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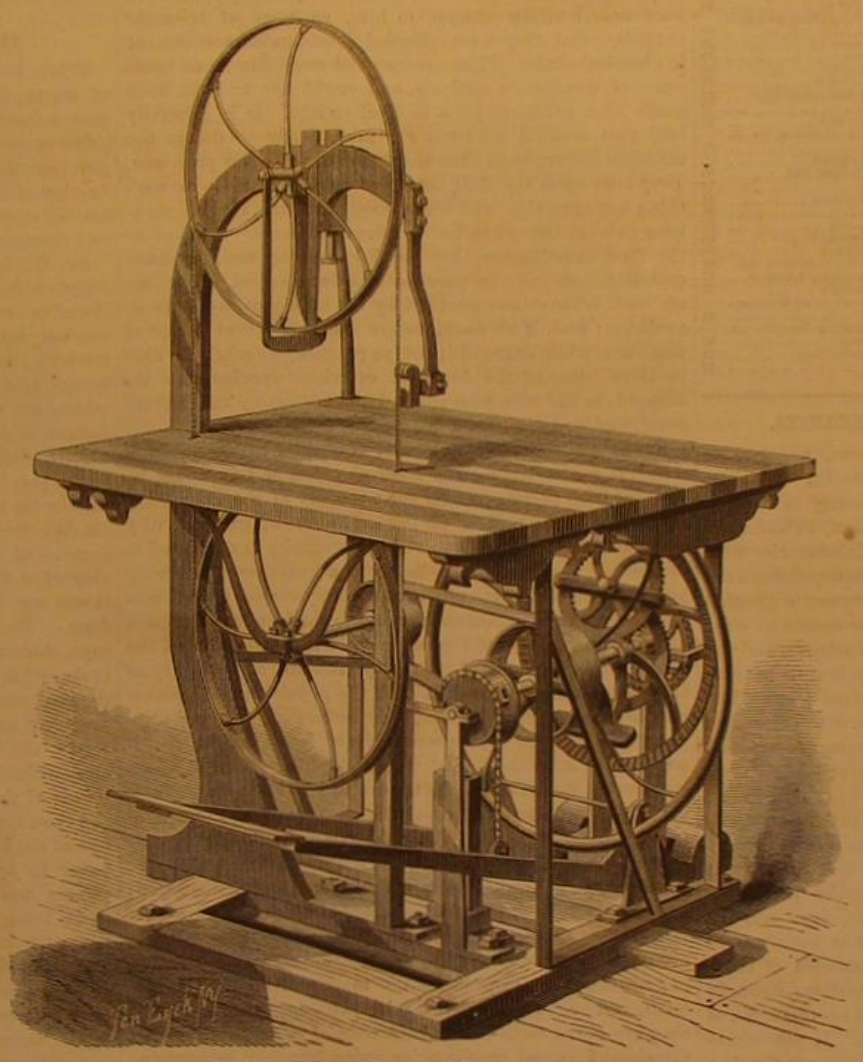
FOOT POWER BAND SAW.

Our engraving represents another application of the "Vertical Multiplier"—a device which has already been fully explained and described in these columns—to the band saw. As we presume that the general details of the invention are sufficiently familiar to our readers, we consider no minute explanation of principle or working parts here necessary. Actual experience has fully demonstrated and we have convinced ourselves of the fact from a careful inspection that—leaving out all mooted questions of a theoretical nature—by this ingenious combination the motive power is economized to an unexampled degree, through the all but annihilation of frictional loss. That which makes this application of more importance than any other on the same principle made by the inventor is the fact that, so far as we are informed, it is the first successful attempt to operate band saws by man power: and it is perhaps safe to consider that any effort to accomplish the same results, through the old principle of gearing, would prove unavailing.

In the machine depicted, forty steps of the treadle correspond to thirteen hundred and sixty revolutions of the saw pulley. The motion is perfectly continuous and, so far as we can judge, the saw works with a rapidity and effectiveness little short of that which it would attain if driven by steam. In trials in our presence, the blade divided three inch stuff, and even live oak timber, with great readiness, while sharp curves and scrolls were cut with no apparent difficulty. There is little doubt but that, to wood workers having no steam power conveniences, this application of the invention is destined to form an important acquisition.

We would refer those desiring to examine more closely into the principle, which, it is clear, may be indefinitely extended, to the illustrated descriptions in Volumes XXII. and XXVI. of this journal. Detailed information may be obtained by addressing the Combined Power Company, 23 Dey street, New York city.



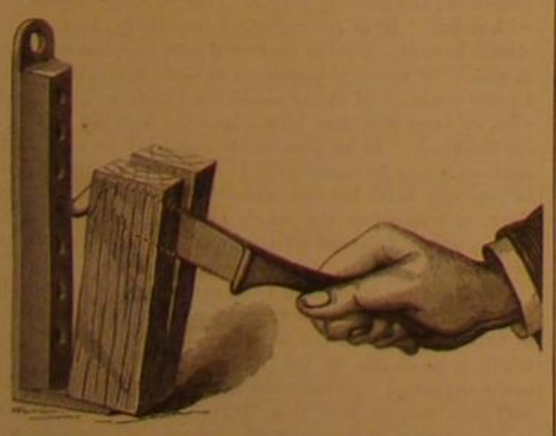
FOOT POWER BAND SAW.

Improved Cask.

A Mr. Trimner has recently invented a cask, which consists in making one or both ends partly or entirely of glass, so that the observer may see whether it is full when delivered, when it has become sufficiently empty to replace it with a fresh one, at what rate its contents are being reduced, and also, when empty, whether the cask has been properly cleaned. The inventor, in some cases, uses a cask head made entirely of glass, and in others a strip of glass let in vertically or diagonally, and properly secured from leakage.

KINDLING WOOD SPLITTER.

This ingenious little device will doubtless save many of self-inflicted cuts and bruises due to the awkward blows of



hatchets in inexperienced hands. It is a kindling wood splitter, and consists simply of a strong blade, at one end of which is a handle, and at the other a projection which fits into one of the holes of a perforated standard. It is only necessary to place the stick of wood under the knife, as shown in the engraving, and press down on the handle. Mr. Franz Wagner, of New York city, is the patentee.

A Novel Problem.

Four hundred and fifteen miles of track, on a road running north and south, were laid, between 1850 and 1861, says a correspondent of the *Railroad Gazette*, with the fish bar joint fastening, similar to that now in general use. The difference in the elevations of the north and south ends of the tracks does not exceed 150 feet—the southern end being the lowest—and the grades undulate; but at no point is a greater elevation attained than 200 feet above or 125 below the southern end. On about one half of the distance the track was laid with both rail joints on the same cross tie, and the balance with "broken joints." The rails were not "slotted," neither were any "stop chairs" used to prevent the track from "creeping." The track has been in use from 11 to 20 years and the creeping of both rails has been southward, and the western has crept much faster than the eastern. In places where the grade does not exceed 5 to 8 feet per mile, for 20 or 30 miles, the joints of the western are now opposite to the center of the eastern rails, while the latter have also moved southward. On the heaviest grades descending northward, there is little or no tendency to move down hill or northward.

Perhaps some one can explain why the western rails creep faster than the eastern.

Automatic Fire Alarms.

A correspondent, F. I. R. E., suggests a system of small tubes throughout a building, with small chambers full of some volatile liquid (such as alcohol, bisulphide of carbon, etc.) attached thereto at intervals. One end of each tube should be closed, and the other should terminate in a piston and cylinder arrangement, the motion of the piston being used to ring a bell. A similar result might be obtained by using an explosive compound in the chambers.

Another plan is to stretch electric wires of fusible metal through the premises, the melting of the wires serving to break the circuit and give an alarm.

THE number of blood globules is greater in mammifers than in birds, in the latter than in fishes. This number is almost always in an inverse ratio to the volume of the globules; the relation between number and volume is not proportional. Birds gain more by the augmentation of the volume of their blood globules than they lose by the diminution in their number.

The Public Document.

Congressman Cox, in a recent speech, said that a Philadelphia editor thus relieves his mind on a subject familiar to all newspaper offices, the inevitable Pub. Doc.: "We owe our thanks to Judge Kelley for the latest Patent Office reports. We already have sixteen hundred of these interesting volumes in our little library, but they have been read and re-read so many times that we know every page of them by heart. This new volume came opportunely and gratefully on Christmas morning, and that night we gathered our little family around the fire and read it through to them. The affecting tale entitled 'Improvement in Monkey Wrenches,' seemed to touch every heart, and when we came to the climax of the little story about 'Reversible Pieboards,' there was not a dry eye between the front door and the stable. During the reading of the piteous narrative entitled 'Gum Washers for Carriage Axles,' the whole family gave expression to boisterous emotion, and the hired girl was so much excited that she lost her presence of mind and went around to her mother's, inadvertently, with six pounds of sugar and a butter kettle full of flour, and came home at midnight intoxicated. We can never sufficiently thank Judge Kelley for the innocent enjoyment thus furnished us. The memory of that happy evening will linger in our minds very much longer than that hired girl ever lingers when she lights on a lot of substance which she thinks will suit the constitution of her aged parent."

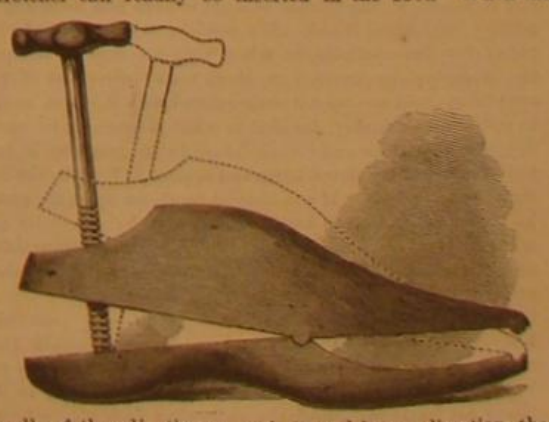
Acetate of Soda for Preserving Meat.

We published, in Vol. XXVII., page 149, an account of M. Sacc's researches upon the antiseptic properties of acetate of soda, and refer to it again for the purpose of recommending, to the manufacturers of vinegar in the South, the substitution of soda ash for lime in absorbing the products of the distillation of wood. The soda ash may cost considerable more than the lime, but the resulting acetate of soda can be employed to great advantage in the preservation of food, and it would be possible to send the cheap beef of the South, after preservation in the acetate, to a market where it would fetch a high price. Another advantage in the employment of soda is that the crude acetate can be easily refined, and from it the pure glacial acetic acid can be made by treatment with sulphuric acid.

SHOE STRETCHER.

This ingenious device is the invention of Mr. T. C. Maris, of Marietta, Ohio, and is so arranged that either the instep or the toe of the shoe may be enlarged at will. It is constructed in two portions which, together, conform to the shape of the shoe.

In operation, the two plates are adjusted by the set screw, so that both the fulcrums of the upper plate rest in corresponding recesses in the sole plate, in which position the stretcher can readily be inserted in the boot. When the



handle of the adjusting screw is turned in one direction, the heel end of the upper plate is depressed and rocks on the rear fulcrum, which causes the toe end of the plates to expand and stretch the toe end of the boot in a suitable manner. When, on the other hand, the handle is turned in the opposite direction, the heel end of the upper plate is raised, as shown by the dotted lines in the engraving, and the toe end rests upon its fulcrum, so that the instep of the shoe can be stretched to any degree required.

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THE DOCTORS AND THE APOTHECARIES.

Apothecaries were originally confectioners, engaged in making preserves, candied fruit and bonbons for the tables of the rich. By degrees, they took to dealing in healing herbs; and after the invention of distillation, sublimation and the chemical processes, they fitted up laboratories with furnaces and expensive apparatus; and in consequence of the cost attending such improvements the governments granted certain monopolies and privileges, and in the course of time the art of compounding medicines became a science, and the physicians gladly handed over their prescriptions to persons more familiar with drugs than they themselves were. The modern apothecary is, or ought to be, a man of as thorough education as the physician, but it too frequently happens that the ancient and original idea of the confectioner's shop is retained, and the druggist becomes a dealer in small wares, or, in other words, a shopkeeper. In Germany it is considered entirely *infra dig.* for a pharmacist, as a scientifically educated apothecary prefers to be called, to sell candy, hair brushes and articles of the toilet. The regular profession confine themselves to the preparation of medicines and the filling up of prescriptions, and their position in society is on a par with that of the doctors. We are reminded of these things just at the present time by the accusations, brought by some medical practitioners against certain apothecaries, of falsifying prescriptions for purposes of gain. It sometimes happens that the medicine called for by the prescription is a very dear one, and, if the usual profit were to be charged, the druggist would lose the customer and the patronage of the doctor at the same time. The statement is made that, to avoid this double calamity, only half the prescribed quantity of the rare chemical is taken, or some cheap drug is substituted for the dear one. This is a pretty serious charge to make against a whole profession, and we have not seen it anywhere stated that the doctors are so sweeping in their denunciations; but there have been so many instances of complaint of gross negligence, if not of intentional fraud, that it is the duty of the pharmaceutical profession to cause a searching investigation to be made into the truth or falsity of the charges. It is bad enough to have blunders committed, and it would be intolerable to supplement the difficulty by adding intentional fraud. We confess to a feeling of sympathy for the apothecaries when they attempt to decipher the hieroglyphics handed to them under the name of prescriptions; and we cannot comprehend why it is not as easy to write out the order, for that is what it amounts to, on the druggist in a clear and comprehensible language as it is to indicate it in abbreviated Latin and ornament it with cabalistic signs and symbols. If a merchant sends an order for goods, he writes it in a clear legible hand, and he generally gets what he wants. This is an ordinary business transaction, and if a mistake were to be made it could be rectified without endangering the life of anybody. It is really, therefore, of less consequence in such matters to be so very particular; but, in the matter of drugs and poisons, one would think that every precaution ought to be taken. We recently read in a medical work that arnica was a favorite remedy in Germany for amaurosis, and the following formula is recommended:

℞ Ext. Arnicæ,..... ℥ ij.
Strychniæ Sulph.,..... gr. xii.
Conf. Rosæ,..... q. s., ft. pil. cxl.

This is all very well when printed, but suppose it comes to the apothecary in a cramped and irregular hand, written with a pencil and half rubbed out. He may be able to read what particular medicines were prescribed, but the quantities of each might baffle all attempts at interpretation, and whether we take ten grains or twenty grains of strychnin is a matter of serious importance to the patient. In such an extremity we dare say that the druggist tries to err on the right side, and halves the supposed amount, and he is now accused of forgetting to make a corresponding deduction in the price. The physician's side of the story is that the apothecaries are sometimes not properly educated, and hence make mistakes in reading prescriptions. They say that pharmacists must be familiar with Latin and with all the abbreviations usual in the profession. On the other hand, some of the pharmacists say that the doctors have neglected their own Latin and are far behind the times in chemistry. They lay at the door of the physician that he attempts to compound the most impossible mixtures, in utter contempt of the laws of affinity and of double decomposition. When prescriptions of this character come into the hands of the experienced apothecary, he sometimes secretly changes them; or, if the chemical reactions do not form poisons, he follows strictly the letter of the law and throws the responsibility upon the doctor. We have been told by a professor of chemistry in New York that certain prescriptions have been confidentially shown to him, as items of scientific curiosity, and they have afforded considerable amusement in chemical circles. The errors cited were due to an ignorance of qualitative analysis, and ought not to have been made by a graduate of a medical college. It is generally said that medical students are more ready to desert the chemical lecture room than the course of any other professor. They look upon the dull details of acids and salts as anything but agreeable, and are always ready to take up physiology and anatomy as offering more attractions. Just before the final examination, they employ a tutor and, by hard cramming, contrive to pass the necessary ordeal. This, we are told, is the course pursued by the negligent students of medicine; and, if we could follow the subsequent career of this class, while engaged in active practice, we might be able to trace some of the blunders of which apothecaries are accused to the men who shirked the laboratory and lecture room, and crammed for a degree.

There are, therefore, evidently two sides to the question which is now agitating the medical press, and it would be well for both parties to seek for a remedy of the evils complained of. The medical profession is one of great dignity and importance. The health of a community is entrusted to physicians, and the responsibility is a grave one, requiring years of careful preparation and nicely tested experience. Hardly second in importance, owing to the immense progress made in chemistry and pharmacy, is the education of the apothecary. Colleges of pharmacy are quite as necessary as colleges of medicine, and, if both the physician and apothecary are thoroughly educated, the question of Latin prescriptions or technical terms would have less significance; it would soon solve itself, and we should hear no more about it. But all the education in the world would prove of little value without absolute honesty in prescribing and equal integrity in compounding. The physician should know what he is about, and, after making his diagnosis and prognosis, should write his prescription with due care and deliberation; and this being done, the apothecary must follow it to the last grain. Any tampering with prescriptions, as one would present a false invoice at the Custom House, for the purpose of greater pecuniary profit, is not to be tolerated for a moment, and ought to be visited with penalties far more severe than are ever attached to an infraction of revenue laws. Let the physicians and apothecaries unite together in securing such legislation as will protect both themselves and the community from the impending danger.

PHOTOGRAPH PORTRAITS---AN IMPROVEMENT.

At a recent meeting of the Photographic Society of the American Institute in this city, a discussion took place upon the merits of the new method of shortening the exposure of photographic plates in taking gallery portraits. Several of our leading photographers took part in the discussion, and specimen negatives were shown. Mr. H. J. Newton exhibited a negative upon which were two pictures, both of the same subject, showing no apparent difference, although one was taken with an exposure of seventeen seconds, the other with only seven seconds. In the example of another negative, one of the pictures had an exposure of thirty-six seconds, the other eighteen seconds, both equally good. The operation is as follows: The sensitive plate is first placed in the camera and exposed to red light, which is admitted through the tube, the mouth of which is covered by a red colored glass. This exposure to red light is continued for from ten to twenty seconds. The shield slide is then pushed in and the red glass removed, after which the portrait of the sitter is taken in the usual manner, except that the time of sitting is greatly reduced.

This is a very simple improvement. Any of our photographic readers may try it, and adopt it in their galleries. Mr. Anthony, Mr. Kurtz, and other photographers regarded the process as quite useful. Mr. Kurtz said the great object of the photographer, in portraiture, was to secure a natural expression of the features; in a long exposure, it was impossible for any sitter to maintain such expression. Then, in taking portraits of children, it is of the first importance to have a short exposure of the plates. The improved process gives these advantages, without much perceptible loss in the details. The theory on which this process depends appears to be this: when the photographic action is once started on the plate, it is easily maintained. It may be compared to the inertia of a wheel or a car. When the inertia is once overcome, it is easily kept in motion.

THE EYE AND THE SUN.

Mr. Oliver Byrns, of Canada, has forwarded to us a pamphlet in which he argues that, because the pupil of the eye becomes expanded during the darkness of night, the disk of the sun on its rising is apparently larger than when that luminary reaches the zenith. He also says that when the sun is in the horizon its rays have to pass through a thicker stratum of air than when it is overhead; that the atoms of air are competent to intercept a portion of the sunlight on its passage, and the greater the distance of the air to be passed through, the more light will be cut off. Hence the gross amount of light which reaches the observer's eyes will increase from sunrise till midday, and decrease from midday to sunset, and the pupils will contract and expand in proportion. He finally thinks the time may come when the orbit of the earth will be found a circle. Comment on such theories is useless. They indicate a mental atmosphere of ignorance of astronomy, optics, and physiology so dense that the strongest light of common sense would become utterly absorbed in endeavoring to permeate its obscurity. We suppose that if this philosopher took a dose of belladonna or inserted a little atropia in his visual organs, he would expect to see the sun cover nearly the entire firmament.

STEAM AS A FIRE EXTINGUISHER.

While we are discussing the dangers of steam as a cause of conflagration, it is curious to observe that the German scientific and industrial journals are discussing the value of steam as a fire extinguisher, and some of the local governments are preparing to take measures for the introduction of special steam boilers for the sole purpose of generating steam rapidly, so as to blow it into burning buildings and smother the flames by displacing the air by steam.

Dr. Wiedenbuch, of Wiesbaden, recently published in the *Polytechnic Journal* an article on this subject, and points out the advantage that steam, while it is not a supporter of combustion and extinguishes fire by driving the air away, is not irrespirable *per se*, and does not act injuriously on living beings, like carbonic acid, sulphurous acid, and other gases which are also non-supporters of combustion. The only danger of steam is that, when escaping under great pressure, as when superheated, it will scald any one who is close to the point of escape; while, at a distance, it cools so rapidly by its own expansion that it soon becomes harmless. Dr. Wiedenbuch's last opportunity of witnessing the effectiveness of steam as a fire extinguisher was on the occasion of a fire in a factory 180 feet long and 30 feet wide; it was one story high, with an attic separated by a wooden floor. The attic was filled with a great many tuns of rags, shavings, leather scraps, etc.; and among these, a fire broke out in the night, which was only discovered when half the roof was in flames. As the location of the establishment was quite out of the way, more than an hour elapsed before the fire engines arrived from the nearest station; meanwhile the conflagration met but little resistance, by reason of the very unsatisfactory preparations against fire, and soon the whole roof was in flames; it fell in, and the fate of the lower story appeared sealed. There was a steam boiler in an outhouse with the furnace banked; the fire therein was quickly increased by means of wood, the steam being still up. A courageous carpenter, contrary to the orders of the Fire Marshal, who had decided that the walls should be thrown down, went into the burning factory, and by means of a heavy axe broke the first cast iron steam pipe he could reach; of course the steam immediately escaped under considerable pressure, filled the whole place, and extinguished one burning mass after the other; and even the rag heaps in the attic, which, after the fall of the roof, were burning in the open air, became more and more surrounded with steam, so that in half an hour after the steam was admitted all danger was considered over, and the firemen, who had in the meantime arrived with their engines, considered their labor unnecessary, it having been so effectually replaced by steam.

The German papers point out that every manufacturer who uses a steam boiler possesses the most powerful fire extinguisher, which he may make available by proper additional arrangements. For instance, wrought iron gas pipes connected with the boiler, branching off into every room, may be provided with stop cocks which, in case of fire, may be turned on, and so every portion of the building may be filled with steam. It is recommended, especially, that theaters should have steam tubes connected with a system of heating in which, by means of petroleum or some equivalent as fuel, a great quantity of steam could be raised within ten minutes, or even less, and blown into the burning portion of the building. As no pressure is necessary for such an apparatus, it may be constructed in a simple manner, and still be perfectly safe; but the quantity of steam must be sufficient, and therefore the whole problem is to generate the largest possible amount of steam at low temperature and pressure.

Finally, it is proposed in Germany to make transportable steam boilers, and connect them in case of fire with a system of tubes, with which the buildings are to be provided, and which is accessible at the front of the house, so as to be easily connected with the steam generator in the street. We may here remark that this very same plan was patented in this country, in the spring of 1870, by Dr. Orazio Lugo, a distinguished chemist at that time residing in Baltimore. The plan was at that time very favorably received by insurance companies; and it is remarkable that it has not yet received a more extensive application.

We wonder what our German friends will say when they are informed that, according to a no less authority than the Fire Marshal of the metropolis of the New World, steam is

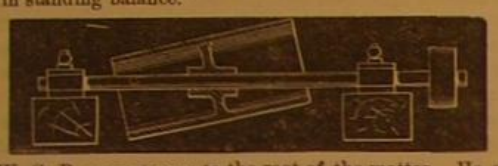
a dangerous element in regard to fires, and is even "a highly ignitable substance."

THE BALANCE WHEEL QUESTION.

We have received a large mass of correspondence on the subject of the inclined balance wheel question, which we set right in our issue of the 25th ult., and, as there promised, we glean out for our readers some of the more interesting letters. We are much pleased with the accuracy and clearness exhibited by many of our correspondents, some of whom are evidently accustomed to reason logically and to express themselves with precision, notwithstanding their unfamiliarity with the labor of writing for the press.

G. B. D. says that, in the case of the balance wheel set at an angle on the shaft: "It is just as much out of balance as two unbalanced pulleys would be when secured to the shaft at a short distance from each other, with their heavy sides one opposite the other. . . . A cheap method of trying an experiment of this kind is to construct a top, as shown in the figure, making it of metal. . . . If this top can be made to run steadily like an ordinary top, then W. must pay the forfeit," otherwise R. loses.

A Canadian friend and subscriber, J. P., after paying the SCIENTIFIC AMERICAN a pleasant compliment which we appreciate fully, shows, by a similar argument, that the wheel would be unsteady, and presents several sketches. We select one, a pulley, shown in the next figure. He says: "An experienced mechanic needs but a glance to see that a cylinder keyed on in that way will not run at a high rate of speed, but may yet be in standing balance."



W. G. B. goes at once to the root of the matter. He asks a question which reveals the misconception, which gave rise originally to error in the solution of this really very simple problem. He asks if Haswell is right in saying that "The centrifugal force of two bodies which perform their revolutions in the same time, the quantities of matter in which are inversely as their distance from the center, are equal to one another."

Haswell *is* right, and another correspondent, H. B., shows why, in the following concise statement: "The centrifugal force is not only proportional to the *ris vivæ*, but, at the same time, is inversely as the distance from the center."

"The transformed equation is $F = \frac{W.R.}{32.1.6}\left(\frac{2\pi 1416}{60}\right)^2 N^2$, in which R is the radius of the circle described by the revolving body, N the number of revolutions per minute. It shows clearly the centrifugal force to be in proportion to the momentum and as the square of the number of revolutions. As two bodies on the same shaft have the same number of revolutions, a running balance is established when the bodies are in standing balance and revolve in the same plane, as then the centrifugal forces are equal in opposite directions and in the same line, therefore balancing one another.

"A running balance is not obtained in case of a standing balance, if both weights are on different points of the shaft, because then the centrifugal forces, although equal and in opposite directions, cannot balance each other, since they are not in the same line.

"The forces tend to bend the shaft and therefore exert pressures on the bearings which have constant relation to the revolving shaft, but not to the bearings, and, in consequence, shake the bearings or the whole foundation."

TRACTION ENGINES OR ROAD LOCOMOTIVES.

Under the above heading, Professor R. H. Thurston, of the Stevens Institute of Technology, publishes in the *Journal of the Franklin Institute* a very able and comprehensive article, and incorporates therewith the following *resumé* of facts and deductions drawn from experiments recently conducted by him with the Aveling and Porter road locomotives.

1. A traction engine may be so constructed as to be capable of being easily and rapidly manœuvred on the common road and in the midst of ordinary obstructions.

2. Such an engine may be placed in the hands of the average mechanic, or even of an intelligent youth of 16, with confidence that he will quickly acquire, under instruction, the requisite knowledge and skill in its preservation and management.

3. An engine, weighing rather more than five tuns, may be turned continuously in a circle of 18 feet radius without difficulty and without slipping either driving wheel, even on rough ground, and may be turned in a roadway of a width but slightly greater than the length of the locomotive, by proper manœuvring.

4. A road locomotive weighing 5 tuns 4 cwt. has been constructed, which is capable of drawing, on a good road, more than 23,000 pounds up the almost unexampled grade of 533 feet to the mile, at the rate of four miles per hour.

5. Such a locomotive may be made, under similar conditions, to draw a load of more than 63,000 pounds up a hill rising 225 feet to the mile, at the rate of two miles per hour, doing the work of more than twenty horses.

6. The action of the traction engine upon the road is beneficial, even when exerting its maximum power, while with horses the injury to the road bed is very noticeable.

7. The coefficient of traction is, with such heavily laden wagons as were used in the course of the experiments and under the circumstances noted, not far from four per cent on a well made macadamized road.

8. The amount of fuel, of good quality, used may be reckoned at less than 500 pounds per day, where the engine is a considerable portion of the time heavily loaded and during the remaining time running light.

Professor Thurston's deductions may be briefly summarized as follows: The traction power of the engine is equal to that of twenty horses. This amounts to, excluding the weight of the locomotive, seventy-five tuns, while the machine possesses a decided advantage over the animal. The working time of the traction engine may be stated to be ordinarily twenty per cent greater than that of a dray horse, and to be capable of indefinite extension when required. The first cost of steam and of horse power is nearly equal, the difference being in favor of steam, leaving also on the side of the engine the immense advantage arising from its ability to work longer hours when required. The total annual expense of an engine of the above power and capabilities may be reckoned at $2,439 as a maximum figure, including cost of attendance. And, lastly, a steam traction engine, capable of doing the work of 25 horses, may be purchased and worked at as little expense as a team of six or eight horses.

THE SIGNAL SERVICE BUREAU.

The report of the Chief Signal Officer of the Army for the year 1872 contains an immense amount of valuable and practical information regarding meteorological science. Full details are added relative to the progress of the labors of the Government in the establishment of signal stations, the education of observers, and the publication of reports showing that this important service has materially advanced in usefulness and efficiency during the past year. Ten additional stations have been established within the United States, and the total number of points at which observations are now made is seventy-two. From the first station in the Aleutian islands to those upon the British coasts, the reports from both of which are noticed, there intervenes nearly half a circumference of the earth's surface. From the stations on the Aleutian islands comes the first intimation of storms or meteoric disturbances having their origin on the coast of Asia. The Pacific stations report the first appearance on that coast of the disturbances thus traced. The connection is continued by the Rocky Mountain stations, and thus the news travels in advance of the storm.

The organization of a mobilized corps of observers has been commenced. This will be composed of picked men, and its object is to place at the disposal of the government the power of suddenly increasing the number of stations from which reports are to be had in any section of the country which may, at any season of the year, be especially threatened by the storms which seem, at different seasons, to pass more frequently over particular portions of the territories of the United States. It will be possible to occupy, in this way, the stations as stations of report with very great rapidity.

In regard to the accuracy of warnings and predictions, General Myer states that the percentage of cautionary signals verified, by the occurrence of the winds described within a few hours after the display of the signal, is estimated to have been about 70 per cent. The signal, it is explained, is wholly cautionary, for warning of probable danger.

The experiment of a balloon ascent has been tried with fair results. One hundred and fifty-six readings were made, establishing the fact that very delicate instruments may thus be employed.

Arrangements for an interchange of reports have been made with Canada, and a similar course is contemplated with the West India islands. It is believed that many of the cyclonic storms, the indications of which are first felt by the stations of the United States, as then showing the disturbances upon the Gulf of Mexico or near the Atlantic coast, and which storms are afterward to be traced across the States intervening to the lakes or along the Atlantic sea coast, pass over points on these islands from which their presence can be announced. Since January 1, 1872, statements of the changes in the depths of water in the principal western rivers, being in direct relation to the meteoric changes, have been reported daily. It is hoped that a portion of the great problem of the protection of the river commerce from ice and freshets, and of the lower river levees from breakage and overflow, will be solved through the timely warnings that will be given.

The practical results of this branch of the service, with all its errors and imperfections, can be summed, it is believed, in the statement that, since the inauguration of its duties, no great and continuous storm has traversed the territory of the United States, or raged along the length of its lakes, its gulf or sea coast shores, without fair and general premonition, given at the great majority of the points endangered.

ARTIFICIAL FERTILIZATION.

The fructification of soils has its natural pabulum in the sewage of cities, towns and habitations. The devising of means for the utilization of this resource is therefore of paramount importance; but while the problem remains comparatively unsolved, the food required by growing crops must be supplied through the media of artificial fertilizers. These Nature distributes through the globe in the shape of mineral phosphates, consisting of the various kinds of rock guano coprolites, the fossils of marl beds and the minerals of apatite and phosphorite. Before these substances are supplied to the soil, they must not only be finely powdered but converted into forms which are promptly sensitive to the solvent action of aqueous solutions of carbonic and organic acids, very dilute acetic acid, ammoniacal and potassic salts and of the corresponding influences of the soil and plants as exerted during the progress of vegetation. In order to supply the want for methods simple and economical for changing, not merely the physical constitution of the mineral phosphates, but also their chemical temperament, in such a manner as to convert them into fertilizers at once concentrated and potential, Dr. Campbell Morfit has given to the world a work replete with information of the greatest practical value, entitled "Mineral Phosphates and Pure Fertilizers;" it is issued by Van Nostrand of this city, with an elaboration of paper and press work rarely found in volumes of similar description. Its high price, twenty dollars per copy, is its sole defect; but, written by so eminent an authority and appearing at a time when the subject of which it treats is occupying so large a proportion of popular attention, even that drawback will, we are convinced, not prevent the book attaining the wide circulation that it merits.

Dr. Morfit begins with the description of the raw materials, namely: Animal and mineral phosphates of lime, sulphuric acid, hydrochloric acid, crude ammonia liquor, sulphate of ammonia, chloride of ammonia, sulphate of potassa, chloride of potassium, carbonate of potassa, lime and nitrate of soda. In the United States the principal deposit of phosphate is in the neighborhood of the Ashley River, in South Carolina. The material is in the form of hard nodules called marlstones, and the beds are from 40 to 50 miles in extent. In Beaufort county, in the same State, a different variety of phosphate is found distributed over some 1,600 acres. This bed is calculated to yield 10,000,000 tuns.

A chapter is given to the chemical data of the substances employed, and the subject of machinery and the general plan of an establishment for their preparation is minutely explained. To leave nothing unfinished, the letter press is accompanied by twenty-eight plans, large in size and accurately drawn to scale, so that the manufacturer is furnished, not only with full instructions, but with complete drawings from which his machinery may be constructed. The process for refining the crude phosphates of lime, without waste of material and with the reclaiming of other chemical agents found with them, is fully treated upon. The topics of the manufacture of precipitated lime, Columbian lime, and diphosphate of lime, of pure and commercial superphosphate, of Horsford's, Liebig's and other phosphatic baking powders, of pure biphosphate and of the utilization of phosphate alumina precipitate from sewage as a raw material are also discussed at length. The concluding chapters are devoted to the mode of using hydrometers and thermometers, and to the manufacture of various waterproof cements and paints.

RECENT DISCOVERIES IN THE PYRAMIDS.

The Pyramids of Egypt were constructed 4,000 years ago. Mr. Dixon, of England, has for some time been exploring the two remarkable chambers known as the king's and queen's chambers, in the interior of the Great Pyramid. By means of a wire introduced between the joints of the masonry, he found a space, and was thereupon induced to bore into the walls of the queen's chamber, when he discovered a passage way, eight by nine inches in dimensions, evidently a ventilating flue. Its terminus has not yet been found. Within the passage way he found a bronze hook, which is supposed to be the most ancient specimen of bronze now existing. He also found a piece of worked cedar wood and a granite ball, which latter is believed to have been an Egyptian weight. Its diameter is 2¾ inches. As the walls behind which these articles were found were solid on the inner side of the chamber, it is believed that they were placed in the positions where they were found at the time the pyramid was erected.

SILVERING GLASS.

For a long time aldehyde has been employed in the glass silvering process suggested by Liebig; but some difficulties of manipulation have led practical men to prefer other reducing agents. R. Siemens has modified the operation and greatly simplified the reduction of the silver. Dry ammonia gas is passed through aldehyde to produce aldehyde ammonia; 2·5 grammes of aldehyde ammonia and 4 grammes nitrate of silver to 1 liter of water is the proper proportion to take. The nitrate of silver and aldehyde ammonia are separately dissolved in distilled water, mixed and filtered. The object to be silvered must be thoroughly worked to free it of fat, and if it be a globe or bottle, the liquid is poured in as high as it is desired to form the deposit. As soon as the heat, which must be applied, shows 50° C., the separation of the silver begins and soon spreads itself over the whole surface. At first, when the coating is very thin, it looks dark, but soon assumes a metallic luster; when it is a brilliant white, it is time to remove the fluid contents, as the mirror is apt to be injured by too long contact with the aldehyde. Flat objects are laid upon the mixture in the usual manner. In Germany, where aldehyde ammonia can be purchased at a reasonable cost, this process is highly prized. By making his own salt, in the manner described above, the chemist in this country can also avail himself of the method. The simplicity of Siemens' process certainly commends it to favor.

VOLATILITY OF IRON.—It seems that iron is volatile at very high temperatures, the same as gold and platinum. Dr. Elsner, Director of the Berlin porcelain factory, enclosed a small piece of wrought iron in an unglazed crucible and exposed it for several hours to a temperature of at least 3000° C. On removing the cover of the crucible, small needles of metallic iron were easily discerned, clearly showing that iron can be volatilized at high temperatures.

PROFESSOR TYNDALL'S SIXTH AND CONCLUDING LECTURE IN NEW YORK.

We have employed as our source of light the ends of two rods of coke rendered incandescent by electricity. Coke is particularly suitable for this purpose, because it can bear intense heat without fusion or vaporization. Still, refractory as carbon is, if we closely examined our voltaic arc or stream of light between the carbon points, we should find there incandescent carbon vapor. We might also detach the light of this vapor from the more dazzling light of the solid points, and obtain its spectrum; but instead of an unbroken succession of colors from red to violet, we should find but a few bands of color, with spaces of darkness between.

What is true of carbon is true of the metals, the most refractory of which can be fused, boiled and reduced to vapor by the electric current. Professor Tyndall then arranged two carbon points, the end of the lower one being hollowed out. In the cup thus formed, he placed a fragment of the metal thallium. On establishing the current, a flame of a vivid green color appeared upon the screen. On submitting this light to the action of a prism, the spectrum showed as a single green band. Therefore, the lecturer stated, light of one degree of refrangibility, and that corresponding to green, is emitted by the thallium vapor. A particle of silver was then substituted for the thallium. A bright green flame of precisely the same shade as that before obtained appeared, but the spectrum of the vapor exhibited two green bands. By adding to the silver in the camera a bit of thallium, the single band of the latter appeared in the spectrum between the two silver lines. But, continued the speaker, it should be noticed that the thallium band is much the brightest of the three. It is the resistance offered to the passage of the electric current from carbon to carbon that calls forth the power of the current to produce heat. Now thallium is a much more fusible and vaporizable metal than silver, and its vapor facilitates the passage of the current to such a degree as to render it almost incompetent to vaporize silver. As the thallium is gradually consumed, the silver lines increase in brightness until the three bands are of uniform brilliancy.

CHARACTERISTIC BANDS OF THE METALS.

We have in these bands a perfectly unalterable characteristic of these two metals. No other lines except the two green ones, are ever obtained from silver, or any other than the single green band from thallium. Every known metal has its bands, and in no known case are the bands of two different metals alike. Hence, these spectra may be made a test as to the presence or absence of any particular metal. If we pass off from the metals to their alloys, we find no confusion. The lecturer then showed the green bands of copper and the blue and red zinc lines; brass, an alloy of copper and zinc, gave the bands of both metals. But we are not confined to the metals; the salts of the metals yield also the bands. Chemical union is ruptured by a sufficiently high heat, and the vapor of the metal is set free. The chlorides of the metals are particularly suitable for experiments of this character. Common salt, a compound of chlorine and sodium, yields the spectrum of the latter element.

DISCOVERY OF NEW METALS.

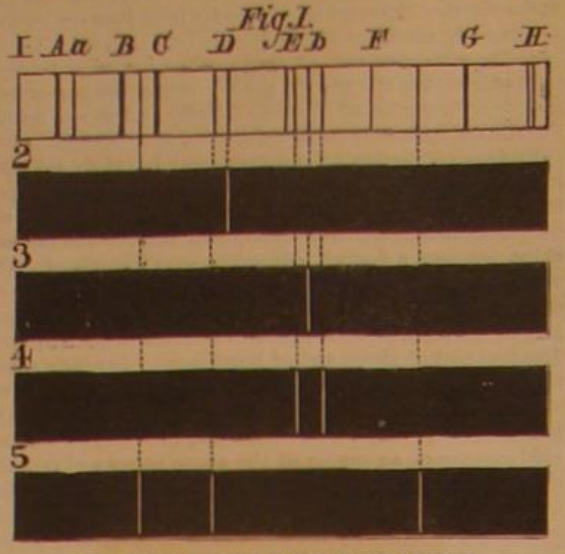
When Bunsen and Kirchoff, after having determined the spectra of all known substances, discovered a spectrum whose bands did not correspond to any known bands, they immediately inferred the existence of a new metal. By operating upon the mineral waters of Germany, evaporating immense quantities of the fluid, they discovered the metal rubidium, and afterwards a second metal which they named "cæsium;" subsequently Mr. Crookes, by the same method, added thallium to the list of metals.

APPLICATION OF SPECTRUM ANALYSIS.

Kirchoff showed how spectrum analysis might be applied to the investigation of the sun and stars. A spectrum is pure in which the colors do not overlap each other. We purify the spectrum by making our slits narrow and by augmenting the number of our prisms. When a pure spectrum of the sun has been obtained in this way, it is found furrowed by innumerable dark lines. Four of them were first seen by Dr. Wollaston, but they were afterward multiplied and measured by Fraunhofer with such masterly skill that they are now universally known as Fraunhofer's lines. Kirchoff had proved, for every ray of the spectrum, the doctrine that the body emitting a ray absorbed with special energy a ray of the same refrangibility. According to this principle, vapors of metals, if crossed by solar light, ought to absorb rays of the same refrangibility as those which they emit. Kirchoff proved this to be the case: he was able, by the interposition of a vapor, to cut out of the solar spectrum the band corresponding in color to that vapor. Now, the sun possesses a photosphere, or vaporous envelope, doubtless mixed with violently agitated clouds; and Kirchoff saw that the powerful rays, coming from the solid or the molten nucleus of the sun, must be intercepted by this vapor. One dark band of Fraunhofer, for example, occurs in the yellow of the spectrum. Sodium vapor is demonstrably competent to produce that dark band; hence Kirchoff inferred the existence of sodium vapor in the atmosphere of the sun. In the case of metals which emit a large number of bands, the absolute coincidence of every bright band of the metal with a dark Fraunhofer line raises to the highest degree of certainty the inference that the metal is present in the atmosphere of the sun. In this way solar chemistry was founded on spectrum analysis.

Fig. 1 shows a comparison of the bright lines in the spectra of terrestrial substances with the dark lines in the solar spectrum. The spectrum 1 in the engraving is that of the sun, 2, that of sodium, 3, of thallium, 4, of silver, and 5, of lithium.

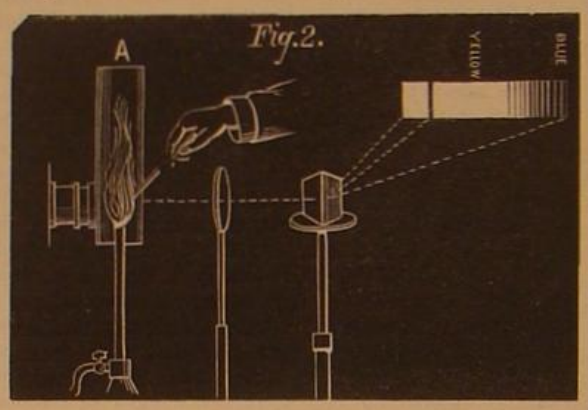
Fig. 1.



EMISSION AND ABSORPTION INTERPRETED.

Professor Tyndall then proceeded to explain the physical meaning of emission and absorption through the analogy of sound. Sounding a tuning fork, he showed that, out of a number of other forks, that of the same rate of vibration as the sounding one continued the sound even when the first was quenched. This is an instance of the absorption of the sound of one fork by the other. The speaker then exhibited on the screen the bright yellow band forming the spectrum of the sodium flame. He then arranged the apparatus shown in Fig. 2, in which A is the burning sodium, held in a shade

Fig. 2.



so as to screen the light. On sending the white light of the electric beam through this flame, the spectrum appeared on the screen with the yellow sodium light as it were cut out, and to all intents a dark Fraunhofer band was produced in its place.

THE CAREER OF OPTICS OUTLINED.

Professor Tyndall then proceeded to review the course of investigation as regards light, which had been passed over in the lectures delivered. Begun by the Arabian philosopher Alhazan in 1100, it was taken up in succession by Roger Bacon, Vitellio and Kepler. Then came the fundamental discovery of Snell, and its application by Descartes to the explanation of the rainbow. Newton followed with his experiments in the analysis and synthesis of white light, by which it was proved to be compounded of various kinds of light of different degrees of refrangibility. In 1676, Olaf Roemer, a Dane, determined, from the occultations of Jupiter's satellites, that light requires time to pass through space and that it moves with a velocity of 190,000 miles a second. Then an English astronomer, Bradley, determined that the rays from a star overhead are caused to slant by the motion of the earth through space. By knowing the speed of the earth in its orbit and the obliquity of the rays due to this course, he also calculated the velocity of light, with results identical to those obtained by Roemer. Dollond next proved that Newton's idea, that refraction and dispersion were inseparable and that one could not be abolished without abolishing the other, was wrong. By combining two different kinds of glass, he found that color might be abolished and a residue of refraction left, and this discovery he applied to the making of achromatic lenses. In 1808, Malus, by looking through Iceland spar at the sun reflected from the window of the Luxembourg Palace in Paris, discovered the polarization of light by reflection. In 1811, Arago discovered the splendid chromatic phenomena which we have had illustrated by plates of gypsum in polarized light; he also discovered the rotation of the plane of polarization by quartz crystals. In 1813, Seebeck discovered the polarization of light by tourmaline. The same year, Brewster discovered those magnificent bands of colors that surround the axes of bi axial crystals. In 1814, Wollaston discovered the ring of Iceland spar.

Professor Tyndall then reviewed the undulatory theory, as developed and asserted by Dr. Young, at considerable length. After Young came Fresnel, who grasped the theory in its entirety, and followed the ether into its eddies and estuaries in the hearts of crystals of the most complicated structure and into bodies subjected to strains and pressures.

CONCLUDING REMARKS.

Professor Tyndall then announced that he had reached the terminus of the course he had projected; and he concluded his lecture with an able disquisition on the study of science and its progress in America. Science, he said, must be cultivated for its own sake, for the pure love of truth, rather than for the applause and profit that it brings. Could we watch the true investigator in his laboratory, unless animated by his spirit, we could hardly understand what keeps him there. Many of the objects which met his attention might appear to us to be utterly trivial; and, if we were to step forward and ask him what is the use of his work, the chances are that we would confound him. He might not be able to assure us that it will put a dollar into the pocket of any human being, living or to come. That scientific discovery may not only put dollars into the pockets of individuals but millions into the exchequers of nations, the history of science amply proves; but the hope of its doing so is not the motive power of the investigator. The speaker then alluded to the need for original investigation in England and America. If the spirit of our great investigators die out, we shall find ourselves eventually in the condition of the Chinese, mentioned by De Tocqueville, who, having forgotten the scientific origin of what they did, were at length compelled to copy without variation the inventions of an ancestry who, wiser than themselves, had drawn their inspiration direct from Nature.

PRACTICAL APPLICATIONS DEPENDENT UPON ANTECEDENT DISCOVERY.

To keep society as regards science in healthy play, three classes of workers are necessary: First, the investigator of natural truth, whose vocation it is to pursue that truth, and extend the field of discovery for the truth's own sake, and without any reference to practical ends. Secondly, the the teacher of natural truth, whose vocation is to give public diffusion to the knowledge already won by the discoverer. Thirdly, the applier of natural truth, whose vocation it is to make scientific knowledge available for the needs, comforts, and luxuries of life. These three classes ought to co-exist, and interact upon each other.

It is at our peril that we neglect to provide opportunity for those studies and pursuits which have no practical rewards and from which therefore the rising genius of the country is incessantly tempted away. If great scientific results are not achieved in America, continued Professor Tyndall, it is not to the small agitations of society that I should be disposed to ascribe the defect, but to the fact that men among you who possess the genius for scientific inquiry are laden with duties of administration or tuition so heavy as to be utterly incompatible with the continuous or tranquil meditation which original investigation demands. I do not think this state of things likely to last. I have seen in America willingness on the part of the individuals to devote their fortunes in the matter of education to the service of the commonwealth, for which I cannot find a parallel elsewhere.

This willingness of private men to devote fortunes to public purposes requires but wise direction to enable you to render null and void the prediction of De Tocqueville. Your most difficult problem will be not to build institutions, but to make men; not to form the body, but to find the spiritual embers which shall kindle within that body a living soul. You have scientific genius among you; not sown broadcast, believe me, but still scattered here and there. Take all unnecessary impediments out of its way. You have asked me to give these lectures, and I cannot turn them to better account than by asking you in turn to remember that the lecturer is usually the distributor of intellectual wealth amassed by better men. It is not as lecturers but as discoverers that you ought to employ your highest men. Keep your sympathetic eye upon the originator of knowledge. Give him the freedom necessary for his researches, not overloading him either with the duties of tuition or of administration, not demanding from him so-called practical results—above all things, avoiding that question which ignorance often addresses to genius: "What is the use of your work?" Let him make truth his object, however impractical for the time being that truth may appear. If you cast your bread thus upon the waters, then be assured it will return to you, though it may be after many days.

A Needy but Liberal Inventor.

The Commissioner of Patents lately received the following letter from an inventor who stands in need of one thousand dollars:

JANY THE SIXTH,
CINCINATTI, OHIO.

Commissioners Esqs of the patent office. Dere sirs—if you will send me one thousand dollars Cash i will invent a improved self acting operating automaton mechinery and one million—after the mechine proves satisfaction if i dont accomplish it i will refund the money in ten years.

Experiments with the Lay Torpedo at Newport.

A second trial of the Lay Torpedo was recently made at the United States torpedo station on Goat Island, Newport harbor. After being launched the boat started off in good order, but, after having run some five eighths of a mile, she became unmanageable. The wire of her cable parted so that she refused to mind her port helm, describing a series of circles until her motive power was shut off. The total distance run was about two miles, which she accomplished in twenty minutes and thirty seconds.

HARNESS DRESSING.—Long continued observations show that harness and other leather, exposed to the action of ammonia continually given off in stables, becomes weak and rotten sooner than other leather. Even when care is taken to protect it with grease, this takes place. Professor Artus recommends the addition of a small quantity of glycerin to the oil or fat employed in greasing such kind of leather, asserting that it keeps it always pliable and soft.

Air Power.

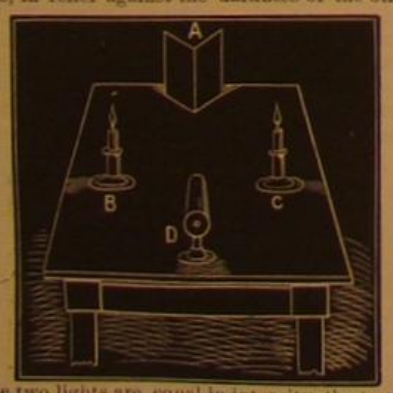
A letter from Brunswick, Me., to the Portland *Argus*, gives the following information relating to the use of air as a motive power in that village:

"On the Androscoggin River, some three fourths of a mile below the railroad station, is the site of a mill, long since burned, and the motive power which operates the condenser is a water wheel at the place. The wheel, it is said, is capable of driving four condensers of equal power with the one now in use. But it is only with results already accomplished, that we have to do. At the railroad station is an engine of ten horse power, running circular saws for sawing wood and various machinery in the blacksmith shop in the vicinity. Thence a small pipe passes on through the village, furnishing power to Worthly Brothers, jewelers, who are running a small engine of about one horse power. Parent and Dafriend also use an engine of two horse power in their blacksmith shop; Dennison & Co., box makers, an engine of two horse power, and Professor Brackett, of Bowdoin College, one of three horse power, for the manufacture of instruments, while the laboratory, of the College has one of six horse power. So that, nominally, this small condenser furnishes in all twenty-four horse power, and all unite in saying that the air power is much more efficient than steam in working the same engines; it does not drag, but recovers itself instantly from any strain or check, and is in every way a success."

REMARKS BY THE EDITOR.—The employment of pneumatic power for industrial purposes is constantly increasing. By its use the Mt. Cenis tunnel, through the Alps, seven miles in length, was bored. The Hoosic tunnel, in Massachusetts, five miles in length, now nearly finished, is being cut by the same means. The St. Gothard tunnel, in Switzerland, lately commenced, which is to be thirteen miles in length, will also be cut by means of compressed air. The Hell-Gate rocks, under the East River in this city, are in process of removal by the same agency. In planing mills, the pneumatic method is used to carry the shavings from the planers to the furnaces of the steam boilers; in grain and wool houses, to convey the stock. At the iron furnaces pneumatic elevators are used to lift the cars and their loads of ore from one point to another. In London the pneumatic method drives five ton freight cars in tubes under ground; the post office department of that city has now in use several miles of pneumatic tubes laid under the streets, in which letters are conveyed with great rapidity. In this country the largest scale on which the system has been applied is at the works of the Pneumatic Transit Company, on Broadway, where a railway passenger car, running in a nine foot tunnel under that street, is operated by compressed air. For an underground railway this pneumatic method is especially useful; cinders, gas, smoke, dust, noise and locomotives, all are avoided; the cars may be driven smoothly along with great rapidity. In England, some years ago, during the experimental trials of the pneumatic cars, the trains were driven by this method at a velocity of sixty miles per hour. The pneumatic car under Broadway has carried between two and three hundred thousand passengers, but, owing to the shortness of the tunnel, so high a speed cannot be reached. As soon as the Legislature grants the necessary authority, the works will be extended through the city from the Battery to Harlem river. New York will then be able to boast of having the safest, most agreeable and most rapid means of passenger conveyance of any city in the world.

A SIMPLE PHOTOMETER.

The photometer is an instrument used to compare the intensities of two lights. If, for instance, it is desired to determine whether the flame of one lamp is brighter than that of another, or if one kind of gas has greater illuminating power, according to M. Yoon the following simple and ingenious process may be employed: Bend an ordinary white card, as at A, in the accompanying illustration, so that the two faces will be at right angles, and stand it upright on a table. One of the faces is to be exposed to the light to be examined, and the other to the second light to which the first is to be compared. Let B and C be such lights, placed on lines perpendicular to the faces of the card. It is clear that if one is stronger than the other, one of the faces of the card will be more brightly illuminated and will appear, at the angle, in relief against the darkness of the other face;



but if the two lights are equal in intensity, the two sides of the card will be equally illuminated, and the appearance of relief will totally disappear. It is only necessary to practice moving the lights toward or from the faces until the relief at the angle becomes invisible, then to measure the distances from the lights to the corresponding faces on lines perpendicular to the latter. The intensity of each light will, of course, be inversely proportional to the square of its distance from the face of the card.

The experiment can be more satisfactorily performed by looking at the angle of the card through a small tube, as at D, or even through the hand partially closed.

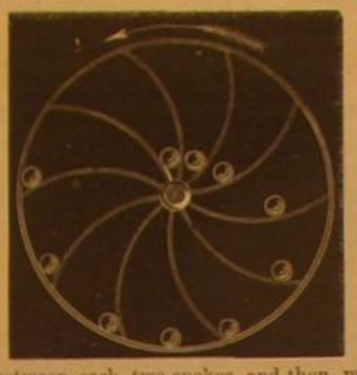
Correspondence.

Perpetual Motion.

To the Editor of the Scientific American:

In the SCIENTIFIC AMERICAN of January 18, I notice a question by A. J. S., respecting perpetual motion, and also the extremely simple experiment with the tub. Since valuable discoveries have been made by persons in search of such motion (Sir Richard Arkwright, for instance), I for one would like to encourage A. J. S. to persevere, as he might discover some motion, if not a "perpetual" one.

If, by reason of want of perseverance, muscular power, or moral influence, the experiment with the tub should fail, then let him make a wheel, as sketched, with spokes curved and with a groove on each side, so that a metal ball could run freely in it without falling out; let him place one of



these balls between each two spokes, and then, may be, he will see something move without the aid of either cog wheels or levers. If he does not, let him call upon

BRUMAGEM.

Williamsburgh, N. Y.

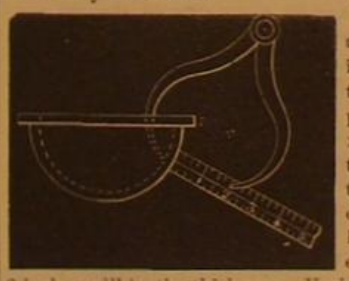
REMARKS BY THE EDITOR.—Our correspondent is evidently laboring under the impression that the example of perpetual motion which he presents differs in principle from the attempt of a man to lift himself in a tub. But a glance at his diagram ought to satisfy him that both plans are alike. One half of his balls pull up, the other half push down; just as the man in the tub pulls up with his hands and pushes down with his feet.

If our correspondent thinks that his wheel will move, why does he not try it? It is easily made. He will find that it stands still. He intimates that the plan he gives contains no levers. But every one of the curved spokes is a lever.

A Wrinkle.

To the Editor of the Scientific American:

A few days ago, having to get the thickness of a casting where the use of the calipers alone was impracticable, the idea here shown occurred to me, and I found it to be of great service. Pattern makers will doubtless find it useful in their daily avocations.



Hold a common rule, as shown, in line where it is required to know the thickness, and set calipers to some equal figure on the rule, say 2 inches; this allows the calipers to be removed without changing their distance. By measuring the calipers, the dimension above 2 inches will be the thickness. Various crooked bodies may be measured in this way, as well as the thickness of plates, etc., with flanges all round. JOHN WALKER.

Woodberry, Md.

An Invention Wanted.

To the Editor of the Scientific American:

I would pay a handsome sum for an invention (and it would be worth it) by which any music played on the piano could be reproduced. CHARLES T. SHELTON.

489 Chapel street, New Haven, Conn.

Bursting Cylindrical Boilers.

To the Editor of the Scientific American:

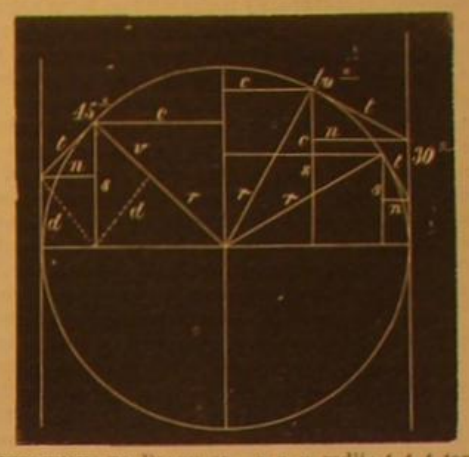
I was somewhat disappointed in the promised letter "to the point" by S. S., in the SCIENTIFIC AMERICAN of December 7.

The letter, however, with four formidable diagrams, is strong in proof of an undisputed point, namely, that the horizontal forces give the pressure, required to rupture, as the diameter. This singular oversight may be my excuse for repeating what I stated in your paper of October 19, to which S. S. refers. "Let the diameter be 1, the half circle 1·57, and the steam force 1 lb. per inch; then, by the resolution of the radial forces into horizontal and vertical, a steam force of ·637 lbs. will be the mean horizontal pressure on the half circle of 1·57, or $·637 \times 1·57 = 1$, being the diameter, and so far agreeing with the current error.

But, in the resolution of the vertical forces, we have a mean horizontal force from them of ·363 lbs. steam pressure on the half circle, or $·363 \times 1·57 = ·57$, in addition to the former, exclusively horizontal. I further repeat in substance, from my reply to Mr. Creuzbaur of December 14, that, without the action of the vertical forces, the ring would be elongated horizontally, unless arrested by the ignored vertical forces, to preserve the circle, and at the expense of increased strain on the said horizontal forces.

The direct horizontal pressure of ·637 lbs. is the mean of the cosines, and the additional derived from the vertical, of ·363 lbs., is the mean of the complement to the cosines. It is incumbent on the diameter advocates to dispose of the vertical forces in some way, and not evade or rule them out of existence by labored and fruitless efforts.

Some of my communicants are on the "anxious seat," and desire to know how I arrive at the mean additional force of ·363 from the vertical forces. For their information, I refer to the diagram:



REFERENCES TO DIAGRAM.—*r*, *r*, *r*, radii; *t*, *t*, *t*, tangents to radii; *s*, *s*, *s*, sines and vertical forces; *c*, *c*, *c*, cosines and horizontal forces; *n*, *n*, *n*, horizontal forces from the vertical.

VALUES.—At 30°, sin. ·500, cos. ·866, tangt. ·268, *n* ·134; at 45°, sin. ·707, cos. ·707, tangt. ·4144, *n* ·293; at 60°, sin. ·866, cos. ·500, tangt. ·5774, *n* ·500.

FORMULÆ.—At 30°, $r : s :: t - n$, ·134; at 45°, $r . s :: t - n$, ·293; at 60°, $r : s :: t - n$, ·500.

If the test of the parallelogram law be applied, we have for example the vertical force on sine at 45° resolved into the forces or lines *t* and *r*, the dotted lines completing the parallelogram. It is strange that so great a geometrical error as 57 per cent should so long have remained undiscovered or taken for granted. Its ramifications are numerous and important. The error assigns to a sphere the explosive pressure as the area of the bi-section, instead of the entire in-surface of the hemisphere.

I am aware of the responsibility of opposing an opinion hitherto considered invulnerably orthodox; but I am sustained by eminent scientists, both of England and this country; and by a recent letter from Professor Henry, of the Smithsonian Institute, I have his entire approval of my position. THOMAS W. BAKEWELL.

Pittsburgh, Pa.

The Superheated Steam Question.

To the Editor of the Scientific American:

If the discussion upon the superheated steam question is not closed, allow me to give your readers the following facts for their consideration:

The pumping engine of these works is supplied with steam from an ordinary tubular boiler, but, for the purpose of testing the comparative efficiency of the Miller boiler, the inventor was allowed to locate his boiler in the rear of the tubular boiler and connect with the same steam pipe. For the testing, a run of forty-eight successive hours with each boiler was contemplated, and was begun during the month of August last. We made and completed our first forty-eight hours run with the tubular boiler with no results that bear on this subject. The Miller boiler consists of a series of sections of tubes about three inches in diameter by ten feet long, arranged so as to give two in a horizontal row and five in a vertical row to each section, the size of the boiler being made up of the number of sections. Of these five vertically arranged tubes, four are inclined at an angle of about 30° with the horizon and the fifth is horizontal. The inclined tubes are water tubes, having interior circulating tubes of about an inch and a quarter diameter. One end of these water tubes is closed, the other connecting into a casting common to a section. The fifth or upper tube is for superheating, and it is so arranged interiorly that it is almost impossible for water to enter it. There are other pipes and connections which I need not describe here, my aim being to show that the same fire that reaches the water tubes also reaches the superheating tube. Unfortunately we had no thermometer in the steam pipe; but one in the steam chest indicated a temperature of 316°, when that due to saturated steam was about 236°, showing about 80° of superheat.

We commenced our run with the Miller boiler at 9.30 A. M. on August 22, 1872. The pressure of steam carried was about the same as on the other boilers, namely, 65 pounds. The temperature due to this pressure is 298°, and assuming that the superheating did not exceed 80° the temperature of the steam was about 378°. The steam cylinders are steam jacketed, and covered with felting and black walnut lagging. Pine ribs touch the cylinders, to which the lagging is fastened. At about 1.30 P. M., smoke began to creep through the crevices of the lagging near the steam chests, and it constantly increased from that time. I then had no apprehensions that it would actually set the lagging on fire, although the smoke continually increased in volume. At 3.20 P. M., while I was absent from the engine room for a few minutes, it increased very rapidly, so much so that it drove the men out of the

engine room. I then gave orders to stop the experiments, and have the fires hauled and fire hose attached; but before the orders could be executed, the front part of the engine was enveloped in a sheet of flame. This occurred during broad day light; no lamps were used about the engine, and the boilers were in another room. Will some one inform me to what to attribute this fire if not to superheated steam?

A. F. NAGLE.

Mechanical Engineer, Providence Water Works.

REMARKS BY THE EDITOR.—This fire was probably occasioned by the presence of oil in the jacket or in the wood covering, or both, the increased heat being sufficient to excite the combustion. It is well known that oil and wood, oil and cotton rags, oil and various other materials will, under certain conditions, spontaneously ignite without being aided by artificial heat. But under other conditions they require to be assisted by a certain degree of exterior heat before they inflame. Such probably was the case in the present example. All engineers understand the importance of guarding well against fires from oily wiping rags or cotton. Care should also be taken to prevent access of oil to the jackets and wooden coverings of steam cylinders, pipes and boilers.

Although in most cases of spontaneous combustion in mechanical establishments, it will be found that oily matters were present and were the inducing cause, still it is well to remember that there are conditions in which substances will spontaneously inflame without the presence of oil. For example, charcoal may be so prepared, its water so completely expelled by heat, and its particles rendered so finely porous that it will absorb oxygen from the air so rapidly as to ignite spontaneously, with but very little assistance from exterior heat. Clean cotton, when sufficiently dried and its fibers placed in a favorable position, may if gently heated be made to inflame spontaneously. There have been well authenticated instances of spontaneous fires in cotton factories where clean cotton had been allowed to remain in proximity to steam pipes. As one example of this kind, we might refer to a fire which broke out in the picker room of the Utica Steam Cotton Company, Utica, N. Y., in January, 1872. There are various kinds of inflammable materials which, if they are arranged so as to furnish the proper conditions of porosity and temperature, will spontaneously ignite.

ASTRONOMICAL NOTES.

OBSERVATORY OF VASSAR COLLEGE.

For the items of meteorological information, for those of auroras, and for some of the computations in the following notes, I am indebted to students.

The places of the planets and the times of rising and setting are given approximately, the aim being to furnish to every-day readers such information as will enable them to recognize the principal planets. M. M.

Position of Planets for February, 1873.

Mercury.

Mercury is very near the sun throughout the month. It souths at 41 minutes before noon on the 1st, and at 38 minutes after noon on the 28th. It rises on the 1st at 6h. 40m. A. M. and sets a little before 4 P. M.; on the 28th it rises about 7 A. M. and sets at 6h. 15m. P. M.

Venus.

On the 1st, Venus rises a few minutes after 9 in the morning and sets a few minutes after 9 in the evening. On the 28th, she rises about a quarter after 8 in the morning and sets a quarter before 10 in the evening.

At this time (January 20) Venus as seen through the telescope has the appearance of the moon at first quarter, or half moon.

Mars.

Mars is increasing in apparent diameter. He is near the star λ *Virginis* on the 1st, being a little above it when on the meridian. It passes below this star, and, on the last of the month, souths nearly at the same time with α *Libræ*, but is above that star in altitude.

On the 1st it rises at midnight, souths 21 minutes after 5 in the morning and sets 20 minutes before eleven. On the 28th it rises at 10h. 58m. P. M., and sets at 9h. 16m. A. M.

Jupiter.

Jupiter rises on the 1st at 6h. 24m. P. M., and sets at 8 A. M. He rises on the 28th at 4h. 20m. P. M., and set sat 6h. 6m. A. M.

On January 19, the bands which cross the equatorial portion of Jupiter's disk were seen to be flecked by dark and light spots, brown and white, while a rosy tinge colored the belted region. The dark spots can be seen with telescopes of small power; the white spaces are seen only by the use of a good telescope.

Saturn.

February 1, Saturn rises at 6h. 20m. A. M., and sets at 3h. 44m. P. M. February 28, he rises at 4h. 48m. A. M., and sets at 2h. 12m. P. M.

Uranus.

Uranus is among the small stars of *Cancer*. February 1, it rises at 4h. 17m. P. M., and sets at 6h. 53m. A. M.

February 28, it rises at 2h. 26m. P. M., and sets at 5 the next morning.

Neptune.

Neptune, which cannot be seen without a good telescope, rises on the 1st at 10h. 15m. A. M., and sets at 11h. 9m. P.M.

On the 28th, it rises at 8h. 30m., souths at 2h. 58m., and sets at 9h. 26m. P. M.

Occultations.

The star τ *Tauri* was occulted (the moon seemed to pass over it) on the 9th of January. The star disappeared at 10h. 38m. 59·4s

Sun Spots.

A very large spot can be seen at this time (January 20) on the sun. It has passed the center of the disk, but can be seen for some days.

Aurora.

There was a fine aurora on January 7. It was first noticed about 6 P. M. At times during the evening, it extended from the northwest far around to the east, with red and greenish tints; and between 10 and 10.20 P. M., the flashes were brilliant, and followed one another with unusual rapidity.

Meteorological Items.

FROM DECEMBER 15 TO DECEMBER 31, INCLUSIVE.

Highest thermometer	2 P. M.,	December	20	35°
Lowest "	9 P. M.,	"	25	–4°
Highest barometer	2 P. M.,	"	19	30·53
Lowest "	7 A. M.,	"	22	29·11

Amount of rain very slight. Prevailing wind northwest, not violent.

FROM JANUARY 1 TO JANUARY 15, INCLUSIVE.

Highest thermometer	2 P. M.,	January	3	43°
Lowest "	7 A M.,	"	12	–3°
Highest barometer	9 P M.,	"	15	30·64
Lowest "	9 P. M.,	"	9	29·55

Amount of melted snow and rain, 2·75 inches. Prevailing wind south, not violent.

PLUMBAGO, BLACK LEAD, GRAPHITE.

"Plumbago (black lead, graphite), its uses and how to use it; by Orestes Cleveland, President of the Joseph Dixon Crucible Company, established 1827. Jersey City, N. J. Published by the Company. 1873."

The above is the title page of a valuable little work, in which we find the following useful information concerning plumbago. Most of it is new to the public, and will be read with interest.

The purposes for which plumbago is valuable, the best methods of applying it, the properties and true character of the mineral itself, its sources, and the circumstances that surround it in the commerce of the world, the various grades and adulterations, are all points upon which great numbers, even of those who come in daily contact with it or use it, are by no means familiar, and many are wholly ignorant.

We have been forty-five years engaged in the manipulation of plumbago, being the oldest house in the trade in this country, handle more of it now than any other single establishment in the world, and have been successful in its application to different branches of industry; we may, therefore, offer information without being accused of not understanding the subject treated.

The black lead of commerce, and what is so called by the trade, in first hands, is found only in Europe, principally in Germany, that which comes to this market being wholly from that country.

The plumbago of commerce comes mainly from the island of Ceylon, in India, but is found in many parts of the United States, being mined successfully, however, only at Ticonderoga, in the State of New York. It is also mined to a small extent in the Ottawa region of Canada, though I believe so far without profit.

It is, therefore, known in trade as Ceylon plumbago. It is very refractory. I have experimented by subjecting, for two hours, a piece, with sharp projecting angles, to a heat that would melt steel, and on cooling found the sharpest points perfect; but it will exhaust if left on top of such a fire. It is found in veins in a pure state, is removed in lumps, and a selection of these forms the "prime lump" of commerce.

The formation most common in the pure state is that of laminated crystals, elongated at right angles with the sides of the vein, if not more than from four to six inches wide; but when the vein widens the crystallization often radiates from numerous centers, and the whole formation is very beautiful; the foliated variety is equally valuable and more brilliant, but rare in any quantity; the acicular form of crystal is not apt to be as pure in the lump, but is useful for most purposes; the granulated variety, the purest of all, is of little use for crucibles, but, with suitable manipulation, produces the finest grades for electrotyping and fine lead pencils, and is unequaled for lubricating. Pure plumbago is free from grit, when pulverized and rubbed between the fingers, and the polish produced in the same way is instantaneous and very bright, being like a darker shade of polished silver. It is found mixed with iron, rhombspar and other forms of lime, the rock and earth in which the vein is carried, and many other foreign substances injurious for all the purposes for which pure plumbago is needed; so that much care is necessary in purchasing the raw material for a given purpose. Lime, for instance, is fatal to plumbago for crucible making. The plumbago is mined in the interior of the island of Ceylon, and is brought down to Colombo in bullock carts. It is there selected into grades; so much as may be finely broken up is sifted, and the coarser part of this is called "chips," while the finer part is called "dust." The "dust" from prime lump is, of course, very different in character from the dust left from the poorer grades of lump, and all of it, whether lump or dust, after being handled and packed in barrels in Colombo, becomes so black and bright, by the poor particles rubbing against the good, that the touch of an expert is required to distinguish between the grades.

The German black lead is not refractory, and is therefore useless for any purpose that brings it in contact with the fire. It has no value for the crucible maker, or for stove polish, and is of but little use as a lubricator. It has a very low conducting power, even in its pure state, and the best quality that comes to market is far from pure. None of it comes in its original state as mined, but all of it is washed and floated, and so the grades are produced. In fact, it resembles a weak black clay more nearly than it does true plumbago in nature as well as appearance. It is used often on account of its cheapness, when it would be cheaper to use the real plumbago even at five times the price.

As this is only intended for a preliminary circular, to be followed by an elaborate work in which the subject will be fully treated, I shall pass at once to such points as seem to me useful for the trade, either as dealers or manufacturers.

PENCILS.

The first, and still the most widely extended, use of plumbago was for marking-crayons or pencils. The original method of manufacture was very simple. The lumps of mineral were cut into the required shape, and used in the natural state. At a later date it was sawn into the shape now used, and covered with wood, making the well known lead pencil; but the Borrowdale mine in England, the best known, finally ceased to produce the mineral pure enough for the purpose, and that method was reluctantly abandoned. The refuse about the mine was then utilized by purifying and pressing it into blocks, and these in turn were sawn into "pencil leads." But the leads made in this way were weak and unreliable; and even had they been useful, the march of civilization required pencils of different grades, some soft and others harder, while the sawn leads were all alike. The present method consists in selecting the best granulated plumbago (found till recently only in Germany), pulverizing it very finely, and floating it in water through a series of vats, the coarser particles settling to the bottom of the first vat, the finer in the next, and so on till, after passing through several, that which settles in the last vat is considered fine enough for the purpose. A suitable clay is found as yet only in Germany, and this is treated to the floating process, the finest only being fit for use. The plumbago and clay are then mixed together with water to the consistency of cream, and ground together like grinding paint. When this operation is completed, the mass is plastic, water enough having evaporated to leave it in that state. It is then placed in a press and forced through an opening of the size desired for the pencil leads, and the leads are cut to a suitable length, straightened, and dried. When dry enough to handle, they are placed in a crucible, the air excluded, and subjected to a high heat, which bakes them and brings them out ready to be placed in the cedar for pencils. The different grades are produced by the different mixtures of clay and plumbago; the more clay the harder the grade produced. Skill in the manipulation, the exercise of great care as it progresses, and an expert to select the raw materials, are absolute pre-requisites for a perfect product, and our success has been greater than we hoped for, to start with. We shall have five grades of the commercial pencils, ranging from the very soft up to a very hard grade. They are smooth, reliable, and pleasant to use beyond any heretofore made, and are a credit to us and to the country as an American manufacture. We are the only Americans making fine pencils, but are not unwilling to place our common commercial polygrade pencils by the side of the finest drawing pencils heretofore used by artists, ours being made by machinery only, while those are made by hand. All of the fine pencils used in this country have so far been imported, but we propose to turn the tide of trade homeward.

CRUCIBLES OR MELTING POTS, RETORTS, ETC.

Forty-five years ago the only plumbago crucible was made by the Dutch, the melting pots used in most countries being made of clay and sand; but the late Mr. Joseph Dixon, the founder of our house, in 1827 made crucibles by using the plumbago found in the State of New Hampshire, of a quality so far superior to the Dutch black lead pots that he took the market from the first. He afterwards saw specimens that had been brought from Ceylon as curiosities, by captains in the India trade; and finding them so much better than the New Hampshire plumbago, he procured a shipment, being the first importation of Ceylon plumbago in the United States.

Captain Rogers, who brought that shipment, is still alive and residing in Boston.

For crucibles, the pure lumps known as "prime lump" only should be used, ground to a fineness that leaves the particles bright and glistening when held to the light, but not so fine as to destroy this appearance. It is then mixed with clay, and the best known for that purpose is found at Mayence, comes down the Rhine, and is shipped to this country from Rotterdam. A small amount of finely pulverized charcoal should be added to render the crucible porous. As little clay should be used as will suffice to hold the plumbago together, the object in using the clay being only to cement the particles of plumbago.

After a thorough mixture, the crucibles are turned into the desired shape, much the same as pottery ware; they are then dried and baked in a kiln like pottery.

In use the crucibles should be placed in the fire, and not on it. The fire should surround the crucible to the very top.

If used with a blast, the blast should not strike the crucibles direct, but there should be coal for the blast to strike against.

The crucible should be kept in a dry place, the least dampness being fatal. If they are well made no annealing is needed, the object of annealing being only to complete the shrinkage that should be fully accomplished in the "burning" by the crucible maker. To provide against slight dampness, however, it is well, when possible, to use the crucible for the first time in a new fire, placing the crucible in the furnace at the time of lighting the fire, so that it heats up gradually with its surroundings. After the first time even this pre-

caution is unnecessary. For melting brass, copper, gold, silver, or alloys of metals, a Dixon plumbago crucible should run from twenty to forty meltings according to the fuel, draft, care, or other circumstances.

I have known them used seventy and even eighty times, with a natural draft and great care. For melting steel, they will run from four to six times. They can be made to *run* longer by care and a system of cleaning the slag from the surface after each melting, and coating the crucible with a mixture consisting of fire clay, plumbago, charcoal and silica, pure fine quartz sand being, in my judgment, the most useful form of silica to employ; other substances have been used, but these are all that are of any real value. The carbon from the interior of gas retorts would be better than charcoal, but it cannot be had in quantity and is too hard to pulverize cheaply; and in consequence of that hardness is used successfully in electric batteries where a carbon is wanted.

STOVE POLISH.

Plumbago of the best quality is the only suitable material for stove polish, but lower grades will produce a fair polish for trade; and if the manufacturer is sufficiently expert in the examination, he may use the best grade of Ceylon "dust," but much of that which comes to market is too poor. For stove polish, the plumbago should be pulverized till the particles are too small to glisten, and what would otherwise be a shining mass becomes a dead black flour, and this appearance is so near that of the German black lead that the difference can only be discovered by handling. Plumbago cannot be pulverized fine enough in stone mills without running it over so many times that the cost is too great, and hence so much poor stove polish is found in market, offered by respectable manufacturers. The black lead, even when pulverized equally fine, has a harsh feeling between the thumb and finger, polishes but little and with considerable rubbing, leaving a dark, poor polish; while the plumbago, if good, feels smooth, almost oily, and polishes with very little rubbing, leaving a bright silvery polish. The finer the plumbago is pulverized, the better it is for stove polish, as each particle should be so small that it flattens out at once on the iron, adheres to it, and polishes quickly; while larger particles will fly off and be wasted, as well as creating a dust, and requiring more labor to produce a fine polish. The polish from pure Ceylon plumbago will last on the iron for a long time, while the polish from the German black lead will burn a reddish brown when the stove is raised to a red heat. But as the German is less than half the price of the Ceylon, it is used with it as an adulteration, and for the cheaper kinds the German is used alone. The Ceylon is adulterated also with coal dust, pulverized slate, and many other substances. Dishonest makers of stove polish have this temptation, that only experts can detect the adulteration; and they succeed in palming off their mixtures because the particles of adulteration do not prevent the particles of plumbago from polishing the iron to a small extent. For instance, a thousand particles of adulteration and a thousand particles of plumbago, mixed together, can be sold at a low price, and the particles of plumbago will do the polishing, while most of the particles of adulteration will fly off in the process. It is true that the polish will not be as bright, and will require more time and labor to produce it, than if the one thousand particles of pure plumbago had been used alone, so that half the quantity of the pure article is better than the double quantity adulterated. In using the mixture, a great number of particles of the adulteration are rubbed against the iron with particles of the plumbago outside, and in all such cases the polish on that point is poor and the plumbago wasted, because it cannot get to the iron. I do not believe that an adulteration of an equal number of particles of base matter with the best plumbago is worth more to use than from one fifth to one fourth the value of the pure article, and a vast amount of stove polish offered in market has not a fourth part of plumbago in it, and even that is of the lower grades, used only for its cheapness. A thimblefull of the best plumbago, pulverized to the degree of that used by our company for stove polish, will, with the least amount of labor, polish as much surface as a quarter pound package of the usual merchantable stove polish with much time and hard rubbing bestowed upon it, and the polish of the former will be creditable after that of the latter will be a disgrace to a neat housewife. For stove dealers the difference is very great, a poor article being dear to them if it costs nothing. Perhaps no article except mustard can be so successfully adulterated as plumbago. I have been particular in speaking of the adulterations because the remarks will serve to enlighten those who buy for other purposes than stove polish. The proper methods of pulverizing I leave to be described in the future work.

LIQUID STOVE POLISH.

Liquid stove polish, called by quacks in trade "inventions" and advertised as such, are mixtures in which there is no value except the little plumbago they contain, and the liquid is generally water, with a little soluble blue for a "blind." But recently there have appeared "inventions" of this sort which are made with various volatile fluids, the object being to apply something that will evaporate quickly. These liquids are of no value in themselves, plumbago being used in the mixture for the polish; the article would be better if made of only plumbago and water. But some of the mixtures are dangerous to have about a stove from the explosive fluid used. A "patent" article I have seen is dangerous in any kitchen, and no insurance company would write a policy on any building where it is used, if the ingredients were known. Liquid stove polish is the dearest form in which it is put up, because, in order to make the mixture cheap, very little plumbago is used. A ten cent package of Dixon's stove polish would make a dollar's worth of liquid polish, and so you pay ninety cents for a worthless mixture, labor, bottles, cans, etc. Many makers of liquid stove polish are shrewd enough to use in their mixtures a good quality of plumbago, so that when it is tried, of course it gives a good result; but the deluded purchaser forgets that he can buy good plumbago for *himself* at many times less money.

HOW TO POLISH A STOVE.

The remarks about stove polish and its adulterations should be read by every stove dealer; but the prejudices of the men who polish stoves for the stove dealers are deeply rooted, and their practice very stupid.

For instance, the majority of them still apply a varnish to the stove and then throw against the wet iron a handful of plumbago, allowing the surplus above what sticks to the stove to fall down into a large pan or box placed so as to catch it.

Now, if the plumbago is ground fine enough to be economical to use, this method would scatter it over the store so that everything would be covered with it and a great waste be the result; but the most of that used by stove dealers is so coarse that this does not take place to any great extent; many dealers will pay the price for good plumbago, pulverized fine enough to make it cheaper for them than a low priced article. The varnish creates a disgusting odor when a customer gets the stove home and makes a fire in it, besides being more expensive than water. The proper way to polish a new stove is to mix the plumbago with water to about the consistency of cream, have it in an open dish, apply it to the iron like paint, and with a dry stiff brush polish quickly till dry, and this polish will be brighter and last longer than any varnish polish; and if the plumbago is right this method is much more economical in material and labor.

LUBRICATING.

As a lubricator none but the very best plumbago will answer. For coarse and common purposes a plumbago not quite pure may be better than none; but for metal surfaces, journal boxes, car axles, and all metal bearings, the plumbago should be pure and entirely free from grit. From the "prime lump" should be selected the very choicest lumps, and these should be pulverized till the particles will not glisten, but the mass becomes a dead black.

It cannot be made fine enough if separated by bolting, but must be separated by floating either in water or air. The simplest method is the water separation, and during the process it should be treated to a bath of dilute sulphuric acid, which will take up the particles of spar and iron, leaving the sulphates of lime, magnesia and iron easily washed out. Details of the whole process will be given in the future work. I have seen a very attractive preparation, very smooth between the thumb and finger, free from grit, and useful for many purposes, but the particles under the microscope show themselves in light scales instead of infinitesimal grains, and this was separated in water; but I think the defect was in the method of pulverizing, it having evidently been done by the use of stones.

The Dixon lubricating plumbago is pulverized by rolling 32 lb. iron balls, and is brought into infinitely fine grains, giving it more body and usefulness than the scale form.

There is no purpose for which plumbago should be as pure and as fine as for lubricating, except for electrotyping; but a large part of that which is offered for sale as a lubricator is adulterated, some of it being composed mainly of the German black lead, and is of no more use than common clay for the purpose. For blowing cylinders, the best quality of Ceylon plumbago, pulverized to the finest grade, pure and left with a good body, is the most economical. For engines, rolling mills, and machine bearings, the very finest should always be used. For wood bearings, after oiling with the plumbago a few times, the oil can be dispensed with, and the pure plumbago only applied in the dry powder. For metal bearings, it should be freely mixed with oil. On hot axles or journals, apply it freely dry, and then oil up as usual. If the railroads would all use the best grade of Ceylon plumbago, pulverized and prepared as described, hot journals would be very rare, and much delay and loss in freighting saved, as well as annoyance to passengers avoided. No substance is known that is so useful for lubricating as plumbago, and yet although used for that purpose more than two hundred years ago, the true method of preparing it was not known till within a few years, and it comes upon the market now little understood, and almost like a new material. It is destined to work great changes. Mixtures and quack nostrums are sold with sounding names, but the plumbago in them is all they contain of the least value, and it is better to use it pure.

ELECTROTYPING.

To the electrotyper absolute purity in his plumbago is a necessity, and hence any adulteration will discover itself at once on trial. The purest selected Ceylon lumps should be treated as described for lubricating, but the separating process should be carried to a finer point, and the acid bath given with care. The acid should be applied till with a thorough stirring no effervescence takes place, or bubbles rise to the surface. In electrotyping, the great conducting power of the plumbago asserts itself.

FACINGS FOR MOLDS, OR FOUNDERY FACINGS.

For this purpose plumbago is but little understood, although it is used to a limited extent. That it is valuable most skillful molders are aware, consequently much of the trash that is sold for "facings" is called plumbago, to make it sell, without containing a particle of anything even resembling the real mineral. Most of that which is sold to the stove plate and other smooth casting founderies for "black lead," is innocent ground slate, but some of it is a mixture of ground coal and German black lead, while charcoal would be better than either if ground fine enough. Ceylon plumbago combines the two qualities of a substance almost as refractory as asbestos, and the most perfect conductor of heat. These are the essentials of a perfect "facing." It cannot b pretended that any other substance will answer as well, u n less it will combine and *form* a flux upon the surface of the metal. As for the mechanical operation of filling up the pores, or smoothing the mold, plumbago has no equal. For iron castings it need not be a perfectly pure article, but that it be pulverized very fine is absolutely necessary for economical work and the best results.

For pianos, plumbago is employed to coat the bridge over which the wires are drawn, because of its perfect lubrication; it prevents the wire from adhering to the wood, and should be as free from impurity as that used by the electrotyper, but need not be pulverized as finely.

For organs, it is used to lubricate the slides, and should be the same as that used by piano makers.

The German black lead imparts a peculiar tone to the colors and a softness and smoothness to the touch of felt hats. The very best lump only should be accepted. As it has once been washed and dried in lumps, they will readily separate again in water, and no pulverizing is needed.

For coloring dark glass for carboys, bottles, etc., the best German black lead is used in lumps, but no inferior grade will answer.

For paint, plumbago has long been known as possessing great value. The elements do not exhaust it, water sheds from it as from oil itself, and fire does not affect it. The grade need not be the highest.

For the bottoms of boats and yachts it has long been used especially for racing boats; but only the best Ceylon plumbago, very finely pulverized, is valuable.

REFRACTORY MIXTURES.

For tweers, pointing up furnaces, etc., take "prime lump" Ceylon plumbago, pulverized to scales as directed for crucibles. Then mix equal parts of Dutch pipe clay, fire clay, half the quantity (by measure, not weight) of charcoal, and the same half quantity of silica (pure quartz sand, ground fine, being the best); to this mixture add as much of the plumbago as possible, and leave the mass thin enough to work. It should be made just thin enough with water, so that it will run rather sluggishly.

Plumbago for polishing powder should be of the very best quality, finely pulverized. The German black lead is sometimes used, but is not economical for the powder maker, and for high priced powder is useless.

Shot is polished with plumbago, and it should be absolutely pure, pulverized to the finest grade from Ceylon "prime lump."

FOR BLAST FURNACES.

Plumbago thrown into the blowing cylinders, if adulterated with coal dust, will be worse than nothing. It should be pure and very fine, so that each particle that strikes the side of the cylinder will assist in polishing the surface. The German black lead is of no value, because as many particles of the clay character will stick to the iron, as there will be particles of the black lead character to lubricate the iron and render it smooth.

A more extended work upon the subject is to be published, copies of which can be had free by addressing the Joseph Dixon Crucible Co., Jersey City, N. J.

A Remarkable Explosion.

A most remarkable explosion, which illustrates the expansive force of steam, took place on the evening of January 21st, at Pittsburgh, Pa.

While the workmen at Bateman & Garrison's foundery were moving a ladle filled with several tuns of molten metal, the crane hooks broke, letting the iron fall into a hole which contained some two feet of water, and a terrific explosion followed. The roof of the building was carried away, and the walls cracked. Houses in the vicinity had windows badly shattered. Several workmen were slightly injured though none seriously. The damage to the foundery will amount to about $10,000.

The Shaker and Shakeress.

We have received the first number of the new volume of the "Shaker and Shakeress," of which Elder F. W. Evans, of Mount Lebanon, N. Y., has become editor, and Eldress Antoinette Doolittle, editress. The typography of the paper is excellent; the contents are almost wholly original, consisting of contributions from various members of the Shaker Society, relating chiefly to spiritual affairs.

VEGETABLE AND FLOWER SEEDS.—Mr. J. J. H. Gregory, of Marblehead, Mass., is well know as one of the few leading seed growers in this country. He was the original introducer of the Hubbard squash, the Marblehead cabbages, and many other of our new and valuable vegetables. All seeds from his establishment are sold under three special warrents. His advertisements will be found in this number, and we invite attention to them. His illustrated catalogue for 1873 (now ready) will be sent free to all applicants.

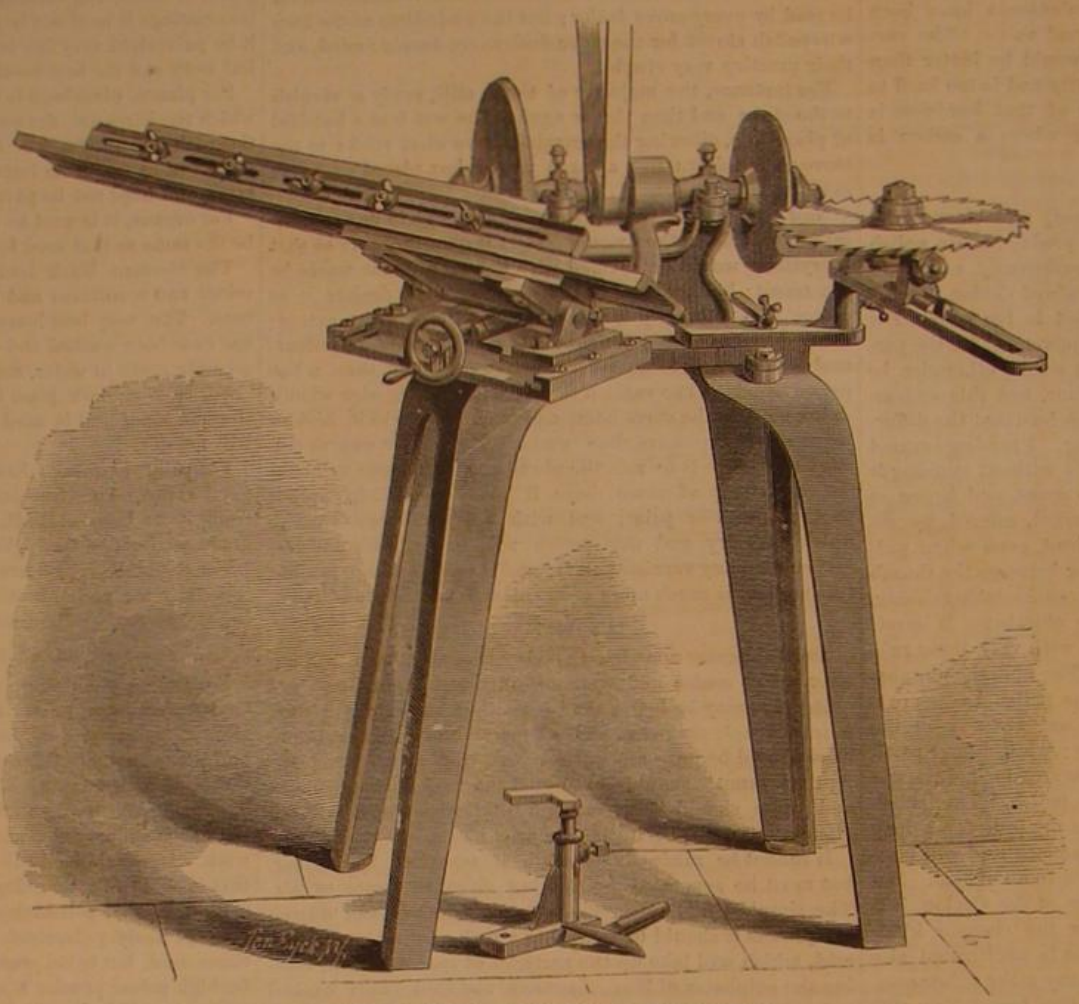
A LONG TRAIN.—The Harrisburgh (Pa.) *State Journal* says that a freight train, consisting of four locomotives and 128 eight wheel cars left that place on the morning of December 15, on the Pennsylvania Railroad, and reached Altoona the same afternoon. The train was considerably over half a mile long.

COMBINATION GRINDING MACHINE.

Since the introduction of solid emery wheels as a substitute for files and grindstones for sharpening saws and other tools, several different machines have been devised, each adapted to the grinding of particular classes of implements. By the apparatus represented in our engraving, it is claimed that all the tools used by wood workers can be sharpened, so that, in one machine, not costly in price, is furnished all that is required for grinding saws, planing knives, molding, and hand tools, in an effective manner, and with considerable saving of room, power, and expense.

The nature and construction of the device is sufficiently shown in our illustration. It is furnished with improved countershaft and patent belt shipper (not represented), and also with improved boxes, which exclude all dust and emery from the bearings. At either side, is shown the saw and planer knife grinding attachments, which may be readily detached whenever the machine is required for other work. Four wheels, we are informed, of different shapes, for grinding molding tools, may be used at once.

The efficiency of this apparatus has received a merited recognition in the shape of premiums from both the Cincinnati and American Institute Fairs of 1872. The machine can be procured only of the Northampton Emery Wheel Company, of Leeds, Mass., or of their agents. A list of the agencies in the principal cities will be found in our advertising columns.



COMBINATION GRINDING MACHINE.

Manufacture of Mad Stones.

A Virginia paper says there is a man in that State who is engaged in the manufactory of mad stones for the cure of hydrophobia. The original madstones were brought from France and Italy, and have the appearance and the weight of the more porous kind of bone. The domestic manufacturer gets the bone itself, and saturates it with some chemical or other, and sells small bits of it at $5 each. Besides its virtue as a relief for hydrophobia, the bone is said to cure tetanus. "The cases of lock jaw," says the Virginia editor, "are too few to make this discovery important. Can't some one invent a cure for limber jaws? They cost the State a great deal."

IMPROVED SELF CAR COUPLER.

This is an effective and simple device for automatic coupling, so arranged as to preclude the necessity of a man going between the cars. No springs or intricate machinery are used; it is impossible for the pin to be thrown out by any jarring or wrenching of the train, and the apparatus can be readily substituted for the old-fashioned coupling without necessitating the removal of the latter.

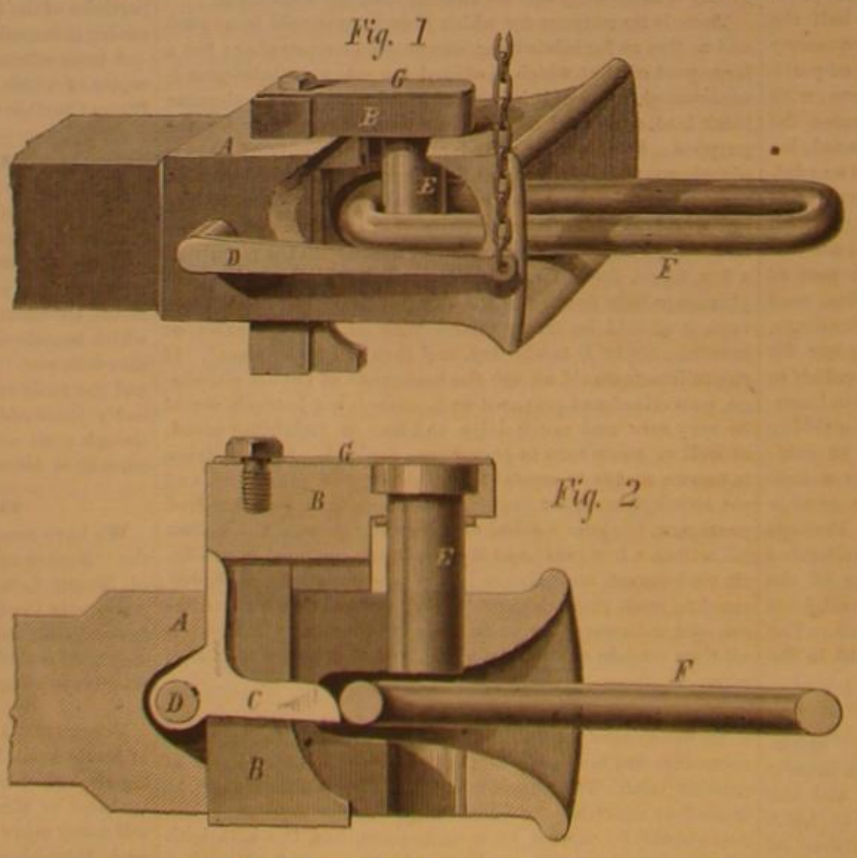
Fig. 1 is a perspective view of the invention, and Fig 2, a sectional view, the former showing portions broken away.

A is the bumper, in the rear part of which works a slotted bar, B. C is a bell crank keyed to a horizontal shaft, D, which passes through the bumper in rear of the bar, B. Through an orifice in the upper horizontal portion of the latter, the pin, E, passes. This pin is of any ordinary description, and its head is countersunk in its support. G is a plate attached to the bar, B, and arranged to turn over the head of the coupling pin in order to prevent it from being jolted or otherwise thrown out.

Fig. 2 shows the device arranged for operation. By elevating the lever, shown on the outer end of the shaft, D, the bell crank, C, which works in the slot in the vertical portion of the bar, B, is turned so that one of the arms comes in contact with said bar and raises it. By this means the pin, E, is also lifted clear of the link opening. While one arm of the bell crank, C, is engaged in supporting the bar, B, the other arm projects into the rear of the opening in the bumper. The upper portion of the last mentioned arm, it will be noticed from the engraving, is curved or beveled. As the link, F, enters the bumper, it strikes the curved end of the horizontal arm. Acting thereon, it forces the latter downward, thus moving forward at the same time the vertical arm. The bar, B, being no longer supported, falls and carries with it the pin, which passes through the link and locks the coupling. In this position the device is shown in Fig. 1.

The chain on the lever which actuates the shaft, D, may be carried to any convenient point, so that by thus actuating the lever, the car can be instantly uncoupled at any moment. After the link is once forced in and engaged, it does not press anything but the solid iron of the bumper, and is not in contact with the lower part of the bell crank. The bar, B, is locked by the bell crank in whatever position it may be in, and by its weight holds the lever perfectly level. This coupling, it is claimed, will always operate even on the sharpest curves. If it should get out of order it may still be employed in the ordinary manner, the pin, E, being inserted by hand.

The coupling is the invention of Mr. M. Disney, of California. Further information may be obtained by addressing Mr. H. C. Kibbe, 419 California street, San Francisco, Cal.



DISNEY'S SELF CAR COUPLER.

Marine Camels.

E. S. F., of Washington, D. C., comments on C. W. Stewart's letter, published on page 36 of our current volume, and states that the marine camel has already been invented and constructed. It is a floating screw dock which will lift a vessel of six thousand tuns, entirely out of the water if necessary. It can be made to draw not more than ten feet of water; it can, if necessary, be self-propelling. Its lifting power consists of sixty screws, worked by two steam engines, placed on two floating hulls. The hulls are three hundred and fifty feet long by forty feet beam and fourteen feet depth of hold, the vessels to be lifted being placed between the floating hulls. One or two vessels can be raised at a time. It is a Baltimore invention.

The Narrow Gage in Kansas.

The Kansas Central Railroad was opened for traffic, September, 1872. It is of three feet gage; in its construction and equipment the principle of economy in first cost has been carried probably to the extreme limit. The line goes nearly due west from Leavenworth, across Leavenworth and Jefferson counties, thence northwesterly up the valley of the Grasshopper river, across a corner of Atchison county, and about eight miles into Jackson county to Holton. Length, fifty-six miles. Reconnoissances have been made westward with the avowed intention of continuing the line to Denver Cal., six hundred miles further. The cross sections adopted in construction were, in filling, eight feet width of road bed and slopes of one and one half to one; in cutting, ten feet road bed and slopes of one to one in loose earth, and considerably steeper in the clay and shales, in which the heaviest cuttings were made. These dimensions have been found too small. The fills have already washed down, so that in many cases the ends of the ties have no support; while the width of the cuttings is entirely inadequate to the required drainage. Considerable repairs have already been necessary on this account. Moreover, when the iron was laid it was impossible to rectify the alignment upon the narrow embankments; but the center line of the embankments, as the contractors left them, necessarily became the center line of the track.

It is evident, and is acknowledged by the officers of the road, that the limit of economy in the cross sections has been passed.

The maximum curve used is twelve degrees, and the line is extremely crooked. The maximum grade is seventy-five feet to the mile. There is a constant succession of short undulating gradients.

Two Baldwin locomotives, of twelve tuns each, are used, having four driving wheels connected, and single leading trucks, and cylinders nine by six inches, and one Baldwin locomotive of seventeen tuns, with six driving wheels connected, single leading truck and eleven by sixteen inch cylinders.

The passenger cars seat thirty-two persons. It may be well to mention here that the lateral oscillation of these cars, when moving at fifteen miles an hour, is much greater than that upon notoriously ill-conditioned roads of broader gage, at twenty miles or more. How far this fact is due to the diminished gage is an interesting question. The weights of the box cars are about 9,500 pounds; of stock cars, 8,500; and of the flats, about 7,000 pounds; and their working loads are fixed at eight tuns.

The construction and equipment of the road, as it now is, cost, according to the statement of the superintendent, Mr. Buchanan, $15,000 a mile, of which the equipment is estimated at $1,000 per mile.

Unfortunately, no fair comparison can be made of the cost of construction of the Kansas Central, as it now is, with that of a first class road of any gage; for the cross sections are confessedly too small, and the timber substructure must be considered as at best but semi-permanent.

The traffic is very light. They run two daily trains each way, the mail and the mixed. The schedule times for the trains are: The mail, 14½ miles an hour; the mixed, 10 miles an hour.

The foregoing information is given in the *Railroad Gazette*, by Mr. Henry G. Prout.

The Air and Fires in Buildings.

A correspondent, B. G., states that there is a pressing necessity for some system of confining fires to the buildings in which they originate, and he points out that the air has as much to do with conflagrations in cities as fire itself. The force and heat of the air, during a large fire, are sufficient to destroy plate glass windows, and so establish communication between buildings. He therefore suggests the employment of iron shutters to close all openings in buildings; these shutters, to be worked by hand if hydraulic or steam power were not available, could be connected together, so that one operation would suffice to close them all.

AT Chicago recently, a lady at church was seen to bow her head as if in pious thought. She suddenly raised it and leaned back against the seat, when an explosion occurred that shook the building. She had pressed too heavily on an air cushion bustle.

THE NEW ST. THOMAS' HOSPITAL.

This hospital is one of several noble charitable institutions, established in London, and endowed by the "Boy King," Edward VI. It originally was erected close to the further, or Surrey, side of London Bridge, but was rendered unsuitable for its purpose by the proximity of the South Eastern Railway, an extension of which took away part of the hospital grounds. With enormous sums, received from the railway company as compensation, and from the sale of the rest of the land, which was very valuable, the trustees determined to erect a new building; and as the neighborhood in which the former building stood was already amply provided by the celebrated Guy's Hospital with the means of relieving the suffering poor, a site in another district was decided upon. A position on the Southern Thames Embankment, facing the Houses of Parliament, was finally selected; and the hospital, consisting of five separate and similar buildings, of which our engraving presents two, was erected and is now in use. The building in the back ground, between the two sections of the hospital, is the chapel. The river Thames flows in the foreground of our picture, and the hospital buildings extend from near Westminster Bridge towards Lambeth Palace.

ST. THOMAS' HOSPITAL, LONDON, ENGLAND.

The buildings are thoroughly adapted to the requirements of the charity, and are at the same time worthy of their noble purpose. Handsome as the new structure is, all unnecessary expenditure has been avoided and every advantage which science and experience can suggest for the alleviation of the sufferings of the sick poor has been secured.

"These great purposes," said Queen Victoria, in opening the new buildings to public use, "are not least effectually promoted by an adequate supply of careful and well trained nurses; and I do not forget that in this respect your hospital is especially fortunate, through the connection with it of a staff trained under the direction of the lady whose name will always remain associated with the care of the wounded and the sick."

The allusion is to the celebrated Miss Nightingale, who has on her hands the organization of the staffs of nurses of several of the London hospitals, and who gives herself freely and unsparingly to the work with which her name is inseparably connected.

Snow on Leaky Roofs.

R. B. M., of Utica, New York, suggests the application of waste heat from the house by conveying it by a tin tube up to the eaves of the roof. To the lower end of the tin tube should be attached a conductor, arranged over a gas burner. If the eaves are kept warmer than the apex of the roof, the snow will melt and leaking through the roof will be prevented. An iron steam pipe three inches in diameter, three feet below the surface of the ground, will melt the snow for a distance of three or four feet on each side of the pipe, and this when the steam has passed through 5,000 feet of coiled pipe. Of course the boiler for this arrangement is a large one; it is, says R. B. M., of sixty horse power, and works at ninety pounds pressure. The warming of the side walks by this means would prevent the freezing and bursting of hydrants and water pipes. The heat now wasted is enormous in quantity; but if necessary, reservoirs of heat should be constructed, and a charge made for a supply therefrom.

Light.

According to the theory generally received at present, the whole universe is an immeasurable sea of highly attenuated matter, imperceptible to the senses, in which the heavenly bodies move with scarcely any impediment. This fluid, which is called ether, fills the whole of space—fills the intervals between the heavenly bodies, as well as the pores or interstices between the atoms of a substance. The smallest particles of this subtle matter are in constant vibratory motion; when this motion is communicated to the retina of the eye, it produces, if the impression upon the nerves be sufficiently strong, a sensation which we call light. Every substance, therefore, which sets the ether in powerful vibration, is luminous; strong vibrations are perceived as intense light and weak vibrations as faint light, but both of them proceed from the luminous object at the extraordinary speed of 186,000 miles in a second, and they necessarily diminish in strength and proportion as they spread themselves over a greater space. Light is not, therefore, a separate substance, but only the vibration of a substance, which, according to its various forms of motion, generates light, heat, or electricity. —*Spectrum Analysis, by Schellen.*

The Hudson River Ice Crop.

The present winter has been a most favorable one for the New York dealers. The harvesting of ice is now at its hight in this vicinity, and within fifteen days it will probably be brought to a close. The city of New York is chiefly supplied with ice from the Hudson river, along whose banks, commencing some miles above the city, many very large and costly ice houses are to be found. Thirty thousand tuns are commonly stored in a building, but some of the ice houses have a capacity of seventy thousand tuns.

The work of gathering the ice is worthy of a passing notice. It is first nicely scraped and planed for a distance of three or four acres, in front of or near the house, and then cut up into blocks or cakes 22 by 32 inches, and in some places 44 inches square, the work of cutting being done by saws made for the purpose. Then a canal is cut from the sawn acres to the mouth of the elevators at the house, and through this canal the polemen shove the ice along till it reaches the elevators, which are worked by steam, which catches it up two cakes abreast and conveys it to open slideways on each floor of the building, when it shoots out and down on to the floor over an inclined plane, where stowers stand ready with hooks to pack it away. Since the company have brought steam engines into use to work the elevators with, instead of horses, each house manages to lift from the river and stow away thirty cakes of ice per minute, each cake weighing about 250 pounds. This is 18,000 cakes per day, and as there are forty-two ice houses on the river, 756,000 cakes of ice are housed daily; or, to get it into weight, 94,500 tuns! One single elevator is capable of putting in 2,250 tuns per day.

The total amount of ice stored for our city market is one million five hundred thousand tuns, being almost one tun of the crystals for every inhabitant of New York and Brooklyn.

In the harvesting of this great mass of ice there are employed 6,500 men, 1,000 horses, and 42 steam engines. There are over twelve companies in the business, one of which—the Knickerbocker Ice Company—enjoys fully one half. The various planes, plows, saws, elevators, and the operations of ice harvesting generally, were fully illustrated last year in the SCIENTIFIC AMERICAN.

The Cyprus Antiquities for the Metropolitan Museum.

About two hundred boxes of the Phœnician antiquities, collected by General Di Cesnola among the ruins on the island of Cyprus and recently purchased for the Metropolitan Museum of Art, have arrived in this city. The collection, which contains ten thousand pieces illustrative of the history, religion, art and race of the ancient dwellers on the above mentioned island, which were discovered on the sites of the Temple of Golgos and the Tomb of Idalium, is dated at from 1,200 to 1,800 B. C. Twenty thousand dollars of the purchase money has already been paid, and the balance, we learn, is due within two years.

ENGLISH AGRICULTURAL IMPLEMENTS.

We find in the English *Farmer* a detailed report of the recent Smithfield Club Cattle Show, from which we extract the following notes descriptive of various important agricultural implements, and the results obtained by their actual use. We should remark, in passing, that the Smithfield Club, under the auspices of which this exhibition is yearly held at Agricultural Hall at Islington, London, is an association numbering among its members all the great landowners, farmers, cattle breeders, and agriculturists of England. It is devoted to the furtherance of agricultural science in all its branches, and especially to the improvement of the various breeds of cattle.

THE DOUBLE FURROW PLOW.

Chief of all other novelties made, perhaps, within the last two or three years, is the double furrow plow, and the special machine made by Messrs. James and Frederick Howard, of Bedford, who are the largest agricultural implement makers in England, combines the best points yet obtained. The plowman has merely to release a lever handle, when, by the onward progress of the horses, the shares are lifted out of the ground, which greatly facilitates the turning. To show the great saving of labor effected by the use of this implement, an instance of a farm of 320 acres cultivated in the four course system is given. In this case, there would be 80 acres to plow for wheat, 80 acres for barley, and 80, say thrice, for roots or green crops, which together make 400 acres to be plowed, being one hundred days' work for eight horses with four single plows. The same work would be done in the same time by five horses with two double plows, thereby setting two men and two horses at liberty to be employed in other work, These 100 days for two men and two horses cannot be valued at less than 10s. ($2.50) a day, which gives £50 ($250) gained, or above 3s. (75 cents) per acre per annum. On a farm using sixteen horses with eight single plows, plowing eight acres daily, twelve horses in four triple teams and four double plows would do the same work, leaving two men, two boys, and two horses to do other labor. It is considered by our contemporary that steam should, for heavy work, supersede the horse altogether. The engines are ready to start into a fresh field the moment they have stopped work, and remove themselves and the whole of the apparatus without any additional manual or animal labor.

FISKEN'S PATENT WINDLASS

consists of two drums carried on a strong angle iron frame, mounted on wheels. These drums are driven by strong spur gearing, to which motion is communicated by means of a friction clutch moving freely up and down on a spindle, on which is keyed the double grooved pulley, round which the endless rope passes and keeps it always running. Both the drums run on eccentric axles or studs, and either or both of them may be thrown into gear at once by means of levers. The main winding drum is underneath the frames and as near the ground as practicable, thus keeping the draft very low, a point which cannot be over estimated. It revolves in a horizontal direction, and the coiling pulleys are allowed to swing freely round to suit any angle at which it may be desired to work. By this means, all undue strains are avoided. The winding forward drum is on the upper side of the framing, and contains 50 yards of steel rope. This rope is pulled out in front and hooked to a claw anchor. When it is required to move forward, as the land is cultivated, this drum is thrown into gear, and as it coils the rope on, the whole machine is drawn forward or backward, the steerages with which each windlass is provided enabling it to follow any hedge, no matter how crooked.

Messrs. Barford and Perkins'

THREE FURROW PLOW

is simple in construction, and the frame being made in parallel bars instead of beveled framing, a lighter weight is required to produce equal strength. The plow is very manageable at the headlands; the steerage is quick, and the holder has perhaps more power over the implement than in other plows of a like kind. The beams are expanding, and furrows of any width, from 8 to 11 inches, can be turned over.

Mr. Murray, of Banff, Scotland, has devised

A NEW STEAM PLOW,

in which the principal novel feature is a combined plow and subsoiler, which is convertible into a three furrow plow or a two furrow plow and two subsoilers. There is a strong bracket attached to the side of the frame, and the subsoiler tine is fixed in the same with a strong wrought iron shoe upon it, and runs in the previously plowed furrow close behind the wheel. This tine and shoe can be so regulated as to go to any depth, from 3 to 9 inches below the plow; the plow follows, and covers up the loosened subsoil. The second subsoiler runs immediately behind the first plow, and the second plow follows, and again covers up the loosened subsoil, and leaves the firm furrow unbroken in the subsoil for the wheel to pass over in the next "bout," which is, as already stated, immediately followed by the first subsoiler, and thus the whole field is plowed and subsoiled without a wheel or the least pressure upon it, and leaving it in a fine, loose, broken up state, allowing the water to sink freely, and be also operated upon by the winter frost and air.

Regarding

REAPING MACHINES,

they have received a wonderful impetus since the English Exposition of 1851. Americans, Englishmen, and Scotchmen have alike been vieing with each other in an attempt to perfect them. There is scarcely a farm of any size (with a tenant of any enterprise) which cannot exhibit one in its shed after the work is over for the season; and on many farms there are four, five, and six in use. We have said that they were to be seen in the shed when the reaping was over; we regret that this is not always the case, as too often the machines are left out in the rain to their great detriment. A few pounds of paint, well distributed over the implements out of employ, would ensure many of them lasting more years than they do, under the let-well-alone system, and keep them good looking all the while.

Wood's

COMBINED REAPER AND MOWER

is considered the best. The raker's seat is so placed that he can easily lift the crop and gather down the grain. A seat for the driver has been added, which not only removes weight from the horses' backs, but so balances the machine that all pressure is taken from their necks.

Messrs. Haughton & Thomas, of Carlisle, have introduced a reaping and mowing machine, called

THE ROYAL CLIPPER.

The pole and frame are so connected that, by the application of a screw, the driver can set the fingers and knife to any angle of "cut" without leaving his seat. The crank shaft pinion is fixed near the upper bearing which tends to evenness in the wearing of the brasses.

Messrs. W. A. Nicholson & Son exhibit

A DOUBLE ACTION HAY MAKING MACHINE.

It has four motions, namely: a forward motion of the ordinary speed and a more rapid one, and also a slow and a quick backward motion. The quick forward speed is calculated for a heavy slow horse, while the ordinary speed is right for a quick stepper. The ordinary rapid back action is best for lightening up and finishing the crop, and the slow motion, for delicate handling of grass that has been allowed to stand until over ripe.

THE SKELETON HARVEST CART

is a light wagon designed for use in the harvest field, where heavy bodied and wheeled carts make such indentations that the plowman has difficulty in getting over them. With a length of 12 feet, it has a breadth of 6 feet 6 inches.

Tasker's patent

BALANCE ELEVATOR

has a trough made of a sufficient length to enable the corn or hay to be delivered at the required hight without raising the trough to an almost upright position, consequently the produce elevated is delivered farther in the stack instead of being dropped just at the outside, as is the invariable result obtained from all elevators in which a shorter (and therefore cheaper) trough is used.

The

THRASHING MACHINES

made by Messrs. Nalder, differ from those of other makers in the relative position of the places for the corn, chaff, cavings, and straw. The former is delivered at the back end of the machine, and the chaff behind the head wheel, having a more roomy span than usual, which also enables them to blow the chaff for chaff bagging direct into the bag at once without the use of an extra blower strap, the bags being fixed on a sliding frame and taken away from either side of the machine.

The Cost of Pavements.

Commissioner Van Nort of the Department of Public Works of this city has made careful investigations into the subject of the various kinds of pavements now in use on streets. From his report, we give several extracts below.

It will be noticed that, of the various kinds of wooden pavements that have been laid, none have successfully withstood the test of actual usage. It did not require, however, any official report to advise us of this fact, for the wretched condition of the streets in which wood has been substituted for stone is ample evidence of the unsuitableness of the former for city thoroughfares and heavy traffic.

The bituminous or asphalt pavements are even worse than those of wood. In several of our streets and avenues during the days of the Ring, parties contrived to get permits to lay their combinations of tar, gravel and stone. As a result a large portion has been removed, and the present appearance of the roadway where it remains would be a disgrace to a military corduroy. The Commissioner says nothing on the subject of foot pavements, though we should rejoice to see the department over which he presides take some action in regard to the dangers of the sidewalks which now line our principal streets. It has become fashionable of late to lay massive blocks of granite in place of the times honored blue flagging. The friction which wears away the latter simply polishes the former, so that, on wet days and more especially in icy weather, they present a surface as dangerous as one of smooth ice.

Add to these the system of raised vault covers, which are just curved enough to cause an unwary walker's feet to slip from under him, and it is doubtful if a more complete man trap could well be devised. Iron pavements are even worse and indeed the only materials, over which one can pass in frosty weather without fear of a sudden fall, are the limestone flags or granite of which the surface is made very rough and irregular.

The Belgian pavement, it will be noticed, is considered the best; and among the others enumerated are the old fashioned or cobble stone pavement. The report states, in regard to prices for new work, that they at present range about as follows:

1. For cobble stone pavements, 55 cents per square yard.
2. For Belgian or trap block, $2.40 per square yard.
3. For Guidet improved, $6 per square yard.
4. For granite block, like trap, $2.56 to $2.89 per square yard.
5. For Fisk bituminous or asphaltic, $3.50 per square yard.
6. For wooden, $5 per square yard.

When not subjected to much travel, the cobble stone pavement is durable, if well laid, and comparatively cheap to maintain.

The Belgian granite or trap block pavement is more expensive than the cobble stone, but is much better for travel and infinitely more durable under heavy traffic; and it is easier and cheaper repaired than any other kind subjected to equal wear.

The Guidet improved pavement has been in use but a few years and gives satisfaction so far, but it is the most expensive at first of any in use, and its durability and proportionate cost of maintenance is yet unknown.

The bituminous or asphaltic pavements so far have not proved serviceable in this city and are expensive to lay and maintain. In many European cities they are well thought of, but in Paris the use of horses on them, unless smooth shod, is forbidden, and great difficulty is experienced in travelling on them with smooth shod horses in winter weather.

There are, and have been, many kinds of wooden pavements laid in this city within a few years, but so far all have proved very expensive to lay and maintain, and it is doubtful if any form or preparation of wood can be made and maintained except at great cost, as the same organic difficulty exists with all kinds, namely, speedy decomposition; various preparations of the wood have been tried within the last ten years, but all have failed to preserve the wood from decay. Of all the wooden pavements in use, the stone foundation appears to be the most durable.

Herewith is appended a statement showing the amount of wooden pavement laid in this city since the year 1866, in various places, with the number of square yards and the contract cost and total expense of each.

The aggregate number of yards is 391,688, and the total cost has been $2,254,478.97, exclusive of 1,416 yards laid at private expense, the cost of which could not at this time be ascertained; the average time the pavement has been laid is about three years, and its condition such as will average about one half rotted and worn out; during the present year there has been expended on repairs to wooden pavements the sum of $85,000, which, at the cost of $4 per yard for relaying, gives 21,250 yards relaid, or 5½ per cent of the whole, and the amount of the appropriation for the year has been insufficient to do the needed repairs, consequently many of the streets which were first paved with it are in very bad condition.

Assuming that no more wooden pavements will be laid in this city, it is estimated that at least 80,000 square yards of renewal will be required in each year to maintain the present quantity; and if that is done with patented material at the present price of $4 per yard, it will entail an annual expense of $320,000 for 18·3 miles in length of streets, or an average of $17,486 per mile per year, while the repairs to stone pavements in 290 miles of streets have cost but $150,000 or an average of $517 per mile per year.

Steam Improvements.

Sir William Fairbairn, in a recent address, made the following prediction: It has been my province for a great number of years to encourage and promote the use of high pressure steam, and, by working it expansively in properly constructed engines, to effect a saving of fuel under any condition and and every circumstance in which it is employed. I need scarcely inform you that much has already been done in that way, and that a saving of one half the fuel has been effected by working high steam expansively, or in other words, it may be stated that the same quantity of fuel does double the work it accomplished forty years ago. This, you will observe, is a well known fact; and it is encouraging to find that we are still far wide of the maximum of pressure by which still greater saving may be effected; and I entertain sanguine hopes that the time is not far distant when another half may be saved, and when we may congratulate the public on a further saving to the amount of one, or a fraction of one, pound of coal per horse power per hour. This can only be effected by an increase of pressure, retention of heat, and a judicious application of the force through the medium of a well constructed engine. I am not prepared to state the amount of pressure to which steam may be increased; but, judging from my own experimental researches, and those of others, I have reason to believe that we are still far short of the maximum to which the pressure of steam and economy of fuel may be carried.

SINGULAR DEFECT IN AUSTRALIAN GOLD.—It said that some 6,000 or 7,000 lbs. of Australian gold, known as "brittle," having recently been coined by the French mint for the Bank of France, all the pieces have been found to admit of being easily broken, and they have therefore to be remelted. This is attributed to the presence of a small percentage of antimony and arsenic, extremely difficult of removal; and these elements are known to produce a similar effect in all metals or alloys which are subjected to the molecular changes induced by the pressure and heat developed under the action of the dies in the coming press. A medal, which bears on the obverse the portraits of Dr. Janssen and Mr. Lockyer, and on the reverse the chariot of the sun with Phœbus indicating the prominences of an eclipsed sun, has been forwarded to the latter gentleman by the French Government, in commemoration of his discovery of the method of observing the sun's chromosphere without an eclipse.

IT is stated that the authorities of the Royal Gun Factories, Woolwich, England, have designed and are prepared to construct a 70 tun gun, which shall throw a projectile of 1,400 pounds.

Recent American and Foreign Patents.

Improvement in Revolving Fire Arm.

Otto Schneeloch, Brooklyn, N. Y.—The object of this invention is to throw as many balls of a given size as possible from a barrel of minimum weight; and this is accomplished by constructing the several bores of a triangular shape, one angle of the triangle having its vertex near the center, while the other two have their vertices near the circumference of the cylinder. These triangles may be plane or spherical, and isosceles or otherwise, since the principle involved consists in causing the balls to approximate as nearly as possible to the center of cylinder, and in the closest juxtaposition to one another. This utilizes the greatest portion of volume of the cylinder without impairing the necessary strength of the metal.

Improvement in Pipe Tongs and Cutters.

James E. Roache, New York city.—This invention relates to an adjustable and very simple instrument for clamping pipes, tubes, and other objects of varying diameters, and to means whereby the same instrument can be converted into a cutting tool for pipes and cylindrical or prismatic rods or tubes. The invention consists in the new general arrangement of parts whereby the tongs will be operated by a strong jaw resting on a lever that is vertically adjustable, and has its fulcrum on the end of a screw, so that, by turning said screw and raising or lowering the lever, the size of the tongs will be adjusted for smaller or larger articles. The invention also consists in the arrangement of a cutting tool, which is placed upon the recessed griping edge of the movable jaw, and thereby held with sufficient firmness to operate in the desired manner.

Improved Oil Cake Stripper.

Washington Hawes, Port Richmond, N. Y.—This invention consists of a revolving cylinder with one or more hooks or points in its surface combined with a table, whereon the oil cake to be stripped of its cloth covering is placed under the cylinder in such manner that one end of the cloth cover is hooked up by pins on the cylinder, and attached to it so that the revolution causes the cloth to be wound on it and stripped from the cake, which is first moved from under the roller and then over it and partly under it again, in such manner that the cloth which is wrapped over the cake endwise will be unwrapped from both sides and the ends, and the cake delivered upon the table, to be removed. The motion of the cylinder then ceases, and the cloth pulled off by hand, the cylinder being revolved by pulling the cloth An elevating device is also combined with the table for use, if necessary, in pressing the cake upon the roller, to cause the pins to engage the cloth.

Improved Rudder for Vessels.

Augustus H. Murphy, New York city.—This invention consists of adjustable bearings, with friction rollers for the rudder post, placed on the deck and adjusted around it under a collar attached to it by screws, so as to make a close bearing that will prevent lateral play, and at the same time allow it to turn freely, also so as to support a portion of the weight by the collar which, said bearings and the collar being removed, will allow the rudder to be unshipped and a new one to be shipped readily at sea, in case of necessity. The invention also consists of a rod so applied to the rear edge of the rudder in such manner that in case it becomes desirable to support the lower end of the rudder with brace chains, they can be attached above the water and afterward let down to the lower end, or, in case of shipping a new rudder, the chains, after doing service at the lower end, can be raised up to the surface of the water to be detached.

Improved Water Ram.

Christopher Hodgkins, Marlborough, N. H.—The invention consists in holding the valve beam by a slide. The two supply pipes of the ram are provided at their outer ends with valves which are suspended from a beam, for the objects specified in the letters patent of the United States numbered 119,564, and dated October 10, 1871. Instead of communicating directly with the air chamber, the pipes are in the present case separated thereform by diaphragms of leather, rubber, or equivalent fabric, made slightly bagging above the apertures of the pipes. The spring water or liquid to be raised is admitted through a pipe to a chamber, which is interposed between the diaphragms and the bottom of the air chamber. A valve closes a hole in the bottom of the air chamber. Thus it will be seen that the operating water in the pipes is separated from the water to be raised by the bagging diaphragms. The water to be raised is further separated from the discharge pipe by a suitable valve. When a valve of one supply pipe is raised, the pressure of water within causes the diaphragm above it to be swelled up, and the water in the chamber, being thereby pressed and being less elastic than the air in the air chamber, enters the air chamber, whence it escapes to the discharge pipe. The same action will be effected alternately by the two pipes, as their respective valves are closed.

Improved Wagon Brake.

Ezra T. Bucknam, Sonora, Cal.—This invention relates to improvements in that particular class of self-acting wagon brakes in which the reach passes loosely through the rear axle and permits it to move forward when the wagon is descending a hill and thus put on the brakes. The improvements consist, first, in the peculiar manner of suspending the brakes, and the arrangement of the levers for applying them; secondly, in an improved manner of securing the wagon bed upon the bolsters and rear axle bed so as to cause the full weight of the load to regulate the pressure of the brakes upon the wheels. It also relates to an arrangement of rollers or a revolving sleeve upon the front standards, for the purpose of acting in combination with the rollers on the bolster, to allow the bed to slide forward freely.

New Mixing Apparatus for Soap, Paste, Clay, etc.

James Atkiss, Brooklyn, N. Y.—This invention relates to a new machine for mixing soap, clay, paste, or other material of any kind; and consists, first, in making the rotary mixing tool, which turns within the containing cylinder, up and down, movable while being revolved, so that it will reach and agitate all the stratums of the contents of the cylinder. This adjustment is done by mounting the rotary mixing tool upon a spindle which has a screw thread cut upon it beneath he containing vessel, and which passes through a female screw secured in or under the bottom of said vessel, so that when the spindle is revolved it will be screwed up or down, as the case may be. A sleeve embraces the said spindle beneath the containing vessel, and is connected with an arm of a rock shaft, from which another arm connects, by a rod, with a weighted lever, so that as the sleeve, by the rotation of the spindle, is moved up or down the rock shaft will be vibrated, whose connection with the weighted lever will cause the same to first swing in one direction and then in the other. This connection of the weighted lever serves to regulate the position of several gear wheels, by which motion is transmitted from the driving shaft to the aforementioned screw spindle. The object of this connection is to reverse automatically the motion of the spindle without reversing the motion of the driving shaft; and this object is attained by the aforementioned connection of the rock shaft with the weighted lever; for when the sleeve has been worked up to its greatest hight the weighted lever will be projected to one side and tipped to carry the opposite gear in connection with the driving shaft; and when, on the other hand, the sleeve has been carried down to its greatest extent the weighted lever will be once more tipped in the opposite direction to reverse the transmission of motion from the driving shaft. Thus it will be observed that the invention appertains not only to the mixing tool and mode of turning and operating the same, but also to the means of regulating the direction of motion transmitted from the driving shaft to the screw spindle.

Improvement in the Manufacture of Horse Shoe Nails.

Hazen R. Underhill, Derry, N. H.—This invention has for its object to furnish improved horse shoe nails, stiffer, smoother, and more uniform than nails made in the ordinary manner, being thus more readily driven and less liable to injure the hoof, and which shall at the same time be no more expensive; and it consists in the mode of forming horse shoe nails, that is to say, by rolling, forging, or swaging them into round form, and then flattening them with a drop hammer; and in horse shoe nails made with rounded edges and flat sides.

New Process of Treating Grain.

Alexandre Sezille, Paris, France.—Heretofore grain has been prepared for bread making by grinding. This grinding allows but about eighty per cent of the grain to be utilized, leaving twenty per cent of bran and residuum. his eighty per cent of flour allowing a high yield of forty per cent of white bread, produces one hundred and twelve kilogrammes of white bread, out of one hundred kilogrammes of grain. By this process, without grinding a yield of from one hundred and forty-five to one hundred and fifty kilogrammes of white bread is obtained out of one hundred kilogrammes of grain —a yield exceeding the ordinary one by thirty-three per cent. The grain is slightly wet with two or three per cent, according to its dryness, of water heated to 30° or 40 centigrade. Steam may be employed if desired. This wetting is made mechanically and gradually as the grain is required for decortication. In three or four minutes after being moistened, the pellicle of the grain expands and is ready for decortication, for which any suitable apparatus may be employed. The grain after being moistened should not tand more than fifteen minutes before being submitted to the decorticating process, as the dampness, instead of being confined to the pellicle, would begin to affect the bodies of the kernels and make the decortication more difficult. The grain when properly decorticated can be preserved for any desired length of time, to be afterward converted into paste, when required. To remove the coloring matter of the grain, which is located directly under the epidermis, and which, upon fermentation, produces the brown bread, the decorticated grain is steeped in a bath of water heated to 80° centigrade for half an hour, by which time the temperature of the water has fallen to 46° or 45°. The water is then decanted, and new water of the same temperature—namely, 45° or 45°, and no more—is put on the grain three or four times in the space of three or four hours. By this time the grain has absorbed enough water to be easily converted into paste, which is done by passing it twice through cylinders similar to those used by chocolate dealers. The paste thus obtained is ready for fermentation, and has then only to undergo the ordinary baking process to become good bread.

New Apparatus for Graining Gunpowder.

Paul A. Oliver, Wilkesbarre, Pa.—This invention has for its object to facilitate the reduction of gun and blasting powder into grains of the requisite size and configuration; and consists principally in the use of a series of reciprocating knives, which cut the cakes of powder into pieces and gradually reduce the pieces until the desired degree of fineness has been obtained, all without creating waste in the form of dust to such an extent as the same is being created by the devices now in use. The invention also consists in the combination with said reciprocating cutters of adjustable feed devices for moving the powder to be cut, and of means for cleaning the knives of any powder that may adhere to them.

Improvement in Oyster Tongs.

Isaac Smith, Bruceport, Washington Territory.—This invention consists in providing the head of a pair of oyster tongs with transversely perforated ribs so as to render the bars more readily and conveniently detachable.

Improved Cultivator Plow.

Cealy Billups, Norfolk, Va.—This invention relates to double mold board or shovel plows, and consists in constructing the wings not only with a perforation by which they may be bolted to the shoe, but also with a separate stud on the inside of each shank, which serves to take the strain off the screw and hold the wing securely in position. The ratchets or notches on the side of the shank and shoe, by which this object was accomplished in the improved cultivator plow, patented May 7th, 1872, are somewhat difficult to cast, and hence more expensive than the simple stud under the present plan, while parallel series of perforations allow the required adjustment. The invention also consists in the mode of giving adjustment to the pitch of the plow by a sliding slotted wedge arranged between the standard and beam, whereby, by simply loosening a single clamp screw and moving the wedge in either direction, any desired degree of pitch may be obtained. The invention also consists in a new mode of arranging the handles with respect to the plow irons by attaching them about midway between sole and beam, and so that they will be brought into an oblique plane passing under the shovel or plow. This arrangement is found by practical experiment to give the plowman an easier and more complete control of the plow.

Improved Manufacture of Jewelry.

Shubael Cottle, New York city.—This invention consists in a new method of forming an inner barrel on a jewelry base, and in certain novel means by which it is effected with great celerity and economy.

Improved Piano Action.

John Shandelle, Huntsville, Ala.—This invention has for its object to produce a pianoforte hammer head, which shall present a thin and elastic surface to the string and retain its original elasticity after long and constant use, and the invention consists in constructing the hammer head of india rubber, and in providing the same with an opening near its tip or striking surface.

Improved Smut Mill.

Charles Kuderli, Waumandee, Wis.—This invention relates to a new smut machine in which a vertical shaft, having a series of horizontal disks and vertical wings, is caused to revolve within an upright cylinder of perforated material having horizontal inwardly projecting ribs, so that the disks and wings will throw the wheat or other grain outwardly against the cylinder, while the ribs of the latter will again throw it in toward the shaft, thus reciprocating the grain and insuring the desired result.

New Mixing and Grinding Apparatus for Ink, etc.

Joseph Martin, New York city.—A suitable vessel, the interior of which is made in the form of an inverted truncated cone, forms the outer part of the grinder. The inner part of the grinder is also made in the form of an inverted truncated cone, and fits into the interior of the vessel, space being left between the bottoms of said parts for the ink and paint to pass from the center of the core to its circumference. Upon the top of the core is attached gearing connected with the driving pulley. A tube extends down through the center of the core. To the upper end of the tube is attached a vessel in which the ink and paints are mixed. A post of a smaller diameter than the interior of the tube passes through the core. The lower end of the post is secured to the bottom of the vessel, and its upper end projects into the mixer. A valve retains the ink or paint in the vessel until it has been thoroughly mixed. To the upper part of the post is rigidly attached a cross bar or scraper, in such a position as to be close to the bottom of the vessel, so that the ink or paint may be thoroughly mixed before it is allowed to flow down into the grinder. The valve moves up and down upon the post. As the ink or paint passes down through the tube into the space between the bottom of the core and the bottom of the vessel, it is forced, by its own gravity and the centrifugal force engendered by the revolution of the core, to pass up between the outer surface of the revolving core and the inner surface of the stationary vessel, being thoroughly rubbed and ground during its passage. In the upper edge of the vessel is a spout, through which the ground ink or paint is discharged into a receiver.

Improved Car and Cable Coupling.

Winfield S. Nearing, Morris Run, Pa.—This invention relates to a new kind of clamp which is to be attached to railroad cars or other moving devices for connecting them to wire or other cables that are in motion, so that whenever such car or device is by the clamp connected to the cable it will be propelled by the same, while it will remain at rest as soon as disconnected. The invention consists in constructing a clamp of two pivoted jaws which are held apart by an intermediate spring, and can be drawn together against the rope or cable by a cam attachment to a lever that turns on a pin projecting from one of the jaws.

Improved Insect Trap.

Japhthah W. Stell, Gonzales, Texas, assignor to himself and William B. Cavitt, of same place.—This invention has for its object to furnish an improved ant trap which shall be so constructed that the ants can get into it readily, but can not get out, so that they may be easily destroyed; and it consists in the ant trap formed of the ring plate or disk, the two inclined plates roughened upon their outer sides and smooth upon their inner sides, and the two inclined plates smooth upon both sides.

Improved Cultivator.

Frederick W. Tolley, Coxsackie, N. Y., assignor to himself and A. V. D. Collier, of same place.—This invention has for its object to furnish a malleable or wrought iron plow standard, which shall be so constructed that it will not clog or choke with sods, grass, weeds, or other obstructions, and to which the plow plate may be easily and quickly attached and detached. By suitable construction, when the cultivator is being used, the pressure of the ground will tend to force the plow plate upward, and thus more securely fasten it in place.

Improved Wash Boiler Attachment.

Edward Choate, New York city.—This invention has for its object to furnish an improved automatic circulator for wash boilers, and other boilers and vessels in which steam is used as a cleansing, bleaching or cooking agent, and it consists in the flanged plate provided with a discharge pipe, and having one or more openings formed in the flange at the end of the plate furthest from the pipe, and half an inch, more or less, below the said plate.

Improved Wagon.

John N. Stewart, Belfast, Me.—This invention has for its object to improve the construction of slung bodied carts, in which the cart body rests upon springs which rest upon the middle part of a crank axle, so that the cranks of the axle may be securely supported in position; and it consists in the slotted stakes in combination with the bends or cranks of the axle, and with the cart body resting upon springs attached to said axle. By this construction the axle will be held firmly in position, however much the body may move up and down upon the springs.

Improved Turn Table for Railroads.

John Enright, Cleveland, Ohio.—The invention consists in a turn table for railroad cars or locomotives made in two parts, constructed and applicable to each other so as to exclude dust and prevent obstructions to its easy movement. It also consists in forming a step and groove enlarged to receive lubricating material.

New Steam Coupling for Heating Railroad Cars.

Wm. N. McDuffey and Benjamin F. Jaques, Petersburg, Va.—The invention consists in a coupling wherein the steam inlet and outlet valves and the grapples which hold together the two parts are operated simultaneously by the same device and by the same movement. The invention also consists in combining, with the heating pipes or coil, a pipe which carries the condensed steam back to the feed water chamber, tank or vessel connected therewith

New Machine for Bending Bars and Tubes.

Amos Harris, of Minneapolis, Minn., assignor to himself and Franklin L. Putnam, of same place.—This invention relates to an improved apparatus for straightening or bending metal bars, shafts, tubes, rods, etc.; and it consists in the combination of a hook, a screw, and a bearing plate, forming a clamp adapted to control wearing substances on opposite sides of an article to be bent or straightened, and can be used to draw such surfaces nearer together or spread them further apart until the desired effect has been obtained. The invention is applicable to all shafts, etc., while the same are in lathes or hung in bearings in shops, or in any other position whatever.

Improved Elevator.

Andrew Blass and David Brown, Brooklyn, N. Y.—This invention relates to elevators in hotels and other buildings, whether used for elevating passengers, baggage, or merchandise, and consists in one or more plates or shutters connected by chains or ropes with the bottom of the car or freight platform, so as to partition off and close the elevator well when the car or platform is raised, thus preventing danger to life from falling down the well, and stopping the draft of air and closing the communication by which fire is apt to spread from one story to another.

Improved Oscillating Chair.

William T. Doremus, New York city.—This invention has for its object to furnish an improved oscillating chair, and consists in the combination of one or more hinges and one or more rubber blocks with a pedestal and chair seat, and in the combination of a stationary nut, hollow screw, rigid plate, hinged screws, and rubber block or blocks with each other and with the pedestal and seat of a chair.

Improved Saw Filing Apparatus.

Frederic E. Frey, Bucyrus, Ohio.—This invention relates to a new grinder machine for sharpening or gumming saws, circular or upright, sharpening molding bits, or other articles for which emery or grinding wheels are used. The invention consists more particularly in hanging the emery wheel in a jointed frame, which, by virtue of its several joints, is under full and absolute control of the operator, who can therefore set and apply the grinding wheel at any suitable angle to the article to be sharpened.

Improved Reflecting Lamp Chimney.

Adam Kunkle, Birmingham, Pa.—This invention has for its object to furnish an improved lamp chimney which shall be so constructed as to throw a stronger light and be less liable to break than the ordinary glass lamp chimneys, and which will not require a shade when the lamp is used for reading, sewing, and similar purposes, and which shall be easily cleaned. The chimney is a cylinder of suitable material, with its axis horizontal, in the open ends of which are placed lenses.

Improved Nut Lock.

Bernhard Fürst and Peter Oettinger, Lacon, Ill.—This invention relates to a new nut lock in which a spring dog fits into a recess or chamber of the nut to bite against vertical grooves or creases in the screw.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From January 1 to January 2, 1873, inclusive.

CRUSHING STONE, ETC.—A. H. Smith, Brooklyn, N. Y.

DIES.—C. F. Wilson, Northbridge, Mass.; S. H. Miller, J. E. Folk, Brooklyn, N. Y.

HORSE BRUSHING MACHINE.—J. H. Small, Buffalo, N. Y.

PAPER RULING MACHINE.—E. D. Averell, New York city.

PREPARING COTTON.—T. C. Craven, Hudson, N. Y.

SADDLE CHAIN.—W. B. McClure, J. C. Graham, H. O. Claughton, Alexandria, Va.

SPINNING MACHINERY.—O. Pearl, J. B. Battles, Lawrence, Mass.

NEW BOOKS AND PUBLICATIONS.

THE NATIONAL BUILDER, a complete work on Constructive Carpentry—for the use of Architects, Carpenters, Builders, and Stair Builders. By James H. Monckton. New York: Orange Judd & Co., 245 Broadway. Illustrated. Price, $12.

A finely printed quarto volume, forming an exhaustive treatise on the subject to which it is devoted. The simplest methods of finding all joints and geometrical forms are given, including splayed work, groined ceilings, framing, roofing domes, niches, raking and level moldings, etc. The topics of stair building and hand railing are treated in an entirely original and excellent manner. The work contains ninety-two handsomely executed plates, with one thousand figures printed in colors, presenting designs for stair cases, newels, balusters, and other carpentry. The trades and professions for which this book is written will find in it a great amount of valuable information condensed into the smallest compass.

THE OWENS COLLEGE JUNIOR COURSE OF PRACTICAL CHEMISTRY. By Francis Jones, Clinical Master in the Grammar School, Manchester, England. With a Preface by Professor Roscoe, F. R. S. Price $1.25. New York: Macmillan & Co.

This is an admirable text book, written with the careful attention to detail necessary in an elementary work. Although intended, as its title page indicates, for the use of beginners, it may be read with profit by all students of physical science. Any one who becomes thoroughly acquainted with the contents of this little book will have a well grounded knowledge of the principles of the chemical world. In tuition, the catechism at the end of the work will be found exceedingly valuable.

THE PRACTICAL MAGAZINE; an Illustrated Cyclopædia of Industrial News, Inventions, and Improvements. Price 2s. 6d. monthly. Published for the Proprietary, at 7 Printing House Square, London, England.

A substantial publication, illustrated with numerous engravings, among which we observe Mr. James Short's loom, the illustration and description of which are extracted from our pages. The magazine is well printed, and like most English industrial publications, has its advertising pages well filled.

Business and Personal.

The Charge for Insertion under this head is **$1** *a Line.*

Notes & Queries

1.—V. asks: What is the cause of the scale which is found on malleable iron castings?

2.—C. asks if there is anything better than wax to fill cracks in wood previous to varnishing; if so, what is it?

3.—H. L. B. asks: How can I remove paint (in pinhead spots) about a year old, from plate glass windows?

4.—H. L. B. asks how to make the carmine stamp ink used on a ribbon stamp for canceling purposes.

5.—C. asks: How can I case-harden part of an object, such as the face of a hammer head, and leave the rest soft?

6.—J. B. B. asks: What varnish or composition will make cloth waterproof without causing it to be stiff and sticky, or to lose its color?

7.—C. asks: Can corundum be used for grinding on a wheel, like emery, and is it better than emery for grinding steel and iron

8.—A. M. J. says: I would like to know what cement, if any, there is that will stop the leakage of crude petroleum from iron tanks which are caulked and riveted.

9.—J. E. F. asks how to preserve and stuff birds, and how to dress their feathers, which get spoiled in killing.

10.—L. H. W. asks: How can I temper small pieces of steel wire, 1-16 of an inch in diameter and less and 1 inch long? I wish to temper 100 at a time.

Answers to Correspondents

G. G. S. asks: What is the present variation of the magnetic meridian from the true meridian? What is its variation at different times since 1750? Is it still moving westward, and has it been so through that entire period, or has any change from the west to east taken place? If so, when did it occur? Answer: The information desired can be obtained from the United States Coast Survey Report. The variation is still moving westwardly and has been continuously since the date given. The exact variation at the given locality can be determined at any time by any surveyor who understands his business thoroughly. Apply to the nearest one.

A. H. S. says: I intend to build a residence next spring, and desire to make the house warm and rat proof, if it can be done without too much expense. I proposed to fill every space between the studding with brick and mortar, leaving space of 1½ inches for room for plastering. I am recommended to fill spaces with dry sand or dry ashes sifted fine. If I fill with brick, I must haul them, by team, 8 or 9 miles, while sand may be obtained within half a mile at trifling cost. Which had I better use for my purpose? Will not sand rot wood work, even if put in dry? Will the small nails used to nail on the lath be sufficient to sustain the pressure of the sand, the studding being 15 or 16 feet high? It is suggested that sand would stifle any fire that might start by closing around it, thus rendering building much safer. Answer: There is danger of the outside boarding becoming open by shrinking and warping, in which case the sand will run out through the open joints or laps. Dry sand has been used for deafening between floors to the extent of four inches in thickness, but a special boarding is put in to receive it, so as not to bring the weight upon the plaster; the result in this case as to dry rot has not been determined. But timber encased in plaster and in iron has developed a very dangerous rot in this city. Your safest plan will be to interlath between the studs and plaster one good coat, if you do not wish to incur the expense of brick filling. But you had better fill in at the end of your floor joists with brick, so as to cut off the connection of the floor spaces with the wall spaces, and so prevent the passage of wind or rats into the floors.

S. J. H. asks: Why does not a top fall when spinning, the same as when it is not spinning? Answer: The principle is, in some respects, similar to that of the gyroscope. Consult Peck's "Mechanics for Schools," etc. We will endeavor to find space and time to translate it into less purely mathematical language at some future time.

E. O. McC. asks: How far can water be drawn on a perpendicular, with a fire engine? Answer: Probably not 30 feet. 33'95 feet is the highest that a column of water can be supported by ordinary atmospheric pressure.

J. V. H. N. says: I have a little turbine wheel with which I run my printing presses. It is situated in my second story. The manufacturer stated that I would lose no power by placing it there, provided I made a draft tube of the discharge pipe, by inserting its end in a tub of water and making it air tight. I had the discharge pipe made siphon like at the lower end. The query is: Do I lose power by the siphon arrangement; and, if it is not perfect, would I lose power by the water and tub arrangement, and if so, how much? If I lose power by either arrangement, I should like to know, for in that event I would place the thing in my cellar. Answer: Any arrangement by which you make a complete seal of the lower end of the discharge pipe against the ingress of the air, and thus retain the tube full of water, will be effective with a properly constructed wheel, provided that it is not placed at a greater hight above the discharge opening than that due the pressure of the atmosphere, and provided that the arrangement does not impede the flow of the water. If the seal is imperfect, head is lost and also a proportionate amount of power, by the entrance of the air.

J. F. asks which will be most effective, a circular saw with 48, or one with 26 teeth, in cutting pine board. Answer: The size of saw or speed of its periphery should be given. We cannot give a definite answer as the question is asked. At one speed, the teeth might be set too close if 48 in number, and at other speeds, they would be too far separated if 26 were used.

O. K. asks if it is advisable to drive a 4½ feet burr millstone with a quarter twist belt from the engine shaft to the spindle, and how wide must the belt be. Answer: We do not like quarter turn flat belts, but properly arranged, and with plenty of length, they sometimes do well. Try a 5 inch belt, if you have good distance between the stone and the line shafting.

J. P. W. says: I have lately put into my shop a ventilator 14 inches square and about 14 feet long, extending from the ceiling overhead, 7 feet out of the roof. I have a hood at the top to cover it, which can be raised any distance, from 2 inches to 3 feet: but it will not draw. A current of air sets downwards most of the time. What is the trouble? Answer: We presume that an equally large volume of air rises through the chimney or elsewhere, where the upward draft is more powerful.

T. I. F. asks: In making the driving or band wheel of a common horse power larger, to increase speed, what proportion in length ought the levers to be, to make any gain in favor of the team, if any, as the larger the circuit the slower is the speed? Answer: Increasing the size of the band wheel in the horse power machine will increase speed of driven pulley at the expense of the driving force, which will diminish in similar proportion. No alteration for the purpose of regaining the lost advantage will be successful except by sacrificing the speed gained.

O. N. asks: Which end foremost will a log, thirty feet long and twenty inches in diameter at one end, tapering to a point at the other, tow easiest in water? Answer: The log will move more easily with its sharp end foremost. The principal resistance in propelling properly formed bodies in water comes from the friction between the surface of the body and the water. In the case of a blunt log or a blunt vessel, the resistance is increased by the piling up of the water in front. If the log is moved sharp end first there is no front piling of the water, but the latter is divided and swings away sidewise with little or no resistance, like the pendulum of a clock.

T. R. L. says: Last summer I noticed on the grass of my lawn a circle or ring of a bluish or ash color, about 8 inches wide and 10 feet in diameter. Upon examination I found that each blade of grass composing the circle was covered on both sides with a kind of mildew, which, when undisturbed, was of the bluish color; but when rubbed between the fingers, it became black. The grass was about 4 inches long, and when the mower was run through it, this substance rose in a cloud and was blown away. On another part of the lawn, there was another portion of a circle, about one half. As I never saw one before, can you let us know what caused it, and why it assumed the circular form? Answer: It would be impossible to give a positive answer without some of the substance for microscopical examination. But it is very probable that a mushroom would have been found in the center of the circle, and that the "mildew" was caused by a scattering of the myriad spores of the fungus.

E. A. N. says: A discussion has arisen between myself and an old experienced engineer relative to some trouble that I am having with the feed pipe of the engine that I have charge of. The bends in the heater last but a very short time, and I have had to renew the whole pipe from the pump to the check valve (some parts of it several times) in the last twelve months. The tank is round, and about 8 feet in diameter at bottom, and just taper enough to hold hoops; it is between 8 and 9 feet high and is raised 9 feet from the ground. The pipe from the tank to the pump is one inch gas pipe. The pump has a solid plunger 2⅜ inches in diameter and the pipe that troubles is 1 inch gas pipe. The old engineer contends that the pipe is large enough, and that the water contains some mineral that injures the iron when heated; I say that the pipe is entirely too small, and I suggested to him that the pressure of the tank greatly assisted the atmosphere in promptly filling the vacuum produced by the pump, while the heat communicated to it (the water) would expand it and thus, having the pressure in boiler to contend with, would create great friction. In proof of my position, I called his attention to the stand pipe (which is 1½ inch gas pipe from the check valve to the boiler) and is seemingly as sound now as when put in. Will you give your views on the subject? Answer: We think the pipe too small altogether, unless the pump runs very slowly indeed. If the trouble arises from oxidation by anything dissolved in the feed water, it should be easily detected.

D. M. says: I have a brick building covered with tin, with a parapet roof; and from some defects in putting on the tin, it leaks badly, especially during very heavy rains. The mechanic blames the tinner, and the tinner the mechanic. I think both are to blame. Please advise me whether I had better tear off the roof or not. I had the parapet roof to secure safety from fire from buildings a short distance off. It may be best to change the roof from a parapet. Answer: Do not alter the parapet, but insist upon the tinner's making the roof tight. He should find the openings in it and solder them tight; and if the parapets are of brick, as we presume they are, he should take paint skins and cement the joint where the tin enters the brick work. Most likely the fault lies here.

O. H. asks: What power for each square inch of water passing through pipes from an elevation of 400 feet a distance of five miles could be obtained? I am desirous of this information, as my farm is about the above distance from the water works, and the water pipes to supply the city are more than half the distance down in the streets; and if I could convey the water the distance named, it seems to me I should have, with a five or six inch pipe, a power to cost less than to build a steam engine of ten horse power. Answer: Every ten gallons of water, under the head indicated, is capable of developing about a half horse power, if used in an ordinary water wheel of small size. The pressure will be likely to vary immensely from that due the head with the greater or less amount of water used in the city, and the friction of the pipes will cause considerable loss. The power actually derived from the source referred to will be probably but a small proportion of that due the head, but we cannot undertake to say how small that friction may be. We should anticipate that steam power would be cheaper than water power, and also more reliable, under such circumstances.

I. P. H. asks: When was the game of chess invented, and by whom, and in what country? Who is the standard authority on such games? Are there any reliable books on taxidermy, and whose is best for beginners in that art? Can you inform me where Baiern is located, as I cannot find it on any of the maps? I think it is in the Austrian empire or near it. Answer: The game of chess is said to have been invented in India 5,000 years ago. Staunton and Hoyle are the standard authorities. Professor S. F. Baird has published directions for taxidermists in the Report of the Smithsonian Institute for 1856. Baiern is the German name for Bavaria.

J. asks for a simple method of detecting explosive oils, and states that his neighbors use a burning fluid of which the vapor escapes through a burner. He believes a good refined coal oil to be preferable to this fluid, whatever the latter may be. Answer: A perfect test for mineral oil was described on page 341 of our last volume, under date November 30, 1872. J.'s letter is one of many asking for instruction on practical matters which come to us every day, answers to which have been already published in our journal. Better evidence of the continued usefulness of the SCIENTIFIC AMERICAN could not be adduced.

C. H. says: On December 13, about sunset, there was a bluish light, apparently about the size of a common barrel, at a considerable hight in the air. It traveled westward, and would not have been noticed by many but for the tremendous noise, which jarred the earth and made the windows rattle. It continued roaring all over the sky for several minutes. What was it? Answer: If the blue light had been invested with a tail, it would be easy to account for the phenomenon; but wanting that appendage, science fails to offer a satisfactory solution.

W. H. C. says: I have had an argument with a friend, who takes the position that the sails of a ship, being the first part seen as she approaches, is not a proof of the rotundity of the earth. He argues that the circle of the earth's circumference is too great, and approaches too near a straight line to produce this result within the distance that a ship can be seen with the unaided eye. How is this? What is the rotundity of the earth per mile? Answer: Eight inches.—How far can a large ship be seen on a smooth sea? Answer: About 17 miles, if the masts are 200 feet high.—Suppose a straight line, 50 miles long, to touch the circle of the earth at the center of the line, how far would each end of that line be from the circle? Answer: About 417 feet.

R. H. M. says: We have two flue boilers, each of the following dimensions: 16 feet long, 4 feet diameter, with 48 three inch tubes; the grate surface is 5 feet by 4 feet. They are said to be of fifty horse power each. We have also two other boilers, each 16 feet long, 4 feet 6 inches diameter; one has 64 three inch tubes, the other, 62. The grate surface is 5 feet by 4 feet 6 inches; said to be of 70 horse power each. On the last named boilers our working pressure is 80 pounds; we very frequently find great difficulty in keeping up this pressure, with only one hundred horse power of work on our engine. The length of steam pipe is barely 50 feet, consumption of fuel, 6 tuns best soft coal, in twenty hours. What I desire to know is this: Is the estimated power correct according to dimensions given, allowing the usual percentage (which I believe is 15 per cent) for condensation, etc.? Is the consumption of fuel out of proportion to the amount of work obtained? And is the grate or fire surface sufficient? Answer: Good builders of steam boilers usually allow twelve feet of heating surface per horse power, and, with good engines and boilers, it is sufficient. Five hundred and sixty pounds of coal per hour, with a good engine and boilers, should give at least 120 indicated horse power. And with the best engines and boilers in the market, 100 horse power should be obtained with a consumption of one half the amount of coal given by our correspondent. The proportions of the boilers described seem to us good. Examine the engine and the setting of the boilers. There is a serious defect somewhere.

C. F. W. says: In estimating the power of antifriction cams, I take it for granted the law is the same as for an inclined plane, namely, as often as the hight is contained in the length the power is doubled; but in my case the length of the plane is 6 inches, the hight 3 inches, and when used, both planes work at the same time, but the hight is double, making 6 inches. Is there, or is there not, any power gained besides what is gained by the lever to work the same? Answer: The relation of force exerted to resistance overcome, in the whole combination, can be determined by multiplying the force exerted by the distance over which it moves in its own direction and dividing by the distance traversed by the table of the press. The result gives the resistance which may be overcome, whatever the intermediate mechanism, and provided there is no friction.

M. D. K. asks: 1. What is the highest speed attained in printing cards, circulars, etc., and what is the name of the press? 2. How can I ascertain the power of a toy steam engine? 3. Is there an illustrated dictionary of mechanical terms published? 4. How are colored lithographs made, and are all the colors printed at one impression? Answers: 1. About 1,000 per hour, by the Gordon press or some one of its modifications. 2. Toy steam engines are generally too small for the ordinary formula to accurately represent. Set your engine to work raising a weight, and remember that force sufficient to raise 33,000 pounds a foot high in a minute is a horse power. 3. Consult a bookseller. 4. Each color on a lithographic print is produced by a separate impression.

A. A. D. asks whether the power of a hydraulic press is doubled or quadrupled by the use of two or four small pumps, which inject the water into the large cylinder, instead of one; or, if not, whether the effect of two or four of such small pumps would simply be equal to the effect of one larger one, the diameter orb

rather the area, of the piston of which is equal to the sum of the others. Answer: To determine the power of the hydraulic press, measure the diameters of the pump plunger and the ram of the press. The square of the diameter of the ram is divided by the quantity obtained by multiplying the square of the diameter of the plunger by the distance from the center of the plunger to the fulcrum of the pump handle and dividing by the whole length of handle. The result will be the number of times that the force exerted by the press exceeds that exerted on the pump handle. Friction is not considered. The action of four small pumps worked by the same handle would be equivalent to that of a single pump of double diameter, that is, of area equal to the four combined.

J. K. asks: Is it safe to use any remedy, when chemicals are used, to remove scales from boilers? Answer: Mechanical means are always to be preferred, in the removal of scale once formed, whenever they can be employed. The use of chemicals, in weak solution, where their action can be carefully watched, is proper. If they contain any acid, however, they will injure the exposed metallic surfaces wherever they may come in contact with them. Some apparently harmless remedies produce acids by their decomposition, and serious injury is thus sometimes caused.

To E. E.—To form a perfect cube in perspective, inscribe a regular hexagon in a circle, then connect each alternate angle with the center by a radius. This will give a cube.

To W. G. B.—This communication was received too late to comply with request relating to an earlier note. The desire of our correspondent is, however, fully complied with in our last remarks upon the subject of the balance wheel. The only real gain in attempting to balance a reciprocating piece by a rotating one is that derived from changing the direction of the disturbing action of the momentum. For example, the reciprocating parts of a horizontal stationary engine, if running at high speed, produce horizontal strains which its foundation and holding down bolts are less well fitted to resist than to meet the vertical strains which are produced by the momentum of the rotating piece, which may be used to neutralize those horizontal strains.

J. H. D. says: A friend claims that, if a weight of 40 lbs. be put on a wagon axle (which is 200 lbs. on each wheel), the pressure is the same on the top of the wheel as on the bottom; while I assert that, if there are 14 spokes in the wheel, there is just one fourteenth of the weight on the top. Which is right? Answer: The problem proposed involves the higher mathematics. If the rim is absolutely rigid, and if the joints are unyielding, the strains on the several spokes will vary in proportion to the squares of the cosines of the angles which they make with the vertical. In this case, the force resisted by the vertical spoke, either at top or bottom, is about two fourteenths of the total weight on the wheel, where all the spokes take their proportion of the weight, as indicated above.

X. Y. Z. says: Will some one inform me what causes sinks, hollows, or low places in brass castings? Answer: The defects you speak of are due to various causes, such as uneven shrinkage, molds not thoroughly dried, etc., but principally uneven pouring and too little pressure in the metal from the pot.

J. G. W. sends a mineral specimen and says: The piece I send you is broken off from a larger piece weighing ¼ of a pound. It was found while excavating for a cellar and was embedded about three feet below the surface, in a soil composed of sand and clay. When found, it was covered with an oxide fully ¼ of an inch thick. Many who have examined it think it is of meteoric origin. But I have always supposed that meteors contained a considerable percentage of iron; this does not appear to, for the minutest particles are not in the least affected by a powerful magnet. Answer: It is not of meteoric origin, but is iron pyrites (sulphuret of iron) which is not attracted by the magnet.

S. S. W. C. says: I am using a plain slide valve engine, 10 by 24 inches. The valve cuts off at about two thirds of the stroke. Is it possible to set the eccentric so as to cut off sooner and still give sufficient lead, without changing the length of the valve? Answer: The engine referred to is probably as well arranged as will be found possible. To cut off shorter with a single slide valve would probably cause excessive cushioning. To make a change would require, also, a change in the length of valve face.

C. asks how to make a machine to sand-paper wood. Answer: Use canvas belts strongly sewed together at the ends. The threads may be so tied together as to leave the face on emery side of belt perfectly smooth and level. Size the belt with a coating of thin glue and then let it dry. Hand the belt over two pulleys, so that it can be easily turned. Use the best glue, of about the consistency for glueing wood; put it on hot with a brush, sifting the sand or emery on at once. Go round the belt as quickly as possible, then lay it on a smooth plank, and roll the sand or emery into the glue as hard as possible (an iron pulley, loose on a mandrel, is best); then hang up the belt to dry.

M. H. B. asks: How can I work a blue color into soap? Answer? Ultramarine and smalts or zaffre are the materials used; the pigment ought to be stirred into the soap when the latter is in the mold. The fear that either of these materials will turn green is entirely unfounded.

S. L. A. says that a steel square which he had kept oiled has lost its spring, and asks if oil affects the temper. Answer: The simple covering with oil cannot effect the hardness and elasticity of steel. It is a fact that oil and fats are used to anneal steel, especially thin articles, like springs, but in this case they are dipped into a bath, heated to the point of ignition. Sometimes the tools are covered with the fat or oil, whereupon the latter is ignited.

B. St. J. says: I am running a steam saw mill. When getting up steam after the boiler is cold, there is a thumping or pounding, like striking with a heavy hammer, from the time we get 5 lbs. of steam till we have 40 lbs., when it ceases. What is the cause of said pounding? The boiler is a large flue boiler, four feet in diameter and eighteen feet long. The connection pipe from the pump is exposed three feet to the fire, and is a four inch pipe. When in front of boiler the thumping sounds at back, and at back, sounds in front, and is so heavy as to jar the whole mill and to be heard four or five rods outside. Answer: We presume that the action described is due to the presence of cold water in the steam pipe. Open the throttle valve and the pet cocks in the cylinder, or in some other way drain the steam pipe and allow steam to blow through until the pipe is thoroughly warmed.

D. M. O. asks: Is there any process by which grained sugar can be made from sorghum? Answer: The attempts to make granulated sugar out of sorghum have not proved economical. Several pamphlets have been printed by agricultural publishers on this subject.

J. K. M. asks: What is the most powerful bleaching process, and how can I apply it for bleaching an animal substance? Answer: The best bleaching agent for ordinary purposes is chloride of lime. Permanganate of potash is also much employed. For household use, what is called Javelle water, to be had of druggists, can be used to bleach linen and remove wine stains.

J. P. C. says: I wish to illuminate a magic lantern with an electric light; what is the best battery to use, and what is the number of cups? Are there any magnetic or other machines that would answer the purpose? Answer: It is difficult to manage the electric light without employing Foucault's lamp, and this is expensive. Professor Tyndall made use of three of these lamps at his recent lectures in New York, and ran them with a bichromate battery of 50 cells. It is more convenient to illuminate a magic lantern with the calcium light.

J. F. asks for directions for testing bleaching powder (chloride of lime)? Answer: It is not easy for any one but a professional chemist to test bleaching powders. The directions for accomplishing an accurate analysis are given in Fresenius' work on quantitative analysis.

W. E. G., of Ky., sends a mineral specimen, asking what it is, and of what use. Answer: It is pure galena, the great lead ore of commerce.

J. M. W. asks for a demonstration of the manner in which a bird rises through the air without exertion on its own part, and states that this will open a new field for perpetual motionists. Answer: If you have read the SCIENTIFIC AMERICAN carefully, you will know that a bird does not rise without exertion on its own part, and you will have a wholesome dread of anything further on the subject of perpetual motion.

F. A. K. says: A lever L has its fulcrum at the angle; the power moves the upper part, and the pressure is exerted perpendicularly at the right hand extremity of the lower part. Another lever, of similar dimensions and with its fulcrum similarly placed at the left hand extremity of its lower part, is of shape ⊥. Which will exert the greatest pressure? Answer: The latter, or ⊥ form. If the two arms of L are equal in length, there will be merely a transmission of power, less the friction, and no leverage at all. But in the latter form the leverage and increased power will vary as the point where the power is applied is moved further from the fulcrum; and the leverage will be as this distance is to the length of the horizontal or lower arm of the ⊥.

E. M. asks: What cheap preparation can I use to make a box water tight against either hot or cold water? Answer: Dip the box in hot paraffin.

J. B. W. asks for information with reference to the commission for observing the transit of Venus next year. Who has it in charge, and what has been published with reference thereto? He suggests that a table of contents for each number would be a valuable addition to our paper. Answer: Write to Professor Newcome, Washington, D. C., for information relating to the commission for observing the transit of Venus. We publish a table of contents for each number on our editorial page.

C. M. asks if anthracite coal is injured by exposure to the weather, or by immersion in water? "I have soaked it in water for some days without any increase in weight." Is carbon soluble in any liquid without chemical change? Answer: Anthracite coal is considerably deteriorated by exposure to the air, a fact that is too much overlooked by dealers. There is no solvent for carbon.

A. G. T. says: I read the article on the use of arsenic in paper hangings, etc., and its effect on the health. I have a large case of stuffed birds in my sitting room, which are, of course, prepared in arsenic. Do you consider them injurious to the health of the occupants of the house; and is the profession of taxidermist an unhealthy one? Is Ure's Dictionary of Arts and Manufactures an illustrated work? And could I find in it full descriptions of the manufacture of trams and organzine, and weaving of silk? Answers: Stuffed birds should be kept in close cases, and the room be well ventilated, as moisture and changes of temperature will liberate some of the poisonous arsenic. Taxidermists are liable to all the symptoms of poisoning unless they are very cautious. The article on silk manufacture, in Ure's Dictionary, is fully illustrated.

D. W. P. says that he and another person have a dispute as to whether the heat of the sun's rays is increased by passing through plain glass of uniform thickness. "I hold that it is not; he says that it is." Answer: The heat of the sun's rays is very much diminished in its passage through glass, but not nearly so much as the artificial heat from other sources.

W. S. B. asks: Am I right in supposing that a cubic foot of atmospheric air, at a pressure of say one pound to the square inch, would, at a pressure of two pounds to the square inch occupy a space of two cubic feet and so on, and is it the same with all other gases? What is the best rule for determining the pressure of water at different hights? Answer: The volume of gases is governed by Mariotte's law, which is that, at the same temperature, the volume occupied by the same bulk of air is in inverse ratio to the pressure which it supports. If the pressure of the column of mercury in a tube is equivalent to one atmosphere, adding this pressure to that which the atmosphere exerts on the mercury we have the air subjected to double its usual pressure, and it is, consequently, reduced in volume one half. If we subject it to a pressure of three atmospheres, it will be reduced to one third, of four atmospheres, to one fourth, of its original bulk. The only variations in the law are near the point of liquefaction of gases. For the pressure of water, see hydrostatics in any book of physics.

H. C. S. asks if frost will follow down an empty pipe, covered at the top, so as to freeze at six or twelve inches below the frost level. Or, will a hydrant freeze, if the pipe is empty and the cut off valve is from six to eighteen inches below where the ground is frozen? Answer: If both the pipe and the hydrant are empty, what is there to freeze?

J. L. asks: Is the air which is injected into the receiver or heater of the caloric engine warmed by the exhaust before it is injected or not? Also, is the rigidity of a frozen road bed the only cause of the rails breaking? It is denied by some scientific authorities that iron is less tenacious when it is frosty, but experience seems to contradict such a theory. Answers: The air entering a hot air engine is not usually previously heated. Rails have slightly greater strength, probably, when cold, but they have less elasticity and consequently are less well fitted to resist concussion. We presume that the last fact may fully reconcile experimental deductions with our experience.

E. H. B. says: The water in Lake Michigan, at one point, is nearly two feet lower now than it was in June, 1871. Some persons have an idea that the wearing away of Niagara Falls and the changing of the current in Chicago River is the cause; but I am of the opinion that it is caused by the action of the elements or by evaporation. Will you please inform us what is the cause of the great depression of the waters of this great inland sea? Also where is the wash or caving in of the bluffs and great clay banks along this shore deposited? The wash is immense every year. Answer: The hight of water in the great lakes is greatly influenced by the violence and direction of the winds prevailing during the season, as well as the greater or less amount of rain which has fallen within the drainage area from which the water flows. We do not suppose that the wearing away of Niagara Falls has had the effect noted, but it would probably require a geological survey to determine the real cause precisely. We presume that the soil washed from the banks is widely distributed over the lake bottom, and some of it is probably carried down the Niagara River.

C. A. M. says, in answer to A. J. query 3, page 10, that horn is clarified by first putting into boiling water, and, when thoroughly heated, it is placed upon a wooden pin of a convenient length, and scraped from the tip downwards, removing a shaving the whole length of the horn at each stroke of the shave. It now has a clean surface, and is sawn into one or more cylindrical pieces of convenient size, each of which is split lengthwise by passing it over a circular saw projecting through a table. These pieces are now placed again in boiling water, and, when hot, transferred to boiling whale oil, from which, while still hot, they are taken and rolled or flattened and placed between sheets of Russian iron in a powerful screw hot press. The press is made of several adjacent cast iron boxes containing square openings to receive the charcoal with which they are heated. The pieces remain in about five minutes according to the temperature of the press, and when removed are in the form of flat, amber colored, transparent plates. The color will be darker according to the length of time the pieces remain in the press.

R. B. M. says, in answer to E. S. S., query 9, page 59: Jacket your pipes with asbestos paste, one half inch thick, and then protect the paste by a cover of thin boards or tin; charcoal pulverized, or any other non-conducting material will answer for the jacket. I have jacketed my pipes with fine hay, and have had no

A. G. C. query 24, page 59, can temper his taps in the following manner: After hardening, polish the bottom of one of the cutting grooves until it is bright (an old fine cut file will answer); then place the shank of the tap in the tongs, with point of the tap from you and the polished groove on the upper side, and the point a little elevated; if a taper tap, the large part of the tap should come nearest the fire. Then move it back and forth over a slow fire, that has the coal charred so that it will not smoke. Heat evenly and slowly until the bright groove assumes a deep red color.—Z. D.

C. M. says, in answer to W. L. L., who asked for an explanation of the configuration of frost crystals on windows: The crystalline forms which the vapors of a room assume, while being condensed on the cold panes of a window, depend mostly on the surface condition of the glass. A glass plate, absolutely clean and flat, would show no forms, the frost being equally distributed. The wiping or cleaning of the window inside the room is usually done in a roundish, spiral, or scroll like manner; hence the first adhesion of vapor, and the subsequent crystallization (if we can call it so) follows these lines and produces the well known fern-like or leaf-like forms. But wipe one pane before a frost carefully by horizontal streaks only, and the next to it by vertical streaks; and the frost crystals will be formed in the same directions, respectively, much more resembling those of some chemical salts than vegetable shapes. Snow crystals, forming in the air without any chemical or mechanical obstacles, are always hexagonal, with secondary formations of the same system.

H. M. W. says: C. A. de S. wants to be helped in his indexing. Having had to index 29,000 words, I think I have a right to speak about it. In the first place, I got hold of a somewhat stiffish paper (old ledger paper is excellent); then I cut it into slips of convenient size (1 inch by 3 inches will be about right). I put down on each slip one word or sentence (depending on the kind of index), with page and other reference if such is necessary. When every word or sentence which I wanted in the index was noted down, I got hold of 24 cigar boxes, which I lettered from a to z. I now distributed those slips into the boxes. This done, I put the contents of each box in a separate paper bag, put the now empty boxes again before me, got hold of a, and distributed all slips bearing words beginning with a between these boxes, thus, aa, ab, ac, ad, etc., to the end of the chapter. This done, I got hold of aa, and successively ab, ac, etc., and distributed those slips further. When arranged alphabetically I pasted those slips belonging to a in proper order on brown wrapping paper. Having treated a in this way, I took hold of b, and so on to the end of the alphabet. It took me a fortnight (6 hours a day) to get through with the distribution, and after that the copying took me several months.

A. G. C., on page 59, asks how to temper taps. He must first of all bear in mind that a tap is simply a series of cutters on a bar; hence the cutting parts must be uniformly hard enough to cut, and the base soft as possible to insure durability. This can be best accomplished by dipping at as low a heat as possible and making the outside hard, while the inside will be comparatively soft when rubbed off ready for tempering. Heat a heavy ring (a broken pulley hub is as good as anything), which have on side of your fire for use while hardening taps, and also a heavy pair of tongs, made hot in the same way. Take the lever end of the tap with the hot tongs, and insert the tap in the center of the hot ring, but do not let it touch the sides. It is better to keep turning it round. If the temper draws too fast, where held by the tongs, cool it off; move backward and forward until the right color is attained. This, too, depends on quality of steel and the size and make of the tap, and lastly the purpose for which it is intended.—P McC.

W. A. W. says, in answer to J. E. S. (query 22, page 10), who asked how to make a boiler for a small steam engine, to be heated by a common stove: Anything that you can make tight, with heating surface enough to make the requisite amount of steam, will answer the purpose. I saw a boiler and furnace in Grand Rapids, Mich., that was made something like a box stove with boiler set in the top, about one half the diameter of the boiler being in the firebox; there was no grate in firebox or flue in boiler. It was cast iron and evidently all cast whole, except the bottom of the furnace and front end of boiler. The cylinder of engine was 3 by 5 inches. A safety valve one inch in diameter will be plenty large enough. Ten pounds pressure will be all you will need. Why not gear up higher and run your engine at 400 revolutions per minute instead of 150?

J. W. says, in answer to J. E. S., page 378, volume XXVII., and W. G. B., page 27, volume XXVIII., on transmission of motion: I would say that it is simply absurd to refute a thing we have not seen practically tested. W. G. B. seems to be a true disciple of doubting Thomas, and much like the man who, when he heard of the first iron ship being built, swore it would sink. I simply assert that I have seen belts as wide as four inches work admirably on the plan described by me. And further, it has come under my notice, since I wrote my communication, that seven inch belts were worked on this plan at the planing mill (recently destroyed by fire) on President street, Baltimore, and will be used again in the reconstructed building. I have only to add that, in constructing the shifter, it should only allow the edge of the belt to come fairly with the edge of the loose pulley, so that the pressure of the shifter with the pliability of the belt brings it in contact with the revolving fast pulley, when it takes hold quite easily.

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 Equatorial Protuberance of the Earth. By J. H.

On Aero Steam Engines. By D. B. T.

On Flux and Reflux. By R. W.

On the Action of Water on the Turbine. By J. B. R.

On a Unity of Action by Inventors, concerning Foreign Patents. By J. A. B.

On the Wheel Question. By H. E. M.

On Protection from Fire. By H. & B.

On Financial Science. By N. L.

On Tidal Water Power. By W. B. S.

On the Astronomy of the Ancients. By C. A. L.

On the Motions of the Sun. By A. D.

On the Mineral Wealth of Virginia. By W. De H.

On Marine Camels. By E. S. F.

On the Servant Question. By L. C. G.

On the Use of River Water for Extinguishing Fires in New York. By W. B. D.

On the Detection of Explosive Oils. By J.

[OFFICIAL.]

Index of Inventions

FOR WHICH

Letters Patent of the United States

WERE GRANTED FOR THE WEEK ENDING

January 7, 1872,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

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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:

23,577.—SEWING MACHINE.—W. C. Hicks. March 26.
23,589.—STEAM GENERATOR.—A. B. Latta. March 26.
23,598.—SCREW PROPELLER.—J. Montgomery. March 26.
23,613.—HARVESTER RAKE.—H. H. Scoville. March 26.
23,622.—COOKING STOVE.—P. P. Stewart. March 26.
23,635.—GATE FOR CANAL LOCK.—C. W. Williams. March 26.
23,716.—STOVE.—S. B. Sexton. April 2.
23,735.—DOUBLE SEAMING MACHINE.—J. Wilson, C. Green, W. Wilson, Jr. April 2.
22,793.—CRACKER MACHINE.—J. Fox. April 2.
23,825.—SKATE FASTENING.—J. H. Coe, W. B. Sniffen. Ap. 26.

EXTENSIONS GRANTED.

22,539.—WELDING MACHINE.—J. Allender.
22,572.—SPECTACLE FRAME.—T. Noel.

DESIGNS PATENTED.

6,536.—CARPET.—W. Gilmour, Kidderminster, England.
6,537.—CARPET.—J. Powell, Kidderminster, England.
6,538.—SWORD HILT AND SCABBARD.—V. Price, N. Y. city.
6,539.—CARPETS.—A. Webster, Jr., New York city.

TRADE MARKS REGISTERED.

1,099.—CHAMPAGNE WINE.—F. De Bary & Co., N. Y. city.
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THE INTERSECTION AND DEVELOPMENT OF SURFACES WITH APPLICATIONS.—The Intersection of Cylinders and Cones. The Delineation and Development of Helices, Screws, and Serpentines. Application of the helix—the construction of a staircase. The Intersection of Surfaces—applications to stop-cocks. Rules and Practical Data.

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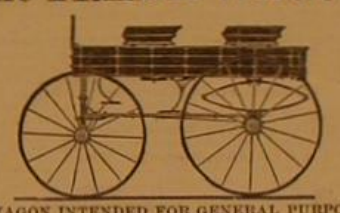

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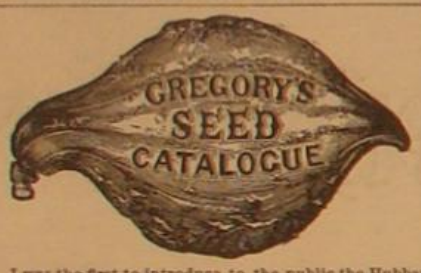

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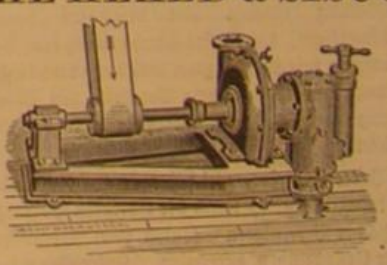

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