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JAMES YOUNG, FOUNDER OF THE PARAFFIN OIL INDUSTRY.

"It would certainly be esteemed one of the greatest discoveries of the age if any one could succeed in condensing coal gas into a white dry solid odorless substance, portable, and capable of being placed upon a candlestick or burned in a lamp," says Liebig in his "Familiar Letters on Chemistry," dated 1843. Seven years later James Young, the subject of the accompanying portrait, completed a long series of experiments with the successful extraction of paraffin from Boghead coal, and then, patenting his discovery, opened to the world a great and growing industry.

Mr. Young began life as a joiner, learning his trade in his father's shop. His spare time, however, was devoted to the study of chemistry and he eventually adopted that profession, becoming at first assistant to Professor Graham in the London University, and subsequently manager of Muspratt's and afterwards of Tennant's chemical works. In 1848 he resigned his position in order to embark in the manufacture of lubricating and burning oil from petroleum; but as his spring became exhausted, he began a series of investigations in order to find an artificial substitute for the natural oil.

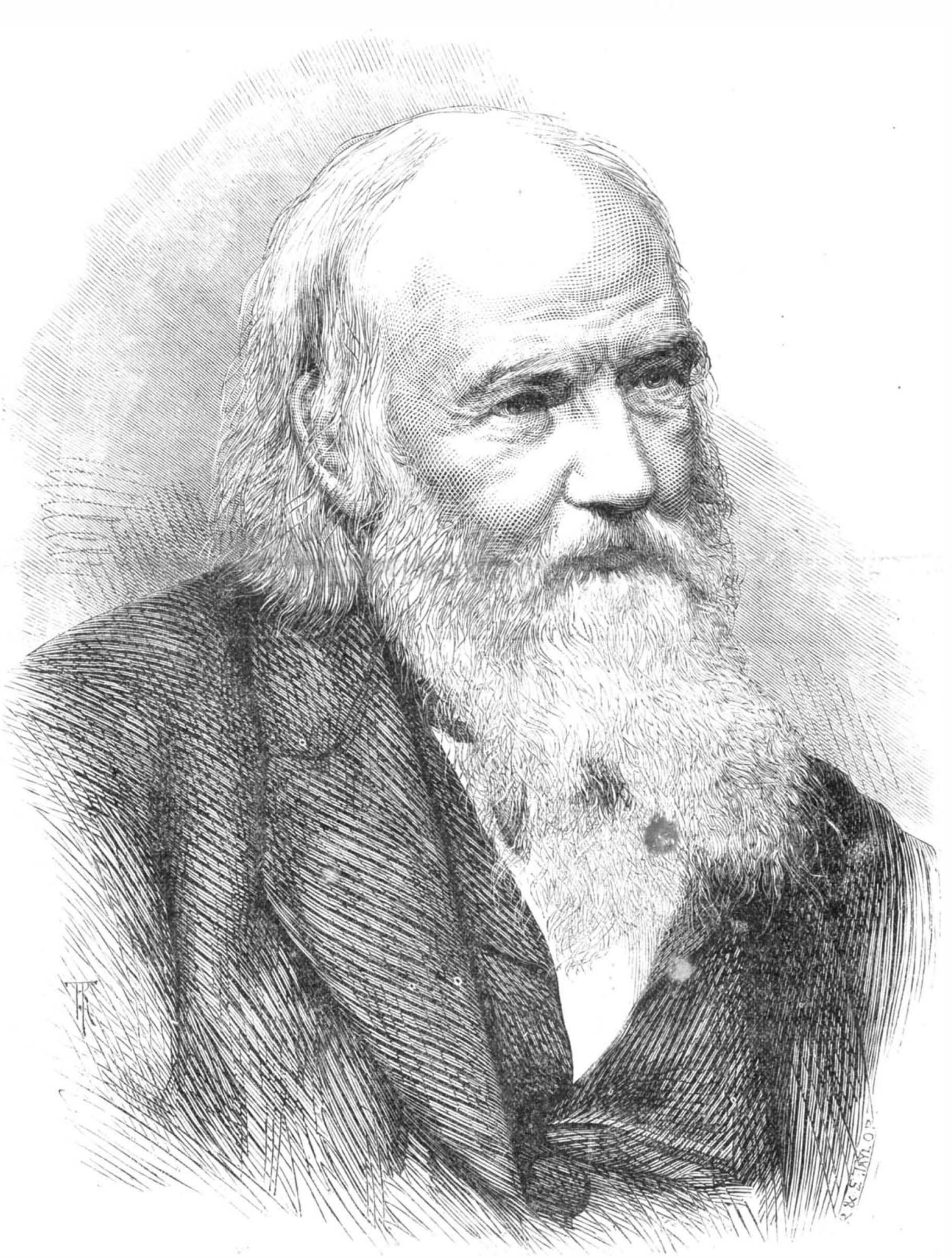
From his own internal consciousness Mr. Young evolved the conclusion that petroleum, or its substitute, might be produced by the action of heat on the coal, the vapor going up into the sandstone to be condensed. The ultimate result of his researches was that, out of a cannel that came to be mixed with the soda ash for making the alkali, he got a quantity of liquid that contained paraffin.

Patenting his discovery, Mr. Young, with ten others, established works for the manufacture of paraffin at Bathgate, Scotland, in the center of the Torbane Hill coal field, a district peculiarly rich in cannel, and began the manufecture of which he is the founder.

Commencing with the raw material, which is principally a stone of slaty texture and a dusky brown color, we may explain that shale pits are generally worked in juxtaposition with the crude oil manufactories. The shale pits vary in depth from twenty to forty fathoms. The best quality is that which, when cut with a knife, does not splinter, but gives off a continuous shaving, such as would be got from a piece of soap or wax. On reaching the pit bank, the shale is tumbled into a crusher, in passing through which it is ground to pieces, sufficiently small to pass easily down the retorts. The more common retort is a flattened cylinder of cast iron, about twelve feet long, which contracts towards the ends, both of which are open, and its lower end dips two or three inches into a shallow pan filled with water. After the retort has been filled with broken shale, the furnace is brought into operation, so as to raise its middle zone to a low red heat. The process of distillation then goes on continuously. At a temperature of 300°, the hydrocarbons contained in the shale are given off in the shape of gas, which is, to a large extent, condensible. At most of the crude oil works, the incondensible vapor is collected in a gas holder, and used for lighting the workshops. The oil obtained from the decomposition of the coals, having assumed the form of vapor, is collected in a large main having connections with the retorts. Through this main the vapor is conveyed to the condensers, which, as a rule, are similar to those used in gas works. As it passes through the condensers, the vapor is reduced to a liquid form, in which state it is run off into reservoirs, some of which contain as many as 100,000 gallons.

On leaving an apparatus called a separator, in which the two components of oil and water are parted from each other, the process of purification commences by a second distillation. The dark green fluid called crude oil, which at this stage has an appearance not unlike natural rock oil or petroleum, is now pumped into large iron pans, where it is boiled to dryness. In this way the hydrocarbons are once more driven off in the form of gas, which, when condensed, yields an oil still rather green in color, but much thinner, lighter and purer than before. The oil in this state is taken to a set of closed vessels, where it undergoes a sort of scouring process, by being stirred up with sulphuric acid. Run off into a settler, still further purified, it rises to the top, where a black tar, formed by the combination of sulphuric acid with various impurities, subsides to the bottom. Being again similarly treated with caustic soda, the oil is still further refined, previous to being passed on by pumps to undergo a third distillation, which is pursued with vitriol and soda, until it becomes a thin, light, and perfectly colorless fluid. This is paraffin oil.

Solid paraffin is obtained from the thicker and heavier oil, of which about twenty gallons are evolved from every hundred gallons of crude oil put through the refining process. The solid paraffin is made by the application of a refrigerating machine. The air thus refrigerated is brought to bear on a stream of brine, which it converts into a freezing mixture, thus enabling solid paraffin to be produced in the hottest summer weather. Remaining in solution at a temperature of 60°, paraffin coagulates into the solid form when the temperature is reduced to 32°. Crude solid paraffin is now worth from $150 to $175 per tun in England. Paraffin candles, from which a clear, lustrous, and perfectly odorless light is obtained, are made at most of the principal Scotch oil works.



JAMES YOUNG, FOUNDER OF THE PARAFFIN OIL INDUSTRY.

In addition to the Bathgate works, Mr. Young also projected the Addiewell works, on a very extensive scale. The land leased for their requirements extended to some three or four thousand acres, all containing shale and other minerals; while some forty acres were set apart for the site of the works. The retort sheds are upwards of 200 yards in length, and each shed contains a double row of retorts. There are altogether close on 400 retorts at these works. This represents a capacity for distilling over 3,000 tuns of shale per week, and producing 120,000 gallons of crude oil, yielding 50,000 to 60,000 gallons of burning oil, in addition to about 12 tuns of refined paraffin, and a large quantity of lubricating oil. To accomplish these results, the appliances are necessarily on a large scale. The heavy vapors are collected in two underground tanks, each capable of containing 12,000 gallons. Any vapor which does not liquefy in the condensing main is passed through a four inch cast iron tubular condenser, which is made up of 1,300 nine feet lengths, or a course of nearly two and a quarter miles! For the purposes of distillation upwards of twenty 2,000 gallon stills, made of malleable iron, are erected. There is a similarly large number of refining stills, each capable of containing 4,000 gallons. A number of immense store tanks, each capable of containing 15,000 gallons, are fitted up contiguous to the refining kilns, being so situated that they can collect the oil as it passes from one stage of the refining operations to another. The building in which the various oils are subjected to chemical treatment is four hundred feet in length and eighty feet wide. It has two fireproof gables, cutting off in the center the engine house from which the machinery is actuated. Underneath the roof of the building there are altogether upwards of a hundred large cast iron vessels, with a capacity varying from 3,000 to 500 gallons. Upwards of 1,000 hands are employed at Addiewell, and in the shale pits adjoining over 500 miners are at work. One and a quarter million cubic feet of gas are produced at the works daily. The Addiewell shale yields from thirty to forty gallons of crude oil per tun, of the specific gravity of 0·870.

Within the comparatively short space of twenty years, the mineral oil trade has attained such a magnitude that it gives employment to over 7,000 workmen, who earn weekly something like $50,000 in wages. At the present time about 800,000 tuns of shale oil are annually distilled, producing nearly 30,000,000 gallons of crude oil, while the quantity of refined burning oil obtained from the crude product is close upon 12,000,000 gallons per annum, in addition to solid paraffin, naphtha, and other chemical products.

Of Mr. Young's more personal history we have left our selves little room to speak; but this is the less to be regretted, as his has been essentially a scientific career. For a number of years past he has held the office of President of the Andersonian University, in Glasgow. Surrounded by the members of his own family and by those of his lamented friend Livingstone—for he has really been *in loco parentis* to the children of the African traveler—Mr. Young, for whose portrait we are indebted to the *Practical Magazine*, now spends the great bulk of his time at his beautiful estate of Kelly, near Greenock, Scotland, or at his no less fine and romantic estate of Durris in Aberdeenshire. But he also mixes to some little extent in public life, contributing liberally to all movements of a patriotic or charitable character, and aiding by every means within his power the progress of scientific knowledge.

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(Illustrated articles are marked with an asterisk.)

VELOCITY OF NERVOUS IMPULSES.

In his suggestive lecture on the sun, our English visitor, Mr. R. A. Proctor, makes use of several striking illustrations to give an idea of the immense distance between us and our great luminary. One of these supposes an infant with an arm of the inconvenient length of ninety-one millions of miles, who should stretch forth his hand and touch the sun. Naturally the darling would have his finger burnt; but, so slow is the transmission of feeling, he would have to wait until he was a hundred and thirty-five years old before he could be conscious of the fact. In this estimate Mr. Proctor evidently adopts the rate of nerve motion obtained some twenty years ago by the observations of Dr. Hirsch—that is, about one hundred and eleven feet a second. The later and more elaborate researches of Dr. Schleske show a rapidity of conduction by the sensory nerves of about ninety-seven feet a second, which would require our sunburnt infant to wait some years longer before discovering his indiscretion. If he trusted his sight in the matter, he might become aware of the danger of his distant member in the short space of eight minutes, so much more rapid is the speed of light than the movement of feeling along the nerves. The passage of volition along the motor nerves appears to be still slower; so that upwards of a century and a half, perhaps, might elapse before the mental order to withdraw the finger could be carried out.

However slow the rate of nervous movement may be, as compared with the velocity of light or the still fleeter motion of electricity, it is nevertheless so rapid that until quite recently it was thought to be immeasurable, within the limited range in which our observation of it is possible. The most widely separated points in the course of any nerve allow but a few feet of difference at best for timing the periods of sensation or volition; and the nervous impulse travels so quickly that such small distances would seem to be wholly annihilated. To our consciousness a prick on the great toe is discovered as promptly as one on the cheek; and it is only by the intervention of the most delicate and ingenious of mechanical contrivances that the difference in time is made apparent.

The first step toward making the solution of this interesting problem possible was taken in the antiphysiological art of gunnery. In the development of that art, it became necessary to measure the speed of projectiles, both in the gun and during the several stages of their flight. For this purpose Pouillet's chronoscope was devised, by means of which an electric current was made to indicate the duration of the most rapidly transient processes. Thus the passage of a bullet along the barrel of a gun was found to occupy the hundred and fiftieth part of a second. It quickly occurred to Helmholtz that here, possibly, was a means of measuring the speed of nervous action. His application of the method was too complex for description in this place; it was, however, so trustworthy as to leave no doubt of the practical accuracy of its results. His object was to measure the intervals of time, if there were any, between the excitation of a nerve at two different points and the corresponding contractions of the muscle. The difference between such intervals would, of course, be the time required for the passage of the nervous impulse over the space between the two points of excitation. Experimenting with the leg of a frog, two sets of observations were obtained, differing from each other by a small but constant quantity. For the more distant point of excitation, a measurable fraction of a second longer was uniformly required to make the muscle contract. The difference of distance being exactly measured, the rate of propagation of the nervous impulse was easily calculated. Instead of rivaling the velocity of electricity, as had hitherto been supposed, the rapidity of conduction in the motor nerves of the frog was found to be no more than eighty five feet a second. All this was as early as 1851. To test the accuracy of the result thus obtained, Professor Helmholtz devised another and more simple apparatus, which he called a myographicon. In this the contracting muscle was made to directly register the beginning and successive stages of the contraction by means of a style working against a rotating cylinder. This confirmed the general correctness of the estimate obtained with Pouillet's apparatus, the rate demonstrated being a little over 89 feet a second.

Various improvements of the myographicon were soon suggested by Du Bois Raymond and others, whose observations, while differing slightly in result, were not conflicting with previous results, due allowance being made for temperature and other disturbing conditions. The maximum rate obtained by the last named observer was 30 meters a second, or $98\frac{1}{2}$ feet. This was the estimate on which he based his widely quoted illustration of the harpooned whale. If one of these sea monsters, a hundred feet long, were struck in the tail, he said it would take a full second before the sense of pain could reach the victim's brain; and, omitting the time necessary for perception and volition, another second must pass before an order could be telegraphed to the tail to retaliate by upsetting the harpooner's boat.

In all the experiments on motor nerves thus far, the leg of a frog had been used. In 1867, Baxt and Helmholtz applied the test to man, using an improvement of the myographicon suggested by Du Bois Raymond. The result gave the rate of conduction for the motor nerves of man, corresponding to that already obtained by Hirsch for the sensory nerves. A very careful series of experiments by the same observers, in the summer of 1869, showed a mean rapidity for the motor nerves in man very much greater, or about 254 feet a second. But this by no means invalidated the result already obtained, since, as Helmholtz had shown, the rate varies greatly with temperature, being not more than one tenth as great at 32° as at 60° or 70°.

More recently it has been established by Dr. Munck that the velocity of nervous impulses is different in different nerves, and in different parts of the same nerves, the rapidity increasing as the termination of the nerve is approached, and by Marey's observation, that fatigue of the muscles has the effect of seriously reducing the rate of nervous conduction; while Wittich has found that the rate is in some degree dependent on the mode of excitation, being greater when electricity is used than when the stimulus is mechanical. The same observer also reports a considerable difference between the rates of motor and sensory nerves, the latter excelling by at least a third.

The measurement of the rate at which the nervous impulse travels brainward necessarily involves a process very different from any employed in the study of the motor nerves. The problem was first attacked by the Swiss astronomer Dr. Hirsch. Soon after Helmholtz took up the other branch of the investigation, and his solution of it was as ingenious as it was successful. It involved the measurement, with the delicate chronometric instruments employed by astronomers, of the difference in time between the appreciation of impressions made at a distance from the brain, say on the great toe, and others nearer, as on the cheek. Roughly described, the plan adopted was substantially this: The observer sat with his finger on a signal key, with which he announced the perception of an electric shock as soon as possible after feeling it, thus closing an electric circuit which had been broken by the shock. The minute interval between the breaking and closing of the circuit measured the time taken by the transmission of the shock to the brain, the time required for the perception of the sensation, time for willing the movement of the signal key, time for the transmission of this volition to the proper muscles, time for the contraction of the muscles, and finally the time lost in the physical process of signaling. Obviously all these parts, except the first, must be substantially the same in all experiments by the same person, using the same finger for making the signal. Any difference in the whole time must therefore be owing to the greater or smaller distance of the particular point of impression from the brain. This difference being measured with tolerable exactness, it is possible to calculate pretty closely the rate at which the nervous impulse is transmitted. The estimate first made by Dr. Hirsch was, as already noted, 111 feet a second. More recent determinations give averages ranging from 97 feet, by Dr. Schleske, to 136 feet, Wittich's estimate for a nervous impulse excited by electricity. With a mechanical stimulus, he found an average velocity of 124 feet. These figures, of course, are to be taken relatively. The rate varies in different individuals, and, doubtless, in the same individual, with varying conditions of health, temperature, and so on, the general average being about that of a high wind, a race horse, or a locomotive. Light excels it about ten million times, and electricity more than fifteen million times.

But, it may be asked, what is the use of all these investigations? Of what account is a delay of the hundredth part of a second, more or less, in the perception of a sensation or the transmission of a volition, so long as we are not conscious of it? In astronomy, it has proved to be of material account; and it is more than probable that the knowledge of the normal rate of nervous impulses thus obtained may some day be of the greatest help in the diagnosis of nervous diseases.

With the nicest appliances for observing and timing phenomena, there still remain discrepancies between the reports of different observers, however skillful. Time is required for the act of perception, for willing the pre-determined signal, and yet more for executing the volition, all of which directly affect the accuracy of the observation; and since these intervals differ with different observers, the exact moment of an occurrence cannot be fixed without knowing and allowing for them.

THE AUTOPSY OF PROFESSOR AGASSIZ.

Dr. Morrill Wyman, of Cambridge, Mass., has published a report on the autopsy recently made upon the body of Professor Agassiz, from which it may be deduced that the disease to which the great naturalist succumbed was one of long standing. The arteries at the base of the brain showed evidence of extensive chronic disease of their lining membrane, and also several important changes which were fatal. In the left ventricle at the lower third, a firm, organized clot, of the size of a peach stone, attached to the wall at the anterior portion near the septum, was found, and around this clot a more recent one had formed, its center softened and granular. From this, probably some small portions had been carried by the blood to the arteries at the base of the brain, doing their part in obstructing them and causing the fatal alterations above noted. The lungs showed evidence of old inflammation. The entire weight of the brain was 53·4 ounces avoirdupois, and its greatest weight, between the ages of 35 and 40 years, was estimated at 56 5 ounces.

Without entering into the technical details of the investigation, the result shows that the trouble began with inflammation of the lining membrane of the lungs, and that the morbid processes, carried by the blood from heart to brain, there disorganized and checked the circulation. The malady was too deeply situated to have admitted of surgical aid, nor could any effort of human skill have averted death from its effects. The autopsy was made in the interests of science and in deference to the expressed wishes of Professor Agassiz, long since placed on record.

MICROSCOPIC CRYSTALS IN PLANTS.

Besides the familiar bundles of needle-shaped crystals, called raphides, dispersed throughout the cellular structure of certain plants, there are in the seed covers and leaves of several orders of plants, and in the pods of the bean family, multitudes of prismatic crystals of extreme minuteness, which have hitherto escaped detection. In the horned poppy, these crystals are as small as the 8,000th of an inch in diameter. In the gooseberry and elm, they are $\frac{1}{3000}$ of an inch; in the black currant, about half as large; in the black bryony, they are about $\frac{1}{1500}$ of an inch in diameter, thickly set at regular distances throughout the seed covers. In the gooseberry, they are so distinctly and regularly placed in the outer skin—each crystal in a separate cell—that they present the appearance of crystaline tissues. In plants of the bean family, the size is variable, the average being about $\frac{1}{3000}$ of an inch. In the garden pea, they are much larger. These crystals appear to consist chiefly of oxalate of lime, sometimes carbonate. Raphides are mainly phosphate of lime.

Plants most relished by animals are found to be especially rich in these microscopic crystals. In a piece of the midrib of a clover leaflet, $\frac{1}{10}$ of an inch in length, Mr. Gulliver, who has added more than any other to our knowledge of these minute but important products of vegetable action, has counted 10 chains of crystals with 25 in a chain, making 250 in all, or no less than 17,500 to the inch. In like manner 21,000 crystals were reckoned for one inch of the sutral margin of a single valve of a pea pod. The pod had four such margins, each three inches in length; so that in a single pod there must have been as many as 250,000 crystals. In view of the marvelous number of these crystals, as well as their regularity and constancy, Mr. Gulliver believes it no longer possible for physiologists to maintain that such structures are accidental freaks of nature, of no relation to or value in the life and use of the species.

THE FIRELESS LOCOMOTIVE.

Mr. Richard H. Buel, a well known consulting engineer in this city, has recently published in the *Railroad Gazette* an account of a trial trip with one of the engines of the Fireless Locomotive Company. This article is interesting as being the first in which the theory of the action has been fully set forth. We have, on several occasions, made mention in our columns of the fireless locomotive, and have pointed out the advantages it possesses in many cases, such as greater comparative safety, less need of skilled attendants, and the absence of smoke and other products of combustion. Mr. Buel, in the article referred to, demonstrates that the locomotive can be operated successfully, if properly designed and managed; and he points out such improvements as seem to be desirable. We give a brief summary of the principal statements, omitting all mathematical work:

The locomotive with which the experiment was made consists of a platform set upon a four wheeled truck, carrying a cylindrical reservoir 37 inches in diameter and 9 feet long, with a steam dome 1 foot in diameter and 2 feet high. The steam space of the reservoir is connected with a pair of vertical engines, each having a diameter of 5 inches and a stroke of 7 inches; a 2 inch pipe, perforated with small holes, runs the whole length of the reservoir, near the bottom. In charging the reservoir this pipe is connected with the steam space of a stationary boiler, and steam is admitted until the pressure in the boiler and the reservoir are the same. The locomotive is then ready to run, and will continue to move until the water in the reservoir has cooled down so much as to be incapable of furnishing steam of a working pressure.

In making the trial trip, the pressure in the reservoir at starting was 142 pounds per square inch; and at the end of 49 minutes, during 35·5 of which the engines were in motion, it had fallen to 22, giving a mean pressure during the run of 81·5 pounds per square inch. At the start, the reservoir was half full of water. Indicator diagrams were taken during the run, and such *data* were noted as were possible. From these, it appears that the whole distance run was about 4·5 miles; the average horse power developed by the engines was 3·61, and the number of pounds of water evaporated in the reservoir, calculated from the indicator diagrams, 147. The writer then shows that if the engines had been designed in accordance with the best modern practice, the distance run by the locomotive, with this same evaporation, would have been from 2 to 2½ times as great. A calculation is then given, showing that, with a reservoir of the same size and engines about one and a half times as powerful as in the actual case, starting with a pressure in the reservoir of 275 pounds per square inch and ending with a pressure of 20, the locomotive might be expected to continue in motion for nearly six hours before the reservoir required recharging.

THE ORIGIN OF THE DIAMOND.

If we can trust a paragraph just now going the rounds of the press, the "diamond in the sky" of the nursery verses must be taken not as a happy comparison but as a genuine prophecy of scientific discovery.

It—that is, the paragraph—gravely alleges, on the strength of some supposed philosopher's opinion, that diamonds are in all probability a cosmic product—chips of original creation, so to speak—which the earth has picked up in the course of her travels through space; in short, that they are of meteoric origin. To the popular mind there must be something plausible in the suggestion, else it would not have been so favorably received by so many intelligent editors, ever on the alert for bits of valuable scientific information wherewith to regale their intelligent readers. Indeed, what could be more plausible to those whose knowledge of the diamond is embraced by the one word, carbon, and whose acquaintance with it is limited to some little familiarity with the appearance of the cut gem? How pure, how hard, how brilliant! What fitter product could there be of the heavenly spaces? But facts are earthly and very stubborn, prone ever to take the shine out of splendid theories. It is true that the diamond is a puzzle even to chemists; that the mode of its formation is a mystery; that even its place in the order of Nature is a matter of doubt. Like amber, it is found among minerals. Amber is known to be a vegetable product; and the diamond is thought by some to show strong evidence of a similar origin.

Its antecedents are mysterious, it must be admitted, but not wholly dark. Enough is known to make it certain that the notion of its cosmic origin is not to be seriously entertained, unless one is prepared to accept at the same time the far-fetched, germ-bearing meteor which Sir William Thomson suggested as the importer of life to our previously lifeless planet. In no other way, barring the earthly production of the gem, can we account for the presence of plant germs in the bodies of diamond crystals. Where in extra terrestrial spaces could the diamond, now at Berlin, have picked up its enclosed organic forms, so closely resembling *protococcus pluvialis?* Or that other diamond its chain of green corpuscules, like *polinoglœa macrocca?*

As surely as flies in amber prove the presence of animal life during some stage in the formation of that singular substance, the vegetable organisms found in diamonds are proof that these gems were formed amid surroundings not inconsistent with the presence of vegetation, perhaps in water: a supposition that finds support not only in the fact of their occasional inclusion of organic matter, but still more in the presence of *dendrites*, such as form on minerals of aquatic origin, in a diamond belonging to Professor Goppert. Crystals of gold, iron and other minerals have also been found inside of diamonds; still other diamonds are superficially impressed by sand and crystals, which leads some to believe them to have been originally soft; but it is quite as probable that these foreign substances may have interfered in some way with the perfect development of the diamond crystals, forcing them to grow around or partly around the obstructions.

Thus, even in its crystaline condition, the diamond is not always such a simple body as is popularly supposed. The writer of the paragraph in question speaks of it as "pure carbon crystalized," fit product of pure matter in pure space. So it is, sometimes, but it is also stained with impurities at times, and tinged with color, a thing of grades and degrees. And lower down in the scale are the imperfectly crystaline forms, known as boart and carbonado, harder than the true gem, but cruder and possibly more useful. It would be as correct to judge the common mineral quartz solely from its appearance in what is known as Brazilian pebble, as the diamond solely from the flashing brilliant. One exhibits no greater range of grades and shades and qualities than the other.

Though supremely beautiful in its best estate, the diamond appears to be but an earthly product, after all, subject like everything else, even theories, to earthly imperfections There may be a diamond factory up in the sky somewhere but the evidence of it is not strong. Arizona, even, promises a better field for exploration.

THE DEATH OF DR. LIVINGSTONE.

Information has recently reached England of the decease of Dr. Livingstone, the celebrated African explorer, during June last. It seems that, in journeying over a partially submerged country, he was obliged to wade some four days through quite deep water. The exposure brought on a severe attack of dysentery, of which he fell the victim.

David Livingstone was born near Glasgow, Scotland, in the year 1815, and at the age of twenty-five became one of the agents of the London Missionary Society in Southern Africa. During the sixteen years of his residence in that country, he traversed the region from the Cape of Good Hope to 10° south latitude, and then followed the Zambesi river to its mouth, thus completing a journey of over 11,000 miles. Returning to England, he organized a small expedition which set out in 1858, and returned in 1863, after further exploring the above mentioned country. In 1868 Dr. Livingstone again went back to Africa, and again entered a region totally unknown to civilization. Until found by the *Herald* reporter Stanley, some two years ago, little was heard from him, and numerous rumors of his death were extensively circulated. After Stanley's departure, he continued his exploration, but no news of him has been received until the present time, when the British officials at Zanzibar transmit the intelligence of his death.

It would be difficult to describe the labors of this most indefatigable of travelers in the space here at our disposal. In his death geographical science loses one of its most persevering students. It may be truly said that for a blank spot on the map of Africa—for a region unknown save through tradition—he has substituted a country rich, fertile and productive, which, before many years, will exercise no small effect upon the commerce of the world. His labors toward the suppression of the slave trade are well known, and have tended largely to limit the spread and decrease the barbarities of that infamous traffic. He resolutely refused to discontinue his work until he should believe it complete; and so, isolating himself from home and his own race for nearly a quarter of a century, he has existed among the savages, enduring privations without number. Though to many his toil may appear fruitless, and the years of patient search, barren in directly useful results, the world is nevertheless the gainer by the example of "one who loved his fellow men," who, single hearted in his devotion, died as he had lived, a martyr to science.

STEAM BOILER EXPLOSIONS.—THE WORK ACCOMPLISHED BY THE UNITED STATES COMMISSION.

We have received many inquiries of late as to what has been accomplished by the Commission appointed to investigate the causes of steam boiler explosions. The preliminary report of this Commission has just been transmitted to Congress. Below we give a summary of the principal points:

The following Commissioners were appointed to conduct the experiments: D. D. Smith, Supervising Inspector-General of Steam Vessels, President; Charles W. Copeland, of New York city; Benjamin Crawford, of Alleghany City, Pa.; Isaac V. Holmes, of Mount Vernon, O.; and Francis B. Stevens, of New Jersey. Mr. Stevens having declined to serve, J. R. Robinson, of Boston, Mass., was appointed in his place. The Commission above named held their first meeting on June 25, 1873, and in September issued circulars to scientific men and engineers, asking for expressions of their views. In these circulars they state the various theories of steam boiler explosions:

1. Gradual increase of steam pressure.
2. Low water and overheating of the plates of the boiler.
3. Deposit of sediment or incrustation on the inner surfaces exposed to the fire.
4. The generation of explosive gases within the boiler.
5. Electrical action.
6. Percussive action of the water, in case of rupture of boiler in the steam chamber.
7. The water being deprived of air.
8. Spheroidal condition of the water.
9. Repulsion of the water from the fire surfaces or plates.

The Commission also issued a circular, asking that safety valves be sent to them for test.

They received numerous replies to their first circular, which they state contained valuable suggestions. More than twenty safety valves were sent to them, both from the United States and abroad.

The Commissioners divided themselves into two committees, the eastern and western, the first to make arrangements for conducting experiments at Sandy Hook, and the second at Pittsburgh. There were five boilers, with the necessary connections, at Sandy Hook, which had been placed there by Mr. Stevens, and these were presented to the Commission by that gentleman. A bomb-proof was erected, the pipes were re-arranged and extended, a blower engine and blower were set up, an old steamboat boiler was connected, and four ordinary range boilers were set up. Gages were procured, and were compared with each other and otherwise tested for several days. On the 7th of November, 1873, the Commissioners commenced their experiments.

A boiler was tested by hydrostatic pressure to 182 pounds per square inch. A pyrometer was arranged so that the temperature of the crown sheet could be ascertained. Steam was raised to 50 pounds per square inch, and the water was blown off below the crown sheet. When the temperature of the latter had reached 750°, and the steam pressure was 54 pounds, one of the flues collapsed.

An old steamboat boiler that had been tested with cold water to a pressure of 44 pounds was next experimented with. A fire was made in the furnace, the boiler having an ample supply of water; and when the pressure was 70 pounds per square inch, two of the top sheets of the boiler gave way. The pressure gradually rose to 73 or 74 pounds, when the safety valve suddenly opened and the experiment was brought to a close. A subsequent examination showed that an old crack had existed at some points of the rupture.

On the 13th of November, the water in the pipes was frozen, and the Commissioners decided to suspend operations at Sandy Hook for the season.

Preparations had been completed for the experiments at Pittsburgh, five boilers being placed in position, bomb-proofs erected, and a shop and store room fitted up. The boilers were of the ordinary two flue variety in use on western rivers, two of them being of steel and three of iron.

Experiments were commenced on November 20, with one of the iron boilers. The fire was not sufficient to produce a greater pressure than 195 pounds per square inch. The experiment was repeated, and a pressure of 202 pounds per square inch was attained. On the 21st of November another boiler was tested, and the fire gave out when the pressure had reached 342 pounds per square inch, with no other effect than producing some slight leaks. The first boiler was also tried again, its furnace having been enlarged, but the highest pressure attained was 220 pounds per square inch. On the 22d of November, the same boiler was tried once more, and this time a pressure of 275 pounds per square inch was reached before the fire gave out. Steam was then raised on the second boiler, and both flues were collapsed from end to end. An instant before the collapse, two men entered the bomb-proof, which contained three recording gages. According to their statements the three gages showed, at this time, 400, 450, and 500 pounds per square inch, respectively; but the record given by the gages, when examined after the collapse, was 350 pounds. The Commissioners remark that one of the results of the experiments has been to develope the fact that the instruments employed were quite unreliable, under the extraordinary pressures and temperatures to which they were subjected. No other results or conclusions are given, it being remarked that they can be more effectively embodied in a final report. The Commissioners report that about $50,000 (half of the appropriation) has already been expended.

The above is a careful synopsis of the report, given nearly in the words of the Commissioners. But we feel that we ought not to let the matter drop without some few comments. Our own position on the subject of boiler explosions has been often clearly defined, and our readers well know that we look for nothing more mysterious than too much steam, or too weak a boiler. At the same time, we are willing to concede that great good may result from experiments of this kind, properly carried out. One part of the work of the Commission we have looked forward to with the greatest interest. We refer to the test of safety valves. The only extended trial of the kind of which we have knowledge was made by the Life Saving Commission, a few years ago; and the result of that trial showed clearly that many of the safety valves in common use were wrongly named. It is difficult for us to see why the Commission, organizing early in the summer, delayed their experiments until the approach of cold weather. It is still more difficult to understand why the cessation of operations has been so complete. Surely, if every change of pressure and temperature of the steam affects the accuracy of a gage (which is quite a novel proposition to engineers) the Commissioners could continue their experiments, and reach a definite conclusion upon this point. The tests of safety valves, also, might well be continued through the winter. There is a strong suspicion in the minds of many that this Commission is not working purely in the interest of Science. It seems somewhat remarkable that the Supervising Inspector-General, who has so many other important duties, should be the chief man in the Commission. The fact that such an enormous sum of money has been expended, with such slight results, is calculated to awaken inquiry; and the refusal of Mr. Stevens, who inaugurated this style of experiments, to serve on the Commission, is a most significant fact. The public are vitally interested in all work of this character, and we but do our duty in calling attention to the shortcomings of the Commissioners, as evidenced by their own report.

Dangers of Gasoline.

At Bennington, Vt., last month, the knitting factory of H. E. Bradford was destroyed by fire. A leakage of the gasoline pipes permitted the flow of this heavy hydrocarbon gas along the floor until it reached the fire at the boiler, when a terrible explosion took place, demolishing the building. Nine women were instantly killed and several others were badly hurt. One of the especial dangers attending the use of gasoline is that, in case of leakage, it moves along the cellar bottom or lower floors of the building, and there is no means of detecting its presence until it reaches fire, when the entire mass explodes with terrible violence. Many sad accidents have occurred from its use. The ordinary street gas is less dangerous, because, being lighter, it commingles with the air, and its presence is soon detected by the olfactories.

ALLAN'S FLOATING BATTERIES AND SALOONS.

Mr. Alexander Allan, of Scarborough, well known to the world as the inventor of the straight link valve motion, has recently invented and patented certain modifications of the Bessemer steady cabin idea. Mr. Allan does not attempt to deal with the subject of sea sickness further than trying to show that the arrangements he suggests will reduce the movements which authorities state are the principal causes of it. These are given as (1st) pitching, (2d) rolling, (3d) angular pitching, (4th) angular rolling, (5th) vibration from waves striking the ship, (6th) tremor from engines, (7th) longitudinal advance of ship, (8th) upward and downward motion of translation, (9th) seeing swinging or moving objects, and smells of burnt grease, engine room, and bilge water.

The first four motions are overcome by Fig. 1. The float is guided as a large pendulum, on its center ball and pillar, ballasted in the bottom, and floats freely in the water surrounding in its dock. If the ship takes all the four movements given above, the dock would do the same; but the water in the dock would keep its atmospheric level, and the pendulous spherical float would keep pace with it and maintain its level also, whatever point of the compass the movement came from.

As regards vibrations from waves striking the ship: The dock in which the cabins float is of about the least vibratory shape; it is away from the ship's side or skin; the medium in which the cabins float is free to take the reduced vibrations to its surface and liberate them in smaller waves, and would not affect the convex surface of the floating cabin.

As respecting the tremor from engines, this would be reduced in the same way by the non-vibratory shape of the dock, the floating medium carrying vibratory waves to its surface, and the strong shape of the floating body. Then for the longitudinal advance of the ship: While the ship remains on an even keel, we do not see any cause of disturbance more than in the advance of a railway train or carriage of any kind.

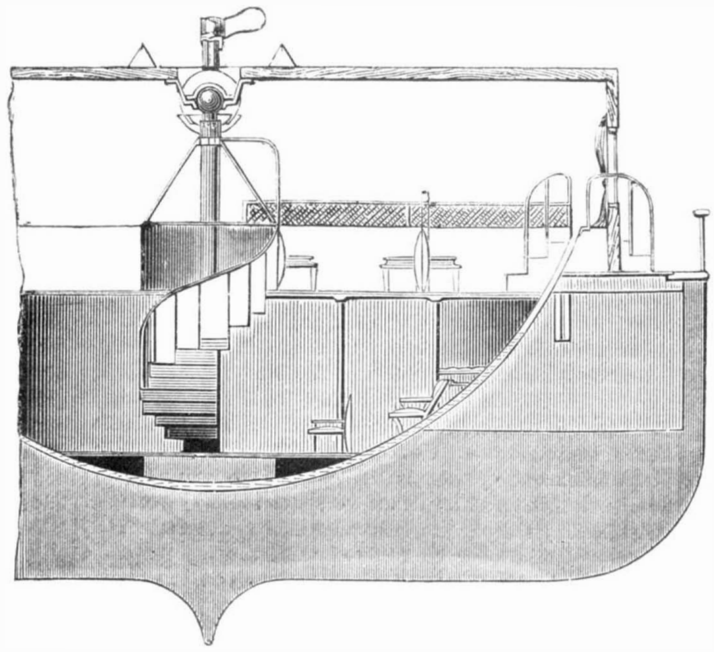


Fig. 1.—ALLAN'S FLOATING SALOON.

As to the upward and downward motion of translation. This, Mr. Allan fears, cannot be entirely neutralized, and some speakers at the Society of Arts' discussion did not consider it the worst movement or a serious one. Should the ship plunge or lurch suddenly into the trough of a sea, the floating cabin would acquire momentum, which would be checked or buffeted, and the effect or shock would be reduced in the cabins by the float dipping lower (say by one eighth inch to one fourth inch), raising the water in the dock somewhat.

As to the subject of swinging or moving objects: In the lower cabin passengers would not see any article in motion. In the saloon, to prevent the passengers seeing the roof approaching and receding as the ship rolled, an awning could be arranged to cover a large area of the roof, supported on the float like a huge umbrella; and should the roof touch the wires of support, by an extreme roll they would regain position as the ship righted. These cabins will be without the usual smells of engine room and bilge water.

Fig. 2 shows a modification of the arrangement in which the ball socket is fixed on a spindle fitted to a spider frame, secured to armored shields erected on deck. This keeps the caisson steady.

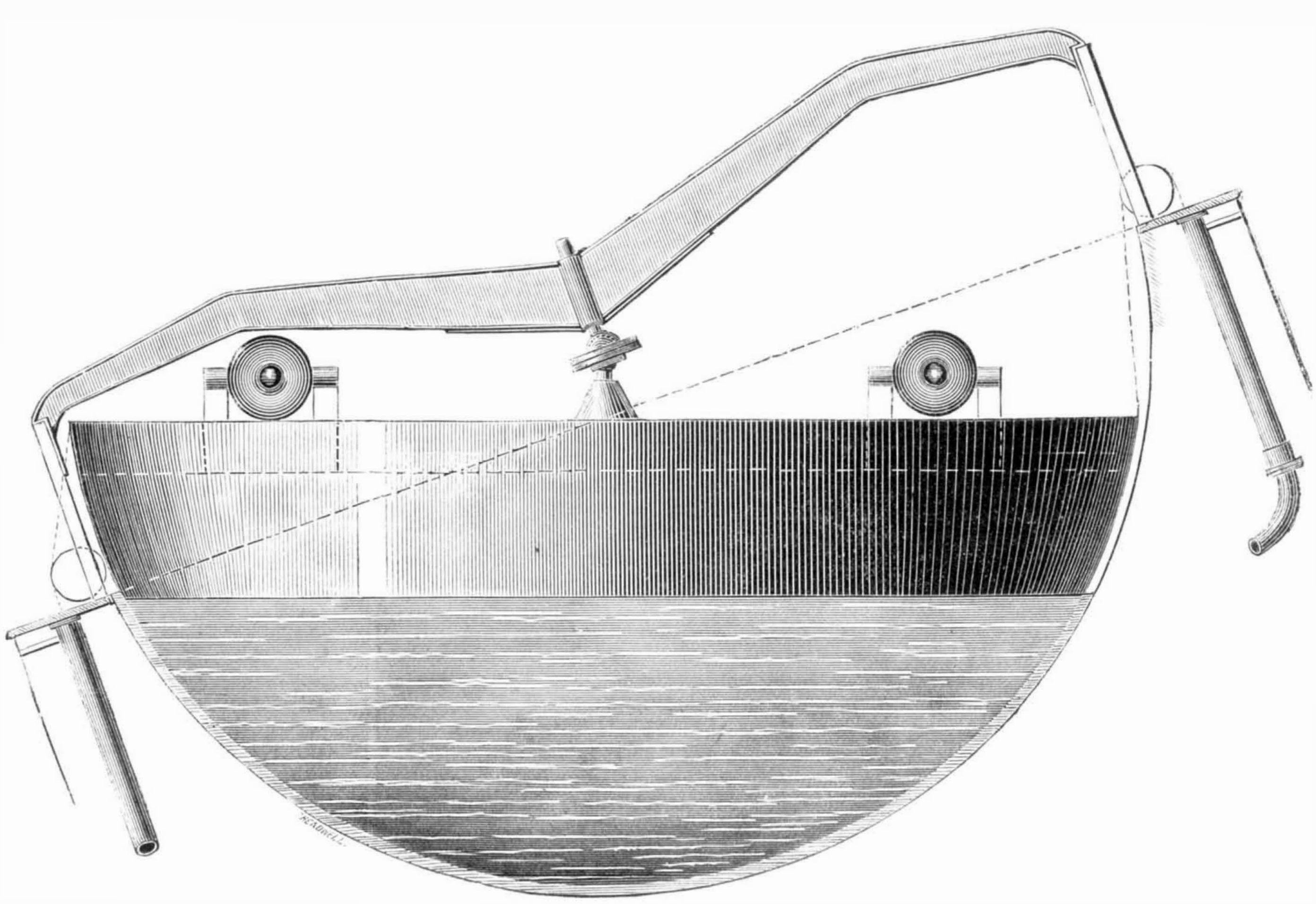


Fig. 2.—ALLAN'S FLOATING BATTERY.

Mr. Allan's specification includes a number of ingenious modifications of the main principle, for which we have not space. We have said enough to show that Mr. Bessemer is not alone in the field of invention as a producer of steady platforms, and we have no doubt that Mr. Allan's consummate knowledge as a mechanical engineer would enable him to command a great element of success in putting his invention in practice.—*The Engineer.*

Influence of the Winds on Vegetation.

A writer in the *American Exchange and Review* has recently called attention to the extent to which vegetation is dependent for its life and growth on the winds, by which alone vapor and rain are conveyed from the place of formation and distributed over the earth. While animal life is able, by its powers of locomotion, to seek the necessary moisture, the vegetable world, were it not for the air currents, would perish from the earth. This destruction would obviously be very rapid as the quantity of the solid matter in a plant is small compared to that of the water. And therefore the moisture of the soil is more necessary to vegetable growth than are the mineral constituents; and the water not only provides the means of growth of the plant, but also accelerates the decay by which the solid constituents are returned to the earth, to rise anew in the plant life of another generation.

For the evaporation by which water is raised into vapors, for the subsequent distribution of that vapor and for its condensation in the falling rain, Nature has provided the ceaseless, omnipresent aerial currents. The magnitude of this process of exhaustion and restitution may be estimated from the fact that the total daily discharge of all the rivers in the world into all the oceans is but the quantity of rain which has fallen in a single day. The sun's heat falling on a water surface converts a part of it into a vapor, which rises into and is diffused through the atmosphere, in obedience to the laws that govern the mingling of gases. Within a certain limit this vapor remains invisible, and cannot be distinguished from the main bulk of the air. At every temperature the air is capable of holding in an invisible condition a definite quantity of vapor. The warmer the air, the more it can hold. But for every temperature there is a point, beyond which it is impossible for more vapor to pass it. This point is called the point of saturation, or the dew point. When the air has reached its dew point, and its temperature is increased, no visible effect is produced—its capacity for moisture is simply increased; but if its temperature be lowered, then it is no longer capable of holding all its moisture and the surplus becomes visible in some form or other of precipitation, namely, as fog, cloud, dew, rain, hail, or snow. In order to account, then, for any precipitation of moisture, it is necessary first that a sufficient quantity of vapor pass into the air to bring it to its dew point, and then that the temperature be lowered. The quantity of moisture thus precipitated will clearly depend upon two circumstances, namely, the temperature of the air when the dew point is reached, and the temperature to which it was subsequently lowered. The higher the one and the lower the other, the greater will be the precipitation.

The means by which the lowering of the temperature can be accomplished are varied. A warm vapor-laden air may blow into a cold region, and thus have its temperature lowered sufficiently below the dew point to give a considerable rainfall. A cold wind may mingle with a warm one, and thus produce a moderate shower; or powerful ascending currents may carry the moisture of the lower strata into the upper regions of the atmosphere, where the temperature is very low.

The deposition of the moisture of the air is, then, in all the cases we have considered, referable to atmospheric motion: for upon it will depend the presence or the absence of moisture in any region, and consequently the presence or absence of vegetable life. The ocean of aqueous vapor partakes perfectly of the movements of the atmosphere. It in fact derives its movements mainly from those of its bulkier neighbor. It is to the motion of the winds, then, that we must look for the explanation of the peculiarities that attend the distribution of moisture.

Car Coupling Slaughters.

During the eleven months ending December 1, 1873 four hundred persons were killed while coupling cars on the Pennsylvania railroad. "Is it the fault of the inventions, or is it the fault of the railway companies, that some of the improved devices be not more widely used, and the slaughter of employees stopped?" asks a correspondent of the *Commercial Advertiser.*

Several devices have been fully described and illustrated in our columns, and many have, when practically used, proved valuable inventions. We think there is little room for argument on the point that if a railroad company chooses to ignore modern improvements, and persists in retaining on its cars the old fashioned connection, saving perhaps the few dollars otherwise invested in experimenting at the cost of the lives of hundreds of its employees, the blame falls fairly and squarely on their shoulders and the public should fully appreciate the fact.

The Stability and Reciprocal Metamorphoses of the Oxides of Nitrogen.

The above subject, already studied by many chemists, has recently been investigated by M. Berthelot, and many new facts have been adduced. Hyponitric acid, until the present considered to be most stable of the oxides of nitrogen, has been, by the above chemist, decomposed into oxygen and nitrogen. The gas, hermetically sealed up in a glass tube, was submitted to the action of series of electric sparks. In an hour and a quarter the acid was decomposed; and after eighteen hours, but 14 per cent of the primitive volume remained. As this limit could not be passed, total decomposition was believed to have taken place.

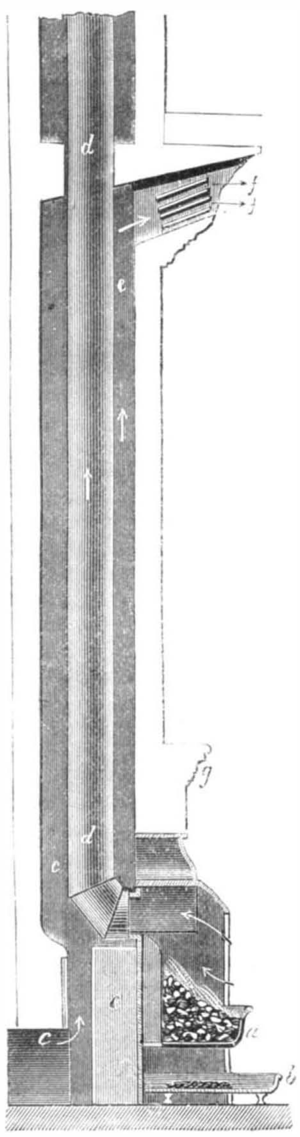
M. Berthelot also notes a curious anomaly which is presented by the combination of nitrous acid with oxygen, in order to produce hyponitric acid. Contrary to the usual result, a dilatation takes place. Two volumes of nitrous acid unite with one of oxygen, and the result is four volumes of hyponitric acid.

Passing to protoxide of nitrogen, the author finds that it is at about 1060° Fah. that the gas is decomposed by heat. The electric spark decomposes it very rapidly; in one minute one third of the gas is decomposed; and at the end of three minutes, two thirds or three quarters. The deutoxide of nitrogen, under the action of the spark, resolves itself, one part into nitrogen and oxygen and the other into protoxide of nitrogen and oxygen. The protoxide at the limit forms two thirds of the decomposed portion. Under the influence of prolonged contact (cold) with the binoxide, many mineral and organic substances undergo slow and partial oxidation.

"A MASS. MAN" points out that Massachusetts stand next to Connecticut on the roll of inventive genius, as show by the table on page 65 of our current volume.

CAPTAIN GALTON'S VENTILATING FIREPLACE.

Mr. C. William Siemens, F.R.S., recently delivered a lecture before the operative classes at Bradford, England, on the important subject of fuel. The portion of the discourse under the subheading of domestic consumption was mainly devoted to advocating the use of Captain Galton's ventilating fireplace, a sectional engraving of which we herewith present. Referring to the invention, Mr. Siemens termed it "the one grate that combines an increased amount of comfort with reasonable economy, and which, although accessible to all, is as yet very little used." It is not patented.



The device differs little in external appearance from an ordinary grate except that it has a high brick back which forms the exterior boundary of a chamber, *c*, into which air passes directly from without, becomes moderately heated (to 84° Fah.), and using, in a separate flue, *e*, is injected into the room at *f*, under the ceiling. A plenum of pressure is thus established within the room, whereby indrafts through doors and windows are avoided, and the air is continually renewed by passing away through the fireplace chimney as usual. The latter, *d*, it will be noticed, is encircled by the air flues, so that the heat of the ascending products of combustion is utilized throughout its whole length. *a* and *b* are respectively the grate and ash pit, which are curved outwards slightly in advance of the mantel.

Mr. Siemens remarks that the cheerfulness of an open fire, the comfort of a room filled with fresh but moderately warmed air, and great economy of fuel, are here happily combined with unquestionable efficiency and simplicity. Such high commendation emanating from so distinguished an authority will, we think, bespeak for the apparatus more than an ordinary share of attention. It seems to us that the principle underlying its construction may lead to some better arrangement of heating and ventilating devices in our public halls and school rooms, and thus prevent many of the difficulties pointed out in our recent editorial on this important subject.

HOW GREENBACKS ARE CANCELLED.

The money received by mail comes in all sorts of damaged conditions, and has all imaginable kinds of horrible or ludicrous histories. Sometimes it has been swallowed by a calf or a goat, which, finding a pocketbook carelessly left within its reach, proceeded to regale itself with the salt which the leather had absorbed from the perspiration, until the book was forced open and the contents exposed. The green notes had an inviting and familiar appearance, and the confiding animal eagerly swallowed them, and so sealed his own death warrant; for the owner, returning and seeing the wreck of the pocketbook, rightly conjectured where his money had disappeared, put the unwilling thief to death and recovered the half digested notes. Others have been found on the bodies of drowned or murdered men, weeks perchance after their death. Frequently they have been so burned that nothing remains but the charred resemblance of notes, so frail and brittle that a slight touch will change them to cinders.

The identification and restoration of notes which have been burnt is a difficult and interesting operation. Every one has observed that a printed paper, after having been burnt, if not subjected to a strong draft or roughly handled, retains its original form, and that the printing is distinct and legible, and appears as if it had been raised or embossed on the paper, but that if it is touched never so gently it crumbles into dust. Notes in this condition are frequently received at the Department for redemption. The counter subjects each note and fragment of a note to a careful inspection in a strong light, under a powerful glass, until she determines the denomination and issue, and then pastes it upon a piece of thin, tough paper, in order that it may be safely handled. But this pasting, by destroying the raised or embossed appearance, at once and for ever precludes all chance of again identifying the kind or denomination of the note. Henceforth it is but a plain, black piece of paper, giving no indication that it ever represented money. It is therefore very necessary that the counter should be quite sure that her judgment is correct before the note is pasted upon the paper. She must also—a most difficult task—determine whether the note is genuine or counterfeit. And yet counterfeits are discovered by these experts among the charred remains of notes with almost as much certainty as among perfect notes.

The whole basement floor of the north wing of the Treasury building, at Washington, including the large room under the cash room, is occupied by these busy counters. One hundred and eighty women are engaged in counting redeemed money in this division. The work is far from pleasant, for the money is often deplorably dirty and emits the most nauseating smells.

Such labor cannot fail to be detrimental to health, especially as want of space has necessitated the crowding of the counters almost as closely as they can sit. Hence we are not surprised to see that many of the women are pale and thin, and apparently weary and careworn.

Entering the last room to which our inspection will lead us, a busy scene is presented. Messengers, each accompanied by a counter, are hastening to and fro with boxes containing bundles of money carefully strapped and labeled, while a bevy of women surround a large table which they almost screen from our gaze, but which the continual "thud!" "thud!" that salutes our ears proclaims to be the site of the cancelling machine. Approaching, we find that

FIG. 1.—CANCELLING REDEEMED GREENBACKS.

the apparatus consists of two heavy horizontal steel bars, about five feet in length, working on pivots about a foot from the ends nearest to us. To the shorter end of each is attached a punch, while the other is connected by a lever with a crank in the sub-basement beneath, which is propelled by a turbine water wheel, furnished with Potomac water from one of the pipes which supply the building. The bundles of notes, each containing one hundred pieces, are passed rapidly and dexterously under the punch by a man whose fingers seem ever just on the verge of complete destruction, but which always escape in some marvelous manner unhurt and whole. The punch savagely and easily cuts a hole in each end of each bundle. This is done for the purpose of effectual cancellation. The bundles, when all have been punched, are returned to the box, the messenger picks it up, and the counter and he hasten away to turn over the money to the clerk who is to make up the cash account of the division and ascertain whether all the money received and delivered to the counters has been returned and accounted for. From the time when the money is received by her, until it is thus delivered, the counter is responsible for it, and is required to keep it constantly within sight, except when it is locked away for the night. For this reason she accompanies the messenger who carries her box to the cancelling room, superintends the punching, and returns with the money to the clerk, to whom it is delivered, when her responsibility ends.

Just beyond the punches, a knife of formidable aspect and

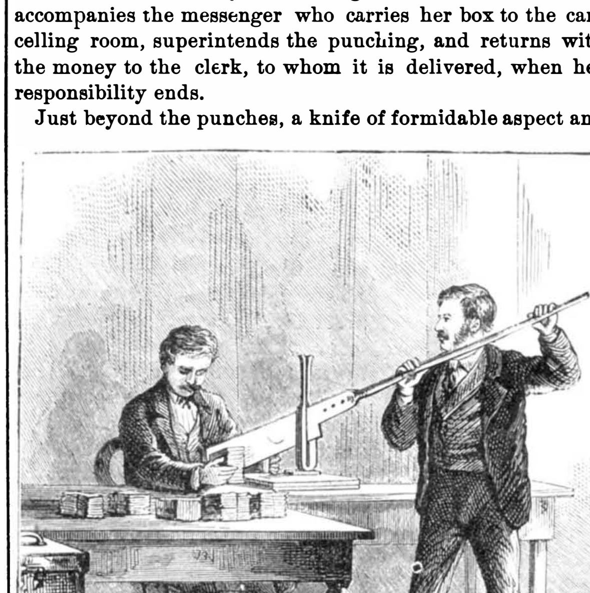
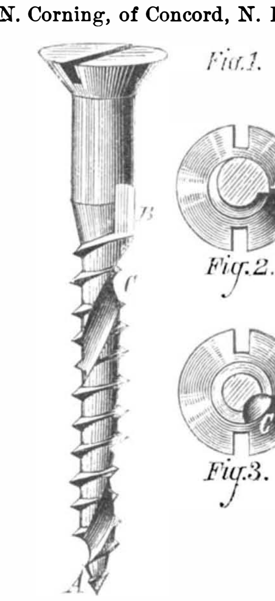


Fig. 2.—CUTTING CANCELLED GREENBACKS.

proportions is engaged in cutting the cancelled bundles in two in the middle of each note. After a sufficient quantity of money has been counted, it is made up into lots of about one hundred thousand dollars of fractional currency and proportionately larger amounts of legal tender notes, and sent in to be cut in two by this knife. The straps with which the bundles of notes are surrounded are so printed as to be also cut in two, and to show upon each half the denomination of the notes, the issue, and the number inclosed. The counter's initials and the date of counting are also written upon each end, as well as a number or letter to identify the bundle, so that if, upon recounting the money, errors are discovered, they can be traced in a moment to the proper counter, date, and bundle. One set of half notes is delivered to counters in the Secretary's office, the other to counters in the Register's office, in each of which the money is recounted. This is done as a check upon the Treasurer's counters, and for the purpose of securing as complete accuracy as possible.

IMPROVED WOOD SCREW.

Messrs. A. N. Ladd and C. N. Corning, of Concord, N. H., are the patentees of a novel and apparently useful form of wood screw herewith illustrated. The improvement consists in combining the German twist bit with the screw, in such a manner that the latter will cut its own way or hole in the wood, so as to enter the same easily and avoid splitting or other difficulty. The device may be used with the common straight bit, if desired, but the German twist bit, as shown at A, Fig. 1, is believed to be the best combination. A section of the screw is represented at Fig. 2, and Fig. 3 is a similar view of a cutter (B, Fig. 1) in the shaft of the screw, by which a hole is cut for the shaft of a larger size than is made by the bit portion of the screw. The channel or groove, C, is cut, no through the threads alone, but into the body of the screwt and retains the wood cut away by the bit.



DRAWING AND SKETCHING---PRACTICAL HINTS AND RECIPES.

We give below a number of useful suggestions and recipes relating to drawing, compiled from a variety of sources and comprising, so far as possible, the most recent improvements, as well as the plainest directions attainable, which seem to us likely to be of service to the student of the art.

In selecting a drawing board, choose wood of close grain, well seasoned, free from knots, and of even surface. Notice that the edges are perfectly straight and at right angles. A slight roundness may be given to the face with advantage in order that the drawing paper when stretched may rest tightly and flatly upon it. An apparently excellent form of board, lately introduced in the market, consists of strips of pine wood glued up to the required width with the heart side of each piece of wood to the surface. A pair of hard wood ledges are screwed to the back, the screws passing through the ledges in oblong slots bushed with brass, which fit closely under the heads and yet allow the screws to move freely when drawn by the contraction of the board. To give the ledges power to resist the tendency of the surface to warp, a series of grooves are sunk in, half the thickness of the board over the entire back. These grooves take the transverse strength out of the wood to allow it to be controlled by the ledges, leaving at the same time the longitudinal strength of the wood nearly unimpaired. A slip of hardwood is let into the edge of the board and sawn apart at about every inch to admit contraction. Its object is to make the two working edges perfectly smooth, thus allowing of an easy movement with the square.

Whatman's (English) drawing paper is generally preferred It is known by the following names, according to dimensions of sheet: Demy 15 × 20 inches, medium 17 × 22, royal 19 × 24 super royal 19×27, elephant 23×28, imperial 22 × 30, colombier 23 × 34, atlas 26 × 34, double elephant 27 × 40, antiquarian 31 × 53. Its cost for "selected best" varies from $1.00 to $30.00 per quire. Paper can usually be bought ready mounted on muslin, but the process can be easily accomplished by first tacking the cloth tightly to a frame and covering it with a coat of strong size, leaving the same until nearly dry. The sheet is then well laid with paste, in two coats, the second being applied some ten minutes after the first. The paper must lastly be placed carefully upon the muslin, patted down all over with a clean cloth, and left to become thoroughly dry before removing from the board.

In fastening paper to the drawing board, there is no necessity of soaking the sheet, as is recommended in many handbooks on drawing. Lay the paper, back up, and go over it with a large flat camel's hair brush well filled with clean water. Wet the sheet to a distance of about an inch and a half from the edges. Two applications of water are sufficient, the second being applied when the wet gloss of the first disappears. Then turn the sheet over, wet side against the board, and bend up the edges, tightly all round, against a flat ruler, afterward passing the paste brush between the turned up edge and board. The ruler is afterward drawn over the glued edge and pressed along. The next adjoining edge must be treated in the same manner and so on until all sides are secured. Wetting paper on the right side with a sponge or cloth is a bad habit and tends to destroy the fine surface, rendering it unsuitable to receive clean washes of ink or color. The right side of Whatman's paper can be told by holding the sheet up to the window,and noticing that the water mark reads from left to right; the reverse side should not be used except for rough sketching,as it generally has knots and other imperfections, which exhibit themselves when washed over.

As regards pencils, the market offers quite a number of excellent varieties from which a selection can be made. Faber's are standard articles, though a cheaper but equally good pencil is made by the Dixon Crucible Company. The latter is used by the artists of the SCIENTIFIC AMERICAN in drawing upon wood, no light test for the qualities of a pencil, by the way, and has proved of excellent quality. In sharpening a pencil, it should be remembered that, for sketching, a fine conical point is required, but for fine drawing it is much better to have the end thin and flat. To produce this, the wood is cut away from two sides only, so as to make a chisel-shaped extremity, and afterwards removed from the other sides only sufficient to slightly round the edge. This kind of a point can easily be kept sharp by rubbing the lead occasionally upon a bit of fine sand paper.

The best eraser is known as bottle rubber, which is quite soft. It has the merit of not fretting the surface of the paper. A good way of hiding small mistakes in ink lines, in places where scraping with a knife cannot be well accomplished, is to touch the spots over with flake white, mixed rather dry, with a fine sable brush.

A good black and indelible drawing ink, it is stated, may be made by dissolving shellac in a hot water solution of borax and rubbing up in this a fine quality of Indian ink. After using, the drawing pen should be dipped in alcohol and wiped dry. Good Indian ink will show, when the stick is broken, a very bright and almost prismatic colored fracture; if employed singly and without admixture, it should be used at the first rubbing. Redissolving renders its washes cloudy and irregular in tone.

To fix pencil drawings,various plans are in use. The simplest way is to cover the paper with new milk and dry carefully. Water starch, cold isinglass water, size or rice water, may also be applied with a camel's hair brush. Collodion mixed with paraffin, stearin, or castor oil, has been suggested for the same purpose, and is said to render the sketches much clearer and more easily copied.

Drawings may be copied in facsimile by the aid of various mechanical contrivances, or transferred by the use of transfer paper. The latter is made by rubbing white paper with a composition consisting of 2 ounces of tallow, ½ ounce powdered black lead, ¼ pint linseed oil, and sufficient lamp black to make it of the consistency of cream. These should be melted together, and rubbed on the paper while hot. The prepared sheet is placed between the original and the blank paper, blackened side against the latter. The lines of the original are then gone over with a steel point (a darning needle with the point ground off will answer) and are thus caused to appear on the paper below. Copies may be multiplied by perforating the picture, or a copy of it if it be desirable not to destroy the original,with a number of fine needle holes along the outlines, and then laying upon the paper. A piece of cotton wool dipped in finely powdered blacklead,(or chalk,which is better),is then gently patted over the surface, so that the powder passes through the holes and appears on the sheet below. The outline is then filled out with pencil.

Rénault's reproducing process consists in first making the drawing on strong glazed paper with glutinous ink and afterwards covering the lines with bronze powder. If the drawing thus prepared be pressed upon a sheet of sensitized paper, the lines of the original drawings are reproduced in black by the chemical action of the pulverized metal upon the sensitized paper. By softening the ink with the vapor of alcohol, and renewing the bronze when it is exhausted, many impressions may be produced.

Tracing paper can almost always be readily procured at a small expense. It is not difficult to make by washing thin paper with a mixture of spirits of turpentine 6, resin 1, and boiled nut oil 1, parts by weight, applied with a soft sponge; or a simpler way is to brush over thin unsized paper with a varnish of equal parts of Canada balsam and turpentine. Vegetable parchment, sometimes used for drawing purposes, is made by dipping ordinary paper for a few seconds in a solution containing one part water to six sulphuric acid. Careful washing at once is necessary to remove every trace of the acid.

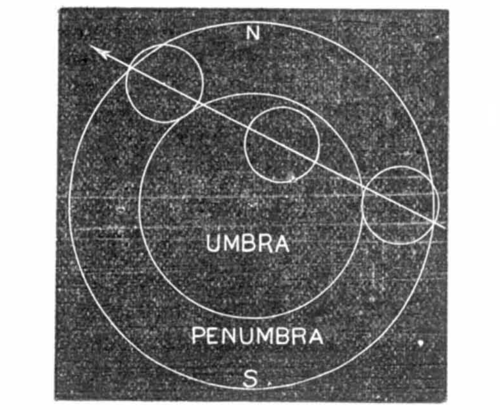
In using colors, at the outset purchase none but the very best, as with no other can purity of tone in washes be gained. The following table, showing the general indication of tints used in mechanical drawing, will perhaps prove useful: Carmine or crimson lake for brickwork in plan or section to be executed; Prussian blue, flint work, lead, or parts of brickwork to be removed by alteration; Venetian red, brick work in elevation; violet carmine, granite; raw sienna,timber not oak; burnt sienna, oak or teak; Indian yellow, fir; Indian red, mahogany; sepia, concrete or stone; burnt umber, clay earth; neutral tint or Payne's gray, cast iron, rough wrought iron; dark cadmium, gun metal; gamboge, brass; indigo, bright wrought iron; indigo with a little lake, bright steel; Hooker's green, meadow land; cobalt blue, sky. If washes do not flow well, owing to greasiness of the paper, a few drops of prepared ox gall in the water with which they are mixed will generally remedy the trouble. In coloring tracings on thin paper, work on the back and mix the colors quite dark.

Correspondence.

Total Eclipse of the Moon, October 24, 1874.

To the Editor of the Scientific American:

On October 24, 1874, a total eclipse of the moon will occur, which will be visible throughout the United States and Canada.



The accompanying diagram represents the path of the moon through the earth's shadow during the eclipse and the moon's position at the time of the middle of the eclipse. The first and last contact with the umbra, or shadow, are also shown. The Washington mean times of the different phases, as given in the *American Nautical Almanac* for 1874, are as follows:

First contact with penumbra	11h. 35·8m.
First contact with shadow	12h. 33·7m.
Total phase begins	13h. 51·7m.
Middle of eclipse	14h. 8·6m.
Total phase ends	14h. 25·4m.
Last contact with shadow	15h. 43·5m.
Last contact with penumbra	16h. 41·3m.
Magnitude of eclipse (moon's diameter = 1)	1·053
Duration of total phase	33·7m.
Entire duration of eclipse	5h. 5 5m.

The mean time at which the phases occur at any other place may be easily found by simply adding or subtracting the longitude of the place from Washington, to or from the times above given, the correction being added when the longitude is east, or subtracted when it is west.

The times of the occurrence of this eclipse, as given above, are astronomical, being reckoned from 0h. at noon of October 24 upwards, so that the greater portion of the eclipse occurs on the morning of October 25, civil time.

St. Catharine's, Ontario, Canada. J. M. BARR.

The Devil Fish of Newfoundland.

To the Editor of the Scientific American:

In your article on the devil fish. in No. 9, volume XXIX., you speak of "historians, otherwise credible, reporting the capture of some which measured 40 feet." As a proof of their veracity, I inclose you a photograph of an arm or sucker which measures 17 feet in length. It was coiled for the purpose of bringing the whole within the field of the camera, the diameter being 2 feet 6 inches as it lay on the table of the artist. It is of a nearly uniform circumference of 3½ inches for 14 feet 6 inches of its length, and 6 inches at the thickest portion of the remainder containing the suckers.

While off the eastern end of Belleisle, in Conception Bay, the crew of a fishing boat noticed what they supposed to be an old sail upon the water, and proceeded to make prize by striking it with a boat hook, when, to their astonishment, the limb now photographed was thrown across the boat from gunwale to gunwale; it was broken from the creature some feet (not less than two) from the body, and subsequently pieces were cut off by the boys of the settlement to which the men belonged, before an attempt was made to preserve the specimen. How much was lost in this way cannot be told. When fresh, the length was taken by a reliable person as 19 feet, but with the same tape line, some time afterwards, I found it reduced to 17, probably by the strong pickle used for its preservation.

Another sucker, described as being as thick as a man's thigh, was also thrown into the boat, of which a length of five feet was chopped off but, unfortunately, lost. The men used their oars as levers over the gunwale to pry the boat from the creature, which shortly rushed off at great speed, then, stopping, went into a flurry, throwing the peculiar inky fluid of the squid with great violence over a space of two hundred yards, and in such quantities as would have swamped the boat had the discharge taken place close to it.

The hurried and alarmed observations of the crew are, of course, worth but little as to actual size, but the men think the total length could not have been less than 60 feet.

About three weeks previously a creature, described as of great length (probably 60 feet), was seen from the shore while swimming in the bay, within a few miles of the same place.

The specimen is now in spirits in the museum being formed by Alexander Murray, Esq., F.G.S., our geological surveyor.

Since writing the foregoing, an entire devil fish was captured by getting foul of some nets at Torbay, about nine miles from here. The body is about 6 feet 6 inches long, and the eight main tentacles about the same length, with two others of 22 feet each, measured from the head to the extreme point. To bring the entire length into view these were hung over a rail. The body and eight tentacles around the head are about of equal length, and this seems to be the usual proportion of the structure of these creatures, with two other slenderer arms three and a half to four times longer.

The notice of this specimen has brought out many anecdotes of large squids having been stranded on our shores, in all cases reliable as to great size, and more or less so as to actual dimensions, which range (for the bodies) to eighty and even ninety feet. Without accepting them as authentic, the fact seems established that a considerable number of these creatures, of large size, exist in the Newfoundland and Labrador waters. J. T. NEVILLE,
Inspector of Lighthouses.

St. John's, Newfoundland.

[Our thanks are due to our correspondent for the photographs mentioned in his letter, and which have safely reached us. They exhibit a hideous and formidable monster, and represent with great clearness, on the long tentacles, the suckers by which the animal attaches itself to whatever may come within its grasp. It is to this species that Victor Hugo alludes in his novel, "The Toilers of the Sea," in which one of the personages is clutched by a devil fish, and slowly drawn to a horrible death.—ED.]

Poisonous Aniline Dyes.

To the Editor of the Scientific American:

I fully agree with you that aniline dyes should not be used in candies. I recently ate about three inches of stick candy, of a red color, and was taken sick with a burning pain in the stomach and upper intestines. I grew worse; in three days I was not able to walk without being faint and giddy, and had much pain all the time. A doctor prescribed for a case of aniline poisoning, and three doses of medicine put me out of danger. I am now about well again.

WILLIAM WARD.

Cleveland, Ohio.

Microscopical Exhibition.

The Odontographic Society lately gave a microscopical exhibition in the rooms the of Philadelphia Dental College, before an audience of about five hundred ladies and gentlemen, who manifested the most marked interest in the display of instruments and objects.

The microscopes, forty in number, were placed upon the operating tables, extending one hundred feet. The instruments were arranged so as to be a distance apart sufficient to afford a fair view of the objects without inconvenience to the visitors. In addition to the microscopes belonging to the members of the society, a number of valuable instruments were kindly loaned for the occasion by the Biological and Microscopical Section of the Academy of Natural Sciences, and by several eminent microscopists. The microscopes included every variety of form, from the one thousand dollar grand microscope of Ross and the binocular of Beck, to the inexpensive student's microscope.

The objects exhibited were mainly confined to the teeth of man and animals. The sections of the teeth of man, the cat, horse, cow, sheep, elephant hog, etc., afforded an excellent opportunity of observing and contrasting the difference in the arrangement of the enamel, dentine and cementum in those animals, while the gizzards of the cricket and the cockroach showed the provision made by Nature for the comminution of their food. Among the more notable specimens shown, in addition to those already named, may be mentioned: 1st, a longitudinal section of a dilacerated incisor, and section of a human incisor with the cementum covering a portion of the enamel; longitudinal section of a human molar with vascular canals in the dentine, and a human embryo of twenty-nine days; section of an adult human incisor and the lower jaw (tooth *in situ*) with the vessels of the dental pulp and Haversian canals injected with carmine; hypertrophied root of human molar; enamel columns of human tooth; transverse section of buck's horn and other sections of teeth; section of molar tooth and jaw of a cat, with vessels of dental pulp; periosteum and Haversian canals injected with carmine.

Dr. Joseph G. Richardson gave a very satisfactory demonstration of the circulation of the blood in the capillaries of the web of the frog's foot, in the museum of the college.

Professor S. B. Howell, aided by Professor Hunt, exhibited a number of interesting objects by means of the gas microscope, and demonstrated the importance of this instrument as a valuable and indispensable aid to the teacher of histology and physiology.

The success attending this effort on the part of the society has decided the members to give another microscopical exhibition at no distant day.—*Dental Cosmos.*

Physiology of the Siamese Twins.

Dr. Hollingsworth, of North Carolina, who examined the bodies of the Siamese twins at the time of their decease, found the band which connected them to be an extension of the sternum, for about four inches in length and two in breadth. The band was convex above and in front, and concave underneath. The two bodies had but one navel, which was in the center of the band, and it is supposed that there were two umbilical cords branching from this, one extending into each body. The connecting link was found to be the ensiform cartilage, and was as hard as bone, and did not yield in the least. [It may be here mentioned that, for some time previous to their death, no motions were observable in the band.] The doctor said that he did not think they would have survived a separation, not from the fact of being afraid of separating the arteries, but from fear of producing peritonitis. No hæmorrhage would have been produced, so far as could be seen, as there were no arterial connections of any account.

SCIENTIFIC AND PRACTICAL INFORMATION.

PRESERVING ARMY CLOTHING FROM MILDEW.

An appropriation of $100,000 has recently been asked from Congress to be expended during the next fiscal year in the preservation of army clothing from moth and mildew by a patent process. The process in question appears to be that patented by George A. Cowles and others, September 20, 1864, and is based on the preservative action of sulphate of copper on vegetable fibers. By the addition of alum, the preserving qualities of the mixture are, it is claimed, greatly enhanced; and when gelatin is also combined, the fibers are said to be not only proof against decay, but also impervious to water. The ingredients are proportioned as follows: Alum 2 lbs. dissolved in 60 lbs. of water, blue vitriol 2 lbs. dissolved in 8 lbs. of water, to which is added gelatin 1 lb. in 30 lbs. of water. A still further improvement is said to be effected by acetate of lead, ½ lb. dissolved in 30 lbs. of water. The solutions are all hot and separately mixed, with the exception of the vitriol, which is added cold. The inventors claim that the process is cheap, and does not interfere with the strength of the goods.

THE HOME PRODUCTION OF STEEL RAILS.

Eight establishments in the United States are now making rails from steel made by the Bessemer process. Their annual production is 150,000 tuns, an aggregate which, it is expected, will ere long be increased some thirty-three per cent. Steel rails are becoming stronger in popularity; and as the demand increases, there is every reason to believe that our productive power will eventually prove adequate to meet its full requirements without necessitating our dependence in any degree upon foreign makers for supplies.

A SUBSTITUTE FOR BRISTLES.

The fiberous bark of the sugar palm (*arenga saccharia*) proves to be a good substitute for bristles and animal and human hair. The treatment is simple. The bark is first immersed in water and boiled for some time in an alkaline solution; the fibers are then soaked in an emulsion of fat, alkali, and water for about 12 hours, after which time they are sufficiently hard and elastic for the above named use.

SULPHIDE OF CADMIUM FOR COLORING SOAP.

The coloring power of the above mentioned material is so great that its price is of little importance. It is, however, frequently adulterated with zinc white, which may be readily discovered by digesting the suspected substance in acetic acid, filtering, and adding a solution of carbonate of soda, which produces a white precipitate if zinc be present.

DYEING FELTS WITH ANILINE COLORS.

All aniline colors are suitable for the dyeing of felt, and the coloring matters can be repeatedly applied when a deepened effect is required. As brown is a color frequently used in felt-dyeing, it may be mentioned that fine shades of this color are obtained by using certain products from fuchsin (known in the trade as cerise, maroon, etc.) mixed with indigo, carmine, picric acid, and a little sulphuric acid. The shade known as "Bismarck" may be prepared from Manchester brown mixed with the last named ingredients, substituting fuchsin for sulphuric acid.

NEW SURGICAL DEVICES.

Two great surgical novelties have lately been introduced into European hospital practice. The first is the aspirator, originated by Dr. P. Smith, which has been extensively employed by Dr. Diculafoy, of Paris. By this instrument fluids can be extracted from formations at some distance from the surface, with safety and certainty. The second novelty is the introduction of a bloodless method of amputation and other operations on the limbs by means of a compressing bandage, by which the limb is blanched with a circular elastic cord, which compresses both the arteries and veins of the limb. This plan, proposed by Professor Esmarch, has been adopted by many hospital surgeons. It remains to be seen whether there are any drawbacks to this system, and especially whether, in certain cases, embolism is likely to result from displacement of clot, which may have already formed in the veins of a damaged limb.

THE RAMIE INDUSTRY.

If any inventor has a good machine capable of thoroughly, quickly, and economically preparing ramie fiber for the market, there is a good prospect of its being largely to his interest to perfect the same, and bring it before the public at as early a day as possible. The great obstacle to the introduction of this valuable plant—which, from the fact of its being an excellent substitute for silk, is destined to be one of the most important of our American products—is the difficulty of separating the fiber from the bark that envelopes it. The Chinese do this work by hand, producing one or two pounds per day of marketable fiber, and using an ordinary knife. Of course this slow process will not pay here. Several machines, we are aware, have already been invented; but for some reason, the proprietors take but little pains to bring them into notice. The plant can be successfully cultivated in California and the Gulf States. It can be cut by an ordinary mowing machine, and an acre of land will produce from 400 to 500 pounds at a cutting. The crude ramie staple is worth from $320 to $340 per tun in Europe. American manufacturers offer for it from 20 to 25 cents per pound, when furnished in considerable quantities.

HIPPOPHAGY in France is increasing. During July, August, and September of 1873, the meat of 1,548 horses, 140 asses, and 15 mules, was consumed in Paris, showing an increase of nearly 100 per cent over the same months in 1872.

The Application of Solar Heat as a Motor Force.

That the heat of the sun may be transformed into mechanical force no one can doubt; for we see daily what masses of water solar heat raises into the air, to be precipitated to the earth; and we know what an enormous mechanical force is here represented.

But while solar heat is the cause of nearly all mechanical force developed on the earth, we have yet hitherto known of no means whereby it may be directly utilized for mechanical work. It has been proposed, indeed, to employ solar heat, concentrated by lenses or mirrors, for driving a steam or caloric machine. These machines, however, are not suited for this, as they involve too great a waste of heat. Moreover, in concentration a large quantity of heat must be lost.

Machines which serve for the transformation of heat into mechanical work rest on the principle that a liquid or gaseous substance, acted on by the heat, undergoes a molecular change, through which a certain mechanical force is developed. The changes of solid bodies, under influence of heat, are too small for transformation of the heat into mechanical work, or to render them means of movement, although, through such molecular change, a certain mechanical force is developed. Gaseous bodies have been applied as a means of movement in the caloric and gas machines; but with the small differences of temperature which occur in some machines, they cannot be employed as such, with advantage. Thus nothing remains but to employ a liquid; and it must be one whose boiling point is very low. There are several such liquids, sulphurous acid, methylic chloride, methylic ether, etc. Of all these, sulphurous acid best deserves attention, as it has several useful properties for the end in view. It is not difficult to condense. The keeping of it presents no difficulties, and it may quite well be put in ordinary steam boilers.

Take a vessel, A, filled with sulphurous acid, exposed to the sun's rays; the tension of the sulphurous acid vapor, if the temperature of this vessel exceeds that of the surrounding air by 10° or 20°, must be from 1 to 3 atmospheres higher than that of the sulphurous acid vapor in another vessel B, similarly filled with sulphurous acid, but which has only the temperature of the surrounding air. We can thus arrange an engine, which agrees in principle with the steam engine with merely this difference, that the water is replaced by sulphurous acid, the fuel by the solar heat; while the vessel exposed to the sun's rays represents the steam boiler, the vessel kept at ordinary temperature may represent the condenser. The sulphurous acid, condensed after doing work in vessel B, could easily be driven back by a force pump into the boiler representing vessel A. The capability of work of such a machine must naturally increase with the amount of the heat communicated to vessel A, or be proportional to the surface exposed to the solar rays.

If now, we conceive a factory or shop, the roof of which is covered with vessels containing sulphuric acid, and which is furnished with a sun machine, made on the above principle; such a machine might indeed work while there was sunshine but in default of this, the establishment would be brought to a standstill. True, the solar heat might be replaced by the heat of the air, if the temperature of the air were pretty high, and one had at hand a cooling substance like ice. But as this is not always the case, the establishment should have, besides the sun machine, an apparatus which might "store up" some of the work done by this. As such, Natterer's apparatus for condensing carbonic acid might with great advantage be used. If a supply of carbonic acid were kept in a large gasometer, like those in ordinary gasworks, the Natterer apparatus might be fed from this. In a wrought iron vessel thus filled with liquid carbonic acid, we should have an enormous store of mechanical force, which might be made to replace the action of solar heat in the sun machine, partially or wholly. After work done, the carbonic acid, becoming gaseous again, might be collected in the gasometer. Or, again, the sun machine, while in action, might drive an ice machine, and might, in default of sunshine, profit by the ice it had produced, for maintenance of its working.

We thus see that, from the present standpoint of Science, it is possible to construct a constantly working sun machine.—*G. A. Bergh, in Poggendorff's Annalen.*

To Inventors.

C. E. G. lays down the following maxims for the guidance of inventors.

1. Know definitely what you want to accomplish, stick to it, and let other matters go, for the time.
2. Post yourself thoroughly as to the laws governing the action of each part of your machine.
3. Always bear in mind that whatever is gained in time is lost in power, and *vice versa*.
4. Think over every machine, of a nature similar to yours, which you have seen; and when your idea is clear in your head, compare it with those of inventors who have preceded you in the same line.
5. Be sure that the cost of your device will not prevent its use.
6. Avoid all complicated arrangements; make every machine of as few parts as possible.
7. Imagination, judgment, and memory are the faculties to employ. Imagination will bring forth new forms and actions, judgement will compare them with other devices and determine their relative value, and memory will store up the results for future use.

AS A TEST for red wine, which is sometimes artificially colored, Cottini recommends nitric acid: 50 parts wine are mixed with 6 parts of nitric acid (of 42° B.) and heated to 95° Fah. The natural wine will not change its color if left for some hours, but the artificially colored will lose its hue in a few minutes.

ABOUT OURSELVES.

"The steel engraving 'Men of Progress' is received, for which accept my thanks. The few subscribers I have sent you were not worthy the acknowledgment you have given for them."

"I beg to acknowledge the receipt of the magnificent steel plate engraving entitled 'Men of Progress,' and can assure you it surpasses anything I had the least conception of; it not only being collectively a most appropriate subject, but also one that cannot fail to be appreciated by all."

The above are extracts from a couple of letters received from patrons in Canada and in Indiana, who have obtained clubs of subscribers for us. Their views are but examples of many others, whose appreciative commendations of our efforts reach us daily.

The rapidity with which our subscription lists are augmenting and the constant addition of new names, not singly but by tens and twenties, indicate quite clearly that the stringency of the late panic has all but disappeared, and that business, especially in mechanical and manufacturing establishments, has resumed its wonted vigor. So far from our circulation having become diminished by the financial troubles, we are happy to announce that it never has been nearly as large at this season of the year, nor have we ever known a new year which, dating from its beginning, has brought us so large an accession of new subscribers or such prompt renewals from old patrons. It would indeed be ungrateful on our parts did we fail to acknowledge our appreciation of the kind words which reach us, and the more substantial, though not more agreeable, recognition of our efforts evinced by the constantly increasing ranks of our army of readers. It remains for us to strive to merit the praise already accorded, by making the SCIENTIFIC AMERICAN, for the coming year, better and more useful than ever before

The Hartford Steam Boiler Inspection and Insurance Company.

The Hartford Steam Boiler Inspection and Insurance Company makes the following report of its inspections in the months of October and November, 1873:

The number of visits made during these months was 2,449, and the number of boilers inspected, 4,919; of which inspections 1,441 were internal and entire. The hydraulic pressure was applied in 3[illegible]5 cases. The number of defects discovered was 2,083, of which 555 were regarded as dangerous. These defects in detail were as follows:

Furnaces out of shape, 80—14 dangerous; fractures, 194—93 dangerous; burned plates, 118—40 dangerous; blistered plates, 314—52 dangerous; deposit of sediment, 394 cases, of which 62 were regarded as dangerous; cases of incrustation and scale, 355—26 dangerous; cases of external corrosion, 127—37 dangerous; internal corrosion, 88—24 dangerous; internal grooving, 31—9 dangerous; water gages defective, 85—9 dangerous; blow-out defective, 38—12 dangerous; safety valve overloaded, 37—16 dangerous; pressure gages defective, 288—58 dangerously so. These variations were from —7 to +20. Boilers without gages, 157—5 of these were run at high pressures; deficiency of water, 23 cases—5 dangerous; braces and stays loose and broken, 102—49 dangerous; boilers condemned, 28. Corrosion, either internal or external, has in many cases been found to be making great injury during these two months. In one case, three boilers were found connected together by cast iron pipe over the bridge wall. The joints in this pipe were made with copper gaskets. At the connection on No. 1, the shell around the flange was badly eaten by corrosion, and very thin. In another case, eight soft patches of copper were found on a boiler. Five boilers that had been long neglected were found in bad condition, the flues being corroded entirely through. When boilers are not blown down frequently, impurities in the water become concentrated, and act very injuriously on the iron. The number of condemned boilers was unusually large, and they were in a dangerous condition, liable to accident at any moment.

Chainmakers' Peculiarities.

"The Troy chainmakers in that city," says the Troy *Times*, "are a peculiar set of men. They are eighteen in number, and are all English. Each chainmaker employs three assistants, and earns, when at work, about $25 per day. After paying three helpers, the chainmakers have from $10 to $15 per day for themselves. They are stubborn, industrious and saving. This branch of manufacturing is in its infancy in this country; and as the workers are few, they have a practical control of the trade. When strikes and lock-outs occur, they are able to hold out longer than other mechanics. Their extraordinary wages and their disposition to save what they earn almost invariably enable them to hold out until their employers yield. Their stubborness was well illustrated two or three years ago. They held out until their savings were all gone; then they went to work upon the streets and elsewhere for $1.50 per day until matters were arranged between the owners of the chain works and themselves.

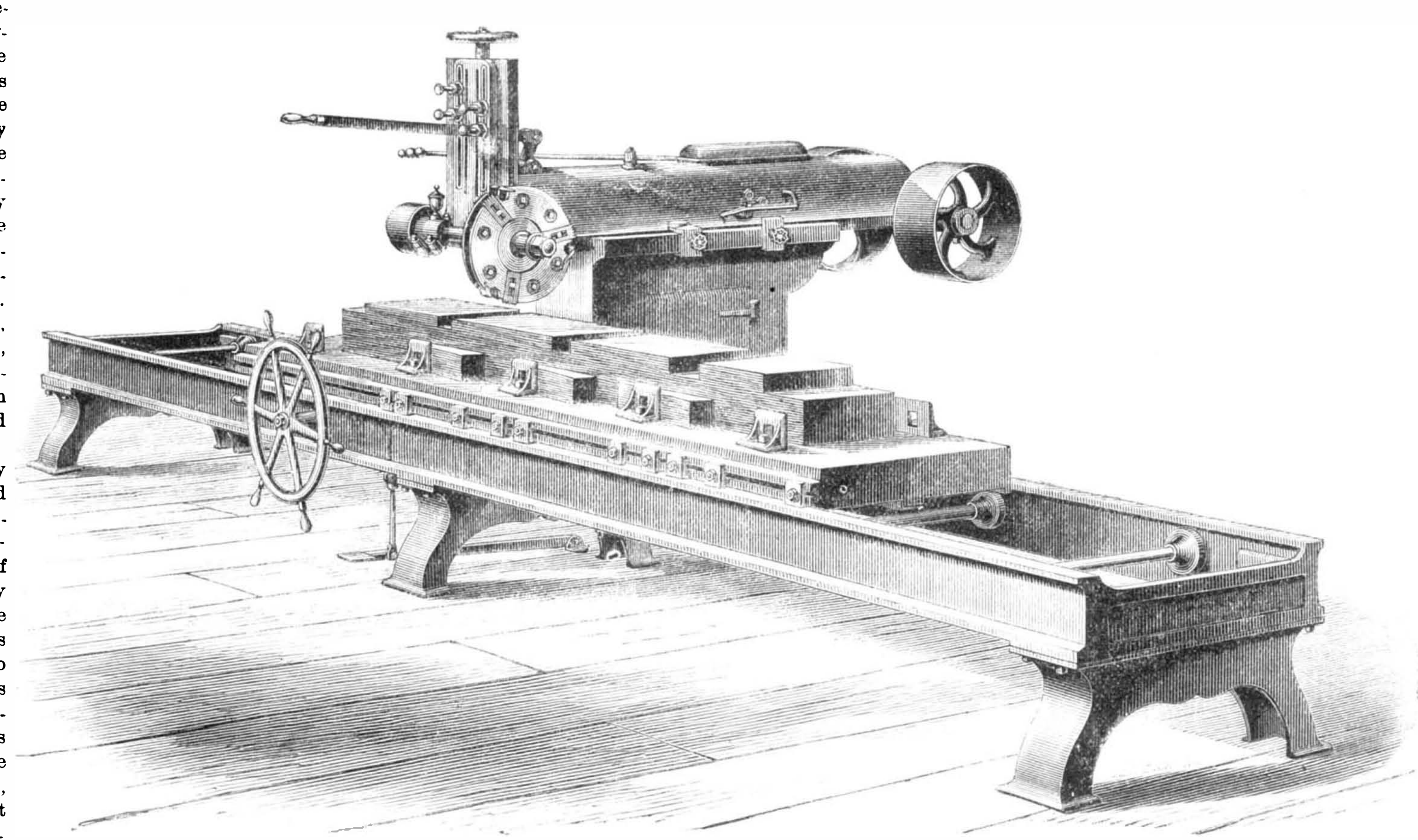
"Last spring these men were working at an advance of ten per cent over the wages paid when gold was selling at fifty cents premium. During the summer they demanded and received another advance of ten per cent. In November, the lack of work compelled the owners to close the works. A few weeks since they secured an order for about sixty tuns of chain cable of a peculiar kind. Only three of the chainmakers can work upon these cables, and to these three the owners offered work at the highest wages. They refused to go to work unless the other chainmakers were also furnished employment. In this position affairs are at present. The firms have work for only three chainmakers."

IMPROVED GAINING MACHINE.

Grooves cut at right angles to the fiber of timber are termed gains in the technical language of carpentry. These gains, which in the present method of erecting the heavy work of the period are very numerous, especially in bridges and railroad car timbers, have heretofore been done in a great measure by hand labor, or by rotary cutter heads projected through the surface of a table sufficient for the depth of the gain, over which the timber was carried to complete the gain transversely.

These methods, however, have not the advantages claimed to be attainable by the use of the improved gainer, produced by the extensive wood working tool builders, Messrs. J. A. Fay & Co., of Cincinnati, Ohio, and represented in the annexed engraving.

This is a very massive and substantial machine, occupying an area of ten by twenty feet upon the floor. Timbers of any size to twelve inches thick by twenty-four inches wide can, we are informed, be gained at any desired angle upon it. The limit of depth of gain is four inches, the width indefinite.



IMPROVED GAINING MACHINE.

By means of the stops, to be seen in front of the table in connection with the treadle and spring pin through the way, duplicates of timbers may be produced indefinitely, the stops indicating the width and distance apart of the gains.

The depth of the gains is determined by the position of the stops placed in the slots in the cutter slide, and which will indicate four depths of gains. The table is moved longitudinally upon friction rollers by means of a rack and pinion underneath operated by a hand wheel in front. The cutter head, with its slide, has a vertical movement governed by the lever in front and counterbalanced by a combination of springs inclosed in the moving frame. The cutter head can be placed anywhere within its range of movement without changing the position of the governing hand lever. This is accomplished by turning the hand wheel on top of the cutter slide.

The sliding frame, which conveys the cutter head in its traverse movement over the table, is actuated by means of a series of gearing driving a pinion in a fixed rack. This mechanism is contained within the frame, in self stopped at any point by means of a shipper and adjustable stops on the side of the column, and started by the operator turning the handle under the hand lever which engages the belt with the tight pulley. The motion of this sliding frame is at a fixed speed, whether for wide or narrow timber, a peculiarity no other gainer possesses. This equal speed in either direction enables the cutting to be done both ways, the cutter head being so constructed as to facilitate the operation.

The countershaft from which the machine is driven is placed vertically over the center of the distance of the travel of the pulley shaft, in the rear end of the sliding frame. The arc of the circle struck from the countershaft being but slightly different from its chord, the tension of the belt is not affected sufficiently to be any detriment to the working of the machine.

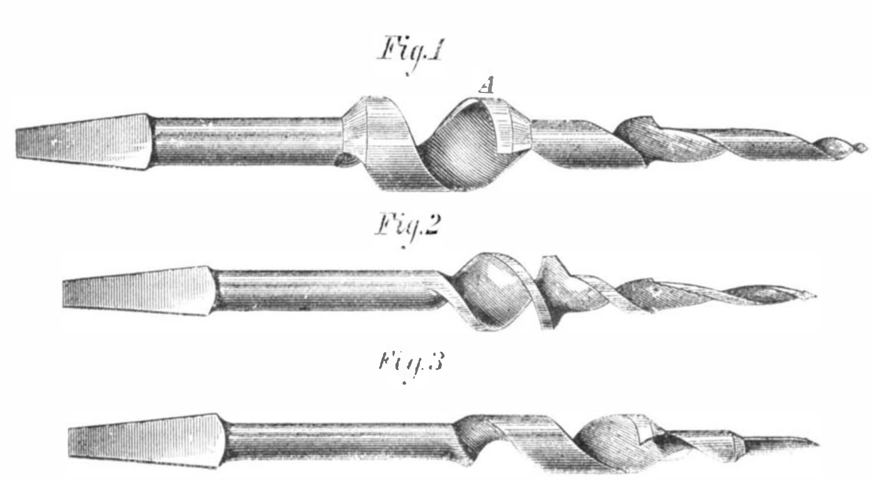
The improvements in this machine consist of the equable traverse movement of the cutter head, the ease of adjustments, the fixed positions of the handles for the operator, and other mechanical refinements introduced where they will be appreciated by every mechanic. Patented January 20, 1874.

MONSON'S IMPROVED AUGER.

Mr. Christian Monson, of Moscow, Iowa county, Wis., has invented a novel and, we should judge, very useful form of auger, which, he states, is capable of boring orifices of different sizes, and is, besides, adapted to making holes for screws.

The bit, as will be remarked from Fig 1, is provided with three distinct sizes of screw, each of which parts is made tapering in form. The larger of the three, A, is provided with a projection by means of which it is rendered suitable for countersinking. Fig. 2 is a modification of the above and has two sizes of screw and a double thread. The point also, it will be noticed, is somewhat differently constructed, being provided with slight projections which, according to the inventor, are not easily worn or broken. Fig. 3 is still another modification of the first form, having also two sizes of screws but a triangular shaped point. This latter is well suited for easily penetrating wood, and is said not to be liable to become broken or dull.

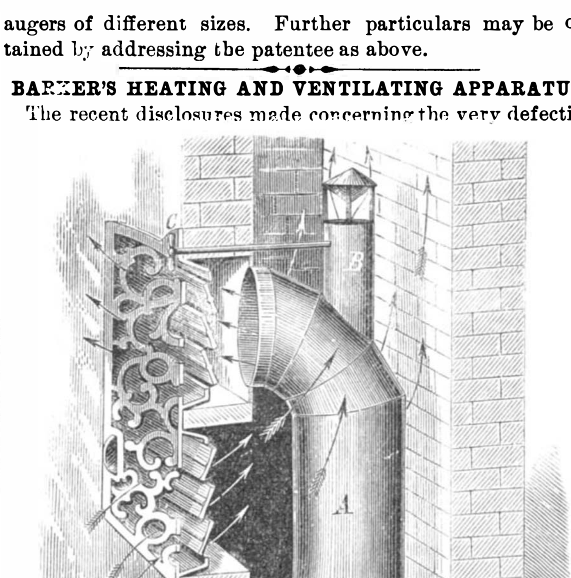
The tapering form of the tool makes the hole for the blank part of the screw, that portion being, of course, larger than the threaded part, while the countersinking and boring are both accomplished by the single operation. The invention will commend itself to wood workers, on the score of economy, as it tends to save the expense of a number of separate augers of different sizes. Further particulars may be obtained by addressing the patentee as above.



MONSON'S IMPROVED AUGER.

BARKER'S HEATING AND VENTILATING APPARATUS.

The recent disclosures made concerning the very defective heating and ventilating arrangements in the public schools and court rooms of this city have, to a considerable degree, aroused the attention of the public, not only in this but in other localities, to the existing necessity of improved and simple means for securing constant supplies of pure fresh warm air in crowded apartments. We illustrate in this issue the Galton fireplace, lately introduced in England and strongly commended by high sanitary authority. We herewith present another device of equal timely importance, consisting in a novel adaptation of the furnace flue and register. The apparatus, the construction of which will be readily understood from the annexed engraving, seems to us, judging from the explanation of the inventor as below given, a plan of much merit and hence worthy of the careful examination of health boards, architects, builders, and property owners generally.



Our illustration, partly in perspective and partly in section, shows the invention quite clearly. A supplementary flue, A, flared at its lower end, surmounts the flue leading from the furnace. Its upper extremity is curved to terminate in the upper half of a register through which the hot air is delivered into the room. It will be observed that the register, though having a single grating of the usual size, is divided by a horizontal partition, and each portion is provided with a separate set of slats, either of which may be opened or closed at will. While the hot air from the flue, A, pours into the room in an ascending current, as indicated by the arrows, the cold and heavy vitiated air, which sinks to the floor, makes its exit into the lower half of the register, entering the main flue in the space between the supplementary pipe and the brick work, and thence passing up the chimney. By this means, it is claimed, a constant circulation of air is maintained in the apartment.

The small pipe, B, arranged above the flue, A, is provided within with a valve operated by a suitable rod and handle, C, outside the register. By this device either a portion or the whole of the hot air rising in the flue, A, may be discharged with the vitiated air flue, the register of the hot air pipe being either opened or closed accordingly, and thus increasing the warmth and consequently the draft of the vitiated air flue, a result of much importance in crowded rooms, where the heat becomes excessive and the air very impure. The inventor informs us that, in practice, the truth of the views above noted is fully proved; a candle or handkerchief held before the two portions of the combined register indicating clearly the direction of the ingress and egress currents. By a simple modification the device is adapted for floor registers, and in cases where several flues pass up the wall side by side, a metal partition is used to separate each at the point of location of its register, enabling the apparatus to be conveniently and readily applied. The invention has already elicited favorable notice from eminent sanitary authorities in this city, Philadelphia, and Washington. It is covered by four patents of quite recent date. For further information address the inventor, Mr. George R. Barker, Germantown, Philadelphia, Pa.

Gold for Illuminating.

Procure a book of leaf gold, take out of the leaves gently and grind them in a mortar with a piece of honey about the size of a hazel nut, until it is thoroughly intermixed with the gold, then add a little water and re-work it; put the whole into a phial and shake it well. Let it remain an hour or two, and the gold will deposit at the bottom of the phial. Pour off the liquor, and add weak prepared gum in its stead, sufficient to make it flow freely from the pen or camel's hair pencil. When required for use, shake it occasionally.—*Revell's Potichomanie.*

PISCICULTURE IN CANADA.—Several correspondents having sent us inquiries on this subject, we are desired by the author of the letter signed "Canadian" (on page 36 of our current volume) to state that he will be happy to give information and advice to any one interested in the subject His name is Rev. J. Alexander Morris, Ottawa, Ontario.

THE AUSTRALIAN FEVER TREE.

A question of considerable general interest was recently discussed at a meeting of the French Academy of Sciences. The subject was the remarkable sanitary influence of the *eucalyptus globulus*, when planted in marshy grounds; and the tree in brief, it seems, has the curious and valuable power of destroying the malarious element in any atmosphere where it grows.

The species is indigenous to Tasmania, and is known among the colonists by the name of the Tasmanian blue gum tree, on account of its dark bluish tinged leaves. Growing in the valleys and on thickly wooded mountain slopes it, often attains a hight of from 180 to 220 feet, with a circumference of trunk of from 32 to 64 feet. The foliage is thin and oddly twisted, surmounting, with a thin crown, the top of the pillar-like stem. The wood exhales an aromatic odor, and, after seasoning, is said to be incorruptible. For this reason, it is largely used in the building of piers, vessels, and other structures exposed to the ravages of the weather. It is largely exported, to the aggregate value, an authority states, of $4,000,000 per year.

To the peculiar camphor-like odor of the leaves and the large absorption of water by the roots is doubtless owing the fact of the beneficial influence of the tree. Where it is thickly planted in marshy tracts, the subsoil is said to be drained, as if by extensive piping.

Miasma ceases, we are told, wherever the eucalyptus flourishes. It has been tried, for this purpose, at the Cape; and, within two or three years, completely changed the climatic condition of the unhealthy parts of that colony. Somewhat later, its plantation was undertaken, on a large scale, in various parts of Algiers, situated on the banks of a river, and noted for its extremely pestilential air: about 13,000 eucalypti were planted. In the same year, at the time when the fever season used to set in, not a single case occurred, yet the trees were not more than nine feet high. Since then, complete immunity from fever has been maintained. In the neighborhood of Constantina, it is also stated, was another noted fever spot, covered with marsh water both in winter and summer; in five years, the whole ground was dried up by 14,000 of these trees, and farmers and children enjoy excellent health. Throughout Cuba, marsh diseases are fast disappearing from all the unhealthy districts where this tree has been introduced. A station house, again, at one end of a railway viaduct in the department of the Var, was so pestilential that the officials could not be kept there longer than a year; forty of the trees were planted, and it is now as healthy as any other place on the line.

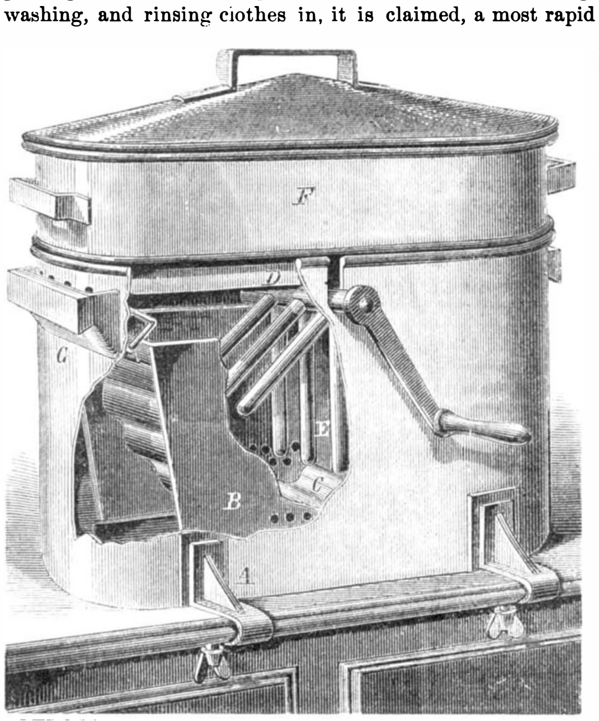
La Nature, to which journal we are indebted for the annexed engraving of the peculiar leaves and flowers of the tree, adds that careful experiments have proved that, in a medicinal preparation, it cures the worst cases of intermittent fever, against which quinine proves powerless. It is also valuable as a disinfectant, and as a dressing for wounds; while more recent investigations point to the fact that it may be rendered of great service in catarrhal affections.

The tree has been acclimatized, to a certain extent, in the South of France, Algiers, Corsica, Spain, Cuba, and Mexico. We should imagine that it might be cultivated, with immense advantages, in the swamps of our Southern States.

THE AUSTRALIAN FEVER TREE.

IMPROVED WASH BOILER.

In the novel form of wash boiler represented in our engraving, the laundress is provided with a means of boiling, washing, and rinsing clothes in, it is claimed, a most rapid and efficient manner. The garments, it is further stated, are thoroughly cleansed, and this without injuring the most delicate fabrics.



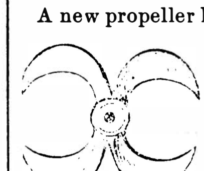
The boiler proper is akin in shape to that usually employed, and is supplied with clamps, A, so that it may be firmly secured to the edge of the top of the stove or range by means of set screws. Inside the main receptacle is placed a vessel, B, the sides of which are vertical and support a circular corrugated bottom, disposed as shown at C. In the lower part of the sides are formed a number of perforations to allow of the free passage of the water. D is a shaft, one end of which is journaled in a socket secured to the main receptacle, and the other passes through a short vertical slot made in the edge of the latter, carrying at its extremity a crank. The shaft, which may be secured in this slot by a suitable latch, not shown, is provided with a number of radial arms, E, which project from its lower part, so as nearly to touch the corrugated bottom of the vessel, B. The water and soap being placed in the boiler, the clothes are laid in the inner receptacle, and, the crank being rocked, are caused by the arms, E, to sweep back and forth upon the corrugations, thus quickly being cleansed.

In order to prevent the spattering of water out of the boiler, during the rinsing, an extension, F, is provided, which fits in the mouth of the latter, and this is surmounted by the cover, which conforms in shape to the opening of either extension or boiler. At one end of the boiler is secured a spout, G, to which is attached a cleat to receive a wringer. The water pressed from the clothes is conducted by the spout back into the boiler, through the perforations in the side of the latter for the purpose. Handles are provided for lifting the apparatus, and a faucet may be placed at its lower part for drawing off the water.

The device is the invention of Mrs. Mary A. Barnes, of Olympia, Thurston county, Washington Territory. Patent is ordered to issue through the Scientific American Patent Agency.

New Marine Propeller.

A new propeller has been introduced by Dr. Collis Browne, which differs considerably from any other in use, somewhat resembling, when at rest, the letter X, as shown by the illustration, and claiming to offer many advantages over those commonly employed. These are absence of vibration, reduction of wear and tear to machinery, ready adaptability to any screw steamship, and facility of checking a ship's way, with the power of driving her full speed astern in a few seconds on reversal, as well as giving considerable increase of speed, and effecting a great saving of coal. This propeller has been tried at a measured mile by the steam yacht Lapwing.



During a trial under 58 lbs. pressure of steam, with a consumption of 81 lbs. of coal per hour, the propeller made 220 revolutions per minute with the tide slack, and the furnace burning hard steam coal, the measured mile being run in five minutes. During a trial under 64 lbs. pressure, with a consumption of 112 lbs. of coal per hour, and using the ordinary fan propeller making 280 revolutions per minute, with the tide slack and the furnace burning best Welsh coal, the vessel made the measured mile in six and a half minutes.

As far as this experiment goes, the new propeller shows a superiority over the fan form.—*Iron.*

SOME experiments made by the directorate of the government railroads of the Netherlands, in regard to the preservation of exposed sheet iron, have lately been published. Plates prepared in various ways were placed in exposed situations, and examined after three years. The result of the examination showed that as good a method as any of preparing the plates was to clean them by scraping and brushing, and then paint them with red lead.

The Dry Inkstand an Old Device.

"An inkstand containing carbonaceous and extractive matter in a dry state, which, with the addition of water only, will supply ink." Patented in England in 1820, by John Moody.

The outside of the inkstand may be made of brass, tin, or other metal, and of any shape that may be thought desirable. Within must be introduced a small vessel, which may be made of lead, earthenware, or glass, with a hole to admit a pen, in which the composition is placed; and the whole of the interior may be filled up with a cement, which may be made as follows: Melt two pounds of sulphur over a slow fire in a glazed pipkin; when melted, take it off the fire, and let it stand ten minutes or a quarter of an hour, until it is of the consistency of oil, then add to it lamp black, or any other color that may be thought proper, and stir it well together, and then pour it into the inkstand. The composition of carbonaceous and extractive matter is made and produced as follows: Take half a pound of fine honey, and the yolk of a new laid egg, mix them, and let them stand three days, frequently stirring them well together; then add half a pint of strong extract of galls, which extract is made by infusing one pound and a quarter of best blue galls, powdered, into three pints of soft or salt water; let them stand for six days, often stirring them; then filter the whole through a fine wire sieve, and evaporate the liquor to one half (that is to say, one pint and a half), over a gentle fire, in an iron pot.

Then take another half a pint of extract of galls, as above prepared, in which dissolve three ounces of gum arabic, one ounce of white sugar candy, and one ounce of indigo, all in powder. Then take the remaining half pint of extract of galls, a half pint of strong decoction of logwood (which decoction must be made by boiling half a pound of logwood in powder, in a pint and a half of soft or salt water, until reduced to half a pint), into which put two ounces of blue galls in powder, two ounces of lamp black, two ounces of willow wood charcoal, ground very fine, and three ounces of sulphate of iron calcined to whiteness in powder, and stir them well together. Then knead the whole well together, in a marble mortar, into a stiff paste, which put into the stands, and let it harden in the air, over which paste must be placed a small quantity of cotton that has previously been soaked in vinegar that has been well saturated with salt.

Fixing Slates.

Slates, instead of being nailed to the roof, may be fastened by movable hooks, about 2 inches long, which are soldered to conically formed zinc plates, 4 to 6 inches long. The slates are thus kept securely between the hook and zinc plate, and can be removed simply, with the greatest facility, by turning the hook. Thus one or more of the slates can be taken out for repair, or new ones inserted, without interfering with the rest. The method is said to make a roof watertight.

SELF-PUMPING WELL-BORING DRILL.

With the improved drill represented in the annexed illustrations, the inventors claim that not only faster and better work can be accomplished, but that the apparatus can be more conveniently manipulated, and will penetrate further into the ground before its removal for cleaning is required, than the borers in common use. It is also stated that a hole, with this device, may be sunk by hand to a distance of 200 feet, and with a lever to any desired depth; while the operator is enabled, during the progress of the boring, to know exactly the kind and depth of strata through which the tool is passing.

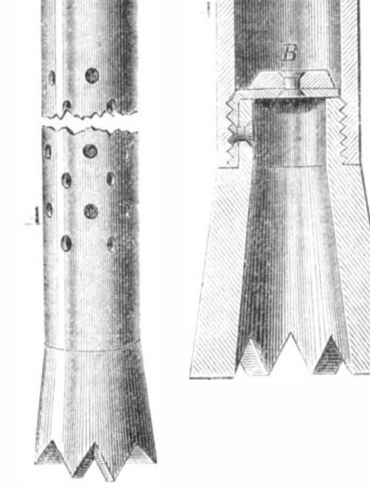


Fig. 1 Fig. 2

The drill is made tubular and somewhat flaring, so that it forms an orifice a little larger than its body. Its lower edge is serrated, so as to cut a ring groove into the strata, the core of the bore passing up through the cavity in the drill. The upper end of the latter is rabbeted, and, by means of a screw thread cut thereon, is attached to a perforated tube, A, Figs. 1 and 2. The object of the holes in the tube is to allow the water to escape, and thus lessen the weight of the drill as it is moved up and down. To the upper end of the drill is hinged a valve, B, represented in section, Fig. 2, which opens upwards into tube A, so as, when the tool is raised, to carry the contents of the pipe up with it. Sections of tubing—part of one of which is shown at G Fig. 1—are screwed to the part B, and increase in number with the depth of bore.

Another advantage claimed is that, should the portions of the device become detached, a screw rod may be readily inserted and the separated parts drawn out.

Patented through the Scientific American Patent Agency, November 11, 1873, by Messrs. Timothy Phillips and Joseph Golletz. Further particulars may be obtained by addressing the inventors at Leavenworth, Leavenworth county, Kansas.

AN old subscriber, P. H. W., writes to say that he owns a propeller steamer of the following dimensions: Length 42 feet, beam 7 feet; boiler 4 feet 8 inches high, with 78 one inch tubes 2 feet long, and 31 two inch drop tubes 18 inches long; the engine has a cylinder $5\frac{1}{4}$ inches diameter x 7 inches stroke; the screw is 38 inches in diameter with 5 feet pitch. She has run 7 miles in 40 minutes, carrying 65 lbs. steam, the screw making 165 revolutions per minute. The boiler is of $\frac{5}{16}$ inch iron, and will carry 130 lbs. on the inch if required.

MR. R. F. MUSHET has lately written a letter to the editor of the London *Engineer*, in relation to the age of a Bessemer steel rail which, he says, was the first cast steel rail ever laid down. The rail was laid down on the Midland railway, in the early part of 1857, and was taken up in 1873. It thus appears that it was in use for 16 years, sustaining daily, Sundays excepted, the passage of 250 trains, and at least 250 detached engines and tenders, or, during the 16 years, about 1,252,000 trains, and the same number of detached engines and tenders.

THE HOOSAC TUNNEL ALIGNMENT.—Mr. H. W. N. Cole claims the credit of this for Mr. C. O. Wederkinch, who has had entire charge of the work, has run all the lines, and invented his own instruments for doing it.

HOW SHALL I INTRODUCE MY INVENTION?

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From January 6 to January 12, 1874, inclusive.

ADJUSTABLE PULLEY.—E. F. Allen, Providence, R. I.
COMBUSTION OF FUEL, ETC.—D. T. Casement, Painesville, O.
DENTAL FILLING.—C. E. Blake, San Francisco, Cal.
ELECTRIC BRAKE.—S. W. Wilson (of Philadelphia, Pa.), London, England.
ELECTRIC MOTOR.—J. B. Stone, Boonton, N. J.
FLUID PRESSURE REGULATOR.—D. T. Casement, Painesville, O.
HYDRATE OF MAGNESIA.—C. H. Phillips, New York city.
HYDROCARBON FURNACE.—G. W. Morris *et al.*, Baltimore, Md.
PUMP VALVE.—W. Painter, Baltimore, Md.
RAISING SUNKEN VESSELS.—H. F. Knapp, New York city.
RENDERING TALLOW, ETC.—J. A. Miller, Providence, R. I.
SCREW MAKING MACHINE.—W. H. Post, Hartford, Conn.
SNAP CONNECTOR.—S. Reynolds, Pittsburgh, Pa.
TESTING WOOD, IRON, ETC.—R. H. Thurston, Hoboken, N. J.
VENTILATING WINDOW.—Bradley Window Company, New York city.

DECISIONS OF THE COURTS.

United States Circuit Court---District of Massachusetts.

MELODEON PATENT.—ANDREW H. HAMMOND *et al. vs.* THE MASON & HAMLIN ORGAN CO.

[Decided December 2, 1873.]

SHEPLEY, *J.*:

This is a bill in equity by the complainants as assignees and owners of the letters patent reissued to El Dora Louis, as administratrix of Lafayette Louis, on the 25th of July, 1871, for an improvement in melodeons or reed instruments, consisting of the application of mechanism to produce a "tremolo" in the musical note on said instruments. The original patent to Lafayette Louis was issued November 18, 1856.

Defendants by their plea admit that they manufacture and sell in connection with their own organs tremolo attachments made precisely in accordance with the specification, drawings, and model of an application for letters patent, dated September 25, 1868, made by Lafayette Louis, the assignor of the complainants. The plea admits for the purpose of this hearing that this mechanism embodies the invention described in the patent of said Louis, on which this bill in equity is brought.

The plea sets up a justification in using these mechanisms under a license under the original patent granted by Louis to Mason & Hamlin, the assignors of these defendants, and also under a series of contracts between Louis and the defendants themselves relating to the specific device used by them. It is not necessary to consider the questions discussed at the bar in relation to the license set up in the plea under the original patent, as we are satisfied that the defendants are protected under their agreements with Louis, dated September 25, 1868.

It appears that Louis, prior to the 25th of September, 1868, made an invention of a combination of the fan tremolo with a rotary wind wheel, and applied for a patent for this combination. On the same day he entered into three contracts with these defendants. The first was an absolute conveyance to the defendants of all his "right, title, and interest in and to said invention and letters patent which may issue therefor," and authorized the Commissioner of Patents to issue said patent to the Mason & Hamlin Organ Company, as the assignees of all his right, title, and interest in and to said invention and letters patent.

The second agreement grants to the defendants the right to make, use, and sell the invention above named, and assigned to them, as above stated, in connection with so much of the inventions secured by the letters patent of November 16, 1856, (on which this suit is brought,) and by a patent of June 10, 1862, "as is contained in the said mechanism." The defendants agree to pay a royalty for each and every tremolo mechanism substantially the same as that described and shown in the said application and accompanying specifications, drawing, and model, until the expiration of the term for which the said letters patent shall be granted, referring to the letters patent for which application was on that day made.

This contract provided for one contingency—that was the granting of letters patent on the application then made. The invention and the right to use the specific mechanism had been conveyed to the defendants. If, by the granting of letters patent to them as assignees of Louis, they should obtain the exclusive right to use the invention, then in such case they were to pay Louis a royalty of one dollar for each tremolo manufactured by them during the term of the patent. The contingency contemplated did not happen—letters patent were not granted for the combination applied for.

The third agreement provided for another contingency—namely, the failure of the defendants to obtain a patent for the invention of 1868, which is the case as it now exists. This agreement provided that—

Whereas the said Louis has invented an improvement in keyed reed musical instruments, and has this day executed his application for the grant of letters patent of the United States to secure the same, and has also made and executed an assignment thereof to the said Mason & Hamlin Organ Company, and a license to make, use, and sell the mechanism described in the specification, drawings, and model accompanying the said application, under letters patent originally issued as number 16,094, and dated November 18, 1856, and subsequently reissued as number 2,498, dated February 26, 1867, and again reissued as number 2,944, dated May 26, 1868, and also under letters patent numbered 35,528, and dated June 10, 1862; now, therefore, in consideration of one dollar to him paid and for other good and valuable consideration, the said Louis hereby covenants and agrees with the said company, that if the said company fail to procure said letters patent for which application has been executed as aforesaid, then he, the said Louis, will and does hereby grant unto the said Mason & Hamlin Organ Company the exclusive right under the said letters patent already granted, and under any and all reissues thereof, to make, use, and sell the specific mechanism described and set forth in the said executed application and the specification, drawings, and model accompanying the same.

Taking into consideration the three contracts, it is plain that Louis had invented a new combination of the old parts patented by him. He applied for letters patent for this new combination. He conveyed to defendants for a valuable consideration, and unconditionally, the invention and the right to make, use, and sell the specific mechanism described in the application including the old parts as well as the new combination.

If the defendants succeeded in obtaining a patent for the new combination, they were to pay a royalty in addition to the consideration they had already paid for the invention; but if no letters patent could be obtained the defendants were none the less the owners of the right to make, use, and sell the "invention" and the mechanism it contains, and "the specific mechanism" described in the application.

Independent of the granting, reissuing, or extension of any letters patent, without limitation of time, they had purchased and taken a conveyance of the right to make, use, and sell those specific devices in that specific combination. This is what they do use and this only, and this they have a right to use. Their right is not limited to the term of the original patents embracing the parts of the combination. It is true that the third contract, in case of failure to obtain a patent for the new combination, grants to the defendants the exclusive right, under the patents already granted for the parts, to make, use, and sell the specific mechanism described in the application for letters patent for the new combination; but they had the right to use this specific mechanism. The license under the old patents was only intended to make this right exclusive. Their exclusive right under them might end with the expiration of the term of the old patents: but their right was independent of their existence or duration.

Bill dismissed.

United States Circuit Court---District of Massachusetts.

BUTTON PATENT.—CHARLES L. POTTER *vs.* OSCAR S. THAYER *et al.*

[In Equity.—Before Shepley, Judge.—Decided December 2, 1873.]

A patent for attaching a helical shaft to a button by soldering it to a circular disk which is sunk into a corresponding recess in the button, and is prevented from turning by a cross bar also sunk into the button, is not infringed by a button similar in other respects, but in which the shank is prevented from turning by serrations on the edges of the disk and of the recess into which the disk is jammed.

Bill dismissed.

NEW BOOKS AND PUBLICATIONS.

JOHNSON'S DENTAL MISCELLANY, a Monthly Journal of American and Foreign Dental, Surgical, Chemical, and Mechanical Literature. Per annum, $2.50. Volume I, No. 1. New York: Johnston Brothers, 812 Broadway.

This is an ably edited and readable periodical, which has, we believe, an excellent prospect of success.

QUANTITATIVE CHEMICAL ANALYSIS. By T. E. Thorpe, Ph.D., F.R.S.E., Professor of Chemistry in the Andersonian Institution, Glasgow. New York: John Wiley & Son, 15 Astor Place.

This very excellent and original work has long been waited for by scientific men. The rapid growth of chemical science soon makes our text books become antiquated, and the best works on analytical investigations hitherto published have not been able to embody many theories and results which are universally recognized as true. It is not probable that Fresenius will ever fail to be read by students in chemistry; but we must look to more modern writers for works dealing with contemporary science, of which Professor Thorpe's book is an admirable specimen.

MECHANICS' GEOMETRY, Plainly Teaching the Carpenter, Joiner, Mason, Metal Plate Worker, and Other Artisan, the Constructive Principles of his Calling. Illustrated by Accurate Explanatory Cardboard Models and Diagrams. By Robert Riddell, Author of "Hand Railing Simplified," "Practical Geometry," "The Carpenter and Joiner," etc. Philadelphia: Published by the Author, 1214 Hancock street.

This is one of the most valuable practical works which has come under our notice. The problems dealt with are judiciously selected, and contain directions for nearly every useful form. But its especial merit lies in the illustrations, of which the parts are movable from the cardboard on which they are printed, so that the desired pyramid, octagon, sloping roof, cone, or other form may be made by the reader, at once affording a practical idea of the construction intended to be illustrated. The text of the book is clear and exact, and any mechanic who wishes to ascertain the first principles of rules of construction in common use, as well as those in search of improved methods, will be able to acquire from it a good knowledge of practical geometry. It is altogether a volume of the highest value, and is likely to do much to promulgate scientific knowledge of the useful arts. In the interests of our skilled workmen and the cause of technical education, we wish it an extended circulation.

THE LARYNX THE SOURCE OF THE VOWEL SOUNDS. By Thomas Brian Gunning, New York. Baltimore: Journal of Dental Science Office, 86 West Fayette street.

An elaborate *resumé* of the statements of Professors Tyndall, Helmholz and others, in support of the author's own views and reasoning thereon.

THE ANIMAL KINGDOM. Volume II, No. 1. Published by the American Society for the Prevention of Cruelty to Animals.

A pleasant and useful little publication, well suited for the perusal of young people, in whom it is likely to create a sympathy for the objects of the praiseworthy institution by which it is issued, and to teach all of us to respect and help those who cannot help themselves.

THE WORKSHOP for January contains a continuation of a valuable article on the Vienna Exposition in connection with art industry—more especially, in the present number, with reference to gold and silver work. The usual large proportion of admirably executed engravings of the finest products of European decorative artists are added, and comprise some exquisite designs in cabinet work, mural decoration, jewelry, etc. In order to render the advantages offered of practical utility, a large sheet of working drawings is supplied. Published by E. Steiger, Nos. 22 and 24 Frankfort street, New York city. Subscription, $5.40 per year.

We have also received from the same publisher the first number of ART WORKMANSHIP, a superbly printed periodical which is designed to form a complete historical atlas of art work. Its object is to present, by finely executed engravings on separate and detached pages, together with the necessary letter press, full descriptions of the treasures of public and private collections, the admitted masterpieces of churches, monasteries, and town halls, and, in fact, of all known objects of art which will serve both to educate the taste and supply good models. The work is to cover a wide ground and embrace the subjects of wearing apparel, embroidery, and lace, vessels in clay, glass, and crystals, goldsmith's work, wrought and cast iron work, paneling and wood mosaic, wall decoration, bookbinding, and, in brief, every thing of value to followers of artistic pursuits. Each part contains a colored plate and some six or seven plain engravings on heavy paper. Issued in twelve monthly parts, at $1 each, or at $10 per year.

Recent American and Foreign Patents.

Improved Seed Sowing Machine.

We have recently been favored with a description of an improved seeder the patent of which is owned by Mr. Christian Monson, of Moscow, Iowa county, Wis., the inventor of the new auger illustrated elsewhere in this issue. The machine, it is stated, has been in successful use for some time, and has developed many important advantages. The essential features of the device consist in the seed-distributing mechanism, which includes two seed boxes, one in front of the other. The bottom of the larger box is formed of alternate plates and angular surfaced blocks, in the former of which are holes. Beneath these orifices and extending across the frame is a cylinder, around the circumference of which circular recesses are cut to correspond with the apertures in the bottom of the receptacle. The cylinder is so arranged as to slide in its bearings longitudinally, so that each hole in the seed box may be over one of three sets of circumferential recesses at will, and govern the quantity of seed to be delivered. These sets are of different sizes. There is a revolving shaft inside the cylinder having arms passed loosely through holes made therein. By this means the seed is agitated and caused to fall through the apertures in the bottom and fill the recesses in the cylinder as it rotates below. A brush suitably arranged cuts off the flow, and the cylinder, continuing its revolution, throws the grain into tubes, and thence into other conduits, the lower ends of which furrow up the ground in advance. The smaller seed box also has a beater shaft within, and supplies its seed to a cylinder below, in which, however, there is but a single radial recess, the size of which can be governed by suitable means. This may be used, the other mechanism being out of gear, to distribute the seed at intervals, the grain being delivered to the tubes of course but once at each rotation of the cylinder. There are three seed tubes or drills which enter the ground, and which make rows five inches apart. They are governed by suitable mechanism so as to be easily raised from the ground, and are also prevented from becoming easily clogged. Attached to the rear of the machine, which is mounted on wheels in a suitable frame by a draft bar and drawhead, is a roller above which the driver's seat is disposed. This attachment is provided with all machines, or, if the apparatus be first purchased separately, it can be supplied at, we are informed, a small cost. The use of brushes in cutting off the grain prevents any injury to the kernels, and the mechanism, it is stated, measures out the seed with exactness. The machine can be used for planting corn or other grain, either in drills, hills, or check rows. It is readily adjusted to suit the distance apart of the hills and the quantity of seed to be delivered. The owner of the patent adds that the invention has been quite thoroughly tested and extensively manufactured. He is desirous of increasing his facilities, however, and wishes to dispose of territorial rights. Patterns furnished at small cost. Further particulars may be obtained by addressing as above.

Improved Device for Cleaning Steam Generators.

David L. Latourette, New York city.—This invention proposes to provide steam boilers with independent and permanent pipe connections, the same having cocks or valves, whereby, as soon as they are blown off, a current of steam or other fluid may be forced through the boilers, said current being impelled by suitable means. The injection pipe is attached to the boiler at one end on the upper side, and the discharge pipe or connection at the diagonally opposite end. Thus the current of steam or other fluid acts on the sedimentary deposit immediately around the point of entrance, and thence extends its influence to all the remaining parts of the inner surface of the boiler, and, driving the same before it, carries it toward the lowest and most distant point, where it is forced out of the boiler through the pipe connection there applied.

Improved Compound Tool.

John Dillon, New York city.—The hammer head is provided with a short handle, which is made hollow and with a square socket in the outer end to adapt it to be used as a wrench for turning bolts, nuts, etc. Upon the outer surface of the end of the handle is formed a screw thread to fit into the hollow handle. The shanks of a small gimlet and of a brad awl are attached to the opposite sides of the button, which has a screw thread cut upon its edge to fit into the screw thread of the handle. By reversing the button, the brad awl or gimlet may be made to project as one or the other may be required for use. A small set screw, which screws in through a small hole in the handle, prevents the disk from turning when the tool is turned backward. The outer end of the handle is notched, and the inner surface of one or both the jaws thus formed is serrated to adapt them to serve as a wrench. One of the jaws is sharpened to serve as a fine screw driver, and the other is made to serve as a coarse screw driver. In the hammer head, near the claws, is formed a socket, into which fits the brad awl, where it is secured in place by a set screw. As thus arranged, the tool becomes a crank for turning a shank or other object.

Improved Shoe Fastening.

Samuel Babbitt, Brazil, Ind., assignor to himself and William E. Sibley, Boston, Mass.—The flap of one quarter covers the slit at the instep and overlaps the other quarter, so as to close the slit as tight as possible against water and dust. A strap is attached, near one end, to the flap near the bottom of the slit, passes through metal loops on both flap and body of the shoe, in a zigzag course to the top, and is doubled through a buckle, and attached at its upper end to the flap. The doubled portions passing through the loop allow of loosening the shoe sufficiently without drawing the strap out of the buckle, thus saving considerable inconvenience that would attend the pulling of it out.

Improved Grain Drill.

Samuel Hart, Fulton, N. Y.—A long grain hopper extends across the front portion of the machine with a chamber into which the grain escapes through the passage, which is regulated by a gate. The side of this chamber is made to fit nearly half around a small dropping roller containing pockets, opposite which there are slots, through which the grain passes into the pockets. The roller has as many pockets as there are to be drills in the machine, and each pocket discharges into a spout for sowing in drills. The drill stocks may be readily released for adjustment or removal. The dropping spouts terminate over the drill tubes, and have, when the machine is to be used for planting, a gate or valve closing against the lower end by a spring shank to retain the grain until it should fall into the hill.

Improved Printer's Side Stick and Quoin.

Francis Keehn, Milwaukee, Wis.—The object of this invention is one for the use of printers, consisting of an improved side stick and quoins, by which the forms may be easily set without injuring the imposing stone, and firmly retained during the printing process. The invention also consists in constructing the side stick with wedge-shaped sections, which are wider at the base, forming a projecting step, along which the wedge-shaped quoins, with a similarly projecting top step, are guided, so as to confine the type in the chase.

Improved Piano and Organ Attachment.

Leon J. Fremaux, New Orleans, La.—This invention consists of movable boards, having pins and bridges arranged on one side in the order of the music, like the projections of the barrel of a music box. This is caused to slide along the top of a box by a hand crank and suitable gearing. In the box are levers corresponding to all the keys of the piano and organs, connected by suitable contrivances with cushioned plungers or hammers which are made to strike the keys of the instrument when the projections on the moving board come in contact with the levers. The piano or organ is thus caused to play the piece represented on the board by the projections. Different boards will be used for different tunes. The box containing the apparatus is so contrived that it can be applied to any piano and organ by simply placing it on the front above the keys, and securing it by clamps and adjusting devices attached to the box, forming a simple and ingenious contrivance. It requires four or more boards for each tune, as the parts are always repeated alternately, and each board is used in the order in which its part of the tune is played, the others being removed.

Improved Adjustable Hanger for Mirrors, etc.

James Wright, New York city.—This invention has for its object to furnish an improved device enabling the mirror or picture to be hung without injuring the plastering or cutting the woodwork of the house, and without the use of step ladders or other contrivances for attaining the requisite hight. The device consists of an upper strip of wood which is hung upon a nail in the wall. The lower part of this strip forms a tongue which is slotted, and which enters a dovetail groove made longitudinally in a second strip. A square bodied bolt and thumbscrew passes through the lower strip and tongue, so that the two may be clamped in any position. The upper end of the lower strip terminates in a band which encircles the upper strip, serving as a keeper for the latter, and also as a support for the hook which sustains the mirror.

Improved Sewing Machine.

Theodore A. Weber, Philadelphia, Pa., assignor to Albert Lathrop Runyon.—The first part of the invention consists of an arrangement of a rotating looper and a vibrating loop spreader for opening the loops wide enough for passing a commercial spool, so that the rotating looper shall first take the thread from the needle and open the loop to some extent before the vibrating spreader takes it, instead of the reverse arrangement, which has been before used. By this arrangement, it is claimed, a much shorter and stiffer needle can be used, and there is less liability of the needle springing away from the looper and missing stitches. The second part of the invention consists in the arrangement of an upper thread take-up, to operate in connection with the under bulged plate take-up, heretofore used. When the spool has passed through the loops, and the spreader begins to go back to release the loops, the bulged plate enters it, and draws the thread laterally over its swell, so as to keep the necessary tension on the slack given up by the spreader. At the same time the upper take-up begins to rise, the needle arm, having previously reached the upper limit of its movement and begun to descend again, acts, in conjunction with the bulged plate, to keep the loops taut. The bulged plate escapes through the loop as fast as it is taken up, and the latter passes off the horn as it vanishes, the horn preventing it from being caught by the needle and the spreader.

Improved Curtain Fixture.

Henry K. Warner and Charles E. Smith, Rochester, Minn.—Two wooden bars are connected together longitudinally, so as to be at right angles to each other, and are provided with suitable eye bolts, so as to be suspended from the upper part of the window casing. The curtain roller is pivoted in suitable brackets secured in the angle between the bars. One bracket is detachably secured to the bars by a pin, so that by drawing out said pin the bracket may be swung outward and the roller detached. The shade is wound upon the roller by means of a cord, one end of which is attached to a spool attached to one end of the roller, and which is wound upon said spool by drawing down or unwinding the shade. The cord passes through a guide notch formed in the lower edge of the vertical bar, where it is kept in place by a pin, so that by withdrawing the said pin the cord will be released, so as to be detached with the shade and roller. The cornice is hinged to the forward edge of the horizontal and upper bar, and is so formed as to pass around the forward side of the roller, so as to cover the said roller and protect the shade from the falling dust. The end parts of the cornice fit and rest upon the brackets. To the lower edge of the bar is attached a catch which is made with a tapering slot, so that by moving the cord into the narrow part of said slot it will be held securely, holding the shade in any desired position.

Improved Carpet Stretcher and Tacker.

Zadock A. Ward, Pittsfield, Mass.—This invention is an improvement in the class of implements for simultaneously stretching and nailing carpets, in which a hammer and tack or nail conducting channel and toothed pusher are main elements. To the lower end of the handle is rigidly connected, under suitable angle, an upright guide piece, which is provided at its broader lower part with forward curved teeth for the taking hold and stretching of the carpet. In a recess in this guide piece, and supported by a spiral spring above the same, is a sliding bolt, the upper end of which is struck by a hammer head. The latter is secured to a curved lever pivoted to the handle. The lever projects at some distance below its fulcrum, and is connected at its end with a curved rod which is operated by a shorter handle. The tack conducting and feeding arrangement is placed into a recess at the upper side of the lower part of the handle, adjoining and opening into the T shaped recess of the guide piece. A T shaped tack conductor slides in inverted position in the recess by the action of a coiled spring, on its upper part, projecting into the recessed part of the guide piece. The U shaped carpet tacks are placed one adjoining the other on the central part of the conductor, and held thereon by means of a covering plate. The tacks are fed into the recess of the guide piece and acted upon by the spring bolt, which drives them into the carpet at the required time.

Improved Steam Cooker.

John Bentz, Parkersburg, West Va.—This invention is a steam cooking apparatus, which admits the steam to the victuals in each part or drawer thereof on closing the drawers, shutting off the steam on opening the drawers. No steam can thereby escape and burn the fingers, but the cooker works uniformly with the full heating power. The different parts of the cooker are arranged above each other, separated by partitions, and connected at their rear sides with a vertical extension of the boiler. The steam enters through short tubes, with valves applied therein, opening into larger tubes of the drawers, with horizontal guide pins, which push the valves open when the drawers are within the cooker, and shut off the steam when the drawers are opened for inspection.

Improved Hemmer for Sewing Machines.

Louis Sexauer, Brooklyn, N. Y., assignor to himself and John B. Christoffel, Brooklyn, E. D., N. Y.—The invention consists of an auxiliary presser which is employed in combination with an extension hemmer. It consists of a spring plate bolted on the plate of the hemmer, and a secondary plate provided with an adjusting screw. The spring plate is secured adjustably, and so arranged that the end will rest on the top of the machine presser, to be lifted up by it, while the plate itself tends to spring down on the cloth. The secondary plate is to be forced down upon the cloth at the outer end, to press and smooth the fold down flat, so as to run along the guide properly to guide the hem to the needle. The adjusting screw is to regulate the distance of the secondary plate from the spring plate, according to the thickness of the cloth. For example, if the cloth be light and thin, it should be adjusted lower than if the cloth be thick, because the sewing machine presser presses down into the thick cloth, and the latter will be higher relatively to the point of support of the secondary presser

Improved Bridge.

James Valleley, Canton, O.—For constructing metal arches for bridges this inventor proposes to make hollow trunks, either of four or six sides, formed of flat plates, or some of flat plates and some of lattice bars, united at the angles by angle bars. These trunks have a section of the form of a trapezoid when four sided, and of the form of two trapezoids, placed base to base, when constructed with six sides. The shoe for the end of the arch or chord is formed of two metal pieces, one of which receives the end of the chord on its face, and is supported by trunnions in bearings on the top of the other piece, which is bedded in the foundation, so that the piece supporting the end can turn readily, as required by the expansion and contraction of the arch.

Improved Draft Equalizer.

William McClelland, Sr., Fowler, Ill.—The object of this invention is to produce an equalizing attachment for three horses, to be applied to reapers and other vehicles, by which a greater effect is obtained, and the side draft regulated, as required. The weight of the tongue on the neck of the horses may also be adjusted. The invention consists of a curved bar which is attached to the tongue, and carries the rear extending bar, with regulating rod, which connects with and is adjustable on a cross bar of the hounds Both bars together support the equalizing bar, and allow the adjustment of the same into any required position.

Improved Car Coupling.

Thomas Rens Land, Grass Valley, Cal.—The link has at each end a flat, spear-shaped head which, when the cars come together, enters a spiral opening in a circular block. As the link is pushed through this spiral opening, it turns a block one quarter around and lifts up a weighted lever attached. When the spear-shaped head of the link has passed entirely through, the weighted lever drops and returns the block to its original position, which position is such that the narrower width of the spiral opening will be crossed by the broader part of the spear head of the link, and therefore the link will be prevented from being withdrawn through the opening. The block is held in the drawhead by a circular flange or a second block, which enters a corresponding circumferential groove in said first block. The flanged block is secured to the plates by bolts. The link is sustained in a horizontal position, and guided to enter the spiral opening by the assistance of the socket piece, which has a square stem which plays back and forth in a square hole in the center of the blocks. The spiral springs connecting the stem to the blocks operate to relieve the cars from the effects of the shock of meeting when in the act of coupling. The end of the link closely fits in this socket piece, the other end of the link being held in a similar manner in the coupling iron of the car adjoining.

Improvement in the Propulsion of Vessels.

Charles P. Macowitzky, Corpus Christi, Texas.—This invention has for its object to improve the construction of the device for which letters patent No. 135,391 were granted February 18, 1873. The piston rod of a steam engine is secured to an arm which passes through a slot in the bottom or side of the vessel and a slot in a sliding frame, and is rigidly attached to a rack bar. The latter slides upon the frame and engages with a gear wheel, attached to the paddle, so that the said paddle may be projected and withdrawn by the movements of the said rack bar. The paddles are pivoted to the sliding frame, so that they may be carried back and forth by and with said frame or plate in its movements. By suitable construction the arm and rack bar will be first moved to adjust the paddles, and the rack bar, paddles, and arms will then be moved together to make the stroke. The mechanism of the parts may be so adjusted with respect to the piston rod, that the paddles will be projected upon the forward or back stroke, as may be desired.

Improved Valve.

George R. Crane, Painesville, O.—The disk of the valve is surmounted by a hollow cylindrical extension, which is enclosed in a cage formed of three vertical standards, suitably secured at their lower ends. These standards prevent the valve from tilting laterally, and have studs at their upper ends to keep the same in place. The valve is secured with a ring of leather, fitted into a recess in its face which is secured by a clamping disk, nut and bolt. The valve seat in the bottom plate is made in two parts, of which one is in a flat plane, and the other is conical or concave. With the flexible bushing of the valve constructed to correspond with these forms, all the advantages of both for securing a tight joint are claimed to be obtained, as the elastic substance will shape itself to both parts, and afford greater security. The valve can be removed readily for repairing the bushing by unscrewing the fastening of one of the standards, and the bushing can be easily taken out.

Improved Car Coupling.

Hamlin G. Russell, Lincoln, Ill.—Each drawbar is provided with a coupling hook which is pivoted, at the rear end of the same, to a strong vertical rod. A strong band spring is connected to a hook and placed in such a manner between it and the side of the drawbar that the force of the same presses the hook toward that side of the drawbar. The opposite side of the drawbar is made with a solid inclined part at the mouth for the easy entering of the coupling hook of the adjoining car, which part is supplied with a vertical groove along its rear edge, into which the hook locks. A catch plate is secured to the side of the drawbar in the rear, so that its front part has an elastic spring-like action. On the approaching of the cars, the hooks lock into the vertical grooves. For uncoupling, a suitably arranged lever is carried sidewise, so that the catch plates act on the ends of the hooks and disengage them from grooves. The play in vertical direction which is given to the hooks along the grooved parts allows the coupling of cars of different hights, while the side play of the hooks instantly disconnects the cars when any one should get off the track.

Improved Sash Holder.

Samuel Chard, Mianus, Conn.—This invention is intended to furnish means for holding window sashes in any desired position, and for fastening them when they are down. The sash is raised by pushing back the catch by means of a knob which releases a lip. The catch is held back until the sash is in the desired position, when the knob is let go. The pressure of the spring is designed to counteract the weight of the sash to some extent, but the catch, being free to turn on its knob pivot, acts as an eccentric and securely holds the sash.

Improved Mechanism for Towing Boats.

Giles S. Olin, Deer Lodge, Montana Terr.—The tug boat is provided with engines for furnishing motive power, and a propeller wheel is made to operate at the stern. A drum is supported on a horizontal shaft by stands which are attached to the sides of a frame. This drum is revolved by the motive power with the shaft when winding up the two ropes, and on the shaft when unwinding it. The drum is given a slight longitudinal motion by means of a lever, which couples it with the gear wheel on the drum shaft. The motive power is applied to the propeller by means of a central shaft. The propeller shaft and the two shafts are coupled together and uncoupled by means of a shifting lever, the propeller wheel being used only periodically, or to move the tug ahead and unwind the rope. The towing of the boat, or train of boats, is done while the tug is anchored and stationary. The towing rope may be of any length which can be conveniently wound on the drum. One end of the rope is attached to the drum, and the other end to the train of boats. The drum is thrown into gear with the shaft, and the train of boats is drawn near to the tug by revolving the drum and winding up the rope. When this is accomplished, the propeller wheel is slipped into gear and the tug is driven ahead, while the drum is uncoupled, so that it revolves freely on the shaft and unwinds the rope. When the rope is unwound, the propeller wheel is uncoupled, the tug is anchored, the drum is thrown into gear, and the rope is again wound up, and this process is repeated as rapidly as desired.

Improved Glove Turning Machine.

Frederick Vanderpool, Mayfield, N. Y., assignor to himself and James E. Wood, of same place.—The object of this invention is to furnish a convenient glove-turning machine, by which all the fingers and the hand part, with the exception of the thumb, may be turned simultaneously in a rapid and easy manner. The invention consists of a stationary frame with finger tubes, over which the glove to be turned is placed. A spring frame with hand board and finger rod slides in the stationary frame, and serves, by being pressed down on the finger ends, to carry the glove and hand part over it by one upward motion of the same.

Improved Grinding Mill.

David A. Caldwell, Jacksonville, Ill.—A spur gear of ordinary construction is arranged loose on a shaft, with its toothed rim meshing with a pinion on the runner spindle. The supplementary driving wheel is placed under and supports the gear, being itself fast on the same shaft. It has radial slots or notches in the upwardly projecting flange formed around its periphery, to receive the arms of the gear; and sockets are formed in the opposite sides or walls of said slots, to receive springs, which bear against the opposite sides of arms of the wheel. The springs are so arranged, as to strength and length, that one only will come in contact with the wheel when driving one run of stone; but, when driving two, the longest one will contract enough for the shorter one to come into action, thus making the elastic and yielding capacity alike applicable in the use of part or all of the power. To secure the springs in place, and connect the two wheels together, plates are bolted at their ends to the wheel, and cover the sockets, confining the arms of the gear wheel in the slots of the wheel. The spindle step is mounted in a steel box, which is fixed on the end of the short arm of a lever, pivoted on a pedestal which is to be supported on an independent foundation. The long arm, which is forked or notched, extends to and embraces the lower part of a temper screw, under a follower working up and down on guide rods, and operated by the screw, which is stepped in a pedestal which supports the said rods by a bar, the upper ends being connected to and stayed by another bar, through which the temper screw passes, but not screwing in it. The temper screw rod extends up through the stone floor and a dial plate thereon, and has a pointer and hand crank or wheel, the one for turning it, and the other for indicating on the dial the extent of the movement of the screw. This screw is provided with a collar at its bearings in the stone floor, so that it cannot move endwise, by which, when turned, it works the follower up or down, according to which way it is turned, and thereby causes the vertical adjustment of the stone.

Improved Blade for Agricultural Implements.

Winfield Scott, Floyd Court House, Va.—The object of this invention is to render hoes and other agricultural implements more durable, and it consists in making the outer corners of the blade thick and rigid, and making the blade thin, or bringing it to an edge between the corners.

Improved Transfer Apparatus for Railroads, etc.

Joseph Jones, Alfred Harley, and Charles H. Fisher, Albany, N. Y.—This invention consists in an apparatus for gradually overcoming the inertia of and attaching cars, carriages, or other vehicles to a cable or belt, while the latter is in continuous motion, and for increasing or diminishing the adhesion of the cable.

Improved Mill Pick and Hammer.

Allen H. Vanfossen, North Wales, Pa.—This invention consists in a mill pick hammer, which has a tap hole on one edge of the holder, and whose head is provided with a set screw, an oblong rectangular socket, and tap holes on side and edge.

Improved Breech Loading Fire Arm.

Joseph C. Dane, La Crosse, Wis.—This invention is an improvement in breech loading, of the class in which the firing pin or striker acts by momentum, the movement of the hammer being arrested just previous to the delivery of the blow on the cartridge. The improvement relates to the construction of the striker with an annular recess in its lower end, to adapt it to receive the spiral spring which encircles the firing pin proper, and to arrest its movement and impart the requisite weight.

Improved Farm Fence.

Jacob Haish, De Kalb, Ill.—This invention relates to means whereby the rails of a wire fence panel may be not only made much stronger, but whereby it will be enabled to turn stock and allow for expansion and contraction by heat and cold. It consists in making the rail of several pieces of wire, each fastened at one end to the post or another piece of wire, and then carried out and hooked by a bent end with a corresponding one from the opposite direction, spikes being thrown out on each side of the fence at the point of junction. With two wires to each rail, spikes will thus be thrown out on each rail preferably at intervals of about a foot, more or less.

Improved Rotary Engine.

John B. Adt, Baltimore, Md.—This invention relates to means whereby rotary engines may be more conveniently packed, the piston kept always radial to the center of the shell, and the usual clapping noise avoided. The invention consists in a combination with the case and the eccentric shaft that carries the disk of the ring plates and carrying piston, and slotted to allow the said shaft to move.

Improved Self-Adjusting Track Cleaner.

James S. Hagerty, Baltimore, Md.—This invention relates to means whereby the dust, dirt, snow, or other obstacles which are found upon railway tracks, may be speedily and effectually removed in advance of the wheels, while all liability to fracture or displacement of the scraper may be avoided. This is done by means of a scraper, a scraper stock, a bar and a grooved lug, jointed and operating together in a novel and effective manner.

Improved Damper for Stoves.

Edward F. Cook, Omaha, Neb.—The object of this invention is to provide means for retaining stove dampers in any desired position when they are in use; and it consists in a hoop or ring attached to the damper plate at right angles with the damper spindle, so that the hoop or ring will bear against the pipe in which the damper is placed and hold the latter in position by the friction thus produced.

Improved Lubricating Journal Box.

Jean Morin, New York city.—The object of this invention is to furnish a self-lubricating journal box for axles and shafts of all kinds, which secures an even and regular supply of oil to the bearings. Chambers extend vertically at the sides of the outer case of the journal box, and contain the lubricating oil, which is filled in by means of tube from the outside, which also indicates the quantity of oil in the chambers by the hight of the oil therein, so that the requisite supply can easily and readily be regulated and kept up. The oil receptacles connect with each other by means of flat, lateral, and longitudinal channels, at some distance below the axle, which channels are connected by central and symmetrically arranged side channels with the bearing and axle. The side channels are wider at the base, narrowing toward the upper end, and contain the wicks, which touch with their upper ends the axle, and feed the oil evenly to the same. The semi-cylindrical axle bearing is cast of bronze and provided with top recesses and a downward projecting central guide tube, which fits into the central channel of the case. The wicks extend to the flat lateral channels, take up the lubricating oil and convey it by capillary attraction to the lower part and sides of the journal in proportion to the number of rotations of the same. The cap piece serves to keep the side wicks in contact with the axle.

Improved Dropper for Seed Planters.

Hermann H. Koeller, Camp Point, Ill.—The bottom of the seed box is formed with a circular recess in its center, in the sides of which are formed slots to receive the sliding bar, by the movements of which the dropper is operated. To the center of the bottom is attached a projection which passes up through the sliding bar and forms a pivot for a star wheel, which is made with seven rays, the outer ends of which are made more inclined upon one edge than the other, so that the point or extreme end of the arms may be at one side of the radius passing through the centers of the said arms. To the upper side of the sliding bar are attached two wedge-shaped projections, which fit into the space between the rays of the star wheel, and which alternately strike an arm of the wheel and turn it through half the space of one arm. The dropping plate is made in the form of a circle with its middle part cut away, and is carried around by and with the star wheel. In the dropping plate, near its outer edge, are formed fourteen holes arranged in a circle and at equal distances apart, which receive the seed from the hopper and carry it to the discharge hole through the bottom through which it falls into the guide spout that conducts it to the ground. Upon the lower side of the sliding bar is formed a projection which works in a slot in the bottom, and to the end of which is pivoted the end of a bar, the other end of which is pivoted to a bar, which is in turn pivoted to the conductor spout so as to detain the corn in the conductor spout. This is operated at each movement of the sliding bar to allow the corn to drop to the ground.

Answers to Correspondents

S. C. C. will find a description of Mure and Clamond's thermo-electric battery on p. 24, vol. 29.—C. R. H. can temper steel plow molds by the process for case hardening described on p. 362, vol. 25.—S. C. C. can brown gun barrels by following the directions on pp. 154, 266, vol. 26.—T. T. C. and others write to point out that the explanation of the compound lever on p. 11, vol. 30, should be "$36\times17.5\times20$, weight balanced at A," and not "$36\times13\times20$," etc.—N. K. L. will find recipes for brass lacquer and dip on pp. 219, 282, vol. 29. Booksellers' addresses appear in our advertising columns.—A. W. can arrange his lenses in a wooden telescope, according to the description on p. 7, vol. 30.—H. E. S. will find directions for making paste on p. 280, vol. 28.—A. G. S. will find directions for making cider vinegar in our answer to J. F. A. on p. 58, vol. 30, the process described in which will serve as well with cider as with malt.

H. C. asks: How large should a cylinder be for a circular wrought iron boiler 18 inches in length, 14 inches in hight, with 5 two inch flues, capable of standing 75 lbs. pressure to the square inch? A. Diameter one inch, stroke three.

J. G. asks: What is the percentage of fuel saved by feeding water into a boiler at 200° when before it was fed in at 125°? A. You do not send enough data to enable us to answer this question. We can give you the general method of finding the gain by increasing the heat of the feed water, and you can apply it to your case. Let H = total heat of the steam. F = one temperature of feed. f = a higher temperature of feed. Then $\frac{f-F}{H}\times100$ = per cent of gain by increasing the temperature of the feed water. EXAMPLE: Suppose, in the case mentioned by you, that the steam has a pressure of 60 lbs. by gage. $H=1207{\cdot}8°$ per cent of gain $=\frac{200-125}{1207{\cdot}8}\times100=6{\cdot}2+$

N. G. asks: Can I transmit the power to a grist mill by friction bevel wheels, one on the horizontal shaft which runs at 225 revolutions per minute, the other on a perpendicular shaft whence a belt leads to the spindle? What would be the dimensions of the wheels, and of what should I make them? A. You do not state how much power you desire to transmit. We think, however, that you would experience trouble in the use of wooden wheels.

J. H. O. says: One of your correspondents states that the heated hydrocarbon vapors are liable to spontaneous explosions when mixed with atmospheric air. May not such explosions occur in ordinary temperatures in the use of any of the light hydrocarbon oils? A. From the great volatility of some of the hydrocarbon compounds, we are inclined to think that what seemed like spontaneous explosion was really caused by some hydrocarbon vapor coming in contact with flame at some distant point. In this respect impure or imperfectly refined kerosene is sometimes more dangerous than gunpowder, the volatile inflammable vapors even at a great distance taking fire in contact with flames, and leading like a train to inflammable fluid. We think, however, that there is a field here for careful experiment to determine the precise conditions under which these volatile compounds inflame or explode.

H. A. W. says: "I read that, to make imitation sapphires, I should take one ounce of paste and mix with two grains of precipitated oxide of cobalt. What does the paste alluded to consist of? What is oxide of cobalt?" A. The paste you mean is a very fusible, highly transparent, dense glass, also called strass, frit, etc., and is the base of all artificial gems. There are various recipes for making paste: the following is an imitation of the diamond: Rock crystal, 1,600 grains, borax 560 grains, carbonate of lead, 3,200 grains, oxide of manganese ½ to 1 grain. Powder each separately, mix together, fuse in a clean crucible, pour into water, separate any reduced lead, and again powder and remelt. Precipitated oxide of cobalt is prepared by adding a solution of carbonate of soda to a solution of sulphate of cobalt, washing, drying, and igniting the powder which falls. This is what gives the transparent paste the blue color, characteristic of the oriental sapphire.

N. A. T. asks: 1. What is the best compound for making artificial ice, and how must it be applied? A. A very convenient freezing mixture without ice may be made by rapidly dissolving 1 part nitrate of ammonia in 1 part of water. This is said to cause a reduction of temperature of 46° Fah., or from 60° to 14° above zero. 2. What is the average cost per hundred lbs. of ice frozen by artificial process? A. Ice in New Orleans manufactured by artificial means is said to be produced for $3 per tun; but with improved machinery the time is probably coming when it will be made in our great cities for $1 per tun. 3. Where can I get the best advice on pisciculture? A. See the *Science Record* for 1874.

A. H. W. asks: 1. What sized wire (insulated) and how much should be used for a helix made of iron one inch by two feet, and bent in the common U shape? Should the iron be painted? A. 1. It is not necessary to paint the iron. The force of an electromagnet varies in proportion to the number of convolutions of the wire, the quantity of electricity in circulation, and the square root of the diameter of the soft iron. 2. Why does water feel so cold, after having peppermint in your mouth? A. It may be because the nerves are rendered more sensitive.

G. S. R. asks: What is the stowage capacity in cubic feet of a tun of Franklin coal, also of Lehigh coal? A. We gave average values for the space in feet occupied by a tun of coal on p. 60, 135, vol. 29, and stated then that there was so much difference of weight in the various qualities that it was impossible to give definite figures without more data.

W. S. M. asks: 1. How shall I proceed to fill the boxes for a foot lathe spindle with Babbitt metal? Should the spindle be wrapped with a thickness of paper before the metal is poured in? A. It will be better to use a piece of paper. 2. Please give directions for making a hard, heavy, black paint for the unfinished cast iron parts. A. There is a black varnish made from petroleum that answers very well. 3. How much should the back gears diminish the speed so as to turn wrought iron 3 inches in diameter? A. You should arrange the gears to give the iron a surface velocity of about 30 feet a minute. In regard to your other questions, they are rather indefinite, as the dimensions you ask for are dependent upon many circumstances. It would be well for you to inspect some good lathes, and take measurements.

A. R. G. asks: 1. Should I gain any power in a small turbine water wheel by continuing two of the buckets spirally up the shaft to the top of the penstock, or would the wheel run too fast for the water at the top of penstock? Would a close fitting or a wide penstock be best if the wheel is used under heads from 16 feet upwards? If this is an improvement, would it be patentable? A. These matters could best be determined by experiment. An examination of previous patents (see prospectus in our advertising pages) would be necessary to enable us to answer your last question.

R. C. M. asks: Could a steel saw be used with economy in sawing stone, using adjustable teeth? "I have been experimenting with black carbons, but find it is impossible to make them stay in their places." A. We believe the diamond tooth saw is found to be more economical.

S. A. G. says: We have a 30 horse engine, with a cut-off, and we find that the cylinder has worn more at each end than at the center. We have been told that this is a common occurrence with cut-off engines; is it so? As we have a good deal of trouble with the cut-off, we thought of doing away with it, and using a governor to regulate at throttle. Will this cause the cylinder to wear in the center so as eventually to make it more uniform? A. We think the best way to remedy the trouble will be to re-bore the cylinder.

H. R. says: We are engaged in a manufacture requiring iron of great tensile strength. What kinds would you recommend? A. Pure gray cast iron, and Ulster wrought iron.

P. J. D. asks: 1. How do you calculate the thickness of a horizontal stationary engine frame? A. It is treated as a beam. 2. In your answer to J. O. R. about the length of lever for a roll valve, what does the decimal 0·672 represent, and how do you get it? A. There is a slight mistake in this example, which occurred through an oversight. Referring to the figure, the chord R C is equal to twice A B, multiplied by the sine of half the angle B A C. B A C = 97° 31′. A B = 3 inches. Hence, $BC = 2\times3\times\sin 47°\,45' = 6\times0{\cdot}74 = 4{\cdot}44$ inches and lever $AE = 3\times11\div4{\cdot}44 = 7{\cdot}66$ inches, nearly.

A. C. F. asks: What is tinsel? How could I make the red kind? A. Tinsel is thin metallic foil coated or plated with silver or gold. The red kind of which you speak is probably copper. You could not make it without expensive machinery and skill. The makers and dealers in fancy boxes could probably supply you.

R. A. McL. asks: 1. What pressure of steam will a tin boiler of the following dimensions stand: Hight one foot, diameter of top and bottom respectively four and eight inches? A. Treat it as a cylindrical boiler having the diameter of the largest part. 2. Has a rotary steam engine ever been constructed on the principle of the turbine water wheel? If so, did it work? 2. Such engines have been made and have worked, how economically we are not able to state.

M. H. P. asks: Is coal tar good to put on an old tin roof to keep it from rusting? How shall I apply it? A. Coal tar is often used for roofing purposes. For particulars as to its preparation, correspond with some manufacturer of roofing materials.

C. asks: 1. Can you give me a description of the circular slide valves for steam engines? A. There are several patent valves of this description in the market, and, by addressing their manufacturers, you can obtain the necessary information. 2. Why is it that they have not succeeded in navigating submarine boats with men in them? Is it because there is no motor suitable to propel them, or because they roll over and become unmanageable, and are likely to turn upside down? A. We believe this has been accomplished on several occasions.

Z. E. H. asks: 1. What is the simplest way of drawing a meridian line? A. We gave a method on page 409, vol. 29, which is quite simple and tolerably accurate. 2. How is mean time calculated? A. Mean time is calculated by supposing that an imaginary sun, called the mean sun, moves uniformly with the mean velocity of the true sun. 3. What is meant by "sun fast" and "sun slow" and "true midday?" A. The difference of time, as given by the true and mean suns, shows a correction of "sun fast" or "sun slow." True midday is the time of the passage of the sun over the meridian. 4. What is equinoctial time? A. Equinoctial time is reckoned from the moment when the point of *Aries* passes the vernal equinox. 5. What is the simplest method of finding the variation or error of a watch or clock? A. By observing the meridian transit of the sun. 6. Have we a national standard of time? A. The calculations in the *Nautical Almanac* are generally made for Washington time.

J. C. S. asks: When the strain is between the head of a bolt and the nuts, which of the nuts bears the strain, the first or the jam nut? A. A great deal depends upon the adjustment. With the threads accurately cut, the strain might be equally divided. 2. I have a little girl who often amuses herself by looking in my eyes. We sit facing a lighted lamp. She places her right eye as close as possible to my left, and we turn our eyes toward each other. They are then partially shaded, and we see all the interior fluid and optic nerves. Do I see her eyes or the reflection of my own? A. We suppose you see into her eyes.

A. R. P. asks: How far is it possible for the naked eye to see any object at sea, above the curvature of the earth? How far is it possible for the naked eye to see on land within a radius of 200 miles of Pittsburgh, at an elevation of 1,000 feet. A. In general it may be stated that a white object illuminated by the light of the sun can be seen at a distance of 17,250 times its own diameter. A red object, under the same circumstances, would be seen only half as far, and a blue object a still less distance. An object can be seen in ordinary daylight only about half as far as it could be if directly illuminated by the rays of the sun. These figures will of course vary somewhat with different eyes.

W. H. G. asks: 1. How does the duplex telegraph work? A. Consult some good work on the electric telegraph for particulars. 2. Must I wind the wire around the core of an electromagnet in one direction? A. The wire must be wound in one direction.

R. H. G. asks: 1. Is there any method of keeping powdered alum and bicarbonate of soda together, without destroying the properties of either? A You can mix dry powdered alum and dry bicarbonate of soda together without any fear of decomposition taking place. 2. How can alum be dried, as in its commercial condition it contains about 50 per cent water? A. By exposing ordinary alum to heat, as by throwing a piece upon a hot iron plate, it melts, loses its water of crystallization, and becomes reduced to what is termed burnt alum. At a white heat, alum decomposes.

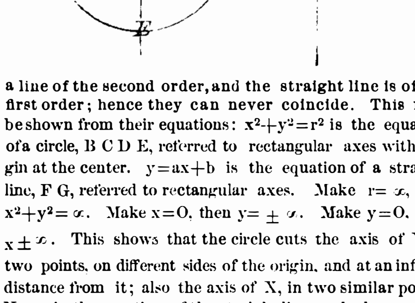
G. B. asks: Which is the most injurious to drink, Japan tea or Java coffee? What effect has te upon the nervous system when drank at night just before retiring? Does coffee of moderate strength produce thickness of the blood and cause dizziness and headache? A. Very strong coffee and tea are considered injurious when drank to excess, and the effect of either when taken by a person not accustomed to their use before retiring is to stimulate the nervous system and cause sleeplessness. They may cause dizziness and headache in some constitutions, but we have doubts about their thickening the blood.

G. W. C. says: I wish to make a sand paper with considerable grit. What can I use better than sand or emery? I want something that will last, to rub down a hard substance. A. Perhaps an emery wheel will answer your purpose.

O. M. C. asks: What is the process of making potato flour? A. The tubers, after being washed and peeled, are rasped by a revolving grater, and the pulp washed on a hair sieve to free it from feculous matter. When a sufficient quantity has passed through the sieves, the starch particles are allowed to subside, and the water is drawn out. Fresh water is let in, and the whole stirred up and again allowed to subside; this process is repeated till the starch is pure. It can be dried in perforated boxes, or placed on porous bricks to absorb the moisture, or dried by heat or the air.

J. S. H. asks: Where was the first locomotive built and run in the United States? A. Mr. Cady Staley mentions, as the first locomotive in the United States, one constructed by Oliver Evans, in Philadelphia in 1801.

W. L. C. says: The teacher of our geometry class asserts that "an infinite circle is coincident with an infinite straight line." He argues that, as long as a line is in the least curved, if produced, it will form a circle; and that the curve may be made less, and therefore the circle is not infinite, and from this conclusion argues that an infinite circle is a straight line. I hold that if it is possible to come to this, the circle ceases, and the line is neither an infinite or any other kind of a circle. 1. According to his definition, is an infinite circle possible? 2. If so, which is right? A. The circle is



a line of the second order, and the straight line is of the first order; hence they can never coincide. This may be shown from their equations: $x^2+y^2=r^2$ is the equation of a circle, B C D E, referred to rectangular axes with origin at the center. $y=ax+b$ is the equation of a straight line, F G, referred to rectangular axes. Make $r=\infty$, then $x^2+y^2=\infty$. Make $x=0$, then $y=\pm\infty$. Make $y=0$, then $x\pm\infty$. This shows that the circle cuts the axis of Y in two points, on different sides of the origin, and at an infinite distance from it; also the axis of X, in two similar points. Now, in the equation of the straight line, make $b=\infty$, then $y=ax+\infty$. Make $x=0$, then $y=\infty$. Make $y=0$, then $x=-\infty$. Hence the straight line cuts the axis Y in one point, and the axis of X in one point, at an infinite distance from the origin.

J. C. K. says: A press with movable type suitable for desk use, not larger than an ordinary seal press, would meet with a ready sale. A. Such presses are commonly sold in our large cities.

A. W. C. asks: 1. How can I tan bear skins with the hair on, so that the hair will not fall out? A. Pulverize and mix one part alum and two saltpeter; sprinkle on the flesh of the skins, and lay two flesh sides together; fold up tight and hang in a dry place. Rub over the edge of a board to make them supple. 2. How can I paste labels on tin or iron, so that they will not fall off? A. Add 1 tablespoonful of brown sugar to every quart of flour paste, and mix thoroughly.

D. R. S. asks: How can I ventilate show windows, so as to prevent sweating and freezing in cold weather? A. Make some small holes at the bottom and top, so that the exterior air will circulate through your show window.

M. W. J. asks: I. Is there any machine for breaking stone for railroad beds, macadamized roads, etc.? A. Yes. 2. Can I raise fish, such as bass, trout etc., in a large artificial pool, by running a small stream of spring water through it? A. Yes.

H. N. asks: 1. If any one invents an article which is partly made of rubber, has he to pay a royalty to a rubber company? A. There are several patents in force which protect the use of certain processes of treating rubber. 2. Can anything be done with old scraps of tin? A. The tin may be melted off the iron by heat, or dissolved in hydrochloric acid, making muriate of tin. 3. Is broken window glass valuable? A. Glass makers buy it to melt up.

L. M. C. asks: What is the weight of an ordinary passenger engine of 4 feet 8½ inches gage? A. From 25 to 40 tuns. How long a circuit will the Tom Thumb telegraph operate? A. 15 or more miles.

W. T. R. asks: Will the Tom Thumb battery answer for silver plating on a small scale? A. Yes

M. M. asks: If I hang a rope over a loose pulley and put my feet in a loop in one end and take the other in my hands to elevate myself, what proportion of my weight do I pull down with my hands? My friend says I have no advantage over a single rope. I say I gain nearly half. Which is right? A. We think that your friend is right.

E. M. C. asks: 1. Can you inform me of any process by which steel springs exposed to the action of sea water may be prevented from rusting, which will not impair the temper as galvanizing does? In response to a similar enquiry some time since you advised plating with nickel. But nickel plating does not protect iron or steel when exposed to sea water or sea air. Articles so plated seem to have even an increased tendency to rust, owing possibly to a slow galvanic action. A. Sea water is a compound that few metals (and those are rare and expensive) can successfully resist for a great length of time. Zinc and iron are rapidly corroded. This is probably owing to the affinity which chlorine possesses for the metallic elements. Gold and platinum, the most unalterable of metals, are rapidly dissolved in nitro-muriatic acid, where the attacking element is nascent chlorine. We would suggest some strong transparent varnish for the steel. 2. I have been told by a plater that the passage of a current of electricity or galvanism through tempered steel (as in electro-plating) destroys the temper. Is this correct, or an error? A. We are not aware of any reliable experiments on this point. 3. Can you give a reliable recipe for marine glue? A. In making marine glue, the india rubber and naphtha should be heated and agitated in a covered vessel until solution is complete, and then the powdered shellac added, and heat and stirring continued until liquefaction has taken place.

A. H. D. asks: 1. What is the process of japanning on iron to get a finish like that on sewing machines? Is the varnish baked on or not? A. Japanning consists merely in covering the surface of the metal with a black varnish. The principal ingredients of this varnish are amber and asphaltum dissolved in oil. Oil of turpentine is afterwards added to promote drying. Is bronze or gold leaf used most in ornamenting? A. We should say bronze leaf, from its cheapness. 3. Is there any book that gives explicit directions for the same? A. Ure's "Dictionary" will give you some information.

W. B. says: "If a galvanic battery consists of a number of cells, each cell containing a lead and a zinc plate, with a solution of sulphate of copper, will any electricity be generated if I join all the lead plates together and the zinc, or will I have to join a lead to a zinc and so on through all the cells before any electricity will be generated? A. By joining all the lead plates together, and all the copper, we obtain a quantity current, and by joining the lead of one cell to the copper of the next, and so on, an intensity current is produced.

E. V. asks: Is there any trustworthy means of making benzine or benzoline non-explosive? A. The dangerous nature of benzine and similar hydrocarbons is due to their volatility, and the fact that their vapors form with the oxygen of the air a mixture which explodes on the application of flame. We can only prevent this by enclosing these compounds in airtight vessels, or by combining them to such an extent with non-volatile substances of which they are natural solvents that their vapors have but feeble tension. We know of no chemical means to preserve the chemical constitution of pure benzine intact, and yet deprive it of one of its most characteristic properties.

J. L. A. asks: 1. How is adhesive court plaster made? A. Dissolve 1 part of isinglass in 10 parts of water; strain and add gradually 2 parts tincture of benzoin. Apply the mixture, gently warmed, to the surface of thin silk, black or white, by means of a camel's hair brush. Give as many coats as necessary, allowing each to become dry before applying the next, and lastly give the prepared surface one coat of the tincture of benzoin alone. The silk should be stretched on a frame. 2. How can I dissolve copper, nickel, brass, and other metals easily, so as to mold them? A. You can melt the metals named by exposing them to a strong heat, in crucibles made of a mixture of plumbago and clay. They can then be cast in molds.

J. B. H. asks: How can I remove black ink stains from a white plaster wall? A. Rub the spot with a cloth dipped in a weak solution of oxalic acid, until the stain is removed, and then with a damp cloth. Afterwards rub dry with a dry cloth.

D. M. asks: What metals expand on cooling? A. An alloy that expands on cooling may be made by melting together 2 parts antimony, 9 parts lead, 1 part bismuth.

C. D. M. asks: What gums or equivalents are insoluble in coal oil? A. The ordinary vegetable gums, properly so called, of which gum arabic is the type, are insoluble in alcohol, ether, and oils. Their action with coal oil might properly be made the subject of experiment.

V. R. C. asks; What quantities each of acetate of lime, sulphuric acid, and water are necessary to make acetone, such as is sometimes used for corroding lead? A. You have reference, we suppose, to the production primarily of acetic acid, from which acetone is formed. An ordinary acetic acid may be made without distillation by pouring 60 parts sulphuric acid, diluted with 5 parts water, on well dried acetic lime, 100 parts. Digest well in a close vessel, with a gentle heat, stirring occasionally: and afterwards pour off the clear liquid. Acetone is formed by passing the vapor of acetic acid through an iron tube heated to dull redness, and condensing.

J. O. T. asks: 1. How can I remove common india ink from mechanical drawings without injuring the paper? A. India ink must be removed by the edge of a sharp eraser or penknife, and the part carefully rubbed over with any hard smooth substance. Fine sand paper is also useful for this purpose. For small errors, it is perhaps best to paint them out with thick Chinese or flake white. 2. How can the drawings be cleaned, without injury to either paper or ink? A. A good quality of fine vulcanized rubber should clean your paper without leaving dirt. Try stale bread. 3. Can the four roots of the following equations be obtained? If so, how? $\left\{ \begin{matrix} x^2+y=7 \\ y^2+x=11 \end{matrix} \right\}$ A. These equations involve the higher mathematics, and we could not publish the solution in these columns. A glance will show that $x=2$ and $y=3$. 4. How can I best secure a place as assistant to some civil engineer? A. Under the circumstances, we can offer little practical advice. There is always a fair demand for skilled and experienced engineers, but in order to start in this, as well, indeed, as in any other profession, the influence and aid of friends is of incalculable advantage. You might make it a point to call upon the superintendents of railroads in your vicinity and prefer your request in person for a place, or perhaps endeavor gain room in the office of some well known engineer, where you could learn much of the profession, and besides form acquaintances which would lead to a more lucrative position.

F. M. D. asks: Is there any invention, patented or otherwise, for the purpose of aiding pedestrianism, such as a spring attached to the foot? A. Devices ao assist the feet in walking have been made.

L. E. G. asks: 1. What is the idea of amalgamating the zinc of a galvanic battery? Can I use common sheet zinc? A. The object of amalgamating the zinc is to prevent the action of the acid upon it except when the electric current is passing. You can use common sheet zinc, but it will soon wear out. 2. How can I make porous cups? A. The porous cups are made of unglazed earthenware. A potter will probably bake them for you, of any shape desired. 3. Does the acid of the porous cup flow into the fluid of the zinc, or does it evaporate? A. In Grove's battery the nitric acid in the porous cup is gradually decomposed. It merely comes in contact through the porous cup with the fluid in the zinc cell, and this is necessary to allow the passage of the electric current. 4. How is Smee's voltaic battery constructed? A. Smee's battery consists of a strip of silver or platinum suspended between two plates of zinc, and the whole immersed in dilute sulphuric acid.

G. B. G. asks: What is the composition and mode of preparation of the enamel, black and white, used on clock and watch faces, and are the letters and figures printed on or put in with a pen by hand? A. Black enamel: Peroxide of manganese 3 parts, zaffre 1 part. Mix, and add as required to white enamel, which is: Washed diaphoretic antimony 1 part, fine glass, free from lead, 3 parts. Mix, melt, pour into water, powder, melt again; and repeat this three or four times. Figures are put on white enamel as on china, while in the "biscuit" state, before vitrification.

A. & B. ask: If there were a hole through the earth, and a ball were dropped in the hole, would the ball ever stop, or would it pass through and through as a pendulum swings? B. says that the ball would stop as a pendulum does when it has no power to move it, that is, shorten its stroke every time it swings until it stops. A. We think B. is right.

F. L. K. asks: How can I find the weight of a solid ball 15 inches in diameter? A. Multiply the cube of the diameter of the ball in inches by 0·5236, and by the weight of a cubic inch of the material of which the ball is composed.

F. P. H. asks: Why does a star, seen with the naked eye, look irregular? When viewed through a telescope, it appears round. A. The twinkling of stars is due both to the varying density of the atmosphere and to the defects in the eye. Stars do not appear round through the telescope except when the latter is out of focus, and then the cause is obvious.

J. C. asks: How can I exterminate red roaches? A. Take flowers of sulphur ½ lb., potash 4 ozs. Melt in an earthen pan over the fire; pulverize and make a strong solution in water, and sprinkle the places which they frequent.

J. A. asks: How can I bronze small iron castings? A. Take 1 pint methylated finish, 4 ozs. gum shellac, ½ oz. gum benzoin; put in a bottle in a warm place, and shake occasionally. When the gum is dissolved, let it stand in a cool place two or three days to settle; then pour off the clear into another bottle, cork it well, and keep it for the finest work. The sediment left in the first bottle is to be thinned with spirit to make it workable for first coats or coarse work. It must be strained through a cloth. Then take ½ lb. finely ground bronze green, varying the shade as required by adding lampblack or red or yellow ocher. Let the iron be clean and smooth: take as much varnish and bronze powder as required, and lay on, with a brush, in a thin coat, having slightly warmed the articles to be bronzed. When dry, add another coat if necessary, and touch up where required with a little of the bronze on a pencil. Just before it is dry, gold powder may be put on. Varnish over all finally.

J. A. asks: How can I separate albumen from blood? A. By receiving the blood in moderately deep vessels and allowing it to coagulate, much of the serum or albumen will separate and rise to the top, whence it may be skimmed off.

R. M. W. asks: What does "Patented, S. G. D. G." mean? The paper on which I saw it came from Europe, and I think the article patented is a French or Belgian invention. A. The French authorities require these letters to be marked on patented articles. They stand for "*Sans Garantie du Gouvernement*," "without guarantee of the government." 2. Is there any patent on the rubber hand stamp? A. You can readily find this out by examining one. Patented articles are required by law to be marked "patented," with date of patent. We believe it is patented. 3. Is there any successful stump extractor? A. We have illustrated several stump extractors. 4. What is the best compound for printer's rollers? A. You can make composition rollers by dissolving with heat, in two pounds of treacle, one pound of good glue, previously soaked a night in water. For greater hardness, use more glue. 5. Is it possible to analyze a mixture of chemicals in order to tell what the ingredients are? A. Yes.

C. W. says: I had occasion to mend a topaz ring, and I did it in the usual manner, using a round stick of charcoal and imbedding the stone in plaster of Paris. The stone was a dark one and was changed through the operation to a very light one. What was the cause of its changing, and how can I restore it? A. We suspect that heat has had something to do with the change of color. The yellow Brazilian topaz, strongly heated, becomes rose red, and the Saxon topaz, when gently heated, white. We are afraid nothing can be done to restore the color.

H. G. B. asks: 1. Will platinized silver do for the negative metal of a Grove battery? If so, what is the best way to platinize it? Will it do to platinize copper instead of silver? A. Either platinized silver, lead, or copper will answer in Grove's battery, but it must be well plated. The platinum solution used is the double chloride of platinum and potassium, dissolved in a solution of caustic potash.

G. H. J. asks: 1. What are the so-called glass cards made of, and how are they colored? A. You probably mean cards glazed with soluble glass. This can be applied in the liquid state like a varnish. When dry, it forms a hard, glassy, transparent surface. Various pigments can be used for coloring. See our advertising columns.

J. D. says: I produce an orange color with bichromate of potash, alum, litharge, acid, and soda. What must I add to deepen it? A. This is a matter to be determined by experiment. Consult some practical chemist, who may have facilities at hand to make the necessary experiments.

W. V. D. asks: How much worm surface is required to condense a gallon of proof spirit in an hour? I am told that, to condense 200 gallons of proof spirit in 12 hours, about 180 feet of 2½ or 3 inch copper pipe would be required. A. This is a question which we can hardly dismiss satisfactorily in a few lines in this column. You should read the article on evaporation in Ure's "Dictionary."

M. T. asks: Why does coffee, either ground or in the berry, even if closely kept in a tin can, lose its aroma, and become disagreeable and bitter? A. The aromatic principles of coffee, on which its flavor depends, are volatile, and consequently, unless the roasted coffee is rigidly excluded from the air (which is almost impossible in ordinary vessels), the flavor is soon lost, and the bitter principles, among which is tannin, are left behind. The best coffee is made from the freshly roasted and ground berry, by infusing it in boiling water for a few minutes. The coffee should not be boiled in the water.

W. C. asks: What is tungstate of soda, recommended for making clothing uninflammable? Would it make wooden tobacco pipes uninflammable? A. Tungstate of soda is a compound of tungstic acid and soda. Tungstic acid can be readily made from the native tungstate of lime. The compound in solution, to which a little phosphate of soda has been added, has long been used in England for the purpose of rendering fine fabrics uninflammable. It does not prevent charring from the action of fire, however; its only use being to prevent substances burning with flame. It would be difficult to permeate hard wood with the solution.

S. B. R. asks: On what stuffs can the aniline dyes be used? How can I dye cotton goods with aniline black? A. All fabrics of silk, wool, and cotton can be dyed with aniline preparations. To get an intense black, it is necessary to mordant in chloride of manganese, working the cotton in it for about an hour; wring out well and, without rinsing, pass into boiling soda lye, holding lime in suspension. After the fixation of the manganese salt, wash the cotton in water and pass into a lukewarm chloride of lime bath, taking care that the chloride be not used in excess.

H. A. C. asks: What is the best manner of sticking tinfoil to glass for Leyden jars, disks, etc.? A. We think gum tragacanth will answer very well.

P. says: I wish to be an engineer. Which would be the best city for me to go to, to get instruction? Is mechanical drawing taught free at the Cooper Institute in New York? Is there anything of the kind in Boston, Philadelphia, or any other large city? A. You can obtain all necessary instruction, including drawing, at the Cooper Institute. We scarcely think you will find as good a free school in any other city in this country.

E. B. W. says: On page 43 of your current volume, W. S. B. asks if a block can be squared on all sides. It is quite common for mechanics to affirm, in the most positive manner, that this cannot be done. There are a few points connected with this question, which, not being generally understood, cause them to come to this erroneous conclusion. If a good workman will take a try square, such as is commonly found in machine shops, and commence on a block of metal say two inches square, and work as close as possible, he will find that when he has reached the fourth side, it and the blade of his square will not coincide. There is a cause for this, and it lays mainly in the angle of the square being a small fraction less or more than 90°. When he has reached the fourth side, this error in the square has been multiplied by four, and becomes plainly visible. The whole experiment, then, becomes simply a delicate test of the square. If he will take a piece of sheet steel and form a try square out of it, and with this commence and square the block, noting, when he has reached the fourth side, which way his square is out, and carefully correct it with a fine file or scraper, he will, after several patient efforts, have it so nearly perfect that no error will appear at the fourth side of the block. In a word, he will have made a perfect try square, and with it he can square other blocks, coming out at the fourth side correctly the first time. The secret of the "impossibility" in this problem rests in the inexactness of tools and workmanship; for certainly if the four corners of the block are just 90° each, the opposite sides will be parallel.

J. S. says, in reply to L. and H., who have difficulty in burning sawdust: "I have a boiler of similar dimensions and I burn my sawdust successfully. I use a fan (costing only about 12 or 15 dollars) of 24 inches diameter, with 6 inch wings, driven at 1,000 revolutions per minute. I also employ a trunk made of inch boards to conduct the blast into the ash pit. I use a grate bar which is lighter than the common bar, with the spaces (½ inch) running crosswise and of zigzag shape. I use also a little wood or slack coal to keep the fire going."

A. J. K. says, in answer to J. W. B.'s query as to calculating machines: There are machines which add, divide, subtract, and multiply six figures into six figures. "I used one in San Francisco. There are two in use in that city now. They are manufactured in Paris."

J. C. says, in reply to J. F., who inquired about a certain clock with a glass dial on which the hands turn without any apparent motive power: "I believe the timepiece is nothing but Robert Houdin's clock, which works as follows: At one end of each hand there is a large disk; these seem to be only counterpoises, but, in reality, they contain concealed watch movements, which, working on the center by means of appropriate levers, cause each hand to move on the dial and mark the correct time in a mysterious manner. If J. F. looks closely on these disks, he will probably see, on some part of their surfaces, squares, used to wind them up with a key, like an ordinary watch."

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

C. L. McC. & Co.—Your specimen is galena in quartz.

H. M. H.—Your specimens contain copper and iron. 2 and 4 contain carbonate of copper and copper pyrites. No 1 is white pyrites. No. 3 resembles quartz and white pyrites.

E. G. A.—Your specimen did not reach us. Send us a small sample.

T. M. B.—This is a specimen of earthy chlorite, consisting chiefly of silica, magnesia, alumina, and oxide of iron. The term chlorite is derived from a Greek word meaning green, on account of the greenish appearance of the mineral. It is of no economical importance, although the compact variety was employed by the Indians for pipes.

J. W.—Your specimens are ochers, that is, clays charged with oxide of iron, to which their color is due. The red especially seems to be a valuable mineral paint. You should correspond with some one who is interested in the use or sale of such articles.

S. B. B.—Your mineral is decomposed hornblende.

J. W. Jr.—The enclosed is blue clay, a silicate of alumina. When clay burns white, it is used in the manufacture of white earthenware.

R. M. L.—Your mineral is specular oxide of iron.

S. C.—Clay containing much free silica and brown oxide of iron.

B. F. M.—Dark colored clay, a silicate of alumina.

J. E. S.—Your mineral is white quartz, sometimes, though improperly, called diamond. The purest variety, which is crystaline and transparent, is used by jewelers, and is also made sometimes into spectacle lenses, called pebble lenses. Quartz is silica, while the diamond is pure carbon. Quartz will scratch and sometimes cut glass, but not with the facility of the diamond.

M. R. L.—The minerals sent are oxide of iron, chiefly micaceous oxide, so called from its occurring in small bright spangles like mica. From its glimmering, splendent appearance you have probably mistaken it for silver. The other ores are galena, a valuable ore of lead This sometimes contains a paying quantity of silver but this can only be estimated by an analysis.

J. E. G.—1, epidote; 2, quartzite; 3, copper pyrites; serpentine; 5, chlorite schist: 6, carbonate of lime.

G. S. R. asks: How can I reduce leather, buffalo hides, for instance, to a pulp, which will set into a hard and durable mass?—A. M. asks: How can I find the weight of a person's head without cutting it off?—J. V. B. asks: Is there any substance with which I can coat cardboard, to make a white slate, to be written on with a lead pencil?—G. W. F. asks: 1. Can you give me a rule for setting out circular saw teeth? 2. How can I temper a burr for gumming out saw teeth?—C. P. asks: In taking impressions of the human head in plaster, I have trouble in making the hair and whiskers stand out naturally. What can I do to remedy this?

COMMUNICATIONS RECEIVED.

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

On the Morse System of Telegraph Signals By W. L.

On Utilizing Coal Dust. By J. H.

On the Preservation of Timber. By J.H.M

On the Principles of Ventilation. By C. A. W.

On Asphalt. By C. F. D.

On the Relative Attraction of the Earth and Sun. By W. M. D.

On a Substitute for Mica in Stoves. By A. A. H.

On Mr. R. A. Proctor and the Million Dollar Telescope. By S. H. M. Jr.

On Preventing Incrustation in Boilers. By E.

On Ocean Towers. By W. K.

Also enquiries from the following:

S. H. W.—H. C. A.—H. S. W.—H. B.—W. W. A.—L. A. C. —G. S.—W. W. S.

Correspondents in different parts of the country ask: Who makes a centrifugal clothes wringer? Who make smoke-consuming devices for boiler furnaces? Who makes corn-shucking machines? Who makes woodworking machinery bits? Who makes an instrument, other than the ear trumpet, for helping the partially deaf to hear? Makers of the above articles will probably promote their interests by advertising, in reply, in the SCIENTIFIC AMERICAN.

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

January 13, 1874,

AND EACH BEARING THAT DATE.

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APPLICATIONS FOR EXTENSIONS.

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:

27,898.—REFLECTOR.—I. P. Frink. April 1.
27,901.—HARVESTING MACHINE.—M. Hallenbeck. April 1.
27,923.—FENCE MAKING MACHINE.—J. Moore *et al.* Ap. 1.
28,338.—GRAIN BINDING MACHINE.—D. W. Ayres. May 6.

EXTENSIONS GRANTED.

26,860.—TINWARE MAKING MACHINE.—S. J. Olmsted.
258 (whole No. 31,262).—FARE BOX.—J. B. Slawson.

DISCLAIMER.

26,860.—TINWARE MAKING MACHINE.—S. J. Olmsted.

DESIGNS PATENTED.

7,104.—WATCH CASES.—L. Bushnell, New Bedford, Mass.
7,105.—BOTTLES.—A. Michael, New York city.
7,106.—BATH TUBS.—J. L. Mott, Mott Haven, N. Y.
7,107.—PICTURE FRAME.—E. Renaud *et al.*, New York city.
7,108.—CARPET.—T. J. Stearns, Boston, Mass.
7,109.—PACKING BOX.—S. F. Whitman, Philadelphia, Pa.
7,110.—TABLE CASTER HANDLES.—H. C. Wilcox, West Meriden, Conn.
7,111.—CAKE OR FRUIT BASKETS.—H. C. Wilcox, West Meriden, Conn.

TRADE MARKS REGISTERED.

1,595.—PHARMACEUTICAL PREPARATION.—J. Carnrick, New York city.
1,596.—SHIRTS.—W. H. Cole, New York city.
1,597.—TOBACCO, ETC.—F. Miranda, New York city.

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 (3½ years)	$10
On application for Design (7 years)	$15
On application for Design (14 years)	$30

[Specially reported for the Scientific American.]

CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA, JANUARY 23, 1873.

3,054.—H. M. Baker, W. F. Stone and J. H. Vermilya, Washington, D. C., U. S., assignees of G. W. Hunter, same place. Improvements on sewing machines, called "Hunter's Sewing Machines." Jan. 23, 1874.

3,055.—J. Pratt and A. Roy, Montreal, P. Q., assignees of J. Goullioud, same place. *Nouvelles et utiles ameliorations aux machines a tisser les corsets, les guetres, etc.*, called "*Temple Entraineur Ameliore.*" New and useful improvements in machine for weaving corsets, gaiters, etc. Jan. 23, 1874.

3,056.—H. Martin, Chicago, Ill., U. S., M. H. King, Springfield, Hampden county, Mass., U. S. Improvements on brick machines, called "Martin's Brick Machine." Jan. 23, 1874.

3,057.—E. N. Randall, West Troy, Vt., U. S., and G. E. Braley, same place. Improvements on milk vats, called "Randall's Improved Milk Vat." Jan. 23, 1874.

HOW TO OBTAIN Patents and Caveats *IN CANADA.*

PATENTS are now granted to inventors in Canada, without distinction as to the nationality of the applicant. The proceedings to obtain patents in Canada are nearly the same as in the United States. The applicant is required to furnish a model, with specification and drawings in duplicate. It is also necessary for him to sign and make affidavit to the originality of the invention.

The total expense, in ordinary cases, to apply for a Canadian patent, is $75, U. S. currency. This includes the government fees for the first five years, and also our (Munn & Co.'s) charges for preparing drawings, specifications and papers, and attending to the entire business. The holder of the patent is entitled to two extensions of the patent, each for five years, making fifteen years in all.

If the inventor assigns the patent, the assignee enjoys all the rights of the inventor.

A small working model must be furnished, made to any convenient scale. The dimensions of the model should not exceed twelve inches.

If the invention consists of a composition of matter, samples of the composition, and also of the several ingredients, must be furnished.

Persons who desire to apply for patents in Canada are requested to send to us (MUNN & Co.), by express, a model with a description in their own language, showing the merits and operation of the invention, remitting also the fees as above for such term for the patent as they may elect. We will then immediately prepare the drawings and specification, and send the latter to the applicant for his examination, signature, and affidavit. It requires from four to twelve weeks' time, after completion of the papers, to obtain the decision of the Canadian Patent Office. Remit the fees by check, draft, or Postal order. Do not send the money in the box with model. Give us your name in full, middle name included

Inventions that have already been patented in the United States for not more than one year may also be patented in Canada.

On filing an application for a Canadian patent, the Commissioner causes an examination as to the novelty and utility of the invention. If found lacking in either of these particulars, the application will be rejected, in which case no portion of the fees paid will be returned to the applicant.

Inventors may temporarily secure their improvements in Canada by filing *caveats*; expense thereof, $35 in full.

For further information about Canadian patents, assignments, etc., address

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

VALUE OF PATENTS, And How to Obtain Them.

Practical Hints to Inventors.

PROBABLY no investment of a small sum of money brings a greater return than the expense incurred in obtaining a patent, even when the invention is but a small one. Large inventions are found to pay correspondingly well. The names of Blanchard, Morse, Bigelow, Colt, Ericsson, Howe, McCormick Hoe, and others, who have amassed immense fortunes from their inventions, are well known. And there are thousands of others who have realized large sums from their patents.

More than FIFTY THOUSAND inventors have availed themselves of the services of MUNN & Co. during the TWENTY-SIX years they have acted as solicitors and Publishers of the SCIENTIFIC AMERICAN. They stand at the head in this class of business; and their large corps of assistants, mostly selected from the ranks of the Patent Office: men capable of rendering the best service to the inventor, from the experience practically obtained while examiners in the Patent Office: enables MUNN & Co. to do everything appertaining to patents BETTER and CHEAPER than any other reliable agency.

HOW TO OBTAIN PATENTS

This is the closing inquiry in nearly every letter, describing some invention which comes to this office. A *positive* answer can only be had by presenting a complete application for a patent to the Commissioner of Patents. An application consists of a Model, Drawings, Petition, Oath, and Full Specification. Various official rules and formalities must also be observed. The efforts of the inventor to do all this business himself are generally without success. After great perplexity and delay, he is usually glad to seek the aid of persons experienced in patent business, and have all the work done over again. The best plan is to solicit proper advice at the beginning. If the parties consulted are honorable men, the inventor may safely confide his ideas to them; they will advise whether the improvement is probably patentable, and will give him all the directions needful to protect his rights.

To Make an Application for a Patent.

The applicant for a patent should furnish a model of his invention if susceptible of one, although sometimes it may be dispensed with; or, if the invention be a chemical production, he must furnish samples of the ingredients of which his composition consists. These should be securely packed, the inventor's name marked on them and sent by express, prepaid. Small models, from a distance, can often be sent cheaper by mail. The safest way to remit money is by a draft or postal order, on New York, payable to the order of MUNN & Co. Persons who live in remote parts of the country can usually purchase drafts from their merchants on their New York correspondents.

How Can I Best Secure My Invention?

This is an inquiry which one inventor naturally asks another, who has had some experience in obtaining patents. His answer generally is as follows, and correct:

Construct a neat model, not over a foot in any dimension—smaller if possible—and send by express, prepaid, addressed to MUNN & Co., 37 Park Row, together with a description of its operation and merits. On receipt thereof, they will examine the invention carefully, and advise you as to its patentability, free of charge. Or, if you have not time, or the means at hand, to construct a model, make as good a pen and ink sketch of the improvement as possible and send by mail. An answer as to the prospect of a patent will be received, usually, by return of mail. It is sometimes best to have a search made at the Patent Office; such a measure often saves the cost of an application for a patent.

Preliminary Examination.

In order to have such search, make out a written description of the invention, in your own words, and a pencil, or pen and ink, sketch. Send these, with the fee of $5, by mail, addressed to MUNN & Co., 37 Park Row, and in due time you will receive an acknowledgment thereof, followed by a written report in regard to the patentability of your improvement. This special search is made with great care, among the models and patents at Washington, to ascertain whether the improvement presented is patentable.

Foreign Patents.

The population of Great Britain is 31,000,000; of France, 37,000,000; Belgium, 5,000,000; Austria, 36,000,000; Prussia, 40,000,000, and Russia, 70,000,000. Patents may be secured by American citizens in all of these countries. Now is the time, when business is dull at home, to take advantage of these immense foreign fields. Mechanical improvements of all kinds are always in demand in Europe. There will never be a better time than the present to take patents abroad. We have reliable business connections with the principal capitals of Europe. A large share of all the patents secured in foreign countries by Americans are obtained through our Agency. Address MUNN & Co., 37 Park Row, New York. Circulars with full information on foreign patents, furnished free.

Caveats.

Persons desiring to file a caveat can have the papers prepared in the shortest time, by sending a sketch and description of the invention. The Government fee for a caveat is $10. A pamphlet of advice regarding applications for patents and caveats is furnished gratis, on application by mail. Address MUNN & Co. 37 Park Row, New York.

Value of Extended Patents.

Did patentees realize the fact that their inventions are likely to be more productive of profit during the seven years of extension than the first full term for which their patents were granted, we think more would avail themselves of the extension privilege. Patents granted prior to 1861 may be extended for seven years, for the benefit of the inventor, or of his heirs in case of the decease of former, by due application to the Patent Office, ninety days before the termination of the patent. The extended time inures to the benefit of the inventor, the assignees under the first term having no rights under the extension except by special agreement. The Government fee for an extension is $100, and it is necessary that good professional service be obtained to conduct the business before the Patent Office. Full information as to extensions may be had by addressing MUNN & Co. 37 Park Row, New York.

Trademarks.

Any person or firm domiciled in the United States, or any firm or corporation residing in any foreign country where similar privileges are extended to citizens of the United States, may register their designs and obtain protection. This is very important to manufacturers in this country, and equally so to foreigners. For full particulars address MUNN & Co., 37 Park Row, New York.

Design Patents.

Foreign designers and manufacturers, who send goods to this country, may secure patents here upon their new patterns, and thus prevent others from fabricating or selling the same goods in this market.

A patent for a design may be granted to any person whether citizen or alien, for any new and original design for a manufacture, bust, statue, alto relievo, or bas relief, any new and original design for the printing of woolen, silk, cotton, or other fabrics, any new and original impression, ornament, pattern, print, or picture, to be printed, painted, cast, or otherwise placed on or worked into any article of manufacture.

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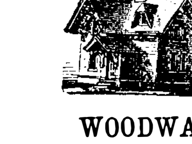

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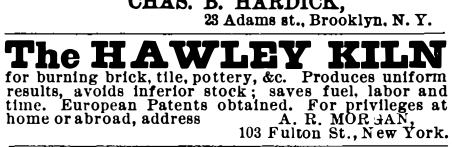

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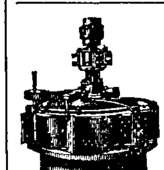

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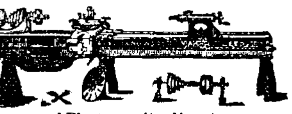

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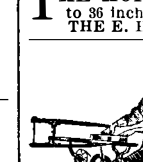

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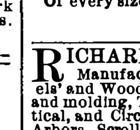

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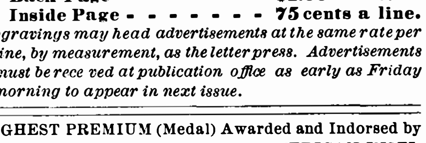

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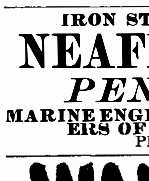

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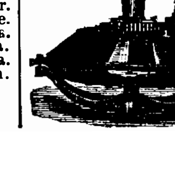

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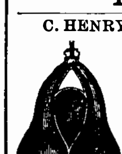

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