the boiler round on a swivel, and vertical seams, by raising or lowering it in the usual manner with mechanical arrangements of this class.

The pressure is derived from an accumulator, and it amounts to 700 lbs. per square inch in the present case. This pressure is only admitted into the large cylinder when the dies come in contact with the hot rivet, the slack being taken up by the action of a smaller cylinder. By this arrangement a considerable saving of power is effected; for if the large cylinder took its supply and moved the levers their entire distance by accumulator pressure, it is evident that great waste of power would ensue thereby, and in all direct acting steam-riveting machines this waste must come from the nature of their construction.

The hydraulic cylinder, and all valves, levers, weights, etc., are placed in a pit below ground, clear out of the way of men working, and safe from frost or accidental injury. Of course the pit is covered over, and in winter carefully protected from cold; and where, as is sometimes the case, these machines stand practically out of doors, a precaution of this kind should never be neglected.

The upper end of the powerful cast iron levers which form the most conspicuous part of this machine are perfectly free from all surroundings, except only a conveniently placed handle for starting or reversing; this handle stands behind one of the levers, and therefore does not appear in the present illustration. These levers are so strong that any accidental blow given to them can do no harm; and the readiest access is obtained to every part of the machine. Steel dies are simply placed in bored holes, and naturally hold themselves there.

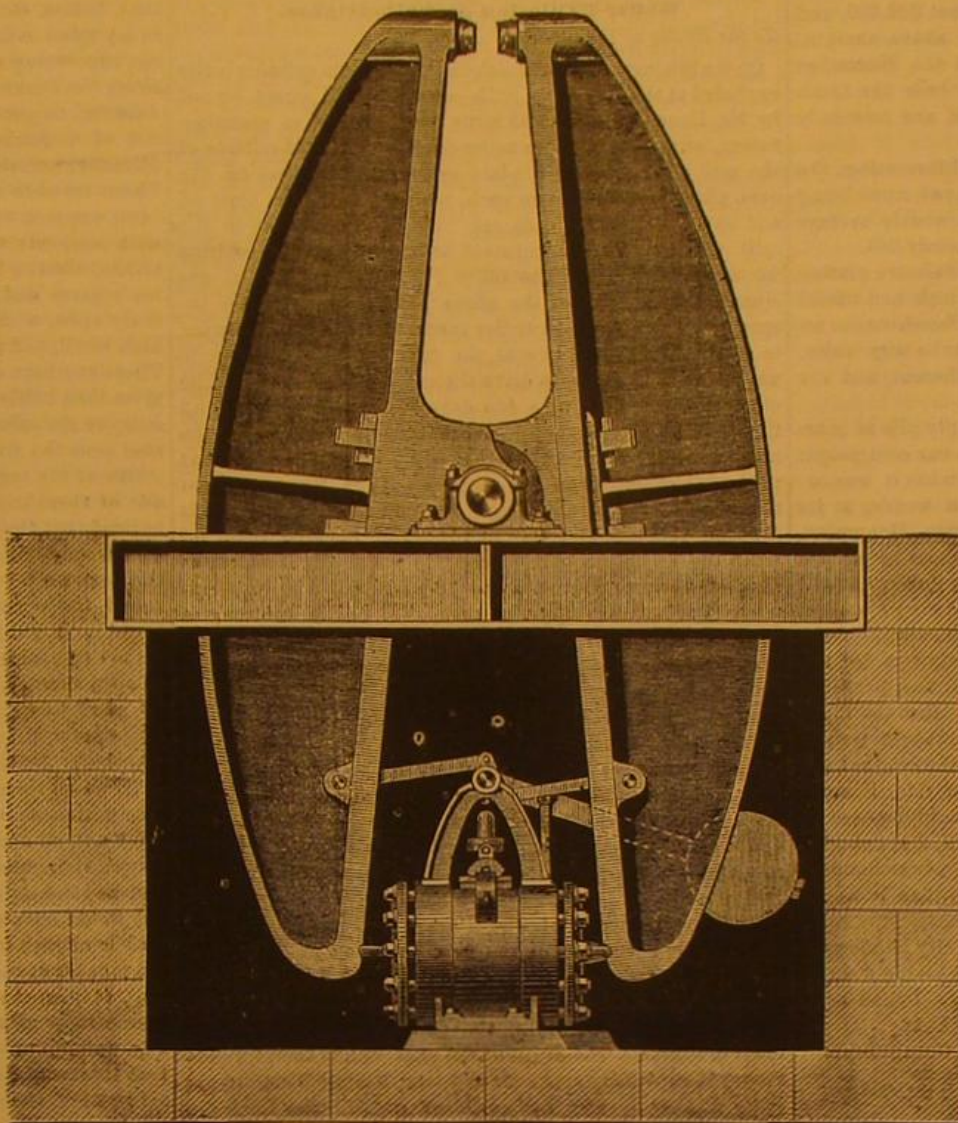
When all is prepared, and a heated rivet in position, a movement of the handle admits high pressure water to the smaller cylinder, the dies rapidly close upon the rivet, the self-acting valves admit water to the larger cylinder, and without noise or vibration, the work is done. The dull, heavy pressure crushes together the thick plates; and after holding them and the rivet together for a moment that the latter may cool, the pressure is released, the dies recede, another rivet is soon completed, and a boiler is finished with astonishing ease and rapidity.

The distance, from the center shaft on which both levers work to the dies or center of the hydraulic cylinder, is 6 feet in the present case; so that, after deducting the center bearing and wrought iron straps to carry the tensile strain, there remains a clear space of 5 feet for boiler plates, and this is found to be ample for the several classes of work for which this particular machine is used.—*The Engineer*.

New Australian Trees and Plants.

Mr. Walter Hill, the Government botanist, has reported to the Queensland Secretary for Lands that his party have examined the banks of the Mulgrave, Russell, Mossman, Daintree, and Hull rivers, and have been more or less successful in finding suitable land for sugar and other tropical and semi-tropical productions. The ascent of the summit of Bellenden Kerr was successfully made by Johnstone, Hill, and eight troopers. At 2,500 feet in height they observed an

undescribed tree with crimson flowers, which excels the *poinciana regia*, *colvillia racemosa*, *lagerstroma regia*, and the *jacaranda mimosifolia*. At 4,400 feet a tree fern, which will excel in grandeur all others of the alboreous class. A palm tree at the same height which will rival any of the British-Indian species in gracefulness. "On the banks of the Daintree we saw a palm tree cocoa, which far exceeds the unique specimens in the garden of the same genera from Brazil in grandeur and gracefulness. While cutting a given line on the banks of the river Johnstone, for the purpose of examining the land, an enormous fig tree stood in the way, far exceeding in stoutness and grandeur the renowned forest giants of California and Victoria. Three feet from the

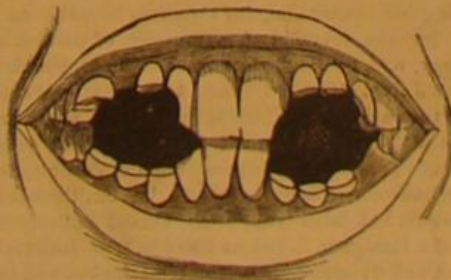


HYDRAULIC RIVETING MACHINE.

ground it measured 150 feet in circumference; at 55 feet, where it sent forth giant branches, the stem was nearly 80 feet in circumference. The river Johnstone, within a limited distance from the coast, offers the first and best inducements to sugar cultivation."

Effect of Pipe Smoking on Teeth.

Dr. Erich Richter, of Ula, Col., gives, in *Dental Cosmos*, the accompanying engraving of dental abrasion from the use of clay pipes. The patient, a miner, a native of Germany, addicted to smoking, could not refrain from it even while at work. It was his custom, while using the pick or shovel, to support the pipe between the canines and first bicuspid, and, when making heavy strokes, the pipe would move a little. After a few years he could close his teeth and still have room for the pipe.



The accompanying diagram illustrates the effect upon the teeth. The left superior cuspid is worn down nearly to the gum, and looks as though it had been filed for pivoting and then polished. The pulp cavity is not exposed, but is covered with so thin a layer of dentine as to make the touch of an instrument painful. The other abrasions are all in the form of a segment of a circle, and are all highly polished. The second left lower and the first upper bicuspid have been extracted. The teeth are all free from caries, but discolored badly.

New Local Anesthetic.

Some time since the *Medical Record* quoted from an American source a statement that if camphor be powdered by rubbing it in a mortar with a few drops of spirit, and an equal weight of chloral hydrate added, a liquid is produced which is a valuable local anesthetic. Mr. Lennox Browne, writing

to the *British Medical Journal*, confirms this statement, and says that it is of the greatest value as a local application in neuralgia. Mr. Browne, having employed it during several months, has found great and sometimes instantaneous relief to follow its application in every case. It is only necessary to paint the mixture lightly over the painful part and allow it to dry. The application never blisters, though it may occasion a tingling sensation of the skin. The compound has also been found of great service in the relief of toothache.—*Pharmaceutical Journal*.

Death Valley.

According to the recent expeditionary report of Lieutenant Wheeler, the Death Valley in California is a detrital sink of unique physical characteristics. This whole region presents a series of valleys or detrital plains, each entirely inclosed by the ridges of Cordilleras that are more or less distinct as a series of mountain masses. The Death Valley proper is one of the most remarkable of all known interior continental depressions, and has portions near the center of its axial line below the level of the sea, although far inland, and lying much to the north of the lower border of the great interior basin. It is the sink of the Amargosa river, which has its source in the areas of drainage formed to the south and east of Belmont, Nevada, traverses the desert of that name while passing southward, until, reaching lat. 35° 41' 5", it makes an abrupt angle to the west, and thence, at right angles to the north, reaches the point of greatest depression, a little less than 500 feet below the sea level, in the heart of Death Valley proper. This valley, of the ordinary oval form, is fully 70 miles in length, varying from 5 to 15 miles in width, surrounded by frowning mountains of volcanic and sedimentary origin, the Telescope range, rising higher than 10,000 feet. The line crossing this dismal area from the mouth of Death Valley cañon to the thermal springs in Furnace creek, presenting a labyrinthine maze of efflorescent, saline forms, creates at the level of vision a miniature ocean, the vibrations of whose contorted waves has a sickening effect upon the senses. The lurid glare, horizoned by the bluish haze radiated from the mountain sides, appears focused to this pit, though broad in expanse. It seems, coupled with the extreme heat, to call for the utmost powers of mental and physical endurance.

The journey through the Valley of Death occasioned the utmost apprehension, evinced through the entire season. To this was added the effect of the fearful cloud burst experienced while among the Telescope mountains, to the west, and the absence of the guide who had ventured toward the northwestern arm of the valley, it was feared to return no more. The transit of 48 hours, in a temperature that remained at 117° Fah. at midnight, so exhausted both men and animals that further travel was rendered precarious.

Testing Dyes for Adulteration.

Red dyes must neither color soap and water nor lime water, nor must they themselves become yellow or brown after boiling. This test shows the presence or absence of Brazil wood, archil, safflower, sandal wood, and the aniline colors. Yellow dyes must stand being boiled with alcohol, water, and lime water. The most stable yellow is madder yellow; the least stable are anatto and turmeric; fustic is rather better. Blue dyes must not color alcohol reddish, nor must they decompose on boiling with hydrochloric acid. The best purple colors are composed of indigo and cochineal, or purpurin. The former test applies also to them. Orange dyes must color neither water nor alcohol on boiling; green, neither alcohol nor hydrochloric acid. Brown dyes must not lose their color on standing with alcohol, or on boiling with water. If black colors have a basis of indigo, they turn greenish or blue on boiling with sodium carbonate; if the dye be pure gall nuts, it turns brown. If the material changes to red on boiling with hydrochloric acid, the coloring matter is logwood without a basis of indigo, and is not durable. If it changes to blue, indigo is present.—*Dingler's Polytechnisches Journal*.

Phosphoric Acid on Oats.

E. Wolff describes water culture experiments in which the nourishing solutions, eight in number, supplied graduated quantities of phosphoric acid. The percentage of phosphoric acid in the dry crop varied with the amount supplied. When this percentage fell below 0.33 (with good field oats it is about 0.44) the amount of straw seriously diminished, but an increase of phosphoric acid above this point did not increase the straw. The corn, however, was greatly affected by an increased supply, and gave by much the largest yield when the phosphoric acid reached 1.11 per cent of the dry crop. The ash of the straw contained no silica, none having been supplied; its percentage of phosphoric acid was 4.4—18.9, that in the ash of field oats (silica deducted) being 9.1. In the ash of the corn, the phosphoric acid varied only from 37.7—43.9 per cent, the percentage in the ash of field oats being 41.3.

Correspondence.

Notes from Washington, D. C.

To the Editor of the Scientific American:

The Hon. M. D. Leggett, Commissioner of Patents, having been the subject of a series of scurrilous and defamatory articles in a disreputable paper, published in this city, and called the *Capitol*, has thought proper to strike back, and in a letter to the *Zanesville Daily Courier* makes public a variety of facts concerning the personal history of the editor author of the paper in question, which are anything but complimentary.

Donn Piatt, the editor of the paper, values the character thus given him by the Commissioner at about \$20,000, and has therefore brought a libel suit for the above amount. The case will probably come on for trial at the November term of this year, when we may expect to hear the truth about some very peculiar transactions that are now only vaguely hinted at.

The ordinary business of the Office is still increasing, the number of patents issued during the month of April being 1,204, or an average of 301 per week. The weekly average for the corresponding period of last year was only 263.

Among the patents lately issued is one for electro-plating with cobalt, which, it is stated, will form a thick and useful covering that perfectly protects the plated surface from the action of the elements, and the coating is said to be very white, exceedingly hard and durable, tenacious, adherent, and not liable to tarnish.

For many years past there has been an ugly pile of marble in this city, which has been an eyesore to our own people and a wonder to the visitors here: a wonder what it was originally designed for and (when informed) a wonder at its unfinished state. I refer to the Washington Monument, which in its present appearance suggests a cross between a factory chimney and a shot tower; and if ever finished, it will serve more as a memento of the want of taste in its design than as an honor to Washington. For ten or twelve years past nothing has been done to it, owing mainly to a lack of funds, which the wretchedly poor design has probably caused, and partly to a very strong suspicion that the foundation is not strong enough to carry the immense weight which finishing the monument, according to the original design, would bring to bear on it. In view of this, Senator Morrill proposes that the material in it should be used to form a large monumental arch, by which plan, it is thought, a structure that would not disgrace him in whose honor it was raised may be erected at less expense than it would take to finish the present abortion.

Mr. Sutro, of Sutro tunnel fame, is in this city looking after his interests before Congress, and has been giving a series of entertaining lectures on mines and mining. I shall send you a few interesting items therefrom in my next.

Washington, May 19, 1874.

OCCASIONAL.

The Overflow of the Mississippi.

To the Editor of the Scientific American:

The Mississippi river, its relation to commerce and agriculture, and especially the protection of these alluvial lands by the restriction of the waters which flow near, through, and now over many of them, are points of vital interest to a large section of the great South.

As the Mississippi valley is the home of our chief staple, the nation should have yielded all the aid she lawfully could to every scheme looking to the protection of those lands and to enriching, draining, and cultivating them in a proper and scientific manner; but the government has absolutely refused to do anything, and has altogether withdrawn any semblance of encouragement to agriculture in this region. The water that irrigates this great valley turns the spindles of the Eastern and Middle States. Thousands of the laboring classes of these sections find the bread that we cast upon these waters come to them.

At this time, the condition of this country is attracting unusual attention. The overflow in the Mississippi valley, the consequent damages to the crops, extending perhaps to an entire failure and the terrible results following the same, direct our notice and the action that should arise therefrom to the experience of those whose knowledge of the locality extends over a series of many years. In looking for protection from these waters by embankments called levees, and endeavoring to place metes and bounds to this inland sea, we must admit that the treatment has failed. Levees have proved useless on smaller streams; and agriculturists on the lands of this river, who have had the advantage of twenty-five or fifty years experience, and who were, for the most part, in favor of the levee system as now used, are convinced that it is and always will be a failure. If it could be successful, the advantage is not sufficient to justify the expense. That the lands are more productive, that better crops of corn and cotton are made, in the overflowed regions cannot be doubted.

During the last half century, there has been but one year in which a crop could not have been made as well and better without a levee than with one. That year was 1858. Land sellers, speculators, and theorists on the subject, are the only advocates of that levee system. What we wish to find is some better system of protection. There are two ideas prevalent among practical men who acknowledge the inexpediency of the present system of protection. The one is to straighten the river and levee the outlets; the other is to divert the volume of water by canaling the upper portion of the river and the largest tributaries, and thereby lessen the quantity of water and the danger to this region, and also to level the outlets, as in the other suggestions. Either

of these ideas, practically applied, would succeed in the direction of protection to these overflowed lands. And it would be much better judgment on the part of the nation to discuss these ideas in a practical way before expending the public money on a scheme for the protection of the cotton region. The application of these ideas needs science and capital. The government can command both; and as it is a subject of eminent national import, the nation ought to take the matter in hand. It would be a public benefaction; and the whole country, the readers of your valuable paper, would be greatly interested in the discussion of the scientific aspect of this subject.

Austin, Miss.

J. F. S.

Boiler Explosion at Philadelphia.

To the Editor of the Scientific American:

On the 8th instant, about 3 o'clock P. M., a plain cylinder boiler exploded at the Keystone Mills on Callowhill street, owned by Mr. Henry Hoppen, who rents portions out to manufacturers, with power. The boiler room was located outside of the mill and contained 6 plain cylinder boilers set on the oven plan, in sets of two each, with separate feed, blow off and safety valves for each set. The two sets next to the mill wall have been in constant use in their present position for the past 8 years. The other two have been out of use since last June. All of the above have been under the inspection of the Hartford Boiler Insurance Company. Owing to getting in a bad lot of coal, the four boilers in use would not maintain pressure to drive the engine up to speed. The other two were fired up a few days back so as to bring up the pressure (60 pounds per square inch) necessary to run the mill at speed. All seemed right until a short time previous to the explosion, when the engineer, Hugh Sweeny, found the outside boiler was leaking. He immediately hauled his fire from this set, and was in the act of blowing them off when the explosion took place. He was badly scalded, as also was Thomas Devoe, a lad 13 years old who was employed in the mill. Both of them died on the morning of May 10. On making an examination of the boiler, I find that it parted at the junction of the second and third rims, through the line of rivets a part of the way. The fourth rim had a new piece along its whole length and about 17 inches wide, which, Mr. Hoppen says, was ordered to be done by the inspector of the Hartford Boiler Insurance Company. My examination shows that the boiler has been cracked through the line of rivets at the point of rupture, no doubt for some years back, as there are no signs of junctions of metals, at the point of separation, in two places of over 2 feet in length.

How the inspector of the Hartford Company and the boiler makers who put on the new patch could have overlooked these cracks passes my comprehension. I am satisfied if the hammer test had been properly applied, followed by the hydraulic pressure, the patch would have shown itself defective. The cause of the explosion is therefore obvious; it exploded from wear and tear, having been in use some 25 years. The average duration of boiler life is 10 years.

This latter is objected to by some people from the fact that a large number of boilers older than the above are working older than the above and have done so for years with steam of an equal or even a greater pressure; still they are continuing to do so only at a risk, and their past exemption is no security against explosion in the future. A year ago a boiler exploded which was 20 years old and killed 11 persons. This boiler, over 25 years old, has killed 2 persons. Now I believe that 13 human lives are worth more than all the boilers over ten years old in this city. The law should be that a boiler after ten year's use, no matter its condition, should be replaced. Our railroad companies understand this; after a car wheel has run a certain number of miles it is condemned, and why should not boilers be also? Man wears out by use, and so does iron.

Philadelphia, Pa.

W. BARNET LE VAN.

A National Museum of Science.

To the Editor of the Scientific American:

Would it not be an appropriate and beneficial mode of celebrating our Centennial, for Congress to make an appropriation for the erection of a museum of natural history, mineralogy, and geology, the corner stone of which should be laid on July 4, 1876? It seems to me that it is a national disgrace that a country which is so wealthy, and one which possesses within itself so much material to make a first class museum of the above description, should be contented with the miscellaneous collections now in the Smithsonian Institution, which has been supported almost entirely by the bounty of a foreigner. Let us leave to that institution the formation and development of an archaeological and ethnological museum, and let the nation excel the world in the magnificence of its natural history collections, for we can scarcely hope to rival European nations in our strictly art collections.

Now that the time of the year is approaching when our various scientific and educational bodies will hold their annual meetings, I think it would be well for them to take some action upon the subject, and, by memorials, show Congress that there is a large body of learned and thinking men in the country who have arrived at the conclusion that the time has come when our Government, "of and for the people," should expend annually as large a sum, in behalf of science, literature, and the useful arts, as it now expends in supporting one regiment of soldiers or one ship of war. I firmly believe (after extensive travels) that our people are the most interested of any in the world in scientific pursuits; and when we think how much has been accomplished in this

country in this way, without the aids which even the smallest foreign nation extends to its investigators, I think that, with such aid, a very few years will not fail to see our land the home of the sciences, and filled with students from abroad. But at any rate, we ought to be as far progressed and civilized as Russia now is; but at present we are far behind even her in our national liberality to culture and learning.

Chicago, Ill.

S. G. L.

The Ants of Brazil.

To the Editor of the Scientific American:

An article on the army ants of Central America, their doings, habits, etc., in a recent number of your journal brings to my mind some observations, which I made several years ago concerning a species of ants, inhabitants of the country along the banks of the Uruguay and Parana rivers in South America, on parallel 35° S. latitude. Their habitations consist of mounds, some of which are at least ten feet in diameter, and rise above the ground some three or four feet. These mounds seem to be built of coarse grass (a sort of bent, common to that section of the country), intermixed with soil. At the base, at intervals of about a foot, were arches, about $\frac{1}{2}$ inch wide and the same height in the center, for ingress and egress. The country is rolling, lying entirely open, with an occasional patch of dwarf trees on some high knoll, and ravines fringed with trees of larger growth. There are here and there roads, which are really nothing more than cattle trails, leading from the *estancieros* in the camp to the *saladeros* (salting establishments) which are situated near the river.

One of the large mounds was situated within a few feet of one of these trails; and as I was walking along the trail, I noticed that the front of the mound had a different appearance from any I had seen. So I examined it, and found all the ports on the front barricaded. All the rest of the way round, the ports were open and the ants were passing out, seeming very diligent about their business. From each of these little ports or doors leads a path, away into the camp or open country. The first, next the trail, ran nearly parallel, and I traced it more than a quarter of a mile. From the other ports, the paths led off, as spokes from the nave of a wheel.

To watch these ants and see them work and give tokens of recognition as they met each other was very interesting. Each ant, on leaving the fortress, took his path and hurried away; and, on meeting some particular friend, would stop and apparently shake hands and pass on. Returning, each ant would have a piece of the stalk of the grass, from a half inch to an inch long on his shoulder, as a soldier would carry his musket at easy march. When they arrived at the fortress, they would dip down the forward end of their load and march in as naturally as human beings could; and by steadily watching them for a while, you would almost imagine that they were human beings on a small scale.

Stratford, Conn.

TRUMAN HOTCHKISS.

Bunsen's Battery Improved.

To the Editor of the Scientific American:

While Bunsen's battery is one of the most intense in use, considering its cost, there are two serious objections to its general adoption. The first is a want of continuous action, which renders it entirely unfit for many purposes; secondly, the offensive and deleterious vapor, which arises from it while in action, is an objection of scarcely less importance.

I have been laboring for some time to improve the constancy of this form of battery, while at the same time preserving its intensity; and this I have accomplished by filling the porous cup around the carbon with coarsely powdered (it should be powdered about as fine as gunpowder) graphite, which is a hard substance obtained from the inside of gas retorts. The battery is set in action by moistening the powder with nitric acid, which is done by pouring a few spoonfuls into the porous cup. I have found that the current developed by this arrangement will be sustained for a long period of time, while its intensity is equal, if not superior, to that when acid alone is used. The poisonous vapor arising from the battery is very little, owing to the small quantity of acid employed.

There is, however, a circumstance attending the use of this battery, on which it will be well to make a remark. Sometimes, in making connections with the carbon, a screw is forced into it; and when this is the case, the screw becomes corroded and partially cuts off the current, and in some instances I have known it to cut the connection almost entirely off. If the points of the screws were plated with platinum or gold, the difficulty would be completely overcome.

JAMES POOL.

Friendsville, Ill.

BUT few persons are aware of the magnitude and perfection to which the manufacture of doors and window blinds by machinery has arrived in the United States. It is stated by those who profess to know that the number of doors alone made within the one State of New York, exceeds 30,000 per day, or not far from nine millions per year. From statistics deemed reliable, it is believed that the amount of capital invested in this branch of manufactures in this country cannot fall short of \$40,000,000.

THE home of the cactus family appears to be in southern Arizona. Here the grand cactus, *cereus giganteus*, is from thirty feet to forty feet high, and from three feet to four feet in diameter.

The Eucalyptus Tree.

The San Francisco *Bulletin* gives the following account of the *eucalyptus globulus*, or Australian gum tree, obtained principally from Messrs. Sontag & Co., of San Francisco, who have given much attention to its cultivation. (We recently published an engraving of this tree in the SCIENTIFIC AMERICAN.)

The eucalyptus is favorably known to all residents of California, where probably not less than 1,000,000 trees are planted. In this city, in front of handsome residences, you will find it, with its magnificent drooping branches, making an effective and graceful shade tree. In Oakland, the broad avenues are lined with them, eucalyptus forests are planted in the country surrounding Oakland, and, in fact, in every country of this State where the cold winter will permit it to live, the eucalyptus will be found growing. The wonderful properties of this tree have only within the past few years been discovered and appreciated. It is justly claimed that when the tree flourishes in low, marshy, and feverish districts, all miasma will cease. It destroys the malarial element in any atmosphere where it grows, and is a great absorbent of moisture, draining the subsoil almost as thoroughly as a regular system of piping. The eucalyptus is an evergreen, and is found in its native country (Tasmania) in boundless forests, both on the hillsides and in the lowlands, under extremes of climates, both as to heat and cold, ranging from 130° to 20° Fah. Whether it will endure a greater degree of cold, we think, has not as yet been determined. It is, however, worthy of a trial. Its remarkably rapid growth is a matter of much surprise, attaining, as it does, a maximum height of about 300 feet, with a circumference of from thirty to fifty. For timber and fuel it is exceedingly useful, being hard and easily worked, and very serviceable for such purposes as the keels of vessels, bridges, etc., where strength and durability are essential. It is estimated that from \$4,000,000 to \$5,000,000 in value of this timber is exported annually from Australia. The leaves of this tree are of a dark bluish color, about ten inches long, an inch wide, thin, and oddly twisted. They exhale a strong camphor-like odor, quite agreeable and pleasant, which, with the large absorption of water by the roots, causes the beneficial influence of the tree. It bears a small white flower, having no odor. In consequence of its anti-febrile qualities, the English Government has planted it extensively in the East Indies and Africa, in fever districts, with the most satisfactory results. In France, Cuba, Spain, Mexico, and many other places where malaria, fever, ague, and other pestilential diseases prevailed, the eucalypti have been planted. The wonderful properties of this tree have been discussed by many scientific institutions in Europe. In the Academy of Sciences, in this city, its medicinal and anti-miasmatic qualities have received considerable attention. Dr. Pigne Dupuytren testified before that Academy of the virtues of the eucalyptus, and stated that both he and Dr. D'Oliviera had tested it in the French Hospital. In the garden surrounding this hospital, a large number of the trees are planted for sanitary purposes. It had been found efficacious in the treatment of affections of the larynx and of the mucous membrane in general. Experiments, carefully made, have proved that, in a medicinal preparation, it cures cases of intermittent fever, against which quinine alone proves powerless. It is also valuable as a disinfectant. In Algeria its cultivation was undertaken on a large scale. Some 13,000 eucalypti were planted in an extremely pestilential and unhealthy section, where fever prevailed to a great extent every year. During the first year of their growth, at the time when the fever used to set in, not a single case of fever occurred, yet the trees were only nine feet high. Since then this place is reported free from its unwelcome visitations. In the vicinity of Constantinople, another fever spot, marshy and sickly, the whole ground was dried up by 14,000 of these trees. In Cuba, marsh diseases are rapidly disappearing upon the introduction of this tree. A railway station in the Department of the Var was so pestilential that the officials could not remain there longer than a year. Forty of these trees were planted, and the unhealthy condition of the place was changed. Two miles from Haywards, in this State, the surveyor-general planted groves of the eucalyptus, one of about ninety acres and the other seventy acres, the whole comprising about 150,000 trees. They are now only about five years old, yet many of trees are forty to fifty feet high, the whole making a most extensive and beautiful forest, being, for fuel and timber purposes, worth thousands of dollars.

Dynamite as a Stump Puller for Land Reclamation.

The following report of experiments with the newly discovered blasting agent, dynamite, which were carried out on Sir W. S. Maxwell's Cadder estate, is from the *Glasgow Herald*. Dynamite is nitro-glycerin mixed with a silicious earth found near Hamburg, and known as *kieselguhr*, which, being used as a fine powder, absorbs and retains the liquid explosive.

Dynamite is a moist and plastic solid, of a pale brown color, not unlike the finer qualities of sugar. The dynamite is made up in cartridges of various sizes to suit the bore holes, one inch diameter being the general size. The great advantage of this substance over gunpowder is its greater comparative safety, as it will not explode without percussion; when ignited without percussion, rapid combustion ensues, but there is no explosion. In order to make dynamite effective, it is necessary to explode with it some detonating substance. Specially prepared and extra powerful percussion caps are the agents used, in connection with a suitable length of Bickford's fuse, which consists of a line or thread of gunpowder inclosed in a tube made of gutta percha, a piece of this fuse being tipped with one of

the percussion caps. The cartridge was placed on the stump of an old tree and ignited. After a short interval there was a loud and powerful explosion, accompanied with considerable splintering of the wood. We quote the actual experiments *verbatim* from the pages of the *Herald*:

The stumps of a number of trees that had recently been cut down were experimented upon. By means of an auger, a hole about one and a quarter inches in diameter was bored vertically to a depth of twelve or fifteen inches in one of the stumps; and when it was found to be quite through the wood of the stump, it was continued by means of a crowbar to a depth of fully two feet. Two or three cartridges were put into the bore hole and firmly driven home by means of a wooden rammer. Then a small cartridge, called a primer, prepared with a cap-tipped fuse, was dropped in and rammed home, and the hole was tamped or stemmed by filling it to the top with water, care having in this case been taken to put a luting of clay round the junction of the cap with the fuse. The latter was fired, the observers betook themselves to a respectful distance, and in a brief space of time a great upheaval took place. The noise of the explosion, however, was in a great measure smothered. When the members of the party returned to the spot, they found the stump to be rent in a most extraordinary manner; but the general opinion was that the bore hole had been made so deep that the energy of the explosion had spent itself too much upon the subsoil and too little upon the wood. The stump next operated upon was bored to a less depth, and the result of the blasting process was more effective. In either case a few strokes with an ax, by way of severing the principal root members, would be quite sufficient to leave the woody masses in such a condition that they could easily be dragged out and lifted away.

It was suggested by Mr. John Scott that the operation of piercing with an auger should be dispensed with in blasting the next root stump, so as to do the work with as great economy of time as possible. In this instance, therefore, the crowbar was brought into requisition instead of the auger, and by means of it a hole was driven horizontally inward between two of the principal root members to about the center of the stump. The whole was charged and fired in the usual way, the result being a much greater amount of eruptive and disruptive action, with a smaller expenditure of time and labor. One or two other root stumps of large size were blasted in the same way, and it was clearly demonstrated that, under certain circumstances, dynamite could be employed to more advantage immediately underneath than in the mass of material to be operated on. Mr. Scott expresses himself to be fully satisfied, from what he has now witnessed, that he could use the new blasting agent with great effect and economy in land-clearing operations in Canada, so far as tree roots were concerned.

Sebacic Acid.*

When castor oil is gently heated with sodium hydrate, the whole solidifies, after much frothing, to a soft yellow waxy mass of sodium ricinoleate. On raising the heat, this salt melts and decomposes, an oily distillate passing over, and the residue yields sebacic acid. This acid, discovered in 1802 by Thénard, usually crystallizes in a multitude of long, fine, feathery crystals, which, when dry, have a peculiar pearly luster, or from dilute saline solution in long thin needles; but under certain conditions, it separates from the ammonium sebates in very thin, brilliant laminae, with peculiar bright luster.

Soluble in 700 parts at 20°; in 400 parts at 40°; in 240 parts at 50°; in 50 parts of water at 100°. By prolonged boiling, it is possible to dissolve it in 22 parts of water, of which 1 part in 45 remains in solution at 96°. It is readily soluble in cold alcohol and ether, easily dissolved by hot ether, and extremely soluble in hot alcohol. It crystallizes from hot ether in short, transparent needles, and from hot alcohol in the same manner as from hot water.

It is readily soluble in hot nitric acid, and not decomposed by boiling therewith for a moderate time, but separates out when cold; easily soluble in hot hydrochloric acid without change, crystallizing out on cooling; readily soluble in cold sulphuric acid, extremely soluble in sulphuric acid at 100°, and separates out unaltered on dilution with water; not sensibly attached by digestion with nitrohydrochloric acid, or potassium permanganate and sulphuric acid.

Aqueous sebacic acid reddens litmus strongly, tastes acid and bitter, completely neutralizes the alkaline hydrates, decomposes the carbonates of potassium, sodium, barium, strontium, and magnesium, and precipitates solutions of lead acetate and silver nitrate if dilute, but neither mercuric nor calcium chloride, nor silver nitrate if strong, but precipitates the silver ammonio-nitrate.

Even after being twice recrystallized, it is apt to retain traces of a white solid hydrocarbon, melting below 100°, and a pale yellow hydrocarbon, which can be removed only by repeated recrystallization. A trace of hydrochloric acid is also frequently retained, even after a second recrystallization, and is also best removed by repeated crystallization; but it is probably to this trace of retained hydrochloric acid that one or two of the discrepancies in the earlier descriptions are due.

Of the two classes of salts formed by sebacic acid in its capacity of a dibasic acid, the neutral salts would appear to be the more stable, the second class, or the acid salts, being apparently decomposed more readily, and even in some instances by prolonged boiling of their concentrated solution. The acid salts seem to be all more or less soluble in water, and

*From a paper read before the Chemical Society, by E. Nelson, Principal Assistant in the Laboratory of the Royal Veterinary College.

neutral salts of the heavy metals and of calcium insoluble in water, while the rest are soluble.

By treatment of sebacic acid with the salts of various metals, a great variety of crystals and powders of different colors, blue, orange, green, red, white and purple, some of magnificent character, are produced.

Formation of Gum in Fruit-Bearing Trees.

In the wood of a tree diseased with gum, a great number of vessels are always seen more or less completely filled with gum; sometimes they are entirely filled to a certain length, and sometimes the gum only forms a coating either upon all the periphery or only on one side. The gum first shows itself in very small drops, which gradually increase in size and touch each other, forming small irregular masses. Recent German observers have stated that the formation of the gum is due to the disorganization and transformation of the internal part of the wall of the vessel, but the author has come to an opposite conclusion. In examining the wood of an apricot tree from which large masses of gum were extracted, it was found that the vessels were marked with areolated punctures, and with a spiral line due to a thickening of the membrane; also that the surfaces of the masses of gum were marked with deep furrows corresponding with the spiral lines of the vessel wall and even with small projections according with the punctures. It is thus certain, in the author's opinion, that the gum has poured into the interior of the vessel, and that the marks upon it are imprinted from the vessel wall.

In the production of gum in the cellule by the transformation of starch, it has been observed that, on the first appearance of gum in the cellule, the unchanged starch gathers into small masses, around which forms a thin coating of gum. Gradually the starch diminishes, while the coating of gum increases, until at last the starch disappears altogether, leaving generally a vacant space in the center of the mass of gum.

Often the gum, produced in such considerable quantity, is formed neither in the vessel nor in the cellule, but in the spaces between the young tissues, generally between the wood and the bark, yet often also at the different depths in the wood. These gum spaces grow at the expense of the neighboring tissues, which suffer important modifications: the cambium, instead of producing woody fiber, forms cellules in which abundance of starch is deposited, which starch subsequently becomes converted into the gum.—*E. Prillieux (Comptes Rendus)*.

Geology of the West.

Among the geological deductions of the Wheeler expedition are the following: All that portion of the United States west of the plains is characterized by corrugation, that is, the geological formations once horizontal have been bent and broken and thrown into ridges so as to produce a mountainous country. The ridges vary greatly as to height and length, but agree in general northerly trend; so that in traveling north and south, it is generally easy to follow valleys, while in going east or west one is confronted by range after range that he must climb or go around. In the lower parts of this great mountain system, the slow but indefatigable agencies of rain and stream have accumulated so great an amount of detritus that the valleys are clogged and the mountains nearly or quite buried. In this way have been produced the great desert plains of Utah, Arizona, and Southern California, vast seas of sand and saline clay, from the surfaces of which a few half sunken peaks jut forth as islands. These intermissions of the mountainous character are mere concealments, not interruptions, of the corrugated structure; but that structure is interrupted in one place—perhaps in others, but in one notably—by a tract in which the strata are almost undisturbed. The general surface of this exceptional region lies from 6,000 to 8,000 feet above the ocean, and it is intersected by the celebrated cañons of the Colorado and its tributaries. By these gorges and by other modifications, chiefly dependent on erosion, it is divided into a great number of plateaus which the surveys now in progress are defining and naming. The geologists of the expeditions have found it convenient to designate the region, considered as a geological province, as the region of the plateaus, or the Colorado plateau system. It is surrounded on all sides by areas of corrugation, the ranges at the east constituting the Rocky Mountain system proper, and those at the west having been designated as the Cordilleras. At the north and south, these mountain areas coalesce.

Explosion and Firing of Volatile Oils.

A mixture of two parts of perfectly dry permanganate of potassium with two or three parts of concentrated sulphuric acid is a most powerful oxidizing agent, owing to the separation of permanganic acid and its immediate decomposition with the liberation of oxygen. Volatile oils are violently affected by this mixture, if about ten drops are placed in a little dish and then touched with a stout glass rod previously dipped into the mixture. The following produce explosions, often most violently: Oils of thyme, mace, turpentine (rectified), spike, cinnamon, origanum, rue, cubebs, and lemon. The following oils are simply inflamed, particularly if poured upon blotting paper and touched with the mixture, though under certain still unknown circumstances explosion may occur: Oils of rosemary, lavender, cloves, geranium, gaultheria, caraway, cajeput, bitter almond, and rectified petroleum. The following substances are ignited without explosion: Alcohol, ether, wood spirit, benzole, chloroform, sulphide of carbon, and cotton. Gun cotton and gunpowder are not ignited.—*N. Report. f. Pharm.*

IMPROVED DOUBLETREE.

In the improved sway bar of a doubletree, whiffletree, or neck yoke, represented in our engraving, the strength of the wooden portion is materially increased by a brace rod, so that the bar may be made much lighter while still furnishing the necessary strength.

Each end of the sway bar is fitted with a cap or thimble, whereby it is protected from abrasion and splitting, and to which the clevises are attached in the ordinary way—set up at the ends of these caps. By the use of nuts, it is obvious that any degree of tension can be given to the brace rod, and, at the same time, the caps will be tightly secured to the ends of the bar.

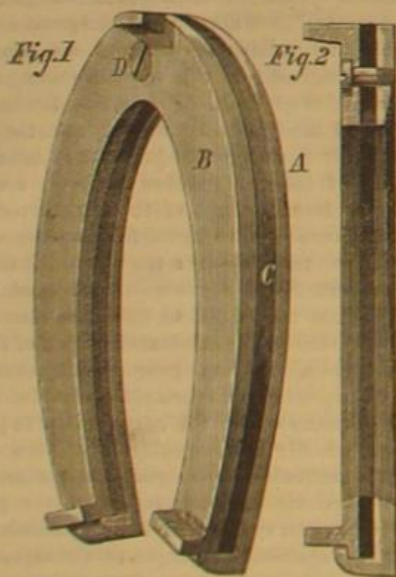
The brace rod, as will be seen, passes through the staple by means of holes made for the purpose at proper distances from the rear side of the sway bar Fig. 2. By using the rod in connection with the wood, as described, the draft on the rod and pressure on the wood are both endwise, thereby, it is claimed, combining the utmost strength of both materials. These doubletrees, whiffletrees, and neck-yokes have, we learn, been thoroughly tested with success. With not very expensive machinery, it is stated, they can be manufactured with great facility. Two arrangements of the device are shown in the separate figures in our illustration.

This improvement is covered by two patents obtained through the Scientific American Patent Agency. For farther particulars regarding sale of rights or sale of territory, etc., address A. N. Case, Kingsville, Ashtabula county, Ohio.

TODD'S IMPROVED HORSESHOE.

Mr. George H. Todd, of Montgomery, Ala., has recently invented a novel horseshoe, which seems well suited for use on city pavements. The object is to afford an elastic resistance to the step, thus avoiding that pounding action upon the stones which injures the hoof and renders so many city horses valueless. Nature has made the hoof elastic, and to confine it, in a bar or kindred inelastic shoe, produces a similar effect to that of inclosing the human foot in an iron boot. As the abrasion of the covering upon the human member causes corns, so does the badly formed or adjusted shoe produce similar infliction upon the feet of horses, subjecting them to temporary and often permanent lameness. Mr. Todd's invention is, therefore, desirable in both a humane and an economical sense, as it aims to restore the elasticity which is lost by the necessary protection of the shoe, and thus to preserve the animal for longer service.

The plan adopted is represented in perspective in Fig. 1, and section in Fig. 2, in the annexed engraving, and consists in making the shoe in two parts, A and B, and confining between them a layer of rubber, C. The portion, A, which is nailed to the hoof in the ordinary manner, may be made of common iron, and the lower part, which takes the shock and wear, of hardened steel or other suitable metal. The two portions and the rubber between them are connected by the screw, D, and the lugs in the ends of part, B, which enter



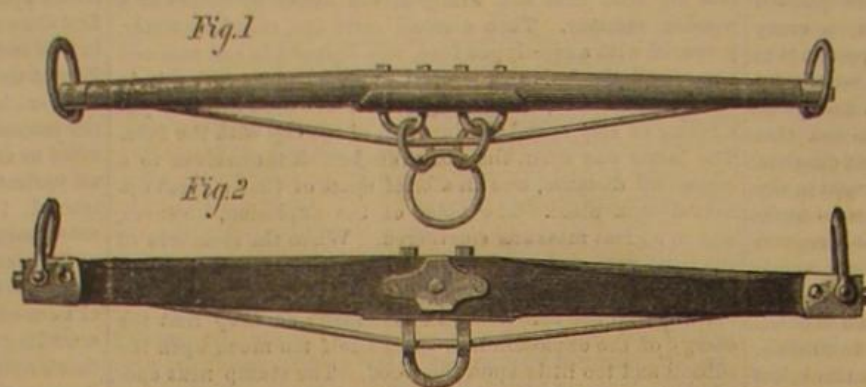
indentations in part A, as shown in the sectional view, Fig. 2. It will be observed that the rubber intercepts the force generated by the impact of the shoe and the ground, and by its yielding reduces the shock before the same reaches the animal. We are informed that there is no permanent spreading of the rubber by compression, and that it answers admirably the above purpose for which it is intended. The inventor states that he was enabled to use a horse when thus shod, which, when wearing the ordinary shoe, was too lame to use.

There are advantages other than those noted, which readily suggest themselves. The shoe is rendered much lighter, and the wear comes almost entirely upon the outer portion; the rubber can be cheaply renewed; the foot piece will not wear a number of the outer plates.

The form of shoe, as represented in our engraving, is somewhat modified to adapt it for trotting horses, to gain greater lightness. To this end the outer piece, with the exception of the toe, through which the holding screw passes, is cut down on its inner side to a mere rim, curved in section, inside of which the rubber, also diminished in size, is

placed as before. The inventor informs us that, instead of making the rubber simply to line the shoe, it may be left a flat piece, extending entirely across the under portion of the hoof. When thus arranged, the latter may be stuffed and the tow or other material held closely in place, the under surface of the rubber serving as additional foothold. The durability of the portion which is directly nailed to the hoof, offers also an additional advantage, in that, when once accurately fitted, the shoe remains so for an indefinite period, and hence the chances of the animal being injured from improperly adjusted shoes are necessarily not so great as when old ones, on wearing out, are constantly replaced.

Further particulars may be obtained by addressing the in-

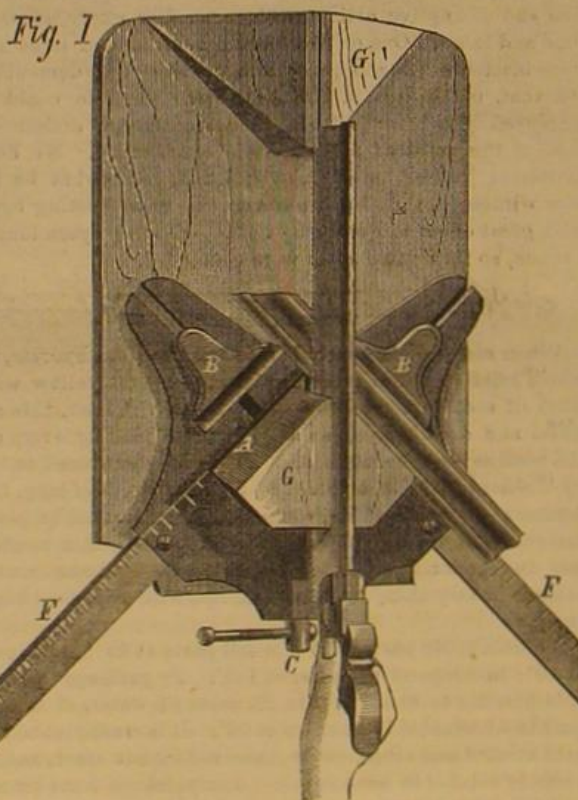


IMPROVED DOUBLETREE.

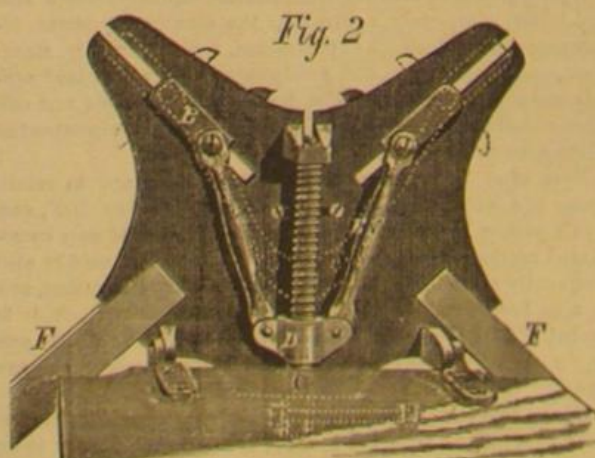
ventor as above, or the shoe itself may be seen at the store of Spies, Kissam & Co., 279 Broadway, New York city.

IMPROVED MITER MACHINE AND FRAME VISE.

Our engravings represent a simple, cheap, and durable device, by means of which frames can be easily made and put together without requiring the work of a skilled mechanic. It consists of a miter box for cutting the ends of the material to proper angles, and a vise which holds the frame firmly while being fastened together. The apparatus, which is



constructed of iron, has on its table a square, A, Fig. 1. B B are two movable blocks which clamp the moldings to be mitered against the sides of the square by pressing against the backs of the pieces, and thus not injuring the faces. The clamps are moved back and forth by a screw, C, on which travels a block, D, Fig. 2, to which are pivoted arms, E, which are connected with blocks, B, underneath the table, as shown. The latter is hinged to the bench, and in Fig. 2 is represented as turned up so as to show its under side. The



motion of the screw and adjacent parts is indicated by the dotted lines.

After one end of the molding is mitered, the piece is placed on the other side of the square, and its extremity

adjusted to such a mark on the measuring arm, F, as denotes the length desired. It is then immediately cut by the saw, thus obviating the trouble of measuring and marking each side of the frame, and also the liability of mistakes. After the pieces are mitered, they may be placed on the square and clamped tight by the blocks, when they can be readily nailed together. Thus constructed the sides will be accurately fitted, as being firmly held during the fastening, they cannot move out of square. This operation repeated for the other corners, completes the frame. If, in fastening, it is found that the molding has become sprung or twisted, the joint, we are informed, may be quickly made perfect by running the saw through it, thus enabling the operator to use moldings which would, in the ordinary manner of working, be of little utility. The saw guide blocks, G, are of wood. One is screwed within the square and the other to the bench. The latter may be made to slide back and forth so as to be brought against the molding. As the blocks wear away, they can be brought together, the screws underneath working through slots for the purpose.

The machine may be hinged to the bench as shown, or may be imbedded in the latter flush with the surface. A circular saw may be employed instead of the hand instrument, if desired.

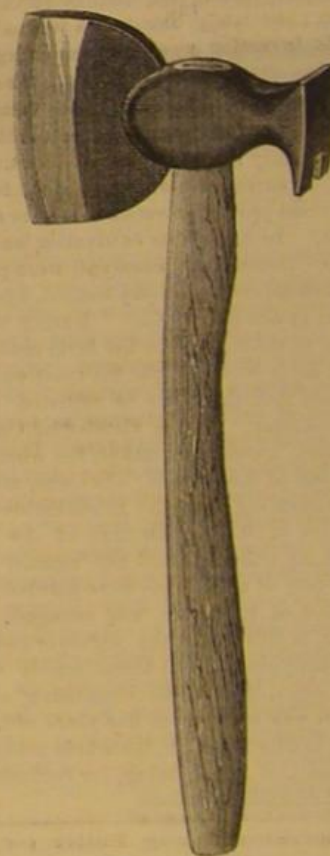
For further particulars address the inventor, Mr. James H. Van Ness, Charlotte, N. C.

Electrical Currents from Albumenoid Substances.

M. Becquerel has shown that, when two heterogeneous liquids are separated by an organic membrane or by a capillary space, they give an electric current capable of producing chemical and mechanical effects, reduction of metals, and double decomposition, etc. M. Onimus finds that the interposition of a layer of albumenoid matter (white of egg, albumen of blood) has the same electro-chemical results. Thus with the solutions of sulphate of copper and of oxalate of potash, separated in a tube by albumenoid substance, beautiful blue crystals of oxalate of copper and potash are obtained. The phenomena, he points out, may throw light on the formation of phosphate of lime in animals.

JENKINS' PATENT COMPOUND HATCHET.

This hatchet is formed simply by punching the blade out of sheet steel, about No. 12, with a hole near the top. The blade is then set in a mold and a head cast on it, the melted iron uniting through the hole and forming a perfect fastening. It is then tempered, ground, and finished.



It is claimed that, in this manner, a hatchet carrying a good cutting edge, and having a head sufficient for ordinary purposes, may be manufactured at a comparatively small cost.

Patented through the Scientific American Patent Agency. The entire right for sale, or a license to manufacture on a royalty may be obtained. For further particulars address Mr. J. Jenkins, Coulter street, Germantown, Pa.

THE French expedition which has been exploring Terra del Fuego reports the finding, in the interior, of a large lake, 15 miles in circumference, surrounded by luxuriant vegetation, and literally covered by an army of wild fowl, among which the most abundant were ducks and geese. These regions are inhabited by rude but hospitable tribes; the women especially are very affable and obliging. One of them, in exchange for some pieces of sugar and common handkerchiefs, gave the leader of the expedition an object to which she attached an immense value, and which she preserved as a relic—the lid of a sardine box.

THE SEAFORTHIA ELEGANS.

Few of the larger growing palms, says a correspondent of the *London Garden*, to which we are indebted for the accompanying engraving, equal this species in beauty; and it has, what is many cases a great advantage, the property of being a rapid grower. Its proper place is planted out in a conservatory that is cool in summer, and kept regularly a few degrees above freezing in winter. Planted out in such a position in a bed of rich loam, and abundantly supplied with moisture, it soon makes a noble plant. Although a native of tropical Australia, it is sufficiently robust in constitution to succeed out of doors as a sub-tropical plant during our summer season, when it should be plunged on a well drained bottom.

Our illustration, showing the way in which it is used in French gardens, exhibits the graceful port of this species at a glance, and also the singularly effective character of the plant when associated with yuccas and other fine foliaged subjects in the open air. Scarcely any other palm is better adapted than this for a center plant in any well arranged group of foliage or flowering plants; and small specimens are useful for this purpose, as well as for the decoration of apartments and reception rooms. It is readily propagated from seeds sown in light soil in pots plunged in a gentle moist bottom heat, and the plants are ornamental from the time they attain 9 or 10 inches in height until they outgrow the quarters allotted to them. Frequent syringings overhead are beneficial to them, especially during hot weather, in order to keep down red spider; and as soon as the pot or tub becomes filled with roots, a little manure water is advantageous to them.

We have noted several small plants doing well in apartments, but they require a plentiful and regular supply of water at the root, and the hard foliage should be washed at least once a week with a soft sponge and clean tepid water. If soap is used, be particularly careful to remove every particle of it from the plant afterwards, by either syringing or sponging with clean water. If only one palm is required, for either pot culture or for planting out in the conservatory, we should recommend this before all others, on account of its graceful habit and easy culture.

An Oyster Patent.

One of the great troubles which oystermen have to contend with is the starfish. This rapacious enemy destroys thousands of bushels of oysters every year, and no device has heretofore proved effective as a protection. But the ingenuity of a Connecticut Yankee has at last triumphed. Mr. Oliver Cook, of Darien, Conn., has lately obtained a patent on the subject. His invention consists in spreading a net, under water, on the ground composing the oyster bed. Mr. Starfish puckers his fingers together, squeezes himself up through the meshes of the net, and then extends his digits again. Being now upon the upper side of the net, he will be infallibly captured whenever the oysterman raises the net to the surface. This is to be frequently done until the enemy is cleared from the coast, when the oysters at once begin to laugh and grow fat.

A Metallic Larynx.

The total extirpation of the larynx was performed not long ago, for the first time, by Professor Billroth, in Vienna, in consequence of epithelial disease, so extensive as to be amenable to no less severe procedure. The correspondent of the *Boston Medical and Surgical Journal* reports that tracheotomy was performed in order to accustom the patient to the use of the canula; when this was accomplished, the extirpation of the larynx was undertaken, by carefully dissecting it away from the surrounding tissues, leaving the hyoid bone and sound portion of the epiglottis. That night, brisk hæmorrhage occurred from some of the smaller arteries, and the patient seemed, for a time, in imminent danger of suffocation; it was also necessary, during the first fortnight, to administer liquid food through an œsophageal tube; but the extensive wound has entirely healed, and the operation must be conceded to be a success, and to reflect no little credit on its originator.

After the operation the man still possessed the power of communicating his wants in an indistinct but intelligible whisper. Subsequently a metallic larynx, provided with vibratory reeds, was fitted to the upper convex surface of the tracheotomy tube, and the man "can congratulate himself that, if his voice is a trifle monotonous in pitch, it is by no means unmusical in tone."

Preservation of Telegraph Poles, Posts and Railway Sleepers.

In the course of a recent discussion before the Society of Telegraph Engineers, London, concerning the best methods of preventing decay in wooden telegraph poles, it was stated that an experience of several years with hop poles had shown that, when their lower ends were simply boiled in an open vessel of creosote, the wood was greatly preserved from decay. The more perfect method of creosoting wood is to boil in creosote under a pressure of 120 lbs. to 150 lbs. per square inch. This involves expensive apparatus, but the wood thus treated will last indefinitely.

It was alleged that simply painting the bottoms of green poles with tar hastened decay, as the sap was sealed up at that point. When the poles were well dried, the application of tar was believed to be useful.

Attention was called to the process of Sigismund Beer, of New York city, which was considered to be an important one. It is certainly very simple, economical, and easily practiced. The wood is merely steeped in solution of borax. This salt is supposed to neutralize the decomposition of the vegetable matters in the wood, which are afterwards washed out.

Mr. Von Truenfeld said that he had not been concerned with wooden posts in England, but he knew of tropical trees which would last, he should say, at least 200 years without showing the slightest signs of decay. He had had occasion to take up poles which had been used in building, and which had been in the ground for over 100 years without showing the least sign of decay or corrosion on the ground



THE SEAFORTHIA ELEGANS.

line. They were poles made of trees growing in the interior of South America, and which were called in the native language the *urunday* and the *curupay* trees. They were generally called by English people iron wood. The wood was so hard that it was impossible to drive a nail into it. It would, perhaps, be an advantage if it could be brought to this country, and used for telegraph poles. He should think that it would last for hundreds of years. It might be worth while for some of our investigators to experiment with the iron wood with a view to its acclimation here.

Galvanic Electricity without Chemical Action.

At a recent meeting of the Physical Society, Mr. Fleming showed his new battery, in which the metallic contact of dissimilar metals is entirely avoided. The arrangement consists of thirty-six test tubes of dilute nitric acid, and the same number of tubes of sodium pentasulphide, all well insulated, alternating with one another. But strips of alternate lead and copper connect the neighboring tubes; by which means the terminals are of similar metal, and a current of sufficient intensity to violently affect a quantity galvanometer obtained. The potential increases, as in the ordinary galvanic arrangement, with the number of cells employed, until sixty cells showed an electro-motive force exceeding that of the same number of Daniell's elements. In this new battery the acid lead is positive to copper, while in the sulphide it is negative. Mr. Fleming further showed how, by using the single fluid nitric acid, and the single metal iron, a similar battery could be constructed, provided one half of each iron strip was rendered passive. This is an important discovery; for it seems to revive the theory that chemical action is not necessary in a galvanic apparatus to produce electricity. At all events it is of sufficient interest to merit the sound inquiry into its principles which physicists seem likely to make.

New Protecting Compound for Iron Ships.

Dissolve thirty-four ounces of shellac in eighty ounces of wood alcohol, which is allowed to stand about twenty-four hours. Then add thirty ounces of Venetian red, and thirty-five ounces of sulphate of lime, and thoroughly mix by passing it through a paint mill.

The paint is now ready for use, and is applied with a brush in the same way as ordinary paint, and will dry instantly, so that the vessel may be lowered into the water within an hour after the paint has been applied to the bottom.

For vessels navigating fresh water, or both salt and fresh water, the proportions of the Venetian red and the sulphate of lime used may be diminished. This paint may also be used upon the inside of the iron work of the vessel. It is the invention of Samuel Williams, of New York city, recently patented.

Condensed Milk Manufacture in Switzerland.

A factory for the production of condensed milk has recently been established at Cham, canton Zug, on the borders of the lake of the same name, in Switzerland. We find the following description of the process in the *Bulletin de la Société d'Encouragement*: The milk is furnished by peasants; and as soon as each person delivers his supply, a sample is taken from the pails, numbered, and allowed to remain quiet over night. The object of this is to judge of the quality of the milk for the rising of cream. Cases of fraud, however, are rare, as the peasantry are generally honest and the penalties imposed by law are extremely severe.

The first operation is to weigh the milk, which to this end is conducted into a copper basin supported by a balance. Its weight being obtained, the milk is allowed to escape into huge wooden reservoirs lined with zinc, and located in the cellar. Here a careful examination is made with the lactometer, and the fluid is drawn off into large cylindrical copper boilers which are placed in a vat furnished with a false bottom under which steam enters. The milk is thus slowly heated, but not boiled. For the latter purpose, it is ladled out into a separate boiler whence it is carried to another tank containing a quantity of white sugar. In order to facilitate the solution of the latter, the liquid is repeatedly passed along a metal trough from one vase to another. When the operation is completed, it is drawn off into evaporating chambers. These receptacles resemble the similar apparatus used in sugar manufacture, and have double bottoms heated by steam. They are united to a column of condensation which communicates with air pumps. Under these conditions the milk boils at 140° Fab. Every little while the workman takes out a sample from which he judges according to its viscosity whether the condensation is sufficient.

When the latter point is reached, the liquid is led down into the cellar and into a tin receptacle which is surrounded by cold water. The milk is thoroughly agitated by hand for some time until completely cool, when it is carried to other reservoirs and thence drawn off into boxes and sealed. The daily product is about 8,000 boxes, each weighing about 13.5 ounces. The milk may be diluted with five times its weight of water.

The Fastest Steamer in the World.

Such is the title claimed by Messrs. Thornycroft for a boat they have just built to the order of the Government of India, for service in the Orissa canals. The dimensions of this vessel are: Length, 87 feet; beam, 12 feet; draft of water, 3 feet 9 inches. The speed contracted for was 20 statute miles per hour. The hull, the working parts of the engines, and the propeller—Thornycroft's patent—are of Bessemer steel, and the woodwork is of teak. The official trial of the boat was made on the 14th ultimo under the inspection of Colonel Haig, R. E., chief engineer of the Bengal Irrigation Works, and the results were: With tide, 25.08 miles per hour; against tide, 24.15 miles per hour; giving a mean speed of 24.61 miles per hour. In another official trial it was shown that the boat could keep up a speed of 23 miles per hour without losing steam. These speeds are extraordinary enough in themselves, but when it is considered that they are attained by a boat only 87 feet long they become absolutely wonderful. The value of swift steam launches as torpedo boats is acknowledged, and already various foreign governments have ordered boats from Messrs. Thornycroft's yard, near London. If torpedo launches can be built to steam at the rate of 16 or 18 miles an hour in a moderately calm sea, the whole face of naval warfare may find itself changed in a very unexpected way.

Novelty in Ship Building.

At East Boston, Mass., there has been built by N. Gibson, as an experiment, a three masted schooner without frame. The vessel is 138 feet long, 32½ feet beam, and 12 feet 2 inches depth of hold. Long, sharp, large capacity and buoyancy. The vessel is composed of square logs of spruce, one foot square, placed one upon the other, and secured together by iron bolts, three feet long and placed twelve inches apart. The owner expects that this vessel will prove to be stronger, more capacious, and faster than vessels of the ordinary construction. In timber there is a saving of forty per cent. Twenty-six tons of iron were used. The construction of vessels on this plan was illustrated by engravings in the *SCIENTIFIC AMERICAN* several years ago. In view of the marked revival of shipbuilding now going on in this country, there is an excellent opportunity for inventors to study out new and useful improvements in maritime devices of every kind. Less attention has been given to this branch of industry by inventive minds, than almost any other.

BURSTING OF A MOUNTAIN WATER RESERVOIR IN MASSACHUSETTS.—A TERRIBLE CALAMITY.

The beautiful valley of Mill river, a tributary of the Connecticut, near Northampton, Mass., was the scene of an awful calamity on the morning of the 16th inst. At about 8 o'clock A. M. the dam of an immense water reservoir, located high up among the hills, above the village of Williamsburg, suddenly burst, and a tremendous flood poured down the river bed, overrunning the banks and sweeping away like chaff whatever stood in its path. Dwelling houses with families peacefully sitting at the breakfast table were instantly swept to destruction. Great factories, mills, bridges, stores, and property of all kinds disappeared in a moment; and upon the summit of the watery crest were to be seen the broken roofs of buildings, timbers, trees, wheels, pianos, and household goods of every description.

The village of Williamsburg was first struck. One third part of the village was instantly plowed through, leaving a broad bed of shapeless disfigured ruins of stones and débris where cottages, flowers, and scenes of peaceful beauty had previously existed. Many of the principal dwellings, factories, and other buildings were taken off, and a large number of the inhabitants perished.

Haydenville seems to have been unfortunately situated between two river curves, and hence, at one end of the town, are to be seen the effects of the madly rushing torrent; in a sweep of highlands at the other, the effects of the devastating undercurrent of the backwater, as it receded from and finally leaped over the lower bank. The great brass works of Hayden Gere & Co. were first swept, by a wall of débris from fifteen to twenty feet high, and with the added momentum the flood went over the road bed, devastating lawns and porticos of houses, leaving a boiler 2,000 feet from its original position, and placing it on an elevated spot in front of a house, tearing out the stone sides of the river and placing the boulders in the bed of the channel or on the sidewalk, and sweeping men, women, and children into eternity. Wooden houses were seen to come bounding along like corks, and from the interior of more than one were heard the shrieks of wives and daughters, whom their husbands and fathers had left a few moments before in fancied security. It was a sight which paralyzed every beholder.

At Skinnersville, the most frightful havoc of all, as regards extent of damage to property, took place in Skinnersville, although fewer lives were lost there than elsewhere. Only three houses were left standing in the village.

On the main street and village green of Leeds only three buildings remain. The Nonotuck silk factory, a solid structure, together with its costly dam, quickly fell, then the Emery Wheel Co.'s premises, the engine house, church, Wagner's button factory, and all the other buildings in the vicinity.

Over one hundred and fifty lives were lost, and property destroyed to the amount of between one million and two millions of dollars.

This terrible calamity was due to the weakness and bad construction of the reservoir dam, built six years ago. Its condition has at all times been a cause of uneasiness to knowing ones at Williamsburg.

THE RESERVOIR AND DAM.

The reservoir was one of a system of dams and reservoirs owned by a corporation called the Mill River and Williamsburg Reservoir Company, which included all the manufacturing establishments on the line of Mill River from Williamsburg to Northampton. It was situated on the east branch of Mill River, about three miles from the village of Williamsburg, in the northeastern corner of Northampton. The stream which supplied it, after joining the west branch at the village of Williamsburg, forms Mill River proper, which flows through Haydenville and Florence, and empties into the Connecticut river at Northampton.

In building the dam a stone wall was first built, which was stipulated to rise from a width of eight feet at the base to two feet at the top, which latter was 42 feet above the bed of the stream. This wall was contracted to be laid in the best known cement, and the projectors claimed it would be as strong as a single shaft of granite. Enveloping this wall on either side was a mass of earth, which sloped down on the water side at an angle of 30°, and on the lower side at an angle of 45°; a lateral section of this earthen support measured about 120 feet at the base, the greater mass of which was on the water side. At the center of the stream, inclosed in a stone wall, running at right angles to the main wall of the reservoir, ran an iron tube of two feet in diameter, for controlling the flow of water, extending, of course, a few feet beyond this eastern wall, at both extremities of its base. This wall of earth, 120 feet wide at bottom, was 16 feet across at the top, covering the crest of the stone wall, two feet in depth, in order to prevent danger from frost, and along its top furnished a good drive way. The water never rose quite to the crest of the dam, being kept about two feet below that line by means of a waste way at the western side. The reservoir covered an area of one hundred and eleven acres, and its average depth was twenty-four feet.

Is the Skunk's Bite Deadly?

While it is apparently difficult to add anything to the odium which is already attached to the common skunk, Rev. Horace C. Hovey finds a way of so doing by bringing forward proof that the animal is as dangerous as it is disagreeable. In the *American Journal of Science and Arts* is a paper by the above writer, in which he considers that a new disease has been discovered, which generally resembles *rabies canina* (of which hydrophobia is a symptom), while differing

from it specifically. To this he gives the name of *rabies mephitica*. It is transmitted by the bite of the skunk, and occurs when the glands which discharge its offensive fluid are inactive, so that it is possible that there may be a causative connection between this inactivity and the generation of malignant virus in the glands of the mouth. Mr. Hovey gives a large number of instances of men and animals dying from this cause in fearful convulsions. The mephitic inoculation, he says, is sure death. From the diagnosis given of the resulting disease, it seems that the period of incubation is about the same as that of *rabies canina*—from ten days to twelve months. The characteristic pustules of hydrophobia, which appear under the tongue and near the orifices of the submaxillary gland, are absent. So also is the abhorrence of water, catching of the breath, difficulty in swallowing, and various other symptoms of the *rabies canina*. There are, however, oscillations of the pupil, rapid alternate contraction and relaxation of the muscles, wiry radial pulse, and rapid action of the carotid, loss of perception, and delirium. The struggles of Nature to eliminate the poison are less prolonged in the *rabies mephitica*, and may be abridged by morphine, which has no narcotic effect in hydrophobia. In view of the great number of skunks in various portions of the country, it would appear that a further and more extended investigation into the nature and causation of this disease is of much importance. If the animal is so fearfully dangerous, its extermination should follow as relentlessly as that of the rattlesnake.

A New District Telegraph Instrument.

We have recently seen a new telegraph instrument designed by Mr. Hamilton E. Towle, and Mr. William Unger, of this city, to replace the apparatus now employed on the district telegraph lines. The device, like the ordinary instruments, gives three distinct calls, "police," "messenger," and "burglar alarm," and may be used for transmitting signals by sound. The notched wheels which break and close the circuit at certain times, making a distinctive signal, in the ordinary apparatus, are replaced by vertical bars formed of metal and rubber, so arranged that the switch passing over them receives the current when touching the metal portions, which are placed at certain intervals apart, and transmits the same to the sounding device at the main office. The machine is set in motion by pressing a button, which removes a detent from holding the clock work. A rod then rises from the top of the apparatus until the signal is completed, when it is pushed down, thus winding up the mechanism ready for another signal. The burglar alarm is so arranged that, by breaking a wire or connection, the current, which before preferably traversed that wire, passes to an electro-magnet, setting the device in action and transmitting a proper signal. We shall probably present before long an illustrated description of this invention, until which time further details are unnecessary.

How the Germans grasp American Inventions.

Engineering recently devoted a page of its space to editorially discussing the subject of breech-loading ordnance in general, and in particular the system invented by Mr. L. M. Broadwell, an American engineer. Our cotemporary says that, with a few unimportant exceptions, all the breech-loading guns exhibited at the Vienna Exposition were constructed after this plan. The specialty of the invention consists in the combination of a self-adjusting gas ring with an adjustable circular bearing plate, which together forms a perfectly gas-tight joint, and which can be repaired at an insignificant outlay of time and money. The history of the device, published in *Engineering*, is quite detailed, and it seems that the claims of the inventor have been fully recognized in France, Russia, Austria, Turkey, Italy, and Switzerland, and that these countries have paid him large sums for his patent rights.

In Germany, however, the usual course of injustice has been followed. Krupp has adopted the improvement, is manufacturing it on a large scale, and declines payment therefor; while the government has refused the inventor a patent on a clearly absurd pretence. The story is perhaps too long to find place in our columns, but it adds new corroboration to the facts which we have already published regarding the oppressive workings of the German patent laws as regards foreign inventors.

Unprofitableness of Government Telegraphs.

Our British friends have no doubt become convinced that, as a financial operation, government management of the telegraphs does not pay. With all the possible manipulation of the accounts and charging to the general post office expenses much that is properly chargeable to the telegraph service, there is a deficit, stated by the *Railway News*, of London, at \$5,000 per week, and which is constantly increasing. The private companies which were superseded by the government in the business, most of them, made the said business profitable to the stockholders, and the public was as well accommodated as it is now, to say the least.

Government telegraphy, as a remunerative branch of the postal service, is a failure; but having assumed the ownership of the elephant, he must, of course, be retained and supported. If government telegraphy in a country like Great Britain, which is densely populated, and whose telegraph facilities are very generally used by the public, the circuits short and easily maintained, and the compensation of employees comparatively very small, cannot be made to pay, what is the prospect in this country? The experience of Great Britain has probably saved our own government and people from the loss, damage, and dissatisfaction inevitably attendant upon government telegraphic administration; but it is well to keep the facts before the public and Congress.—*The Telegrapher*.

Fish Scale Ornaments.

Among recent patents is that of Eduard and Julius Huebner of Newark, who have invented certain new and useful improvements in preparing fish scales for use in the arts, of which the following is a specification:

The object of the invention is to utilize the scales of several varieties of fish, hitherto thrown away as useless, and prepare them for application in the arts, by producing articles of jewelry, artificial flowers, and similar objects. This invention consists in the process of cleansing and purifying the scales till the clear, horny substance or core of the same is obtained, which produces a new article of manufacture, which may be stamped into various ornamental shapes and dyed in all colors, for use in the arts.

Large scales are the most advantageous, taken from fresh fish. Old scales cannot be used, as they lack elasticity and clearness. The fresh scales are exposed for twenty-four hours to the action of pure salt water, for loosening and partially separating the outer layers of organic matter. They are then transferred to distilled water, being placed every two or three hours in clean water and washed therein five or six times, which renders the scales soft and clear. Each scale is then carefully rubbed with clean linen rags, then passed through a press having a linen lining so as to remove the moisture in the scales. The scales are finally placed for one hour in alcohol, and again rubbed and pressed, when they are dry and have a perfectly clear appearance, a mother-of-pearl-like hue, and great elasticity and durability.

The scales are used in this prepared state, or they may be dyed with aniline and other colors, in the usual manner, to be stamped into various kind of ornamental shapes, leaves, and flowers, and applied to the manufacture of jewelry and artificial flowers, for embroidering and inlaying wood, and other uses in the arts.

The New Steam Hammer at Woolwich, England.

To say that it is the largest and most powerful in the world conveys but an inadequate idea of its magnitude and might. The weight of the falling portion is within a few pounds of 40 tons, and the force of the falling weight is accelerated many times by the use of steam to drive it down from the top. It is at least four times as powerful as Krupp's hammer. It is estimated that the use of top steam is equal to allowing the hammer to fall of its own weight 80 feet. It has been allowed a striking fall of 15 feet 3 inches, and nobody has yet determined what is the actual force of the blow which it will strike. The hammer is 45 feet in height, and covers, with its supports, a base of about 120 feet square. Above the ground it weighs 500 tons, and the iron in the foundations below weighs 665 tons. It has cost altogether about \$250,000, the greater part of which has been paid to Messrs. Nasmyth, Wilson & Co., the patentees and manufacturers.

Steam on the Erie Canal.

The Baxter steam canal boat City of New York left this city for Buffalo, with way freight, Saturday 9th inst., at 5:35 P. M. She discharged and received cargo at Utica and Syracuse, and arrived at Buffalo Saturday morning, 16th inst., at 6 o'clock. Time, including all detentions, 6 days, 12 hours, and 25 minutes. She loaded to return on the same day. This seems to demonstrate the perfect practicability of using steam in canal navigation, as the usual time of horse boats is 12 to 14 days. The City of New York is the second boat of the line, and a number more are now being built.

THALLIUM burns in oxygen with a splendid green flame, and its use has been suggested for fireworks in lieu of chlorate of baryta. Thallium is a comparatively new metal. It was discovered in 1861, and has as yet few commercial uses. It resembles lead in appearance and many of its characteristics. Its weight is nearly the same as lead, but it oxydizes much more rapidly than lead.

Recent American and Foreign Patents.

Machine for Matching, Measuring, Singeing, Brushing, and Rolling Carpets.

James Short, New Brunswick, N. J.—This invention consists of an endless belt, with divisions of its length corresponding with the distance from center to center of the figure of the carpet or other woven goods to be matched; also mechanism in connection therewith for drawing the goods alongside of the belt in unison with its movement, and preferably over a table or a cylinder, by which the variation of each piece, in the distance from center to center of the figures, if any, is shown in the aggregate at the end of each piece, where it can be accurately measured with a rule, to be noted on the tag attached to the piece when rolled. The invention also consists in combining, with the mechanism employed for drawing the goods along the matching device and operating the latter, mechanism for measuring, singeing, brushing, and rolling the goods at the same time they are matched, by which one movement of the goods answers for all these several operations. This machine is by the same inventor who devised the very ingenious loom for weaving carpets of any width, illustrated some time ago in our columns. The present invention does away with a large amount of hand labor, and, it is believed, will prove of great utility in the wholesale trade.

Machinery for Burnishing Heels of Boots and Shoes.

Oliver G. Critchet, Belfast, Me.—Steam is introduced into a revolving chamber through a pipe which passes through a stationary head which is tightly packed. On the end of the chamber is a burnishing disk. The chamber is given a rapidly revolving motion, and, being heated by the steam in the chamber, it produces the desired effect.

Improved Pipe Wrench and Cutter.

William W. Micks, Elmira, N. Y.—A clamp-shaped on the inner side, comes in contact with the pipe, and has a round screw-threaded stem that passes through a block, provided with a gripping tool and cutter, and enters a handle which is bored and screw-threaded for the purpose. By turning the handle on the clamp stem the distance between the clamp and block may be altered to accommodate different sizes of pipe. The block is arranged to take a new hold on the pipe whenever the handle is vibrated for that purpose. The tenon of the cutting tool has no play. When it is desired to attach one pipe section to another, or to disconnect the same, the jaw is used. When a pipe section is to be cut in two, the block is reversed and the cutter inserted, the handle being adjusted on the stem according to the size of the pipe.

Improved Signal Lantern.

James C. McMullin, Chicago, assignor to himself and William H. Maesterman, and John Adams Jackson, Jr., Bloomington, Ill.—This invention relates to improvement in the signal lights of locomotives, railroad cars and stations, vessels, docks, lighthouses, and other objects, by which the light is thrown out in such a manner that portions of it are seen at greater, and other portions at lesser, distances, permitting, thereby, the approximate determination of the distance of the lights from the points of observation, and avoiding, to some extent, the danger of collisions or other accidents. The invention consists, mainly, in the construction of the front part of the signal light with a number of lenses of different sizes, arranged with or without colored glasses, or the arrangement of the front part with suitable designs of colored glasses, so that a similar graduation in the intensity of the emitted light is produced.

Improved Compound for Coating Iron Ships' Bottoms.
Samuel Williams, New York city.—This is an improved compound for the outside of iron vessels below the water line, formed of shellac, wood alcohol, Venetian red, and sulphate of lime. The paint is applied with a brush in the ordinary way, and will dry instantly, so that the vessel may be lowered into the water within an hour after the paint has been applied.

Improved Bag Fastener.

Daniel Jones, Hortonville, Wis.—Upon the edge of an arc-shaped plate are formed hooks, the concavities of which connect with fulcrum notches by inclines. To one loop is pivoted the plate, and to another loop a lever, the loops being jointed together and being of such a length that the lever may be fastened on the hooks. The lever is so curved that its short loop may be easily placed in a fulcrum notch, and will allow the long loop to be turned over at great advantage of leverage, drawing the fastener tight around the bag. As soon as this is effected, the loops slip back out of the notches, over the incline, and into the concavity of the hook, where they are securely held.

Improved Watch Chain Hook.

Henry T. Salisbury, Pawtucket, R. I.—This is an improved watch chain hook, by which the watch chain remains always securely attached to the vest without being liable to detachment by accident or pickpockets. The invention consists of a circular pivoted guard hook, which is locked to its stem by means of a central bolt sliding in a tubular sleeve at the inside of the stem. The sleeve is slotted for guiding a projecting rib of the central bolt, which rib is notched and locked by two or more annular bands or rings, and detached from the same when a notch of their inner circumference is brought in line with the slot of the sleeve, so that the bolt may be withdrawn and the hook opened.

Improved Reamer for Earth Borers.

John A. Chandler, Monticello, Iowa.—This invention is a reaming attachment to earth-boring apparatus, by which the lower section of a well below a stratum of quicksand may be quickly enlarged or extended, for the purpose of carrying the curbing down to the bottom of the well, and producing a well of uniform width. After the cut has been continued with the smaller auger till water is obtained, a reaming attachment to the shaft is used, having adjustable guide plates and sliding cutters, for enlarging the narrower section of the well below the curb gradually, from the bottom upward to the full width of the same, so that the curb slides down to the bottom of the well, and produces thereby, after the earth has been removed, a well of equal width.

Improved Saw Table.

Edward H. Hanna and Charles W. Hanna, Dover, Ky.—The pitch board is supported on the bed by means of two screws which are jointed to the board, and work through stands, and are confined in any desired position by nuts. One of two adjusting bars is jointed to the pitch board, and the other to the bed. These bars have each a serrated edge, and lap past each other, so that the serrated edges engage with each other, and are confined by means of a screw clamp when the board is properly adjusted. The pitch board rests on the bed at one end, and is made to stand at any desired angle to the saw. The plank is lapped over the edge of the pitch board, and is sawed by turning the pitch board and bed on the pivot bolt, the desired wind being given by means of the inclination and position of the pitch board.

Improved Burglar Alarm.

George A. Beaver, Richmond, Ind.—This invention consists of the combination of a series of register keys, which are connected in suitable manner to the windows, doors, etc., with a spring match holder, which lights the lamp, sets a clock train and bell in motion, and discharges percussion caps as soon as any one of the register keys releases the spring holder from the catch plate. The change of position of the key indicates the room in which the alarm originated.

Improved Saw Tooth Swage.

Andrew J. McCollum, Indianapolis, Ind., assignor to himself and George D. Emery, same place.—The object of this invention is to provide means for swaging the teeth of circular saws, square or parallel with the saw arbor, so that the saw will run true; and it consists of a slotted arm attached to the saw arbor extending out beyond the saw, having attached to it an adjustable curved arm which carries the swage.

Improved Machine for Cutting Rubber Soles.

George H. Ives, New Haven, Conn.—The object of this invention is to produce for manufacturers of rubber goods an improved machine for cutting out soles, fillings, or any other article from rubber cloth. The usual form of cutters or stamps may be employed. A spring board attached in front of stamps raises the cloth slightly above the stamp after each stroke. The pieces, after being cut, drop on an endless belt or apron, which carries the same off. The rubber cloth is fed from the cloth roller by reciprocating sliding feed blocks, which are operated by the driving shaft, their extent of motion being regulated by adjustable guide pieces. The feed blocks take hold of the cloth after each stroke, and feed the same to the stamp, releasing it on the return motion by passing along inclined guides, which raise the upper feed block.

Improved Rotary Engine.

Truckson S. La France, Elmira, N. Y.—This invention relates to that class of rotary steam engines and pumps in which two revolving cog wheels are employed in a case with semicircular ends, the teeth of the wheels meshing together to cut off the passage between them; and it consists of constructions of the teeth whereby pressure is balanced on the cutting-off teeth to better advantage than in the ordinary arrangements, and water of condensed steam is allowed to escape at the starting of the engine.

Improved Carbureter.

John M. Cayce, Franklin, Tenn.—This invention relates to means whereby air may be carbureted and supplied to the burner with greater uniformity of illuminating power than usual, and in a more economical manner. The invention consists in an air-supply governor that automatically maintains any definite pressure and supply of air; of means by which an over supply of carbon to the air may be prevented, and the relative proportions of oxygen and carbon accurately gaged; in making the carbureter sections held to joint band by a cohesive that will quickly melt during a fire and enable the apparatus to be easily handled and removed; and finally in means for obviating the jerking movement of a double action air pump, and causing it to move with great uniformity of motion.

Improved Portable Steamer for Potatoes, etc.

Carey E. McDonald and John W. Dewees, Philadelphia, Pa.—This is an improved device for outdoor and street trade, for steaming potatoes, ears of corn, oysters, &c. It is made in the general form of a locomotive engine, and is mounted upon wheels. There is a fire chamber, the flue from which passes back beneath the boiler. Steamers, which pass in through the top of the shell of the latter, receive wire baskets, in which the articles are placed to be steamed. In the rear end of the shell is formed an oven. When the articles are removed from the steamers they are placed in the oven to drive off the moisture, and are then placed in the upper compartment to be kept hot until sold.

Improved Blower for Fire Grates.

William D. Guesman, Morgantown, West Va.—This invention relates to counterbalancing the blower by a weighted lever, and operating it by means of a knob projecting through the front of the fireplace, and applied to the lever fulcrum.

Combined Table Castor and Fly Expelling Fan.

William R. Fowler, Baltimore, Md.—This invention relates to fans turned by clock mechanism for the purpose of frightening flies from the family table at meals, and consists in connecting a fan, castor holder, and clock mechanism so that the fanning device and clock mechanism can be laid aside when fly time is over, and the castor employed in the usual way, the appearance of the latter being graceful and acceptable under either contingency.

Improved Gin Saw Filing Machine.

Louis Monroe Asbill, Ridge, S. C.—This invention relates generally to machines that are used to facilitate the filing of gin saw teeth and to supersede the old means of performing the work by hand. The improvement consists in means for giving a variable adjustment to the pile stroke without changing the position of the forward end or point of the file.

Improved Middlings Purifier.

William Dastef, Brooklyn, N. Y.—There is a vertical tube, of large size, into which the middlings are fed, after being dusted, to be subjected to a blast from the fan, for separating the lighter matters from the heavier by carrying them upward, while allowing the latter to fall to the discharge spout. There is an offset in the upper part of the tube, where it is designed that matters light enough to be carried up by the blast, but containing seconds worth saving, together with some refuse, shall fall, to be conducted into another vertical tube, to be subjected to another blast from the fan, by which the lighter matters are again to be separated and carried upward, while the heavier are allowed to fall to a closed receptacle. Above the blast is turned to a horizontal course, so as to further facilitate the falling of whatever matters of value for flour may yet be in the escaping current, and below is a wide laterally descending portion of the lower wall of the passage, for receiving as much of the droppings as may be of value, and conducting them into a third upright tube, when they are again treated to a vertical blast, and the heavier matters let fall, while the refuse is carried off through a horizontal discharge spout. This upright tube receives a separate blast from the fan. The spouts may all return into one receptacle, for conducting the purified middlings to the stones to be reground together, as the object is not so much to make different grades, as it is to apply blasts in the purifier adapted in force to the gravities of the different grades, for thoroughly purifying both the heavy and light matters of value without waste.

Improved Dress Elevator.

Margaret H. Bergen, Brooklyn, N. Y.—This invention consists of a tape of proper length, having rings attached at proper intervals to receive a cord, the middle of which is attached to the center of the back. The tape is sewed at the proper distance from the bottom, following the curve of the dress. From the center of the tape the ends of the cord pass through the eyelets or rings in opposite directions, and are carried up through slits in the dress to the front, where they are passed through a cord holder, which confines them when they have been drawn to the desired degree of tension for the proper support of the dress. The ends of the cord are then confined in a clasp, which is hooked up at one side of the dress.

Improved Fire Extinguisher.

Isaac C. Andrews and Amzi S. Dodd, New York city, assignors to Home Fire Extinguisher Company, same place.—This invention has for its object to improve the construction of fire extinguishers in such a way that the acid vessel may be securely held and readily and surely disengaged to discharge the acid, which cannot be tampered with without indicating it, which will give warning should any one attempt to remove the head while the apparatus is under pressure, and which shall be light and at the same time strong.

Fire Extinguishing Water Pipe Attachment for Buildings.

Thomas Miller, Jersey City, N. J.—This invention relates to utilizing the fire extinguishing water pipe attachments used to conduct the water to the upper stories and the roofs, for fire ladders also; and it consists of, preferably, two pipes side by side, or one separated into two branches above the lower story, with rungs for a ladder crossing from one to the other and connected to them. The rungs are made of tubes, for allowing the water to circulate through them to keep them cool when exposed to fire in the building, and thus form the ladder, available when it would not always be with solid rungs, which heat when solid, so as to render the ladder useless.

Improved Perch for Bird Cages.

Edward Hutchinson, New York city.—This perch is composed of a tubular piece of wood and a cylindrical piece, the latter being for the most part of its length of the same size as the former, but considerably longer, and having a portion of about equal length of the tube reduced sufficiently to enter and fit snugly, and so that the end of the tube and the shoulder of the cylinder will not quite meet together. The reduced portion of the cylindrical piece is provided with small grooves, both longitudinal and circumferential, to afford hiding and nesting places for the small insects which infest birds. By this means the insects may be readily destroyed and cleaned off from the perch by taking it out of the cage from time to time, plunging it in boiling water, and then separating the parts and removing the insects.

Propelling Canal Boats.

H. B. E. Von Elmer, St. Louis, Mo.—This improvement relates to the arrangement of slotted guides and adjustable collars with the paddle levers for the purpose, respectively, of maintaining them in a vertical plane while vibrating, and adjusting the leverage of the paddles, and also the depth to which they shall work in the water.

Improved Gas Regulator.

Charles H. Gartrell, Paducah, Ky.—The object of this invention is to produce an improved gas burner and regulator, which feeds the gas steadily and equally to the flame, and economizes its consumption. The invention consists in forming the burner of different chambers, to which the admission of the gas is regulated, and the flow steadied by means of a distributing cap piece, which spreads the gas and supplies it to the flame.

Improved Circular Sawing Machine.

Oscar A. Dean, Bethel, Vt.—This invention has for its object to improve the construction of circular saw machines, so as to prevent the lumber and slivers from being thrown against the operator, to prevent the operator's hands from being cut while attending the saw, and to prevent the operator from being injured by the saw flying into pieces when running free and when sawing thin lumber; and is an improvement upon the patent granted to the same inventor August 12, 1873. A circular spreader enters the kerf and opens the lumber, so that the same may not bear against the sides of the rear part of the saw. A guard fits over the upper part of the saw, and prevents anything from coming in contact with the upper part of the saw, and also prevents slivers from being thrown by the saw against the operator. It may be raised and lowered as the thickness of the lumber may require, and can be adjusted without disturbing the gage, while the gage can be adjusted without disturbing the guard.

Improved Mincing Machine.

Edward Cloney, New Bedford, and Charles Leplene, Boston, Mass.—This is an improved mincing machine for whalers, for mincing or slicing blubber before putting it in the trying kettles. It consists in a carrier and self adjusting holding device in combination with each other, for feeding the blubber forward to the knives, and in knives for slicing or mincing the blubber as it is carried forward by the carrier. The blades are curved, and are twisted spirally, to correspond with the rapidity of feed, so that the cutting point of the blades may move forward as the piece of blubber, being operated upon by the said blades, is carried forward. The shaft is so arranged, in connection with the carrier, that the blades will cut the slices of blubber not quite off, enabling the blubber to be handled with forks.

Improved Baby-Exercising Corset.

Catherine Tardy, Paterson, N. J.—This is a device which will enable mothers, nurses, and others having the care of children to let them exercise by moving their limbs without creeping about the floor. It consists in an improved baby-exercising corset formed of two parts, connected in front by a cord or lace, and in the rear by cords, straps, or ribbons, and provided with long loops at their upper edges. The long loops enable the attendant to support the child while standing in an erect position.

Improved Carriage Curtain Fastener.

Aaron T. Rice, Beaville, N. J.—This invention relates to an improvement in the class of carriage curtain fasteners formed of annular metallic plates, and a slitted or apertured elastic disk. The improvement consists in providing the elastic disk with a tongue (formed by slitting it diagonally), which engages with the head of the knob; also, in providing the annular plates with coincident notches to adapt them to receive or fit the shank of the button; and in a protective covering applied to the inner metallic plate or ring, to prevent abrasion or wear of the carriage top bow.

Improved Pipe Wrench.

Adam Collis, Altoona, Pa.—The head has a central hole, which allows it to be slipped over the stud which is to be turned. A projecting steel die is placed in one side of the hole, and passes entirely through the head. Its edges are designed to penetrate the stud and prevent the wrench from turning on it. The working lever works loosely in the head. Its end is serrated, and projects into the hole and engages with the bolt. The end of a screw enters a slot in the lever, which allows it to play back and forth. In gripping the bolt, a lip which works through a side slot bears upon the side of the slot, by which a short and most powerful purchase is obtained.

Improved Furnace for Steam Boilers.

Daniel T. Casement, Painesville, Ohio.—This invention consists in a system of inclined tubes in the upper part of the furnace for supporting metal balls, to facilitate the combustion of the gases by their impinging on the red hot surfaces of the balls, in which heat is stored up. The said tubes are arranged in two series, extending from the top or near it on opposite sides diagonally across and downward, crossing each other at the middle forming chambers for storing the balls. They are arranged in this way to facilitate the fastening of them in the furnace walls; also, the cleaning of them from time to time of the deposit that may result from the use of salty or limy water.

Improved Composition for Blackboards.

Richard Sharp, Pittsburgh, Pa., assignor to himself and Robert W. Hare, of same place.—This is a compound composed of ground or powdered pumice stone, colored to the proper shade by ivory black or similar material. The pumice stone thus colored is mixed with coach varnish and turpentine in sufficient quantity to form an adhesive plastic mass, with which wood, stone, metal, or other material is covered. The composition adheres firmly and soon dries, leaving a hard, smooth surface, admirably adapted for blackboards and slates, and for many other purposes.

Improvement in Converting Motion.

James Vivian and Henry S. Mackenzie, Falmouth, England.—This invention relates to means whereby two screw propellers on the same shaft may be conveniently rotated in the same or opposite directions. A shaft is rigidly attached to the screw propeller, and a sleeve, on which is made fast a second propeller, is itself loose on the shaft. There are two wheels, one fast on the shaft and the other on the sleeve, having, respectively, the wrist pins placed on their opposite faces, and each pivoted in sliding blocks. The piston is bifurcated to straddle the shaft, and provided with confined guide boxes placed side by side, and formed by plates and a partition. In these boxes the wrist pin blocks slide from one end to the other at each half revolution of the shaft, going back on the second half revolution. If these blocks are on the same side of the shaft when the piston is operated, the propellers will both move in the same direction, while if placed on opposite sides they will be carried in opposite directions.

Improvement in Preserving Beer and Wine.

William Leist, Milwaukee, Wis.—This is an improved vent attachment to be used in connection with barrels containing fermented liquors, by which the back pressure of the liquids in the casks and their commingling with the liquid in the seal cup are prevented, together with the drawing-up of the liquid of the seal cup into the cask, so that the uninterrupted and effective action of the vent cup is produced. The invention consists in the arrangement of a liquid sealed vessel, provided with an open air pipe and flap valve at the bottom, with a secondary flap valve in the upper part thereof, so that the air enters into the barrel without allowing the liquid in the cask to be forced in the seal cup by the pressure of the gases.

Improved Eaves Trough Hanger.

Lewis E. Gould, Nashua, N. H.—The object of this invention is to furnish an improved eaves trough support which is readily applied to the wall below the roof, and admits of adjustment in horizontal and vertical direction for obtaining the exact position of the trough. The invention consists of a horizontal slotted arm, which is screwed into the wall, and which has adjusted thereon, in horizontal and vertical direction, the upright arm with forked end, for supporting firmly the trough. The connection of the horizontal and upright arms is made by a clamping screw.

NEW BOOKS AND PUBLICATIONS.

ARIADNE FLORENTINA: Six Lectures on Wood and Metal Engraving. Given before the University of Oxford, by John Ruskin, LL.D., Slade Professor of Fine Art. Price \$1. New York: John Wiley & Son, 15 Astor Place.

The subtle criticism and ornate rhetoric of the eminent Oxford Professor are well shown in these six lectures, which exhibit, in every page, the author's marvelous perception of whatever is genuine in all works of ancient and modern art. It is illustrated with facsimile wood cuts, in every respect worthy of the text.

MY VISIT TO THE SUN: or Critical Essays on Physics, Metaphysics, and Ethics. Volume I: Physics. By Lawrence S. Benson, Author of "Benson's Geometry." New York: James S. Burton, 149 Grand street.

The author of this work confesses his "respect for the treasured wisdom of ages, but must say that it will amount to naught if it shrinks from the wand of truth, or if it avoids the light of inquiry." The antagonism between the wisdom of philosophers on the one hand, and truth and inquiry on the other, is implied throughout the book; but the author is not likely to disturb the general belief of educated people that the wisdom of Science is the result and not the enemy of enquiry, and that the organic growth of human knowledge is not likely to shrink from its own "wand," which is that of truth. Certainly, if the accumulated knowledge of the ages is ever to be uprooted by some empirical system of philosophy, it will not be by so discursive and pointless a sketch as the one which we so willingly lay down.

NEW ENGLAND HARDWARE DIRECTORY, containing a Complete and Correct List of Importers, Dealers, and Manufacturers of Metals in the New England States. Boston, Mass.: Edward H. Adams, 83 Washington street.

The information promised in the title of this book is fully given in its pages.

THE AQUATIC MONTHLY AND NAUTICAL REVIEW. Edited by Charles A. Peverelly. \$4 per annum. New York: August Brentano, 33 Union Square.

This magazine maintains the excellent reputation it has in a short time acquired, and its pages will be read with interest by all lovers of the manly sports of yachting and rowing, the season for which is now fairly on its way.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From April 21 to April 23, 1874, inclusive.

BOILER AND FURNACE.—W. H. Richardson, Cincinnati, Ohio.

BOILER AND GRATE BAR.—A. O. Denis et al., Wilmington, Del.

FIRE PLACE, ETC.—M. A. Cushing, Aurora, Ill.

FURNITURE SPRING.—W. T. Doremus, New York city.

KNITTING MACHINE.—D. Bickford, New York city.

LUBRICATOR.—E. S. Fasset et al., Ann Arbor, Mich.

NAIL MACHINERY.—W. Haddock, Pittsburgh, Pa.

REGULATING SPEED OF ENGINE.—K. H. Loomis, New York city.

SPEED INDICATOR.—E. Brown, Philadelphia, Pa.

TREATMENT OF DISEASE.—W. D. Ludlow, New York city.

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Engines, Boilers, Pumps, Portable Engines Machinery Tools. I. H. Shearman, 45 Cortlandt St., N. Y.

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Best Philadelphia Oak Belting and Monitor Stitches. C. W. Army, Manufacturer, 501 & 503 Cherry St., Philadelphia, Pa. Send for circular.

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Dean's Steam Pumps, for all purposes; Engines, Boilers, Iron and Wood Working Machinery of all descriptions. W. L. Chase & Co., 95, 96, 97 Liberty Street, New York.

Steam Fire Engines—Philadelphia Hydraulic Works, Philadelphia, Pa.

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For descriptive circulars, and terms to Agents of new and saleable mechanical novelties, address James H. White, Newark, N. J., Manufacturer of Sheet and Cast Metal Small Ware.

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Portable Engines 2d hand, thoroughly overhauled, at 1/2 Cost. I. H. Shearman, 45 Cortlandt St., N. Y.

Vertical Tubular Boilers, all sizes. Send for reduced price list to Lovegrove & Co., Palla., Pa.



In our answer to H. S. H., p. 15, current volume: "If no heat is lost during compression" should be substituted for "if the temperature is constant during compression."

A. L. M. asks: What is the cost of a machine for making ice? Is a steam engine necessary, and what amount of power does it require? How many pounds will it produce per hour? How much would it cost per hundred pounds, exclusive of first cost? A. Your questions are rather indefinite. A small ice machine, to make from one to two tons a day, will cost about three thousand dollars. The running expenses would be from five to six dollars a day.

W. F. W. asks: Which gives the most power, a two horse engine or a two horse power of the most approved style? The horses weigh 2,000 lbs. each. How much would one horse raise at the rate of one foot a minute by a good power of the endless floor form? A. Ordinarily, an engine of one horse power will do more work in the same time than a horse, and the engine can be kept at work much longer than the horse.

J. D. R. asks: Would it be practicable to build a wooden railroad (using no iron on rails) on which to run a locomotive of say 7 to 7 1/2 tons, hauling from 3 to 4 cars at a load, each car and load weighing not over 5 tons, and to ascend grades of 100 feet to the mile? The rails are to have a bearing surface of 4 inches. What kind of timber would be best for such rails, white oak, rock oak, or maple? A. It would be better to have the rails nearly twice as broad, and to fit the wheels of the locomotive with rubber tires. We would recommend white oak, of the three varieties of timber mentioned.

R. M. R. says: 1. I am building an engine of 2 inches bore and 4 inches stroke, and have finished the cylinder and bed plate. How large ought the balance wheel be, and what should be its weight? It is to take a belt. A. About 10 inches diameter and 2 inches face. 2. How can I make the governor regulate the slide valve? A. There are quite a number of devices in use for regulating the point of cut-off by means of the governor. It would be difficult, however, to make such attachments to so small an engine to any advantage. 3. Would a boiler 4 feet long by 10 inches in diameter with 12 flues 1/2 inch in internal diameter, arranged as a return tubular, be large enough to run the engine at 200 revolutions under 60 lbs. of steam? According to my calculation, the engine would be about 1/2 horse power if the pressure were 60 lbs. on the piston during full stroke. A. It will be large enough, if properly set.

J. T. S. asks: 1. What is the best cement for filling millstones? If plaster of Paris and alum will do, how should it be prepared? A. Take baked plaster of Paris, steep in a saturated solution of alum, recalcine, and reduce to powder. Mix with water for use. 2. I have a throttle valve which has a small piece of the edge of the seat broken off; it lets through so much steam that I cannot stop the engine without taking off the cam rod. Is there any way of remedying this, other than getting a new valve? A. Possibly the seat can be repaired, or a new seat can be fitted in.

S. A. T. asks: 1. What is the *modus operandi* of plating by the galvanic battery? What causes the metal to adhere? Is the metal visible in the solution? A. The metal is not visible in the solution. The attraction of the fine particles of the deposited metal for the properly prepared conducting surface of the negative plate causes its adherence. 2. What is the action of the hydraulic ram? A. The water with a certain head raises a valve and flows into a chamber; but in making its escape the passage of the water is relieved and allows another weighted valve which was closed before to open. This permits the water to flow again, when its pressure once more closes one valve and opens another. Again a portion of water escapes, again the pressure is relieved, and so on intermittently. 3. What is chloride of calcium used for? A. It is employed in many chemical processes. Its avidity for moisture is remarkable. Copies of any of the patents issued can be obtained from this office.

B. R. asks: What is the most accurate rule for finding the friction on the slide valve? A. It is about one quarter of the unbalanced pressure on the valve, increased by one quarter of the weight of the valve.

M. F. J. asks: 1. In your last issue of the SCIENTIFIC AMERICAN, the engineer stated that if a piston rod and cylinder head of an engine were lined with lead, it would save an amount of steam. What can I put on the tin so that hot lead when poured on will run evenly over the surface? A. Build a rim around the head. 2. Would copper be better than tin? A. You can use whichever is most convenient.

M. H. H. says: 1. I and a few friends have had an argument as to which was horizontal motion. Some of us contended that a mill-harr revolved horizontally, and others that the cylinder of a threshing machine was an example of horizontal motion. We concluded to get your views. A. It is usual to speak of a vertical wheel as one in which the shaft is vertical, and to call it a horizontal wheel when the shaft is horizontal. 2. Why is the equatorial diameter of the earth greater than the polar diameter? A. It is supposed to be due to the action of central forces, when the earth was in a fluid state.

J. H. asks: 1. How are black lead crucibles made? Is the lead mixed with any other substance? A. It is mixed with from one third to half its weight of clay. 2. Could I use plaster of Paris molds for casting small brass boxes? A. Yes. 3. What proportion of copper should I use to make a good box? A. You do not give sufficient particulars. You will find compositions for journal bearings in back numbers.

W. E. P. asks: 1. What would be the capacity in gallons per minute of a force pump 5 inches diameter by 10 inches stroke, running at 60 revolutions per minute, with 4 inches suction? Will you give us the formula for the same? A. Multiply area of piston, in inches, by length of stroke and by number of strokes per minute, and divide the product by 231. 2. For cleaning 100 lbs. of cotton waste, how much bisulphide of carbon should be used? A. See p. 44, vol. 29. As to the blower, address the manufacturers.

A. P. B. says: We run our machinery by water, and have a large surplus of power. Is there any practicable and not expensive method of converting the surplus power into heat for warming the shops? What would be the effect of using, say 10 horse power in condensing the atmosphere into strong radiators, to 100 lbs. to the inch? A. Some modification of your plan would probably answer very well. So far as we know, this is a novel idea, and it impresses us very favorably.

A. A. W. says: An engineer tells us that our gage glasses kept breaking, and he could not get any to stand; upon enquiry we found that he often took his glasses out and cleaned them with a piece of waste tied on to a piece of stout wire. Upon our trying the experiment with a piece of telegraph wire, by thrusting it in and out several times through the bore, the glass broke into fragments in a few minutes. Can you explain it? If the discovery may be of service to engineers and others, in the way of caution, I hope that you will give them the benefit of it. A. Most housekeepers know the fact that it will not do to use iron rods in cleaning lamp chimneys. The trouble is probably caused by the unequal heating or cooling of the glass by contact with the iron, throwing strains upon some portions of the glass.

F. W. R. asks: Does the lateral pressure against the sides of a reservoir of water increase with the enlargement of the reservoir? A. In some cases, yes, and in others, no. Thus, if the depth remains constant, an increase of size does not affect the pressure.

C. E. T. says: The common rule among mechanics for finding the speed of a driven shaft, when the diameter of pulley on the shaft and the diameter and speed of the pulley on the driving shaft is given, is to multiply the diameter of driving pulley by the number of its revolutions per minute, and divide by the diameter of driven pulley. Some of those who should know say that unless one thickness of the belt is added to the diameter of each pulley, the answer will not be the true one. By the latter rule, in driving from a large to a smaller pulley, the result of the calculation is a less number of revolutions than by the first rule, and vice versa from a small to a larger pulley. A. The correct method is to add the thickness of the belt. This may be explained as follows: The belt leaves the driving pulley in the direction of a tangent; and neglecting the slipping, the ratio between the velocities of the driving and driven pulleys is the same as would take place with a pair of gear wheels having the same pitch. The part of the belt in contact with the pulley, neglecting the slip, acts as if it were rigidly connected to the pulley, so that the line of connection between the driving and driven pulleys must be in the axis of the wrapping connector, or at the middle of its cross section.

A. R. asks: 1. Are Britannia and white metal the same? A. Yes. 2. What kind of wood is best to use for chucks for spinning? A. A close grained, hard wood.

C. H. C. asks: 1. What can I put on paper to make it impervious to moisture? A. Dissolve 8 ozs. of alum and 3 1/2 ozs. of white soap in 4 pints of water; in another vessel dissolve 2 ozs. of gum arabic and 4 pints of glue in 4 pints of water. Mix the two solutions and make the mixture hot. Immerse the paper in the mixture and then hang it up to dry or pass it between cylinders. 2. What do 5vo., 16mo., 18mo., and 4to. mean? A. 4to. means quarto (4 to a sheet), 8vo. means octavo (8 to a sheet), 12mo. means duodecimo (12 to a sheet) and so on. 3. Will the moon eclipse any stars or planets next month? If so, which one? A. Consult the *Nautical Almanac*.

H. S. asks: What ready method is there of precipitating antimony from solutions with other metals? A. There is no general method of separating antimony from all the metals, when they are present in the same solution. If arsenic and tin are absent, the easiest way is to precipitate with hydrosulphuric acid as sulphide of antimony. In answer to your other questions, see our advertising columns for booksellers' addresses.

G. N. M. asks: What is "red acaroid" of resin," mentioned in a late number of your journal, as part of a recipe for imitating mahogany? A. It is the resin of *santhorrhiza hastata*, a liliaceous tree growing in New Holland; also called resin of Botany Bay. It has a yellow color, an agreeable odor, and is soluble in alcohol, ether, and caustic potash. Its potash solution, treated with hydrochloric acid, deposits benzoic and cinnamic acids. Nitric acid converts it into picric acid, and so readily that this resin appears to be the best raw material for obtaining picric acid. By distillation, the resin yields a light neutral oil, which appears to be a mixture of benzol and cinnamol, and a heavy acid oil, consisting of hydrate of phenyl, mixed with small quantities of benzoic and cinnamic acids.

W. F. asks: 1. Will a single cell of a sulphate of copper battery do to work a private telegraph about 300 feet long? A. Not satisfactorily. 2. How many cells of the above kind would it take to run 1 1/2? A. If copper wire is used, three cells. 3. How many cells

of zinc and lead, as described in the *Science Record* for 1874, would it take to make it work? A. About three. 4. Would copper wire, No. 25, do for the wire to connect the houses? If not, what size copper wire would it take? A. Use No. 12 galvanized iron wire. 5. In making a horseshoe electromagnet, is coarse or fine wire the best? A. Use 22, silk covered. 6. How should it be wound on, the same way on both poles or in opposite directions? A. Wind in the same direction. Connect both inside and both outside wires. 7. In making an induction coil, is it necessary to have the wire insulated? A. Yes. 8. How would it do to have one coil of the primary inside, and then have 4 or 5 coils of the secondary wire, then another coil of the primary wire, then 4 or 5 of the secondary, and so on through the induction coil? A. There would be nothing gained by so doing. 9. In the SCIENTIFIC AMERICAN for April 4, you describe a magneto-electrical machine. About how many feet, and what size of wire does it take to make such a machine, to give shocks? A. Four or five hundred. From No. 32 to 40 will answer.

D. M. T. says: On p. 183 of *Science Record* for 1874, experiments with iodate of calcium are related. Can you inform me how to make this substance? A. Iodate of calcium is prepared by mixing a solution of the iodate of potassium with a solution of chloride of calcium. A large amount of the iodate of calcium thus formed remains dissolved in the water; the remainder crystallizes out slowly. The iodate of calcium is formed by melting iodide of potassium in a crucible, leaving it to cool till it becomes semifluid, and then gradually adding 1 1/2 parts chlorate of potassium the mass becomes a fluid, swells up, and solidifies to a spongy mass of iodate and chloride of potassium. It is dissolved in hot water, the iodate left to crystallize, the crystals redissolved in hot water, and the iodate precipitated by alcohol.

J. N. J. and J. B. ask: Is there a solder that will solder aluminum? A. The largest dealers in and manufacturers of aluminum say that there is no solder that will answer. Try the pure metal.

J. F. A. says: In a factory there is a large belt running over two pulleys. A person standing under the belt with his hat off will have his hat lifted on end; if he raises his hand above his head, a light of a violet blue color will escape from the end of his fingers. What causes the electricity? Can it be collected? If so, how? A. The phenomena are those produced by frictional electricity and are due to the friction of the belts. The electricity could be collected by a series of brass needles placed at suitable points, and directed towards the belts and put into metallic connection with a metallic body presenting the required amount of surface.

H. S. B. asks: 1. How can I purify solutions of sulphate of alumina from iron? They have an acid reaction, and give blue and green precipitates with the prussiates of potash. A. To the dilute solution add a slight excess of solution of ferrocyanide of potassium. Allow the precipitate to settle and separate by decantation and filtration. 2. How can I separate naphthalene from paraffin? I have a crude heavy coal oil which contains both. A. We find no process for this operation.

B. W. R. asks: 1. Has there been any substance discovered lighter than hydrogen? A. No. 2. Please give me the specific gravity of the following: Oxygen, hydrogen, nitrogen, chlorine, fluorine, and carbonic acid. A. The specific gravity of hydrogen being taken as unity, that of oxygen is 16, nitrogen is 14, chlorine is 35.5, carbonic acid is 44. Air being taken as unity, oxygen is 1.10563, hydrogen is 0.06926, nitrogen is 0.97137, chlorine is 2.9, carbonic acid is 1.524. 3. Please give me directions for making a waterproof glue. A. Add 1/2 lb. of common glue or isinglass glue to 2 quarts of skimmed milk; and then evaporate to the thickness of glue. See our advertising columns for booksellers' addresses.

H. K. M. asks: 1. Which is the most successful form of magnetic motor? How are the magnets arranged to give the motion? A. It is said that the best form is that in which electromagnets are arranged in the periphery of a large double wheel, while the armatures are fixed and arranged in such a manner that the accumulative force is obtained. 2. What amount of force does it possess? A. One constructed on a large scale has driven a car, on an ordinary rail track, at the rate of 10 to 15 miles per hour.

J. M. asks: 1. How can I make a solution of gold that can be used to plate small articles with by a Daniell's battery? A. Dissolve one ounce of cyanide of potassium in one quart of nearly boiling distilled water. About half fill a porous cell with the solution, and stand it in the vessel containing the bulk of the solution. Attach a piece of sheet copper to the wire issuing from the zinc of the battery and place it in the porous cell. Put a piece of sheet gold, attached to the copper of the battery by a wire, in the outer solution, and allow the whole to remain in action until the solution has acquired about one pennyweight and a half of gold, which may be ascertained by weighing the gold before and after immersion. The porous cell may now be removed and its contents thrown away. The solution is now ready for use, and should be worked at a temperature of about 130° Fah. 2. How is a composition made, of sawdust, used for making small busts with? A. We do not know the composition you mention. Try patent of Paris for the purpose.

W. F. G. says: 1. I have a battery and all the appliances for silver plating, and succeed in getting a good thick coating of silver on various articles, but I am not able to polish the articles so as to obtain a nice smooth brilliant surface. What tools are used to burnish silver? A. Burnishing tools, which are made for the purpose and are of different patterns, are used. They are rubbed smooth on a damp cloth, and the polish imparted by rubbing to and fro on the silver plated surface with pressure. 2. Can you tell me what kind of chalk is used to mark on glass, and how it is made? A. By mixing powdered chalk and soap and drying the mixture.

H. L. C. asks: 1. In making an electric engine, is it best to use a U shaped piece of iron or two separate pieces? Which is best, wire 1 1/2 of an inch diameter, or a fine thread-like wire, both being properly insulated? A. It is customary now to make the magnet in three pieces, the sides being made of bar magnets screwed into a crosspiece, the whole being nearly in the form of a square. Use No. 22 wire. 2. Does the power of the magnet increase in proportion to the number of layers of wire with which it is wound? A. To a certain point, but the size of the coil should not exceed an inch and a half in diameter.

A. B. asks: 1. What is the cause of mustiness in flour? A. A chemical change which takes place in moist flour. 2. What are the chemical properties of musty flour? A. The gluten of the flour undergoes a change of properties, in consequence of which it slowly loses its soft, elastic, insoluble condition, and becomes converted into a substance closely resembling diastase.

J. K. says: I have been running circular saws for sawing logs for over 12 years, and have not had any two saws with teeth at a uniform distance apart. It seems that it has been demonstrated that a circular saw ought to run 9,000 feet of cutting edge per minute; now if that be so, I think there ought to be some established rule for the distance of the points of the teeth apart. Please inform me if there is any such rule, and state whether there are movable tooth saws that can be used with side set. We never have used that kind, but would if we can use side set. We think the swage set very objectionable. A. The variations in the diameter of saws, the numerous varieties of timber to be sawn, together with various capacities of mills (sawing, as they usually do, from 300 to 5,000 feet per hour), and the fact that solid toothed saws with side set require even numbers of teeth, preclude the possibility of establishing any definite rule. There is no manufacturer of inserted toothed saws who recommends a side set for them; and the fact that inserted toothed saws are fast superseding the old style of solid saws, and are approved by many of our best and most experienced sawyers and lumbermen, who spread the teeth exclusively for the set, seems to conflict with your idea of objectability.—J. E. E., of Pa.

J. W. C. asks: What are the following articles: Pulv. Frondosa Chizeta, Pulv. Milvanti Rad., Pulv. Perino Aluifolia, Ext. Bertula Natura? A. A competent authority says that these names have been written by one not unacquainted with pharmaceutical and chemical preparations, but that they are all bogus names of things which do not actually exist.

S. A. G. asks: 1. How long does it take to send a signal through the Atlantic cable? A. About four seconds. 2. What is the average number of words sent through per minute? A. Three. 4. What is the speed of electricity through copper wire? A. 288,000 miles per second.

J. T. B. S. asks: How can I make a simple muffle furnace for the purpose of enameling photographs? A. Nothing could be simpler than certain forms of muffles, which are already manufactured and sold at low prices.

W. H. S. asks: 1. If a wheel were placed in a perfect vacuum, so arranged that there would be no friction, and set in motion, would it continue to revolve for ever? A. Yes. 2. How is the glycerin commonly sold by druggists manufactured? A. The mother liquor of the soap boiler is first concentrated by evaporation, the saline matter which is thereby gradually separated being removed from time to time. When the fluid is sufficiently concentrated, ascertained by the boiling point having risen to 200° Fah., it is transferred to a still, and the glycerin distilled off by means of superheated steam carried into the still. The distillate is next concentrated and brought to the consistence of sirup in a vacuum pan.

S. P. says, in answer to V. V. V., who asks for a formula for mixing show card paints: The following will answer the purpose: For black, asphaltum varnish 3 parts, dammar varnish 1 part, tube black to suit; temper with spirits of turpentine. For fancy colors with gloss, use any desired shade (tube colors) mixed in dammar varnish; temper as above. These colors should be used freely and as rapidly as possible.

O. K. asks: How can I mend a broken band saw? A. By brazing the ends together. 3. How can I best mend a broken tooth in a circular saw? The saw is 1-12 of an inch thick and of 14 inches diameter. A. File down the rest of the teeth to the same circle. 3. With two horses on a lever power, I run circular saws from 10 to 16 inches diameter, making 900 revolutions per minute. Can I do more work with the same power if I double the speed with countershafting? A. That could only be decided by experiment. There is doubtless a speed at which you will get the best results with a given power; but every piece of gearing you put in consumes some of the power.

J. A. P. asks: Is there any comparatively cheap process by which I can force up a continual stream of water from a well which is 25 feet deep? A. You can possibly employ a windmill.

A. P. R. asks: Has a man, to get steam boat engineer's papers, to be a practical machinist? If not, where would be the best place for a beginner to go to get on? A. It is desirable that he should be, but we believe it is not absolutely essential, provided he can show that he has sufficient practical knowledge to make ordinary repairs to engines and boilers. It might be well for you to try and get a position as fireman or oiler on some steamship line.

L. F. L. asks: Are the hard spots in steel, rendering the same difficult to work, properly called knots? A. This term is not sanctioned by general usage.

T. G. Jr. asks: 1. For a 30 inch diameter steam boiler, about how much should a cast iron head be thicker than a wrought one 1/4 inch thick? A. It could not be made as safe. 2. Can small flues be put into a cast iron head in the usual manner and make a good job? A. Not as well as in the case of a wrought iron plate. 3. How thick should a cast iron head 30 inches diameter, without flues or stay bolts, be to stand 100 lbs. per square inch? A. The arrangement would not be advisable.

C. B. K. asks: 1. Are the civil engineering schools of Europe better than those of America? A. They are generally more thorough. 2. Which are the best in the United States? A. We do not feel able to make a strict comparison between the different engineering schools in the country.

S. S. asks: Can you direct me to an analysis of the boiler scale from sea-going vessels that have no condensers? A. An analysis of the scale found in French sea-going steamers gives the following results: Sulphate of lime 85.2 per cent, carbonate of magnesia 2.45 per cent, free magnesia 5.95 per cent, water 6.5 per cent.

C. W. S. says: I have always been instructed to place my valve with the pressure on top of the seat. Now an engineer of 45 years experience tells me this is wrong; the better pressure ought to be underneath the valve seat. I want to know which is right? A. Your method is most generally adopted. Still, there are advocates of the other system, claiming as an advantage the possibility of packing the stem with pressure in the valve.

W. P. B. asks: 1. What causes the lumpy or boggy formations in marshes and wet places? A. It is caused by the accumulation of dirt and vegetable matter at certain points, which are determined by local causes. 2. What colors shall I mix to make brown madder? A. It is best to make an extract of the burnt root of the madder plant. 3. Can you tell me of a book on fossils, and one on the preservation of birds or other animals? A. Consult Dana's "Geology," and Coues's Field Ornithology.

H. J. H. asks: 1. What is the exact difference between a high and a low pressure engine? A. As the terms are ordinarily used, a low pressure engine has a condenser and air pump, and a high pressure engine has not. 2. In your last week's paper you say the horse power equals pressure on the piston in lbs. multiplied by the velocity of the piston in feet per minute divided by 33,000. If a cylinder is 4 1/2 inches diameter x 6 inches stroke, making 250 revolutions per minute, with steam at 60 lbs. pressure, I make: 4 1/2 x 4 = 21 1/2 x 0.7854 = 15.9048; 15.9048 x 60 = 954.288; 954.288 x 250 = 238565.25 ÷ 33,000 = 7.2292 horse power. If the engine only made 50 revolutions per minute, what would be the correct result? A. The first example is right as far as you have carried it; for the second, we shall have 954.288 x 50 = 47714.4 ÷ 33,000 = 1.4459 horse power.

3. What is meant by injection? I am told that 21 times as much water is necessary for injection in a locomotive boiler as is required for steam. A. Injection water is that used in a condensing engine, to condense the steam. A locomotive does not have a condenser.

T. H. D. S. asks: 1. Has table rapping ever been scientifically explained? A. Frequently. 2. What was the conclusion arrived at? A. That the experimenters were self-deceived as to the supernatural character of the phenomena. 3. Did not Professor Faraday lecture upon the subject? A. Consult his "Experimental Researches."

A. D. asks: What articles are used with lime to make blackboards for school purposes? A. Manufacturers of blackboards for school purposes inform us that they do not use substances with lime. They prepare a surface of hard plaster, and then paint it with a thin coating of pumice, some black substance, and a varnish which, when dry, will not crack. [What difficulties have you found in making gelatin formolds? Do you mean in making the gelatin, or in using it for this purpose?—Eds.]

A. O. asks: 1. What cement is best for the steam chest and cylinder heads of a small steam engine? A. Take white lead 3 parts, and red lead 1 part. 2. Will one of Bunsen's three quart cells do to plate a watch case? A. Yes. 3. How can I make oxygen gas cheaply? A. By strongly heating black oxide of manganese. 4. What is the best packing for the stuffing box of an engine, also the piston? A. Rubber packing is mostly used now.

H. A. F. asks: 1. What are the ingredients of orofide or some other soft metal that will not tarnish and is susceptible of high polish? What kind of mold should I use to have the work come out very smooth? A. Pure copper 100 parts by weight, zinc 17, magnesia 6, sal ammoniac 3 1/2, quicklime 1-90, tartar of commerce 9. The copper is first melted, then the magnesia, sal ammoniac, lime, and tartar in powder, little by little; the crucible is briskly stirred for about half an hour, so as to mix thoroughly, and then the zinc is added in small grains by throwing it on the surface and stirring until it is entirely fused; the crucible is then covered and fusion maintained for about 35 minutes; the crucible is then uncovered, skimmed carefully, and the alloy cast in a mold of damp sand or metal. The orofide melts at a temperature low enough to allow its application to all kinds of ornamentation; it has a fine grain, is malleable, and capable of taking the most brilliant polish; when, after a time, it becomes tarnished from oxidation, its brilliancy may be restored by a little acidulated water. If the zinc is replaced by tin, the metal will be still more brilliant. 3. Can I get the SCIENTIFIC AMERICAN for 1873 from you already bound? A. Volume XXVIII is on sale. The numbers of volume XXIX are mostly out of print.

S. F. S. asks: How can I take perspiration and grease stains out of Panama hats without injuring the straw? A. They can probably be removed by benzine or French chalk.

J. A. F. asks: Is there a liquid preparation that will resist nitric acid as well as if not better than beeswax? A. Yes: melted paraffin.

A. H. T. asks: If a small vessel should be placed in a larger one, and the air pumped out of the large vessel, what would be the effect upon the air in the smaller one? Would there be any pressure outward? A. If the vessels communicated, the air in the inner vessel would expand, and diffuse itself until the air in both the inner and outer vessel had the same degree of tension.

J. G. C. asks: 1. How many cells of the ordinary Smee battery, each cell consisting of 2 zinc and 1 copper plates, 5/4 by 8 inches, will be required to produce the phenomenon of the voltaic arc? A. From 20 to 30 cells, according to the size of the arc required. 2. What number and size of copper wire is best for the inner and outer coils of the Ruhmkorff induction coil? A. For a coil giving a 5 inch spark, from No. 32 to 42 wire for induced current, and No. 6 to 8 wire for the primary.

R. A. M. asks: In making a magneto-electrical machine, capable of producing a power sufficient to kill a human being, what must be the power of the permanent magnet? In other words, what weight must it be capable of lifting? A. The power does not depend upon the attractive force of the permanent magnet alone, and the question is founded on an erroneous idea of the principle and mode of construction of such machines. 2. Are the magneto-electrical machines the best for medical purposes, and are they generally driven by springs? A. They are going out of use, and electro-magnetic machines are now generally employed for medical purposes. They are not generally driven by springs.

G. F. S. asks: Why does the point of the needle of a surveyor's compass, at times, rise and adhere to the glass? A. It is due to magnetic disturbances, and at times to the influence of local attracting forces.

C. C. H. asks: How can I make a glass box to hold a solution of nitrate of silver? I think I could make one of common window glass, if I knew of something with which to fasten it. A. Glass packed with rubber will do.

R. S. asks: What would be the cost of a small swift-sailing steam launch, length of hull 15 or 20 feet? A. About one thousand dollars. 2. What rate of speed per hour would she have? A. Six miles an hour. 3. What would be the power of the engine? A. From four to five horse power. 4. How heavy a load could she carry? A. About 1,000 lbs.

W. E. F. asks: How can I make a cheap Leyden jar? A. We believe there is nothing cheaper than a thin glass candy jar, lined inside and outside with tin foil such as is used to wrap chewing tobacco in. Stick the foil on with mullage, varnish, or flour paste. A still cheaper plan is simply to fill a glass jar nearly full of water, and place it within another vessel of water, so that the water, both outside and inside, shall be on the same level.

J. B. H. asks: 1. Which time of the year is the best for cutting and transplanting large forest trees, and what shall I do to make them grow again? A. See p. 180, vol. 28. 2. How can I make putty of a bright yellow that will stand when laid in wood? A. Mix the putty with chrome yellow.

W. F. A. asks: Will an electromagnet, wound with one insulated copper wire 100 feet long, produce as much magnetism as two wires 50 feet long? A. It is better to have two spools, 50 feet in each. 2. How many feet of wire are there in a Tom Thumb electromagnet? A. Forty.

B. A. R. says: 1. Is it injurious to inhale the dust of common school crayons? A. It is not injurious in small quantities. 2. What causes whirlwinds? A. It is caused by the rush from various quarters of the surrounding air into a rarefied atmosphere, produced by the rising of vast bodies of air, over a heated area. 3. I have noticed several times this spring the smoke from a dwelling gathering around a new barn situated about one hundred yards from the dwelling, about 15 feet below the level of the house. What is the cause of it? A. It finds about the barn a stratum of air of density similar to that in which the smoke itself is floating, and the lower level of the barn and the obstruction which it offers prevent the smoke being carried away by currents in the atmosphere.

X. asks: Why is it that the storm glasses sold in shops are hermetically sealed? Do they not all require to be so constructed as to give access to air? A. The storm glasses made by instrument makers are sealed so as to prevent access of air and evaporation of the solution.

T. A. C. says: The lightning rod on my house passes entirely over it in an unbroken line, and enters the ground to the depth of 10 feet on each side; branches of the rod are connected and extend several feet above the chimney, thus:



1. Is this a good way to arrange a lightning rod? A. Your arrangement of rod is good so far as the building is concerned; but the extent of the rods in the ground is insufficient. 2. Would it add to the security to connect the rod and the water conductors? The latter are tin and extend entirely around the house, but do not reach the ground by 3 or 4 feet. A. It adds to the safety to connect the water conductors and roof with the rod. 3. What would be the effect of a pile of scrap iron around the rod where it enters the earth? A. The effect of scrap iron or iron ore placed around the base of the rod would be to increase the security. The best way would be to dig a trench three feet deep, leading away from the house. Bend the lower end of the rod to run in the trench, and lay your scrap iron along the bottom of the trench. Let the extremity of the rod communicate with the iron. The larger the quantity of iron and the longer the trench the better. Lightning rods are of little value unless that portion which enters the ground is extensive or is placed in connection with a large mass of conducting material, such as iron, iron ore, coke or charcoal.

J. M. says: 1. I have a scroll chuck to a foot lathe which will not run true on the spindle. How shall I remedy it? A. It is a good plan to bolt the chuck to a plate, which can be turned true whenever required. 2. What wages do machinists get during apprenticeship? A. About fifty cents a day. 3. Can a machinist become a mechanical engineer by studying during the time allowed him out of work hours? A. It can be done, but few have the necessary perseverance. 4. On p. 316, vol. 29, you give an engraving and description of an induction coil. How can I make one? A. See p. 364, vol. 25. You should consult some good work on the subject, such as Noad's "Text-book of Electricity." The sketch is not sufficiently complete to enable one to build the coil without other information. 5. Is the current of a battery changed in quantity or in intensity by making the acid solution weaker? A. All the qualities are affected relatively. 6. Can I melt brass in a cast iron crucible in a charcoal fire, with a hand bellows to supply the air? A. Yes. See p. 74, vol. 23.

S. F. R. asks: 1. How can I braze cast iron and wrought iron? A. Tin the surfaces, secure them together, and apply the solder, heating the articles. 2. How can I case-harden wrought iron? A. Place the articles in an airtight case, together with animal or vegetable charcoal, and expose the box to a low red heat for a few hours. 3. How can I soften steel? A. Steel plate is softened for engraver's use by putting it in a cast iron box with a well closed lid, with half an inch depth of pure iron filings over every part of it. The sides of the box must be at least three quarters of an inch in thickness. Expose the box and its contents for 4 hours to a white heat.

T. C. H. asks: 1. Is litmus paper reliable in testing for a minute quantity of nitric acid in a solution of nitrate of silver in water? A. Litmus paper, properly prepared, is reliable. 2. How are the names of sub-scribers printed on the margins of newspapers? A. With stamping machines, made for the purpose. 3. How can I coat a plaster cast of type, etc., with black lead, for electrotyping? A. By rubbing the black lead upon it with a brush. 4. I have attempted to make small stereotype plates by pouring type metal into shallow casts of type, but could not get a sharp cast, what is the reason? A. You should sink your molds into a deep vessel full of molten metal, so as to get a pressure on the cast. 5. What is the best treatment of steel instruments, guns, etc., to prevent rusting? I have heard that opodeldoc rubbed over them was better than oil. Is it better than good oil? A. Gunsmiths say that it is not. A. Did the Pneumatic Transit Railroad prove a success, and how much of it is completed? A. You will find full particulars, dimensions, and engravings of this railway in back numbers of the SCIENTIFIC AMERICAN. It operates with success, and is to be enlarged.

A. W. says, in reply to J. A. McC. Jr., who asked why the paper is not blown off the card; the air which is compressed by being driven through the tube suddenly expands on issuing between the disks, and rushing out in all directions carries with it part of the air separating the disks. This causes a partial vacuum, and the pressure of the air upon the surface of the upper card is greater than that below it, consequently the card is forced toward the tube instead of being blown away.

J. W. C. says that O. W. H. Jr. may fasten cloth to iron by soaking it in a dilute solution of galls, squeezing out the superfluous moisture, and applying the cloth, still damp, to the surface of the iron, which has been previously heated and coated with strong glue. The cloth should be kept firmly pressed upon the iron until the glue has dried.

H. B. says, in reply to J. A. McC., who inquires for the explanation of the experiment described on p. 299: If a vessel or pipe contains a liquid or a gas of a certain pressure, in a state of rest, the pressure on every square inch of the walls of the vessel is the same. This, however, is no longer the case when the liquid or gas is in a state of motion. Where the stream of liquid or gas has to contract by reason of the diminution of the section of the pipe, and consequently has to increase its motion, the pressure increases. In the hydraulic ram, the section of the stream is suddenly reduced to zero, and hence the increased pressure. At places where the section of the pipe widens and the velocity of the liquid has to diminish, the actual pressure will decrease. In the experiment in question, the air is bound to escape from the center in a radial direction between the pasteboard and the paper disk; and as the section of this current of air is rapidly increasing, its pressure is diminished to a degree somewhat below that of the atmosphere, and the surplus of the atmospheric pressure on the back side of the paper disk balances the impact of the current in the center.

C. G. L. says, in answer to correspondents who ask for the method of photographing from tracings on vellum: The negative is made on paper, on which the lines show white on a brown ground. This negative is taken from the tracing without a camera, the transparency of the tracing allowing it to be used as a negative is used in printing a positive. Tints show with greater or less intensity according to the colors used.

H. M. says, in answer to P. J. F., who asks: What is the proper charge of powder for a 12 caliber shot gun? A. 2 3/8 scruples, but you might use double that quantity without any hurt.

M. S. T. says, in answer to W. H. D., who asked whether powder of a coarse grain shoots more strongly than one of a fine grain: When powder of a fine grain is used, only a part of it, nearest the point of ignition, is exploded; the rest is thrown out before it has time to explode. This may be seen by noticing the non-exploded powder inside of a gun which has been fired with fine grained powder. With a coarser powder the explosion is nearly complete, and consequently the force is increased. If blasting powder were used in a gun, the force would be less, because there would be so much space between the grains as to give the gases an opportunity to expand easily. Coarse sporting powder is the best for shot guns.

J. W. R. says, in reply to E. C. B., who wishes to know what jewellers use to clean diamonds: I clean all diamonds and precious stones by washing them with soap and water with a soft brush, adding a little ammonia in the water, and then dry in fine box-wood sawdust. If E. C. B. will put a little pot or pearl-ash in the water, it will answer the same purpose.

H. M. says, in answer to M. F. B.'s query (1) as to which will shoot the greater distance, a breech or a muzzle loading gun: A. If the charge is the same there will not be the least difference. 2. Is 30 inches long enough for a 10 gauge barrel? A. Yes, for any gun barrel; but it would not hurt if it were a little longer. 3. What are the different strengths of the materials used for gun barrels? A. A barrel of any kind of twisted or laminated steel is stronger than a common iron barrel.

O. P. K. says, in reply to B., who asks what is the proper slope in left-handed penmanship: "I have written with either hand for over twenty years; and I hold the pen and slope according to the ordinary rules of penmanship. I am naturally left-handed, but at school I learned to use both hands in writing, and have found it to be of utility. I also use both hands in mechanical work, which is a saving of time." [Our correspondent's letter is written partly with one hand and partly with the other, and it is not possible to see any difference in the penmanship.—Eds.]

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

C. E. M.—Your specimen appears to be a mass of feathers and parts of feathers rolled up into a spherical form.

J. H. S.—It is an old Dutch gold coin, and has no particular value as a curiosity.

J. M. B.—It is a minute fragment of quartz.

E. P. F.—It is a twenty-four sided crystal of lime aluminogarnet, of the form known to mineralogists as the tetragonal trisoctahedron.

D. S. F.—The specimen you sent is metallic zinc, and the ore is zinc ore, probably calamine or blende.

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

- On Measuring the Width of a Stream. By S. N. M.
On Matter and Intellect. By J. E. E.
On the Mensuration of the Circle. By H. E. A.
On a Draft of a New Patent Law. By T. C. H.

Also enquiries and answers from the following:

F. H. B.—V.—J. M.—S. V. P.—W. S. S.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Several correspondents request us to publish replies to their enquiries about the patentability of their inventions, etc. Such enquiries will only be answered by letter, and the parties should give their addresses.

Correspondents who write to ask the address of certain manufacturers, or where specified articles are to be had, also those having goods for sale, or who want to find partners, should send with their communications an amount sufficient to cover the cost of publication under the head of "Business and Personal," which is specially devoted to such enquiries.

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PATENTS

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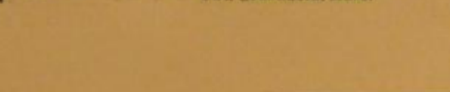
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Vol. XXX.—No. 23.
[NEW SERIES.]

NEW YORK, JUNE 6, 1874.

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IN ADVANCE.

WILLIAM BAXTER AND HIS INVENTIONS.

William Baxter is the son of George Baxter, a Scotch engineer, who, in the year 1805, emigrated to America with his family, settled near Morristown, N.J., and in that locality constructed two of the first cotton mills built in this country.

The subject of this sketch, the youngest son, was born November 29, 1822, and is, therefore, now 51 years of age. When a boy he was placed at work in his father's factory, thus inheriting and acquiring mechanical taste and skill in no small degree. Even when quite a child, he made several ingenious improvements in his father's machinery, and at the age of 12 he was placed in the machine shop of Alexander Paul, of Paterson, where he worked upon the first locomotive ever built in that city. He soon after went with Stephen Vail, of Morristown, and was one of the assistants of Professor Morse in bringing out the magnetic telegraph, helping to put it in operation for the sending of the first message. Returning to Paterson, he remained in that city from 1840 to 1846, superintending the erection of machinery and making many inventions and improvements. Meanwhile he was an extensive reader and a hard student, becoming familiar with the works of the best authors on mechanical engineering, and acquiring the French and Spanish languages. His reputation extended, and he became favorably known as a designer and constructor. He was engaged for some time with the Newark Machine Company, Newark, N. J., where he made the pleasant and profitable acquaintance of Seth Boyden.

In 1851 he was called to Mexico, to erect an extensive cotton factory. For ten years Mr. Baxter was engaged in that country, in works of great magnitude, among which may be mentioned a cotton factory at Talamantes, another near Penyon Blanco (an Indian pass), where he built up a new town in the desert, naming it Belen, which, in English, is Bethlehem; also a woolen factory at the same place, and a large number of extensive mining works at Parral and other places. At Santa Catarina, he constructed a reservoir or artificial lake for the irrigation of the hacienda

of Señor Montez, about 20 square leagues in extent, and which also furnished power for mills. In all he erected in Mexico some fifteen different works. The dams at Belen

of the Sierra Madre mountains, where the gorges were 300 to 400 feet in width, in which ran torrents, often rising 60 feet in a few hours during heavy rains. It was prophesied that these structures would never stand, but they still remain firm. They were constructed upon a new principle, unlike any previous work. The masonry was from 30 to 40 feet high, 60 feet thick at the base, and 10 feet at the top, sloped on both sides, in curved lines, which received and discharged the water horizontally and without shock, thus preventing those excavations by the plunging of the water, so destructive to such works; they were also curved or arched against the streams, and the abutments planted against the solid rock of the mountains. These great reservoirs, with their gates and sluices, were the admiration of all the engineers of the army of occupation.

For one of the cotton factories he constructed a turbine wheel, made of gun metal and finished as highly as a steam engine, the design being an improvement upon the French turbine of Fourneyron. The machine, giving a larger percentage of the power of the stream than any previous form, excited considerable interest among French engineers, several of whom examined it and transmitted drawings and details of the same, together with particulars of the calculations, to the French Academy of Sciences.

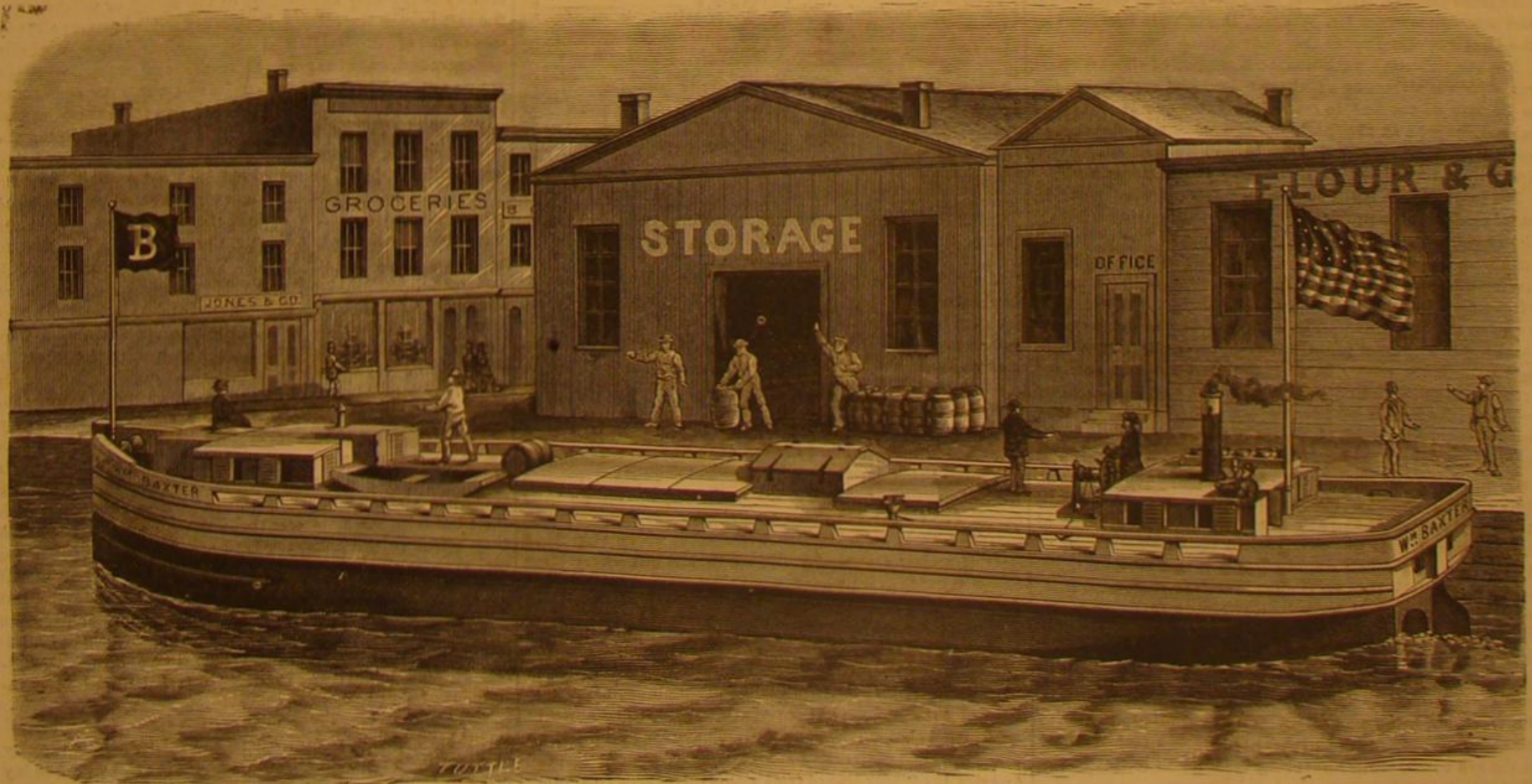
These works were carried on under great disadvantages, necessitating not only the procurement and manufacture of material but the instruction of workmen. Machinery, besides, had to be built, and roads constructed; while, in addition to these difficulties, the labor had to be prosecuted in the proximity of hostile Indians, and required constant military protection. Every establishment, however, erected in Mexico proved a financial success.

During these years Mr. Baxter received from the government of Mexico, both Imperial and Republican, the highest marks of consideration ever extended by them to any private citizen, unless it may have been Mr. Seward. He was offered decorations and even titles, and was urged by the State of Chihuahua to establish and take the presidency of a college of arts and sciences, on the plan of the Cornell University



WILLIAM BAXTER,

and Santa Catarina were very difficult jobs of engineering, all previous attempts to hold the water at those places having been failures. They were built across cañons at the foot



BAXTER'S STEAM CANAL BOAT.

which he declined to do on account of the disturbed state of the government at that time. He was frequently furnished with official passes by both the governments of Maximilian and the Republic, of which the following is a specimen, and shows the high regard in which he was held by all parties, he being strictly neutral in all their struggles:

"BY THE PRESIDENT OF THE REPUBLIC OF MEXICO.

"To all the Authorities, both Military and Civil, wherever this may be presented:

"The bearer of this, Don Guillermo Baxter, an American engineer, is passing through the country on his own private business, and you are hereby commanded to give him whatever protection and assistance he may require, and a military escort when he shall demand the same, Señor Baxter being worthy of the most distinguished consideration.

BENITO JUAREZ."

On his return home, in 1867, he traveled from Durango to the city of Mexico with the President and Cabinet, under the protection of their military escort, making extensive examinations of the mining districts through which they passed.

Since that time, Mr. Baxter has been constantly at work on one mechanical problem after another. On his way home to the States, more as a diversion than otherwise, he whittled out of a piece of pine a model of what is known as "the Baxter adjustable S wrench," which, by means of its peculiar shape, enables the workman to reach parts of complicated machinery previously inaccessible. This indispensable little tool is to be found in factories and workshops in every part of the world. It is manufactured at Birmingham, Conn. Having established his residence at Newark, N. J., Mr.



Baxter turned his attention to the invention of a small, compact, portable, safe, and economical steam power, which should be so easy to manage as to warrant its introduction for all uses among the people. This resulted in bringing out, in the year 1868, the now widely known and justly celebrated Baxter engine. Already thousands of these engines are in use in all parts of the country, and many have been and are being sent to foreign lands. They are manufactured by the Colt Fire Arms Company, Hartford, Conn., on the interchangeable principle, each piece being made in duplicate, which is the first instance of this feature in the manufacture of such machinery.

In these matters, Mr. Baxter has received most valuable aid and assistance from Mr. William D. Russell, President of the Baxter Steam Engine Company.

Mr. Baxter's next work was the invention of a steam street car, which is attracting great attention, and can hardly fail to be one of the first to come into extensive if not general use, as soon as the prejudice against the application of steam to that purpose shall have been overcome. These cars are built at the celebrated Remington Works, Ilion, N. Y.

His last triumph is the successful introduction of steam in canal navigation, a problem which had previously baffled all the engineering talent which had been applied to it. It had long been considered impossible; but the State of New York, having offered a large reward for its solution, a great number of competitors came forward, and Mr. Baxter has just been awarded the first prize. The difficulty has never been the mere use of steam for propelling boats on canals, but to compete with horse power in economy, and thus to cheapen transportation. The official record of the trial trip gives credit to the Baxter boat for a speed of 3.09 miles per hour, upon a consumption of 14.82 lbs. coal per mile, carrying a load of more than 200 tons in addition to her machinery and fuel, which may be condensed as follows: One ton of freight, sixty miles, at a cost of one cent for coal; or, in other words, it is carrying freight at twice the speed and half the cost of the horse boats. It was estimated by the Commissioners of Award that this result would effect a saving of \$4,000,000 per annum on the Erie canal alone, and it is calculated that, when the system shall have been generally introduced, the yearly saving on all the canals of the country will not fall short of \$10,000,000; it will also double the capacity of all canals, being a complete solution of the problem of cheap transportation, enhancing the value of every acre of land in the West, but being no greater boon to the producer than to the consumer, inasmuch as it will reduce the cost of bread on the sea board, while enhancing the price of wheat in the Western granaries.

It would be difficult to overestimate the value, to the community and to the world, of such lives as Mr. Baxter's. The fame such men achieve is rarely commensurate with their deserts. Soldiers, statesmen, orators, authors, artists, all are likely to stand more conspicuously forth before their fellow men, but impelled by his imperative instincts, the mechanical inventor calls to his aid, and into exercise and active use, executive and financial ability; he inspires men to the establishment of new industries, and the employment of thousands of hands; he gives work to both capital and labor, and is the leading force of civilization. No better example can be given of the truth of this assertion than reference to the army of men employed in various capacities upon the inventions of Mr. Baxter, and the number of skilled mechanics required, not only in the manufacture, but in their operation. The portable engine, the street car, and the steam canal boat, all require engineers, and it is not impossible that a hundred thousand young men will, by the influence of these inventions, acquire the necessary knowledge and be lifted to a higher level than they now occupy.

It is not likely that Mr. Baxter will now rest upon his laurels; he is just in the prime of life and in vigorous health, and it is far more probable that, under the impulse of his wider experience, and the stimulus of constantly increasing reputation, his active brain will be at work upon new and perhaps greater problems.

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FORMIC FUNGUS FARMERS.

A short time ago there was discovered in Texas a race of diminutive grangers who had solved the transportation problem by the simple and sensible plan of raising all the grain required for their communities, each for itself and at its own doors, and letting other communities do the same or go hungry. They were ants, clever little fellows, whose agricultural operations were carried on with the utmost system and success, and who were thought to be the only creatures not human who had arrived at so high a stage of civilization. Other harvesting ants collect the chance productions of the fields or trust to the husbandry of man for their supplies of grain; but these are independent farmers, who surround their colonies with grain land, which they keep clear of useless growths by sipping in the bud every plant except the rice grass whose seeds they intend to gather for their winter store, thus giving evidence of no small degree of calculation and forethought, as well as industrial economy.

But it appears that they are not alone in this sort of thing, and that their operations are slight and simple compared with those of the *acadoma* of Central America, better known as leaf-cutting ants. These leaf cutters have long been notorious as the most destructive of all the insect pests of tropical America, the tender-leaved fruit plants introduced from other

localities suffering especially from their ravages. Indeed, multitudes of plantations of orange, mango, and lemon trees have been stripped and destroyed by them, so that in many parts this otherwise profitable industry has had to be given up entirely.

Their nests generally consist of a cluster of low mounds, pierced by tunnels, from half an inch to six or eight inches in diameter, and situated in a little clearing made by killing the shrubbery through the persistent biting off of buds and leaves, evidently to secure sunshine and a free circulation of air. Leading out from these mounds are well marked paths, it may be half a mile long and several inches wide, through-d like the streets of a great city with busy workers bringing in leafy burdens or hurrying outward for a load. As far as the eye can distinguish their tiny forms, says a recent observer, troops and troops of leaves are seen moving up toward the central point, and disappearing down the tunneled passages. The out-going, empty-handed hosts are partly concealed among the bulky burdens of the incomers, and can be distinguished only by looking closely. "The ceaseless, toiling hosts impress one with their power, and one asks: What forest can stand before such invaders? How is it that vegetation is not eaten off the face of the earth? Surely nowhere but in the tropics, where the recuperative powers of Nature are immense and ever active, could such devastations be withstood."

But wonderful as the operations of these leaf cutters are in the open air, they are as nothing to those that go on under ground. Hitherto the use made of the leaves gathered in such immense quantities has been a mystery. Some have thought they must be used directly as food; others, that they were employed in roofing the ants' underground chambers; but no one suspected their real use until the secret was disclosed to the observer already quoted, Mr. Thomas Belt, in the course of certain mining operations which he was superintending in Nicaragua.

On two occasions, earth cuttings were made from below up through very large nests of these ants, in such a way as to lay their operations clearly open to observation. The tunneled passages were found to lead to numerous connected chambers about the size of a man's head, usually three fourths filled with a flocculent mass of light and loosely connected bits of leaves, withered to a brown color and overgrown with a minute white fungus. Mixed with this substance were numbers of ant nurses with pupae and larvae.

By numerous observations, which he describes at length, Mr. Belt became convinced that this fungus growth was the real food of the ants; and all of their outside operations were tributary to its cultivation! In other words the leaves are collected, as human farmers collected manure and guano for indirect use as fertilizers. The ants do not confine themselves to leaves, but take any vegetable substance suitable for growing the fungus on. Nor do they take leaves indiscriminately, grass, for example, being always rejected; and when any ant, more stupid or less experienced than ordinary, makes the mistake of carrying in unsuitable leaves, they are promptly brought out and thrown away. Great care is also taken in regard to the condition of the leaves carried into the chambers. In case a sudden shower comes on, the wet pieces are deposited outside, to be picked up and taken in when nearly dry, should the weather clear up promptly; when spoiled by too much rain, they are left to rot on the ground. On the other hand, in very dry and hot weather, when the leaves would wither on the way to the nest, the ants wait until sundown before going out, or do their gathering wholly in the night.

When a community migrates, the fresh fungus growths are carefully transported to the new burrows in the jaws of the middle sized workers, the larger members of the community acting only as directors of the march or defenders of the rest in case the column is attacked. The nurses already mentioned are the smallest of all, and their duties lie wholly underground, in cutting up the leaves and attending to the young ants. They never carry leaves, but may sometimes be seen running out along the paths with the others, apparently for the fun of the thing; for instead of helping the rest, they perch themselves on the pieces that are being brought in, and so, like petted children, get a ride home.

As might be expected with creatures who have developed so complicated a system of industrial economy, these ants are extremely clever. A single illustration will suffice to show their practical good sense. To drive off a colony which had established themselves in his garden, Mr. Belt gave their nest a soaking with carbolic acid and water. The effect was all that could have been desired. The marauding parties were at once withdrawn from the garden to meet the danger at home; the whole formicarium was disorganized; and big fellows came stalking up to repel the supposed invader, only to descend again in the utmost perplexity. By the next morning a new nest had been established, some yards distant, and the survivors were busy carrying their supplies thither. It happened that between the two stations there was a steep slope. Instead of descending this with their burdens, the ants cast them down at the top, whence they rolled to the bottom, where another relay of laborers picked them up and carried them to the new burrow. It was amusing, says Mr. Belt, to watch the ants hurrying out with bundles of food, dropping them over the slope, then rushing back immediately for more. Is it possible to attribute such a sensible, and at the same time exceptional, division of labor to anything radically different from human intelligence?

GRANITE and macadam are to be banished from the city of London, the Streets Committee having determined to lay down in future nothing but asphalt or wood.

A MODEL TRANSATLANTIC STEAMER.

We have heard it asserted that there is scarcely a steamer crossing the Atlantic that could not be sunk by a few blows from a heavy sledge. We have received ample evidence, in recent ocean disasters, that the action of the waves alone may strain a modern vessel so that she is considered unseaworthy by a modern captain. Such matters are of grave interest to the traveling public, and they may be glad to know that it is possible to build vessels that will be able to withstand much more severe usage. In the early days of iron shipbuilding, it was pointed out, by the best authorities, that the way to make a vessel safe and strong was to build it with a double skin, making, as it were, a ship within a ship. One of the most noted vessels of modern times, the Great Eastern, was constructed in this manner, and our readers may remember that she ran aground in New York harbor, tearing a hole in her outer skin something more than eighty feet long, and that it was not even necessary to dock the vessel to repair the damage. Of course, a vessel built in this manner is much more expensive than one of the ordinary construction, and it is scarcely necessary to remark that very few examples of this kind are to be found in the mercantile marine. Steamship owners and the traveling community seem in general to have opposing interests, the former desiring to build and run vessels as cheaply as possible, while the latter are more interested in the strength of the ship and the efficiency of the officers. It is with great pleasure, then, that we call the attention of our readers to an exceptional case, that of a company which seems disposed to use the best vessels that can be built, regardless of cost. We refer to the company operating the Red Star line of steamers, formerly running from Philadelphia to Antwerp, which have recently changed their place of sailing to this port. Only three vessels of this line, the *Nederland*, the *Vaterland*, and the *Switzerland*, are as yet completed, but several others are in course of construction. Our readers may remember that not long ago the *Nederland* ran ashore on the New Jersey coast, in making what appeared to be an effort to reach Philadelphia overland, and that, after having been aground for about two days and exposed to a pretty severe storm, she was floated again and taken to Philadelphia, apparently uninjured. We need scarcely remark that not every steamer crossing the Atlantic could be expected to behave as well under such circumstances. The *Switzerland*, the other vessel belonging to this line, reached New York on the 8th instant, this being her first voyage. She is 350 feet long, 40 feet beam, has 33 feet depth of hold, and is of about 2,800 tons burden. The vessel is divided by bulkheads into 6 watertight compartments. Each bulkhead is composed of two thicknesses of plate, with a space between, the plates being strongly stayed together. The ship has a double skin, the distance between the outer and inner skins being between 18 and 20 inches, the main and berth decks being built double, in the same manner. The main deck is covered with heavy planks, and the inner skin of the vessel is sheathed with wood. These compartments between the skins are fitted with good sized pumps which can be worked either by hand or by engines on the upper deck. The steam pumps in the engine room are unusually large for a vessel of this size, and it would seem as if nearly every safeguard that could be required, in case of a leak, was provided in the present instance. The door of each watertight compartment can be closed from the upper deck, by means of a screw.

The *Switzerland* has a compound engine, the length of stroke being 48 inches, and the diameters of the two cylinders, 40 and 80 inches. There are accommodations for 160 first class passengers, and for about 900 in the steerage.

Without going very fully into details, we trust that we have shown that the vessel under consideration is one of the most substantial crafts that can be built, and offers security to passengers that cannot be guaranteed in the case of the ocean steamer as ordinarily constructed. Our readers may rest assured, also, that, when ocean travelers demand such safeguards to be provided on all lines, they will be forthcoming, and not before.

LEFT HAND WRITING.

A correspondent asks for the best way of holding the pen in writing with the left hand, and the best angle of slope for the letters. No absolute answer can be given in either case. Hands differ, and what would be an easy position of pen for one person might be a very awkward one for another. Each writer must be governed by the necessities of his individual case, to be discovered rather by thoughtful observation of his own writing than by the study of rules. It is enough to say that the ideal position figured on the covers of copy books can be maintained but for short periods without excessive fatigue, and only by persons having slender hands. It answers well enough for writing as a fine art, but is altogether too stiff and tiresome when much offhand writing is to be done. What is true for the right hand is equally true for the left. A good deal depends, too, on the mode of writing, whether the motion is a wrist stroke or a finger stroke or a combination of the two.

Equal freedom must be allowed in regard to the angle or slope of the writing, providing simply that the greater the departure from the perpendicular the greater the danger of illegibility; while a slight slope to right or left adds much to the gracefulness of the script without making it perceptibly less easy to read.

In writing with the left hand, the easiest position would seem to be with the body square before the table, the arm making an angle of about forty five degrees with the front line of the table, the line of writing being at right angles with the direction of the arm. In this position the writing is naturally "back hand," about twenty degrees from perpendicu-

lar. To the present writer, whose left hand practice began rather late in life, in consequence of an accident which threatened the disabling of the right hand, it is much the easiest way, in left hand writing, to hold the pen reporter-fashion between the first and second fingers, as in this position the pen is held steady with the least effort, and is not so likely to wander from a uniform slope. It is well, however, to accustom one's self to a variety of positions, especially when much writing has to be done, since, by changing the posture, the labor of writing may be thrown on different sets of muscles, and rest obtained without ceasing to write.

One of the clearest and most graceful left hand writers of our acquaintance writes a style that cannot be distinguished, save in a slight peculiarity in shading, from normal right hand penmanship. To one watching the process, the writing appears to be done upside down. The pen is held between the thumb and forefinger in the regular way; but the paper is placed so that the line of writing is perpendicular to the front of the body, the direction of the writing being toward the body. It seems most natural, however, for the writing to slope to the left when the left hand is employed.

There is a special advantage in using the left hand to write with, and one that we have never seen commended. The hand is never in the way of vision. The pen point is always in plain sight, and so is the paper to be written on. There is, consequently, no inducement to stoop forward or to turn the head so as to throw the eyes out of focus. It is a common fault with those who write much that the left eye has a shorter range than the right. It is overworked and compelled to adapt itself to nearer vision. In writing with the left hand, these evils are avoided. An upright posture is the easiest, and the eyes are equally distant from the paper.

RUBBER AS A DEFENSIVE ARMOR.

We have before us a petition for the relief of Jonathan L. Jones, recently submitted to Congress, in which the memorialist prefers a claim against the United States for the sum of \$500,000 for compensation for the use of his patent dated April 15, 1863, for improved defensive armor upon the gunboats *Essex*, *Choctaw*, and *Lafayette*, in their operations against Vicksburg and the Confederate batteries on the Mississippi river during the late war. This armor was composed of one inch of iron plating, backed by one inch of vulcanized india rubber and twenty three inches of solid timber, covering the portions of the hulls abreast the boilers, the forward and after casemates, and the pilot houses. Thus protected, the boats went repeatedly into action, passing Vicksburg, destroying the ram *Arkansas*, and participating in other engagements, during the course of which they were struck, it is alleged, by heavy projectiles, an aggregate of 276 times without the same penetrating that portion of the armor constructed on the memorialist's plan. Shot, it is admitted, passed into the vessels at various times, but never through the parts protected by the armor. A host of letters affidavits, etc., are submitted in corroboration of the assertions advanced; and with the apparently plain claim nicely made out, Mr. Jones goes in for the above mentioned grab. It forcibly reminds us of the efforts of the claimant in the famous Tichborne case.

On the 3rd of October, 1863, Mr. Jones' own target, made of materials furnished by himself, consisting of four one inch wrought iron plates and four sheets of rubber one inch thick, backed by twenty inches of solid oak, was set up against a clay bank in the Washington Navy Yard. The first four inches of the shield nearest the timber were composed of alternate layers of rubber and iron; and the two sheets of one inch rubber and two one inch wrought iron plates were added, the latter being on the outside of the target. The first shot, weighing 169 lbs., was fired from a 11 inch gun at 84 feet distance. It went entirely through plates, rubber, and timber, and penetrated the bank a distance of 12 feet. Diameter of shot hole, 11 1/4 inches. On the 6th of October, the target was placed at an angle of 45° to the line of fire, and a similar shot fired at it. The ball again penetrated everything and entered 6 feet into the clay bank. The holes made by the shot are shown in the annexed engraving, made from the target at the time and published in the SCIENTIFIC AMERICAN. In order fully to prove the inefficiency of Mr. Jones' shield, another target was made, of simply 4 one inch iron plates, backed by 20 inches of solid oak, for comparison, to indicate the effect of the rubber. The first shot fired under similar circumstances to the above went through and penetrated the bank 5 feet. The second projectile, at an angle of 45°, broke in pieces and glanced off, leaving a fragment in the plating. If the members of the committee to whom Mr. Jones' claim has been relegated desire further evidence, we would refer them to the files of the Ordnance Bureau in the Navy Department, as to the detailed account of the tests conducted upon targets Nos. 45 and 46 in the Pencote battery. Further, a year before Mr. Jones produced the above mentioned shield, which failed so conspicuously, a Mr. Bennett, of New York, furnished a rubber plate one inch thick, for target No. 10 in the same series of experiments, and this also was repeatedly penetrated, according to the official report "the same as by previous shots fired at other targets made in the usual way without rubber." Target No. 18 was made of two thicknesses of one inch wrought iron plates backed by 1 1/4 inches of rubber, 7 inches of yellow pine, and three beams 12 inches square

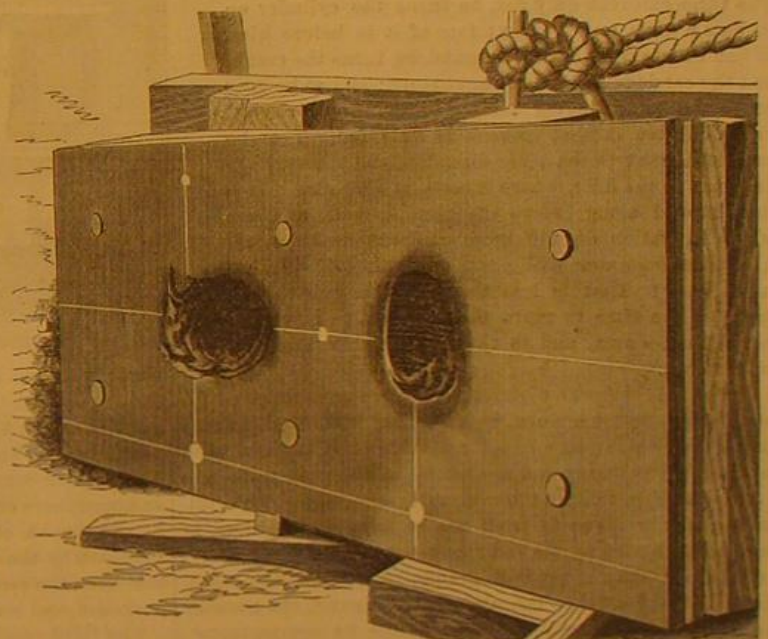
running lengthwise the shield. The shot tore through the plating and rubber as before and penetrated the bank for 17 feet. Target No. 21 had two inches of rubber between two one inch iron plates and 7 inches of pine, with beams as before. This was pierced with equal facility by two shots. Target No. 37 was faced with 4 one inch rubber plates and backed with 4 1/2 inches of scrap iron and 20 inches of oak. All the rubber was forced off. Trials at similar targets without the rubber proved the latter to be of no value.

It would be idle for us to proceed further in disproving Mr. Jones' assertions. Leaving out the above experiments altogether, it is a very simple matter to show that even theoretically the inventor's ideas are false. Rubber alone in the form of plates or blocks opposes a resistance to projectiles of about fifty per cent of that of oak. The balls go through it almost as if it were tallow. Now when it is conceded that the shot easily penetrated targets unprovided with the material, it is palpably absurd to suppose that the addition of a substance so easily pierced would add materially to the general resisting power.

That there is any truth in the "philosophy" of the results said to have taken place, namely, that the rubber causes a diffusion of the force through its elasticity, we cannot for a moment admit. As in the converse case of shooting a tallow candle through a door, no time is afforded in the passage of the shot through the single inch of iron for its force to act and react before the penetration is effected.

How Commodore Porter could have been ignorant of the experiments which proved the inefficiency of the rubber, we fail to understand; nor can we reconcile the letters of the officers in its favor in any other manner than by supposing that the results ascribed to the armor must have been due to other causes, a fact which we think would have been apparent had the gentlemen considered the subject in the light of the simplest mechanical laws.

In justice to Mr. Jones, however, it may be added that although his shield could not have repelled the shot, it nevertheless may have served some useful purpose, as the crews



of the vessels evidently believed in it; and hence, going into action with a greater confidence in their safety, they perhaps performed better work. This, however, is hardly worth \$500,000 to the people.

PHOTOGRAPHY AT THE BOTTOM OF THE SEA.

Dr. Neumayer has recently exhibited before the Berlin Geographical Society a photographic apparatus designed for the determination of the temperature and of the currents at great depths in the ocean.

The invention is composed of a copper box, hermetically sealed and furnished with an exterior appendix made like a rudder. In the interior is a mercury thermometer and a compass, each enclosed in a glass receptacle in which are admitted traces of nitrogen gas. A small electric battery completes the apparatus. When the latter is allowed to descend attached to a sounding line, the action of the current on its rudder causes it to assume a parallel direction, thus indicating the set of the flow by the relative position of compass, needle, and rudder. The thermometer of course shows the surrounding temperature. In order to fix these indications, a piece of photographic paper is suitably disposed near the glass cases containing the instruments. Then at the proper time a current of electricity is established through the gas in the receptacles, causing an intense violet light, capable of acting chemically upon the paper for a sufficient length of time to allow of the photography thereon of the shadows of the compass needle and of the mercury column. Within three minutes, it is said, the operation is complete, when the apparatus is hoisted and the paper removed.

AN AMERICAN RIVER NILE.—The valley of the Rio Grande del Norte, in New Mexico, recalls the features of the Egyptian Nile. A large population is entirely dependent upon the river. An annual rise of the waters carries a muddy sediment, superior in fertilizing properties, as was proved by analysis, to that of the great African river. While the amount of phosphoric acid is nearly the same, the amount of potash is considerably higher. Thousands of acres are lying idle along the valley of the stream, awaiting the enterprising farmer.

FATTENING CHICKENS BY MACHINERY.

It seems to be generally admitted by *gourmands* that no chickens of mechanical fattening have such exquisite flavor as those submitted to the process. In the Gardens of Acclimatation at Paris, this is very scientifically practised under the direction of M. Odile Martin. "Its advantages," say the authorities, "do not consist in the rapidity of the process alone, but above all in the special quality of the meat thus produced. It is solid, very tender, exceedingly fine-grained, not overfat (which would not be an advantage), very white in color, and of a flavor quite exceptionally excellent."

If this is so, of course there is no help for the chickens. They must perforce enter their *épinettes*, and be mathematically crammed. Behold here the ingenious contrivance of the Gardens of Acclimatation for manufacturing this "exceptionally excellent" flavor!

It is a huge cylinder with fourteen faces, each in five stories of three compartments each. It holds, therefore, 210 fowls. The cylinder is hollow and empty, except for the axis on which it turns. This hollow construction renders it easily ventilated and kept clean. Before it is a box for the operator. This box, or carriage, moves up and down by pulleys. The *gaveur*—that sounds less offensive than crammer—operates thus: Commencing at the bottom of one of these fourteen faces, he seizes with the left hand the neck of the chicken; and pressing on each side of the beak, the bird is forced to open its mouth, as any lady knows who has doctored a sick chicken or canary. The *gaveur* then introduces the metallic end of the rubber tube into the throat of the chicken, and by a pressure of the foot on a pedal the food rises, and at the same time the amount passing through the tube is indicated on a dial in front of the operator. It is therefore a skillful operation; for the *gaveur*, whatever other motions are necessary, must pay strict attention to the needle on the dial, or he will give his chicken too much or too little. The three chickens duly fed, he turns the cylinder on its axis a little, and the next face of it is before him. When he has completed the round he turns the crank, and the carriage rises to the next story; and so he goes on to the top. Having completed the upper circuit, every chicken in that *épinette* is duly fed. Then he turns the crank in the other direction, and the carriage descends to the floor, where it rests on a railroad. It is then moved along before the next *épinette*, and the whole operation on 210 more chickens is repeated. A skillful operator will *gave*, or cram, 400 chickens in an hour! That is less than nine seconds to each one; for the time to move the cylinder, to move the carriage up, down, and to the next *épinette*, must be counted out.

Under this *épinette* régime, it requires an average of fifteen days to fatten a duck, eighteen for a chicken, twenty for a goose, and twenty-five for a turkey. The food used for chickens is barley and corn meal mixed with milk into a dough so thin that no other liquid is necessary. The ordinary quantity given is from ten to twenty centiliters, or from seven tenths to one and four tenths of a gill each time; but this quantity is reached gradually. When the maximum that any chicken can assimilate is found, the number indicating this quantity is placed before its compartment, and the *gaveur* must measure it exactly on the dial.

Truly this is an age of wonders. What a labor-saving invention this *épinette* must be to the chickens! Maybe it is not wise to give these details. What if some enterprising American should be thereby tempted to invest his whole fortune in a grand improved automaton steam power *épinette*, warranted to feed ten thousand chickens a minute! —*Harper's Magazine.*

JUPITER'S SATELLITES.

M. Camille Flammarion, the distinguished French astronomer, says in *La Nature* that on March 25 last the planet Jupiter offered in the telescope the curious aspect of being unaccompanied by any of his satellites. The first was concealed behind the disk. The second and third passed over the face of the planet, accompanied by their shadows, and the fourth was at its greatest elongation and hence far out of the field. The appearance of the planet is shown in our



illustration, the disk being divided into parallel zones, the darkest of which extended below the equator for some 20°. Above this was a broader and lighter band, and then a white region, terminating at about the 50th degree of latitude in a gray zone. On the white belt was projected a black spot, No. 1, near which was a second circle, No. 2, of a grayish color. A third point was with difficulty discernible at 3,

passing along the upper limit of the gray band. By noting the changes in position of these spots, M. Flammarion reached the conclusion that No. 1 was the shadow of the third, and No. 2 of the second satellite, both of which were passing over the planet, and that No. 3 was the third satellite itself. Consequently at the period of observation there must have been upon Jupiter two total simultaneous and contiguous eclipses of the sun.

The various shades of the spots lead to the determination of some curious and important facts regarding the satellites. The second satellite was evidently more luminous than the third, since it remained invisible on the white zone; while the third was even darker than the gray belt over which it traveled. The latter in fact was hardly brighter than the

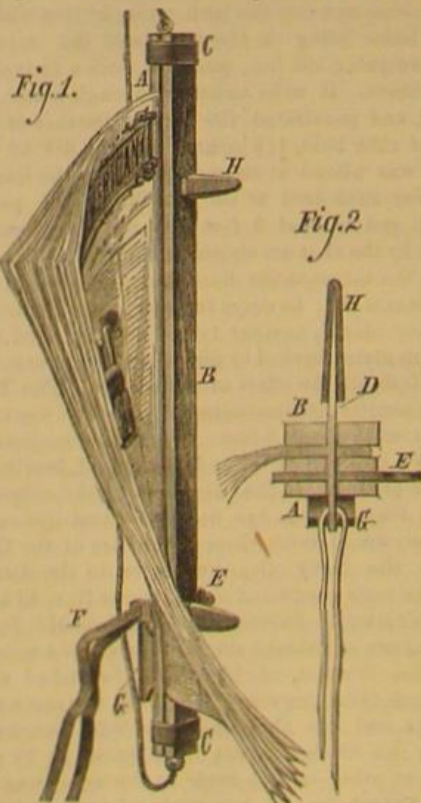


FATTENING CHICKENS BY MACHINERY.

shadow of the second. Stranger still, the shadow of the third was blacker than that of the second. This cannot be ascribed to the 0.5" difference in size, or to the effect of the penumbra, for the latter is practically nothing; and hence M. Flammarion considers it due to refraction produced across an atmosphere enveloping the second satellite. It is well known that in certain eclipses of the moon the refraction produced by the terrestrial atmosphere is so considerable that even the central region of the lunar disk is not totally darkened, and remains red like the entire moon.

The third satellite, ordinarily white, appeared darker, and hence must either have become changed in the physical condition of its atmosphere or else have turned another side. Dawes, Lassell, and Secchi have, however, all distinguished spots on the body; and to the exposition of these, its clouded appearance was probably due. Hence it revolves, but, unlike our moon, in a period different from that of its revolution around the planet.

THE NE PLUS ULTRA NEWSPAPER AND MAGAZINE FILE.
In the ingenious form of file represented in the annexed



illustrations, the newspaper or magazine is held so that each page succeeds the other in regular order throughout the entire volume, similarly to the pages of a book. Every jour-

nal is clamped securely in its place, and after the numbers, making a volume, are complete, binding by tapes may be quickly and easily effected without necessitating the displacement of a single paper. For libraries and reading rooms, where many periodicals are received which are subsequently bound for preservation, we think that this invention will prove quite convenient, as it saves the necessity of re-arranging the copies after removal from the files, and of the somewhat tedious process of piercing each one in order to pass through the tapes which temporarily hold the sets together for the binder.

Fig. 1 of our engraving gives a perspective view of the file with papers clamped therein. There are two bars of wood or other suitable material, A and B, of which the rear bar, A, is the thickest. These are held together by rubber bands, C, which, secured to bar, A, slip over the ends of the bar, B. Any other convenient and similar fastening may be employed. Through both bars, at a suitable distance from each end, are slots, through which pass blades, D, the forward ends of which are made lancet-shaped, to enable them to pass readily through the papers. As shown in the sectional view, Fig. 2, these blades are secured in the rear bar by pins, E, which pass through said bar and through holes in the blades. The rear ends of the latter project, and have eyes through which tapes, F, are threaded. At G are rubber blocks, which serve as fenders to keep the projecting extremities of the blades from marring the wall against which the file may be suspended. Sheaths, H, of wood or other material, are also provided to protect the sharp ends of the blades, and there is a cord attached, as shown, for hanging up the device.

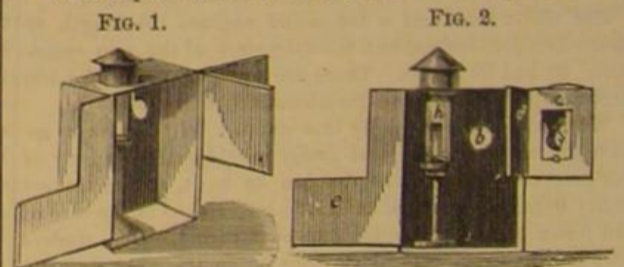
In using the file the caps, H, are removed, and bands, C, slipped off. The bar, B, being removed, is laid in proper position upon the back margin of the last page of the paper, when both the latter and the bar are pressed against the points of the blades, so that the same pass through the slots in the bar. The bar and paper are then pressed back against the bar, A, and the bars and caps replaced. When the file is full, the pins, E, are removed, and the blades and tapes drawn through the bars. The bar, B, is then detached as before described, the papers are removed, and the tapes are tied behind, forming a volume ready to be laid away or sent to the binder.

Patented through the Scientific American Patent Agency, March 24, 1874. For further information regarding proposals to manufacture, royalty, etc., address the patentee, Mr. Alexander L. Whitehall, Waukegan, Iroquois county, Ill.

THE WONDER CAMERA.

A "wonder camera" is a sort of magic lantern, so contrived as to enable one to use opaque objects for projection upon the screen instead of glass transparencies. For example, if a photographer wishes to show his customer how an enlargement from a carte will look, he simply has to put the carte in the "wonder camera" and "throw it up." Many enlargement scales may be made in this way. Any person may make a "wonder camera" for himself on a plan given by Mr. T. Carter. He says:

"After experiment I have succeeded in making the above



instrument in a very simple manner. It consists of a wooden box, with a top made of tin or sheet iron; the chimney is made of the same material. The lens is the same as used upon a camera for making photographs. At the back of

the box (as will be seen by reference to the elevation and plan Figs. 2 and 3) are two doors placed upon hinges.

When the box is in use, the door, e, is kept closed. The other door consists of two parts placed at right angles to one another; the

object of this is to fill the opening in the door, e, while the pictures are being attached to c; when c is swung into position opposite, the lens, placed at b, d, is carried to one side. If stereoscopic views are to be shown, a slit may be cut, at e, through which they may be inserted without opening the box. The door, e, should be cut off a little at the bottom so as to admit air. The light is placed at h, as nearly opposite the picture as possible. It should be a strong light; an argand burner is the best. At the back of the light is a piece of tin, bent into the form of a reflector. The light coming from h strikes c, and is reflected through the lens upon the screen. The plan of the box is represented with the top removed. I have given no dimensions, as they will depend upon the focal distance of the lens and height of the light. Care must be used to have the distance from the lens to c, when closed, equal to the focal distance." —*Photo. News.*

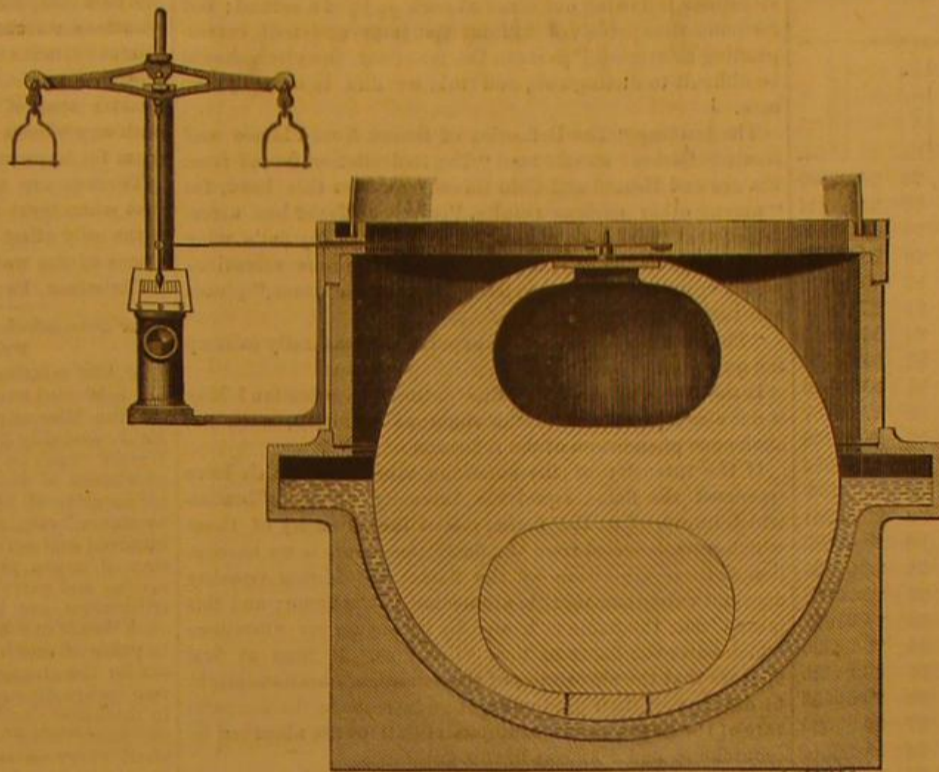
In India, a timber bridge of 205 feet span has been erected, principally of satinwood.

Correspondence.

SOLAR ATTRACTION AND THE EARTH'S ORBITAL CENTRIFUGAL FORCE.

To the Editor of the Scientific American:

The accompanying illustration represents an instrument constructed for the purpose of proving, by actual practical test, that the sun's attractive energy is balanced by the centrifugal force called forth by the earth's orbital motion round the sun. I desire it to be distinctly understood, however, that my intention is not to demonstrate what astronomers proved centuries ago, namely, that solar attraction is counteracted by the centrifugal force resulting from the orbital motion of the earth round the luminary. Léon Foucault, in his celebrated experiment of swinging a pendulum from the dome of the Panthéon in Paris, simply intended to furnish ocular proof of the correctness of the assumption that our planet rotates round an axis at right angles to the equator. So with regard to the instrument under consideration: the object is simply to furnish ocular proof of the correctness of the assumption that the sun's attractive energy is counteracted by the centrifugal force developed by the orbital motion of the earth round the sun. The reader is aware, from previous statements in these columns, that my scheme consists in presenting a highly polished iron globe, floating on the surface of mercury, to the sun at the moment of rising or setting, the terrestrial attraction being then exerted at right angles to the line of solar attraction, hence incapable of interfering with its action. From previous statements the reader is also aware that experiments, conducted with the new instrument its sunrise and sunset, have established the fact that, although a tractive force of a few grains is capable of moving the polished iron globe over the surface of the mercury, yet no movement whatever takes place when it is subjected to the pull exerted by the attraction of the sun as stated. A brief description will suffice to explain the nature of the instrument. The illustration represents a section through the center of the iron globe and the circular cistern which contains the mercury. Two spheroidal



cavities, it will be seen, are formed in the globe, the upper cavity being empty while the lower one is filled with a metal of much greater specific gravity than iron, the object being to retain the vertical axis of the floating globe in a fixed position. A movable ring is applied at the upper part of the mercurial cistern, admitting of a free rotary motion while the cistern remains stationary. To the said ring an angular bracket is secured, supporting the central column of a delicate chemical balance. Obviously this arrangement admits of the scale beam being turned in such a direction that it points toward the rising or setting sun, without disturbing the mercurial cistern or its contents. The lower end of the vertical index of the scale beam is connected with the floating iron globe by means of a straight steel wire, as shown in the illustration; this wire extending beyond the vertical axis of the globe, a small counter weight being applied at the extreme end of the extension in order to relieve the balance from disturbing influence. To prevent dust from lodging on the mercury, a glass shade covers the cistern, resting in a groove at the upper part of the rotating ring, the shade also preventing currents of air from agitating the sensitive globe during experiments. Such is the nature of the instrument constructed for comparing the energy of solar attraction and orbital centrifugal force, which Dr. Vander Weyde says he has "disposed of" by his discovery that a "floating object is identical with a lever scale, as the liquid balances the floating body," and because (see his communication inserted May 23) he understands the instrument "only too well, so well indeed as to know that even the attraction of the rising and setting moon can never affect such an arrangement." I will not detain the reader by demonstrating the absurdity of mixing up questions concerning lunar attraction with a question relating solely to the comparative energy of the earth's orbital centrifugal force and solar attraction. I deem it necessary, however, to point out briefly the utter fallacy of Dr. Vander Weyde's stated objections. It requires but a slight acquaintance with dynamics to perceive that his first objection has absolutely no bearing on the question. Of course, the weight of the floating iron globe is balanced by the weight of the liquid metal which supports it; but how can the pull exerted by the rising sun on the iron globe be affected by the earth's attraction because the weight of the globe is balanced by the weight of the fluid mass which it displaces? The second objection urged by Dr. Vander Weyde, that my instrument is incapable of showing that solar attraction balances the earth's orbital centrifugal force because the instrument is not affected by the rising and setting moon, scarcely needs refutation. It will suffice to state that, when the floating iron globe is presented to the rising sun, the mercury which supports the globe remains perfectly level, because the centrifugal force which acts on the fluid metal exactly balances the sun's attractive energy. But, in presenting the instrument to the rising moon, the unbalanced pull exerted by its

attraction on the mercury will produce an inclination of the surface of the latter in a direction opposite to the satellite. Obviously, that inclination will bring the floating globe under the influence of terrestrial attraction to an extent exactly balancing the lunar attraction. Having called the reader's attention to Dr. Vander Weyde's objections, it would be inconsistent not to notice the communication from Mr. Hugo Bilgram, published in the SCIENTIFIC AMERICAN of May 23, concerning my demonstration on page 291, current volume. Mr. Bilgram says: "Though Captain Ericsson in his communication of March 14 proved to be master of the subject, he evidently overlooked one point." This "overlooked" point your correspondent thus adverts to: "Though solar attraction does balance the orbital centrifugal force while the sun is rising, it will not do so three hours afterwards." Now, the sole object of my demonstration was to prove that such is the fact, my figures showing that, although

solar attraction exactly balances orbital centrifugal force at sunrise, the energy of solar attraction gradually overcomes the orbital centrifugal force during the diurnal revolution, until at noon the difference amounts to 0.0001312. My demonstration also proved that a weight of 20,000 pounds suffers a diminution of 0.001546 of a pound during six hours of diurnal rotation, owing to the very cause which Mr. Bilgram asserts that I have overlooked!

Referring to the experiments which have been instituted with my solar attraction instrument, it will be well to observe that, although the energy of lunar attraction is practically imperceptible, it has been deemed best to conduct the observations when the moon is in the first quarter, its attraction being then exerted at right angles to the line of solar pull. Let us now consider whether the observations have been conducted on a sufficiently large scale to warrant definite conclusions. The weight of the iron globe employed being 181.47 pounds, calculations based on the relative mass of the sun and the earth and other known data show that the pull of the sun amounts to 748 grains. The startling fact that the floating iron globe, while subjected to such a considerable direct horizontal pull, remains stationary, at once suggests the following question: Is the surface of the mercury in the cistern perfectly level in a line pointing east and west,—does not solar attraction raise the surface of the fluid metal at the eastern edge of the cistern, thereby producing an inclined plane which solar energy is incapable of causing the iron globe to mount? This important question the writer has disposed of by the following device: Two open cisterns containing mercury, connected by a horizontal tube, are placed twenty feet apart on a level stone foundation. Above the center of each cistern a micrometric mechanism is applied, by means of which the height of the mercury may be measured with the utmost precision. The two cisterns with their connecting tube being placed east and west, and time allowed for the mercury to come to a state of perfect equilibrium, the micrometers are adjusted.

This adjustment, it should be particularly observed, is made when the sun is in the zenith, at which time its attraction evidently cannot disturb the equilibrium of the fluid metal in the connected cisterns. The contact of the micrometers and the mercury is then examined from time to time during the diurnal revolution, the final observation being made when, near sunset, the two cisterns point towards the luminary, at which moment the attractive force, tending to disturb the equilibrium of the fluid metal, is at its maximum. Regarding the result of the observations conducted P. M., it may be briefly stated that, when the micrometers are properly adjusted, not the least excess of elevation of the level of the mercury in the western cistern is produced by solar attraction, at the moment when the attractive energy is exerted in the direct line of the two cisterns. Persons familiar with cosmical questions will say that, in case the sun and moon should be nearly in conjunction when the observation

is made, lunar attraction will sensibly affect the equilibrium of the mercury in the cisterns. The relative energy of terrestrial and lunar attraction at the earth's surface being in the mean ratio of 320,602 to 1, a difference of level in the cisterns amounting to 0.000748 of an inch takes place under the stated conditions. Consequently this difference calls for a correction, after the adjustment at noon, readily effected by turning one of the micrometric screws through an arc of 8° 40', the pitch being thirty-two threads per inch. The perfectly level state of the mercury in the cistern of the solar attraction instrument having been established by such accurate means, the absence of any motion of the floating globe when subjected to the pull of the rising and setting sun furnishes positive ocular demonstration of the fact that the sun's attractive energy exerted on the mass of the iron globe is exactly balanced by the centrifugal force resulting from its orbital motion round the luminary. No reflecting observer, aware of the actual amount of the solar pull (748 grains), can witness the perfect repose of the floating iron globe on the level surface of the mercury, at the moment when the sun is rising, without being impressed with the importance of what he beholds. Again, if he has previously calculated the curvature of the orbit in which the instrument is moving, he can assert that the velocity of the floating iron globe round the sun must exceed 18 miles per second, in order to develop, by centrifugal force, an energy capable of counteracting the pull which he knows the globe is subjected to while he is watching its repose on the surface of the fluid metal. J. ERICSSON.

The Planet Mars.

To the Editor of the Scientific American:

A few particulars relating to the future movements of Mars may be of interest to your readers:

At the present time this planet is badly situated for observation, being nearly at its greatest distance from the earth and but a few degrees east of the sun. The next opposition of Mars will not occur until the 20th of June, 1875. The planet will then be seen near the well known Milk Dipper of *Sagittarius*. This opposition will not be a very favorable one, however. The low altitude which the planet will attain in our northern latitudes will render it difficult to obtain good views.

Moreover, on account of the ellipticity of the orbits of Mars and the earth (especially that of Mars), the planet is much farther from the earth at some oppositions than at others; and on this occasion, it will not be as well situated in this respect as is sometimes the case.

At the next following opposition, however, which will take place in the first part of September, 1877, Mars will be very favorably situated for observation. The planet will, on this occasion, arrive nearly at its minimum distance from our globe; and as it will be situated but a few degrees south of the equinoctial, it will, when on the meridian, be at a convenient altitude for observation in these latitudes.

It happens, in 1877, that Saturn will arrive in opposition to the sun nearly at the same time as Mars. Both planets will be seen, near the time of their opposition, close together, in the constellation *Aquarius*, near the line which separates that constellation from *Pisces*.

At the next opposition, in November, 1879, Mars will not be well situated, but a favorable opposition will occur again in 1892.

At present, the perihelion point of the orbit of Mars is in heliocentric longitude 333° 45', and the aphelion is in heliocentric longitude 153° 45'. Mars is therefore most favorably situated when its opposition occurs in the latter part of August, while the most unfavorable oppositions take place in the latter part of February. In the former case the apparent diameter of the planet reaches 23' 5", and in the latter case it is only about 13".

St. Catherine's, Ontario.

J. M. BARR.

Laying Out Railroad Curves and Gear Wheels.

To the Editor of the Scientific American:

In your issue of April 11, 1874, I notice an article from the pen of H. C. Parsons, concerning the laying out of railroad curves. Having felt the need of some simple mode for this operation, I discovered the following method, which I find sufficiently correct and easy of application. I append a sketch, the rule for its application, and tables of coefficients with which to ascertain the chords. These tables are calculated especially for laying out gear wheels, by using the angular or chordal pitch instead of the arc; therefore it must always be borne in mind that the pitch mentioned is the chord of the arc.

RULE.—Divide the circle into a convenient number of equal parts of degrees and minutes, then use one half of the same for the changes on the instrument, in establishing points. Then apply rule 2 of my table of coefficients for gears, which will give the chord of the arc of each division of the circle.

Example: What will be the angle for the instrument and the length of the chords for a circle of 600 feet radius, divided into 36 parts of 10° each? Answer: The angle will be 5°, and the chord of the arc will be 104.58 feet.

By this method at least one third of the circle can be laid without moving the instrument, or the latter can be shifted

to any point of the circle, whenever any obstructions or irregularities of the land make it requisite to do so. By dividing the circle into many parts, the chords can be brought down to any desirable length.

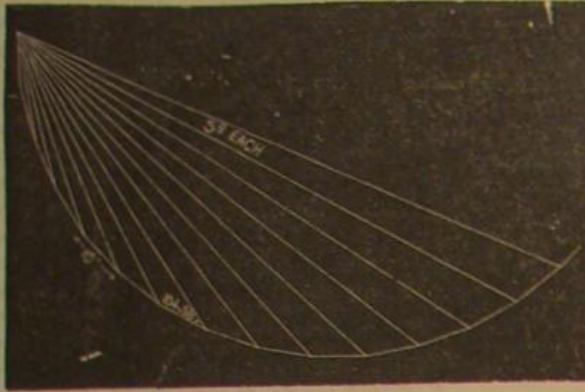


TABLE OF COEFFICIENTS.

Table with 8 columns: No. of Teeth, Coefficient, No. of Teeth, Coefficient, No. of Teeth, Coefficient, No. of Teeth, Coefficient. It lists coefficients for various tooth counts from 4 to 25.

Rule 1: To find the diameter of a wheel when the pitch and number of the teeth are known: Multiply the coefficients in the table, corresponding to the number of teeth, by the given pitch, in inches and hundredths; the product will be in inches and hundredths.

Rule 2: To find the pitch of a wheel, when the diameter and number of teeth are known: Divide the given diameter by the coefficient in the table corresponding to the number of teeth, and the quotient will be the pitch.

Rule 3: To find the number of teeth in a wheel where the pitch and diameter are known: Divide the given diameter by the given pitch, and the number in the table corresponding to the quotient will be number of teeth.

These tables were computed by two distinct processes, at seven places of decimals, and are warranted not to vary more than 1/100 of an inch in the diameter of a wheel of 200 teeth and 3 inch pitch.

New Bedford, Mass. H. C. CRANDALL.

Professor Mayer's Discoveries in Acoustics.---A Note from the Author.

To the Editor of the Scientific American:

Will you permit me to correct two erroneous statements in the accounts you published of my discoveries in acoustics, recently read before the National Academy of Sciences?

Under the heading "The Duration of the Sensation of Sound," for "he concludes that the whole ear vibrates as one mass," etc., read as follows: The following table gives the notes, the number of their vibrations, and the duration of their residual sensations, (the French notation, used by König, is adopted):

Table with 3 columns: Note, No. of vibrations per second, Duration of residual sensation of the sound. It lists notes C1 through C5 with their respective vibration counts and durations.

Calling D, the duration of the residual sensation, and N, the number of vibrations per second of the note, we have:

D = (53248 / (N + 23)) * 0001

Now carrying this law (which we discovered by means of vigorous experimental measures) downwards and upwards, through the range of audible sounds, we have, for 40 vibrations per second, the residual sensation lasting 1/11 of a second after the vibrations which caused the sound have ceased; while for 40,000 vibrations per second, we have a residual sensation of only 1/200 of a second. If we apply the law to vibrations below 40, where they produce, not a

continuous sound, but explosive sensations in the ear, we reach a remarkable result, thus: 39 vibrations per second give a residual sensation of 1/10 of a second; but if the residual sensation is 1/10 of a second, why is it that 30 impacts on the ear, in one second, do not blend? For they follow one another at each 1/30 of a second. This is explained by the fact that co-vibrating parts of the ear, corresponding to sounds produced by vibrations fewer than 40 per second, do not exist, and therefore there are no bodies to co-vibrate and keep up their oscillations after the cause which set them in motion, has ceased to exist, it follows that in other cases the ear is vibrated only as one mass, and the duration of these oscillations of the whole ear are far too short to remain the 1/10 of a second. This supposition also explains why the higher notes, far beyond those used for musical sounds, produce continuous sensations, though we have every reason to believe that no co-vibrating parts of the ear correspond to them; with these high notes, the ear vibrates as a mass, but the duration of this vibration is sufficient to keep up sonorous vibrations, following one other at each 1/2000 of a second; but for notes thus perceived without the intervention of corresponding co-vibrating parts in the inner ear, the pitch should be difficult to distinguish, and this we find is actually the case.

The heading "The Reflection of Sound from Flames and Heated Glasses" should read "The Reflection of Sound from Flames and Heated and Cold Gases." Under this head, for "among other curious results, Professor Mayer has ascertained that there is an absorption of sound in the bat's wing flame; that the flame is heated by the sonorous vibrations which enter it as such, and issue as heat vibrations," please substitute the following:

"The contemplation of these experiments naturally calls up the question:

Is the action of the flame due entirely to reflection? May it not also absorb part of the sonorous vibration, as in the analogous phenomena of the reflection of light?

If the intensity of the sonorous vibrations which have traversed the flame equal the intensity of the vibration which impinged on the flame, minus the intensity of those which were reflected from the flame, then there is no absorption of these vibrations by the flame; but if this equality does not exist, then there is absorption in the flame; and this means that the flame is heated by the sonorous vibrations which enter the flame as heat vibrations. It thus at first appears that the absorption of the sonorous vibrations might be detected by their production of an increase in the temperature of the flame, just as sonorous vibrations are absorbed by caoutchouc, and reappear in this substance.

In the following manner I have recently made experiments in the direction of determining the equivalent of a given sonorous aerial vibration, in fraction of a Joule's unit of 772 foot pounds. I stretched between the prongs of an Ut3 tuning fork a piece of sheet caoutchouc, 100th of an inch in thickness, and about 1/2 inch broad. The effect of this rubber on the vibrating fork is rapidly to extinguish its vibrations, with which the rubber itself is heated; and if a fork be vibrated continuously, by one and the same force, when the rubber is stretched on it and then when it is taken off, the aerial vibrations produced by the fork are far more intense in the latter circumstances than in the former. By a method described by me in the American Journal of Science, February, 1871, I now measured the relative intensities of the aerial vibrations, in these two conditions of vibration. The sheet of caoutchouc was now enclosed in a compound thermobattery, and the fork vibrated during a known interval; the rubber was heated by the vibrations, which would have appeared as sonorous vibrations, if the rubber had been removed from the fork. The amount of heat given to the caoutchouc was accurately determined, by the deflection of a Thomson reflecting galvanometer, connected with the thermo battery; and by knowing the interval during which the fork vibrated, and the amount of heat given by the caoutchouc during this interval, and the equivalent of the heated rubber in water, I calculated the intensity of the sonorous vibration in terms of a thermal unit, from which I at once obtained the value of the sonorous aerial vibrations, when the fork was not heating the rubber, in other words, when it vibrates freely. I thus found that the sonorous aerial vibrations, during ten seconds, of an Ut3 fork placed in front of its resonator, equaled about the 100,000th part of a Joule's unit; that is, they can be expressed in the work done in lifting 54 grains one foot high. This quantity of heat, which is equal to the heating of 1 pound of water one 100,000th of a degree Fab., expressed the amount by which the gas flame would be heated, if it absorbed all of the sonorous vibrations issuing from the Ut3 resonator. But this is such a small fraction of the entire heat in the flame that it is far within the actual fluctuations in temperature in the flame; and, even if the flame were constant in temperature, this small increase could not be detected by any known thermometric method. We cannot therefore determine the amount of absorptive power of a flame, or sheet of heated air, for sonorous vibrations, by experiments on their increased temperature, when sonorous vibrations impinge on these bodies."

ALFRED M. MAYER.

Stevens Institute of Technology, Hoboken, N. J.

Turbine Water Wheels.

To the Editor of the Scientific American:

In our experience, if we have a flood of water with reasonable head, almost any kind of wheel, if it be large enough, will do; but when we come to substitute a turbine for an overshot wheel, on light streams, we find that it is a nice matter to decide on the size the wheel should be to give sufficient power and to use the water economically. We

venture to say here that there have been more failures in turbines on light streams on account of using too large wheels than from all other causes combined; and we set it down as a well established fact, without having reference to any water wheel pamphlets, that there are now in use and have been for some years several different makes of turbine wheels that will give from seventy-five to eighty per cent, when working with seven eighths to full gate; and persons interested can inform themselves more satisfactorily by corresponding with parties having wheels in use than by consulting pamphlets on the subject.

It is said that the best wheels afford almost all their power at five eighths gate or under. Now this is entirely at variance with our experience. Putting in a turbine wheel, on a light stream, that would be large enough to drive the machinery at half gate would be a failure simply because of the small percentage yielded, and consequently the use of too much water for the amount of power given.

Substituting large wheels operating at from one quarter to one half gate, for small wheels requiring seven eighths gates, results in the use of much less water for a given effect, and is also at variance with our experience and can only be based on the idea that the wheels give a better percentage at one quarter than at three quarter gate, which is not the case with any wheels we are acquainted with; but there is ample room for improvement in turbine wheels in that direction.

There is one advantage in using large wheels, and it is that when there is a flush of water it can be utilized, which is the only offset to the loss of power in running at ordinary stages of the water.

J. BROOMELL. Christiana, Pa.

New Steamboat Law. Authorized Increase of Steam Pressure on the Mississippi.

"AN ACT relating to the limitation of steam pressure of vessels used exclusively for towing and carrying freight on the Mississippi river and its tributaries:

Be it enacted by the Senate and House of Representatives of the United States of America in Congress Assembled: That the provisions of an act entitled "An act to provide for the better security of life on vessels propelled in whole or in part by steam," etc., approved February twenty-eighth, eighteen hundred and seventy-one, so far as they relate to the limitation of steam pressure of steamboats used exclusively for towing and carrying freight on the Mississippi river and its tributaries, are hereby so far modified as to substitute for such boats one hundred and fifty pounds of steam pressure in place of one hundred and ten pounds, as provided in said act for the standard pressure upon standard boilers of forty-two inches diameter, and of plates of one quarter of an inch in thickness; and such boats may, on the written permit of the supervising inspector of the district in which such boats shall carry on their business, be permitted to carry steam above the standard pressure of one hundred and ten pounds, but not exceeding the standard pressure of one hundred and fifty pounds to the square inch.

Approved January 6, 1874."

To the Editor of the Scientific American:

A recent act of Congress, regulating the management of steam vessels, authorizes tow and freight boats on the Mississippi river to carry a steam pressure of 150 lbs. to the square inch, instead of 110 lbs. as heretofore, in standard boilers of 42 inches diameter and one quarter of an inch thick. I presume that, by standard boilers, is meant such as are ordinarily well made of good average material and single riveted. However this may be, the pressure stated is clearly in excess, and very dangerously so, of that allowed by the rules generally adopted by first class engineers. A boiler 42 inches in diameter and one quarter of an inch thick, with 150 lbs. to the square inch, is subjected to a strain of 12,600 lbs. to each square inch of sectional area of the solid plate, or fully one quarter of the ultimate tensile strength of good boiler iron. According to Fairbairn, in single riveted work the strength is reduced to 0.52 and in double riveted work to 0.7, of that of the solid plate. Under the above circumstances, therefore, a good new boiler, if single riveted, would be subjected to a working pressure equal to nearly one half of that at which it might be expected to tear asunder, or, if double riveted, to more than one third of the breaking strain. The rule given by Bourne for the thickness of locomotive boilers is to multiply the diameter in inches by the pressure per square inch and divide by 8,900, which, in this instance, would require the shell to be about seven tenths of an inch thick. For marine boilers he allows 3,000 lbs. per square inch of sectional area of plates. Now it does not appear that there is any legitimate reason why the owners of boats, used simply for freight or towing, should be allowed to subject their employees to imminent danger from explosion, while persons merely passengers are protected by law from such danger. That the pressure stated is really known to be dangerous needs no further proof than the fact that it is confined to that class of boats; and since it must be admitted that all citizens are entitled to equal protection, why not the officers and men serving in these vessels? It may be said that they voluntarily expose themselves with full understanding of the circumstance, but this is not always the case, and, if it were, would not be a good argument. An explosion of one of the above mentioned boats occurred in March last, causing the loss of sixteen lives. Dare we say that those lives were less precious because they belonged to engineers, firemen, deck hands, or others forced by the necessity of providing for themselves and families to work under constant dread of danger and death?

JOHN LEPPER.

Washington, D. C.

Of all solid substances found upon the earth, carbon is both the hardest and the softest. In the form of diamond, it is the hardest. In the form of graphite, it is the softest. Both diamond and graphite are the same in chemical composition.

SCIENTIFIC AND PRACTICAL INFORMATION.

TESTING BELTING LEATHER.

M. Eltner proposes the following simple method of determining the value of leather employed on belting. A cutting of the material about 0.03 of an inch in thickness is placed in strong vinegar. If the leather has been thoroughly acted upon by the tanning and is hence of good quality, it will remain, for months even, immersed without alteration, simply becoming a little darker in color. But, on the contrary, if not well impregnated by the tannin, the fibers will quickly swell and, after a short period, become transformed into a gelatinous mass.

NO WATER IN THE SUN.

M. Janssen states that Croce-Spinelli, in his recent balloon ascension to an elevation of 25,000 feet, finds by spectroscopic observation that the lines in the spectrum, ascribed to the vapor of water, are due to the terrestrial and not to the solar atmosphere; since when the former, by reason of the elevation, is greatly eliminated, the bands are also in like proportion decreased. It may therefore be considered that in the sun there is no watery vapor, at least in appreciable quantity, and that consequently the temperature of that body is not yet sufficiently lowered to allow water to form.

THE SWEDISH EXPEDITION TO THE NORTH POLE.

M. Nordenskjöld has recently found, in the ice and snow of the Arctic polar sea, a black dust. This he had melted, and subsequently submitted it to chemical analysis, which has proved that it is composed of nickel and cobalt, and similar in constitution to the meteorites. It seems probable, therefore, that the powder is actually due to the disintegration of these aerial bodies at a short distance from the earth.

The regions which this intrepid traveller has lately explored are the most inhospitable on the globe. He has traversed ice seas, the level of which rises to over three thousand feet above that of the ocean, and which are rent with huge crevasses often entirely concealed by snow and fog, rendering their exploration an enterprise of the greatest danger. M. Nordenskjöld is now organizing a new expedition to start in the spring of 1875.

HYDROGEN ALLOYS.

In pursuing their investigations into the metallic combinations of hydrogen, MM. Hautefeuille and Troost have succeeded in obtaining a definite hydride of sodium. They have since compared this product with the hydride of palladium, in order to determine the density of the hydrogen, could it be solidified under like conditions. The hydride of palladium, having a density equal to 11, if the density of palladium, itself equal to 11.7, be considered, admitting that no variation in volume takes place, the density of the hydrogen is found to be 0.63. Repeating the same calculations for the hydride of sodium, the number 0.63 is obtained. Palladium, however, is much heavier than water, while sodium is lighter; and hence it is believed that the figures 0.63 more truly indicated the density of hydrogen under the above conditions. This number is very near to that which represents the density of lithium, and tends to confirm the opinion that hydrogen is one of the true metals.

A LUMINOUS SIGNAL FOR GEODESIC OPERATIONS.

M. Laussedat proposes, for the above purpose, to direct a spy glass from one station toward a second point, to which the signal is to be transmitted. In the focus of the instrument, he places a diaphragm having a very small aperture; so that, on looking through, the field of vision will be restricted to the tower, steeple, or other locality at which the receiver of the signal is stationed. The eye piece of the telescope is then removed, leaving the diaphragm, and behind the latter is placed, in the axis of the instrument, a light, the conjugate image of which, produced by the conveying glass, falls precisely on the opening of the diaphragm. The luminous ray transmitted through the telescope will fall directly on the edifice comprised on the restricted field of vision, and not elsewhere, and the light is therefore invisible to all without that field. The observer will perceive the objective of the telescope illuminated over all its surface; and necessarily the larger the diameter of the glass, the farther will the signal be visible.

A Chemical Centennial.

Dr. H. Carrington Bolton, of Columbia College, has suggested the idea that, as centennial celebrations are now in order, the present year is eminently appropriate for the organization of a social reunion among the chemists of the United States, in commemoration of events alike important to Science and civilization. Dr. Bolton considers that since so many remarkable discoveries in chemistry were made in 1774, we may date the foundation of modern chemical science from that period, and that consequently the year 1874 marks the lapse of the first century. It is pointed out that in 1774 Scheele first isolated chlorine, recognized baryta as an independent earth, and published his essay on manganese. Lavoisier was engaged in an investigation of the cause of the increase in weight of tin when calcined in close vessels, a research leading to the most important discoveries. Wiegand proved alkalies to be true natural constituents of plants. Cadet described an improved method of preparing sulphuric ether. Bergmann showed the presence of carbonic acid in lead white. On the 27th of September in that year, Comus reduced the "calces" of the six metals by means of the electric spark, before an astonished and delighted audience of savants. On the first of August, 1774, Priestly discovered oxygen, the immediate results of which were the overthrow of the time-honored phlogistic theory and the foundation of chemistry on its present basis.

The proposition has already been acted upon, and the New York Lyceum of Natural History has passed resolutions appointing a committee of five, consisting of Dr. Bolton and Professors Chandler, Wurtz, Leeds and Seeley, to correspond with the chemists of the country with the view of securing their cooperation in the observance of the anniversary. The time fixed, we understand, is the first of August. The idea is a good one and doubtless will be favorably received by the profession.

The Iron Trade.

The Bulletin of the American Iron and Steel Association says:

There are 175,000 men who are usually employed at rolling mills, furnaces, etc., out of employment today in consequence of the depression in the iron business; to these must be added many mechanics and others whose business has not been prosperous, or has been partly or wholly destroyed because the iron business upon which they depend has been prostrated.

More than one half of the rail mills of the country were wholly idle on the first day of January last, and the same number remain idle to day, while others are only running a part of their time. Few mills are running to the extent of their capacity. The amount of work now done by merchant bar mills, car wheel makers, car and locomotive builders, and other branches of business intimately connected with the railroad interest, is fully one half less than it was a year ago.

Merchant bar mills, plate mills, foundries, machine shops, and other establishments not dependent upon the railroads for orders have as a rule less business than during the first month of the panic.

Of the 666 completed furnace stacks in the country, the whole number in blast on the first of January last was 400; out of blast, 266. The aggregate number of furnaces out of blast at this date is as great as it was in January.

The decline in prices is as follows:

Principal Articles.	April, 1873.	April, 1874.
Rails at eastern mills.....	\$82.00	\$68.00
Bar iron at Pittsburgh.....	4 1.5c.	2 1/2c.
Gray forge pig iron at Pittsburgh.....	\$42 00	\$28 00
No. 1 Lehigh pig iron at Philadelphia.....	47.00	33.00

These figures represent an average decline in prices during the past year of over 30 per cent. When it is considered that the prices one year ago, which we have used for comparison, were lower than they have been previously, that money was then abundant and sales for cash were of daily occurrence, and that mill owners and furnacemen then had orders months ahead and now rarely know that they will be able to sell tomorrow what little they make to day, the extent of the disaster to the iron business which yet survives the panic is readily seen.

The Iron Dome of the Capitol.

The iron dome of the Capitol at Washington is 300 feet high, and is surmounted by a metallic statue. In reply to an enquiry, as to whether there was a daily movement of the statue, due to the heat of the sun, the architect, Mr. Clark, gives the following particulars:

The statue on the Capitol has a motion resulting from the unequal expansion of the opposite sides of the dome. The entire length of the line of oscillation of the plummet from the eastern limit to the western limit is only four and a half inches, which would make the inclination in the morning two and a quarter inches to the west, and in the afternoon the same distance to the east. This apportionment of the distance for morning and evening, however, is not strictly correct, and for this reason: that in the morning the east side of the dome is rapidly heated, while the west side is chilled by radiation through the night. Now as the sun passes to the western side of the dome, this side is heated, but as the east side still retains a good portion of its heat, the expansion is more nearly equalized on both sides and the inclination of the statue to the earth to some extent counteracted, so that the inclination to the west is a little greater than that toward the east. The variation is probably about the same all the year around, the extra contracting by cold on one side of the dome during the winter producing the same effect as the extra degree of expansion by heat on the other side in the summer."

Electroplating with Cobalt.

The following process of George W. Beardale, of Brooklyn, N. Y., is stated to form a thick and useful covering, which will very perfectly protect the plated surface from the action of the elements, and form a most beautiful plating, very white, exceedingly hard and durable, tenaciously adherent, and not liable to tarnish:

Dissolve the pure metal cobalt in boiling muriatic acid, and evaporate this solution to dryness. Then dissolve from four to six ounces of the salt thus obtained in a gallon of distilled water, to which add ammonia sufficient to show on test paper the solution just slightly alkaline. Then prepare an anode of the metal cobalt, in granular form or broken into small pieces, free from impurities, as follows: Take a plate of carbon, or of some other material that is a conductor of electricity, but not susceptible of being attacked by the plating solution, and place it within a sack or envelope made of some material that is neither a conductor of electricity, nor attackable by the solution, formed with open meshes or interstices through which the solution may freely circulate. This envelope should be made to conform in shape to the carbon plate, and large enough to leave a space between it and the plate of, say, one half an inch to

one inch; then fill this space with the granules of cobalt, which will, as is evident, surround the plate and be in contact with it.

By an anode thus constructed, a large surface of the cobalt is readily and conveniently exposed to the action of the solvent, and the steady flow of the entire battery current through the cobalt is secured, thereby rendering the dissolution and deposition of the metal steady, uniform, and very perfect.

This anode is to be connected with the copper pole of the battery by connecting the wire to the carbon plate and suspending in the plating solution before described, and the article to be plated is connected in the solution with the zinc pole in the usual way. A battery power of from two to five cells (Smee's battery) will be sufficient to do good work. Care should be taken not to permit the solution to lose its slightly alkaline character, as, if this is not maintained, the plating operation will be rendered imperfect, the tenacity, adherence and uniformity of the deposit becoming thereby impaired.

The Open Treatment of Wounds.

A very remarkable study of surgical cases in the hospital at Zürich has lately been published by Dr. Kroenlein, illustrating the new so-called "open" treatment of wounds advocated by Professor Rose. He compares two periods of several years each, during the first of which the wounds, amputations, etc., were treated by bandaging in the ordinary way.

The results of the two series were, as regards mortality per cent., as follows:

	Bandaging.	Open Treatment.
Thigh.....	86.1	35.7
Leg.....	58.3	18.1
Foot.....	35.2	20.0
Upper arm.....	55.5	14.0
Forearm.....	16.6	0.0
Hand.....	0.0	0.0

Critical researches by the author show that this remarkable result was due neither to the age and sex of the patients, nor to the method of amputation, but solely to the after treatment.

The principal maxims followed by Professor Rose (the present director of the clinic) in the treatment of wounds are to secure absolute rest after arrest of bleeding, and to provide for perfect freedom of discharge and scrupulous cleanliness. Another principle is to interfere with the healing process of wounds only when special indications are afforded, and to consider stitches and bandages of all kinds as interferences to be so avoided. The air to which the wounds are freely exposed in the open treatment must, of course, be pure, and the system accordingly includes the use of energetic ventilation. In the hospital at Zürich, the ventilation is obtained only by constant opening of the doors and windows, a proceeding which, it is true, renders the heating arrangements often insufficient in winter.

The advantages claimed for this open method are:

1. There is no pressure or constriction by dressings.
2. An irritation of the wounds by changing the position and external applications is avoided.
3. There is no danger of infecting the wounds by impure articles.
4. The danger of retention of matter is small.
5. The state of the wounds may be controlled at any time by simply lifting the coverlets.
9. As healing by the first intention is given up, as many ligatures may be applied as are desirable, and thus secondary hemorrhage may be better avoided.
7. The air of the wards is not infected by emanations from the dressings, as in the case of other methods, except Lister's.
8. There is less need of material for dressings, therefore less expense.

Naturally these statistics have excited much attention among surgeons, and corroborative evidence is not wanting to support Professor Rose's views. Mr. Richard Davy, F. R. C. S., writes to the London Medical Times and Gazette that the open treatment of wounds has been practised among his surgical cases for the last five years; the results arrived at have been gratifying, and his firm conviction is that all so-called dressings, to the majority of wounds, are not only needless but injurious.

Amputations, resections, wounds for removal of tumors, injuries, etc., are exposed freely to the atmosphere of the ward. The exceptional cases that receive dressings are burns, scalds, and subcutaneous operations.

The treatment that the wounds are subjected to consists in their adjustment by metallic suture; the atmosphere surrounding the bed is attended to, as to purity and temperature; the surface of the sore is occasionally cleansed by an aqueous spray (the most delicate brush, that destroys itself by usage), and the margins are gently freshened up by a small hog's bristle brush (a separate one for each patient), dipped into clean tepid water.—Medical and Surgical Reporter.

From a comparative pay schedule given in the Naval Gazette, Portsmouth, England, it appears that engineers receive rather more than twice as much pay in the American Navy than is given in the British Navy. For example, an American engineer receives \$2,800 per annum, and the British engineer, \$1,100 per annum.

TO DYE LEATHER BLUE-BLACK.—Take of beeswax 3 ozs., black resin 2 ozs. Melt together, and then add: Prussian blue 1 oz., lampblack 1/2 oz. While the mixture is cooling, add turpentine till a suitable consistency is obtained. It should be applied with a soft rag, and the leather afterwards polished with a brush.

THE TARANTULA WHEEL ROTARY HARROW.

The accompanying engraving represents a novel and, doubtless, very useful agricultural implement to which, from its odd and spider-like appearance, the above appropriate name has been applied. It is a rotary harrow, composed of several wheels, each containing a number of teeth which operate in a manner below described. The wheels are so arranged that they may be turned from a horizontal into a vertical position, thus enabling the device to be conveniently transported from field to field.

At A are two bars, to the inner sides of which are attached brackets, B, through which pass the vertical shafts of the wheels, said shafts being secured by the nuts above. The inner ends of the brackets, C, are slotted to receive cross bars, D, which are secured to them by two bolts, as shown, by removing one of which the connection may be changed from a rigid to a flexible one if desired. In Fig. 2 is shown the position of a wheel when turned vertically on the connection, as above described, as on a hinge. The bars, D, are made with a bow or arch in the middle, to enable the harrow to be used for cultivating corn or other vegetables planted in rows. The harrow teeth are made in U shape, with their ends bent downward and to one side, Fig. 3. The hubs are constructed in two parts secured together by bolts which also pass through the bends of the teeth. The latter are received in grooves, as represented in Fig. 3, and are thus securely clamped and held. The journals are made longer than the hubs in order that the wheels may have play to enable them to adapt themselves to the surface of the ground.

As represented in our engraving, the device is adapted for use as a cultivator, but it may be readily changed to a harrow by hooking the draft bars to the eyes in the brackets, shown at F, at right angles to the beams.

The advantages claimed for the invention are as follows: It is durable, and, being constructed of iron, cannot decay when left out in the field. It is simple in construction. It will run, we are informed, deeper or shallower, as desired. Each tooth cuts through ground three times as far as the distance passed over, owing to the rotation of the wheel, thus harrowing the soil to three times the extent of a simple drag machine. The convenience of moving, afforded by the vertically adjustable wheels, is also a point of merit. There is, besides, a reversible motion in every other wheel when drawn, double harrowing the ground in every direction.

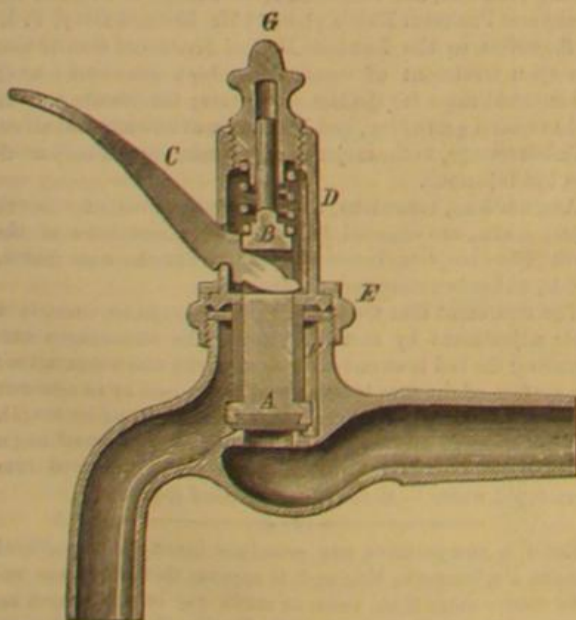
The teeth, it is stated, never choke or clog in any trash, but pull up all that has been plowed under, and scatter it regularly over the surface. None of the soil, consequently, becomes mixed with the refuse, so that the danger of wheat or winter crops freezing, from the springing up of the ground, is largely obviated. For preparing the soil for wheat, we are informed, the machine is especially adapted; and as a cultivator, the inventor states the device to be of great merit.

Two sizes of this harrow are manufactured, one of six wheels, cutting from six and a half to seven and a half feet, making one cultivator. The other and larger size has eight wheels. In field harrowing it is run four wheels abreast, cutting nine feet and nine feet ten inches. By removing two bolts, it is changed into two cultivators. We learn that, in repeated trials, the machine has proved very successful.

Patented through the Scientific American Patent Agency, April 7, 1874. For further particulars address the inventor, Mr. D. L. Benson, Tamaros, Perry county, Ill.

HOTZ'S PATENT SELF-CLOSING FAUCET.

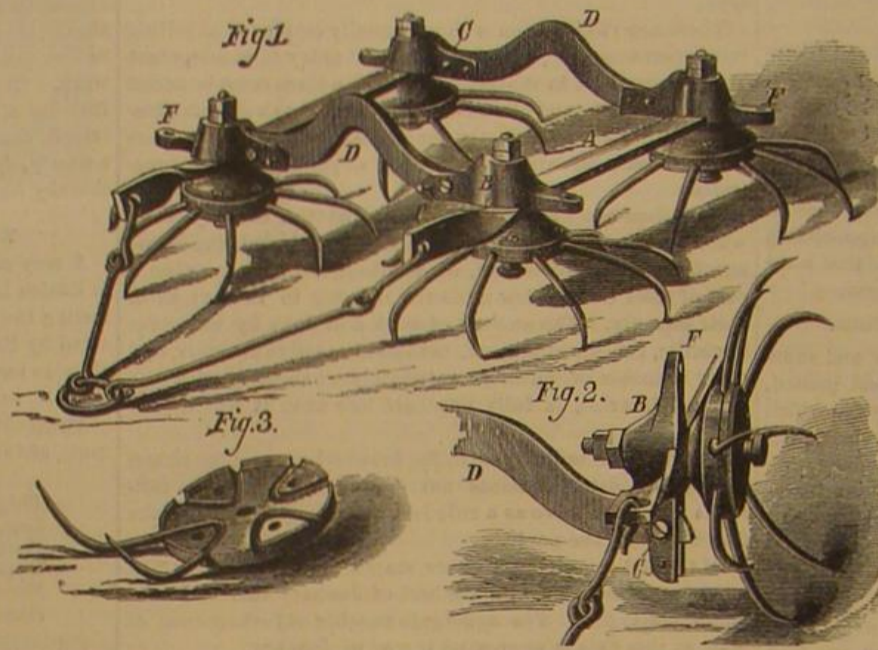
Overflowing basins, leaky faucets, and burst water pipes



are probably the commonest troubles which families in cities have to endure. Plumbers' bills in cities are, as a rule, excessively high, and when, in addition to this expense, the hapless landlord finds himself compelled to pay for the services of a plasterer to repair soaked and fallen ceilings, and of a painter to make good his disfigured walls, it becomes

very clear, to him at least, that an invention which will render water pipes proof against leakage and an overflow of basins is of infinite importance. Faucets which will stay tight, and not require re-grinding every few months, are also an important desideratum. We can assert, from our own experience, having the Hotz faucet some time in use in this office, that it meets all the requirements of a faucet better than any other we have used.

Hotz's self-closing faucet, a sectional view of which is represented in the annexed engraving, is an invention which has been in use some four years, during which time it has withstood severe tests of both frost and heat. The construc-



THE TARANTULA WHEEL ROTARY HARROW

tion consists in a rubber-faced stop valve, A, from the top of which rises a spindle, B, which is slotted to admit the point of a thumb lever, C. D is an upper cylinder, which is flanged and united to the body of the faucet by a union, E, with suitable packing. At the bottom of the cylinder is an annular septum, through which rises the spindle, B. Between the valve, A, and this annular septum, the spindle has, slipped over it, a piece of rubber tubing, F, which abuts against the septum and makes a watertight joint, so that no water can rise into the cylinder. The spindle, B, is made small at the top, and over this portion, and resting upon a shoulder, is placed a coil spring. The upper part of the latter abuts against a male screw, G, which fits into a female screw at the top of the cylinder. Screw G has a milled head, by which it is easily turned up or down to adjust the tension of the spring to the pressure of water against the valve, A. By so regulating the screw that the tension of the spring is just sufficient to overcome the pressure of water against the valve, it is evident that the pipe in connection with the faucet is provided with the means of relieving itself the moment any extra pressure begins within. The tension of the spring, in such case, being overbalanced, the valve will be lifted from below, and water allowed to escape until the equilibrium is restored. No further explanation is, we think, necessary to render it obvious that, so long as the mechanism is properly adjusted and free to work, it is hardly possible for an excess of strain to happen in the pipe.

While this advantage is of first importance, there are others claimed, which are perhaps of nearly equal value. The faucet being self-closing, the danger of its being left running by accident, causing overflow, is obviated. Its construction is such that no grinding of metallic surface is necessary. The deterioration of the piece of rubber tubing and the valve face cannot but be slow; and when worn out, their replacement is a very easy matter, accomplished at a trivial cost. It will be observed that the valve can be regulated to any pressure, and that the water, striking the valve, meets a cushion which is elastic, and hence there is no jarring or hammering of the pipe due to the sudden turning off. Not only is this the case in the single faucet operated; but should the flow from any other cock be quickly stopped, the shock is communicated to the rubber valve which, after lifting, relieves the pipe instantly. From the same cause range boiler explosions will be prevented. Finally, a direct saving is claimed in the cost of pipe, because the heavy tubing necessary to withstand concussions, freezing, and similar forces is rendered unnecessary.

We have had submitted to us reports of several cases which exemplify the successful working of the device, in instances where pipes froze solid throughout a house but no rupture took place. The inventor gives several illustrations (in a pamphlet he has published which parties desiring further information should send for), showing the variety of forms in which the faucet is manufactured in order to suit hydrants, closets, etc.

Considerable ingenuity is shown in the bath tub arrangement, in which the faucet is so governed that it allows water to escape until a sufficient quantity is drawn, when it automatically closes. This is accomplished by a float fastened to a chain of suitable length, attached to the faucet lever. When the float hangs from the latter, its weight is sufficient to raise the valve. The water then runs into the tub until it reaches the float, which it buoys, relieving the lever, and so causing the valve to be shut by its spring.

For further particulars address the E. P. Gleason Manufacturing Co., corner Mercer and Houston streets, New York.

Time Telegraph of the Reading Railroad Company

The manner of giving the correct standard time of the Philadelphia and Reading Railroad Company, to all its telegraph stations, 255 in number, along the main road and all its branches, is as follows: At three minutes to 4 o'clock P. M., daily except Sunday, all business along the lines is suspended; and by means of a series of repeaters, all the lines of this company, 36 in number, are arranged so as to be operated and controlled by one operator at the Reading office, who has a chronometer before him, from which the correct time is given. Commencing at three minutes to 4 P. M., the Reading operator says "time" on the lines, which calls the attention of all operators to adjust their clocks, and is continued at short intervals until five seconds to 4, when he opens the circuit. At 4 o'clock he makes one tap; at fifteen seconds after 4, two taps; at thirty seconds after 4, three taps; at forty-five seconds after 4, four taps, and at one minute after 4, five taps. By this arrangement every telegraph station is able to get the correct time to the second, daily, and thereby have the railroad clocks and watches of the employees properly adjusted, which is a very important matter in the management of a railroad.

Mr. PROCTOR has returned to England from America. He recently gave an intensely interesting lecture at St. George's Hall, Langham Place, on the progress of astronomy in America. Mr. Proctor showed that in many respects the Americans were in advance of Englishmen, both in their instruments and the courageous and rapid manner in which they conduct scientific enquiries. He spoke highly of the manner in which he was received, listened to, and treated in the States.—*English Mechanic.*

CARON'S FOUNTAIN MARKING BRUSH.

Our engraving represents a simple form of fountain brush which will, to porters having goods to mark, expressmen, bulletin writers, and others who have occasion for its use, prove, we think, a handy and time-saving invention. It consists of a rubber tube, A, Fig. 1, lined within with a material known as Frink's indestructible rubber lining, which, we are informed, resists the action of acid compounds. The tube is some five or six inches in length, and has on its upper end a cap and ferrule in one, provided, as shown, with a ring, for suspending when not in use. The lower end has also a ferrule, and is threaded to receive a metal funnel, B, as shown in section, Fig. 2. Over the end of the funnel the brush is slipped. In use, the funnel is removed from its ferrule and the handle filled with ink. The former is then returned; and on being held to write, the liquid flows down to the brush through a small tube, C, which extends up into the extremity of the funnel. It will be seen that the necessity of a pot of ink is avoided, and consequently the hand of the operator ordinarily employed in holding the same is left free. The interior construction is of the simplest description, with no mechanism to get out of order. The ink flows freely, and, from its gradual feed and large supply, lasts for a long time. By its use marks can be easily made on uneven surfaces, such as coarse sacking, which cannot be done, except with considerable difficulty, with the ordinary brush. Fine or coarse lines are readily



traced, as the flow is regulated by the pressure of the hand upon the compressible tube.

Further particulars, regarding sale of rights, etc., may be obtained by addressing Mr. William A. Caron, No. 145 Union street, Springfield, Mass., or Mr. F. W. Wentworth 45 Green street, Boston, Mass.

EMANUEL CHURCH, CLIFTON, ENGLAND.

The large and commercially important city of Bristol is so crowded with docks and warehouses that its merchants are driven out of town for residences; and the beautiful parks and avenues of Clifton, which crown the noble downs overlooking the opulent metropolis of western England, are studded with many exceptionally fine public buildings. One of the best of the recent structures is a church of the perpendicular order, of which we present a view. The building, says the *London Builder*, from which we select the engraving, is spacious and lofty, measuring internally 122 feet by 60 feet, and the roof carried through a uniform height of 60 feet. The chancel is apsidal, and measures 39 feet by 28 feet. The nave is of five bays, with lofty arcade arches springing from circular columns. Arcades of two bays divide north and south chapels from the chancel, designed for vestries and organ chamber.

The church is built of the native stone, of a reddish tint, with bands of deep red sandstone. The dressings are of Bath stone; the chancel steps and dais of Limerick marbles and encaustic tiles. The reredos is carved with subjects in high relief. The steeple reaches to a height of 232 feet, the tower being 108 feet, the spire 114 feet high.

The Polysphenic Ship.

Proceeding from the well known fact that when flat bottomed vessels are urged forward by a strong propelling force their bows are lifted, and in that way some advantage of speed is gained, Mr. Charles Meade Ramus, M. A., Trinity College, Cambridge, designed a ship in which the bottom was composed of two parallel and consecutive inclined planes, so that, being simultaneously lifted fore and aft by two similar lifting forces at the highest rate of speed, it might be able to so maintain its equilibrium as neither to drop forwards nor turn over. Experiments with models showed that a vessel so constructed would, when driven at a sufficiently high speed, rise evenly over the water, so as to skim over it. Further trials proved the superiority of five or six inclines over the lesser number. From the results of his experiments Mr. Ramus calculates that 5,000 horse power will give to a 2,000 ton ship any speed up to sixty knots an hour. Having employed rockets as the propelling power in his experiments, the idea was suggested of using the vessel as a rocket float. Mr. Ramus estimates that a 100 lbs. rocket would be capable of driving a float of one ton displacement at a hundred knots an hour to a distance of two miles. This float, he adds, would carry quite half a ton of explosives, and it is at least very doubtful whether the sides of any ironclad would resist the shock of the explosion that would take place on contact.

Effect of Heat on Textile Fabrics.

Recent experiments on disinfection by means of heat, made by Dr. Ransom, of Nottingham, England, show that white wool, cotton, silk, and paper may be heated to 250° Fah., for three hours without apparent injury, although the wool will

show a faint change in color, especially when new. The same may be said of dyed wools and printed cottons, and most dyed silks; but one kind of white silk easily turns brown by this heat, and pink silks of some kinds are also faded by it. The same temperature will, if continued for a longer period, slightly change the color of white wool, cotton, silk, paper, and unbleached linen, but will not otherwise injure them. A heat of 295° Fah., continued for about three hours, more decidedly singes white wool, and less so unbleached and white cotton and white silk, white paper, and linen, both unbleached

out-going currents, which represent the maximum and minimum temperatures of the chambers. A self-acting mercurial regulator maintained the temperature of the entering current at any required degree.

The Woolwich Furnace.

The Royal Gun Factory, at Woolwich, has been for some time past conspicuous for its efforts to economize fuel, both for steam and manufacturing purposes, and it is now possessed of a novelty in furnaces, in which the economy of fuel

is a striking feature. It is at present applied both to reheating and puddling, and its consumption of fuel and yield of iron taken with scrupulous accuracy.

The saving of fuel is, over a period rising to six months, an average of 40 per cent, while the saving in fettling in the puddling furnace is scarcely less remarkable. The durability of the furnace is also much greater, and the provision against an excess of free air—the pestilent source of waste in the iron trade—is peculiar and effectual in saving iron, whether in reheating or puddling. The plan on which the furnace is constructed is to provide an ordinary furnace with an upcast at the rear of the existing combustion chamber, and in contact with it. The products of combustion from the furnace are led into the said upcast by passing either over, under, or around the body of the furnace. In the upcast is placed a conical cast iron tube in a vertical position, and between the sides of which and the upcast are spaces for the free circulation of the products, the heat of which is taken up by the cast iron vessel or tube. This tube is fitted with a hopper at the top, and check dampers, by which the fuel is let into it without the intrusion of air. Its capacity is equal to containing 12 cwt. of coal, which is kept up by regular charges of about 2 cwt. Its temperature is usually at a bright red heat, and as the fuel descends it is freely rarified. It is provided with an outlet into the combustion chamber, through which a constant stream of carburated hydrogen is passing over the fuel on the fire bars, taking up the free air passing through the interstices of the fuel, and arresting their wasting action in the furnace. The remainder of the fuel that becomes coked is passed by the same channel on to the fire bars coked and hot, so that no cold fuel passes into the combustion chamber. The amount of heat thus carried back into the furnace, and which is the

great economizer, can be partially estimated from the fact that, in place of the waste gases passing off at some 3,000 degrees, it does not exceed 500 degrees, as they escape into the stack beyond the region of utility. These furnaces are not complicated by mechanical aids, the combustion being carried on by indraught. They are easy of adaptation to existing plant, incur but a trifling expense, and give great durability to the bricks, being free from the chemical action so common to furnaces of less perfect action. The present puddling furnace has yielded 250 tons of iron—the work of an ordinary furnace—and is far from its termination. Here a want, urgently pressed upon our attention by ironmakers, seems to be met.—*The Engineer.*



EMANUEL CHURCH, CLIFTON NEAR BRISTOL, ENGLAND.

and white, but does not materially injure their appearance. The same heat, continued for about five hours, singes and injures the appearance of white wool and cotton, unbleached linen, white silk, and paper, some colored fabrics of wool, or mixed wool and cotton, or mixed wool and silk. It is noteworthy that the singeing of any fabric depends not alone upon the heat used, but also on the time during which it is exposed. In these experiments the heat was obtained by burning gas with smokeless flames, and conducting the products of combustion, mixed with the heated air, by means of a short horizontal flue into a cubical chamber through an aperture in its floor, and out of it by a smaller aperture in its roof. Fixed thermometers showed the temperature of the entering and

ASTRONOMICAL NOTES.

OBSERVATORY OF VASSAR COLLEGE.

For the computations of the following notes (which are approximate only) and for most of the observations, I am indebted to students. M.M.

Positions of Planets for June, 1874.

Mercury.

On the 1st of June Mercury rises at 5 in the morning and sets at 8h. 15m. in the evening. On the 30th, Mercury rises at 6h. 40m. A. M., and sets at 9h. 2m. P. M. This planet should therefore be seen after sunset during the latter part of June.

Venus.

On the 1st of June Venus rises at 6h. 8m. A. M., and sets at 9h. 22m. P. M. On the 30th, Venus rises at 7h. 9m. A. M., and sets at 9h. 33m. P. M.

On the 3d of May Venus and Mars were so nearly at the same point of the heavens that, in a telescope of large field, the two could be seen at the same time, giving an excellent opportunity to notice the difference of color. Both are very small at present, being far from the earth.

Mars.

On June 1, Mars rises at 5h. 6m. A. M., and sets at 8h. 12m. P. M. On the 30th, Mars rises at 4h. 36m. A. M., and sets at 7h. 42m. P. M.

Jupiter.

On the 1st Jupiter rises at 0h. 36m. P. M., and sets at 1h. 8m. the next morning. On the 30th, Jupiter rises at 10h. 54m. A. M. and sets at 11h. 18m. P. M.

On May 2 the shadow of Jupiter's fourth satellite passed across the disk of the planet, just skirting the northern edge, appearing like a small black spot. It was seen for 2h. and 15m.

On May 3 Jupiter's third satellite was occulted, that is, the planet seemed to pass over its satellite.

On May 7 the first satellite made a transit across the planet, or the satellite seemed to pass over the planet.

On May 14 the shadow of the third satellite passed across the face of the planet, as a brownish-black spot, not perfectly round. It was seen for about 3 hours.

The broad belt of Jupiter, always seen near the middle of the disk, is at present slightly rosy in color.

Saturn.

Saturn is very beautiful in the early morning, about 4 A. M. It rises at 11h. 29m. P. M. on the 1st of June, and sets at 9h. 21m. the next morning. On the 30th of June it rises at 9h. 33m., and sets at 7h. 21m. the next morning.

Uranus.

Uranus is not well situated for observation and requires a good glass. It rises at 8h. 43m. A. M. on the 1st, and sets at 11h. 10m. P. M. On the 30th it rises at 7h. 1m. A. M., and sets at 9h. 21m. P. M.

Neptune.

It is useless to attempt to see Neptune at the present time. It rises just before daylight on the 1st of June, and sets in the afternoon. On June 30th it rises a little before 1 A. M., and sets at 1h. 54m. P. M.

Meteors.

Meteors were frequent on the morning of April 28; one brighter than Jupiter was seen at 3h. 15m. A. M., starting from *Taurus*.

On the morning of May 12th, from 3 A. M. to 3h. 30m. A. M., meteors were somewhat frequent.

Sun Spots.

The record is from April 18 to May 15. The number of observations is larger than usual. Generally speaking, the spots have been of good size, rather more numerous than usual this year, and have shown little change from day to day. A very interesting series of photographs has been obtained of a group which was first seen on May 7. Reckoning by its subsequent movements, it was then about 12 hours since the sun had turned it fully in sight (or since it had entirely cleared the eastern limb to an observer on the earth). When it was half way to the center, its daily motion was about equal to its width; at the center its motion was about once-and-a-fourth its width. Comparing from day to day, there were very gradual changes, so that its recognition was unmistakable. These small successive changes reached, however, such an amount that, after crossing the disk and reaching the western limb, there could be no likeness traced between its appearance then and its appearance on the 7th. It was seen during eleven days. The ingress and egress were not observed; but estimating by the rate of the passage when near the limb, it occupied twelve or thirteen days for the entire passage from limb to limb, its course being nearly a diameter of the disk. Its rate was more rapid over the latter half of its course, showing that it must have had a motion besides that due to the sun's revolution on its axis. When in the center, twenty-five constituent spots were counted on the photographed disk (which has a diameter of $3\frac{1}{2}$ inches). It had then widened to three times its breadth when at the edge.

Faculae were conspicuous on May 17, but have generally been infrequent.

Zodiacal Light.

This phenomenon, so seldom seen in the spring later than March, was noticed on the evenings of May 3, 5, and 8, stretching very obliquely from the northwest towards the stars of *Castor* and *Pollux*.

Barometer and Thermometer.

The meteorological journal from April 18 to May 17 gives the highest barometer, May 11, 30.41; the lowest barometer, April 26, 29.41; the highest thermometer, May 16, at 2 P. M., 88°; the lowest thermometer, April 18 and April 29, at 7 A. M. 31.5°.

Amount of Rain.

The rain which fell between the morning of April 20 and the morning of April 21 amounted to 2.53 inches.

The rain which fell during the day of April 23 amounted to 0.43 inches.

The rain which fell during the night of May 15 and the morning of May 16 amounted to 0.33 inches.

SOCIAL SCIENCE.

The American Social Science Association is now in session in this city. Several able and learned papers have been read and discussed, from which we give below brief abstracts of the conclusions reached. President Gilman, of the University of California, spoke in reference to that State as a social study. He considers that California is rapidly becoming the center of bullion operations for the world, and that, through the resistance of the State to a paper currency circulation, it has had no share in the panics which have visited other sections of the country. California was one of the first States to inaugurate hostility toward the predominant influence of railroad corporations and monopolies. Erroneous impressions, the speaker stated, exist in the East regarding the state of society, but the future will show that in California the best forms of Christian culture and civilization are to be in the ascendant, education is to be widely diffused, and the favorable sky and soil are to render the physical conditions of life enjoyable to an immense population.

Mr. David A. Wells read a lengthy and exhaustive paper on the rational principles of taxation. It would occupy too much space for us to trace the cogent arguments adduced by the learned speaker, but the general conclusion to which his investigations lead is that the rational principle of taxation is to tax but comparatively few articles, tangible property and fixed signs of property, for in this way only can taxes be assessed equitably, uniformly, and economically; and then leave them to diffuse, adjust, and apportion themselves by the inflexible laws of trade and political economy.

Professor Benjamin Peirce discussed the subject of ocean lanes for steamships, and advocated a systematic organization of the paths of the Atlantic steamers, so as to remove the principal source of the dangers of collision. He considers that, when the number of steamers is increased tenfold, as it will be before many years, each vessel will be in direct proportion liable to destruction from the above cause. The meridian of greatest danger is that of 50° west of Greenwich, as in that locality dense fogs, squadrons of fishing vessels, and stranded icebergs abound. The speaker said that the route taken by the Cunard line reduces the dangers to the least amount, and in conclusion suggested that some provisions on the subject, introduced into marine policies, might be wise and effective. It might be well also to have the logs of all steamers examined, and to cause an adverse report to be a serious and dreaded result.

In a paper on American and European railroads, Mr. Gardner G. Hubbard, of Boston, dealt with the question of cheap transportation. He quoted the opinion of the Senate Committee, that the only means of securing and maintaining trustworthy and effective competition between railways is through national and State ownership or control of one or more lines which, being unable to enter into combination, will serve as regulators of other lines. If two parallel routes between 400 and 500 miles apart, with the Mississippi river in the center, are extended from the Gulf to the Canadian boundary, they will embrace the best cotton, corn, and wheat lands in the world. A short canal will connect the Mississippi with the lakes. A comparatively small sum will open these routes for three quarters of the year. The Senate Committee believe that the most advantageous channels of commerce to be created and improved by the government are the Mississippi river, the northern lines by the lakes, a central line by the Ohio, through Virginia to Richmond, and the southeastern route by the Tennessee, through Alabama and Georgia to the ocean.

The first will open the Mississippi from the Falls of St. Anthony to the Gulf of Mexico. The northern line will open a navigable way through the lakes, the St. Lawrence, the Welland, Erie, and Caughnawaga and Champlain canals, and the Hudson river to New York. The other lines will open the Ohio and Tennessee rivers to their head waters, and thence connect by canals or freight railways with the ocean at Richmond or Savannah. The House Committee recommended a double track freight railway from the Mississippi river to New York, with branches to Chicago and St. Louis, and that government aid shall be given by indorsing the bonds of the company for one half the actual cost of the road, the rates of freight to be fixed and incorporated into the charter. The Senate Committee report favorably on this plan, and it is difficult to understand why they gave the preference to the Richmond route. The cost of the canal and slack water navigation, they estimate at \$55,000,000, or nearly the same as that of the freight railway, and the freight charges will be nearly 10 per cent less by the latter, with a saving of from two to three weeks in time. The railroad will never be closed, while the canals will be frozen at least one month in each year. The benefits that will result from the opening of such a road to the whole country can scarcely be overestimated. The cost of transporting grain from the west will be reduced one half, which will be equal to a saving of \$47,000,000 on the product of 1872. This reduction will enable us to compete with Russia for the supply of Great Britain, and give a market for all our surplus. It will reduce the price of breadstuffs to every consumer in the East, and, in an equal ratio, the freight on merchandise and manufactures to consumers in the west. The speaker admitted the inexpediency of government undertaking that which can be performed by private enter-

prize, but believed that this is the only way in which the needed relief can be obtained.

Dr. J. Foster Jenkins, speaking of tent hospitals, said that the tents should be made of cotton, rather than flax. They should have board floors, either covered with oilcloth, in order to prevent fluids from sinking into the wood, or, preferably, waxed or coated with paraffin. All tents should have a double roof; the ventilation will be better and they will be drier. Both should have openings near the ridge for ventilation. The heating in winter should be by stoves placed underground at the end of the tent, with pipes carried through under the floor.

FLUID EXTRACT OF CHESTNUT LEAVES.—Dr. J. Eisenmann, of Vienna, has experimented with a fluid extract made from the leaves of the European variety of *castanea vesca*, as a remedy for whooping cough which had but recently entered into the spasmodic stage, and in which the subsequent course of the disease could be well ascertained. The results were so favorable that the author calls the attention of European physicians to this remedy.

COMMISSIONER'S DECISIONS.

CLAIMS FOR THE ARTICLE AND APPARATUS IN ONE PATENT.—IMPROVEMENT IN THE MANUFACTURE OF WATCHES. [Decided May 11, 1874.]

LEGGETT, Commissioner.
This applicant comes before the Office with three applications for patents, comprehending, respectively, watch case bezels, watch-case centers, and watch-case backs. In each application the article is claimed and also the die by which it is made. The Examiner requires that each application shall be divided. I had occasion to consider the matter of division of applications in the case of Murray and Waterich. (*Official Gazette*, vol. 3, p. 559.) I do not find any reason now for departing from the tenor of the decision in that case, in which it was stated that the division of applications is matter entrusted under the law to the discretion of the Commissioner; and that the general rule established by the Supreme Court of the United States is that but one distinct subject of invention can legally be embraced in a single patent. Nor have I any doubt that the facilitation of official examinations and the prevention of mistakes in the granting of patents renders it important to the public, and for the true interest of inventors, that the discretion of the Commissioner in enforcing the rule of unity of subject matter in each patent should be exercised to carry the operation of the rule as far as is consistent with reason and justice in every instance. But it cannot be ignored that there are some cases where two things, in one sense entirely distinct, are yet so intimately connected as to have been not only one in inception in the mind of the inventor, but to be inseparable in practical use. A die and its counterpart—the article it forms—are often of this kind. The watch bezel under consideration, for instance, could not be made to be of any use in the manufacture of watches except essentially in the manner hereinafter described, it must be struck up from ductile metal with a die. It could not be profitably cast, spun, or made by hand. Its excellence is due to its form and to its being made of a single piece. The die which is employed must, therefore, always be used to make this article. If two patents were granted, one for the die and the other for the bezel, each might defeat the other, unless the manufacturer should own both. One would always be as ineffectual without a right under the other as one half of a pair of shears without the other half. If, cannot, I think, be good policy to require a division of applications in such cases, so far as the decision in the case of Murray and Waterich may seem to sanction divisions of applications in cases of this nature, I desire to restrict its operation as authority for Examiners in the practice of the Office. The decision of the Examiner is overruled.

COMBINATION CLAIMS.—IMPROVEMENT IN ENVELOPE COUNTING MACHINE. [Decided May 9, 1874.]

TRACHER, Acting Commissioner.
The Examiner objects to the second and third claims "because they do not include the elements necessary to a complete cooperative, unitary result."
The claims are as follows:
1. The tilting table N, in combination with the main double inclined table B, substantially as and for the purposes described.
2. In combination with the tilting table N and main double inclined table B the combined slide and pusher plate L, substantially as shown and set forth.
3. The tilting table and the double inclined table serve the purpose of furnishing a way, first in one direction and then in the other, along which the bunch of envelopes is to be passed.
These two devices, in combination with the pusher, constitute that portion of the apparatus which is necessary to force the bunches along the table, inclined first in one direction and then in the other.
These results are unitary in character. They are not, to be sure, complete; nothing short of the finished operation of the machine can be called a complete result. If a legitimate combination must contain all the elements necessary to a complete result, there can be but one combination claim on any machine, and it must necessarily contain all the devices found in such machine.
The Examiner fails to distinguish between a unitary and a complete result. A complete result may be the combined effect of several unitary results.
It is undoubtedly correct that a combination must contain all the essential elements necessary to secure some distinct and definable result in the operation of a machine, and such result may be called, for want of a better term, unitary. It is only necessary to inquire whether this is done to determine, in any given case, whether the combinations claimed are proper or not.
As stated above, in my opinion, the two claims to which objection is made do include all the elements necessary to unitary results.
The ledge, which the Examiner requires to be included in the combination in each case, is for a distinct purpose, to wit, the support of the elevated ends of the envelopes. It is, perhaps, a consequence of the tilting table and double inclined way, but is not a necessary device to the operation of those elements in the performance of the limited function ascribed to them. In fact, if the faces of the double inclined table were made somewhat wider than half the length of an envelope, no support for the outer ends of the envelopes would be required.
The decision of the Examiner is reversed.

DECISIONS OF THE COURTS.

United States Circuit Court—District of New Jersey.
IMPROVEMENT IN PILE LOOMS.—WILLIAM WEBSTER *et al.*, vs. THE NEW BRUNSWICK CARPET COMPANY.

NIXON, District Judge.
This bill is filed against the corporation defendant for infringing certain letters patent No. 153,981, issued to William Webster, August 27, 1872, for "a new and useful improvement in looms for weaving pile fabrics."
This answer denies the infringement, and sets up as a defense a prior invention by one Ezekiel K. Davis; and that letters patent were granted to him for inventions in looms for weaving pile fabrics, dated February 9, 1868, and numbered 83,651; that the looms which the defendant had in use, and which were alleged in the bill of complaint to infringe the Webster patent, were constructed and operated in conformity to the description contained in the said patent to Davis; that defendant had a license under said patent to use said looms, and that they rightfully and lawfully used under said license.
The Court stated that it was a fair deduction from the testimony that Davis acquired all of his knowledge on the subject from the inspection of Webster's original drawing, made by him in the winter of 1865-66, and exhibited to Davis and others in the spring of 1868. That he did not comprehend the value of the invention, or that he did not then seem himself to be its original and first inventor, is also to be inferred from the fact that it was not claimed in his patent of the subsequent year.
The delay of Webster in taking out his patent after he had completed his invention seems to be satisfactorily explained. Under the circumstances it was not unreasonable. It is the sad story of poor inventors patiently waiting at the door of rich capitalists. The Bigelow patent was about expiring and Webster's new wire motions could only be used in union with some of the patented ingredients of the Bigelow loom. He was unable to make an arrangement with the Bigelow loom, who were licensees of Bigelow, in regard to the adoption of his improvements, and as he could not get others, like Weaver or Beattie, to unite with him from fear of suits for infringements, he was obliged to wait, either for the death of the Bigelow patent or until the heart of capital should relent, in order to give his invention to the world under circumstances that might afford him some compensation for his years of thought and unrewarded effort.
The Court gave a decree for the complainants according to the prayer of the bill, holding substantially as follows:
In a patent for a loom for weaving pile fabrics one claim was for "the lay and its rigid shuttle box, the pivoted vibrating wire trough, the reciprocating driving slide, and the latch moving thereon," and "operated by the wire box," all in combination, and the wire trough was described as vibrating horizontally upon a pivot at one end, to and from the shuttle box, and it was held that a wire trough vibrating upon a horizontal rock shaft underneath was the equivalent of the one described; and a loom with such a wire trough, but in other respects like the one described in the patent, was adjudged to be an infringement.
A patent for a combination is infringed by the use of a similar combination, although one of the elements is omitted, and another is substituted for it, unless the substituted device is a new one, or performs a function essentially different, or was not known at the date of the patent as a proper substitute for the one omitted.
Where the inventor of an improvement upon a patented machine could neither make an arrangement with the owners of the patent to adopt it nor use it without infringing the patent, nor induce others to take it up, and was poor, he was held not to have lost his right in it, although he delayed applying for a patent until another person had made the improvement and obtained a patent for it.
C. A. Seward and E. R. Child, for complainants.
George W. Ford and Wayne Parker, for defendant.

Recent American and Foreign Patents.

Composition to be Applied to the Surface of Paper for Artificial Flowers.

Paul E. Vacquerel, New York city.—This is a composition for protecting and preserving the vegetable paper applied to artificial flowers, consisting of copalony, gum dammar, and camphor, spirits turpentine, poppy seed oil, kerosene, and castor oil. It is an improvement on the composition patented by the same inventor, October 21, 1862.

Improved Scroll Saw Table.

George Halkett Patullo, Dexter, Mich., assignor to himself and David A. Boggs, same place.—This invention relates to the mode of adjusting the tables of scroll and similar saws for sawing scrolls or other forms, square or on a bevel; and consists in the construction and arrangement of parts, by means of which the table is rotated on its pedestal while standing level or at any desired angle with the saw.

Improved Hand Potato Digger.

Horace S. Phelps and Alfred Phelps, Franklin, N. Y.—In using the machine, the upper end of a jointed handle is pushed outward, which raises one set of prongs away from another set, and allows the latter to be thrust into the ground in the manner of an ordinary fork. The end of one handle is then drawn toward another handle, which forces the prongs into the ground to meet the others, inclosing the potatoes between the prongs. The operator then lifts the digger upward, draws it toward him, shakes out the dirt, and drops the potatoes into a basket by pushing one end of a handle outward, leaving the parts in position for the prongs to be again thrust into the ground.

Improved Mitten.

Solomon J. Clute and Daniel M. Durfee, Rockwood, N. Y.—This invention relates to the old and well known class of one fingered mittens, and consists in constructing them from a number of pieces, cut with much economy of material. The palm comprises a piece, which is the palm of the forefinger, another piece, which is the side and back of the front finger and part of the back of the hand, with an extension to take the place of the fourchette of the first finger. The edge of the said extension is sewn to the edge of the part not so extended. The palm and back are formed from the junction of the fore and second fingers at the back of the wrist. An extension takes the place of the fourchette of the forefinger, and is sewn to the edge of the palm, along the inside of the second finger.

Improved Hydrant.

Michael Allen, Schenectady, N. Y.—To pack the joint so as to prevent leakage between the bar connecting the valve with the screw which operates to open and close it and the bottom of the groove in which it works, is a thimble in the passage, an elastic ring, and an adjusting nut, by which the inner end of the thimble is pressed watertight on the bar.

Improved Steam Mining Pump.

Andrew N. Rogers, Central City, Col. Ter.—This invention consists of a reciprocating steam cylinder with a stationary piston and a continuous acting force pump in a light strong frame, having apparatus by which it can be conveniently suspended by ropes and pulleys, so as to be conveniently adjusted as the work progresses. The steam is conducted down to the engine by pipes, and the water is forced up by other pipes, of which sections will be added on as the engine descends. The invention also consists of certain improvements in the construction of the engine and the pump to adapt it for the use for which it is intended.

Improved Plow.

John M. Tingley, Clifton Hill, Mo.—This is an improved short beam plow so constructed that the beam may be adjusted to cause the plow to run deeper or shallower, and to take or leave land, without removing a bolt, and which will enable the beam to be easily detached without removing a bolt. The invention relates specifically to the combination, with the standard and beam, of devices for adjusting the beam.

Improved Hose Patch.

Oscar E. Phillips, Richmond, Va.—The object of this invention is to provide ready and convenient means for repairing hose or pipes employed for conducting water or other liquid, when from over pressure or other cause they have burst or holes have been made therein; and it consists in a metallic patch composed of an inner and an outer plate, between which the hose is clamped by means of one or more screws.

Improved Screw Forming Machine.

Peter H. Howell, Black River Falls, Wis.—This is a guide attachment for swaging machines by which stove and other pipes may be produced with screw threads, so that they may be readily put together and disconnected and the slipping of the same or escape of ashes or sparks be effectually prevented. The device consists of two main standards which carry a vertically and laterally adjustable arm with two wheels, on which the stove or other pipe is placed and fed, under suitable inclination, to the swaging machine.

Improved Violin Bow Rosiner.

Thomas H. Hathaway, New Bedford, Mass.—This is a pocket case for the rosin, which may also be employed for a handle while applying the rosin to the bow hair; and it consists of a little paper or leather case of approximately elliptical form in cross section, open at both ends to allow the bow to be drawn forward and back through it, and provided with end flaps which close the ends and fasten together along one side. In this a piece of rosin is secured, about half filling it and extending from end to end, so as to be rubbed along the string without having to touch the rosin by the hand.

Improved Hay Loader.

Carmi O. Benton, Topeka, Kan.—The axle is bent at right angles near each end, to bring its middle part sufficiently near the ground. To the ends are attached bars, the forward parts of which meet and have an eye to hook upon the middle part of the axle. The bars project to the rearward, and rakes are pivoted to them. When passing from place to place, by unhooking the chain, the rake may be turned up to rest upon the elevator frame. The latter may be adjusted closer to or further from the ground, as may be required. To an endless apron, at suitable distances apart, are attached cross bars, which are provided with prongs, by which the hay collected by the rake teeth is taken from said teeth, carried up the frame, and deposited upon the wagon. The elevator is operated by the advance of the machine.

Improved Cotton Scraper and Thinner.

Charles T. Dollahon, Pittman, Ark.—This invention consists of a master wheel, the axle of which is mounted on the left hand side of the beam, from which a bar extends to the rear end and supports a number of cultivators for cultivating the right hand side of the row, while the wheel runs along the left hand side, and is followed by a scraper on that side. A shaft geared with the master wheel extends across to the left hand side, and has a crank at that end connected with a horizontal elbow lever, which works a chopper, and causes it to chop out portions of the row at certain distances apart. The elbow lever is connected with the crank by contrivances arranged so that it can be thrown out of gear and remain inoperative while the machine is running along one side of the row, as it is only necessary for it to work during one passage of the scrapers, while they are required to run twice along the row, once on each side. Thus the machine scrapes off on one side, cultivates on the other, and chops out, all at the same time, and by running both up and down the row scrapes off and cultivates both sides.

Improved Ice Pitcher.

Joseph B. Cox, Mount Laurel, N. J.—This invention consists in providing a cup on the front side of the pitcher for containing sponge, and a gutter which communicates with it. The water accumulating in the gutter will be taken up by the sponge, so that it cannot be spilled in handling the pitcher, as it would be liable to be allowed to remain in the gutter.

Improved Vapor Bath.

Volney Miller and Horace Cole, Andover, Mo.—There is a small case for confining the vapor, which incloses the whole of the body except the head. There is a vertically adjustable seat under which is a vapor-distributing pan, under which the alcohol lamp is burned. Suitable dampers are provided to regulate the entrance and escape of the vapor.

Improved Die for Welding Links.

John B. Baugh, Detroit, Mich.—This invention consists of a bed die and of two wedge-shaped link dies, which latter work in the bed die and are raised therefrom by a lever which throws up wedges and allows the link to be removed. The face of the steam hammer which strikes the link in the operation of welding has an orifice which receives the top part of the link and thereby keeps the link in place when the welding blow is struck. By this apparatus the operation of welding links for car couplings and for other purposes is greatly facilitated.

Improved Milk Safe.

Hiram Babcock, Aplington, Iowa.—This invention consists of a safe provided with hollow sliding shelves, which are closed at the sides, but open at the ends, where they connect, by slotted apertures, with air chambers at both sides of the shelves, through which a current of air is kept up by regulating draft holes and a pipe connection with chimney.

Improved Medical Compounds.

Robert E. Roberts, Bonham, Texas.—The first compound is prepared for use in the form of pills, of about the weight of three grains each, and consists of podophyllin, leptandrin, extract of butternut bark, extract of rhubarb, extract of jalap, powdered capsicum, sulphate of quinine, and salicine. These pills operate as a tonic as well as a cathartic, and are successfully employed in the treatment of a great variety of diseases. The second compound is also in pill form, and consists of podophyllin, leptandrin, extract of rhubarb, extract of jalap, extract of butternut bark, making a three-grain cathartic pill. These pills are employed for the cure of various diseases, more especially those which affect the bowels and digestive organs.

Improved Clothes Pounder.

David Graffin, Catawauqua, Pa.—This machine for washing clothes may be used with an ordinary wash tub. The invention consists in a disk made concave upon its lower side, and convex upon its upper side, to which is attached a standard and cross handle. Under the disk is secured a semi-spherical knob, and at equal distances from each other are attached four radial semi-cylindrical blocks, the ends of which are rounded off. Midway between each two blocks are attached radial blocks, which are grooved transversely, and the space between each two grooves is rounded off into semi-spherical form. In the spaces between the latter blocks are attached short radial blocks, the ends of which are rounded off, and in which are formed two or more transverse rounded grooves. The concavity draws the clothes in beneath it, so that they will receive the full force of the blows. As the device is raised, its concavity tends to draw the clothes up with it, which loosens the clothes and causes them to move, so that they may become more quickly saturated with water.

Improved Lamp Trimmer and Extinguisher.

William Walton, Williamsburgh, N. Y.—This is an attachment for lamp burners, so constructed that it may be used for trimming the wick and extinguishing the flame, and which shall be simple in construction, convenient in use, and effective in operation. There is a flat wick tube, around which is fitted a sleeve, from which, upon the opposite sides of the wick tube, project two jaws, the upper ends of which are inclined inward, so as, when the sleeve is pushed up, to meet above the top of the tube and pinch off the wick. Suitable devices prevent the jaws from pressing against the wick before they have risen to the proper height above the tube. When the jaws come together, they may form a close cap over the top of the wick tube, and thus extinguish the wick.

Improved Watch Case Spring.

Levi Stone, Mount Vernon, Ohio.—This invention relates to wire springs for watches, and consists in providing one end with a fastening brace, whereby the same spring may be adapted to any case by cutting off a little, more or less, from the end of the brace.

Improved Pump.

George W. Robaugh, Lee Summit, Mo.—This pump consists of a central tube, which guides a piston in the usual manner, surrounded by an outer tube of larger diameter, forming a chamber around the inner tube, and discharging the water from a pipe extending upward from the base of the outer tube. The outer tube has an extension of smaller diameter, in which a second piston with a central valve is guided, it being attached to the extension of the upper piston rod. The lower part of the extension tube connects by a common conical valve in the usual manner with the well tube. The water is raised by the up stroke of the lower piston through the bottom valve into the lower part of the main tube, passing on the down stroke through the valve of the lower piston into the upper part of the main tube, until the same is nearly filled. Each up and down stroke forces then, by the joint action of the pistons and the pressure caused thereby, the water through the discharge pipe, so that a regular and continuous stream of water issues therefrom.

Improved Grinding Wheel.

John T. Henry, Hampden, assignor to himself and Joseph Munger, Waterbury, Conn.—To form a secure and durable attachment of a stone or wheel to its arbor, the same is cut thicker at the center, or around the central opening, and provided with circular shoulders to engage with corresponding shoulders on clamps. One clamp bears against a collar, while the other is forced up and tightly clamps the wheel by a nut.

Improved Portable Fence.

James L. Griffin, Cusseta, Tex.—This improvement in fences consists of half dovetail projections on the ends of the panels, by which the meeting ends of the panel are locked together within a long yoke extending from bottom to top of the panels, and are fastened with a key. The panels are mounted on stakes or blocks, and supported by braces. The object is to furnish a light and cheap fence, which can be manufactured at the mill, and carried into the field ready to put up, and which can be readily taken down and moved about as wanted.

Improved Press.

John Gramelspacher, Jasper, Iowa.—This invention consists of a brake lever pivoted at the middle in the top of the follower stem, and having a fulcrum on each side of it on a rod working up and down through a guiding and supporting beam. The rod also works through a gripping pawl, which allows it to descend freely, but grips and holds it against rising, so that the fulcrum of one side descends while the other is holding the lever for pressing the follower down. This causes the follower to be forced down quickly by the vibrations of the levers.

Improved Stove Pipe.

David Boyd, New York city.—An annular flue is left between outer and inner pipes for the passage of the smoke and heated gaseous products of combustion. By this means, instead of a central column of ascending heat, the heated gases are spread out into a thin layer, and are compelled to part with their heat before being discharged.

Improved Furnace Attachment for Steam Boilers.

Thomas Hall, Lawrence, Mass.—This invention consists of a frame, which is placed on the rear ends of the grate bars at the fire bridge, being open at the bottom, with forward projecting top piece and connecting sides, to which a front plate is attached. This plate extends laterally across the casing, and is inclined diagonally toward the top corner of the same, and is there provided with recesses, through which a current or sheet of air is connected and thrown forward to mingle with the fire gases for their more complete combustion.

Improved Dough Kneader and Cutter.

Frank Mœckel, Galveston, Tex.—This invention is an improved instrument for rapidly and thoroughly kneading dough, and for scraping, rolling and cutting the same, and consists of a main part of U shape, with curved lower part and ends, which main part is used for kneading the dough, while a knife at the upper end serves for scraping and cutting. There is a roller at the lower end for rolling the dough, and suitable cutters applied at the sides for stamping out cakes. A handle at the inside of the lower end serves, in connection with the upper curved end, for the convenient handling of the instrument during kneading.

Improved Window Screen.

George F. Sarles, Bedford Station, N. Y.—This invention consists of an arrangement of the sash in the window, so that the net can be used at the top or bottom of the window, and shifted from one to the other without interfering with the sash.

Improved Plumber's Joint.

Isaac F. Van Duzer, Middletown, N. Y.—A T coupler, of lead, joins a branch to the side of a pipe. It has a groove along the top to receive the side of the pipe in it, and a hole through the center, at right angles to the groove, for the pipe. The couplers are made of lead, so as to slip on the pipes easily to form the basis of the joint. They are fastened by solder, overlapping them at the edges, and flowing in between the parts at the joints, and into the holes, if necessary.

Improved Planter.

Charles D. Wilson, Kentland, Ind.—This invention is an improvement in a well known class of seed planters, and relates chiefly to the arrangement of a toothed disk or wheel in the hopper, above the apertured seed dropping wheel, and on the same shaft therewith. The face of the toothed wheel has projections or teeth attached to it, which are struck by the projections attached to the seed wheel, so that the seed may be dropped by the advance of the machine.

Improved Sagger.

Benjamin Jackson, Geddes, N. Y.—This invention relates to improvements in saggars employed in the process of backing or burning crockery ware, for the purpose of protecting the ware from the direct action of the fire and the injurious products of combustion. The invention consists in constructing a sagger with a series of internal vertical ribs or bars permanently attached to the walls of the same, and provided with notches. The latter are adapted for the reception of detachable pins, designed to support the ware to be burned.

Improved Nail Plate Feeder.

William H. Field, Taunton, Mass.—For the purpose of inserting the nail plate into the nippers, at the front end of the nipper rod, the attendant works a treadle, releasing a spring clutch and throwing the main shaft out of gear. The nipper rod is simultaneously carried back by its handle. The action of a wedge piece on the nippers causes their opening, and allows the ready insertion of a new nail plate in place of the one fed to the cutters. The V-shaped form of collar admits of the opening of the nippers whether the bar levers are in the upper or lower position, so that no time is lost in adjusting them. The treadle is then released, the spring clutch engages instantly the main shaft, and the weight carries the nipper rod and nail plate forward, and feeds the latter to the cutter knives. The intermittent rotary motion of the nail plate, required for giving the same a semicircular turn for the regular cutting of the tapering nails in alternate direction, is obtained by suitable mechanism.

Improved Water Wheel.

Nelson Conner, Jalapa, Ind.—This invention consists of a double wheel, comprising a horizontal wheel, receiving the water at the periphery and discharging it at the center for the upper portion. Another wheel below receives the water at its center from the upper wheel and discharges it at the periphery. The two wheels are contained between top and bottom horizontal disks, and separated, the one from the other, by a flat annular rim a little wider than the depth of the buckets. It is fitted at the outer edge with the bottom plate of the scroll case, to form a joint to confine the water to the upper wheel as it enters from the chutes. The buckets of the lower wheel are arranged to discharge the water in the contrary direction to that in which it is received on the upper buckets, and in a manner to receive the reactionary force, while the upper ones receive its direct action.

Improved Fence Rail Holder.

John W. Graham, Prairie Depot, O.—This invention relates to means whereby the rails or longitudinal boards, which are usually affixed by nails or other fastenings to fence posts, may be spaced at exactly the intervals desired and in a corresponding manner on all the panels. The invention consists in a rail gage constructed and put together in a novel and peculiar manner.

Improved Railroad Car Brake.

William L. Belt, Little Rock, Ark.—This invention relates to means for operating the brakes of a train of cars from the engine, and consists in combining, with the ordinary vibratory brake lever, a grapple and three rods arranged in a novel and peculiar manner, whereby the brakes are brought into operation the moment the power is applied, without waiting for the cars of the whole train or any two of them to come together.

Improved Lifting Jack.

Maxwell B. Henry, East St. Louis, Ill.—The lifting bar has ratchet teeth on opposite sides, and is worked up and down in a vertical stand or frame by means of a lever, to each arm of which are applied a sliding rod and a pivoted pawl. The rods are flattened and bent near the inner end to form springs, which enable the pawls to yield and slide over the ratchet teeth. The rods can also be used to hold the pawls out of engagement with the ratchet bar when the latter is to be lowered.

Improved Commercial Register.

Caleb D. Weeks, New York city.—This invention consists in a commercial register consisting essentially of a series of supply chambers, each having a spiral channel way extending from top to bottom thereof, a series of oppositely perforated and guide tubes, slide tubes, a receiving chamber, a conducting tube, a tilting bottom, cords, and lock box, all combined in a novel and peculiar manner, to serve as a check upon clerks or employees in stores or other places of business.

Inventions Patented in England by Americans.

(Compiled from the Commissioners of Patents' Journal.)

From April 24 to May 6, 1874, inclusive.

- AGRICULTURAL IMPLEMENT.—A. McMartin, New York city.
- AIR ENGINE.—W. Manson, San Francisco, Cal.
- ALKALI PACKAGE.—B. T. Babbitt, New York city.
- ANCHOR.—J. T. Fewkes, Philadelphia, Pa.
- BRAKE AND SIGNAL.—G. Westinghouse, Jr. (of Pittsburgh, Pa.), London, Eng.
- BURNISHING PHOTOGRAPHS.—J. P. Bass, Bangor, Me.
- COMBINATION LOCK.—W. F. Rutter, Philadelphia, Pa.
- CUTTING TEETH ON WHEELS, ETC.—J. A. Peer, San Francisco, Cal.
- EXTENSION TABLE.—F. Osgood, Boston, Mass.
- EYELET.—J. P. Pultz, Plantsville, Conn.
- IGNITION FUSE.—W. A. Leonard, Boston, Mass.
- INSULATOR.—E. R. Gardner, New Bedford, Mass.
- LABEL.—H. Van Geesen, New York city.
- LOOM.—W. Nuttall et al., Westerly, R. I.
- METALLIC CARTRIDGE.—H. Berdan, New York city.
- MOLDING CONCRETE PIPES.—J. W. Stockwell, Portland, Me.
- PETROLEUM FURNACE.—L. C. d'Homergue, Brooklyn, N. Y.
- SEPARATING FLOUR, ETC.—J. T. McNally, Brooklyn, N. Y.
- SEWING MACHINE.—G. H. Bishop, New York city, et al.
- SHOT CARTRIDGE.—A. B. Kay et al., Newark, N. J.
- SHUP JUG.—G. M. Irwin, Pittsburgh, Pa.
- SPADE BAYONET, ETC.—F. Chillingworth, Springfield, Mass.
- SPARK ARRESTER.—H. G. Holmes, New York city.
- SQUIB, ETC.—S. H. Daddow, St. Clair, Pa.
- TRANSMITTING MOTION.—O. M. Chamberlain et al., New York city.

NEW BOOKS AND PUBLICATIONS.

COMPOUND ENGINES. Translated from the French of A. Mallet. No. 10 of Science Series. 50 cents. New York: D. Van Nostrand, 23 Murray and 27 Warren streets.

REPORT ON THE DETERMINATION OF THE ASTRONOMICAL COORDINATES OF CHEYENNE AND COLORADO SPRINGS, MADE DURING THE YEARS 1872 AND 1873, BY FIRST LIEUTENANT GEORGE M. WHEELER, DR. F. KAMPF, AND J. H. CLARK, CIVILIAN ASTRONOMICAL ASSISTANTS. Washington: Government Printing Office.

Lieutenant Wheeler characterizes this elaborate volume as a step in the direction of uniformity of plan in the prosecution of astronomical work in the western interior; and for this reason, and on account of the value of the observations and calculations, we are pleased to know that it is to be distributed among the officers engaged in making explorations.

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A. B. E. L. will find directions for making vinegar on p. 58, vol. 30. Eggs can be preserved by the process described on this page. This also answers L.—G. M. will find a recipe for dyeing silk black on p. 89, vol. 28.—H. C. H. can tin cast iron by the process detailed on p. 212, vol. 26.—J. B. E. should try a quick drying oil paint for his varnished thread.—J. F. should read our article on p. 64, vol. 30, on "Indicating Steam Engines."—A. R. and F. H. should address such queries to engine manufacturers.—C. M. can transfer engravings to metal by the process of transferring to wood, detailed on p. 198, vol. 30.—L. E. B. will find a description of a bone fertilizer on p. 195, vol. 29, and p. 118, vol. 30. For mills see our advertising columns.—L. M. E. W. M., and C. H. F. will find the particulars of the offer of a premium for a car coupling by the German railway confederation on p. 167, vol. 29.—C. A. S. can mold rubber by following the directions on p. 283, vol. 29.—X. L. C. R. S. T. should send his name and address.—H. & B. will find a recipe for aquarium cement on p. 90, vol. 30.—R. F. will find directions for constructing a sun dial on p. 409, vol. 30. A sun dial shows solar time, which must be corrected for mean time by the fast and slow tables published in most almanacs.—H. B. B. will find directions for exterminating ants on p. 231, vol. 27.—G. E. F. should consult the booksellers who advertise in our columns.

M. E. T. asks: Is the force of the powder destroyed by putting tissue paper between the ball and the powder? A. No. 2. What is the *modus operandi* of loading a pistol and catching the ball in the teeth? A. A peculiarly constructed pistol is used. 3. Would an invention for coupling freight cars when standing on the top of the car be of use? A. There is always room for a valuable improvement in any department.

J. S. F. asks: Ought there to be any difference in the capacity for pulling between two locomotives, one having a 34 inch and the other a 30 inch stroke, the cylinders being of such diameters as to contain the same number of cubic inches, the valve motion in each being proportional to the stroke, but being alike in every other particular? A. Yes, if steam pressure, piston speed, and other particulars were the same in both engines.

J. S. asks: What is the best non-conductor of magnetism? A. An interval of space.

W. P. says: I have a boiler 24 feet x 42 inches. Water is supplied by an injector. I wish the water to go into the boiler hotter; it takes 90 lbs. of steam to keep up a supply of water. Would it be practicable to run the water from the injector through a coil into a heater, thence to the boiler, and would it require more steam, or would the heater aid the injector? A. Your injector cannot be in very good order, if it will not work with a lower pressure of steam. You do not send enough data to enable us to answer your question definitely. If the use of the heater causes additional back pressure in the engine, it will be a question, to be determined by experiment, whether the heater is economical or not.

J. H. K. asks: How can I estimate the pressure of a column of water 25 feet high? A. Divide the head of water in feet by 2.3, and the result will be the pressure in the base in pounds per square inch.

W. C. S. asks: 1. In the bursting of a steam boiler, where the top of the boiler is thrown off, does all the water instantly flash into steam? If not, does the water that remains in the boiler instantly cool down to 212° when the pressure is removed? A. A large portion of it would suddenly be converted into steam, which might carry off the remaining water mechanically. 2. What is the temperature of water in a boiler working under average pressure? A. Between 300° and 350° Fab.

B. R. K. asks: Where and by whom was the first steamboat made? A. There are authentic accounts of experiments with small steam vessels in Europe, as far back as 1698. The first practical steamboat, on the authority of Mr. Woodcroft, was the Charlotte Dundas, built by Symington of England, in 1801. Regular steam navigation, that is, the running of a steamer regularly, carrying passengers and freight, was effected in America in 1807, by Fulton, and in England, in 1812, by Bell. You will find these facts, and many others of interest in this connection, impartially stated, and in general well authenticated, in Woodcroft's "Sketch of the Origin and Progress of Steam Navigation."

F. H. asks: Why is a common flat iron called a sad iron? A. Possibly from an old north of England word "sad," applied to anything heavy.

B. asks: How can spiral steel springs made of bars 1/8 an inch square be galvanized without destroying the temper? What would be the result of hardening the springs before galvanizing, and upon withdrawing them from the galvanizing bath and plunging them into cold water? Would this harden them if not previously hardened, the heat of the galvanizing tank being probably under 700° Fah.? Could the temper afterwards be drawn to the requisite point, and if so, by what process? A. We think the best plan would be to plate them by means of a battery.

B. W. asks: Can you inform me how Philadelphia ice cream is made, and why it is different from Boston ice cream? A. The difference is due to the fact that genuine Philadelphia ice cream is made out of the purest and richest materials.

J. B. E. asks: How can I dye ivory and get a nice clear red color? A. Use bichloride of tin for the mordant. After having steeped the ivory in this a short time, immerse in a hot solution of Brazil wood or cochineal.

E. H. M. asks: How are toy balloons made? Are they of india rubber or gun cotton? A. The rubber bags are imported from Paris, and they are merely filled here with pure hydrogen.

E. L. asks: How can I prepare paraffin which melts at a temperature of from 95° to 100° Fah.? A. By removing in the course of the distillation those hydrocarbons of the paraffin series which have a lower melting point.

J. B. H. asks: 1. Is there any cure for hydrophobia? What is the best thing for a person to do when bitten by a mad dog? A. The victims are commonly treated by dosing with whisky. 2. What can I do with my dogs to prevent them from going mad? A. Tie stoncs around their necks and put them under water.

B. & S. say: We are running a 10x18 inches engine at 230 per minute, with a tubular boiler 12 feet long and 52 inches in diameter. The average pressure of steam by gage is 80 lbs. We take the steam from a cast dome with a safety valve on top; the orifice in boiler for dome is 5 inches in diameter, the steam supply being 2 1/4 inches. The boiler foams very much, running mud and dirt through engine, cutting valve, valve seat, and cylinder rings out in a few days' run. One party says that if we put on a steam dome 24 inches in diameter and take steam from that, it will obviate the difficulty. Is this so? Another says that a surface blow-off will be all that is needed. A. You do not send quite enough data. It would seem, however, that the orifice in the boiler for the dome is too small. We think it quite probable that a larger dome, properly connected, would remedy the trouble to some degree. But we think it would be desirable for you to get a feed water heater (of which there are several in the market) that will remove the greater part of the dirt from the water before it goes into the boiler.

W. F. S. asks: Which is the best form, for accuracy, for the inside of a spirit level tube? Should it be a right line or a curved one? A. It is necessary that the tube should be curved.

E. W. S. asks: Will you give me the philosophy of "blowing up"? If a person lies down on his back, upon the floor, holds himself perfectly stiff, crosses his hands so as to get his arms out of the way, and inhales all the air he possibly can; and three, four or more persons stand around him and at a given signal all raise their arms and take a full breath, then lower their arms, at the same time expelling all the air from their lungs upon the person lying upon the floor; with their index finger they can quickly raise him as far as they can reach. A. We think that the blowing up process is chiefly efficacious in making all the lifters act in unison. It must be evident that if four persons lift a man, each one sustains about one fourth of the weight upon one finger; so that, if this weight is not perceptible, it would seem to be due to the imagination.

N. F. A. asks: What is the best for a person to read for general improvement? A. It would be well for you to get a reliable cyclopaedia, which will be a very good work for you to read, for useful information. You will find in it replies to most of your other questions, which are quite similar to many that have recently been answered in our columns.

S. H. asks: 1. What should I read besides the Scientific American in order to know what has been invented or discovered in any particular line? A. The patent records of different countries. 2. Is there a reward offered for plans to improve the mouth of the Mississippi? A. No. 3. Suppose that a pair of birds were placed so that they could not see other birds of their kind. Would such birds build nests like their parents? If so, what is the philosophy of such knowledge? A. They would. The philosophy of their action we cannot explain. 4. Can iron be melted by sun glasses? Why are not such glasses more in use for heating purposes? A. Yes, but it is not generally a convenient method. 5. What will prevent magnets from attracting iron? A. We do not know of anything. 6. Will magnets wear out? A. Yes.

C. S. A. asks: 1. Which is the stronger, wire rope or the same weight of iron made into a solid rod of the same length? A. The former. 2. Is there any substance that will make more gas, at a less cost, than ordinary blasting powder? What will make the most gas in the shortest time? A. These questions are too indefinite.

E. asks: Why are gunpowder engines not in general use? A. Gunpowder engines are too expensive to run to compete successfully with steam engines.

F. H. T. asks: Is there a substance (produced in making gas from coal) which is somewhat like lime and is composed in a great part of carbon? A. No. 2. Is there a process for plating steel on cast iron? A. We never heard of any.

J. H. A. asks: Is there any law that requires a man who runs a steam fire or stationary engine to have a certificate? A. There is no United States law. Most States, however, have local laws on the subject.

F. C. S. asks: What examination must a person pass to get a license to run an engine? I have made the steam engine a study, and feel convinced that I could run one and take good care of it, but I hear that examiners often try to confuse young applicants. A. The laws vary somewhat in the different States. But so far as we know, the examination required for license to run a small engine relates principally to the care and management of the boiler.

P. S. S. asks: Is Cornell University a good school for mechanical engineers, and, all other things being equal, would it be more advantageous for me to go there and study for a mechanical engineer than to enter some first class machine shop? A. You will need instruction at such a school, and practice in the shops also. We think it would be well for you to take such a course first.

J. M. asks: Are there any high pressure engines on steamers running between Liverpool and New York City? A. No.

W. S. D. says: How can I make a glass globe into a globe mirror? A. Melt together 1 oz. clean lead and 1 oz. of fine tin in a clean iron ladle; then immediately add 1 oz. bismuth. Skim off the dross, remove the ladle from the fire, and before it sets add 10 ozs. quicksilver; now stir the whole carefully together, taking care not to breathe over it, as the fumes of mercury are very pernicious. Pour this through an earthen pipe into the glass globe, which turn repeatedly round.

J. B. S. says: 1. I have a four inch whistle, which, when set at its highest pitch, does not give satisfaction. I propose to put a trumpet on it; of what material should it be made? Will galvanized iron do, or tin, if painted? A. Galvanized iron will answer, but the best material is brass. 2. Should the small end be closed? A. By all means close the small end. 3. How close around the whistle should it fit? A. If we fully understand your question, the closer the fit the higher will be the pitch.

H. P. asks: Why is it that pork shrinks from the bone when boiled, if it is killed in the decrease of the moon? A. This is a popular fallacy.

J. R. L. asks: Would it be practicable for an amateur tourist in a trip around the world to use to advantage photographic implements and materials, instead of sketching, for the purpose of securing pictures of the objects of interest and beauty he might meet? Would it require special care and arrangements to adapt such pictures to the stereoscope? A. There is a great number of amateurs, who travel to every part of the world and take excellent photo pictures, and that too with all their apparatus contained in a box no larger than a small valise.

R. A. asks: Is water an element in a scientific sense? If not, what combination is it? A. Water is a compound of two elements, oxygen and hydrogen, in the proportion of 8 parts by weight of oxygen to 1 part by weight of hydrogen.

W. D. S. asks: 1. How can I make the green and the gold lacquer with which they lacquer clocks, and how is it applied? A. For gold lacquer, take of seed lac 6 ozs., amber and gum guttae, each, 2 ozs., extract of red sandal wood in water 24 grains, dragon's blood (6 grains), oriental saffron 36 grains, pounded glass 4 ozs., pure alcohol 36 ozs. Grind the amber, the seed lac, gum guttae, and dragon's blood on a porphyry; then mix them with the pounded glass, and add the alcohol (after forming with it an infusion) and extract of sandal wood. The varnish must then be completed as before; the metal articles are heated, and those which will admit of it are immersed in packets: the tint of the varnish may be varied by modifying the doses of the coloring substances. For green, use any green transparent vegetable color, mixed with the above. 2. With which cement can I mend glass ware? A. Use diamond cement. 3. What mixture can I use to stop cracks in walnut furniture? A. Take equal parts of beeswax and sealing wax and mix them by melting them together, or dissolve in alcohol. Color with amber. 4. How is the gliding done on toilet sets and on furniture? A. Use yellow shellac varnish in the desired pattern, upon which lay the gold leaf.

C. H. M. asks: Which is the healthiest State in the Union? A. That State in which the greatest regard is paid to religion, law, and education. In respect to physical advantages, most are in the first rank.

G. D. F. says: Water boils at the sea level at 212°. Here in Argenta, Montana Territory, it boils at 200°. Does the altitude affect the degree as marked on the thermometer, or is it the pressure of atmosphere only which affects the boiling? A. Water does not boil until the tension of the vapor formed by heating it is greater than the atmosphere's pressure. At the sea level, where the pressure of the atmosphere is about 15 lbs. per square inch, the water must be heated to 212° before its vapor has sufficient tension to overcome this pressure. At Argenta, where you are so much above the sea, and have a much less depth of atmosphere above you, the pressure is not so many pounds, and the boiling point is correspondingly lower.

H. W. G. says: 1. Please give me the analysis of crude carbolic acid or dead oil. A. Carbolic acid consists of 12 atoms of carbon, 6 atoms of hydrogen, and 2 atoms of oxygen. The less volatile portion of the fluids produced by distillation of coal tar contain considerable quantities of this substance. It may be extracted by agitation of the coal oils (boiling between 500° and 600°) with an alkaline solution. The latter, separated from the undissolved portion, contains the carbolic acid in the state of carbolate of the alkali. On addition of a mineral acid, the carbolic acid is liberated, and rises to the surface in the form of an oil. To obtain it dry, recourse must be had to distillation with chloride of calcium, followed by a new rectification. If required pure, only that portion must be received which boils at 370°. Commercial carbolic acid is generally very impure. Some specimens do not contain more than 50 per cent of acids soluble in strong solution of potash. The insoluble portion contains asphaltum, fluid hydrocarbons, and small portions of chiboline and lepidine. 2. Are there any fertilizing properties in it, and if so in what proportion? A. We have never heard of its use as a fertilizer.

J. J. asks: If there is any substance that can be used as a flux in melting iron, that will answer as a substitute for limestone? A. Other substances, like caustic soda or fluor spar, can be used, when certain objects are to be obtained.

L. H. says: On p. 267, vol. 20, one per cent of carbolic acid is recommended for removing green moss from brown stone stoops. How much is that to a quart of water? I have a house with white marble stoops, sills, etc. Will the above remove the discolorations, also the iron rust? A. Seventy-five grains to a quart. It will partly remove the discolorations, but not the iron rust.

J. R. S. asks: Can you tell me how glass is made for a microscope?

R. I. B. asks: 1. How can I dissolve common India rubber and then restore it to its former hardness?

A. C. R. asks: 1. Is electricity instantaneous? A. No. Its velocity is 298,000 miles per second.

J. G. asks: 1. How can I make an electrical condenser? A. With sheets of tinfoil. They are fastened on two sides of a band of oiled silk.

G. S. T. says: I recently found that a lighting rod vendor was using for conductors tubes made of corrugated thin sheet copper.

G. C. R. asks: How are the aniline colors said to be procured from coal tar made?

S. G. Jr. asks: How is the beautiful crystallization upon water coolers and on brass mathematical instruments produced?

G. E. P. asks: How can glucose be distinguished from cane sugar? A. The easiest method is by the saccharimeter.

B. W. M. asks: 1. What is the alloy for white metal for harness castings? A. Melt together 1 lb. brass, 1 1/2 oz. spelter, and 1 oz. tin.

J. E. L. asks: What will keep Russian iron from rusting and becoming discolored during the summer season?

D. asks: What colored veil will afford the best protection to the complexion? Of course an immediate solution would be furnished by a knowledge of the colors which intercept in the greatest measure the actinic or chemical rays of the sun.

E. P. H. asks: Can you give a recipe for the manufacture of a sympathetic ink which will fade completely in a short time after being developed, and which cannot be re-developed?

O. F. M. says: I have set up a page of type and I would like to take a stereotype or electrotype plate from it. How shall I proceed?

A. B. asks: 1. Why does lime water, when breathed on, become opalescent and white, like milk?

S. asks: 1. What would be the temperature of a body in space, removed from the influence of the sun?

G. S. B. says: I am constructing a machine in which I require to use an electric spark, and will have but a small place to spare on my machine for it.

M. O. M. O. B. says: I wish to study mineralogy. What work would be the best for a beginner?

L. says: 1. F. H. H. asks why does water form an exception to the law of contraction by cold? I would ask, does it?

C. L. asks: What is the best method of preparing a composition for plating metals with gold?

A. W. M. asks: 1. What must be the length of the rafters of a house, so that the shingles may last as long as possible, the width of the house being 40 feet?

G. S. D. says: A friend of mine bought a ring, with a stone in it called aquamarine. The stone is cut like a diamond and is very clear; it cuts glass, but not very well.

W. B. P. asks: 1. How can I make a hydro-electrical machine? A. Use a small steam boiler, insulated from the ground by glass pillars.

H. T. H. says: I have a roof covered with canvas that was painted several years ago. The paint is broken in many places, and I wish to remove the old paint.

N. P. L. says: I have an overshot water wheel which does not give as much power as I want.

R. A. says: I am building stationary engines which are used for saw mills, etc., and I am troubled with their pounding.

R. F. B. P. asks: Is a man who uses his right hand at end of the ax, shovel, or sledge hammer, and his left applied to the center of the handle, a right or left handed man?

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

A. H. S.—Two are iron pyrites. One is copper pyrites.—C. S. & F. G.—It is magnetic oxide of iron.

H. M. F.—The little scales are kaolinite, which is a hydrous silicate of alumina.—A. S.—The stone is valuable for some purposes. It is found in quarries.—F. C. K.—It is galena or sulphate of lead, and contains 87 per cent of lead.

E. F. T. asks: How can I print on gelatin?—J. E. B. asks: What is the best stain for staining popular cigar boxes?

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

- On Eremacausis and Cremation. By H. H.
On a Curious Freak of Nature. By C. H. M.
On a Californian Chute. By J. J. G.
On the Sun's Attraction. By W. B.
On Gravitation. By H. B. W.

Also enquiries and answers from the following:
H. B. B. L. V.—J. F.—G. B. S.

Correspondents in different parts of the country ask: Who sells the best drawing instruments?

Several correspondents request us to publish replies to their enquiries about the patentability of their inventions, etc.

Correspondents who write to ask the address of certain manufacturers, or where specified articles are to be had, also those having goods for sale, or who want to find partners, should send with their communications an amount sufficient to cover the cost of publication under the head of "Business and Personal," which is specially devoted to such enquiries.

[OFFICIAL.]

Index of Inventions

FOR WHICH

Letters Patent of the United States WERE GRANTED IN THE WEEK ENDING

May 5, 1874,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

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Table titled 'SCHEDULE OF PATENT FEES' listing fees for various patent services such as 'On each caveat', 'On each Trade Mark', 'On filing each application for a Patent', etc.

Table titled 'CANADIAN PATENTS. LIST OF PATENTS GRANTED IN CANADA, MAY 4 TO MAY 11, 1874.' listing Canadian patent grants.

Main table of patent grants with detailed descriptions, including 'S. 399.—T. P. Billington, Dundas, Wentworth county, Ont. Improvements on farmer's horse power', 'S. 400.—G. Bolton, Arnprior, Renfrew county, Ont.', etc.

Text block containing various notices and advertisements, including 'racks, called "Carleton & Nuffer's Improved Clothes Rack"', 'A. Berry, Sheffield Township, Sheffield county, P. Q.', etc.

Section titled 'Advertisements.' with details on rates: 'Back Page - - - - - \$1.00 a line. Inside Page - - - - - 75 cents a line.'



Text describing the Boulton's Patent machine: 'It is a first class Shaper and Moulder. Dovetails all kinds of Drawer and Joint Work with thick or thin stuff. Warranted Simple, Durable and Efficient. Send for circular and sample of work. Manufactured only by B. C. MACHY CO., Battle Creek, Mich.'

Section titled 'OVER 7,000 IN USE. BLAKE'S STEAM PUMP' with details on its use and availability.

Section titled 'FISH TRAP—(Patented Aug. 5, 1873.) A Nibble as good as a Bite. No chance of Escape. Used same as a Fishing Line. Rights for Sale. Send for Circular. PAVONARIUS & MICHLE, 1108 Ridge Avenue, Philadelphia, Pa.'



Section titled 'L. & J. W. FEUCHTWANGER, DRUGS, CHEMICALS, OILS, &c. 180 FULTON ST., NEW YORK.' listing various chemical and drug products.

Section titled 'WEEK'S DOINGS IN WALL STREET.' providing financial news and market updates.

Section titled 'SENT FREE! A Beautiful CHROMO, RA-CY PAPER, Catalogue of Novelties, Books, Games, etc. FREE for address of 3 Country School Teachers. Address CLIPPER, Elsie, Mich.'

Section titled 'I HAVE FACILITIES for Manufacturing CAST, WROUGHT IRON, WOOD AND MACHINE WORK, WITH YARD AND STORAGE ROOM.' listing services and contact information for F. W. PUGSLEY.

Section titled 'SCROLL SAWS, THE CHEAPEST AND BEST IN USE.' advertising Bickford's Patent Anti Friction Scroll Saw.

Section titled 'The American Turbine Water Wheel.' describing a recently improved water wheel and its performance.

Section titled 'FOR LEGAL ADVICE CONCERNING Infringements and Patents, consult R. B. McMASTER, Counsellor at Law, 23 Park Row, New York. Counsellor and Advocate in Patent Cases.'

Section titled 'PIPE FELTING.' advertising a method for pipe felting and providing contact information for the Vegetable Felting Company.

Section titled 'Todd & Raftery Machine Co.' advertising various machinery and providing contact information.

Section titled 'BUERK'S WATCHMAN'S TIME DETECTOR.' advertising a watchman's time detector and providing contact information.

Section titled 'TRADE MARKS REGISTERED.' listing registered trademarks and their owners.

Section titled 'DESIGNS PATENTED.' listing various designs and their patent status.

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'WE And Our NEIGHBORS'

Text block for 'WE And Our NEIGHBORS' by Harriet Beecher Stowe, describing the book's content and availability.

Text block for 'The Christian Union, Henry Ward Beecher, EDITOR.' providing details about the publication.

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